

**STANDARD TECHNICAL SPECIFICATIONS  
AND DRAWINGS**

**CITY OF SARATOGA SPRINGS, UTAH**

**UPDATED  
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# TABLE OF CONTENTS

## DEFINITIONS

### DIVISION 00 - DESIGN STANDARDS

00100	GENERAL DESIGN STANDARDS
00200	SEWER DESIGN STANDARDS
00300	DRINKING WATER DESIGN STANDARDS
00400	SECONDARY WATER DESIGN STANDARDS
00500	STORM DRAIN DESIGN STANDARDS
00510	HYDROLOGY AND DRAINAGE PLAN
00520	LOW IMPACT DEVELOPMENT (LID) PLAN
00600	STREET DESIGN STANDARDS
00700	ELECTRICAL DESIGN STANDARDS
00800	LANDSCAPING DESIGN STANDARDS
00900	CONSTRUCTION DRAWINGS

### DIVISION 01 - GENERAL REQUIREMENTS

01300	ADMINISTRATIVE REQUIREMENTS
01400	QUALITY REQUIREMENTS
01600	PRODUCT REQUIREMENTS
01700	EXECUTION REQUIREMENTS
01780	CLOSEOUT SUBMITTALS

### DIVISION 02 - SITE CONSTRUCTION

02100	ROADWAY AND GENERAL EARTHWORK
02112	TRENCHING FOR PIPE WORK
02115	STRUCTURAL EXCAVATION
02116	FILL AND BACKFILL
02235	SANITARY SEWER SYSTEM
02335	STORM DRAIN SYSTEM
02340	MANHOLES AND COVERS
02350	STORM WATER TREATMENT SYSTEM
02355	STORM WATER DETENTION PONDS
02410	WATER DISTRIBUTION SYSTEM
02412	PRESSURE REDUCING VALVE STATION
02414	WATER METER VAULT
02415	DISINFECTION OF WATER DISTRIBUTION SYSTEM
02416	AIR-VACUUM VALVE STATION
02580	SECONDARY WATER SYSTEM
02586	BACKFLOW PREVENTER STATION
02621	GRAVEL SURFACING AND ROAD BASE
02631	GEOGRID
02641	BITUMINOUS PAVING
02651	BITUMINOUS, TYPE II SEAL COAT
02652	CONCRETE STREET IMPROVEMENTS
02724	AUTOMATIC SPRINKLING SYSTEM
02725	RESTORING WETLANDS AREAS
02726	LANDSCAPING
02727	RESTORING NATIVE AREA
02728	HYDROSEEDING

02752	CHIP SEAL COAT
02821	VINYL FENCING
02824	ORNAMENTAL IRON FENCING
02828	MISCELLANEOUS EQUIPMENT FOR PLAYGROUNDS AND OTHER AREAS

### **DIVISION 03 - CONCRETE**

03300	CAST-IN-PLACE CONCRETE
-------	------------------------

### **DIVISION 04 - FINISHES**

04900	PAINTS AND COATINGS
-------	---------------------

### **DIVISION 05 - ELECTRICAL**

05530	STREET LIGHTING
05540	OUTDOOR LIGHTING

### **STANDARD SANITARY SEWER DETAILS**

SS-0	SANITARY SEWER DETAILS
SS-1	SANITARY SEWER PIPE TRENCH
SS-2	PRE-CAST SANITARY SEWER MANHOLE
SS-2A	CAST-IN-PLACE SANITARY SEWER MANHOLE
SS-3	SEWER SERVICE CONNECTION
SS-4	SEWER PIPE CASING

### **STANDARD STORM DRAIN DETAILS**

SD-0	STORM DRAIN DETAILS
SD-1	STORM DRAIN PIPE TRENCH
SD-2	GUTTER INLET BOX
SD-3	DOUBLE INLET BOX
SD-4	CLEANOUT BOX
SD-5	COMBINATION GUTTER INLET & CLEANOUT BOX
SD-6	INLET/OUTLET TRASH GRATES
SD-7	STORM DRAIN PIPE CASING
SD-8	DETENTION BASIN EMERGENCY SPILLWAY
SD-9	DETENTION BASIN OUTLET CONTROL BOX

### **STANDARD DRINKING WATER DETAILS**

DW-0	DRINKING WATER DETAILS
DW-1	DRINKING WATER PIPE TRENCH
DW-2	CONCRETE THRUST BLOCKS
DW-2A	CONCRETE THRUST ANCHORS FOR DOWNWARD VERTICAL BENDS IN DRY SOIL CONDITIONS
DW-2B	CONCRETE THRUST ANCHORS FOR DOWNWARD VERTICAL BENDS WHERE SIGNS OF GROUNDWATER ARE PRESENT
DW-2C	ALTERNATIVE THRUST RESTRAINT
DW-2D	ALTERNATIVE THRUST RESTRAINT TABLES
DW-3	DRINKING WATERLINE LOOP
DW-4	FIRE HYDRANT CONNECTION
DW-5	RESIDENTIAL METER CONNECTION 3/4" X 5/8" OR 1"
DW-5A	RESIDENTIAL METER MULTI-CONNECTION 3/4" X 5/8" OR 1"

DW-6	NON-RESIDENTIAL METER CONNECTION 2" OR 1 1/2"
DW-7	4 INCH METER AND VAULT WITH 2" BYPASS FOR 4" LATERAL
DW-8	6 INCH METER AND VAULT WITH 2" BYPASS FOR 6" LATERALS
DW-9	6 INCH METER AND VAULT WITH 4" BYPASS FOR 8" LATERALS
DW-10A	PRESSURE REDUCING VALVE STATION - 1 OF 5
DW-10B	PRESSURE REDUCING VALVE STATION - 2 OF 5
DW-10C	PRESSURE REDUCING VALVE STATION - 3 OF 5
DW-10D	PRESSURE REDUCING VALVE STATION - 4 OF 5
DW-10E	PRESSURE REDUCING VALVE STATION - 5 OF 5
DW-12A	AIR VACUUM RELIEF VALVE IN PUBLIC ROW 1 OF 2
DW-12B	AIR VACUUM RELIEF VALVE IN PUBLIC ROW 2 OF 2
DW-12C	AIR VACUUM RELIEF VALVE IN PRIVATE ROADS 1 OF 2
DW-12D	AIR VACUUM RELIEF VALVE IN PRIVATE ROADS 2 OF 2
DW-12E	AIR VACUUM RELIEF VALVE IN RURAL ROADS 1 OF 2
DW-12F	AIR VACUUM RELIEF VALVE IN RURAL ROADS 2 OF 2
DW-12G	AIR VACUUM RELIEF VALVE VENT DETAILS
DW-13A	2" BLOW OFF VALVE
DW-13B	TEMPORARY 2" BLOW OFF VALVE
DW-14	SAMPLING STATION
DW-14A	SAMPLING STATION IN PUBLIC ROADS
DW-14B	SAMPLING STATION IN PRIVATE ROADS
DW-15	CONCRETE COLLAR
DW-16	DRINKING WATER PIPE CASING

#### **STANDARD PRESSURIZED IRRIGATION DETAILS**

PI-0	PRESSURIZED IRRIGATION DETAILS
PI-1	PRESSURIZED IRRIGATION PIPE TRENCH
PI-2	CONCRETE THRUST BLOCKS
PI-2A	CONCRETE THRUST ANCHORS FOR DOWNWARD VERTICAL BENDS IN DRY SOIL CONDITIONS
PI-2B	CONCRETE THRUST ANCHORS FOR DOWNWARD VERTICAL BENDS WHERE SIGNS OF GROUNDWATER ARE PRESENT
PI-3	1" SINGLE AND DUAL SERVICE LATERALS
PI-4	CONNECTION FOR PUBLIC PARKS & OPEN SPACE
PI-5A	1" SINGLE SERVICE LATERAL BOX
PI-5B	1 1/2" DUAL SERVICE LATERAL BOX
PI-5C	PARTS LIST FOR SINGLE AND DUAL SERVICE LATERAL BOXES
PI-6	2" SERVICE LATERAL
PI-7	4" METER VAULT
PI-8A	AIR VACUUM RELIEF VALVE IN PUBLIC ROW 1 OF 2
PI-8B	AIR VACUUM RELIEF VALVE IN PUBLIC ROW 2 OF 2
PI-8C	AIR VACUUM RELIEF VALVE IN PRIVATE ROW 1 OF 2
PI-8D	AIR VACUUM RELIEF VALVE IN PRIVATE ROW 2 OF 2
PI-8E	AIR VACUUM RELIEF VALVE IN RURAL ROW 1 OF 2
PI-8F	AIR VACUUM RELIEF VALVE IN RURAL ROW 2 OF 2
PI-8G	AIR VACUUM RELIEF VALVE DETAILS
PI-9	2" & 4" DRAIN VALVES
PI-10	RPZ BACKFLOW PREVENTOR FOR SERVICE LATERALS
PI-11	RPZ BACKFLOW PREVENTOR FOR WATER MAINS
PI-12A	2" BLOW-OFF VALVE
PI-12B	TEMPORARY 2" BLOW-OFF VALVE
PI-12C	6" BLOW OFF
PI-13	CONCRETE COLLAR FOR WATER VALVES
PI-14	PRESSURIZED IRRIGATION PIPE CASING



## **STANDARD STREET IMPROVEMENT DETAILS**

ST-0	STREET IMPROVEMENT DETAILS
ST-1	SIDEWALK AND CURB & GUTTER
ST-2A	RESIDENTIAL 30" HIGH BACK CURB AND GUTTER
ST-2B	RESIDENTIAL 24" HIGH BACK CURB AND GUTTER
ST-2C	6" CURB WALL
ST-2D	FALL-OUT CURB AND GUTTER
ST-3	WATERWAY
ST-4A	SINGLE FAMILY RESIDENTIAL DRIVE APPROACH
ST-4B	COMMERCIAL DRIVE APPROACH
ST-5A-E	ADA ACCESSIBLE CURB RAMP
ST-6	DEFECTIVE CONCRETE REPLACEMENT CRITERIA
ST-7	STANDARD INTERSECTION & UTILITIES
ST-8	LOCAL 62' RIGHT-OF-WAY
ST-9A	COLLECTOR 77' RIGHT-OF-WAY
ST-9B	INTERIM COLLECTOR 86.5' RIGHT-OF-WAY MTN VIEW CORRIDOR
ST-10	MINOR ARTERIAL 100' RIGHT-OF-WAY
ST-11	MAJOR ARTERIAL 180' RIGHT-OF-WAY
ST-12	PRINCIPAL ARTERIAL 180' RIGHT-OF-WAY
ST-13	INTERIM ARTERIAL 180' RIGHT-OF-WAY
ST-14	TEMPORARY TURN-AROUND
ST-15	TRAILS
ST-16	CUL-DE-SAC
ST-18	ROUND-ABOUT COLLECTOR 77' RIGHT-OF-WAY
ST-26	TEE PATCH
ST-27	UTILITY MARKER
ST-28	STREET SIGNS AND REGULATORY SIGNS
ST-29	SURVEY MONUMENT
ST-30	PRIVATE ROAD 45' RIGHT-OF-WAY W/O PARK STRIP
ST-31	PRIVATE ROAD 53' RIGHT-OF-WAY W PARK STRIP
ST-32	PRIVATE ROAD 59' RIGHT-OF-WAY RURAL
ST-33	PRIVATE ROAD INTERSECTION & UTILITIES
ST-35	ANGLED ON-STREET PARKING
ST-39	POLYMER CONCRETE JUNCTION BOX
ST-40	CONDUIT: FIBER OPTIC/COMMUNICATION

## **STANDARD STREET LIGHT DETAILS**

LP-0	STREET LIGHT DETAILS
LP-1	NOTES
LP-1A	14' LOCAL STREET LIGHT
LP-1B	CONCRETE BASE FOR LOCAL STREET LIGHT
LP-2A	20' COLLECTOR STREET LIGHT
LP-2B	20' COLLECTOR STREET LIGHT W/ BANNER ARM FOR COLLECTOR ROADS AND COMMERCIAL AREAS
LP-2C	CONCRETE BASE FOR COLLECTOR STREET LIGHT
LP-3A	28' ARTERIAL STREET LIGHT
LP-3B	28' ARTERIAL STREET LIGHT WITH BANNER ARM
LP-3C	CONCRETE BASE FOR ARTERIAL STREET LIGHT
LP-4	LOCAL STREET LIGHT CONNECTION
LP-5	COLLECTOR AND ARTERIAL STREET LIGHT CONNECTION
LP-6	LIGHT POLE BELOW GRADE BOXES INSTALLATION
LP-6A	WIRELESS SUPPORT STRUCTURE-MONOPOLE FOR SMALL CELL WIRELESS FACILITIES

## **STANDARD LANDSCAPING DETAILS**

LS-0	LANDSCAPING DETAILS
LS-1	SPRINKLER SYSTEM MAINLINE ISOLATION VALVE 4" AND LARGER
LS-2	SPRINKLER SYSTEM QUICK COUPLER VALVE
LS-3	SPRINKLER SYSTEM REMOTE CONTROL VALVE
LS-4	METER & CONTROLLER STAINLESS STEEL ENCLOSURE
LS-5	SATELLITE STAINLESS STEEL CONTROLLER ENCLOSURE
LS-6	SPRINKLER SYSTEM LARGE AREA ROTARY HEAD
LS-7	MEDIUM & SMALL AREA SPRINKLER HEAD
LS-8	SPRINKLER SYSTEM MANUAL DRAIN
LS-9	SPRINKLER SYSTEM SLEEVING
LS-10	SPRINKLER SYSTEM PIPE/TRENCH
LS-11	SPRINKLER SYSTEM PIPE AND WIRE TRENCH
LS-12	SPRINKLER SYSTEM AUTOMATIC DRAIN
LS-13	TREE STAKING & PLANTING
LS-14	VINYL FENCE WITH MOW STRIP
LS-15	CONCRETE MOW CURB
LS-16	DRIP IRRIGATION

## **STANDARD PLAT TEMPLATE**

SP-1	STANDARD PLAT TEMPLATE
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# DEFINITIONS

**ACCEPTABLE EQUAL or ACCEPTED EQUAL:** In order to establish a basis of quality and specificity for some items mentioned in the Work, certain processes, types of machinery and equipment, brands, or kind of material may be mentioned on the Accepted Plans by designating a manufacturer by name and referring to their brand or model numbers. Such mention is not intended to exclude Materials wherever in the Specifications a manufacturer's name, brand or model is mentioned, it is to be understood that the phrase "acceptable equal" is assumed to follow thereafter whether or not it does in fact follow.

**ADDENDA:** Written or graphic documents issued and signed or initialed by the Engineer, that clarify, correct or change the Contract Documents.

**AGREEMENT:** The duly executed written agreement between two parties. Other Contract Documents may be attached to or referred to in the Agreement and made a part thereof as provided therein. The Agreement shall include those documents specifically referred to in the signed document between the parties.

**ACCEPTANCE:** Acceptance by the City that documents stamped "Accepted" are in general compliance with the City's preparation requirements of those documents. It is not an acceptance of responsibility or liability for the completeness and accuracy of those documents. Responsibility and liability for engineering documents resides with the licensed professionals and the professional firms who prepare them.

**APPROVED EQUAL:** Equipment or material which, in the opinion of the City's Representative, is equal in quality, durability, appearance, strength, design, performance, physical dimensions, and arrangement to the equipment or material specified, and will function adequately in accordance with the general design.  
**AS-BUILT DRAWINGS:** Drawings which show the Project as actually constructed, and which include any and all changes made to the construction plans before and during construction.

**BEST MANAGEMENT PRACTICE (BMP):** One of potentially several acceptable practices that could be implemented to protect water quality and promote soil conservation.

**CHANGE ORDER:** A document, which is signed by authorized representatives of the Contractor and the City and which authorizes an addition, deletion or revision in the Work, or an adjustment in the sum due the Contractor, or the Project completion time, issued on or after the date of the Agreement.

**CITY INSPECTOR:** The authorized representative of the City or Engineer assigned to make detailed inspections of the Work performed, or of materials furnished by the Contractor.

**CITY/OWNER:** Wherever, in the Contract Documents the word "City" or "Owner" appears, it shall be interpreted to mean "City of Saratoga Springs", unless otherwise denoted.

**CONSTRUCTION ACTIVITIES:** Clearing, dredging, excavating, and grading of land and other activities associated with buildings, structures or other types of real property such as utilities, bridges, dams and roads. Includes mobilization/demobilization and any other activity that occurs on site.

**CONTAMINATION.** The intentional or negligent placement or release upon real property of Hazardous Materials; the presence of an unwanted constituent, contaminant or impurity in a material.

**CONTRACT DOCUMENTS:** The written agreement between the City and the Contractor by which the Contractor agrees to perform the Work and furnish the labor, materials, tools, and equipment in the

performance of the Work. The Contract Documents shall include, but not be limited to (unless the context clearly indicates otherwise), the Saratoga Springs City Specifications, Notice to Contractors, Request for Bids, the Contractor's Bid, Accepted Plans and Specifications, Special Conditions and Contract Bonds, and attached Exhibits; also any and all supplemental agreements amending or extending the Work contemplated. Supplemental agreements are written agreements covering alterations, amendments or extensions to the contract, and include contract Change Orders.

**CONTRACTOR:** The Contractor is the individual, person, or organization responsible for doing the Work. The Contractor is further defined as the individual, firm, co-partnership or corporation, and his, or its heirs, executors, administrators, successors and assigns, or the lawful agent of any such individual firm, partnership, or corporation, or its surety under the contract bond, which constitutes one of the principals to the contract and undertaking to perform the Work herein specified. Where any pronoun is used as referring to the word "Contractor" it shall mean the Contractor as defined above.

**DATE OF PROJECT:** The date of final Acceptance.

**DAYS:** Unless otherwise designated, days as used in the Specifications will be understood to mean calendar days including weekends and holidays.

**DRAWINGS:** The drawings, profiles section and details, or accurate reproductions thereof, accepted by the Engineer, which show the location, character, dimensions and details of the Work.

**EMERGENCY:** Any unforeseen circumstance or occurrence for which adequate preparations could not reasonably have been made to prevent such occurrence or circumstance, the occurrence of which constitutes a clear and immediate danger to persons and/or property, or which causes a substantial interruption of utility services, or any act of God, war, insurrection, invasion, tumult, riot, or public disaster, or imminent danger of any of these, civil commotion, conflagration, or other similar occurrence resulting in a clear and immediate danger to persons and/or property.

**ENGINEER:** The City Engineer, or his or her representative.

**FINAL ACCEPTANCE OF PUBLIC INFRASTRUCTURE:** The date specified in writing by the Engineer when all work, including all punch list work designated by the Engineer, is complete and accepted by the City after the completion of the warranty period following the Project Acceptance for Maintenance.

**HALF-WIDTH ROAD:** Any public or private street right-of-way or easement which is less than the full required width for the road's functional classifications (ie local, collector, arterial, etc.), and which is established so that the additional half-width right-of-way or easement may be provided at a later date to complete a full-width roadway. The pavement width of a Half-Width Road shall equal at least 29 feet, or 50 percent of the required pavement width for the road's functional classification in accordance with the City Standard Specifications, whichever is greater. In addition to the required pavement, the Half-Width Road improvements shall include, at a minimum, the curb, gutter, sidewalk, park strip, landscaping, street lighting, and appurtenant utilities along the frontage of the property being developed. Half-Width Roads are allowed instead of the full cross section when development activity occurs only on one side of the street. In all other cases, the full cross section is required when development activity occurs.

**HAZARDOUS MATERIALS:** (a) Any substances defined, regulated or listed (directly or by reference) as "hazardous substances," "hazardous materials," "hazardous wastes," "toxic waste," "pollutant," "contaminant" or "toxic substances" or similarly identified as hazardous to human health or the environment, in or pursuant to any of the following statutes: (i) the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. §9601 et seq. ("CERCLA"); (ii) the Hazardous Materials Transportation Act, 49 U.S.C. §1802, et seq.; (iii) the Resource Conservation and Recovery Act, 42 U.S.C. §6901 et seq.; (iv) the Clean Water Act, 33 U.S.C. §1251 et seq.; (v) the Clean Air Act, 42 U.S.C. §7401 et seq.; (vi) the Toxic Substances Control Act, 15 U.S.C. §2601 et. seq.; (vii) the Utah Air Conservation Act, U.C.A. §26-13-1 et. seq.; (viii) the Utah Water Pollution Control Act, U.C.A.

§26-11-1 et. seq.; (ix) the Utah Safe Drinking Water Act, U.C.A. §26-12-1 et. seq.; (x) the Utah Solid and Hazardous Waste Act, U.C.A. §26-14-1 et. seq.; (xi) the Utah Hazardous Substance Mitigation Act, U.C.A. §19-6-301 et. seq.; (xii) the Utah Underground Storage Tank Act, §19-6-401 et. seq.; and/or (xiii) any amendments to such enumerated statutes or acts; and (b) Any other hazardous or toxic substance, material, chemical, waste, contaminant or pollutant identified as hazardous or toxic or regulated, under any other applicable federal, State or local environmental laws, including, without limitation, friable asbestos, polychlorinated biphenyl ("PCBs"), petroleum, natural gas and synthetic fuel products and by-products.

**INSPECTED AND ACCEPTED or ACCEPTANCE:** City recognition of conformance to the Standard Specifications.

**LAND SURVEYOR:** One who is duly and lawfully registered with the State of Utah Division of Occupational and Professional Licensing to perform land surveying within the State.

**LAW:** Any applicable City, County, State, or federal statutes or regulations governing anything relating to the Work embodied in the Agreement.

**LOW-IMPACT DEVELOPMENT (LID):** A development approach that promotes the implementation of BMPs that allow storm water to infiltrate, evapotranspire, or harvest and use storm water on site to reduce runoff from the site and protect water quality.

**MATERIALS:** The term "Materials" when used herein shall include the supply items and machinery and equipment required or used in the Work.

**NOTICE OF AWARD:** The written notice by the City to the apparent successful bidder stating that Contract Documents will be forthcoming for signature upon compliance with the conditions enumerated therein.

**PAVEMENT:** The uppermost layer of bituminous or Portland-cement concrete material placed on the traveled way or shoulders for a riding surface, whether rigid or flexible in composition. This term is used interchangeably with "surfacing."

**PAYMENT BOND, PERFORMANCE BOND:** The accepted form of security furnished by the Contractor and its surety, as required in the Contract Documents guaranteeing respectively, payment and completion of Work.

**PROFESSIONAL ENGINEER:** A registered engineer who is licensed to practice in the State of Utah.

**PROJECT MANUAL:** The bound document package prepared for bidding and constructing the Project.

**REFERENCE:** Those bulletins, standards, rules, methods of analysis or test codes and specifications of other agencies, engineering societies, or industrial associations referred to in the Contract Documents. Unless otherwise indicated, these refer to the latest edition, including amendments in effect and published at the time of advertising the Project for bid or issuing the permit, unless specifically referred to by edition, volume or date.

**RIGHT-OF-WAY (ROW):** All public rights-of-way and easements, public footpaths, walkways and sidewalks, streets, roads, highways, alleys, and water or drainage ways. It does not, however, include Public Utility easements not within Public Ways of the City.

**SHOP DRAWINGS:** Drawings, diagrams, illustrations, schedules, brochures, standards performance charts, instructions, or other information prepared by or for the Contractor and submitted to the City to illustrate what materials, equipment or work is to be performed for any portion of the Agreement.

**SPECIFICATIONS:** Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

**STANDARD DETAILS OR PLANS:** The illustrative and extended treatment of or attention to particular items which accompany the Construction Specifications.

**STANDARD SPECIFICATIONS:** The Standard Technical Specifications and Drawings for the City of Saratoga Springs.

**STREET.** The entire width between the boundary lines of the road or way which is owned, maintained and open to the use of the public for use as a thoroughfare, or which is the principal means of access to abutting property; the entire width of every way defined as a public street or highway by the laws of this City or State.

**STRUCTURAL BEST MANAGEMENT PRACTICE:** A best management practice that can be physically installed.

**SUBCONTRACTOR:** The individual, firm, partnership or corporation to which the Contractor subcontracts any part of the Work covered by the Contract Documents.

**SUBGRADE:** That portion of the roadbed surface which has been prepared, as specified, and upon which a layer of specified roadbed material or base, or sub-surfacing, or pavement is to be placed.

**SUBSTANTIAL COMPLETION:** The point at which, in the opinion of the Engineer as evidenced by Engineer's written notice to the Contractor, the Work (or specified part thereof) has progressed to where it is in a state of completion in accordance with the Contract Documents and Standard Specifications, so that the City can reasonably and safely utilize the facility for the purpose for which it is intended, and only insubstantial services and material are required to correct the unfinished or defective portions of the work, and the remaining work will not interfere with the facility's intended use or occupancy.

**SUBSTANTIVE REVIEW:** A general evaluation of the overall design and general compliance with the City Code and the Standard Specifications. It is not an exhaustive review for compliance with each specific provision of the City Code, other applicable standards or regulations, or recognized-and-generally-accepted good engineering practices. Substantive review shall not shift the responsibility and liability for the completeness and accuracy of the plans and related designs from the Engineer of Record to the City.

**SURFACE OR SURFACING:** The uppermost layer of material placed on the traveled way or shoulders, and is usually of asphalt or concrete. This term is used interchangeably with "pavement."

**WORK:** The construction services performed including materials on a City Public Works project and includes all labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations to construct a project under these General Conditions. The term also includes the supervision, inspection, and other on-site functions incidental to the actual construction.

**WORKMANSHIP:** The level of quality of work accomplished on the project through: a) The Contractor's maintenance of performance control and supervision over subcontractors, suppliers, manufacturers, products, services, and site conditions to produce work in accordance with Contract Documents. b) Compliance with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise skill and craft. c) Providing suitable qualified personnel to produce specified quality.

**DIVISION 00**

**DESIGN STANDARDS**

## **SECTION 00100**

### **GENERAL DESIGN STANDARDS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

1. Codes and Standards
2. Design Standards
3. Construction Drawing Requirements

##### **1.2 RELATED SECTIONS**

- A. Section 00620 - Documentation

##### **1.3 SUBMITTALS**

- A. Construction Drawings

1. Submitted Construction Drawings shall be in PDF format with 11 inch x 17 inch page size.
2. One PDF copy of Construction Drawings shall be submitted to the City Engineer for preliminary review.
3. One PDF copy of Construction Drawings shall be submitted to the City Engineer for final acceptance with exhibit illustrating incumbent property. Requirements for Construction Drawings can be found in section 00900.

- B. Easements and Land Acquisition

1. All easements and land acquisitions shall be submitted on the City's standard easement form and shall be included on the recorded subdivision plat.
2. All easements shall be accompanied by an exhibit illustrating encumbered property that is stamped, signed, and dated by a Utah-licensed professional land surveyor.
3. One copy of all necessary easement forms shall be submitted to the City Engineer for review.
4. One signed copy of all necessary easement forms, including exhibits, shall be submitted to the City Engineer for acceptance and recordation.
5. All necessary permits shall be submitted to the City Engineer for acceptance. Required permits include, but are not limited to: State and County utility line permits, canal crossing permits, railroad crossing permits, UPDES permits, Army Corp. of Engineer permits, encroachment, excavation, and grading permits, etc.
6. All necessary permits and easements must be submitted prior to acceptance being granted by the City.
7. Right-of-entry easements shall be provided for all storm drains, storm water devices, and grease traps.



## **1.4 CITY ENGINEER'S AUTHORITY**

- A. The City Engineer has authority to provide a substantive review of submitted Construction Drawings.
- B. The City Engineer shall provide feedback pursuant to his/her substantive review of the Construction Drawings.
- C. Changes to address the City Engineer's feedback shall be made to Construction Drawings and returned to the City Engineer for City acceptance of the Construction Drawings for Construction. Requirements for Construction Drawings can be found in Part 2.3 of this section.
- D. The City Engineer shall have additional authority such as is stated in these Standard Specifications.

## **PART 2 EXECUTION**

### **2.1 CODES AND STANDARDS**

- A. Design for each category shall be based on the following Codes and Standards:
  - 1. Sanitary Sewer Systems.
    - a. ASCE Manual and Reports on Engineering Practice No. 60, Gravity Sanitary Sewer Design & Construction;
    - b. Utah State Department of Health Code of Waste Disposal Regulations;
    - c. Utah Division of Water Quality Administrative Rules for Design Requirements for Wastewater Collection, Treatment and Disposal Systems;
    - d. Currently Adopted Plumbing Code; and
    - e. Current Adopted National Electrical Code.
  - 2. Drinking and Secondary Water Systems.
    - a. State of Utah Administrative Rules for Public Drinking Water Systems;
    - b. Currently Adopted Plumbing Code; and
    - c. Current Adopted National Electrical Code.
  - 3. Storm Drainage Systems.
    - a. City's Standard Specifications, Storm Water Management Plan, and the Storm Water Regulations of the City Code.
    - b. All work not specifically-described in the City's Standard Specifications, Storm Water Management Plan, and the Storm Water Regulations of the City Code shall conform to the Mile High Flood District Urban Storm Drainage Criteria Manual.
  - 4. Transportation System
    - a. Guidelines, procedures and design criteria as defined by AASHTO, ITE, MUTCD, and ADA.
- B. All Work not specifically-described in these Standard Specifications shall conform to the APWA "Manual of STANDARD SPECIFICATIONS" and APWA "Manual of STANDARD PLANS" as published by the Utah Chapter of the American Public Works Association. The latest edition at the time of the work shall be used.
- C. All Work not specifically-described in these design Standard Specifications, the APWA "Manual of STANDARD SPECIFICATIONS", or APWA "Manual of STANDARD PLANS" shall

conform to recognized and generally-accepted good engineering practices.

## **2.2 DESIGN STANDARDS**

- A. Infrastructure designs shall conform to the most recent City of Saratoga Springs current Capital Facilities and Master Plans; and to these Standard Specifications.
  - 1. These Standard Specifications are design guidelines. They do not relieve the developer's engineer from being responsible for examining and understanding local project conditions, confirming the correlation of all design standards with the techniques of construction, coordination of the standards with that of all other industry standards, and for the complete and satisfactory design of the project.

## SECTION 00200

### SEWER DESIGN STANDARDS

#### PART 1 GENERAL:

- A. The impact of any proposed sewer system on the existing sewer systems level of service will be reviewed by the City Engineer. The developer shall install any offsite improvements necessary to mitigate negative impacts to the existing sewer systems' level of service and as required to provide sewer service to their development.
  - 1. Areas that will be serviced through the proposed development will be considered and the method of service to those areas will be determined by the City Engineer. Increased system size may be required by the City Engineer for future development.
  - 2. Sewer lift stations are prohibited. Because the operation of a sewer lift station is a significant, long-term cost for the City and will affect the City budget long term, any exceptions to this prohibition must be specifically authorized by the City Council pursuant to its legislative discretion.
- B. Sewer mains shall be located as indicated on the City's Standard Specifications and shall be located in ROW or dedicated open spaces. In locations where the sewer leaves the public right-of-way, a twenty-foot wide utility easement to the City is required. This easement shall be centered on the sewer line. Utility easements for sewer shall extend 10 feet beyond dead end manholes.
  - 1. Easements shall be shown on the plat or, if outside plat boundaries, recorded using an easement form acceptable to the City Attorney. The offsite easement, entry number, and grantee name shall be shown and referenced on the plat.

#### PART 2 DESIGN REQUIREMENTS:

- A. TRUNKLINES
  - 1. **Minimum Pipe Size.** The minimum size of sewer main line shall be 8 inch diameter.
  - 2. **Maximum Capacity.** All sewer pipes shall be sized to a maximum 80% capacity. Maximum capacities for each sewer pipe size are shown in Table 1.
  - 3. **Minimum Velocity.** Sewer lines shall be designed to maintain a minimum velocity of 2 feet per second (2 fps). The minimum flows allowed in each sewer pipe size required to meet this requirement are shown in Table 1.
  - 4. **Peaking Factors.** The design flow shall be calculated based on equivalent residential connections in addition to a peaking factor depending on the size of sewer pipe. For 8 inch pipe, the peaking factor shall be 4.0. For pipe larger than 8 inches but less or equal to 15 inches, the peaking factor shall be 2.5. For all pipe larger than 15 inches, the peaking factor shall be 2.0.
  - 5. **Minimum Slope.** The minimum sewer slopes are shown in Table 1.

<b>Table 1. Minimum Pipe Slopes and Minimum/Maximum Capacities in Sewer Pipes</b>				
Pipe Size (in)	Flow at Maximum Allowable Capacity (gpm)	Minimum Slopes (ft/ft)	Minimum Design Flow (gpm)	Minimum Upstream ERUs at Minimum Slope
8	251	0.00334	N/A	N/A
10	392	0.00248	245	590
12	564	0.00194	353	851
15	880	0.00144	553	1,333
18	1,268	0.00113	795	2,395
21	1,762	0.00092	1,082	3,260
24	2,254	0.00077	1,414	4,260
Over 24	Engineer's Recommendation			

6. **Depth.** The maximum sewer depth shall be 20.0 feet. The minimum sewer depth shall be 13.0 feet..
  - a. The City Engineer may approve sewer depths less than 13 feet where supported by an engineering study that shows other options are infeasible. In areas of shallower sewer, the following note shall be added to the development plat: "Shallow Sewer Depths! Contractor shall verify sewer depths before excavating for basement. Home(s) with basement may not have sewer service available for basement."
7. **Cover.** A minimum of 3 feet of cover shall be required over all sewer lines, where acceptable to the City Engineer.
8. **Extensions.** Sewer main lines shall be extended to property lines to service future Development and end with manhole. No plugged ends of sewer main lines will be allowed. Manholes shall be constructed at the ends of sewer lines.
9. **Utility Conflicts.**
  - a. Where possible, sewer shall be located at 10 foot minimum horizontal distance from all other public utilities, including but not limited to storm drains and secondary water lines.
  - b. Sewer shall be located a minimum of 18 inches below drinking water lines and a minimum of 18 inches vertical distance from all other public utilities, including but not limited to storm drains and secondary water lines.

## B. MANHOLES

1. **Sizing.**
  - a. The minimum size manhole shall be 4 foot diameter.
  - b. 5 foot diameter manholes shall be used in the following situations:
    - i. Where new sewer lines are connected to existing sewer lines.
    - ii. At all intersections of three or more 8 inch or larger pipe lines.
    - iii. Where the deflection angle of the pipe line exceeds 90 degrees.
    - iv. When both items "ii" and "iii" are designed in the same manhole, a 6 foot manhole is required.

2. **Accessibility.** A 12-foot paved access road shall be constructed to all manholes and shall be capable of supporting H-20 loading. Where future development renders the vertical alignment of an access road uncertain, the pavement requirement can be postponed until the adjacent land develops. However, the developer shall be required to post a cash only bond with the City to guarantee completion of such pavement with an automatic escalation clause to account for inflation and cost increases.
3. **Spacing.**
  - a. The maximum manhole span shall be 400 feet, as measured from center to center of manholes.
  - b. When sewer line depth is between 20 feet and 29 feet, decrease the manhole span to 350 feet. When depths of 30 feet or greater are encountered, decrease the span to 300 feet.
4. **Drops.** Unless otherwise approved by the City Engineer, the minimum drops through manholes shall be as follows:
  - a. Greater than 90° - 0.3 foot drop
  - b. 75° - 90° manholes – 0.2 foot drop
  - c. 25° - 74° manholes – 0.1 foot drop
  - d. 0° - 24° manholes – the grade through the manhole shall be equal to the incoming pipe slopes with a maximum drop of 0.20 feet across the manhole.
5. **Pipes in Manholes.**
  - a. *Variable Diameters.* Where pipes of different diameters melding laterals connect into a manhole, the inside top of the smaller pipe shall match the inside top of the larger pipe.
  - b. *Steep Slopes with Moderate Deflection.* Where incoming slopes at manholes are greater than or equal to 5 percent and the deflection angle within the manhole is greater than or equal to 45 degrees but less than 90 degrees, a 5 foot manhole with an extra deep trough is required.
  - c. *Steep Slopes with Major Deflection.* Where incoming slopes at manholes are greater than or equal to 5 percent and the deflection angle within the manhole is greater than 90 degrees, a 6 foot manhole with an extra deep trough is required
6. **Lining.** Force main discharge manholes and manholes in groundwater shall be epoxy lined or acceptable equal.

C. LATERALS

1. **Benching & Lateral Size.** The benching of the extra deep trough shall be located 25% higher than the diameter of the incoming pipe. The minimum lateral size shall be 4 inch for residential connections; and 6 inch for commercial and industrial connections.
2. **Minimum Slope.** Sewer lateral shall have a minimum slope of 2%.
3. **Tie-In Locations.** Sewer laterals shall tie directly into manholes wherever possible and practical.
4. **Cleanouts & Bends.** Sewer laterals shall conform to the requirements of the Utah State Department of Health Code and the currently adopted plumbing code; with cleanouts at not more than 100 foot spacing; and no more than two bends in excess of 45 degrees without a cleanout.
5. **Frequency.** Each building and/or unit of separate ownership shall require a separate sanitary sewer lateral.

6. **Grease Traps.** Grease traps shall be required on all commercial development where food service uses are anticipated.
  - a. Sampling manholes shall be installed downstream of all grease traps.
  - b. Sampling manhole & grease trap shall be constructed as per TSSD Standards & Specifications and it shall be accepted and inspected by the Timpanogos Special Service District.
  - c. Sampling manhole and grease trap must be inspected and maintained per the Utah Health Code and Utah County Health Department regulations.

## **SECTION 00300**

### **DRINKING WATER DESIGN STANDARDS**

#### **PART 1 GENERAL:**

- A. The State of Utah Administrative Rules for Public Drinking Water Systems, R309-510, provide minimum sizing requirements for drinking water facilities. All pipe and appurtenances shall be ANSI/NSF 61 certified.
- B. The impact of any proposed water system on the existing water systems' level of service will be reviewed by the City Engineer. The developer shall install any offsite improvements necessary to mitigate negative impacts to the existing drinking water systems' level of service and as required to provide water service to their development.
  - 1. Areas that will be supplied through the proposed development will be considered and the method of service to those areas will be determined and accepted by the City Engineer. Increased system size may be required for future development as outlined in the City's Drinking Water Master Plan and as dictated by the City's water modeling.
  - 2. The City Engineer shall consider and accept the system storage requirements for each development.
- C. Drinking water mains shall be located as indicated in the City's Standard Specifications and shall be located in ROW or dedicated open space. In the locations where the drinking water lines leave the public right-of way, a ten-foot wide utility easement to the City is required. This easement shall be centered on the water line. Utility easements for water shall extend 10 feet beyond dead ends and hydrants.
  - 1. Easements shall be shown on the plat or, if outside plat boundaries, recorded using an easement form acceptable to the City Attorney. The offsite easement, entry number, and grantee name shall be shown and referenced on the plat.
- D. Each building and/or unit of separate ownership shall require a separate water service line.

#### **PART 2 DESIGN REQUIREMENTS:**

- A. PIPES
  - 1. Water systems shall be sized as described in the City's Capital Facilities & Master Plans and shall be a minimum of 8 inches in public right-of-way.
  - 2. The minimum fire flow shall be as per state standards. The fire flow may be increased as determined by the City Fire Marshal.
  - 3. The construction drawings shall show pipe sizes, types, and classifications.
    - a. All water system appurtenances shall be labeled
  - 4. The cover over the top of drinking water lines shall be a minimum of 48 inches and a maximum of 72 inches.
  - 5. Drinking water lines shall be located a minimum of 18 inches above sanitary sewer lines and a minimum of 18 inches vertical distance from all other public utilities, including but not limited to storm drains and secondary water lines.

6. The material for drinking water pipeline up to and including 18 inch shall be AWWA C900 DR 18. The material for pipelines larger than 18 inch shall be selected by the City Engineer.
7. Water lines shall be placed in the park strips as required by the Standard Specifications.
  - a. Location shall be on the east side of north/south streets.
  - b. Location shall be on the north side of east/west streets.
8. Fire Hydrants:
  - a. Fire hydrants shall have a maximum spacing of 500 feet in residential areas; and a maximum spacing of 300 feet in commercial and industrial areas.
  - b. Fire hydrants shall be placed at the end of cul-de-sac pipe lines, the end of dead end streets, and every 1,000 feet on offsite transmission lines. Temporary hydrants may not be considered as fire protection hydrants; but shall be used for flushing and maintaining lines.
  - c. Fire hydrant spacing shall be accepted by the City Fire Chief; additional fire hydrants may be required by the City Fire Chief.
9. Where grade change will not allow conventional concrete thrust blocks, pipe restraint devices shall be designed and specified.
10. Concrete thrust blocks are not allowed within roadways at intersections. For example, between existing and future curb lines. Thrust restraint shall be designed in accordance with the Standard Specifications.
11. Water Service Connections shall include the corporation stop at the main line, CTS Poly service line to the meter yoke, an angle stop, back-flow angle valve, PVC meter box, and cast iron frame and cover, as shown on the City Standard Specifications.
12. Drinking water main lines shall be extended to property lines to service future development and shall end with blow-off or hydrant.
13. Permanent dead-end mains shall not exceed 600 feet in length.
14. The maximum allowable deflection of pipe joints shall be less than or equal to half of the manufacturer recommended maximum deflection.

**B. PRESSURES & VELOCITIES**

1. The minimum operating pressure in all parts of the system during peak day demand is to be 40 psi.
2. The maximum operating pressure is to be 100 psi. Higher pressures can be used with acceptance from the City Engineer, based on pipe strength, the presence and nature of service connections, and the potential for transient pressure surges in the subject area of the system.
3. Water systems shall be designed so that pressures conform to the pressure zones shown in the City's Capital Facilities Plan.
4. Individual home booster pumps are not allowed.

**C. VALVES & BLOW-OFFS**

1. Valves shall be gate valves. Valves 16 inch and larger may be installed rotated 90 degrees with a bevel gear actuator.
2. Valve placement:
  - a. Valves shall be placed at the point of curvature of the curb and gutter radius



sections.

- b. Valves shall be placed at intervals not to exceed 800 feet.
  - c. At intersections, valves shall be placed on at least three branches of the system.
  - d. Valves shall be placed on both sides of casings in a location which will not interfere with future removal and replacement of the carrier pipe. Thrust restraint shall be addressed in the design.
  - e. Valve nut elevation shall not exceed 4 feet below finished grade without extension.
  - f. Valves shall be placed at connections to existing infrastructure.
3. Blow-offs shall be placed at the ends of water lines, at low points in the system, and at other locations as shown on the City's Standard Specifications. Alternatively, fire hydrants may be used to fulfill this requirement.

#### D. STATIONS

- 1. Air-Vacuum Valve Stations:
  - a. Air-vacuum valve station venting shall be located in a landscaped area near the edge of the right-of-way (ROW).
  - b. Air-vacuum valve stations shall be placed at high points on transmission lines and at other locations as required for proper system operation.
  - c. Air-vacuum valve stations shall be constructed as indicated on the drawings.
- 2. PRESSURE REGULATING STATIONS shall be provided at all locations where there is a connection between pressure zones.
  - a. The station plumbing shall consist of a main line and a by-pass line. The combined capacity of the main line and by-pass plumbing shall equal the capacity of the incoming pipe line. The main line will normally be one pipe size smaller than the incoming line and the by-pass line will be sized as required.
  - b. Plumbing will include pressure regulating valves on each line, isolation valves on each side of each regulating valve, and all appurtenant plumbing items, as indicated on the Standard Specifications.

## **SECTION 00400**

### **SECONDARY WATER DESIGN STANDARDS**

#### **PART 1 GENERAL:**

- A. The impact of any proposed water system on the existing water systems level of service will be reviewed by the City Engineer. The developer shall install any offsite improvements necessary to mitigate negative impacts to the existing secondary water systems' level of service and as required to provide water service to their development.
  - 1. Areas that will be supplied through the proposed development will be considered and the method of service to those areas will be determined by the City Engineer. Increased system size may be required for future development as outlined in the City's Secondary Water Master Plan and as dictated by the City's water modeling.
  - 2. The City Engineer shall consider and accept the system storage requirements for each development.
- B. Secondary water mains shall be located as indicated on the City's Standard Specifications and shall be located in ROW or dedicated open space. In the locations where the secondary water lines leave the public right-of way, a ten-foot wide utility easement to the City is required. This easement shall be centered on the water line. Utility easements for secondary water shall extend ten feet beyond dead ends.
  - 1. Easements shall be shown on the plat or, if outside plat boundaries, recorded using an easement form acceptable to the City Attorney granting the easements to the City. The offsite easement, entry number, and grantee name shall be shown and referenced on the plat.
- C. Each building and/or unit of separate ownership shall require a separate water service line.

#### **PART 2 DESIGN REQUIREMENTS:**

- A. PIPES
  - 1. Secondary Water systems shall be sized as described in the City's Capital Facilities Plan and shall be a minimum of 6 inches in public right-of-way.
  - 2. The cover over top of secondary water lines shall be a minimum of 36 inches and a maximum of 72 inches.
  - 3. Secondary water lines shall maintain a minimum 18 inches vertical distance from all other public utilities, including but not limited to sanitary sewer, storm drain, and drinking water lines.
  - 4. Secondary water lines shall be placed in the park strips as required by the City Standard Specifications.
    - a. Location shall be on the west side of north/south streets.
    - b. Location shall be on the south side of east/west streets.
    - c. Location shall be on the opposite side of the street from drinking water lines.
  - 5. The material for secondary water pipeline up to and including 18 inch shall be AWWA C900 DR 18. The material for pipelines larger than 18 inch shall be selected by the City Engineer.

6. Concrete thrust blocks are not allowed within roadways at intersections. For example, between existing and future curb lines. Thrust restraint shall be designed in accordance with the Standard Specifications.
7. Drains shall be installed at all low points on pressure irrigation lines.
8. Permanent dead-end mains shall not exceed 600 feet in length.
9. The maximum allowable deflection of pipe joints shall be less than or equal to half of the manufacturer recommended maximum deflection.
10. Water Service Connections shall be constructed as shown on the City Standard Specifications.
11. Secondary water main lines shall be extended to property lines to service future Development and end with blow-off.

**B. PRESSURES & VELOCITIES**

1. The normal minimum operating pressure in all parts of the system during peak day demand shall be 30 psi.
2. The maximum operating pressure is to be 90 psi. Higher pressures can be used with acceptance from the City Engineer, based on pipe strength, the presence and nature of service connections, and the potential for transient pressure surges in the subject area of the system.
3. The system shall be designed for maximum pipe line flow velocities to not exceed 6 feet per second.

**C. VALVES & BLOW-OFFS**

1. Valve placement:
  - a. Valves shall be placed at the projection of the end of curb and gutter radius sections at the point of curvature.
  - b. Valves shall be placed at intervals not to exceed 800 feet.
  - c. At intersections, valves shall be placed on at least three branches of the system.
  - d. Valves shall be placed within 10 feet of the upstream and downstream ends of casing pipes.
  - e. Valves shall be placed at connections to existing infrastructure.
2. Blow-offs shall be placed at the ends of water lines at the low points in the system, and at other locations as shown on the City's Standard Specifications.

**D. STATIONS**

1. PRESSURE REGULATING STATIONS shall be provided at all locations where there is a connection between pressure zones.
  - a. The station plumbing shall consist of a main line and a by-pass line. The combined capacity of the main line and by-pass plumbing shall equal the capacity of the incoming pipe line. The main line will normally be one pipe size smaller than the incoming line and the by-pass line will be sized as required.
  - b. Plumbing will include pressure regulating valves on each line, isolation valves on each side of each regulating valve, and all appurtenant plumbing items, as indicated on the Standard Specifications
2. Air-Vacuum Valve Stations:

- a. Air-vacuum valve station venting shall be located in a landscaped area near the edge of the right-of-way (ROW).
- b. Air-vacuum valve stations shall be placed at high points on transmission lines and at other locations as required for proper system operation.
- c. Air-vacuum valve stations shall be constructed as indicated on the drawings.

## SECTION 00500

### STORM DRAIN DESIGN STANDARDS

#### PART 1 GENERAL:

- A. The impacts of any proposed storm drain system to the existing drainage systems level of service will be reviewed by the City Engineer. The developer shall install any offsite improvements necessary to mitigate negative impacts to the existing storm drain systems' level of service and as required to provide storm drain capacity for their development.
  - 1. Areas that will be drained through the proposed development will be considered and the method of drainage for those areas will be determined by the City Engineer. Increased system size may be required by the City Engineer for future development.
- B. All drainage systems shall be capable of passing the storm runoff from a 100-year event without flooding buildings. Additionally, the capacity of all detention systems shall be sufficient to contain the anticipated runoff volume from the 100-year storm event. Undetained flows from 100-year storm events which are upstream of a detention basin and within the same drainage must be conveyed into that detention basin. Storm drain lines and inlets shall be upsized as necessary to ensure that 100-year flows are conveyed to the detention pond.
- C. Storm drains shall be located as indicated on the City's Standard Specifications and shall be located in the ROW or dedicated open spaces. Storm drain lines shall be extended at developer's cost to property lines to accommodate future development and shall end at a manhole. In locations where the storm drain leaves the public ROW, a 20-foot wide utility easement to the City is required. This easement shall be centered on the storm drain line. Utility easements for storm drain shall extend 10 feet beyond dead end structures.
  - a. Easements shall be shown on the plat or, if outside plat boundaries, recorded using an easement form acceptable to the City Attorney. The offsite easement, entry number, and grantee name shall be shown and referenced on the plat.
  - b. Public and private storm drainage shall not be commingled unless the private property owners choose to accept public storm drainage into their private infrastructure. In such a case the private property owner shall grant an easement to the City accepting that the drainage is the full responsibility of the property owner and execute an agreement with the City that is recorded on the property in the Utah County Recorder's office. This agreement shall release and indemnify the City from potential liabilities associated with the drainage and associated infrastructure, allow the City to enter the property to maintain, repair, or replace the improvements if necessary and bill the property owner, and provide for an automatic lien on the property in the event the property owner does not reimburse the City for its costs.

#### PART 2 SUBMITTALS:

- A. **Hydrology and Drainage Plan:** Prior to beginning design on any storm drain facilities, a hydrology and drainage plan and report shall be submitted and approved in accordance with Section 00510.
- B. **Low Impact Development (LID) Plan:** Redevelopment projects that disturb greater than or equal to one acre, including projects less than an acre that are part of a larger common plan of development or sale which collectively disturbs land greater than or equal to one acre must provide a site-specific and project specific LID plan in accordance with Section 00520.

- C. **Design Submittals:** Once the development has approved drainage and LID plans in place, regular design submittals following the Standard Specifications may proceed.

### PART 3 DESIGN REQUIREMENTS:

#### A. CONDUITS

1. **Design Flow.** Storm drain lines shall be designed to convey the 10-year storm event. Design capacity of the pipe shall be based on full flow capacity without pressurization.
2. **Minimum Pipe Size.** All public storm drains shall be constructed with a minimum size of 15-inches in diameter.
3. **Pipe Material.** All storm drain pipes must be constructed with reinforced concrete pipes. Dual wall HDPE pipe (ADS N-12 or equal) may be allowed if one of the following requirements are met:
  - a. The public storm drain pipe is being installed outside of any existing or future roadway and is in an area that will be permanently non-load bearing.
  - b. The pipe is acting as a transition from private to public storm drain infrastructure and the transition is located at a combo box such that ADS does not extend into the roadway.

The following table (Table 2) shall be utilized when choosing a Manning's "n":

<b>Table 2. Values of Manning's Coefficient (n) for Channels and Pipes</b>	
Conduit Material	Manning's n
Plastic pipe	0.012
Steel/cast iron pipe	0.013
Concrete pipe	0.013
Corrugated metal pipe	0.025
Concrete-lined channel	0.015
Excavated or Dredge Channels	
Earth channel - straight and uniform	0.025
Earth channel - winding, fairly uniform	0.03
Rock	0.04
Unmaintained	0.065
Natural Channel	
Fairly regular section	0.06
Irregular section with pools	0.07

4. **Minimum Cover.** Minimum cover shall be as per manufacturer's recommendation over all storm drain lines. In no case shall cover be less than 18 inches.
5. **Utility Conflicts:**
  - a. Storm Drain lines shall maintain a minimum 18 inches vertical distance from all other public utilities, including but not limited to sanitary sewer, secondary water, and drinking water lines.

6. **Minimum and Maximum Slope / Velocity.** Storm drain lines shall be designed such that the maximum velocity does not exceed 20 ft/sec for a pipe flowing full and that the minimum velocity in the 10-year storm is at least 3 ft/sec. The minimum pipe slopes and corresponding minimum 10-year storm flow rates shall be per Table 3:

Table 3. Minimum Pipe Slopes in Concrete Storm Drains			
Pipe Size (in)	Full Pipe Flow (cfs)	Minimum Slopes (ft/ft)	Minimum 10-year Storm Event Flow (cfs)
15	3.7	0.0032	NA
18	5.3	0.0026	2.57
21	7.2	0.0021	3.54
24	9.4	0.0017	4.86
27	11.9	0.0015	5.87
30	14.7	0.0013	7.27
33	17.8	0.0011	9.34
36	21.2	0.0010	10.78
42	28.9	0.0008	15.05
48	37.7	0.0007	18.40
54	47.7	0.0006	23.19
60	58.9	0.0005	30.49
66	71.3	0.0005	30.62
72	84.8	0.0004	42.61

7. **Configuration.** Where pipes of different diameters connect into a drainage structure, the inside top of the smaller pipe shall match the inside top of the larger pipe.

B. MANHOLES

1. **Location.** A manhole or cleanout structure shall be located at the upstream end of a storm drain conduit and at all changes in pipe size, horizontal alignment, slope, and material of the storm drain. A 12-foot paved access road shall be constructed to all manholes and shall be capable of supporting H-20 loading. Where future development renders the vertical alignment of an access road uncertain, the pavement requirement can be postponed until the land develops so long as the developer also owns the undeveloped land. However, the developer shall be required to post a cash only bond with the City to guarantee completion of such pavement with an automatic escalation clause to account for inflation and cost increases.
2. **Spacing.** Maximum spans between manholes or other junction structures shall be 400 feet from center to center.
3. **Size.** The minimum manhole size shall be 4-foot diameter. 5-foot diameter manholes shall be used in the following situations:
  - a. At all intersections of three or more 8-inch or larger pipes
  - b. Where the deflection angle of the pipeline exceeds 90 degrees

- c. When both items “a” and “b” are designed in the same manhole, a 6-foot manhole is required.
- 4. **Sump Manholes.** Sump manholes designed to infiltrate water are not permitted except in open spaces as part of an approved Low Impact Development Plan as outlined below.
- 5. **Testing.** Testing shall be required and shall conform to ASTM C 1244, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test. If manhole fails test initially, developer shall make necessary repairs per the manufacturer’s recommendations. The manhole shall be re-tested until the satisfactory test is obtained. During the test, the developer shall:
  - a. Plug all lift holes with a non-shrink grout
  - b. Plug all pipes entering manhole and securely brace plugs during test; and
  - c. Place a test head at inside top of cast iron frame; the seal shall be inflated in accordance with manufacturer’s recommendations.
- 6. **Configuration.** Storm drain structures shall be constructed as indicated in the Standard Specifications.

#### C. INLETS

- 1. **Location.** Inlet boxes shall be placed as follows:
  - a. Spaced at no more than 400 feet apart to collect sheet flow of storm water.
  - b. Located at the uphill end of curb returns, unless one is already needed on the downhill side due to slope constraints.
  - c. On lot lines.
  - d. On sags.
- 2. **Cleanout Boxes.** Cleanout boxes shall be located at every change in alignment or slope and at junctions with other lines.
- 3. **Restrictions.** Sufficient inlets shall be included to eliminate the need for waterways. Waterways are not allowed in public streets.
- 4. **Configuration.** Storm drain structures shall be constructed as indicated on the City Standard Specifications. Single gutter inlet boxes are not sufficient for structures which contain more than one pipe connection; in this case, a combination gutter inlet & cleanout box is required.

#### D. HYDRAULIC CAPACITY OF STREETS

- 1. **Design Flow.** Streets shall be designed to convey the 100-year storm discharge from upstream to downstream (i.e. avoid local street sags or low points).
- 2. **Cul-De-Sacs and Dead-End Streets.** Downhill-sloping cul-de-sacs and dead ends should be avoided. If unavoidable due to design constraints, means to safely convey runoff from design storm events across the site must be provided through a trapezoidal channel (designed for the 100-year event and conveyed to a detention basin or water body), which shall be shown on plat with appropriate drainage easements.

#### E. ENCLOSED/OPEN CHANNEL TRANSITIONS



1. **Location and Design.** Energy dissipation is required at all enclosed-to-open-channel and open-to-enclosed-channel transitions and shall be designed according to the Mile High Flood District Urban Storm Drainage Criteria Manual. See Volume 2 Chapter 9.3.2, "Energy Dissipation and Erosion Protection". Specifically. See Chapter 9.3.2.3 "Rock Sizing for Riprap Apron". Note that rock sizes referenced in the figures in the text are defined in the Open Channels Chapter in Section 8. Gradations are specified in Figure 8-34. Bedding requirements are also discussed in this section. The document can be found at the following link: <https://mhfd.org/resources/criteria-manual/>)

#### F. OPEN CHANNELS

1. **Location.** Land that lies within a drainage corridor or natural drainage course shall be left in its natural state whenever possible. The ability of the land to naturally channel, retain, and drain storm water shall be maintained and enhanced in ways that augment the existing natural system.  
  
No subdivision or site design will be permitted that would create a flood or flooding hazard to adjoining or nearby properties including public roads and property.
2. **Channel Section.** The banks of the open channel shall not exceed three (3) feet horizontal to one (1) foot vertical in gradient. The widths of the open channel shall be designed such that the freeboard requirements are met.
3. **Design Flow.** Open channels shall be designed to convey the 100-year storm discharge.
4. **Freeboard.** Minimum freeboard over the 100-year high water elevation shall be the lesser of 1.0 times the depth of the channel depth or 2 feet. In no case, however, shall the freeboard be less than 1 foot.
5. **Restrictions.** No fences or structures shall be constructed across the waterway that will reduce or restrict the flow of water.
6. **Erosion.** Drainage channels shall be designed to prevent erosion, according to Federal Highway Administration Hydraulic Engineering Circular (HEC) Number 15, "Design of Roadside Channels with Flexible Linings".
7. **Material.** The banks of the waterway shall be protected with permanent vegetation. If vegetation will not function properly, rip-rap shall be used. The bed of the waterway shall be protected with turf, sod, or rip-rap. If turf or sod will not function properly, rip-rap shall be used. If the flow velocity in the waterway is such that erosion of the turn side wall will occur and said velocity cannot be decreased by velocity control structures, then rip-rap shall replace turf on the side walls.
8. **Slope.** The gradient of the waterway bed should not exceed a grade that will result in a velocity that will cause erosion of the banks of the waterway.

#### G. DETENTION BASINS AND ORIFICES

1. Release Rate and Volume Capacity.
  - a. The capacity of all detention systems shall be sufficient to contain the anticipated runoff volume from the 100-year storm event, using the methods specified in this manual, over those portions of the gross aggregate area under design, with a maximum release determined based on the drainage area specified by the City and not to exceed 0.2 cfs/acre.
  - b. Flood control detention is not required when there is a runoff route directly to Utah Lake or the Jordan River, excluding all tributary channels that might receive flow downstream of the subjected area. Direct runoff routes include public Right-of-Ways (typically a street) or piped. Overland flow routes must adhere to the specifications within this design manual, and treatment and LID requirements still

- apply to these flows.
- c. Volume that is required to be detained is not allowed to be decreased due to evaporation.
  2. **Maintenance.** All ponds are to be maintained by the HOA or similar entity unless it is a regional pond which serves multiple developments and is identified as a system improvement in the City's Impact Fee Facilities Plan, or alternatively meets the definition of system improvement in Utah Code § 11-36a-102 and is legislatively adopted into the City's Impact Fee Facilities Plan.
  3. **Freeboard.** All ponds, except for above-ground detention in private parking lots that spill to a street, shall have a minimum of 1' of freeboard above the 100-year high water elevation. However, above-ground detention ponds in private parking lots shall provide 1' of freeboard to the finished floor of habitable structures.
  4. **Emergency Outlet / Overflows.** Any flows that exceed design standards and overtop embankments shall be on natural ground, sufficiently apart from the embankment to prevent erosion. If overtopping must occur at the embankment, a spillway shall be designed to prevent and control erosion.
  5. **Location.** Detention ponds are not allowed within residential lots unless all the following requirements are met:
    - a. The area contributing to the detention basin is not part of an HOA and the lot is not within an HOA,
    - b. The maximum number of units draining to the pond is 30,
    - c. The detention pond is completely above ground (i.e. underground storage is not allowed),
    - d. The pond is part of a single-phase subdivision,
    - e. The pond's freeboard line location does not encroach into the public utility easement (PUE) or other easements and is set back 30 feet minimum from private lot structures with foundations, attached decks, driveways, patios, and porch walkways.
    - f. The pond is designed pursuant to the Standard Specifications (see details SD-08 and SD-09),
    - g. All pipes to and from the detention pond are no longer than 30 feet and must be centered within a 20-foot wide utility easement to be dedicated to the City (see PART 1 GENERAL/C of this specification), and
    - h. The Plat identifies that the property owner of the residential lot on which the detention pond is located is responsible to maintain all surface improvements (i.e. landscaping, paving, etc) per the accepted plans.
  6. **Access.** All inlet/outlet structures shall be easily accessible. All inlet/outlet structures must be provided with access roads with a maximum slope of 15%. An exception is made if the distance to the inlet/outlet is within 10 feet of the back of sidewalk and/or the pond is less than 2,500 SF.
  7. **Side Slopes.** Embankment slopes shall be no greater than 3:1 for both upstream and downstream slopes and must include erosion protection. 2:1 slopes are acceptable for downstream slopes if recommended by a licensed geotechnical engineer.
  8. **Liner.** Underground storage systems that are not designed to infiltrate water into the ground shall be lined with a durable impermeable barrier. Geomembrane systems shall include a PVC or HDPE lines that is at least 140 mils thick with a needle-punched non-woven geotextile protective layer.

9. **Geotechnical.** The historic high water table is to be determined based on local ground water data (if available) and test pit(s) or boring(s). The data is to be used to evaluate any negative historic or potential impacts on the development through ground water infiltration. Identify any bedrock encountered and evaluate the potential impact bedrock may have from the infiltration of storm water runoff.
10. **Landscaping.** All ponds are to be landscaped in accordance with the City's Land Development Code.
11. **Parking Lots.** Above ground detention ponds in private parking lots shall have a maximum ponded depth of 8 inches.
12. **Outlet Design:**
  - a. Low-flow pipes are required in all detention ponds to convey flows from small storms.
  - b. Orifice plates shall be located in the outlet control box structure per standard drawings SD-8 and SD-9.
  - c. The minimum size of orifice opening shall be 4 square inches.
  - d. Every effort shall be made by the engineer to limit head to 4 feet or less by increasing the size of the pond.
  - e. Orifice plates with openings that are less area than a 15-inch diameter circle must have rectangular openings and be protected by a snout. Orifice plates with openings that are equal to or greater than 15-inches in diameter may be circular and do not require a snout.

#### H. RETENTION BASINS

1. **Volume Capacity:**
  - a. The capacity of all retention systems must be such that the volume of the 100-year 24-hour storm event will be drained within 48 hours or less. This includes infiltrating the 80<sup>th</sup> percentile storm (see LID requirements below) and draining all additional volume of downstream facilities.
  - b. Detention/retention combination ponds must be sized for the volume that is required to be retained in addition to the volume that is required to be detained and still meet all other detention/retention requirements.
  - c. Volume that is required to be retained is allowed to be reduced due to evaporation so long as it follows LID requirements (see below).
2. **Freeboard.** All retention ponds, including retention/detention combination ponds, shall have a minimum of 1' of freeboard above the 100-year high water elevation.
3. **Emergency Outlet / Overflows.** Any flows that exceed design standards and overtop embankments shall be on natural ground, sufficiently apart from the embankment to prevent erosion. If overtopping must occur at the embankment, a spillway shall be designed to prevent and control erosion. Infiltration basins shall be designed to convey overflows to the public ROW or to a location that has been dedicated for drainage purposes and will protect adjacent property from flooding.
4. **Access / Location.** All inlet/outlet structures shall be easily accessible. All inlet/outlet structures must be provided with access roads with a maximum slope of 15%. An exception is made if the distance to the inlet/outlet is within 10 feet of the back of sidewalk and/or the pond is less than 2,500 SF.
5. **Side Slopes.** Embankment slopes shall be no greater than 3:1 for both upstream and downstream slopes and must include erosion protection. 2:1 slopes are acceptable for downstream slopes if recommended by a licensed geotechnical engineer.

6. **Landscaping.** All ponds are to be landscaped in accordance with the City's Land Development Code.

I. CULVERTS

1. **Design Flow.** Bridges and Culverts shall be designed to convey the 100-year storm event.
2. **Freeboard.** Minimum freeboard over the 100-year high water elevation shall be the lesser of 1.0 times the depth of the headwater or 2 feet. In no case, however, shall the freeboard be less than 1 foot.
3. **Backwater.** Backwater surface computations upstream of culverts shall be performed and shown to be non-damaging to upstream properties.
4. **Configuration.** Culverts shall be designed to have a single opening as multiple side-by-side culverts are susceptible to clogging. Headwalls and wingwalls are required for all conduits which are 42-inch in diameter or larger. Flared end sections are allowed for conduits less than 36-inch in diameter.
5. **Debris.** A culvert/bridge blockage factor of 50 percent shall be used for culverts/bridges placed in drainages with upstream debris producing potential as determined by the City.
6. **Grate.** Grates are required on all culverts 24-inches or larger.

J. TREATMENT DEVICES

1. **Design Flow.** Treatment systems shall be sized to treat 100 percent of the first flush (2-year storm event) and to bypass the maximum flow to the treatment device during a 100-year storm event with no washout of stored pollutants. If flows are controlled by a detention basin prior to treatment, the treatment system shall be sized to treat flows at applicable release rates from the detention basin based on the applicable storm event (2-year for treatment, 100-year for bypass).
2. **Treatment Requirements.** Treatment systems shall be designed to treat all of the flow from developed areas with no bypass into the City storm water system of the treatment design storm parameters. Treatment requirements are as follows:
  - a. Treatment systems shall be designed to remove 80% of the total suspended solids (TSS) 110 microns or larger from the storm water.
  - b. Treatment systems shall be designed to remove the discharges of oil that cause a film or sheen upon or cause discoloration of the surface water
  - c. Treatment systems shall be designed to remove all floatables from the storm water.
3. **Allowable Products.** Only products that have been approved for pretreatment by the Washington Department of Ecology under general use level designation (GULD) or conditional use level designation (CULD) shall be allowed.
4. **Privately Maintained Treatment Devices.** Privately maintained treatment devices shall be located outside of the public right-of-way in common areas or other private property.

K. LOW IMPACT DEVELOPMENT (LID) IMPROVEMENTS

1. **Design Volume.** LID systems are required and must retain volume from at least the 80<sup>th</sup> percentile rainfall event (0.41 inches of rain for Saratoga Springs).
2. **Ownership.** LID systems shall be privately-owned-and-operated.

3. **Selection and Design.** The feasibility, selection and design of LID systems shall be in accordance with Section 00520.
4. **Long-Term Report Requirements.** As part of design, provide a plan using the Utah Storm Water Advisory Committee template (as modified by the City of Saratoga Springs) that will ensure the long-term viability of the storm water infiltration facilities or other LID control measures.

## SECTION 00510

### HYDROLOGY AND DRAINAGE PLAN

#### PART 1 DRAINAGE PLAN REQUIREMENTS:

- A. A Hydrology and Drainage Plan is required for all multi-lot developments and single lot developments larger than 0.5 acres. The report shall contain the following information:
1. General description of the projection, including:
    - a. Location (township, range, section, subdivision and lot).
    - b. Existing site conditions including all existing drainage facilities, and any proposed modifications to drainage facilities.
    - c. Off-site drainage features and characteristics upstream and downstream of the site and any known drainage problems.
    - d. Proposed facilities that will be used to manage on-site and off-site storm water runoff associated with the development.
    - e. Master planned drainage facilities and how the development and proposed drainage facilities conform to the storm drain master plan.
  2. One or more drawings showing the following:
    - a. Existing and proposed property lines.
    - b. Existing and proposed topography (2-foot maximum contour interval) extending at least 100 feet beyond the site.
    - c. Existing and proposed streets, easements, and rights-of-way.
    - d. Existing drainage and irrigation facilities.
    - e. FEMA floodplain and floodway (if applicable)
    - f. Drainage basin boundaries and subbasin boundaries on a topographical map.
    - g. Existing and proposed flow patterns and paths.
    - h. Location of proposed drainage facilities including: major storm drain pipes, swales, channels, and retention and detention basins.
    - i. Location of storm water treatment facilities.
    - j. Location of drainage easements required.
    - k. Other relevant drainage features
    - l. Scale, north arrow, legend, title block showing project name, date, preparers name, seal and signature.
  3. Drainage calculations, including:
    - a. Design runoff calculations (see next section for approved hydrology computation methods):
      - i. Methodology used
      - ii. Summary of pertinent model inputs
      - iii. Results for 2-year, 10-year, and 100-year events.
    - b. Model results in sufficient detail for review of design elements, including:
      - i. Peak flow rates in all major facilities
      - ii. Hydrographs for all storage elements
      - iii. 80<sup>th</sup> percentile storm runoff volume
    - c. Description of compliance with applicable flood control requirements and FEMA requirements, if applicable.
  4. The Conceptual Drainage Plan shall be submitted to the City for review and approval prior to the development of the detailed design drawings.

## PART 2 HYDROLOGY:

### A. DESIGN STORMS

1. **Rainfall Depth and Intensity.** For storm drain design, rainfall depth and intensity shall be defined as shown in Table 4.

<b>Table 4. Precipitation Frequency Estimates with 90% Confidence Intervals (inches)</b>			
Duration	Average Recurrent Interval		
	2-yr	10-yr	100-yr
5-min	0.15	0.26	0.51
10-min	0.23	0.40	0.78
15-min	0.28	0.49	0.96
30-min	0.38	0.66	1.29
60-min	0.47	0.82	1.60
2-hr	0.57	0.92	1.73
3-hr	0.64	0.98	1.74
6-hr	0.81	1.16	1.84
12-hr	0.98	1.39	2.06
24-hr	1.10	1.51	2.11

2. **Distribution and Duration.** Cloudburst rainfall events in Utah typically have durations ranging from a few minutes to three hours. Storms producing widespread rainfall over longer periods are less common and typically associated with slower-moving tropical storm remnants. Table 5 shall be used for sizing drainage and storm water facilities. Design storms for various infrastructure are listed in their applicable sections below.

Table 5. Design Storm Distributions (inches)*			
Time (min)	Return Period		
	2-yr	10-yr	100-yr
0	0.0000	0.0000	0.0000
5	0.0073	0.0067	0.0058
10	0.0073	0.0067	0.0058
15	0.0073	0.0067	0.0058
20	0.0073	0.0067	0.0058
25	0.0073	0.0067	0.0058
30	0.0073	0.0067	0.0058
35	0.1342	0.2337	0.4560
40	0.1060	0.1845	0.3600
45	0.0739	0.1287	0.2512
50	0.0471	0.0820	0.1600
55	0.0283	0.0492	0.0960
60	0.0217	0.0377	0.0736
65	0.0160	0.0279	0.0544
70	0.0122	0.0213	0.0416
75	0.0094	0.0164	0.0320
80	0.0085	0.0148	0.0288
85	0.0075	0.0131	0.0256
90	0.0061	0.0107	0.0208

Table 5. Design Storm Distributions (inches)*			
Time (min)	Return Period		
	2-yr	10-yr	100-yr
95	0.0073	0.0067	0.0058
100	0.0073	0.0067	0.0058
105	0.0073	0.0067	0.0058
110	0.0073	0.0067	0.0058
115	0.0073	0.0067	0.0058
120	0.0073	0.0067	0.0058
125	0.0073	0.0067	0.0058
130	0.0073	0.0067	0.0058
135	0.0073	0.0067	0.0058
140	0.0073	0.0067	0.0058
145	0.0073	0.0067	0.0058
150	0.0073	0.0067	0.0058
155	0.0073	0.0067	0.0058
160	0.0073	0.0067	0.0058
165	0.0073	0.0067	0.0058
170	0.0073	0.0067	0.0058
175	0.0073	0.0067	0.0058
180	0.0073	0.0067	0.0058

\*These design storms capture the critical elements of shorter-duration storms that often control in subbasins with short times of concentration.

## B. DRAINAGE BASIN CHARACTERIZATION

1. **Soil Classification.** The hydrologic soil group classification for the drainage basin must be determined by using a site specific analysis or from a soil survey, such as the Natural Resources Conservation Service (NRCS) soil survey data.
2. **Land Use.** Existing land use shall be obtained from site survey or analysis of current aerial photography. Future land use shall be estimated based on proposed development or from the City's General Plan if future development plans are unknown.
3. **Physical Parameters.** Physical parameters of a drainage basin, such as drainage basin area, length, and slope, shall be obtained using a current topographic map and existing storm drain facilities. In areas of proposed development, physical parameters shall be obtained from the development concept.

## C. RUNOFF COMPUTATIONAL METHODS

1. **Acceptable Methods.** There are two standard methods that are acceptable for estimating the peak runoff and volumetric runoff: the Federal Aviation Administration (FAA) method and a dynamic hydrograph simulation model. Table 6 indicates the requirements to be fulfilled in order to use each method.



Table 6. Runoff Computational Method Requirements	
Method	Restrictions
FAA	Catchment Area <sup>1</sup> < 50 Acres No in-series (cascading) detention basins are proposed
Hydrograph Simulation Model	No Restrictions

<sup>1</sup> Note that catchment area is specific to the storm drain element being sized or designed. E.g. If pipelines within a 20 acre development are being sized, required flows may be calculated using the FAA method. However, if the flows from the development discharge to a detention basin that serves 100 acres, a hydrograph simulation model would be required for calculating flows at the detention basin.

## 2. FAA Method.

- a. **Peak Runoff Equation.**  $[Q=CIA]$  where,
  - i. Q = Instantaneous Peak Runoff (cfs)
  - ii. C = Runoff Coefficient (See Table 4)
  - iii. I = Average Intensity (inches/hour)
  - iv. A = Area (acres)
- b. **Time of Concentration.** Defined as the time to peak discharge. Time of concentration shall be calculated using the method found in the Natural Resources Conservation Service Technical Release 55, June 1986 (TR-55). TR-55 contains a sample worksheet (Worksheet 3), which can be used to calculate the time of concentration. The minimum allowable time of concentration to be used in runoff calculations shall be 5 minutes. Careful consideration should be given to each subbasin, including separate consideration of subbasin portions (such as paved areas) that have the potential of producing a higher peak runoff than the whole basin.
- c. **Rainfall Intensity.** Rainfall intensity shall be calculated from the precipitation-frequency table (Table 1). The duration is assumed to equal the time of concentration. The required design storm frequency is also defined in the precipitation-frequency table.
- d. **Runoff Coefficients.** The runoff coefficients in Table 7 shall be used.

Table 7. Runoff Coefficient for Rational Method			
Surface	2-yr	10-yr	100-yr
Landscaping	0.01	0.07	0.44
Roofs	0.74	0.78	0.84
Paved	0.84	0.86	0.89

- e. **Restrictions.** This method is only allowed for catchments less than 50 acres.
- f. **Runoff Computations.** Runoff computations for directly connected impervious areas (DCIA) shall be performed separately from areas that have pervious surfaces.

### 3. DYNAMIC HYDROGRAPH SIMULATION MODEL

- a. **Acceptable Software.** Acceptable modeling softwares include the following:
  - i. AutoDesk® SSA (acceptable hydrology methods within AutoDesk® SSA include HEC-1, EPA, SWMM, and TR-55. If using TR-55, separate subbasins for pervious and impervious areas shall be created to be in compliance with the requirements described below. Use of other hydrology methods is not allowed);
  - ii. HEC-HMS;
  - iii. SWMM.
- b. **Model Output Requirements.** Simulation models and their accompanying output files must be full and complete for all stormwater infrastructure with catchments greater than 50 acres, including pipe sizing. Result summaries must include, at a minimum, the standard outputs from the software for subbasins, nodes, links, and storage facilities. All major conveyance infrastructure must be modeled and submitted in result summaries. Result summaries must be accompanied by a corresponding figure which labels each of the aspects listed above. An electronic copy of the model must also be submitted.
- c. **Input Categories.** There are four main input categories in a dynamic hydrograph simulation model, which are: design storm, loss method, transform method, and routing method. The design storms shall be obtained using the procedure described below. For the loss, transform, and routing methods, there are often multiple options that can be selected within a given model. Below is a description of the approved methods.
  - i. **Loss Method.** The NRCS Curve Number Loss Method shall be used. The primary input parameter for this method is the runoff Curve Number (CN). As described below, for developed areas, the percent of impervious area is also entered. The initial abstraction is typically left blank as the program will calculate the initial abstraction based on the CN.
    - (a). **CN for Pervious Areas.** Tables 2-2 a-d in TR-55 shall be used to determine CNs. A composite CN may be used to estimate runoff from areas with pervious surfaces.
    - (b). **Modeling Impervious Areas.** The DCIA should be used when modeling developed areas. When modeling a developed subbasin to estimate storm water runoff, the pervious and impervious areas must be modeled using separate subbasins. Some methods, including TR-55, suggest that a composite CN can be selected that will account for impervious area. However, in western areas of the United States including Utah, those methods tend to underestimate the runoff potential for the impervious areas and may not be used. As described above, most dynamic hydrograph simulation models are capable of modeling DCIAs by simply entering a percentage of a subbasin that is DCIA. Other models/software may require that two separate subbasins be modeled, one for the pervious area, and one for the DCIA. Regardless of the model or method selected, the final results must be based on separate consideration of pervious and impervious drainages and may not use a composite CN for these two drainage types.

ii. **Transform Method.** The NRCS Unit Hydrograph Transform Method shall be used. This method requires the input of a single variable: lag time.

- (a). **Lag Time for Natural Watersheds.** The U.S. Army Corps of Engineers' version of Snyder's equation shall be used to calculate the lag time for natural watersheds (USBR, 1989) as shown below:

$$\text{Lag Time} = C_t \left( \frac{LL_{ca}}{S} \right)^{0.33}$$

$C_t$  = 1.6

$L$  = Length, in miles, of the longest watercourse

$L_{ca}$  = Length, in miles, along  $L$  to the centred of the basin

$S$  = Overall drainage basin slope, in feet/mile.

- (b). **Lag Time of Urban Areas.** The lag time for small urban areas should be assumed to be equal to the time of concentration. TR-55 contains a sample worksheet (Worksheet 3) that can be used to calculate the time of concentration.

iii. **Routing Method.** The Muskingum-Cunge method shall be used for routing runoff hydrographs. This method uses "reaches" to connect subbasins. Examples of reaches in the real world include open channels and pipes. This method requires that the following parameters be input:

- (a). Length – Total length of the reach element.
- (b). Slope – Average slope for the entire reach.
- (c). Invert – Optional. Typically, not used.
- (d). Cross Section Shape – Multiple cross sections are available to select from. Depending on the cross section chosen, additional information is required (i.e. diameter, side slope).
- (e). Manning's "n" – Average value for the entire reach. Typical values for Manning's "n" used for storm drain conveyance facilities area shown in Table 2.

d. **Model Calibration.** Model calibration shall be required by the applicant during the review process if data output is inconsistent with the Citywide model maintained by the City.

## SECTION 00520

### LOW IMPACT DEVELOPMENT (LID) PLAN

#### PART 1 LID PLAN REQUIREMENTS:

- A. **General Requirement.** Redevelopment projects that disturb greater than or equal to one acre, including projects less than an acre that are part of a larger common plan of development or sale which collectively disturbs land greater than or equal to one acre must provide a site-specific and project specific LID Report aimed at net gain to onsite retention or a reduction to impervious surface to provide similar water quality benefits. If a redevelopment project increases the impervious surface by greater than 10 percent, the project shall manage rainfall on-site, and prevent the off-site discharge of the net increase in the volume associated with the precipitation from all rainfall events less than or equal to the 80<sup>th</sup> percentile rainfall event. This objective must be accomplished by the use of Low Impact Development (LID) practices which are outlined in this section.
- B. **LID Report Requirements.** Submit an LID Report which includes the following information:
1. **Location Description.** The report must clearly identify the location of the development site by address. Latitude and Longitude coordinates are to be provided if an address is not available or applicable. The report must include an aerial image of the site showing property boundaries, adjacent developments or reference points including roads, and the locations of the infiltration site(s).
  2. **Topography.** The report must describe the pre- and post- development site topography including vegetative types and land surface contours at a minimum of 1-foot intervals.
  3. **Design Volume.** The report must identify the minimum allowable retention volume, which is 0.41 inches across the subject area.
  4. **Calculations.** All calculations which are outlined in the Standard Specifications which relate to the chosen LID measure must be submitted.
  5. **Qualifications.** The report shall include a summary and concluding statement from a qualified individual regarding the feasibility of on-site retention of storm water as required by the State General Permit via infiltration, rain harvesting, and evaporation. This individual is considered qualified if they are licensed in the state of Utah as a Professional Geologist or a Professional Engineer.
  6. **Engineer's Certification.** "I hereby certify that this report for the [list LID control here, i.e. "onsite retention and infiltration of storm water"] of this development was prepared by me (or under my direct supervision) according to good engineering practices and applicable engineering standards. I understand that the City assumes no responsibility or liability whatsoever for the feasibility and long-term viability of the facilities addressed herein."

#### PART 2 ALLOWABLE LID CONTROL MEASURES

- A. The following is a list of allowable LID control measures that can be used to meet retention requirement and LID requirements. The Utah Department of Water Quality (UDWQ) has provided design guidance for these controls that can be found in "A Guide to Low Impact Development within Utah" or at the following link: <https://deq.utah.gov/water-quality/low-impact-development>. The UDWQ design guidance shall be used if design guidance for the controls listed below is not included in this document.
1. **Groundwater Infiltration.** All infiltration systems must meet the requirements outlined in the City's Standard Specifications as outlined in this document. The following infiltration methods are allowed:

- a. Infiltration Basins (See Fact Sheet ID-1 in the UDWQ LID manual for more information)
  - b. Infiltration Trenches (See Fact Sheet ID-2 in the UDWQ LID manual for more information)
  - c. Dry Wells (See Fact Sheet ID-3 in the UDWQ LID manual for more information)
  - d. Underground Infiltration Galleries (See Fact Sheet ID-4 in the UDWQ LID manual for more information)
2. **Bioretention.** Bioretention controls, including Rain Gardens, Bioretention Cells, Bioswales, Vegetated Strips, and Tree Box Filters, are allowable LID control measures. See fact sheets BR1 through BR5 in the UDWQ LID manual for more information.
  3. **Rainwater Harvesting.** Rainwater harvesting is allowed in accordance with the requirements of Utah Code § 73-3-1.5. Depending on the volume of rainwater collected and stored for beneficial use, the new or redevelopment must register with and meet the requirements of the Utah Division of Water Rights to harvest rainwater, found on their website: <http://waterrights.utah.gov/forms/rainwater.asp>. See Fact Sheet HR-1 in the UDWQ LID manual for more information.
  4. **Minimize Impervious Area.** Minimizing impervious area at developments reduces the flow volume into the City's System. Design guidance can be found on Fact Sheet SD-1 in the UDWQ LID manual.
  5. **Control through other LID measures.** Other LID control measures outlined in the UDWQ LID manual are allowed to be used if shown to be feasible and to meet the intent of this section.
  6. **Restrictions.** No LID control measure is allowed to be designed within park strips. Pervious surfaces are not permitted in public areas and must be approved by the City Engineer in order to be allowed in private developments. Class V underground injection wells, as defined by State Code, must be registered with the Utah Division of Water Quality and are not allowed in the City's Drinking Water Source Protection Zones 1.

### PART 3 FEASIBILITY EVALUATION

- A. **General.** An evaluation shall be completed to determine the feasibility of various LID control measures and develop a final LID solution. To assist in this evaluation, the City has prepared the "Saratoga Springs BMP Selection Flow Chart" attached at the end of this specification section. The LID Plan Report shall start at the top of the flow chart and document feasibility for each decision point until an appropriate LID solution is identified.
- B. **Infiltration Feasibility.** The preferred LID solution for most applications will be infiltration. Correspondingly, all LID plans must address the feasibility of infiltration. To consider infiltration, a geotechnical study must be completed which includes the following:
  1. Representative 20-foot borings identifying ground water level, soil types, and characteristics within any potential infiltration area at the following frequency:
    - a. Two (2) borings for the first 10,000 ft<sup>2</sup>.
    - b. One (1) additional boring for each 10,000 ft<sup>2</sup> thereafter; not to exceed a maximum of 10 borings in a single infiltration facility.
    - c. The number of borings may be reduced based on defined local geology by a licensed geologist to one additional boring for each 20,000 ft<sup>2</sup>.
    - d. Samples shall be taken at and below the proposed water/soil interface of the infiltration facility to sufficiently identify the Natural Resource Conservation Service (NRCS) soil group. These samples shall be analyzed by a certified laboratory. Additional samples shall be taken for any substantial changes in material at greater depths.

2. Allowed infiltration rates upon which the infiltration facility is to be designed will be determined based on the following:
  - a. A determination of Saturated Infiltration Rate for each sample based on the Hydrologic Soil Group and Typical Soil Texture as shown in Table 8.
  - b. The identification of the lowest Saturated Infiltration Rate among the samples.
  - c. Hydraulic conductivity testing of in situ soils according to ASTM D5856 may be used in replacement of Table 8 if the developer believes in situ soil rates differ from what is shown in Table 8 as long as the City Engineer accepts the results.
3. The lowest saturated infiltration rate determined from Table 8 shall be reduced by a factor of 2.5. The lowest calculated infiltration rate shall be reduced by a factor of 1.5 if ASTM D5856 is used in replacement of Table 8.

<b>Table 8. Saturated Hydraulic Conductivity Rate According to Soil Type</b>					
NRCS Hydrologic Soil Group	Typical Soil Texture	Saturated Infiltration Rate (mm/h)	Saturated Infiltration Rate (in/h)	Porosity	Field Capacity
A	Sand	200	8.0	0.437	0.062
A	Loamy Sand	50	2.0	0.437	0.105
B	Sandy Loam	25	1.0	0.453	0.190
B	Loam	12.7	0.5	0.463	0.232
C	Silt Loam	6.3	0.25	0.501	0.284
C	Sandy Clay Loam	3.8	0.15	0.398	0.244
D	Clay Loam & Silty Clay Loam	<2.3	<0.09	0.465	0.325
D	Clay	<1.3	<0.05	0.475	0.378

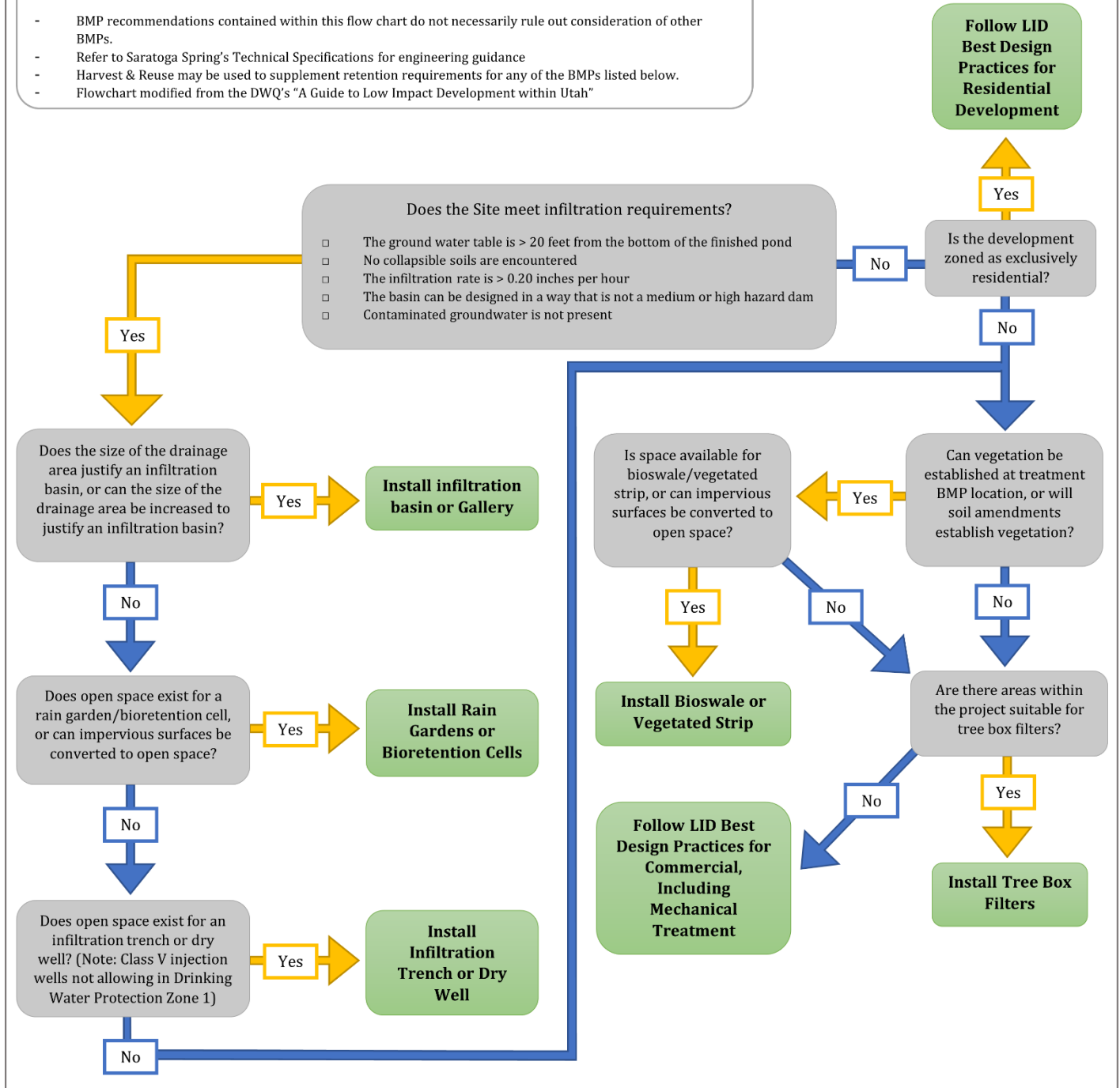
4. Infiltration will not be considered feasible (and will correspondingly not be allowed) if any of the following are true:
    - a. The ground water table or bedrock is  $\leq 20$  feet from the bottom of the finished pond.
    - b. Collapsible soils are encountered with a collapse potential greater than 2%
    - c. The saturated infiltration rate shown in the Table 8 (after accounting for factor of safety) is  $\leq 0.20$  inches per hour.
    - d. The infiltration basin will be classified as a medium or high hazard dam per State of Utah regulations.
    - e. Contaminated groundwater is present at the infiltration basin
- C. **LID Alternatives.** If infiltration of the 80<sup>th</sup> percentile storm is infeasible, consideration of other alternatives in the “Saratoga Springs BMP Selection Flow Chart” must be considered and addressed:
1. Based on the results of this evaluation, a rationale shall be provided for the use of alternative design criteria.

2. For bioretention, the engineer must evaluate and document the ability of these controls to practically and feasibly remove pollutants at the site.
3. For harvest and reuse, the Engineer must analyze and document the ability and feasibility of the development to practically capture, sort, and use rainwater on site.
4. The new or redevelopment project must document and quantify the LID control that will be used. The LID control measures selected should represent a reduction in runoff volume to the maximum extent reasonable if full retention of the 80<sup>th</sup> percentile storm is infeasible due to constraints such as high groundwater, soil conditions, slopes, accessibility, excessive costs, or others.

# Saratoga Springs BMP Selection Flow Chart

## Notes:

- BMP recommendations contained within this flow chart do not necessarily rule out consideration of other BMPs.
- Refer to Saratoga Spring's Technical Specifications for engineering guidance
- Harvest & Reuse may be used to supplement retention requirements for any of the BMPs listed below.
- Flowchart modified from the DWQ's "A Guide to Low Impact Development within Utah"





## SECTION 00600

### STREET DESIGN STANDARDS

#### PART 1 GENERAL:

1. Streets systems, consisting of curb and gutter, sidewalks, ADA ramps, street pavement, and appurtenant items shall be designed as described below, as shown in Tables 6 - 10, and as shown in the Standard Specifications.
  - a. Table 6 shows the ROADWAY DESIGN STANDARDS; including right-of-way widths, pavement widths, street grades, and appurtenant design criteria.
  - b. Table 7 shows the access management standards for all roadway types.
  - c. Table 8 shows the subgrade protection layer required to be placed to protect subgrade soils. Prior to placement of any typical pavement section, a subgrade protection layer must be placed. Directions for this are outlined on Table 11.
  - d. Table 9 shows the typical pavement sections required for the different categories of traffic. Different options are provided for some of the sections.
  - e. Table 10 shows the Geosynthetic Requirements for Type 1 and 2 geogrids if those options are utilized.
2. Streets shall be constructed with asphaltic concrete, untreated base course, and granular borrow material for sub-base and/or subgrade protection, and a geotextile as required.
  - a. Thickness of each course shall be determined based on the subgrade and pavement classification. Table 6 outlines the design standards. Table 8 outlines the required subgrade protection based on the design CBR of the subgrade. Table 9 outlines the required pavement section based on classification of the roadway.
  - b. Thickness shall be increased beyond the Standard Specifications if recommended by a geotechnical engineer.
3. No new street pavement will be cut into for three years after acceptance of pavement.
4. Street light locations shall be at intersections and every 300 feet, placed on alternating sides of streets, or 600 feet on the same side of the street:
  - a. At every intersection, corner, and any bends greater than 30 degrees in the road. The spacing requirements shall be met accordingly once these areas are developed.
  - b. Shall be installed at property lines where attainable.
  - c. Shall be a minimum of 5 feet from any tree. Branches may need to be pruned as determined by the engineering inspector in the field at the time of installation
  - d. Shall not be installed within 5 feet from the edge of any driveway.
  - e. Any structure such as block walls, fences, retaining walls, etc., shall leave a minimum of eighteen (18) inches to the face of the street light pole on all sides.
  - f. Wherever there is an overhead utility that may conflict with the installation of the street light circuits and/or street light poles, those conflicts must be resolved between the developer and the utilities involved before the street light bases are constructed at no expense of the City or Rocky Mountain Power. The resolution must be approved by the City and Rocky Mountain Power.
5. Fiber optic/communication conduit is required on public streets categorized as local, collector, and arterial per Standard Specification details ST-8, ST-9A, ST-9B, ST-10, ST-11, ST-12, ST-13, and ST-40.
6. Type 2 slurry seal shall be placed on all streets upon completion of paving.

7. Because preference is given to pedestrians, a driveway approach is required for all private accesses (APWA Plan 225 for commercial accesses and private streets, and City Standard DWG ST-4A for single-family residential accesses) unless recommended otherwise by the City Engineer, based on site-specific considerations, such as:
  - a. Speed, slope, and width of the adjacent street
  - b. Width of the proposed access
  - c. Volume across the proposed access
  - d. Drainage.
8. Curb returns adjacent to ADA ramps shall have a maximum slope of 2% where possible. Where the base of the curb ramp or the edge of the flush landing must join an intersection of two streets with running grades greater than 2 percent, the base of the curb ramp or the edge of the flush landing may be warped to meet the street running grade. Every effort shall be made to minimize this grade by warping the street cross slope plus or minus 4% on both legs of the intersection.
9. The following table serves as a guide to design professionals by providing a summary of the City of Saratoga Springs Street Design Standards. These Standards are required unless specifically accepted otherwise by the City of Saratoga Springs City Council. In the absence of standards specified by the City, street design shall conform to the latest edition of the American Association of State Highway and Transportation Officials (AASHTO) "A Policy on Geometric Design of Highways and Streets." Other published professional standards, i.e. ITE, ASCE, may be considered at the sole discretion of the City Engineer.

**TABLE 6**

Roadway Design Standards				
DESIGN ELEMENT	LOCAL (Class I)	COLLECTOR (Class II)	MINOR ARTERIAL (Class III)	MAJOR & PRINCIPLE ARTERIAL (Class IV)
Posted Speed	25mph	30mph	40mph	55mph
Typical Section Elements				
ROW Width	62'	77'	95'	180'
Pavement Width	32'	44'	67'	82' or 106'
Number of Lanes	2	3	5	5 & 7
Side Cut/Fill Slopes	3:1 up to 5 feet high and 2:1 above 5 feet high			
20 Year ESAL Requirement	60,000	250,000	700,000	2,000,000
Vertical Design Elements				
Vehicle Design	Passenger, School Buses, Delivery trucks, dump Trucks	Passenger, School Buses, Delivery trucks, Dump/Concrete Trucks	Passenger, School Buses, Delivery Trucks, Dump / Concrete Trucks	Passenger, School Buses, Delivery Trucks, Dump/Concrete Trucks, Semi Loads
Minimum Centerline Grade	0.5%			
Maximum Centerline Grade	12%(a)	8%	7%	5%
Maximum Grade in Cul-de-Sacs	5%	Not Allowed		
Maximum Centerline Grade Break w/o Vertical Curve	1%	0.5%	0.25%	
Maximum TBC Grade Break w/o a Vertical Curve <sup>(b)</sup>	2%	2%	2%	
Minimum Crest Vertical Curve "K" Value	19	Varies with design speed. Refer to AASHTO: A Policy on Geometric Design of Highways and Streets, Latest Edition		
Minimum Sag Vertical Curve "K" Value	37	Varies with design speed. Refer to AASHTO: A Policy on Geometric Design of Highways and Streets, Latest Edition		
Minimum Length of a Vertical Curve	60'	3 times the design speed		

**TABLE 6 CONTINUED**

Roadway Design Standards				
DESIGN ELEMENT	LOCAL	COLLECTOR	MINOR ARTERIAL	MAJOR & PRINCIPLE ARTERIAL
Posted Speed	25mph	30mph	40mph	55mph
Horizontal Design Elements				
Minimum Mid-Block Centerline Curve Radius	100'	Varies with design speed and superelevation. Refer to AASHTO: A Policy on Geometric Design of Highways and Streets, Latest Edition		
Maximum Superelevation Rate	2%	4%		
Intersections				
Intersection Sight Distance	Refer to AASHTO: A Policy on Geometric Design of Highways and Streets, Latest Edition			
Minimum Corner Curb Radius at TBC	25	25	35	40
Minimum Angle of Intersection	90° is desired. Where excessive physical constraints exist, the following minimum angles may be allowed if approved by City Engineer: local / local intersections 70°, collector / local or collector / collector intersections 80°, any intersection with City minor arterials or City major arterials 80° minimum.			
Maximum Centerline & Lane Offset Across Intersection	0' offset is desired. Where excessive physical constraints exist, up to 2' maximum offset may be allowed if approved by City Engineer.			
Curves and Centerline Angle Points in Intersection	Curves in an intersection and within 100 ft of the PC curb return of an intersection are discouraged. Centerline angle points are not allowed in intersections and are discouraged within 100 ft of the PC curb return of an intersection.			
Maximum Centerline Grade <sup>(c)</sup> at Intersection	5% or 2% <sup>(d)(e)</sup>	5% or 2% <sup>(d)</sup>		
Vertical Tie-In	Lower streets shall match the centerline crowns in an intersection. Higher streets shall tie in 10' off the centerline of local streets and at the edge of the outside travel lane of other streets.			

<sup>(a)</sup> A maximum running slope of 12% is allowed in purely-residential areas. It must be shown how bus service is provided to areas with streets greater than 10%.

<sup>(b)</sup> Maximum grade break of 2% along TBC with Minimum length of 25 feet between breaks.

<sup>(c)</sup> Grade must extend to the PC/PT of the intersecting street.

<sup>(d)</sup> If roadway centerline grade is 5% or less, then per PROWAG R302.5.2.1 Where a *pedestrian access route* is contained within a *crosswalk* at an intersection approach with yield or stop control devices, the cross slope of the *pedestrian access route* shall be 1:48 (2.1%) maximum. If roadway centerline grade is 5% or less, then per PROWAG R302.5.2.2 Where a *pedestrian access route* is contained within a *crosswalk* at an uncontrolled approach or crosswalk with traffic signal PROWAG R302.5.2.3, the cross slope of the *pedestrian access route* shall be 1:20 (5.0%) maximum.

<sup>(e)</sup> 6% maximum roadway centerline grade at an intersection and 20mph vertical curve "K" values are allowed when all of the following conditions are met:

1. The area is in the Hillside Development Area.
2. Cuts or fills for road construction are 10ft or greater even when Table 6 proposed vertical curve K-values, intersection grades, and road grades are maximized.
3. The posted speed approaching the intersection is reduced to 20mph.

**Table 7: City of Saratoga Springs Access Management Standards**

Functional Classification	Minimum Driveway Spacing (feet) <sup>1,2,3,4,9</sup>			Public/Private Cross Street Unsignalized Intersection Spacing (feet)	Minimum Signal Spacing (feet)	Geometric Design of Driveway Access <sup>8</sup>						
	Upstream and Downstream (Desirable feet)	Opposing Upstream (feet)	Opposing Downstream (feet)			Residential Driveways			Commercial, Retail, or Multi-family Driveways			
						Approach Width (feet) <sup>6</sup>	Edge Clearance (feet) <sup>7</sup>	Curb Return Radius (feet)	Approach Width (feet) <sup>6</sup>	Edge Clearance (feet) <sup>7</sup>	Curb Return Radius (feet)	
Principal Arterial/Freeway Interchange Areas	State of Utah Highway Access Management Standards Apply (see Tables 9 & 10)					State of Utah Highway Access Management Standards Apply (see Tables 9 & 10)						
Major Arterial w/o Median Barrier	350	175	160	660	2640	12 min	6 min	10 min	Two Way	20 min	25 min	
Major Arterial w/ Median Barrier	200	130	160	400	2640			15 max	One Way		60 max	
Minor Arterial w/o Median Barrier	200	115	105	660	1320							
Minor Arterial w/ Median Barrier	200	65	105	400	1320							
Collector w/o Median Barrier	150	105	90	250	1320	30 max		15 max	16 min	30 max	60 max	
Collector w/ Median Barrier	150	50	70	150	1320							
Local Collector w/o Median Barrier	85	105	90	250	1320							
Local Collector w/ Median Barrier	85	50	70	150	1320							
Local w/ or w/o Median Barrier	-	-	-	150 <sup>8</sup>	N/A							

1. Driveway spacing is measured as shown in Figure 1.
2. Corner clearance requirements for access points should meet or exceed the minimum driveway spacing requirements.
3. For corner properties, access to public streets should be provided from the lesser (lowest functional classification) street.
4. Driveways in right-turn lane transition areas should be discouraged.
5. For the benefit of traffic safety and flow, access points may be required to be designed to prohibit certain types of turning movements.
6. Wider driveway widths may be permitted to accommodate additional turning and/or acceptance lanes.
7. Distance between side property line and edge nearest drive as measured along traveled way.
8. Local streets shall be at least 250 feet away from arterial streets unless the intersected street has a median - in which case, the spacing shall be at least 150 feet.
9. Distances for minimum driveway spacing apply from driveway to driveway and also from driveway to nearest adjacent road.

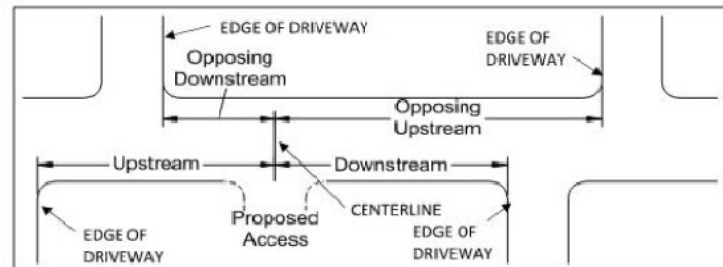
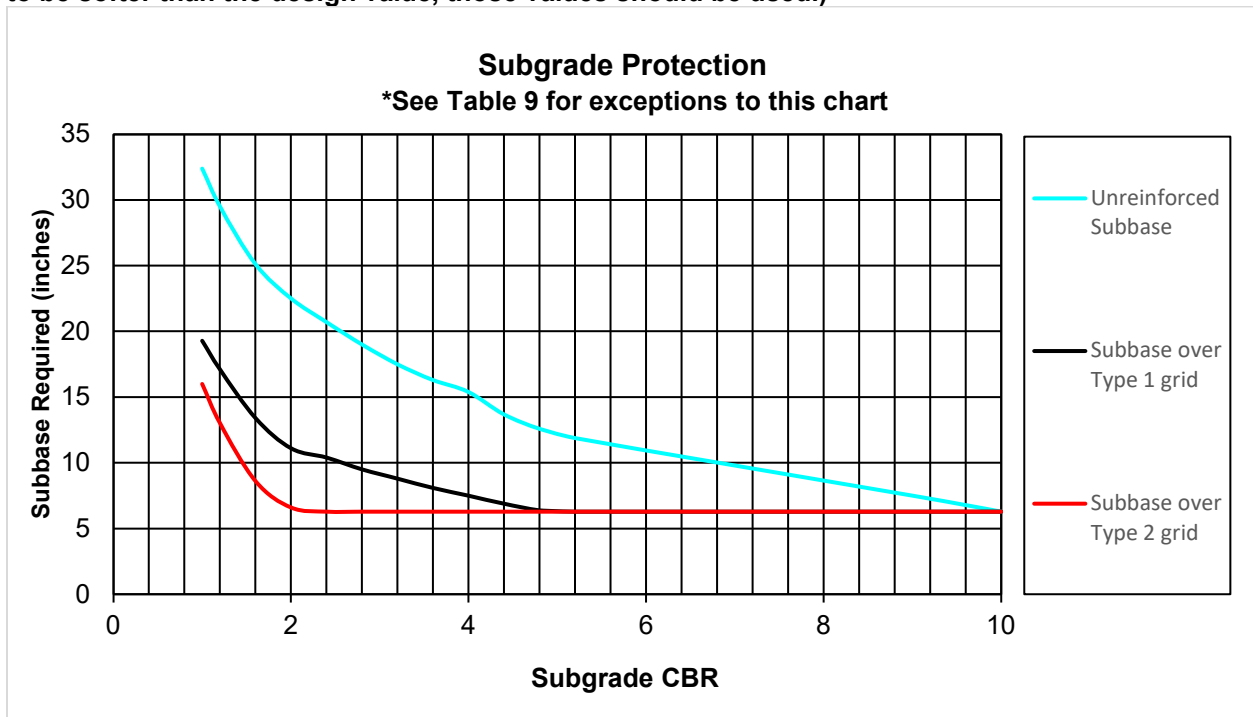


Figure 1: Measurements for Minimum Access Spacing Standards

**TABLE 8**

(Subgrade protection layer must be placed over the subgrade soils prior to placement of the pavement section. A design CBR must be determined by a geotechnical engineer. Based on this CBR value, the chart below provides how much Granular Borrow must be placed to adequately support the typical sections referenced in Table 12. If the in-situ CBRs of the subgrade are found to be softer than the design value, those values should be used.)



**TABLE 9**

Minimum Pavement Sections Based on Classification		
(The following section(s) must be placed on top of the subgrade protection layer outlined in Table 8)		
Residential Typical Section (Class I)		
3" AC (Asphalt Concrete) 8" UTBC (Untreated Base Course) Properly-Prepared Subgrade (for CBR values greater than 7%, subgrade protection not required)		
Collector Typical Section Options (Class II)		
4" AC 8" UTBC Properly-Prepared Subgrade (for CBR values greater than 10%, subgrade protection not required)	3" AC 8" UTBC Type 1 Geogrid Properly-Prepared Subgrade (for CBR values greater than 6%, subgrade protection not required)	
Minor Arterial Typical Section Options (Class III)		
5" AC 8" UTBC Properly-Prepared Subgrade (for CBR values greater than 10%, subgrade protection not required)	4" AC 8" UTBC Type 1 Geogrid Properly-Prepared Subgrade (for CBR values greater than 7%, subgrade protection not required)	
Major & Principle Arterial Road Typical Section Options (Class IV)		
5" AC 6"UTBC 9" GB (Granular Borrow) (for CBR values greater than 9%, 9" GB is not required) Properly-Prepared Subgrade Protection Layer (for CBR values less than 30%, subgrade protection layer not required)	5" AC 8" UTBC Type 1 Geogrid Properly-Prepared Subgrade Protection Layer (for CBR values greater than 9%, subgrade protection layer not required)	4" AC 6" UTBC Type 1 Geogrid 9" GB (for CBR values greater than 7%, 9" GB not required) Properly-Prepared Subgrade (for CBR values greater than 19%, subgrade protection layer not required)
<div>(a) Road classification and structural design must be submitted by a licensed and qualified engineer.</div> <div>(b) Roadway structural design must take into consideration construction loads due to the construction of adjacent development phases.</div> <div>(c) All traffic classifications require a 1/2" mix HMA design</div> <div>(d) If collapsible soils are identified in the initial soils investigation or during construction, the subgrade soil shall be over-excavated and re-compacted a minimum of 18-inches or deeper unless otherwise directed by a licensed and qualified geotechnical engineer. This determination will be made on a case-by-case basis, depending on the facts and circumstances.</div>		



**TABLE 10**

Structural Geogrids for Typical Pavement Sections					
Alternate products to Type 1 and Type 2 Geogrids used for subgrade protection will need to provide the full-scale calibration and validation of their methodology, as outlined by Giroud-Han. Alternate products to Type 1 geogrid used within a typical pavement section will need to provide full-scale Accelerated Pavement Testing, as outlined in NCHRP Report 512, validating their design methodology. Testing submitted for Type 1 geogrids must be performed on paved sections with at least 100,000 passes of a dual wheel tandem loading.					
Biaxial Type 1 Geogrid Quality Control Values					
Geogrid Properties		Test Method		MD	CMD
Type of Geogrid		Punched and Drawn			
Rib Shape		Rectangular or Square			
Rib Thickness		Nominal Dimensions Minimum 0.05 in			
Nominal Aperture Size		I.D. Callipered 1.0 to 1.5 inches			
Flexural Stiffness		ASTM D-5732-95		Minimum 750,000 mg-cm	NA
Minimum True Initial Modulus in Use		ASTM 6637-01		Minimum 27,420 lb/ft	Minimum 44,550 lb/ft
Junction Efficiency		GRI-GG2-87 93%			
Aperture Stability Modulus at 20 cm-kg		Kinney-01		0.65 m-N/deg	NA
Resistance to Long Term Degradation		EPA 9090 Immersion Testing		100%	
Biaxial Type 2 Geogrid Quality Control Values					
Geogrid Properties		Test Method		MD	CMD
Type of Geogrid		Punched and Drawn			
Rib Shape		Rectangular or Square			
Rib Thickness		Nominal Dimensions Minimum 0.07 in			
Nominal Aperture Size		I.D. Callipered 1.0 to 1.5 inches			
Flexural Stiffness		ASTM D-5732-95		Minimum 2,000,000 mg-cm	NA
Minimum True Initial Modulus in Use		ASTM 6637-01		Minimum 27,420 lb/ft	Minimum 44,550 lb/ft
Junction Efficiency		GRI-GG2-87 93%			
Aperture Stability Modulus at 20 cm-kg		Kinney-01		0.75 m-N/deg	NA
Resistance to Long Term Degradation		EPA 9090 Immersion Testing		100%	
Triaxial Type 1 Geogrid Quality Control Values					
Geogrid Properties	Test Method	Longitudinal	Diagonal	Transverse	General
Type of Geogrid					Punched and Drawn
Rib Pitch	Nominal Dimensions	1.6	1.6		
Mid-rib depth	Nominal Dimensions		0.05	0.05	

Mid-rib width	I.D. Callipered		0.04	0.04	
Rib Shape	ASTM D-5732-95				Rectangular
Aperture Shape	ASTM 6637-01				Triangular
Radial Stiffness	ASTM 6637-01				15,430 lb/ft @ 0.5% strain
Junction Efficiency	GRI-GG2-87				93%
Resistance to Long Term Degradation	EPA 9090 Immersion Testing				100%
<b>Triaxial Type 2 Geogrid Quality Control Values</b>					
Geogrid Properties	Test Method	Longitudinal	Diagonal	Transverse	General
Type of Geogrid					Punched and Drawn
Rib Pitch	Nominal Dimensions	1.6	1.6		
Mid-rib depth	Nominal Dimensions		0.07	0.06	
Mid-rib width	I.D. Callipered		0.04	0.05	
Rib Shape	ASTM D-5732-95				Rectangular
Aperture Shape	ASTM 6637-01				Triangular
Radial Stiffness	ASTM 6637-01				29,500 lb/ft @ 0.5% strain
Junction Efficiency	GRI-GG2-87				93%
Resistance to Long Term Degradation	EPA 9090 Immersion Testing				100%

**B. SPECIAL SOILS DESIGN:**

1. There are many areas within the City where collapsible soils exist. Where these collapsible soils exist within a proposed development, the soil's bearing capacities shall be determined by an accepted geotechnical engineer. The foundations for all facilities to be constructed on these soils shall be designed by the geotechnical engineer to support the facilities as required. These facilities shall include utility lines, roadways, structures and appurtenant items.
2. The City Engineer may designate areas where known collapsible soils exist. Soils reports done for a proposed development shall also be used to define if and where any areas of collapsible soils may exist. Where these areas exist, special care shall be taken with all construction, as described herein.

**C. RESTORATION OF SURFACES:**

1. All improved surfaces shall be restored to match original conditions, as acceptable to the City Engineer.
2. Paved surfaces shall be restored to the thickness plus 1" and types as required to match adjacent paved surfaces; conforming to the Standard Specifications.
3. Landscaped areas shall be restored to match adjacent areas, conforming to the City Standard Specifications and as acceptable to the City Engineer. Landscape materials shall conform to adjacent materials.

4. Cultivated areas shall be restored to match adjacent areas, conforming to the City Standard Specifications and as acceptable to the City Engineer. These areas shall be seeded with material conforming to adjacent materials.
5. All disturbed areas, not improved, shall be restored with native grasses to match adjacent areas, conforming to the City Standard Specifications and as acceptable to the City Engineer. These areas shall be seeded with material conforming to adjacent materials, as acceptable. Restored area shall achieve 70% plan coverage prior to acceptance.

**SECTION 00700**

**ELECTRICAL DESIGN STANDARDS**

**PART 1 GENERAL:**

1. NOT USED

## **SECTION 00800**

### **LANDSCAPING DESIGN STANDARDS**

#### **PART 1 GENERAL:**

1. NOT USED. SEE THE FOLLOWING CITY STANDARD SPECIFICATION SECTIONS:
  - a. 02724 AUTOMATIC SPRINKLING SYSTEM
  - b. 02725 RESTORING WETLANDS AREAS
  - c. 02726 LANDSCAPING
  - d. 02727 RESTORING NATIVE AREA
  - e. 02728 HYDROSEEDING
  - f. 02752 CHIP SEAL COAT
  - g. 02821 VINYL FENCING
  - h. 02824 ORNAMENTAL IRON FENCING
  - i. 02828 MISCELLANEOUS EQUIPMENT FOR PLAYGROUNDS AND OTHER AREAS

## SECTION 00900

### CONSTRUCTION DRAWINGS

#### PART 1 GENERAL

- A. Preliminary Construction Drawings shall include at a minimum, the following information:
1. Cover Sheet that includes:
    - a. Project Name;
    - b. Sheet index;
    - c. Vicinity Map;
    - d. Legend;
    - e. Contact information for key contacts including developer, engineer, utility companies, and City;
    - f. Data Table for Overall project and for each phase that lists in SF, Acres, and by percent of total;
      - i. Total Area
      - ii. Total Impervious Area
      - iii. Total Lot or Building Pad Area
      - iv. Total Landscape Area
      - v. Total ROW area; and
      - vi. Total Number of Lots
    - g. City Standard notes:
      - i. Contractor shall field verify locations and invert elevations of existing manholes and other utilities before staking or constructing any new sewer lines.
      - ii. Contractor shall field verify locations and invert elevations of existing storm drain structures and other utilities before staking or constructing any new storm drain lines.
      - iii. All construction shall comply with the Standard Technical Specifications and Drawings for the City of Saratoga Springs, Utah.
      - iv. Existing Utilities have been noted to the best of Engineers knowledge, however it is owner's and contractor's responsibility to locate utilities in field and notify City Engineer and City if discrepancies exist prior to continuing any construction.
      - v. Post-acceptance alterations to lighting plans or intended substitutions for accepted lighting equipment shall be submitted to the City for review and acceptance.
      - vi. The City reserves the right to conduct post-installation inspections to verify compliance with the City's requirements and accepted Lighting Plan commitments, and if deemed appropriate by the City, to require remedial action at no expense to the City.
      - vii. All exterior lighting shall meet IESNA full-cutoff criteria.
  2. Existing/Demolition Plan Sheet that includes:
    - a. Existing topography;
    - b. All existing features in and adjacent to project including;
      - i. Roads,
      - ii. Sidewalks and curb and gutter,
      - iii. Utilities both underground and overhead and existing pole locations,
      - iv. Existing striping including lane configurations and crosswalk locations,

- v. Existing Buildings,
  - vi. Wells and septic systems,
  - vii. Trees,
  - viii. Street Lights, and
  - ix. Utility pedestals and transformers.
- (a). Plans for the removal or relocation of existing infrastructure as needed for project;
  - (b). Areas classified as sensitive lands including 100-yr flood plains, natural drainages, water bodies, rivers, wetlands, and 30% + slopes; and
  - (c). Existing easements or other encumbered areas.
3. Overall Site Plan Sheet that includes:
- a. Street names and widths;
  - b. Subdivision lots with lot numbers, areas in SF and Acres, and boundary dimensions;
  - c. Street centerline and ROW data;
  - d. Hydrant Locations;
  - e. Lighting locations;
  - f. Roadway improvements (curb, gutter, sidewalk, drive approach, ADA ramps, monuments);
  - g. Parking Layout (if applicable);
  - h. Dimensioning and labeling of applicable items including setbacks, ROW's, spacing between structures, curb return radii, etc.; and
    - i. Phasing of project including location of temporary turn-around's at phase boundaries.
4. Overall Grading and Drainage Plan Sheet that includes:
- a. Existing Contour Lines (in grey) at one-foot intervals except in areas exceeding 10% slopes, in which case two-foot contour intervals are required;
  - b. Proposed Contours at one-foot intervals except in areas exceeding 10% slopes, in which case two-foot contour intervals are required, (proposed contours should tie back to existing at limits of grading);
  - c. County or City benchmark elevation;
  - d. Storm drain system showing pipe alignments, sizes, materials, slopes, junction boxes, inlets, and catch basins;
  - e. Detention system including spillways and overflow structures;
  - f. Location and type of storm water treatment device;
  - g. Points of connection to existing system; and
  - h. Slope Arrows and labels along gutters, swales, catch and fill slopes, parking areas, and lots.
5. Overall Utility Plan that includes:
- a. Sanitary Sewer system showing pipe alignments, sizes, materials, slopes, manholes, and laterals;
  - b. Drinking and Secondary Water systems showing pipe alignments, sizes, materials, slopes, manholes, meters, and laterals;
  - c. Location of meters and lateral for all open space areas;
  - d. Locations of all water valves and fire hydrants;
  - e. Locations and types of all pipe bends and fittings;
  - f. Existing Utilities and plans for relocations as necessary;

- g. Points of connection to existing structures and pipe lines shall be labeled; and
  - h. Existing and proposed easements as required by the Standard Specifications.
6. Storm Water Pollution Prevention Plan (SWPPP) for construction site activities:
- a. Be advised that a SWPPP is required to accompany final construction plans.
7. Landscaping and Irrigation Plan Sheet that includes:
- a. Landscaping plans;
  - b. Planting Schedule;
  - c. Irrigation Schematic;
  - d. Metered Points of Connection;
  - e. Fencing locations and types; and
  - f. Conceptual Layout of Amenities within open spaces with labels and dimensions.
8. All sheets shall include
- a. Drawing scale for both vertical and horizontal;
  - b. North arrow pointed towards the top of the sheet or to the left of the sheet;
  - c. Match Lines if necessary to refer reader to adjacent drawings;
  - d. All submitted Preliminary Construction Drawings shall be size 11" x 17"; and
- B. Final Construction Drawings shall include all Preliminary Construction Drawing Items as well as, at a minimum, the additional following information:
1. Grading and Drainage Plan shall include:
- a. Size and shape of all structures;
  - b. Rim elevation of all structures;
  - c. Invert-in and invert-out elevations at all structures;
  - d. Drain pipe size, type, and class;
  - e. Location and complete details of detention basins and appurtenant structures;
  - f. Storm water treatment system;
  - g. Plan and profile views of all storm drain lines with stationing of all structures;
  - h. Plan and profile views of all roadways with slope labels, vertical curves, and points of inflection;
  - i. Profile views shall show existing and final surface profiles;
  - j. Spot Elevations at 50' intervals along all TBC, Walls, PC, PT, Low Points, High Points, Ridge Lines, Connection to exiting, all transition locations;
  - k. The locations of any utility conflicts;
  - l. Data table with Cut/Fill quantities and Import/Export quantities;
  - m. Phase boundaries and identification of what will be completed with each phase
  - n. Grading details for all pedestrian ADA ramps in compliance with local and national standards.
  - o. Data table (broken up by phase if applicable) with quantities of each storm drain and site/road improvement item totaled by type and size including pipes, structures, fittings, and materials.
2. Sewer systems designs shall include:
- a. Size of all manholes;
  - b. Rim elevation of all manholes;
  - c. Invert-in and invert-out elevations at all manholes;
  - d. Sewer pipe size, type, and class;



- e. Location and complete details of sewage lift stations or other structures;
  - f. Plan and profile views of all sanitary sewer lines with stationing of all structures and laterals;
  - g. Profile views shall show existing and final surface profiles;
  - h. The locations of any utility conflicts;
  - i. Phase boundaries and identification of what will be completed with each phase; and
  - j. Data table (broken up by phase if applicable) with quantities of each sewer improvement item totaled by type and size including pipes, structures, fittings, and materials.
3. Drinking and Secondary Water system designs shall include:
- a. Pipe line sizes, types and class;
  - b. Locations and types of all valves and fire hydrants;
  - c. Locations and types of all pipe line fittings including bends, tee's, crosses, and reducers;
  - d. Air-vac and blow-off valve locations in both plan and profile views;
  - e. Plan and profile views of all water lines with stationing of all structures and laterals;
  - f. Profile views shall show existing and final surface profiles;
  - g. The locations of any utility conflicts, and the location and design of all waterline looping;
  - h. Phase boundaries and identification of what will be completed with each phase; and
    - i. Data table (broken up by phase if applicable) with quantities of each drinking water and secondary improvement item totaled by type and size including pipes, structures, fittings, and materials.
4. Storm Water Pollution Prevention Plan for construction site activities:
- a. Use the Utah Division of Water Quality template.
5. Long-Term Storm Water Management Plan:
- a. Use the Utah Storm Water Advisory Committee template which has been modified for use by projects within the City of Saratoga Springs.
6. Construction Details sheets shall include all applicable City Standard or non-standard Details including:
- a. Typical Road Sections and pavement section designs;
  - b. Sidewalks and Curb and Gutter;
  - c. Sewer;
  - d. Water;
  - e. Storm Drain;
  - f. Street Lights; and
  - g. Any other relevant details.
7. Striping and Signage Plan Sheet with details shall include:
- a. Street Names;
  - b. Traffic Control Signage locations and types with references to MUTCD designations;
  - c. Pavement Marking locations and types with references to MUTCD and FHWA designations;
  - d. City Standard details for signage and striping;

- e. Stationing of all signage and start and stop locations for striping;
  - f. Traffic calming locations and details; and
  - g. Phase boundaries and identification of what will be completed with each phase.
8. Lighting/Electrical Plan with details shall include:
- a. Lighting locations and types;
  - b. Photometric plan for parking areas and open spaces;
  - c. Lighting details;
  - d. Phase boundaries and identification of what will be completed with each phase;
  - e. Location of power sources, conduit, electrical master meters and utility boxes; and
  - f. City Standard Notes for Lighting Plans including:
    - i. Post-acceptance alterations to lighting plans or intended substitutions for accepted lighting equipment shall be submitted to the City for review.
    - ii. The City reserves the right to conduct post-installation inspections to verify compliance with the City's requirements and accepted Lighting Plan commitments, and if deemed appropriate by the City, to require remedial action at no expense to the City.
    - iii. All exterior lighting shall meet IESNA full-cutoff criteria.
    - iv. One-line diagrams that include both proposed street lighting as well as modifications made to the existing lighting system shall be drawn and submitted to the City for approval before construction. Source connections for each circuit shall be identified and approved with power company. Voltage drops for each circuit shall be calculated, documented, and submitted with design. Voltage drops shall not exceed 5% loss as measured from utility connection to end of circuit, regardless of where utility connection is located or whom it was constructed by. The city reserves the right to require voltage drop testing after construction to verify compliance with voltage drop requirements.
9. All sheets shall include:
- a. All civil drawings shall be signed and stamped by a Utah licensed professional engineer.
10. Landscaping and Irrigation Plan Sheet shall include:
- a. Detailed landscaping plans with designations for all areas and what surface treatments they shall receive;
  - b. Locations of all planting, designations for planting types and a comprehensive planting schedule;
  - c. Planting and landscaping details;
  - d. Detailed Irrigation design with the location of all valves, filters, and other appurtenances;
  - e. Metered Points of Connection;
  - f. Fencing locations, types and complete details for fences, posts, gates, and mow strips; and
  - g. Complete design of all open spaces including trails, pavilions, play areas, and other amenities including labels, dimensions, manufacture, model numbers, and all applicable details and typical sections.
11. Revisions made to drawings during the plan review process shall be made using coded revision clouds. Where clouds overly complicate a drawing, a description of the changes shall be noted and the note shall be clouded. If no such clouds are provided on the revised drawings, the revised drawing shall not be accepted and the original drawing shall stand.

- C. As-built drawings shall be provided electronically in pdf format containing construction drawings with all field changes and modifications, including but not limited to:
1. Street light alignment, location of conduit, power sources, and street lights;
  2. Location of Fire Hydrants, drinking water, secondary water, and sewer laterals stubbed into each lot with dimensions reference to permanent surface improvements;
  3. Landscaping and Irrigation improvements;
  4. As-Built drawings shall comply with Section 01780;
  5. As-Built drawings shall be stamped and signed by a professional engineer with signature block stating "I have field verified that these record drawings are complete and accurately represent what was constructed for this project.";
  6. Pond Certification form stamped and signed by a professional engineer;
  7. As-built drawings should not include detail sheets or a SWPPP plan; and
  8. As-built drawings shall include a topographic view of the site along with all detention basins.
- D. Easements Requirements:
1. Residential Development: All on and offsite easements (for public and private improvements) must be recorded before construction can begin on any part of the project;
  2. Non-Residential Development: All on and offsite easements (for public and private improvements) must be recorded before occupancy will be granted for any buildings; and
  3. Miscellaneous Construction: All on and offsite easements (for public and private improvements) must be recorded before construction can begin on any part of the project.
- E. Reimbursement Requirements:
1. Reimbursements for any infrastructure upsizing beyond the project improvement needs (system improvements) must be presented to the City Council at the preliminary plat or site plan process for authorization to have staff work on a reimbursement agreement with the developer/applicant;
  2. Reimbursement agreements must be accepted by the City Council and executed by both parties before construction can begin on the project (both residential and non-residential);
  3. If the developer/applicant wishes to begin construction before there is an agreement in place with the City, they must sign a waiver stating they accept the risk that they may not be reimbursed for any improvements installed, even if they are system improvements (also applies to system improvements installed by an applicant outside of the development process such as grading permits or encroachment permits).

**END OF SECTION**

**DIVISION 01**

**GENERAL REQUIREMENTS**

## **SECTION 01300**

### **ADMINISTRATIVE REQUIREMENTS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Preconstruction meeting.
- B. Progress meetings.
- C. Coordination drawings.
- D. Submittals for review, information, and project closeout.
- E. Number of copies of submittals.
- F. Submittal procedures.

##### **1.2 RELATED SECTIONS**

- A. Section 01700 - Execution Requirements: Additional coordination requirements.
- B. Section 01780 - Closeout Submittals: Project record documents.

##### **1.3 PROJECT COORDINATION**

- A. Project Coordinator: City Engineer.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for project access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to the City Engineer:
  - 1. Requests for interpretation.
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Design data.
  - 6. Manufacturer's instructions and field reports.

7. Progress schedules.
8. Coordination drawings.
9. Closeout submittals.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.1 PRECONSTRUCTION MEETING**

- A. City Engineer will schedule a meeting after Notice of Award.
- B. Attendance Required:
  1. Owners/ Representative.
  2. City Representative.
  3. Contractor.
  4. Excavator
- C. Agenda:
  1. SWPPP and NOI Permit
  2. Long-Term Storm Water Management Plan.
  3. Submission of executed bonds and insurance certificates, prior to meeting.
  4. Traffic Control plans
  5. Submission of list of Subcontractors, and progress schedule.
  6. Designation of personnel representing the parties in Contract, Developer, Contractor, Owner, and the City Engineer.
  7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  8. Review safety standards and procedures.
  9. Scheduling.
  10. Scheduling activities of a testing company and Geotechnical Engineer, if required.
  11. Construction water availability and procedures.
- D. Record minutes and distribute copies within two days after meeting to participants, with one copy to Contractor, City Engineer, Owner, participants, and those affected by decisions made.

### **3.2 PROGRESS MEETINGS AND INSPECTIONS**

- A. Schedule and administer meetings throughout progress of the Work at maximum monthly intervals.
- B. Notify the City Inspector in writing at least 2 weeks in advance to request an inspection for the acceptance or rejection of project improvements. Allow at least 2 weeks to process bond reductions for accepted items upon completion of inspection. If site is impeded by winter weather conditions, City inspector shall reschedule inspection as soon as is practicable.

- C. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- D. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, City Representative, as appropriate to agenda topics for each meeting.
- E. Agenda:
  - 1. Review minutes of previous meetings.
  - 2. Review of Work progress.
  - 3. Field observations, problems, and decisions.
  - 4. Identification of problems which impede planned progress.
  - 5. Review of submittals schedule and status of submittals.
  - 6. Review of off-site fabrication and delivery schedules.
  - 7. Maintenance of progress schedule.
  - 8. Corrective measures to regain projected schedules.
  - 9. Planned progress during succeeding work period.
  - 10. Coordination of projected progress.
  - 11. Maintenance of quality and work standards.
  - 12. Effect of proposed changes on progress schedule and coordination.
  - 13. Other business relating to Work.
- F. Record minutes and distribute copies within two days after meeting to participants, with one copy to Contractor, City Engineer, Owner, participants, and those affected by decisions made.

### **3.3 COORDINATION DRAWINGS**

- A. Provide information required by Project Coordinator for preparation of coordination drawings.
- B. Review drawings prior to submission to City Engineer.

### **3.4 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:
  - 1. Product data.
  - 2. Shop drawings.
  - 3. Samples for selection.
  - 4. Samples for verification.
- B. Submit to City Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review and upon acceptance by the City, contractor shall provide copies and distribute

in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01780 - CLOSEOUT SUBMITTALS.

### **3.5 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
  - 1. Design data.
  - 2. Certificates.
  - 3. Test reports.
  - 4. Inspection reports.
  - 5. Manufacturer's instructions.
  - 6. Manufacturer's field reports.
  - 7. Other types indicated.
- B. Submit for the City Engineer's knowledge as contract administrator or for the Owner.

### **3.6 SUBMITTALS FOR PROJECT CLOSEOUT**

- A. When the following are specified in individual sections, submit them at project closeout:
  - 1. Project record documents.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Bonds.
  - 5. Other types as indicated.
- B. Submit for the Owner's benefit during and after project completion.

### **3.7 NUMBER OF COPIES OF SUBMITTALS**

- A. Documents for Review:
  - 1. Small size sheets, not larger than 8-1/2 x 11 inches: Submit the number of copies which the Contractor requires, plus two copies which will be retained by the City Engineer.
  - 2. Larger sheets, not larger than 36 x 48 inches: Submit the number of opaque reproductions which Contractor requires, plus two copies which will be retained by City Engineer.
- B. Documents for Information: Submit two copies.
- C. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.
- D. Samples: Submit the number specified in individual specification sections; one of which will be retained by the City Engineer.
  - 1. After review, produce duplicates.
  - 2. Retained samples will not be returned to Contractor unless specifically so stated.



### **3.8 SUBMITTAL PROCEDURES**

- A. Transmit each submittal electronically or hard copy with transmittal letter.
- B. Sequentially number the transmittal letters. Revise submittals with original number and a sequential alphabetic suffix.
- C. Identify the Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- D. Apply Contractor 's stamp, signed or initialed certifying that review, acceptance , verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- E. Deliver submittals to City Engineer at business address.
- F. Schedule submittals to expedite the Project, and coordinate submission of related items.
- G. For each submittal for review, allow 7 days excluding delivery time to and from the Contractor.
- H. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- I. Provide space for Contractor and City Engineer review stamps.
- J. When revised for re-submission, identify all changes made since previous submission.
- K. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- L. Submittals that are not requested will not be recognized or processed.
- M. All submittals requiring acceptance from the City shall expire 6 months from the acceptance date. Expired submittals require a resubmittal and acceptance from the City.

**END OF SECTION**

**SECTION 01400**  
**QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. References and standards.
- B. Quality assurance submittals.
- C. Control of installation.
- D. Tolerances.
- E. Testing and inspection services.
- F. Manufacturers' field services.

**1.2 RELATED SECTIONS**

- A. Section 01300 - Administrative Requirements: Submittal procedures.
- B. Section 01600 - Product Requirements: Requirements for material and product quality.

**1.3 REFERENCES**

- A. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- B. ASTM D 290 - Standard Practice for Bituminous Mixing Plant Inspection.
- C. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- D. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- E. ASTM E 543 - Standard Practice for Agencies Performing Nondestructive Testing.
- F. ASTM E 548 - Standard Guide for General Criteria used for Evaluating Laboratory Competence.
- G. Use the latest issue of the above referenced standards as of the City's acceptance date of the Construction Drawings.

**1.4 SUBMITTALS**

- A. Testing Agency Qualifications:
  - 1. USE AMRL/CCRL Accredited Laboratory. Comparable accreditations will be accepted at discretion of the City.

2. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
  3. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of and deficiencies reported by the inspection.
  4. USE WAQTC/UDOT TTQP Certified Technicians, with certifications in area of testing or inspection being performed. Comparable accreditations will be accepted at discretion of the City.
- B. Test Reports: After each test/inspection, promptly submit two copies of report to City Engineer and to Contractor; within maximum of 24 hours.
1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of test/inspection.
    - h. Date of test/inspection.
    - i. Results of test/inspection.
    - j. Conformance with Contract Documents.
    - k. When requested by City Engineer, provide interpretation of results.
  2. Test reports are submitted for the City Engineer's knowledge as contract administrator or for the Owner, for information for the purpose of assessing conformance with information given and the design concept expressed in the contract documents.
- C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor to City Engineer, in quantities specified for Product Data.
1. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
  2. Certificates may be recent or previous test results on material or Product, but must be acceptable to City Engineer.
- D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- E. Manufacturer's Field Reports: Submit reports for the City Engineer's benefit as contract administrator or for the Owner.
1. Submit information for the purpose of assessing conformance with information given and the design concept expressed in the contract documents.
- F. Erection Drawings: Submit drawings for the City Engineer's benefit as contract administrator or for the Owner.

1. Submit for information for the purpose of assessing conformance with information given and the design concept expressed in the contract documents.
2. Data indicating inappropriate or unacceptable Work may be subject to action by the City Engineer or Owner.

## **1.5 REFERENCES AND STANDARDS**

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code or project specification.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from the City Engineer before proceeding.
- F. Neither the contractual relationships, duties, nor responsibilities of the parties in Contract nor those of the City Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.
- G. Submittals shall be as shown on the drawings and of the size and quality equal to or better than specification. If the Contractor desires to use other Materials than these specified herein, the Contractor shall secure written acceptance from the City Engineer before using these items in construction work. The standards for determining an acceptable equal will fall upon the City Engineer and will be based upon the standard of quality and salient characteristics established by the product brand name requested in the Standards and Specifications such as its size, strength, durability, rating, material composition, and compatibility with other system components. Any requests for consideration of an alternate equal must be accompanied by sufficient data to determine the products design specifications and to verify its performance characteristics such as:
  1. Design data;
  2. Product data;
  3. Shop drawings;
  4. Certificates;
  5. Test reports;
  6. Inspector reports;
  7. Manufacturer's field reports; and
  8. Other performance and testing data.
- H. All products, methods, tools, components, installation methods, etc. must be submitted and accepted by the City before use.

## **1.6 TESTING AND INSPECTION AGENCIES**

- A. Contractor shall employ and pay for services of an accredited testing agency to perform project specified testing and inspection. See Supplemental General Conditions and project specifications for specified testing.
- B. Employment of agency or test results in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
  - 1. Testing agency: Comply with requirements of ASTM E 329, ASTM E 548, ASTM C 1093, ASTM E 543, ASTM C 1021, ASTM C 1077, ASTM C 1093, ASTM E 1212, and ASTM C 1579.
    - a. Use the latest issue of the above reference standards as of the date of the Project.
  - 2. Inspection agency: Comply with requirements of ASTM D290.
  - 3. Laboratory: Authorized to operate in State in which Project is located.
  - 4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
  - 5. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or National Institute of Standards and Technology.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.1 CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work meeting the requirements of these Standards and Specifications.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from City Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified and/or certified by their industry to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

### **3.2 TOLERANCES**

- A. Monitor fabrication and installation tolerance control of Products to produce acceptable Work.

Do not permit tolerances to accumulate.

- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from City Engineer before proceeding.
- C. Adjust Products to appropriate dimensions; position before securing Products in place.

### **3.3 TESTING AND INSPECTION**

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
  - 1. Provide qualified personnel at site every day to manage daily activities. Cooperate with City Engineer and Contractor in performance of services.
  - 2. Perform specified sampling and testing of Products in accordance with specified standards.
  - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  - 4. Notify City Engineer and Contractor of observed irregularities or nonconformance of Work or Products immediately upon such observance.
  - 5. Perform additional tests and inspections required by City Engineer.
  - 6. Attend preconstruction meetings and progress meetings, when requested.
  - 7. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
  - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Agency may not accept any portion of the Work.
  - 3. Agency may not assume any duties of Contractor.
  - 4. Agency has no authority to stop the work without City's authorization.
- D. Contractor Responsibilities:
  - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
  - 2. Cooperate with laboratory personnel, and provide access to the Work.
  - 3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  - 4. Notify City Engineer and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
  - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by the City Engineer. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Sum/Price.

### **3.4 MANUFACTURERS' FIELD SERVICES**

- A. When specified in individual specification sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to City Engineer 30 days in advance of required observations.
  1. Observer subject to being accepted by the City Engineer.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### **3.5 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If it is not practical to remove and replace the Work, the City Engineer will direct an appropriate remedy or adjust payment.

### **END OF SECTION**

## **SECTION 01600**

### **PRODUCT REQUIREMENTS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations and procedures.
- E. Spare parts and maintenance materials.

##### **1.2 RELATED SECTIONS**

- A. Section 01400 - Quality Requirements: Product quality monitoring.

##### **1.3 SUBMITTALS**

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
  - 1. Submit within 15 days after date of Agreement.
  - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project.
- D. Provide written statement that materials and equipment being furnished are suitable and proper for the intended installations; that suppliers have investigated intended uses; and that items will satisfactorily perform and operate in the installations.

#### **PART 2 PRODUCTS**

##### **2.1 PRODUCTS**

- A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- B. Provide interchangeable components of the same manufacture for components being replaced.

##### **2.2 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.



- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

## **PART 3 EXECUTION**

### **3.1 SUBSTITUTION PROCEDURES**

- A. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.
- B. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse Owner and City Engineer for review or redesign services associated with re- acceptance by authorities.
- C. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- D. Substitution Submittal Procedure:
  - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
  - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
  - 3. The City Engineer will notify Contractor in writing of decision to accept or reject request.

### **3.2 TRANSPORTATION AND HANDLING**

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

### **3.3 STORAGE AND PROTECTION**

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.

- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- F. Store loose granular materials on relatively solid, flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

## **SECTION 01700**

### **EXECUTION REQUIREMENTS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Surveying for laying out the work.
- C. Cleaning and protection.
- D. Closeout procedures, except payment procedures.

##### **1.2 RELATED SECTIONS**

- A. Section 01300 - Administrative Requirements: Submittals procedures.
- B. Section 01400 - Quality Requirements: Testing and inspection procedures.
- C. Section 01780 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

##### **1.3 SUBMITTALS**

- A. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
  - 1. On request, submit documentation verifying accuracy of survey work.
  - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
  - 3. Submit surveys and survey logs as for the project record.
- B. Provide NOI (UPDES) permit prior to commencing work.

##### **1.4 QUALIFICATIONS**

- A. For survey work employ a land surveyor registered in Utah and acceptable to City Engineer. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.
- B. For field engineering employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located.

##### **1.5 PROJECT CONDITIONS**

- A. Grade work areas to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
- E. Erosion and Sediment Control: Plan and execute erosion control plan during construction to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
  - 1. Minimize amount of bare soil exposed at one time.
  - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
  - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
  - 4. Each week and after all rain/snow events inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

## **1.6 COORDINATION**

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Coordinate completion and clean-up of work of separate sections.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01600.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Document existing conditions with video and photographs. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
- B. Examine and verify specific conditions described in individual specification sections.
- C. Prior to Cutting: Examine existing conditions prior to commencing work, including elements

subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### **3.2 PREPARATION**

- A. Cut, move, or remove items as necessary for access to construction area. Replace and restore at completion where necessary.
- B. Remove unsuitable material, such as brush, weeds, wood, metals, concrete and rocks. Load and haul removed materials and dispose of in a legally acceptable manner.

### **3.3 LAYING OUT THE WORK**

- A. Verify locations of survey control points prior to starting work.
- B. Immediately notify City Engineer of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Control datum for survey is that established by Owner provided survey.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Report to City Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons within 24 hours.
- G. Utilize recognized engineering survey practices.
- H. Establish elevations, lines, grades and elevations. Locate and lay out by instrumentation and similar appropriate means:
- I. Each day verify layouts by same means.
- J. Maintain a complete and accurate log of control and survey work as it progresses.

### **3.4 GENERAL INSTALLATION REQUIREMENTS**

- A. Install Products as specified in individual sections.
- B. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new Work abuts or aligns with existing, perform a smooth and even transition.

### **3.5 PROGRESS CLEANING**

- A. Maintain construction areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipes and other closed spaces, prior to enclosing the space.
- C. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.
- D. Follow UPDES permit and SWPPP. Roads shall be kept free of debris and rubbish and shall

be cleaned at the end of each workday as necessary.

### **3.6 PROTECTION OF INSTALLED WORK**

- A. Protect installed work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.
- C. Prohibit traffic from landscaped areas.
- D. Contractor responsible for all damage prior to acceptance.

### **3.7 FINAL CLEANING**

- A. Execute final cleaning prior to final project assessment.
- B. Clean site; sweep paved areas, rake clean landscaped surfaces.
- C. Remove waste and surplus materials, rubbish, and construction facilities from the site.

### **3.8 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
  - 1. Provide copies to City Engineer and Owner.
- B. City Inspector shall accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.
- C. Notify City Engineer when work is considered ready for Substantial Completion within 48 hours.
- D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for City Engineer's review.
- E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.
- F. City Inspector shall accompany Project Coordinator on preliminary final inspection.
- G. Notify City Engineer when work is considered finally complete within 48 hours.
- H. Complete items of work determined by Inspector or City Engineer's final inspection.

**END OF SECTION**

**SECTION 01780**  
**CLOSEOUT SUBMITTALS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Project Record Documents.
- B. Warranties and bonds.

**1.2 RELATED SECTIONS**

- A. Conditions of the Contract: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01300 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01700 - Execution Requirements: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.
- F. Section 01785 - Project Evaluation.

**1.3 SUBMITTALS**

- A. Project Record Documents: Submit documents to City Engineer.
- B. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
  - 2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.1 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.

3. Addenda.
  4. Change Orders and other modifications to the Contract.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
  - C. Store record documents separate from documents used for construction.
  - D. Record information concurrent with construction progress.
  - E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
    1. Manufacturer's name and product model and number.
    2. Changes made by Addenda and modifications.
  - F. Record Drawings: Legibly mark each item on accepted construction drawings to record actual construction including:
    1. Measured depths of foundations in relation to finish main floor datum.
    2. Measured depths of manholes in relation to rim elevation.
    3. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
    4. Field changes of dimension and detail.
    5. Details not on original Contract drawings.
  - G. Complete Pond Certification form and deliver to City.

**END OF SECTION**



**DIVISION 02**

**SITE CONSTRUCTION**

## **SECTION 02100**

### **ROADWAY AND GENERAL EARTHWORK**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Excavating; filling and grading for street surfacing, concrete street improvements and appurtenances, as indicated on the drawings; removing and disposing of excess and unsuitable material; and compacting as required.
- B. Removing vegetation, topsoil material; and stockpiling material on-site.
- C. Removing and disposing of existing concrete items as indicated.
- D. Backfilling, compacting and grading around and adjacent to new concrete work and paving, as indicated on the drawings.
- E. Finish grading.
- F. Dust control.

##### **1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching for Pipe Work: trenching and backfilling for pipe work.
- B. Section 02115 - Structural Excavation: Building and foundation excavating.
- C. Section 02116 - Fill and Backfill: Backfilling for project pipe lines and at structures.

##### **1.3 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Samples: Submit 10 pound sample (or amount required by the testing laboratory or Owner) of each type of material as required in the accepted drawings and specifications.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.
- F. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

##### **1.4 QUALITY ASSURANCE**

- A. Perform work in accordance with City of Saratoga Springs, Standards and Specifications Drawings.
  - 1. Maintain one copy of standards on job site.

## **1.5 PROJECT CONDITIONS**

- A. Protect above- and below-grade utilities that remain.
- B. Protect landscaping, such as plants, lawns, rock out-croppings, and other features, adjacent to work areas, from excavating equipment and vehicular traffic.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

## **PART 2 PRODUCTS**

### **2.1 FILL MATERIALS**

- A. See Section 02116 - Fill and Backfill.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Notify utility company to remove and relocate utilities, where and as required.
- D. Verify that survey bench mark and intended elevations for the Work are as indicated.
- E. Identify any areas of collapsible soils within the work area, and inform the City Engineer of their locations.
- F. Compact and proof roll subgrade as per City Standards & Specification. Verify Existing soil Conditions and the removal of unsuitable materials with City inspector.

### **3.2 EXCAVATING**

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil material when wet.
- C. Excavate to lines, grades and cross-sections as indicated on the drawings.
- D. Notify City Engineer of unexpected subsurface conditions within 24 hours and discontinue affected work in area until notified by the City Engineer to resume work.
- E. All excavating shall be done according to OSHA Standards and all other applicable regulations.
- F. Excavation and grading operations shall be conducted in such a manner so as to cause minimum inconvenience to adjacent property, including dust control.
- G. Surfaces of excavated areas shall, at all times, have sufficient grade and smoothness as necessary to ensure proper drainage. If existing drainage is interrupted, provide temporary facilities to re-route and maintain drainage so that adjacent properties are not damaged.

Temporary drainage facilities shall be considered incidental to work involved; and shall be removed after work is completed.

- H. When unsuitable material is encountered in excavated areas at subgrade elevations, excavate as required to remove unsuitable material and backfill areas with selected backfill material.
- I. Remove large rocks and boulders encountered at subgrade elevations to a depth of not less than 6- inches below subgrade, and fill and compact excavation with suitable material.
- J. Remove excess and unacceptable excavated material from site and dispose of in an acceptable manner.
- K. See Section 02116 for backfilling and filling procedures.
- L. Slopes: Slopes greater than 3:1 shall be stabilized with accepted erosion control matting.
- M. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- N. During construction, provide and maintain sufficient means and devices to promptly remove and properly dispose of all water entering excavations or other parts of the work.
  - 1. Dispose of water from work area in a legally acceptable manner, without damage to adjacent property.
  - 2. No pipe, concrete footings, foundations or floors shall be installed in water.
  - 3. Water shall not be allowed to rise over concrete until it has set for at least 24 hours.
  - 4. Water shall not be allowed to rise against walls and supporting beams for a period of 14 days after completion of walls and beams.
  - 5. Any damage to pipe work or concrete work caused by water shall be repaired by the Contractor, at their expense.
- O. The use of explosives will not be allowed; unless use has been specifically reviewed and accepted by the City Engineer. All blasting shall be done by a reputable contractor specializing in the use of explosives.

### **3.3 REMOVING MISCELLANEOUS ITEMS**

- A. Projects that eliminate the need for existing infrastructure shall be required to remove unneeded infrastructure at the project's sole expense, unless the Public Works Director and City Engineer deem it to be in the City's best interest for such infrastructure to remain.
  - 1. Remove existing pipelines, culverts, curb and gutter, sidewalk, waterways, and driveway pavement as necessary to complete work and as directed by the accepted drawings.
  - 2. Saw-cut existing concrete items at limit of removal as necessary to complete work and as directed by the accepted drawings; break up and demolish the concrete item; and load, haul and dispose of concrete debris in a legally acceptable manner.

### **3.4 SOIL REMOVAL**

- A. Segregate excavated material at time of excavation into topsoil material, acceptable material, and unsuitable material, as determined by the City Engineer.
- B. Stockpile topsoil to be re-used on site; remove excess material from site and dispose of in an

acceptable manner.

- C. Stockpile acceptable subsoil to be re-used on site; remove unacceptable and excess material from site and dispose of in a legally acceptable manner.
- D. Stockpile materials separately in areas designated on site, within 200 feet of point of excavation; pile depth not to exceed four feet and protect from erosion.

### **3.5 BACKFILLING AND FILLING**

- A. Remove all vegetation, debris, unsuitable soil materials, obstructions and deleterious materials from designated areas prior to placement of backfills or fills.
- B. Where existing ground surfaces have density less than that specified for particular area, plow area to required depth, pulverize existing material, moisture-condition to optimum moisture content and compact to required percentage of maximum density.
- C. Place backfill and fill material in lifts accepted by a Geotechnical Engineer. Moisture-control each layer to provide optimum moisture content of material; but keep moist enough at all times to provide dust control.
- D. Compact each layer to required percentage of maximum density for each area classification.
- E. Do not place backfill or fill material on surfaces that are soft, unsuitable, frozen or contain frost or ice.
- F. See Section 02116 for backfilling and filling procedures.
- G. Correct areas that are over-excavated.
  - 1. Use structural fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- H. Park strips shall be backfilled 3 inches below TBC.

### **3.6 COMPACTING**

- A. Compact backfill and fill material to provide not less than the following percentages of maximum density for each area classification:
  - 1. Roadways: Under paving and similar construction, compact subgrade and each layer of backfill or fill material as specified in Section 02116.
  - 2. Concrete Items: Under curb and gutter, sidewalks, and other concrete items, compact top 6- inches of subgrades and each layer of backfill or fill material as specified in section 02116.
  - 3. Non-Landscaped Unpaved Areas: Compact each layer of backfill or fill material as specified in section 02116.
- B. Moisture Control. Before compaction, moisture control subgrades or layers of backfill and fill material, as required, to achieve optimum moisture content of material.
  - 1. For dry material, apply water uniformly to surface of material in a way that will prevent free water from appearing on surface during or after compaction operations.

2. For soil material that is too wet to allow compaction, remove and replace backfill or fill material, or scarify subgrade material and air dry, until desired moisture content is reached.
- C. Proof roll until surface is verified as non-yielding by City Inspector.

### **3.7 FINISH GRADING**

- A. Grade project areas uniformly to lines and grades, as indicated, including adjacent transition areas.
- B. Finish surfaces shall be smooth and compact, with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.
- C. Place topsoil in areas where seeding, sodding, and planting is indicated.
1. Place topsoil to the following compacted thicknesses:
    - a. Areas to be seeded with grass: 6 inches.
    - b. Areas to be sodded: 4 inches.
    - c. Areas for shrub beds: 18 inches.
    - d. Areas for flower beds: 12 inches.
  2. Remove roots, weeds, rocks, and foreign material while spreading.
  3. Near plants, spread topsoil manually to prevent damage.
  4. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
  5. Lightly compact placed topsoil.

### **3.8 TOLERANCES**

- A. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevations.
- B. Top Surface of Finish Grade: Plus or minus 1/2 inch from required elevations.

### **3.9 FIELD QUALITY CONTROL**

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.
- B. See Section 02116 for compaction density and gradation testing.
- C. Frequency of density testing: one test for each lift at 150 linear foot spacing for roadways, curb and gutter, sidewalks and other items.
- D. Frequency of gradation testing: One test prior to first lot and then additional testing as necessary to verify the consistency of the material.
- E. Proof Roll until surface is verified as non-yielding by City Inspector.

### **3.10 CLEAN-UP**

- A. Remove unused stockpiled materials; leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.
- C. All disturbed areas shall be restored with native grasses to match adjacent areas, conforming to the City Standards. These areas shall be seeded with material conforming to adjacent materials, as acceptable. Restored area shall achieve 70% plant coverage, and be free of erosion and invasive species prior to acceptance.

**END OF SECTION**

## **SECTION 02112**

### **TRENCHING FOR PIPE WORK**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Excavating, backfilling and compacting for project pipe lines.

##### **1.2 RELATED SECTIONS**

- A. Section 02115 - Structural Excavation: Excavating for miscellaneous structures.
- B. Section 02116 - Fill and Backfill: Backfilling for project pipe lines and at structures.

##### **1.3 REFERENCES**

- A. Use latest issue of the reference standards as of the date of the project.
- B. AASHTO T 99 - Moisture-Density Relations of Soils Using a 5.5-lb (2.5 kg) Rammer and a 12-inch Drop.
- C. AASHTO T 180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-inch Drop.
- D. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- E. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- F. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- G. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN m/m<sup>3</sup>)).
- H. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- I. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- J. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- K. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- L. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- M. Specification for Excavating on State Highways.
- N. General Safety Orders Covering Utah Industries - Section 69, Trenches.



- O. United States Department of Labor OSHA Publication 2085 - "Employer - Employee, Safe Practice for Excavation and Trenching Operations".
- P. Utah Occupational Safety and Health Rules and Regulations - General Standard (UOSHA).

#### **1.4 DEFINITIONS**

- A. Pipe Line Grades and Elevations: Indicated on drawings.
- B. Trench Cross Sections: Indicated on standard trench detail drawings.
- C. Subgrade Elevations: Bottom of road base in paved areas, as indicated on drawings.
- D. Finish Grade Elevations: Top of pavement in paved areas, as indicated on drawings.
- E. Ground Elevations: Indicated on the drawings.

#### **1.5 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Samples: 10 pound sample of each type of fill (or amount requested by the testing laboratory); submit to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.

#### **1.6 PROJECT CONDITIONS**

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where accepted by the City Engineer.
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  - 2. Prevent contamination.
  - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the work match design drawings.
- D. Protect plants, lawns, and other features to remain.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, and other improvements from excavating equipment and vehicular traffic.

## **PART 2 PRODUCTS**

### **2.1 FILL MATERIALS**

- A. See Section 02116 - Fill and Backfill.

### **2.2 SOURCE QUALITY CONTROL**

- A. See Section 01400 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Notify utility company to remove and relocate utilities, where and as required.
- D. Identify any areas of collapsible soils within trench areas, and inform the City Engineer of their locations.

### **3.2 TRENCHING**

- A. Excavate trenches as required to allow project pipe to be installed to line and grade as indicated on the drawings.
- B. Notify City Engineer of unexpected subsurface conditions within 24 hours and discontinue affected Work in area until notified to resume work.
- C. All trenching shall be done according to OSHA Standards and other applicable regulations.
- D. Do not interfere with 45 degree bearing splay of adjacent foundations.
- E. Excavate trenches to width, depth and cross section as indicated on the trench detail drawings.
- F. Hand trim excavations. Remove loose matter.
- G. Remove large stones over 4 inches in diameter and other hard matter which could damage piping or impede consistent backfilling or compaction.
- H. Remove excavated material that is unsuitable for re-use on the project from site and dispose of in an acceptable manner.
- I. When unsuitable material is encountered in trenches at subgrade elevations, excavate as

required to remove the unsuitable material and backfill areas with acceptable material as per section 02116.

- J. Stockpile excavated material to be re-used in area designated on site.
- K. Remove excess excavated material from site and dispose of in an acceptable manner.
- L. Excavation beyond or below lines and grades indicated shall be refilled with acceptable material as per section 02116 and compacted, at the Contractor's expense.
- M. During construction, provide and maintain sufficient means and devices to promptly remove and properly dispose of all water entering excavations or other parts of the work.
  - 1. Dispose of water from work area in an acceptable manner, without damage to adjacent property.
  - 2. No pipe, concrete footings, foundations or floors shall be installed in water.
  - 3. Water shall not be allowed to rise over concrete until it has set for at least 24 hours.
  - 4. Water shall not be allowed to rise against walls and supporting beams for a period of 14 days after completion of walls and beams.
  - 5. Any damage to pipe work or concrete work caused by water shall be repaired by the Contractor, at their expense.
- N. The use of explosives will not be allowed; unless use has been specifically reviewed and accepted by the City Engineer. All blasting shall be done by a reputable contractor specializing in the use of explosives.
  - 1. Comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage, and use of explosives and protection of life and property.
  - 2. Contractor shall be fully responsible for all damage attributable to their blasting operations.
  - 3. Excessive blasting or over shooting will not be permitted.
  - 4. Remove any material outside of authorized cross-section which may be shattered or loosened by blasting operation.

### **3.3 PREPARATION FOR PIPE LINE PLACEMENT**

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with bedding material, or stabilization material, or other acceptable material, as per section 02116.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.
- D. When bedding utilities in ground water, installation of stabilization-separation geotextile will be required to separate backfill material and native subgrade materials, if common fill cannot provide a working surface to prevent soils migration.

### **3.4 BACKFILLING**

- A. Install as per Section 02116 – Fill and Backfill

### **3.5 BEDDING AND FILL AT SPECIFIC LOCATIONS**

- A. Install as per Section 02116 – Fill and Backfill

### **3.6 TOLERANCES**

- A. Top Surface of Backfilling in unimproved areas: Plus or minus 1 inch from required elevations.
- B. Top Surface of Backfilling in improved areas: Plus or minus 1/2 inch from required elevations.

### **3.7 FIELD QUALITY CONTROL**

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.
- B. Testing is to be done as per APWA Standards and Specification; test results must be sent to the City Engineer or Inspector within 24 hours after the tests are completed.
- C. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
  - 1. Perform gradation testing in accordance with ASTM C136.
- D. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- E. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- F. Frequency of density tests: one test per lift per 150 linear foot of trench.
- G. Frequency of Gradation test: one test prior to first lot, then 25, or as necessary to verify the consistency of the material.

### **3.8 CLEAN-UP**

- A. Remove unused stockpiled materials; leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.
- C. All disturbed areas shall be restored with native grasses to match vegetation in adjacent areas, conforming to the City Standards. These areas shall be seeded with material conforming to adjacent materials, as acceptable. Restored area shall achieve 70% plant coverage, be free of erosions and invasive species prior to acceptance.

**END OF SECTION**

## **SECTION 02115**

### **STRUCTURAL EXCAVATION**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Excavating for structure volume below grade, footings, slabs-on-grade, paving, curb and gutter, sidewalks and other concrete work.

##### **1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching for Pipe Work: Excavating, backfilling and compacting for project pipe lines.
- B. Section 02116 - Fill and Backfill: Fill materials, filling, and compacting.

##### **1.3 PROJECT CONDITIONS**

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION**

##### **3.1 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Identify any areas of collapsible soils within the work areas, and inform the City Engineer of their locations.

##### **3.2 EXCAVATING**

- A. Excavate to accommodate new structures and construction operations to lines and elevations indicated.
- B. Notify City Engineer of unexpected subsurface conditions within 24 hours and discontinue affected Work in area until notified to resume work.
- C. All excavating shall be done according the OSHA Standards and other applicable safety regulations.
- D. Do not interfere with 45 degree bearing splay of foundations.
- E. Cut excavations wide enough to allow construction of structures as indicated; bottom dimensions shall be sufficient to provide at least 12 inches clear between extreme outside of concrete work and side of excavation. No tunneling or under cutting will be permitted.

- F. Hand trim excavations. Remove loose matter.
- G. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 02116.
- H. When unsuitable material is encountered in excavations at subgrade elevations, excavate as required to remove unsuitable material and backfill areas with selected backfill material.
- I. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- J. Remove excavated material that is unsuitable for re-use from site and dispose of in a legally acceptable manner.
- K. Stockpile excavated material to be re-used in areas designated on site.
- L. Remove excess excavated material from site and dispose of in a legally acceptable manner.

### **3.3 BACKFILLING**

- A. Backfilling shall conform to the requirements of Section 02116 - Fill and Backfill.
- B. Backfill under structures with granular borrow, and compact to 95 percent of maximum density.
- C. Backfill around structures with granular borrow, up to subgrade or finish grade elevations, as indicated, and compact to 95 percent of maximum density.
- D. Employ placement method that will not disturb or damage structure.
- E. Backfill shall be brought up uniformly around structures, so as to eliminate any possibility of unbalanced loading on structure which could damage or movement.
- F. No backfill shall be placed against concrete work until concrete has been inspected and accepted by the City Inspector; and backfill operation has been authorized.
- G. Granular Fill: Place and compact materials in equal continuous layers not exceeding uncompacted 8-inch lifts.
- H. Structural Backfill: Place and compact materials uniformly around structures in equal continuous layers not exceeding uncompacted 8-inch lifts.
- I. Correct areas that are over-excavated with structural backfill material, compacted to minimum 95 percent of maximum dry density; at the Contractor's expense.

### **3.4 FIELD QUALITY CONTROL**

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.
- C. Testing is to be done as indicated in Supplemental General Conditions; test results will be sent to the City Engineer within 24 hours after the tests are completed.

- D. Perform compaction density testing on compacted backfill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017, as listed in Section 02112.
- E. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("Standard Proctor"), ASTM D 1557 ("Modified Proctor"), or AASHTO T 180, as indicated in Section 02112.
- F. If tests indicate work does not meet specified requirements, remove work, replace and re-test.
- G. Frequency of Tests: as required by the City Standards and Specifications as necessary to verify the consistency of the material.

### **3.5 PROTECTION**

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

### **3.6 CLEAN-UP**

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. All disturbed areas shall be restored with native grasses to match adjacent areas, conforming to the City Standards. These areas shall be seeded with material conforming to adjacent materials, conforming to the City Standards. Restored area shall achieve 70% plan coverage prior to acceptance.

### **END OF SECTION**

## **SECTION 02116**

### **FILL AND BACKFILL**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Backfilling and compacting for project pipe lines.
- B. Filling, backfilling, and compacting for miscellaneous structures.

##### **1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching for Pipe Work: Excavating for project pipe lines.
- B. Section 02115 - Structural Excavation: Excavating for structures.

##### **1.3 REFERENCES**

- A. AASHTO M 145 - Standard Specification for Classification of Soils and Soil–Aggregate Mixtures for Highway Construction Purposes.
- B. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in.(457 mm) Drop; American Association of State Highway and Transportation Officials.
- C. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- E. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- F. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN m/m<sup>3</sup>)).
- G. ASTM D 1883 - Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils
- H. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- I. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- J. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- K. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- L. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).



- M. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- N. ASTM D 6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
- O. ASTM C 117 - Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.
- P. Use the latest issue of the above reference standards as of the date of the Project.

#### **1.4 DEFINITIONS**

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.
- C. Pipe Invert Elevations: Indicated on drawings.
- D. CBR – California Bearing Ratio
- E. WAQTC – Western Alliance for Quality Transportation Construction. WAQTC Certification is implemented through UDOT or other State Highway Agency's Transportation Technician Qualification Program (TTQP).
- F. Stratified Samples – Samples spread out evenly over an area or tonnage. For example, if planning four samples for 10,000 SF, take one sample from each 2,500 SF of the 10,000 SF area.
- G. Commercial Source – Fill material meeting material requirements of this specification acquired from a qualified off-site source.
- H. Off-site Source – An established operation that has been producing materials meeting state, county, municipal or APWA standards, under a documented quality control program, for a minimum of 3 years.

#### **1.5 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Submit source documentation and mix design as per Article 2.2 Materials Sources: Submit name of imported materials source.
- C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports per Table 1 and Article 3.3.
- E. Fill Quality Control Plan (FQCP) as per Article 1.6.E.1.
- F. Fill Quality Control results as per Article 1.6.E.4.

#### **1.6 QUALITY CONTROL**

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and

testing.

- B. Perform quality control testing as per Table 1.

<b>Table 1: Sampling and Testing Frequencies</b>			
	Roadway	Flatwork/Driveways	Backfill
Gradation <sup>a</sup> and Plastic Index; ASTM C136, AASHTO T 90	Every 500 Tons	1 per day or Every 500 Tons <sup>c</sup>	
Density <sup>b</sup> , ASTM D 5195	Every 2500 SF	Every 150 LF or 2500 SF <sup>c</sup>	Every 150 LF
a. Report all sieves required for AASHTO Soil Classification and maximum particle size. b. Density target of 95% of Modified Proctor, ASTM D 1557. c. Use whichever frequency is greater.			

- C. Submit test and inspection reports to the City in accordance with Section 01400.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Native/On-Site Produced Material Quality Control Requirements
1. Provide a Fill Quality Control Plan (FQCP) when excavating, using or producing fill material from on-site materials sources. This applies to crushed, blended or excavated native materials. Submit the FQCP to the City for review a minimum of 15 days prior to the commencement of the material processing operation.
    - a. The FQCP shall be site specific and state how the Contractor proposes to control the materials, equipment, and operations for the material processing operation.
    - b. The FQCP shall be signed and dated by the Contractor's representative at the time the FQCP is submitted to the Engineer.
    - c. The FQCP shall be maintained to reflect the current status of the operations, and revisions shall be provided in writing and approved by the City prior to initiating any changes.
    - d. At a minimum the FQCP shall contain the following information:
      - i. Quality Control Organization, including name, telephone number, duties, and employer of all quality control personnel necessary to implement the FQCP. Laboratory shall comply with ASTM D3740 and APWA Section 01 45 00 requirements. Provide the minimum number of quality control personnel:
        - (a). FQCP Field Manager - The person responsible for the execution of the FQCP and liaison with the City. Use a FQCP Field Manager with experience in the management of crushing/blending operations and an understanding of statistical control of materials.
        - (b). Quality Control Technician - The person responsible for conducting quality control sampling, testing and inspection to implement the FQCP. There may be more than one Quality Control Technician. The Technician shall be a WAQTC Qualified Technician or directly supervised by a WAQTC Qualified Technician for duties performed. The field manager and quality control person may be the same person.
        - (c). For projects with more than one on-site produced material, FQCP Field Manager or QCT must be on-site at all times to observe and document placement practices, and verify that on-site produced materials are placed in proper locations and constructed according to applicable City standard.

- ii. Crushing, Blending and Handling practices
  - (a). Include the following, at minimum
    - (i) Practices to be employed, including equipment and procedures to be used, to produce a homogeneous material meeting specification requirements.
    - (ii) Approximate daily tonnage to be produced
    - (iii) Anticipated schedule for production
- iii. Sampling and Testing locations and frequencies for each material to be produced or placed. Meet the following sampling and testing minimums:
  - (a). Source quality test results as required by Article 1.5 Submittals.
  - (b). Pre-crusher/pre-blend/on-site material
    - (i) 1 each, minimum, per source or stockpile, per day.
      - 1 Gradation – ASTM C136
      - 2 Plasticity Index
  - (c). Post-crusher/post-blend/native testing
    - (i) Perform the following tests, at minimum, for every 500 tons, or portion thereof, of material produced:
      - 1 Washed Gradation – ASTM C117, ASTM C136
      - 2 Moisture Content
      - 3 Soil Classification, including Atterberg Limits
    - (ii) Use stratified samples over projected production run
    - (iii) Restart minimum requirements if any of the following occur:
      - 1 Production run is stopped.
      - 2 Changes are made to production process, including change in source, > 10% change in rate, change in equipment, or any other change that results in change in material produced.
      - 3 If source or produced material stockpile is relocated.
- iv. Tolerances and Actions
  - (a). Establish and document tolerances using control charts for action and suspension limits for controlling production operation. Use action limits for initiating minor changes to production process. Use suspension limits for halting production. Recommended Action and Suspension limits are included in Table 2. Modifications can be proposed with appropriate explanation and justification.

<b>Table 2</b>		
Sieve	Action Limit	Suspension Limit
1/2" and Larger	6.7 - 9.5	> 9.5
3/8" Sieve	5.5 - 8.0	> 8.0
#4 Sieve	5.0 - 7.0	> 7.0
#16 Sieve	3.0 - 5.5	> 5.5
#200 Sieve	1.6 - 2.3	> 2.3
Values are deviations from target grading curve, expressed as percent of dry weight of sample.		

- (i) Document all deviations outside of action or suspension limits and associated corrections made to production process.
    - (ii) Document where rejected materials are stockpiled
  - (b). Place produced materials in separate stockpiles by production run. Stockpiles should be separated horizontally by a distance equivalent to the stockpile height. Alternatively, a physical barrier acceptable to the City can be maintained between stockpiles.
  - (c). Rework or remove and replace products not produced under or conforming to the requirements of this section.
- v. Disposal or use plan for material produced that does not meet requirements of this specification.
2. If the Contractor's Quality Control operation is not functioning to City standards, the City may withdraw permission to use on-site material.
  3. The City may require the replacement of ineffective or unqualified equipment or Quality Control personnel. Operations may be required to stop until appropriate Quality Control operations are taken.
  4. Submit On-Site Fill Quality Control test results and inspection documentation to the City or its representative at the completion of material processing operations each day. Documents should be electronically filed on a site available for the City to view.

## **1.7 ACCEPTANCE**

- A. The City will perform acceptance decisions for all projects. The City may accept the lot based on results of the quality control test results defined in Article 1.6.
  1. A lot is equal to one day's production.
  2. The City will reject the lot if the Contractor QC data is outside the limits of Table 1.
  3. At the City's discretion, the City may perform acceptance testing in accordance with Table 1.
- B. If tests indicate work does not meet specified requirements, remove work, replace and retest.

## **1.8 CITY QUALITY ASSURANCE**

- A. If the contractor fails to follow the approved FQCP, the City may require the employment of a third-party independent firm, chosen by the City, to control operations, at the contractor's expense.

## **PART 2 PRODUCTS**

### **2.1 FILL MATERIALS**

- A. Granular Borrow: Imported borrow or soil excavated on-site; conforming to Type A-1-a of AASHTO Classification of Soils and Soil-Aggregate Mixtures.
  1. Non-plastic (PI = 0), well graded as per Unified Soils Classification System (USCS) standards, 3-inch maximum
  2. Free of debris and organic material
  3. Do not use material that does not have determinable proctor value.

4. At least 50% of granular borrow material should have fractured faces per ASTM D5821.
  5. Use Granular Borrow with a minimum laboratory CBR value of 30%, ASTM D 1883.
- B. Common Borrow: Imported borrow or soil excavated on-site; conforming to Type A-4, or better, of AASHTO Classification of Soils and Soil-Aggregate Mixtures.
1. Free of rocks larger than 3 inches, organic matter and debris.
  2. Do not use material that does not have determinable proctor value.
- C. Concrete for Fill: Lean concrete.
1. Conforming to Flowable Fill, as per APWA Standard and Specifications section 31 05 15 (Cement Treated Flowable Fill).
- D. 1/2" Free Draining Gravel: Angular crushed, washed stone; washed, free of shale, clay, friable material and debris.
1. Graded in accordance with ASTM C 136, within the following limits:
    - a. 1 inch sieve: 100 percent passing.
    - b. 3/4 inch sieve: 95 to 100 percent passing.
    - c. 3/8 inch sieve: 30 to 65 percent passing.
    - d. No. 4 sieve: 5 to 25 percent passing.
    - e. No. 8 sieve: 0 to 10 percent passing.
    - f. No. 16 sieve: 0 to 5 percent passing.
    - g. No. 200 sieve: 0 to 2 percent passing.
- E. 1" Free Draining Gravel: Free draining granular backfill material; natural or crushed aggregate.
1. Graded in accordance with ASTM C-136, within the following limits:
    - a. 1 1/2 inch sieve: 100 percent passing.
    - b. 1 inch sieve: 95 to 100 percent passing.
    - c. 1/2 inch sieve: 25 to 60 percent passing.
    - d. No. 4 sieve: 0 to 10 percent passing.
    - e. No. 200 sieve: 0 to 2 percent passing.
- F. Sand: Non-plastic (PI = 0); free of silt, clay, loam, friable or soluble materials, and organic matter. Squeegee gravel is not acceptable.
1. Graded in accordance with ASTM C 136; within the following limits:
    - a. 3/8 inch sieve: 100 percent passing.
    - b. No. 4 sieve: 75 to 100 percent passing.
    - c. No. 16 sieve: 0 to 100 percent passing.
    - d. No. 40 sieve: 0 to 100 percent passing.
    - e. No. 100 sieve: 4 to 70 percent passing.
    - f. No. 200 sieve: 0 to 40 percent passing.
- G. Topsoil: Topsoil shall meet APWA standards & specifications (section 31 05 13).

## **2.2 SOURCE QUALITY CONTROL**

- A. See Section 01400 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Materials Sources: Submit name of imported or native materials source and Aggregate Composition Test Reports demonstrating compliance with Article 2.1.
  - 1. Submit to the City at least 10 working days before placement.
  - 2. Include, at minimum, the following:
    - a. Soil Classification (AASHTO M-145)
    - b. Target Gradation (Percent passing for standard sieve set from ASTM D 6913)
    - c. Modified Proctor Value (AASHTO T-180)
    - d. CBR Value, Compacted to 95% Modified Proctor, 10lb surcharge (ASTM D 1883)
    - e. If tests indicate materials do not meet specified requirements, change material and retest.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Verify structural ability of unsupported walls to support imposed loads by the fill.
- C. Proof roll until surface is verified as non-yielding by the City Inspector.

### **3.2 PREPARATION**

- A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Granular Borrow.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

### **3.3 FILLING**

- A. Fill to finish contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations where indicated;
  - 1. In the ROW or other load-bearing foundation surfaces fill flush to required elevation, compacted to 95 percent of maximum dry density. AASHTO T-180 ("Modified Proctor")
    - a. Lift Thickness:
      - i. Minimum – 1.5 times the maximum aggregate size

- ii. Maximum – 12 inches loose, 8 inches compacted
- 2. Soil Fill: Place and compact material in equal continuous layers not exceeding Geotechnical Recommendations.
- C. Employ a placement method that does not disturb or damage other work.
- D. Do not fill over porous, wet, frozen, or spongy, or undocumented fill.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend project slopes into existing areas.
- G. Reshape and re-compact fills subjected to vehicular traffic.

### **3.4 FILL AT SPECIFIC LOCATIONS**

- A. Fill within Right-of-Way up to subgrade elevation:
  - 1. Use Common borrow with CBR greater than the native layer below.
  - 2. Fill to finish grade elevations.
- B. Structural backfill and pavement subbase:
  - 1. Use Granular Borrow as per the Geotechnical/Pavement Engineer.
  - 2. Fill up to subgrade elevations.
  - 3. Foundation walls and footings, as per geotechnical Engineering Recommendations. Backfill simultaneously on each side of unsupported foundation walls until supports are in place
- C. Bedding and Backfill for Pipe Lines in Trenches:
  - 1. Pipe Bedding: Shall follow City Standard Drawings for Trenches SS-1, DW-1, PI-1, and SD-1.
- D. Trench Backfill: Shall follow City Standard Drawings for Trenches SS-1, DW-1, PI-1, and SD-1.
- E. At Landscaped Areas above subgrade/native elevation:
  - 1. Use common borrow.
  - 2. Fill up to 6 inches below finish grade elevations.

### **3.5 TOLERANCES**

- A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.
- B. Top Surface of Filling Under Paved Areas: Plus or minus 1/2 inch from required elevations.
- C. “Red Head” staking and “string test” required for finish grade verification.

### **3.6 PROJECT CONDITIONS**

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need
- B. When fill materials need to be stored on site, locate stockpiles where designated.
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  - 2. Prevent contamination.
  - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

### **3.7 CLEAN-UP**

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition, grade to prevent standing surface water.
- C. All disturbed areas shall be restored with native grasses to match adjacent areas, conforming to the City Standards. These areas shall be seeded with material conforming to adjacent materials, conforming to the City Standards. Restored area shall achieve 70% plant coverage, free of erosion & invasive species, prior to acceptance.

**END OF SECTION**



## **SECTION 02235**

### **SANITARY SEWER SYSTEM**

#### **1.1 PART 1 GENERAL**

#### **1.2 SECTION INCLUDES**

- A. Sanitary sewer piping, fittings and accessories.
- B. Casing pipes and accessories.
- C. Connection of project pipe to existing manholes.
- D. Sewer Service Connections.

#### **1.3 RELATED SECTIONS**

- A. Section 02112 - Trenching for Pipe Work: Excavating of trenches.
- B. Section 02116 - Fill and Backfill: Pipe bedding and trench backfilling.
- C. Section 02340 - Manholes and Covers.
- D. Section 03300 - Cast-In-Place Concrete.

#### **1.4 REFERENCES**

- A. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- B. ASTM D 3034 - Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
- C. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- D. ASTM F 679 - Standard Specification for Poly Vinyl Chloride (PVC) Large-Diameter Gravity Sewer Pipe and Fittings; 18-inch through 24-inch smooth solid wall sewer pipe.
- E. Use the latest issue of the above reference standards as of the date of the Project.

#### **1.5 DEFINITIONS**

- A. Pipe Bedding: Fill placed within the pipe zone, which is under, beside and directly over pipe, prior to subsequent backfill operations; see standard trench detail drawing.

#### **1.6 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories, and fittings.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents:
  - 1. Record location of pipe lines, connections, manholes, sewer laterals, and invert elevations.
  - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

## **1.7 REGULATORY REQUIREMENTS**

- A. Conform to applicable code for materials and installation of the Work of this section.

## **1.8 PROJECT CONDITIONS**

- A. Coordinate the Work on sewer lines and connections to existing manholes with the City Engineer or City Inspector.

## **PART 2 PRODUCTS**

### **2.1 SEWER PIPE MATERIALS**

- A. Plastic Pipe: ASTM D 3034, SDR 35, Type PSM, Poly Vinyl Chloride (PVC) material; inside nominal diameter of 4 inches through 15 inches, bell and spigot joint ends with gaskets.
- B. Plastic Pipe: ASTM F 679, Poly Vinyl Chloride (PVC) material; inside nominal diameter of 18 inches through 24 inches, bell and spigot joint ends with gaskets.
- C. Joint Seals for Plastic Pipe: ASTM C 477 rubber compression gaskets for positive seal.
- D. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required configurations.
  - 1. Clean outs and clean out caps shall be cast iron in non-residential applications and as specified by International Pumping Code.

### **2.2 CASING PIPE MATERIALS**

- A. Welded Steel Pipe: AWWA C 200, steel water pipe; diameter as indicated.
- B. Casing Insulators: fusion coated steel casing insulators with 12-inch wide band and 2-inch wide glass reinforced plastic runners; Model C12G-2, manufactured by Pipeline Seal and Insulator, Inc.
- C. Casing End Seals: flexible S-shaped seals fabricated on synthetic rubber with stainless steel bands and clamps; Model S Pull-On End Seals, manufactured by Pipeline Seal and Insulator, Inc.
- D. Casings under irrigation canals are subject to the applicable canal company's regulations.

### **2.3 BEDDING AND COVER MATERIALS**

- A. Pipe Bedding Material: As specified in Section 02116.

- B. Trench Backfill Material: As specified in Section 02116.

## **PART 3 EXECUTION**

### **3.1 TRENCHING**

- A. See Section 02112 for trenching; Sections 02115 and 02116 for structural excavation and fill and backfill.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill pipe zone with bedding material, tamp in place and compact; then complete backfilling of trench and compact.

### **3.2 INSTALLATION - SEWER PIPE**

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on project plan and profile drawings.
- B. Install pipe, fittings, and accessories in accordance with appropriate ASTM standards and manufacturer's instructions. Seal joints watertight.
- C. Install pipe to alignment and slope gradients noted on project drawings; with maximum variation from design alignment of 0.25 foot and from design elevations of 0.10 foot. As-built pipe slope shall meet design slope within 10% error of design grade, except for pipes at minimum slopes.

### **3.3 INSTALLATION - CASING PIPES**

- A. See Sections 02115 and 02116 for structural excavation and fill and backfill; and for additional requirements.
- B. Install casing pipes by ramming process where indicated.
- C. Install casing pipes at the line and grade as required to allow carrier pipes to be installed within the casing pipes at the design line and grade, as indicated on the drawings.
- D. Place casing insulators on carrier pipes to properly center and position carrier pipe inside the casing pipes; space insulators as recommended by the pipe manufacturer.
- E. Carrier Pipe inside of casing shall have restrained joints.
- F. Seal each end of casing with appropriate size flexible end seals; install according to manufacturer's instructions and recommendations.
- G. Seal bore holes at each end, around periphery of casing, with grout, impervious clay or brick masonry.
- H. Contractor shall be solely responsible for the accuracy, safety and adequacy of construction methods and procedures for installing casing pipes, and for any damage which may result from their failure. All operations of the Contractor for installation of casing pipes shall be subject to acceptance by the agency having jurisdiction over the item being crossed.
- I. Contractor shall enter any agreement with, and furnish any and all indemnity and other bonds that may be required by, the agency listed above, for their protection against injury and

interference with flow of water caused by the operations of the Contractor.

- J. Contractor shall secure required permission from the agency listed above before commencing with the installation of casing pipes and related work along and across the respective areas.

### **3.4 CONNECT PROJECT PIPE INTO EXISTING SEWER MANHOLE**

- A. See Sections 02115 and 02116 for structural excavation and fill and backfill.
- B. Connection of project pipe into existing sewer manhole shall include:
  - 1. All excavating required for the connection; and backfilling excavations after the connection is completed, and compacting backfill as required.
  - 2. Removing existing and/or abandoned pipes where and if required.
  - 3. Core-cutting hole through wall and base of existing manhole, where required, with appropriate size coring machine; and preparing hole for connection.
  - 4. Installing new pipe in place and connecting to manhole wall with appropriate type flexible coupling, as recommended by the coupling manufacturer.
  - 5. Reforming manhole floor and invert channel to provide smooth channel transitions to accommodate new connected pipes.
  - 6. Sealing around new pipe with non shrink grout where it intersects manhole wall; make connection watertight.
  - 7. Perform all other operations necessary to restore existing manhole to an acceptable condition to the City Inspector.
- C. If existing manhole does not have steps, connection shall also include furnishing and installing new manhole steps. Steps shall be installed as described in Section 02340, Manholes.
- D. Provide temporary facilities to divert existing sewer flows around work areas in a manner acceptable to the City Engineer.

### **3.5 SEWER SERVICE CONNECTIONS**

- A. Sewer service lines shall extend from a 4-inch or 6-inch wye branch placed in the sewer main, as indicated on the drawings.
  - 1. Normally, a 22 1/2 degree or 45 degree bend, rotated so that proper alignment and grade is established, shall be installed in the main line wye branch.
  - 2. In some instances, the bend may be omitted; and in some instances, two bends may be required.
  - 3. Nose-on connections are not permitted.
- B. All pipe and fittings shall be heavy wall PVC sewer pipe conforming to the specifications found elsewhere in this Section.
- C. Installation:
  - 1. Pipe and fittings for sewer service lines shall be installed as described herein.

2. 4-inch and 6-inch sewer laterals shall be installed at a minimum slope of 1/4-inch per foot, which is about a 2.0 percent grade.
  3. Sewer service lines shall be installed at a uniform grade and alignment; and shall be free of low spots or adverse grades.
- D. Cleaning and Testing.
1. Sewer service lines shall be cleaned, flushed and tested in accordance with applicable requirements of this Section. All testing documentation shall be furnished to the City prior to acceptance.
  2. After flushing and testing have been completed, the end of the service line shall be plugged until the home or business is connected.

### **3.6 CONSTRUCTING COLLARS AROUND EXISTING MANHOLE COVERS**

- A. Construct collars around existing manhole covers after street pavement has been restored.
- B. Collars shall be constructed according to City standards per City Standard Drawing SS-2.

### **3.7 FIELD QUALITY CONTROL**

- A. Clean and Flush new sewer pipe as follows.
  1. Take every precaution to prevent dirt, grease, and all other foreign matter from entering each length of pipe before making connections in field.
  2. After each section of piping is installed, it shall be thoroughly cleaned to remove rocks, dirt, and other foreign matter by washing, sweeping, scraping or other methods that will not harm lining of pipe.
  3. For safety and to prevent rocks and other foreign matter from entering pipe, all open ends of pipe shall be plugged when workmen are not on the job or in the immediate area.
  4. Flushing and testing shall be completed by the Contractor.
  5. All temporary water connections for flushing and drainage shall be furnished, installed, and subsequently removed by the Contractor after completion of the operation.
- B. Perform field inspection and testing in accordance with Section 01400 and 02112.
- C. Pipe installation shall be inspected by the City Engineer or Inspector prior to backfilling of trench; backfilling will be done only after it is authorized by the City Engineer or City Inspector.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to City.
- E. Test for Leakage: Test all pipe, fittings and other items for leakage, in presence of a City Inspector, after items have been cleaned. All joints, couplings, fittings shall be watertight.
  1. Air Test: Low pressure air test may be performed. Section of pipe being tested shall be sealed; line under test shall be pressurized to approximately 3.5 psi; and pressure allowed to stabilize for a minimum of two minutes. During this period air shall be added if pressure drops below 3.5 psi. After this stabilization period, timing shall begin. The time of test, in minutes, shall be equal to the pipe diameter in inches. The maximum allowable pressure drop during specified time period shall be 1.0 psi.

- F. Deflection Test, PVC Sewer Pipe: After PVC sewer pipe has been cleaned, perform deflection test on each section of pipe line between manholes. The maximum allowable pipe deflection, the reduction in vertical inside diameter, shall be 5 percent. Maximum allowable deflection shall be applied to the base inside diameters shown in Table 63, Base Inside Diameters For Deflection Measurements of ASTM D 3034 SDR35 PVC Sewer in the Uni-Bell "Handbook of PVC Pipe", to determine minimum permissible diameter, or other appropriate sources. Testing devices shall include deflectometer, calibrated television or photography, or properly sized mandrel or sewer ball.
- G. Televiser Sewer Lines. After pipe lines have been tested for leakage and deflection, the main sewer lines shall be televised, along with appropriate narrative, by company specializing in this type work. A digital copy of the video shall be provided to the City Engineer. Video shall be provided digitally and shall be in color by a camera capable of pan and tilt capabilities. Maximum speed shall be 20' per minute. Video shall be continuous with steady stream of water running in pipe. If the sewer line has a slope under 2%, televise before warranty and at the end of warranty.

### **3.8 PROTECTION**

- A. Protect pipe and bedding material from damage or displacement.

**END OF SECTION**

## **SECTION 02335**

### **STORM DRAIN SYSTEM**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Storm drain pipe, fittings, and accessories.
- B. Connection of project storm drain pipe line to existing storm drains.
- C. Cleanout boxes, gutter inlet boxes, inlet boxes, diversion boxes, and appurtenant items.
- D. Storm water treatment systems.

##### **1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching for Pipe Work: Excavating, bedding, backfilling and compacting.
- B. Section 02115 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02116 - Fill and Backfill: Bedding and backfilling.
- D. Section 02340 - Manholes and Covers.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for miscellaneous construction.

##### **1.3 REFERENCES**

- A. ASTM C 14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
- B. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- C. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- D. Use the latest issue of the above reference standards as of the date of the Project.

##### **1.4 DEFINITIONS**

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

##### **1.5 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories, and miscellaneous structures.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Project Record Documents:

1. Record location of pipe lines, connections, cleanouts, gutter inlet boxes, inlet boxes, and miscellaneous structures and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

**1.6 REGULATORY REQUIREMENTS**

- A. Conform to applicable code for materials and installation of the Work of this section.

**1.7 PROJECT CONDITIONS**

- A. Coordinate the Work with other contractor working in the area.

**PART 2 PRODUCTS**

**2.1 DRAIN PIPE MATERIALS**

- A. Concrete Pipe: Non-reinforced, ASTM C 14 (ASTM C 14M), Class 3 minimum; inside nominal diameter as indicated, bell and spigot end joints.
- B. Concrete Pipe: Reinforced, ASTM C 76 (ASTM C 76M), Class III minimum with Wall type B; mesh reinforcement; inside nominal diameter as indicated, bell and spigot end joints.
- C. Reinforced Concrete Pipe Joint Device: ASTM C 443 (ASTM C 443M), rubber compression gasket joint.

**2.2 PIPE ACCESSORIES**

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- B. Trash Grates: shall be fabricated galvanized steel grates of design and size.

**2.3 STORM DRAIN STRUCTURES**

- A. Frames and Covers: Heavy duty cast iron, as indicated; designed for H-20 highway loading.
1. Gutter Inlet Box:
    - a. Lid Design: bicycle proof design grate; size and type as indicated.
  2. Cleanout box:
    - a. Lid Design: solid, with pick holes; size and type as indicated.
  3. Inlet Box:
    - a. Lid Design: bicycle proof design grate; size and type as indicated.
  4. Manholes: see Section 02340.
- B. Precast Box: type and size as indicated; minimum floor and wall thickness of 6-inches, minimum top slab thickness of 8-inches; design for H-20 highway loading; sleeved to receive storm drain pipe sections. Concrete work shall conform to Section 03300.



- C. Cast-in-Place Box: of type and size indicated; concrete work shall conform to Section 03300; sleeved to receive storm drain pipe sections.
- D. Joint Filler: flexible, bituminous mastic, gasket type sealant.

## **2.4 BEDDING AND BACKFILL MATERIALS**

- A. Bedding: As specified in Sections 02112 and 02116.
- B. Backfill: As specified in Sections 02112 and 02116.

## **PART 3 EXECUTION**

### **3.1 TRENCHING**

- A. See Section 02112, Trenching for Pipe Work, and Sections 02115 and 02116 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around pipe with bedding material as indicated, tamp in place and compact; then complete backfilling.

### **3.2 INSTALLATION - PIPE**

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.
- B. Install concrete pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal Watertight and provide concrete collar on exterior of manhole or junction box. Seal with non-shrink grout on interior of manhole or box.
- C. Install pipe to slope gradients noted on drawings; with maximum variation of 10% of the design slope.
- D. Connect to existing storm drain boxes as indicated.
- E. Install trash grates over the ends of all exposed inlets, 15-inch diameter and larger.

### **3.3 INSTALLATION - STORM DRAIN STRUCTURES**

- A. Trim bottom of excavation clean and smooth to correct elevation; place bedding as indicated.
- B. Install precast boxes plumb, according to the manufacturer's instructions, at the design elevations as indicated; connect project pipes with appropriate type flexible couplings.
- C. Construct cast-in-place concrete boxes, as indicated; connect project pipes with appropriate type flexible couplings.
- D. Establish elevations and pipe inverts for inlets and outlets as indicated.
- E. Install lid and frame level in top slab of box, as indicated, according to manufacturer's instructions.
- F. Fill all joints between box sections, grade rings, and cover frames with joint sealant.

### **3.4 INSTALLATION - STORM WATER TREATMENT SYSTEMS**

- A. Storm water treatment systems shall be constructed where and as required to meet all applicable rules and regulations.

### **3.5 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400 and 02112.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- C. Infiltration Test: Infiltration test required when pipe line is below groundwater level. The amount of water leaking into the pipe shall be measured; allowable infiltration shall be one gallon per day per inch diameter of pipe per mile of pipe.
- D. Exfiltration Test: Exfiltration test required when pipe line is above groundwater level. The section of pipe to be tested, including upstream structure, shall be filled with water to not less than four feet nor more than eight feet above lowest point of pipe section being tested. The amount of water added during the test period to maintain water level shall be measured; allowable exfiltration shall be one gallon per day per inch diameter of pipe per mile of pipe. An air test per manufacturer's recommendation may be permitted in lieu of exfiltration test as accepted by the City Inspector.
- E. Deflection Test: Check alignment by sighting through pipe or by measurements. Pipe lines shall not vary from horizontal alignment shown on the drawings by more than 0.25 foot.
- F. Televiser Sewer Lines. After pipe lines have been tested for leakage and deflection, the main sewer lines shall be televised, along with appropriate narrative, by company specializing in this type work. A copy of the videotape shall be provided to the City Engineer. Video shall be provided on a CD and shall be in color by a camera capable of pan and tilt capabilities. Maximum speed shall be 20' per minute. Video shall be continuous with steady stream of water running in pipe.

### **3.6 PROTECTION**

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

**END OF SECTION**

## **SECTION 02340**

### **MANHOLES AND COVERS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Monolithic cast-in-place concrete manholes with masonry or precast transition to lid frame, covers, anchorage, and accessories.
- B. Modular precast concrete manhole sections with tongue-and-groove joints, precast transition to lid frame, covers, anchorage, and accessories.

##### **1.2 RELATED SECTIONS**

- A. Section 03300 - Cast-In-Place Concrete.

##### **1.3 REFERENCES**

- A. ASTM A 48 - Standard Specification for Gray Iron Castings.
- B. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
- C. ASTM C 923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manholes Structures, Pipes and Laterals.
- D. Use the latest issue of the above reference standards as of the date of the Project.

##### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of pipe inverts.
- C. Product Data: Provide manhole covers, component construction, manhole steps, features, configuration, and dimensions.

##### **1.5 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in manufacturing products specified in this section with at least three years of documented experience.

#### **PART 2 PRODUCTS**

##### **2.1 MANUFACTURERS**

- A. Amcor-White, Inc.
- B. Geneva Pipe Company.
- C. Substitutions: See Section 01600 - Product Requirements.

## **2.2 MATERIALS**

- A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C 478 (ASTM C 478M), with gaskets in accordance with ASTM C 923 (ASTM C 923M).
- B. Concrete: As specified in Section 03300.
- C. Concrete Reinforcement: As specified in Section 03300.
- D. Manhole Lining: Epoxy coating in accordance to manufacturer specifications.

## **2.3 COMPONENTS**

- A. Manhole Base: precast concrete manhole base of appropriate size.
  - 1. Provide appropriate size flexible sleeves of synthetic rubber, with stainless steel clamps and bolts, for all pipe openings in base section.
  - 2. Construct poured-in-place manhole base where manhole is to be constructed over existing sewer pipe line. Manhole base shall be constructed as indicated on the drawings.
- B. Manhole Rise Sections: precast riser sections of appropriate size and length, extending from top of base section to bottom of top section.
- C. Manhole Top Section: precast eccentric cone section of appropriate size, with 30-inch diameter top opening.
  - 1. Flat slab top sections can be used only where indicated on the plan drawings; designed for H-20 live loading and one-foot minimum earth cover.
- D. Joints: Base section, riser sections, and top section shall have lipped male/female ends, which shall provide uniform and continuous interior wall surface.
  - 1. Joints shall be sealed mastic sealer. Joints may be air tested if the inspector has reason to believe that a joint is not tight.
- E. Grade Rings: precast grade rings, as required, to adjust height of manhole lid and frame.
  - 1. Grade rings shall have key locks and use flexible, bituminous mastic, gasket-type sealer to insure watertight installation.
  - 2. Maximum aggregate height of tow rings to be 12".
- F. Lid and Frame: ASTM A 48, Class 30B Cast iron construction, machined flat bearing surface, removable lid with cleated surface and pick holes, solid lockable lids if indicated, vented lid design in improved areas and solid lid design in unimproved areas, H-20 highway load rating; lid molded with identifying name. Provide Model A-1180 manufactured by D & L Supply. Lids shall be marked with "SARATOGA SPRINGS" and with either "WATER", "SEWER", "PRESSURE IRRIGATION", or "STORM DRAIN", as applicable. Manholes with solid lids shall be epoxy lined.
- G. Manhole Steps: Formed, copolymer polypropylene-encased, steel rungs; 1/2inch diameter minimum. Cast-in-place or vibrate into green concrete. Model PSI-FF manhole steps, manufactured by M. A. Industries, Inc.
- H. Collars: Construct according to City Standard Drawing SS-2.

## **2.4 CONFIGURATION**

- A. Manholes shall be constructed as indicated on the Standard Manhole Detail drawing.
- B. Shaft Construction: Concentric with eccentric cone top section; lipped male/female joints; sleeved to receive pipe sections.
- C. Shape: Cylindrical, unless indicated otherwise.
- D. Clear Inside Dimensions: 48 inch, 60 inch or 72 inch diameter, as indicated.
- E. Design Depth: As indicated.
- F. Clear Lid Opening: 30 inch diameter, as indicated.
- G. Pipe Entry: Provide openings for all pipes entering manhole, as indicated.
- H. Steps: 12 inches on center vertically, set into manhole wall directly under opening.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

### **3.2 PREPARATION**

- A. Where native material encountered at foundation depth of manhole is considered unsuitable, remove unsuitable material; and place and compact bedding material, to limits directed by the City Engineer or City Inspector.

### **3.3 MANHOLES**

- A. Install precast concrete manhole base level on a compacted foundation, according to manufacturer's instructions.
- B. Construct cast-in-place manhole base over existing sewer lines. Manhole base shall be constructed as indicated on the drawings.
  - 1. After new manhole has been completed, saw-cut into top of existing sewer pipe, remove section of pipe as required, and dispose of the removed material; construct watertight grout invert channels through new manhole, between new pipe and existing pipe line. Invert channel shall be formed to direct sewage flows through the manhole as indicated.
  - 2. Divert existing sewage flows around work area to allow connection to existing pipe line to be made.
- C. Forces main discharge manholes shall be epoxy lined.
  - 1. Manhole shall be prepared and liner installed as per manufacture recommendation.

2. Additional manholes immediately downstream of the discharge manhole may also need to be epoxy lined as determined by the City Engineer.
- D. Place manhole riser sections plumb and level, from the manhole base to the top section, as indicated and according to manufacturer's instructions; anchor to base; align steps perpendicular to sewer line, and seal joints.
  - E. Place top section, cone section or flat slab, on top riser section, with opening positioned over steps. Top of cone section or flat slab shall be from 10-inches to 18-inches below final surface elevation.
  - F. Install grade rings, as required, to adjust top of lid and frame to match finish elevation.
  - G. When coring a manhole a minimum of 6" shall be left between outer edge of core and top and bottom of manhole section.
  - H. Connect pipe to manhole with appropriate type flexible coupling as recommended by manufacturer. Provide pipe joint or flexible coupling on all pipes approximately 18-inches from outside of manhole. Grout around pipe after installation is complete. Make connections watertight.
  - I. Grout inside of manhole base sections to form channel between connected pipes, as indicated. Trowel smooth. Top of channel shall be a same elevation as top of outlet pipe.
  - J. Set cast iron frames and covers level without tipping, to correct elevations. After placement, grout around the exterior of frame from top of concrete top section to top of frame, as indicated, to ensure watertight condition. No wood material shall be used to place frames in final position; only solid materials shall be used as accepted by the City Inspector.
  - K. After manhole base has been completed, furnish and install temporary pipe plugs to seal all interior pipe openings; plugs to be Brent DuoSeal Pipe Plug by Burke Rubber Company, Cherne Pipe Plug by Cherne Manufacturing Company. Pipe plugs shall remain in place until final review and acceptance of completed sewer. Plugs shall then be removed; and shall be property of Contractor.
  - L. In paved areas, collars shall be constructed around covers as indicated. Collars shall be constructed after new pavement has been placed and accepted by the City Engineer or City Inspector.
  - M. Coordinate with other sections of work to provide correct size, shape, and location.
  - N. 5-foot and 6-foot manholes. 5-foot manholes shall be used in the following situations:
    - a. At all intersections of three or more 8-inch or larger pipe lines.
    - b. Where the deflection angle of the pipe line exceeds 90 degrees.
    - c. When both items "a" and "b" are designed in the same manhole, a 6-foot manhole is required.

### **3.4 FIELD QUALITY CONTROL**

- A. Manholes shall be tested using vacuum test method to demonstrate integrity of installed materials and construction procedures. Method and material for repair shall be accepted by the City Engineer or City Inspector.
  1. Each manhole shall be tested immediately after assembly and backfilling.

2. Plug all lift holes with a non-shrink grout.
  3. Plug all pipes entering manhole; securely brace plugs during test.
  4. Test head shall be placed at inside top of cast iron frame; and the seal shall be inflated in accordance with manufacturer's recommendations.
- B. Testing shall conform to ASTM C 1244, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
- C. If manhole fails initial test, make necessary repairs per the manufacturer's recommendations. The manhole shall be re-tested until the satisfactory test is obtained.

**END OF SECTION**

## **SECTION 02350**

### **STORM WATER TREATMENT SYSTEM**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Storm water treatment systems.
- B. Reinforced concrete structures.

##### **1.2 RELATED SECTIONS**

- A. Section 02115 - Structural Excavation: Excavating for structures and appurtenant items.
- B. Section 02116 - Fill and Backfill: Bedding, backfilling and compacting.
- C. Section 02335 - Storm Water System.
- D. Section 03300 - Cast-in-Place Concrete: Concrete for structures and appurtenant items.

##### **1.3 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product data on storm water treatment system and appurtenant items including removal curves and washout testing that validate the unit selection
- C. Shop Drawings:
  - 1. Provide dimensional shop drawings; prepared at a scale of not less than 3/16-inches per foot (1:75).
  - 2. Shop drawings shall be annotated to indicate all materials to be used and all applicable standards for materials, required tests of materials, and design assumptions for structural analysis.
  - 3. Submit hard or electronic copies of equipment shop drawings to the City Engineer for review and acceptance.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents: Record actual locations structures and appurtenant items. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

##### **1.4 QUALITY CONTROL INSPECTION**

- A. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the City Engineer. Such inspection may be made at the place of manufacture, or on the work site after delivery, or at both places.
  - 1. The sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture.



2. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once.
  3. All sections which have been damaged beyond repair during delivery will be rejected and, if already installed, shall be repaired to the City Engineer's acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.
- B. All sections shall be inspected for general appearance, dimensions, soundness, and related items. The surface shall be dense, close textured and free of blisters, cracks, roughness and exposure of reinforcement.
- C. Imperfections may be repaired, subject to the acceptance of the City Engineer, after demonstration by the manufacturer that strong and permanent repairs result.
1. Repairs shall be carefully inspected before final acceptance.
  2. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days when tested in 3 inch diameter by 6 inch long cylinders stored in the standard manner.
  3. Epoxy mortar may be utilized for repairs.

## **PART 2 PRODUCTS**

### **2.1 STORMWATER HYDRODYNAMIC VORTEX TREATMENT STRUCTURE (HVS)**

1. Construct the reinforced concrete structure for the treatment system as indicated on the drawings.
2. Structure dimensions, wall thicknesses, and slab thicknesses shall be as indicated on the dimensional drawings.
3. Concrete for structure shall conform to Section 03300; and shall meet the following additional requirements:
  - a. All concrete shall be cured in accordance with the City Standards and Specifications. Concrete sections shall not be stripped until the concrete has attained a compressive strength of 4,000 psi or 5 days after fabrication and/or repair, whichever is the longer.
  - b. Joints shall be as shown on the drawings with a butyl mastic sealant conforming to ASTM C 990.
4. Pipe openings shall be sized to accept pipes of the specified size(s) and material(s), and shall be sealed with a hydraulic cement conforming to ASTM C 595M or Link-Seal.
5. Internal aluminum plate components shall be aluminum alloy 5052-H32 in accordance with ASTM B 209.
6. Brick or masonry used to build the manhole frame to grade shall conform to ASTM C 32 or ASTM C 139 and shall be installed in conformance with Section 02340 and all City requirements.
7. Manhole frames and covers shall be in accordance with Section 02340; with the words "Storm Water Treatment System" cast in covers.
8. A bitumen sealant in conformance with ASTM C 990 shall be utilized in affixing the aluminum swirl chamber to the concrete vault.
9. The cast iron manhole frames and covers shall be sized as per the manufacturer's drawings and shall be in accordance with ASTM A48, CL.35B and AASHTO M105. The masonry fixing bolts shall be Type 304 stainless steel.

B. Treatment System Components and Design.

1. Storm water treatment system shall include a tangential inlet to induce a swirling flow pattern that will accumulate and store settleable solids in a manner and a location that will prevent re-suspension of previously captured particulates. Swirl chamber diameter shall be sized for the anticipated storm water flows.
2. Storm water treatment system shall be of a hydraulic design that includes flow controls designed and certified by a professional engineer, using accepted principles of fluid mechanics, which raise the water surface inside the tank to a pre-determined level in order to prevent the re-entrainment of trapped floating contaminants.
3. Storm water treatment system shall have a design treatment capacity sized for the anticipated storm water flows; and shall not re-suspend trapped sediments or re-entrain floating contaminants at flow rates up to and including the design treatment capacity.
4. Storm water treatment system shall have usable sediment storage capacity of volume designed by the manufacturer for the anticipated storm water flows.
5. The system shall be designed such that the pump-out volume is less than one-half of the total system volume.
6. The system shall be designed to not allow surcharge of the upstream piping network during dry weather Conditions and shall have a sediment sum that is protected from high flows during peak flow events.
7. A water-lock feature shall be incorporated into the design of the storm water treatment system to prevent the introduction of trapped oil and floatable contaminants to the downstream piping during routine maintenance and to ensure that no oil escapes the system during the ensuing rain events.
8. Direct access shall be provided to the sediment and floatable contaminant storage chambers to facilitate maintenance. There shall be no appurtenances or restrictions within these chambers.
9. The manufacturer shall certify that storm water treatment system conforms to the performance requirements described herein for the anticipated storm water flows.

C. Manufacturer.

1. Only products that have been approved for pretreatment by the Washington Department of Ecology under general use level designation (GULD) or conditional use level designation (CULD) shall be allowed.

## **2.2 SEPARATION TYPE STORM WATER TREATMENT SYSTEMS**

A. Reinforced Concrete Structures.

1. Construct the reinforced concrete manholes for the treatment system as indicated on the drawings.
2. Manholes shall be sized by the manufacturer to conform to the performance requirements described herein.
3. Manholes shall be constructed as described in Section 02340.
4. Pipe openings shall be sized to accept pipes of the specified size(s) and material(s), and shall be sealed with a hydraulic cement conforming to ASTM C 595M or Link-Seal.
5. Manhole frames and covers shall be in accordance with Section 02340; with the words "Storm Water Treatment System" cast in covers.

- B. Treatment System Components and Design.
  - 1. The storm water treatment system shall include a primary manhole, separator unit, storage manhole, pipes, fittings, and appurtenant items.
  - 2. The primary manhole will accumulate and store coarse settleable solids; and the storage manhole will accumulate and store fine settleable solids, oils and floatable contaminants. Manholes shall be designed to prevent re-suspension of previously captured particulates; and shall be sized for the anticipated storm water flows.
  - 3. The separation unit and piping shall be designed and certified by a professional engineer, to totally treat the anticipated storm water flows. No overflow of the system will be allowed.
- C. Manufacturer.
  - 1. Only products that have been approved for pretreatment by the Washington Department of Ecology under general use level designation (GULD) or conditional use level designation (CULD) shall be allowed.

### **2.3 STORM WATER TREATMENT SYSTEM PERFORMANCE**

- A. Performance. Storm water treatment systems shall adhere to the following performance specifications at the anticipated design treatment capacities.
  - 1. Treatment standard: 80% TSS based on a particle size with a max 110  $\mu$ m average (D50) particle size at the water quality flow rate
  - 2. Detained Water Quality Flow Rate: 100-yr peak flow through the orifice during the critical storm less than 24 hours in duration
  - 3. Undetained Water Quality Flow Rate: 2 year peak flow through the system during the critical storm less than 24 hours in duration
  - 4. Peak Flow (pass through) rate: 100-yr peak flow through the system during the critical storm less than 24 hours in duration
- B. The design engineer shall determine the following performance requirements:
  - 1. Total treatment capacity.
  - 2. Sediment storage capacity.
- C. The design engineer shall submit calculations used to determine anticipated storm water flows.
  - a.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that the storm drain pipe line sizes, locations, and invert elevations are as indicated on the drawings.

### **3.2 PREPARATION**

- A. Prepare ends of storm drain pipe for connections to treatment system structures.

### **3.3 EXCAVATION**

- A. See Sections 02115 and 02116 for additional requirements.
- B. Excavate to the limits as described in Section 02116.
- C. After the concrete structures have been completed, backfill around and over the structure, tamp in place and compact. See Section 02116 for requirements.

### **3.4 CONSTRUCTION - CONCRETE STRUCTURE**

- A. Furnish all labor, materials, equipment and appurtenant items required to construct the reinforced concrete structure for the storm water treatment system, in accordance with the drawings and the specifications.
- B. Furnish, place and compact granular base of the thickness indicated; conforming to Section 02116.
- C. Construct the reinforced cast-in-place concrete structure as indicated on the drawings.
  - 1. Precast concrete vaults may be used with the following requirements.
    - a. Concrete shall conform to the requirements of Section 03300.
    - b. Precast concrete vaults shall be designed for HS20-44 loading as determined by a Licensed Professional Engineer.
    - c. Precast sections shall have tongue and groove joints with a butyl mastic sealant conforming to ASTM C990
    - d. Vaults shall conform to the dimensions indicated for the cast-in-place vault, and to the appropriate required described herein.
    - e. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of Stormwater Treatment Systems shall conform to ASTM specification C 891 "Standard Practice for Installation of Underground Precast Utility Structures".
    - f. Holes made in the concrete sections for handling or other purposes shall be plugged with a non-shrink grout or by using grout in combination with concrete plugs.
    - g. Where holes must be cut in the precast sections to accommodate pipes, do all cutting before setting the sections in place to prevent any subsequent jarring which may loosen the mortar joints. The Contractor shall make all pipe connections; connections shall be watertight.
- D. The treatment system shall be installed inside of the vault before the top slab for the vault is constructed or installed.
- E. Outlet weirs shall be constructed where and as required and using manufacturer's recommendations.
- F. After constructing the roof section of the vault, set precast concrete manhole riser sections, to the height required to bring the cast iron manhole covers to grade, so that the sections are vertical and in true alignment with a 1/4-inch maximum tolerance allowed.
- G. Backfill around vault in a careful manner, bringing the fill up in 6-inch lifts on all sides.
- H. If leaks appear, clean the inside joints and caulk with lead wool.

- I. Construct 12' paved access road to storm water treatment manhole; access roads are to meet all city road standards as per section 00500 (Tables 6 - 10).

### **3.5 CONSTRUCTION - CONCRETE MANHOLES**

- A. Furnish all labor, materials, equipment and appurtenant items required to construct reinforced concrete manholes for the separation type storm water treatment system, in accordance with the drawings and the specifications.
- B. Furnish, place and compact granular base of the thickness indicated; conforming to Section 02316.
- C. Construct the reinforced concrete manholes as indicated on the drawings; conforming to Section 02640.

### **3.6 INSTALLATION - TREATMENT SYSTEMS**

- A. HVS Treatment System.
  1. Furnish all labor, materials, equipment and appurtenant items required and install storm water treatment systems and appurtenances in accordance with the Drawings and these specifications, and according to manufacturer's written instructions and recommendation.
  2. After constructing the base and wall sections, prepare to install the swirl chamber.
    - a. Place the 3/4-inch thick by 3/4-inch wide butyl mastic seal vertically on the outside of the swirl chamber starting one inch above the bottom of the swirl chamber and continuing to a height equal to the elevation of the bottom of the upper aperture of the swirl chamber.
    - b. The butyl mastic seal should about the downstream side of the pre-drilled mounting holes that attach the swirl chamber to the long walls of the concrete vault.
    - c. Next, install the extruded EPDM seal on the bottom edge of the 180 degree downstream section of the swirl chamber by first applying a bead of Sikaflex-1a polyurethane elastomeric sealant into the extruded slot, then slide the seal onto the swirl chamber. The extruded seal should extend 3-inches upstream of the mounting holes, toward the inlet end of the vault.
    - d. Set the swirl chamber into position and keep the seal approximately 1/2-inch above the floor of the concrete vault. Apply a continuous bead of Sikaflex-1 a sealant under the cupped bottom of the seal.
    - e. Set and anchor the circular swirl chamber by bolting the swirl chamber to the side walls of the concrete vault at the three (3) tangent points and at the inlet tab using HIL TI brand stainless steel drop-in wedge anchors, or equivalent, 3/8-inch diameter by 2-3/4 inch minimum length at heights of approximately three (3) inches off the floor and at fifteen (15) inch intervals to approximately the same height of the butyl mastic sealant (at locations of pre-drilled holes in aluminum components). Apply a continuous bead of Sikaflex-1 a sealant to the intersection of the inside bottom edge of the extruded seal and the vault floor.
  3. Prior to constructing the roof section, bitumen sealant equal to ASTM C 990 shall be placed along the top of the baffle wall, using more than one layer of mastic if necessary, to a thickness at least 1-inch greater than the nominal gap between the top of the baffle and the roof section.
    - a. The nominal gap shall be determined either by field measurement or the shop drawings.
    - b. After construction of the roof section has compressed the butyl mastic sealant in the gap, finish sealing the gap with a non-shrink grout on both sides of the gap

- using the butyl mastic as a backing material to which to apply the grout.
- c. Also apply non-shrink grout or Sikaflex-1a to the joints at the side edges of the baffle walls.

B. Separation Type Treatment System.

1. Furnish all labor, materials, equipment and appurtenant items required and install storm water treatment systems and appurtenances in accordance with the Drawings and these specifications, and according to manufacturer's written instructions and recommendation.
2. Manholes shall be constructed as described herein, and according to the requirements of the treatment system manufacturer.
3. The separator unit, pipe and fittings, and appurtenant items, shall be installed according to the shop drawings and as recommended by the manufacturer.

**3.7 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400.
- B. If tests indicate that the Work does not meet specified requirements, remove the Work and replace or repair the work as required; and retest at no cost to the City Engineer.

**3.8 PROTECTION**

- A. Protect the treatment systems from damage or displacement until backfilling operations have been completed.

**END OF SECTION**

## **SECTION 02355**

### **STORM WATER DETENTION PONDS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Storm water detention ponds.
- B. Pond pipe lines, structures, and appurtenant items.

##### **1.2 RELATED SECTIONS**

- A. Section 02100 - General Excavation: General excavating, embankments and compacting.
- B. Section 02112 - Trenching for Pipe Work: Excavating, bedding, backfilling and compacting.
- C. Section 02115 - Excavation: Excavating for structures and appurtenant items.
- D. Section 02116 - Fill and Backfill: Bedding, backfilling and embankment material.
- E. Section 02335 - Storm Drain System.
- F. Section 02724 - Automatic Sprinkling System.
- G. Section 02726 - Landscaping.
- H. Section 03300 - Cast-in-Place Concrete: Concrete for structures.

##### **1.3 REFERENCES**

- A. See Section 02335 for storm water system materials.

##### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, accessories and soil and embankment material.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- E. Storm water detention ponds, structures and all appurtenant items shall be sized and designed by the developer's engineer. Ponds shall be designed and constructed according to the City's standards. The plan drawings shall be submitted to the City Engineer for review; along with all calculations required to show how the various components were sized and how they are intended to operate. No work shall be done until the plan drawings have been accepted by the City Engineer.
- F. Geotechnical report and recommendations.

## **1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with City's requirements as described herein.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store materials as recommended by the manufacturers.

## **PART 2 PRODUCTS**

### **2.1 EMBANKMENT AND BACKFILL MATERIALS**

- A. Embankment and Backfill Materials: As specified in Sections 02112, 02115 and 02116.

### **2.2 PIPE LINES AND STRUCTURES**

- A. Pipe lines and structures shall be constructed as specified in Section 02335.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that location and elevations are as indicated.

### **3.2 PREPARATION**

- A. Clear and grub the pond site, as required; and dispose of cleared material in a legally acceptable manner.
- B. Remove top soil material as described in Section 02100.

### **3.3 POND CONSTRUCTION**

- A. See Section 02112 and Sections 02115 and 02116 for additional requirements.
  - 1. See Section 02335 for installation of pipe lines. Construct a pipeline under the pond, or a concrete-lined low-flow channel through the bottom of the pond to convey flows that are less than the capacity of the outlet.
- B. Excavate for ponds and structures to the limits indicated on accepted drawings; conforming to the requirements of Section 02100.
  - 1. Furnish, place and compact gravel base, as indicated on the drawings, for structures.
  - 2. Furnish, place and compact pipe bedding and backfill material for pipe trenches.
- C. Compact sub-base as described in Section 02115.
- D. Construct embankments as indicated on the drawings and as described in Section 02100.
  - 1. Embankments shall have maximum slopes of 3 horizontal to 1 vertical.
  - 2. Construct a 12-foot wide (minimum) maintenance access road to the bottom of pond and for access to structures. The access road pavement shall be capable of supporting H-20 loading. The maximum slope shall be 15 percent.



3. Embankment shall provide a minimum of 1' of freeboard.
- E. Construct pond structures as indicated on accepted construction drawings.
    1. Bubble-up type inlet boxes shall be constructed in the pond to discharge high flows of storm water into the pond; and to allow water to drain from the pond at controlled rates, as required. Boxes shall be as indicated on the construction drawings; and shall be constructed with floor of boxes at least 6-inches below pipe inverts.
    2. Construct an overflow box or spillway in the pond as per the accepted construction drawings. Overflow box shall have a trash grate of accepted design; and spillway shall convey overflows to the public row or to an acceptable location as accepted by the City Engineer.
  - F. Construct automatic sprinkling system for pond area, as indicated on accepted construction drawings; conforming to Section 02724.
  - G. Landscape the pond area, as indicated on accepted construction drawings; conforming to Section 02726.

### **3.4 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to City.

**END OF SECTION**

## **SECTION 02410**

### **WATER DISTRIBUTION SYSTEM**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Pipe and fittings for project water lines, to include domestic water lines, fire water lines, and drinking water lines.
- B. Valves, Fire hydrants, and appurtenant items.

##### **1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching for Pipe Work: Excavating, bedding, backfilling and compacting.
- B. Section 02115 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02116 - Fill and Backfill: Bedding and backfilling.
- D. Section 02415 - Disinfection of Water Distribution Systems: Disinfection of site service utility water piping.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for thrust restraints.

##### **1.3 REFERENCES**

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; The American Society of Mechanical Engineers.
- C. ASTM B 88 - Standard Specification for Seamless Copper Water Tube.
- D. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- E. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society.
- F. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association (ANSI/AWWA C104/A21.4).
- G. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association (ANSI/AWWA C105/A21.5).
- H. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association (ANSI/AWWA C111/A21.11).
- I. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).
- J. AWWA C502 - Dry Barrel Fire Hydrants; American Water Works Association (ANSI/AWWA

C502/C502a).

- K. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- L. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; (ANSI/AWWA C508/C508a).
- M. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- N. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C515).
- O. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; (ANSI/AWWA C600).
- P. ASTM D2774 - Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
- Q. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution; American Water Works Association; (ANSI/AWWA C900/C900a).
- R. AWWA C200 - Steel Water Pipe casings, 6-inches and larger as needed.
- S. Use the latest issue of the above reference standards as of the date of the Project.

#### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of all improvement including, pipe lines, valves, connections, thrust restraints, services and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### **1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with Owner's requirements as described herein.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store valves in shipping containers with labeling in place.

### **PART 2 PRODUCTS**

#### **2.1 WATER PIPE**

- A. Ductile Iron Pipe: AWWA C151:
  - 1. Fittings: Ductile iron, standard thickness.
  - 2. Joints:

- a. Push-On Joints: AWWA C111, push-on type with rubber gasket.
  - b. Mechanical Joints: AWWA C111, mechanical joint type with gasket, bolts, and nuts.
  - c. Flange Joints: AWWA C110, flange type with gasket, bolts, and nuts.
- 3. Jackets: AWWA C105 polyethylene jacket with polyethylene tape.
- B. Copper Tubing: ASTM B 88, Type K, annealed: Not allowed in right-of-ways.
  - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
  - 2. Joints: Compression connection or AWS A5.8, BCuP silver braze.
- C. PVC Pipe: AWWA C900 DR-18 for lines up to and including 24 inches in diameter.
  - 1. Fittings: AWWA C111, cast iron.
  - 2. Joints: ASTM D 3139 compression gasket ring.
- D. Polyethylene Pipe: ASTM D2737, C.T.S., 200 psi, SDR 9.
  - 1. Joints: Mueller compression type couplings.
- E. High Density Polyethylene Pipe: AWWA C906:
  - 1. Material: PE 4710 High Density Polyethylene (HDPE) meeting ASTM D3350 cell classification of 445474C
  - 2. Pressure Class 200. DR 11.
  - 3. Fittings: AWWA C906, molded or fabricated: or mechanical joint ductile iron fittings.
  - 4. Joints: Butt fusion.
- F. Trace Wire: #14 gauge to be installed on all buried pipe. Provide continuity test to ensure proper installation.
- G. Detector Tape: Blue plastic tape imprinted with "DRINKING WATER" in large letters, to be installed on all buried pipes.

## **2.2 CASING PIPE MATERIALS**

- A. Jack And Bore Construction Method:
  - 1. Welded Steel Pipe: AWWA C 200, steel water pipe; diameter as indicated.
  - 2. Casing Insulators: Fusion coated steel casing insulators with 12-inch wide band and 2-inch wide glass reinforced plastic runners; Model C12G-2, manufactured by Pipeline Seal and Insulator, Inc.
  - 3. Casing End Seals: Flexible S-shaped seals fabricated on synthetic rubber with stainless steel bands and clamps; Model S Pull-On End Seals, manufactured by Pipeline Seal and Insulator, Inc.
  - 4. Casings under irrigation canals shall meet the more-stringent of either the City Standards or the canal company's standards and regulations
- B. Horizontal Directional Drilling Method:

1. High density polyethylene pipe, AWWA C906, PE 4710
2. Diameter Ratio (DR): 17 or 11
3. Joints: butt fused.

## **2.3 VALVES**

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
1. Jackets: AWWA C105 polyethylene jacket with polyethylene tape.
- B. Gate Valves:
1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
  2. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint or flanged ends as indicated, and cast iron valve box.
  3. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends, as indicated, and cast iron valve box.
  4. Product: Mueller Resilient Wedge or American Flow Control 2500 NRS RS.
- C. Check Valves From 2 Inches to 24 Inches:
1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
  2. Product: Valmatic Surge Buster Swing-Type Check Valve.
- D. Corporation Stops: Shall be type for connecting to copper or polyethylene pipe; Mueller No. H- 15000.
- E. Blow-Off Hydrants: shall be Non-Freeze Blow-Off Assembly.

## **2.4 HYDRANTS**

- A. Hydrants: AWWA C502, UL 246, dry barrel type.
1. Jackets: AWWA C105 polyethylene jacket with polyethylene tape.
  2. Inside dimension: 7 inches minimum, with minimum 5 inches diameter valve seat opening.
  3. Minimum net water area of barrel not less than 190 percent of valve opening.
  4. 6 inch flanged inlet connection with accessories, gland bolts, and gaskets.
  5. Product: Mueller "Super Centurion 250", Waterous "Pacer WB 67-250", or Clow "Medallion" Fire Hydrants.
- B. Hydrant Extensions: Fabricate with rod and coupling to increase barrel length, 1 extension maximum.
- C. Hose and Streamer Connection: Two hose nozzles, 2 1/2-inch size, one pumper nozzle, 4 1/2 inch size.

- D. Finish: Buried portion of hydrant shall be painted with two coats of CA50 coal tar enamel. Exposed portion shall be painted with Primer and two coats of enamel in red color conforming to the currently adopted Fire Code.

## **2.5 BEDDING AND COVER MATERIALS**

- A. Bedding: As specified in Sections 02112 and 02116.
- B. Backfill: As specified in Sections 02112 and 02116.

## **2.6 ACCESSORIES**

- A. Service Saddles: shall be bronze, double-strap type; Mueller No. H-16134.
- B. Concrete for concrete collars, slabs, and thrust restraints: Concrete type specified in Section 03300.

## **2.7 RESIDENTIAL WATER CONNECTIONS**

- A. Meter boxes, meter setters, meters, and appurtenant items shall be as indicated on the drawings.

# **PART 3 EXECUTION**

## **3.1 EXAMINATION**

- A. Verify that water main and main line tee size, location, and invert are as indicated.
- B. Verify bedding material and installation.
- C. Verify trails lines continuity.
- D. Verify thrust block installation and sizing.

## **3.2 PREPARATION**

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

## **3.3 TRENCHING**

- A. See Section 02112 and Sections 02115 and 02116 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required square footage of thrust restraint bearing on subsoil as indicated on the drawings.
- D. Backfill around sides and to top of pipe with backfill material, tamp in place and compact, then complete backfilling.

### **3.4 INSTALLATION - PIPE**

- A. Maintain separation of water main from sewer piping in accordance with State code.
- B. Establish elevations of buried piping to ensure not less than four feet of cover over pipe; or as indicated on the drawings.
- C. Install pipe to indicated elevation to within tolerance of one inch.
- D. Install ductile iron piping and fittings to AWWA C600.
- E. Install PVC pressure pipe and fittings to ASTM D2774.
- F. Install pipe lines to line and grade indicated.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Install access fittings to permit disinfection of water system performed under Section 02415.
- I. Install #14 trace wire and detector tap above all pipe; coordinate with Section 02112.
- J. Do not drop pipe into trench. Pipe shall be lowered into the trench using mechanical equipment attached to the pipe with flexible straps attached in at least two locations.
- K. Keep exposed pipe ends closed when not actively working to prevent the contamination of the interior of the pipe.

### **3.5 INSTALLATION - CASING PIPES**

- A. See Sections 02315 and 02316 for structural excavation and fill and backfill; and for additional requirements.
- B. Install casing pipes where indicated.
- C. Install casing pipes at the line and grade as required to allow carrier pipes to be installed within the casing pipes at the design line and grade, as indicated on the drawings.
- D. Place casing insulators on carrier pipes to properly center and position carrier pipe inside the casing pipes; space insulators as recommended by the pipe manufacturer.
- E. Carrier Pipe inside of casing shall have restrain joints per City Engineer.
- F. Seal each end of casing with appropriate size flexible end seals; install according to manufacturer's instructions and recommendations.
- G. Seal bore holes at each end, around periphery of casing, with grout, impervious clay or brick masonry.
- H. Contractor shall be solely responsible for the accuracy, safety and adequacy of construction methods and procedures for installing casing pipes, and for any damage which may result from their failure. All operations of the Contractor for installation of casing pipes shall be subject to acceptance by the agency having jurisdiction over the item being crossed.
- I. Contractor shall enter any agreement with, and furnish any and all indemnity and other bonds that may be required by, the agency listed above, for their protection against injury and

interference with flow of water caused by the operations of the Contractor.

- J. Contractor shall secure required permission from the agency listed above before commencing with the installation of casing pipes and related work along and across the respective areas.

### **3.6 INSTALLATION - VALVES AND HYDRANTS**

- A. Set valves on concrete block.
- B. Center and plumb valve box over valve operating nut. Set box cover flush with finished grade. Valve nut not to exceed 4' in depth without valve nut extension.
- C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.
- D. Set hydrants to grade, with bury mark at ground level and with nozzles at least 18 inches above ground level.
- E. Locate hydrant control valve as indicated on the accepted drawings.
- F. Provide a drainage pit, 24 inches square by 12 inches deep, filled with 1/2-inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening

### **3.7 SERVICE CONNECTIONS**

- A. Provide water service as indicated in detail with meter box and meter yoke with double check valve.

### **3.8 CONNECTIONS TO EXISTING WATER LINES**

- A. Connection to existing water lines shall be made where and as indicated on the accepted drawings. The sizes of pipe, fittings, valves and appurtenant items required to make connection shall correspond to the sizes of existing pipe and of project pipe.
- B. Excavate to existing pipe line at point of connection; determine actual conditions of existing pipe and all fittings and appurtenant items required to make the connection; and have all materials needed on site prior to any shut down or cutting into existing pipe lines.
- C. Connection which involve cutting into existing pipe lines include: cutting and removing sections of existing pipe and fittings as required; cleaning and preparing ends of existing pipe as required for connection; furnishing and installing all new pipe, fittings and valves required to make the connection of project pipe to the existing pipe as indicated; and all appurtenant work required to complete the connection.
- D. Connection into existing pipe lines under pressure include: furnishing and installing mechanical joint tapping sleeve of the appropriate size on the existing pipe at point of connection; furnishing and installing tapping valve, with valve box, on sleeve; tapping existing pipe with drilling machine and equipment, without interrupting flow in existing pipe line; and all appurtenant work required to complete the connection.
- E. Connection to existing pipe line shall be made at such times and within the time limits and according to the directions as agreed to between the Contractor and the Owner.
- F. Cut and plug existing pipe lines where indicated on the drawings. Excavate as required to locate existing pipe lines to be abandoned in place; cut the existing pipe, as required; and



install permanent plug in end of pipe to be abandoned.

- G. Follow AWWA C651 guidelines for cutting existing pipes.

### **3.9 RECONNECT EXISTING WATER SERVICE LINES**

- A. Reconnect existing water service lines where and as indicated on the accepted drawings. The sizes of pipe, fittings, saddles, corporation stops, and appurtenant items required to make reconnections shall correspond to the sizes of existing service lines and of project pipe.
- B. Excavate as required to locate the existing service line; determine actual conditions of existing service line and all fitting and appurtenant items needed to make the reconnections; and have all materials needed on site prior to any shut down of existing service line.
- C. After project pipe line has been thoroughly tested, disinfected and put into operation, disconnect existing water service lines from the existing water line. Excavate as required to expose the existing service line; cut the existing service line and remove back to main as required; and remove the existing corporation stop from the existing pipe and install a permanent plug in the tap in the existing water line which is to be abandoned.
- D. Tap the project pipe line with the appropriate size tapping machine and install a double strap service saddle, with corporation stop, on the project pipe. New copper tubing sized polyethylene (blue) pipe shall be furnished and installed to make the connection from the end of the existing service line to the new corporation stop. The new CTS sized poly pipe tubing shall be connected to the end of the existing service line with the appropriate type coupling and to the new corporation stop. In all reconnections, at least five feet of new tubing shall be installed, as indicated. Insulating couplings or adapters shall be used to connect pipe of dissimilar material.
- E. After the existing water service line has been disconnected from the existing water line, the reconnection work shall be pursued diligently so that the service line is reconnected to the project water line and put back into service in the shortest possible time.

### **3.10 REMOVING EXISTING FIRE HYDRANTS**

- A. Existing fire hydrant installations shall be removed and delivered to the Owner.
- B. Excavate as required to locate the existing hydrant supply line and control valve; determine actual conditions of existing supply line and all fitting required to complete the removal; and have all material needed at the job site prior to any shut down or cutting into existing pipe.
- C. After project pipe line has been thoroughly tested, disinfected and put into operation, cut the existing hydrant supply line and remove back to tee at main. Install a plug in the tee and secure with bolts as per manufacture recommendation. Remove the existing hydrant, control valve and valve box and deliver the material to the Owner.
- D. After the hydrant installation has been completely removed and the existing pipe plugged, backfill the excavation to match adjacent ground surfaces; and compact material as described herein.

### **3.11 WATER METER RELOCATION**

- A. Contractor shall notify the water customer and the City 48 hours in advance before starting the water service meter relocation. Contractor will be responsible for obtaining all necessary permits from the City. Contractor shall verify size and type of materials required for the water

service meter relocation before commencing work. The Contractor shall also be responsible for relocation, reconnection, and replacement of any damaged materials.

1. After existing meter box is moved, the resultant void shall be backfilled, compacted, and the surface restored.
2. The meter box, ring, and lid shall be installed to one inch above final grade.
3. The relocated service shall be located so the meter box is centered in the park strip and the meter shall be rotated from perpendicular to parallel to the street.
4. The water service meter setter shall be installed in the horizontal and up-right position and with the top of the angle stop eighteen (18) to twenty two (22) inches below the finish grade. (See Standard Details CW-5).
5. Length of water service CTS poly pipe extension shall be the minimum length necessary to install the water service meter setter in its new location.
6. Contractor shall replace any water service meter that is damaged or misplaced as a result of the Contractor's operation.
7. Place a compression coupler over the section of CTS poly pipe at the location where the pipe was crimped.
8. Extend the trace wire and splice using a grease nut.

- B. Water services may need to be upgraded to current City Construction Standards.

### **3.12 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 200 PSI for 2 hours.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- D. Disinfection and bacteria testing per section 02415.

**END OF SECTION**

## **SECTION 02412**

### **PRESSURE REDUCING VALVE STATION**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Pressure regulating valve (PRV) station; including reinforced concrete vault, pipe, fittings, valves, and appurtenant items.

##### **1.2 RELATED SECTIONS**

- A. Section 02115 - Excavation: Excavating for structures and appurtenant items.
- B. Section 02116 - Fill and Backfill: Bedding and backfilling.
- C. Section 02410 - Water Distribution System: Pipe, fittings, valves and appurtenant items.
- D. Section 02415 - Disinfection of Water Distribution Systems: Disinfection of station piping.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for concrete vault and thrust restraints.

##### **1.3 REFERENCES**

- A. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM C 858 - Standard Specification for Underground Precast Concrete Utility Structures.
- C. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- D. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- E. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C151).
- F. Use the latest issue of the above reference standards as of the date of the Project.

##### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

##### **1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with Owner's requirements as described herein.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store valves and appurtenant items in shipping containers with labeling in place.

## **PART 2 PRODUCTS**

### **2.1 REINFORCED CONCRETE VAULT**

- A. Reinforced Concrete Vault. The reinforced concrete vault is shown on the drawings as constructed of poured-in-place concrete; but a precast reinforced concrete vault may be provided at the option of the Contractor.
  - 1. The vault shall be sized to adequately accommodate all valves, pipe, fittings and appurtenant items to be enclosed in the vault.
  - 2. Poured-in-Place Concrete. A poured-in-place reinforced concrete vault, of the size indicated on the construction drawings, may be constructed; which shall conform to applicable requirements of Section 03300.
  - 3. Precast Concrete. A precast reinforced concrete vault of equal dimensional and strength characteristics, as determined by the City Engineer during shop drawing review, may be provided. Precast vault shall have wall thickness of 9-inch minimum, bottom slab thickness of 6-inch minimum, and top slab thickness of 9-inch minimum; designed for H-20 highway loading.
    - a. Precast vault shall conform to ASTM C 858; and shall be as manufactured by Amcor-White, Inc., Dura-Crete.
  - 4. Reinforcement. Reinforcing steel shall be as specified in Section 03300, using Grade 60 bar of the size(s) shown on the construction drawings.
  - 5. Steps. Plastic encased steel steps shall be installed in station walls; spaced at 12-inches on center and centered under the access opening. Steps shall be copolymer poly-propylene- encased, 60,000 tensile strength steel, Model PSI-FF manhole steps, as manufactured by M. A. Industries, Inc.
    - a. An aluminum ladder may be provided and permanently installed.
- B. Access Doors: The access door leaf and channel frame, with strap anchors, shall be constructed of steel with hot-dip galvanized finish (ASTM 123); designed for H-20 highway loading. Doors shall be provided with 316 stainless steel hardware throughout; including all parts of the latch and lifting mechanism assemblies, hold open arms and guides, and all brackets, hinges, pins and fasteners. The doors shall have recessed has covered by a hinged lid flush with the surface of the door.
  - 1. The access doors shall be Type J Access Doors as manufactured by The Bilco Company of the size indicated on the drawings. The manufacturer shall guarantee the door against defects in material and workmanship for a period of five years.
- C. Proprietary Items. Provide proprietary items of the type, size and manufacture noted on the drawings or as required to complete the work.
- D. Miscellaneous Metal Work. Furnish and erect miscellaneous metal work as required to complete the pressure regulating station, as described herein and as shown on the drawings.

1. Codes. Specifications for the Design, Fabrication and Erection of Structural Steel For Buildings of the American Institute of Steel Construction shall govern the work. Welding shall be done in accordance with applicable and most recent American Welding Society Standards.
  2. Substitutions. Substitutions of sections or modifications of details, or both, and the reasons therefore shall be submitted for acceptance by the City Engineer.
  3. Responsibility for Errors. The Contractor shall be responsible for all errors of detailing, fabrication, erection, and correct fitting of the miscellaneous metal work.
  4. Materials. Material shall conform to their respective specifications as follows:
    - a. Bolts and Nuts: ASTM Standard A-307
    - b. Gray Iron Castings: A-48 Class 40 or Better
    - c. Structural Steel: ASTM Standard A-36
    - d. Washers: ASTM Standard B-27.2, Type B
    - e. Miscellaneous Items: Miscellaneous items shall be as indicated on the drawings or as required.
- E. Painting. All exposed pipe, valves, fittings, and metal work inside of the station shall be painted with either: four coats of alkyd paint, Painting System II (Steel Structural Painting Council - Specification No. 2); or four coats of phenolic paint, Painting System III (Steel Structural Painting Council - Specification No. 3). Painting shall include surface preparation, pretreatment, primer coat, inter-mediate coats, and finish coat, as specified; with total dry film thickness not less than 4.0 mils. Aluminum surfaces which will be in contact with concrete after erection shall be coated with bituminous mastic coating, SSPC- Paint 12, prior to erection.

## **2.2 VALVE STATION PLUMBING**

- A. Pipe and Fittings.
1. Ductile Iron Pipe: AWWA C151: See Section 02410. Exposed pipe and fittings shall not be coated with coal tar pitch varnish; but shall be painted as specified herein.
  2. Copper Tubing: ASTM B 88, Type K, annealed: See Section 02410.
  3. Galvanized Steel Pipe: ASTM A 53: Galvanized steel pipe shall be Schedule 80, seamless or welded pipe, with threaded ends. Fittings shall be 150 lb. galvanized malleable iron banded type, with screwed ends. Unions shall be galvanized railroad type with ground brass-to-iron seats.
- B. Valves.
1. Manufacturer's name and pressure rating marked on valve body.
  2. Gate Valves Up To 3 Inches:
    - a. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel.
    - b. Product: Powell U.S. Bronze Gate Valves.
    - c. Substitutions: See Section 01600 - Product Requirements.
  3. Gate Valves 3 Inches and Over:
    - a. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends as indicated, and cast iron valve box.
    - b. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut,

single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.

- c. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box, or accepted equal.

4. Pressure Reducing Valves:

- a. Valves shall have cast iron or stainless steel bodies, with bronze pilot and trim; designed to reduce a higher inlet pressure to a steady lower pressure downstream, regardless of flow rate.
- b. Valves shall be hydraulically operated; capable of holding delivery pressure to within one or two psi of valve setting; and shall be adjustable, with downstream pressure range of 30 to 110 psi.
- c. Pressure reducing valves shall be Clayton Model 90G-01AB Pressure Reducing Valves, as manufactured by Cla-Val Company.
- d. Other type valves may be required for specific applications within the water system.

5. Strainers:

- a. Strainers shall have cast iron bodies and covers, stainless steel strainer and stainless steel bolts.
- b. End flanges shall be ANSI class 125 standard flanges
- c. Stainless steel strainers shall have an area of two times the nominal inlet pipe opening.
- d. Strainers shall be designed for easy access and in-line servicing of strainer element; and shall have drain plugs for periodic flushing
- e. Strainer screens to be #4 mesh

6. Combination Air-Vacuum Release Valves.

- a. Valves shall be designed to release large quantities of air from pipes during filling, admit large quantities of air into pipes during draining, and release small accumulations of air during normal operation of pipes.
- b. Valves shall be equal in quality to "Heavy-Duty Combination Air Release Valves, No. 143C", as manufactured by Valve and Primer Corp. (APCO); and shall meet the provisions of these specifications.

7. Hose Gate Valves.

- a. Hose gate valves shall be high grade brass with handwheel, inside screw ends, rising stem, screwed bonnet, taper wedge double disc. Valve shall be designed to operate at 200 psi water pressure.
- b. Hose gate valves shall be equal to Powell U.S. Bronze Hose Gate Valve No. 527.

8. Pressure Relief Valves.

C. Miscellaneous Items.

- 1. Dismantling Joint. The dismantling joint shall be Romac DJ 400, with anchor studs as recommended by the manufacturer; for connecting ductile iron pipe to flanged valves, equipment and fittings.
- 2. Mechanical Couplings. The mechanical couplings shall be Dresser, Rockwell; for connecting the size and type of pipe shown on the drawings. Couplings exposed to soil shall be primed and coated with a 1/4-inch layer of coal tar or rust preventing wax compound.

3. Gauges. Gauges shall be as shown on the drawings and of the size and quality equal to or better than United States Gauge "A" Line, Figure No. 5000, or Ashcroft 1279. Gauges shall have a range of 0 to 350 psi.
  4. Gauge Cocks. Gauge cocks shall be of high grade bronze with tee head; designed for 200 psi water pressure, and factory-tested to 300 psi; Crane Nos. 708, 712, 744.
  5. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, for up to 2 inch service lines.
  6. Other Items. Other miscellaneous materials shall be as indicated on the drawings.
- D. Hangers, Supports and Blocks.
1. Provide all hangers, supports, clamps, guides, sleeves, inserts, anchors and other such devices required for hanging or supporting pipe, preserving alignment, prevention of movement, passage of pipe through walls and floors, or securing pipe in any manner. The required number, location and detail of such items may or may not be indicated on the drawings; but, in any case, such work shall be provided as work incidental to furnishing and installing any type of pipe, fittings and appurtenances, and no extra payment will be made for this work.
    - a. Piping shall be supported or suspended in such manner as to prevent sagging or over stressing of pipe, valves, fittings or connections; and so that no pipe, fittings, valves or other items transfer load or strain to equipment of any kind.
  2. Supports.
    - a. Concrete supports shall be installed under pipe and valves wherever shown on the drawings. Concrete supports shall be neatly constructed and finished. No supports shall be made until all pipe is in its final position.
    - b. All other pipe supports shall be of the adjustable type of the style and size recommended by the manufacturer; and shall be located as indicated on the drawings. Floor flanges shall be of the size required to fit the pipe attached to the saddle support and as recommended by the manufacturer. Adjustable pipe supports shall be used as kick blocks for pipe in open locations.
  3. Blocks. Concrete thrust blocks shall be used wherever shown on the drawings or where thrust is great enough to cause movement of the piping.
- E. Miscellaneous. Miscellaneous appurtenant items shall be as indicated on the drawings or as required to complete the station.

## **2.3 BEDDING AND BACKFILL MATERIALS**

- A. Bedding: As specified in Sections 02115 and 02116.
- B. Backfill: As specified in Sections 02115 and 02116.

## **2.4 ACCESSORIES**

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

# **PART 3 EXECUTION**

## **3.1 EXAMINATION**

- A. Verify that water main size, location, and invert are as indicated.

### **3.2 PREPARATION**

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

### **3.3 EXCAVATING**

See Section 02112 and Sections 02115 and 02116 for additional requirements.

- A. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required square foot of thrust restraint bearing on undisturbed subsoil as indicated on the drawings.
- C. Backfill around sides and to top of pipe with backfill material, tamp in place and compact, then complete backfilling.

### **3.4 CONSTRUCTION - VALVE VAULT**

- A. Construct the vault for the pressure regulating station at the location indicated on the drawings; in accordance with the details shown on the construction drawings and as specified herein.
- B. Earthwork shall be done in accordance with applicable requirements of Section 02115.
  - 1. Foundation Material. Where native material encountered at the foundation depth is found to be unable to provide adequate structural support of the vault or is determined to be moisture sensitive, the unsuitable material shall be removed and replaced by the appropriate granular borrow material as per the accepted drawings or under the direction of a licensed geotechnical engineer.
  - 2. Excess Material. Unsatisfactory and excess excavated materials shall be removed from the work site and disposed of in a legally acceptable manner.
- C. Concrete Work. Comply with requirements of Section 03300, for placement, consolidation, finishing and protection of cast-in-place concrete.
- D. Precast Concrete Vault. Precast concrete vault shall be installed level and plumb, in accordance with the manufacturer's written instructions and recommendations.
- E. Access Door: Install according to manufacturer's written instructions and recommendations.
- F. Miscellaneous Metal Work.
  - 1. Miscellaneous metal work shall be fabricated and assembled in the shop to the greatest extent possible.
  - 2. Miscellaneous metal work shall be erected in conformity with AISC Code of Standard Practice.



### **3.5 INSTALLATION - PLUMBING**

- A. All pipe, fittings, valves, equipment and appurtenant items, together with supports and anchors, shall be installed as specified herein and as indicated on the drawings; in conformity with currently adopted plumbing codes.
- B. Equipment shall be installed as shown on the drawings, and in accordance with accepted manufacturer's written instructions.
- C. Strainers shall be installed upstream of all pressure regulating valves.
- D. All material and workmanship shall conform to applicable requirements of the currently adopted plumbing code.
- E. Establish elevations of buried piping to ensure not less than four feet of cover over pipe.
- F. Install pipe to indicated elevation to within tolerance of one inch.
- G. Install ductile iron piping and fittings to AWWA C600.
- H. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- I. Install access fittings to permit disinfection of water system performed under Section 02515.
- J. Set valves on concrete block.
- K. After plumbing system has been installed and completed, it shall be tested and disinfected as specified herein; including an operating test for acceptance of the work. Tests shall be performed in the presence of the City Engineer or their authorized representative.
- L. Pressure reducing valve settings shall be calibrated in the field by valve supplier's representative according to pressure settings provided by the City.

### **3.6 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with section 01400.
- B. Pressure test water piping to 200 PSI for 2 hours (see section 02410).
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

**END OF SECTION**

## **SECTION 02414**

### **WATER METER VAULT**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Water meter stations, complete, including:
  - 1. Reinforced concrete vault.
  - 2. Pipe, fittings, valves, meter, and appurtenant items.
- B. Station testing.

##### **1.2 RELATED SECTIONS**

- A. Section 02115 - Excavation: Excavating for structures and appurtenant items.
- B. Section 02116 - Fill and Backfill: Pipe bedding and excavation backfilling.
- C. Section 02410 - Water Distribution System: Pipe, fittings, valves and appurtenant items.
- D. Section 02415 - Disinfection of Water Distribution Systems: Disinfection of station piping.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for structures and thrust blocks.

##### **1.3 REFERENCES**

- A. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM A 234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- C. ASTM C 858 - Standard Specification for Underground Precast Concrete Utility Structures.
- D. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; (ANSI/AWWA C104/A21.4).
- E. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; (ANSI/AWWA C105/A21.5).
- F. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; (ANSI/AWWA C111/A21.11).
- G. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).
- H. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- I. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; (ANSI/AWWA C508/C508a).

- J. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- K. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C515).
- L. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; (ANSI/AWWA C600).
- M. Use the latest issue of the above reference standards as of the date of the Project.

#### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, meters, and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, meters, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### **1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with City's requirements as described herein.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store valves, valves and appurtenant items in shipping containers with labeling in place.

### **PART 2 PRODUCTS**

#### **2.1 REINFORCED CONCRETE VAULT**

- A. Reinforced Concrete Vault. The reinforced concrete vault is shown on the drawings as constructed of poured-in-place concrete; but a precast reinforced concrete vault may be provided at the option of the Contractor.
  - 1. Concrete work shall conform to applicable requirements of Section 03300.
  - 2. Poured-in-Place Concrete. A poured-in-place reinforced concrete vault, of the size indicated on the drawings, may be constructed; which shall conform to applicable requirements of Section 03300.
    - a. Poured-in-place concrete vault shall have wall thickness of 9-inch minimum, bottom slab thickness of 6-inch minimum, and top slab thickness of 9-inch minimum; designed for H-20 highway loading.
    - b. Submit construction drawings of the vault for review by the City Engineer, before any work is begun. The drawings shall be stamped by a professional licensed structural engineer.

3. Precast Concrete. A precast reinforced concrete vault of equal dimensional and strength characteristics may be provided. Precast vault shall have wall thickness of 9-inch minimum, bottom slab thickness of 6-inch minimum, and top slab thickness of 9-inch minimum; designed for H-20 highway loading.
    - a. Precast vault shall conform to ASTM C 858; and shall be as manufactured by Amcor-Old Castle or Dura-Crete.
  4. Reinforcement. Reinforcing steel shall be as specified in Section 03300, using Grade 60 bar of the size(s) shown on the drawings.
  5. Steps. Plastic encased steel steps shall be installed in station walls; spaced at 12-inches on center and centered under the access opening. Steps shall be copolymer polypropylene- encased, 60,000 tensile strength steel, Model PSI-FF manhole steps, as manufactured by M. A. Industries, Inc.
- B. Access Doors: The access door leaf and channel frame, with strap anchors, shall be constructed of steel with hot-dip galvanized finish (ASTM 123); designed for H-20 highway loading. Doors shall be provided with 316 stainless steel hardware throughout; including all parts of the latch and lifting mechanism assemblies, hold open arms and guides, and all brackets, hinges, pins and fasteners. The doors shall have recessed hasp covered by a hinged lid flush with the surface of the door.
- a. The access doors shall be Type J Access Doors as manufactured by The Bilco Company, of the size indicated on the drawings. The manufacturer shall guarantee the door against defects in material and workmanship for a period of five years.
- C. Proprietary Items. Provide proprietary items of the type, size and manufacture noted on the drawings or as required to complete the work.
- D. Miscellaneous Metal Work. Furnish and erect miscellaneous metal work as required to complete the pressure regulating station, as described herein and as shown on the drawings.
1. Codes. Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings of the American Institute of Steel Construction shall govern the work. Welding shall be done in accordance with AWS D1.1 of the American Welding Society Standards.
  2. Substitutions. Substitutions of sections or modifications of details, or both, and the reasons therefore shall be submitted for acceptance by the City Engineer.
  3. Responsibility for Errors. The Contractor shall be responsible for all errors of detailing, fabrication, erection, and correct fitting of the miscellaneous metal work.
  4. Materials. Material shall conform to their respective specifications as follows:
    - a. Bolts and Nuts: ASTM Standard A-307
    - b. Gray Iron Castings: A-48 Class 40 or Better
    - c. Structural Steel: ASTM Standard A-36
    - d. Washers: ASTM Standard B-27.2, Type B
    - e. Miscellaneous Items: Miscellaneous items shall be as indicated on the drawings or as required.
- E. Painting. All exposed pipe, valves, fittings, and metal work inside of the station shall be painted with either: four coats of alkyd paint, Painting System II (Steel Structural Painting Council - Specification No. 2); or four coats of phenolic paint, Painting System III (Steel Structural Painting Council - Specification No. 3). Painting shall include surface preparation, pretreatment, primer coat, inter-mediate coats, and finish coat, as specified; with total dry film thickness not less than 4.0 mils. Aluminum surfaces which will be in contact with

concrete after erection shall be coated with bituminous mastic coating, SSPC-Paint 12, prior to erection.

## **2.2 METER STATION PLUMBING**

### **A. Pipe and Fittings.**

1. Ductile Iron Pipe: AWWA C151: See Section 02410. Exposed pipe and fittings shall not be coated with coal tar pitch varnish; but shall be painted as specified herein.
2. Copper Tubing: ASTM B 88, Type K, annealed: See Section 02410.
3. Galvanized Steel Pipe: ASTM A 53: Galvanized steel pipe shall be Schedule 80, seamless or welded pipe, with threaded ends. Fittings shall be 150 lb. galvanized malleable iron banded type, with screwed ends. Unions shall be galvanized railroad type with ground brass-to-iron seats.

### **B. Valves.**

1. Manufacturer's name and pressure rating marked on valve body.
2. Gate Valves:
  - a. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends as indicated, and cast iron valve box.
  - b. AWWA C 515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
  - c. Product: Mueller Resilient Wedge Gate Valve, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box.
3. Combination Air-Vacuum Release Valves.
  - a. Valves shall be designed to release large quantities of air from pipes during filling, admit large quantities of air into pipes during draining, and release small accumulations of air during normal operation of pipes.
  - b. Valves shall be equal in quality to "Heavy-Duty Combination Air Release Valves, No. 143C", as manufactured by Valve and Primer Corp. (APCO); and shall meet the provisions of these specifications.
4. Strainers:
  - a. Strainers shall have cast iron bodies and covers, stainless steel strainer and stainless steel bolts.
  - b. End flanges shall be ANSI class 125 standard flanges
  - c. Stainless steel strainers shall have an area of two times the nominal inlet pipe opening.
  - d. Strainers shall be designed for easy access and in-line servicing of strainer element; and shall have drain plugs for periodic flushing.

### **C. Meters. Meters shall be of design, type, size and manufacturer as accepted by the City Engineer.**

### **D. Miscellaneous Items.**

1. Dismantling Joint. The dismantling joint shall be Romac DJ 400, for connecting ductile iron pipe to the flanged valves, equipment and other fittings.

2. Mechanical Couplings. The mechanical couplings shall be Dresser or Rockwell, for connecting the size and type of pipe shown on the drawings. Couplings exposed to soil shall be primed and coated with a 1/4-inch layer of coal tar or accepted rust preventing wax compound.
  3. Gauges. Gauges shall be as shown on the drawings and of the size and quality equal to or better than United States Gauge "A" Line, Figure No. 5000. Gauges shall have a range of 0 to 350 psi.
  4. Gauge Cocks. Gauge cocks shall be of high grade bronze with tee head; designed for 200 psi water pressure, and factory-tested to 300 psi; Crane Nos. 708, 712, 744.
  5. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134.
  6. Other Items. Other miscellaneous materials shall be as indicated on the drawings.
- E. Hangers, Supports and Blocks.
1. Provide all hangers, supports, clamps, guides, sleeves, inserts, anchors and other such devices required for hanging or supporting pipe, preserving alignment, prevention of movement, passage of pipe through walls and floors, or securing pipe in any manner. The required number, location and detail of such items may or may not be indicated on the drawings; but, in any case, such work shall be provided as work incidental to furnishing and installing any type of pipe, fittings and appurtenances, and no extra payment will be made for this work.
    - a. Piping shall be supported or suspended in such manner as to prevent sagging or over stressing of pipe, valves, fittings or connections; and so that no pipe, fittings, valves or other items transfer load or strain to equipment of any kind.
  2. Supports.
    - a. Concrete supports shall be installed under pipe and valves wherever shown on the drawings. Concrete supports shall be neatly constructed and finished, as indicated on the drawings. No supports shall be made until all pipe is in its final position.
    - b. All other pipe supports shall be of the adjustable type of the style and size recommended by the manufacturer; and shall be located as indicated on the drawings. Floor flanges shall be of the size required to fit the pipe attached to the saddle support and as recommended by the manufacturer. Adjustable pipe supports shall be used as kick blocks for pipe in open locations.
  3. Blocks. Concrete thrust blocks shall be used wherever shown on the drawings or where thrust is great enough to cause movement of the piping.
- F. Miscellaneous. Miscellaneous appurtenant items shall be as indicated on the drawings or as required to complete the station.

## **2.3 BEDDING AND BACKFILL MATERIALS**

- A. Bedding: As specified in Sections 02115 and 02116.
- B. Backfill: As specified in Sections 02115 and 02116.

## **2.4 ACCESSORIES**

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. The Contractor shall furnish all labor, materials and equipment as required to construct the water meter station, complete, as described herein, and as shown on the drawings.
- B. All work shall be done according to the current adopted plumbing codes, and to manufacturer's written instructions and recommendations.
- C. The Contractor shall test the station to assure proper operation.

### **3.2 EXAMINATION**

- A. Verify that design drawings conform to project conditions.
- B. Verify that water main size, location, and invert are as indicated.

### **3.3 PREPARATION**

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

### **3.4 EXCAVATING**

- A. Excavating for the meter station shall be done to ensure proper grades and alignment as shown on the drawings.
- B. See Section 02112 and Sections 02115 and 02116 for additional requirements.
- C. Hand trim excavation for accurate construction or placement of concrete vault to elevations indicated.
- D. Backfill around structure with backfill material, tamp in place and compact to required densities.

### **3.5 CONSTRUCTION - VALVE VAULT**

- A. Construct the vault for the meter station at the location indicated on the drawings; in accordance with the details shown on the drawings and as specified herein.
- B. Earthwork shall be done in accordance with applicable requirements of Section 02115.
  - 1. Foundation Material. Where native material encountered at the foundation depth is found to be unable to provide adequate structural support of the vault, or is determined to be moisture sensitive, the unsuitable material shall be removed and replaced by the appropriate granular borrow material as per the accepted drawings or under the direction of a licensed geotechnical engineer.
  - 2. Excess Material. Unsatisfactory and excess excavated materials shall be removed from the work site and disposed of in a legally acceptable manner.

- C. Concrete Work. Comply with requirements of Section 03300, for placement, consolidation, finishing and protection of cast-in-place concrete and reinforcement.
- D. Precast Concrete Vault. Precast concrete vault shall be installed level and plumb, in accordance with the manufacturer's written instructions and recommendations.
- E. Access Door: Install according to manufacturer's written instructions and recommendations.
- F. Miscellaneous Metal Work.
  - 1. Miscellaneous metal work shall be fabricated and assembled in the shop to the greatest extent possible.
  - 2. Miscellaneous metal work shall be erected in conformity with AISC Code of Standard Practice.

### **3.6 INSTALLATION - PLUMBING**

- A. All pipe, fittings, meters, valves, equipment and appurtenant items, together with supports and anchors, shall be installed as specified herein and as indicated on the drawings; in conformity with the currently adopted plumbing code.
- B. Equipment shall be installed as shown on the drawings, and in accordance with accepted manufacturer's written instructions.
- C. Strainers shall be installed upstream of all meters with a No. 4, 100 micron, screen.
- D. All material and workmanship shall conform to applicable requirements of the currently adopted plumbing code.
- E. Establish elevations of buried piping to ensure not less than four feet of cover over pipe; or as indicated on the drawings.
- F. Install pipe to indicated elevation to within tolerance of one inches.
- G. Install ductile iron piping and fittings to AWWA C600.
- H. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- I. Install access fittings to permit disinfection of water system performed under Section 02415.
- J. Set valves on concrete block.
- K. After plumbing system has been installed and completed, it shall be tested and disinfected as specified herein; including an operating test for acceptance of the work. Tests shall be performed in the presence of the City Engineer or their authorized representative.

### **3.7 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 200 PSI for 2 hours (see section 02410).
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.



### **3.8 OPERATIONAL TESTING**

- A. Provide City Engineer with seven days written notice of operational test of backflow preventer.
- B. Test shall consist of the operation of the station for propose of checking operation and assuring of absence of leaks.
  - 1. Repair pipe, fittings, valves, or connections which show evidence of leakage.
- C. After all repairs or replacements have been made, repeat the above required test.

**END OF SECTION**

## **SECTION 02415**

### **DISINFECTION OF WATER DISTRIBUTION SYSTEM**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Disinfection of project pipe lines specified in Section 02410.
- B. Disinfection of site domestic water lines, site fire water lines, and hydrant supply lines and water service lines specified in Section 02410.
- C. Testing and reporting results.

##### **1.2 RELATED SECTIONS**

- A. Section 02410 - Water Distribution System.

##### **1.3 REFERENCES**

- A. AWWA B300 - Hypochlorites; American Water Works Association; (ANSI/AWWA B300).
- B. AWWA B301 - Liquid Chlorine; American Water Works Association; (ANSI/AWWA B301).
- C. AWWA B302 - Ammonium Sulfate; American Water Works Association; (ANSI/AWWA B302).
- D. AWWA B303 - Sodium Chlorite; American Water Works Association; (ANSI/AWWA B303).
- E. AWWA C651 - Disinfecting Water Mains; American Water Works Association; (ANSI/AWWA C651).
- F. Use the latest issue of the above reference standards as of the date of the Project.

##### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Test Reports: Indicate results comparative to specified requirements.
- C. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.
- D. Disinfection report:
  - 1. Type and form of disinfectant used.
  - 2. Date and time of disinfectant injection start and date and time of disinfectant injection completion.
  - 3. Test locations.
  - 4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
  - 5. Date and time of flushing start and completion.

6. Disinfectant residual after flushing in ppm for each outlet tested.
- E. Bacteriological report:
  1. Date issued, project name, and testing laboratory name, address, and telephone number.
  2. Time and date of water sample collection.
  3. Name of person collecting samples.
  4. Test locations.
  5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
  6. Coliform bacteria test results for each outlet tested.
  7. Certification that water conforms, or fails to conform, to bacterial standards of State.

## **1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with AWWA C651.
- B. Testing Firm: Company specializing in testing potable water systems, certified by governing authorities of Utah.
- C. Submit the bacteriologist's signature and the Utah certified authority associated with testing.

## **1.6 REGULATORY REQUIREMENTS**

- A. Conform to applicable code or regulation for performing the work of this Section.
- B. Provide certificate of compliance from Utah certified authority having jurisdiction indicating acceptance of water system.

## **PART 2 PRODUCTS**

### **2.1 DISINFECTION CHEMICALS**

- A. Chemicals: AWWA B300, Hypochlorite; AWWA B301, Liquid Chlorine; AWWA B302, Ammonium Sulfate; and AWWA B303, Sodium Chlorite.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that piping system has been cleaned and inspected.

### **3.2 EXECUTION**

- A. Provide and attach required equipment to perform the work of this Section.
- B. Introduce treatment into piping system if not already added during installation.
- C. Maintain disinfectant in system for 24 hours.
- D. Flush, circulate, and clean until required cleanliness in accordance with this section, is achieved; use municipal domestic water.

- E. Replace permanent system devices removed for disinfection.
- F. Perform bacteria test at location accepted by City Inspector. After receiving clean bacteria test results, pressure test system to 200 psi for 2 hours. Repair leaks and re-test.
- G. Perform a second bacteria test upon completion and acceptance of pressure test.

### **3.3 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Test samples in accordance with AWWA C651.

**END OF SECTION**

## **SECTION 02416**

### **AIR-VACUUM VALVE STATIONS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Air-Vacuum Valve Stations; including reinforced concrete vault, pipe, fittings, valves, and appurtenant items, as indicated on the drawings and as described herein.

##### **1.2 RELATED SECTIONS**

- A. Section 02115 - Excavation: Excavating for structures and appurtenant items.
- B. Section 02116 - Fill and Backfill: Bedding and backfilling.
- C. Section 02410 - Water Distribution System: Pipe, fittings, valves and appurtenant items.
- D. Section 02415 - Disinfection of Water Distribution Systems: Disinfection of station piping.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for concrete vault and thrust restraints.

##### **1.3 REFERENCES**

- A. ASTM B 43 - Standard Specifications for Seamless Red Brass Pipe, Standard Sizes.
- B. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- C. ASTM C 858 - Standard Specification for Underground Precast Concrete Utility Structures.
- D. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- E. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- F. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Associations; (ANSI/AWWA C515).
- G. Use the latest issue of the above reference standards as of the date of the Project.

##### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

## **1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with Owner's requirements as described herein.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store valves and appurtenant items in shipping containers with labeling in place.

## **PART 2 PRODUCTS**

### **2.1 GRAVEL BASE. Gravel shall conform to the requirements of Section 02116.**

### **2.2 REINFORCED CONCRETE VAULT**

- A. Precast Riser Sections. Riser sections shall be reinforced concrete pipe sections, class IV, with tongue and groove joints; meeting the requirements of ASTM C 76. Riser sections shall extend from the top of the base to the bottom of the cover slab.
  - 1. Joints. Joints between precast sections, except grade rings, shall be sealed with pre-lubricated rubber gaskets conforming to requirements of ASTM C443 and C361; and shall be equal to Forsheda No. 114 Seal, as manufactured by Forsheda Pipe Seal Company.
- B. Top Sections. Top sections shall be precast flat slab tops, with top opening of 30-inch diameter, minimum. Design shall be based on H-20 live loading and one-foot minimum earth cover.
- C. Grade Rings. Precast grade rings shall be provided as required to adjust height of cover slab. The maximum height of the grade rings shall be 12-inches; and shall have key locks and use mastic sealer to insure water-tightness.
- D. Concrete. Concrete, poured-in-place, and grout shall conform to applicable requirements of Section 03300.
- E. Frames and Covers. Frames and covers shall be cast iron with a 22 3/4-inch diameter clear opening; and shall be gravity, solid, non-rocking, heavy duty type meeting requirements for Salt Lake City Standard Manhole Rings and Covers. Covers shall be vented in improved areas and solid in unimproved areas; shall have cleated surfaces and pick holes; and shall be marked with "SARATOGA SPRINGS" and either "WATER" or "PRESSURE IRRIGATION".
  - 1. Castings. Castings shall be of uniform quality free of porosity, hard spots, and shrinkage defects. Exposed surfaces shall be smooth and true to pattern. Iron shall conform to ASTM A48, Gray Iron Castings, Grade B.
- F. Proprietary Items. Provide proprietary items of the type, size and manufacture noted on the drawings or as required to complete the work.

### **2.3 VALVE STATION PLUMBING**

- A. Pipe and Fittings.
  - 1. Ductile Iron Pipe: AWWA C151: See Section 02510. Exposed pipe and fittings shall not be coated with coal tar pitch varnish; but shall be painted as specified herein.
  - 2. Copper Tubing: ASTM B 88, Type K, annealed: See Section 02410.

3. Red Brass Pipe: ASTM B 53, Red brass pipe shall be Schedule 80, seamless pipe with threaded ends. Fittings shall be Schedule 80 with screwed ends.

B. Valves.

1. Manufacturer's name and pressure rating marked on valve body.
2. Gate Valves Up To 3 Inches:
  - a. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel operator.
  - b. Product: Powell U.S. Bronze Gate Valves.
  - c. Substitutions: See Section 01600 - Product Requirements.
3. Gate Valves 3 Inches and Over:
  - a. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends as indicated and cast iron valve box.
  - b. AWWA C 515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
  - c. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box.
4. Combination Air-Vacuum Release Valves.
  - a. Valves shall be designed to release large quantities of air from pipes during filling, admit large quantities of air into pipes during draining, and release small accumulations of air during normal operation of pipes.
  - b. Valves shall be equal in quality to "Heavy-Duty Combination Air Release Valves", of the appropriate type and size, as manufactured by Valve and Primer Corporation (APCO); and shall meet the provisions of these specifications.
5. Hose Gate Valves.
  - a. Hose gate valves shall be high grade brass with handwheel, inside screw ends, rising stem, screwed bonnet, taper wedge double disc. Valve shall be designed to operate at 200 psi water pressure.
  - b. Hose gate valves shall be equal to Powell U.S. Bronze Hose Gate Valve No. 527.

C. Miscellaneous Items.

1. Dismantling Joint. The dismantling joint shall be Romac DJ 400, with anchor studs as recommended by the manufacturer; for connecting ductile iron pipe to the flanged valves, equipment and fittings.
2. Mechanical Couplings. The mechanical couplings shall be Dresser, Rockwell, for connecting the size and type of pipe shown on the drawings. Couplings exposed to soil shall be primed and coated with a 1/4-inch layer of coal tar or rust preventing wax compound.
3. Gauges. Gauges shall be as shown on the drawings and of the size and quality equal to or better than United States Gauge "A" Line, Figure No. 5000. Gauges shall have a range of 0 to 350 psi.
4. Gauge Cocks. Gauge cocks shall be of high grade bronze with tee head; designed for 200 psi water pressure, and factory-tested to 300 psi; Crane Nos. 708, 712, 744.

5. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, for up to 2 inch service lines.
  6. Other Items. Other miscellaneous materials shall be as indicated on the drawings and as required to complete the station.
- D. Hangers and Supports. Provide all hangers, supports, clamps, guides, sleeves, inserts, anchors and other such devices required for hanging or supporting pipe, preserving alignment, prevention of movement, passage of pipe through walls and floors, or securing pipe in any manner. The required number, location and detail of such items may or may not be indicated on the drawings; but, in any case, such work shall be provided as work incidental to furnishing and installing any type of pipe, fittings and appurtenances, and no extra payment will be made for this work.
- a. Piping shall be supported or suspended in such manner as to prevent sagging or over stressing of pipe, valves, fittings or connections; and so that no pipe, fittings, valves or other items transfer load or strain to equipment of any kind.

## **2.4 BEDDING AND BACKFILL MATERIALS**

- A. Bedding: As specified in Sections 02115 and 02116.
- B. Backfill: As specified in Sections 02115 and 02116.

## **2.5 ACCESSORIES**

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

# **PART 3 EXECUTIONS**

## **3.1 EXAMINATION**

- A. Verify that water main size, location, and invert are as indicated.

## **3.2 PREPARATION**

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

## **3.3 EXCAVATING**

- A. See Section 02112 and Sections 02115 and 02116 for additional requirements.
- B. Hand trim excavation for accurate placement of station to elevations indicated.
- C. Backfill around sides and to top of valve vault with backfill material, tamp in place and compact.

## **3.4 CONSTRUCTION - VALVE VAULT**

- A. Construct the vault for the air-vacuum valve station at the location indicated on the drawings; in accordance with the details shown on the drawings and as specified herein.



- B. Earthwork shall be done in accordance with applicable requirements of Section 02115.
  - 1. Foundation Material. Where native material encountered at the foundation depth is found to be unable to provide adequate structural support of the vault or is determined to be moisture sensitive, the unsuitable material shall be removed and replaced by the appropriate granular borrow material as per the accepted drawings or under the direction of a licensed geotechnical engineer.
  - 2. Excess Material. Unsatisfactory and excess excavated materials shall be removed from the work site and disposed of in a legally acceptable manner.
- C. Concrete Work. Comply with requirements of Section 03300, for placement, consolidation, finishing and protection of cast-in-place concrete.
- D. Precast Items. Precast riser sections shall be installed, from the gravel base to the cover slab, in accordance with the manufacturer's recommendations; and shall be installed to stand plumb. Precast flat slab tops shall be installed on the top riser section; with the opening positioned as indicated on the drawings. The top of concrete flat slab tops shall be approximately 12-inches below final surface elevations.
- E. Placement of Frame and Cover.
  - 1. Placement. After the top slab of the station has been placed, the cast iron frame and cover shall be installed into the opening in the top slab; using precast grade rings to place the cover flush with adjacent finish grade.
  - 2. Grouting. After placement of the frame and cover, grout around the exterior of the frame from the top of concrete top slab to the top of frame, as indicated on the drawing, to insure a watertight condition.
- F. Flexible Pipe Couplings. A pipe joint or flexible coupling shall be provided on all pipes connected to the stations, located approximately 18-inches from the outside of the station. The joint or coupling shall be of the same size as the pipe, and shall be as recommended by the pipe manufacturer.
- G. Miscellaneous Metal Work.
  - 1. Miscellaneous metal work shall be fabricated and assembled in the shop to the greatest extent possible.
  - 2. Miscellaneous metal work shall be erected in conformity with AISC Code of Standard Practice.

### **3.5 INSTALLATION - PLUMBING**

- A. All pipe, fittings, valves, equipment and appurtenant items, together with supports and anchors, shall be installed and connected to operate as specified herein and as indicated on the drawings; in conformity with the currently adopted plumbing code, and in conformity to good and acceptable plumbing practices according to industry standards.
- B. Equipment shall be installed as shown on the drawings, and in accordance with accepted manufacturer's written instructions.
- C. All material and workmanship shall conform to applicable requirements of the currently adopted plumbing code.
- D. Establish elevations of buried piping to ensure not less than four feet of cover over pipe; or as

indicated on the drawings.

- E. Install pipe as required to indicate elevation to within tolerance of one inches.
- F. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- G. Install access fittings to permit disinfection of water system performed under Section 02415.
- H. Set valves on concrete block.
- I. Mechanical couplings exposed to soil shall be primed and coated with 1/4-inch layer of coal tar, or rust preventing wax compound.
- J. Adjustable pipe supports shall be used to support pipe and valves; and shall be equal to Grinnell Company Figure 264.
- K. After plumbing system has been installed and completed, it shall be tested to show its functional fitness by operating the station; and shall be tested for water-tightness as specified herein; and disinfected as specified herein. Tests shall be performed in the presence of the City Engineer or their authorized representative.
- L. Buried pipe or otherwise inaccessible pipe shall be tested before it is concealed, and again in connection with the final testing.

### **3.6 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 200 psi for 2 hours.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

### **END OF SECTION**

## **SECTION 02580**

### **SECONDARY WATER SYSTEM**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Pipe and fittings for project water lines, to include secondary water lines.
- B. Valves and appurtenant items.
- C. Water Service Connections.

##### **1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching for Pipe Work: Excavating, bedding, backfilling and compacting.
- B. Section 02115 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02116 - Fill and Backfill: Bedding and backfilling.
- D. Section 02340 - Manholes and Covers.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for thrust restraints.

##### **1.3 REFERENCES**

- A. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- B. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
- C. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; (ANSI/AWWA C104/A21.4).
- D. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; (ANSI/AWWA C105/A21.5).
- E. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; (ANSI/AWWA C111/A21.11).
- F. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).
- G. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association.
- H. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- I. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; (ANSI/AWWA C508/C508a).
- J. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water

Works Association; (ANSI/AWWA C509/C509a).

- K. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C515).
- L. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; (ANSI/AWWA C600).
- M. ASTM D2774 - Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
- N. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution; American Water Works Association; (ANSI/AWWA C900/C900a).
- O. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch through 3 inch, for Water Service; American Water Works Association.
- P. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch, for Water Distribution; American Water Works Association.
- Q. AWWA C200 - Steel Water Pipe Casing, 6-inches and larger as needed.
- R. Use the latest issue of the above reference standards as of the date of the Project.

#### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### **1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with the City's requirements as described herein.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store valves in shipping containers with labeling in place.

### **PART 2 PRODUCTS**

#### **2.1 WATER PIPE**

- A. Ductile Iron Pipe: AWWA C151:
  - 1. Fittings: Ductile iron, standard thickness.
  - 2. Joints:
    - a. Push-On Joints: AWWA C111, push-on type with rubber gasket.
    - b. Mechanical Joints: AWWA C111, mechanical joint type with gasket, bolts, and

- nuts.
  - c. Flange Joints: AWWA C110, flange type with gasket, bolts, and nuts.
- 3. Jackets: AWWA C105 polyethylene jacket with polyethelene tape; purple color.
- B. PVC Pipe: AWWA C900, DR-18 for waterlines up to and including 24 inches in diameter:
  - 1. Fittings: AWWA C111, cast iron.
- C. Polyethylene Pipe: ASTM D 3035, for 200 psi pressure rating:
  - 1. Fittings: AWWA C901, molded or fabricated.
  - 2. Joints: Compression.
- D. High Density Polyethylene Pipe: AWWA C906:
  - 1. Material: PE 4710 High Density Polyethylene (HDPE) meeting ASTM D3350 cell classification of 445474C.
  - 2. Pressure Class 200. DR 11
  - 3. Fittings: AWWA C906, molded or fabricated; or mechanical joint ductile iron fittings.
  - 4. Joints: Butt fusion.
- E. Trace Wire: Number 14 gauge detectable conductor. Provide testing for continuity. Placed on all buried pipe.
- F. Detector Tape: Purple plastic tape, imprinted with "PRESSURIZED IRRIGATION" in large letters. Placed on all buried pipe.

## **2.2 CASING PIPE MATERIALS**

- A. Jack and Bore Construction Method
  - 1. Welded Steel Pipe: AWWA C 200, steel water pipe; diameter as indicated.
  - 2. Casing Insulators: fusion coated steel casing insulators with 12-inch wide band and 2-inch wide glass reinforced plastic runners; Model C12G-2, manufactured by Pipeline Seal and Insulator, Inc.
  - 3. Casing End Seals: flexible S-shaped seals fabricated on synthetic rubber with stainless steel bands and clamps; Model S Pull-On End Seals, manufactured by Pipeline Seal and Insulator, Inc.
- B. Horizontal Directional Drilling Method:
  - 1. High Density Polyethylene Pipe, AWWA C906, PE 4710
  - 2. Diameter Ratio (DR): 17 or 11
  - 3. Joints: Butt fused.

## **2.3 VALVES**

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
  - 1. Jackets: AWWA C105 polyethylene jacket with polyethelene tape; purple color.

- B. Gate Valves:
1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
  2. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint or flanged ends as indicated, and cast iron valve box.
  3. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
  4. Product: Mueller Resilient Wedge Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box.
- C. Ball Valves Up To 2 Inches:
1. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, compression inlet end, compression outlet, with control rod, valve key, and extension box.
- D. Check Valves From 2 Inches to 24 Inches:
1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
  2. Product: Valmatic Surge Buster Swing-Type Check Valve.
- E. Corporation Stops: shall be type for connecting to copper or polyethylene pipe; Mueller No. H-15000, for up to 2-inch service line.
- F. Air Release Valves: shall be combination air release valves; APCO Combination Air Release Valves, of size indicated on the drawings.
- G. Blow-Off Hydrant: shall be Non-Freezing Blow-Off Assembly.

## **2.4 SECONDARY WATER CONNECTIONS**

- A. Secondary water connections shall be constructed as indicated on the drawings.
- B. Connections shall include meter boxes, meters, valve boxes, stop & water valves, and all appurtenant items, as indicated on the drawings.

## **2.5 BEDDING AND COVER MATERIALS**

- A. Bedding: As specified in Sections 02112 and 02116.
- B. Backfill: As specified in Sections 02112 and 02116.

## **2.6 ACCESSORIES**

- A. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, for up to 2 inch service lines.
- B. Concrete for Thrust Restraints: Concrete type specified in Section 03300.
- C. Manhole and Cover: Refer to Section 02340.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that water main and main line tee size, location, and invert are as indicated.

### **3.2 PREPARATION**

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

### **3.3 TRENCHING**

- A. See Section 02112 and Sections 02115 and 02116 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required area of thrust restraint bearing on subsoil as indicated on the drawings.
- D. Backfill around sides and to top of pipe with backfill material, tamp in place and compact, then complete backfilling.

### **3.4 INSTALLATION - PIPE**

- A. Establish elevations of buried piping to ensure not less than 36 inches of cover over pipe; or as indicated on the drawings.
- B. Install pipe to indicated elevation to within tolerance of one inch.
- C. Install ductile iron piping and fittings to AWWA C600.
- D. Install PVC pressure pipe and fittings to ASTM D2774.
- E. Install pipe lines to line and grade indicated.
- F. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- G. Slope water pipe and position drains at low points.
- H. Install trace wire and detector tape above all pipe; coordinate with Section 02112.

### **3.5 INSTALLATION - CASING PIPES**

- A. See Sections 02115 and 02116 for structural excavation and fill and backfill; and for additional requirements.
- B. Install casing pipes by jacking process where indicated.
- C. Install casing pipes at the line and grade as required to allow carrier pipes to be installed within the casing pipes at the design line and grade, as indicated on the drawings.

- D. Place casing insulators on carrier pipes to properly center and position carrier pipe inside the casing pipes; space insulators as recommended by the pipe manufacturer.
- E. Carrier Pipe inside of casing shall have restrain joints.
- F. Seal each end of casing with appropriate size flexible end seals; install according to manufacturer's instructions and recommendations.
- G. Seal bore holes at each end, around periphery of casing, with grout, impervious clay or brick masonry.
- H. Contractor shall be solely responsible for the accuracy, safety and adequacy of construction methods and procedures for installing casing pipes, and for any damage which may result from their failure. All operations of the Contractor for installation of casing pipes shall be subject to acceptance by the agency having jurisdiction over the item being crossed.
- I. Contractor shall enter any agreement with, and furnish any and all indemnity and other bonds that may be required by, the agency listed above, for their protection against injury and interference with flow of water caused by the operations of the Contractor.
- J. Contractor shall secure required permission from the agency listed above before commencing with the installation of casing pipes and related work along and across the respective areas.

### **3.6 INSTALLATION - VALVES**

- A. Set valves on concrete block.
- B. Center and plumb valve box over valve operating nut. Set box cover flush with finished grade.

### **3.7 INSTALLATION - AIR RELEASE STATIONS**

- A. Locate air release stations as indicated on the construction drawings.
- B. Set air valve and piping plumb according to manufacturer's written instructions and recommendations; set vault plumb on solid foundation.
- C. Set top of valve box to grade, with cover matching finish grade.

### **3.8 SERVICE CONNECTIONS**

- A. Provide water service lines, as indicated on the drawings. Residential service lines shall include stop & waste valves with valve boxes; meter boxes, valve and appurtenant items; and valve boxes with ball valve; and all appurtenant work. The Developer is to provide meter(s) for multi-family; institutional; and commercial service connections.
- B. Water service lines shall extend to locations designated by the City Engineer, which will be near property lines of property being served and inside side-lot PUE, as indicated.
- C. All pipe, fittings and valves shall conform to the specifications found elsewhere in this Section.
- D. Pipe, fittings and valves shall be installed as described herein.
- E. Service lines shall be installed at uniform grades and alignments; and shall be free of low



spots or adverse grades.

- F. Service lines shall be cleaned, flushed and tested in accordance with applicable requirements of these specifications.

### **3.9 CONNECTIONS TO EXISTING WATER LINES**

- A. Connection to existing water lines shall be made where and as indicated on the drawings. The sizes of pipe, fittings, valves and appurtenant items required to make connection shall correspond to the sizes of existing pipe and of project pipe.
- B. Excavate to existing pipe line at point of connection; determine actual conditions of existing pipe and all fittings and appurtenant items required to make the connection; and have all materials needed on site prior to any shut down or cutting into existing pipe lines.
- C. Connections that involve cutting into existing pipe lines include: cutting and removing sections of existing pipe and fittings as required; cleaning and preparing ends of existing pipe as required for connection; furnishing and installing all new pipe, fittings and valves required to make the connection of project pipe to the existing pipe as indicated; and all appurtenant work required to complete the connection.
- D. Connection into existing pipe lines under pressure include: furnishing and installing mechanical joint tapping sleeve of the appropriate size on the existing pipe at point of connection; furnishing and installing tapping valve, with valve box, on sleeve; tapping existing pipe with drilling machine and equipment, without interrupting flow in existing pipe line; and all appurtenant work required to complete the connection.
- E. Connection to existing pipe line shall be made at such times and within the time limits and according to the directions as agreed to between the Contractor and the City Engineer or City Inspector.
- F. Cut and plug existing pipe lines where indicated on the drawing. Excavate as required to locate existing pipe lines to be abandoned in place; cut the existing pipe, as required; and install permanent plug in end of pipe to be abandoned.

### **3.10 CONNECTIONS TO DRINKING WATER LINES**

- A. Connections of secondary water systems to drinking water systems shall be done as indicated on the drawings and as described in Section 02586 BACKFLOW PREVENTER STATION.
- B. Connections of secondary water services to drinking water systems shall be done as indicated on the drawings and as described in Section 02587 SERVICE WATER BACKFLOW PREVENTER STATION.

### **3.11 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400 and 02112.
- B. Pressure test water piping to 200 psi for 2 hours.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to the City.

**END OF SECTION**

## **SECTION 02586**

### **BACKFLOW PREVENTER STATION**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Backflow preventer stations, complete, including:
  - 1. Backflow preventer valves.
  - 2. Pipe, fittings, valves, and appurtenant items.
- B. Station testing.

##### **1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching for Pipe Work: Excavating, pipe bedding, backfilling and compacting.
- B. Section 02115 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02116 - Fill and Backfill: Pipe bedding and excavation backfilling.
- D. Section 03300 - Cast-in-Place Concrete: Concrete for structures and thrust blocks.

##### **1.3 REFERENCES**

- A. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM A 234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- C. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; (ANSI/AWWA C104/A21.4).
- D. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; (ANSI/AWWA C105/A21.5).
- E. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; (ANSI/AWWA C111/A21.11).
- F. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).
- G. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association.
- H. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- I. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; (ANSI/AWWA C508/C508a).

- J. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- K. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C515).
- L. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; (ANSI/AWWA C600).
- M. Use the latest issue of the above reference standards as of the date of the Project.

#### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, controllers, sprinkler heads, and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, controllers, sprinkler heads, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### **1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with City's requirements as described herein.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store valves and appurtenant items in shipping containers with labeling in place.

#### **1.7 OPERATING AND MAINTENANCE DATA**

- A. Provide instructions covering full operation, care and maintenance of backflow preventer valves; and manufacturer's parts catalog. Information shall be included in the manual for operation and maintenance of the backflow preventer station.
- B. Instruct Owner's designated maintenance personnel in the proper operation of the valves.
- C. Submit 3 copies of written instructions recommending procedures to be established by the City Engineer for the maintenance of the valves from year to year.
  - 1. Submit prior to expiration of required one year guarantee period.
  - 2. Provide information in the manuals that include the following:
    - a. written index near front of Manual listing location in the Manual of all emergency data regarding the installation;
    - b. complete nomenclature of all replaceable parts, their part numbers, current cost, and name and address of the nearest vendor of replacement parts; and
    - c. copy of all guarantees and warranties issued on the installation showing all dates of expiration.

## **PART 2 PRODUCTS**

### **2.1 PIPE AND FITTINGS**

- A. Ductile Iron Pipe: AWWA C151:
  - 1. Fittings: Ductile iron, standard thickness.
  - 2. Joints:
    - a. Push-On Joints: AWWA C111, push-on type with rubber gasket.
    - b. Mechanical Joints: AWWA C111, mechanical joint type with gasket, bolts, and nuts.
    - c. Flange Joints: AWWA C110, flange type with gasket, bolts, and nuts.
  - 3. Jackets: AWWA C105 polyethylene jacket.
- B. Steel Pipe: ASTM A 53:
  - 1. Fittings: ASTM A 47.

### **2.2 VALVES**

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Gate Valves:
  - 1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
  - 2. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint or flanged ends as indicated, and cast iron valve box.
  - 3. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
  - 4. Product: Mueller Resilient Wedge Gate Valves or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box.
- C. Ball Valves Up To 2 Inches:
  - 1. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, compression inlet end, compression outlet, with control rod, valve key, and extension box.
- D. Swing Check Valves From 2 Inches to 24 Inches:
  - 1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
  - 2. Product: Mueller Swing-Type Check Valve.
- E. Corporation Stops: shall be type for connecting to copper or polyethylene pipe; Mueller No. H- 15000, for up to 2-inch service line.
- F. Air Release Valves: shall be combination air release valves; APCO Combination Air Release Valves, of size indicated on the drawings.

## **2.3 BACKFLOW PREVENTER**

- A. The backflow preventer shall be a reduced pressure type valve.
  - 1. The backflow preventer shall be bronze for 6-inch and smaller valves, and epoxy coated ductile iron for 8-inch and larger valves.
  - 2. The backflow preventer shall consist of two independently acting, spring-loaded check valves with a differential pressure relief valve located between the check valves.
  - 3. The backflow preventer shall include inlet and outlet shutoff valves; and four test cocks, three on the backflow preventer valve bodies and one on the inlet shutoff valve.
- B. The backflow preventers shall be of the appropriate size and type, as manufactured by Febco or Watts.

## **2.4 MISCELLANEOUS METAL WORK**

- A. Miscellaneous metal work shall be provided as indicated on the drawings, as required to complete the Station.

## **2.5 PAINTING**

- A. All exposed pipe, valves, fittings, and metal work for the station shall be painted.
  - 1. Painting shall consist of either:
    - a. 4 coats of alkyd paint, Painting System II (Steel Structural Painting Council - Specification No. 2);
    - b. 4 coats of phenolic paint, Painting System III (S. S. P. C. - Specification No 3).
  - 2. Painting shall include surface preparation, pretreatment, primer coat, inter-mediate coats, and finish coat, as specified; with total dry film thickness not less than 4.0 mils.
  - 3. Aluminum surfaces which will be in contact with concrete after erection shall be coated with bituminous mastic coating, SSPC-Paint 12, prior to erection.

## **2.6 MISCELLANEOUS ITEMS**

- A. Miscellaneous appurtenant items shall be as indicated on the drawings or as required to complete the station.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. The Contractor shall furnish all labor, materials and equipment as required to construct the backflow preventer station, complete, as described herein and as shown on the drawings.
- B. The backflow preventer station shall be constructed on the supply line to the sprinkling system, as shown, where the supply line is connected to a drinking water line.
- C. All work shall be done according to the currently adopted plumbing codes, and to manufacturer's written instructions and recommendations.
- D. The Contractor shall test the station to assure proper operation.

### **3.2 EXAMINATION**

- A. Verify that design drawings conform to project conditions.
- B. Verify that water line sizes and locations are as indicated on the drawings.

### **3.3 PREPARATION**

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside of pipes before assembly.
- C. Prepare pipe connections to equipment with flanges, mechanical joints or mechanical couplings.

### **3.4 EXCAVATING**

- A. Excavating for the backflow preventer station shall be done to ensure proper grades and alignment as shown on the drawings.
- B. See Section 02112 and Sections 02115 and 02116 for additional requirements.
- C. Hand trim excavation for accurate placement of pipe to elevations indicated.
- D. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required area of thrust restraint bearing on subsoil as indicated on the drawings.
- E. Backfill around sides and to top of pipe zone with pipe bedding material, tamp in place and compact to required density.
- F. Backfill trench from top of pipe zone to top of trench with trench backfill material, tamp in place and compact to required density.

### **3.5 INSTALLATION - PIPE**

- A. Establish elevations of buried piping to ensure not less than 2 feet of cover over secondary water lines and 4 feet over drinking water lines; or as indicated on the drawings.
- B. Install pipe to indicated elevation to within tolerance of one inches.
- C. Install ductile iron piping and fittings to AWWA C600.
- D. Install pipe lines to the line and grade indicated.
- E. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- F. Slope water pipe and position drains at low points.

### **3.6 INSTALLATION – VALVES**

- A. Set valves level and plumb, as indicated.
- B. Install adjustable pipe supports under each valve.

- C. Reduced pressure (RP) backflow preventer assemblies shall be installed as indicated on the drawings and as described herein.
  - 1. The assemblies shall be installed in a horizontal position only.
  - 2. The assemblies shall be maintained as an intact assembly.
  - 3. The bottom of the RP assembly shall be minimum of 12-inches above the ground or floor level; and shall not be closer than 12 inches to any wall, ceiling or other encumbrance. Assemblies shall be readily accessible for testing, repair and maintenance.
  - 4. RPZ assemblies shall NOT be installed in a pit.
  - 5. The relief valve on the RP assembly shall not be directly connected to any waste disposal line, including sanitary sewer, storm drains or vents.
  - 6. RP assemblies shall be protected from freezing and vandalism where applicable.

### **3.7 CONCRETE WORK**

- A. Construct a concrete slab for the station over a compacted gravel base, as shown on the drawing.
- B. Concrete work and reinforcing shall conform to the requirements of Section 03300 of these specifications.

### **3.8 MISCELLANEOUS ITEMS**

- A. Miscellaneous appurtenant items shall be furnished and installed as indicated on the drawings or as required to complete the station.

### **3.9 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 200 PSI for 2 hours.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to City.

### **3.10 OPERATIONAL TESTING**

- A. Provide the City Engineer or City Inspector with seven days written notice before operational test of backflow preventer. Test must be completed by a certified backflow technician.
- B. Test shall consist of the operation of the station for propose of checking operation and assuring of absence of leaks.
  - 1. Repair pipe, fittings, valves, or connections which show evidence of leakage.
- C. After all repairs or replacements have been made and accepted by the City Engineer or City Inspector, repeat the above required test.

### **END OF SECTION**

## **SECTION 02621**

### **GRAVEL SURFACING AND ROAD BASE**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. New gravel road base.
- B. Restore gravel road base.
- C. New gravel road surfacing.
- D. Restore gravel road surfacing.

##### **1.2 RELATED SECTIONS**

- A. Section 01300 - Administrative Requirements
- B. Section 01400 - Quality Requirements
- C. Section 02112 - Trenching for Pipe Work.
- D. Section 02116 - Fill and Backfill: Compacted fill under base course.
- E. Section 02641 - Bituminous Paving: Binder and finish asphalt courses.

##### **1.3 REFERENCES**

- A. APWA Standards and Specifications - 2012 Edition
- B. AASHTO T 11 - Materials Finer than 75-
- C. AASHTO T 19 - Bulk Density ("Unit Weight") and Voids in Aggregate
- D. AASHTO T 27 - Sieve Analysis of Fine and Coarse Aggregates
- E. AASHTO T 89 - Determining the Liquid Limit of Soils
- F. AASHTO T 90 - Determining the Plastic Limit and Plasticity Index of Soils
- G. AASHTO T 96 - Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- H. AASHTO T 193 – The California Bearing Ratio
- I. AASHTO T 335 - Determining the Percent of Fracture in Coarse Aggregate
- J. ASTM C 117 - Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing
- K. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- L. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil



Using Modified Effort

- M. ASTM D 5195 - Standard Test Method for Density of Soil and Rock In-Place at Depths Below Surface by Nuclear Methods

#### 1.4 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Submit source documentation and mix design as per Article 2.02
- C. Compaction Density Test Reports per Article 1.05.

#### 1.5 QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform quality control testing as per Table 1.

Table 1: Sampling and Testing Frequencies			
Gradation, ASTM C136	Roadway Every 500 Tons	Flatwork/Driveways 1 per day or Every 500 Tons	Backfill
Density, ASTM D 5195	Every 2500 SF	Every 150 LF or 2500 SF	Every 150 LF
Report all sieves identified in the UDOT Specification. Density target of 95% of Modified Proctor, ASTM D 1557. Use whichever frequency is greater.			

- C. Submit test and inspection reports to the City in accordance with Section 01400.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

#### 1.6 ACCEPTANCE

- A. The City will perform acceptance decisions for all projects; based on results of the quality control test results defined in Article 1.05.
  - 1. The City will reject the lot if the Contractor QC data is outside the limits of Table 1.
  - 2. At the City's discretion, the City may perform acceptance testing in accordance with Table 1.
- B. If tests indicate work does not meet specified requirements, remove work, replace and retest.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Untreated Base Course.
  - 1. Material: Use 1-1/2 inch UDOT Specification

## **2.2 SOURCE QUALITY CONTROL**

- A. See Section 01400 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work.
- D. Materials Sources: Submit name of imported materials source and Aggregate Composition Test Reports demonstrating compliance with Article 2.01.
  - 1. Submit to the City at least 10 working days before placement.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. For new gravel road base and gravel surfacing, verify that sub-base has been compacted, inspected and accepted by the City Inspector, that gradients and elevations are correct, and that it is dry.
- B. Verify that all areas of collapsible soil have been identified and properly prepared for road base.
  - 1. Submit report to the City summarizing investigative procedures and results prior to placement of base course.
- C. For restoration of gravel road base and gravel surfacing, verify trenches and excavations have been backfilled, compacted, inspected and accepted by the City Inspector, that gradients and elevations are correct, and that they are dry.

### **3.2 PREPARATION**

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.
- C. Red head staking required for grade verification.

### **3.3 INSTALLATION**

- A. New gravel road base and surfacing.
  - 1. Place gravel road base material over prepared substrate to provide total compacted thickness as indicated on plans.
- B. Restoration of gravel road base and surfacing.
  - 1. Restore gravel road base, along with temporary gravel surfaces, within one day after trench backfill has been placed, compacted, and inspected and accepted by the City Inspector.

2. Temporary gravel shall be maintained by blading, sprinkling, rolling, adding additional gravel as required, and appurtenant work to provide a safe, uniform surface over trench area satisfactory to the City Inspector. The temporary surface shall be restored at least every 7 days until the final surfacing is to be placed; and sprinkled with water at least once each day, including weekends and holidays.
  3. When final surfacing is to be placed, remove the temporary gravel to the bottom of the surface to be restored. After removing temporary gravel, the sub-base shall be graded and rolled to provide a compact, smooth base for placement of final surfacing.
  4. Place gravel road base material over prepared substrate to provide total compacted thickness equal to the adjacent road base, but not less than the thickness as indicated.
- C. Place material at near optimum moisture.
- D. Level and contour surfaces to elevations and gradients indicated.
- E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- G. Provide red head staking and string test for finished grading verification.
- H. When aggregate materials need to be stored on site, locate stockpiles where indicated.
1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  2. Prevent contamination.
  3. Protect stockpiles from erosion and deterioration of materials.
  4. Aggregate stockpiles shall be placed so that the aggregate gradation is maintained and segregation of larger and smaller aggregate does not happen.
- I. Verify that survey bench marks and intended elevations for the Work are as indicated.

### **3.4 TOLERANCES**

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation from Design Elevation: Within 1/2 inch.

### **3.5 CEASE PRODUCTION**

- A. Cease production when any two out of three consecutive tests meet one of the following criteria:
1. Gradation does not meet limits of the UDOT Specification
  2. Density does not meet requirements of Table 1 after reworking and retesting.
- B. Prior to continuing product, a corrective action plan must be submitted to the City Engineer and accepted. This plan must indicate the changes in production procedures that will be implemented to correct the deficiencies.

### **3.6 CLEAN-UP**

- A. Remove unused stockpiled materials; leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. All disturbed areas shall be restored with native grasses to match adjacent areas, conforming to the City Standards. These areas shall be seeded with material conforming to adjacent materials. Restored area shall achieve 70% plan coverage prior to acceptance.

**END OF SECTION**

## **SECTION 02631**

### **GEOGRID**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Geogrid for use in roadway and roadway embankment applications.

##### **1.2 RELATED SECTIONS (Not Used)**

##### **1.3 REFERENCES**

- A. American Association of State Highway and Transportation Officials (AASHTO)
  - 1. AASHTO Recommended Practice for Geosynthetic Reinforcement of the Aggregate Base Course of Flexible Pavement Structures, AASHTO PP46-01, April 2001 Interim Edition of the AASHTO Provisional Standards.
  - 2. Standard Specification for Highway Bridges (1997 Interim)
  - 3. AASHTO Guide for Design of Pavement Structures (1993)
  - 4. AASHTO Guide for Design of Pavement Structures (1993)
- B. American Society for Testing and Materials (ASTM)
  - 1. D5732-95 - Standard Test Method for Stiffness of Fabrics
  - 2. D6637-01 - Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-rib Tensile Method
  - 3. D4354-96 - Practice for Sampling of Geosynthetics for Testing
  - 4. D4759-92 - Practice for Determining the Specification Conformance of Geosynthetics
  - 5. D5818-95 - Practice for Obtaining Samples of Geosynthetics from a Test Section for Assessment of Installation Damage
- C. Geosynthetic Research Institute (GRI)
  - 1. GRI-GG2-87 - Standard Test Method for Geogrid Junction Strength
- D. U.S. Department of Transportation – Federal Aviation Administration (FAA)
  - 1. Specification for Geogrid Reinforced Base Courses, Engineering Brief No. 49 (1994).
- E. U.S. Environmental Protection Agency (U.S. EPA)
  - 1. EPA 9090 - Compatibility Test for Wastes and Membrane Liners
- F. U.S. Army Corps of Engineers (U.S. COE)
  - 1. Draft specification for Grid Aperture Stability by In-Plane Rotation
  - 2. CW-02215 Determination of Percent Open Area.
- G. American Society of Civil Engineers (ASCE)

1. Giroud, J.P., and Han, J. (2004). "Design method for geogrid reinforced unpaved roads. Part I – Development of design method." Journal of Geotechnical and Geoenvironmental Engineering, 130 (8), 775-786.
2. Giroud, J.P., and Han, J. (2004). "Design method for geogrid reinforced unpaved roads. Part II – Calibration and applications." Journal of Geotechnical and Geoenvironmental Engineering, 130 (8), 787-797. City Road Repair and Crack Seal Program 2013 02072 - 2 GEOGRID

#### 1.4 DEFINITIONS

- A. Geogrid - A biaxial polymeric grid formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth to function primarily as reinforcement.
- B. Multi-Layer Geogrid - A geogrid product consisting of multiple layers of grid which are not integrally connected throughout.
- C. Woven Geogrid – A geogrid product formed by weaving discrete strips of polymer into a network.
- D. Welded Strip geogrid – A geogrid product formed by heat bonding (welding) discrete strips of polymer into a regular network.
- E. Minimum Average Roll Value (MARV) - Value based on testing and determined in accordance with ASTM D4759-92.
- F. Traffic Benefit Ratio (TBR) (also known as Traffic Improvement Factor or TIF) - A ratio comparing the performance of a pavement cross-section with a geogrid-reinforced base course to a similar cross-section without geogrid reinforcement, based on the number of cycles to failure, with failure defined as a selected depth of rut.
- G. True Initial Modulus in Use - The ratio of tensile strength to corresponding zero strain. The tensile strength is measured via ASTM D6637 at a strain rate of 10 percent per minute. Values shown are MARVs. For multi-layer geogrid products, rib tensile testing shall be performed on the multi-layer configurations, as prescribed by ASTM D6637.
- H. Junction Strength - Breaking tensile strength of junctions when tested in accordance with GRI- GG2 as modified by AASHTO Standard Specification for Highway Bridges, 1997 Interim, using a single rib having the greater of 3 junctions or 8 inches and tested at a strain rate of 10 percent per minute based on this gauge length. Values shown are minimum average roll values. For multi-layer geogrid products, junction strength testing shall be performed across junctions from each layer of grid individually, and results shall not be assumed as additive from single layers to multiple layers.
- I. Flexural Stiffness (also known as Flexural Rigidity) - Resistance to bending force measured via ASTM D5732-95, using specimens of width two ribs wide, with transverse ribs cut flush with exterior edges of longitudinal ribs (as a "ladder"), and length sufficiently long to enable measurement of the overhang dimension. The overall Flexural Stiffness is calculated as the square root of the product of the MD and XMD Flexural Stiffness values. For multi-layer geogrid products, flexural stiffness testing shall be performed directly on the multi-layer configuration without using any connecting elements other than those used continuously throughout the actual product, and results shall not be assumed as additive from testing performed on a single layer of the multi-layer product.
- J. Aperture Stability Modulus (also known as Torsional Rigidity or Torsional Stiffness) -

Resistance to in-plane rotational movement measured by applying a 20 kg-cm (2 m-N) moment to the central junction of a 9-inch by 9-inch specimen restrained at its perimeter. Values shown are MARVs. For multi-layer geogrid products, torsional stiffness testing shall be performed on each layer of grid individually, and results shall not be assumed as additive from single layers to multiple layers. City Road Repair and Crack Seal Program 2013 02072 - 3 GEOGRID

- K. Subgrade Improvement – Placement of a geogrid immediately over a soft subgrade soil in order to improve the bearing capacity and mitigate deformation of the subgrade soil. The goal of this application is to reduce undercut requirements, improve construction efficiency, reduce the amount of aggregate subbase/base material required, provide a stiff working platform for pavement construction, or combination of these.
- L. Base Reinforcement - Placement of a geogrid beneath or within the aggregate base course of a flexible pavement system to improve the stiffness of the system. The goal of this application may be to reduce the amount of aggregate base material required (reducing initial cost), increase the life of the pavement (reduce life-cycle cost), or a combination of the two.

## **1.5 SUBMITTALS**

- A. Submit geogrid product sample approximately 4 inches by 7 inches or larger. Refer to ASTM D 4354.
- B. Submit geogrid product data sheet and certification from the Manufacturer that the geogrid product supplied meets the requirements of this Section.
- C. Submit Manufacturer's installation instructions and general recommendations.
- D. Submit the following to the City Engineer at least 2 days prior to bid letting for alternate geogrid materials that do not meet the requirements of this Section. The City Engineer will respond with a written justification to allow or disallow the requested alternate Geogrid.
  - 1. Full-scale laboratory and in-ground testing of pavement structures reinforced with the specific geogrid. Testing must be conducted in full-scale at an Accelerated Pavement Testing Facility in the United States. Testing must quantify the structural benefit of the submitted product. Full scale testing must be included in the submittal. The geogrid submitted must meet or exceed that of the design geogrid.
  - 2. A list of 5 comparable projects that are similar in terms of size and application, are located in the United States, and where the results of using the specific alternate geogrid material can be verified after a minimum of five years of service life.
  - 3. A sample 4 x 7 inches or larger.
  - 4. Recommended installation instructions.
  - 5. Additional information as requested by the City Engineer to fully evaluate the product.

## **1.6 QUALITY ASSURANCE**

- A. Manufacturer shall have at least five years continuous experience in manufacturing polypropylene geogrid or experience manufacturing at least 10,000,000 square feet of polypropylene geogrid.
- B. Geogrid installer shall be manufacturer's representative or trained to install manufacturer's product.

- C. Pre-Construction Conference - Prior to the installation of the geogrid, the Contractor shall arrange a meeting at the site with the geogrid material supplier and, where applicable, the geogrid installer. The Owner and the City Engineer shall be notified at least 3 days in advance of the time of the meeting. A representative of the geogrid supplier shall be available on an "as needed" basis during construction.

## **1.7 ACCEPTANCE**

- A. Owner rejects geogrid at installation if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transport, handling or storage.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver geogrid to site in rolls. Each roll shall have identification tag indicating manufacturer and product type. Ship per manufacturer's recommendations.
- B. Storage and Protection
  - 1. Prevent excessive mud, wet concrete, epoxy, or other deleterious materials from coming in contact with and affixing to the geogrid materials.
  - 2. Store at temperatures above -20 degrees F (-29 degrees C).
  - 3. Rolled materials may be laid flat or stood on end.
  - 4. Geogrid materials should not be left directly exposed to sunlight for a period longer than recommended by the manufacturer.

## **1.9 PROJECT CONDITIONS**

- A. Place geogrid when ambient temperature is between 40 degrees Fahrenheit and 95 degrees Fahrenheit.
- B. Do not place geogrid during any precipitation; in presence of moisture such as fog, rain, dew; or excessive winds.

## **1.10 WARRANTY**

- A. Provide one year written warranty for materials and workmanship for geogrid.

# **PART 2 PRODUCTS**

## **2.1 MATERIALS**

- A. Geogrid General—
  - 1. Synthetic fiber net at least 85-percent by weight of polypropylene, polyethylene, or polyester.
  - 2. Resistant to chemical attack, rot and mildew.
  - 3. No tears or defects that will adversely alter properties of product.
- B. Roadway Aggregate Geogrid - Base Reinforcement



1. Geogrids are a regular network of integrally connected polymer tensile elements constructed in a single layer with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. Geogrids must also be dimensionally stable and able to retain their geometry under manufacture, transport and installation.
2. Geogrids shall have the following properties:

Type 1 Geogrid			
Biaxial Type 1 Geogrid Quality Control Values			
Geogrid Properties	Test Method	MD	CMD
Type of Geogrid		Punched and Drawn	
Rib Shape	Observation	Rectangular or Square	
Rib Thickness	Nominal Dimensions	Minimum 0.05 in	
Nominal Aperture Size	I.D. Callipered	1.0 to 1.5 inches	
Flexural Stiffness	ASTM D-5732-95	Minimum 750,000 mg-cm	NA
Minimum True Initial Modulus in Use	ASTM 6637-01	Minimum 27,420 lb/ft	Minimum 44,550 lb/ft
Junction Efficiency	GRI-GG2-87	93%	
Aperture Stability Modulus at 20 cm-kg	Kinney-01	0.65 m-N/deg	NA
Resistance to Long Term Degradation	EPA 9090 Immersion Testing	100%	
Biaxial Type 2 Geogrid Quality Control Values			
Geogrid Properties	Test Method	MD	CMD
Type of Geogrid		Punched and Drawn	
Rib Shape	Observation	Rectangular or Square	
Rib Thickness	Nominal Dimensions	Minimum 0.07 in	
Nominal Aperture Size	I.D. Callipered	1.0 to 1.5 inches	
Flexural Stiffness	ASTM D-5732-95	Minimum 2,000,000 mg-cm	NA
Minimum True Initial Modulus in Use	ASTM 6637-01	Minimum 27,420 lb/ft	Minimum 44,550 lb/ft
Junction Efficiency	GRI-GG2-87	93%	
Aperture Stability Modulus at 20 cm-kg	Kinney-01	0.75 m-N/deg	NA
Resistance to Long Term Degradation	EPA 9090 Immersion Testing	100%	

- a) Resistance to elongation when initially subjected to load measured via ASTM 6637 without deforming test materials under load before measuring such resistance or employing “secant” or “offset” tangent methods of measurement.
- b) Resistance to bending force measured via ASTM D-5732-95, using specimens of width two ribs wide, with transverse ribs cut flush with exterior edges of longitudinal ribs (as a “ladder”), and of length sufficiently long to enable measurement of the overhang dimension. The overall Flexural Stiffness is calculated as the square root of the product of machine-and cross-machine-direction Flexural Stiffness values.

<b>Triaxial Type 1 Geogrid Quality Control Values</b>					
Geogrid Properties	Test Method	Longitudinal	Diagonal	Transverse	General
Type of Geogrid					Punched and Drawn
Rib Pitch	Nominal Dimensions	1.6	1.6		
Mid-rib depth	Nominal Dimensions		0.05	0.05	
Mid-rib width	I.D. Callipered		0.04	0.04	
Rib Shape	ASTM D-5732-95				Rectangular
Aperture Shape	ASTM 6637-01				Triangular
Radial Stiffness	ASTM 6637-01				15,430 lb/ft @ 0.5% strain
Junction Efficiency	GRI-GG2-87				93%
Resistance to Long Term Degradation	EPA 9090 Immersion Testing				100%
<b>Triaxial Type 2 Geogrid Quality Control Values</b>					
Geogrid Properties	Test Method	Longitudinal	Diagonal	Transverse	General
Type of Geogrid					Punched and Drawn
Rib Pitch	Nominal Dimensions	1.6	1.6		
Mid-rib depth	Nominal Dimensions		0.07	0.06	
Mid-rib width	I.D. Callipered		0.04	0.05	
Rib Shape	ASTM D-5732-95				Rectangular
Aperture Shape	ASTM 6637-01				Triangular
Radial Stiffness	ASTM 6637-01				29,500 lb/ft @ 0.5% strain
Junction Efficiency	GRI-GG2-87				93%
Resistance to Long Term Degradation	EPA 9090 Immersion Testing				100%

- Load transfer capability determined in accordance with GRI-GG2-87 and expressed as a percentage of ultimate tensile strength.
- Determined from tensile stiffness measured in any in-plane axis from testing in accordance with ASTM D6637-01.
- Resistance to loss of load capacity or structural integrity when subjected to chemically aggressive environments in accordance with EPA 9090.

3. Using multiple layers of geogrid to meet the requirements set forth in the preceding table will not be accepted.
  4. Acceptance Requirements – Base the actual minimum average roll values furnished by the manufacturer on representative test results from the manufacturing plant which produced the geogrid. Meet or exceed each of the specified minimum values. Clearly label all geogrids as being part of the same production run certified as meeting all applicable requirements.
- C. Acceptable Manufacturers:
1. Structural Geogrid, TX5 or BX1500, Tensar Earth Technologies, (801) 789-5407 or (800) 836- 7271.

## **2.2 SOURCE QUALITY CONTROL PREPARATION**

- A. Manufacturer shall conduct inspections and testing during production to verify product meets material properties specified.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Subgrade shall be smooth, free of all foreign and organic material, sharp objects, or debris of any kind.
- B. Subgrade shall have no sharp changes or abrupt breaks in grade.
- C. Subgrade shall not have standing water or excessive moisture.

### **3.2 INSTALLATION**

- A. Install geogrid in accordance with manufacturer's instructions.
- B. Layout geogrid on prepared subgrade or Granular Borrow. Place temporary anchoring such as Granular Borrow or Untreated Base Course material, pins, or staples as necessary to prevent movement.
- C. Provide 1-foot minimum overlap at edges and ends of rolls.
- D. Place overlap shingle style in direction of fill advancement to ensure stability during installation.
- E. Place and compact fill in accordance with manufacturer's recommendations and in accordance with Section 02116.

### **3.3 PROTECTION**

- A. Protect subgrade from damage while unrolling geogrid.
- B. Protect geogrid from damage from equipment, tools, and personnel working on geogrid.
- C. Protect geogrid from damage during backfill operations.

**END OF SECTION**

## **SECTION 02641**

### **BITUMINOUS PAVING**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Bituminous paving for new surfaces.
- B. Bituminous paving for restoration of bituminous surfaces.
- C. Bituminous paving for overlay.

##### **1.2 RELATED SECTIONS**

- A. Section 01300 – Administrative Requirements
- B. Section 01400 - Quality Requirements.
- C. Section 02100 – Roadway and General Earthwork.
- D. Section 02116 - Fill and Backfill: Compacted subgrade for paving.
- E. Section 02621- Gravel Road Base Course: Gravel road base course.

##### **1.3 REFERENCES**

- A. AASHTO M 303 – Lime for Asphalt Mixtures
- B. AASHTO R 35 – Superpave Volumetric Design for Hot-Mix Asphalt
- C. AASHTO T 19 – Bulk Density ("Unit Weight") and Voids in Aggregate
- D. AASHTO T 89 – Determining the Liquid Limit of Soils
- E. AASHTO T 90 – Determining the Plastic Limit and Plasticity Index of Soils
- F. AASHTO T 96 – Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- G. AASHTO T 104 – Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- H. AASHTO T 176 – Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
- I. AASHTO T 195 – Determining Degree of Particle Coating of Asphalt Mixtures
- J. AASHTO T 209 – Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
- K. AASHTO T 255 – Total Evaporable Moisture Content of Aggregate by Drying
- L. AASHTO T 304 – Uncompacted Void Content of Fine Aggregate

- M. AASHTO T 324 – Hamburg Wheel-Track Testing of Compacted Hot-Mix Asphalt (HMA)
- N. AASHTO T 335 – Determining the Percentage of Fracture in Coarse Aggregate
- O. APWA Standard Specifications – 2012 Edition
- P. Asphalt Institute Manual SP-2: Superpave Mix Design
- Q. ASTM D 4791 – Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
- R. UDOT Quality Management Plan 514: Hot Mix Asphalt (latest edition as of date of project)
- S. UDOT Standard Specifications (latest edition as of date of project)

#### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures
- B. Volumetric Mix Design as per Article 2.02 D.
- C. Verification of current UDOT HMA Mix Plant certification as per Article 1.05 B.
- D. Verification of Laboratory Accreditation and Technician Certification as per Article 1.05 D.
- E. Daily Plant Production records and Quality Control Data as per Article 1.05 E and Article 1.06 A.
- F. Cold weather paving plan as per Article 1.09 A.2.

#### **1.5 QUALITY ASSURANCE**

- A. Perform Mix Design and Quality Control work in accordance with Section 32 12 05 of the APWA Standard Specifications unless otherwise directed within this specification.
- B. HMA Mixing Plant: Use UDOT 514 QMP certified Asphalt Mix Plant.
  - 1. Submit plant certification and lab accreditation documentation with mix design.
- C. Obtain materials from same source throughout or submit new mix design.
- D. Independent Laboratory: Use AMRL certified laboratory and WAQTC/UDOT TTQP certified technicians.
  - 1. Submit lab accreditation documentation with mix design
  - 2. Submit field technician certification documentation at least 5 working days before paving
- E. Submit daily plant production records and Quality Control data within 1 working day after completion of each day of paving.

#### **1.6 QUALITY CONTROL AND QUALITY DEMONSTRATION**

- A. Quality Control is performed by Contractor or their representative. Perform QC sampling and testing of material in accordance with Section 01400 - Quality Requirements.

1. Submit QC data and plant daily production summary to the City at least 24 hours prior to the start of paving subsequent lots.
  - a. Include component percentages and totalized quantities for the individual mix run for the following:
    - i. Asphalt Binder
    - ii. All aggregates, including RAP
    - iii. Anti-Strip Ingredient
    - iv. Water
- B. A lot equals the number of tons of HMA placed during each production day.
- C. Gradation and asphalt binder content
  1. Gradation and Binder Content samples may be post-paver samples from the grade, truck samples from the plant or windrow samples.
  2. Evaluate a lot on the average of all test results for the lot.
    - a. Take at least one gradation and binder content sample for each 500 tons, or portion thereof.
  3. Perform and report to the City Engineer gradation and asphalt binder content testing.
  4. Lot is acceptable for Gradation/Asphalt Binder Content when test results for gradation and binder content are within the limits of Table 1.
- D. Mix Volumetrics
  1. Take one volumetric verification sample per 500 tons of mix, or fraction thereof.
    - a. Determine mix maximum specific gravity.
    - b. Compact in accordance with mix design parameters.
  2. Calculate and report Effective Asphalt Content (by Volume), Air Void Content, VMA, VFA and Dust to Binder Ratio for each sample taken.
- E. Density and Thickness Quality Demonstration
  1. Demonstrate lot density and thickness based on the test results of 4 random density/thickness cores per lot.
    - a. Random location is based on use of random number table, generator or other objective measure to establish both station and off-set for each sample.
    - b. Density and thickness may be evaluated in non-destructive formats. Obtain written permission from the City for non-destructive evaluation prior paving.
      - i. Density is based on documented summary of results of 10 **randomly** located nuclear density tests using **core-correlated gauge specific to this mix.**
        - (a). Submit random density locations to the City Engineer prior to paving.
        - (b). One nuclear density test is the average of two determination of at least 1 minute, taken at right angles to each other over the same location.
      - ii. Thickness is based on documented summary of minimum 10 random thickness checks with a depth probe during compaction efforts or ground penetrating radar after compaction efforts, including any corrective actions taken.

- c. For lift thicknesses less than 2", use non-destructive format as detailed above.
2. Contractor obtains cores from random locations within two days after the pavement is placed.
  - a. Move transversely to a point 1 ft from the edge of the pavement for In-place density if the random location for coring falls within 1 ft of the edge of the overall pavement section (outer part of shoulders).
  - b. Fill core holes with HMA or high AC content cold mix and compact.
  - c. Begin testing the cores within 24 hours for density acceptance.
3. Lot is acceptable for density when test results are within the limits of Table 1.
4. Lot is acceptable for thickness when:
  - a. The average thickness of the lot is not more than ¼ inch less than the total thickness specified.
  - b. No individual core shows a deficient thickness of more than ⅜ inch.
5. Deficient Thickness: Place additional material where lots are deficient in thickness.
  - a. Use a minimum compacted lift of 3 times the nominal maximum aggregate size.

<b>Table 1: Quality Control Acceptance Limits Gradation, Binder Content, Density</b>	
Parameter	Acceptable Limits
½ inch sieve for ¾ inch HMA ⅜ inch sieve for ½ inch HMA (percent passing by weight)	Lot Average*: Target Value 3.0% Individual Test: Target Value 6.0%
No. 8 sieve (percent passing by weight)	Lot Average*: Target Value 2.5% Individual Test: Target Value 5.0%
No. 50 sieve (percent passing by weight)	Lot Average*: Target Value 2.0% Individual Test: Target Value 3.0%
No. 200 sieve (percent passing by weight)	Lot Average*: Target Value 1.0% Individual Test: Target Value 2.0%
Total Asphalt Binder Content	Lot Average*: Target Value 0.2% Individual Test: Target Value 0.4%
Density Target Value: 93.5 percent of Mix Design Maximum Specific Gravity (Rice) (for design overlay thickness < 1.5" target is 92.5% of Rice)	Lot Average*: Target Value 2.0% Individual Test: Target Value 4.0%

\* Lot Average not applicable to lots with only 1 test. Use Individual Test limits when evaluating lots with only 1 test.

## 1.7 ACCEPTANCE

- A. The City will make acceptance decisions for all projects. The City may accept or reject a project if it is not up to the specifications included herein.
  1. Project Definitions
    - a. Capital Projects: Projects where City has contracted directly with the General Contractor for construction of the roadway.

- b. Non-Capital Projects: All other projects, including Development, Permit and Utility work.
- 2. Acceptance Practices
  - a. For Capital projects, the City, or its representative, will perform testing for gradation, asphalt binder content, density, thickness and smoothness on samples taken by the contractor in the presence of the City or its representative.
    - i. Testing will be performed by an AMRL certified laboratory and WAQTC/UDOT TTQP certified technicians.
    - ii. For Capital projects with total tonnages equal to or larger than 1000 tons, the City will accept material based on Articles 1.07 B through 1.07 F. Projects less 1000 tons will be accepted based on Table 1 limits.
  - b. For the Non-Capital projects, the City may accept the lot based on results of the quality control test results and plant production records defined in Article 1.06.
    - i. The City will reject the lot if the Contractor QC data for density, gradation or binder content is outside the limits of Table 1.
    - ii. The City may perform partial or full acceptance testing on non-Capital projects in accordance with Articles 1.07B through 1.07E, Article 1.07H, and Article 1.07I.
      - (a). The City will reject the lot if the Acceptance data is outside the limits of Table 1, if calculated PT is less than 80%, or if True-Elevation tolerance of Article 7H is not met.
        - (i) 80% limit for PT is not applicable for small projects with total tonnages less than 1000 tons.
- B. A lot equals the number of tons of HMA placed during each production day.
- C. Gradation and asphalt binder content
  - 1. The City Engineer will evaluate a lot on the test results of four samples with the following exceptions:
    - a. Compute disincentive using the test results from three samples if only three samples can be taken for the production day.
    - b. Add the lot to the next day's production if three random samples cannot be taken.
    - c. Add the lot to the previous day's production for the final day's production if three random samples cannot be taken.
    - d. The lot may be increased to include up to three production days when agreed upon in advance by both the Contractor and City Engineer when less than 900 tons are anticipated per production day.
  - 2. Take samples at locations directed by the City Engineer or their representative. The City Engineer will inform the Contractor of the time and place of sampling not more than 15 minutes before the sampling.
    - a. The City takes immediate possession of the sample(s).
- D. Mix Volumetrics
  - 1. In conjunction with the gradation and binder content samples, the City will test for, calculate and report Air Void Content, VMA, VFA and Dust to Binder Ratio.
    - a. Laboratory compaction in accordance with mix design parameters.
    - b. Calculations will be based on sample maximum specific gravity.



E. Density and Thickness

1. Density Sampling and Testing

- a. For paving areas not containing paving Fabric: Contractor obtains cores within two days after the pavement is placed.
  - i. The City Engineer will mark coring location for in-place density and joint density cores.
  - ii. Move transversely to a point 1 foot from the edge of the pavement for in-place density if the random location for coring falls within 1 foot of the edge of the overall pavement section (outer part of shoulders).
  - iii. Fill core holes with HMA or high AC content cold mix and compact.
  - iv. The City Engineer will witness the coring operation, take possession of the cores immediately, and begin testing the cores for density acceptance.
- b. For paving areas with paving Fabric, the owner will perform density testing with a core- correlated nuclear gauge instead of cores.

2. Density Requirements

- a. The limits for in-place density are in accordance with Table 3.
- b. Use the average of the Maximum Specific Gravity tests for each lot.

3. Thickness Requirements

- a. The City will accept a lot for thickness when:
  - i. The average thickness of all sub-lots is not more than 1/4-inch greater, nor 1/4-inch less than the total thickness specified.
  - ii. No individual sub-lot shows a deficient thickness of more than 3/8-inch.
- b. Excess Thickness: The City Engineer may allow excess thickness to remain in place or may order its removal.
  - i. For excess material left in place on unit price contracts, the City will not pay for any material above the upper thickness tolerance.
- c. Deficient Thickness: Place additional material where lots or sub-lots are deficient in thickness.
  - i. Use Minimum compacted lift of 3 times the nominal maximum aggregate size.
- d. Thickness tolerances established above do not apply to leveling courses. Check final surfaces in stage construction.
- e. Thickness acceptance for thin lift projects less than 2 inches consists of checking thickness regularly with a depth probe during compaction efforts and taking corrective action as necessary.

F. For Capital Projects, the City will apply Disincentives for Gradation/Asphalt Content and In-Place Density. The City Engineer will compute Disincentive for each lot.

- 1. Compute disincentive for Gradation/Asphalt Binder and In-place Density according to Table 2.
- 2. Base the disincentive on Percent within Limit (PT) computation using Tables 3, 4, and 5.
  - a. Evaluate with the appropriate number of tests "n" in Table 4.
- 3. Use lowest single value combined for gradation (each of the sieves) and asphalt binder content for calculating the gradation/asphalt binder content disincentive.
- 4. Use Table 5 to determine PT for in-place density.

<b>Tables 2: Disincentive for Gradation, Asphalt Binder Content, and Density</b>	
PT Based on Min. Four Samples	Disincentive (Dollars/Ton)
> 88	0.00
84-87	-0.26
80-83	-0.60
76-79	-0.93
72-75	-1.27
68-71	-1.60
64-67	-1.93
60-63	-2.27
<60	Reject

<b>Tables 3: Upper and Lower Limit Determination</b>	
Parameter	UL and LL
½ inch sieve for ¾ inch HMA ¾ inch sieve for ½ inch HMA	Target Value 6.0%
No. 8 sieve	Target Value 5.0%
No. 50 sieve	Target Value 3.0%
No. 200 sieve	Target Value 2.0%
Asphalt Binder Content	Target Value 0.35%
Density	Lower Limit: Target Value - 2.0% Upper Limit: Target Value + 3.0%

Tables 4: Quality Index Values for Estimating Percent Within Limits										
PU/PL	n=3	n=4	n=5	n=6	n=7	N=8	n=10	n=12	n=15	n=20
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
<60	≤0.35	≤0.29	≤0.27	≤0.26	≤0.25	≤0.25	≤0.24	≤0.24	≤0.24	≤0.24

Enter table in the appropriate "number of tests" column and round down to the nearest value.

<b>Table 5: Definitions, Abbreviations, and Formulas for Acceptance</b>	
Term	Explanation
Target Value (TV)	The target values for gradation and asphalt binder content are given in the Contractor's volumetric mix design. See this Section article 1.4 for density target values.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results—the arithmetic mean.
Sample Standard Deviations	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 3)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 3)
Upper Quality Index (QU)	$QU = (UL - AVE)/s$
Lower Quality Index (QL)	$QL = (AVE - LL)/s$
Percentage of Lot Within UL (PU)	Determined by entering Table 4 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 4 with QL.
Total Percentage of Lot Within UL and LL (PT)	$PT = (PU + PL) - 100$
Disincentive	Determined by entering Table 2 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to at least four decimal place accuracy, which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

- G. Rejected Lots: Rejected lots do not necessarily indicate bad material, rather insufficient data to perform proper acceptance. Submit an engineering analysis for all rejected lots.
1. Include in the analysis:
    - a. A summary of the specific issues leading to rejection, including identification of any specific acceptance data being disputed.
    - b. Justification for dispute of the specific acceptance data in question.
    - c. An engineering evaluation of the expected performance of the pavement based on available project quality control or acceptance data other than acceptance data in question.
    - d. Copies of all data supporting the engineering evaluation of expected performance.
    - e. Summary of recommended changes to mitigate future occurrences of disputed results.
  2. The City Engineer may allow a rejected lot to remain in place based on review and concurrence with engineering analysis.
    - a. Capital Projects: A maximum of \$25 per ton price reduction will be assessed. The City may adjust or remove the price reduction based on the results of the engineering analysis.
    - b. Non-Capital Projects: No price reduction will be assessed. The City may require additional work by the contractor to mitigate concerns of any lot allowed to remain in place.
- H. Variation from True Elevation: Construct final riding surface within 1/2 inch of plan elevation.
- I. Smoothness

1. Limit all longitudinal and transverse pavement deviations to less than  $\frac{1}{8}$  inch from the lower edge of a 10-foot straightedge.
2. Meet smoothness requirements of Table 6.

<b>Table 6: Roughness Tolerances</b>			
Speed Mph	Profile Roughness <sup>d</sup> (Inches/Mile), Maximum		Profile Deviation <sup>c</sup> Inches/25 feet
	IRI <sup>a</sup>	PI <sup>b</sup>	Maximum
Residential			
All Speeds	–	–	0.4
Arterials and Collectors			
0 to 30	120	50	0.4
31 to 45	90	35	0.4
45 +	70	21	0.3

(a) IRI (International Roughness Index), ASTM E 950. Use 1/4 car analysis.

(b) PI (Profile Index), ASTM E 1274. Use a zero blanking band.

(c) Profile deviation applies to bump and depression measurements.

(d) Evaluate PR lots based on average of two traces from each lot, in the direction of travel, approximately 2.5 feet from each edge of pass.

3. Smoothness is evaluated before the placement of preservation surfacing including: Thin Bonded Polymer Overlay, Microsurfacing, Slurry Seal, Bonded Wearing Course, Stone Matrix Asphalt or Chip Seal Coat.
4. Profile Roughness: Verify bumps and depressions are corrected so profile roughness index in each lot meets tolerance:
  - a. Lot is 0.1 mile (528 feet long) for each paving pass. Add segments shorter than 250 feet to preceding lot. Treat partial segments longer than 250 feet as a lot.
  - b. Perform trace on each paving pass, regardless of location in roadway.
    - i. Exclude bridge decks from profile roughness evaluation. Profile deviation (bump) requirements still apply.
5. Profile Deviation: Verify “must grind” bumps and depressions are removed from the lot surface:
  - a. Lot is area of total placement. No area is excluded.
  - b. Begin traces 50 feet before edge of new pavement and end traces 50 feet after edge of new pavement. Areas (including the 50 feet end traces) exceeding profile deviation tolerances are “must grind” areas.
6. Correct all defects at no additional cost to the City.
  - a. Correct defects across the entire width of the traffic lane or shoulder either by grinding or by surface replacement.
  - b. Seal areas in HMA, and SMA that have been ground with a flush coat application.
    - i. Use a CSS-1h, CSS-1, CQS-1, based on 2:1 dilution of emulsion concentrate (approximately 60% binder/40% water) to water.
    - ii. Apply the emulsion at  $0.11 \pm 0.01$  gal/yd<sup>2</sup>. Provide beginning and ending meter reading from applicator for application rate verification.

## **1.8 REGULATORY REQUIREMENTS**

- A. Conform to applicable City requirements for paving work on City streets.

## **1.9 ENVIRONMENTAL REQUIREMENTS**

- A. Place asphalt mix when base/pavement surface and ambient temperatures are 50°F or higher.
  - 1. Submit a cold-weather paving plan to the City for any work to be performed outside the above limits. Include modified procedures and practices to ensure proper compaction will be obtained.
  - 2. The City determines and provides written acceptance if it is acceptable to place outside the above limits.
- B. Do not place on surfaces that have standing water or are frozen.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Asphalt Binder: Use PG 64-28 conforming to APWA Standard Specifications Section 32 12 05 or UDOT Standards Specifications Section 02745.
- B. Aggregate: Crusher processed virgin aggregate material consisting of crushed stone, gravel, or slag meeting Table 7.
  - 1. Coarse aggregates
    - a. Retained on No. 4 sieve
  - 2. Fine aggregates
    - a. Clean, hard grained, and angular
    - b. Passing the No. 4 sieve

<b>Table 7: Aggregate Properties – HMA</b>			
Test Method	Test No.	Arterials and Collectors	Local streets
One Fractured Face	AASHTO T 335	95% minimum	90% minimum
Two Fractured Face	AASHTO T 335	90% minimum	80% minimum
Fine Aggregate Angularity	AASHTO T 304	45 minimum	
Flats or Elongates	ASTM D 4791, 3:1 ratio	20% maximum	
L.A. Wear	AASHTO T 96	35% maximum	
Sand Equivalent	AASHTO T 176 (Pre-wet method)	45 minimum	
Plasticity Index	AASHTO T 89 and T 90	Non-Plastic	
Unit Weight	AASHTO T 19	minimum 75 lb/cu ft	
Soundness (sodium sulfate)	AASHTO T 104	16% maximum loss with five cycles	
Clay Lumps and Friable Particles	AASHTO T 112	2% maximum	
Natural Fines	N/A	0%	

- C. Meet gradation requirements in Table 8. Use ½” gradation unless specifically directed otherwise by the City Engineer.

<b>Table 8: Aggregate Gradations (Percent Passing by Dry Weight of Aggregate)</b>			
Sieve Size		¾ inch	½ inch
Control Sieves	1 inch	100.0	
	¾ inch	90.0 - 100.0	100.0
	½ inch	<90	90.0 – 100.0
	¾ inch		<90
	No. 4	Provide target for Information Only	
	No. 8	23.0 - 49.0	28.0 - 58.0
	No. 16	Provide target for Information Only	
	No. 30		
	No. 50		
	No. 100		
	No. 200	2.0 - 8.0	– 10.0

- D. Antistrip Agent: Hydrated Lime - AASHTO M 303, Type I in 3:1 slurry (water to lime) format.
- E. Tack Coat: Homogeneous, Catonic Emulsified Asphalt, Grade CQS-1 or CQS-1h, conforming to Section 32 12 13.13 of APWA Standard Specifications.

## 2.2 ASPHALT PAVING MIXES AND MIX DESIGN

- A. Perform Superpave Volumetric Mix Design according to Asphalt Institute Manual SP-2 and the following:
1. Comply with Table 9 and Table 10.
  2. Use minimum 11.0% effective asphalt binder by volume of mix.

3. Incorporate hydrated lime as necessary to meet Hamburg Wheel Tracker Requirements.
4. Do not use mix designs more than 1 year old.

<b>Table 9: Volumetric Design Gyrations</b>				
Pavement Category	Compaction Parameters			Voids Filled with Asphalt (VFA) (%)
	N <sub>initial</sub> /% of G <sub>mm</sub> *	N <sub>design</sub> /% of G <sub>mm</sub> *	N <sub>max</sub> /% of G <sub>mm</sub> *	
All Classes	7/ ≤ 90.5	75/ = 96.5	115/ ≤ 98	70 – 80

\* G<sub>mm</sub>: Theoretical maximum specific gravity of mix. Refer to AASHTO T 209.

<b>Table 10: Volumetric Design Requirements</b>	
HMA design mixing and compaction temperatures	As recommended by Binder Supplier, 325°F Maximum
Dust to Binder Ratio (by weight)	0.6 - 1.20 (Design) 0.6 - 1.40 (Production)
Voids in Mineral Aggregate (VMA) at N <sub>design</sub> AASHTO R 35.9.2 using G <sub>sb</sub> (dry) for virgin and recycled aggregates. Equation based on percent of total mix.	14.5% - 16.0% for ½ inch (report for information only – effective binder content and design air voids are primary design controls)
Hamburg Wheel Tracker AASHTO T 324, 50°C	Maximum 10 mm impression at 10,000 passes

- B. Recycled Asphalt Pavement (RAP): Mix design shall contain 15% or less recycled asphalt binder from RAP by total weight of binder. Do not adjust virgin binder grade when adding RAP.
  1. RAP aggregate is required to meet Table 7 with exception of Sand Equivalent
- C. Submit proposed mix design of each class of mix for review at least 10 working days prior to beginning of work. Include the following.
  1. Date of mix design.
  2. Asphalt Binder source, type, chemical composition, and grade.
  3. Effective and total binder target percentages, by weight **and by volume**, and calculated dust to effective binder ratio (by weight).
  4. Compaction density at N<sub>initial</sub>, N<sub>design</sub>, and N<sub>max</sub>.
  5. Volumetric targets including air voids, voids in the mineral aggregate (VMA), and voids filled with Bituminous Binder (VFA).
  6. Hamburg Wheel Tracker results and lime percentage
  7. Target Grading Curve for aggregate, including all sieves listed in Table 9.
  8. RAP properties including asphalt binder content and grade, and RAP percentage.
  9. Aggregate source and physical properties as identified in Table 8. Test results shall not be older than 455 days from the date of submission.
  10. 1Aggregate bulk and apparent specific gravities, percent absorption and blend percentage.
  11. Optimum compaction temperature at the project site.



D. Warm Mix Asphalt

1. At the City's discretion, warm mix asphalt application based on foamed asphalt or surfactant based applications may be used.
2. In addition to meeting requirements of articles 2.02.A through 2.02.C above, include warm-mix process description and related modifications to laboratory testing procedures in submittal.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads; and that the base course has been inspected and accepted by the City Inspector.
- B. Perform redhead and string-line test, verify gradients and elevations of base are correct.
- C. Locate, reference, and protect all utility covers, monuments, curb and gutter and other components and street fixtures affected by the paving operations.
- D. Remove all moisture, dirt, sand, leaves, dust, mill remnants and other objectionable material from the prepared surface.

#### 3.2 PREPARATION - TACK COAT

- A. Apply tack coat with minimum 98% coverage.
- B. Apply tack coat to all contact surfaces of curbs, gutters, existing pavement, manhole frames and other utility structures.
- C. Apply tack coat to all longitudinal joints and between lifts.
- D. Apply tack in accordance with Table 11, based on 2:1 dilution of emulsion concentrate (approximately 60% binder/40% water) to water. Provide beginning and ending meter reading from applicator for application rate verification.

Table 11: Minimum Tack Application Rates (gal/SY)	
Milled Surface	0.08
Existing HMA Surface	0.05
New HMA Surface (less than 48 hrs since placement)	0.03
Vertical and Contact Surfaces (Hand spray applications)	Minimum 98% Coverage

#### 3.3 HMA PRODUCTION AND PLACING ASPHALT PAVEMENT

- A. Dry aggregate material to an average moisture content of not more than 0.2 percent by weight. Mix uniformly; May be verified by AASHTO T 255. Adjust burners to avoid damage or soot contamination of the aggregate
- B. Coat with asphalt binder 100 percent of the particles passing and 98 percent of the particles retained on the No. 4 sieve.
  1. May be verified by AASHTO T 195.

2. Discontinue operation and make necessary corrections if material is not properly coated.
- C. Maintain temperature of the HMA between identified limits for mixing and compaction as defined on Volumetric Mix Design Submittal.
  1. The City Engineer will reject all materials heated over the identified limits.
  2. Remove all material rejected by the City Engineer for overheating and dispose of in a legally acceptable manner.

### **3.4 CEASE PRODUCTION**

- A. Cease production when any two out of three consecutive lots meet one of the following criteria:
  1. A net disincentive
  2. Air voids at Ndes averaged for each lot are less than 2.5 or greater than 4.5 percent
  3. Effective binder content averaged for each lot is not within Target Value  $\pm$  0.5 percent
  4. Dust to binder Ratio exceeds limits in Table 11.
- B. Submit a corrective action plan to the City Engineer before production continues indicating the changes in production procedures that will be implemented to correct the deficiencies.

### **3.5 PLACING ASPHALT PAVEMENT**

- A. Provide a compactable sloped edge adjacent to the next lane to be paved when full-width or Echelon paving is impractical and more than one pass is required. Echelon paving is the preferred method for constructing a longitudinal joint.
- B. Adjust the production of the mixing plant and material delivery until a steady paver speed is maintained.
- C. Offset longitudinal joints 6 to 12 inches in succeeding courses.
  1. Place top course joint within 1 ft of the centerline or lane line.
- D. Offset transverse construction joints at least 6 ft longitudinally.
- E. Do not allow construction vehicles, general traffic, or rollers to pass over the uncompacted end or edge of freshly placed mix until the mat temperature drops to a point where damage or differential compaction will not occur.
- F. Taper the end of a course subjected to traffic at approximately 50:1 (horizontal to vertical).
  1. Remove the portion of the pass that contains the tapered end before placing fresh mix.
- G. Use a motor grader, spreader box, or other City Engineer accepted spreading method for projects under 180 yd<sup>2</sup>, irregular areas, or for miscellaneous construction such as detours, sidewalks, and leveling courses.
- H. Use a minimum compacted lift equal to 3 times the nominal maximum aggregate size.
- I. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

- J. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

### **3.6 CONTRACTOR INITIATED CHANGES IN MIX DESIGN**

- A. Changes in job mix gradation:
  - 1. Submit a written request for a change in a job-mix gradation at least 48 hours prior changing. Include basis for requesting change. Submittal must meet requirements of Article 2.02 C.
  - 2. Do not change until permission from City or its representative is received.

### **3.7 PROTECTION**

- A. Immediately after placement, protect pavement from injury or damage until surface temperature is less than 120 degrees F.
- B. Allow pavement to cool on its own without the use of any other method.

**END OF SECTION**

## **SECTION 02651**

### **BITUMINOUS TYPE II SLURRY SEAL COAT**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Bituminous Type II Slurry Seal coat for overlay.

##### **1.2 RELATED SECTIONS**

- A. Section 1300 – Administrative Requirements
- B. Section 1400 – Quality Requirements

##### **1.3 REFERENCES**

- A. AI MS-19 - A Basic Asphalt Emulsion Manual; The Asphalt Institute – Latest Edition
- B. APWA Standards and Specifications Section – 2012 Edition
- C. ASTM C 29 - Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
- D. ASTM C 88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- E. ASTM C 117- Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing
- F. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- G. ASTM C 136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- H. ASTM D 242 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures
- I. ASTM D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
- J. ASTM D 3319 - Standard Practice for Accelerated Polishing of Aggregates Using the British Wheel
- K. ASTM D 3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal
- L. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- M. ASTM D 5821 - Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
- N. ISSA A105 Guidelines
- O. UDOT 2012 Standard Specifications

## **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures
- B. Mix Design as per Article 2.01 D.
- C. Laboratory Accreditation as per Article 2.01 B.
- D. Field Quality Control data as per Article 3.6

## **1.5 FIELD QUALITY CONTROL**

- A. Perform Field Quality Control Sampling and Testing. Any repeatable sampling and testing approach is acceptable. Identify and correct any material not meeting the following Field Tolerances:
  - 1. Residual Asphalt Content:  $\pm 1\%$  by dry weight of aggregate
  - 2. Slurry consistency (ISSA TB #106):  $\pm 0.2"$  from mix design
  - 3. Application Rate:  $\pm 2$  lb/yd<sup>2</sup> (when surface texture does not vary significantly)
- B. ASTM C 136: If sieve analysis shows stockpile aggregate gradation non-compliance, either remove the material or blend in other aggregates to bring it into compliance. This may require a new mix design. Screening may be required at the stockpile to remove any defective material.
- C. Submit daily summary to the City within 24 hours of completion of each day's placement.

## **1.6 QUALITY ASSURANCE**

- A. Use a paving crew foreman that has completed at least three (3) projects of similar size and nature.
- B. Use a laboratory that follows and complies with ASTM D 3740 and APWA Section 01 45 00 requirements.
- C. Do not change accepted aggregate or emulsified asphalt source until City Engineer accepts new source and new mix design.
- D. Remove any product found defective after installation and install accepted product at no additional cost to OWNER.

## **1.7 REGULATORY REQUIREMENTS**

- A. Conform to applicable City requirements for paving work on City streets, Section 1300 – Administrative Requirements.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Emulsified Asphalt Cement: Use quickset emulsified asphalt, CQS-1H, with minimum 2% SBR polymer solid based on mass of residual asphalt.
- B. Aggregate: Use aggregate conforming to the following:

1. Material: Stone, slag, or other high quality particle or combination meeting Table 1.

<b>Table 1 – Physical Properties</b>			
Criterion	ASTM	Minimum	Maximum
Angularity (fractured faces), percent	D 5821	80	--
Wear (hardness or toughness), percent	C 131	--	35
Soundness (weight loss in 5 cycles), percent	C 88	--	10
Clay Content (sand equivalent) percent SS-II	D 2419	55	--
Polishing, BPN	D 3319	28	--
Water absorption, percent	--	--	1.25

**NOTES**

- a. Angularity of aggregate retained on No. 4 sieve with at least one (1) mechanically fractured face or clean angular face. Provide 100 percent (maximum) for all non- local roadways.
- b. Wear of aggregate retained on No. 12 sieve after 500 revolutions.
- c. Soundness for combined coarse and fine aggregate measured using five (5) cycles Na<sub>2</sub>SO<sub>4</sub>.
- d. Clay content before additives.

2. Gradation: Meet requirements of Table 2, ASTM C 136 on a dry weight and percent passing basis:

<b>Table 2 – Master Grading Band Limits</b>	
Sieve	Percent Passing
3/8 in.	100
No. 4	90 – 100
No. 8	65 – 90
No. 16	45 – 70
No. 30	30 – 50
No. 50	18 – 30
No. 100	10 – 21
No. 200	6 – 15

**NOTES**

Portion retained on the No. 4 sieve clean and free of clay coatings.  
Portion passing No. 200 sieve includes mineral fill, ASTM C 117.

**C. Additives:**

1. Mineral Filler: ASTM D 242
2. Portland cement, hydrated lime, limestone dust, fly ash, or aluminum sulfate to regulate setting time and improve workability.
3. Limestone dust, fly ash, or rock dust to alter aggregate gradation.

**D. Mix Design:**

1. Use an AMRL accredited laboratory.
2. Perform mix design in accordance with Table 3.

<b>Tables 3: TESTS</b>		
ISSA TEST NO. (ISSA A105 Guidelines)	DESCRIPTION	SPECIFICATION
ISSA TB-106	Slurry Seal Consistency	2cm Minimum 3cm Maximum
ISSA TB-139 For quick-traffic systems	Wet Cohesion 30 Minutes Minimum (Set) Wet Cohesion 60 Minutes Minimum (Traffic)	12 kg-cm Minimum  20 kg-cm Minimum
ISSA TB-109 For heavy-traffic areas only	Excess Asphalt by LWT Sand Abrasion	50 g/ft <sup>2</sup> Maximum (538 g/m <sup>2</sup> Maximum)
ISSA TB-114	Wet Stripping	Pass (90% Minimum)
ISSA TB-100	Wet-Track Abrasion Loss, One- hour soak	75 g/ft <sup>2</sup> (807 g/m <sup>2</sup> )
ISSA TB-113	Mix Time**	Controllable to 180 Seconds Minimum

\*\* Perform the mixing test and set-time test at the highest temperatures expected during construction.

- E. Submit proposed mix design for review at least 10 working days prior to beginning of work. Include the following:
1. Date of mix design
  2. Emulsion source and grade
  3. Total emulsion target percentages.
  4. Bulking effect of moisture content on unit weight – ASTM C 29
  5. Stripping test results
  6. Target Grading Curve for aggregate, including all sieves listed in Table 3.
  7. Aggregate source and physical properties as identified in Table 2. Test results shall not be older than 455 days from the date of submission.
  8. Aggregate bulk and apparent specific gravities, percent absorption and blend percentage.
- F. Temporary Raised Pavement Markers:
1. Use Temporary Raised Pavement Markers as manufactured by Davidson Plastics Company.
  2. Markers shall have polyurethane plastic bodies with reflective tape, clear flexible polyvinyl-chloride protective covers, and solid butyl rubber adhesive on bottom surface.
  3. Markers shall be 2-inches high and 4-inches wide; and of the color selected by the City Engineer.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. General
1. Fat or bleeding pavements may require scratch course application.
  2. Cracked or porous pavements may require thin SSI slurry surface treatment.
  3. Asphalt concrete inlay may be required in rut deformations.

- B. Surface Repair: Patch holes, raveled areas, and low areas with asphalt concrete.
- C. Repair all cracks greater than 1/8" in width.
  - 1. Remove plant material from cracks, edges and joints.
  - 2. Blow cracks clean.
  - 3. Seal cracks with crack sealant as per Article 2.3, UDOT Standard Specification 02745 – Asphalt Material. Use squeegee or other device to remove excess asphalt and provide flat surface.
  - 4. Allow crack seal to cure a minimum of 24 hours before applying slurry seal.
- D. Traffic Control:
  - 1. Implement the notification and traffic control plan requirements. Do not proceed without certified flaggers.
  - 2. Grind off existing pavement markings and lane striping. Use reflective tabs to mark striping location before applying slurry seal.
- E. Cleaning:
  - 1. Clean existing paved surfaces of all dirt, sand, dust and other objectionable material with use of power broom, prior to placing seal coat. Power broom shall be inspected and accepted by the City Engineer or City Inspector prior to use.
  - 2. Remove loose material that may cause drag marks.
  - 3. Do not flush water over cracked pavement or apply pressurized water to cracked Pavement.
- F. Tack Coat:
  - 1. Apply tack coat to high-absorbent, polished, oxidized, or raveled asphalt surfaces or to concrete or brick surfaces.
  - 2. Apply tack coat and pave over concrete Cover Collars.
  - 3. Use the same asphalt emulsion as used in slurry seal application.

### **3.2 PROTECTION**

- A. Protect trees, plants and other ground cover from damage.
- B. Prune trees to allow equipment passage underneath, APWA Section 32 01 93. Repair tree damage at no additional cost to OWNER.
- C. Install Invert Covers, APWA Section 01 71 13.
- D. Mask Street Fixtures.
- E. Protect curb, gutter, sidewalk and other structures from spatter, mar, or overcoat.
- F. Protect slurry seal from traffic until seal has cured. Cure time depends on type of asphalt, mixture characteristics and weather.



### **3.3 PLACING TEMPORARY ROAD MARKERS**

- A. Prior to placing seal coat, install raised markers to mark striping location.
- B. Install raised markers in accordance with the manufacturer's written instructions and recommendations.
- C. Remove covers immediately after rolling is complete.

### **3.4 CONSTRUCTION EQUIPMENT**

- A. Paver: Use a continuous-flow mixing unit meeting the following:
  - 1. Capable of applying at least 15,000 square yards of material per day.
  - 2. Capable of accurately delivering a predetermined portion of aggregate, water, and asphalt emulsion to the mixing chamber.
  - 3. Prevent loss of slurry from the distributor by using a mechanical type squeegee distributor equipped with flexible material in contact with the pavement surface.
  - 4. Has a lateral control device and a flexible strike-off capable of being adjusted to lay the slurry at the mix design application rate.
- B. Meter Calibration: On a test strip at least 500 feet long, determine the correct meter settings on the mixing equipment. The settings are to produce a product that complies with the following:
  - 1. Thirty (30) minutes maximum initial set time. Initial set occurs when blotting of the slurry seal surface yields only water (no emulsion).
  - 2. No distress when exposed to traffic two (2) hours after placement.

### **3.5 PLACING SEAL COAT MATERIAL**

- A. Place seal coat in accordance with the following:
  - 1. Use an application rate of 15 to 18 pounds per square yard.
  - 2. Machine meter settings must match mix design.
  - 3. Pre-wet existing pavement
  - 4. Wait at least two (2) hours if an adjacent pass has broken and started to cure.
  - 5. Apply slurry seal material such that, when cured, it presents a uniform, skid-resistant appearance with all cracks filled.
  - 6. Do not apply lane marking tape or paint for traffic control until layout and placement has been verified with the City Engineer.
- B. During application, water and additives may be adjusted (per mix design) for better consistency or set time. All other changes require a new mix design.
- C. Operate equipment to meet the following conditions in the spreader box:
  - 1. Do not exceed four (4) minutes total mixing time.
  - 2. Do not add additional water.
  - 3. No lumping, balling or unmixed aggregate.

4. No segregation of the emulsion and aggregate fines from the coarse aggregate.
  5. No breaking of emulsion.
  6. Carry a sufficient amount of slurry in all parts of the spreader at all times so that full width and complete coverage is obtained with no streaks or narrow spots. Avoid overloading the spreader.
- D. Apply seal coat in accordance with the following:
1. Dampen surface immediately before application of slurry seal. All surfaces are to be uniformly damp with no free water standing on the surface or in cracks when seal coat is applied.
  2. If coarse aggregate settles to bottom of mix, remove slurry from pavement.
  3. In areas where spreader box cannot be used, apply slurry by hand.
- E. Install joints in accordance with the following:
1. Make transverse joints straight-cut butt type, not over-lap type.
  2. Place longitudinal joints on lane lines. Limit overlap to three (3) inches maximum.
  3. Tolerance for joint match is 1/4 inch difference in elevation when measured with a 10 feet long straight edge over the joint.
  4. Use construction paper or comparable products so all beginning and ending joint lines from each construction pass are straight.
  5. Stop and correct paving operation if longitudinal or transverse joints have uncovered areas or unsightly appearance.
- F. Install seal with edge and end lines meeting the following:
1. Mask off end of streets and intersections to provide straight lines.
  2. Make straight lines along lip of gutter and shoulders. No runoff on these areas permitted.
  3. Vary edge lines no more than two (2) inches per 100 feet.

### **3.6 FINISHING DETAILS**

- A. Do not create build-up when constructing longitudinal and transverse joints.
- B. Place slurry seal adjacent to concrete pavements or concrete curb and gutter with a straight longitudinal edge. Do not allow over-lap on these areas. Remove slurry seal placed on concrete at no cost to the City.
- C. Maintain straight lines at all locations.
- D. Place slurry seal at side streets and intersections out to right-of-way line.
- E. Use hand squeegees to spread slurry in areas that cannot be reached with slurry seal machine.
1. Lightly dampen areas before mix placement.
  2. Provide complete and uniform coverage.

3. Avoid unsightly appearance by maintaining smooth surfaces and transitions during hand work.
4. Use the same type of finish in hand worked areas as applied by the spreader box.

### **3.7 REPAIR**

- A. Remove spatter or mar from curb and gutter, sidewalk, guard rails and guide posts at no additional cost to OWNER.
- B. Remove slurry seal from Street Fixtures.
- C. Make correction lines straight. Provide good appearance.
- D. Fill any joints or cracks that are not covered by slurry seal. Leave no streaks, holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying pavement.
- E. Repair collateral damage caused by construction.

### **3.8 LIMITATIONS**

- A. Do not apply slurry seal during rain, when standing or flowing road surface moisture is present, or during other adverse weather conditions.
- B. Do not apply slurry seal if either the pavement or air temperature is below 50 degrees F and falling. Slurry seal may be applied when both the pavement and air temperatures are above 45 degrees F and rising.
- C. Do not apply slurry seal when the temperature is projected below 35 degrees F within 24 hours of placing slurry seal.
- D. Cease slurry seal operations when weather or other conditions prolong opening road surface to traffic beyond two hours.
- E. Keep traffic off roadway surface until the slurry seal has cured.

**END OF SECTION**

## **SECTION 02652**

### **CONCRETE STREET IMPROVEMENTS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Cast-in-place concrete curb and gutter and appurtenant items.
- B. Cast-in-place concrete waterways and appurtenant items.
- C. Cast-in-place concrete sidewalks and appurtenant items.
- D. Cast-in-place concrete driveway pavement and appurtenant items.
- E. ADA ramps and appurtenant items.
- F. Curb-cut type driveway entrances and appurtenant items.
- G. Cast-in-place concrete speed tables.

##### **1.2 RELATED SECTIONS**

- A. Section 02100 - Roadway and General Excavation.
- B. Section 02115 - Structural Excavation.
- C. Section 02116 - Fill and Backfill.
- D. Section 02621 - Gravel Road Base.
- E. Section 03300 - Cast-In-Place Concrete.

##### **1.3 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.

#### **PART 2 PRODUCTS**

##### **2.1 MATERIALS**

- A. Concrete: As specified in Section 03300 - Cast-in-Place Concrete; using 3/4 inch maximum aggregate.
- B. Concrete Reinforcement: As specified in Section 03300.
- C. Gravel Base: As specified in Section 02621 - Gravel Road Base.
- D. Expansion Joint Filler: Shall be 1/2-inch thick; conforming to ASTM D 1751 or AASHTO M 213. Joint filler shall be one-piece; and shall extend full width and depth of concrete section; 1/4-inch below and conforming to finished top surfaces of concrete items.
- E. ADA Ramp Warning Panels.

1. Panels shall be detectable warning systems conforming to ADA, FHWA and all other applicable appurtenant regulations; designed for exterior use and surface application.
2. Panels shall be durable panels molded from polyurethane, with truncated domes, meeting both state and federal ADA guidelines. .
3. Panels shall be molded from high strength polyurethane.
  - a. Submit manufacturer's literature describing products, installation procedures and routine maintenance; and three samples of surface applied mat to be supplied.
  - b. Panels shall have slip resistance in wet and dry environments.
  - c. Panel color shall be yellow; conforming to Federal Color # 33538. Color shall be homogenous throughout the mat.
4. Panels shall comply with Americans with Disabilities Act, Title 49, Section 4.29 2.
5. Mats shall be installed according to manufacturer's written instructions and recommendations.
  - a. Mats shall be applied to concrete surfaces with heavy-duty elastomeric two-part polyurethane ground adhesive, as recommended by the manufacturer.
  - b. Edges and seams shall be sealed with cyanoacrylate sealer, as recommended by the manufacturer.
  - c. Low profile nylon expansion anchors shall be installed after mats are installed, according to the manufacturer's instructions and recommendations.
6. After mats have been installed, the mats shall be protected from damage as recommended by the manufacturer.
7. Mats shall be cleaned by method specified by manufacturer.
8. Panels shall be Detectable Warning Mats as manufactured by Detectable Warning Systems, Inc.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify excavation for concrete items is correct.
- B. Verify that sub-base has been compacted and accepted by the City Engineer or City Inspector, and that gradients and elevations are correct.
- C. Verify that all areas of collapsible soil have been identified and properly prepared for sub-base.

#### **3.2 EARTHWORK**

- A. See Section 02100 - General Excavation and Section 02115 - Structural Excavation for requirements for excavating, backfilling and compacting; See Section 02116 - Fill and Backfill for requirements for filling and backfilling; and see Section 02621 - Gravel Road Base for requirements for gravel base.
- B. Hand trim excavations for accurate placement of gravel base for concrete items.
- C. Furnish, place, grade and compact untreated base course for concrete work, as indicated on the drawings.
  1. Curb and Gutter: compacted thickness shall be 6 inches.

2. Waterways: compacted thickness shall be 6 inches.
  3. Sidewalks: compacted thickness shall be 6 inches.
  4. Driveway Pavement: compacted thickness shall be 6 inches.
- D. Backfill around completed concrete items to required elevations, tamp in place and compact as required.

### **3.3 CONSTRUCTION**

- A. Form Work.
1. Forms shall be set to the required grade and lines, as indicated on the drawing; rigidly braced and secured.
  2. Install sufficient quantity of forms to allow continuous progress of work; and so that forms can remain in place for at least 24 hours after placement of concrete.
  3. Check completed form work for grade and alignment, before placing any concrete. Tolerances for form work shall not exceed 1/8-inch in 10 feet for the top of forms; and 1/4-inch in 10 feet for the vertical face.
  4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.
- B. Concrete Placement.
1. Comply with applicable requirements of Section 03300 - Concrete for design, mixing and placement of concrete; and with the requirements herein.
  2. Do not place concrete until subgrade and forms have been inspected and accepted for line and grade.
  3. Moisten subgrade as required to provide a uniform dampened condition at time concrete is placed.
  4. Place concrete using methods which will prevent segregation of concrete mix, and with as little re- handling as possible.
  5. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.
  6. Consolidate concrete along the face of forms with an internal vibrator. Keep vibrator away from joint assemblies or side frames. Consolidate with care to prevent dislocation of reinforcement and joint materials.
  7. Use only square-faced shovels for hand spreading and consolidation.
  8. Where ADA ramps and curb-cut type driveway entrances are to be constructed, the curb of new curb and gutter shall be eliminated down to the limits and for the width indicated on the drawings; and the curb shall be sloped on each side of the ramp and driveway entrance.
- C. Expansion/Construction Joints. Construct joints true-to-line, with face perpendicular to the surface of the concrete item and at right angle to centerline of the concrete item, unless shown otherwise. Joints shall be filled with joint filler material. The contractor must follow all included guidelines unless indicated otherwise on the drawings.

1. Curb and Gutter. Provide joints at a spacing not to exceed 100 feet, on center; unless indicated otherwise on the drawings. Construct joints by inserting a 1/8-inch thick steel division plate, matching cross-section of curb and gutter, into concrete; plate shall not extend into bottom 4-1/2 inches of the curb and gutter. Set division plate into plastic concrete and carefully remove after concrete has hardened.
  2. Sidewalks. Provide joints at a spacing not to exceed 40 feet, on center; unless indicated otherwise on the drawings. Construct joints by inserting a 1/8-inch thick steel division plate into concrete; plate shall be embedded 1/4 of sidewalk thickness, measured from the top of sidewalk. Set division plate into plastic concrete and carefully remove after concrete has hardened.
  3. Driveway Pavement. Provide joints as indicated on the drawings; and where pavement abuts other concrete construction.
  4. Speed Tables. Provide joints as indicated on the drawings; and where speed tables abut other concrete construction.
  5. Cold Joint. Provide expansion joints at all start/stop locations.
- D. Construction Joints. Construct construction joints true-to-line, with face perpendicular to the surface of the concrete item and at right angle to centerline of the concrete item, unless shown otherwise. The contractor must follow all included guidelines unless indicated otherwise on the drawings and as directed by the City Engineer.
1. Provide construction joints where required.
  2. Curb and Gutter. Provide construction joints at a spacing not to exceed 10 feet, on center; unless indicated otherwise on the drawings.
  3. Waterways. Provide construction joints to match the width of the sidewalk, on center; unless indicated otherwise on the drawings.
  4. Sidewalks. Provide construction joints at a spacing not to exceed 5 feet, on center; unless indicated otherwise on the drawings.
  5. Driveway Pavement. Provide construction joints at a spacing not to exceed 6 feet, on center; unless indicated otherwise on the drawings.
  6. Speed Tables. Provide construction joints at a spacing not to exceed 10 feet, on center; unless indicated otherwise on the drawings.
- E. Finishing and Ruling.
1. After striking off and consolidating concrete, smooth exposed surfaces by screeding and floating; adjust floating to compact surfaces and produce uniform texture.
  2. After floating, check surfaces for trueness with a 10-foot long straightedge. Distribute concrete as required to remove surface irregularities; and refloat repaired surfaces to provide smooth, continuous surfaces with a tolerance of 1/4-inch when measured by the 10-foot long straightedge.
  3. Work edges of gutters, waterways, sidewalks and driveway pavement, transverse joints, and contraction joints with an edging tool; and round to 1/4-inch radius, unless indicated otherwise.
  4. Work edges of top back of curbs with an edging tool; and round to 1/2-inch radius, unless indicated otherwise.
  5. Finishing:
    - a. Curb and Gutter. After completion of floating and when excess moisture and

surface sheen has disappeared, trowel finish exposed surfaces smooth, free of trowel marks, and uniform in texture and appearance.

- b. Waterways. After completion of floating and when excess moisture and surface sheen has disappeared, trowel finish exposed surfaces smooth, free of trowel marks, and uniform in texture and appearance. Surfaces shall be warped to match flow lines of gutters at each end of waterway, as indicated on the drawings.
- c. Sidewalks. After completion of floating and when excess moisture and surface sheen has disappeared, broom finish exposed surfaces by pulling a fine-hair broom across concrete surfaces, perpendicular to line of traffic, until uniform in texture and appearance.
- d. Driveway Pavement. Pavement shall be finished as specified for sidewalks; with rough flat finish.
- e. Speed Tables. After completion of floating and when excess moisture and surface sheen has disappeared, trowel finish exposed surfaces smooth, free of trowel marks, and uniform in texture and appearance.

F. Form Removal and Repair Work.

- 1. Forms shall not be removed for at least 24 hours after concrete has been placed.
- 2. After form removal, clean ends of joints and point-up minor honeycombed areas.
- 3. Remove and replace areas or sections of concrete with major honeycomb areas.

G. Curing Concrete.

- 1. Protect and cure finished concrete, complying with applicable requirements of Section 03300 - Concrete.
  - a. Use white colored cure.
- 2. Use moist-curing methods for initial curing, whenever possible.
- 3. A membrane-forming curing compound shall be used when required by the City Inspector; applied in accordance with the manufacturer's written instructions.

### 3.4 SPECIAL CONSTRUCTION

- A. Curb-Cut Type Driveway Entrances. Driveway entrances shall consist of modifying the curb of 30 inch curb and gutter and warping surfaces of 6-inch thick concrete driveway pavement or concrete sidewalk for the width and to the configuration indicated on the drawings, as described herein. Contractor must follow all included guidelines unless indicated otherwise on the drawings and as directed by the City Engineer.
  - 1. Curb of curb and gutter shall be eliminated down to the limits indicated on the drawings, and to the width of the existing driveway; and the curb shall be sloped on each side of the driveway as indicated.
  - 2. Where there is a park strip between the sidewalk and back of curb and gutter, driveway pavement, 6-inches thick, shall be constructed between the sidewalk and the back of curb. The surfaces of the driveway pavement shall be shaped to form a smooth entrance from the curb-cut at the curb and gutter to the edges of the sidewalk, as indicated.
  - 3. Where the sidewalk is adjacent to the back of curb and gutter, 6-inches thick sidewalk shall be constructed at the driveway entrance, as indicated. The surfaces of the sidewalk shall be shaped to form a smooth entrance from the curb-cut at the curb and gutter to the edge of the sidewalk adjacent to the property line, as indicated.



- B. ADA Ramps. ADA ramps shall be constructed at curb and gutter radius sections at street intersections, as indicated on the drawings. Work shall consist of modifying the curb of 30 inch curb and gutter and warping surfaces of concrete sidewalk for the width and to the configuration indicated on the drawings. Contractor must follow all included guidelines unless indicated otherwise on the drawings.
1. Excavate as required to establish the proper sub-base for the gravel base for the ramp.
  2. Furnish, place, grade and compact gravel base, 6-inches thick. Follow all current ADA requirements.
  3. Curb of curb and gutter shall be eliminated down to the limits and to the width indicated on the drawings; and the curb shall be sloped on each side of the ADA ramp as indicated.
  4. Where there is a park strip between the sidewalk and back of curb and gutter, concrete pavement, 5-inches thick, shall be constructed to match back of curb and gutter radius section and the ends of the sidewalk on each side of the ramp. The surfaces of the concrete pavement shall be shaped to form a smooth ramp from the curb-cut at the curb and gutter to the ends of the sidewalk, as indicated.
  5. Where the sidewalk is adjacent to the back of curb and gutter, concrete pavement, 5-inches thick shall be constructed to match back of curb and gutter radius section and the ends of the sidewalk on each side of the ramp, as indicated. The surfaces of the concrete pavement shall be shaped to form the ADA ramp from the curb-cut at the curb and gutter to the ends of the sidewalk, as indicated.
  6. Warning panels shall be installed as indicated on the standard drawings; according to the manufacturer's drawings, written instructions and recommendations.
- C. Speed Tables. Speed tables shall be constructed as indicated on the drawings.

### **3.5 REPAIR AND MAINTENANCE**

- A. Contractor shall repair and maintain project curb and gutter, waterways, sidewalks, driveway pavement, driveway entrances, ADA ramps, and other concrete structures as required, during the guarantee period.
1. All repairs shall be made with materials similar and equal to those described in these specifications.
  2. All construction shall be done as described in these specifications.
- B. Contractor shall, at least one month before expiration of the guarantee period, make all such repairs as may be necessary to produce concrete items which will:
1. Conform substantially in contour to the concrete item as first constructed.
  2. Be free from cracks or depressions showing disintegration of the concrete mixture of the concrete item.
  3. Be free from all settlement of the surface of the concrete pavement holding water, or other settlements showing variation of 3/8-inch or more from the edge of a four-foot long straightedge.
  4. Not have settled because of incomplete compaction of the subgrade.
- C. When repairs, that are necessary to be made during the guarantee period, amount to more than fifty percent of a section between two expansion joints, the entire section shall be removed and disposed of; and that section shall be reconstructed in accordance with these

specifications.

### **3.6 PROTECTION OF CONSTRUCTED CONCRETE ITEMS**

- A. Protect concrete items of this section from damage by subsequent construction activities.
- B. Replace damaged concrete items which cannot be repaired to a level accepted by the City Inspector.

### **3.7 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01400.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design to engineer and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- E. Compressive Strength Tests: ASTM C 39. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cu yd or less of concrete placed.
- F. Take two additional test cylinders during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each load at point of discharge; and perform slump test with each set of test cylinders taken.
  - 1. If maximum slump for the application is exceeded, it will be assumed that the water content is excessive and the load shall be rejected.
  - 2. If slump is less than the minimum for the application, a measured quantity of water may be added to the mix; quantity shall not exceed 1/6 gallon of water per bag of cement.
  - 3. Water shall be added only in the presence of a City inspector and after a slump test has been made.
  - 4. If concrete has been mixed for more than one hour, the loss of slump shall be considered as being caused by setting of concrete; water shall not be added, and the load shall be rejected.
- H. Perform test to determine air content in accordance with ASTM C 231; a minimum of one test shall be done each time a slump test is made. Air content shall be within specified limits.

**END OF SECTION**

## **SECTION 02724**

### **AUTOMATIC SPRINKLING SYSTEM**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Complete automatic sprinkling system, including:
  - 1. Pipe and fittings.
  - 2. Valves, valve boxes, and appurtenant items.
  - 3. Automatic controller, control valves, valve boxes, wires and appurtenant items.
  - 4. Sprinkler heads and appurtenant items.
  - 5. Connections to water main lines.
- B. System design and testing.

##### **1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching for Pipe Work: Excavating, pipe bedding, backfilling and compacting.
- B. Section 02115 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02116 - Fill and Backfill: Pipe bedding and excavation backfilling.
- D. Section 02586 - Backflow Preventer Station.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for structures and thrust blocks.

##### **1.3 REFERENCES**

- A. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM A 234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- C. ASTM D 1785 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- D. ASTM D 2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
- E. ASTM D 2241 - Standard Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
- F. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
- G. ASTM D 2466 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedules 40.

- H. ASTM D 2564 - Standard Specification for Solvent Cement for Poly Vinyl Chloride (PVC) Plastic Piping Systems.
- I. ASTM D 2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
- J. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- K. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
- L. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; (ANSI/AWWA C104/A21.4).
- M. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; (ANSI/AWWA C105/A21.5).
- N. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; (ANSI/AWWA C111/A21.11).
- O. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).
- P. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association.
- Q. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- R. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; (ANSI/AWWA C508/C508a).
- S. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- T. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Associations: (ANSI/AWWA C515).
- U. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; (ANSI/AWWA C600).
- V. STM D2774 - Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
- W. W AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution; American Water Works Association; (ANSI/AWWA C900/C900a).
- X. X AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 4 inch through 63 inch, for Water Distribution;
- Y. American Water Works Association.
- Z. Y Use the latest issue of the above reference standards as of the date of the Project.

#### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, controllers, sprinkler heads, and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, controllers, sprinkler heads, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### **1.5 SYSTEM DESIGN**

- A. The sprinkling system shall be designed to provide adequate coverage to all areas to be watered.
- B. Project drawings of the system shall be submitted to the City Engineer, showing design and general layout of pipe distribution system and sprinkler heads required to provide complete coverage and uniform distribution.
  - 1. Drawings shall indicate pipe sizes, control valves, quick-coupling valves, automatic controller, control wiring, electrical service line, connections to water mains, backflow preventers, filters, and all appurtenant items.
  - 2. Pipe system for spray heads shall have minimum pipe size of 3/4-inch; rotor pop-up sprinklers shall have minimum pipe size of 3/4-inch; and impact rotor pop-up or rotors above I-40 shall have minimum pipe size of 1-inch.
  - 3. Quick-coupling valves shall be placed in the system where indicated on the drawings.
  - 4. Drawings shall show system design pressures and PVC pipe classifications (either Schedule 40 or Schedule 80). A pipe size over 4" shall utilize gasketed joints.
- C. Design a pipe distribution system to provide sufficient water to each of the heads. Spray Heads and Rotator Heads shall be on separate zones.
- D. The Contractor may modify the layout of heads to better fit project conditions with notification and City approval; providing that complete coverage and uniform distribution is maintained.

#### **1.6 QUALITY ASSURANCE**

- A. Perform Work in accordance with City's requirements as described herein.
- B. A third party audit by a certified irrigation auditor verifying the distribution uniformity (DU) of the system is 70% for the rotors and 50% for spray heads. Testing results to be submitted prior to start of warranty period for new development in accordance with the City's land development code.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store valves, controllers, heads, and appurtenant items in shipping containers with labeling in place.

## **1.8 OPERATING AND MAINTENANCE DATA**

- A. Provide complete As-Builts for entire system. Also Provide an 8 ½"x 11" laminated zone map illustrating each zone by color and zone number.
- B. Provide instructions covering full operation, care and maintenance of system and controls; and manufacturer's parts catalog.
- C. Instruct City's designated maintenance personnel in the proper operation of the system, including adjustment of sprinkler heads.
- D. Submit 3 copies of written instructions recommending procedures to be established by the City Engineer for the maintenance of the system from year to year.
  - 1. Submit at least 30 days before the expiration of required one year guarantee period.
  - 2. Provide information in the manuals that include the following:
    - a. Written index near front of Manual listing location in the Manual of all emergency data regarding the installation;
    - b. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name and address of the nearest vendor of replacement parts; and
    - c. Copy of all guarantees and warranties issued on the installation showing all dates of expiration.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. All sprinkler heads, control valves, quick-coupling valves, automatic controllers and appurtenant items for the sprinkling system shall be supplied by the same supplier.

### **2.2 WATER SUPPLY AND DISTRIBUTION PIPE**

- A. PVC Pipe: AWWA C900 DR 18.
  - 1. Fittings: AWWA C111, cast iron.
  - 2. Joints: ASTM D 3139 compression gasket ring.
- B. Polyethylene Pipe: ASTM D 3035, for 160 psig pressure rating:
  - 1. Fittings: AWWA C901, molded or fabricated.
  - 2. Joints: Compression.
- C. High Density Polyethylene Pipe: AWWA C906:
  - 1. Material: PE 4710 High Density Polyethylene (HDPE) meeting ASTM D3350 cell classification of 345434C.
  - 2. Fittings: AWWA C906, molded or fabricated; or mechanical joint ductile iron fittings.
  - 3. Joints: Butt fusion.
- D. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters for all plastic pipe.

## **2.3 SPRINKLING SYSTEM DISTRIBUTION AND LATERAL PIPE**

- A. PVC Pipe: ASTM D 1785, Schedule 40 or 80, as required.
  - 1. Fittings: ASTM D 2466, Schedule 40 or 80, as required.
  - 2. Joints: Cemented with Primer and solvent weld, using I.P.S. Brand, purple primer and grey solvent weld or approved equal. Red Hot Blue not permitted.
  - 3. Schedule 80 pipe shall be used between stop & waste valves and master valves; and Schedule 40 pipe shall be used downstream from master valves.
- B. Polyethylene Pipe: ASTM D 3035, for 160 psi pressure rating:
  - 1. Fittings: AWWA C901, molded or fabricated.
  - 2. Joints: Compression.
- C. The minimum pipe size for distribution and lateral pipes to be 3/4-inch.

## **2.4 VALVES**

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Gate Valves Up To 3 Inches:
  - 1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel.
  - 2. Product: Powell U.S. Bronze Gate Valves.
  - 3. Substitutions: See Section 01600 - Product Requirements.
- C. Gate Valves 3 Inches and Over:
  - 1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
  - 2. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint or flanged ends as indicated, and cast iron valve box.
  - 3. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
  - 4. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box.
- D. Ball Valves Up To 2 Inches:
  - 1. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, compression inlet end, compression outlet, with control rod, valve key, and extension box.
  - 2. Treat the Ball Valve and Handle to prevent moisture from metal causing corrosion.
- E. Swing Check Valves from 2 Inches to 24 Inches:

1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
  2. Product: Mueller Swing-Type Check Valve.
- F. Corporation Stops: shall be type for connecting to copper or polyethylene pipe; Mueller No. H- 15000 for up to 2-inch service line.
- G. Air Release Valves: shall be combination air release valves; APCO Combination Air Release Valves, or of size indicated on the drawings.

## **2.5 SPRINKLER HEADS**

### **A. Part Circle Rotor Pop-Up Sprinklers.**

1. Part circle rotor pop-up sprinklers shall be a single nozzle gear drive type, capable of covering the design radius at the site pressure with a discharge rate as recommended by the manufacturer; and shall have an infinitely adjustable arc of coverage from 40° to 360°. Spacing design shall be based on a 10-20% reduction of manufacturer recommendation.
2. Sprinkler case shall be constructed of rugged ABS plastic. The internal assembly shall include water-lubricated gear drive, pressure-activated wiper seal, SAM check device and heavy duty screen. The rotation of the sprinkler shall be accomplished by a gear drive.
3. The sprinkler nozzle shall have an outlet trajectory of 25° from the horizontal, with adjustment screw.
4. The sprinkler shall have a heavy-duty stainless steel retract spring to ensure positive pop-down. Pop-up height shall be not less than 6 inches; and the inlet shall be one-inch (FNPT).
5. The sprinkler shall be constructed so that all internal parts, including inlet screen, are accessible through the top of the sprinkler case without disturbing the soil around the case. The sprinkler shall have a rubber cover and vandal resistant cover screws.
6. Sprinklers shall be Part Circle Rotor Pop-up Sprinklers, of the appropriate size and type, as manufactured by Rain Bird Sprinkling Mfg. Corporation, Hunter Industries.

### **B. Full Circle Rotor Pop-Up Sprinklers.**

1. Full circle rotor pop-up sprinklers shall be a single nozzle gear drive type, except for Hunter I-40 Opposing Nozzles, capable of covering the design radius at the site pressure with a discharge rate as recommended by the manufacturer.
2. Full circle sprinklers shall have the same construction as the part circle sprinklers described above.
3. Sprinklers shall be Full Circle Rotor Pop-up Sprinklers, of the appropriate size and type, as manufactured by Rain Bird Sprinkling Mfg. Corporation or Hunter Industries.

### **C. Full/Part Circle Rotor Pop-Up Sprinklers.**

1. Rotor pop-up sprinklers shall have full or part circle capabilities in one unit; and shall be a single nozzle, water lubricated, turbine drive type with internal impact speed reduction, capable of covering the design radius at the site pressure with a discharge rate as recommended by the manufacturer.
2. Part circle sprinkler shall have an infinitely adjustable arc of coverage from 25° to 350°. The sprinkler shall not reverse direction during continuous operation in the full circle mode. Arc adjustment shall not require any tools.



3. The sprinkler case shall be constructed of rugged ABS plastic. The sprinkler shall include a stainless steel locking set-screw at cap threads to provide vandal resistance and a "Seal-A-Matic" (SAM) device built onto the inlet screen shall hold back 8 feet of elevation change to prevent puddling. The sprinkler shall have a non-strippable drive mechanism and shall permit manual rotation of the pop-up stem; and shall have a pressure-activated, multi-function, soft elastomer wiper seal that positively seals against the nozzle flange to keep debris out of the rotor and to clean debris from the pop-up stem as it retracts. The sprinkler range nozzle shall have an outlet trajectory of 23° from the horizontal. The sprinkler shall have a screen attached to the drive housing to filter inlet water and prevent the nozzle from clogging.
4. Sprinklers shall have a heavy-duty stainless steel retract spring to ensure positive pop-down. Pop-up height shall be not less than 5 5/8-inch; and the bottom inlet shall be 3/4-inch (FNPT).
5. Sprinklers shall be constructed so that all internal parts, including inlet screen, are accessible through the top of the sprinkler case without disturbing the soil around the case. The sprinkler shall have a rubber cover and vandal resistant cover screws.
6. Sprinklers shall be Full/Part Circle Pop-up Rotor Sprinklers, of the appropriate size and type, as manufactured by Rain Bird Sprinkling Mfg. Corporation, Hunter Industries.

D. Sprinkler Types and Spacing.

1. Large Area Rotors: Hunter I-40 at 45 foot maximum spacing.
2. Medium Area Rotors: Hunter I-20 at 30 foot maximum spacing.
3. Spray Heads: Rainbird # 1806 for turf areas; # 1812 for shrub beds.
  - a. East to west park strips: provide 120 percent coverage; 12 foot spacing typical, or 15' Nozzels.
  - b. North to south park strips: provide 100 percent coverage; 15 foot spacing typical.
  - c. Built in check valves required if elevation changes from one head to next head.
  - d. No Adjustable Arc Nozzles, Fixed Arc Nozzles only.
  - e. No MP Rotator Nozzles.
  - f. Bottom inlet only
4. Drip Systems: Hunter PCN Nozzles, series bubbler nozzles placed adjacent to plants higher in grade to allow flow to root zones of the plant.
  - a. Compatible with Pro Spray bodies or 1800 heads.
  - b. No fixed risers for bubblers.
  - c. Pop-Ups/spray head bodies with PCN bubbler nozzles.
5. Type of landscape areas will determine flow requirements.
  - a. P.R.V., if needed, use an individual pressure regulating device, such as an accuset.

## 2.6 ELECTRIC CONTROL VALVES

- A. Electric remote control valves shall be normally closed 24 VAC, 60 cycle, solenoid actuated globe pattern design capable of having a flow rate as required with a pressure loss not to exceed 1.5 psi. The valve pressure rating shall not be less than 200 psi.
- B. Valve body and bonnet shall be constructed of heavy-duty glass-filled UV resistant nylon and have stainless steel studs and flange nuts; diaphragm shall be of nylon reinforced nitrile rubber.

- C. Valve shall have both internal and external manual open/close control, for manually opening and closing the valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box.
- D. Valves shall house a fully-encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning. The 24 VAC, 60 Hz solenoid shall open with 19.6 VAC minimum at 200 psi. At 24 VAC, average inrush current shall not exceed 0.41 amps.
- E. Valves shall have a brass flow control stem for accurate manual regulation and/or shut off of outlet flow. The valve must open or close in less than one minute at 200 psi, and less than 30 seconds at 20 psi.
- F. Valves shall have a self-cleaning stainless steel screen designed for use in dirty water applications.
- G. Valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.
- H. Control valves shall be Electric Remote Control Plastic Scrubber Valves, of the appropriate size and type, as manufactured by Rain Bird Sprinkling Mfg. Corporation, Hunter ICV Control Valves with Filter Sentry.

## **2.7 QUICK-COUPLING VALVES**

- A. Quick-coupling valves shall be a 1" minimum one piece type; constructed on heavy cast brass. The cover shall be a durable, self-closing, and locking rubber cover. The valves shall be opened and closed by a brass key of the same manufacturer, having an appropriate outlet. The valve throat shall have a keyway with detent positions for regulating flow.
- B. Quick-coupling valves shall be Model 3-RC, as manufactured by Rain Bird Sprinkling Mfg. Corp

## **2.8 CONTROL WIRE**

- A. Control wire shall be UF No. 14 gauge or larger; conforming to the requirement of Section 05123. For two wire systems, shall use Maxi-cable 14-2 paired 14 awg double jacketed wire. Control wire to be placed in ¾-1" conduit with sweep elbows into each valve box. For multiple wire pats, each path shall be colored differently. Polypipe is acceptable for two wire conduit.

## **2.9 SPRINKLING SYSTEM CONTROLLER**

- A. Sprinkling system controller shall be capable of fully automatic or manual operation of the system.
- B. The controller shall operate on a 17 VAC, plus or minus 10%, power input; and be capable of operating four 24 VAC electric remote control valves per station. The controller shall have a reset circuit breaker to protect it from power overload.
- C. The controller shall be constructed such that all internal parts are accessible through the controller door without disturbing the cabinet installation.
- D. The controller shall be a WeatherTRAK ETPro3-CH2o-2W two-wire controller, of the appropriate size and type, and CWM enclosure (cold rolled steel coated wall mount). Other enclosure options include: SWM (Stainless Wall Mount), SPT (Heavy Duty Stainless

pedestal), CWM-CPED (Light Duty Coated Pedestal).

- E. The decoders shall be WeatherTRAK H2O-2, installed with each solenoid valve.
- F. The enclosure for the controller shall be a combined 120/240 volt commercial meter socket with enclosure, as required.
  - 1. The enclosure unit shall have a compact, double door, front and back design; to provide viewing and programming convenience.
    - a. Construction shall be 100 percent stainless steel; finish shall be brushed stainless steel.
    - b. The unit shall be weather and vandal resistant, NEMA TYPE 3R rated, with three-point locking system; and shall be UL listed.
    - c. The unit shall have a 10-year limited warranty.
  - 2. Meter section:
    - a. UL listed, E.U.S.E.R.C. 308 accepted commercial meter socket, 100 amp rated, with test block bypass provision.
    - b. Hinged viewing window to provide convenient access for metering agency.
    - c. Shall include 100 amp load center with 8 positions.
    - d. Surge/line protection shall be WeatherTRAK WT2W-LSP. Line surge protection required for every five valves or 500 ft along the two-wire path.
  - 3. The enclosures shall be Strong Box Metered Stainless Steel Combination Enclosure, Model SB- 24SS / 120/240 V, as required and as manufactured by V.I.T. Products, Inc.

## **2.10 MISCELLANEOUS ITEMS**

- A. Miscellaneous appurtenant items shall be provided as indicated on the drawings or as required to complete the sprinkler system.

## **2.11 PIPE BEDDING AND BACKFILL MATERIALS**

- A. Bedding: As specified in Sections 02112 and 02116.
- B. Backfill: As specified in Sections 02112 and 02116.

## **2.12 ACCESSORIES**

- A. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, for up to 2 inch service lines.
- B. Concrete for Thrust Restraints: Concrete type specified in Section 03300.
- C. Manhole and Cover: Refer to Section 02340.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. The Contractor shall furnish all labor, materials and equipment as required to construct the complete automatic, underground sprinkling system, as described herein and as shown on the design drawings, as indicated on the submittal drawings; and shall furnish and install all supplementary and miscellaneous items, appurtenances, and devices incidental to or

necessary for a workable and complete sprinkling system installation.

- B. All material shall be installed according to the manufacturer's written instructions and recommendations.
- C. The Contractor shall test the entire sprinkling system to assure proper operation prior to final inspection with City representation for systems check

### **3.2 EXAMINATION**

- A. Verify that design drawings conform to project conditions.
- B. Verify that existing water main sizes and locations are as indicated on the drawings.

### **3.3 PREPARATION**

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges, mechanical joints or mechanical couplings.

### **3.4 TRENCHING**

- A. Trenching for the sprinkling system shall be done to ensure proper grades, slopes and alignment; and to provide minimum cover over main lines of 24-inches and 12-inches over laterals.
- B. See Section 02112 and Sections 02115 and 02116 for additional requirements.
- C. Hand trim excavation for accurate placement of pipe to elevations indicated.
- D. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required area of thrust restraint bearing on subsoil as indicated on the drawings.
- E. Backfill around sides and to top of pipe zone with pipe bedding material, tamp in place and compact to required density.
- F. Backfill trench from top of pipe zone to top of trench with trench backfill material, tamp in place and compact to required density.

### **3.5 INSTALLATION - PIPE**

- A. Group piping with other piping work whenever practical, per City Standard LS-11.
- B. Establish elevations of buried piping to ensure not less than 2 feet of cover over main lines and 12 inches over laterals; or as indicated on the drawings.
- C. Install pipe to indicated elevation to within tolerance of one inch.
- D. Install ductile iron piping and fittings to AWWA C600.
- E. Install PVC pressure pipe and fittings to ASTM D2774.

- F. Install pipe lines to line and grade indicated.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Slope water pipe and position drains at low points.
- I. Install trace wire above top of PVC and PE pipe; coordinate with Section 02112.

### **3.6 INSTALLATION - VALVES**

- A. Set valves on concrete block.
- B. Center and plumb valve box over valve operating nut. Set box cover flush with finished grade.

### **3.7 INSTALLATION - CONTROL VALVES**

- A. Install control valves where and as shown on the submittal drawings.
  - 1. Each control valve shall have threaded unions installed immediately upstream and downstream of all valves.
  - 2. Each control valve shall have its own isolation valve, immediately upstream of the first union. No "Action" manifolds allowed.
  - 3. Install only one control valve per rectangular box. Valve box to be Carsen Jumbo size, or approved equal by the City.
  - 4. Use of male adapters are prohibited.
- B. Set valves on concrete block.
- C. Center and plumb valve boxes and brace over valves. Set box cover flush, not level, with finished grade. All valve lids to have label of the assigned zone number.

### **3.8 INSTALLATION - QUICK-COUPLING VALVES**

- A. Quick-coupling valves shall be installed where and as shown on the submittal drawings.
- B. Quick-coupling valves are to be installed in the system to provide the Owner access so that the system can be winterized by blowing out the system with compressed air; therefore, the valves shall be located as indicated on the drawings.

### **3.9 INSTALLATION - AUTOMATIC CONTROLLER**

- A. The controller and remote control valves shall be compatible, having similar operational and adjustment features.
- B. The controller shall have a weatherproof panel enclosure; with the controller mounted on a pedestal, where and as indicated on the drawings; in such a manner that all normal adjustments can be conveniently made by the operator.
- C. The controller shall be properly grounded in accordance with local codes.
- D. Control wire shall be installed from the controller to all control valves and other equipment as required for proper operation of the sprinkling system.

### **3.10 WIRE AND ELECTRICAL WORK**

- A. Electrical control and ground wire shall be suitable for sprinkler control cable of sizes indicated on the drawings and as recommended by the manufacturer or supplier.
- B. Use Type "UF", 600 volt, stranded or solid copper, single conductor wire, with PVC insulation and bearing UL-approved for direct underground burial, for connecting the automatic remote control valves to the automatic controller.
  - 1. Use wire with 4/64-inch insulation, minimum covering of ICC-100 compound for positive weatherproofing protection.
  - 2. For wire sizes 14, 12, 10 and 8 use a single conductor solid copper wire; and for sizes 6 and 4 use stranded copper wire.
  - 3. Control or "hot" wires shall be red and all common or "ground" wires shall be white.
- C. Make all connections with UL acceptance 3M DBRY-6 type seal to make a waterproof connection.
- D. Verify that all wire types and installation procedures conform to NEC and local codes.

### **3.11 INSTALLATION - SPRINKLER HEADS**

- A. Flush the sprinkler system thoroughly to remove all foreign materials prior to the installation of sprinkler heads.
- B. Install rotor pop-up heads with a swing joint connection, as indicated on the drawings.
  - 1. All swing joints shall consist of three 90 degree Schedule 40 PVC street ells and Schedule 80 nipples with a minimum length of 12 inches.
  - 2. Size of swing joint pipe and fittings shall be as shown on the drawings.
- C. Install spray heads as indicated on the drawings.

### **3.12 BACKFLOW PREVENTER STATION**

- A. Provide Reduce Pressure Zone (RPZ) where and as indicated on the drawings; see Section 02586.

### **3.13 CONNECTIONS TO EXISTING WATER LINES**

- A. Connection to existing water lines shall be made where and as indicated on the drawings. The sizes of pipe, fittings, valves and appurtenant items required to make connection shall correspond to the sizes of existing pipe and of project pipe.
- B. Excavate to existing pipe line at point of connection; determine actual conditions of existing pipe and all fittings and appurtenant items required to make the connection; and have all materials needed on site prior to any shut down or cutting into existing pipe lines.
- C. Connections that involve cutting into existing pipe lines include: cutting and removing sections of existing pipe and fittings as required; cleaning and preparing ends of existing pipe as required for connection; furnishing and installing all new pipe, fittings and valves required to make the connection of project pipe to the existing pipe as indicated; and all appurtenant work required to complete the connection.

- D. Connection into existing pipe lines under pressure include: furnishing and installing mechanical joint tapping sleeve of the appropriate size on the existing pipe at point of connection; furnishing and installing tapping valve, with valve box, on sleeve; tapping existing pipe with drilling machine and equipment, without interrupting flow in existing pipe line; and all appurtenant work required to complete the connection.
- E. Connection to existing pipe line shall be made at such times and within the time limits and according to the directions as agreed to between the Contractor and the City Engineer.

### **3.14 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 1.25 times pipe line working pressure in psi.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to City.

### **3.15 OPERATIONAL TESTING**

- A. Provide the City Engineer or City Inspector with seven days written notice of sprinkling operational system test.
- B. Test shall consist of the operation of the entire system through one cycle of controller for propose of checking coverage and assuring of absence of leaks.
  - 1. Repair water lines, valves, or connections which show evidence of leakage.
- C. After all repairs or replacements have been made and accepted by the City Engineer or City Inspector, repeat the above required test.

**END OF SECTION**

## **SECTION 02725**

### **RESTORING WETLANDS AREAS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Restoration of wetlands areas.

##### **1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

##### **1.3 REFERENCES**

- A. Standards of Official Seed Analysis of North America.

##### **1.4 DEFINITIONS**

- A. Weeds: Includes Cheatgrass (*Bromus Tectorum*), Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel and Phragmites.

##### **1.5 SUBMITTALS**

- A. See appropriate sections of the Contract Documents for submittal procedures.
- B. Certification: Submit certification of grass species and location of seed source.

##### **1.6 QUALITY ASSURANCE**

- A. Seed Vendor: Company specializing in seed with minimum five years' experience, and certified by the State of Utah.
- B. Installer Qualifications: Company accepted by the seed vendor.

##### **1.7 REGULATORY REQUIREMENTS**

- A. Comply with the requirements of the U.S. Army Corps of Engineer for work within wetlands areas.
- B. Comply with regulatory agencies for fertilizer and herbicide composition.
- C. Provide certificate of compliance from authority having jurisdiction indicating acceptance of fertilizer and herbicide mixture.

#### **PART 2 PRODUCTS**

##### **2.1 MATERIALS**

- A. Wetlands Seed Mix.



1. Seed Mix. Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by the Association of Seed Analysis of North America. Provide seed of species, mechanically premixed to the specified proportions, with minimum percentages of purity, germination and maximum percentages of weed seed as certified. Seed Mix shall be a blend of the listed seeds, as supplied by Granite Seed Company of Lehi, Utah.
  2. Standards. Seed mix shall comply with "Standards of Official Seed Analysis of North America"; for 85% purity, 80% germination and 1% (maximum) weed seed.
  3. Submit seed vendor's certified statement for each seed mixture required; stating botanical and common name, percentage by weight, and percent of purity, germination and weed seed for each seed species.
  4. Provide Wetland seed mix of the following species and with proportions as accepted by the Corps of Engineers:
    - a. Nebraska Sedge (*Carex nebrascensis*)
    - b. Baltic Rush (*Juncus balticus*)
    - c. Redtop (*Agrostis alba*)
    - d. Garrison Creeping Foxtail (*Alopecurus Arundinaceus*)
  5. Sow the seed mix in quantities to provide pure, live seed at the coverage rate of 20 pounds per acre.
  6. Delivery. Seed shall be delivered to the site in original unopened containers, bearing the dealer's guaranteed analysis and germination percentage and a certificate or stamp or release by a County agriculture commissioner.
- B. Fertilizer: Recommended for seed mix, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.
- C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

## **2.2 TESTS**

- A. Provide analysis of topsoil fill under provisions of Section 01400.
- B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- C. Testing is not required if recent tests within six months are available for imported topsoil. Submit these test results to the testing laboratory for acceptance. Indicate, by test results, information necessary to determine suitability.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that prepared soil base is ready to receive the work of this section.

### **3.2 PREPARATION**

- A. Prepare sub-grade in accordance with Section 02112.
- B. Place topsoil, where required, in accordance with Section 02112 and Section 02100.

### **3.3 FERTILIZING**

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to seeding.
- C. Apply fertilizer no more than 48 hours before installing erosion control mat and seeding.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

### **3.4 RESTORATION OF WETLANDS AREAS**

- A. Restore existing wetlands areas that are disturbed or damaged by project trenching operations or structural excavations, as indicated on the drawings. Wetlands areas shall be as classified by the U.S. Army Corps of Engineers, following field reconnaissance and testing; and shall be to the limits designated by the City Engineer.
  - 1. Restoration shall be done according to the wetlands permit included with the accepted project drawings.
  - 2. Remove the top 2 feet of top soil material and store separately from other excavated material.
  - 3. After the lower portions of trench or excavations are backfilled with acceptable materials and compacted, the stockpiled top soil material shall be placed in the upper portion of the trench or excavations and compacted.
  - 4. Top of restored top soil shall match adjacent ground surfaces.
  - 5. Restoration of wetlands areas shall include preparation of seedbeds and seeding the areas to be restored.
  - 6. Condition of restored wetlands areas shall match original conditions.
- B. Planting.
  - 1. Preparation.
    - a. Till area to be planted to a depth of not less than 4 inches prior to seeding; and to a homogeneous mixture of fine texture, free of lumps and clods.
    - b. Grade planting areas to provide smooth, even surfaces with a loose, uniformly fine texture. Roll and rake and remove ridges and fill in depressions as required.
    - c. Moisten prepared areas by sprinkling before planting, if soil is dry. Water thoroughly and allow surface to dry off before planting. Do not create muddy soil condition.
  - 2. Seeding.
    - a. Seed shall be applied by hydraulic method with a hydro-seeder at the coverage rate recommended by the seed vendor. Seeding may be done using spreader or seeding machine, at the rate indicated and as recommended by the seed vendor. Do not use wet, moldy or damaged seed.
    - b. Distribute seed evenly over entire area by sowing equal quantities in two opposite directions.
    - c. Seeding shall not be performed when the wind velocity exceeds 5 miles per hour, or is determined detrimental to the uniform distribution of seed.

3. All materials must be available for inspection prior to application.
4. Restore prepared areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.
5. All landscaping will be covered by a warranty for a period of one year.
  - a. Seeded Areas. At the end of the warranty period, seeded areas shall have 70 percent coverage of full, established growth; free of all noxious weeds.
  - b. At end of warranty period, replant areas showing root growth failure, bare or thin spots, and eroded or settled areas within 10-days of written notice. Plant with materials of like kind and size, planted in the next growing season, with a new warranty commencing on the date of planting. All corrective work will be at no additional cost to the Owner.

**END OF SECTION**

## **SECTION 02726**

### **LANDSCAPING**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Preparation of subsoil.
- B. Fertilizing.
- C. Seeding
- D. Maintenance.

##### **1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
- B. Section 02100- Roadway and General Excavation: Slopes protection and topsoil placement.

##### **1.3 REFERENCES**

- A. Standards of Official Seed Analysis of North America.
- B. ANSI Z60.1, American Standard for Nursery Stock.

##### **1.4 DEFINITIONS**

- A. Weeds: Includes Cheatgrass (*Bromus Tectorum*), Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Phragmites.

##### **1.5 SUBMITTALS**

- A. See appropriate sections of the Contract Documents for submittal procedures.
- B. Certification: Submit certification of grass species and location of seed source.
- C. Maintenance Data: Include maintenance instructions, cutting method and maximum height; types, application frequency and recommended coverage of fertilizer.
- D. NOI permit and Erosion Control Plan per section 01700.

##### **1.6 QUALITY ASSURANCE**

- A. Seeds.
  - 1. Vendor: Company specializing in supplying seed with a minimum five years' experience, and certified by the State of Utah.

2. Installer Qualifications: Company accepted by the seed vendor.
- B. Trees and Shrubs.
1. Vendor: Company specializing in growing and cultivating trees and shrubs with a minimum five years' experience, and certified by the State of Utah.
  2. Installer Qualifications: Company specializing in installing and planting trees and accepted by tree supplier.

## **1.7 REGULATORY REQUIREMENTS**

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating acceptance of fertilizer and herbicide mixture.

## **1.8 MAINTENANCE AND SERVICE**

- A. Furnish service and maintenance of seeded or sodded areas prior to acceptance onto warranty as well as up to the end of warranty when applicable. Seeded areas shall have a 100 percent coverage of full, established growth, free of all weeds, prior to acceptance onto warranty.









## **PART 2 PRODUCTS**







### **2.1 MATERIALS**

- A. Lawn Seed.
  1. Seeded area is to be irrigated, maintained, and kept weed free by the contractor until the turf is fully established with a root depth of 4 inches before acceptance by the City and/or start of the warranty period per the City's land development code.
  2. Lawn Grass Mix. Lawn grass seed shall be fresh, clean, new crop seed; mechanically premixed to the specified proportions. Lawn grass seed shall be a blend of the following seeds: Kentucky Bluegrass, 80%, Rye Grass, 20%; planted at a rate of 3.0 pounds per 1000 square feet.
  3. Standards. Grass seeds shall comply with "Standards of Official Seed Analysts of North America," published by the Association of Official Seed Analysts, most recent edition; for 85% purity, 80% germination and 1% (maximum) weed seed (68% PLS).
  4. Delivery. Seed shall be delivered to the site in original unopened containers, bearing the dealer's guaranteed analysis and germination percentage and a certificate or stamp or release by a County agriculture commissioner.
  5. Seed to be applied by hydraulic method shall be mixed with wood fiber mulch, fertilizer and polymer at 50 pounds per 100 square feet.
  6. Fertilizer: Recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.
  7. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.
- B. Trees: Shall be Grade A trees of the type acceptable to the City Engineer; with deciduous 2 ½" caliper, ornamental 1 ½" caliper, and evergreen 6' tall. Trees shall be grown in climatic




conditions similar to those in locality of the Work; with branching, configuration and cane requirements as indicated in ANSI Z60.1, American Standard for Nursery Stock. Provide trees of normal growth and uniform heights, according to the species, with straight trunks and well developed leaders, laterals and roots. Provide legible labels attached to tree indicating botanical genus, species, and size. The following trees are acceptable to the City of Saratoga Springs for Landscaping Dedicated to the City, other trees may be considered on a case by case basis:










#### Recommended Tree & Plant Palate

PUBLIC PLANTING						
	SPECIFIC NAME (BOTANICAL)	TYPE	SIZE (H X SPREAD)	PATTERN	PRODUCE/ COLOR IN BLOOM	SPECIAL INSTRUCTIONS
Large Shade Trees > 50 ft	Bloodgood London Plane Tree  (Platanu Acerifolia 'Bloodgood')		60' x 60'	Allee  Regular Clustered	1/3" berry/ N/A	Tolerates Salt, Yellow fall color
	Bur Oak*  (Quercus Macrocarpa)		60' x 60'	Allee  Regular	Nut/ N/A	Tolerant of Urban conditions, soil adaptable
	Sycamore Maple  (Acer psuedoplatanus)		60' x 40'	Allee  Regular	Samara/ N/A	Tolerates alkaline and salt conditions
	Silver Linden*  (Tilia Tomentosa)		60' x 40'	Allee  Regular Clustered	N/A / Yellow green	Green leaf surface, silver underside. Tolerant of heat/drought.
	Expresso Kentucky Coffee Tree  (Gymnocladus dioica 'Expresso')		60' x 40'	Allee  Regular Clustered	1/3" berry / N/A	Tolerates wide range of conditions/salt
	Emerald Queen Norway Maple*  (Acer platanoides 'Emeral Queen')		50' x 40'	Allee  Regular Clustered	Smara/ N/A	Tolerant of Urban conditions, soil adaptable
	Accolade Hybrid Elm  (Ulmus x "Accolade')		50' x 40'	Allee  Regular	Samara / N/A	Pollution/ Salt/ drought tolerant
	Crimson King Maple  (Acer Platanoides 'Crimson King')		45' x 40'	Allee  Regular Clustered	Samara/ N/A	Well adapted to extremes in soils. Withstands hot, dry condition.

	Magyar Maidenhair Tree* (Ginko Biloba 'Magyar') <b>Male Species Only</b>		50' x 30'	Regular, Clustered	N/A / N/A	Tolerates high ph, salt, urban conditions. Excellent yellow fall color.
	Catalpa (catalpa speciosa) <b>Podless Only</b>		50' x 30'	Allee Regular Clustered	White	Attractive flower, withstands dry, alkaline conditions.
	Austrian Pine (Pinus nigra)		50' x 30'	Clustered	Cone	Can withstand urban conditions and alkaline soils.
	Scotch Pine (Pinus sylvestris)		40' x 30'	Clustered	Cone	Can withstand urban conditions and alkaline soils.
	Cottonwood (Populus sargentii) <b>cottonless variety</b>		80' x 50'	Regular	N/A / N/A	Great fall color. Tolerant of poor soils/salt/drought
	English Columnar Oak (Quercus robur 'fastigiata')		60' x 15'	Allee Regular Clustered	Acorn/ Red	Prefers well drained soil and alkaline conditions.









\*Indicates trees suitable for parkstrips

PUBLIC PLANTING						
	SPECIFIC NAME (BOTANICAL)	TYPE	SIZE (H X SPREAD)	PATTERN	PRODUCE/ COLOR IN BLOOM	SPECIAL INSTRUCTIONS
Medium Shade Trees  45 ft to 50 ft	Queen Elizabeth Hedge Maple (Acer Campestre 'Queen Elizabeth')		45' x 45'	Regular Clustered	N/A / N/A	Pollution/salt/drought tolerant
	Rocky Mountain Juniper ( <i>Juniperus scopulorum</i> )		40' x 15'	Regular Clustered	Cone / N/A	Drought tolerant/native
	Shangri-La Maidenhair Tree* ( <i>Ginko biloba</i> 'Shangri-la')		45' x 25'	Allee Regular Clustered	Seed / N/A	Males should be planted, excellent yellow fall color

	Armstrong Maple* ( <i>Acer freemanii</i> )		45' x 15'	Allee Regular Clustered	Samara / N/A	Distinctly upright, soil adaptable
	Common Hackberry* ( <i>Celtis occidentalis</i> )		40' x 30'	Regular Clustered	1/3" Berry / N/A	Tolerates drought/pollution/po or soils/ salt
	Little Leaf Linden* ( <i>Tilia cordata</i> )		40' x 25'	Allee Regular Clustered	N/A / Yellow green	Tolerant of urban conditions, soil adaptable
	Sensation Box Elder* ( <i>Acer negundo</i> 'Sensation')		30' x 30'	Allee Regular Clustered	Samara / N/A	Tolerant of urban conditions/ poor soils/ salt
	Thornless Honeylocust* ( <i>Gleditsia triacanthos</i> var. <i>inermis</i> )		30' x 25'	Regular Clustered	Samara / N/A	Brilliant red fall color
	Gamble Oak ( <i>Quercus gambelii</i> )		25' x 20'	Clustered	Acorns / N/A	Native/great red fall color/
	Big Tooth Maple ( <i>Acer</i> <i>grandidentatum</i> )		30' x 20'	Clustered	Samara / N/A	Great red fall color/requires well drained soil
	Sky Rocket Juniper ( <i>Juniperus</i> <i>scopulorum</i> 'Skyrocket')		20' x 3'	Allee Regular Clustered	Cones / N/A	Drought tolerant/withstands alkaline conditions
	Frontier Elm ( <i>Ulmus</i> x 'frontier')		30' x 25'	Allee Regular Clustered	N/A / N/A	Resistant to Dutch Elm disease

\*Indicates trees suitable for parkstrips



PUBLIC PLANTING						
	SPECIFIC NAME (BOTANICAL)	TYPE	SIZE (H X SPREAD)	PATTERN	PRODUCE/ COLOR IN BLOOM	SPECIAL INSTRUCTIONS
Small Shade Trees <25 ft	Service Berry (Amelanchia sp.)		25' x 20'	Regular, Clustered	Nut/ White	Cream white fragrant flower, tolerates poor soils.
	Tatarian Maple * (Acer Tataricum)		25' x 20'	Clustered	Samara / N/A	Tolerates cold, drought, high ph soils. Excellent red fall color.
	Lavalle Hawthorn* (Crataegus x lavallei)		25' x 20'	Clustered	1/2" berry (persistent) white	Bronzy or coppery- red fall color with bright red persistent berries into winter.
	Canada Red Chokecherry (Prunus virginiana 'Canada Red')		25' x 20'	Allee, Regular, Clustered	1/3" berry white	Soil adaptable, tolerant of urban conditions, very attractive foliage.
	Amur Maackia (Maackia amurensis)		20' x 20'	Allee, Regular, Clustered	1/3" berry / white	Bronzy or coppery- red fall color with bright red persistent berries into winter.
	Flowering Plum (Prunus cerasifera 'Thundercloud')		20' x 15'	Allee, Regular, Clustered	N/A / pink flowers	Purple leaf. Tolerant of urban conditions.
	Crabapple (Malus 'Indian Magic')		20' x 20'	Allee, Regular, Clustered	Orange berry/ Deep pink blossoms	Persistent fruit. Tolerates urban conditions.
	Crabapple (Malus 'prairifire')		20' x 20'	Allee, Regular, Clustered	Red berry/ Red Blossoms	Persistent fruit. Tolerates urban conditions.

\*Indicates trees suitable for parkstrips

PUBLIC PLANTING						
	SPECIFIC NAME (BOTANICAL)	TYPE	SIZE (H X SPREAD)	PATTERN	PRODUCE/ COLOR IN BLOOM	SPECIAL INSTRUCTIONS

Hedge	Karl Foerster Feather Reed Grass ( <i>Calamagrostis x acutiflora</i> 'Karl Foerster')		4'	Formal Massing	Seed heads/ White/Gold	Very attractive as a hedge in formal massings
	Blue Mist Spirea ( <i>Caryopteris x clandonensis</i> )		3 – 5'	Formal Massing	N/A / Blue/Purple	Flowers in summer/early fall
	Rubber Rabbit Brush ( <i>Chrysothamnus nauseosus</i> )		4'	Informal Grouping	N/A / Yellow	Yellow fall cover/seeds and cover for birds
	Red Osier Dogwood ( <i>Cornus sericea</i> )		8 – 15'	Informal Grouping	White berries / White	Attractive winter red twigs
	Hedge Cotoneaster ( <i>Cotoneaster lucida</i> )		4 – 6'	Informal Grouping	Black berries / White	Dark green lustrous leaves in summer
	Mormon Tea ( <i>Ephedra nevadensis</i> )		2 – 4'	Informal Grouping	N/A / N/A	Drought tolerant/evergreen
	Forsythia ( <i>Forsythia</i> )		4 – 6'	Formal Massing	N/A / Yellow	Early spring flowers are powerful in large massing
	Rose of Sharron ( <i>Hibiscus syriacus</i> )		6 – 12'	Formal Massing	N/A / White/Pink/ Purple/Blue	Showy flowers in summer
	Utah Honeysuckle ( <i>Lonicera utahensis</i> )		3 – 5'	Formal Massing	Small red berries / white	Traditional pioneer plant
	Maiden Hair Grass ( <i>Miscanthus sinensis</i> )		6'	Formal Massing	Seed heads / Bronze/Purple	Very attractive as a hedge in formal massings.
	Heavy Metal Switch Grass ( <i>Panicum virgatum</i> 'Heavy Metal')		5'	Formal Massing	Seed heads / gold	Upright/stiff habit
	Mock Orange ( <i>Philadelphus coronarius</i> )		8'	Formal Massing	N/A / White	Traditional pioneer plant, fragrant flowers
	Purple Leaf Sand Cherry ( <i>Prunus x cistena</i> )		8'	Formal Massing	N/A / White	Red/purple leaves
	Squawbush Sumac ( <i>Rhus trilobata</i> )		4 – 6'	Informal Grouping	Small red pubescent	Excellent red fall color

					berries / White	
	Golden Currant ( <i>Ribes aureum</i> )		3'	Formal Massing	Yellow spring berries / Yellow	Red fall color/fruit for birds
	Wild Rose ( <i>Rosa woodsii</i> )		2 – 6'	Informal Grouping	Rosehips / Pink/magenta	Drought tolerant
	Sutherland Gold Elderberry ( <i>Sambucus racemosa</i> 'Sutherland Gold')		8'	Formal Massing	Red/Black berries / White	Edible fruit/attractive yellow foliage
	Snow Berry ( <i>Symphoricarpos alba</i> )		3'	Informal Grouping	White berries / White	Showy white berries
	Amur Maple ( <i>Acer ginnala</i> )		10' - 20'	Formal Massing	Samara / N/A	Excellent Red Fall Color
	Utah Serviceberry ( <i>Amelanchier utahensis</i> )		6 – 15'	Informal Grouping	Red/purple/black pome / White	Important food source for wildlife
	Boxwood ( <i>Buxus sempervirens</i> )		2 – 4'	Formal Massing	N/A / N/A	Evergreen shrub
	River Birch ( <i>Betula occidentalis</i> 'font clump')		15 – 20'	Informal Cluster	Catkin / N/A	Wet conditions/ Attractive red bark
	Hicks Yew ( <i>Taxus x media</i> )		4 – 10'	Formal Massing	N/A / N/A	Evergreen shrub
	American Cranberry Bush Viburnum ( <i>Viburnum trilobum</i> 'Bailey Compact')		4'	Formal Massing	N/A / N/A	Rounded formal habit

\*Indicates trees suitable for parkstrips

PUBLIC PLANTING						
	SPECIFIC NAME (BOTANICAL)	TYPE	SIZE (H X SPREAD)	PATTERN	PRODUCE/ COLOR IN BLOOM	SPECIAL INSTRUCTIONS
Ground Cover	Bugleweed (Ajuga)		4"	Formal Massing	N/A / Blue/ purple	Many cultivars are well adapted to region.
	Basket of Gold (Alyssum)		8" to 12"	Informal Grouping	N/A / Yellow Flower	Early spring bloomer
	Compinkie Rockcress (Arabis alpine 'Compinkie')		6"	Informal Grouping	N/A / Deep Rose	Evergreen foliage
	Kinnikinnik (Arctostaphylos uva ursi)		6" to 8"	Informal Grouping	Red Berries/ N/A	Evergreen, excellent red fall color.
	Rockcress (Aubrieta)		4" to 6"	Formal Massing	N/A / Magenta	Drought tolerant once established.
	Chocolate Flower (Berlandiera lyrata)		18"	Informal Grouping	N/A / Yellow	Drought tolerant once established.
	Poppy Mallow (Callirhoe involucrata)		2" to 4"	Informal Grouping	N/A / Magenta	Aggressive spreader. Attractive when paired with Berlandiera
	Snow in Summer (Cerastium arvense)		4" to 6"	Formal Massing	N/A / White	
	Dwarf Tickseed (Careopsis 'nana')		6" to 8"	Formal Massing	N/A / Gold	Late spring bloomer.
	Hardy Ice Plant (Delosperma)		4" to 6"	Informal Grouping	N/A / Varies	
	Yarrow (Achillea millefolium)		2' x 2'	Informal Massing	N/A / Yellow Flowers	Drought tolerant.
	Sulphur Flowers (Eriogonum umbellatum aureum)		5"	Informal Grouping	N/A / Yellow	Summer bloomer

	Goblin Blanket Flower (Gaillardia 'Goblin')		12"	Informal Grouping	N/A / Yellow/Red	Heavy reseeder
	Mountain Boxwood (Pachistima myrsinides)		8"	Informal Grouping	N/A / N/A	Evergreen
	Sedum (Sedum)		4" to 12"	Informal Grouping	N/A / Varies	Many cultivars are well adapted to region
	Scarlet Globemallow (Sphaeralcea coccinea)		6" to 12"	Informal Grouping	N/A / N/A	
	Lambs Ear (Stachys Byzantine "Helen Von Stein')		8" to 10 "	Informal Grouping	N/A / Rose-purple	
Small Shrub	Silvermound Sage (Artemisia schmidtiana)		10" to 12"	Formal Massing	N/A / N/A	Uniform Mounding shape
	Black Sage (Artemisia nova)		18"	Informal Grouping	N/A / N/A	Drought tolerant once established.
	Creeping Potentilla (Potentilla neumanniana)		12"	Formal Massing	N/A / Yellow	Slow growing creeping form
	Dwarf Mugo Pine (Pinus Mugo Mops)		3' x 3'	Formal Massing	Cone/ N/A	Evergreen
Perennial	Blue Flax		15"	Formal Massing	N/A / Blue	Heavy reseeder

\*Indicates trees suitable for parkstrips

## 2.2 TESTS

- A. Provide analysis of topsoil fill under provisions of Section 01400.
- B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for acceptance. Indicate, by test results, information necessary to determine suitability.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that prepared soil base is ready to receive the work of this section.

### **3.2 PREPARATION**

- A. Prepare sub-grade in accordance with Section 02116.
- B. Place topsoil where required.
- C. Top of sod or soil to be one-inch below edge of sidewalks, curb & gutter, ball courts, mow strips and other concrete surfaces.
- D. Place topsoil to the following compacted thicknesses:
  - a. Areas to be seeded with grass: 6 inches.
  - b. Areas to be sodded: 4 inches.
  - c. Areas for shrub beds: 18 inches.
  - d. Areas for flower beds: 12 inches.

### **3.3 FERTILIZING**

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to seeding.
- C. Apply fertilizer no more than 48 hours before installing erosion control mat and seeding.
- D. Lightly water to aid the dissipation of fertilizer.

### **3.4 PLANTING SEED**

- A. Seeding.
  - 1. Turf only. Seeded area is to be irrigated, maintained, and kept weed free by the contractor until the turf is fully established with a root depth of 4 inches prior to acceptance by the City and/or prior to start of the warranty period per the City's land development code. Landscaped Areas. Landscaped areas shall be seeded with grass seed and sod, as required, as described herein.
- B. Seeding shall not be performed when the wind velocity exceeds 5 miles per hour, or is determined detrimental to the uniform distribution of seed.
- C. Till areas to be planted to a depth of not less than 4-inches prior to seeding.
- D. Grade planting areas smooth, even surface with a loose, uniformly fine texture. Roll and rake and remove ridges and fill in depressions as required.
- E. Moisten prepared seeding area by sprinkling to a depth of six inches before planting; the area shall be surface dry at the time of application. Do not create a muddy soil condition.
- F. Seed shall be applied by hydraulic method with a hydro-seeder at the coverage rate

recommended by the seed vendor. Seed may be applied by broadcast or drilled method at the recommended coverage by the seed vendor.

- G. Seeded areas shall have a 100 percent coverage of full, established growth that is free of all weeds.
- H. Rate of Application.
  - 1. Lawn Grass seed mix shall be applied at rate of 4 pounds per 1000 square feet.
- I. All materials must be available for inspection prior to application.
- J. Restore prepared areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

### **3.5 PLANTING TREES**

- A. Trees. Trees shall be planted where accepted by the City.
- B. Trees shall be planted during normal planting season.
  - 1. Excavate only for depth of root ball. The excavated area for tree planting shall be at least two times the diameter of the root ball, or as recommended by the supplier.
  - 2. Place trees for final orientation review by the City Engineer prior to backfilling the root ball.
  - 3. Installation of trees shall be done according Drawing No. LS-13; and as recommended by the supplier. Backfill material shall be acceptable to the supplier and inspected and accepted by the City Inspector.
  - 4. After installation, trees shall be pruned as required, complying with ANSI A300.
  - 5. Trees shall be protected as recommended by the supplier.

### **3.6 LANDSCAPED AREAS**

- A. Landscaped areas that are to be covered with landscaping bark, rocks or other materials, shall be treated with herbicide to kill weeds to control weed growth.
- B. Landscaped areas shall be watered with the most efficient type sprinkler system available that meets all other City specifications.
- C. Landscaped areas shall have a 100 percent coverage free of all weeds. Prior to acceptance, areas showing root growth failure, bare or thin spots, and eroded or settled areas shall be replanted. Plant with materials of like kind and size. All corrective work will be at no additional cost to the Owner.

### **3.7 MAINTENANCE REQUIREMENTS FOR LANDSCAPED AREAS DURING WARRANTY PERIODS**

- A. Turf.
  - 1. General: Maintain seeded areas prior to acceptance as well as through the warranty period when applicable. Supply additional topsoil, where necessary, including areas affected by erosion or settlement.

2. Watering: Water to ensure uniform seed germination and to keep surfaces of soil damp. Apply water slowly so soil will not puddle or crust.
  3. Fertilizing:
    - a. Fertilize during planting; and two weeks after planting.
    - b. Fertilize formulation to be determined from soil analysis taken yearly.
  4. Mowing:
    - a. Cut lawn grass for the first time when it reaches a height of 3-inches.
    - b. After first mowing, water to moisten soil from 3-inches to 5-inches deep.
    - c. After first mowing, mow on a 7-day cycle, preferably on Thursdays or Fridays.
    - d. Use string trimmers on all hardscape edging, posts, utilities, etc. on the same day as mowing.
    - e. Use metal blade edgers against concrete/turf areas one time per month.
  5. Grading: Roll when required to remove minor depressions or irregularities.
  6. Control Growth of Weeds: Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
    - a. Apply 2-4-D chemical for control of broadleaf weeds. Apply when conditions are most beneficial for control of weeds, usually mid-April and mid-September.
  7. Reseeding: Immediately replace seed to areas which show deterioration or bare spots.
  8. Protection: Protect seeded areas with warning signs during maintenance period. When necessary, erect temporary fences or barriers to control pedestrians.
  9. Turf areas shall have 100 percent coverage of full, established growth that is free of all weeds.
- B. Trees.
1. General: Maintain trees prior to acceptance as well as through the warranty period when applicable. Supply additional top soil where areas have been affected by erosion or settlement.
  2. Maintain tree health immediately after planting. Trim only dead or broken branches; remove clippings and dead branches from the site. Control diseases.
  3. Watering:
    - a. After planting, keep ground continuously moist until healthy growth is established.
    - b. Thereafter, deep root water trees two times per month during first year of establishment.
    - c. Deep root watering is required for coniferous trees during winter months.
  4. Weeding: Uproot and remove weeds completely. Do not allow growth and germination of weed seeds. Fill in large holes caused by weeding with top soil and rake smooth.
    - a. Maintain weed free tree rings with 3-inch mulch depth. Tree rings to have 2 foot radius.
  5. Protection: Protect trees against traffic by erecting temporary barriers and warning signs. Replant damaged trees.
  6. Maintain wrappings, guys, turnbuckles, and stakes. Adjust turnbuckles to keep wire tight. Repair or replace accessories where required.
- C. Aeration. Aerate turf areas a minimum of two times per year; in the spring and in the fall. Core aerate; leave cores and break up if needed.



- D. Irrigation System.
  - 1. Repair all breaks immediately.
  - 2. Perform weekly inspections and make needed adjustments.
  - 3. Make seasonal adjustments to controllers as needed.
- E. Erosion and Settlement. Repair trench settling, ruts, and rivulets caused by mowing equipment, irrigation and/or precipitation immediately.

### **3.8 WARRANTY**

- A. All landscaping will be covered by a warranty for a period of one year.
- B. Seeded Areas. At the end of the warranty period, seeded areas shall have a 100 percent coverage of full, established growth; free of all noxious weeds, as defined in this section's definitions.
  - 1. At end of warranty period, replant areas showing root growth failure, bare or thin spots, and eroded or settled areas within 10-days of written notice. Plant with materials of like kind and size, planted in the next growing season, with a new warranty commencing on the date of planting. All corrective work will be at no additional cost to the Owner.
- C. Trees. Warranty for trees shall include death, unhealthy conditions, or if trees die from poor planting practices. Replace any unsatisfactory or dead tree within 10-days of written notice. Provide replacement trees of same size and species, planted in the next growing season, with a new warranty commencing on the date of planting. All corrective work will be at no additional cost to the Owner.

### **END OF SECTION**

## **SECTION 02727**

### **RESTORING NATIVE AREA**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. This specification addresses the restoration of vegetation in areas which were disturbed by construction activity outside of public right of ways. Restoration of these areas includes weed removal, grading, import of topsoil, automated irrigation systems, hydroseeding or sod installation.
- B. The micro-climate of Saratoga Springs City is highly influenced by the topography of the mountains immediately to the west and further west of the City. Because the City is located on the lee side (East) of the mountains very little rainfall occurs and is not consistent. The lack of rainfall does not create a force majeure condition for this specification. Compliance with plant germination and growth are required to meet the standard of success specified herein. At various times of year and in various years, Contractors may need to provide temporary irrigation of the project sites in order to meet the acceptance standard in PART 3/3.1 of this specification.
- C. Contractor may elect to install hydroseed or sod. For the sod option an irrigation system is required. For the hydroseed option the specification does not require an irrigation system.
- D. To improve the likelihood of successful plant growth and avoid the cost of addressing plant failure, Contractor may elect to provide additional thickness of topsoil and temporary automatic sprinkler systems (for hydroseeding option).

##### **1.2 SECTION INCLUDES**

- A. Preparation of the site including import of topsoil.
- B. Hydroseeding or installing sod.
- C. Supply and installation of erosion control matting.
- D. Installing irrigation systems.
- E. The inspection and definition of germination success
- F. Maintaining the site and replacing areas which did not achieve germination success.
- G. The definition of the beginning of the warranty period and work that is required during the warranty period.

##### **1.3 RELATED SECTIONS**

- A. The following City Standard Specifications are referenced:
  - 1. 00500 Design Standards
  - 2. 02100 Roadway and General Earthwork
  - 3. 02116 Fill and Backfill

4. 02740 Automatic Sprinkling System
5. 02726 Landscaping
6. 02728 Hydroseeding

#### **1.4 REFERENCES**

- A. Standards of Official Seed Analysis of North America.
- B. ANSI Z60.1, American Standard for Nursery Stock.

#### **1.5 DEFINITIONS**

- A. Weeds: The definition of Weed includes Cheatgrass (*Bromus Tectorum*), Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Phragmites.
- B. Coverage: coverage is defined as the successful mature growth of plants in hydroseeded or sodded areas with less than 10% of weeds present. Mature growth shall be determined by the presence of seeds produced by the mature plants. The City may use various methods of measuring coverage, including on-site ground level inspections, aerial photography, and drone photography.

#### **1.6 SUBMITTALS**

- A. See appropriate sections of the Contract Documents for submittal procedures.
- B. Topsoil:
  1. Submit documentation of the topsoil in compliance with Section 02116.
  2. Submit the source of the topsoil.
- C. Irrigation System:
  1. Submit documentation of the irrigation components to be used in the project.
- D. Hydroseeding:
  1. Submit seed supplier's qualifications.
  2. Submit seed mix.
  3. Submit installer's qualifications.
- E. Sod:
  1. Submit sod supplier's qualifications.
  2. Submit sod seed mix.
  3. Erosion control matting:
  4. Submit documentation for erosion control matting documentation compliance with the specifications.

- F. Maintenance:
  - 1. Prepare and submit a maintenance plan identifying the work to be performed, the individual responsible for maintenance, and contact information for the responsible person.

## **1.7 SEED SUPPLIER AND INSTALLER QUALIFICATIONS**

- A. Seed Suppliers: The minimum qualification requirements for Seed Suppliers are:
  - 1. The company shall specialize in supplying seed.
  - 2. Have a minimum five years' experience supplying seeds, and
  - 3. Be a member of the Utah Crop Improvement Association.
- B. Seed Installers: The minimum qualification requirements for Seed Installers are:
  - 1. The company shall specialize in landscaping construction and maintenance.
  - 2. Have an active Utah contractor's license with S330 Landscape & Recreation Contractor classification.
  - 3. Have a minimum five years' experience as a landscape contractor.
  - 4. Have a written approval to install seeds supplied by the Seed Supplier for this project.

## **1.8 REGULATORY REQUIREMENTS**

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating acceptance of fertilizer and herbicide mixture.

## **1.9 MAINTENANCE SERVICE**

- A. Furnish service and maintenance of seeded or sod areas up to the end of warranty. Maintenance services includes confirming irrigation systems are functional, repairing irrigation systems, re-seeding, and repairing eroded areas.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Topsoil - See Section 02116, Fill and Backfill.
  - 1. Topsoil is required
- B. Erosion Control Matting (Erosion Control Blanket)
  - 1. Erosion control matting shall be erosion control blankets (ECB) which will provide temporary, biodegradable cover material to reduce slope erosion, enhance vegetation germination and growth, and minimize germination of weeds.
  - 2. ECBs shall be provided in rolls and wrapped with a suitable material to protect against moisture intrusion and extended ultraviolet exposure prior to placement. Each roll shall be labeled with a date code for identification.

3. ECBs shall consist of a seed free aspen curled wood excelsior with 80% of the wood fibers equal to or greater than six inches in length. The fiber count shall be a minimum of 7,000 per square yard with a mass of 0.73 lbs/yd.
4. The top and bottom of the ECB shall have green polypropylene netting containing oxo-biodegrader and UV additives. The net openings shall be 1.0-inch x 2.0-inch maximum.
5. Erosion control blankets performance capabilities shall meet ASTM D 6459 and AST D 6460.
6. Staples shall have a minimum length of six inches with a U-shaped top.
7. ECBs shall be Manufactured by American Excelsior Company or equal.

## **2.2 TEMPORARY AUTOMATIC SPRINKLING SYSTEMS**

### **A. Design Requirements**

1. Contractor shall submit an irrigation design prepared by a Landscape Architect or Certified Irrigation System Designer.
2. The irrigation design shall include the following elements:
  - a. System to have automatic controller and control valves.
  - b. Filter when using secondary water.
  - c. Backflow preventer when using culinary water.
  - d. Low Precipitation Sprinkler Heads.
  - e. Device to raise the head to 20 inches minimum above grade.
  - f. Sprinkler head spacing no further than 120% of coverage (30' heads spaced no further than 36').
3. Irrigation systems shall be automatically operated.
4. Irrigation systems shall be designed and installed in compliance with Section 02724 Automatic Sprinkling Systems.

## **2.3 SEED/SOD OPTIONS**

### **A. Seed/Sod Options**

1. Contractor may elect to hydroseed or install sod as specified below.

### **B. Plant Option A: Sod.**

1. BioNative sod supplied from BioGrass Sod Farms, Inc. or equivalent sod comprised of Idaho Bentgrass seed, and Utah native wheat grass seed; Streambank Wheatgrass, Western Wheatgrass and Thickspike Wheatgrass with 98% purity and grown in with NanoGro fertilizer for thicker density and establishment.
2. Automated sprinkling systems are required for sod installations.

### **C. Plant Option B: Seed Mix.**

1. Provide fresh, clean, new crop seed complying with tolerance for purity and germination established by Official Seed Analysis of North America. Provide proof of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed. Seed blend shall consist of the following:

Crested Wheatgrass	38%
'Sodar' Streambank Wheatgrass	35%
'Covar' Sheep Fescue	20%
'Rabbitbrush' Chrysothamnus nauseous	2%
'Appar' Lewis Blue Flax	1%
'Lutana' Cicer Milkvetch	1%
Western Yarrow	1%
Rocky Mountain Penstemon	1%
'Californica' California Poppy	1%

2. When using the hydroseeding method erosion control blankets are required on all areas which were hydroseeded. Erosion control blankets shall be installed on top of the hydroseed. Erosion control blankets shall be installed by hand without driving on top of the hydroseeded areas. Care shall be taken to avoid disturbing hydroseeded areas.
3. Temporary automated sprinkling systems are not required for hydroseed installations. Sprinkler systems may be installed at Contractor's option.
4. Hydroseeding shall be performed in compliance with Section 02728 Hydroseeding.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that prepared soil base has no existing weeds and the site has been graded smooth without depressions, humps, or exposed rocks.

#### **3.2 PREPARATION-TOPSOIL**

- A. Prepare sub-grade in accordance with Section 02116.
- B. Prior to placing topsoil there shall not be any actively growing weeds. If active weeds are present Contractor shall remove the weeds by grubbing the site. Weed plant material shall be physically removed from the site.
- C. If the site has been allowed to lay dormant for more than two months after rough grading Contractor shall apply a non-selective herbicide to plants growing on the site. After applying herbicide, Contractor shall wait two-three weeks before grubbing the site.
- D. After grubbing and fine grading the site, Contractor shall install a three-inch (3") depth of topsoil on all areas to be hydroseeded or have sod installed.

#### **3.3 IRRIGATION SYSTEM**

- A. Install irrigation systems in accordance with Section 02740.

### **3.4 HYDROSEEDING**

- A. Install hydroseed in accordance with Section 02728.

### **3.5 SOD INSTALLATION**

- A. Install sod per supplier's recommendations.

### **3.6 EROSION CONTROL BLANKET INSTALLATION**

- A. Install Erosion Control Blanket (ECB) per manufacturer's guidelines.
  - 1. ECBs shall be installed in a vertical pattern. ECBs shall be anchored with staples. Adjacent strips shall be abutted or overlapped to allow for a common row of staples to anchor both blankets.
  - 2. Horizontal joints shall be overlapped with adjacent blankets using a common row of staples with the adjoining blanket.
  - 3. Damaged ECB material shall not be installed.

### **3.7 ACCEPTANCE**

- A. Acceptance of restoration shall be based on a site inspection at the three separate site stages defined below. A successful inspection is required at each of the three stages.
  - 1. Germination: Germination is evidenced by plants which are alive and growing.
  - 2. Maturity. Maturity is evidenced by plants which have produced seeds.
  - 3. End of Warranty Period.
- B. Contractor may request a site inspection with ten days' notice to the City.
  - 1. ACCEPTANCE STANDARD
    - a. The Acceptance Standards for a successful inspection are:
      - i. Plants occupy more than 70% of the area.
      - ii. Weeds occupy less than 10% of the area.
      - iii. Bare spots shall not be larger than 3 square feet.
      - iv. No more than 10% of total areas with bare spots larger than 1 square feet.
      - v. No more than 15% of total areas with bare spots larger than six square inches.
    - b. If the inspection is acceptable, the Contractor may proceed to the maintenance period. Contractor may schedule the next inspection when ready.
    - c. If the inspection fails, the Contractor shall address deficiencies at Contractor's cost. Another inspection at this milestone is required.
    - d. To confirm coverage, the City will use site inspections, aerial photography, and drone photography, at its election.

### **3.8 MAINTENANCE REQUIREMENTS FOR NATIVE AREA DURING WARRANTY PERIODS**

- A. Furnish service and maintenance of restored area for one year. During the warranty period the contractor shall provide the following services:

1. Inspect the site at least monthly.
2. Remove weeds as required to achieve the acceptance standard.
3. Remove garbage and litter from the site.
4. Maintain and repair the irrigation system.
  - a. Repair all breaks immediately.
  - b. Perform weekly inspections and make needed adjustments.
  - c. Make seasonal adjustments to controllers as needed.
5. Repair erosion and settling damage.

### **3.9 WARRANTY**

- A. The warranty period will begin when a successful inspection has been achieved at the Maturity stage as defined in paragraph 3.7.
- B. All landscaping will be covered by a warranty for a minimum of one year.
- C. The warranty period will end with a successful site inspection as defined in paragraph 3.7.

**END OF SECTION**



## SECTION 02728

### HYDROSEEDING

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Includes But Not Limited To
  - 1. Furnish and install seeded lawn as described in Contract Documents.
- B. Related City Standard Specification Sections
  - 1. 02116 Fill and Backfill
  - 2. 02727 Restoring Native Area

##### 1.2 QUALITY ASSURANCE

- A. Pre-Installation Meetings - Participate in pre-installation meetings specified in previous sections.
- B. Do not make substitutions. If acceptable seed landscape material is not obtainable, submit to Architect proof of non-availability and proposal for use of equivalent material. When authorized, adjustment of contract amount will be made.

#### PART 2 PRODUCTS

##### 2.1 MATERIALS

- A. Topsoil – Refer to City Standard Specification 02116 Fill and Backfill.
- B. Erosion Control Blanket
  - 1. Use Curlex I Erosion Control Blanket covering all hydroseeded areas.
- C. Seed
  - 1. Provide fresh, clean, new crop seed complying with tolerance for purity and germination established by Official Seed Analysis of North America. Provide proof of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed. Seed blend shall consist of the following:

'Sodar' Streambank Wheatgrass	35%
Crested Wheatgrass	40%
'Covar' Sheep Fescue	20%
'Appar' Lewis Blue Flax	1%
'Lutana' Cicer Milkvetch	1%
Western Yarrow	1%
Rocky Mountain Penstemon	1%
'Californica' California Poppy	1%

2. Purchase seeds from a reputable seed company containing a certification submittal of weight, purity, and germination. Certification submittal date of purchased seeds shall be within 365 days prior to application of seeds.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

#### **A. Protection**

1. Take care and preparation in work to avoid conditions which will create hazards. Post signs or barriers as required.
2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.

#### **B. Surface Preparation**

1. Seven days maximum prior to seeding -
  - a. Loosen area 4 inches deep, dampen thoroughly, and cultivate to properly break up clods and lumps.
  - b. Rake area to remove clods, rocks, weeds, roots, and debris.
  - c. Grade and shape area to receive seed to bring surface to true uniform planes free from irregularities and to provide drainage and proper slope to catch basins.
  - d. After areas have been prepared, take no heavy objects over them except lawn rollers.
  - e. Rake or scarify and cut or fill irregularities that develop as required until area is true and uniform, free from lumps, depressions, and irregularities.

### **3.2 INSTALLATION**

- A. Site Tolerances - Final grade of soil after installing topsoil and hydro-seeding is complete shall be one inch below top of adjacent pavement of any kind.
- B. Install 3" depth of approved topsoil.
- C. One Step Hydro-Seeding – After topsoil is placed and areas are graded, hydro-seed with adequate equipment at time when little or no wind is blowing. Perform operation within the following dates: March 1 to May 1 and October 1 to November 1. Hydro-Seeding shall consist of preparing the seed mixture at a rate of 40 pounds per acre, fertilizer at a minimum rate of 50 pounds per acre, 'silva-fiber' at a rate of fourteen hundred pounds per acre of area. With water, agitate these components into a well mixed slurry substance and spray the mixture, under pressure, onto the prepared area.

- D. After completion of One Step hydro-seeding place erosion control blanket.
1. Before installing erosion control blanket, the seedbed shall be inspected by the Owner's Representative to ensure it has been properly compacted and fine graded to remove any existing rills. It shall be free of obstructions, such as tree roots, projections such as stones, and any other foreign objects. The contractor shall proceed when satisfactory conditions are present, After the area has been properly shaped, seeded, fertilized and compacted, remove the erosion control blanket protective cover. Next, locate the start of the roll, making sure the roll is facing toward the area to be covered, and then roll out the product. The product shall be rolled out flat, even, and smooth without stretching the material then anchored to the sub-grade.
  2. Erosion control blanket to be installed vertically on the slope; however, on short slopes it may be more practical to install horizontally across the width of the application when agreed upon by the Engineer prior to installation. If more than one width is required, simply abut the edges of the vertically installed blankets together and secure them with a common row of staples. Overlapping adjacent sides of erosion control blankets ins not required when installed vertically on slopes. Erosion control blankets shall be trenched at the head of the slope if the blanket cannot be extended three feet over the slope crest or if overland flow is anticipated from upslope areas.

### **3.3 MAINTENANCE**

- A. The contractor shall be responsible for the weeding of hydroseeded areas until accepted by the owner and Architect. The contractor shall be responsible for re-seeding, filling in low areas, repairing or replacing erosion control blanket, etc., as required.

### **3.4 FIELD QUALITY CONTROL**

- A. Inspection
1. Refer to City Standard Specification Section 02727 for Acceptance Standards

### **3.5 ADJUSTING**

- A. Replace damaged areas at no additional cost to Owner.

### **3.6 CLEANING**

- A. Immediately clean up any soil or debris spilled onto pavement and dispose of all deleterious materials.

### **3.7 PROTECTION**

- A. Protect Hydro-seeded areas against traffic or other use immediately after seeding is completed by placing warning signs and barricades.
- B. Provide protection of hydro-seeded areas against trespassing, erosion, and damage of any kind. Remove this protection after seeded areas have been accepted by City Inspector.

**END OF SECTION**

## **SECTION 02752**

### **CHIP SEAL COAT**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Materials and procedures for applying emulsified asphalt, followed with an application of cover material and bituminous fog seal.
- B. Cover materials.

##### **1.2 RELATED SECTIONS**

- A. Section 01300 – Administrative Requirements
- B. Section 01400 – Quality Requirements

##### **1.3 REFERENCES**

- A. ASTM C 88: Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- B. ASTM C 117: Amount of Material Finer than 0.075 mm Sieve in Aggregate.
- C. ASTM C 131: Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- D. ASTM C 136: Sieve Analysis of Fine and Coarse Aggregates.
- E. ASTM C 142: Clay Lumps and Friable Particles in Aggregates.
- F. ASTM D 5: Penetration of Bituminous Materials.
- G. ASTM D 36: Softening Point of Bitumen (Ring-and-Ball Apparatus).
- H. ASTM D 242: Mineral Filler for Bituminous Paving Mixtures.
- I. ASTM D 1664: Coating and Stripping of Bitumen-Aggregate Mixtures.
- J. ASTM D 2170: Kinematic Viscosity of Asphalts (Bitumens).
- K. ASTM D 2419: Sand Equivalent Value of Soils and Fine Aggregate.
- L. ASTM D 3319: Accelerated Polishing of Aggregates Using the British Wheel.
- M. ASTM D 3628: Selection and Use of Emulsified Asphalts.
- N. ASTM D 3740: Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- O. ASTM D 3910: Design, Testing, and Construction of Slurry Seal.
- P. ASTM D 4791: Flat or Elongated Particles in Coarse Aggregate.

- Q. ASTM D 5281: Determining the percentage of Fractured Particles in Coarse Aggregate.
- R. UDOT Standard Specifications (Latest Ed.)

#### **1.4 SUBMITTALS**

- A. See Section 01300 – Administrative Requirements, for submittal procedures.
- B. Mix Design as per Article 2.04.
- C. Laboratory Accreditation as per Article 1.06 B.
- D. Field Quality Control data as per Article 1.05 C and 1.05 D.
- E. Traffic Control Plan as per APWA Section 015526
- F. Asphalt bill of ladings. Identify weight of asphalt, weight of emulsified asphalt (after water has been added) in accordance with Article 1.05 E and 1.05 F.

#### **1.5 FIELD QUALITY CONTROL**

- A. Perform Field Quality Control Sampling and Testing in accordance with the following.
  - 1. Asphalt Emulsion. Lot size is one (1) day production with 1500 SY sublots.
    - a. Perform and Document at least one visual inspection per subplot. Place binder uniformly with no ridging and no bare spots.
    - b. Perform and Document one yield test based on applicator meter readings and field measurements per subplot.
  - 2. Aggregate Gradation. Lot size is one (1) day production with 500 ton sublots. Take and test at least one gradation sample per subplot. ASTM C136.
  - 3. Aggregate Application. Lot size is one (1) day production with 1500 SY sublots.
    - a. Perform and Document at least one visual inspection per subplot. Place aggregate uniformly with no ridging and no bare spots.
    - b. Perform and Document one yield test based on delivery tonnage and field measurements per subplot.
  - 4. Aggregate Embedment. Lot size is one (1) day production with 1500 SY sublots. Perform and document at least one visual inspection per subplot.
    - a. Asphalt See-through: Not more than 15 percent black (asphalt) can be seen through the newly laid and compacted rock chip after sweeping.
    - b. Embedment: After rolling and evaporation, random sampling of at least 5 large particles reveals large particles are embedded in the asphalt binder on their flat side to a depth of 50 percent to 70 percent.
- B. Identify and correct any materials or processes not meeting requirements of this specification.
- C. Submit daily summary of Quality Control efforts to the City within 24 hours of completion of each day's placement.
- D. Submit all documentation verifying asphalt application rates, chip application rates, and other calibration verification for applied materials during the chip seal operations to the to the City within 24 hours of completion of each day's placement.

- E. Provide vendor's bill of lading certifying the emulsion meets the requirements of Article 2.01.
- F. Provide vendor's bill of lading certifying the flush coat material was diluted according to Article 2.02

## **1.6 QUALITY ASSURANCE**

- A. Use a paving crew foreman that has completed at least three (3) projects of similar size and nature.
- B. Use an AMRL accredited laboratory that follows and complies with ASTM D 3740 and APWA Section 01 45 00 requirements.
- C. Do not change source of asphalt emulsion or aggregate until City accepts new source and new mix design.
- D. Reject product that does not meet requirements of this Section.
- E. Remove any product found defective after installation and replace at no additional cost to OWNER.

## **1.7 ACCEPTANCE**

- A. Acceptance is by lot.
- B. Opening chip seal surface to traffic does not constitute acceptance.
- C. Lot will be acceptable if:
  - 1. Average gradation of each sieve for lot is within the Target Grading Band for that sieve, and;
  - 2. Number of samples in lot with any sieve measurement outside of the Target Grading Band does not exceed two (2), and;
  - 3. Material on 200 sieve gradation does not exceed allowable.
  - 4. Chip Seal Emulsion and Flush Coat emulsion Bills of Lading demonstrate conformance.

## **1.8 REGULATORY REQUIREMENTS**

- A. Conform to applicable City requirements for paving work on City streets, Section 01300 – Administrative Requirements.

## **PART 2 PRODUCTS**

### **2.1 CHIP SEAL EMULSIONS**

- A. Use the following Cationic Emulsions according to UDOT Sections 02745 – Asphalt Materials.
  - 1. Posted Speed ≤25mph: CRS-2A
  - 2. Posted Speed ≤45mph: LMCRS-2
  - 3. Posted Speed >45mph: CRS-2P

- B. Use HFRS-2P according to UDOT Section 02745 – Asphalt Materials if source aggregate has demonstrated historic incompatibility with cationic emulsions.

## 2.2 FLUSH COAT

- A. Flush Coat: Homogeneous, Cationic Emulsified Asphalt, Grade CQS-1 or CQS-1h, conforming to Section 32 12 13.13 of the APWA Standard Specifications, diluted two parts concentrate to one part water by the Manufacturer.

## 2.3 COVER MATERIAL

- A. Use crusher processed virgin aggregate consisting of natural stone, gravel, or slag according to Table 1.

Table 1: Chip Seal Cover Material Properties		
Unit Weight	AASHTO T 19	3100 lb/ft, max
One Fractured Face	AASHTO T 335	95% minimum
Two Fractured Faces	AASHTO T 335	90% minimum
LA wear	AASHTO T 96	30% maximum
Soundness	AASHTO T 104	10% maximum
Flats & Elongates (1:3)	ASTM D 4791	10% maximum
Polishing	AASHTO T 278, T 279	31 minimum

### NOTES

Wear of aggregate retained on No. 8 sieve.

Soundness for combined coarse and fine aggregate measured using five (5) cycles.

- B. Meet gradation limits in Table 2. Refer to AASHTO T 27 and T 11.

Table 2: Gradation Limits		
Sieve Size	Percent Passing	
	Type I – ¼"	Type II – ⅜"
½ in	100	100
⅜ in		95-100
¼ in	95-100	0 - 15
No. 8	0 - 3	0 - 3
No. 200	0 - 1.5	0 - 1.5

## 2.4 MIX DESIGN

- A. Mix Design: Provide the following. Allow CITY 10 days to evaluate the submittal.
1. Date of mix design. IF older than 60 days from date of submission, recertify mix design.
  2. Type and grade of asphalt emulsion to be used (if not specified).
  3. Target grading curve for the aggregate used.
  4. Aggregate physical properties (this section Article 2.3). The information is for suitability of source and not for project control. Test results shall not be older than 455 days from the date of submission.
  5. Asphalt and aggregate compatibility documentation.
  6. Initial asphalt and aggregate application rates.

7. Fog seal application rate (if applicable).

## **2.5 BLOTTER MATERIAL**

- A. Blotter material – granular materials meeting Table 3 when testing according to ASTM C136.

<b>Table 3: Granular Materials</b>	
Sieve Size	Percent Passing
No. 4	90 to 100
No. 10	25 to 80
No. 200	0 to 15

## **2.6 TEMPORARY RAISED PAVEMENT MARKERS**

- A. Use Temporary Raised Pavement Markers as manufactured by Davidson Plastics Company.
- B. Markers shall have polyurethane plastic bodies with reflective tape, clear flexible polyvinyl-chloride protective covers, and solid butyl rubber adhesive on bottom surface.
- C. Markers shall be 2-inches high and 4-inches wide; and of the color selected by the City Engineer.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Clean the road surface of all dirt, sand, dust, and other objectionable material to the satisfaction of the City.
- B. Protect all structures including but not limited to guardrail, guideposts, concrete barriers, all drains, and parapet walls.
- C. Cover manholes, valve boxes, drop inlets, and other service utility entrances before placing any chip seal coat.
- D. Protect curb, gutter, and sidewalk from spatter, mar or overcoat.
- E. Protect trees, plants and other ground cover from damage. Prune trees to allow equipment passage underneath. Repair tree damage at no additional cost to OWNER.
- F. Stockpile blotter material at a site within 20 minutes delivery time of each road section being chip sealed. Have application equipment on site before beginning chip seal work.
  1. Stockpiling of blotter material may be waived upon City acceptance if blotter material can be obtained and ready to spread within 20 minutes of a road section being chip sealed.
  2. Equipment to spread blotter material is subject to inspection by the City.
- G. Traffic Control:
  1. Implement the notification and traffic control plan requirements. Do not proceed without certified flaggers.



2. Grind off existing pavement signs and lane striping. Use reflective tables to mark striping location before applying chip seal.
- H. Protect chip seal from traffic until seal has cured. Cure time depends on type of asphalt emulsion and weather.

### **3.2 LIMITATIONS**

- A. Complete all work between May 15, and August 31.
- B. Do not place chip seal coat if surface moisture is present.
- C. Place seal coat when:
1. Pavement temperature is between 70 and 136 degrees F.
  2. Air temperature is between 50 and 110 degrees F.
  3. Forecasted temperature is not expected to be below 40 degrees F within 3 days after placement.
- D. Do not apply any bituminous asphalt after 6:00 p.m. if temperatures in this Section, article 3.2, paragraph C cannot be maintained throughout all night time hours.
- E. Do not open to traffic the same day chip seal coat is placed.
1. Sweep and open to traffic no earlier than 6:00 a.m. the day following placement of cover material.
- F. Apply bituminous flush coat material after receiving acceptance from the City but no earlier than 6 days after application of the cover material.
1. Apply bituminous flush coat material when the air temperature in the shade is 50 degrees F and rising and the pavement temperature is 70 degrees F and rising.
  2. Do not apply bituminous flush coat material during fog, rain, or other adverse conditions.
- G. Allow at least 7 calendar days after completing flush coat before applying permanent pavement markings.

### **3.3 TEMPORARY PAVEMENT MARKINGS**

- A. Prior to placing seal coat, install raised markers to mark striping location.
- B. Install raised markers in accordance with the manufacturer's written instructions and recommendations.
- C. Remove covers immediately after rolling is complete.

### **3.4 EQUIPMENT**

- A. Use distributor trucks according to the following requirements:
1. Tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of the tank contents.

2. Insulated tanks capable of storing the binder at temperatures that allow the binder to remain consistent with the appropriate viscosity for proper application rates
    - a. Use tanks equipped with baffles to prevent pressure surges resulting from the asphalt sloshing in the tank when starting and stopping.
    - b. Use trucks equipped with devices to provide for accurate and rapid correlation and control of the amount of bituminous material being applied with that of the truck or distributor gauges.
  3. Constant volume circulation pumps and heaters to maintain a pressurized system so binder will be uniformly heated.
    - a. Circulation pump must spray a constant volume for the entire length of the spray bar for each application.
  4. Spray bar nozzles designed to provide an appropriate fan width to provide uniform transverse distribution without corrugation or streaking.
    - a. Adjust the spray bar height to provide uniform distribution of binder across the application width and triple lapping of the binder on the pavement surface
    - b. Use a fully circulating spray bar with a positive shutoff valve.
  5. Computerized rate control system allowing the operator to control all distributor operations from the cab to include:
    - a. Pressure regulation of the material application and automatic rate control adjustment to the unit ground speed.
      - i. 1) Hydrostatic system capable of maintaining a tolerance of +/- 0.3 gal/yd<sup>2</sup>
    - b. Spray bar height and width adjustment and shut off of individual spray bar sections.
- B. Use a self-propelled aggregate (chip) spreader specifically designed and manufactured for chip seal operations, equipped with the following:
1. Computerized controls that will apply a uniform, even layer of aggregate across the full width of the binder and adjust output to the unit ground speed.
    - a. Use gates adjustable to drop the correct amount of aggregate +/- 1 lb/yd<sup>2</sup>.
  2. Variable width spreader with hydraulic control extension and adjustable discharge gates.
  3. Spreading hopper with a minimum capacity to cover a full lane of travel plus 1 ft/pass.
  4. Spinner broadcast type of aggregate spreader not allowed.
- C. Use sufficient number of dump trucks to circumvent any interruption in the supply of chips to the spreader.
1. Use tandem axle dump trucks or larger or conveyor discharge trucks to minimize the number of hook-ups.
  2. Use dump trucks with matching hitches and compatible with the aggregate spreader to provide smooth hook-ups and to minimize any spillage when loading the hopper.
  3. Use trucks in good mechanical condition and that do not leak.
    - a. Use truck tires that do not pick up binder or aggregate when driving on the new surface.
- D. Use at least three articulating type pneumatic rollers for rolling operations.

1. Use rollers weighing between 8 tons minimum and 12 tons maximum with a minimum width of 6 ft.
  2. Use rollers with pneumatic tires of equal size diameter and having treads satisfactory to the City.
  3. Inflate tires so that the entire roller width area is compacted by either the rear-axle tires or the front-axle tires.
    - a. Inflate tires to 90 psi, +/- 5 psi.
- E. Sweeping equipment:
1. Use rotary brooms with nylon or steel bristles or pickup or vacuum brooms for pavement cleaning or brooming operations.
    - a. Keep downward pressure to a minimum.
    - b. Use water as requested by the City if excessive dust is generated during sweeping operations.
    - c. Use pickup or vacuum sweepers in urban areas where aggregate accumulates in gutters or where removal is required from the edge of the shoulder.
    - d. Do not dislodge embedded aggregate when brooming chip sealed roadway.
- F. Blotter Material Equipment
1. Apply blotter material using a truck mounted spinner broadcast spreader.
- G. All equipment is subject to inspection by the City.

### **3.5 ASPHALT MATERIAL/COVER MATERIAL APPLICATION**

- A. Apply asphalt material at a rate sufficient to obtain 50 percent chip embedment before the rolling operation and 70 percent chip embedment after rolling operation.
1. Adjust application rates throughout the project depending on existing conditions.
- B. Apply the asphalt emulsion at a minimum temperature of 145 degrees F.
- C. Do not apply asphalt material if material does not spray through the distributor in a uniform way and remain in place on the roadway.
- D. Place building paper adjacent to the transverse construction joint before starting each spraying operation.
1. Maintain the control valve to act instantaneously both at start-up and cut-off.
- E. Locate longitudinal joints within 6 inches of the traffic lane line location.
1. Construct meet lines with no skip or voids between adjacent passes.
  2. Do not place a double thickness of cover material.
- F. Calibrate the spreader at the beginning of each day and as often as necessary to comply with Table 4.
- G. Apply the aggregate within +1 to -2 pounds per square yard of mix design:

1. Use a damp chip but not saturated. (Note: If water can be seen running out of the haul truck, the chips are too wet).
2. For polymer and latex modified emulsions, apply chips immediately.
3. For other emulsions, maintain a distance of not more than 100 feet between distributor and chip spreader.
4. Maintain the chip spreader speed so that chips do not bounce or roll during application.
5. Spread larger aggregate first.
6. Hand broom cover material if necessary to distribute aggregate uniformly over the pavement surface.

<b>Table 4: Approximate Spread Rates</b>	
Unit Weight lbs/ft <sup>3</sup>	Application Rate lbs/yd <sup>2</sup>
60 – 65	17
65 – 70	18.4
70 -75	19.8
75 – 80	20.7
80 – 85	22.1
85 – 90	23.5
90 – 95	24.9
95 – 100	25.8

### **3.6 SURFACE ROLLING**

- A. Use at least three pneumatic-tire rollers in a longitudinal direction to roll surface after the cover material has been spread.
- B. Roll at least three passes to seat the cover material.
  1. A pass is defined as traveling in one direction only.
- C. Control bleeding with blotter material.
- D. Set the roller speed to prevent bounding or skidding. Do not exceed 5 mph.
  1. Reduce roller speeds during directional changes to prevent surface tearing.
- E. Synchronize the speed of the distributor and chip spreader with that of the rolling operation.
  1. Begin initial rolling, consisting of one complete coverage, immediately behind the chip spreader.
  2. Begin secondary rolling, consisting of second and third coverage, immediately after completing initial rolling.
  3. Synchronize all operations to keep rolling operations within 2,500 feet of the ongoing chip seal application.
- F. Sweep excess cover material off the roadway after the emulsion has set.

1. Remove excess cover material to the satisfaction of the City before opening the roadway to traffic.
- G. Repair all damage to the seal coat before opening the roadway to traffic.

### **3.7 BITUMINIOUS FLUSH COAT APPLICATION**

- A. Clean the surface of all dirt, sand, dust, loose chips, and other objectionable material to the satisfaction of the City before applying bituminous flush coat.
- B. Apply the bituminous flush coat at a rate of 0.11,  $\pm$  0.01 gal/yd<sup>2</sup>.
  1. Keep traffic off the flushed surface until the bituminous material has set sufficiently to prevent tracking or pick-up.

### **3.8 REPAIR**

- A. Remove spatter or mar from curb, gutter and sidewalk at no additional cost to OWNER.
- B. Remove chip seal from street fixtures.
- C. Remove any product found defective after installation and replace at no additional cost to OWNER.
- D. Fill any joints or cracks that are not covered by chip seal coat. Leave no streaks, holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying Pavement.
- E. Repair collateral damage caused by construction.

**END OF SECTION**

## **SECTION 02821**

### **VINYL FENCING**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes: PVC Fencing and Gates
- B. Related Sections: Section(s) related to this section include:
  - 1. Division 3: Concrete
  - 2. Division 2: Site Construction
    - a. 02300- Earthwork

##### **1.2 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM D256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
  - 2. ASTM D 638 Standard Test Method for Tensile Properties of Plastics.
  - 3. ASTM D 648 Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
  - 4. ASTM D792 Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
  - 5. ASTM D790 Standard Test Method for Flexural Properties of Unreinforced and Reinforce Plastics and Electrical Insulating Materials.
  - 6. ASTM D4216 Standard Specification for Rigid Poly Vinyl Chloride (PVC) and Related PVC and Chlorinated Poly Vinyl Chloride (CPVC) Building Products and Compounds.
  - 7. ASTM F694 Standard Specification for Rigid Poly Vinyl Chloride (PVC) Exterior Profiles Used For Fencing.

##### **1.3 DEFINITIONS**

- A. Posts: Vertical structure support members of the fence/gate system.
- B. Rails: Horizontal structural support members of the fence/gate system.
- C. Pickets: Vertical members between the bottom and top rails.
- D. Aluminum Channel: Structural supports inside rails.
- E. Galvanized Steel Channel: Structural support inside rails.

##### **1.4 SYSTEM DESCRIPTION**

- A. The contractor shall provide a complete PVC fencing/gate system of the design, style and strength defined herein. Fencing and gate components are comprised of Section 02821 profiles made of extruded, rigid polyvinylchloride (PVC). This PVC material is specially

formulated for outdoor use with superior color hold and impact resistant properties after extended outdoor exposure. The system shall include all posts, rails, pickets, caps, metal inserts, and accessory items necessary to complete the installation.

## **1.5 SUBMITTALS**

- A. General: Submit listed submittals in accordance with Conditions of the Contract.
- B. Product Data: Submit product data for specified products.
- C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, and finish colors. Include details showing fabrication and installation of rails and pickets, including plans, elevations, sections, details of components, and attachments to other units of work, if required.
- D. Samples: Submit selection and verification samples for finishes, colors, and profiles if requested.
- E. Quality Assurance Submittals: Submit the following:
  - 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties. Include copies of selected test reports by independent laboratories verifying the compliance of fencing components and systems with applicable building codes upon request.
  - 2. Compliance Reports: Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction. Provide evidence that the polyvinyl chloride fencing systems are in compliance with applicable building code in effect for the project.
  - 3. Certificates: Product certificates signed by the manufacturer certifying that materials comply with specified performance characteristics and criteria and physical requirements.
- F. Closeout Submittals: Submit the following:
  - 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals Section 02821 includes methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
  - 2. Warranty: Warranty documents specified herein.

## **1.6 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Polyvinyl Chloride Fencing Fabricator/Installer Qualifications: Engage a licensed fabricator to ensure successful completion of project.
  - 2. Ensure consistent quality standards of PVC fence accessories, fittings and fasteners are maintained throughout the project.
  - 3. Manufacturer Qualifications: Manufacturer should be capable of providing field service representation during construction and should be capable of approving acceptable installer and application methods.

## **1.7 DELIVERY, STORAGE & HANDLING**

- A. General: Comply with Division 1 Product Requirements Sections.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and Protection: Store materials protected from exposure to material handling damage and accumulation of dirt and grime, at temperature and humidity conditions recommended by manufacturer. Handle and store product according to recommendations. Store in original packaging whenever possible until components are required on the project.

## **1.8 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
- B. Project Warranty: Refer to Conditions of the Contract for project warranty provisions used with their permission. The manufacturer is responsible for technical accuracy.
- C. Manufacturer's Warranty: Submit, for City's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights City may have under Contract Documents.

## **PART 2 PRODUCTS**

### **2.1 PVC FENCING & GATE SYSTEMS**

- A. Manufacturer: Vinyl products are manufactured from 100% new vinyl. The base ingredient is rigid PVC (polyvinyl chloride) homopolymer compound with a high level of titanium dioxide pigment for long-term UV resistance and impact modifiers for strength. The formulation is similar to that of vinyl siding and windows, which have more than 20 years of proven long-term durability and structural integrity.
  - 1. Post Profile Types and Sizes: As indicated on detail.
  - 2. Rails Profile Types and Sizes: As indicated on detail.
  - 3. Pickets Profile Types and Sizes: As indicated on detail.
  - 4. Caps Profile Types and Sizes: As indicated on detail.
  - 5. Finishes: Smooth, soft gloss.
  - 6. Colors: Titanium dioxide is the main ultraviolet light inhibitor in the PVC material used to manufacture these products. Since it is a white pigment, dark colors are not practical or possible. Decorative cap rails are available with a selection of architectural accent colors in high performance acrylics.
  - 7. Product System Testing: Provide PVC fencing system that complies with the following physical and chemical properties:
    - a. ASTM D256 – Izod impact greater than 5 ft-lb/in (2.1 N\*m/m) at 23 degrees C.
    - b. ASTM D638 – Tensile strength 6290 psi (43 MPa).



- c. ASTM D638 – Tensile modulus 430,000 psi (2963 MPa).
- d. ASTM D648 – Deflection temperature 67 degrees C.

## **2.2 PRODUCT SUBSTITUTIONS**

- A. Substitutions: Substitutions of sections or modifications of details, or both, and the reasons therefor shall be submitted for acceptance by the City Engineer.

## **2.3 ACCESSORIES**

- A. PVC Fence System Materials:
  - 1. General: Posts, rails, pickets, post caps, and picket caps shall comply with ASTM D4216, Class 143354311122.
  - 2. Posts: One piece extruded square profile size per detail.
  - 3. Rails: One piece extruded square profile size per detail.
  - 4. Pickets and Panels: One piece extruded profile size per detail.
  - 5. Post Caps Molded: Specify to fit the selected post profile
    - a. Sizes per detail
    - b. Styles per detail
  - 6. Rail Caps Molded: Specify to fit the selected post profile.
    - a. Sizes per detail
    - b. Styles per detail
  - 7. Picket Caps Molded: Specify to fit the selected post profile.
    - a. Sizes per detail
    - b. Styles per detail
  - 8. Gate Components size per detail.
  - 9. Aluminum/Galvanized Steel Reinforcement Insert type and size per detail.
  - 10. Miscellaneous Component type and size per detail.
  - 11. Fasteners per detail.

## **2.4 RELATED MATERIALS**

- A. Related Materials: Refer to other sections listed in Related Sections Paragraph herein for related materials.
- B. Adhesive and Cement:
  - 1. Adhesive: PVC based adhesive with the same UV properties.
  - 2. Products: Subject to compliance with requirements, provide the following:
    - a. “Quik-Crete”

## **2.5 FABRICATION SECTION**

- A. General: Fabricate fencing systems to comply with requirements indicated for design, dimensions, details, finish and member sizes, including wall thickness, but not less than those required to support structural loads.

## **2.6 SOURCE QUALITY**

- A. Source Quality: Obtain PVC fencing system products.

## **PART 3 EXECUTION**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- A. Compliance: Comply with product data, including product technical bulletins, product catalog installation instructions, product carton instructions for installation, or design/detail drawings.

### **3.2 EXAMINATION**

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installing in accordance with that manufacturer's instructions.

### **3.3 PREPARATION**

- A. All new installation shall be laid out by the contractor in accordance with the consultation plans.

### **3.4 INSTALLATION**

- A. Depending upon the style of fence being installed, set fence posts on 8' centers. Posts shall be placed 30" in the ground and set in concrete.
- B. Gate posts and corner posts on all fences and line posts on taller fences shall be reinforced with cement and two No. 4 rebar members. Concrete should not contact rails to allow for expansion.
- C. Place assembled fence sections into position and slide rails into posts. The rails are secured into posts by tabs which are notched into the rails and catch on the inside wall of the posts. Top rails may be further secured with a #8-3/4" screw through the rail, inside the post.
- D. Install gates using bolt-on hardware supplied by the manufacturer.

### **3.5 FIELD QUALITY REQUIREMENTS**

- A. Site tests to be performed during and/or after product installation.
- B. Inspection requirements to be performed after product installation.
  - 1. Site visits: 2 site visit inspections.

### **3.6 CLEANING**

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace products that have installed and are damaged. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and dispose of in a legally acceptable manner.

**END OF SECTION**

## **SECTION 02824**

### **ORNAMENTAL IRON FENCING**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes: Ornamental Iron Fencing
  - 1. Fence framework, panels, and accessories.
  - 2. Anchoring of posts to Concrete Retaining Walls.
- B. Related Sections: Section(s) related to this section include:
  - 1. Division 2: Site Construction
    - a. 02821 - PVC Fencing
  - 2. Division 3: Concrete:
    - a. 03300 - Cast-in-Place Concrete

##### **1.2 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM B117 Practice for Operating Salt-Spray (Fog) Apparatus.
  - 3. ASTM D523 Test Method for Specular Gloss.
  - 4. ASTM D714 Test Method for Evaluating Degree of Blistering in Paint.
  - 5. ASTM D822 Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
  - 6. ASTM D1654 Test method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
  - 7. ASTM D2244 Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
  - 8. ASTM D2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
  - 9. ASTM D3359 Test Method for Measuring Adhesion by Tape Test.
  - 10. 1ASTM F2408 Ornamental Fences Employing Galvanized Steel Tubular Pickets.

##### **1.3 SUBMITTALS**

- A. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.
- B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
- C. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation,

and anchor bolt templates.

- D. Proposed fencing pattern and color.

#### **1.4 PROTECT RECORD DOCUMENTS**

- A. Accurately record actual locations of property perimeter posts relative to property lines.

#### **1.5 QUALITY ASSURANCE**

- A. Contractor shall provide laborers and supervisors who are thoroughly familiar with the type of constructions involved and materials and techniques specified.

#### **1.6 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing the products specified in this Sections with minimum five years' experience.

#### **1.7 PRODUCT HANDLING AND STORAGE**

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

#### **1.8 QUALIFICATIONS**

- A. All structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 20 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.
- B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufactures warranty shall be guaranteed for five (5) years from date of original purchase.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL**

- A. Fencing shall be 6-foot ornamental iron fencing.
- B. Fencing shall be Ameristar E-Coated Rakeable fencing.

#### **2.2 FABRICATION**

- A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.
- B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by Ameristar's proprietary fusion welding process, thus completing the rigid panel assembly (Note: The process produces a virtually seamless, spatter-free-good-neighbor appearance, equally attractive from either side of the panel).

- C. The manufactured panels and posts shall be subjected to an inline electrode position coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be black. The coated panels and posts shall be capable of meeting the performance requirements in the ASTM F2408 standard.
- D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.

## **2.3 FITTINGS AND HARDWARE**

- A. Use manufacturer recommended fittings and hardware.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Drill holes into concrete retaining wall to provide anchoring location.
- B. All new installation shall be laid out by the contractor in accordance with the construction plans.
- C. Anchor posts into concrete wall with manufacturer recommended bolting system.

### **3.2 FENCE INSTALLATION**

- A. Fence posts shall be spaced 3-3/4" on center, plus or minus 1/2". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer.

### **3.3 FENCE INSTALLATION MAINTENANCE**

- A. When cutting/drilling rails or posts, adhere to the following steps to seal the exposed steel surfaces:
  - 1. Remove all metal shaving from cut area.
  - 2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry.
  - 3. Apply 2 coats of custom finish paint matching fence color.
- B. Failure to seal exposed surfaces per steps 1-3 above will negate warranty.
- C. Manufacturer recommended spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that pain pens be used to prevent overspray.

**END OF SECTION**

## **SECTION 02828**

### **MISCELLANEOUS EQUIPMENT FOR PLAYGROUNDS AND OTHER AREAS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Acceptable equipment and materials for playgrounds, open space areas and miscellaneous other areas.

##### **1.2 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on equipment, materials, and appurtenant items.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of installed equipment, materials and appurtenant items. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

##### **1.3 QUALITY ASSURANCE**

- A. Perform Work in accordance with City's requirements as described herein.

##### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store all equipment, materials and appurtenant items in shipping containers with labeling in place.

##### **1.5 OPERATING AND MAINTENANCE DATA**

- A. Provide instructions covering full operation, care and maintenance of system and controls; and manufacturer's parts catalog.
- B. Instruct City's designated maintenance personnel in the proper maintenance of all equipment, materials, and appurtenant items.
- C. Submit 3 copies of written instructions recommending procedures to be established by the City Engineer for the maintenance of the equipment, materials and appurtenant items from year to year.
  - 1. Submit prior to expiration of required one year guarantee period.
  - 2. Provide information in the manuals that include the following:
    - a. Written index near front of Manual listing location in the Manual of all emergency data regarding the installations;
    - b. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name and address of the nearest vendor of replacement parts; and
    - c. Copy of all guarantees and warranties issued on the installation showing all dates of expiration.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. All equipment, materials, and appurtenant items shall be as manufactured accepted by the City Engineer.
- B. All equipment, materials and appurtenant items shall be inspected and accepted by the City prior to installation.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. The Contractor shall furnish all labor, materials and equipment as required to install the equipment, materials and appurtenant items for playgrounds, open space areas, and other miscellaneous areas, as described herein and as shown on the design drawings, as indicated on the submittal drawings; and shall furnish and install all supplementary and miscellaneous items, appurtenances, and devices incidental to or necessary for completion of the installations.
- B. All material shall be installed according to the manufacturer's written instructions and recommendations.
- C. The Contractor shall test the installations to assure proper operation.
- D. All playground equipment shall be installed by personnel certified by manufacture.

### **3.2 EXAMINATION**

- A. Verify that design drawings conform to project conditions.

### **3.3 ELECTRICAL WORK**

- A. All required electrical work shall be done as specified in Division 5.

### **3.4 FIELD QUALITY CONTROL**

- A. A third party certified playground safety inspector (CPSI) shall perform a field inspection and testing in accordance with Section 01400.
- B. The third party audit shall be submitted to the city in accordance with section 01400.
- C. If tests indicate that installations do not meet specified requirements, remove installations, replace and retest at no cost to City.

### **3.5 OPERATIONAL TESTING**

- A. Where required, provide the City Engineer or City Inspector with seven days written notice of operational tests.
- B. After all repairs or replacements have been made and accepted by the City Engineer or City Inspector, repeat the required tests.

**END OF SECTION**

## **DIVISION 03**

## **CONCRETE**



## **SECTION 03300**

### **CAST-IN-PLACE CONCRETE**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Concrete form work.
- B. Floors and slabs on grade.
- C. Concrete foundation walls and vaults.
- D. Concrete reinforcement.
- E. Joint devices associated with concrete work.
- F. Miscellaneous concrete elements, including equipment pads, thrust blocks, manholes, and other miscellaneous items.
- G. Concrete curing.

##### **1.2 REFERENCES**

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International.
- B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International.
- D. ACI 305R - Hot Weather Concreting; American Concrete Institute International.
- E. ACI 306R - Cold Weather Concreting; American Concrete Institute International.
- F. ACI 308 - Standard Practice for Curing Concrete; American Concrete Institute International.
- G. ACI 309R - Guide for Consolidation of Concrete; American Concrete Institute.
- H. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; American Concrete Institute International.
- I. ACI 347 - Guide to Form work for Concrete; American Concrete Institute.
- J. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
- K. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- L. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

- M. ASTM C 33 - Standard Specification for Concrete Aggregates.
- N. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- O. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.
- P. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
- Q. ASTM C 150 - Standard Specification for Portland Cement.
- R. ASTM C 171 - Standard Specification for Sheet Materials for Curing Concrete.
- S. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- T. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.
- U. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- V. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.
- W. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
- X. ASTM C 881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- Y. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- Z. ASTM C 1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
- AA. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- BB. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- CC. COE CRD-C 572 - Corps of Engineers Specifications for Polyvinylchloride Waterstop; Corps of Engineers.
- DD. Use the latest issue of the above reference standards as of the date of the Project.

### **1.3 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data & Mix Designs: Submit manufacturers' data on manufactured products and mixes.
- C. Samples: Submit one, four inch long sample of waterstops and construction joint devices.
- D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.

- E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

#### **1.4 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Acquire cement from same source and aggregate from same source for entire project.
- C. Follow recommendations of ACI 305R when concreting during hot weather.
- D. Follow recommendations of ACI 306R when concreting during cold weather.

### **PART 2 PRODUCTS**

#### **2.1 FORM WORK**

- A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
  - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
  - 2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
  - 3. Form Ties: Snap-Off type that will leave no metal within 1-1/2 inches of concrete surface. Use of tie wire as form ties will not be permitted.

#### **2.2 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).
  - 1. Deformed billet-steel bars.
  - 2. Unfinished.
- B. Welded Steel Wire Fabric: ASTM A 185, plain type.
  - 1. Coiled Rolls or flat sheets.
  - 2. Mesh Size and Wire Gage: As indicated on drawings.
- C. Reinforcement Accessories:
  - 1. Tie Wire: Annealed, minimum 16 gage.
  - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
  - 3. Provide galvanized or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

#### **2.3 CONCRETE MATERIALS**

- A. Cement: ASTM C 150, Type IIA - Air Entraining Portland type.
- B. Cement: ASTM C 150, Type V - Sulfate Resistant Portland type when exposed to sewage.

- C. Fine and Coarse Aggregates: ASTM C 33.
- D. Fly Ash: ASTM C 618, Class F.
- E. Calcined Pozzolan: ASTM C 618, Class N.
- F. Water: Clean and not detrimental to concrete.
- G. Synthetic Fiber Reinforcement: Comply with ASTM C 1116; 1/2 inch length.

## **2.4 ADMIXTURES**

- A. Air Entrainment Admixture: ASTM C 260.
- B. Chemical Admixtures: ASTM C 494, Type D - Water Reducing and Retarding.

## **2.5 CONCRETE ACCESSORIES**

- A. Epoxy Bonding System: ASTM C 881, type as required by project conditions.
- B. Non-Shrink Grout: ASTM C 1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
  - 1. Minimum Compressive Strength at 48 Hours: 2,400 psi.
  - 2. Minimum Compressive Strength at 28 Days: 7,000 psi.
- C. Moisture-Retaining Cover: ASTM C 171; clear polyethylene or white burlap-polyethylene sheet.
- D. Liquid Curing Compound: ASTM C 309, Type 1, with white pigment.

## **2.6 JOINT DEVICES AND MATERIALS**

- A. Waterstops: PVC type, COE CRD-C 572.
- B. Joint Filler: ASTM D 1751; use full depth, Asphalt impregnated fiberboard or felt, 1/2 inch thick; tongue and groove profile.
- C. Hydrophilic Waterstops: DuraJoint Expand-Tite EXP 100, as manufactured by Four Seasons Construction Products, Inc.; of the recommended type and size.
  - 1. Primer: as recommended by the manufacturer.

## **2.7 CONCRETE MIX DESIGN**

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Admixtures: Add accepted admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- C. Fibrous Reinforcement: Where indicated, add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.
- D. Normal Weight Concrete:

1. Compressive Strength, per ASTM C 39 at 28 days: 4,000 psi.
2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
4. Cement Content: Minimum 592.2 pound per cubic yard; 6.3 bag mix.
5. Water-Cement Ratio: Maximum 48 percent by weight.
6. Total Air Content: 4 to 8 percent for concrete exposed to freezing and thawing; and 2 to 4 percent for other concrete; per ASTM C 173.
7. Maximum Slump: 4 to 2 inches for structures; 3 to 1 1/2 inches for blocks and pavement.
8. Maximum Aggregate Size: one inch.

## **2.8 MIXING**

- A. Transit Mixers: Comply with ASTM C 94.
- B. During hot weather or under other conditions contributing to rapid setting of concrete, mixing times will be reduced as follows:
  1. When air temperature is between 85 and 90 degrees (F), reduce mixing time and delivery time from 90 minutes to 75 minutes.
  2. When air temperature is above 90 degrees (F), reduce mixing time and delivery time to 60 minutes.
- C. Provide batch ticket for each batch used in the work. Ticket shall indicate project identification name and number, date, mix type, mix time, quantity, and amount of water added.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

### **3.2 PREPARATION**

- A. Form work: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Forms shall be full depth, mortar tight, properly aligned, as indicated, to produce concrete surfaces meeting the surface requirements specified herein.
- C. Forms shall be constructed so they can be removed without hammering on or prying against concrete, and without damaging concrete in any way.
- D. Verify that forms are clean before applying release agent.
- E. Coordinate placement of joint devices with erection of concrete form work and placement of form accessories.
- F. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- G. In locations where new concrete is doweled to existing work, drill holes in existing concrete,

fill holes with epoxy bonding agent, and insert steel dowels.

- H. The City Inspector's review of form work will not relieve the Contractor from any responsibility as to the adequacy of the form work, shoring and bracing design. All form work installed by the Contractor shall be solely at their risk. The City Inspector's review will not lessen or diminish the Contractor's liability.
- I. Alignment and Tolerances. Form work shall be designed and constructed so that concrete surfaces of finished structures will comply with the tolerances specified in ACI 347; and will conform to the following:
  - 1. Vertical Alignment: maximum allowable variation, from bottom to top of a wall, is plus or minus 3/8 inch.
  - 2. Plumb: maximum allowable variations as follows:
    - a. In plumb and surfaces of columns and walls is plus or minus 1/4 inch in any 10-feet of length; and a maximum of one-inch for entire length.
    - b. In plumb for exposed corner, control-joint grooves, or other conspicuous lines is plus or minus 1/4 inch in any 20-feet of length; and a maximum of 1/2-inch for the entire length.
  - 3. Wall Thickness: shall not vary more than minus 1/8 inch or plus 1/2 inch.
  - 4. Level or Grade: maximum variation from level or grade indicated shall not exceed plus or minus 1/4 inch in any 10-feet of length; or plus or minus 3/8-inch in any 20-feet of length.
  - 5. Distance: maximum variation in distance between walls, columns, or other members shall not exceed plus or minus 1/4 inch in any 10-feet of length; and not more than one-inch total variation.

### **3.3 INSTALLING REINFORCEMENT**

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Install wire fabric in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

### **3.4 PLACING CONCRETE**

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify City Inspector not less than 24 hours prior to commencement of placement operations. No concrete shall be placed until all form work, construction joints, reinforcing steel, and other items have been completed.
- D. Before placing concrete, inspect and complete form work installations, reinforcing steel placement, and items to be embedded or cast-in.
- E. Notify other crafts involved in ample time to permit installation of their work; cooperate with other trades in setting such work

- F. All dirt, chips, sawdust, debris, mud, water and other foreign matter shall be removed from within forms or within excavated areas adjacent to forms before any concrete is placed.
- G. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- H. Separate slabs on grade from vertical surfaces with 1/4 inch thick joint filler.
- I. Install joint devices in accordance with manufacturer's instructions.
- J. Concrete shall be conveyed from mixer to forms as rapidly as possible within specified time limits; and by methods that will prevent segregation of concrete mix.
- K. Concrete shall be placed within 15 minutes after it has been discharged from mixer.
- L. Provide adequate equipment and labor for conveying concrete to ensure a continuous flow of concrete at delivery point.
- M. Concrete shall be deposited as close as possible to its final position in the forms; there shall be no vertical drop greater than 8 feet, except where suitable equipment is provided to prevent segregation of concrete and where specifically authorized.
- N. Deposit concrete so that it will be effectively consolidated in horizontal layers not more than 12 inches thick; except that all slabs shall be placed in single layer.
- O. Where placement consists of several layers, place each layer while the preceding layer is still plastic to avoid cold joints, and within 30 minutes after placement of preceding layer.
- P. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- Q. Place concrete continuously between predetermined expansion, control, and construction joints.
- R. Do not interrupt successive placement; do not permit cold joints to occur.
- S. Do not use concrete which becomes non-plastic or unworkable, does not meet the required quality control limits, or which has become contaminated by foreign materials. Do not use re-tempered concrete. Remove rejects concrete from the project site and dispose of in a legally acceptable manner.
- T. Place floor slabs in checkerboard or saw cut pattern indicated.
- U. Saw cut joints within 24 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- V. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft.
- W. Concrete shall not be placed in water; nor shall water be allowed to rise over freshly placed concrete until the concrete has set sufficiently to prevent its being damaged thereby.

### **3.5 CONSOLIDATING**

- A. Consolidate each layer of concrete immediately after placement with internal vibrators in

accordance with ACI 309, except for slabs 4 inches thick or less.

- B. Vibrators shall be inserted vertically at uniform spacing over entire area of placement; spacing to be approximately 1-1/2 times radius of action of vibrator. Vibrators shall penetrate rapidly to bottom of layer being placed, and at least 6 inches into the preceding layer.
- C. Vibrators shall be supplemented by hand spading adjacent to forms on exposed surfaces. Concrete shall be compacted and well worked into all corners and angles in forms, and around reinforcement and embedded items.

### **3.6 FORM REMOVAL**

- A. Forms shall be removed in a manner that will prevent damage to concrete and ensure complete safety of the structure.
- B. Forms shall not be removed until inspected and accepted by the City Inspector.
- C. Form work for columns, walls and other members not supporting weight of concrete may be removed when concrete has attained sufficient strength to resist damage from removal operation; but not before at least 48 hours after concrete placement.
- D. Form work for columns, walls, roof slabs, and other members supporting weight of concrete may not be removed until concrete has attained sufficient strength to carry imposed loads as determined by compression tests, and not until inspected and accepted by the City Inspector.

### **3.7 CONCRETE FINISHING**

- A. Repair and patch surface defects, including tie holes, on all surfaces immediately after removing form work.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
  - 1. Smooth Rubbed Finish: Wet concrete and rub with Carborundum brick or other abrasive, not more than 24 hours after form removal.
  - 2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
  - 1. Wood float surfaces that will receive trowel finish or other finishes, as indicated.
  - 2. Steel trowel surfaces that will be left exposed.
  - 3. Broom finish exterior concrete to provide non-slip finish.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:50 nominal.
- F. All exposed edges to be chamfered; 3/4 inches minimum.



### **3.8 CURING AND PROTECTION**

- A. Comply with requirements of ACI 308 and immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
  - 1. Normal concrete: Not less than 7 days.
- C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
- D. Surfaces Not in Contact with Forms:
  - 1. Start initial curing as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-fog spray, saturated burlap, or other accepted method.
  - 2. Begin final curing after initial curing but before surface is dry.
    - a. Moisture-retaining cover: Seal in place with waterproof tape or adhesive.
    - b. Curing compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

### **3.9 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01400.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design to engineer and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- E. Compressive Strength Tests: ASTM C 39. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cu yd or less of concrete placed.
- F. Take two additional test cylinders during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each load at point of discharge; and perform slump test with each set of test cylinders taken.
  - 1. If maximum slump for the application is exceeded, it will be assumed that the water content is excessive and the load shall be rejected.
  - 2. If slump is less than the minimum for the application, a measured quantity of water may be added to the mix; quantity shall not exceed 1/6 gallon of water per bag of cement.
  - 3. Water shall be added only in the presence of the City Inspector and after a slump test has been made.

4. If concrete has been mixed for more than one hour, the loss of slump shall be considered as being caused by setting of concrete; water shall not be added, and the load shall be rejected.
- H. Perform test to determine air content in accordance with ASTM C 231; a minimum of one test shall be done each time a slump test is made. Air content shall be within specified limits.

### **3.10 DEFECTIVE CONCRETE**

- A. Test Results: The testing agency shall report test results in writing to City Engineer and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the City Engineer or Inspector. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of City Engineer or Inspector for each individual area.

### **3.11 SCHEDULE - CONCRETE TYPES AND FINISHES**

- A. Structure Not Exposed to View: 4,000 psi 28 day concrete; form finish surface, with honeycomb and holes filled and repaired.
- B. Exposed Structures: 4,000 psi 28 day concrete; air entrained, smooth rubbed finish.

**END OF SECTION**

## **DIVISION 04**

### **FINISHES**

## **SECTION 04900**

### **PAINTS AND COATINGS**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints, stains, varnishes, and other coatings.
- C. Painting materials and methods for conduit identification specified in Section 16075.
- D. See Schedule - Surfaces to be finished, at end of section.

##### **1.2 REFERENCES**

- A. ASTM D 16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D 4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood- Base Materials.
- C. NPCA (US) - Guide to U.S. Government Paint Specifications; National Paint & Coatings Association.
- D. SSPC (PM1) - Steel Structures Painting Manual, Vol. 1, Good Painting Practice; Society for Protective Coatings.
- E. SSPC (PM2) - Steel Structures Painting Manual, Vol. 2, Systems and Specifications; Society for Protective Coatings.
- F. Use the latest issue of the above reference standards as of the date of the Project.

##### **1.3 DEFINITIONS**

- A. Conform to ASTM D 16 for interpretation of terms used in this section.

##### **1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on all finishing products.
- C. Samples: Submit one paper chip samples, 2 x 2 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

## **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years' experience.

## **1.6 REGULATORY REQUIREMENTS**

- A. Conform to applicable International Fire and Building Codes for flame and smoke rating requirements for products and finishes.

## **1.7 DELIVERY, STORAGE, AND PROTECTION**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

## **1.8 ENVIRONMENTAL REQUIREMENTS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

# **PART 2 PRODUCTS**

## **2.1 MANUFACTURERS**

- A. Paints:
  - 1. Benjamin Moore & Co.
  - 2. Sherwin-Williams Co.
- B. Substitutions: See Section 01600 - Product Requirements.

## **2.2 PAINTS AND COATINGS - GENERAL**

- A. Paints and Coatings: Ready mixed, except field-catalyzed coatings. Prepare pigments:
  - 1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.

2. For good flow and brushing properties.
  3. Capable of drying or curing free of streaks or sags.
- B. Colors to be selected by the Owner from the manufacturer's standard colors and shall be accepted by the City Planner.

## **2.3 PAINT SYSTEMS - EXTERIOR**

- A. Paint WE-OP-3A - Wood, Opaque, Latex, 3 Coat:
1. One coat of latex primer sealer.
  2. Semi-gloss: Two coats of latex enamel.
- B. Paint ME-OP-3A - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.
  2. Semi-gloss: Two coats of latex enamel.
- C. Paint ME-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.
  2. Semi-gloss: Two coats of latex enamel.
- D. Paint ME-OP-2A - Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with zinc chromate primer.
  2. Semi-gloss: Two coats of latex enamel.
- E. Paint ME-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with zinc chromate primer.
  2. Semi-gloss: Two coats of latex enamel.
- F. Paint MgE-OP-3A - Galvanized Metals, Latex, 3 Coat:
1. One coat galvanize primer.
  2. Semi-gloss: Two coats of latex enamel.
- G. Paint MgE-OP-3L - Galvanized Metals, Latex, 3 Coat:
1. One coat galvanize primer.
  2. Semi-gloss: Two coats of latex enamel.

## **2.4 PAINT SYSTEMS - INTERIOR**

- A. Paint WI-OP-3A - Wood, Opaque, Latex, 3 Coat:
1. One coat latex primer sealer.
  2. Semi-gloss: Two coats of latex enamel.

- B. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:
  - 1. One coat of latex primer sealer.
  - 2. Semi-gloss: Two coats of latex enamel.
- C. Paint CI-OP-3A - Concrete/Masonry, Opaque, Latex, 3 Coat:
  - 1. One coat of block filler.
  - 2. Semi-gloss: Two coats of latex enamel.
- D. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:
  - 1. One coat of block filler.
  - 2. Semi-gloss: Two coats of latex enamel.
- E. Paint MI-OP-3A - Ferrous Metals, Unprimed, Latex, 3 Coat:
  - 1. One coat of latex primer.
  - 2. Semi-gloss: Two coats of latex enamel.
- F. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
  - 1. One coat of latex primer.
  - 2. Semi-gloss: Two coats of latex enamel.
- G. Paint Mgl-OP-3A - Galvanized Metals, Latex, 3 Coat:
  - 1. One coat galvanize primer.
  - 2. Semi-gloss: Two coats of latex enamel.
- H. Paint Mgl-OP-3L - Galvanized Metals, Latex, 3 Coat:
  - 1. One coat galvanize primer.
  - 2. Semi-gloss: Two coats of latex enamel.
- I. Paint CI-OP-3Af - Concrete/Masonry, Latex Floor Enamel, 3 Coat:
  - 1. One coat of alkali resistant primer.
  - 2. Gloss: Two coats of latex floor enamel.
- J. Paint CI-OP-3E - Concrete/Masonry, Epoxy Enamel, 3 Coat:
  - 1. One coat of catalyzed epoxy primer.
  - 2. Gloss: Two coats of catalyzed epoxy enamel.
- K. Paint GI-OP-3A - Gypsum Board/Plaster, Latex, 3 Coat:
  - 1. One coat of latex primer sealer.
  - 2. Semi-gloss: Two coats of latex enamel.

- L. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
  - 1. One coat of latex primer sealer.
  - 2. Semi-gloss: Two coats of latex enamel.
- M. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:
  - 1. One coat of latex primer sealer.
  - 2. Semi-gloss: Two coats of latex-acrylic enamel.

## **2.5 ACCESSORY MATERIALS**

- A. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Plaster and Gypsum Wallboard: 12 percent.
  - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
  - 3. Interior Wood: 15 percent, measured in accordance with ASTM D 4442.
  - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D 4442.
  - 5. Concrete Floors: 8 percent.

### **3.2 PREPARATION**

- A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.
- C. Marks: Seal with shellac those which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.



- E. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- F. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Concrete Floors to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- I. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- J. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- K. Interior Wood Items to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- L. Exterior Wood to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied. Back prime concealed surfaces before installation.

### **3.3 APPLICATION**

- A. Apply products in accordance with manufacturer's instructions.
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat.
- E. Sand wood surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

### **3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT**

- A. Refer to Section 15075 and Section 16075 for schedule of color coding of equipment, duct work, piping, and conduit.
- B. Paint shop-primed equipment, where indicated.

- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Finish equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color coding scheme indicated.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.5 FIELD QUALITY CONTROL**

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection.
- B. Owner will provide field inspection.

### **3.6 CLEANING**

- A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site. Dispose of any such waste material in a legally acceptable manner.

### **3.7 SCHEDULE - SURFACES TO BE FINISHED**

- A. Do Not Paint or Finish the Following Items:
  - 1. Items fully factory-finished unless specifically noted.
  - 2. Fire rating labels, equipment serial number and capacity labels.
  - 3. Stainless steel items.
- B. Paint the surfaces described below under Schedule - Paint Systems.
- C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
  - 1. Paint all insulated and exposed pipes, conduit, boxes, mechanical equipment, and electrical equipment occurring in finished areas, unless otherwise indicated.
  - 2. Paint shop-primed items occurring in finished areas.
- D. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

### **3.8 SCHEDULE - PAINT SYSTEMS**

- A. Concrete, Concrete Block, Brick Masonry: Finish all surfaces exposed to view, as indicated.
  - 1. Interior: CI-OP-3L, semi-gloss.
- B. Gypsum Board: Finish all surfaces exposed to view.
  - 1. Interior Ceilings and Bulkheads: GI-OP-3L, flat.
  - 2. Interior Walls: GI-OP-3A, semi-gloss.
- C. Wood: Finish all surfaces exposed to view.

1. Exterior trim and frames: WE-OP-3A.
  2. Interior trim and frames: WI-OP-3A, semi-gloss.
- D. Steel Fabrications: Finish all surfaces exposed to view.
1. Exterior: ME-OP-3A, gloss; finish all surfaces, including concealed surfaces, before installation.
  2. Interior: MI-OP-3L, gloss.
- E. Galvanized Steel: Finish all surfaces exposed to view, as indicated.
- F. Shop-Primed Metal Items: Finish all surfaces exposed to view, as indicated.
1. Finish the following items:
    - a. Mechanical equipment.
    - b. Electrical equipment.

**END OF SECTION**

**DIVISION 05**

**ELECTRICAL**

**SECTION 05530**  
**STREET LIGHTING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Street lighting for City streets.

**1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching.

**1.3 REFERENCES**

- A. See appropriate sections of these specifications.

**1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

**1.5 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as meeting their standards for the purpose specified and indicated.

**1.6 COORDINATION**

- A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's installation instructions for equipment furnished under this and other sections.
- B. Determine connection locations and requirements. Lights shall be 120 v. nominal to ground.
- C. Coordinate all work on lighting system with Rocky Mountain Power.
- D. Sequence electrical connections to coordinate with start-up of equipment.

**1.7 LIGHTING REQUIREMENTS**

- A. Light source shall be LED with a color temperature of 3000K.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Street lights, including poles and luminaires, shall be as indicated on the drawings.
  - 1. Manufacturer: HADCO Division of Genlyte Thomas Group L.L.C.
- B. Disconnect Switches: As specified in applicable Sections and in individual equipment sections.
- C. Wiring Devices: As specified in Section 05140.
- D. Wire and Cable: As specified in Section 05123.
- E. Boxes: As specified in Section 05138. Junction box lids to be marked "Saratoga Springs Electric".
- F. Concrete: As specified in Section 03300.
- G. Conduit: As specified in Section 05131.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Private Street Lights:
  - 1. Must be master-metered and
  - 2. Shall not contain any City identification, such as the City logo.
- B. Verify location of street light with Project Engineer.
- C. Verify location and type of power source with Rocky Mountain Power.

### **3.2 INSTALLATION - STREET LIGHTS**

- A. Construct concrete base for light pole; size and type to be according to manufacturer's written instructions and recommendations. Anchor bolts shall be installed according to manufacturer's template.
- B. Install light poles and luminaires, with lamps, in accordance with manufacturer's written instructions and recommendations. Poles shall be plumb and securely attached to the concrete base.
- C. Install an electrical junction box near the base of each light pole.
- D. Install an Electrical junction/fuse ground box four to ten feet from Rocky Mountain Power source, as indicated on drawings and according to the Rocky Mountain Power Streetlight Point of Disconnect Diagram.
- E. Install underground electrical conductors in conduit from electrical junction/fuse ground box (Rocky Mountain Power Street Light point of Disconnect Ground Box) to electrical junction ground box at streetlight pole, as indicated on the drawings. Conductors shall be #6, Copper,

XHHW-2. Trenching shall be done as described in Section 02112. Conduit to be installed with sand bedding and 24-inches of cover. Trenches shall be backfilled and compacted to required densities.

- F. The neutral conductor shall be bonded (as per NFPA 70, 250.4) at the Rocky Mountain Power Street Light Point of Disconnect Ground Box.
- G. Connection to power source will be made by Rocky Mountain Power. The contractor shall leave a 5- foot pig-tail at the Power source to be used for the connection. The contractor shall provide a trench and run the conduit from the electrical junction/fuse ground box (Rocky Mountain Power Street Light point of Disconnect Ground Box) to the source, as required by Rocky Mountain Power.
- H. Make electrical connection to light poles in accordance with equipment manufacturer's instructions and as indicated on the drawings.
- I. All work shall be done in accordance with the National Electrical Code (NEC) and International Building Code (IBC) and, where applicable, with the requirements of Rocky Mountain Power.

### **3.3 FIELD QUALITY CONTROL**

- A. Perform field inspection, testing, and adjusting in accordance with Section 01400.
- B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

### **3.4 ADJUSTING**

- A. Aim and adjust luminaires to provide illumination levels and distribution as recommended by the manufacturer.

### **3.5 CLEANING**

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures.
- C. Clean finishes and repair damage.

### **3.6 OPERATIONAL DEMONSTRATION**

- A. Demonstrate luminaire operation by verifying with City Inspector it's continuous operation for a minimum of 48 hours.

### **3.7 PROTECTION OF FINISHED WORK**

- A. Re-lamp luminaires which have failed lamps at Substantial Completion.

**END OF SECTION**

**SECTION 05540**  
**OUTDOOR LIGHTING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Outdoor lighting

**1.2 RELATED SECTIONS**

- A. Section 02112 - Trenching.

**1.3 REFERENCES**

- A. Illuminating Engineering Society of North America (IESNA) Lighting Handbook.
- B. See appropriate related sections of these specifications.

**1.4 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

**1.5 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as meeting their requirements for the purpose specified and indicated.

**1.6 COORDINATION**

- A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's installation instructions for equipment furnished under this and other sections.
- B. Determine connection locations and requirements.
- C. Coordinate all work on lighting systems with Rocky Mountain Power.
- D. Sequence electrical connections to coordinate with start-up of equipment.

**1.7 LIGHTING REQUIREMENTS AND DESIGN STANDARDS**

- A. The purpose of lighting requirements is to require and set minimum standards for outdoor lighting to:



1. Provide for and control lighting in outdoor public places where public health, safety and welfare are potential concerns.
2. Protect drivers and pedestrians from the glare of non-vehicular light sources.
3. Protect neighbors and the night sky from nuisance glare and light trespass from improperly selected or poorly placed, aimed, applied, maintained or shielded light sources.
4. Promote energy-efficient lighting design and operation.
5. Protect and retain the intended visual character of the various venues of the City.

B. Applicability.

1. Uses that are proposed to operate during hours of darkness where there is public assembly and traverse, including but not limited to the following: residential, commercial, industrial, parking lots, sales lots, recreational and institutional uses, and sign, billboard, architectural and landscape lighting applications.
2. The City may require lighting be incorporated for other uses, applications and locations.
3. The glare-control requirements herein contained apply to lighting in all uses, applications and locations.

C. Definitions.

1. Lighting definitions shall be as described in the IESNA Lighting Handbook. If there is a difference between what is provided for here and the most recent edition of the IESNA Lighting Handbook, the terms found in the most recent edition will prevail. If there is a standard herein that is not contained in the most recent edition of the IESNA Lighting Handbook, the standard herein shall be imposed unless inconsistent with the most recent edition of the IESNA Lighting Handbook
2. The following definitions are selected from the Handbook for ready reference.
  - a. Full Cutoff - attribute of a lighting fixture from which no light is emitted at or above a horizontal plane drawn through the bottom of the fixture, and no more than 10% of the lamp's intensity is emitted at or above an angle 10 degrees below that horizontal plane, at all lateral angles around the fixture.
  - b. Cutoff - attribute of a lighting fixture from which no more than 2.5% of the lamp's intensity is emitted at a horizontal plane drawn through the bottom of the fixture or above, and no more than 10% of the lamp's intensity is emitted at or above an angle 10 degrees below that horizontal plane, at all lateral angles around the fixture.
  - c. Fully Shielded – attribute of a lighting fixture provided with internal and/or external shields and louvers to prevent brightness from lamps, reflectors, refractors and lenses from causing glare at normal viewing angles.
  - d. Glare - excessive brightness in the field of view that causes loss in visual performance or annoyance, so as to jeopardize health, safety or welfare.
  - e. Light Trespass – light emitted by a lighting fixture or installation, which is cast beyond the boundaries of the property on which the lighting installation is sited.

D. Design Criteria.

1. Illumination Levels. Outdoor lighting, as allowed by the City, shall have intensities and uniformities and glare control in accordance with the current recommended practices of the IESNA as contained in the latest edition of the IESNA Lighting Handbook and applicable Recommended Practices, except as may otherwise be required by the City.

- a. The design calculations for outdoor lighting installations shall be in accordance with the Lighting Handbook. This includes, but is not limited to, calculation methods and procedures, photometric classifications, and photometric testing procedures.
  - b. Illuminance selection should be based on the usage of the area to be illuminated, the level of activity, and night-time security requirements.
  - c. Parking Stalls and Sidewalks, footpaths, and grounds around open parking lots shall be illuminated to a minimum of 0.5 fc, with a uniformity ratio of 10:1, the maximum shall not exceed 20 fc.
  - d. Primary ingress and egress trails and walkways in parks and public areas shall be illuminated to a minimum of 0.1 fc, with an average of 1 fc.
  - e. Primary building entrances shall be lit to a minimum of 5 fc.
2. Lighting Fixture Design.
- a. Fixtures shall be of a type and design appropriate to the lighting application and shall conform to Chapter 19.11 of the City Code.
  - b. For the lighting of predominantly horizontal surfaces, such as, but not limited to parking areas, roadways, vehicular and pedestrian passage areas, merchandising and storage areas, automotive-fuel dispensing facilities, automotive sales areas, loading docks, cul-de-sacs, active and passive recreation areas, building entrances, sidewalks, bicycle and pedestrian paths, and site entrances, fixtures shall be aimed straight down and shall meet IESNA full- cutoff criteria.
    - i. Fixtures with an aggregate rated lamp lumen output per fixture that does not exceed the rated output of a standard 60-watt incandescent lamp, i.e., 1,000 lumens, are except from the requirements of this paragraph.
  - c. For the lighting of predominantly non-horizontal surfaces, such as, but not limited to, facades, landscaping, signs, billboards, fountains, displays and statuary, fixtures shall be fully shielded and shall be installed and aimed so as to not project their output into the windows of neighboring residences, adjacent uses, past the object being illuminated, skyward or onto public roadways.
    - i. Fixtures with an aggregate rated lamp lumen output per fixture that does not exceed the rated output of a standard 60-watt incandescent lamp, i.e., 1,000 lumens, are except from the requirements of this paragraph.
  - d. "Barn lights", aka "dusk-to-dawn lights", where visible from other properties, shall not be permitted unless fully shielded.
3. Control of Nuisance and Disabling Glare.
- a. All lighting shall be aimed, located, designed, fitted and maintained so as not to present a hazard to drivers and pedestrians by impairing their ability to safely traverse and so as not to create a nuisance by projecting or reflecting objectionable light onto a neighboring use or property.
  - b. Floodlights and spotlights shall be so shielded, installed and aimed that they do not project their output into the windows of neighboring residences, adjacent uses, past the object being illuminated, skyward or onto a public roadway or pedestrian way.
  - c. Parking facility and vehicular and pedestrian way lighting (except for safety and security applications and all-night business operations), for commercial, industrial and institutional uses shall be automatically extinguished no later than one hour after the close of business or facility operation. When safety or security lighting is proposed for after-hours illumination, it shall not be in excess of thirty-three (33) percent of the number of fixtures required or permitted for illumination during regular business hours.
  - d. Illumination for signs, billboards, building facades and/or surrounding landscapes for decorative, advertising or aesthetic purposes is prohibited between 11:00 p.m.

and dawn, except that such lighting situated on the premises for a commercial establishment may remain illuminated while the establishment is actually open for business, and until one hour after closing.

- e. Vegetation screens shall not be employed to serve as the primary means for controlling glare.
  - i. Glare control shall be achieved primarily through the use of such means as cutoff fixtures, shields and baffles, and appropriate application of fixture mounting height, wattage, aiming angle and fixture placement.
- f. The illumination projected from any property to a residential use shall at no time exceed 0.1 footcandle, measured line-of-sight from any point on the receiving property.
- g. The illumination projected from any property to a non-residential use shall at no time exceed 1.0 footcandle, measured line-of-sight from any point on the receiving property.
- h. Externally illuminated billboards and signs shall be lighted by fixtures mounted at the top of the billboard or sign and aimed downward. The fixtures shall be designed, shielded and aimed to limit the light output onto and not beyond the sign or billboard.
  - i. Except for certain recreational lighting, fixtures meeting IESNA full-cutoff criteria shall not be mounted in excess of twenty (20) feet above finished grade. Fixtures not meeting IESNA full- cutoff criteria shall not be mounted in excess of sixteen (16) feet above finished grade.
- i. The United States flag and the state flag shall be permitted to be illuminated from dusk till dawn. All other flags shall not be illuminated past 11:00 p.m. Flag lighting sources shall not exceed 10,000 lumens per flagpole. The light source shall have a beam spread no greater than necessary to illuminate the flag.
- j. Under-canopy lighting, for such applications as gas/service stations, hotel/theater marquees, fast- food/bank/drugstore drive-ups, shall be accomplished using flat-lens full-cutoff fixtures aimed straight down and shielded in such a manner that the lowest opaque edge of the fixture shall be below the light sources at all lateral angles.
  - i. The average illumination intensity in the area directly below the canopy shall not exceed 20 maintained footcandles and the maximum intensity shall not exceed 40 maintained footcandles.
- k. The use of white strobe lighting for tall structures, such as smokestacks, chimneys, and radio/ communications/television towers is prohibited during hours of darkness, except as specifically required by FAA.

## **1.8 OUTDOOR LIGHTING PLAN SUBMISSION**

- A. For land development applications where site lighting is required and is proposed, lighting plans shall be submitted to the City Engineer for review and acceptance, with the preliminary and final land development plan applications and conditional use applications; and shall contain the following:
  - 1. A plan or plans of the site, complete, with all structures, parking spaces, building entrances, traffic areas(both vehicular and pedestrian), landscaping that might interfere with lighting, and adjacent uses that might be adversely impacted by the lighting.
    - a. The lighting plan shall contain a layout of all proposed fixtures by location, orientation, aiming direction, mounting heights, and types.
    - b. The submission shall include, in addition to proposed area lighting, all other

exterior lighting, such as, architectural, building-entrance, landscape, flag, signs, etc.

2. A 10 ft x 10 ft illuminance grid (point-by-point) plot of maintained horizontal footcandles overlaid on the site plan, plotted out to 0.0 footcandles, which demonstrates compliance with the light trespass, intensity and uniformity requirements as set forth in the Lighting Handbook.
  - a. When the scale of the plan makes a 10 ft x 10 ft grid plot illegible, a larger grid spacing may be used.
3. The lamp lumen ratings and types, maintenance (light-loss) factors and IES file nomenclature used in calculating the illuminance levels.
4. Description of the proposed equipment, including fixture catalog cuts, photometrics, glare reduction devices, lamps, on/off control devices, mounting heights, pole foundation details and mounting methods.
5. Landscaping plans shall contain lighting fixture locations and shall demonstrate that the site lighting and landscaping have been coordinated to minimize conflict between vegetation and intended light distribution, both initially and at vegetation maturity.
6. A visual-impact plan that demonstrates appropriate steps have been taken to mitigate the potential consequences of on-site and off-site glare and to retain the intended character of the City.
  - a. This plan may require the inclusion of initial vertical footcandle values at specific off-site venues, such as, bedroom windows of adjacent residential uses.
7. Plan notes. The following notes shall appear on the Lighting Plan:
  - a. Post-acceptance alterations to lighting plans or intended substitutions for accepted lighting equipment are not permitted.
  - b. The City reserves the right to conduct post-installation inspections to verify compliance with the City's requirements and with the Lighting Plan provided in the accepted drawings. Remedial action due to non-conformance shall be provided at no expense to the City.
  - c. All exterior lighting shall meet IESNA full-cutoff criteria.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Outdoor lighting, including poles, luminaries and appurtenant items, shall be as indicated on the construction drawings.
  1. Outdoor lighting shall conform to all the Lighting Requirement and Design Standards described above.
  2. Outdoor lighting shall be acceptable to the City Engineer.
  3. Fixtures shall be of the cutoff type, in accordance with the candlepower distribution classification of the Lighting Handbook.
    - a. The manufacturer of the fixtures shall provide certification of the cutoff classification based on photometric testing performed in accordance with the Lighting Handbook and the applicable testing procedures referenced therein.
    - b. Fixtures which do not meet the strict definition for cutoff fixtures, yet employ advanced or alternative technology which causes the photometric performance to approach that of cutoff fixtures, may be accepted by the City Engineer, on a case-by-case basis.

- i. (1) Such fixtures include, but are not limited to, period-style fixtures with refractive globes and internal cutoff reflectors.
- B. Conduit: See Section 05131
- C. Wiring Devices: As specified in Section 05140.
- D. Wire and Cable: As specified in Section 05123.
- E. Boxes: As specified in Section 05138. Junction box lids to be marked "Street Lights" or "Lighting."
- F. Concrete: As specified in Section 03300.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify location of outdoor lighting items with the City Engineer.
- B. Verify location and type of power source with Rocky Mountain Power.

### **3.2 INSTALLATION - OUTDOOR LIGHTING**

- A. Mounting heights of lighting fixtures shall be as described in Paragraph 1.07 above.
- B. Poles supporting outdoor lighting fixtures shall be installed as indicated on the construction drawings that have been reviewed and accepted by the City Engineer.
  - 1. Poles for outdoor lighting fixtures for the illumination of parking areas and located directly behind parking spaces, or where they could be hit by snow plows, shall be placed a minimum of five (5) feet outside paved areas or tire stops, or placed on concrete pedestals at least thirty (30) inches high above the pavement.
  - 2. Construct concrete bases for light poles, as indicated on the construction drawings; size and type to be according to manufacturer's written instructions and recommendations. Anchor bolts shall be installed according to manufacturer's template.
  - 3. Install light poles on bases, in accordance with manufacturer's written instructions and commendations. Poles shall be plumb and securely attached to the concrete base.
- C. Install pole mounted cutoff fixtures, with lamps, in accordance with manufacturer's written instructions and recommendations.
  - 1. Fixtures for the illumination of horizontal areas shall be aimed straight down, as described in Paragraph 1.07 above.
  - 2. Cutoff fixtures shall be mounted plumb and level in accordance with the intended application of their design.
    - a. The photometric nadir or the fixture (zero degree vertical angle of the candlepower distribution) shall be oriented plumb and the vertical angle of 90 degrees above the nadir (horizontal) shall be oriented level.
    - b. Cutoff fixtures shall not be installed in a canted or tilted position which permits candlepower distribution above the horizontal.
- D. Install other types of lighting fixtures, with lamps, for other types of installations as indicated

on the construction drawings, in accordance with manufacturer's written instructions and recommendations.

- E. All electrical feeds for lighting poles shall be run underground. No overhead feeds will be permitted.
  - 1. Electrical feeds shall be installed as indicated on the construction drawings.
  - 2. Install an electrical junction box near the base of light poles, as required.
  - 3. Install underground electrical supply line lighting control panel to junction box at base of light pole, as indicated on the drawings. Wire shall be in conduit. Trenching shall be done as described in Section 02112. Conduit to be installed with sand bedding and 24-inch cover. Trenches shall be backfilled and compacted to required densities.
  - 4. Make electrical connection to light poles in accordance with equipment manufacturer's instructions and as indicated on the drawings.
  - 5. All work shall be done in accordance with the National Electrical Code (NEC) and the International Building Code (IBC) and, where applicable, with the requirements of Rocky Mountain Power.

### **3.3 FIELD QUALITY CONTROL**

- A. Perform field inspection, testing, and adjusting in accordance with Section 01400.
- B. Operate each lighting fixture after installation and connection. Inspect for improper connections and operation.

### **3.4 ADJUSTING**

- A. Aim and adjust lighting fixtures to provide illumination levels and distribution as recommended by the manufacturer and as indicated on the construction plans.

### **3.5 CLEANING**

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures.
- C. Clean finishes and repair damage.

### **3.6 PROTECTION OF FINISHED WORK**

- A. Re-lamp lighting fixtures which have failed lamps at Substantial Completion.

**END OF SECTION**

# STANDARD SANITARY SEWER DETAILS

## INDEX:

- SS-1    SANITARY SEWER PIPE TRENCH**
- SS-2    PRE-CAST SANITARY SEWER MANHOLE**
- SS-2A    CAST IN PLACE SANITARY SEWER MANHOLE**
- SS-3    SEWER SERVICE CONNECTION**
- SS-4    SEWER PIPE CASING**

## **NOTE:**

**REFER TO TIMPANOGOS SPECIAL SERVICE DISTRICT FOR GREASE TRAP DETAIL**

**SANITARY SEWER  
DETAILS**

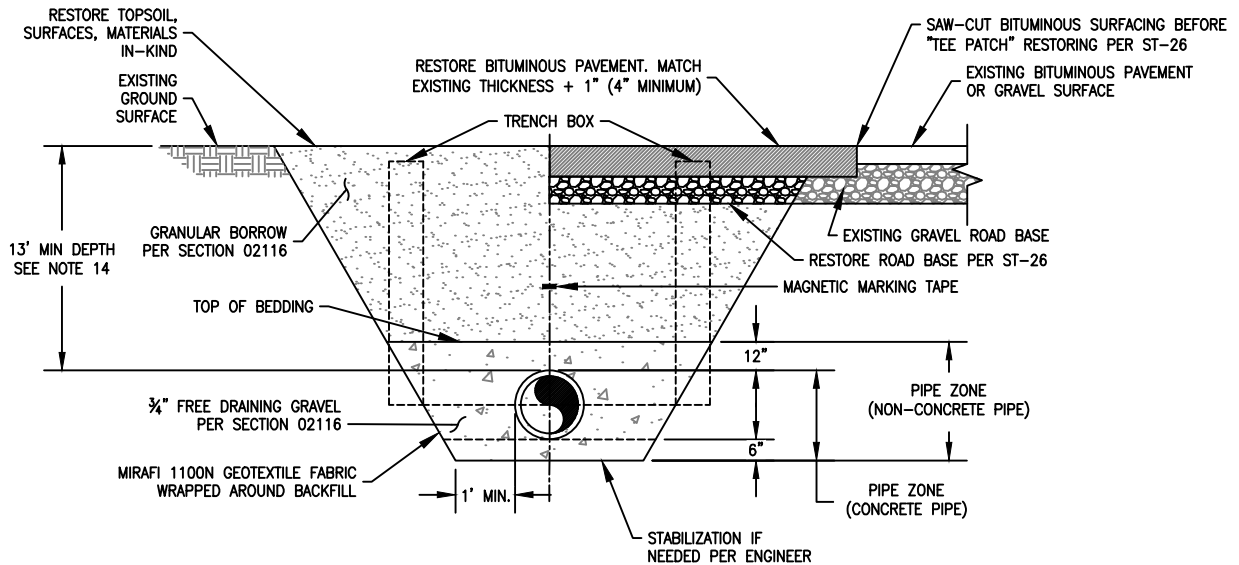
DATE: AUGUST 2022		REVISIONS			
DRAWING NAME: SS-0		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:	SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

SANITARY SEWER

**SS-0**



**CROSS-SECTION: TYPICAL TRENCH**

**NOTES:**

1. CONTRACTOR SHALL LOCATE ALL UNDERGROUND UTILITIES BEFORE LAYING PIPE WITHIN 300' OF SAID UTILITIES WHICH MAY BE EXPOSED, DAMAGED OR CROSSED AS SHOWN ON THE DRAWINGS OR AS "BLUE STAKED". THE CONTRACTOR WILL MAKE ARRANGEMENTS WITH THE UTILITY COMPANY TO MOVE THE UTILITY IF NECESSARY OR OBTAIN PERMISSION FROM THE CITY ENGINEER TO MODIFY GRADE OF PIPELINE IN ORDER TO GO AROUND UTILITIES.
2. PROVIDE GEOTECHNICAL REPORT. FOLLOW RECOMMENDATIONS OF GEOTECHNICAL REPORT
3. PIPE ZONE SHALL BE PLACED IN LIFTS AND TAMPED
4. TRENCHES SHALL BE COMPACTED IN LIFTS TO 95% DENSITY
5. GEOTEXTILE FABRIC IS REQUIRED WHERE EVIDENCE OF EXISTING OR PAST GROUNDWATER CONDITIONS ARE PRESENT. THESE LOCATIONS ARE TYPICALLY EAST OF REDWOOD RD AND SOUTH OF CROSSROADS BLVD.
6. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPAIRED AT THE SOLE EXPENSE OF THE PARTY WHO DAMAGED THE UTILITY.
7. THE MINIMUM CLEAR WIDTH OF THE TRENCH, MEASURED AT THE SPRING LINE OF THE PIPE, SHOULD BE 12 INCHES GREATER THAN THE DIAMETER OF THE PIPE. IN ROCKY SUB-GRADES, 18" OF CLEARANCE SHALL BE PROVIDED ON ALL SIDES OF PIPE.
8. INSTALL MAGNETIC DETECTOR TAPE 3' ABOVE PIPE OR 2' ABOVE PIPE WHEN PIPE IS SHALLOWER THAN 4'.
9. THE CITY RECOMMENDS CONTRACTOR MEET ALL OF THE REQUIREMENTS ESTABLISHED FOR SAFE TRENCHING. (SEE OSHA AND UOSH REQUIREMENTS, LATEST EDITIONS).
10. TESTING: ALL NEW SANITARY SEWERS TO HAVE POST INSTALLATION CCTV AND NECESSARY REPAIRS MADE BEFORE ACCEPTANCE. ALL LINES SHALL BE PRESSURE TESTED TO 4.0 PSI MINIMUM FOR 5 MINUTES. A MANDREL OR BALL CAN BE USED TO VERIFY DEFORMATION OF A PIPE AS DETERMINED FROM THE CCTV UNLESS SPECIFIED OTHERWISE. MANHOLES SHALL BE TESTED AS PER CITY STANDARDS.
11. ALL SEWER LINES TO BE INSTALLED IN PUBLIC RIGHT-OF-WAY OR RECORDED SEWER EASEMENT UNLESS OTHERWISE APPROVED BY THE CITY ENGINEERS.
12. WHERE COLLAPSIBLE SOILS ARE ENCOUNTERED, FURNISH, PLACE AND COMPACT IMPORTED BACKFILL MATERIALS AS REQUIRED AND AS DIRECTED.
13. MAXIMUM DEPTH SHALL BE 20' TO THE TOP OF PIPE UNLESS APPROVED OTHERWISE BY THE CITY ENGINEER.
14. MINIMUM DEPTH SHALL BE 3' TO TOP OF PIPE. IF THE SEWER LINE IS NOT 13' DEEP A NOTE MUST BE PLACED ON THE PLAT "SHALLOW SEWER DEPTHS. BEFORE EXCAVATING BASEMENTS, CONTRACTOR MUST VERIFY SEWER DEPTH." A 2' SPACING MUST BE MAINTAINED BETWEEN ALL WATER LINE PIPE CROSSINGS AND THE TOP OF THE SEWER PIPE.
15. SEWER MAINS AND LATERALS ARE NOT ALLOWED TO BE OVER THE TOP OF CULINARY LINES.

**SANITARY SEWER  
PIPE TRENCH**

DATE: SEP 2023		REVISIONS			
DRAWING NAME: SS-1		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:	SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			

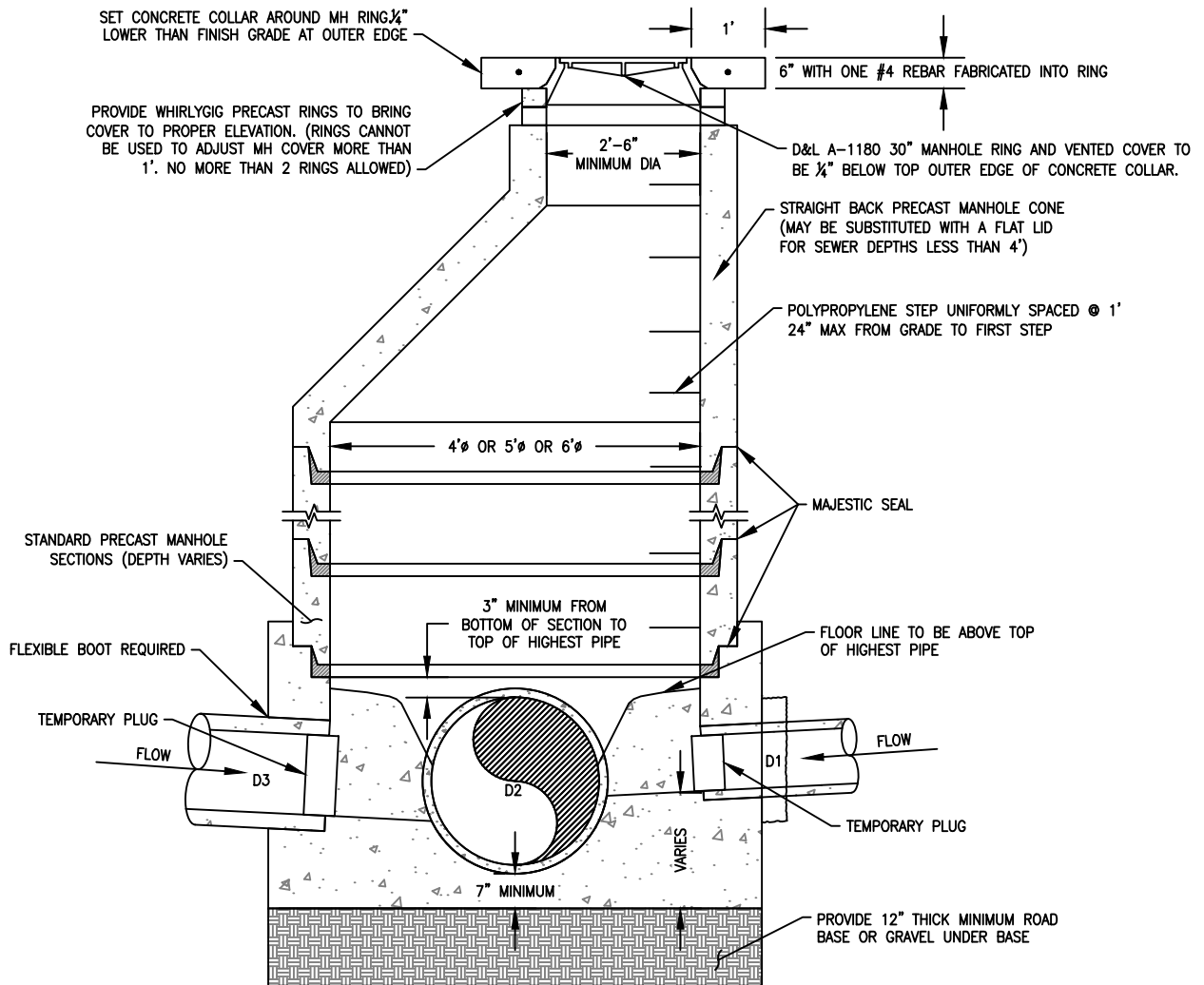


STANDARD DETAILS

SANITARY SEWER

**SS-1**





**NOTES:**

1. PRE-CAST BASES ARE REQUIRED. POURED-IN-PLACE BASES ARE ALLOWED ONLY ON EXISTING SEWER. SEE SS-2B FOR CAST-IN-PLACE BASE.
2. AFTER ALL GRADING AROUND MANHOLE HAS BEEN COMPLETED AND FINAL SURFACING IS IN PLACE REMOVE TEMPORARY PLUGS, DEBRIS AND PLYWOOD FROM INSIDE OF MANHOLES.
3. MANHOLES DEEPER THAN 20' SHALL HAVE THICKNESS PER THE MANUFACTURER'S RECOMMENDATION.
4. CONE AND WALL SECTIONS SHALL CONFORM WITH ASTM C-478 STANDARDS.
5. ALL MANHOLES TO BE HS-20 RATED.
6. MANHOLES OUTSIDE OF ROW SHALL HAVE SOLID LOCKING LIDS.
7. FLAT CAST RINGS ARE NOT PERMITTED.
8. LID SHALL BE VENTED AND MARKED "SS SEWER".
9. MANHOLES WITH SOLID LIDS MUST BE EPOXY LINED.
10. MANHOLES ARE NOT ALLOWED WITHIN SIDEWALKS, GUTTERS, WATERWAYS OR OTHER PEDESTRIAN PATHWAYS.
11. IF GRADE ALLOWS, INVERTS OF D1 AND D3 SHALL MATCH THE 0.75 DEPTH POINT OF D2. OTHERWISE AS APPROVED BY THE CITY ENGINEER.
12. PLUG OUTLET OF DOWNSTREAM MANHOLE UNTIL CONSTRUCTION IS COMPLETE.

**PRE-CAST  
SANITARY SEWER  
MANHOLE**

DATE: MARCH 2022		REVISIONS			
DRAWING NAME: SS-2		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

SANITARY SEWER

**SS-2**

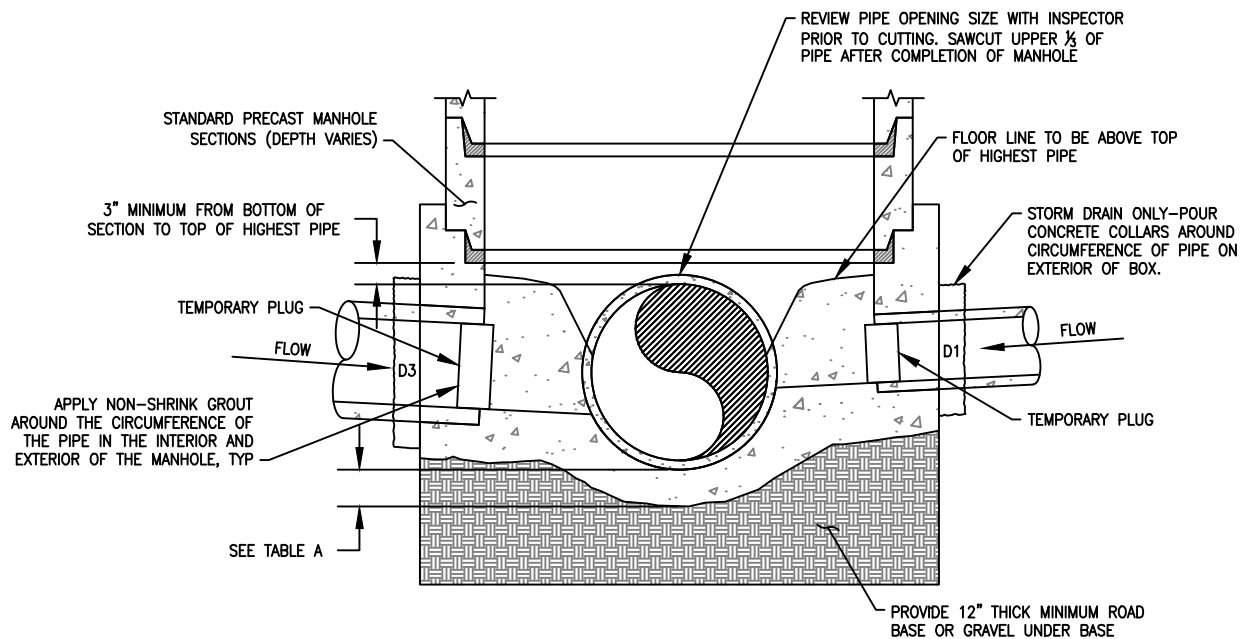


TABLE A	
DEPTH	FLOOR THICKNESS
0'-20'	10"
20' OR MORE	18"

**NOTES:**

1. POURED-IN-PLACE BASE ARE ALLOWED ONLY ON EXISTING SEWER MAINS, WHEN ACCEPTED BY THE CITY ENGINEER.
2. AFTER ALL GRADING AROUND MANHOLE HAS BEEN COMPLETED AND FINAL SURFACING IS IN PLACE, REMOVE TEMPORARY PLUGS, DERIS AND PLYWOOD FROM INSIDE OF MANHOLES.
3. CONE AND WALL SECTIONS SHALL CONFORM WITH ASTM C-478 STANDARD.
4. ALL MANHOLES TO BE HS-20 RATED.
5. MANHOLES WITH SOLID LIDS MUST BE EPOXY LINED.
6. MANHOLES OUTSIDE OF ROW SHALL HAVE SOLID LOCKING LIDS.
7. FLAT CAST RINGS ARE NOT PERMITTED.
8. LID SHALL BE VENTED AND MARKED "SS SEWER".
9. IF GRADE ALLOWS, INVERTS OF D1 AND D3 SHALL MATCH THE 0.75 DEPTH POINT OF D2. OTHERWISE AS APPROVED BY THE CITY ENGINEER.
10. PLUG OUTLET OF DOWNSTREAM MANHOLE UNTIL CONSTRUCTION IS COMPLETE.

**CAST IN PLACE  
SANITARY SEWER  
MANHOLE**

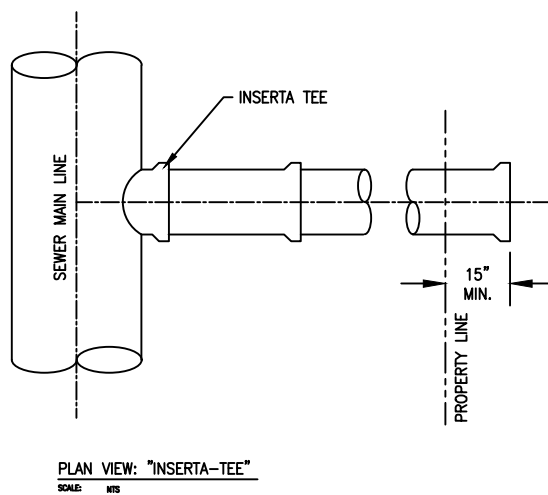
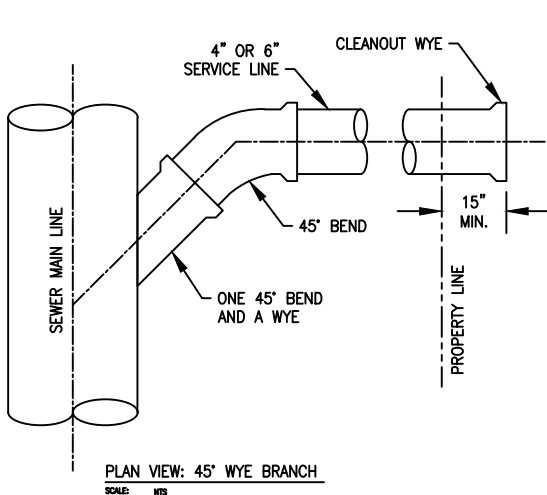
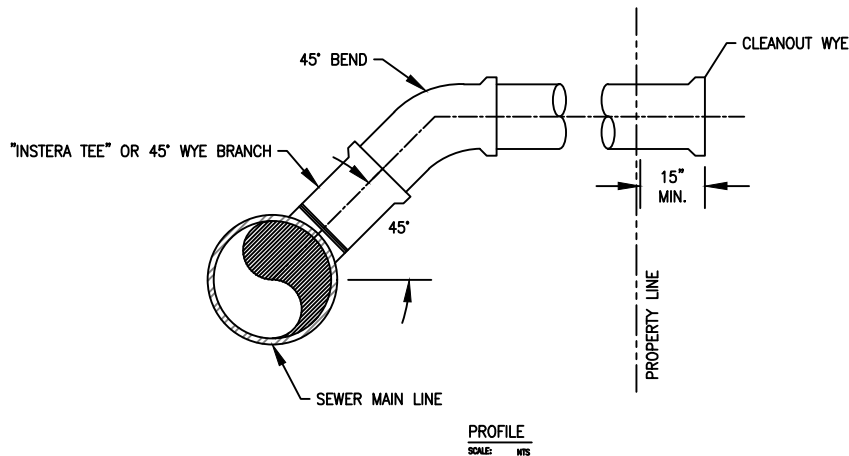
DATE: SEP 2023		REVISIONS			
DRAWING NAME: SS-2		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:		APPROVED:			
		SARATOGA SPRINGS CITY			
		<small>1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794</small>			



STANDARD DETAILS

SANITARY SEWER

**SS-2A**



**NOTES:**

1. ALL RESIDENTIAL SERVICES SHALL BE 4" DIAMETER. NON-RESIDENTIAL SHALL BE 6" DIAMETER UNLESS DIRECTED OTHERWISE AND SHALL BE EXTENDED FROM MAIN LINES TO PROPERTY LINES.
2. EVERY RESIDENTIAL UNIT SHALL HAVE A SEPARATE SEWER LATERAL.
3. MINIMUM GRADE SHALL BE 2% FOR SERVICE LINES.
4. ALL 90° BENDS AT CONNECTION TO MAIN MUST BE CONSTRUCTED WITH ONE 45° BEND AND A WYE.
5. DIRECT NOSE ON IS ALLOWED WHEN CONNECTING TO EXISTING MAIN LINE. USE RUBBER BOOT AS PER CITY WITH STAINLESS STEEL STRAPS, IF REQUIRED. CORE EXISTING PIPE, DO NOT BREAK OUT WITH A HAMMER.
6. NOTIFY CITY 24 HOURS IN ADVANCE OF ANY CONNECTION. EVERY CONNECTION TO BE INSPECTED BY CITY.
7. CONNECTION TO USERS TO BE DONE BY OTHERS.
8. PVC WYES ARE REQUIRED FOR ALL NON-RESIDENTIAL CONNECTIONS.

## SEWER SERVICE CONNECTION

DATE:  
SEP 2023

DRAWING NAME:  
SS-3

DRAWN BY:  
JRP

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
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UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

SANITARY SEWER

**SS-3**

SS-4

# STANDARD STORM DRAIN DETAILS

## INDEX:

- SD-1 STORM DRAIN PIPE TRENCH**
- SD-2 GUTTER INLET BOX**
- SD-3 DOUBLE INLET BOX**
- SD-4 CLEANOUT BOX**
- SD-5 COMBINATION GUTTER INLET & CLEANOUT BOX**
- SD-6 INLET/OUTLET TRASH GRATES**
- SD-7 STORM DRAIN PIPE CASING**
- SD-8 DETENTION BASIN EMERGENCY SPILLWAY**
- SD-9 DETENTION BASIN OUTLET CONTROL BOX**

**STORM DRAIN  
DETAILS**

DATE:  
MARCH 2022

DRAWING NAME:  
SD-0

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

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SPRINGS CITY

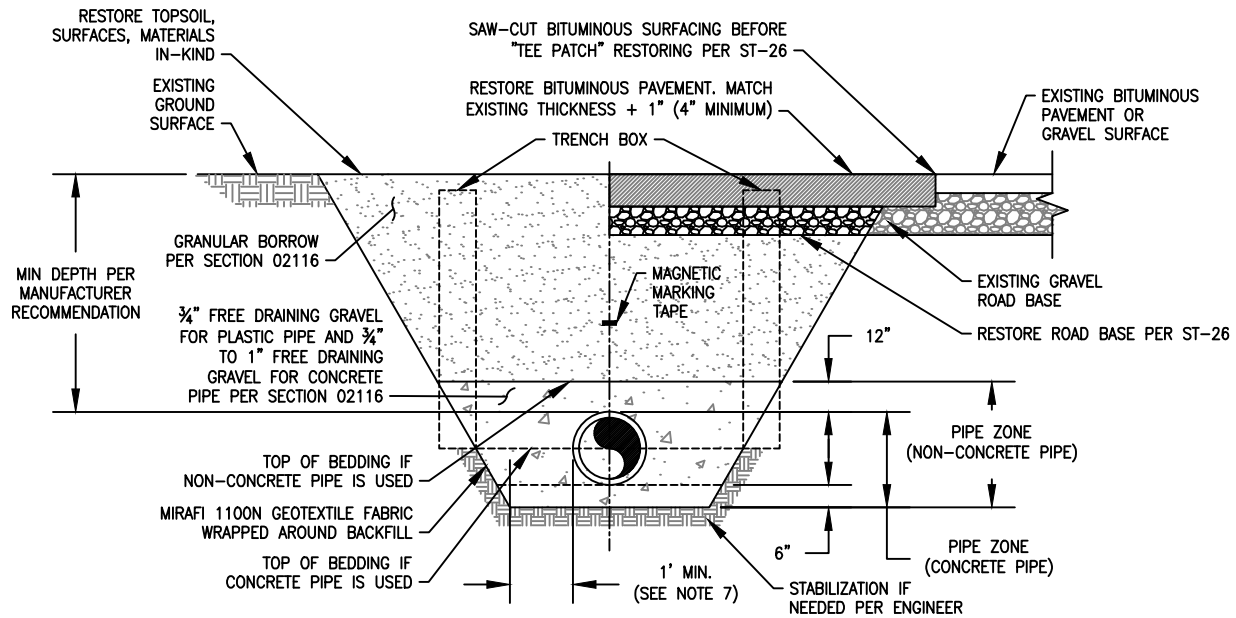
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PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STORM DRAIN

**SD-0**



**CROSS-SECTION: TYPICAL TRENCH**

**NOTES:**

1. CONTRACTOR SHALL LOCATE ALL UNDERGROUND UTILITIES BEFORE LAYING PIPE WITHIN 300' OF SAID UTILITIES WHICH MAY BE EXPOSED, DAMAGED OR CROSSED AS SHOWN ON THE DRAWINGS OR AS "BLUE STAKED". THE CONTRACTOR WILL MAKE ARRANGEMENTS WITH THE UTILITY COMPANY TO MOVE THE UTILITY IF NECESSARY OR OBTAIN PERMISSION FROM THE CITY ENGINEER TO MODIFY GRADE OF PIPELINE IN ORDER TO GO AROUND UTILITIES.
2. PROVIDE GEOTECHNICAL REPORT. FOLLOW RECOMMENDATIONS OF GEOTECHNICAL REPORT
3. PIPE ZONE SHALL BE PLACED IN LIFTS AND TAMPED
4. TRENCHES SHALL BE COMPACTED IN LIFTS TO 95% DENSITY
5. GEOTEXTILE FABRIC IS REQUIRED WHERE EVIDENCE OF EXISTING OR PAST GROUNDWATER CONDITIONS ARE PRESENT. THESE LOCATIONS ARE TYPICALLY EAST OF REDWOOD RD AND SOUTH OF CROSSROADS BLVD.
6. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPAIRED AT THE SOLE EXPENSE OF THE PARTY WHO DAMAGED THE UTILITY.
7. THE MINIMUM CLEAR WIDTH OF THE TRENCH, MEASURED AT THE SPRING LINE OF THE PIPE, SHOULD BE 12 INCHES GREATER THAN THE DIAMETER OF THE PIPE. IN ROCKY SUB-GRADES, 18" OF CLEARANCE SHALL BE PROVIDED ON ALL SIDES OF PIPE.
8. INSTALL MAGNETIC DETECTOR TAPE 3' ABOVE PIPE IN TRENCH.
9. THE CITY RECOMMENDS CONTRACTOR MEET ALL OF THE REQUIREMENTS ESTABLISHED FOR SAFE TRENCHING. (SEE OSHA AND UOSH REQUIREMENTS, LATEST EDITIONS).
10. TESTING: ALL STORM DRAIN LINES TO HAVE POST INSTALLATION CCTV AND NECESSARY REPAIRS MADE BEFORE ACCEPTANCE. A MANDREL OR BALL CAN BE USED TO VERIFY DEFORMATION OF A PIPE AS DETERMINED FROM THE CCTV UNLESS SPECIFIED OTHERWISE. AIR TEST MAY BE REQUIRED BY ENGINEER TO 4 PSI FOR 10 MIN. WITH NO LOSS OF AIR PRESSURE.
11. ALL STORM DRAIN TO BE INSTALLED IN PUBLIC RIGHT-OF-WAY OR RECORDED DRAINAGE EASEMENT UNLESS OTHERWISE APPROVED BY THE CITY ENGINEERS.
12. WHERE COLLAPSIBLE SOILS ARE ENCOUNTERED, FURNISH, PLACE AND COMPACT IMPORTED BACKFILL MATERIALS AS REQUIRED AND AS DIRECTED.

**STORM DRAIN  
PIPE TRENCH**

DATE:  
SEP 2023

DRAWING NAME:  
SD-1

DRAWN BY:  
JRP

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

**SARATOGA  
SPRINGS CITY**

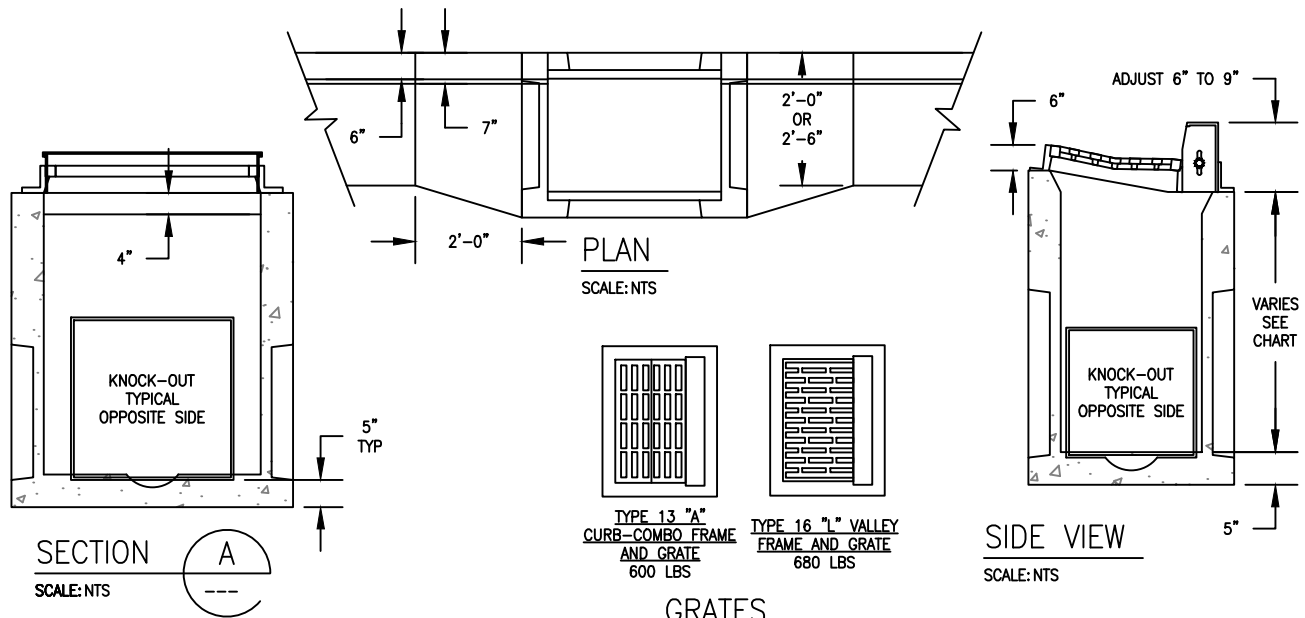
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STANDARD DETAILS

STORM DRAIN

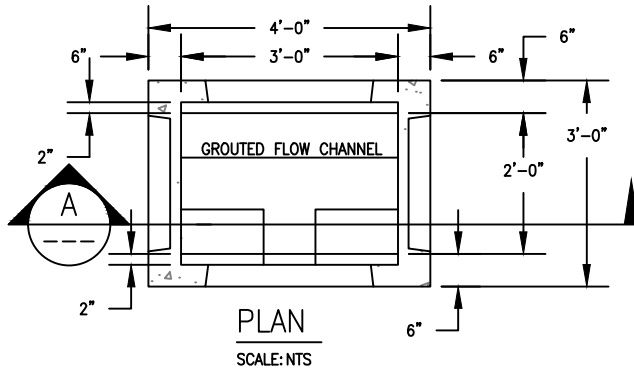
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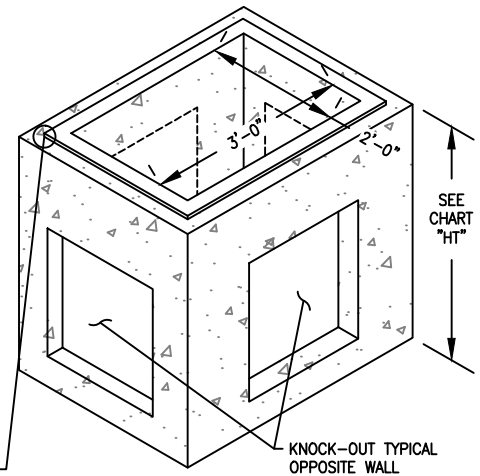
TYPE 13 "A" CURB-COMBO FRAME AND GRATE 600 LBS

TYPE 16 "L" VALLEY FRAME AND GRATE 680 LBS

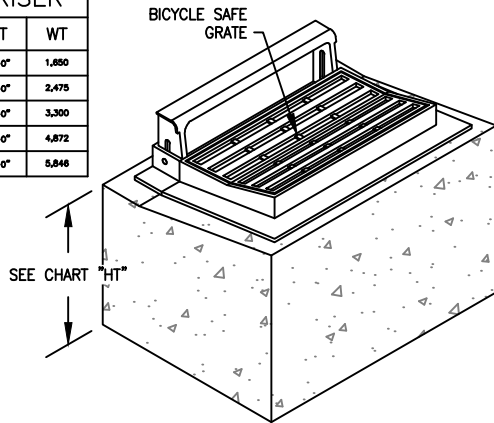
**GRATES**  
SCALE: NTS



BASE	
HT	WT
3'-0"	3,140
4'-0"	4,112
5'-0"	5,088
6'-0"	6,062



RISER	
HT	WT
2'-0"	1,850
3'-0"	2,475
4'-0"	3,300
5'-0"	4,872
6'-0"	5,846



IF RISER IS REQUIRED, THE BASE IS POURED WITH A "SHIP-LAP" JOINT

**NOTES:**

- DESIGNED FOR AASHTO HS-20 LOADING.
- DESIGNED ACCORDING TO ASTM C57 AND ASTM C858-83.
- ALL SUMPS TO BE GROUTED WITH FLOW CHANNELS FORMED INTO THE BOTTOM OF THE BOX TO MINIMIZE DEBRIS ACCUMULATION.
- BICYCLE SAFE GRATES ONLY. PROVIDE TYPE 13 "A" GRATE, D&L I-3516 OR TYPE 16 "L" GRATE, D&L I-3517.
- POUR CONCRETE COLLARS AROUND CIRCUMFERENCE OF PIPE ON EXTERIOR OF BOX.
- USE NON-SHRINK GROUT AROUND CIRCUMFERENCE OF PIPE ON INTERIOR OF BOX.
- CURB HOODS SHALL BE USED ONLY IN CURB APPLICATIONS.
- FRAMES REQUIRE 4 BEARING WALLS.

**GUTTER INLET BOX**

DATE:  
SEP 2023

DRAWING NAME:  
SD-2

DRAWN BY:  
ETL

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

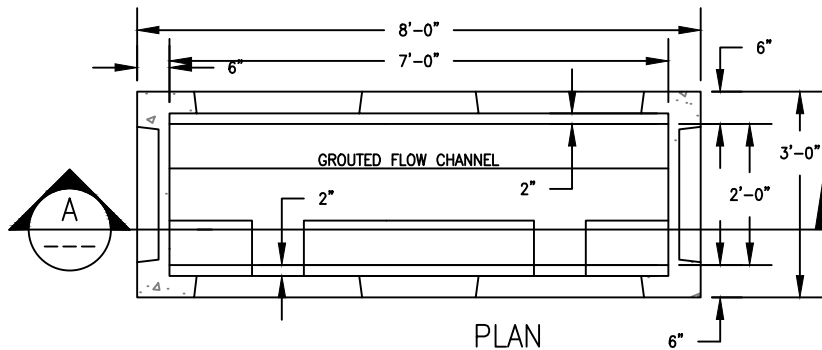
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SPRINGS CITY

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UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

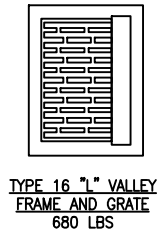
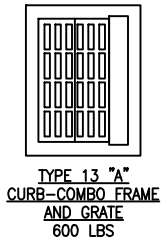
STANDARD DETAILS

STORM DRAIN

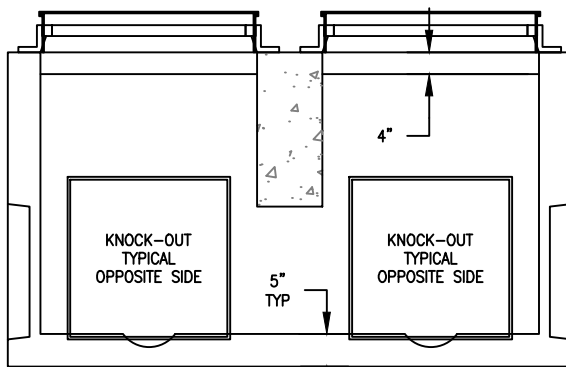
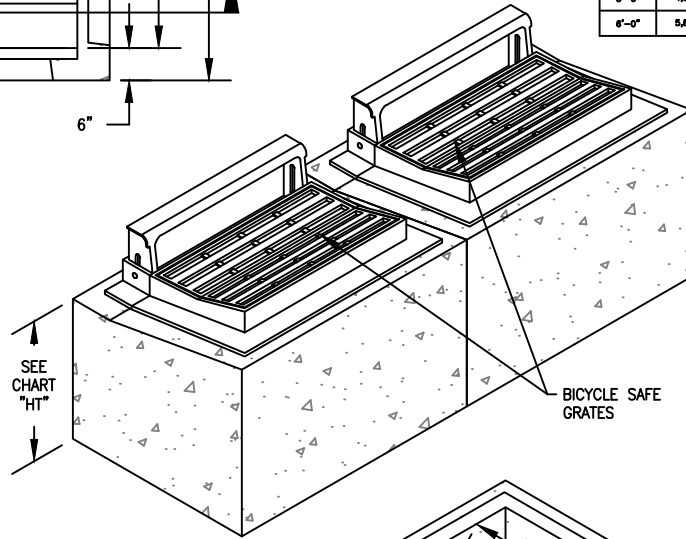
**SD-2**



RISER	
HT	WT
2'-0"	1,650
3'-0"	2,475
4'-0"	3,300
5'-0"	4,872
6'-0"	5,846

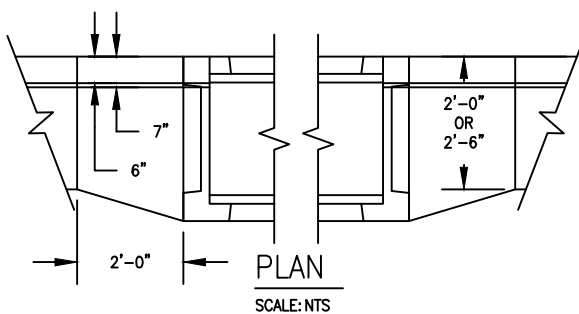
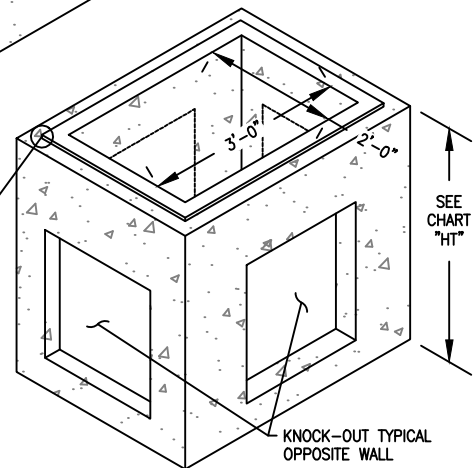


GRATES  
SCALE: NTS



IF RISER IS  
REQUIRED, THE BASE  
IS POURED WITH A  
"SHIP-LAP" JOINT

BASE	
HT	WT
3'-0"	3,140
4'-0"	4,112
5'-0"	5,088
6'-0"	6,062



#### NOTES:

1. DESIGNED FOR AASHTO HS-20 LOADING.
2. DESIGNED ACCORDING TO ASTM C57 AND ASTM C858-83.
3. ALL SUMPS TO BE GROUTED WITH FLOW CHANNELS FORMED INTO THE BOTTOM OF THE BOX TO MINIMIZE DEBRIS ACCUMULATION.
4. BICYCLE SAFE GRATES ONLY. PROVIDE TYPE 13 "A" GRATE, D&L I-3516 OR TYPE 16 "L" GRATE, D&L I-3517.
5. POUR CONCRETE COLLARS AROUND CIRCUMFERENCE OF PIPE ON EXTERIOR OF BOX.
6. USE NON-SHRINK GROUT AROUND CIRCUMFERENCE OF PIPE ON INTERIOR OF BOX.
7. CURB HOODS SHALL BE USED ONLY IN CURB APPLICATIONS.
8. FRAMES REQUIRE 4 BEARING WALLS.

## DOUBLE INLET BOX

DATE: SEP 2023	
DRAWING NAME: SD-3	
DRAWN BY: JRP	
CHECKED:	APPROVED:

REVISIONS			
REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

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#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

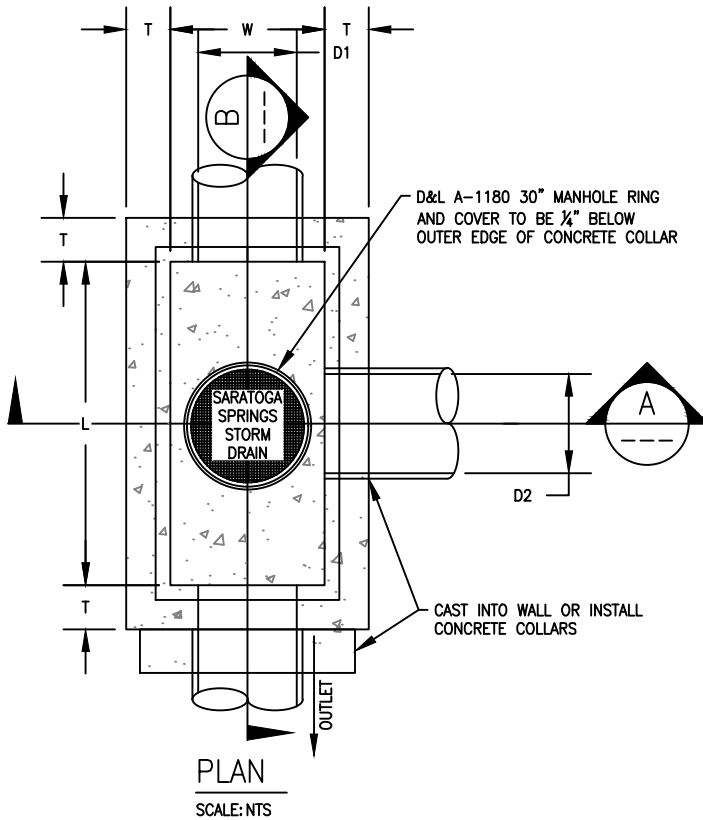


STANDARD DETAILS

STORM DRAIN

SD-3



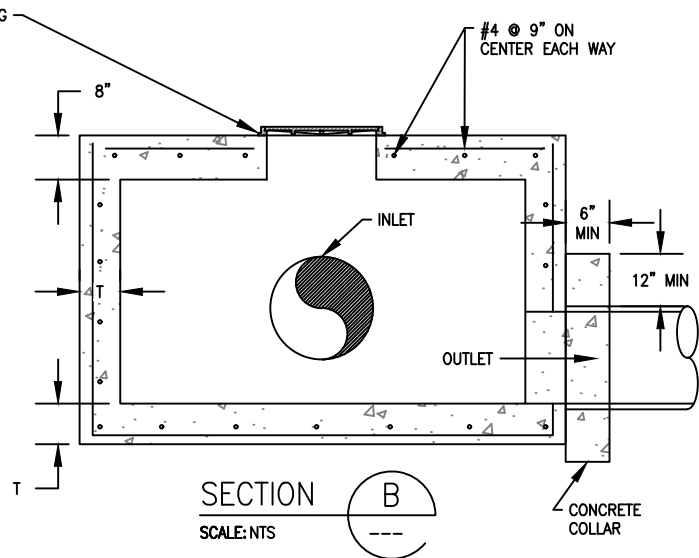
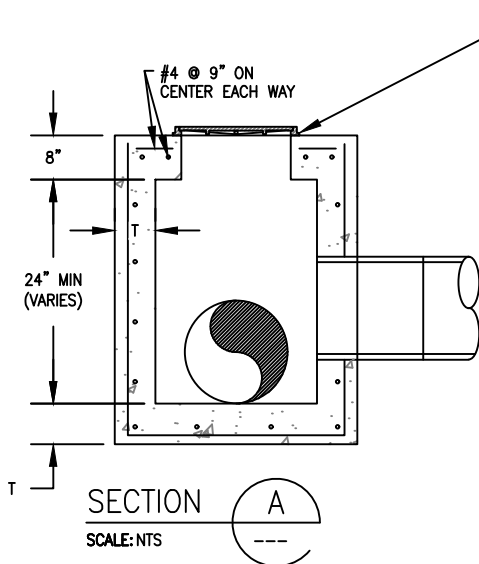


**NOTES:**

1. BOTTOM OF THE BOX SHALL BE GROUTED TO ENSURE FLOW LINE OF PIPE IS FLUSH WITH BOTTOM OF BOX.
2. AMCOR CB110 OR EQUAL BOXES WILL BE ACCEPTED.
3. PRE-CAST MANHOLES ARE ALSO ACCEPTABLE.
4. "FLAT" CASTING RINGS AND COVERS ARE NOT ACCEPTABLE.
5. DESIGN FOR AASHTO HS-20 LOADING.
6. POUR CONCRETE COLLARS AROUND CIRCUMFERENCE OF PIPE ON EXTERIOR OF BOX.
7. USE NON-SHRINK GROUT AROUND CIRCUMFERENCE OF PIPE IN INTERIOR OF BOX.
8. BOXES NOT MEETING REQUIREMENTS MUST BE APPROVED BY CITY ENGINEER.

**DIMENSIONS**

W	D1+12" (24" MINIMUM)
L	D2+24" (44" MINIMUM)
T	6" IF L IS LESS THAN OR EQUAL TO 5'-0"
T	8" IF L IS GREATER THAN 5'-0"



**CLEANOUT BOX**

DATE:  
SEP 2023

DRAWING NAME:  
SD-4

DRAWN BY:  
JRP

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

**SARATOGA  
SPRINGS CITY**

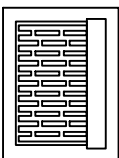
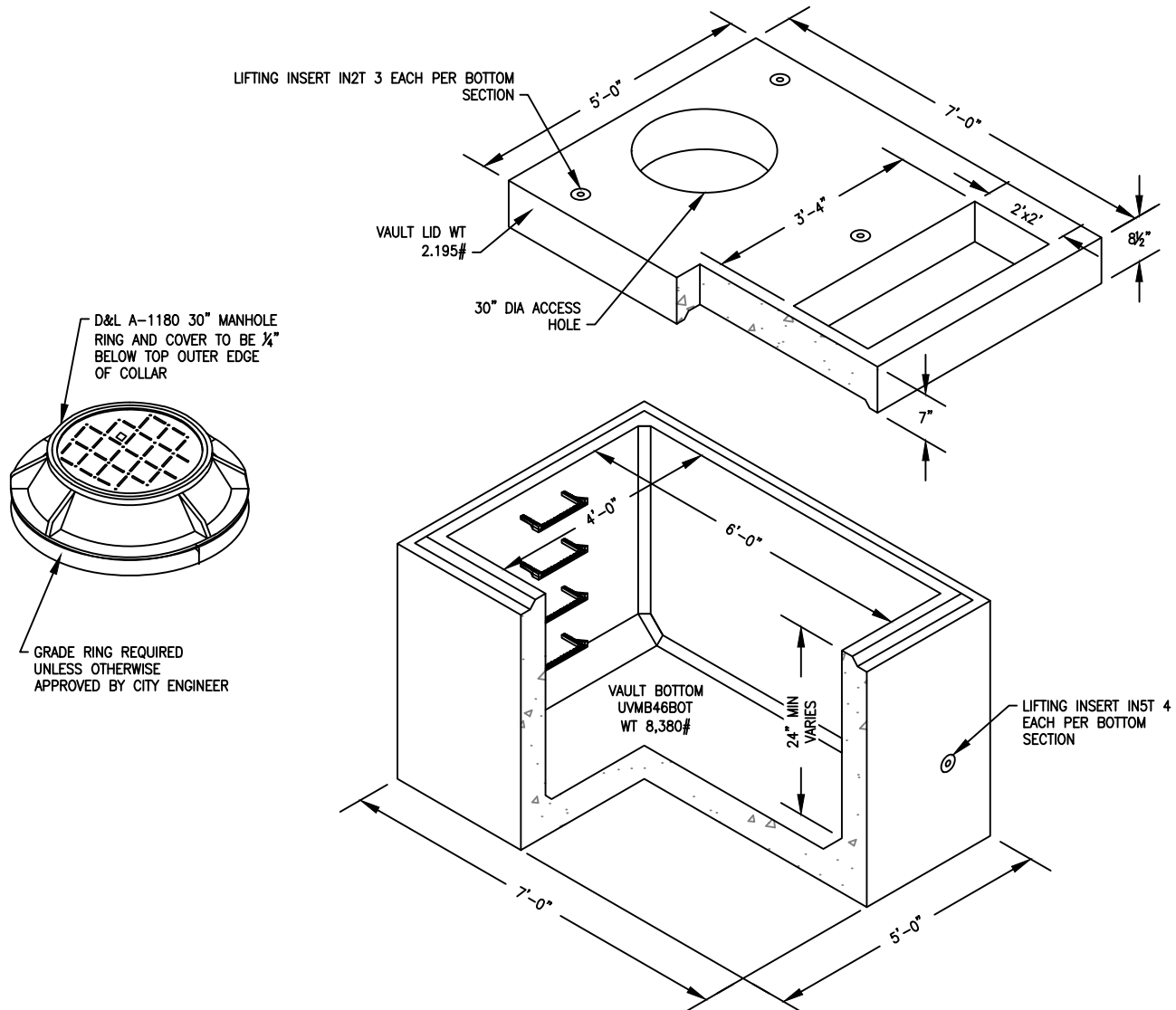
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UT 84045  
PHONE: 801-786-9793  
FAX: 801-786-9794



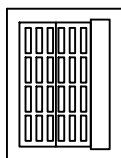
STANDARD DETAILS

STORM DRAIN

**SD-4**



TYPE 16 "L" VALLEY  
FRAME AND GRATE  
680 LBS



TYPE 13 "A"  
CURB-COMBO FRAME  
AND GRATE  
600 LBS

## GRATES

SCALE: NTS

### NOTES:

1. VAULTS ARE DESIGNED TO MEET ASTM C858 WITH AASHTO HS-20 LOADING.
2. OPENINGS MAY BE SIZED AND LOCATED AS REQUIRED.
3. OPTIONAL HARDWARE MAY BE CAST IN AS REQUIRED.
4. CHECK HARDWARE SECTION FOR OPTIONAL HARDWARE.
5. POUR CONCRETE COLLARS AROUND CIRCUMFERENCE OF PIPE ON EXTERIOR OF BOX.
6. USE NON-SHRINK GROUT AROUND CIRCUMFERENCE OF PIPE ON INTERIOR OF BOX.
7. BICYCLE SAFE GRATES ONLY. PROVIDE TYPE 13 "A" GRATE, D&L I-3516 OR TYPE 16 "L" GRATE, D&L I-3517.

## COMBINATION BOX

DATE:  
SEP 2023

DRAWING NAME:  
SD-5

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

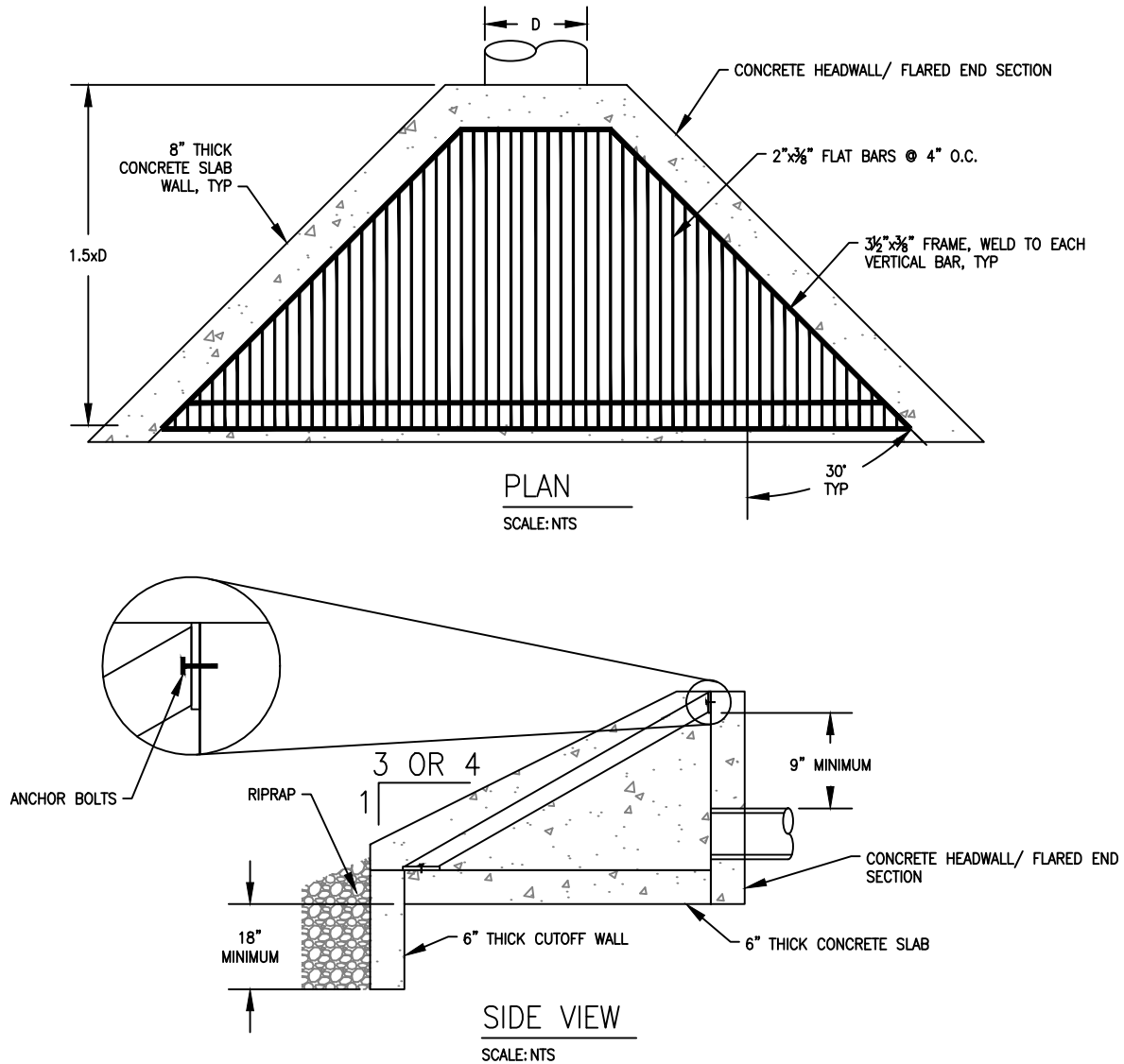
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UT 84045  
PHONE: 801-786-9793  
FAX: 801-786-9794



STANDARD DETAILS

STORM DRAIN

**SD-5**



**NOTES:**

1. INSTALL AT ALL INLETS OF STORM DRAIN PIPE 15" OR GREATER.
2. CONTRACTOR SHALL PROVIDE SHOP DRAWINGS PRIOR TO FABRICATION.
3. FABRICATION SHALL BE ALL STEEL, FLAT, HOT DIP GALVANIZED AFTER FABRICATION.
4. FLARED END SECTIONS SHALL BE CONCRETE UNLESS OTHERWISE APPROVED BY CITY ENGINEER.
5. REINFORCE ALL CONCRETE WITH #4 BARS AT 9" O.C. EACH WAY MINIMUM.
6. HOT-DIP GALVANIZED TRASH RACK AND ALL HARDWARE.
7. ANCHORS: 1/2" SET ANCHOR BOLTS, DRILL AND EPOXY @ 24" OC, MINIMUM OF 2 BOLTS.
8. FOR PRECAST FLARED END SECTIONS, TIE TO CUTOFF WALL WITH DOWELS AT 12' OC.
9. CROSSBAR REQUIRED PER ENGINEERS DISCRETION.

**INLET/OUTLET  
TRASH GRATES**

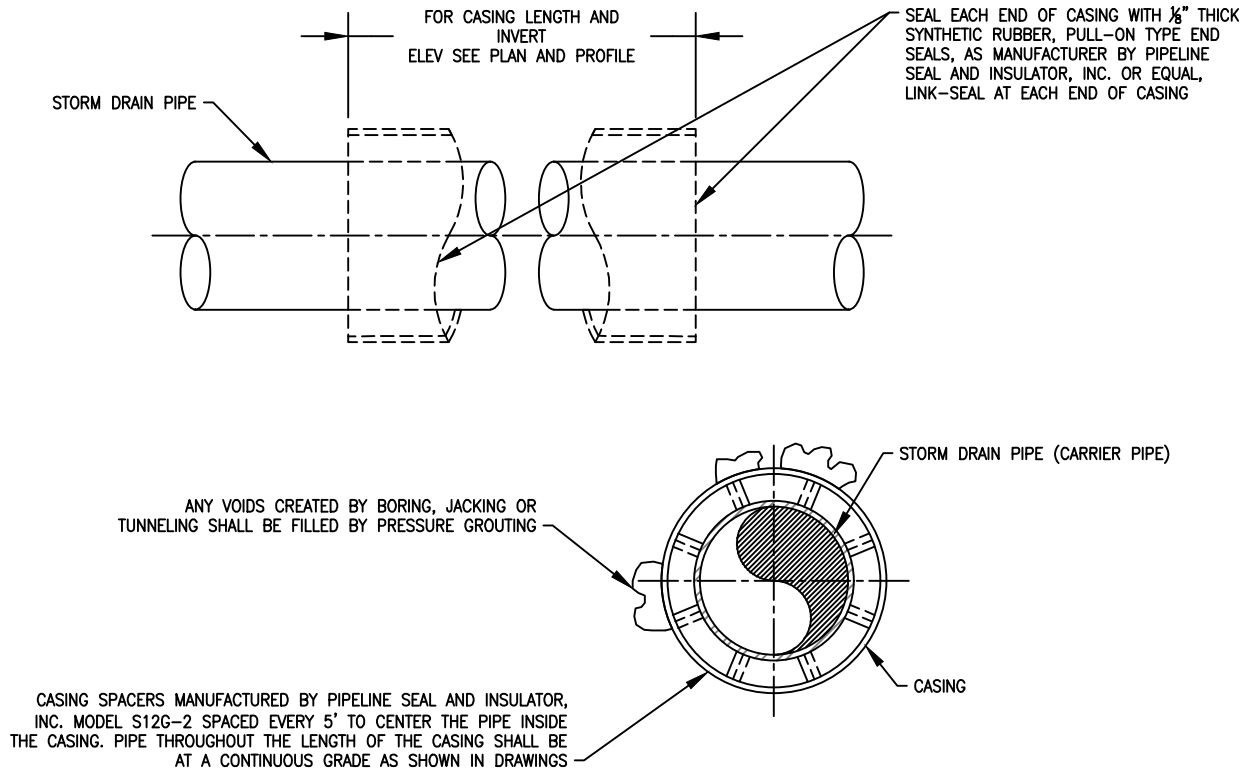
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DRAWN BY: JRP					
CHECKED: APPROVED:					
SARATOGA SPRINGS CITY					
<small>1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794</small>					



STANDARD DETAILS

STORM DRAIN

**SD-6**



### MINIMUM WALL THICKNESS OF CASINGS

DIAMETER	WALL THICKNESS
12" AND UNDER	0.188"
14"-18"	0.312"
20"-22"	0.375"
24"-28"	0.438"
28"-32"	0.500"
34"-42"	0.562"

LARGER CASINGS AS DIRECTED BY THE CITY ENGINEER

#### NOTES:

1. CASING PIPES SHALL BE REQUIRED AS INDICATED ON THE DRAWINGS AND/OR WHERE REQUIRED BY THE CITY INSPECTOR OR ENGINEER.
2. THE INSIDE DIAMETER OF THE CASING PIPE SHALL BE SIZED AT LEAST 4" LARGER THAN THE OUTSIDE DIAMETER OF CARRIER PIPE AS MEASURED AT BELL ENDS.
3. CARRIER PIPE SHALL BE TESTED BEFORE SEALING THE ENDS OF THE CASING.
4. SPACERS SHALL BE SECURELY ATTACHED TO CARRIER PIPE PER MANUFACTURER'S REQUIREMENTS.
5. CASING PIPE SHALL BE WELDED STEEL ASTM A53, GRADE B. 42,000 PSI YIELD STRESS.
6. THERE SHALL BE A MAXIMUM OF 1' FROM THE ENDS OF THE CASING TO THE SPACER.
7. HDPE (SOLID WALL) CARRIER PIPES ARE ALLOWED WITHIN CASING FROM MANHOLE TO MANHOLE.

## STORM DRAIN PIPE CASING

DATE:  
SEP 2023

DRAWING NAME:  
SD-7

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

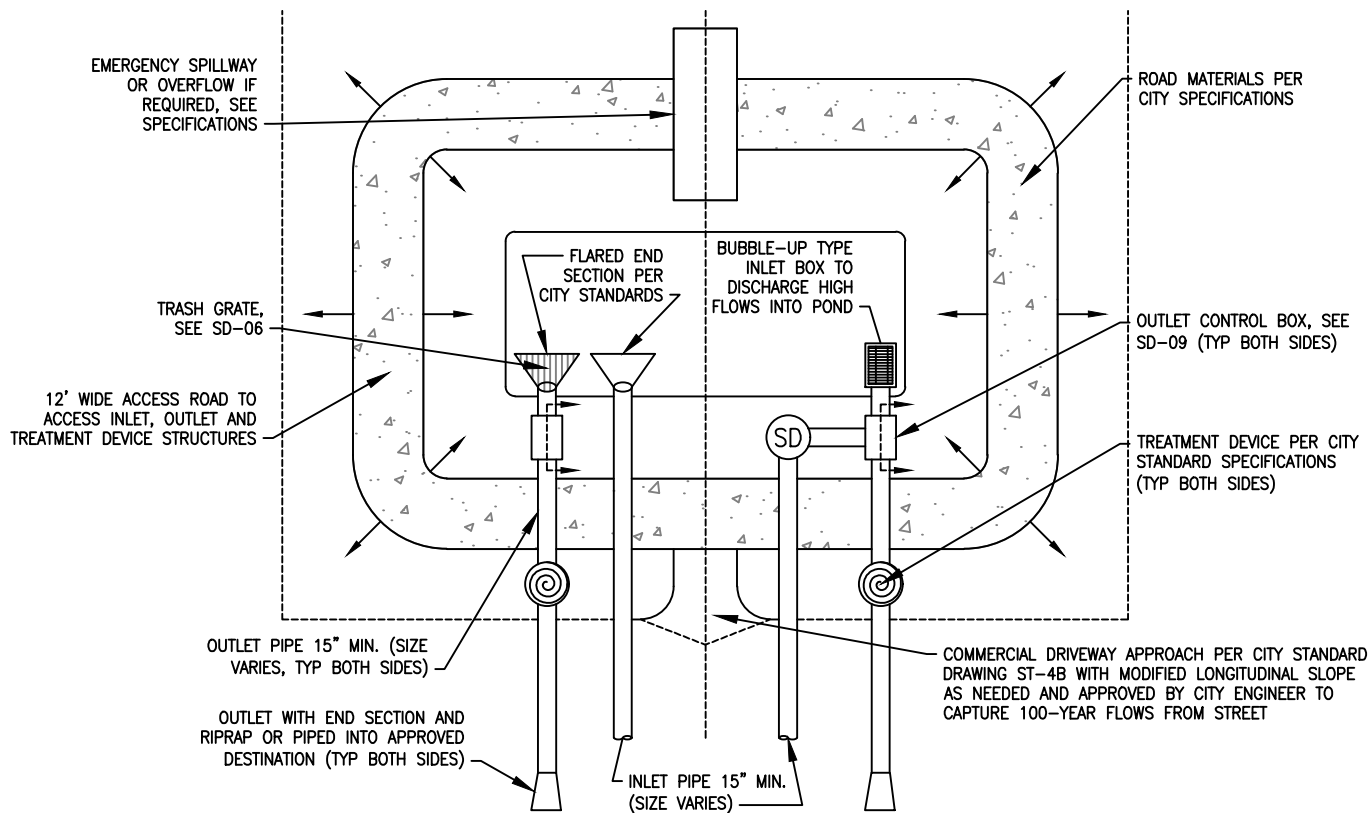
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STANDARD DETAILS

STORM DRAIN

**SD-7**

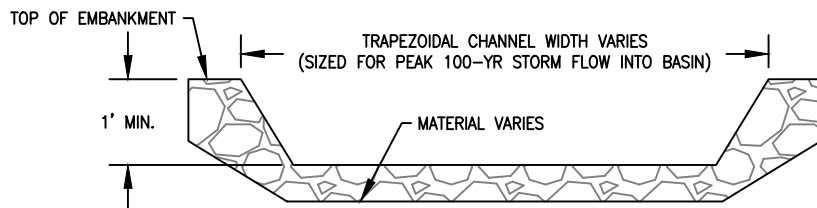


**SITE PLAN**

SCALE: NTS

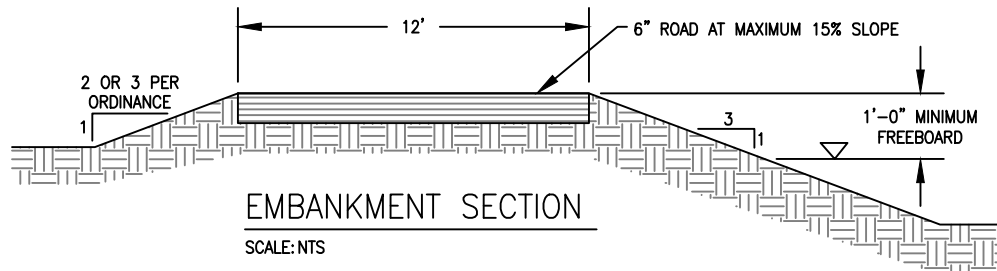
**NOTES:**

1. ACCESS ROAD IS REQUIRED AT ALL INLETS AND OUTLETS UNLESS ENGINEER CAN SHOW MAINTENANCE AT THE STRUCTURE IS MINIMAL AND/OR THE DISTANCE TO THE INLET/OUTLET IS WITHIN 10 FEET OF THE BACK OF SIDEWALK AND/OR THE POND IS LESS THAN 2,500 SF AND THE CITY ENGINEER ACCEPTS THE CONCEPT.
2. SEE CITY SPECIFICATION SECTIONS 02112 (TRENCHING), 02115 (EXCAVATION), 02116 (FILL AND BACKFILL), AND 02621 (GRAVEL SURFACING AND ROAD BASE).
3. ALL DETENTION BASINS WHICH DO NOT INCORPORATE APPROVED LID RETENTION AS PART OF DESIGN MUST USE "DETENTION ONLY ALTERNATIVE".
4. ARMORED EMERGENCY SPILLWAYS ARE ONLY REQUIRED IF FLOWS WHICH OVERTOP THE BASIN CANNOT BE SUFFICIENTLY CONVEYED WITHOUT DAMAGING THE EMBANKMENT. FLOWLINE ELEVATION OF EMERGENCY SPILLWAY IS ABOVE 100-YEAR HIGH WATER ELEVATION OF POND AND INCLUDES 1' OF FREEBOARD.
5. GRADE DETENTION BASINS TO DRAIN TO BUBBLE-UP TYPE INLET BOXES TO BE LOCATED AT THE LOW POINT OF THE DETENTION POND.



**EMERGENCY SPILLWAY**

SCALE: NTS



**EMBANKMENT SECTION**

SCALE: NTS

**DETENTION BASIN  
EMERGENCY SPILLWAY**

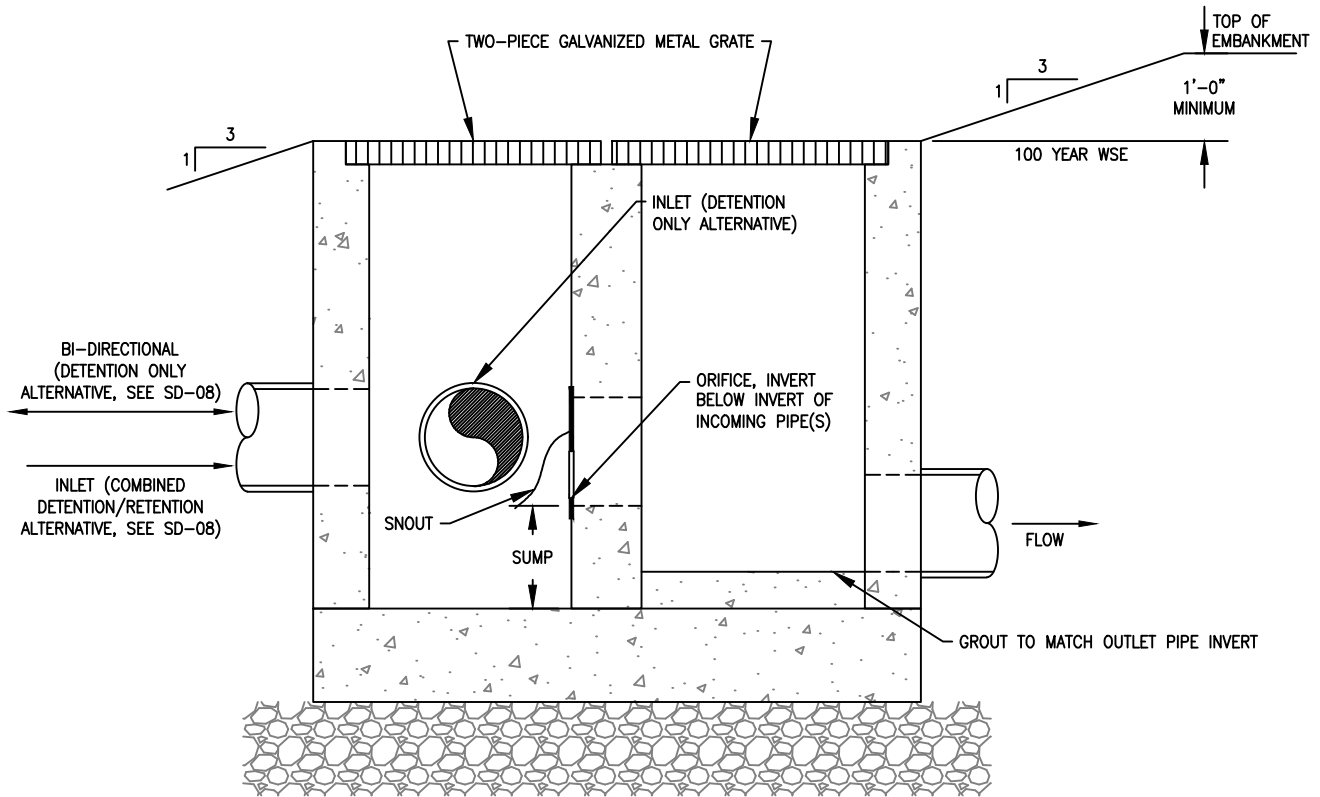
DATE: SEP 2023		REVISIONS			
DRAWING NAME: SD-8		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED: APPROVED:		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

STORM DRAIN

**SD-8**



## OUTLET CONTROL BOX

SCALE: NTS

### NOTES:

- ORIFICE PLATES WITH OPENINGS THAT ARE LESS THAN AREA THAN A 15"Ø CIRCLE MUST HAVE RECTANGULAR OPENINGS AND BE PROTECTED BY A SNOUT. ORIFICE PLATES WITH OPENINGS THAT ARE EQUAL TO OR GREATER THAN 15"Ø MAY BE CIRCULAR AND DO NOT REQUIRE A SNOUT.
- SNOUT SHALL BE INSTALLED PER MANUFACTURERS RECOMMENDATIONS.
- SEE CITY SPECIFICATION SECTIONS 02112 (TRENCHING), 02115 (EXCAVATION), AND 02116 (FILL AND BACKFILL).
- SUMP DEPTH TO BE 3x EQUIVALENT DIAMETER OF ORIFICE. IN NO CASE SHALL THE SUMP BE LESS THAN THE DIAMETER OF THE INCOMING PIPE.

## DETENTION BASIN OUTLET CONTROL BOX

DATE:  
SEP 2023

DRAWING NAME:  
SD-9

DRAWN BY:  
JRP

CHECKED:

APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STORM DRAIN

**SD-9**

# STANDARD DRINKING WATERLINE DETAILS

## INDEX:

DW-1	DRINKING WATER PIPE TRENCH
DW-2	CONCRETE THRUST BLOCKS
DW-2A	CONCRETE THRUST ANCHORS FOR DOWNWARD VERTICAL BENDS IN DRY SOIL CONDITIONS
DW-2B	CONCRETE THRUST ANCHORS FOR DOWNWARD VERTICAL BENDS WHERE SIGNS OF GROUNDWATER ARE PRESENT
DW-2C	ALTERNATIVE THRUST RESTRAINT
DW-2D	ALTERNATIVE THRUST RESTRAINT TABLES
DW-3	DRINKING WATERLINE LOOP
DW-4	FIRE HYDRANT CONNECTION
DW-5	RESIDENTIAL METER CONNECTION 3/4" X 5/8" INCH OR 1"
DW-5A	RESIDENTIAL METER MULTI-CONNECTION 3/4" X 5/8" OR 1"
DW-6	NON-RESIDENTIAL METER CONNECTION 2" OR 1 1/2"
DW-7	4 INCH METER AND VAULT WITH 2" BYPASS FOR 4" LATERAL
DW-8	6 INCH METER AND VAULT WITH 2" BYPASS FOR 6" LATERALS
DW-9	6 INCH METER AND VAULT WITH 4" BYPASS FOR 8" LATERALS
DW-10A	PRESSURE REDUCING VALVE STATION - 1 OF 5
DW-10B	PRESSURE REDUCING VALVE STATION - 2 OF 5
DW-10C	PRESSURE REDUCING VALVE STATION - 3 OF 5
DW-10D	PRESSURE REDUCING VALVE STATION - 4 OF 5
DW-10E	PRESSURE REDUCING VALVE STATION - 5 OF 5
DW-12A	AIR/VACUUM RELIEF VALVE IN PUBLIC ROW - 1 OF 2
DW-12B	AIR/VACUUM RELIEF VALVE IN PUBLIC ROW - 2 OF 2
DW-12C	AIR/VACUUM RELIEF VALVE IN PRIVATE ROADS - 1 OF 2
DW-12D	AIR/VACUUM RELIEF VALVE IN PRIVATE ROADS - 2 OF 2
DW-12E	AIR/VACUUM RELIEF VALVE IN RURAL ROADS - 1 OF 2
DW-12F	AIR/VACUUM RELIEF VALVE IN RURAL ROADS - 2 OF 2
DW-12G	AIR VACUUM RELIEF VALVE VENT DETAILS
DW-13A	2" BLOW OFF VALVE
DW-13B	TEMPORARY 2" BLOW OFF VALVE
DW-14	SAMPLING STATION
DW-14A	SAMPLING STATION IN PUBLIC ROADS
DW-14B	SAMPLING STATION IN PRIVATE ROADS
DW-15	CONCRETE COLLAR
DW-16	DRINKING WATER PIPE CASING

**DRINKING WATER  
DETAILS**

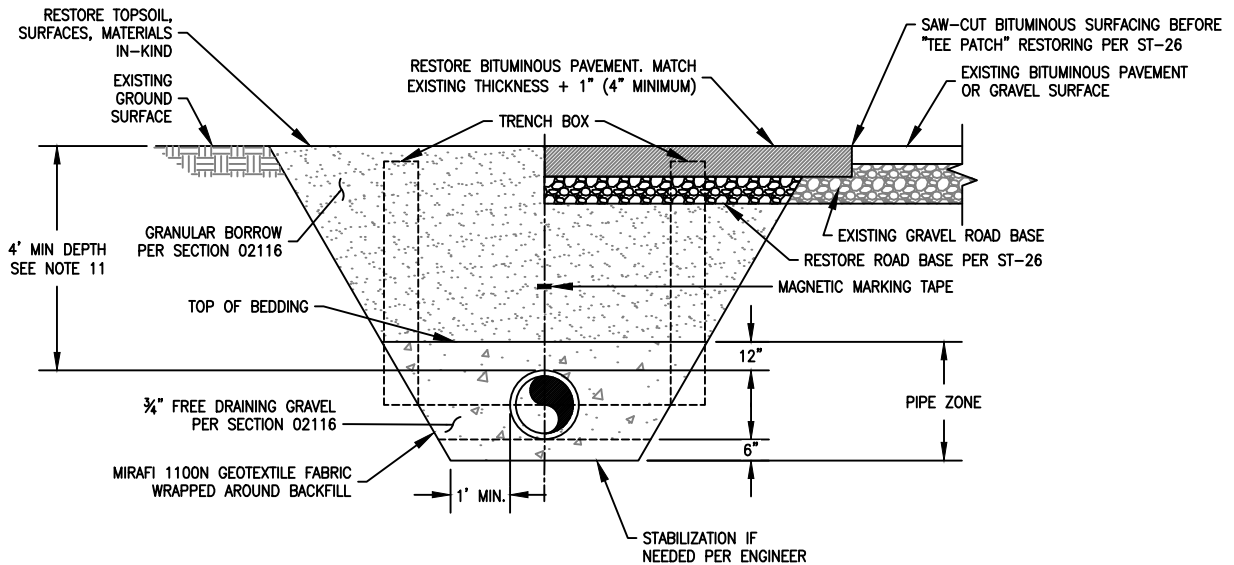
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DRAWING NAME: DW-0		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:	SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

DRINKING WATER

**DW-0**



### CROSS-SECTION: TYPICAL TRENCH

#### NOTES:

1. CONTRACTOR SHALL LOCATE ALL UNDERGROUND UTILITIES BEFORE LAYING PIPE WITHIN 300' OF SAID UTILITIES WHICH MAY BE EXPOSED, DAMAGED OR CROSSED AS SHOWN ON THE DRAWINGS OR AS "BLUE STAKED". THE CONTRACTOR WILL MAKE ARRANGEMENTS WITH THE UTILITY COMPANY TO MOVE THE UTILITY IF NECESSARY OR OBTAIN PERMISSION FROM THE CITY ENGINEER TO MODIFY GRADE OF PIPELINE IN ORDER TO GO AROUND UTILITIES.
2. PROVIDE GEOTECHNICAL REPORT. FOLLOW RECOMMENDATIONS OF GEOTECHNICAL REPORT
3. PIPE ZONE SHALL BE PLACED IN LIFTS AND TAMPED
4. TRENCHES SHALL BE COMPACTED IN LIFTS TO 95% DENSITY
5. GEOTEXTILE FABRIC IS REQUIRED WHERE EVIDENCE OF EXISTING OR PAST GROUNDWATER CONDITIONS ARE PRESENT. THESE LOCATIONS ARE TYPICALLY EAST OF REDWOOD RD AND SOUTH OF CROSSROADS BLVD.
6. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPAIRED AT THE SOLE EXPENSE OF THE PARTY WHO DAMAGED THE UTILITY.
7. THE MINIMUM CLEAR WIDTH OF THE TRENCH, MEASURED AT THE SPRING LINE OF THE PIPE, SHOULD BE 12 INCHES GREATER THAN THE DIAMETER OF THE PIPE. IN ROCKY SUB-GRADES, 18" OF CLEARANCE SHALL BE PROVIDED ON ALL SIDES OF PIPE.
8. INSTALL MAGNETIC DETECTOR TAPE 3' ABOVE PIPE AND LOOP TO GROUND SURFACE IN VALVE BOXES PER DW-15.
9. THE CITY RECOMMENDS CONTRACTOR MEET ALL OF THE REQUIREMENTS ESTABLISHED FOR SAFE TRENCHING. (SEE OSHA AND UOSH REQUIREMENTS, LATEST EDITIONS).
10. WHERE COLLAPSIBLE SOILS ARE ENCOUNTERED, FURNISH, PLACE AND COMPACT IMPORTED BACKFILL MATERIALS AS REQUIRED AND AS DIRECTED.
11. MINIMUM COVER OVER TOP OF PIPE SHALL BE 48-INCHES BELOW THE FINISHED GRADE. THIS DEPTH MAY BE INCREASED AS REQUIRED TO MISS UNDERGROUND UTILITIES, STORM DRAINS, OR OTHER OBSTRUCTIONS, OR WHERE INDICATED ON THE DRAWINGS.
12. FURNISH AND INSTALL POLY-WRAP ON DUCTILE IRON PIPE.

## DRINKING WATER PIPE TRENCH

DATE:  
SEP 2023

DRAWING NAME:  
DW-1

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
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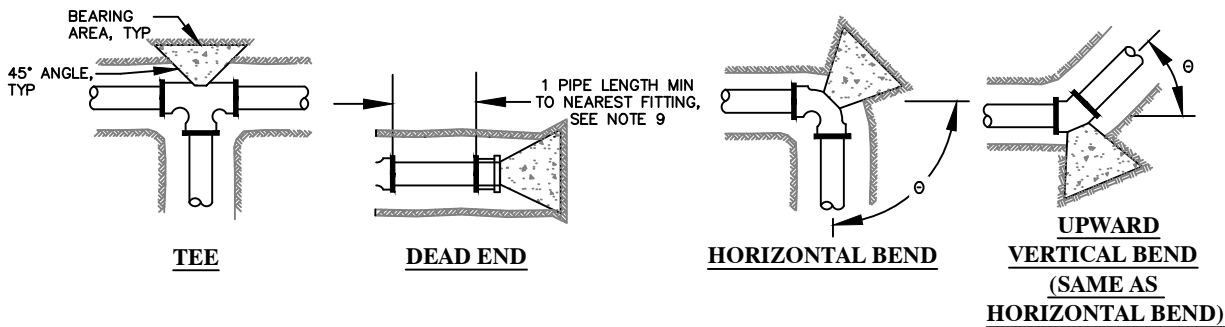


STANDARD DETAILS

DRINKING WATER

**DW-1**





**FOR REDUCERS, CROSSES, AND DEAD END VALVES USE  
ALTERNATIVE RESTRAINT PER DW-2C AND DW-2D**

**TABLE 1: SOIL BEARING STRENGTH**

SOIL TYPE	BEARING STRENGTH (lb/ft <sup>2</sup> )
FINE GRAINED (CLAYS & SILTS)	1,000
GRANULAR (SAND & GRAVEL WITH OR WITHOUT CLAY & SILT)	3,000

NOTE: VALUES FROM DUCTILE IRON PIPE RESEARCH ASSOCIATION.

**SAFE BEARING LOAD FORMULA**

$$\text{THRUST BLOCK AREA AGAINST TRENCH WALL (SQ. FEET)} = 1.5 \times \frac{\text{THRUST ON FITTING (LBS) SEE TABLE 2}}{\text{BEARING STRENGTH (LBS/SQ. FT) SEE TABLE 1}}$$

**TABLE 2:**

THRUST ON FITTING (LBS) AT 200 PSI PRESSURE						
PIPE SIZE (IN)	TEES DEAD-ENDS	90° BEND	45° BEND	22.5° BEND	11.25° BEND	
6	7,697	9,624	4,328	2,207	1,109	
8	12,724	14,217	7,694	3,923	1,971	
10	19,007	22,215	12,022	6,129	3,079	
12	26,547	31,989	17,312	8,826	4,434	
14	35,343	43,540	23,564	12,013	6,036	
16	45,396	56,869	30,777	15,690	7,883	
18	56,706	71,975	38,953	19,858	9,977	
20	69,272	88,858	48,090	24,516	12,317	
24	98,175	127,955	69,249	35,303	17,737	

**TABLE 3:**

REQUIRED THRUST BLOCK BEARING AREA (SQ. FT) FINE GRAINED SOILS (CLAYS & SILTS)						
PIPE SIZE (IN)	TEES DEAD-ENDS	90° BEND	45° BEND	22.5° BEND	11.25° BEND	
6	12	15	7	4	2	
8	20	22	12	6	3	
10	29	34	19	10	5	
12	40	48	26	14	7	
14	54	66	36	19	10	
16	69	86	47	24	12	
18	86	108	59	30	15	
20	104	134	73	37	19	
24	148	192	104	53	27	

**TABLE 4:**

REQUIRED THRUST BLOCK BEARING AREA (SQ. FT) GRANULAR SOILS (SAND & GRAVEL WITH OR WITHOUT CLAY & SILT)						
PIPE SIZE (IN)	TEES DEAD-ENDS	90° BEND	45° BEND	22.5° BEND	11.25° BEND	
6	4	5	3	2	1	
8	7	8	4	2	1	
10	10	12	7	4	2	
12	14	16	9	5	3	
14	18	22	12	7	4	
16	23	29	16	8	4	
18	29	36	20	10	5	
20	35	45	25	13	7	
24	50	64	35	18	9	

**NOTES:**

1. CONCRETE THRUST BLOCKS ARE NOT ALLOWED UNDER PAVED SURFACES WITHIN PUBLIC RIGHT OF WAYS, I.E. BETWEEN INITIAL AND FUTURE CURB LINES. ALL PIPE FITTINGS WITHIN THE PUBLIC RIGHT OF WAY SHALL BE RESTRAINED PER DW-2C AND DW-2D OR SHALL BE DESIGNED AND SPECIFIED BY THE PROJECT ENGINEER.
2. RESTRAINED PIPE JOINTS MAY BE USED AS AN ALTERNATIVE TO THRUST BLOCKS PER DW-2C AND DW-2D.
3. MINIMUM SIZE OF THRUST BLOCK SHALL BE DETERMINED FROM THE TABLES ON THIS DRAWING.
4. CONCRETE MIX STRENGTH SHALL BE 2,000 PSI MIN.
5. PLACE CONCRETE AGAINST UNDISTURBED SOIL.
6. CAPS OR PLUGS SHALL BE LOCATED 1 PIPE LENGTH, IE, 18 FEET MINIMUM, FROM NEAREST FITTING OR JOINT.
7. FITTINGS SHALL BE POLYETHYLENE WRAPPED PRIOR TO PLACING CONCRETE THRUST BLOCK. CARE SHOULD BE TAKEN TO ASSURE THAT THE JOINT, INCLUDING BOLTS WILL BE ACCESSIBLE AFTER PLACING THE THRUST BLOCK.
8. RESTRAINT SIZING IS BASED UPON A MAXIMUM OPERATING PRESSURE OF 150 PSI, A TEST PRESSURE OF 200 PSI, AND A MINIMUM SOIL BEARING STRENGTH INDICATED IN TABLE 1 ABOVE AND UP TO 24" DIAMETER. CONDITIONS WITH PRESSURES, SOILS, OR PIPE SIZE OUTSIDE OF THESE LIMITS REQUIRE A PROJECT SPECIFIC DESIGN.
9. SITE SPECIFIC HORIZONTAL BEARING STRENGTH VALUES MAY BE USED TO CALCULATE THRUST BLOCK SIZES IF A SITE SPECIFIC GEOTECHNICAL REPORT HAS BEEN PREPARED FOR THE SPECIFIC SITE IDENTIFYING SOIL BEARING STRENGTH.
10. IF A SITE SPECIFIC GEOTECHNICAL REPORT HAS BEEN PREPARED WITH SPECIFIC SITE SOIL BEARING STRENGTH, SITE SPECIFIC HORIZONTAL THRUST BLOCK SIZES MAY BE CALCULATED AND SUBMITTED TO THE CITY FOR CONSIDERATION.
11. FITTINGS SHALL BE POLYETHYLENE WRAPPED PRIOR TO PLACING CONCRETE THRUST BLOCK. CARE SHOULD BE TAKEN TO ASSURE THAT THE JOINT, INCLUDING BOLTS WILL BE ACCESSIBLE AFTER PLACING THE THRUST BLOCK.
12. THRUST BLOCK BEARING AREA SHALL BE ROUNDED UP TO NEAREST WHOLE NUMBER.

**CONCRETE THRUST  
BLOCKS**

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-2

DRAWN BY:  
ABO

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

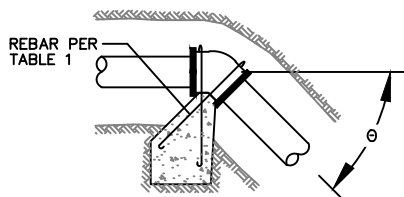
SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

STANDARD DETAILS

DRINKING WATER

**DW-2**



### DOWNWARD VERTICAL BENDS

### THRUST BLOCK VOLUME FORMULA FOR DOWNWARD VERTICAL BENDS

$$\text{THRUST BLOCK VOLUME (CUBIC FEET)} = \frac{\text{THRUST ON FITTING (LBS) SEE TABLE 2}}{\text{DW-2}} \div \text{UNIT WEIGHT OF CONCRETE (150 LBS/CU FT)}$$

**TABLE 1:**

FOR 45° BEND VERTICAL DOWNWARD BENDS WITHOUT GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	29
8	4	2	1	52
10	4	2	1	81
12	5	2	1	116
14	5	2	2	158
16	6	2	2	206
18	6	2	3	260
20	7	3	3	321
24	8	4	3	462

**TABLE 3:**

FOR 11.25° BEND VERTICAL DOWNWARD BENDS WITHOUT GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	8
8	3	1	1	14
10	3	1	1	21
12	3	1	1	30
14	4	2	1	41
16	4	2	1	53
18	4	2	1	67
20	5	2	1	83
24	6	2	1	119

**TABLE 2:**

FOR 22.5° BEND VERTICAL DOWNWARD BENDS WITHOUT GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	15
8	3	1	1	27
10	4	2	1	41
12	4	2	1	59
14	5	2	1	81
16	5	2	1	105
18	6	2	1	133
20	6	2	1	164
24	6	2	3	236

#### NOTES:

1. CONCRETE THRUST BLOCKS (OR ANCHORS) ARE NOT ALLOWED UNDER PAVED SURFACES WITHIN PUBLIC RIGHT OF WAYS, I.E. BETWEEN INITIAL AND FUTURE CURB LINES. ALL PIPE FITTINGS WITHIN PUBLIC RIGHT OF WAYS SHALL BE RESTRAINED PER DW-2C AND DW-2D OR SHALL BE DESIGNED AND SPECIFIED BY THE PROJECT ENGINEER.
2. RESTRAINED PIPE JOINTS MAY BE USED AS AN ALTERNATIVE TO THRUST BLOCKS PER DW-2C AND DW-2D.
3. REINFORCING BARS REQUIRED FOR HANGING THRUST BLOCKS SHALL BE EPOXY COATED.
4. MINIMUM SIZE OF THRUST ANCHORS SHALL BE DETERMINED FROM THE TABLES ON THIS DRAWING.
5. CONCRETE MIX STRENGTH SHALL BE 2,000 PSI MIN.
6. THRUST ANCHORS FOR PIPE SIZES LARGER THAN 24" SHALL BE DESIGNED BY THE PROJECT ENGINEER.
7. FITTINGS SHALL BE POLYETHYLENE WRAPPED PRIOR TO PLACING CONCRETE THRUST ANCHOR. CARE SHOULD BE TAKEN TO ASSURE THAT THE JOINT, INCLUDING BOLTS WILL BE ACCESSIBLE AFTER PLACING THE THRUST ANCHOR.
8. THRUST BLOCK BEARING AREA SHALL BE ROUNDED TO THE NEAREST WHOLE NUMBER.
9. RESTRAINT SIZING IS BASED UPON A MAXIMUM OPERATING PRESSURE OF 150 PSI AND A TEST PRESSURE OF 200 PSI.

## CONCRETE THRUST ANCHORS FOR DOWNWARD VERTICAL BENDS IN DRY SOIL CONDITIONS

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-2A

DRAWN BY:  
ABO

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

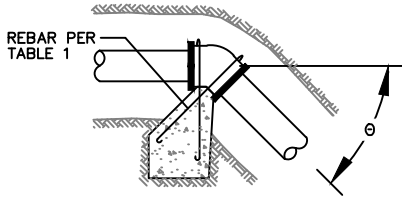
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

DRINKING WATER

**DW-2A**



### DOWNWARD VERTICAL BENDS

### THRUST BLOCK VOLUME FORMULA FOR DOWNWARD VERTICAL BENDS

$$\text{THRUST BLOCK VOLUME (CUBIC FEET)} = \frac{\text{THRUST ON FITTING (LBS) SEE TABLE 2}}{\text{DW-2}} \div \text{UNIT WEIGHT OF CONCRETE (150 LBS/CU FT)}$$

**TABLE 1:**

FOR 45° BEND VERTICAL DOWNWARD BENDS IN GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	49
8	4	2	1	87
10	4	2	1	137
12	5	2	1	197
14	5	2	2	268
16	6	2	2	350
18	6	2	3	443
20	7	3	3	546
24	8	4	3	787

**TABLE 3:**

FOR 12.25° BEND VERTICAL DOWNWARD BENDS IN GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	13
8	3	1	1	22
10	3	1	1	35
12	3	1	1	50
14	4	2	1	69
16	4	2	1	90
18	4	2	1	113
20	5	2	1	140
24	6	2	1	202

**TABLE 2:**

FOR 22.5° BEND VERTICAL DOWNWARD BENDS IN GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	25
8	3	1	1	45
10	4	2	1	70
12	4	2	1	100
14	5	2	1	137
16	5	2	1	178
18	6	2	1	226
20	6	2	1	279
24	6	2	3	401

#### NOTES:

1. CONCRETE THRUST BLOCKS (OR ANCHORS) ARE NOT ALLOWED UNDER PAVED SURFACES WITHIN PUBLIC RIGHT OF WAYS, I.E. BETWEEN INITIAL AND FUTURE CURB LINES. ALL PIPE FITTINGS WITHIN PUBLIC RIGHT OF WAYS SHALL BE RESTRAINED PER DW-2C AND DW-2D OR SHALL BE DESIGNED AND SPECIFIED BY THE PROJECT ENGINEER.
2. RESTRAINED PIPE JOINTS MAY BE USED AS AN ALTERNATIVE TO THRUST BLOCKS PER DW-2C AND DW-2D.
3. REINFORCING BARS REQUIRED FOR HANGING THRUST BLOCKS SHALL BE EPOXY COATED.
4. MINIMUM SIZE OF THRUST ANCHORS SHALL BE DETERMINED FROM THE TABLES ON THIS DRAWING.
5. CONCRETE MIX STRENGTH SHALL BE 2,000 PSI MIN.
6. THRUST ANCHORS FOR PIPE SIZES LARGER THAN 24" SHALL BE DESIGNED BY THE PROJECT ENGINEER.
7. FITTINGS SHALL BE POLYETHYLENE WRAPPED PRIOR TO PLACING CONCRETE THRUST ANCHOR. CARE SHOULD BE TAKEN TO ASSURE THAT THE JOINT, INCLUDING BOLTS WILL BE ACCESSIBLE AFTER PLACING THE THRUST ANCHOR.
8. THRUST BLOCK BEARING AREA SHALL BE ROUNDED TO THE NEAREST WHOLE NUMBER.
9. RESTRAINT SIZING IS BASED UPON A MAXIMUM OPERATING PRESSURE OF 150 PSI AND A TEST PRESSURE OF 200 PSI.

**CONCRETE THRUST ANCHORS  
FOR DOWNWARD VERTICAL  
BENDS WHERE SIGNS OF  
GROUNDWATER ARE PRESENT**

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-2A

DRAWN BY:  
ABO

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
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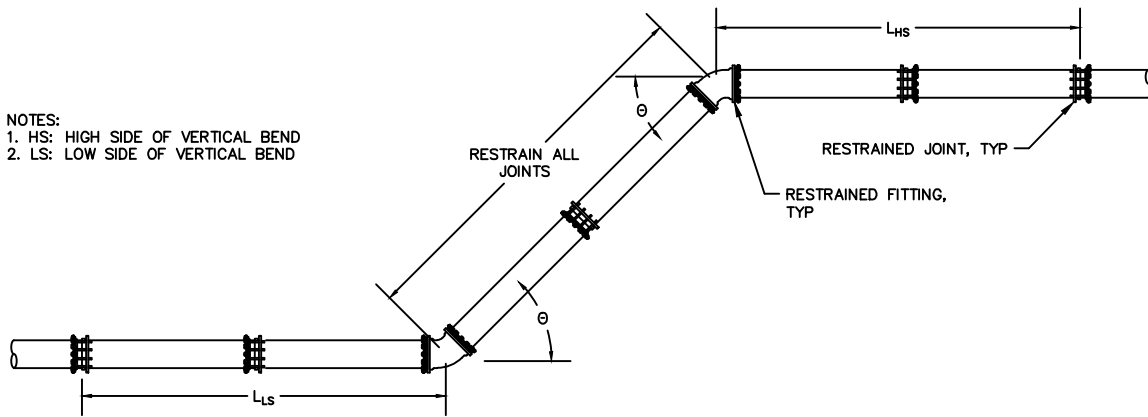
STANDARD DETAILS

DRINKING WATER

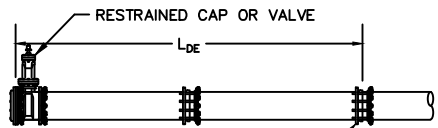
**DW-2B**

**NOTES:**

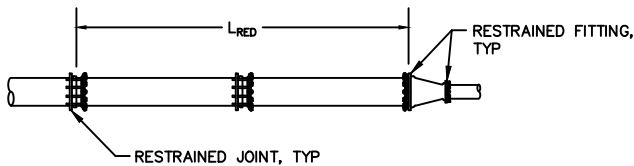
1. HS: HIGH SIDE OF VERTICAL BEND
2. LS: LOW SIDE OF VERTICAL BEND



**VERTICAL BEND**

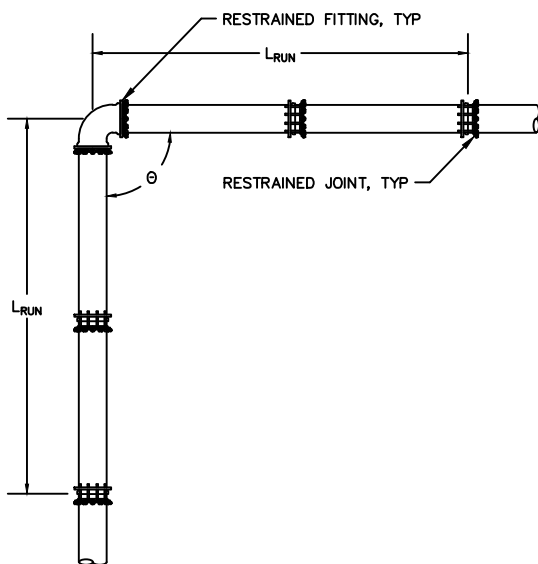


**DEAD END (CAP OR VALVE)**

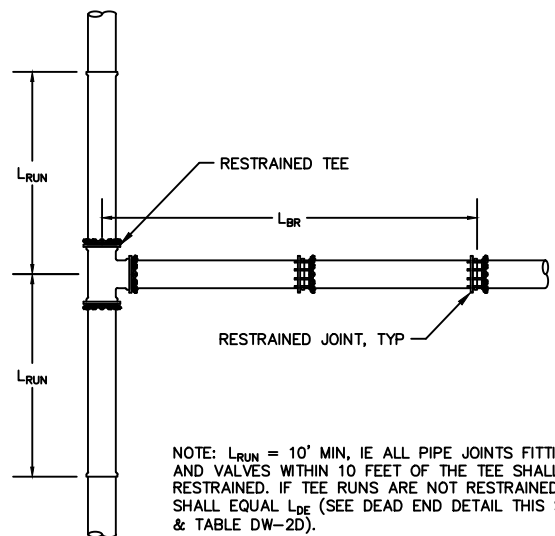


**REDUCER**

NOTE: RESTRAINED JOINTS ONLY REQUIRED ON THE LARGE PIPE SIDE OF REDUCERS.

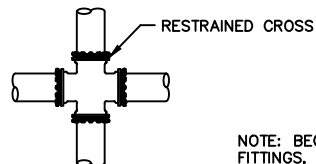


**HORIZONTAL BEND**



NOTE:  $L_{RUN} = 10'$  MIN, IE ALL PIPE JOINTS FITTINGS, AND VALVES WITHIN 10 FEET OF THE TEE SHALL BE RESTRAINED. IF TEE RUNS ARE NOT RESTRAINED,  $L_{BR}$  SHALL EQUAL  $L_{DE}$  (SEE DEAD END DETAIL THIS SHEET & TABLE DW-2D).

**TEE**



NOTE: BECAUSE RESTRAINT IS REQUIRED FOR ALL FITTINGS, FORCES AT CROSSES ARE BALANCED AND NO ADDITIONAL RESTRAINT IS REQUIRED AT CROSSES.

**CROSS**

**SHEET NOTES:**

1. MULTIPLE STYLES OF RESTRAINED FITTINGS ARE ACCEPTABLE. SUBMITTALS ARE REQUIRED.
2. IF RESTRAINTS ARE EXTERNAL TO THE BELL OF THE PIPE AND EVIDENCE OF GROUNDWATER IS PRESENT, THE RESTRAINT FITTING SHALL BE WRAPPED IN A THREE PART EPOXY COATING BY DENSO OR TRENTON.

**ALTERNATIVE THRUST  
RESTRAINT**

DATE: APRIL 2024
DRAWING NAME: DW-17
DRAWN BY: ABO
CHECKED: APPROVED:

REVISIONS			
REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

DRINKING WATER

**DW-2C**

## PIPE RESTRAINT TABLES

### PVC

#### BENDS AND DEAD ENDS

MINIMUM LENGTH OF PIPE TO BE RESTRAINED (FT)

SIZE	HORIZONTAL BEND			VERTICAL BEND				DEAD ENDS
	90°	45°	22.5°	45°		22.5°		
	L <sub>RUN</sub>	L <sub>RUN</sub>	L <sub>RUN</sub>	L <sub>HS</sub>	L <sub>LS</sub>	L <sub>HS</sub>	L <sub>LS</sub>	
6"	14	6	3	18	6	9	3	43
8"	18	8	4	24	8	11	4	57
10"	23	9	5	29	9	14	5	70
12"	27	11	5	35	11	17	5	84
14"	31	13	6	40	13	19	6	96
16"	36	15	7	45	15	22	7	109
18"	40	17	8	50	17	24	8	121
20"	44	18	9	55	18	27	9	133
24"	53	22	11	65	22	31	11	157

#### TEES

MINIMUM LENGTH OF PIPE (L<sub>BR</sub>) TO BE RESTRAINED (FT)

BRANCH SIZE	RUN SIZE									
	6"	8"	10"	12"	14"	16"	18"	20"	24"	
	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>
6"	20	20	20	20	20	20	20	20	20	20
8"		20	20	20	20	20	20	20	20	20
10"			20	20	20	20	20	20	20	20
12"				21	20	20	20	20	20	20
14"					35	26	20	20	20	20
16"						48	40	32	20	20
18"							61	54	41	20
20"								73	61	20
24"										98

#### REDUCERS

MINIMUM LENGTH OF PIPE (L<sub>RED</sub>) TO BE RESTRAINED (FT)

	6"	8"	10"	12"	14"	16"	18"	20"
8"	25							
10"	45	25						
12"	63	46	26					
14"	79	65	47	26				
16"	94	82	66	48	26			
18"	108	97	84	67	48	25		
20"	121	112	100	85	68	48	25	
24"	147	139	130	118	103	87	69	48

### DUCTILE IRON (WRAPPED)

#### BENDS AND DEAD ENDS

MINIMUM LENGTH OF PIPE TO BE RESTRAINED (FT)

SIZE	HORIZONTAL BEND			VERTICAL BEND				DEAD ENDS
	90°	45°	22.5°	45°		22.5°		
	L <sub>RUN</sub>	L <sub>RUN</sub>	L <sub>RUN</sub>	L <sub>HS</sub>	L <sub>LS</sub>	L <sub>HS</sub>	L <sub>LS</sub>	
6"	16	7	3	34	7	16	3	82
8"	21	9	4	45	9	21	4	108
10"	27	11	5	55	11	26	5	133
12"	32	13	6	65	13	31	6	158
14"	37	15	7	75	15	36	7	182
16"	42	18	8	85	18	41	8	206
18"	48	20	9	95	20	46	9	229
20"	53	22	10	104	22	50	10	252
24"	63	26	13	123	26	59	13	296

#### TEES

MINIMUM LENGTH OF PIPE (L<sub>BR</sub>) TO BE RESTRAINED (FT)

BRANCH SIZE	RUN SIZE									
	6"	8"	10"	12"	14"	16"	18"	20"	24"	
	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>	L <sub>BR</sub>
6"	18	18	18	18	18	18	18	18	18	18
8"		18	18	18	18	18	18	18	18	18
10"			18	18	18	18	18	18	18	18
12"				40	18	18	18	18	18	18
14"					65	48	32	18	18	18
16"						90	76	61	32	18
18"							115	102	77	18
20"								139	116	18
24"										185

#### REDUCERS

MINIMUM LENGTH OF PIPE (L<sub>RED</sub>) TO BE RESTRAINED (FT)

	6"	8"	10"	12"	14"	16"	18"	20"
8"	47							
10"	85	48						
12"	118	88	48					
14"	149	123	89	48				
16"	177	155	126	90	48			
18"	204	184	159	127	91	48		
20"	229	212	189	161	129	91	48	
24"	278	263	245	222	195	165	130	91

### NOTES:

- PIPE SIZES LARGER THAN 24" SHALL BE RESTRAINED PER DESIGN ENGINEER RECOMMENDATION AND CITY ENGINEER APPROVAL.
- TABLES ASSUME THE PIPE ZONE SOILS ARE SAND AND THE DESIGN PRESSURE IS 200 PSI.
- IF A THRUST BLOCK IS USED ON A FITTING WITHIN THE REQUIRED RESTRAINED DISTANCE, THE LENGTH OF RESTRAINED PIPE SHALL BE DECREASED TO THE LENGTH OF PIPE FROM THE FITTING TO THE THRUST BLOCK.
- IN CONDITIONS WITH INDICATIONS OF GROUNDWATER, THRUST RESTRAINT FITTINGS SHALL BE WRAPPED WITH THREE PART WAX TAPE COATING SYSTEM BY DENSO OR TRENTON.

## ALTERNATIVE THRUST RESTRAINT TABLES

DATE: APRIL 2024	
DRAWING NAME: DW-17A	
DRAWN BY: ABO	
CHECKED:	APPROVED:

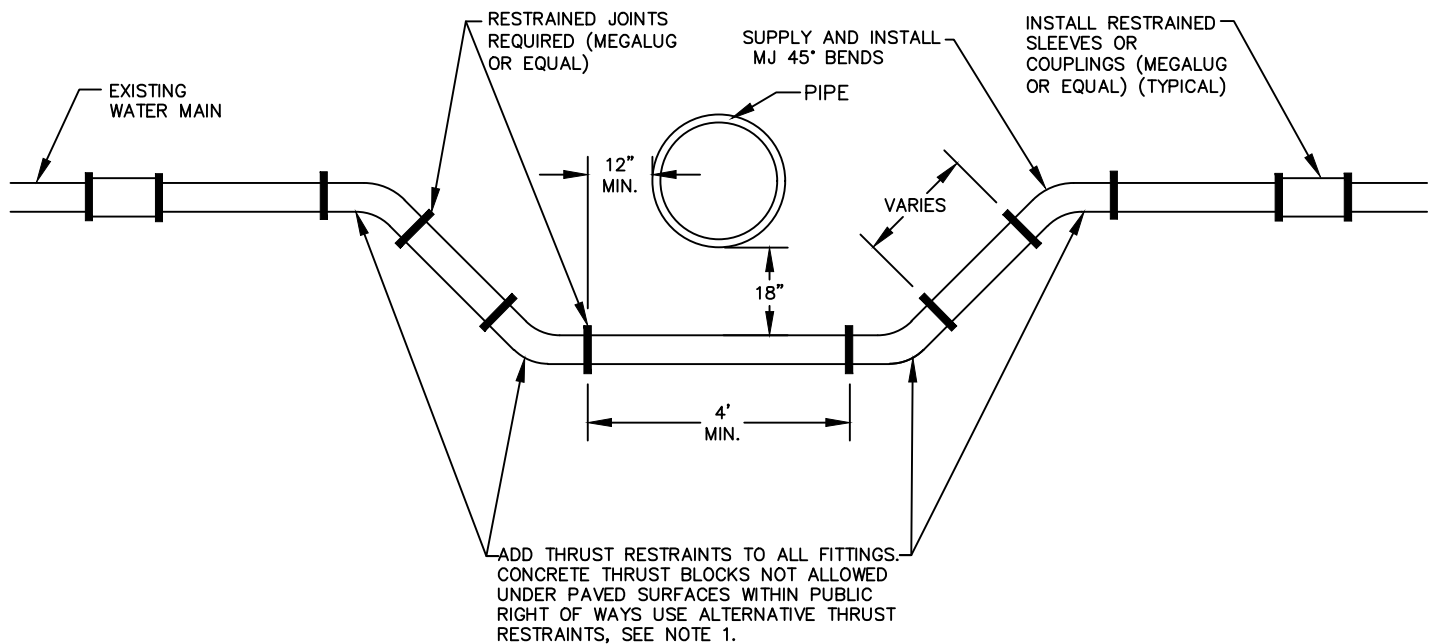
REVISIONS			
REVISION	DATE	BY	COMMENTS

**SARATOGA  
SPRINGS CITY**

1307 N. COMMERCE DR.  
 #200, SARATOGA SPRINGS,  
 UT 84645  
 PHONE: 801-766-9793  
 FAX: 801-766-9794



STANDARD DETAILS
DRINKING WATER
DW-2D



#### NOTES:

1. CONCRETE THRUST BLOCKS ARE NOT ALLOWED UNDER PAVED SURFACES WITHIN PUBLIC RIGHT OF WAYS, I.E. BETWEEN INITIAL AND FUTURE CURB LINES. ALL PIPE FITTINGS SHALL BE RESTRAINED PER DW-17 OR SHALL BE DESIGNED AND SPECIFIED BY THE PROJECT ENGINEER.
2. CITY TO BE GIVEN 72 HOUR NOTICE BEFORE LOOPING ANY WATERLINE WHEN SHUT OFF IS REQUIRED
3. A CASE OR SLEEVE IS REQUIRED WHEN CROSSING DRINKING WATER UNDER SANITARY AND STORM SEWER.

## DRINKING WATERLINE LOOP

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-3

DRAWN BY:  
ABO

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

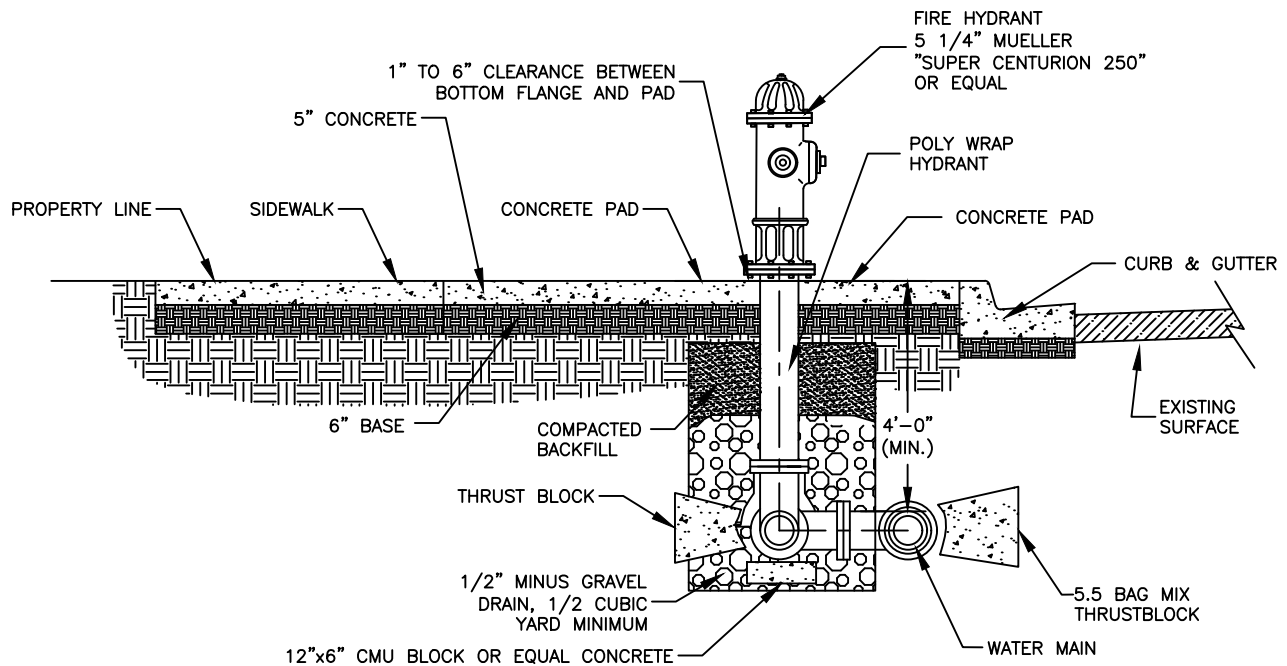
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



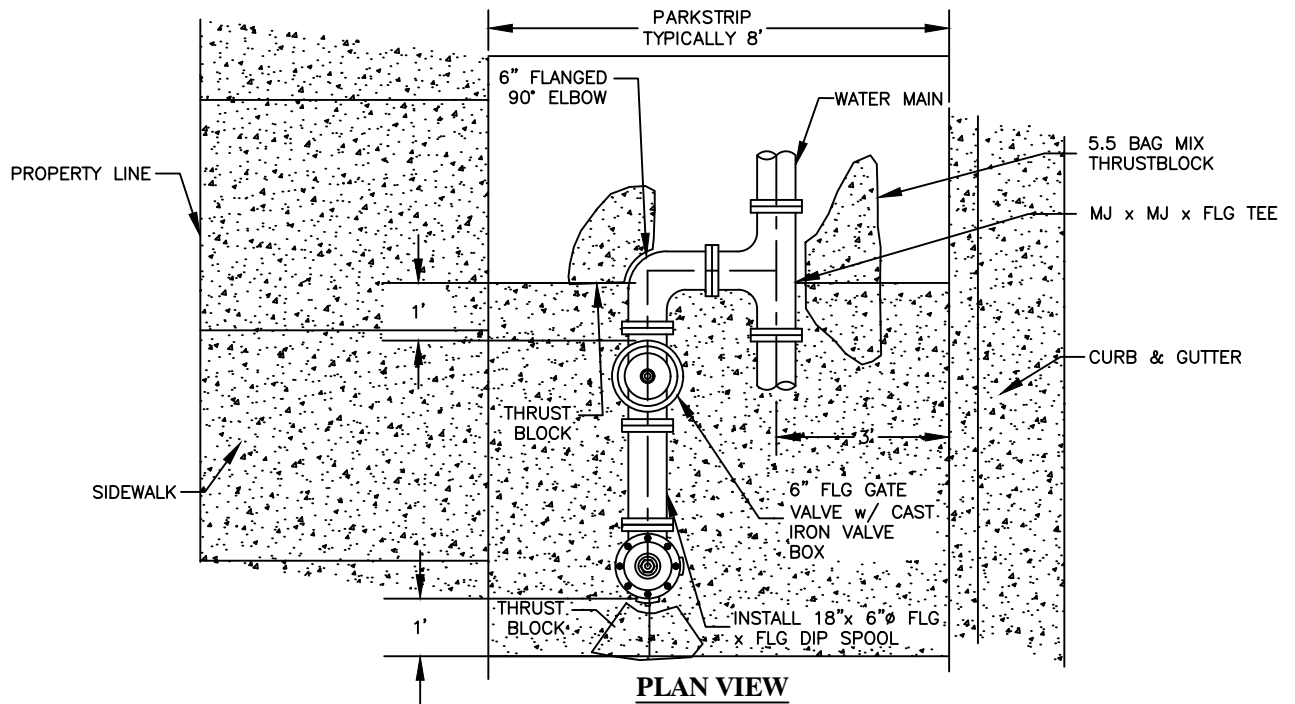
STANDARD DETAILS

DRINKING WATER

**DW-3**



**SECTION VIEW**



**PLAN VIEW**

**NOTES:**

1. HYDRANT SHALL BE "TRAFFIC" TYPE WITH A REPLACEABLE BREAK-AWAY UNIT IMMEDIATELY ABOVE GROUND.
2. IN NON PARKSTRIP AREAS, HYDRANT PAD SHALL BE MINIMUM 4-FT x 4-FT

**FIRE HYDRANT  
CONNECTION**

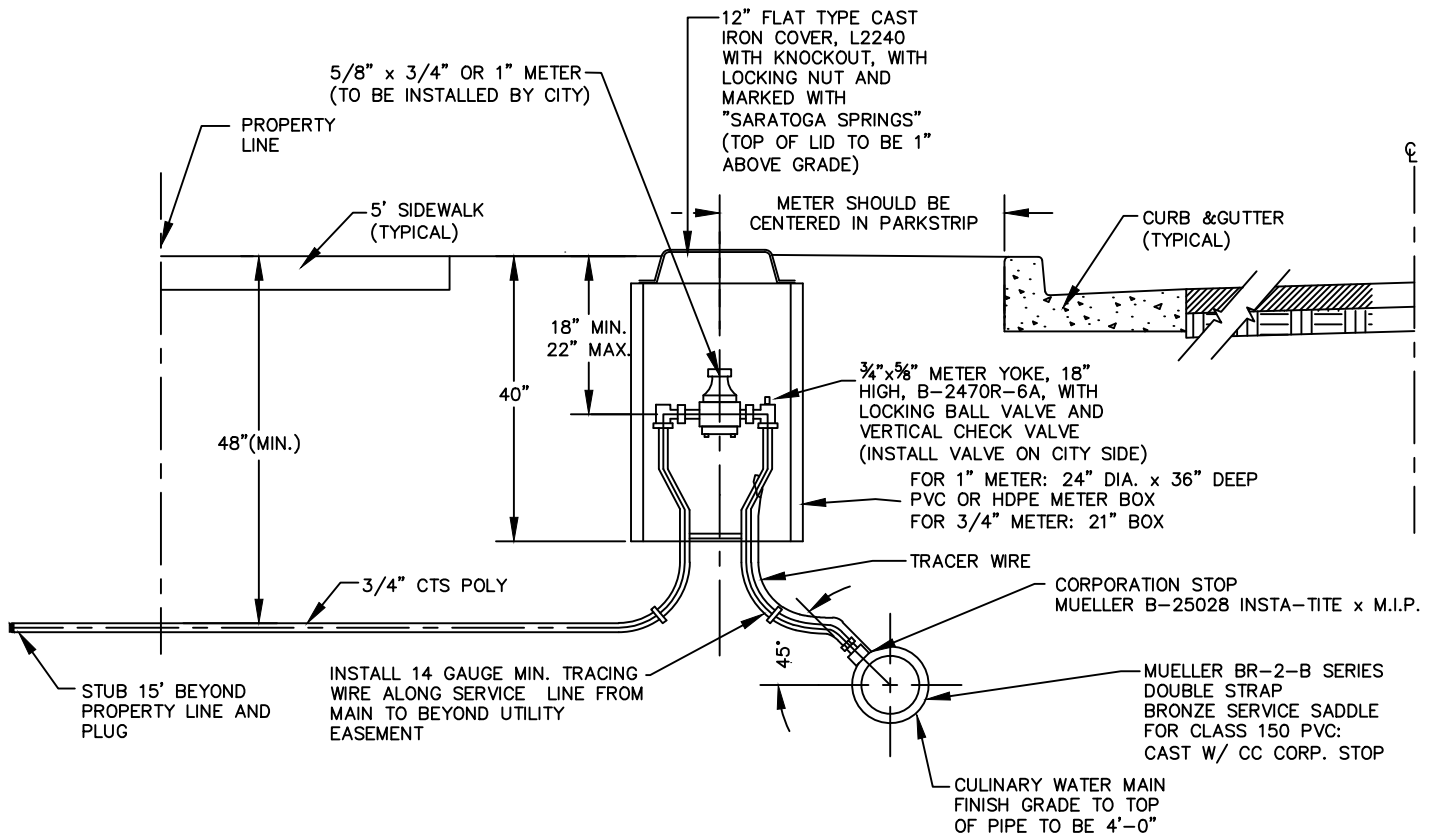
DATE: MARCH 2022		REVISIONS			
DRAWING NAME: DW-4		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:		APPROVED:			
SARATOGA SPRINGS CITY					
<small>1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794</small>					



STANDARD DETAILS

DRINKING WATER

**DW-4**



### NOTES:

1. INSPECTION: METER BOX AND SERVICE LINE SHALL BE INSPECTED BY CITY PRIOR TO BACKFILLING.
2. BACKFILL: INSTALL BACKFILL IN LIFTS NOT EXCEEDING 8" AFTER COMPACTION. COMPACT EACH LIFT TO AN AVERAGE DRY DENSITY OF 95% WITH NO DENSITY TEST RESULT LESS THAN 92%.
3. CONTRACTOR TO SUPPLY ALL MATERIALS EXCLUDING METER
4. METER BOXES SHOULD BE PVC OR HDPE.
5. PIPE: INSTALL MINIMUM 3/4" CTS POLY PIPE (SDR-9) FROM MAIN TO METER AND FROM METER TO BUILDING. MINIMUM 1" POLYETHYLENE PIPE TO BE USED IN COMMERCIAL AREAS. INSTALL TRACING WIRE FROM MAIN LINE TO METER.
6. PLACEMENT: ALL METERS ARE TO BE INSTALLED IN THE PARK STRIP 5-FT FROM PROPERTY LINE AND MUST NOT BE LOCATED IN A DRIVEWAY OR IN A SIDEWALK.
7. METER YOKE TO BE MUELLER B-2470R-6A, OR ACCEPTABLE EQUAL
9. SERVICE SADDLES SHALL BE MUELLER BR-2-B SERIES, OR EQUAL
11. METER LID TO BE 1" ABOVE LINE GRADE OF WALK/CURB
12. STAINLESS STEEL LINER INSERTS WILL BE REQUIRED INSIDE OF TUBING AT COMPRESSION FITTINGS.
13. WATER SERVICES SHALL BE STUBBED TO A POINT APPROXIMATELY 1' BEYOND UTILITY EASEMENT (PUE).
14. 1" METER INSTALLATION TO BE SIMILAR USING 1" METER, PIPE, AND FITTINGS.

## RESIDENTIAL METER CONNECTION 3/4" x 5/8" OR 1"

DATE:  
MARCH 2022

DRAWING NAME:  
DW-5

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

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SPRINGS CITY

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UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

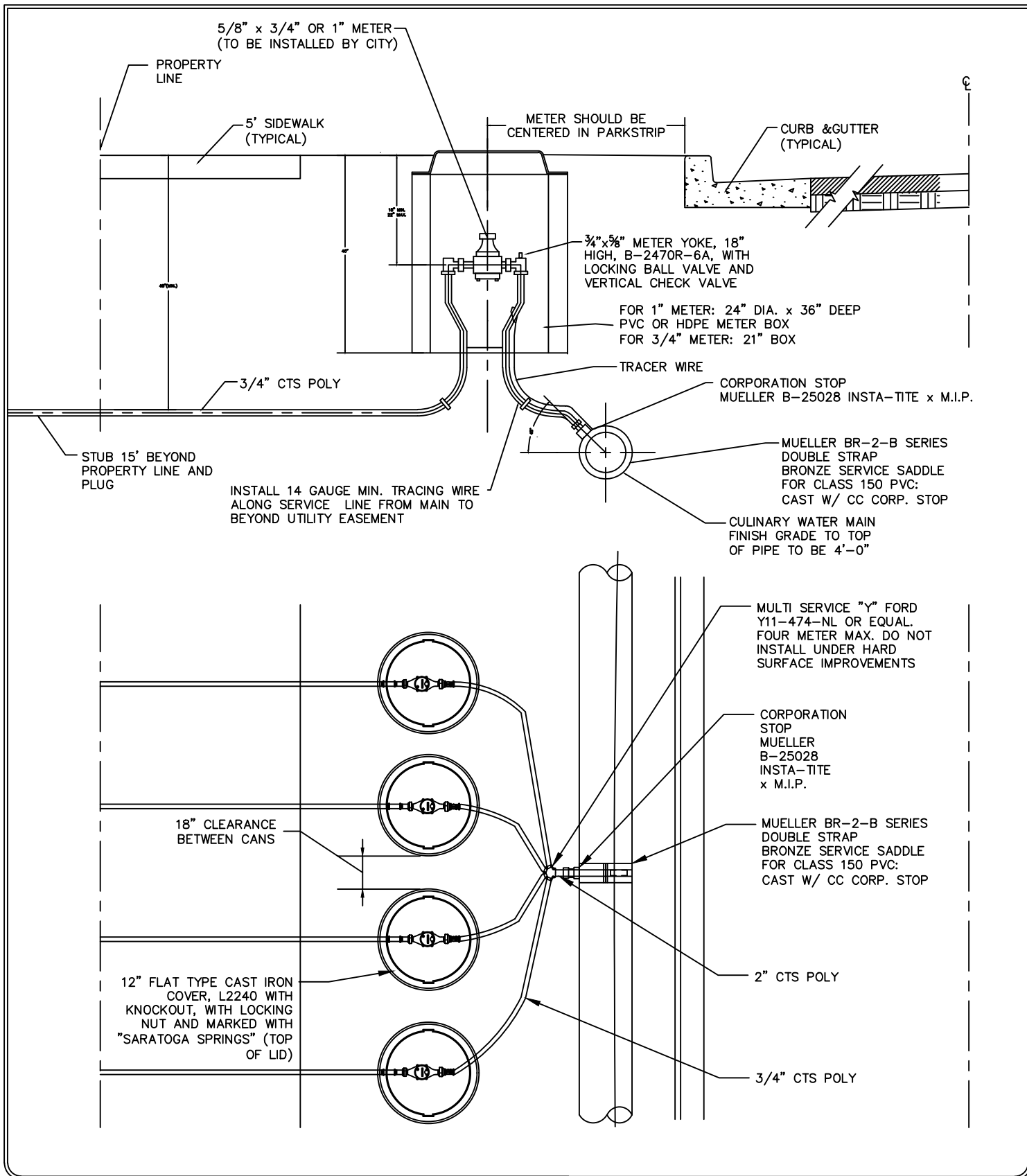


STANDARD DETAILS

DRINKING WATER

**DW-5**





# **RESIDENTIAL METER MULTI-CONNECTION** 3/4" x 5/8" OR 1"

DATE: MARCH 2022		REVISIONS			
DRAWING NAME: DW-5A		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:				
SARATOGA SPRINGS CITY					

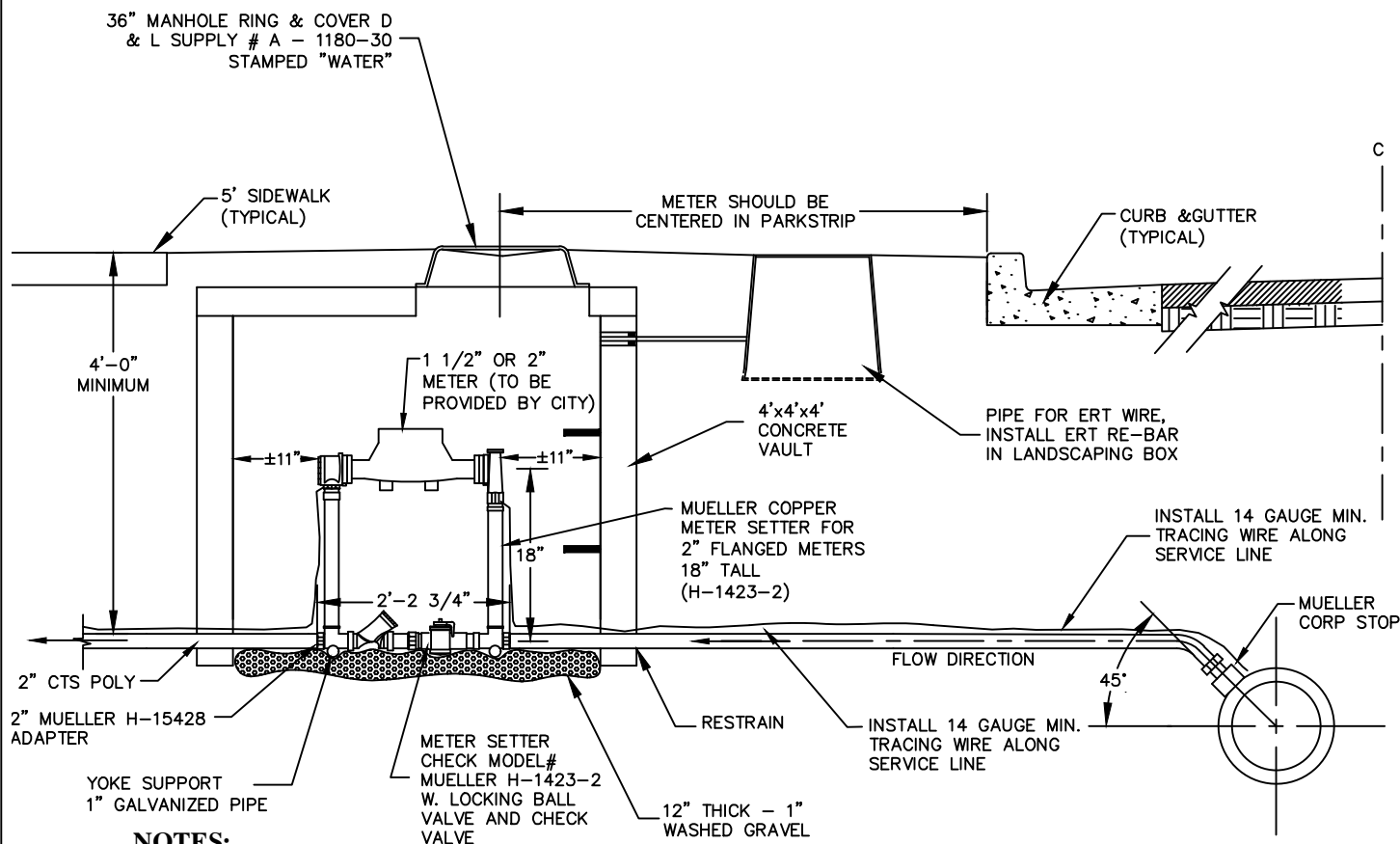
1307 N. COMMERCE DR.  
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UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

DRINKING WATER

**DW-5A**



# **NOTES:**

1. INSPECTION: METER BOX AND SERVICE LINE SHALL BE INSPECTED BY CITY PRIOR TO BACKFILLING.
2. BACKFILL: INSTALL BACKFILL IN LIFTS NOT EXCEEDING 8" AFTER COMPACTION. COMPACT EACH LIFT TO AN AVERAGE DRY DENSITY OF 97% WITH NO DENSITY TEST RESULT LESS THAN 95%.
3. CONTRACTOR TO SUPPLY ALL MATERIALS EXCLUDING METER.
4. METER BOXES SHALL BE A 4'x4'x4' CONCRETE VAULT.
5. PIPE: INSTALL MINIMUM 2" CTS POLY PIPE FROM MAIN TO METER AND FROM METER TO BUILDING. INSTALL TRACING WIRE FROM MAIN LINE TO METER
6. PLACEMENT: ALL METERS ARE TO BE INSTALLED IN THE PARK STRIP, MUST BE PLACED NEAR THE MIDPOINT OF THE LOT, AND MUST NOT BE LOCATED IN A DRIVEWAY OR IN A SIDEWALK.
7. METER SETTER TO BE MUELLER H-1423-2, OR ACCEPTABLE EQUAL. INSTALL CORRECT SIZE METAL PIPE TO STABILIZE SETTER.
8. PIPE SPLICES SHALL BE MADE USING A COMPRESSION FITTING; MUELLER 110 COMPRESSION CONNECTION (MUELLER H-15403) W/ STAINLESS STEEL INSERTS
9. WATER SERVICES SHALL BE STUBBED TO A POINT APPROXIMATELY 1 (ONE) FOOT BEYOND UTILITY EASEMENT.
10. IN TRAFFIC AREAS, BOXES SHOULD BE ABLE TO SUPPORT H-20 LOADING. (NOTE: TYPICALLY WATER METERS ARE NOT ALLOWED IN TRAFFIC AREAS.)
11. METER LID TO BE 1" ABOVE THE LINE GRADE OF WALK/CURB.
12. 1 1/2-INCH METER INSTALLATION TO BE SIMILAR; USING 1 1/2-INCH METER, PIPE, FITTINGS AND SETTER.

## **NON-RESIDENTIAL METER CONNECTION 2 " OR 1 1/2"**

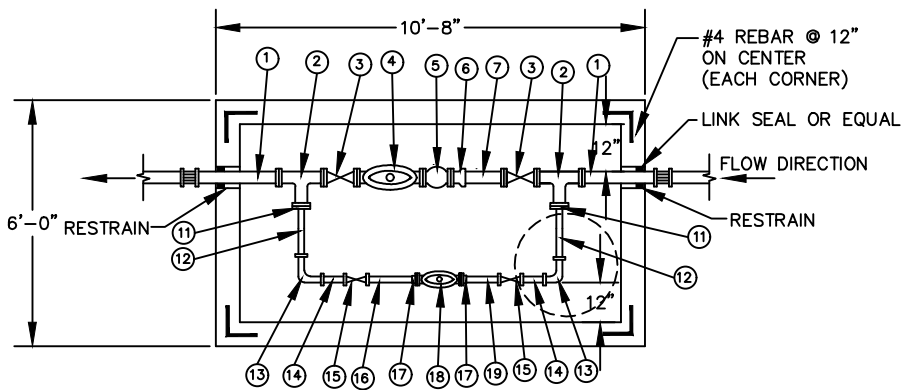
DATE: MARCH 2022		REVISIONS			
DRAWING NAME: DW-6		REVISION	DATE	BY	COMMENTS
DRAWN BY: ETL					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		<small>1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794</small>			



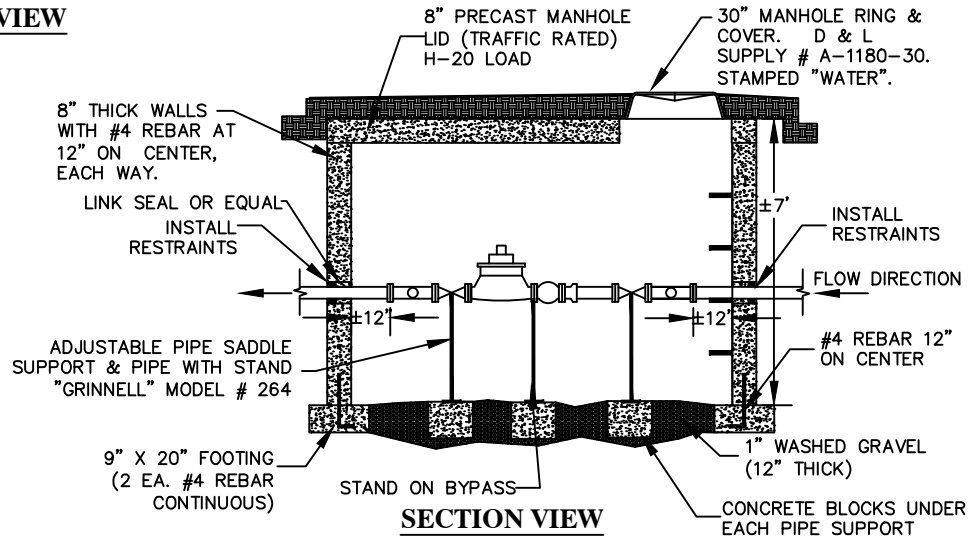
STANDARD DETAILS

DRINKING WATER

**DW-6**



**PLAN VIEW**



**SECTION VIEW**

**NOTES:**

1. INSPECTION: METER BOX AND SERVICE LINE SHALL BE INSPECTED BY CITY PRIOR TO BACKFILLING.
2. BACKFILL: INSTALL BACKFILL IN LIFTS NOT EXCEEDING 8" AFTER COMPACTION. COMPACT EACH LIFT TO AN AVERAGE DRY DENSITY OF 97% WITH NO DENSITY TEST RESULT LESS THAN 92%.
3. ALL 4" INTERIOR FITTINGS TO BE FLANGED AND ALL 2" INTERIOR FITTINGS TO BE BRASS, SCHEDULE 40 (THREADED).
4. WATER METERS SHALL BE PROVIDED BY CITY.
5. PLACEMENT: ALL METERS ARE TO BE INSTALLED IN THE PARK STRIP AND MUST BE PLACED NEAR MIDPOINT OF THE LOT AND MUST NOT BE LOCATED IN A DRIVEWAY, OR IN A SIDEWALK.
6. CONTRACTOR SHALL SUPPLY ALL MATERIALS AND LABOR, EXCLUDING THE WATER METER.

**4" PIPE SCHEDULE**

#	QTY	DESCRIPTION
1	1	FLxPE D.I. SPOOL LENGTH = $\pm 48"$
2	1	4"x4"x4" FLGD. TEE
3	1	4" FLxFL GATE VALVE (MUELLER)**
4	1	4" FLxFL METER*
5	1	FLANGED METER STRAINER
6	1	4" FLANGED COUPLING ADAPTER
7	1	FLxPE D.I. SPOOL (LENGTH AS NEEDED)

**2" PIPE SCHEDULE**

#	QTY	DESCRIPTION
11	2	4" BLIND FLANGE W\2" TAP
12	2	$\pm 23"$ NIPPLE
13	2	2" 90° ELBOW
14	2	2"x6" NIPPLE
15	2	2" GATE VALVE (MUELLER) #2380-8**
16	1	2"x $\pm 21.5"$ NIPPLE
17	2	2" SCREW-ON FLANGE
18	1	2" METER*
19	1	2" NIPPLE, LENGTH AS NEEDED

\*SUPPLIED BY CITY

\*\* GATE VALVE SHALL BE FURNISHED WITH A HANDWHEEL.

**4 INCH  
METER AND VAULT  
WITH 2" BYPASS  
FOR 4" LATERAL**

DATE:  
AUGUST 2022

DRAWING NAME:  
DW-7

DRAWN BY:  
JRP

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

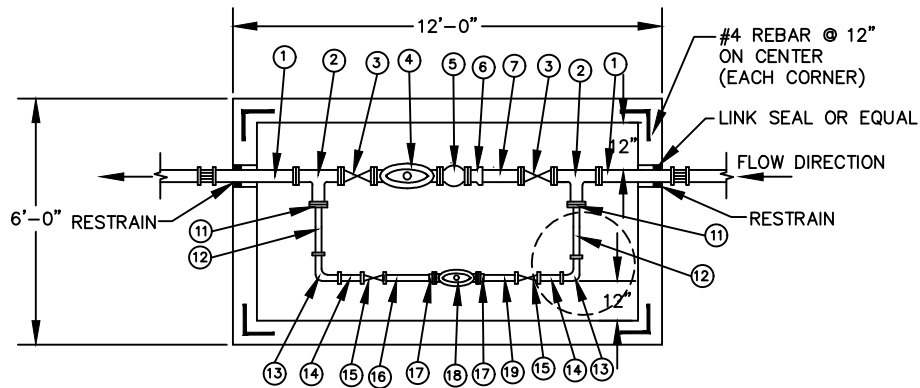
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UT 84045  
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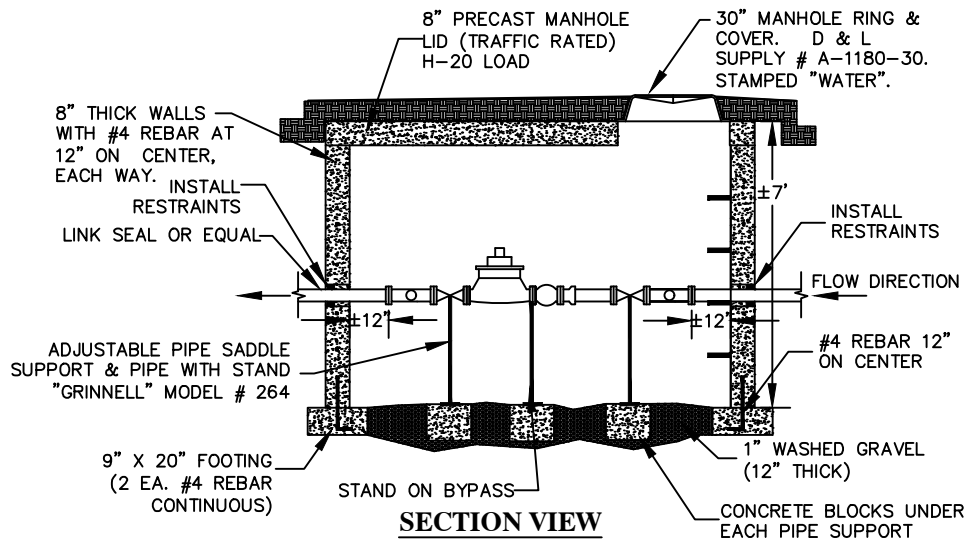
STANDARD DETAILS

DRINKING WATER

**DW-7**



**PLAN VIEW**



**SECTION VIEW**

**NOTES:**

1. INSPECTION: METER BOX AND SERVICE LINE SHALL BE INSPECTED BY CITY PRIOR TO BACKFILLING.
2. BACKFILL: INSTALL BACKFILL IN LIFTS NOT EXCEEDING 8" AFTER COMPACTION. COMPACT EACH LIFT TO AN AVERAGE DRY DENSITY OF 95% WITH NO DENSITY TEST RESULT LESS THAN 92%.
3. ALL 4" INTERIOR FITTINGS TO BE FLANGED AND ALL 2" INTERIOR FITTINGS TO BE BRASS, SCHEDULE 40 (THREADED).
4. PLACEMENT: ALL METERS ARE TO BE INSTALLED IN THE PARK STRIP, MUST BE PLACED NEAR MIDPOINT OF THE LOT AND MUST NOT BE LOCATED IN A DRIVEWAY OR IN A SIDEWALK.
5. CONTRACTOR SHALL SUPPLY ALL MATERIALS AND LABOR EXCLUDING METER.
6. BACKFILL AND COMPACT PER SECTION 02116.

**6" PIPE SCHEDULE**

#	QTY	DESCRIPTION
1	1	FLxPE D.I. SPOOL LENGTH = ±48"
2	1	6"x6"x2" FLGD. TEE
3	1	6" FLxFL GATE VALVE (MUELLER)*
4	1	6" FLxFL METER**
5	1	FLANGED METER STRAINER
6	1	6" FLANGED COUPLING ADAPTER
7	1	FLXPE DI SPOOL, LENGTH AS NEEDED

**2" PIPE SCHEDULE**

#	QTY	DESCRIPTION
11	2	4" BLIND FLANGE W\2" TAP
12	2	±23" NIPPLE
13	2	2" 90° ELBOW
14	2	2"x6" NIPPLE
15	2	2" GATE VALVE (MUELLER) #2380-8*
16	1	2"x ±21.5" NIPPLE
17	2	2" SCREW-ON FLANGE
18	1	METER**
19	1	2" NIPPLE (LENGTH AS NEEDED)

\* GATE VALVE SHALL BE FURNISHED WITH A HANDWHEEL.

\*\* SUPPLIED BY CITY

**6 INCH  
METER AND VAULT  
WITH 2" BYPASS  
FOR 6" LATERALS**

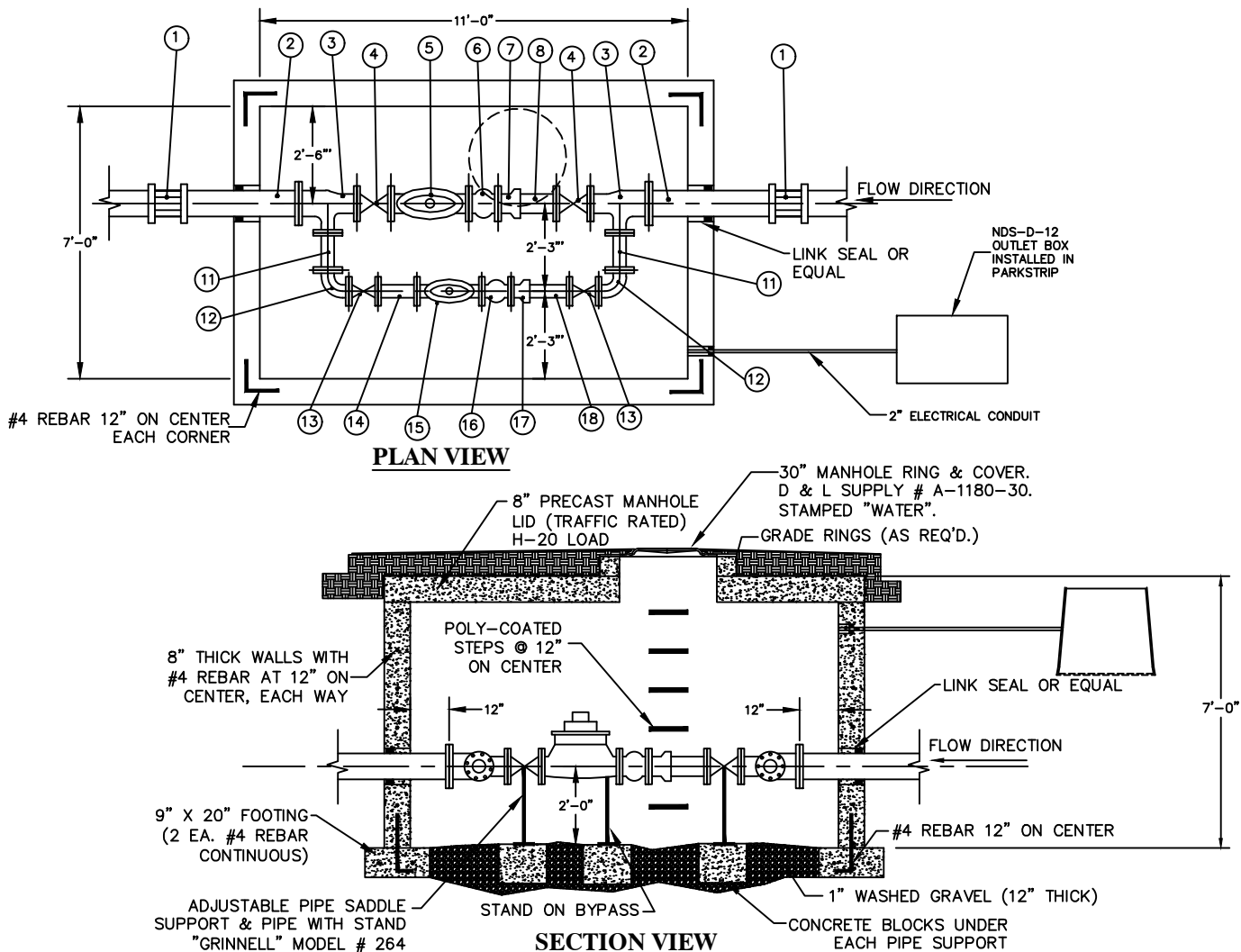
DATE: MARCH 2022		REVISIONS	
DRAWING NAME: DW-8		REVISION	DATE BY COMMENTS
DRAWN BY: JRP			
CHECKED: APPROVED:			
		SARATOGA SPRINGS CITY	
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794	



STANDARD DETAILS

DRINKING WATER

**DW-8**



#### 8" & 6" PIPE SCHEDULE

#	QTY	DESCRIPTION
1	2	8" MECHANICAL COUPLINGS
2	2	8" FLxPE D.I. SPOOL (LENGTH AS NEEDED)
3	2	8"x6"x4" FLxFLxFL TEE
4	2	6" FLxFL GATE VALVE (MUELLER)*
5	1	6" FLxFL METER**
6	1	6" FLANGED METER STRAINER
7	1	6" FLANGED COUPLING ADAPTER
8	1	6" FLxPE D.I. SPOOL (LENGTH AS NEEDED)

#### 4" PIPE SCHEDULE

#	QTY	DESCRIPTION
11	2	4" FLxFL D.I. SPOOL (LG = ±11.5")
12	2	4" FLxFL 90° BEND
13	2	4" GATE VALVE (MUELLER)*
14	1	4" FLxFL D.I. SPOOL (LG = ±12")
15	1	4" METER**
16	1	4" FLxFL METER STRAINER
17	1	4" FLANGED COUPLING ADAPTER
18	1	4" FLxPE D.I. SPOOL (LENGTH AS NEEDED)

\* GATE VALVE SHALL BE FURNISHED WITH A HANDWHEEL.

\*\* SUPPLIED BY CITY

#### NOTES:

1. INSPECTION: METER BOX AND SERVICE LINE SHALL BE INSPECTED BY CITY PRIOR TO BACKFILLING.
2. BACKFILL: INSTALL BACKFILL IN LIFTS NOT EXCEEDING 8" AFTER COMPACTION. COMPACT EACH LIFT TO AN AVERAGE DRY DENSITY OF 95% WITH NO DENSITY TEST RESULT LESS THAN 92%.
3. ALL INTERIOR FITTINGS TO BE FLANGED, UNLESS OTHERWISE INDICATED.
4. PLACEMENT: ALL METERS ARE TO BE INSTALLED IN THE PARK STRIP, MUST BE PLACED NEAR MIDPOINT OF THE LOT AND MUST NOT BE LOCATED IN A DRIVEWAY OR IN A SIDEWALK.
5. CONTRACTOR SHALL SUPPLY ALL MATERIALS AND LABOR EXCLUDING METER

### 6 INCH METER AND VAULT WITH 4" BYPASS FOR 8" LATERALS

DATE:  
AUGUST 2022

DRAWING NAME:  
DW-9

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
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FAX: 801-766-9794



STANDARD DETAILS

DRINKING WATER

**DW-9**

# **PRESSURE REDUCING VALVE STATION**

DATE: OCTOBER 2023	
DRAWING NAME: DW-10A	
DRAWN BY: ABO	
CHECKED:	APPROVED:

REVISIONS			
REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

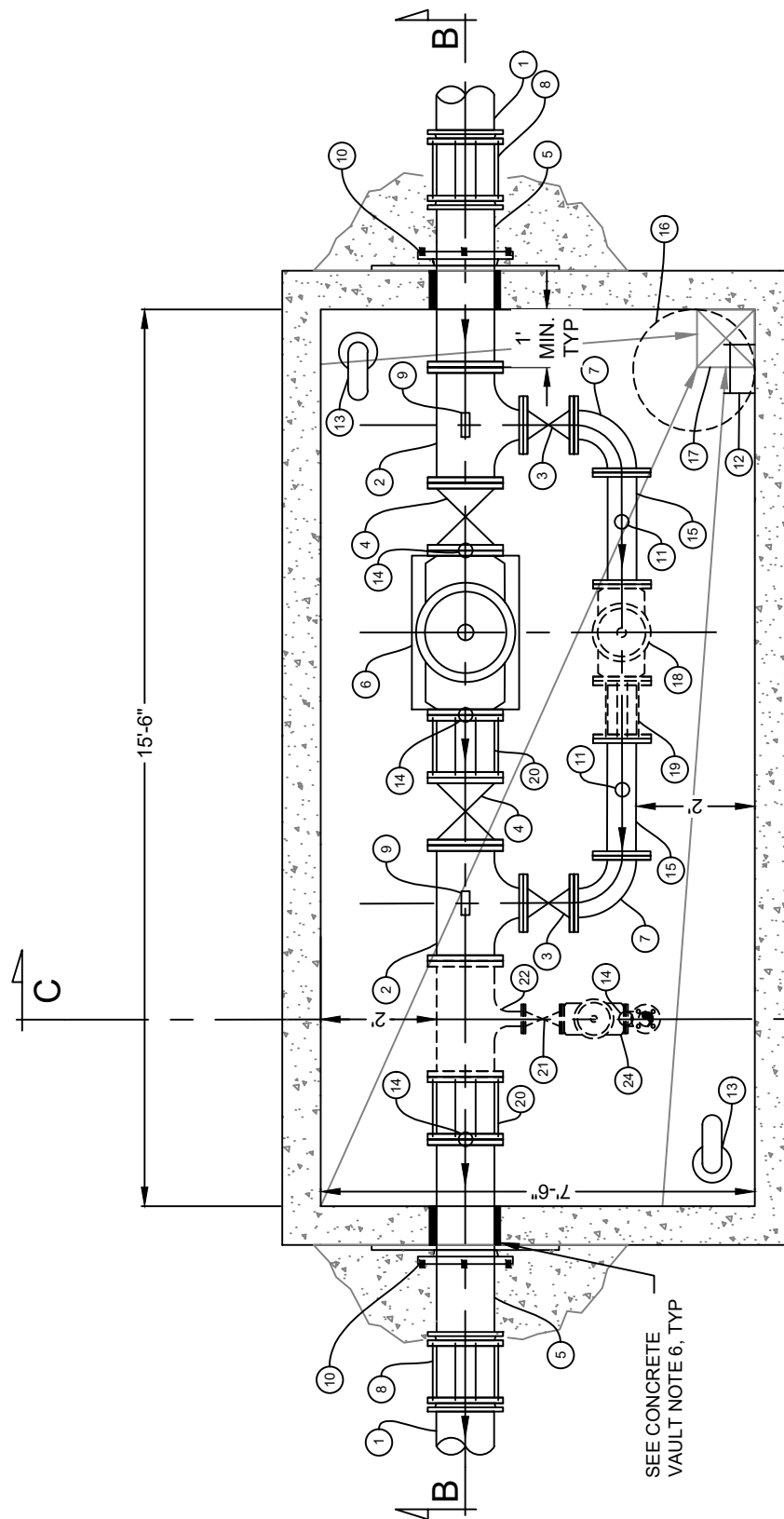
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UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

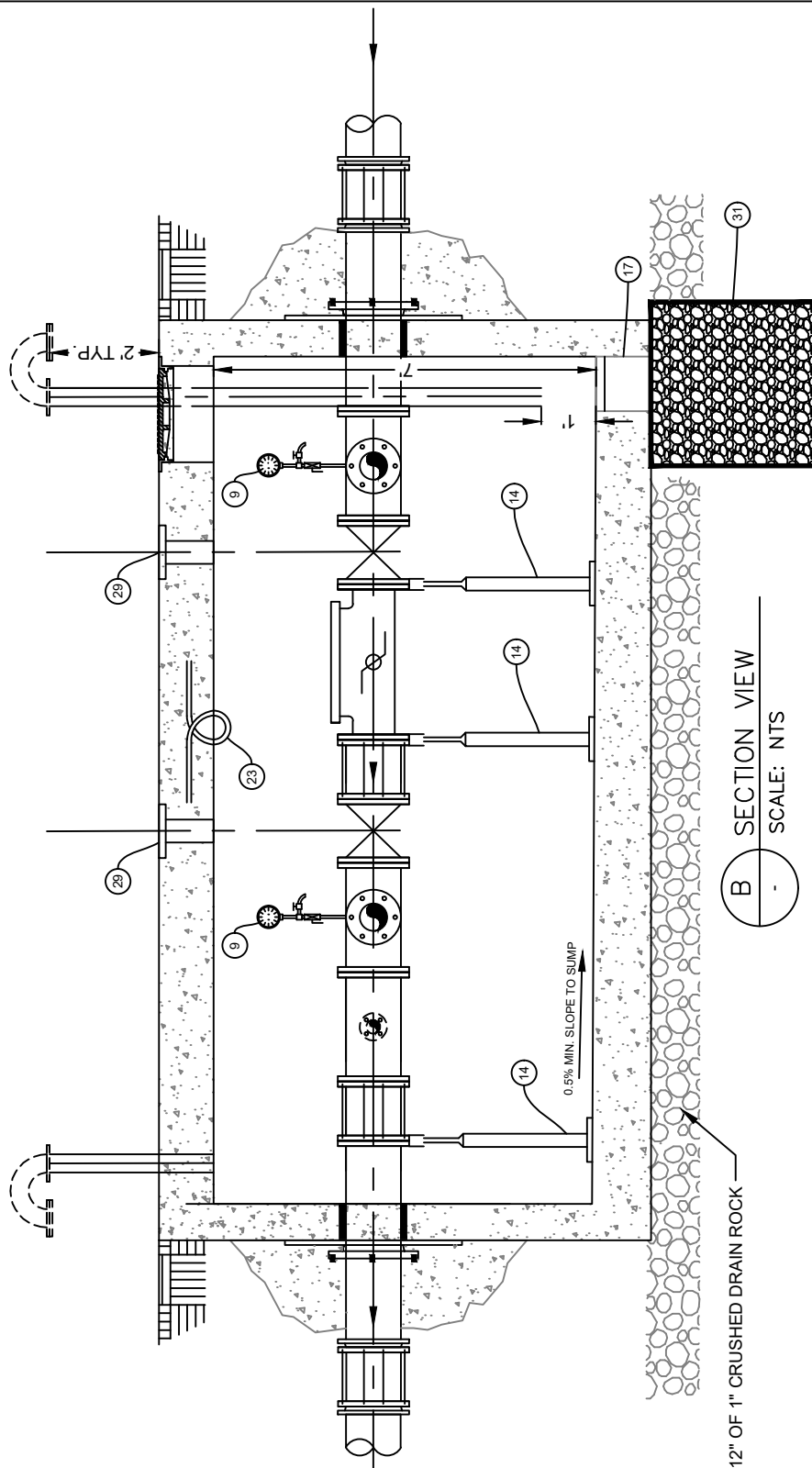
DRINKING WATER

**DW-10A**



A - PRESSURE REDUCING VALVE VAULT  
PLAN VIEW  
SCALE: NTS  
FOR CLARITY, ROOF DECK NOT SHOWN

SHEET NOTES:  
1. THIS DETAIL INCLUDES  
DW-10A THROUGH DW-10E.



B SECTION VIEW  
SCALE: NTS

12" OF 1" CRUSHED DRAIN ROCK

**SHEET NOTES:**

1. THIS DETAIL INCLUDES DW-10A THROUGH DW-10E.

# **PRESSURE REDUCING VALVE STATION**

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-10B

DRAWN BY:  
ABO

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

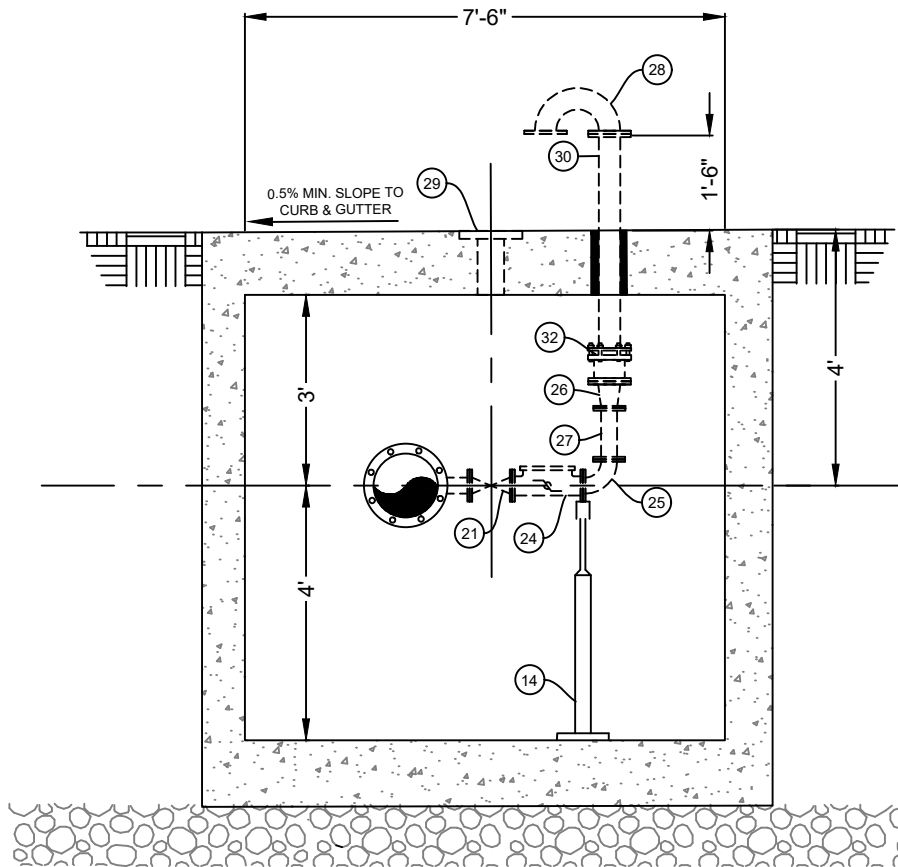
1307 N. COMMERCE DR.  
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UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

DRINKING WATER

**DW-10B**



C
 SECTION VIEW  
 SCALE: NTS

**SHEET NOTES:**

1. THIS DETAIL INCLUDES DW-10A THROUGH DW-10E.

**PRESSURE REDUCING  
VALVE STATION**

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-10C

DRAWN BY:  
ABO

CHECKED: APPROVED:

REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

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#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

DRINKING WATER

DW-10C



PIPE SCHEDULE	
#	DESCRIPTION
1.	MAINLINE PIPE UP TO 12"
2.	[MAINLINE DIA]" X 6" FL TEE
3.	6" FL GATE VALVE WITH HANDWHEEL
4.	[MAINLINE DIA]" FL GATE VALVE WITH HANDWHEEL
5.	[MAINLINE DIA]" FL X PE D.I. PIPE
6.	[MAINLINE DIA]" CLA-VAL OR SINGER PRV
7.	6" 90 DEGREE FL ELBOW
8.	[MAINLINE DIA]" LONG SLEEVE COUPLING
9.	PRESSURE GAUGE PER DETAIL B
10.	MEGALUG SERIES 1100 SDB RESTRAINT. INSTALL ADJACENT TO CONCRETE WALL. COAT WITH DENSO THREE PART WAX TAPE COATING SYSTEM.
11.	PIPE SUPPORT WITH RESTRAINING ROD
12.	POLYPROPYLENE M.H. STEPS @ 12" O.C.
13.	4" DIA SCH 20 GALVANIZED STEEL STAND PIPE W/ FL GOOSENECK POINTING DOWNWARD. 4" SCREENED OUTLET TO BE USED ON OPEN END, SEE DETAIL C.
14.	FLANGE SUPPORT WITH RESTRAINING ROD, SEE DETAIL D AND GENERAL NOTE 4.
15.	6" FL SPOOL
16.	25 1/4" EJ V1600-3 CAST FLUSH WITH CONCRETE. COVER SHALL BE STAMPED "WATER", SEE DETAIL A.
17.	12" X 12" RECESSED SUMP WITH REMOVABLE GRATE LOCATED BENEATH MANHOLE.
18.	6" CLA-VAL OR SINGER PRV, SEE GENERAL NOTE 2
19.	6" FL COUPLING ADAPTOR (SP) ROMAC DJ405, 12" INSTALLATION LENGTH, SEE GENERAL NOTE 2
20.	[MAINLINE DIA]" FL COUPLING ADAPTOR (SP) ROMAC DJ405, 13" INSTALLATION LENGTH
21.	3" FL GATE VALVE WITH HANDWHEEL, SEE GENERAL NOTE 2
22.	[MAINLINE DIA]" X 3" FL TEE, SEE GENERAL NOTE 2
23.	PICKING FYE
24.	3" CLA-VAL PRESSURE RELIEF VALVE (MODEL 50G-01B, SEE NOTE 4) ON LOW PRESSURE SIDE, SEE GENERAL NOTE 2
25.	3" FL ELBOW
26.	4" X 3" FL REDUCER, SEE GENERAL NOTE 2
27.	3" FL D.I. SPOOL, SEE GENERAL NOTE 2
28.	4" FL STAND PIPE W/ FL GOOSENECK POINTING DOWNWARD. 4" SCREENED OUTLET TO BE USED ON OPEN END, SEE DETAIL C AND GENERAL NOTE 2.
29.	MUELLER BEVELED ADJUSTABLE TOP FOR MVB COMPOSITE VALVE BOX, PART AJBV-4D, CENTERED OVER VALVE. TYP FOR ALL GATE VALVES
30.	4" FL X PE D.I. SPOOL
31.	3'X3'X3' CUBE OF CRUSHED GRAVEL WRAPPED WITH MIRAFI 1100 GEOTEXTILE FABRIC
32.	4" ROMAC RFCA

SHEET NOTES:

1. THIS DETAIL INCLUDES DW-10A THROUGH DW-10E.

**PRESSURE REDUCING  
VALVE STATION**

DATE: OCTOBER 2023		REVISIONS	
DRAWING NAME: DW-10D		REVISION	DATE BY COMMENTS
DRAWN BY: ABO			
CHECKED:	APPROVED:		
		SARATOGA SPRINGS CITY	
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794	



STANDARD DETAILS

DRINKING WATER

**DW-10D**

### CONCRETE VAULT NOTES:

VAULT BOX SHALL MEET THE FOLLOWING CONDITIONS:

1. H-20 LOADING.
2. NO HORIZONTAL JOINTS THROUGH THE PIPE OPENINGS.
3. THE FLOOR WILL SLOPE AT A 0.5% MINIMUM TOWARDS THE SUMP.
4. REINFORCEMENT MUST BE EPOXY COATED.
5. SHOP DRAWINGS SHALL BE SUBMITTED TO THE CITY ENGINEER FOR ACCEPTANCE PRIOR TO FABRICATION.
6. PRESSURE PIPE PENETRATIONS SHALL BE 4" LARGER THAN CARRIER PIPE NOMINAL SIZE. LINK SEAL IS REQUIRED.
7. ROOF DECK SHALL HAVE 0.5% MINIMUM SLOPE, REFER TO C SECTION VIEW.

### GENERAL NOTES:

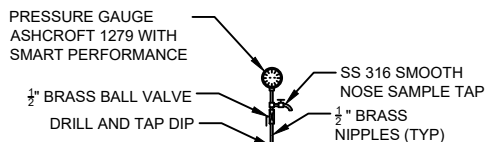
1. IF AN AIR VALVE IS NEEDED FOR THE PROJECT, AN AIR VALVE MAY BE INSTALLED ON THE DOWNSTREAM SIDE OF THE PRV INSTEAD OF A SEPARATE AIR VALVE VAULT. SEE STANDARD DETAILS DW-12 AND PI-8. A SPECIFIC DESIGN DETAIL MUST BE SUBMITTED FOR REVIEW TO AND ACCEPTED BY THE CITY ENGINEER.
2. AT THE DIRECTION OF THE CITY ENGINEER, THE DASHED FEATURES MAY BE REQUIRED FOR SPECIFIC LOCATIONS. OTHERWISE, THESE FEATURES MAY BE DELETED. THE VAULT DIMENSIONS SHALL NOT CHANGE. IF THE 6-IN PRV IS DELETED, IT SHALL BE REPLACED WITH A GATE VALVE AND A LONGER SPOOL PIECE.
3. FOR WATERMAIN SIZES ABOVE 12" OR FOR PIPE SIZES NOT IN COMPLIANCE WITH THIS DETAIL, A SPECIFIC ENGINEERING DESIGN MUST BE SUBMITTED FOR REVIEW TO AND ACCEPTED BY THE CITY ENGINEER.
4. PIPE SUPPORTS SHALL BE HOT DIPPED GALVANIZED AFTER MANUFACTURE. FLANGE SUPPORTS SHALL BE B-LINE B3094 W/ B3089 AND B3088T.
5. CONTRACTOR'S SUPPLIER TO SET VALVE PRESSURE SETTING BASED ON VALUES PROVIDED BY THE CITY.

### SHEET NOTES:

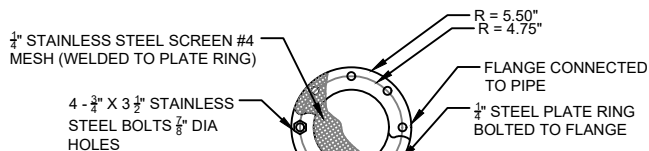
1. THIS DETAIL INCLUDES DW-10A THROUGH DW-10E.



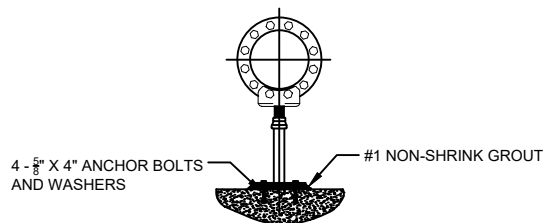
MANHOLE COVER  
DETAIL A



PRESSURE GAUGE  
DETAIL B



4" SCREENED OUTLET  
DETAIL C



FLANGE SUPPORT  
DETAIL D

## PRESSURE REDUCING VALVE STATION

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-10E

DRAWN BY:  
ABO

CHECKED:

APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

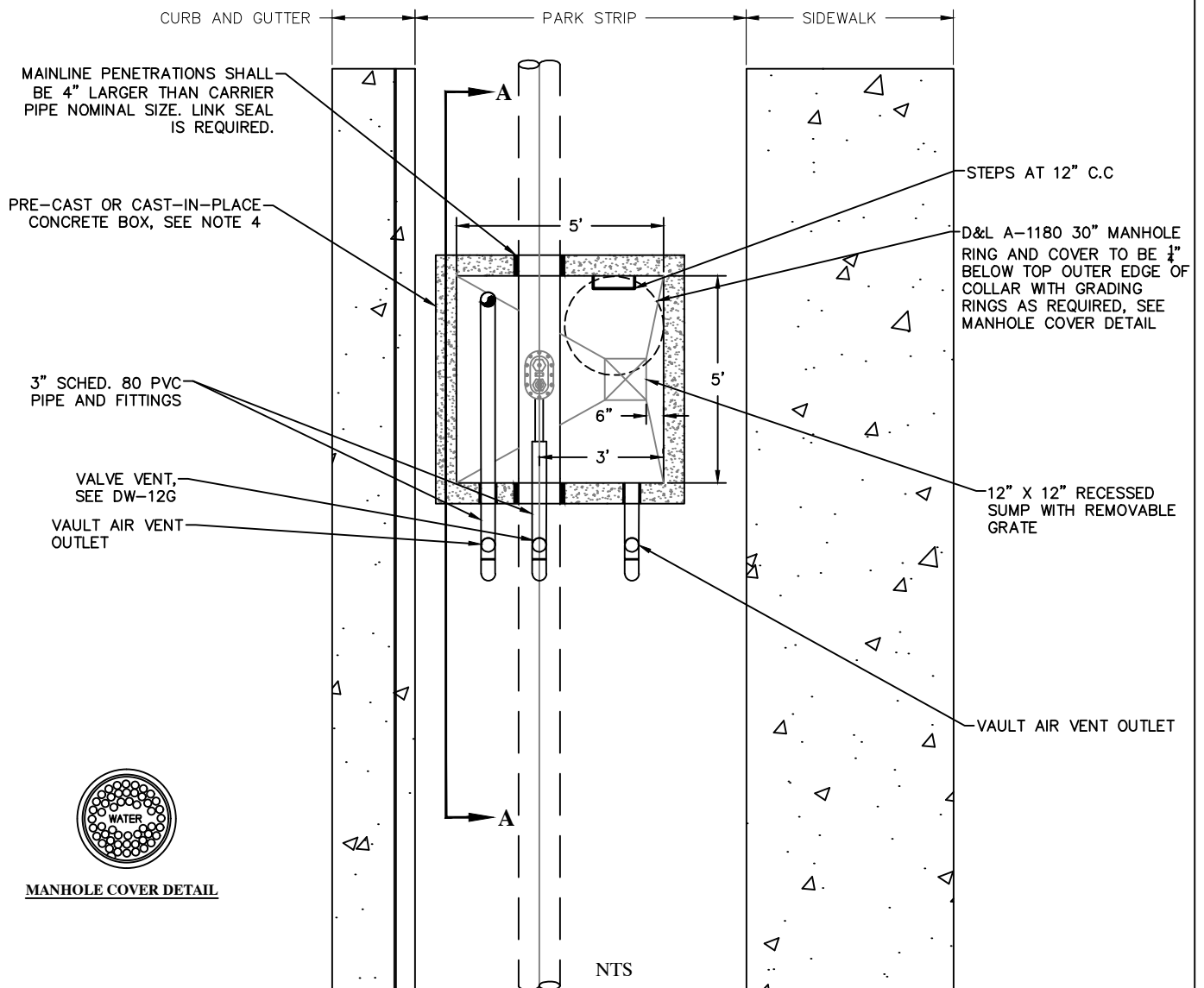
SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

STANDARD DETAILS

DRINKING WATER

DW-10E



### NOTES:

1. THIS DETAIL ONLY APPLIES TO ROAD SECTIONS ST-8, ST-9A, ST-10. APPLICATIONS FOR OTHER PUBLIC ROADWAY SECTIONS MUST BE A CUSTOM DETAIL THAT HAS BEEN SUBMITTED TO AND ACCEPTED BY THE CITY ENGINEER.
2. SIZE OF AIR-VACUUM RELIEF VALVE & PIPING SHALL BE 2" UNLESS OTHERWISE DIRECTED BY THE CITY ENGINEER.
3. BOLLARDS AROUND VENT COVER NOT REQUIRED UNLESS OTHERWISE DIRECTED BY CITY INSPECTOR.
4. A PRECAST BOX SHALL BE H-20 LOADING WITH NO HORIZONTAL JOINTS THROUGH THE PIPE OPENINGS. A SEPARATE DETAIL CAST-IN-PLACE VAULT BOX MUST BE ACCEPTED BY THE CITY ENGINEER PRIOR TO CONSTRUCTION.
5. THE FLOOR SHALL BE SLOPED AT A 2% MINIMUM TO MEET FLUSH WITH THE RIM OF THE SUMP.

### SHEET NOTES:

1. THIS DETAIL INCLUDES DW-12A, DW-12B, & DW-12G.

## AIR VACUUM RELIEF VALVE IN PUBLIC ROW PLAN VIEW

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-12

DRAWN BY:  
ABO

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

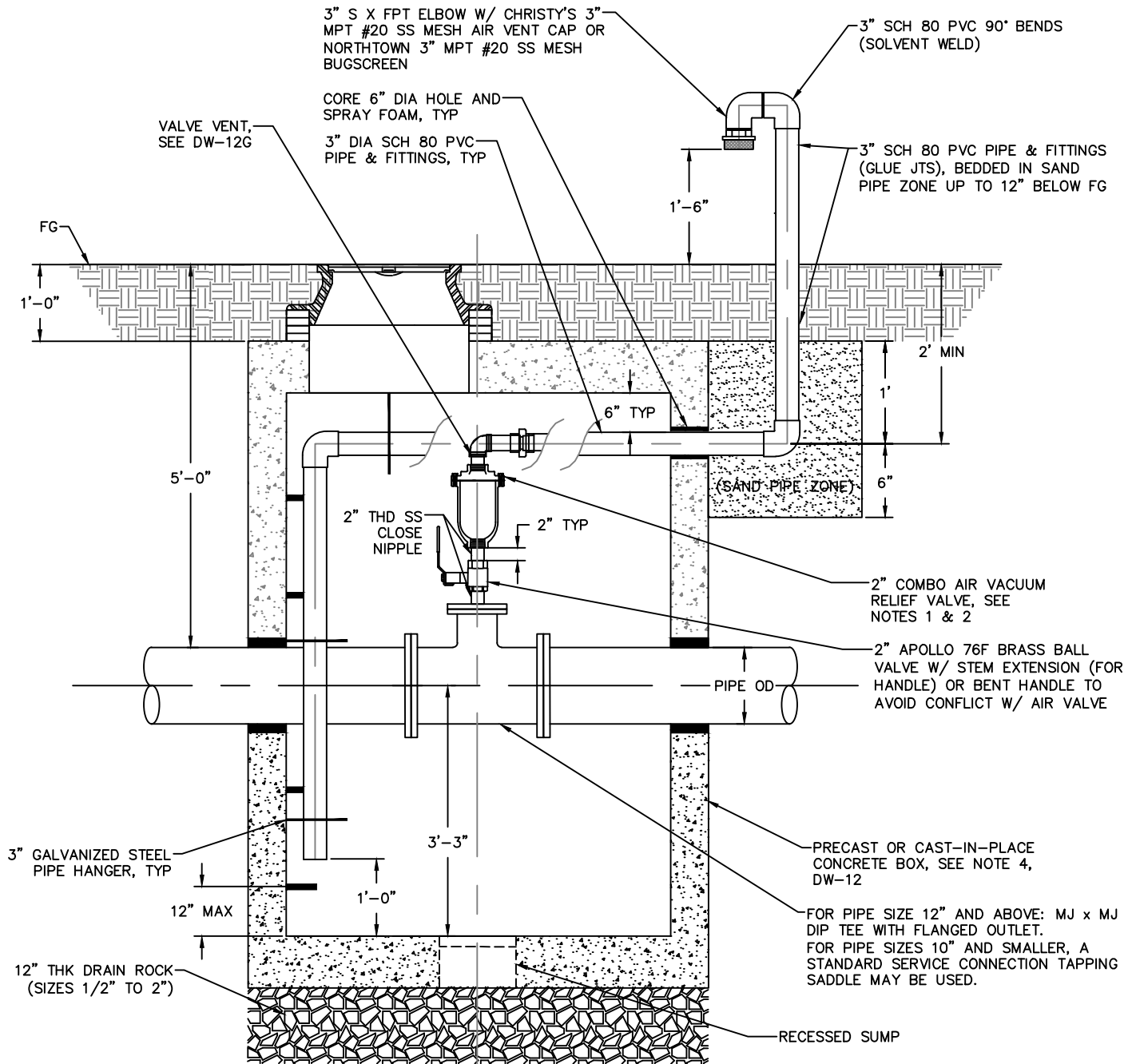
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

DRINKING WATER

**DW-12A**



### AIR VACUUM RELIEF VALVE SECTION A

NTS

### SHEET NOTES:

1. THIS DETAIL INCLUDES DW-12A, DW-12B, AND DW-12G

### NOTES:

1. COMBO AIR VACUUM RELIEF VALVE SHALL BE VENT-O-MAT 050RBX 1921 S4 (4 FUNCTION), APCO, SINGLE BODY MODEL AVC 145C, ARI D-60, OR VALMATIC 202C. VALVE SHALL BE TREADED OR FLANGED DEPENDING ON MANUFACTURER.
2. AIR VALVE SHALL BE INSTALLED PLUMB WITHIN 3 DEGREES OF VERTICAL ALIGNMENT
3. DRINKING WATER PIPELINE IS DEEPER THAN STANDARD BURY DEPTH. ENSURE APPROACHING PIPES DO NOT CREATE ADDITIONAL LOCALIZED HIGH POINTS.

## AIR VACUUM RELIEF VALVE IN PUBLIC ROW

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-12.1A

DRAWN BY:  
ABO

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

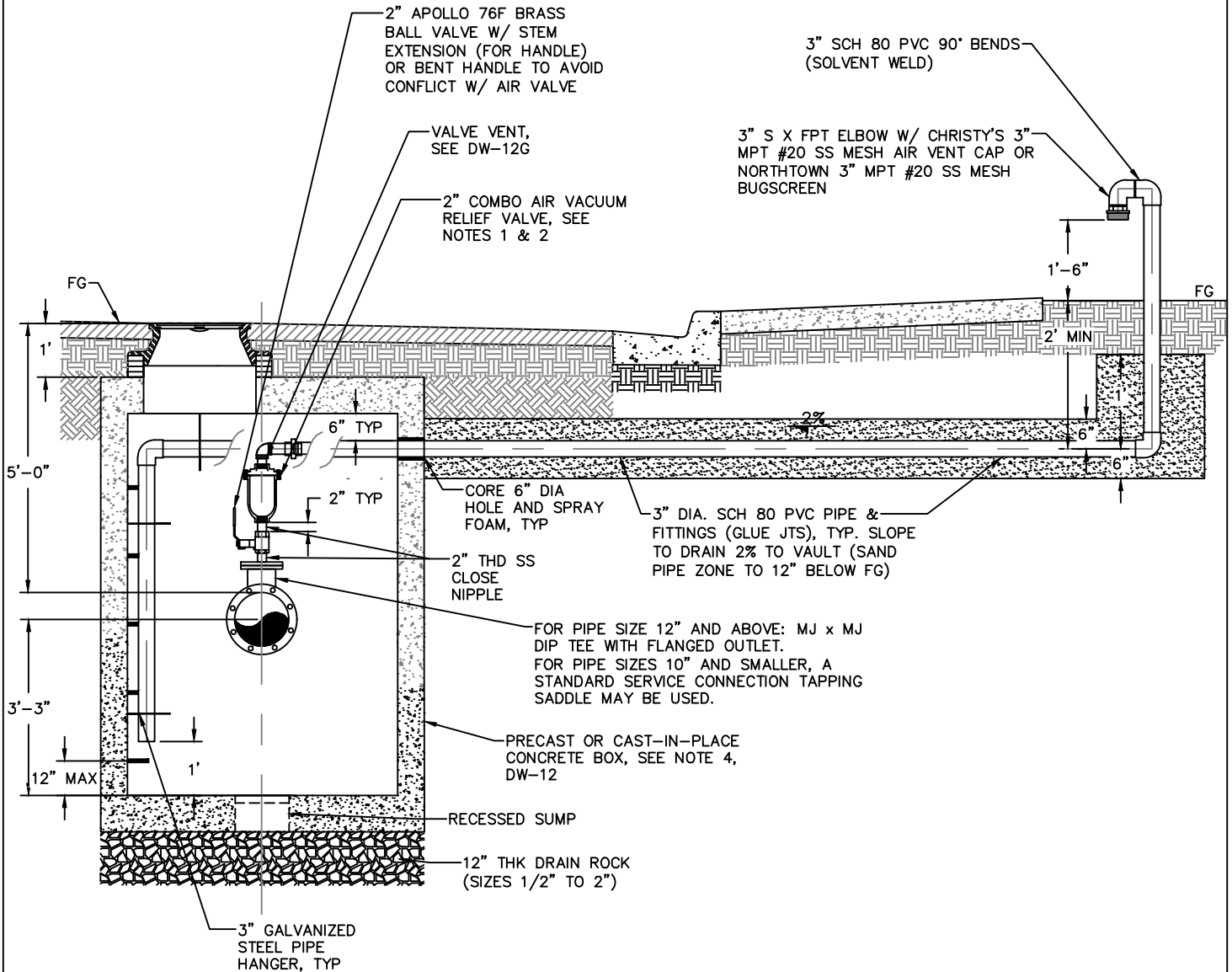


STANDARD DETAILS

DRINKING WATER

DW-12B





### AIR VACUUM RELIEF VALVE SECTION A

NTS

#### NOTES:

- COMBO AIR VACUUM RELIEF VALVE SHALL BE VENT-O-MAT 050RBX 1921 S4 (4 FUNCTION), APCO, SINGLE BODY MODEL AVC 145C, ARI D-60, OR VALMATIC 202C. VALVE SHALL BE TREADED OR FLANGED DEPENDING ON MANUFACTURER.
- AIR VALVE SHALL BE INSTALLED PLUMB WITHIN 3 DEGREES OF VERTICAL ALIGNMENT.
- DRINKING WATER PIPELINE IS DEEPER THAN STANDARD BURY DEPTH. ENSURE APPROACHING PIPES DO NOT CREATE ADDITIONAL LOCALIZED HIGH POINTS.

#### SHEET NOTES:

- THIS DETAIL INCLUDES DW-12C, DW-12D, & DW-12G.

## AIR VACUUM RELIEF VALVE IN PRIVATE ROADS

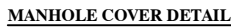
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DRAWING NAME: DW-12.2A		REVISION	DATE	BY	COMMENTS
DRAWN BY: ABO					
CHECKED: APPROVED:					
SARATOGA SPRINGS CITY					
1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794					



STANDARD DETAILS

DRINKING WATER

DW-12D



**DW-12E**



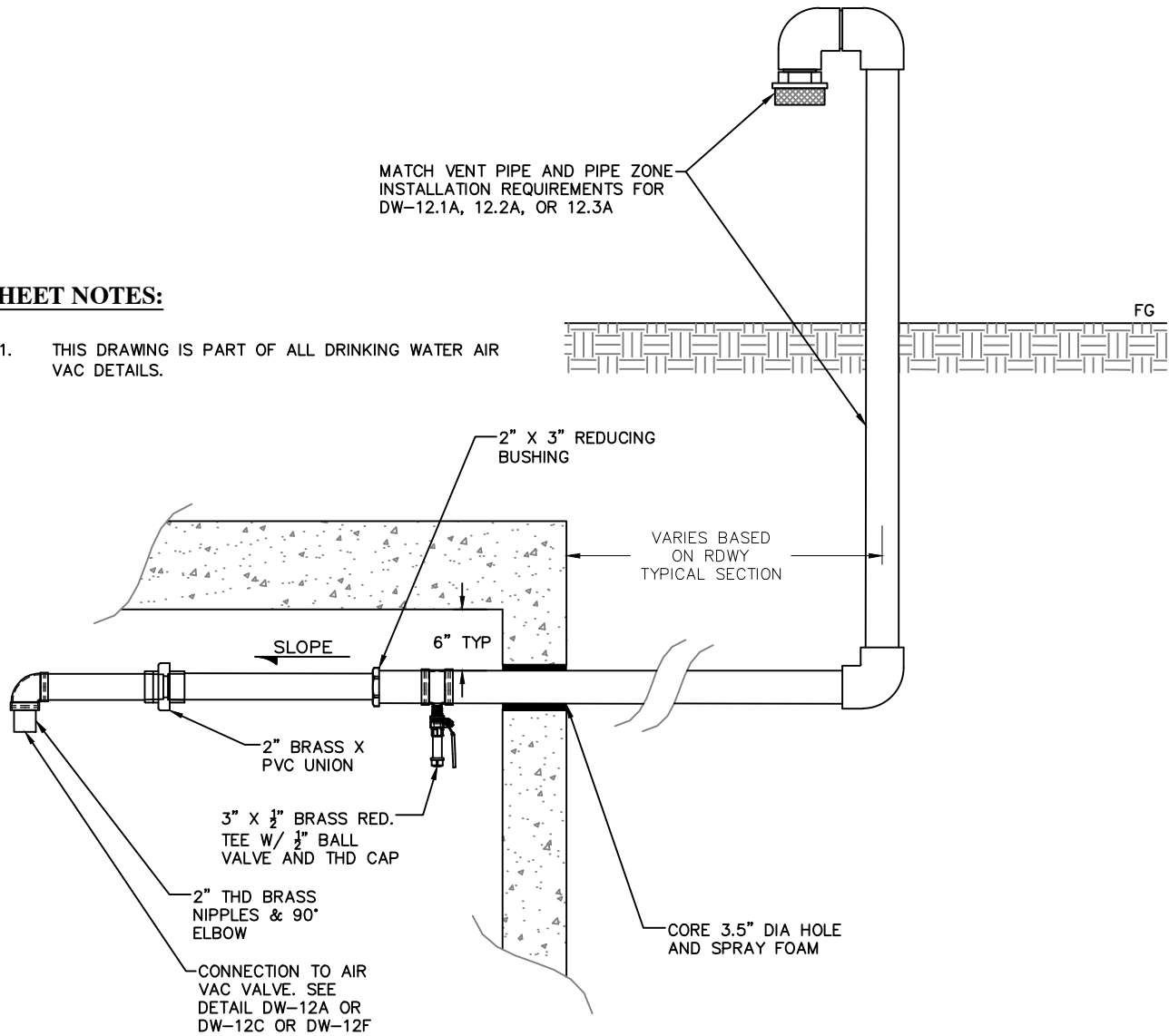




MATCH VENT PIPE AND PIPE ZONE  
INSTALLATION REQUIREMENTS FOR  
DW-12.1A, 12.2A, OR 12.3A

# **SHEET NOTES:**

1. THIS DRAWING IS PART OF ALL DRINKING WATER AIR VAC DETAILS.



**DETAIL B - VENT**  
NTS

## **AIR VACUUM RELIEF VALVE VENT DETAILS**

DATE:  
APRIL 2024

DRAWING NAME:  
DW-12B

DRAWN BY:  
ABO

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

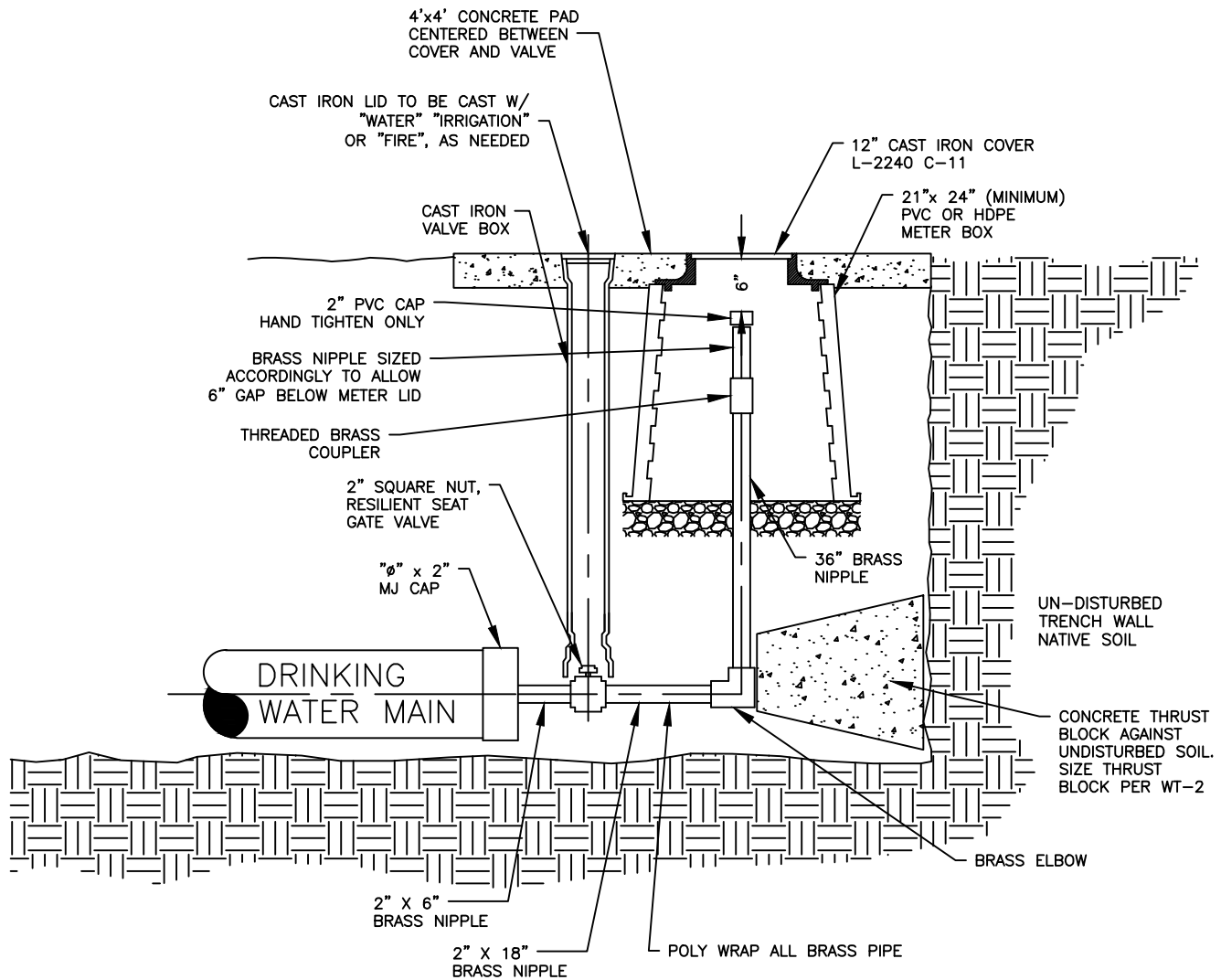
SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

STANDARD DETAILS

DRINKING WATER

**DW-12G**



## 2" BLOW-OFF VALVE

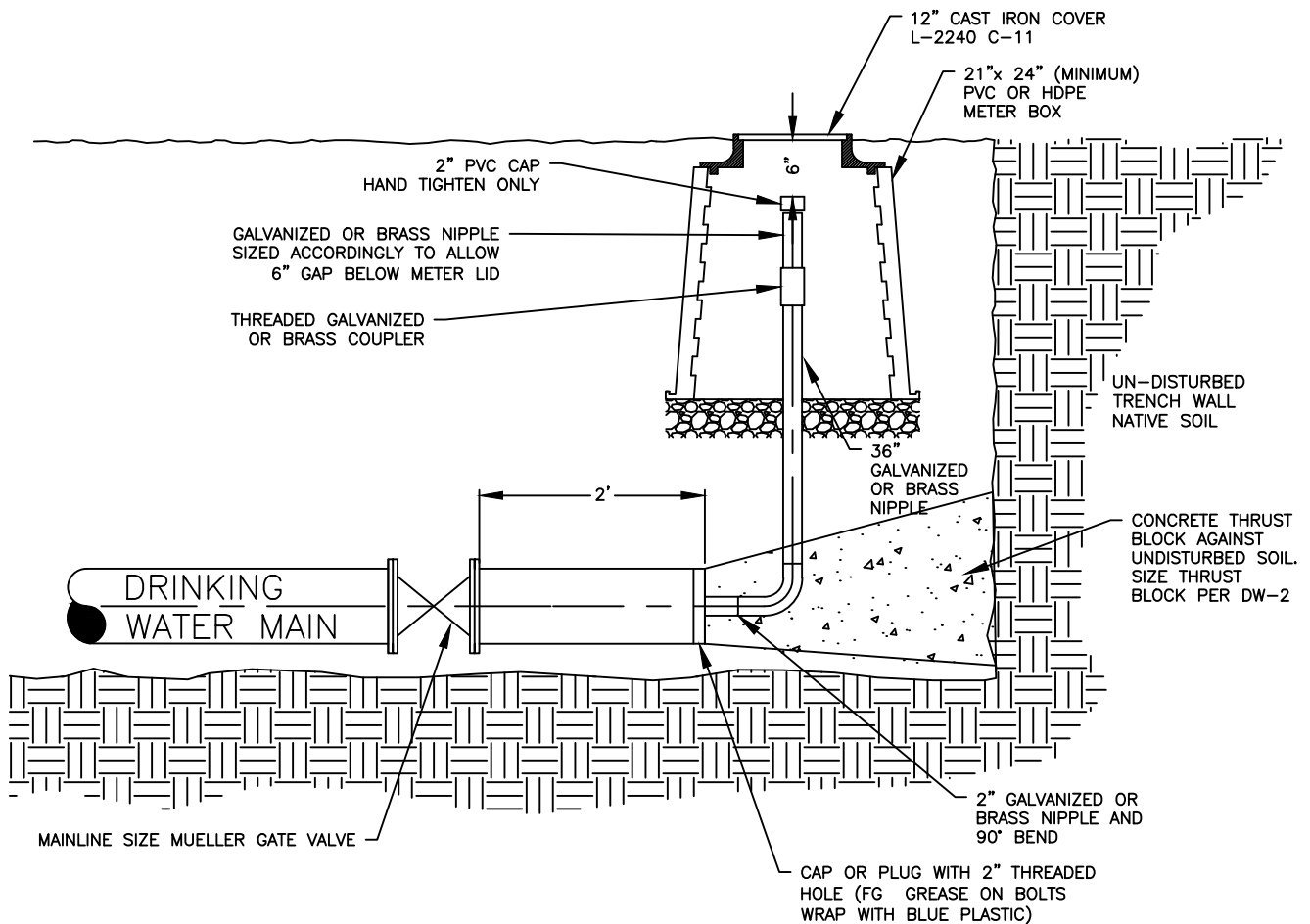
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DRAWING NAME: DW-13A		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

DRINKING WATER

**DW-13A**



## TEMPORARY 2" BLOW-OFF VALVE

DATE:  
MARCH 2022

DRAWING NAME:  
DW-13B

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

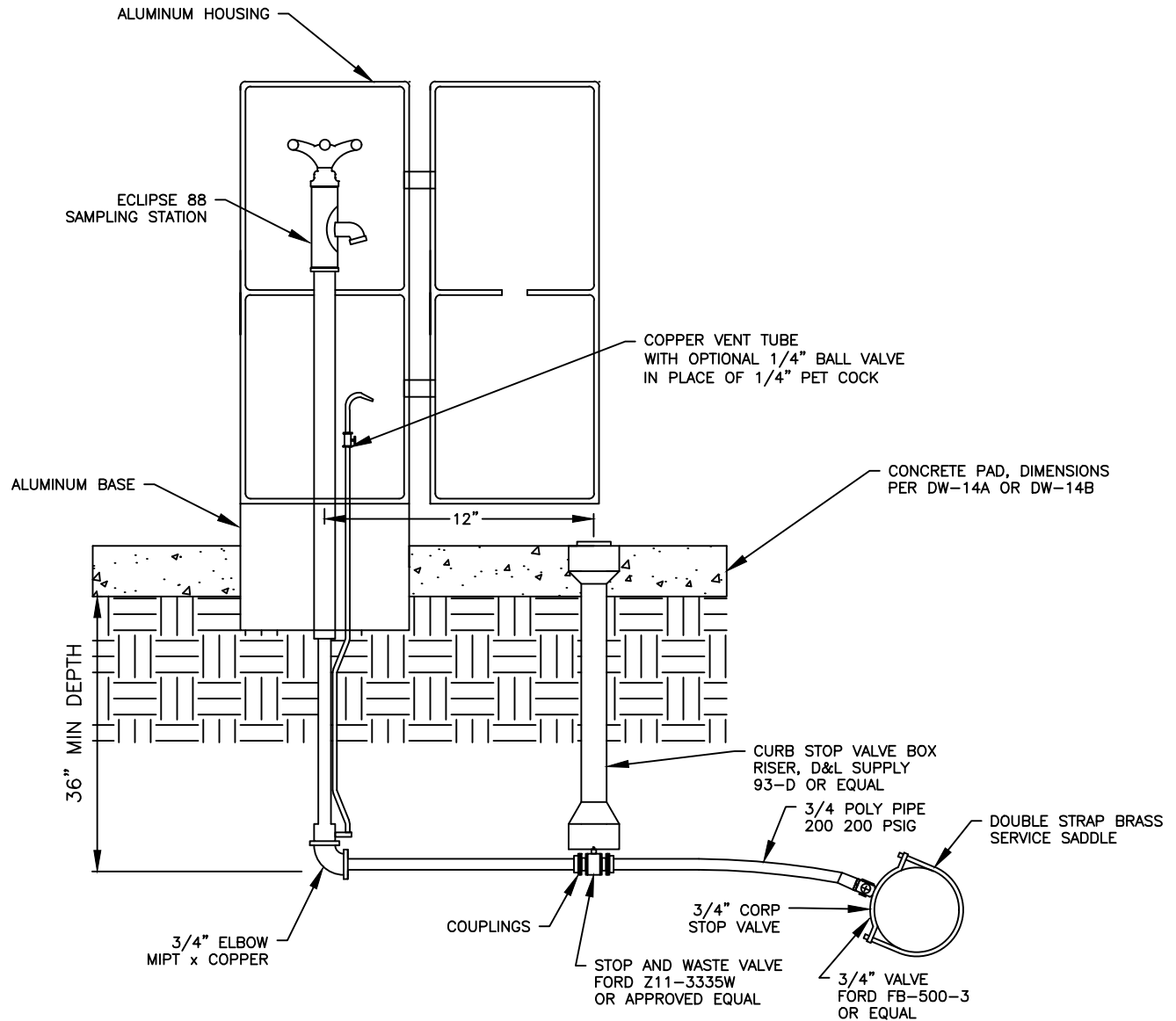
SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

STANDARD DETAILS

DRINKING WATER

**DW-13B**



NOTES:

1. ONE SAMPLING STATION REQUIRED IN EACH RESIDENTIAL DEVELOPMENT AND A MINIMUM OF ONE SAMPLING STATION PER 100 LOTS.
2. SAMPLE STATIONS TO BE LOCATED ON A LOT LINE.
3. PRIOR TO BACKFILLING AROUND THE ASSEMBLY, SECURE INSPECTION OF INSTALLATION BY ENGINEER.
4. PROVIDE BRASS FITTINGS AND NIPPLES IF NOT SPECIFIED OTHERWISE.

## SAMPLING STATION

DATE:  
APRIL 2024

DRAWING NAME:  
DW-14

DRAWN BY:  
ABO

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

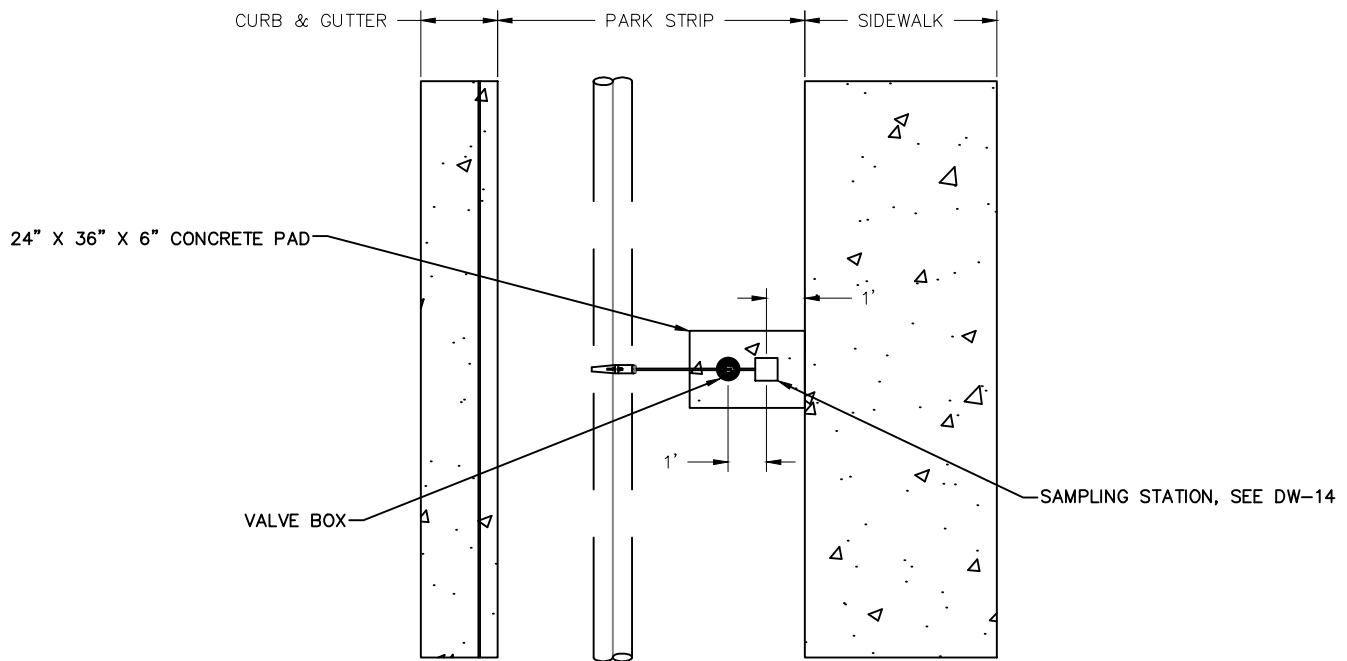
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

DRINKING WATER

**DW-14**



**NOTE:**

1. THIS DETAIL ONLY APPLIES TO ROAD SECTIONS ST-8, ST-9A, ST-10. APPLICATIONS FOR OTHER PUBLIC ROADWAY SECTIONS MUST BE A CUSTOM DETAIL THAT HAS BEEN SUBMITTED TO AND ACCEPTED BY THE CITY ENGINEER.

**SAMPLING STATION  
IN PUBLIC ROADS  
PLAN VIEW**

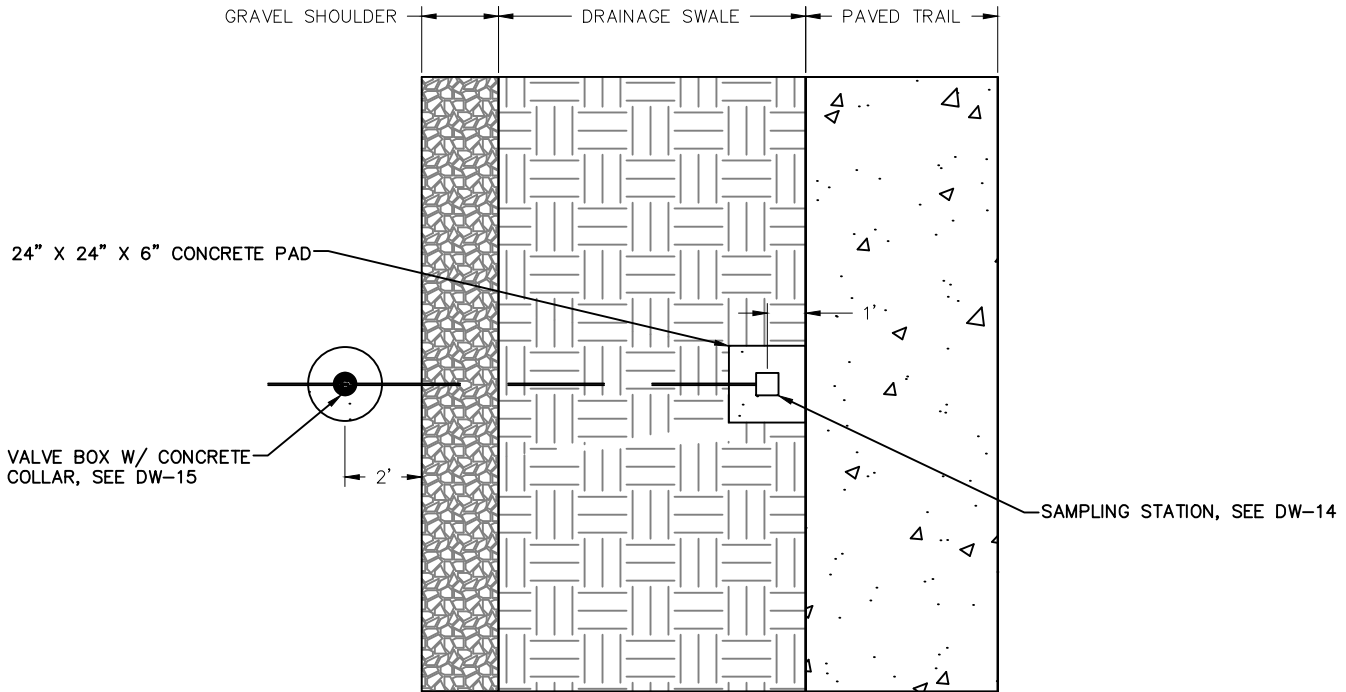
DATE: APRIL 2024		REVISIONS			
DRAWING NAME: DW-14A		REVISION	DATE	BY	COMMENTS
DRAWN BY: ABO					
CHECKED:	APPROVED:	<b>SARATOGA SPRINGS CITY</b>			
		<small>1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794</small>			



STANDARD DETAILS

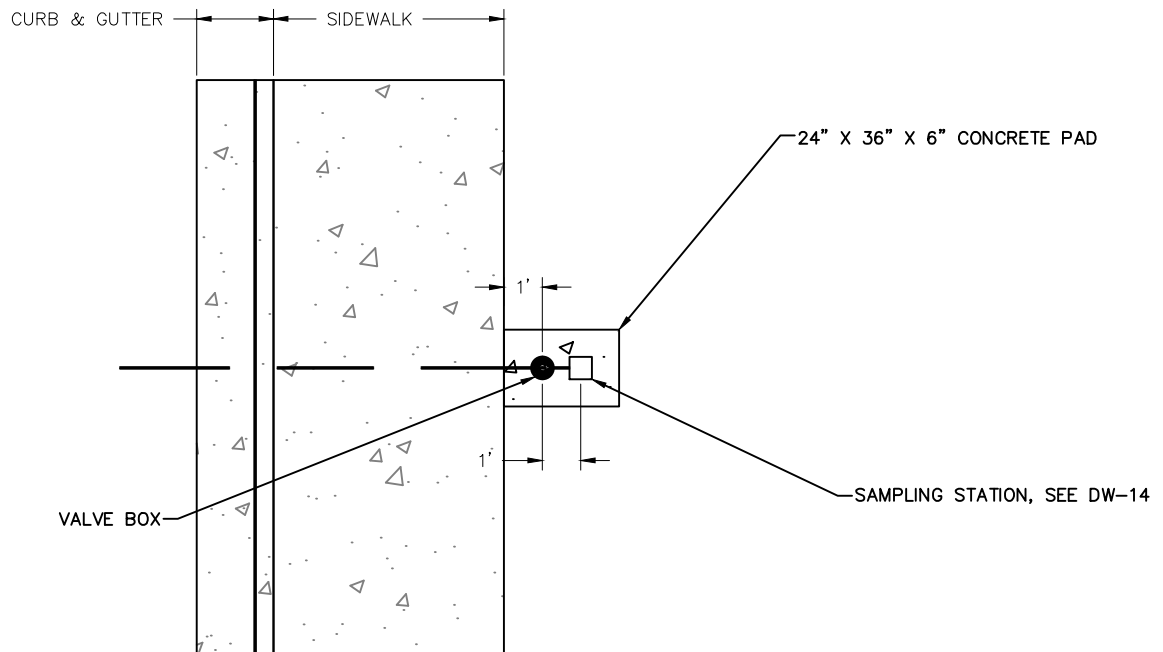
DRINKING WATER

**DW-14A**



**NOTE:**

1. THIS DETAIL ONLY APPLIES TO ROAD SECTIONS ST-32.



**NOTE:**

1. THIS DETAIL ONLY APPLIES TO ROAD SECTIONS ST-30 & ST-31.

**SAMPLING STATION  
IN PRIVATE ROADS  
PLAN VIEW**

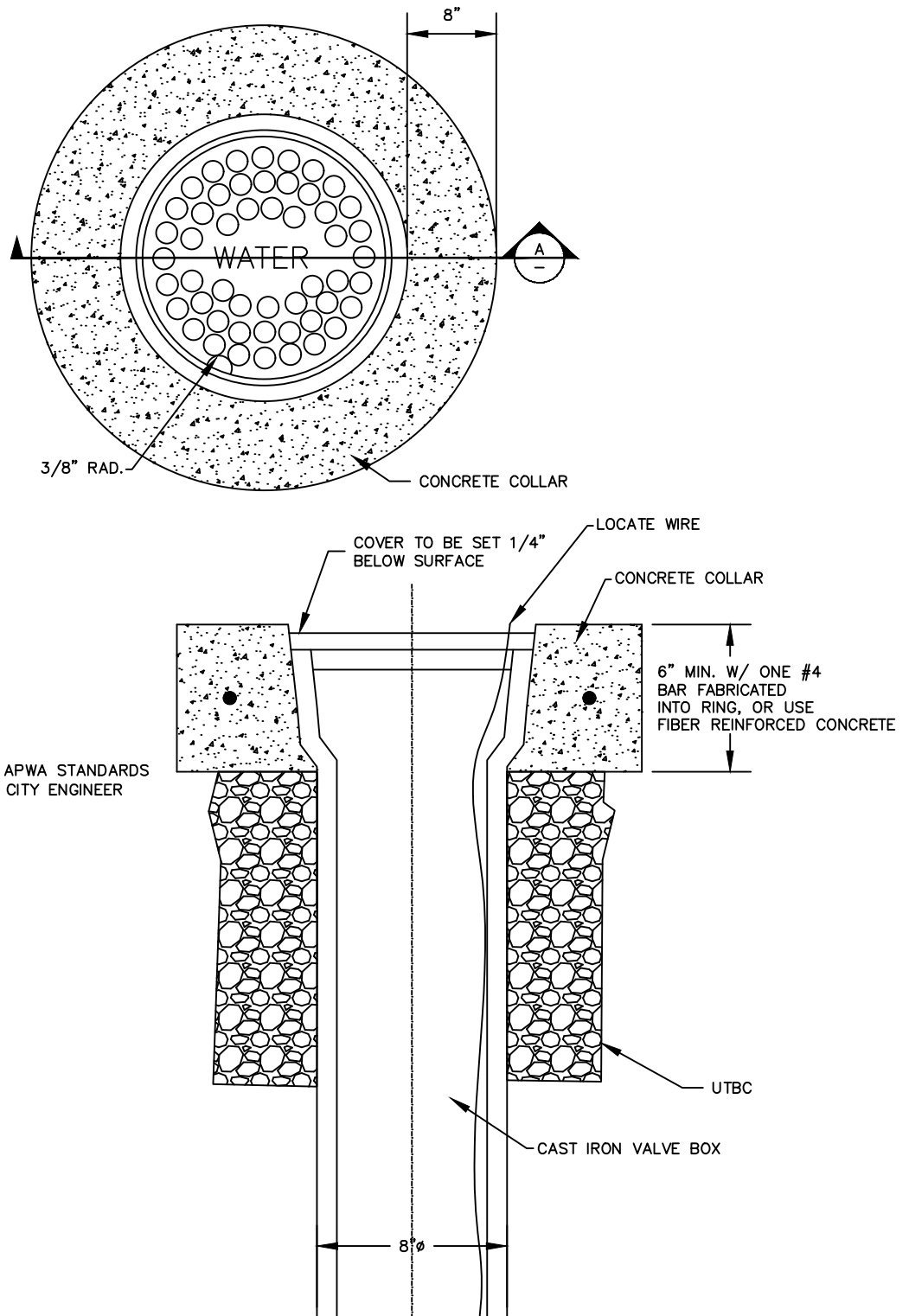
DATE: APRIL 2024		REVISIONS			
DRAWING NAME: DW-14B		REVISION	DATE	BY	COMMENTS
DRAWN BY: ABO					
CHECKED: APPROVED:					
SARATOGA SPRINGS CITY					
<small>1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794</small>					



STANDARD DETAILS

DRINKING WATER

**DW-14B**



### NOTES:

1. ALL WORK SHALL CONFORM TO APWA STANDARDS UNLESS OTHERWISE APPROVED BY CITY ENGINEER

## CONCRETE COLLAR

DATE:  
MARCH 2022

DRAWING NAME:  
DW-15

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

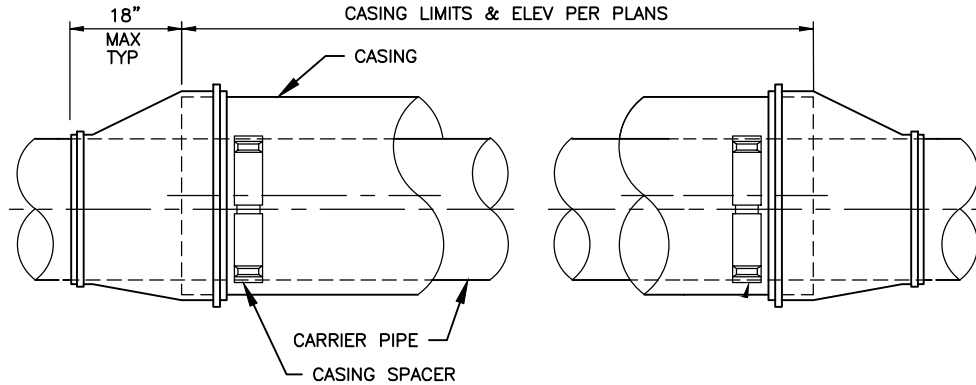
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

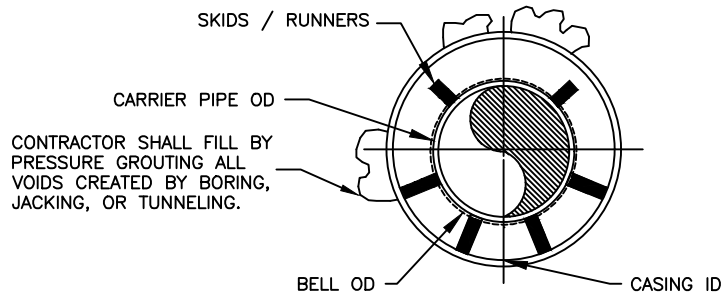
DRINKING WATER

DW-15



### CASING & END SEALS

SCALE: NTS



### CASING SECTION

SCALE: NTS

MINIMUM WALL THICKNESS OF CASINGS	
Diameter	Wall Thickness
12" and under	0.188"
14" - 18"	0.312"
20" - 22"	0.375"
24" - 26"	0.438"
28" - 32"	0.500"
34" - 42"	0.562"

LARGER CASINGS AS DIRECTED BY THE CITY ENGINEER.

### NOTES:

- JACK AND BORE CONSTRUCTION METHOD SHALL USE STEEL CASINGS SPECIFIED IN THIS DETAIL.
- DIRECTIONAL DRILLED CONSTRUCTION METHOD SHALL USE HDPE CASINGS. THE MATERIAL SHALL BE PE 4710, DR 17, OR 11.
- CASING INTERIOR DIAMETER SHALL BE A MINIMUM OF 4" LARGER THAN THE CARRIER PIPE OUTSIDE DIAMETER.
- SEAL ENDS OF CASING WITH  $\frac{1}{8}$ " MIN THK RUBBER CASING SEAL (WITH SS CLAMPS) BY PIPELINE SEAL & INSULATOR (PSI), OR EQUAL. LOOSEN THE END SEAL BAND AROUND CARRIER PIPE ON DOWNHILL SIDE OF CASING.
- IF CARRIER PIPE & CASING ARE BOTH METAL, CONTRACTOR SHALL SUBMIT ELECTRICAL ISOLATION TEST VERIFYING ISOLATION BEFORE TYING TO PIPE ON EACH END.
- CASING SPACERS SHALL BE AT 5' MAX SPACING. MAINTAIN CARRIER PIPE AT CONSTANT GRADE THROUGH CASING.
- LEAK TEST CARRIER PIPE BEFORE SEALING CASING END SEALS.
- SECURELY ATTACH SPACERS TO CARRIER PIPE PER MANUFACTURER REQUIREMENTS.
- LOCATE CASING SPACERS PER MANUFACTURER. PROVIDE SPACERS 1' FROM EACH END OF EACH PIPE JOINT. PROVIDE A SPACER 1' FROM END OF EACH CASING.

## DRINKING WATER PIPE CASING

DATE: APRIL 2024		REVISIONS			
DRAWING NAME: DW-16		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		<small>1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794</small>			



STANDARD DETAILS

DRINKING WATER

**DW-16**



# STANDARD PRESSURIZED IRRIGATION DETAILS

## INDEX:

PI-1	PRESSURIZED IRRIGATION PIPE TRENCH
PI-2	CONCRETE THRUST BLOCKS
PI-2A	CONCRETE THRUST ANCHORS FOR DOWNWARD VERTICAL BENDS IN DRY SOIL
PI-2B	CONCRETE THRUST ANCHORS FOR DOWNWARD VERTICAL BENDS WHERE SIGNS OF GROUNDWATER ARE PRESENT
PI-3	1" SINGLE AND DUAL SERVICE LATERALS
PI-4	CONNECTION FOR PUBLIC PARKS & OPEN SPACE
PI-5A	1" SINGLE SERVICE LATERAL BOX
PI-5B	1 ½" DUAL SERVICE LATERAL BOX
PI-5C	PARTS LIST FOR SINGLE AND DUAL SERVICE LATERAL BOXES
PI-6	2" SERVICE LATERAL
PI-7	4" METER VAULT
PI-8A	AIR VACUUM RELIEF VALVE IN PUBLIC ROW 1 OF 2
PI-8B	AIR VACUUM RELIEF VALVE IN PUBLIC ROW 2 OF 2
PI-8C	AIR VACUUM RELIEF VALVE IN PRIVATE ROW 1 OF 2
PI-8D	AIR VACUUM RELIEF VALVE IN PRIVATE ROW 2 OF 2
PI-8E	AIR VACUUM RELIEF VALVE IN RURAL ROW 1 OF 2
PI-8F	AIR VACUUM RELIEF VALVE IN RURAL ROW 2 OF 2
PI-8G	AIR VACUUM RELIEF VALVE DETAILS
PI-9	2" & 4" DRAIN VALVES
PI-10	RPZ BACKFLOW PREVENTER FOR SERVICE LATERALS
PI-11	RPZ BACKFLOW PREVENTER FOR WATER MAINS
PI-12A	2" BLOW OFF VALVE
PI-12B	TEMPORARY 2" BLOW OFF VALVE
PI-12C	6" BLOW OFF VALVE
PI-13	CONCRETE COLLAR FOR WATER VALVES
PI-14	PRESSURIZED IRRIGATION PIPE CASING

**PRESSURIZED  
IRRIGATION  
DETAILS**

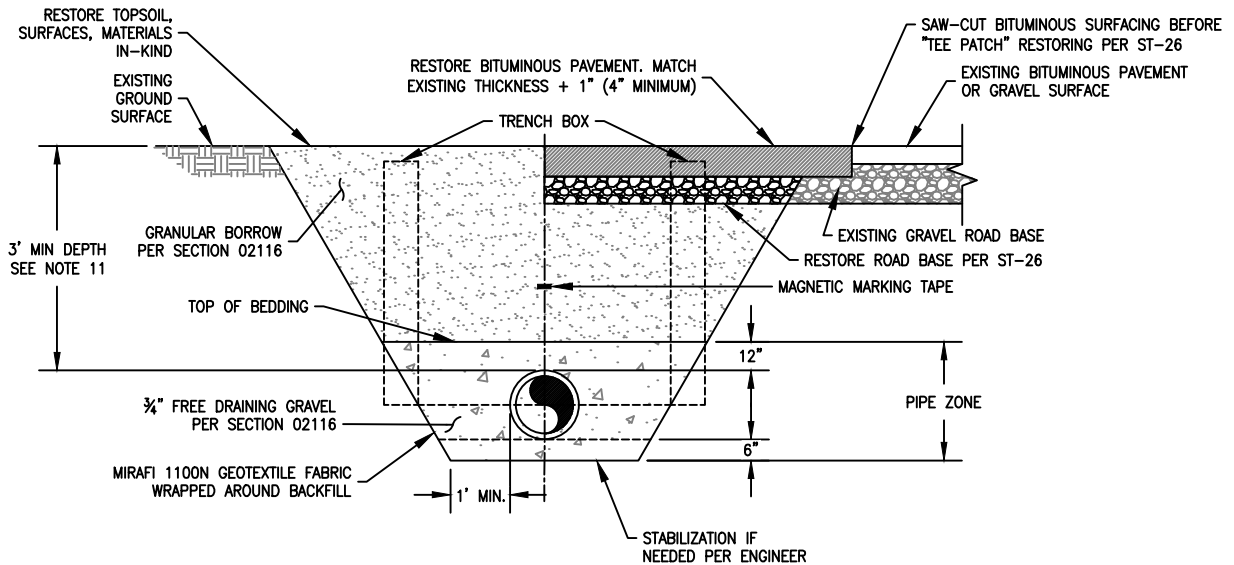
DATE: MARCH 2022		REVISIONS			
DRAWING NAME: PI-0		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:	SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

PRESSURIZED IRR

**PI-0**



**CROSS-SECTION: TYPICAL TRENCH**

**NOTES:**

1. CONTRACTOR SHALL LOCATE ALL UNDERGROUND UTILITIES BEFORE LAYING PIPE WITHIN 300' OF SAID UTILITIES WHICH MAY BE EXPOSED, DAMAGED OR CROSSED AS SHOWN ON THE DRAWINGS OR AS "BLUE STAKED". THE CONTRACTOR WILL MAKE ARRANGEMENTS WITH THE UTILITY COMPANY TO MOVE THE UTILITY IF NECESSARY OR OBTAIN PERMISSION FROM THE CITY ENGINEER TO MODIFY GRADE OF PIPELINE IN ORDER TO GO AROUND UTILITIES.
2. PROVIDE GEOTECHNICAL REPORT. FOLLOW RECOMMENDATIONS OF GEOTECHNICAL REPORT
3. PIPE ZONE SHALL BE PLACED IN LIFTS AND TAMPED
4. TRENCHES SHALL BE COMPACTED IN LIFTS TO 95% DENSITY
5. GEOTEXTILE FABRIC IS REQUIRED WHERE EVIDENCE OF EXISTING OR PAST GROUNDWATER CONDITIONS ARE PRESENT. THESE LOCATIONS ARE TYPICALLY EAST OF REDWOOD RD AND SOUTH OF CROSSROADS BLVD.
6. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPAIRED AT THE SOLE EXPENSE OF THE PARTY WHO DAMAGED THE UTILITY.
7. THE MINIMUM CLEAR WIDTH OF THE TRENCH, MEASURED AT THE SPRING LINE OF THE PIPE, SHOULD BE 12 INCHES GREATER THAN THE DIAMETER OF THE PIPE. IN ROCKY SUB-GRADES, 18" OF CLEARANCE SHALL BE PROVIDED ON ALL SIDES OF PIPE.
8. INSTALL MAGNETIC DETECTOR TAPE 3' ABOVE PIPE OR 2' ABOVE PIPE WHEN PIPE IS SHALLOWER THAN 4' AND LOOP TRACING WIRE TO GROUND SURFACE IN VALVE BOXES PER DW-15.
9. THE CITY RECOMMENDS CONTRACTOR MEET ALL OF THE REQUIREMENTS ESTABLISHED FOR SAFE TRENCHING. (SEE OSHA AND UOSH REQUIREMENTS, LATEST EDITIONS).
10. WHERE COLLAPSIBLE SOILS ARE ENCOUNTERED, FURNISH, PLACE AND COMPACT IMPORTED BACKFILL MATERIALS AS REQUIRED PER SPECIFICATIONS.
11. MINIMUM COVER OVER TOP OF PIPE SHALL BE 36-INCHES BELOW THE FINISHED GRADE. THIS DEPTH MAY BE INCREASED AS REQUIRED TO MISS UNDERGROUND UTILITIES, STORM DRAINS, OR OTHER OBSTRUCTIONS, OR WHERE INDICATED ON THE DRAWINGS.
12. FURNISH AND INSTALL POLY-WRAP ON DUCTILE IRON PIPE.

**PRESSURIZED  
IRRIGATION  
PIPE TRENCH**

DATE:  
SEP 2023

DRAWING NAME:  
PI-1

DRAWN BY:  
JRP

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

**SARATOGA  
SPRINGS CITY**

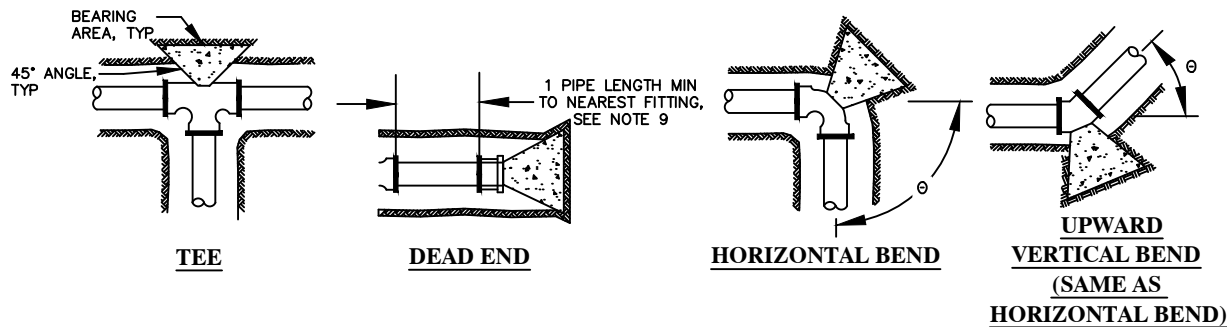
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

PRESSURIZED IRR

**PI-1**



**FOR REDUCERS, CROSSES, AND DEAD END VALVES USE  
ALTERNATIVE RESTRAINT PER DW-2C AND DW-2D**

**TABLE 1: SOIL BEARING STRENGTH**

SOIL TYPE	BEARING STRENGTH (lb/ft <sup>2</sup> )
FINE GRAINED (CLAYS & SILTS)	1,000
GRANULAR (SAND & GRAVEL WITH OR WITHOUT CLAY & SILT)	3,000

NOTE: VALUES FROM DUCTILE IRON PIPE RESEARCH ASSOCIATION.

**SAFE BEARING LOAD FORMULA**

$$\text{THRUST BLOCK AREA AGAINST TRENCH WALL (SQ. FEET)} = 1.5 \times \frac{\text{THRUST ON FITTING (LBS) SEE TABLE 2}}{\text{BEARING STRENGTH (LBS/SQ. FT) SEE TABLE 1}}$$

**NOTES:**

1. CONCRETE THRUST BLOCKS ARE NOT ALLOWED UNDER PAVED SURFACES WITHIN PUBLIC RIGHT OF WAYS, I.E. BETWEEN INITIAL AND FUTURE CURB LINES. ALL PIPE FITTINGS WITHIN THE PUBLIC RIGHT OF WAY SHALL BE RESTRAINED PER DW-17 OR SHALL BE DESIGNED AND SPECIFIED BY THE PROJECT ENGINEER.
2. RESTRAINED PIPE JOINTS MAY BE USED AS AN ALTERNATIVE TO THRUST BLOCKS PER DW-17.
3. MINIMUM SIZE OF THRUST BLOCK SHALL BE DETERMINED FROM THE TABLES ON THIS DRAWING.
4. CONCRETE MIX STRENGTH SHALL BE 2,000 PSI MIN.
5. PLACE CONCRETE AGAINST UNDISTURBED SOIL.
6. CAPS OR PLUGS SHALL BE LOCATED 1 PIPE LENGTH, IE, 18 FEET MINIMUM, FROM NEAREST FITTING OR JOINT.
7. FITTINGS SHALL BE POLYETHYLENE WRAPPED PRIOR TO PLACING CONCRETE THRUST BLOCK. CARE SHOULD BE TAKEN TO ASSURE THAT THE JOINT, INCLUDING BOLTS WILL BE ACCESSIBLE AFTER PLACING THE THRUST BLOCK.
8. RESTRAINT SIZING IS BASED UPON A MAXIMUM OPERATING PRESSURE OF 150 PSI, A TEST PRESSURE OF 200 PSI, AND A MINIMUM SOIL BEARING STRENGTH INDICATED IN TABLE 1 ABOVE AND UP TO 24" DIAMETER. CONDITIONS WITH PRESSURES, SOILS, OR PIPE SIZE OUTSIDE OF THESE LIMITS REQUIRE A PROJECT SPECIFIC DESIGN.
9. SITE SPECIFIC HORIZONTAL BEARING STRENGTH VALUES MAY BE USED TO CALCULATE THRUST BLOCK SIZES IF A SITE SPECIFIC GEOTECHNICAL REPORT HAS BEEN PREPARED FOR THE SPECIFIC SITE IDENTIFYING SOIL BEARING STRENGTH.
10. IF A SITE SPECIFIC GEOTECHNICAL REPORT HAS BEEN PREPARED WITH SPECIFIC SITE SOIL BEARING STRENGTH, SITE SPECIFIC HORIZONTAL THRUST BLOCK SIZES MAY BE CALCULATED AND SUBMITTED TO THE CITY FOR CONSIDERATION.
11. FITTINGS SHALL BE POLYETHYLENE WRAPPED PRIOR TO PLACING CONCRETE THRUST BLOCK. CARE SHOULD BE TAKEN TO ASSURE THAT THE JOINT, INCLUDING BOLTS WILL BE ACCESSIBLE AFTER PLACING THE THRUST BLOCK.
12. THRUST BLOCK BEARING AREA SHALL BE ROUNDED UP TO NEAREST WHOLE NUMBER.

**TABLE 2:**

THRUST ON FITTING (LBS) AT 200 PSI PRESSURE					
PIPE SIZE (IN)	TEES DEAD-ENDS	90° BEND	45° BEND	22.5° BEND	11.25° BEND
6	7,697	9,624	4,328	2,207	1,109
8	12,724	14,217	7,694	3,923	1,971
10	19,007	22,215	12,022	6,129	3,079
12	26,547	31,989	17,312	8,826	4,434
14	35,343	43,540	23,564	12,013	6,036
16	45,396	56,869	30,777	15,690	7,883
18	56,706	71,975	38,953	19,858	9,977
20	69,272	88,858	48,090	24,516	12,317
24	98,175	127,955	69,249	35,303	17,737

**TABLE 3:**

REQUIRED THRUST BLOCK BEARING AREA (SQ FT) FINE GRAINED SOILS (CLAYS & SILTS)					
PIPE SIZE (IN)	TEES DEAD-ENDS	90° BEND	45° BEND	22.5° BEND	11.25° BEND
6	12	15	7	4	2
8	20	22	12	6	3
10	29	34	19	10	5
12	40	48	26	14	7
14	54	66	36	19	10
16	69	86	47	24	12
18	86	108	59	30	15
20	104	134	73	37	19
24	148	192	104	53	27

**TABLE 4:**

REQUIRED THRUST BLOCK BEARING AREA (SQ FT) GRANULAR SOILS (SAND & GRAVEL WITH OR WITHOUT CLAY & SILT)					
PIPE SIZE (IN)	TEES DEAD-ENDS	90° BEND	45° BEND	22.5° BEND	11.25° BEND
6	4	5	3	2	1
8	7	8	4	2	1
10	10	12	7	4	2
12	14	16	9	5	3
14	18	22	12	7	4
16	23	29	16	8	4
18	29	36	20	10	5
20	35	45	25	13	7
24	50	64	35	18	9

**CONCRETE THRUST  
BLOCKS**

DATE:  
OCTOBER 2023

DRAWING NAME:  
PI-2

DRAWN BY:  
ABO

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

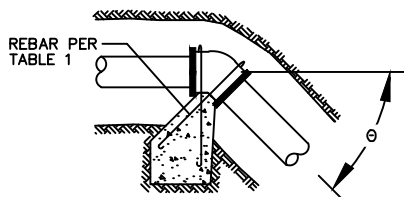
SARATOGA  
SPRINGS CITY

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STANDARD DETAILS

DRINKING WATER

**PI-2**



### DOWNWARD VERTICAL BENDS

### THRUST BLOCK VOLUME FORMULA FOR DOWNWARD VERTICAL BENDS

$$\text{THRUST BLOCK VOLUME (CUBIC FEET)} = \frac{\text{THRUST ON FITTING (LBS) SEE TABLE 2}}{\text{DW}-2} \div \text{UNIT WEIGHT OF CONCRETE (150 LBS/CU FT)}$$

**TABLE 1:**

FOR 45° BEND VERTICAL DOWNWARD BENDS WITHOUT GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	29
8	4	2	1	52
10	4	2	1	81
12	5	2	1	116
14	5	2	2	158
16	6	2	2	206
18	6	2	3	260
20	7	3	3	321
24	8	4	3	462

**TABLE 3:**

FOR 11.25° BEND VERTICAL DOWNWARD BENDS WITHOUT GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	8
8	3	1	1	14
10	3	1	1	21
12	3	1	1	30
14	4	2	1	41
16	4	2	1	53
18	4	2	1	67
20	5	2	1	83
24	6	2	1	119

**TABLE 2:**

FOR 22.5° BEND VERTICAL DOWNWARD BENDS WITHOUT GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	15
8	3	1	1	27
10	4	2	1	41
12	4	2	1	59
14	5	2	1	81
16	5	2	1	105
18	6	2	1	133
20	6	2	1	164
24	6	2	3	236

#### NOTES:

1. CONCRETE THRUST BLOCKS (OR ANCHORS) ARE NOT ALLOWED UNDER PAVED SURFACES WITHIN PUBLIC RIGHT OF WAYS, I.E. BETWEEN INITIAL AND FUTURE CURB LINES. ALL PIPE FITTINGS WITHIN PUBLIC RIGHT OF WAYS SHALL BE RESTRAINED PER DW-17 OR SHALL BE DESIGNED AND SPECIFIED BY THE PROJECT ENGINEER.
2. RESTRAINED PIPE JOINTS MAY BE USED AS AN ALTERNATIVE TO THRUST BLOCKS PER DW-17.
3. REINFORCING BARS REQUIRED FOR HANGING THRUST BLOCKS SHALL BE EPOXY COATED.
4. MINIMUM SIZE OF THRUST ANCHORS SHALL BE DETERMINED FROM THE TABLES ON THIS DRAWING.
5. CONCRETE MIX STRENGTH SHALL BE 2,000 PSI MIN.
6. THRUST ANCHORS FOR PIPE SIZES LARGER THAN 24" SHALL BE DESIGNED BY THE PROJECT ENGINEER.
7. FITTINGS SHALL BE POLYETHYLENE WRAPPED PRIOR TO PLACING CONCRETE THRUST ANCHOR. CARE SHOULD BE TAKEN TO ASSURE THAT THE JOINT, INCLUDING BOLTS WILL BE ACCESSIBLE AFTER PLACING THE THRUST ANCHOR.
8. THRUST BLOCK BEARING AREA SHALL BE ROUNDED TO THE NEAREST WHOLE NUMBER.
9. RESTRAINT SIZING IS BASED UPON A MAXIMUM OPERATING PRESSURE OF 150 PSI AND A TEST PRESSURE OF 200 PSI.

## CONCRETE THRUST ANCHORS FOR DOWNWARD VERTICAL BENDS IN DRY SOIL CONDITIONS

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-2A

DRAWN BY:  
ABO

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

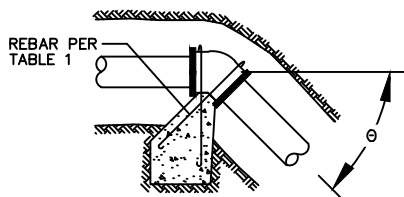
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UT 84045  
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FAX: 801-766-9794



STANDARD DETAILS

DRINKING WATER

PI-2A



### DOWNWARD VERTICAL BENDS

### THRUST BLOCK VOLUME FORMULA FOR DOWNWARD VERTICAL BENDS

$$\text{THRUST BLOCK VOLUME (CUBIC FEET)} = \frac{\text{THRUST ON FITTING (LBS) SEE TABLE 2}}{\text{DW-2}} \div \text{UNIT WEIGHT OF CONCRETE (150 LBS/CU FT)}$$

**TABLE 1:**

FOR 45° BEND VERTICAL DOWNWARD BENDS IN GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	49
8	4	2	1	87
10	4	2	1	137
12	5	2	1	197
14	5	2	2	268
16	6	2	2	350
18	6	2	3	443
20	7	3	3	546
24	8	4	3	787

**TABLE 3:**

FOR 12.25° BEND VERTICAL DOWNWARD BENDS IN GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	13
8	3	1	1	22
10	3	1	1	35
12	3	1	1	50
14	4	2	1	69
16	4	2	1	90
18	4	2	1	113
20	5	2	1	140
24	6	2	1	202

**TABLE 2:**

FOR 22.5° BEND VERTICAL DOWNWARD BENDS IN GROUNDWATER				
PIPE SIZE	BAR SIZE	EMBEDMENT LENGTH (FT)	# OF BARS	CONCRETE VOLUME (FT <sup>3</sup> )
6	3	1	1	25
8	3	1	1	45
10	4	2	1	70
12	4	2	1	100
14	5	2	1	137
16	5	2	1	178
18	6	2	1	226
20	6	2	1	279
24	6	2	3	401

### NOTES:

1. CONCRETE THRUST BLOCKS (OR ANCHORS) ARE NOT ALLOWED UNDER PAVED SURFACES WITHIN PUBLIC RIGHT OF WAYS, I.E. BETWEEN INITIAL AND FUTURE CURB LINES. ALL PIPE FITTINGS WITHIN PUBLIC RIGHT OF WAYS SHALL BE RESTRAINED PER DW-17 OR SHALL BE DESIGNED AND SPECIFIED BY THE PROJECT ENGINEER.
2. RESTRAINED PIPE JOINTS MAY BE USED AS AN ALTERNATIVE TO THRUST BLOCKS PER DW-17.
3. REINFORCING BARS REQUIRED FOR HANGING THRUST BLOCKS SHALL BE EPOXY COATED.
4. MINIMUM SIZE OF THRUST ANCHORS SHALL BE DETERMINED FROM THE TABLES ON THIS DRAWING.
5. CONCRETE MIX STRENGTH SHALL BE 2,000 PSI MIN.
6. THRUST ANCHORS FOR PIPE SIZES LARGER THAN 24" SHALL BE DESIGNED BY THE PROJECT ENGINEER.
7. FITTINGS SHALL BE POLYETHYLENE WRAPPED PRIOR TO PLACING CONCRETE THRUST ANCHOR. CARE SHOULD BE TAKEN TO ASSURE THAT THE JOINT, INCLUDING BOLTS WILL BE ACCESSIBLE AFTER PLACING THE THRUST ANCHOR.
8. THRUST BLOCK BEARING AREA SHALL BE ROUNDED TO THE NEAREST WHOLE NUMBER.
9. RESTRAINT SIZING IS BASED UPON A MAXIMUM OPERATING PRESSURE OF 150 PSI AND A TEST PRESSURE OF 200 PSI.

**CONCRETE THRUST ANCHORS  
FOR DOWNWARD VERTICAL  
BENDS WHERE SIGNS OF  
GROUNDWATER ARE PRESENT**

DATE:  
OCTOBER 2023

DRAWING NAME:  
DW-2A

DRAWN BY:  
ABO

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

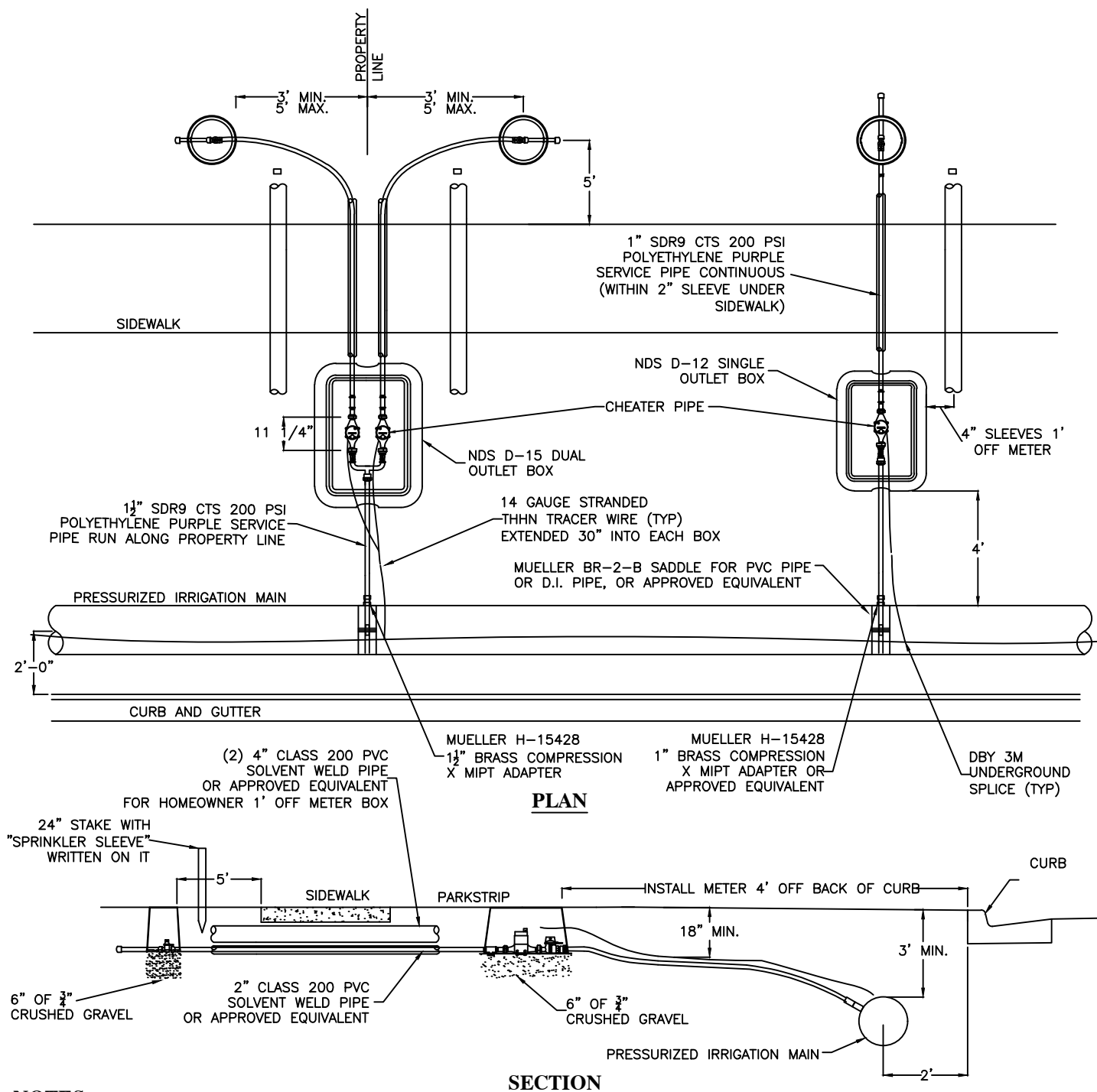
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FAX: 801-766-9794



STANDARD DETAILS

DRINKING WATER

**PI-2B**



#### NOTES:

1. STANDARD SERVICE SIZE SHALL BE  $1\frac{1}{2}$ " FOR DUAL SERVICES AND 1" FOR SINGLE SERVICES. SEE DETAIL PI-5A AND PI-5B FOR SERVICE BOX AND METER DETAILS.
2. STAINLESS STEEL LINER INSERTS WILL BE REQUIRED INSIDE OF TUBING AT COMPRESSION FITTINGS.
3. ALL FITTINGS SHALL BE COMPATIBLE WITH SERVICE SIZE.
4. SERVICE LATERAL SHALL SLOPE TOWARDS PRESSURIZED IRRIGATION MAIN.
5. SPRINKLER SLEEVE SHALL NOT BE IN LINE WITH ANY UTILITY BOXES.
6. 4" SLEEVE SHALL BE BURIED 1' BELOW GRADE.
7. CHEATER PIPE TO BE EXACTLY  $11\frac{1}{4}$ " FROM FACE TO FACE.

## 1" SINGLE & DUAL SERVICE LATERALS

DATE: MARCH 2022		REVISIONS			
DRAWING NAME: PI-3		REVISION	DATE	BY	COMMENTS
DRAWN BY:					
CHECKED:	APPROVED:				
SARATOGA SPRINGS CITY					

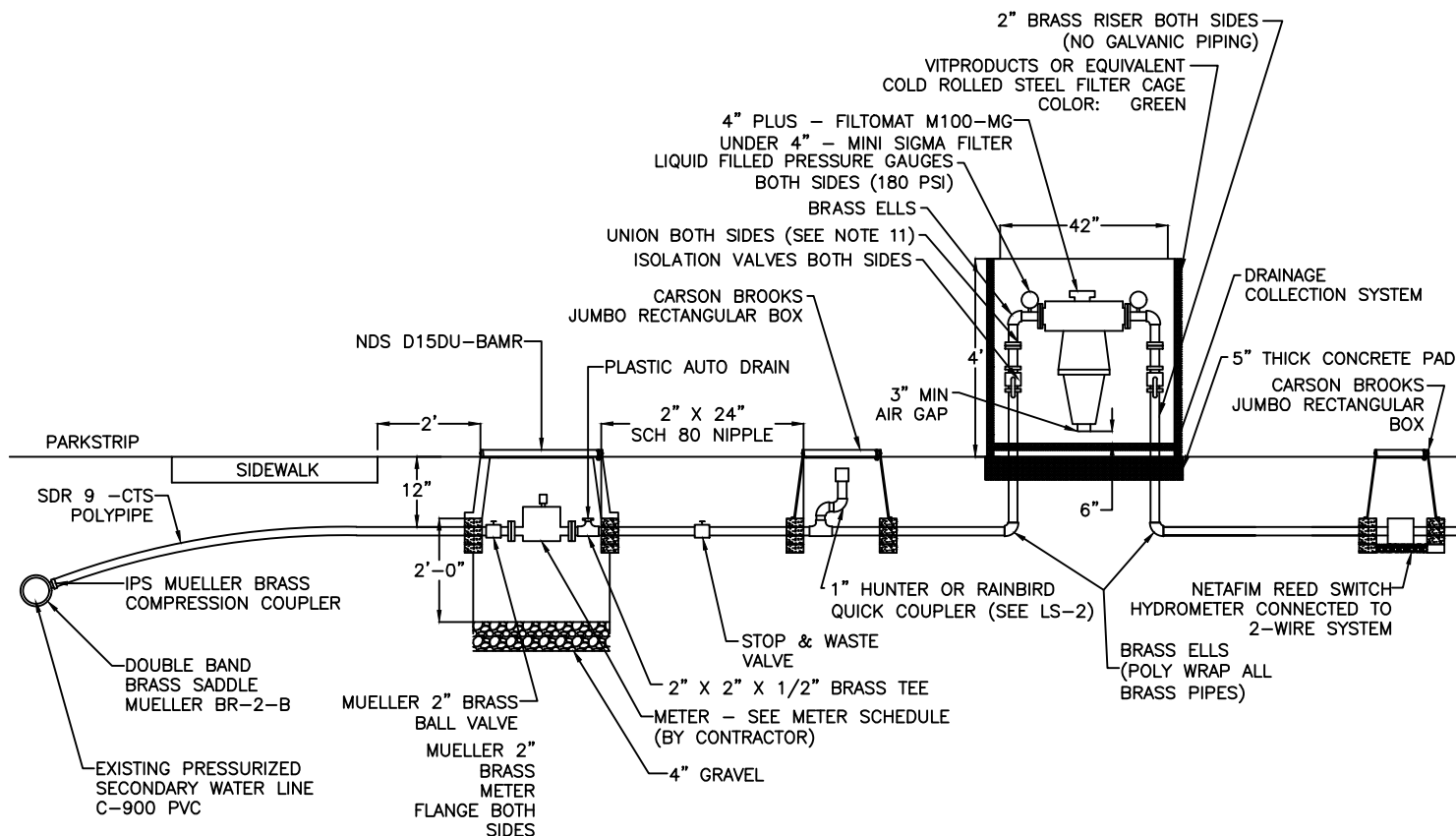
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PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

PRESSURIZED IRR

**PI-3**



### PUBLIC PARKS & OPEN SPACE SECONDARY WATER CONNECTION (2" & SMALLER P.O.C.)

#### **NOTES:**

1. MINIMUM SURFACE RESTORATION SHALL BE 3" BITUMINOUS OVER 8" ROADBASE COMPACTED TO 95%. AT MAJOR STREETS, CITY ENGINEER WILL PROVIDE PAVEMENT DESIGN.
2. SERVICES MAY BE TUNNELED OR JETTED UNDER CURB AND GUTTER, DRIVEWAYS, OR SIDEWALKS. OTHER STRUCTURES SHALL BE OPEN CUT WITH SURFACE RESTORATION AT THE ENGINEERS DIRECTION.
3. IF TAPPING SADDLES ARE USED, METHOD OF SAWING/DRILLING TAP HOLES, TYPE OF SADDLE, PROCEDURES MUST BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.
4. ALL PIPE AND FITTINGS UPSTREAM OF FILTER TO BE SCH 80 UNLESS SPECIFIED AS BRASS.
5. SCH 40 PIPE AND FITTINGS ALLOWED DOWNSTREAM OF FILTER.
6. NO MALE ADAPTERS.
7. 18" BURY TO TOP OF PIPE.
8. CONTRACTOR SHALL BE RESPONSIBLE FOR MEETING ALL OF THE REQUIREMENTS ESTABLISHED FOR SAFE TRENCHING. (SEE OSHA REQUIREMENTS)
9. ALL CONSTRUCTION SHALL MEET CURRENT SARATOGA SPRINGS CITY STANDARDS, SPECIFICATIONS, & ORDINANCES.
10. STAINLESS STEEL LINER INSERTS WILL BE REQUIRED INSIDE OF TUBING AT COMPRESSION FITTINGS.
11. ALL FITTINGS SHALL BE COMPATIBLE WITH SERVICE SIZE. FLANGE FITTINGS FOR 3" AND ABOVE. NO UNIONS UNDER 3".
12. SEE STANDARD FOR PRESSURIZED IRRIGATION SERVICE BOX, 2" PRESSURIZED IRRIGATION SERVICE, AND 4" PRESSURIZED IRRIGATION SERVICE.
13. SERVICE LATERAL SHALL SLOPE TOWARDS PRESSURIZED IRRIGATION MAIN.
14. SPRINKLER SLEEVE SHALL NOT BE IN LINE WITH ANY UTILITY BOXES.
15. SEE SERVICE DETAILS FOR BOX DESCRIPTIONS & TYPES
16. ALL PIPES TO BE BURIED WITH 14 GAUGE STRANDED THHN TRACE WIRE AND MARKING TAPE.

### **CONNECTION FOR PUBLIC PARKS & OPEN SPACE**

DATE: MARCH 2022	
DRAWING NAME: PI-4	
DRAWN BY: JRP	
CHECKED:	APPROVED:

REVISIONS				
REVISION	DATE	BY	COMMENTS	

SARATOGA  
SPRINGS CITY

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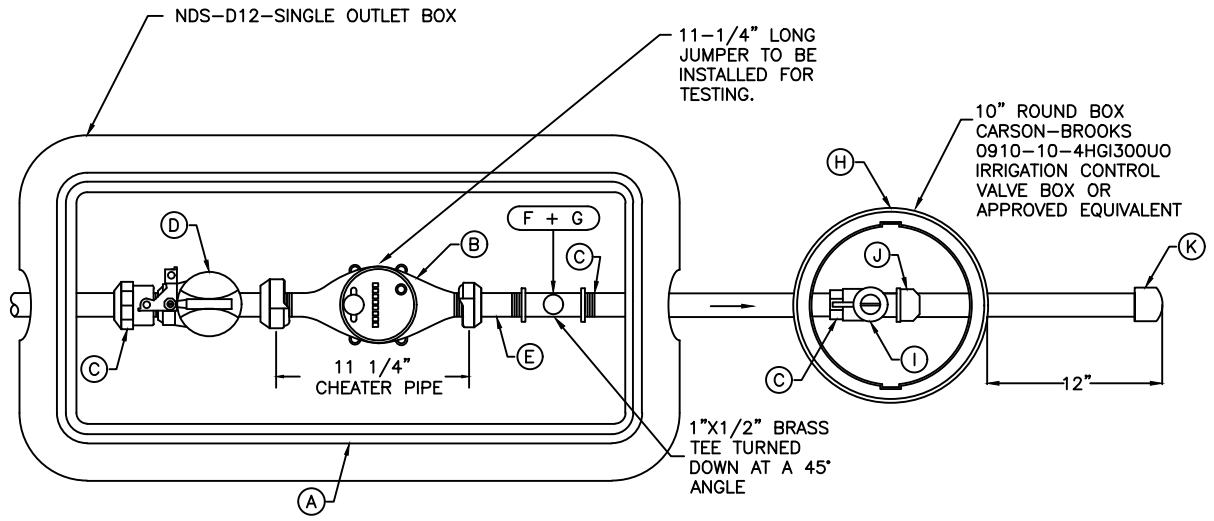
STANDARD DETAILS

PRESSURIZED IRR

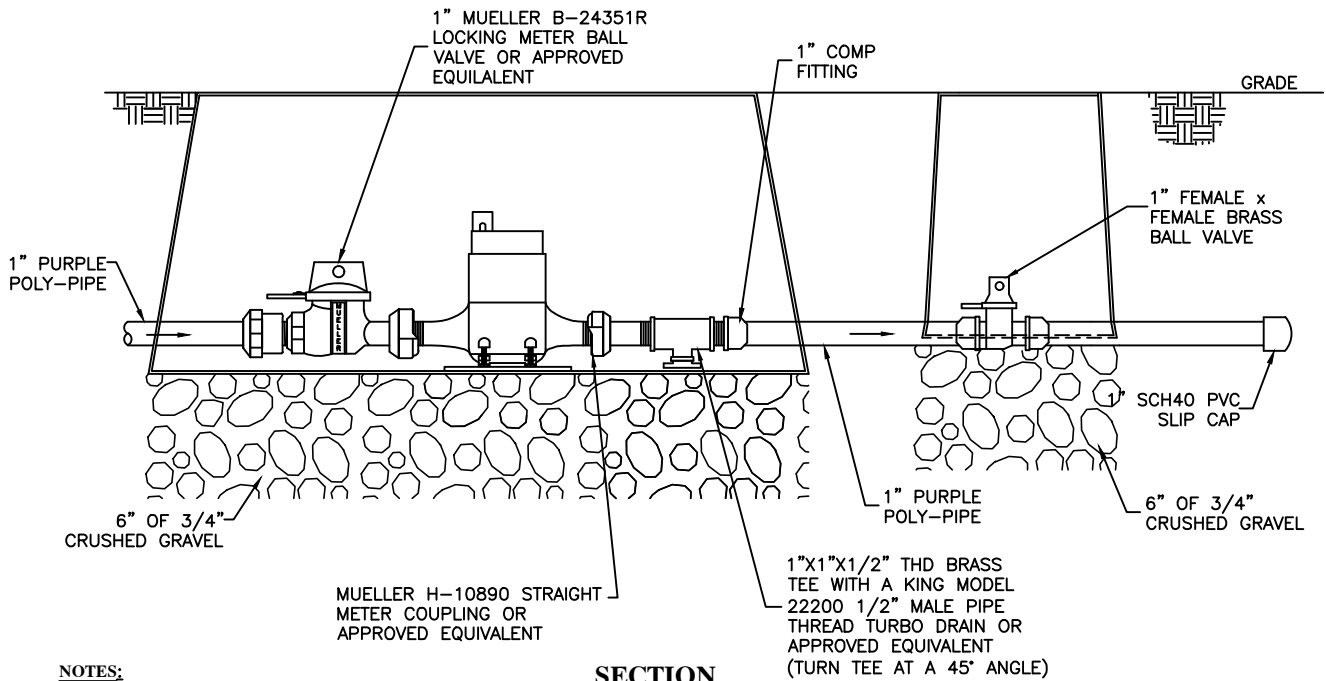
**PI-4**



**\*SEE DETAIL PI-3 FOR INSTALLATION DETAILS**



**PLAN**



**SECTION**

**NOTES:**

1. RESIDENTIAL METERS PROVIDED BY THE CITY. COMMERCIAL METERS PROVIDED BY THE CONTRACTOR.
2. ALL PIPES SHALL BE BURIED WITH 14 GAUGE STRANDED THHN TRACE WIRE
3. CHEATER PIPE TO BE EXACTLY 11' 1/4" FROM FACE TO FACE

**1" SINGLE  
SERVICE  
LATERAL BOX**

DATE: MARCH 2022		REVISIONS			
DRAWING NAME: PI-5A		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED: APPROVED:					
SARATOGA SPRINGS CITY					
1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794					

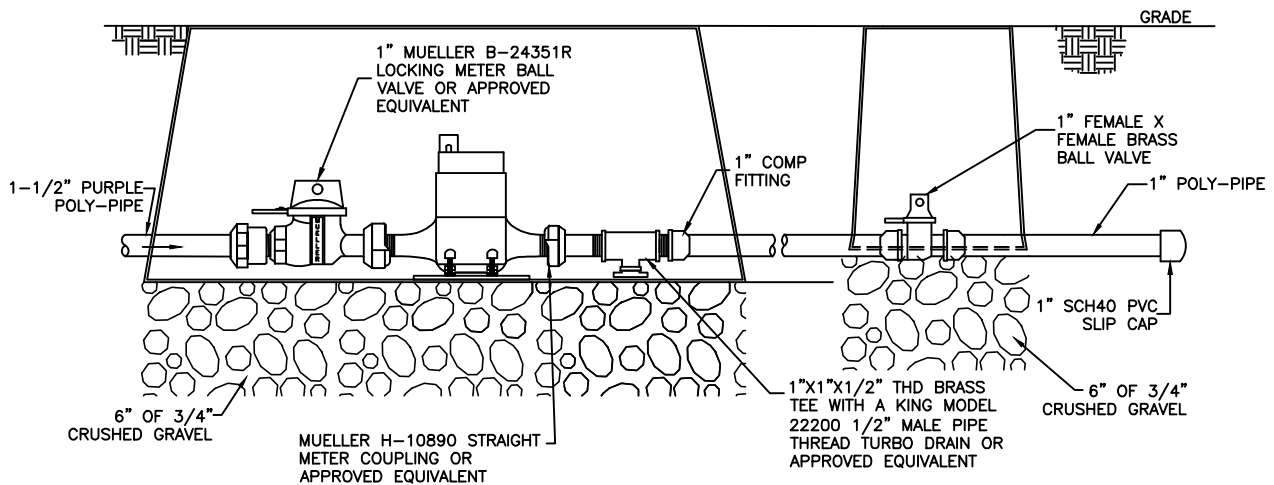
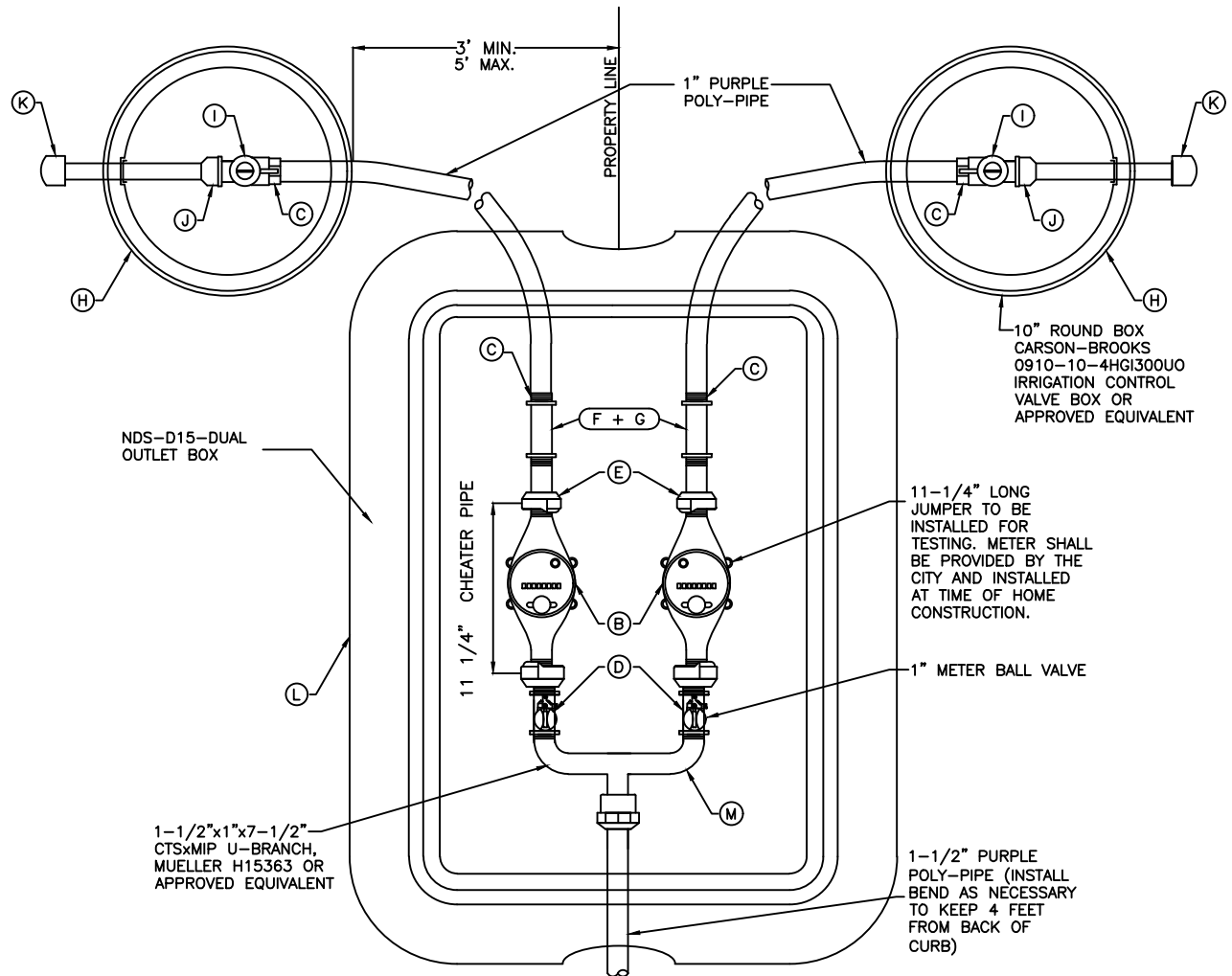


STANDARD DETAILS

PRESSURIZED IRR

**PI-5A**





Note:

1. CHEATER PIPE TO BE EXACTLY 11' 1/4" FROM FACE TO FACE.

**\*SEE DETAIL PI-3 FOR INSTALLATION DETAILS**

# **1 1/2" DUAL SERVICE LATERAL BOX**

DATE: MARCH 2022		REVISIONS			
DRAWING NAME: PI-5B		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:	SARATOGA SPRINGS CITY			1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794



STANDARD DETAILS

PRESSURIZED IRR

**PI-5B**

## SCHEDULE OF PLUMBING MATERIAL FOR WATER METER BOXES

### 1" SINGLE SERVICE CONNECTION

<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
A	1ea	14"x19"x12" METER BOX W/ SINGLE OUTLET
B	1ea	1" METER (SUPPLIED AND INSTALLED BY CITY)
C	3ea	1" COUPLER CCT/MIPT H15428
D	1ea	1" STR BALL METER VALVE B24351R
E	1ea	1" STR METER COUPLER H10890
F	1ea	1"x1/2" BRASS TEE
G	1ea	1/2" MALE PIPE THREAD AUTO DRAIN
H	1ea	10" IRRIGATION VALVE BOX
I	1ea	1" BRASS BALL VALVE 600 WOG
J	1ea	1" MALE ADAPT SXM1PT SCH 40
K	1ea	1" SLIP CAP SHC 40

### 1 1/2" TO DUAL 1" SERVICE CONNECTION

<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
A	2ea	1" METER (SUPPLIED AND INSTALLED BY CITY)
B	4ea	1" COUPLER CCT/MIPT H15428
C	2ea	1" STR BALL METER VALVE B24351R
D	2ea	1" STR METER COUPLER H10890
E	2ea	1" BRASS TEE
F	2ea	1/2" MALE PIPE THREAD AUTO DRAIN
G	2ea	10" IRRIGATION VALVE BOX
H	2ea	1" BRASS BALL VALVE 600 WOG
I	2ea	1" MALE ADAPT SXM1PT SCH 40
J	2ea	1" SLIP CAP SHC 40
K	1ea	13"x20"x12" JUMBO METER BOX W/ DOUBLE OUTLET
L	1ea	1.5"x7.5" CTSxMIP U-BRANCH H15363

## **PARTS LIST FOR SINGLE AND DUAL SERVICE LATERAL BOXES**

DATE:  
MARCH 2022

DRAWING NAME:  
PI-5C

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

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SPRINGS CITY

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#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



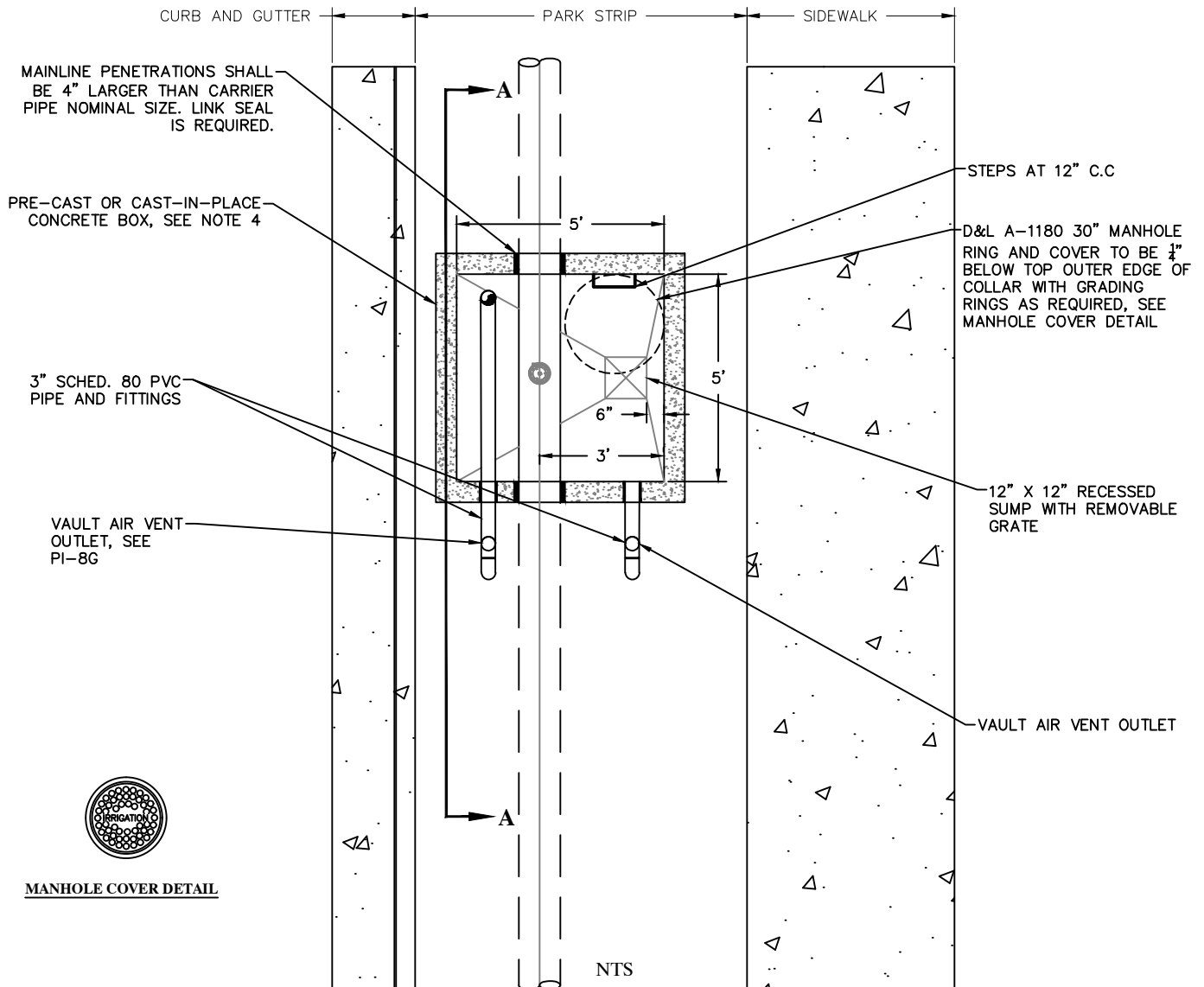
STANDARD DETAILS

PRESSURIZED IRR

**PI-5C**







### NOTES:

1. THIS DETAIL ONLY APPLIES TO ROAD SECTIONS ST-8, ST-9A, ST-10. APPLICATIONS FOR OTHER PUBLIC ROADWAY SECTIONS MUST BE A CUSTOM DETAIL THAT HAS BEEN SUBMITTED TO AND ACCEPTED BY THE CITY ENGINEER.
2. SIZE OF AIR-VACUUM RELIEF VALVE & PIPING SHALL BE 2" UNLESS OTHERWISE DIRECTED BY THE CITY ENGINEER.
3. BOLLARDS AROUND VENT COVER NOT REQUIRED UNLESS OTHERWISE DIRECTED BY CITY INSPECTOR.
4. A PRECAST BOX SHALL BE H-20 LOADING WITH NO HORIZONTAL JOINTS THROUGH THE PIPE OPENINGS. A SEPARATE DETAIL CAST-IN-PLACE VAULT BOX MUST BE ACCEPTED BY THE CITY ENGINEER PRIOR TO CONSTRUCTION.
5. THE FLOOR SHALL BE SLOPED AT A 2% MINIMUM TO MEET FLUSH WITH THE RIM OF THE SUMP.

### SHEET NOTES:

1. THIS DETAIL INCLUDES PI-8A, PI-8B, & PI-8G.

## AIR VACUUM RELIEF VALVE IN PUBLIC ROW PLAN VIEW

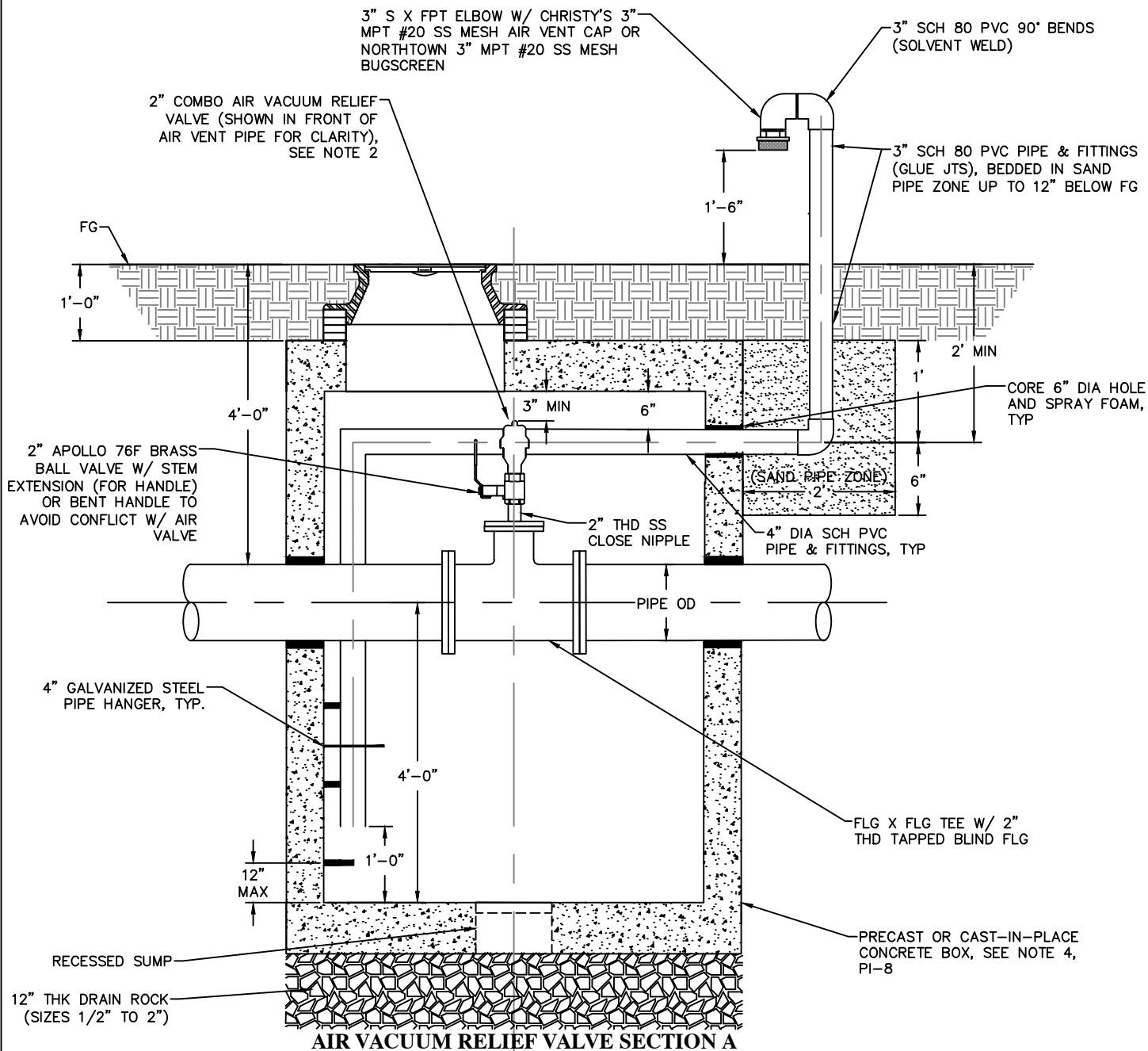
DATE: APRIL 2024		REVISIONS			
DRAWING NAME: PI-8.1		REVISION	DATE	BY	COMMENTS
DRAWN BY: ABO					
CHECKED: APPROVED:					
		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-765-9793 FAX: 801-765-9794			



STANDARD DETAILS

PRESSURED IRR

PI-8A



#### NOTES:

1. THIS DETAIL ONLY APPLIES TO ROAD SECTIONS ST-8, ST-9A, ST-10, AND ST-31. APPLICATIONS FOR OTHER PUBLIC ROADWAY SECTIONS MUST BE A CUSTOM DETAIL THAT HAS BEEN SUBMITTED TO AND ACCEPTED BY THE CITY ENGINEER.
2. COMBO AIR VACUUM RELIEF VALVE SHALL BE VENT-O-MAT SERIES 2" RPS NTP.
3. PRESSURIZED IRRIGATION PIPELINE IS DEEPER THAN STANDARD BURY DEPTH. ENSURE APPROACHING PIPES DO NOT CREATE ADDITIONAL LOCALIZED HIGH POINTS.

#### SHEET NOTES:

4. THIS DETAIL INCLUDES PI-8A & PI-8B.

### AIR VACUUM RELIEF VALVE IN PUBLIC ROW SECTION VIEW

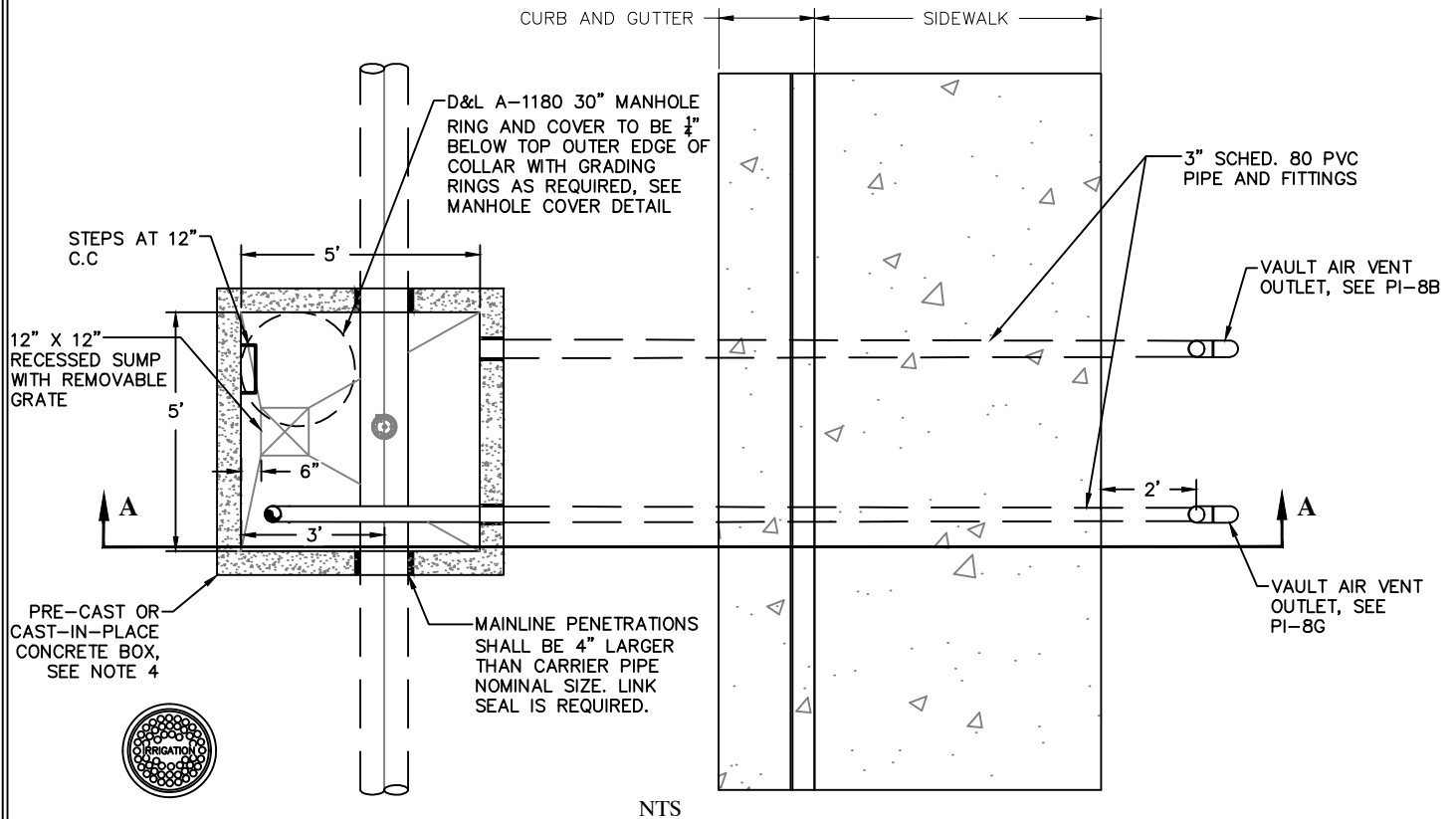
DATE: APRIL 2024		REVISIONS	
DRAWING NAME: PI-8.1A		REVISION	DATE BY COMMENTS
DRAWN BY: ABO			
CHECKED: APPROVED:			
		SARATOGA SPRINGS CITY	
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-765-9793 FAX: 801-765-9794	



STANDARD DETAILS

PRESSURIZED IRR

**PI-8B**



**MANHOLE COVER DETAIL**

### NOTES:

1. THIS DETAIL ONLY APPLIES TO ROAD SECTIONS ST-30 & ST-31.
2. SIZE OF AIR-VACUUM RELIEF VALVE & PIPING SHALL BE 2" UNLESS OTHERWISE DIRECTED BY THE CITY ENGINEER.
3. BOLLARDS AROUND VENT COVER NOT REQUIRED UNLESS OTHERWISE DIRECTED BY CITY INSPECTOR.
4. A PRECAST BOX SHALL BE H-20 LOADING WITH NO HORIZONTAL JOINTS THROUGH THE PIPE OPENINGS. A SEPARATE DETAIL CAST-IN-PLACE VAULT BOX MUST BE ACCEPTED BY THE CITY ENGINEER PRIOR TO CONSTRUCTION.
5. THE FLOOR SHALL BE SLOPED AT A 2% MINIMUM TO MEET FLUSH WITH THE RIM OF THE SUMP.

### SHEET NOTES:

1. THIS DETAIL INCLUDES PI-8C, PI-8D, & PI-8G.

## AIR VACUUM RELIEF VALVE IN PRIVATE ROW PLAN VIEW

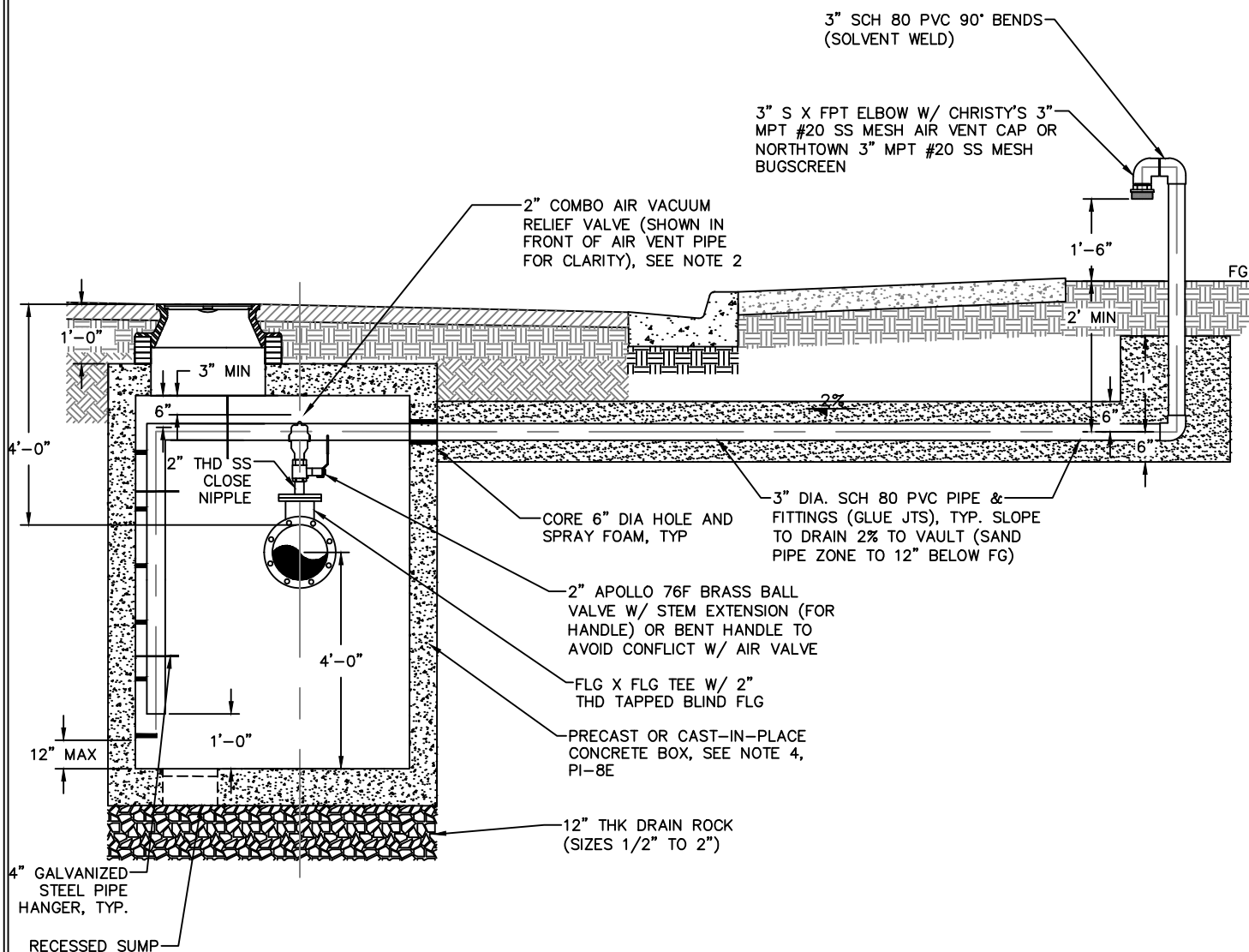
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DRAWING NAME: PI-8.2		REVISION	DATE	BY	COMMENTS
DRAWN BY: ABO					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

PRESSURIZED IRR

**PI-8C**



### AIR VACUUM RELIEF VALVE SECTION A

NTS

#### NOTES:

1. THIS DETAIL ONLY APPLIES TO ROAD SECTIONS ST-30 & ST-31.
2. COMBO AIR VACUUM RELIEF VALVE SHALL BE VENT-O-MAT SERIES 2" RPS NTP.
3. PRESSURIZED IRRIGATION PIPELINE IS DEEPER THAN STANDARD BURY DEPTH. ENSURE APPROACHING PIPES DO NOT CREATE ADDITIONAL LOCALIZED HIGH POINTS.

#### SHEET NOTES:

1. THIS DETAIL INCLUDES PI-8C AND PI-8D.

## AIR VACUUM RELIEF VALVE IN PRIVATE ROW

DATE:  
APRIL 2024

DRAWING NAME:  
PI-8.2A

DRAWN BY:  
ABO

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

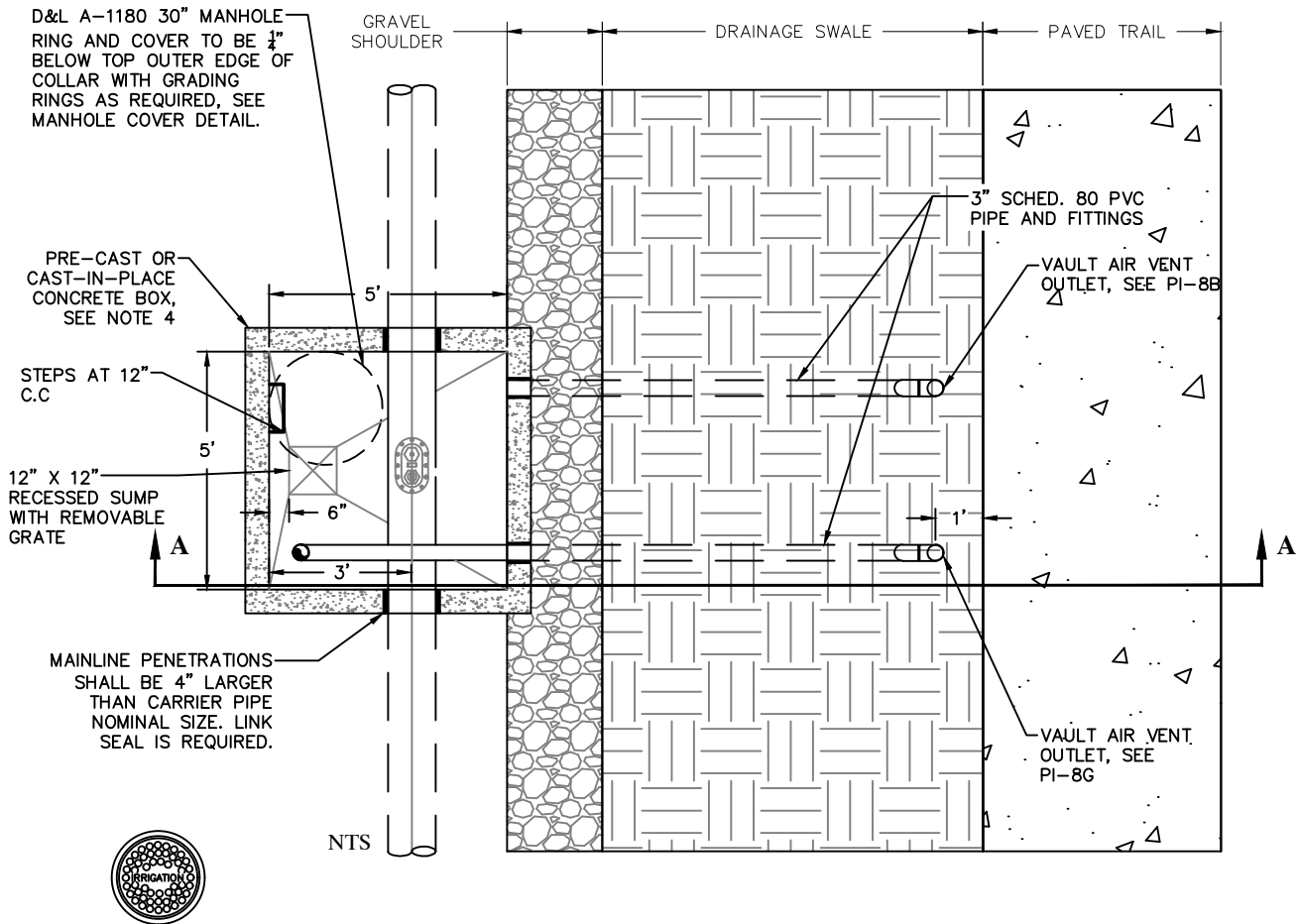


STANDARD DETAILS

PRESSURIZED IRR

PI-8D





**MANHOLE COVER DETAIL**

**NOTES:**

1. THIS DETAIL ONLY APPLIES TO ROAD SECTIONS ST-32.
2. SIZE OF AIR-VACUUM RELIEF VALVE & PIPING SHALL BE 2" UNLESS OTHERWISE DIRECTED BY THE CITY ENGINEER.
3. BOLLARDS AROUND VENT COVER NOT REQUIRED UNLESS OTHERWISE DIRECTED BY CITY INSPECTOR.
4. A PRECAST BOX SHALL BE H-20 LOADING WITH NO HORIZONTAL JOINTS THROUGH THE PIPE OPENINGS. A SEPARATE DETAIL CAST-IN-PLACE VAULT BOX MUST BE ACCEPTED BY THE CITY ENGINEER PRIOR TO CONSTRUCTION.
5. THE FLOOR SHALL BE SLOPED AT A 2% MINIMUM TO MEET FLUSH WITH THE RIM OF THE SUMP.

**SHEET NOTES:**

1. THIS DETAIL INCLUDES PI-8E, PI-8F, & PI-8G.

**AIR VACUUM  
RELIEF VALVE  
IN RURAL ROW  
PLAN VIEW**

DATE: APRIL 2024		REVISIONS			
DRAWING NAME: PI-8.3		REVISION	DATE	BY	COMMENTS
DRAWN BY: ABO					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-765-9793 FAX: 801-765-9794			



STANDARD DETAILS

PRESSURIZED IRR

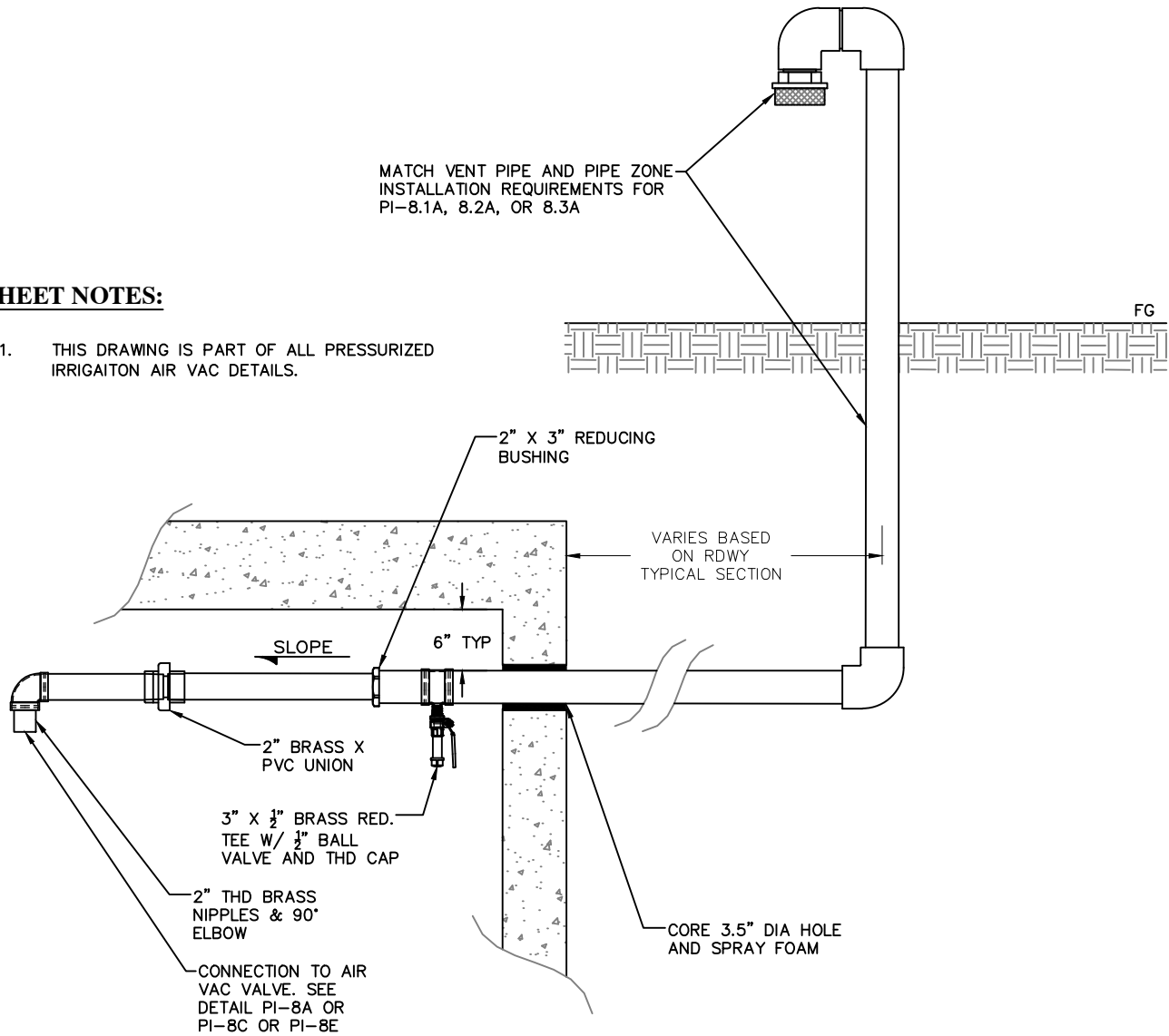
**PI-8E**



MATCH VENT PIPE AND PIPE ZONE  
INSTALLATION REQUIREMENTS FOR  
PI-8.1A, 8.2A, OR 8.3A

# **SHEET NOTES:**

- THIS DRAWING IS PART OF ALL PRESSURIZED  
IRRIGATION AIR VAC DETAILS.



**DETAIL B - VENT**  
NTS

## **AIR VACUUM RELIEF VALVE VENT DETAILS**

DATE:  
APRIL 2024

DRAWING NAME:  
PI-8B

DRAWN BY:  
ABO

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

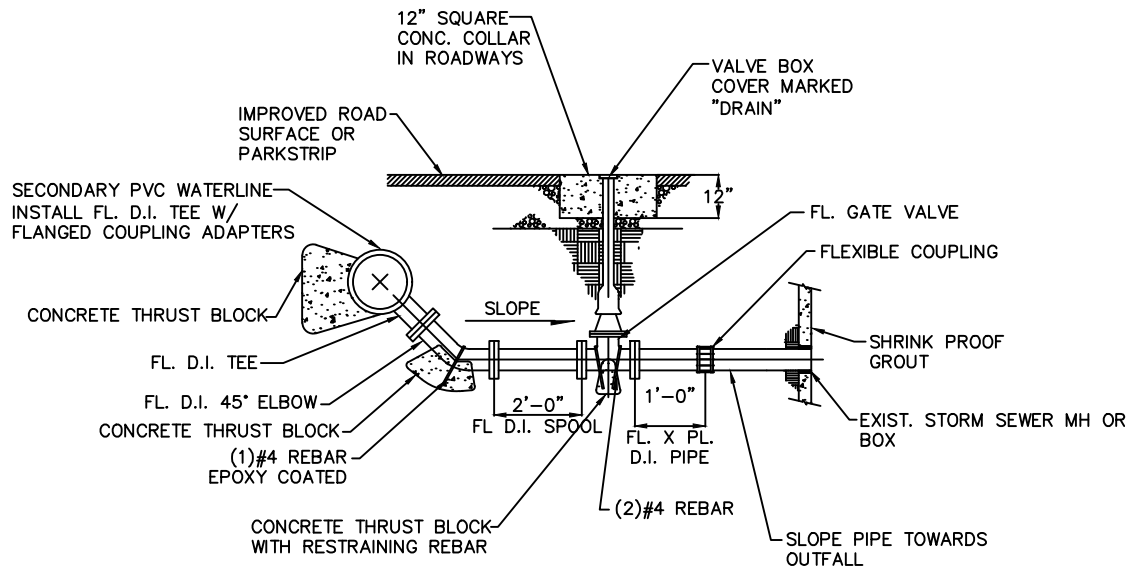
SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

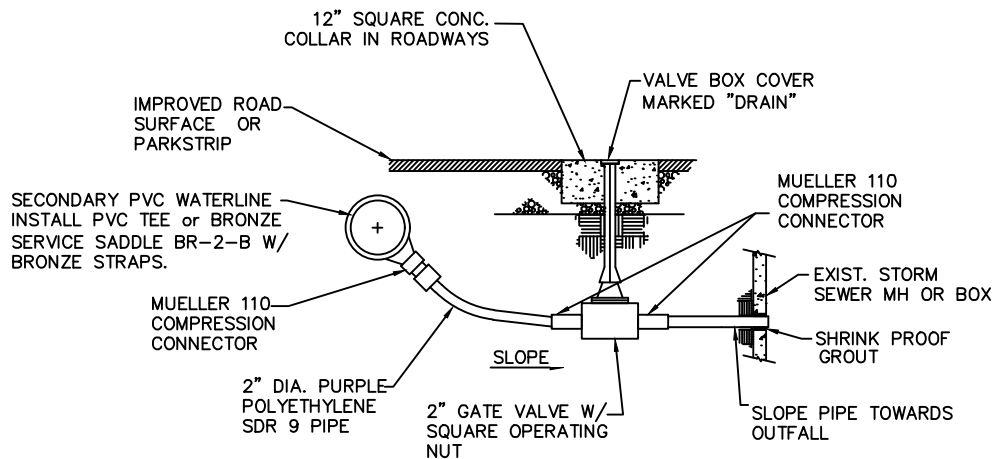
STANDARD DETAILS

PRESSURIZED IRR

**PI-8G**



**4" DRAIN VALVE DETAIL**



**2" DRAIN VALVE DETAIL**

**NOTES:**

1. USE 2" DRAINS ON 6" AND SMALLER PIPE LINES
2. USE 4" DRAINS ON 8" AND LARGER PIPE LINES
3. MARK "D" FOR DRAIN IN CONCRETE CURB

**2" & 4" DRAIN VALVES**

DATE:  
MARCH 2022

DRAWING NAME:  
PI-9

DRAWN BY:  
JRP

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

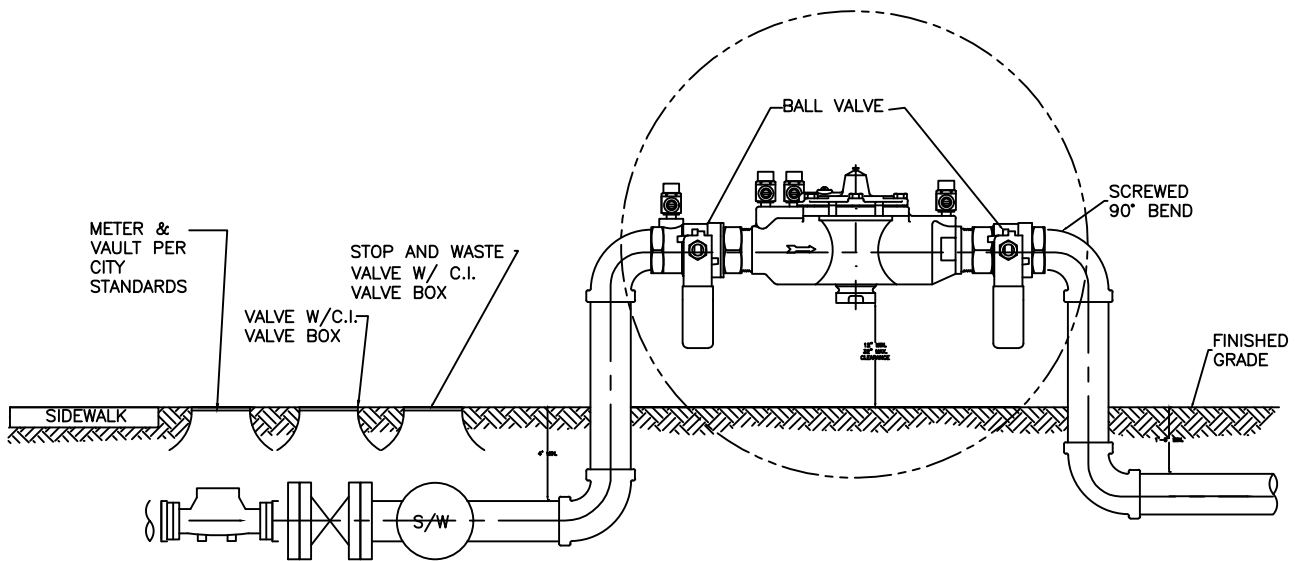
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

PRESSURIZED IRR

**PI-9**



**NOTES:**

1. TO BE USED WHEN SECONDARY SERVICE IS CONNECTED TO THE CULINARY SYSTEM.
2. RPZ VALVE ASSEMBLY & PIPES TO MATCH SECONDARY LATERAL SIZE.
3. ABOVE GROUND FITTINGS TO BE EPOXY PAINTED.  
BLUE ON CULINARY SIDE, PURPLE ON SECONDARY SIDE
4. SHOP DRAWINGS TO BE SUBMITTED TO SARATOGA SPRINGS CITY ENGINEER FOR APPROVAL PRIOR TO SHIPMENT.
5. THE RPZ ASSEMBLY DETAIL SHALL BE VERIFIED PER MANUFACTURER RECOMMENDATIONS
6. PROVIDE BOLLARDS OR OTHER PROTECTION IF AND AS DIRECTED BY CITY INSPECTOR.

**RPZ BACKFLOW  
PREVENTER  
FOR SERVICE LATERALS**

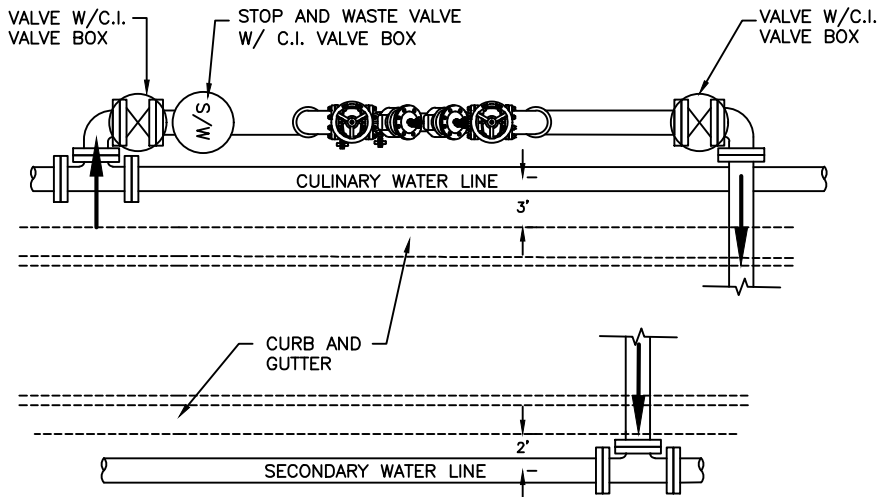
DATE: MARCH 2022		REVISIONS			
DRAWING NAME: PI-10		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



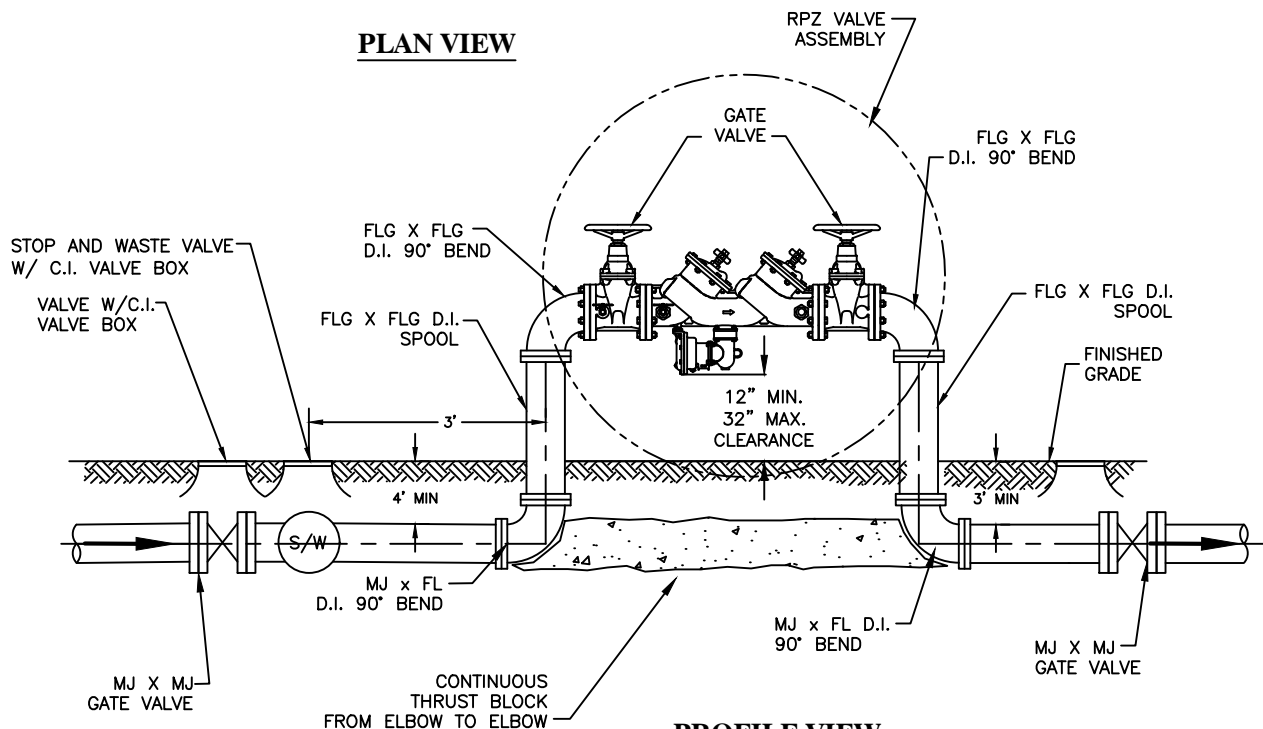
STANDARD DETAILS

PRESSURIZED IRR

**PI-10**



**PLAN VIEW**



**PROFILE VIEW**

**NOTES:**

1. TO BE USED WHEN CHARGING THE SECONDARY SYSTEM WITH CULINARY WATER.
2. RPZ VALVE ASSEMBLY & PIPES TO MATCH SECONDARY MAIN SIZE.
3. ABOVE GROUND FITTINGS TO BE EPOXY PAINTED. BLUE ON CULINARY SIDE, PURPLE ON SECONDARY SIDE
4. SHOP DRAWINGS TO BE SUBMITTED TO SARATOGA SPRINGS CITY ENGINEER FOR APPROVAL PRIOR TO SHIPMENT.
5. THE RPZ ASSEMBLY SHALL BE VERIFIED PER MANUFACTURERS RECOMMENDATIONS.
6. PROVIDE BOLLARDS OR OTHER PROTECTION IF AND AS DIRECTED BY CITY INSPECTOR.

**RPZ BACKFLOW  
PREVENTER  
FOR WATER MAINS**

DATE:  
MARCH 2022

DRAWING NAME:  
PI-11

DRAWN BY:  
JRP

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

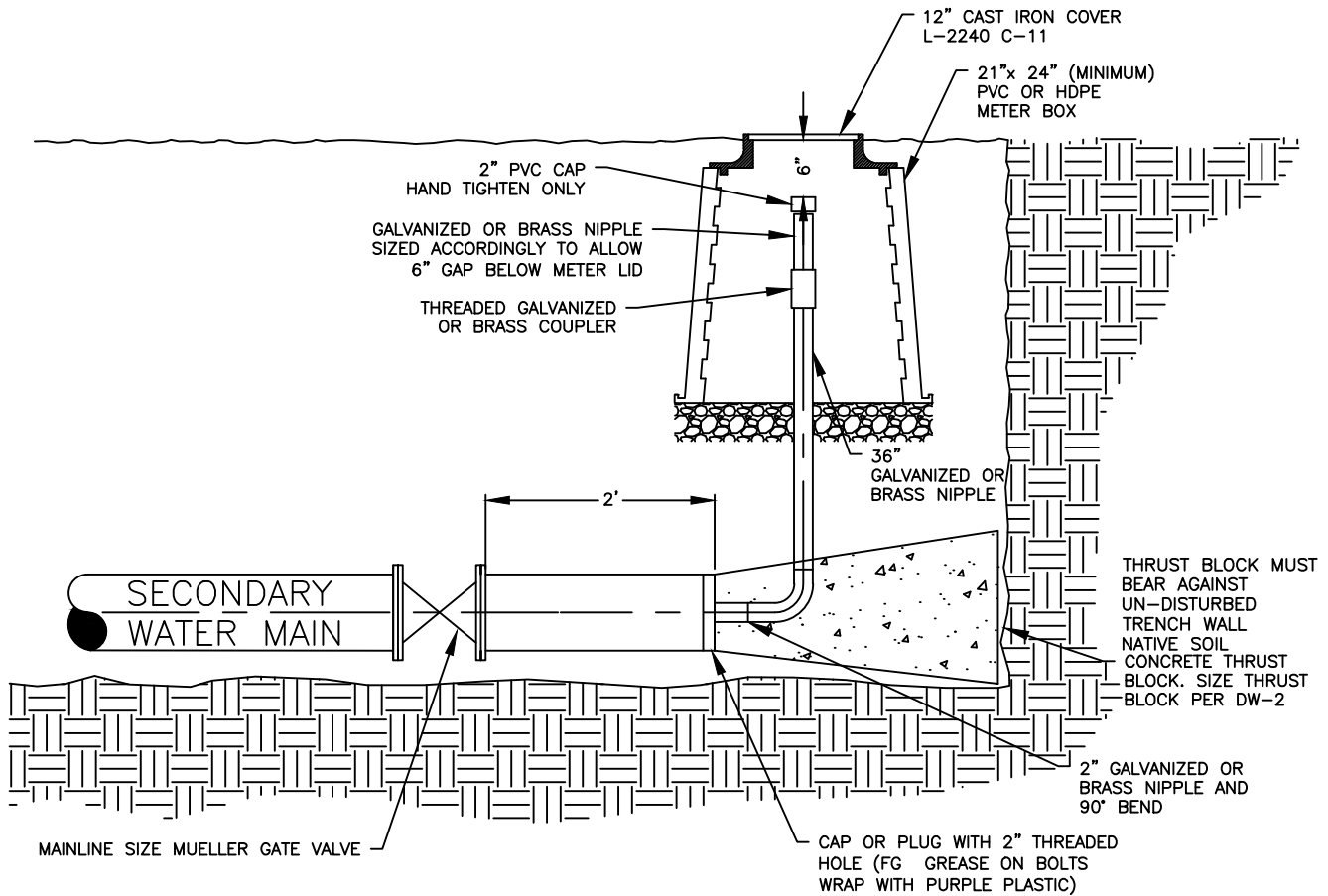
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

STANDARD DETAILS

PRESSURIZED IRR

**PI-11**

**PI-12A**



## TEMPORARY 2" BLOW-OFF VALVE

DATE:  
MARCH 2022

DRAWING NAME:  
PI-12B

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

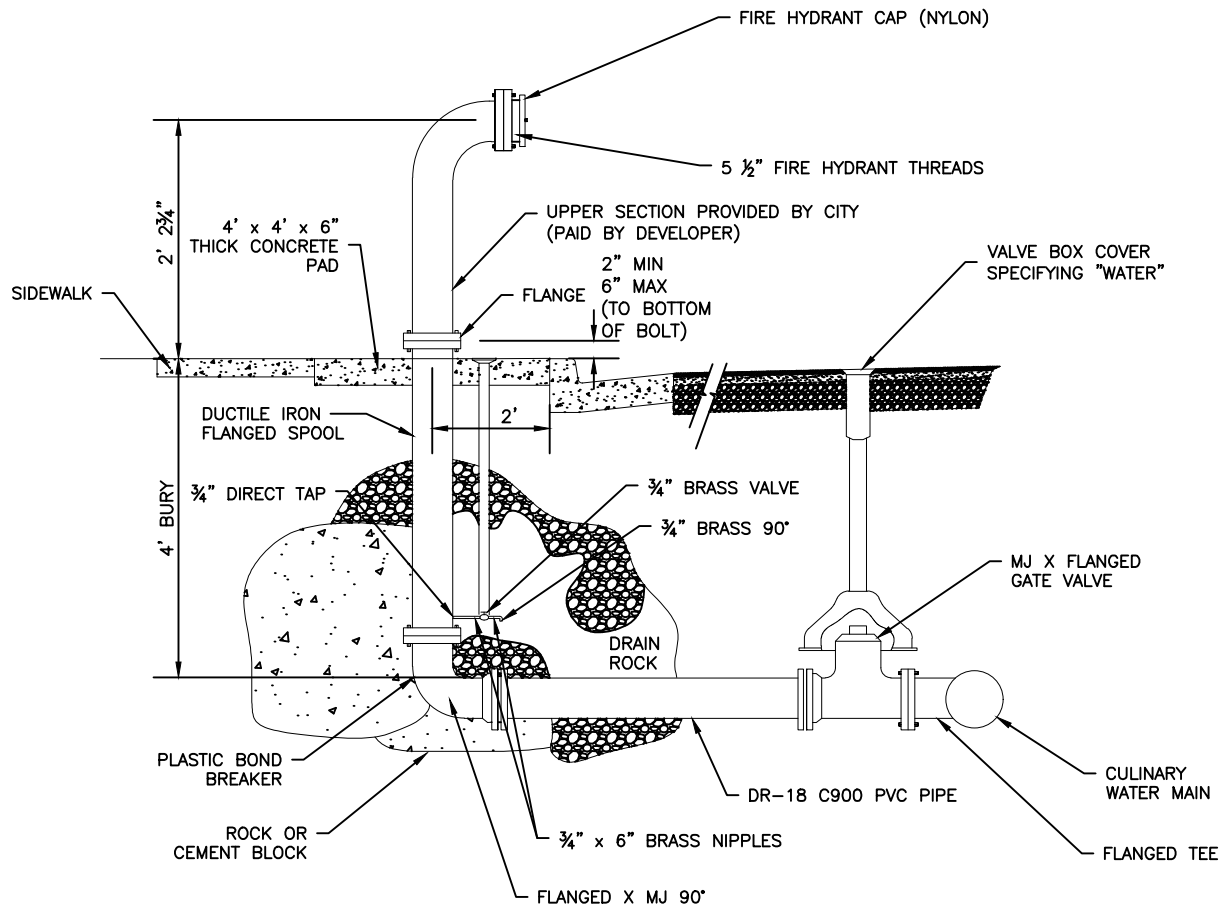


STANDARD DETAILS

PRESSURIZED IRR

**PI-12B**





#### NOTES:

1. 2" SIZE FOR 8" OR SMALLER LINES. 6" SIZE FOR 10" OR LARGER LINES. OTHER SIZES AS DIRECTED BY THE CITY ENGINEER
2. BLOW-OFF SHALL BE INSTALLED 2' BEHIND THE WALK WITH CONCRETE PAD WHEN THERE IS NO PLANER.
3. WHEN INSTALLING CONCRETE PAD AROUND BLOW-OFF, CONTRACTOR SHALL PLACE CRACK CONTROL JOINTS DIAGONALLY FROM THE BLOW-OFF TO THE CORNERS OF SAID PAD.
4. A THREE (3) FOOT HORIZONTAL CLEARANCE MUST BE MAINTAINED AROUND THE OUTSIDE OF ALL BLOW-OFFS.
5. BLOW-OFF TOP, ADAPTOR, AND CAP TO BE SUPPLIED BY THE WATER DEPARTMENT.

## 6" BLOW-OFF

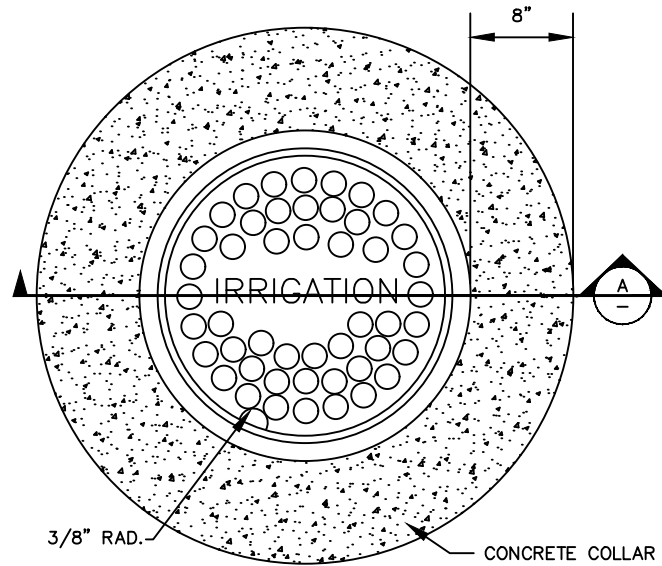
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DRAWING NAME: PI-12B		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

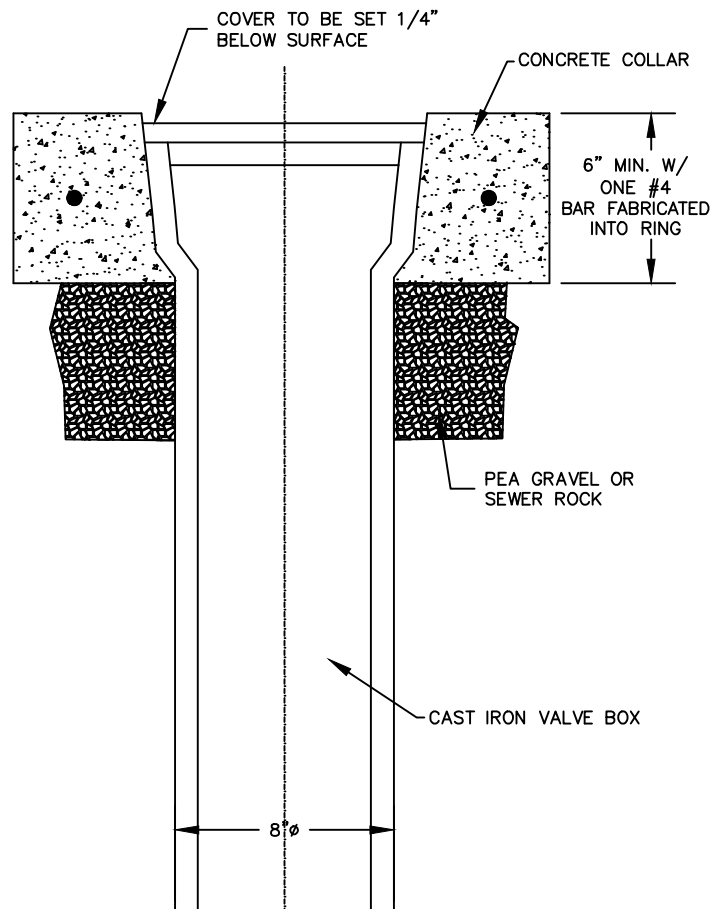
PRESSURIZED IRR

**PI-12C**



### NOTES:

1. ALL WORK SHALL CONFORM TO APWA STANDARDS UNLESS OTHERWISE APPROVED BY CITY ENGINEER



## CONCRETE COLLAR FOR WATER VALVES

DATE:  
AUGUST 2022

DRAWING NAME:  
PI-13

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

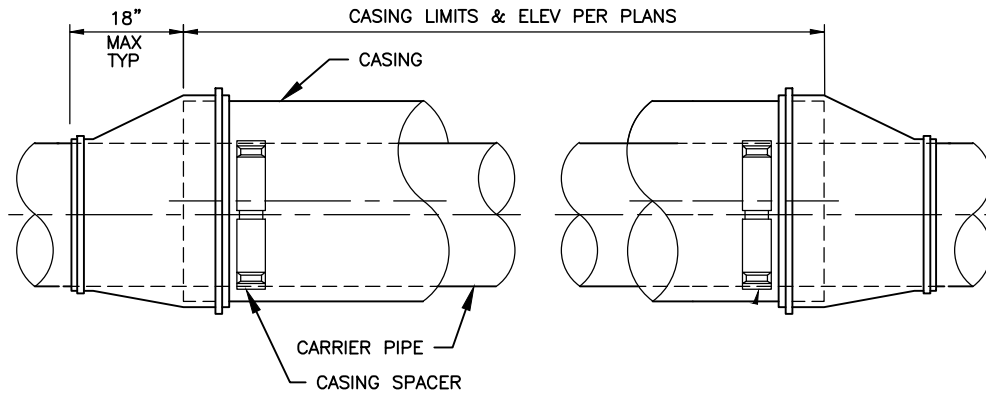
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

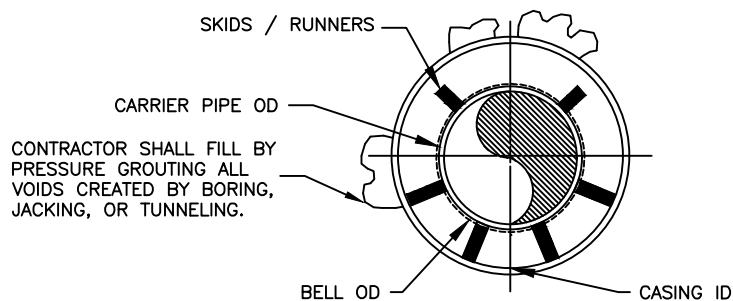
PRESSURIZED IRR

PI-13



### CASING & END SEALS

SCALE: NTS



### CASING SECTION

SCALE: NTS

MINIMUM WALL THICKNESS OF CASINGS	
Diameter	Wall Thickness
12" and under	0.188"
14" - 18"	0.312"
20" - 22"	0.375"
24" - 26"	0.438"
28" - 32"	0.500"
34" - 42"	0.562"

LARGER CASINGS AS DIRECTED BY THE CITY ENGINEER.

### NOTES:

1. JACK AND BORE CONSTRUCTION METHOD SHALL USE STEEL CASINGS SPECIFIED IN THIS DETAIL.
2. DIRECTIONAL DRILLED CONSTRUCTION METHOD SHALL USE HDPE CASINGS. THE MATERIAL SHALL BE PE 4710, DR 17, OR 11.
3. CASING INTERIOR DIAMETER SHALL BE A MINIMUM OF 4" LARGER THAN THE CARRIER PIPE OUTSIDE DIAMETER.
4. SEAL ENDS OF CASING WITH  $\frac{1}{8}$ " MIN THK RUBBER CASING SEAL (WITH SS CLAMPS) BY PIPELINE SEAL & INSULATOR (PSI), OR EQUAL. LOOSEN THE END SEAL BAND AROUND CARRIER PIPE ON DOWNHILL SIDE OF CASING.
5. IF CARRIER PIPE & CASING ARE BOTH METAL, CONTRACTOR SHALL SUBMIT ELECTRICAL ISOLATION TEST VERIFYING ISOLATION BEFORE TYING TO PIPE ON EACH END.
6. CASING SPACERS SHALL BE AT 5' MAX SPACING. MAINTAIN CARRIER PIPE AT CONSTANT GRADE THROUGH CASING.
7. LEAK TEST CARRIER PIPE BEFORE SEALING CASING END SEALS.
8. SECURELY ATTACH SPACERS TO CARRIER PIPE PER MANUFACTURER REQUIREMENTS.
9. LOCATE CASING SPACERS PER MANUFACTURER. PROVIDE SPACERS 1' FROM EACH END OF EACH PIPE JOINT. PROVIDE A SPACER 1' FROM END OF EACH CASING.

**PRESSURIZED  
IRRIGATION  
PIPE CASING**

DATE: APRIL 2024		REVISIONS			
DRAWING NAME: DW-16		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:	SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

DRINKING WATER

**PI-14**

# STANDARD STREET IMPROVEMENT DETAILS

## INDEX:

ST-1	SIDEWALK AND CURB & GUTTER STANDARDS
ST-2A	RESIDENTIAL 30" HIGH BACK CURB & GUTTER
ST-2B	RESIDENTIAL 24" HIGH BACK CURB & GUTTER
ST-2C	6" CURB WALL
ST-2D	FALL-OUT CURB AND GUTTER
ST-3	WATERWAY
ST-4A	SINGLE FAMILY RESIDENTIAL DRIVE APPROACH
ST-4B	COMMERCIAL DRIVE APPROACH
ST-5A-E	ADA ACCESSIBLE CURB RAMP
ST-6	DEFECTIVE CONCRETE REPLACEMENT CRITERIA
ST-7	STANDARD INTERSECTION & UTILITIES
ST-8	LOCAL 62' RIGHT-OF-WAY
ST-9A	COLLECTOR 77' RIGHT-OF-WAY
ST-9B	INTERIM COLLECTOR 86.5' RIGHT-OF-WAY MTN VIEW CORRIDOR
ST-10	MINOR ARTERIAL 100' RIGHT-OF-WAY
ST-11	MAJOR ARTERIAL 180' RIGHT-OF-WAY
ST-12	PRINCIPAL ARTERIAL 180' RIGHT-OF-WAY
ST-13	INTERIM ARTERIAL 180' RIGHT-OF-WAY
ST-14	TEMPORARY TURN-AROUND
ST-15	TRAILS
ST-16	CUL-DE-SAC
ST-17	ROUNDBOUT COLLECTOR 77' RIGHT-OF-WAY
ST-26	TEE PATCH
ST-27	UTILITY MARKER
ST-28	STREET SIGNS AND REGULATORY SIGNS
ST-29	SURVEY MONUMENT
ST-30	PRIVATE ROAD 45' RIGHT-OF-WAY W/O PARK STRIP
ST-31	PRIVATE ROAD 53' RIGHT-OF-WAY W PARK STRIP
ST-32	PRIVATE ROAD 59' RIGHT-OF-WAY RURAL
ST-33	PRIVATE ROAD INTERSECTION & UTILITIES
ST-35	ANGLED ON STREET PARKING
ST-39	POLYMER CONCRETE JUNCTION BOX
ST-40	CONDUIT: FIBER OPTIC/COMMUNICATION

**STREET  
IMPROVEMENT  
DETAILS**

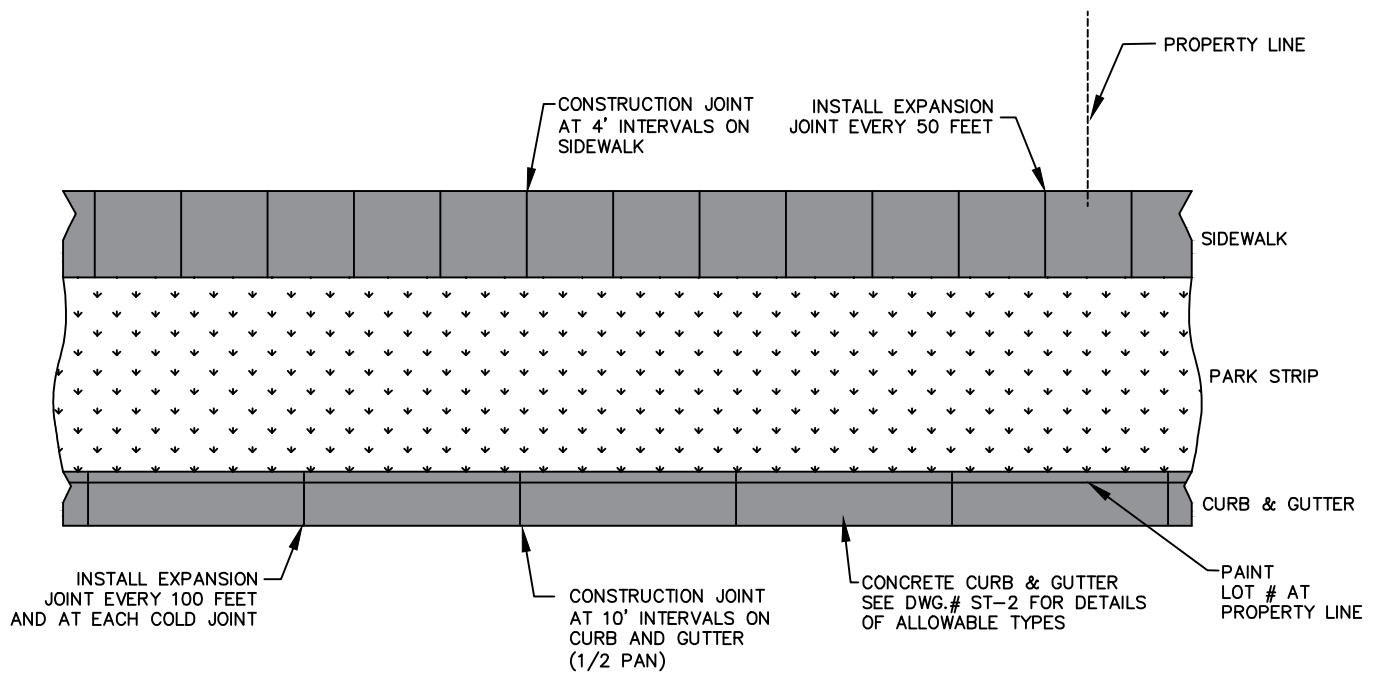
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DRAWN BY: ETL					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		<small>1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794</small>			



STANDARD DETAILS

STREET STANDARDS

**ST-0**



### PLAN VIEW

### NOTES:

1. A MINIMUM 6" DEPTH OF ROADBASE MATERIAL SHALL BE PLACED TO GRADE AND COMPACTED TO 95% OF MAXIMUM DRY DENSITY UNDER DRIVEWAY, WATERWAY, AND CURB & GUTTER PRIOR TO PLACEMENT OF CONCRETE.
2. A MINIMUM 6" DEPTH OF ROADBASE MATERIAL SHALL BE PLACED TO GRADE AND COMPACTED TO 95% OF MAXIMUM DRY DENSITY UNDER SIDEWALK AT ALL OTHER LOCATIONS PRIOR TO PLACEMENT OF CONCRETE.
3. WHERE CONSTRUCTION IS ADJACENT TO STATE HIGHWAY FRONTAGE, STATE HIGHWAY DEPARTMENT REQUIREMENTS SHALL GOVERN.
4. CONCRETE SHALL BE 3/4 INCH MAXIMUM AGGREGATE, 6.3 BAGS PER YARD OF TYPE 2 CEMENT WITH A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS.
5. EXPANSION JOINTS FOR CURB & GUTTER ARE TO BE SPACED NO MORE THAN 100 FT. AND SIDEWALKS SHALL BE SPACED EVERY 50 FT. EXPANSION JOINTS SHALL BE CONSTRUCTED BY PLACING AN APPROVED MATERIAL, (TYPICALLY BITUMINOUS IMPREGNATED FIBERBOARD), THE FULL DEPTH OF THE CONCRETE.
6. CONSTRUCTION JOINT IS MADE BY SCORING THE CONCRETE WITH 1/2" RADIUS EDGING TOOL OR OTHER METHOD APPROVED BY ENGINEER.
7. SLOPE SIDEWALK TO ROADWAY AT 1.5% GRADE (+/- 0.5% MAX).
8. LOCATE ALL INLET GRATES 2' MINIMUM AWAY FROM THE PEDESTRIAN CROSSWALK, WITH ALL DRAINAGE INTERCEPTED BEFORE IT GETS TO THE CROSSWALK AREA.
9. THE SIDEWALK SHALL BE A MIN. 5" THICK CONCRETE.
10. INSTALL MAGNETIC DETECTOR TAPE WITH A MIN. OF 14 GAUGE COATED TRACER WIRE FOR ALL PVC OR OTHER PIPE.
11. PAINT LOT NUMBERS AT PROPERTY LINES.
12. SEWER LATERAL LOCATIONS TO BE MARKED ON TOP OF CURB WITH AN S.
13. CULINARY WATER LATERAL LOCATIONS TO BE MARKED ON TOP OF CURB WITH A W.
14. SECONDARY WATER LATERAL LOCATIONS TO BE MARKED ON TOP OF CURB WITH AN I.
15. WATER VALVE LOCATIONS TO BE MARKED ON TOP OF CURB WITH A V.

## SIDEWALK AND CURB & GUTTER

DATE:  
MARCH 2022

DRAWING NAME:  
ST-1

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

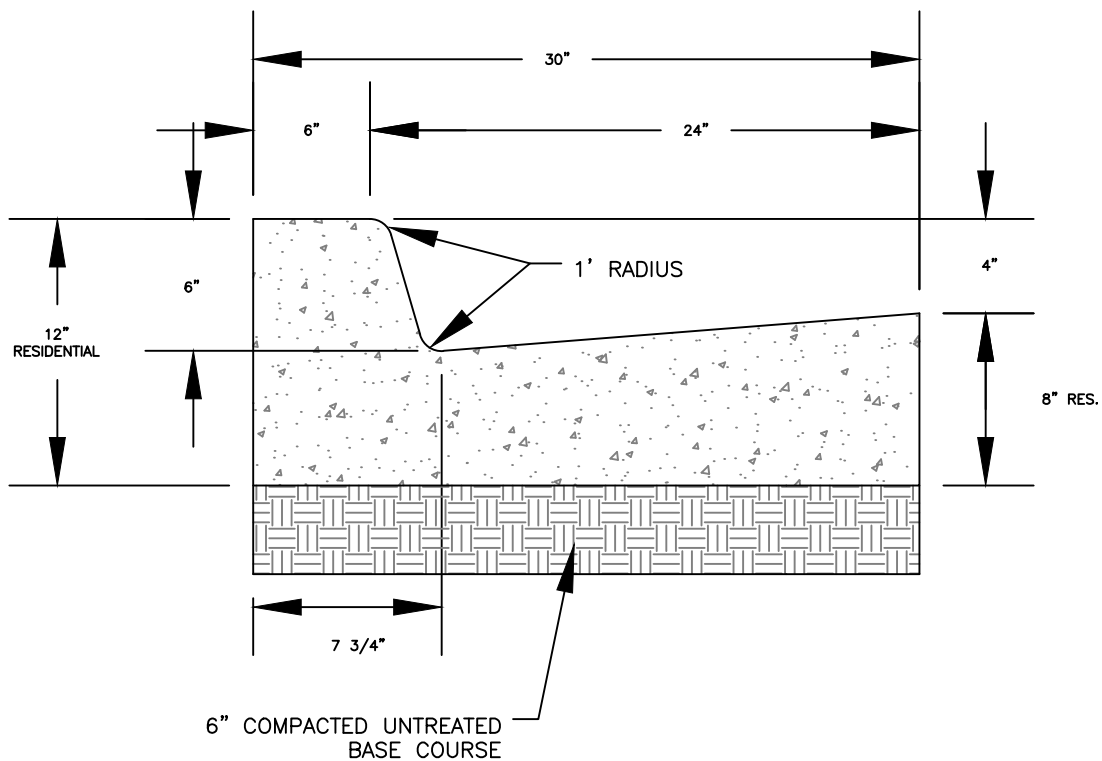
1307 N. COMMERCE DR.  
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UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STREET STANDARDS

**ST-1**



\*FOR USE ON COLLECTOR AND ARTERIAL ROADWAYS

**RESIDENTIAL  
30" HIGH BACK  
CURB & GUTTER**

DATE:  
MARCH 2022

DRAWING NAME:  
ST-2A

DRAWN BY:  
JRP

CHECKED: APPROVED:

REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

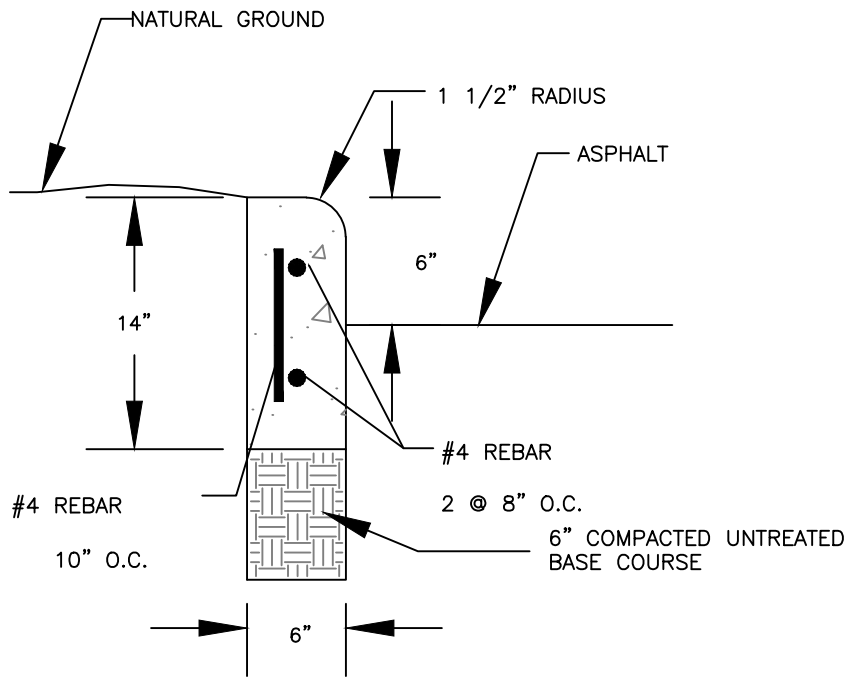
STREET STANDARDS

**ST-2A**



1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS  
UT 84045  
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FAX: 801-766-9794





## 6" CURB WALL

DATE: MARCH 2022		REVISIONS			
DRAWING NAME: ST-2C		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:					
APPROVED:					
SARATOGA SPRINGS CITY					
<small>1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794</small>					

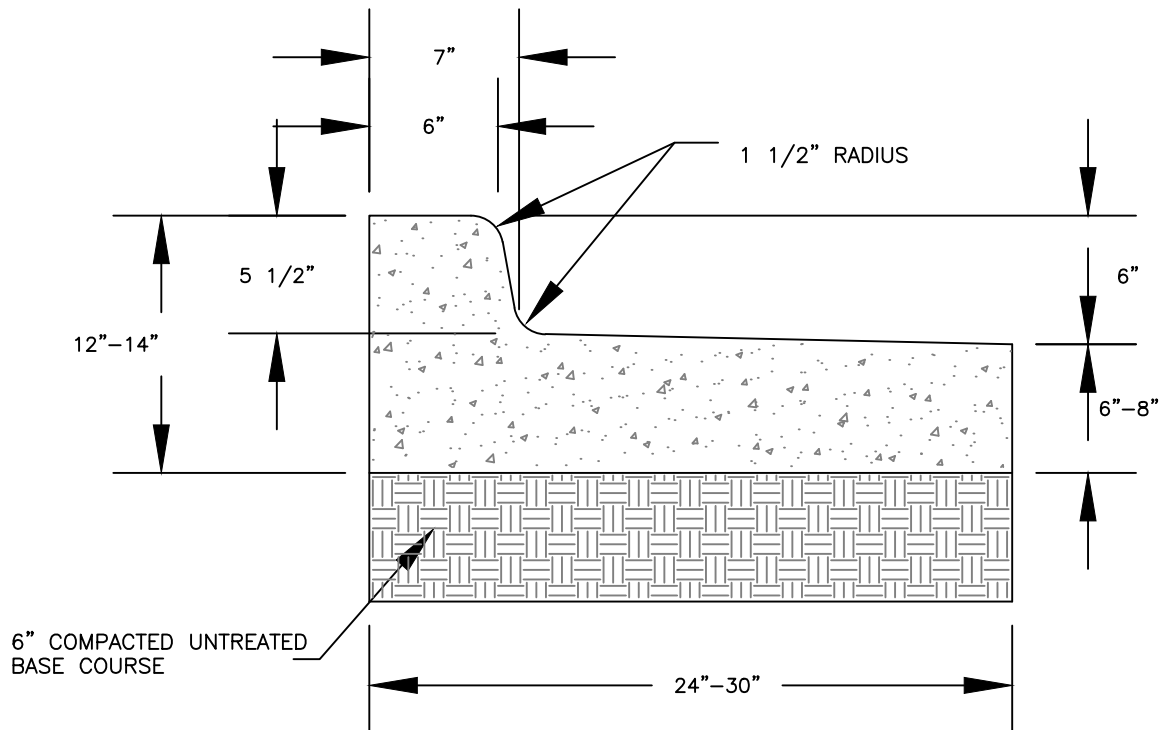


STANDARD DETAILS

STREET STANDARDS

**ST-2C**





# **FALL-OUT CURB & GUTTER**

DATE:  
MARCH 2022

DRAWING NAME:  
ST-2D

DRAWN BY:  
JRP

CHECKED: APPROVED:

## REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

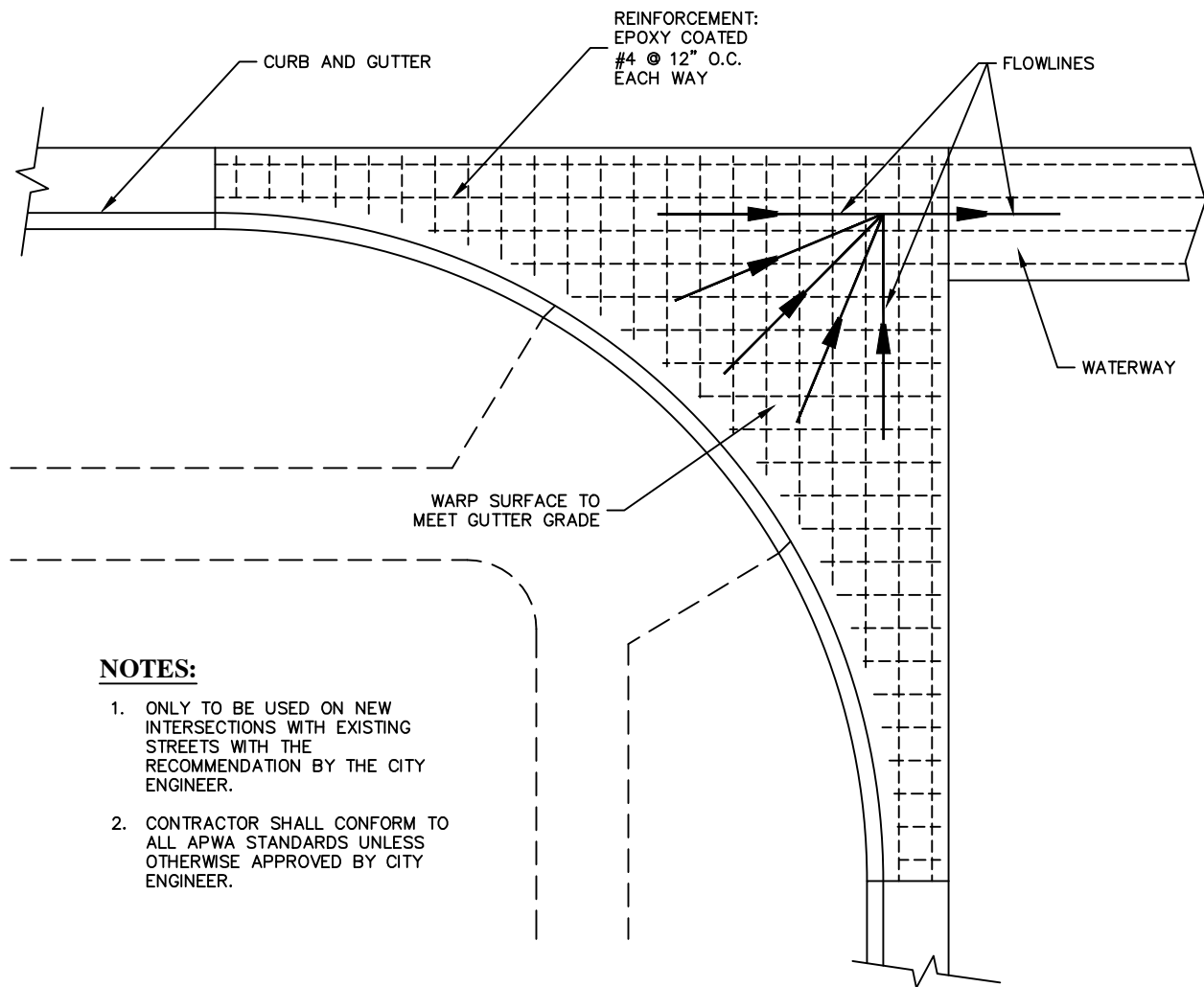
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STREET STANDARDS

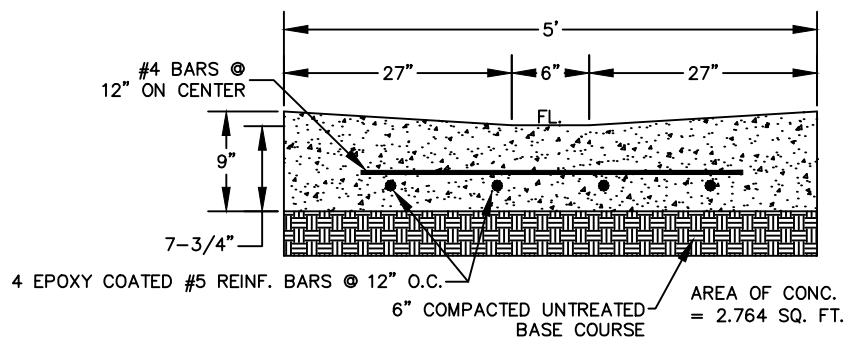
**ST-2D**



**NOTES:**

1. ONLY TO BE USED ON NEW INTERSECTIONS WITH EXISTING STREETS WITH THE RECOMMENDATION BY THE CITY ENGINEER.
2. CONTRACTOR SHALL CONFORM TO ALL APWA STANDARDS UNLESS OTHERWISE APPROVED BY CITY ENGINEER.

**PLAN VIEW**



**WATERWAY**

**WATERWAY**

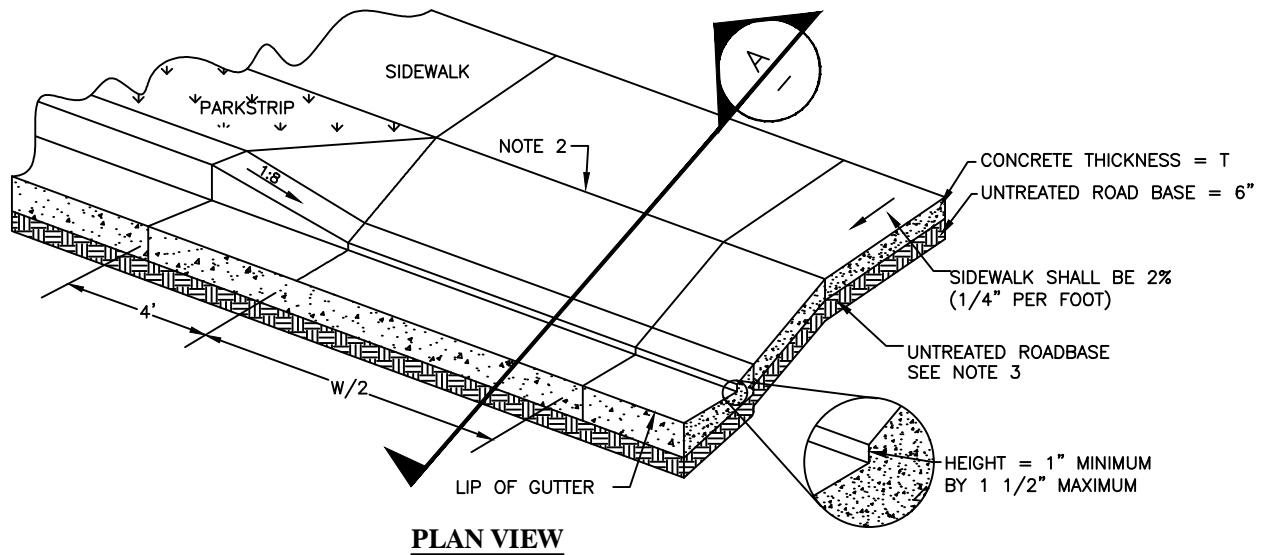
DATE: MARCH 2022		REVISIONS			
DRAWING NAME: ST-3		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:	SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



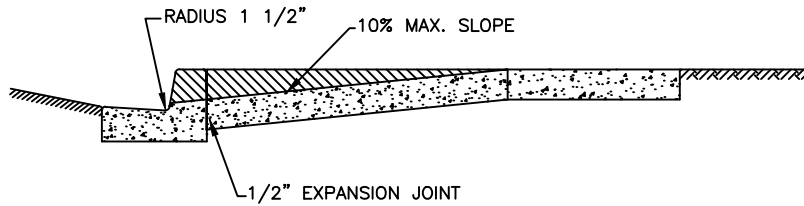
STANDARD DETAILS

STREET STANDARDS

**ST-3**



**PLAN VIEW**



**SECTION 'A'**

**NOTES:**

1. EDGE CONCRETE WITH 1/2" RADIUS EDGING TOOL.
2. PLACE 1/2" EXPANSION JOINT BETWEEN DRIVEWAY APRON AND CURB AND IN THE DRIVEWAY CENTERLINE IF "W" IS GREATER THAN 20'. FILLER MATERIAL SHALL BE FULL DEPTH OF CONCRETE PLUS 1", WITH TOP SET FLUSH WITH TOP OF CONCRETE.
3. USE UNTREATED ROADBASE UNDER CURB, GUTTER AND SIDEWALK. COMPACT TO 95% OF THE MAXIMUM DRY DENSITY.
4. ALL CONCRETE SLABS WITH A LENGTH/WIDTH RATIO GREATER THAN 2:1 SHALL HAVE CONTRACTION JOINTS INSTALLED AS REQUIRED TO STAY WITHIN 2:1 RATIO.
5. BACK EDGE OF SIDEWALK TO BE SET AT AN ELEVATION 2% HIGHER THAN THE TOP BACK OF CURB.
6. SIDEWALK TO BE A MINIMUM OF 5 FEET WIDE UNLESS OTHERWISE SPECIFIED.
7. MATERIALS, CONSTRUCTION, AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH CITY'S STANDARD SPECIFICATIONS.

**DRIVE APPROACH DIMENSIONS**

DIMENSION	LEGNTH ACCORDING TO ZONE
W	12'-0" MIN. RESIDENTIAL ZONES 30'-0" MAX. RESIDENTIAL ZONES
T	0'-5" RESIDENTIAL ZONES

**SLOPE TABLE**

DIMENSION	ZONE
(A) 12% MAX.	RESIDENTIAL ZONE
(B) 13% MAX.	RESIDENTIAL ZONE
(C) 15% MAX.	RESIDENTIAL ZONE

**SINGLE FAMILY  
RESIDENTIAL  
DRIVE APPROACH**

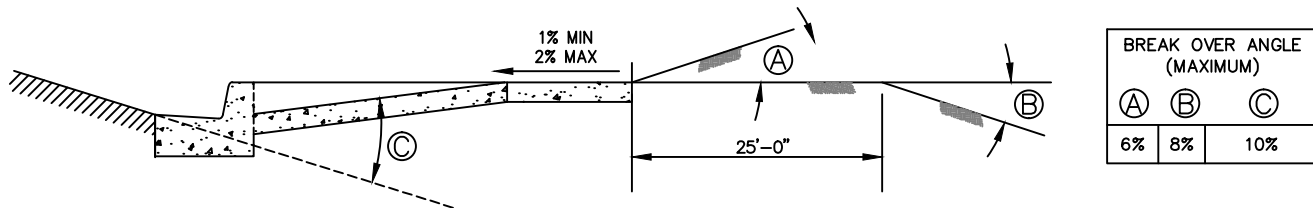
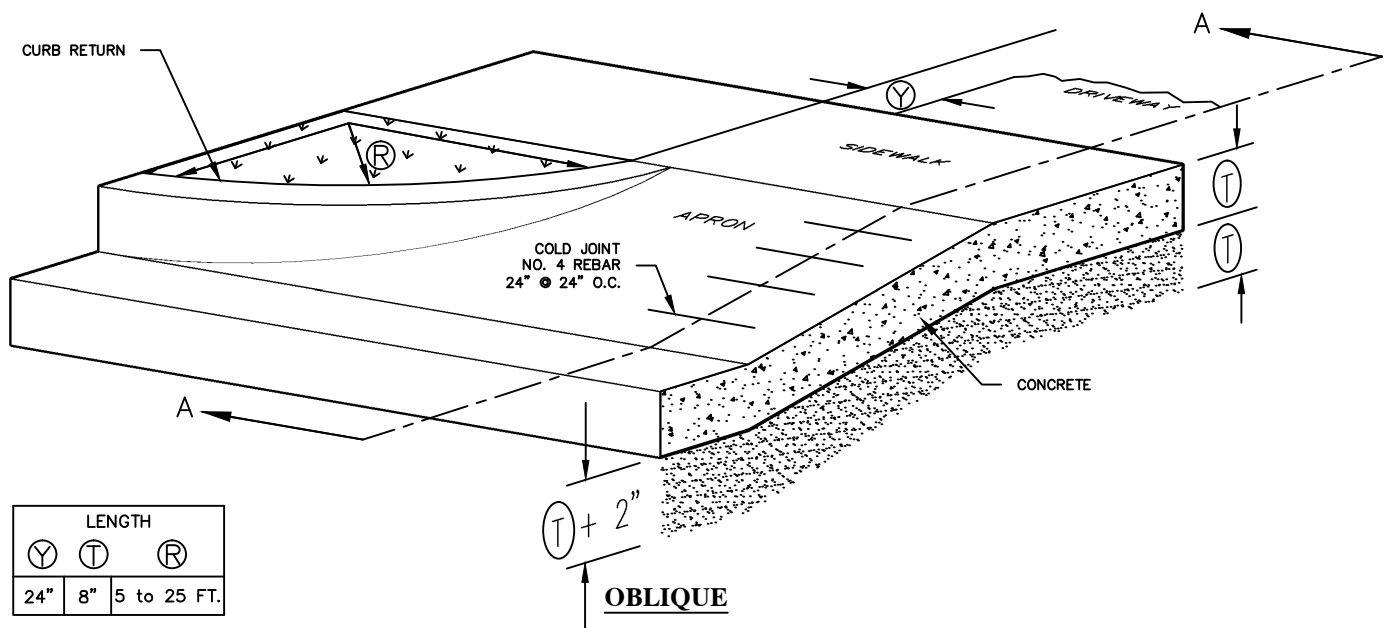
DATE: MARCH 2022		REVISIONS	
DRAWING NAME: ST-4A		REVISION	DATE BY COMMENTS
DRAWN BY: JRP			
CHECKED: APPROVED:			
		SARATOGA SPRINGS CITY	
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794	



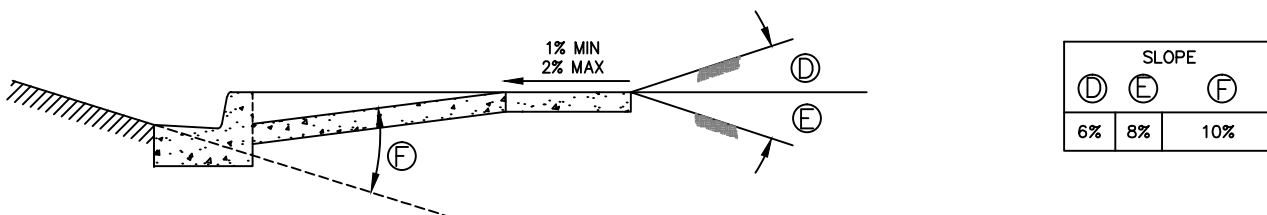
STANDARD DETAILS

STREET STANDARDS

**ST-4A**



**SECTION A-A - APPROACH REQUIRING SERVICE TRUCK ACCESS**



**SECTION A-A - TYPICAL DRIVEWAY APPROACH**

**NOTES**

- EDGE CONCRETE WITH 1/2" RADIUS EDGING TOOL.
- PLACE 1/2" EXPANSION JOINT BETWEEN DRIVEWAY APRON AND CURB AND IN THE DRIVEWAY CENTERLINE IF "W" IS GREATER THAN 20'. FILLER MATERIAL SHALL BE FULL DEPTH OF CONCRETE PLUS 1", WITH TOP SET FLUSH WITH TOP OF CONCRETE.
- USE UNTREATED ROADBASE UNDER CURB, GUTTER AND SIDEWALK. COMPACT TO 95% OF THE MAXIMUM DRY DENSITY.
- ALL CONCRETE SLABS WITH A LENGTH/WIDTH RATIO GREATER THAN 2:1 SHALL HAVE CONTRACTION JOINTS INSTALLED AS REQUIRED TO STAY WITHIN 2:1 RATIO.
- BACK EDGE OF SIDEWALK TO BE SET AT AN ELEVATION 1.5% HIGHER THAN THE TOP BACK OF CURB (2% MAX).
- SIDEWALK TO BE A MINIMUM OF 5 FEET WIDE UNLESS OTHERWISE SPECIFIED.
- MATERIALS, CONSTRUCTION, AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH CITY'S STANDARD SPECIFICATIONS.

**COMMERCIAL  
DRIVE APPROACH**

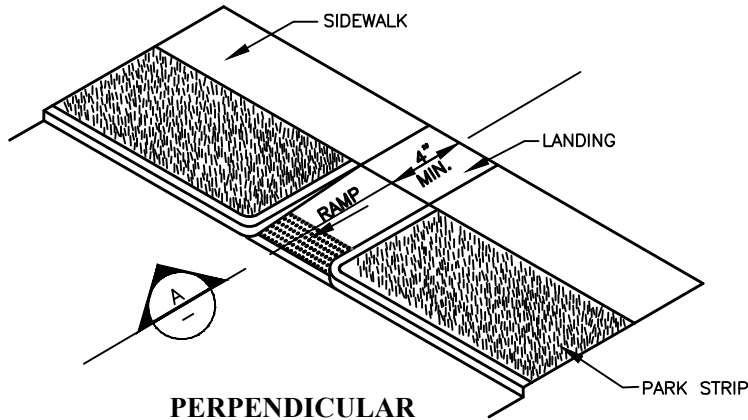
DATE: MARCH 2022		REVISIONS			
DRAWING NAME: ST-4B		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

STREET STANDARDS

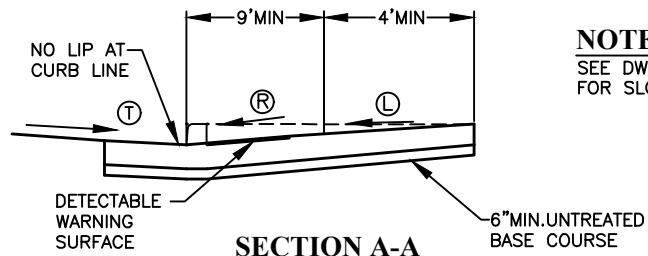
**ST-4B**



**PERPENDICULAR  
PEDESTRIAN RAMP**  
FLARE IS ACCEPTABLE IN  
LIEU OF FULL HEIGHT CURB  
SEE LOCAL AGENCY REQUIREMENTS

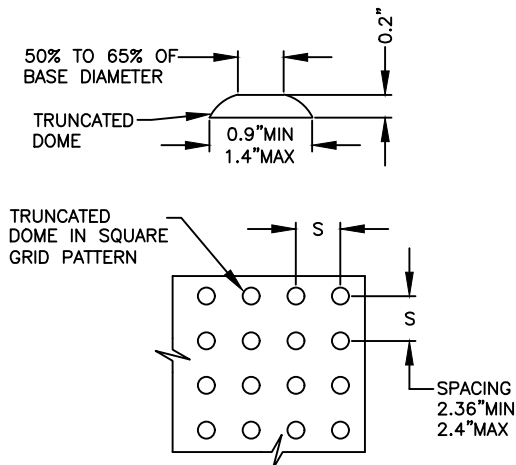
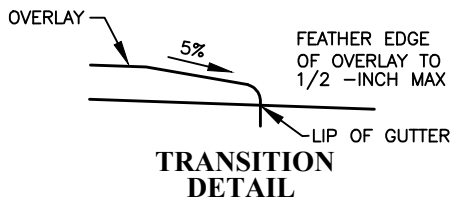
**NOTE:**

SIDEWALK SLOPES STEEPER THAN  
8.3% SHOULD BE GIVEN CONSIDERATION  
FOR THE GRADE CHANGE TO BE  
COMPLIANT WITH ADA STANDARDS

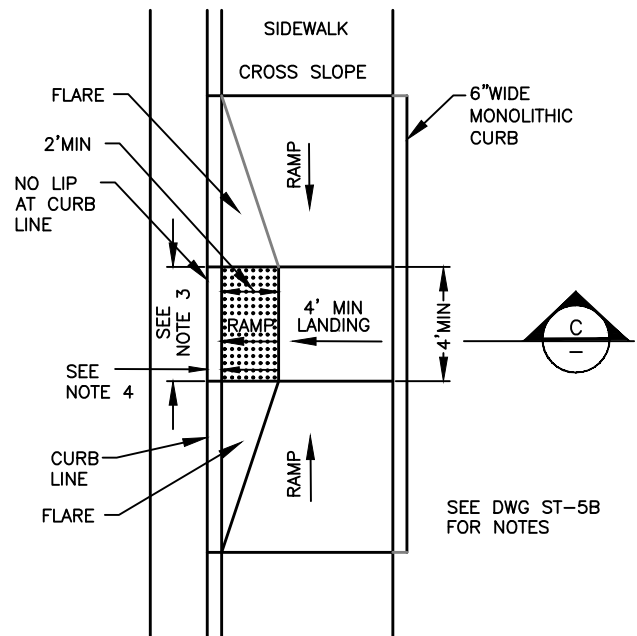


**NOTE:**

SEE DWG ST-5B  
FOR SLOPE DETAIL



**DETECTABLE WARNING SURFACE  
DETAIL A**



SEE DWG ST-5B  
FOR NOTES

**ADA ACCESSIBLE  
CURB RAMP**

DATE:  
AUGUST 2017

DRAWING NAME:  
ST-5A

DRAWN BY:  
ETL

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

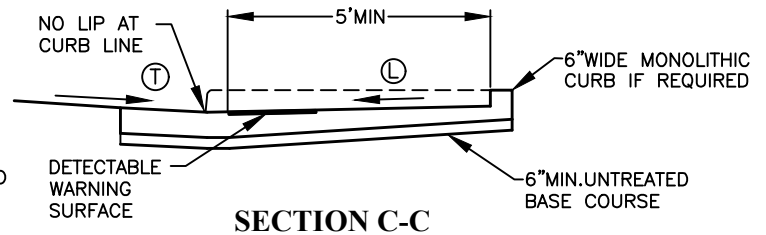
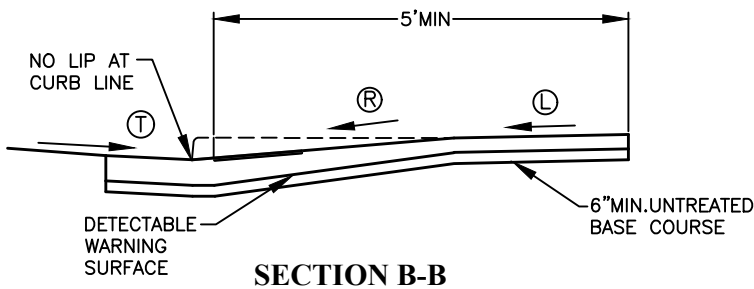
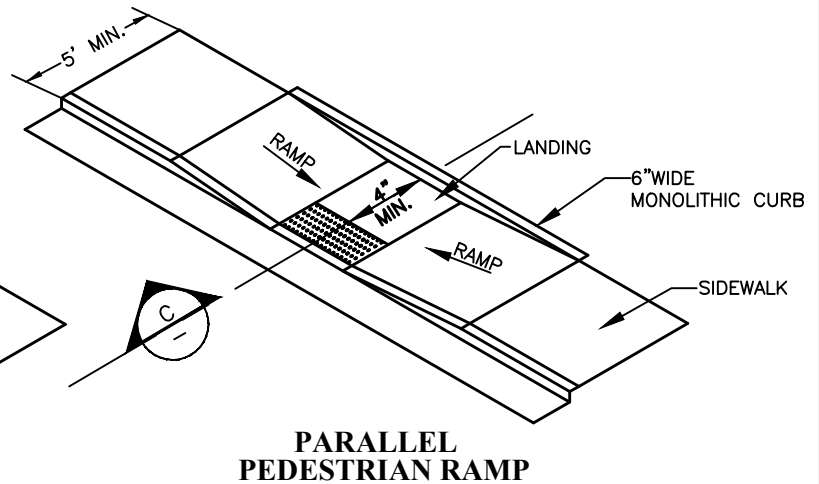
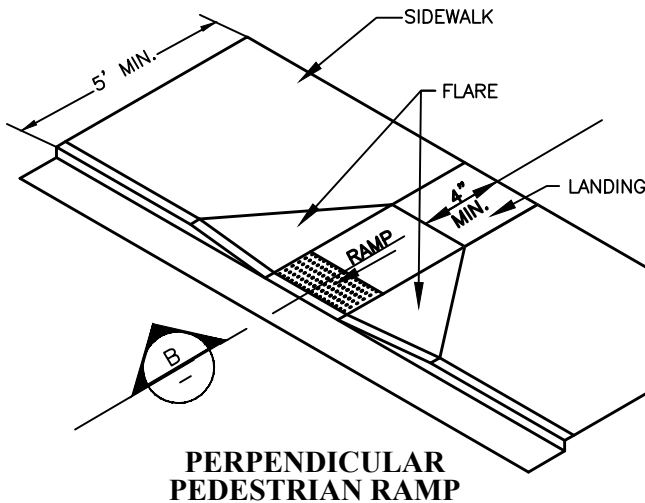
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#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STREET STANDARDS

**ST-5A**



SLOPE TABLE			
	ITEM	MAX. RUNNING SLOPE *	MAX. CROSS SLOPE *
Ⓐ	LANDING	2% (1V:48H) (b)	2% (1V:48H) (b)
Ⓑ	RAMP	8.33% (1V:12H) (c)	2% (1V:48H) (d)
Ⓒ	TRANSITION	5% (1V:20H) (a)	2% (1V:48H) (d)
	SIDEWALK	--	2% (1V:48H)
	FLARE	10% (1V:10H)	--

\* RUNNING SLOPE IS IN THE DIRECTION OF PEDESTRIAN TRAVEL, WHILE CROSS SLOPE IS PERPENDICULAR TO PEDESTRIAN TRAVEL.

(a) TRANSITION RUNNING SLOPE NEEDS TO BE CONSTANT ACROSS ENTIRE CURB CUT. WARP GUTTER PAN TO MEET REQUIRED TRANSITION SLOPE AT CURB CUT.

EXCEPTION:

(b) SLOPE REQUIREMENTS DO NOT APPLY AT MID-BLOCK CROSSINGS.

(c) PARALLEL RAMPS ARE NOT REQUIRED TO EXCEED 15- FEET IN LENGTH.

(d) CROSS SLOPE REQUIREMENT DOES NOT APPLY AT PERPENDICULAR RAMP MID-BLOCK CROSSING.

## NOTES:

1. CONFIGURATION OF RAMPS AND LANDINGS MAY BE CHANGED BUT MUST MEET PEDESTRIAN RAMP DIMENSION AND SLOPE REQUIREMENTS. SPECIFIC SITE CONDITIONS WILL VARY. THE USE OF FLARES, CURBWALLS, ETC. ARE AT THE DISCRETION OF THE ENGINEER.
2. PERPENDICULAR AND PARALLEL PEDESTRIAN RAMPS SHOWN ON THIS DRAWING ARE ACCEPTABLE FOR USE AT MID BLOCK OR CORNER INSTALLATIONS. REFER TO STD DWG ST 5C, 5D AND ST 5C FOR EXAMPLES OF CORNER INSTALLATIONS.
3. PROVIDE DETECTABLE WARNING SURFACE FOR FULL WIDTH OF RAMP, LANDING, OR CURB CUT. SEE DETAIL A, DWG 5A, FOR DETECTABLE WARNING SURFACE DIMENSIONS.
4. LOCATE DETECTABLE WARNING SURFACE SO THAT THE EDGE NEAREST THE STREET IS 6" TO 8" FROM THE CURB LINE.
5. PROVIDE DETECTABLE WARNING SURFACE THAT CONTRASTS WITH ADJACENT WALKING SURFACE, EITHER LIGHT-ON-DARK OR DARK-ON-LIGHT. ACCEPTABLE COLORS INCLUDE: YELLOW.
6. USE CLASS AA(AE) CONCRETE.
7. USE UNTREATED BASE COURSE UNDER ALL CONCRETE FLATWORK.

## ADA ACCESSIBLE CURB RAMP

DATE: MARCH 2022	
DRAWING NAME: ST-5B	
DRAWN BY: JRP	
CHECKED:	APPROVED:

REVISIONS			
REVISION	DATE	BY	COMMENTS

SARATOGA SPRINGS CITY

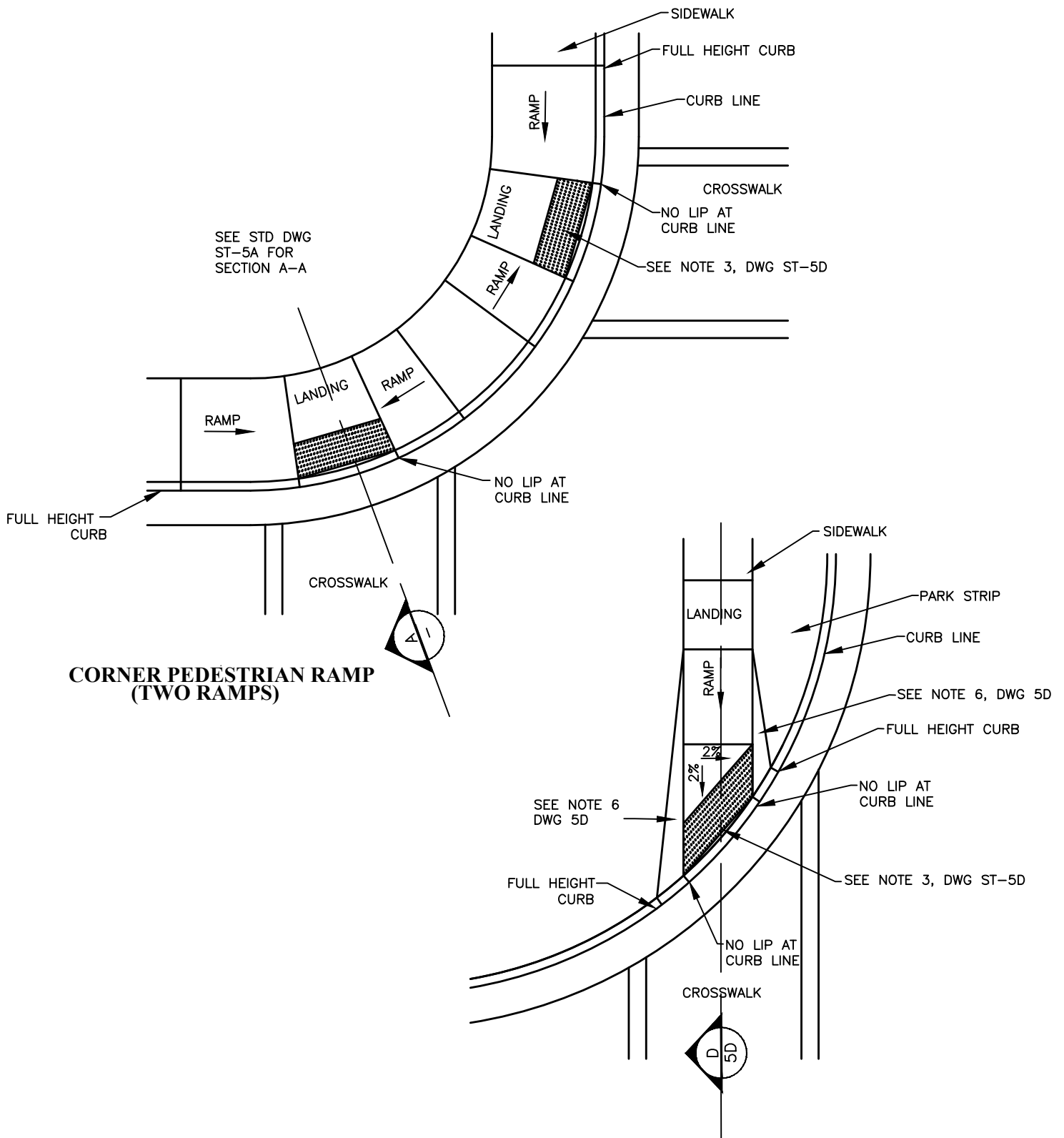
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UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STREET STANDARDS

**ST-5B**



## ADA ACCESSIBLE CURB RAMP

DATE:  
MARCH 2022

DRAWING NAME:  
ST-5C

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

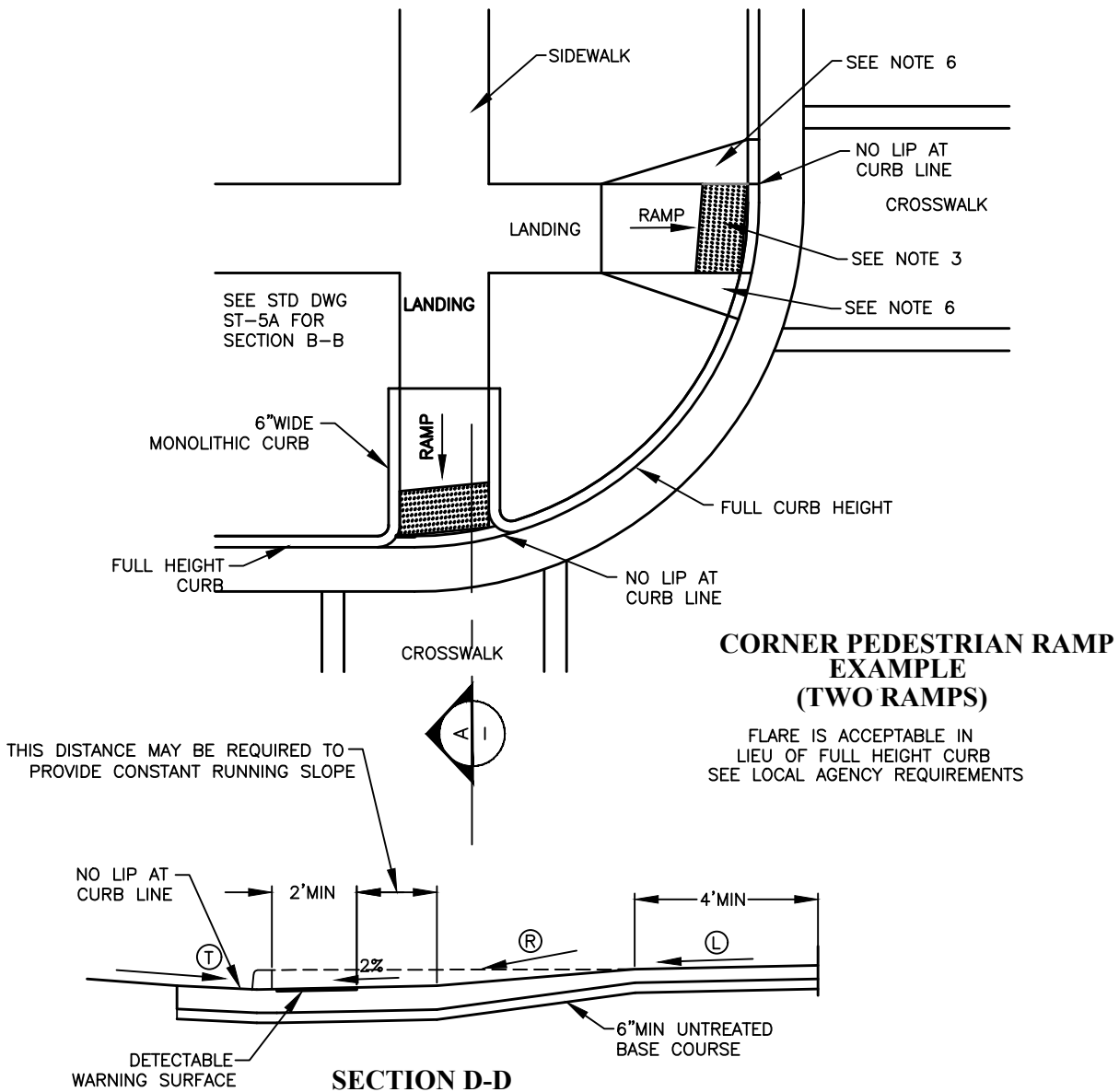
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#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STREET STANDARDS

**ST-5C**



### NOTES:

1. REFER TO STD DWG ST-5A FOR PEDESTRIAN ACCESS RAMP DETAIL AND SLOPE REQUIREMENTS.
2. PROVIDE DETECTABLE WARNING SURFACE FOR FULL WIDTH OF RAMP, LANDING, OR CURB CUT. SEE DETAIL A ON STD DWG ST-5A FOR DETECTABLE WARNING SURFACE DIMENSIONS.
3. LOCATE DETECTABLE WARNING SURFACE SO THAT THE EDGE NEAREST THE STREET IS 6" TO 8" FROM THE CURB LINE.
4. WHEN DETECTABLE WARNING SURFACE IS CUT, GRIND REMAINING PORTION OF ANY CUT DOMES. SEAL ALL CUT PANEL EDGES TO PREVENT WATER DAMAGE.
5. LOCATE CURB CUT WITHIN CROSSWALK.
6. WARP FLATWORK TO MATCH TOP OF CURB AND SIDEWALK.

## ADA ACCESSIBLE CURB RAMP

DATE: MARCH 2022		REVISIONS			
DRAWING NAME: ST-5D		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			

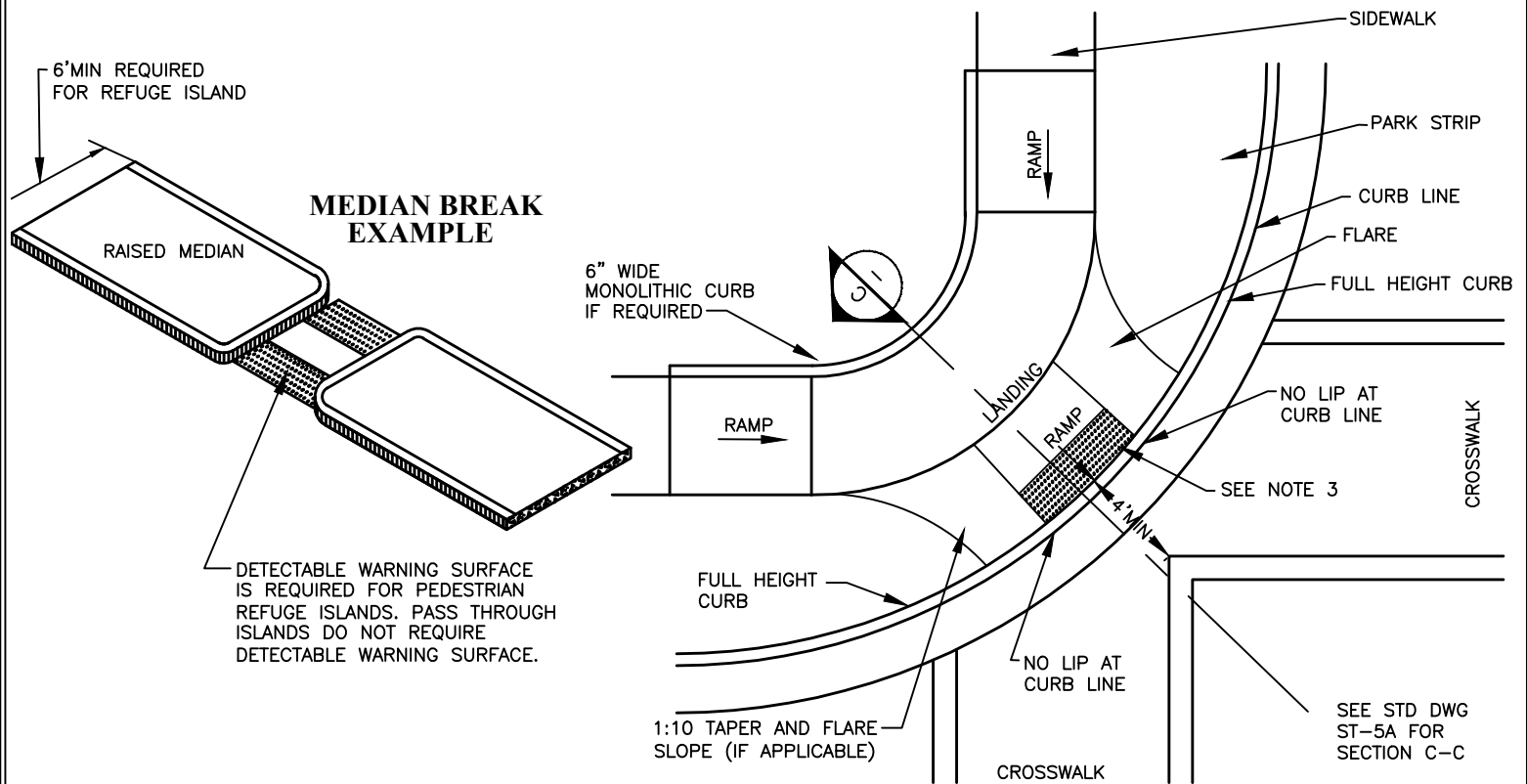


STANDARD DETAILS

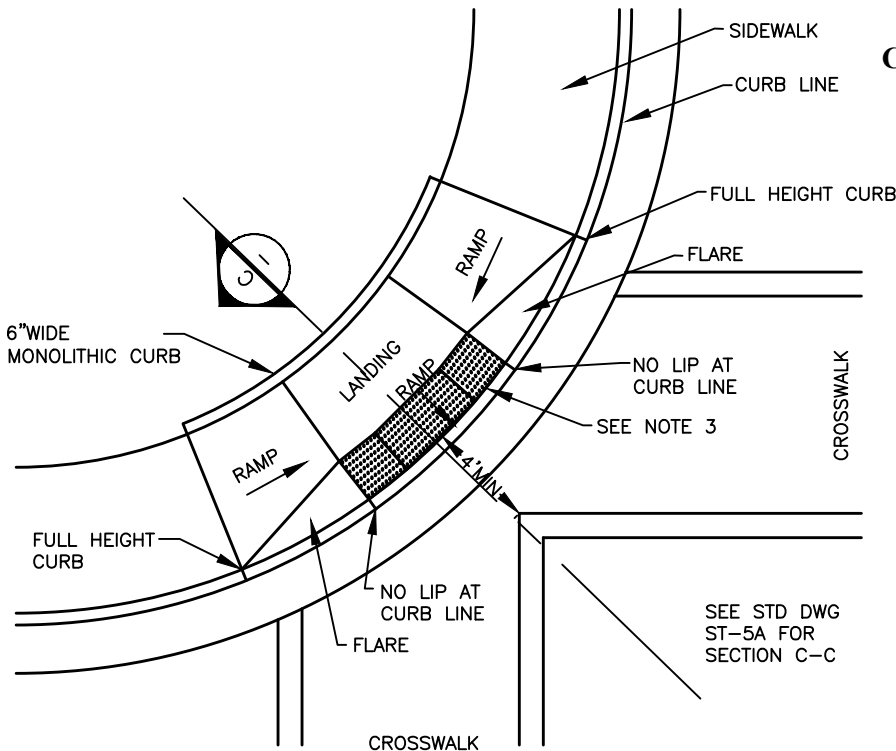
STREET STANDARDS

**ST-5D**





### CORNER PEDESTRIAN RAMP EXAMPLE



### NOTES:

1. REFER TO STD DWG ST 5A FOR PEDESTRIAN ACCESS RAMP DETAIL AND SLOPE REQUIREMENTS.
2. PROVIDE DETECTABLE WARNING SURFACE FOR FULL WIDTH OF RAMP, LANDING, OR CURB CUT. SEE DETAIL A ON STD DWG ST 5A FOR DETECTABLE WARNING SURFACE DIMENSIONS.
3. LOCATE DETECTABLE WARNING SURFACE SO THAT THE EDGE NEAREST THE STREET IS 6" TO 8" FROM THE CURB LINE.
4. WHEN DETECTABLE WARNING SURFACE IS CUT, GRIND REMAINING PORTION OF ANY CUT DOMES. SEAL ALL CUT PANEL EDGES TO PREVENT WATER DAMAGE.
5. LOCATE CURB CUT WITHIN CROSSWALK.

### CORNER PEDESTRIAN RAMP EXAMPLE

## ADA ACCESSIBLE CURB RAMP

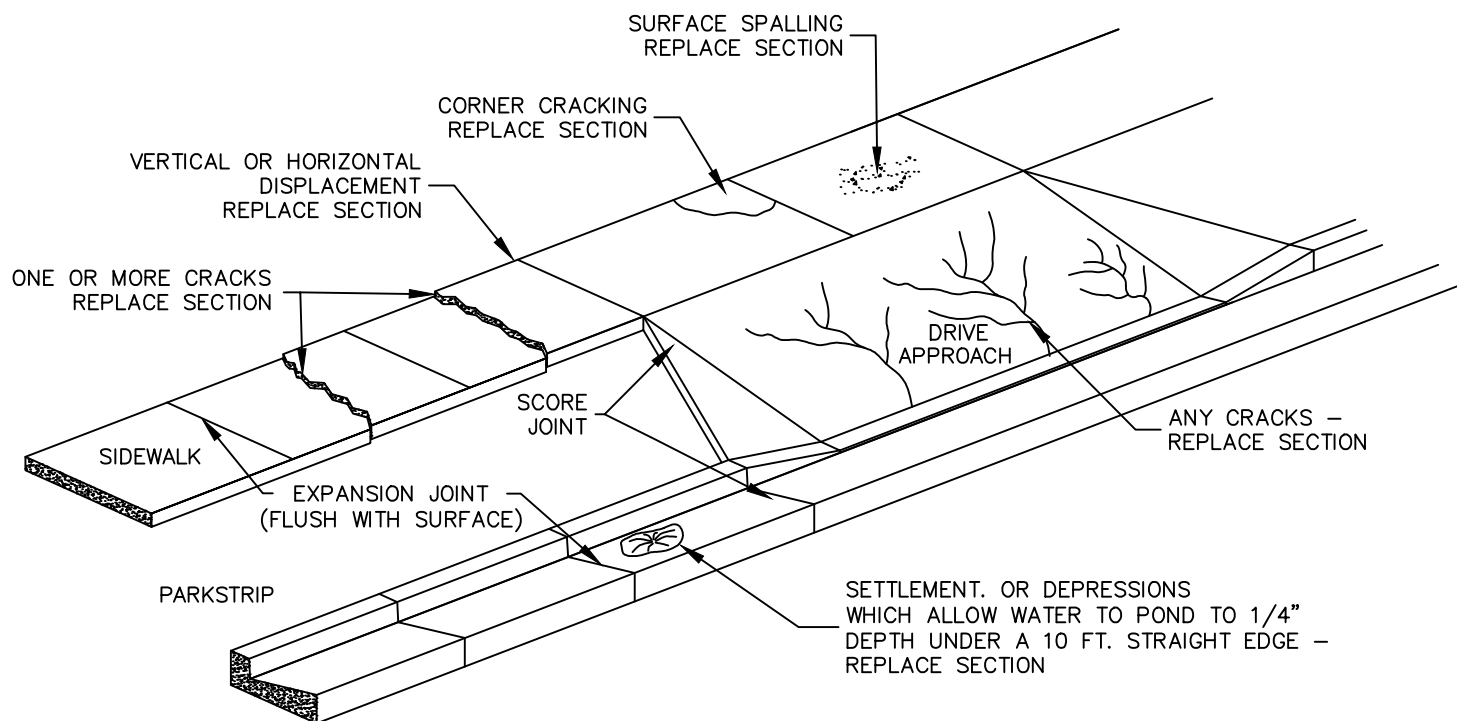
DATE: MARCH 2022		REVISIONS	
DRAWING NAME: ST-5E		REVISION	DATE BY COMMENTS
DRAWN BY: JRP			
CHECKED:	APPROVED:		
		SARATOGA SPRINGS CITY	
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794	



STANDARD DETAILS

STREET STANDARDS

**ST-5E**



### NOTES:

REPLACEMENT IS REQUIRED IF ANY COMPONENT HAS ONE OR MORE OF THE CONDITIONS NOTED ABOVE. OTHERWISE REPAIR SECTION UNDER THE DIRECTION OF THE CITY ENGINEER.

## DEFECTIVE CONCRETE REPLACEMENT CRITERIA

DATE: MARCH 2022	
DRAWING NAME: ST-6	
DRAWN BY: JRP	
CHECKED:	APPROVED:

REVISIONS			
REVISION	DATE	BY	COMMENTS

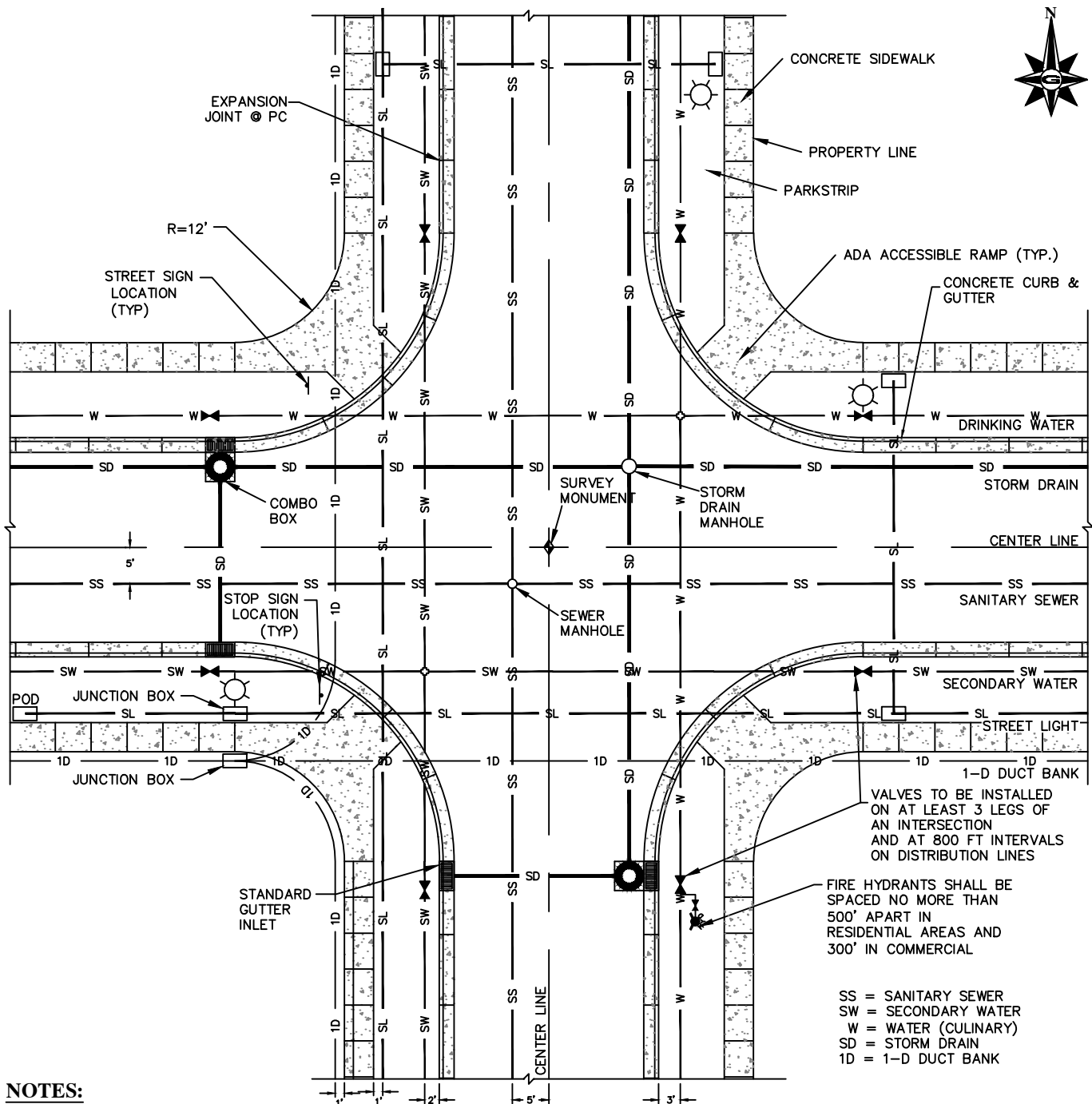
SARATOGA SPRINGS CITY		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794
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STANDARD DETAILS

STREET STANDARDS

**ST-6**



#### NOTES:

1. LAND DRAINS ARE UNACCEPTABLE UNLESS EXPLICITLY ALLOWED BY CITY ENGINEER. WHEN ALLOWED, PIPES SHALL NOT BE PERFORATED OR DESIGNED TO ACCEPT WATER WITHIN THE STREET RIGHT-OF-WAY.
2. CURB RADIUS ON LOCAL AND COLLECTOR RIGHT-OF-WAYS SHALL BE 25', ON MINOR ARTERIALS IT SHALL BE 35', AND ON MAJOR AND PRINCIPAL ARTERIALS SHALL BE 40' AS MEASURED FROM FACE OF CURB.
3. CHECK ALL CITY STANDARDS FOR UTILITY LOCATIONS.
4. STREET LIGHTS ARE TO BE CENTERED IN PARK STRIPS.
5. STREET LIGHTS ARE TO BE PLACED AT INTERSECTIONS AND EVERY 300 FEET, ALTERNATING SIDES OF STREET.
6. MANHOLES SHALL BE LOCATED A MINIMUM OF 7' FROM EDGE OF GUTTER WHEN ROAD CURVATURE REQUIRES DEVIATION FROM THE ABOVE STANDARD.

## STANDARD INTERSECTION & UTILITIES

DATE:  
MARCH 2022

DRAWING NAME:  
ST-7

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REV	DATE	BY	COMMENTS

**SARATOGA  
SPRINGS CITY**

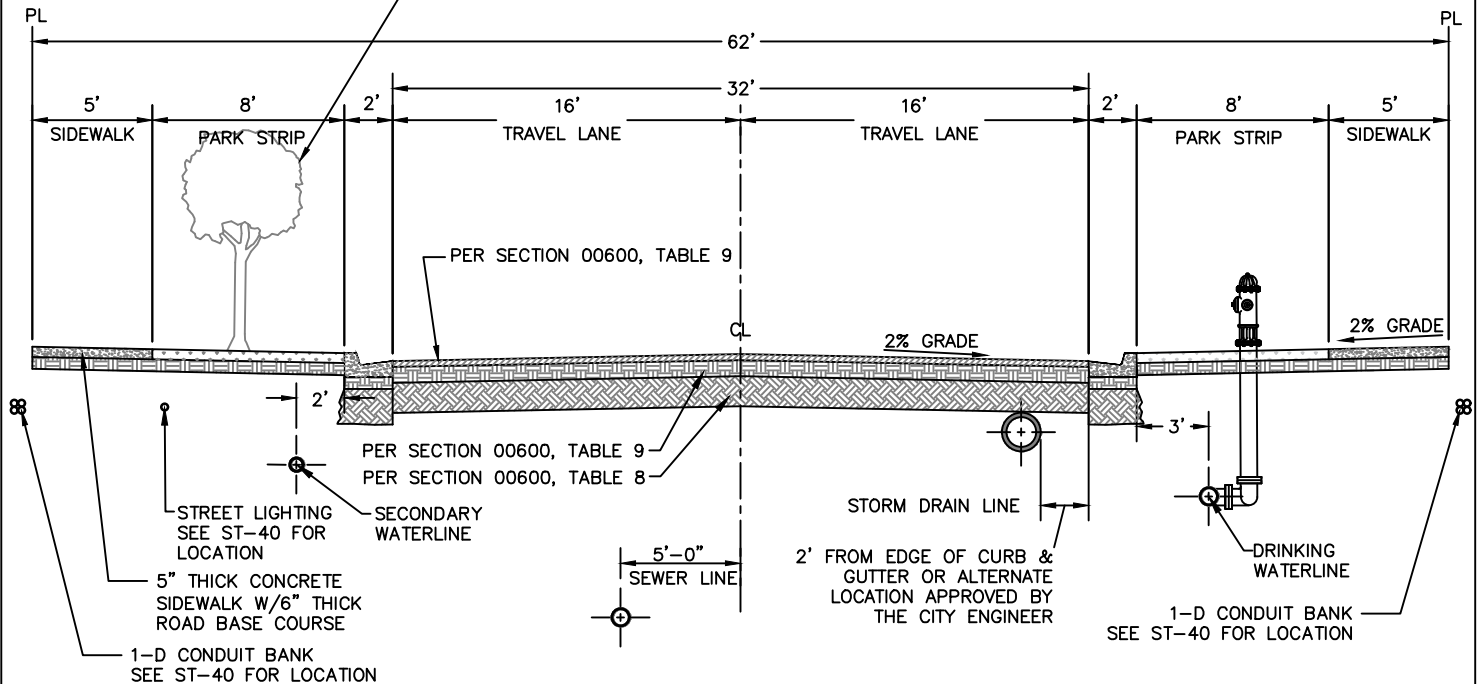
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UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

STANDARD DETAILS

STREET STANDARDS

**ST-7**

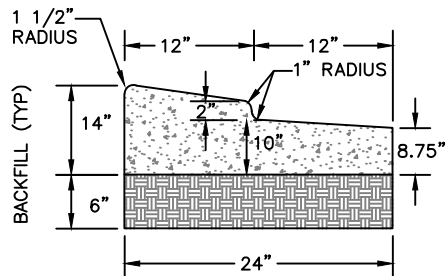
TREES SHALL MEET SPECIFICATIONS FOUND IN SECTION 02726. TREES ARE TO BE PLACED EVERY 50' ON BOTH SIDES OF THE ROAD. STAGGER LOCATIONS FROM ONE SIDE OF THE ROAD TO THE OTHER. GRADE "A" MINIMUM IN ALL APPLICATIONS.



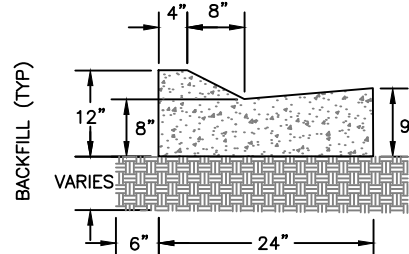
### NOTES:

1. MAXIMUM DIFFERENCE IN ELEVATION BETWEEN CURB ON OPPOSITE SIDES OF STREET SHALL NOT EXCEED 1'-0"
2. PROVIDE A MINIMUM 6" THICKNESS OF 3/4" OR 1" CRUSHED GRAVEL BASE COURSE UNDER SIDEWALKS, DRIVEWAY APPROACHES, AND CURB & GUTTER.
3. INSTALL TYPE 2 SLURRY SEAL.
4. HOUSES MAY FRONT ON THESE STREETS.
5. THIS ROW CROSS SECTION SHALL BE PERMITTED FOR PRIVATE ROAD CROSS SECTIONS IN THE FOLLOWING ZONES: R1-20, R1-10 AND R1-8.
6. RESIDENTIAL 24" HIGH BACK CURB AND GUTTER SHALL BE USED (SEE STANDARD DRAWING ST-2B). MODIFIED CURB AND GUTTER MAY BE USED IN COMMUNITY AND VILLAGE PLANS WHEN DRIVEWAYS ARE SEPARATED BY LESS THAN 10'-FT.

### MODIFIED FALL-OUT CURB AND GUTTER



### MODIFIED CATCH CURB AND GUTTER



**LOCAL  
62' RIGHT-OF-WAY**

DATE:  
MARCH 2022

DRAWING NAME:  
ST-8

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

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SPRINGS CITY

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#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

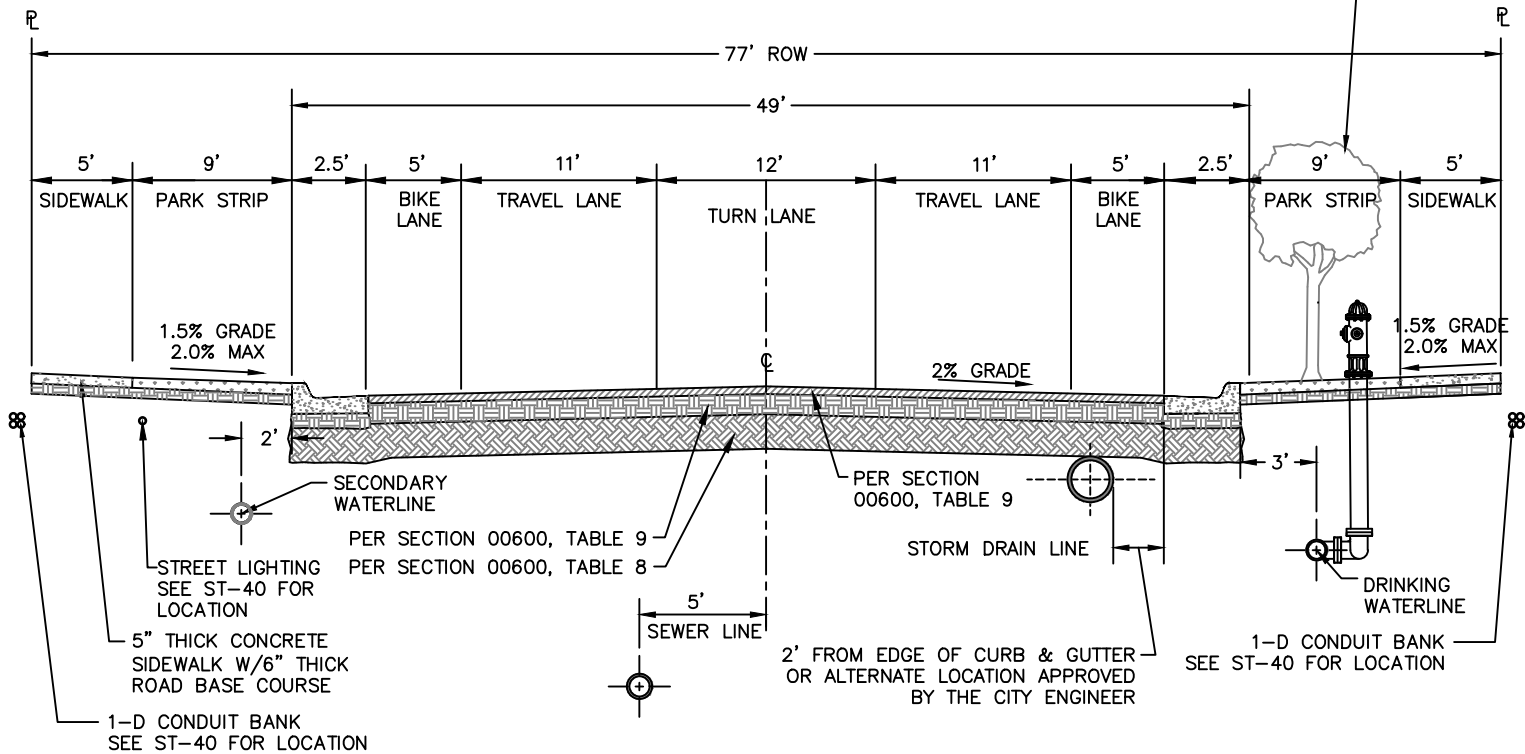


STANDARD DETAILS

STREET STANDARDS

**ST-8**

TREES SHALL MEET SPECIFICATIONS FOUND IN SECTION 02726. TREES ARE TO BE PLACED EVERY 50' ON BOTH SIDES OF THE ROAD. STAGGER LOCATIONS FROM ONE SIDE OF THE ROAD TO THE OTHER. GRADE "A" MINIMUM IN ALL APPLICATIONS.



### NOTES:

1. MAXIMUM DIFFERENCE IN ELEVATION BETWEEN CURB ON OPPOSITE SIDES OF STREET SHALL NOT EXCEED 1'-0"
2. PROVIDE A MINIMUM 6" THICKNESS OF 3/4" OR 1" CRUSHED GRAVEL BASE COURSE UNDER SIDEWALKS, DRIVEWAY APPROACHES, AND CURB & GUTTER.
3. INSTALL TYPE 2 SLURRY SEAL.
4. HOUSES ARE DISCOURAGED FROM FRONTING ON THESE STREETS.

## COLLECTOR 77' RIGHT OF WAY

DATE: MARCH 2022	
DRAWING NAME: ST-9	
DRAWN BY: JRP	
CHECKED:	APPROVED:

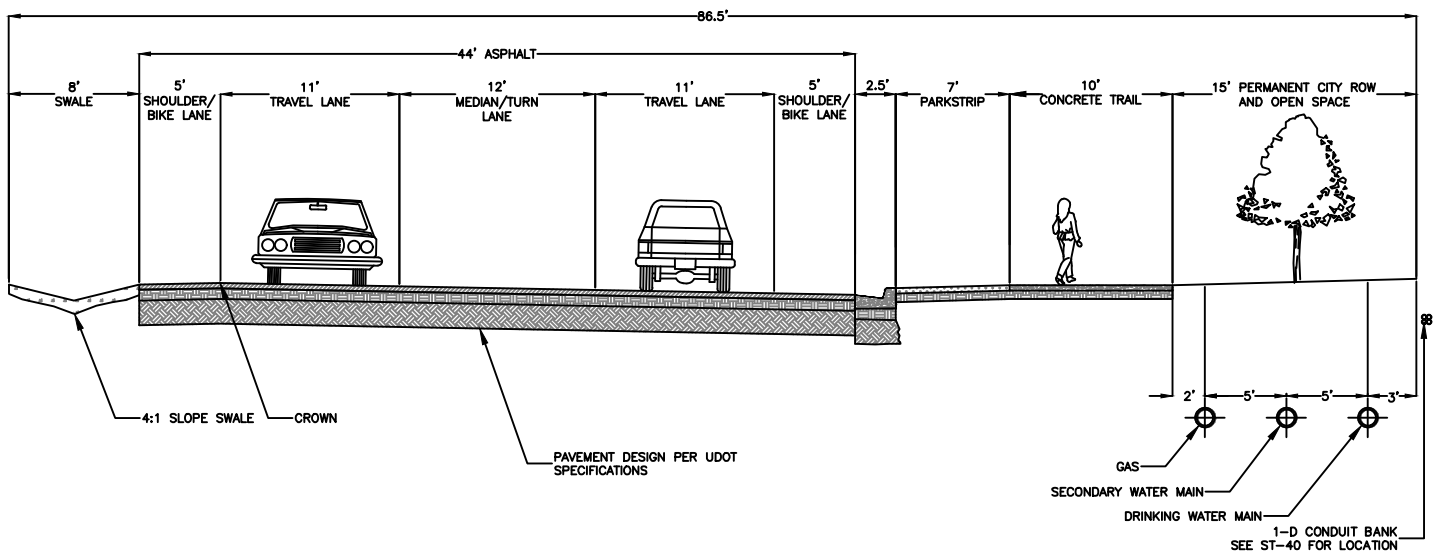
REVISIONS			
REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS
STREET STANDARDS
<b>ST-9A</b>



**INTERIM COLLECTOR  
86.5' RIGHT-OF-WAY  
MTN VIEW CORRIDOR**

DATE:  
MARCH 2022

DRAWING NAME:  
ST-9B

DRAWN BY:  
JRP

CHECKED: APPROVED:

REVISIONS

REVISION	DATE	BY	COMMENTS

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UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

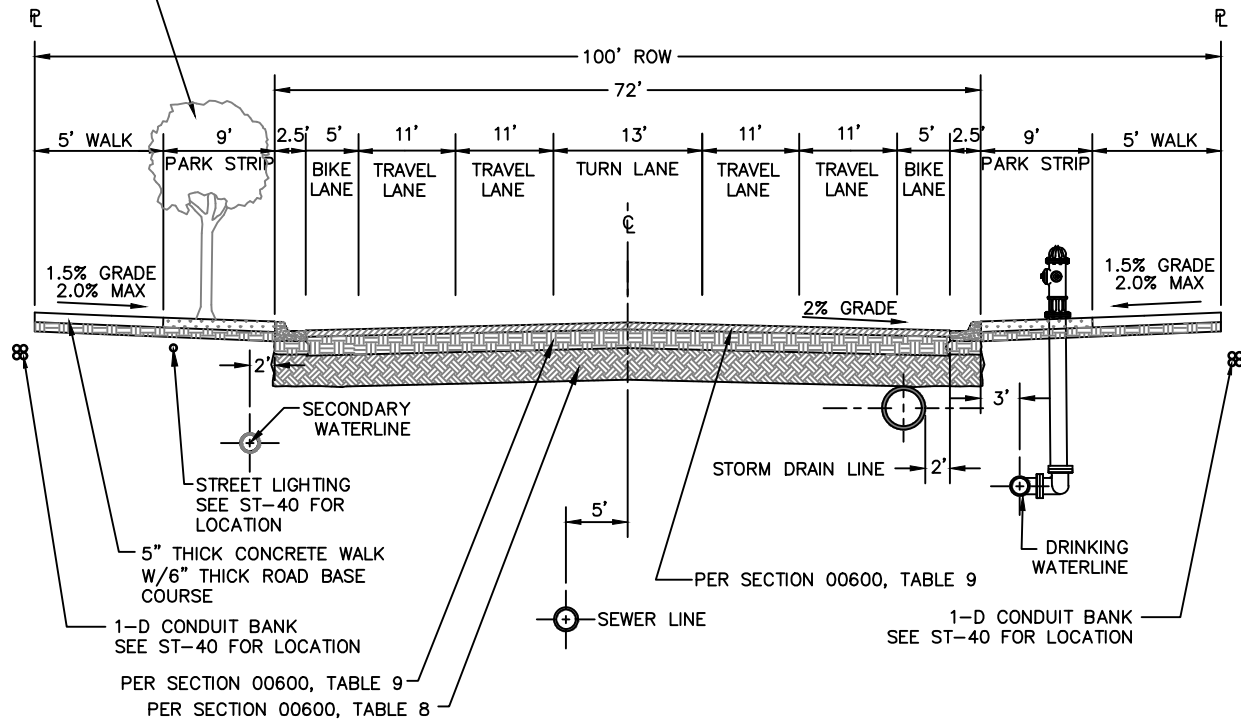


STANDARD DETAILS

STREET STANDARDS

**ST-9B**

TREES SHALL MEET SPECIFICATIONS FOUND IN SECTION 02726. TREES ARE TO BE PLACED EVERY 50' ON BOTH SIDES OF THE ROAD. STAGGER LOCATIONS FROM ONE SIDE OF THE ROAD TO THE OTHER. GRADE "A" MINIMUM IN ALL APPLICATIONS.



#### NOTES:

1. MAXIMUM DIFFERENCE IN ELEVATION BETWEEN CURB ON OPPOSITE SIDES OF STREET SHALL NOT EXCEED 1'-0"
2. PROVIDE A MINIMUM 6" THICKNESS OF 3/4" OR 1" CRUSHED GRAVEL BASE COURSE UNDER SIDEWALKS, DRIVEWAY APPROACHES, AND CURB & GUTTER.
3. INSTALL TYPE 2 SLURRY SEAL.
4. COMMERCIAL OR INDUSTRIAL DRIVEWAYS CAN ENTER THIS ROADWAY, BUT ARE TO BE MINIMIZED.
5. HOUSES ARE NOT PERMITTED TO FRONT ON THESE STREETS.
6. PAVEMENT SECTION SHALL BE ADEQUATE FOR CONSTRUCTION TRAFFIC OR AN ALTERNATE ROUTE SHALL BE PROVIDED.
7. MEDIAN SHALL HAVE PLOWABLE END SECTIONS

## MINOR ARTERIAL 100' RIGHT-OF-WAY

DATE:  
MARCH 2022

DRAWING NAME:  
ST-10

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

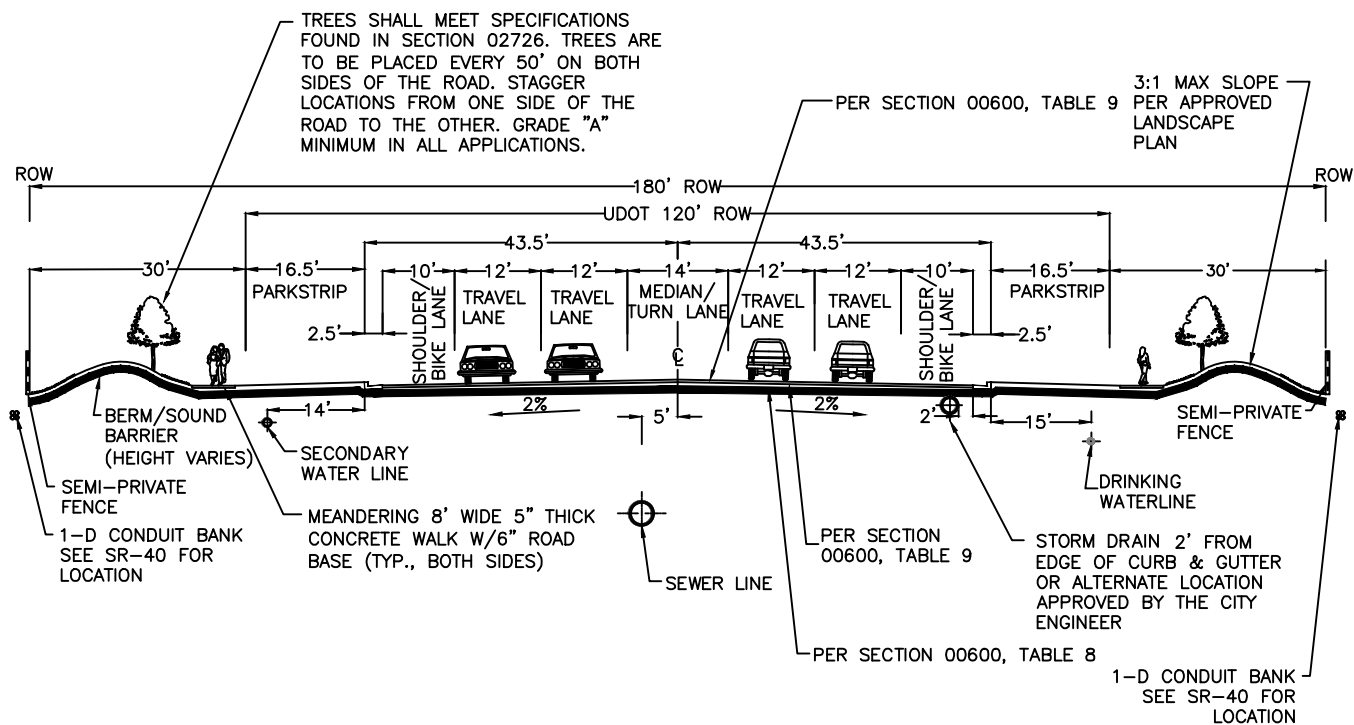
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#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STREET STANDARDS

**ST-10**



### NOTES:

1. MAXIMUM DIFFERENCE IN ELEVATION BETWEEN CURB ON OPPOSITE SIDES OF STREET SHALL NOT EXCEED 1'-0"
2. PROVIDE A MINIMUM 6" THICKNESS OF 3/4" OR 1" CRUSHED GRAVEL BASE COURSE UNDER SIDEWALKS, DRIVEWAY APPROACHES, AND CURB & GUTTER.
3. INSTALL TYPE 2 SLURRY SEAL.
4. HOUSES ARE NOT PERMITTED TO FRONT ON THESE STREETS.
5. ALL COMMERCIAL OR INDUSTRIAL ACCESSES ARE TO BE MINIMIZED.

## MAJOR ARTERIAL 180' RIGHT-OF-WAY

DATE:  
MARCH 2022

DRAWING NAME:  
ST-11

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

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#200, SARATOGA SPRINGS,  
UT 84545  
PHONE: 801-766-9793  
FAX: 801-766-9794



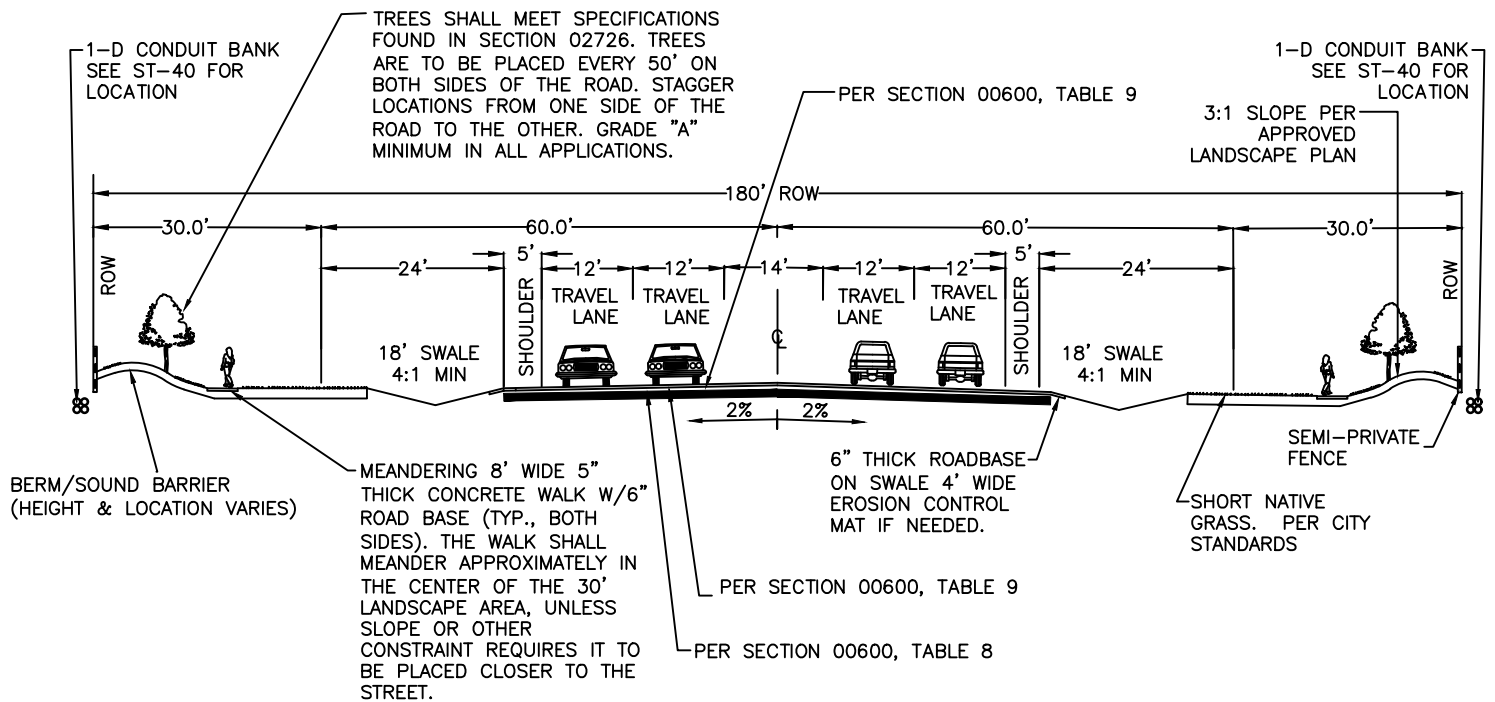
STANDARD DETAILS

STREET STANDARDS

ST-11







### NOTES:

1. MAXIMUM DIFFERENCE IN ELEVATION BETWEEN CURB ON OPPOSITE SIDES OF STREET SHALL NOT EXCEED 1'-0"
2. PROVIDE A MINIMUM 6" THICKNESS OF 3/4" OR 1" CRUSHED GRAVEL BASE COURSE UNDER SIDEWALKS, DRIVEWAY APPROACHES, AND CURB & GUTTER.
3. INSTALL TYPE 2 SLURRY SEAL.
4. HOUSES ARE NOT PERMITTED TO FRONT ON THESE STREETS.
5. ALL COMMERCIAL OR INDUSTRIAL DRIVEWAY ARE TO BE MINIMIZED.
6. SEE ST-40 FOR LOCATION OF STREET LIGHTING AND FIBER CONDUIT.

## INTERIM ARTERIAL 180' RIGHT-OF-WAY

DATE: MARCH 2022	
DRAWING NAME: ST-13	
DRAWN BY: JRP	
CHECKED:	APPROVED:

REVISIONS			
REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS
STREET STANDARDS
<b>ST-13</b>

CONSTRUCT TEMPORARY  
TURNING AREA WITH 10"  
DEPTH OF ROAD BASE  
GRAVEL

EASEMENT AND  
R.O.W. BOUNDARY

DRAINAGE DITCH  
(DIRECTION OF DRAINAGE  
TO BE APPROVED BY THE  
CITY ENGINEER)

8'-0"

4'-0"

4:1 SLOPE FROM  
EDGE OF GRAVEL  
TO FLOW LINE OF  
DITCH

SLOPE=2% TO  
EDGE OF GRAVEL

R=60'-0"

R=48'-0"

28'  
RADIUS

28' RADIUS

SUBDIVISION BOUNDARY LINE

CURB & GUTTER

PROPERTY LINE

SIDEWALK

PARK STRIP

PROPERTY LINE

1. MAXIMUM 4% SLOPE IN  
TURN-AROUND IN ANY DIRECTION
2. TURN-AROUND DESIGN SHALL  
COMPLY WITH FIGURE D103.1 OF  
THE INTERNATIONAL FIRE CODE  
(MOST RECENT EDITION)
3. TURN-AROUNDS ARE REQUIRED  
ON ALL DEAD-END ROADS  
GREATER THAN 150' IN LENGTH  
AS MEASURED FROM THE  
CENTERLINE OF THE CLOSEST  
INTERSECTION

## TEMPORARY TURN-AROUND

DATE:  
MARCH 2022

DRAWING NAME:  
ST-14

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

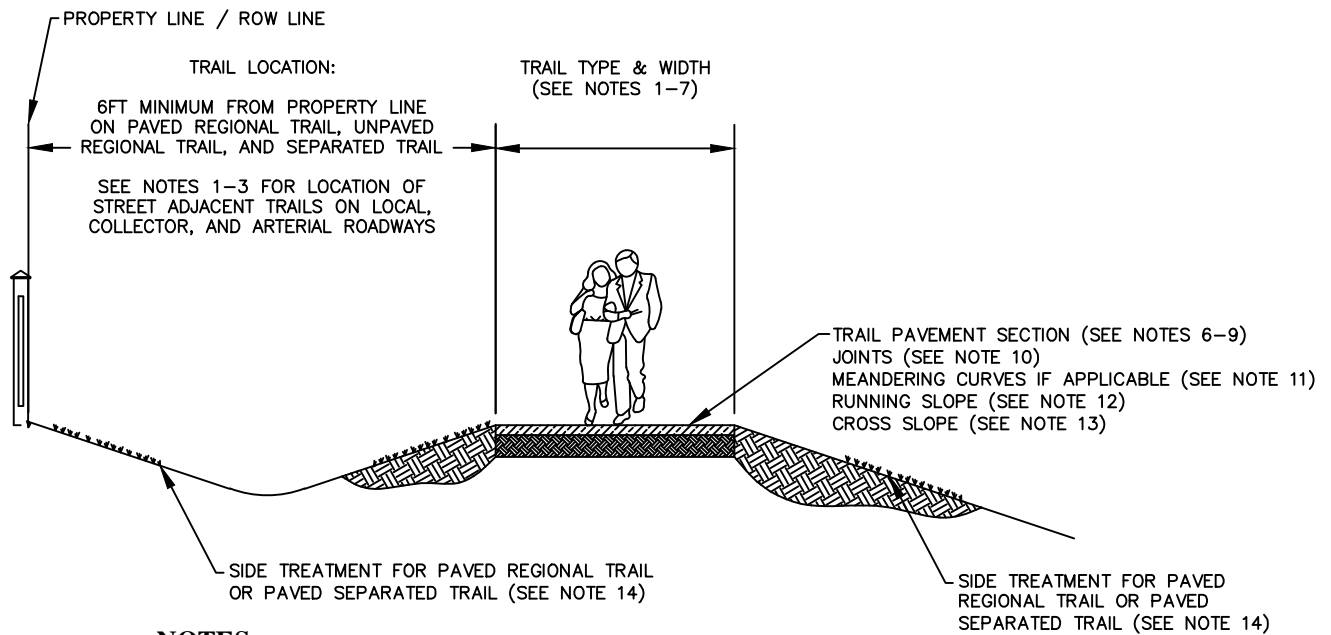
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STREET STANDARDS

**ST-14**



### NOTES:

1. TRAILS USED FOR UTILITY ACCESS SHALL BE 12FT MINIMUM WIDTH.
2. STREET ADJACENT TRAILS/SIDEWALKS SHALL BE CONCRETE 5FT MINIMUM WIDTH FOR LOCAL, COLLECTOR, AND MINOR ARTERIAL ROADWAYS.
3. STREET ADJACENT TRAILS SHALL BE CONCRETE 8FT MINIMUM WIDTH AND MEANDERING FOR MAJOR ARTERIAL, PRINCIPAL ARTERIAL, AND INTERIM ARTERIAL ROADWAYS (SEE STANDARD DRAWINGS ST-11, ST-12, AND ST-13).
4. PAVED REGIONAL TRAILS SHALL BE 12FT MINIMUM WIDTH.
5. PAVED SEPARATED TRAILS SHALL BE 8FT MINIMUM WIDTH.
6. UNPAVED REGIONAL TRAILS SHALL BE AN APPROVED NATURAL SURFACE OR SOFT SURFACE MATERIAL WITH 2FT MINIMUM WIDTH. WIDTH INCREASES BASED ON PROJECTED TRAIL USER TYPE.
7. CONCRETE IS REQUIRED IN RIPARIAN CORRIDORS.
8. CONCRETE TRAILS SHALL BE 5 INCHES CONCRETE OVER 6 INCHES UNTREATED BASE COURSE.
9. ASPHALT TRAILS SHALL BE 3 INCHES ASPHALT OVER 8 INCHES UNTREATED BASE COURSE.
10. CONCRETE TRAILS SHALL HAVE CONSTRUCTION JOINTS AT 8FT INTERVALS AND EXPANSION JOINTS AT 40FT INTERVALS.
11. MEANDERING TRAIL CURVE RADII SHALL BE 100FT MINIMUM.
12. RUNNING SLOPE OF TRAIL:  
  
STREET ADJACENT TRAILS ON LOCAL, COLLECTOR, MINOR ARTERIAL, MAJOR ARTERIAL, PRINCIPAL ARTERIAL, AND INTERIM ARTERIAL ROADWAYS SHALL HAVE A RUNNING SLOPE FOLLOWING THE LONGITUDINAL GRADE OF THE ROADWAY.  
  
PAVED REGIONAL TRAILS, UNPAVED REGIONAL TRAILS, AND PAVED SEPARATED TRAILS SHALL BE CONSTRUCTED TO MATCH THE EXISTING TOPOGRAPHY AS CLOSELY AS POSSIBLE. DESIRED RUNNING SLOPE IS 5% OR LESS. RUNNING SLOPE SHALL NOT EXCEED 12%. NO MORE THAN 30% OF THE TOTAL LENGTH OF THE TRAIL SHALL EXCEED 12:1 (8.33%). IF STEEPER GRADES BETWEEN 5%-12% ARE USED, RESTING INTERVALS OF 100FT OR MORE IN LENGTH SHALL BE PROVIDED MORE FREQUENTLY AS GRADE INCREASES.
13. CROSS SLOPE OF TRAIL SHALL BE 1.5% PLUS MINUS 0.5%.
14. SIDE TREATMENTS OF PAVED REGIONAL TRAILS AND PAVED SEPARATED TRAILS SHALL BE 4:1 LANDSCAPED V-DITCH ON THE UPHILL SIDE OF TRAIL WITH 6FT MINIMUM WIDTH OF V-DITCH AND ON THE DOWNHILL SIDE OF TRAIL A 4:1 LANDSCAPED SLOPE FOR 4 FT MINIMUM. PROVIDE DRAINS UNDER THE TRAIL AT APPROPRIATE LOCATIONS.

## TRAILS

DATE:  
MARCH 2022

DRAWING NAME:  
ST-34

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

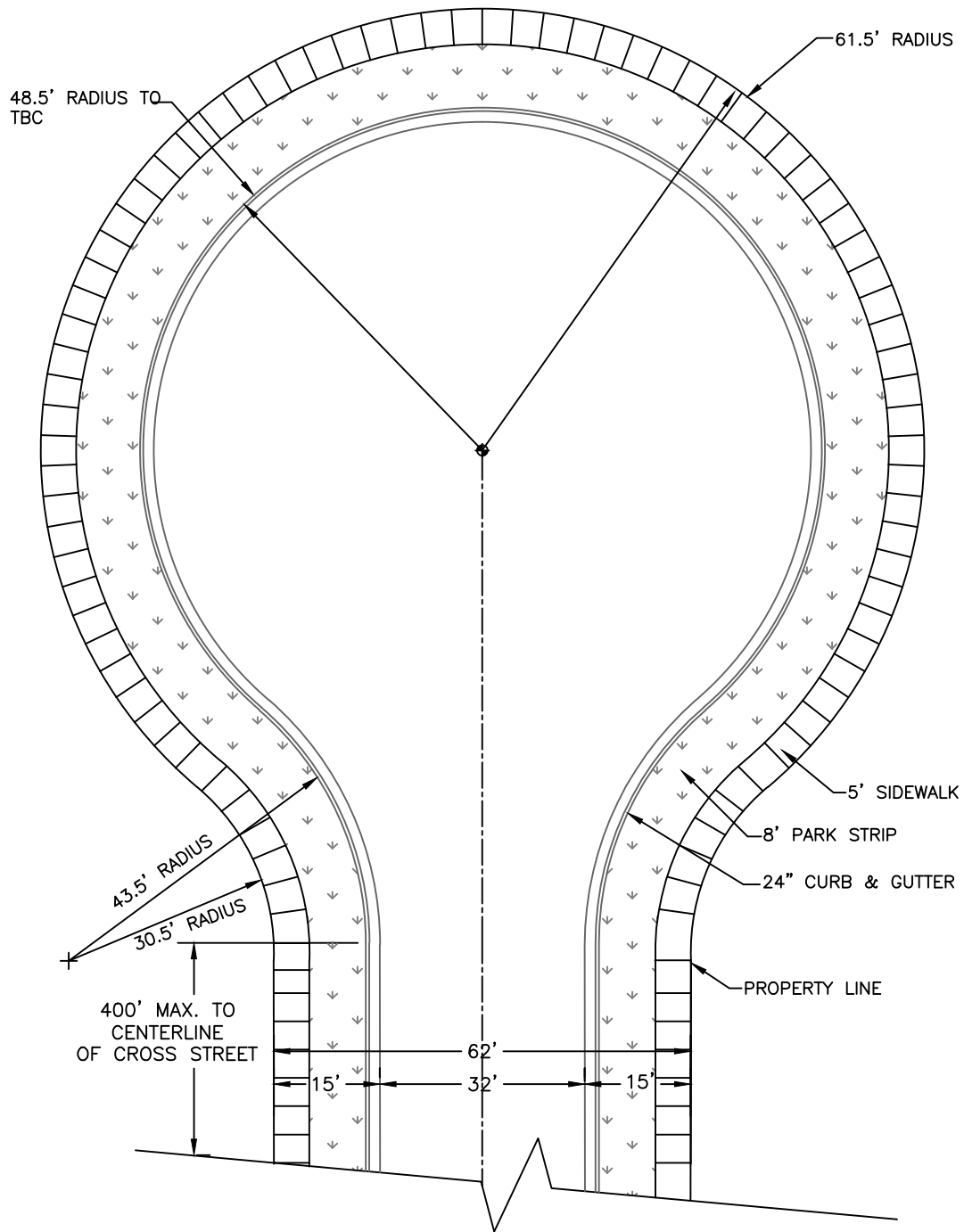
SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

STANDARD DETAILS

STREET STANDARDS

ST-15



**NOTE:**

- 1-CUL-DE-SAC GRADED TO DRAIN AWAY FROM THE BULB WITH MAXIMUM 4% IN ANY DIRECTION
- 2- CUL-DE-SAC DESIGN SHALL COMPLY WITH FIGURE D103.1 OF THE INTERNATIONAL FIRE CODE (MOST RECENT EDITION)

**CUL-DE-SAC**

DATE:  
MARCH 2022

DRAWING NAME:  
ST-16

DRAWN BY:  
JRP

CHECKED: APPROVED:

REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STREET STANDARDS

**ST-16**

- (A) "KEEP RIGHT" SIGN R4-7A 18"x24" INSTALL 3' ABOVE GRADE.
- (B) DIRECTIONAL STREET SIGN, INSTALL 4' ABOVE GRADE
- (C) "ONE WAY" SIGN R6-1 36"x12" AND R6-4A 48"x24"
- (D) "BIKE LANE" SIGN R3-17 24"x30"
- (E) "PEDESTRIAN CROSSING SIGN" W11-2 30"x30" W16-7P 24"x12"
- (F) "YIELD" SIGN R1-2 36"x36"
- (G) "ONE WAY" SIGN R6-2R 18"x24"
- (H) ROUNDABOUT DIRECTIONAL AND SPEED LIMIT SIGN W3-2A 36"x36" W13-1 18"x18" (15 MPH), INSTALL 5.5' ABOVE GRADE
- (I) BIKE LANE ENDS SIGN R3-17 24"x30" R3-17B "ENDS"

37' RADIUS TO LIP. YELLOW MEDIAN REFLECTOR PLACED EVERY 10' AROUND RAISED CURB, AS PER UDOT SPECIFICATIONS (MEDIAN REFLECTOR DETAIL, TYPE 1 GW-1D)

TEXTURED OR SMOOTH COLORED "BAJA RED" CONCRETE (BAJA REED COLOR 160 - HEX 976C51 LIQUID DOSE: 3.05LBS PER 94 LB CEMENT POWDER DOSE: 2LBS PER 94 LB CEMENT 1:20 MIN SLOPE

24.5' RADIUS ROUNDABOUT CENTRAL

CURBED RAMP

PLOWABLE END

ROUNDABOUT TRUCK APRON CURB AND GUTTER SEE DETAIL "E" THIS SHEET

REFLECTIVE YELLOW FLEXI-POST 36" HEIGHT

#### (A) STRIPING AT PLOWABLE MEDIAN END DETAIL

SCALE: NONE

TEXTURED OR SMOOTH COLORED "BAJA RED" CONCRETE (BAJA REED COLOR 160 - HEX 976C51 LIQUID DOSE: 3.05LBS PER 94 LB CEMENT POWDER DOSE: 2LBS PER 94 LB CEMENT

(B) 12" x 36" SIGN - 4.5" MIN WHITE LETTERS ON GREEN BACKGROUND. NO MORE THAN 13 CHARACTERS, INCLUDING SPACES. 2" WIDE ARROW

8" WIDE, 3" HIGH CURB 1" RADIUS, 12" WIDE, 7" THICK GUTTER

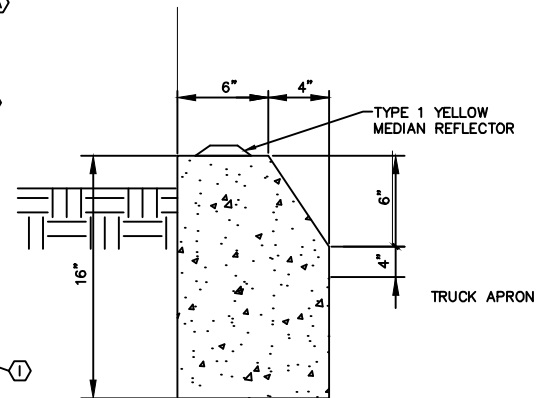
#### (C) ROUNDABOUT TRUCK APRON CURB & GUTTER

SCALE: NONE

2.5' CURB & GUTTER

#### (B) SHARKS TEETH STRIPING

SCALE: NONE



#### (D) TYPE E CURB & REFLECTOR

SCALE: NONE

## ROUND-ABOUT COLLECTOR 77' RIGHT-OF-WAY

DATE:  
MARCH 2022

DRAWING NAME:  
ST-17

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

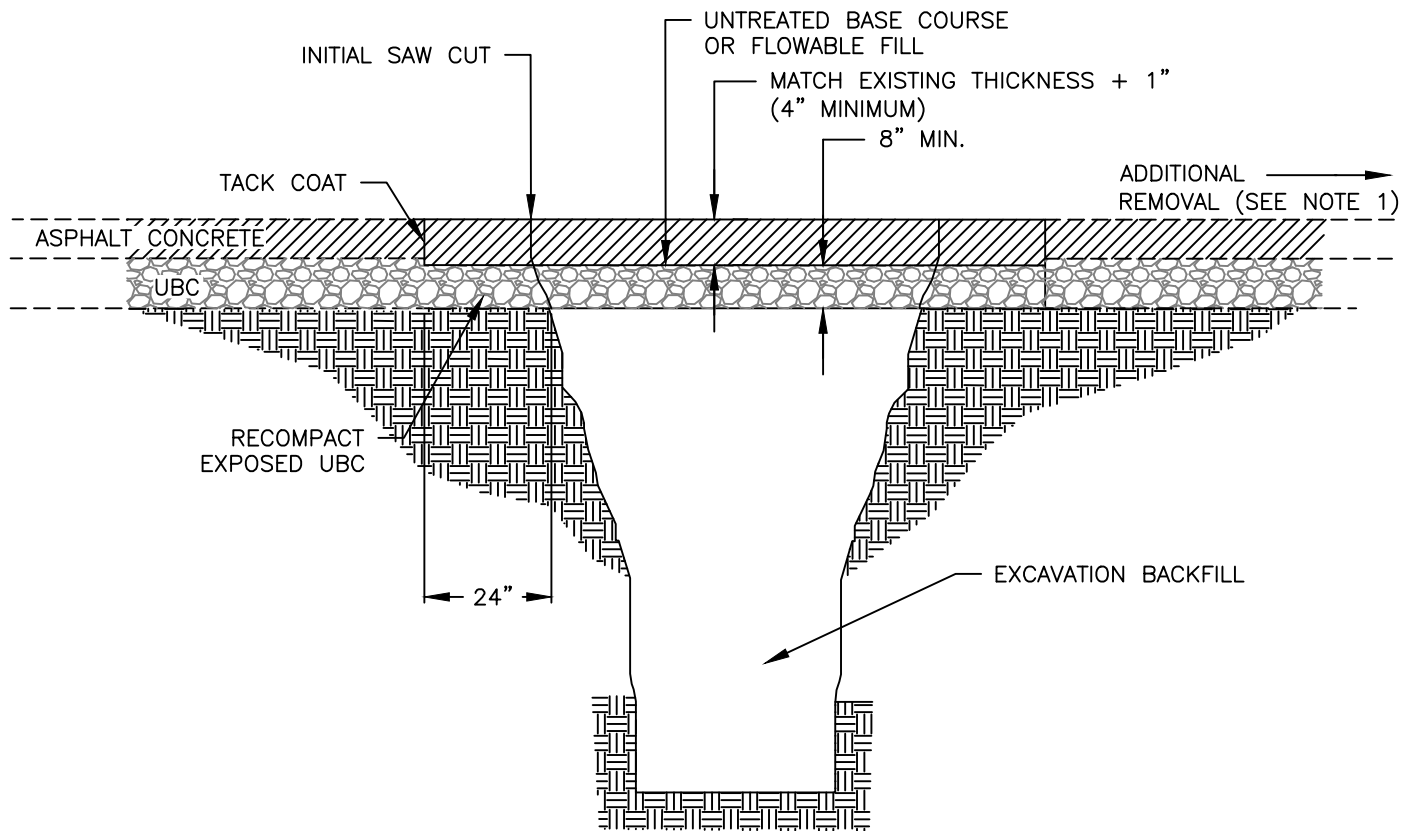
SARATOGA SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

STANDARD DETAILS

STREET STANDARDS

ST-17



## NOTES

1. IF ADDITIONAL PAVEMENT REMOVAL REQUIRED: REMOVE ADDITIONAL PAVEMENT TO A PAINTED LANE STRIPE, A LIP OF GUTTER, A CURB, AN EXISTING PAVEMENT PATCH OR AN EDGE OF THE PAVEMENT IF SUCH STREET FEATURE IS WITHIN 2 FEET OF THE SECOND SAW-CUT.
2. FLOWABLE FILL: PROVIDE 28 DAYS 60 PSI CONTROLLED LOW STRENGTH MATERIAL AS SPECIFIED IN APWA SECTION 31 05 15. USE FILL MATERIAL WHICH FLOWS EASILY AND VIBRATION IS NOT REQUIRED. CURE TO INITIAL SET BEFORE PLACING AGGREGATE BASE OR ASPHALT PAVEMENT. USE FLOWABLE FILL IN EXCAVATIONS THAT ARE TOO NARROW TO RECEIVE COMPACTION EQUIPMENT.
3. JOINT REPAIR: IF A CRACK OCCURS AT THE EDGE, "T" PATCH CONNECTION TO EXISTING PAVEMENT OR AT ANY STREET FIXTURE, SEAL THE CRACK.
4. PATCH REPAIR: REPAIR THE ASPHALT PAVEMENT PATCH IF ANY OF THE FOLLOWING CONDITIONS OCCUR WITHIN THE PATCH:
  - A. PAVEMENT SURFACE DISTORTION EXCEEDS  $\frac{1}{4}$ " DEVIATION IN 10 FEET, REPAIR. PLANE OFF SURFACE DISTORTIONS. COAT PLANED SURFACES WITH CATIONIC OR ANIONIC EMULSION AND PROVIDE SAND BLOTTER.
  - B. CRACK AT LEAST 1-FOOT LONG AND  $\frac{1}{4}$  INCH WIDE OCCUR MORE OFTEN THAN 1 IN 10 SQUARE FEET. REPAIR OPTION: CRACK SEAL.
  - C. ASPHALT RAVELING IS GREATER THAN 1 SQUARE FOOT PER 100 SQUARE FEET. REPAIR OPTION: MILL AND INLAY

## TEE PATCH

DATE: MARCH 2022		REVISIONS			
DRAWING NAME: ST-26		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		<small>1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794</small>			



STANDARD DETAILS

STREET STANDARDS

**ST-26**

### NOTES:

1. MARKERS MUST BE PLACED AT ALL "OFFSITE" UTILITIES. PLACE AT MANHOLES AND EVERY 500' ON ALL UNDERGROUND UTILITIES.
2. MANHOLE MARKERS: MARKERS SHALL BE MANUFACTURED OF FIBER REINFORCED COMPOSITE MATERIAL. THAT REINFORCEMENT SHALL BE COMPRISED OF BOTH LINEAL STRANDS AND HORIZONTAL MESH MATS. MARKERS SHALL BE FLAT WITH ROUNDED RIB DOWN THE CENTER AND RAILS ON EACH SIDE; SHALL BE AT LEAST 3-3/4" WIDE AND AT LEAST 66" TALL.
3. MARKERS SHALL BE CAPABLE OF WITHSTANDING A MINIMUM OF 10 VEHICLE IMPACTS AT 55 MPH WITH A CAR BUMPER.
4. MARKERS SHALL BE COATED WITH A COLORED COATING THAT WILL TOTALLY PREVENT ULTRA-VIOLET LIGHT FROM REACHING THE RESIN PORTION OF THE MARKER. COATING SHALL NOT FADE, PEEL, OR BLISTER AFTER A MINIMUM OF 2000 HOURS IN A QUV WEATHEROMETER.
5. STANDARD SIZE, HIGH VISIBILITY DECALS SHALL BE PLACED ON EACH SIDE OF THE MARKER. THE DECALS SHALL INCLUDE: THE INTERNATIONAL "NO-DIG" SYMBOL; FEDERAL LAW WARNING TO DETER VANDALS; THE WARNING MESSAGE, TO INCLUDE "WARNING", THE TYPE OF UTILITY AND "SARATOGA SPRINGS, CALL 776-9793.
6. COLORS SHALL BE AS FOLLOWS PER APWA SPECIFICATIONS:  
  
RED: ELECTRIC POWER LINES, CABLES, CONDUIT AND LIGHTING CABLES  
  
YELLOW: GAS, OIL, STEAM, PETROLEUM OR GASEOUS MATERIALS  
  
ORANGE: COMMUNICATIONS, ALARM, SIGNAL, CABLES OR CONDUITS  
  
BLUE: POTABLE WATER  
  
PURPLE: RECLAIMED WATER, IRRIGATION AND SLURRY LINES  
  
GREEN: SEWER AND STORM DRAIN LINES

**UTILITY MARKER**

DATE:  
MARCH 2022

DRAWING NAME:  
ST-27

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

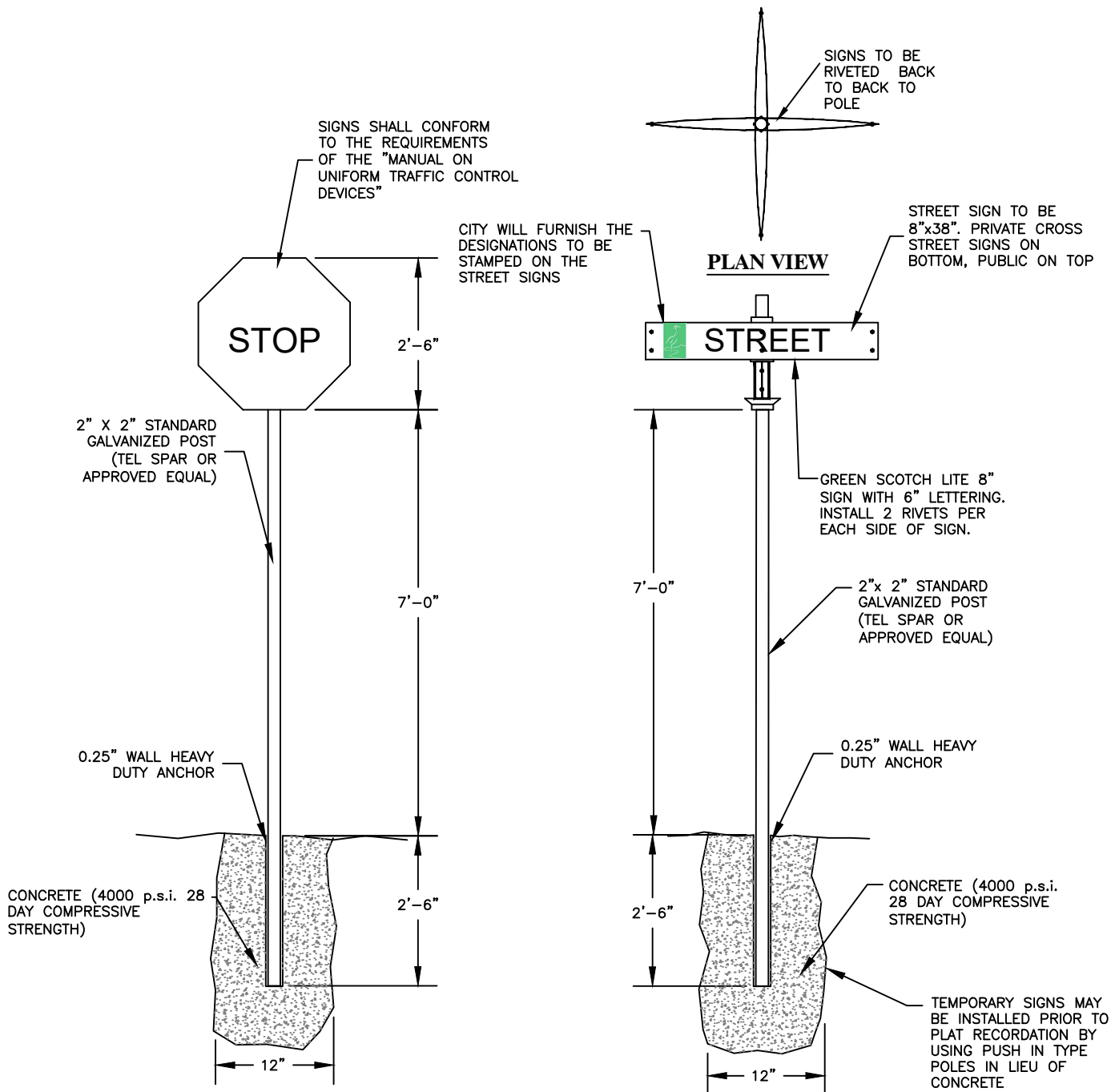


STANDARD DETAILS

STREET STANDARDS

**ST-27**





#### NOTES:

1. SECURE CITY'S APPROVAL OF SIGN FORMAT AND INSTALLATION.
2. INSTALL THE EDGE OF THE SIGN TWO FEET FROM THE VERTICAL EXTENSION OF THE BACK OF CURB AS NEAR AS POSSIBLE TO THE APPROACH CURB POINT OF CURVATURE. SIGNS SHOULD NOT OVERHANG SIDEWALK OR CURB & GUTTER.
3. ALL STREET SIGNS (STOP, SPEED, ETC.) SHALL BE 7' MINIMUM FROM GROUND TO BOTTOM OF SIGN.
4. ALL STREET SIGNS TO BE COATED WITH 3M-HIGH INTENSITY SHEETING, OR ACCEPTABLE EQUAL.
5. PRIVATE STREET SIGNS TO HAVE BLUE BACKGROUND.

## STREET SIGNS AND REGULATORY SIGNS

DATE:  
MARCH 2022

DRAWING NAME:  
ST-28

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

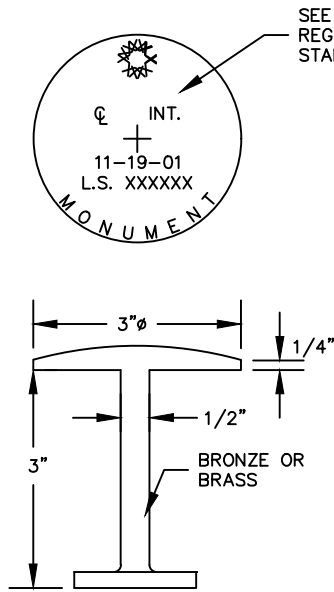
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

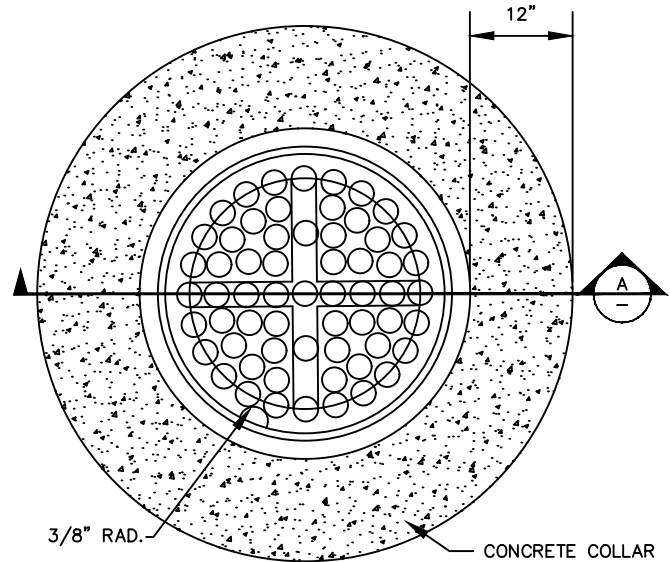
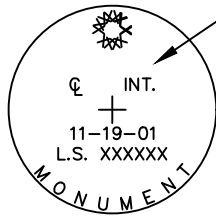
STREET STANDARDS

**ST-28**



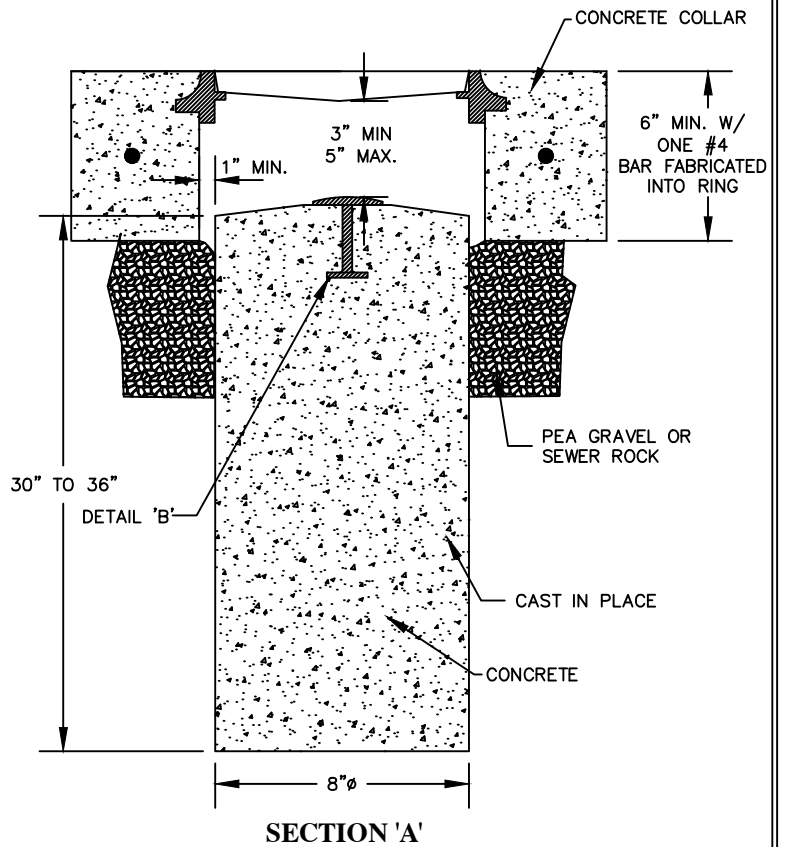
**DETAIL 'B'**

SEE APWA DWG. #272 FOR DETAILS  
REGARDING INFORMATION TO BE  
STAMPED ON MONUMENT CAP



**NOTES:**

ALL WORK SHALL CONFORM TO APWA STANDARDS  
UNLESS OTHERWISE APPROVED BY CITY ENGINEER



**SECTION 'A'**

**SURVEY MONUMENT**

DATE:  
MARCH 2022

DRAWING NAME:  
ST-29

DRAWN BY:  
JRP

CHECKED: APPROVED:

**REVISIONS**

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

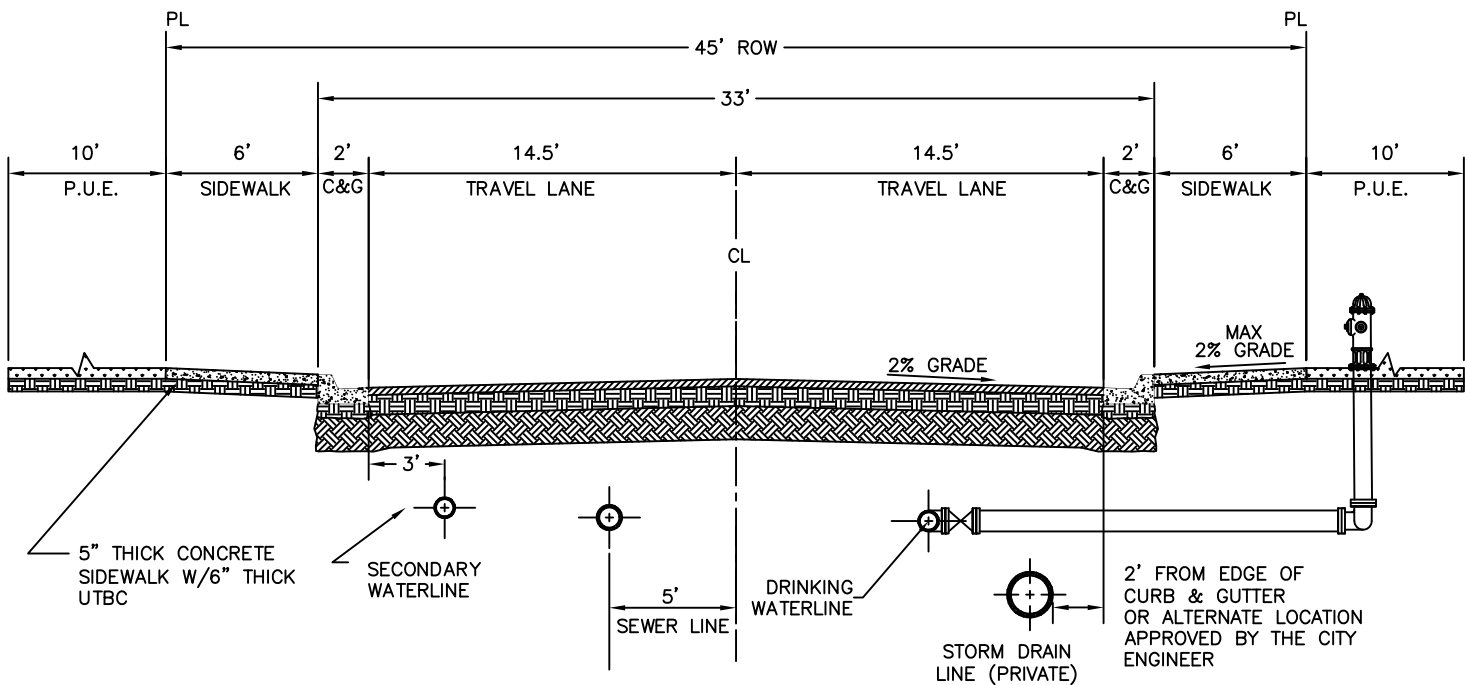
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

STREET STANDARDS

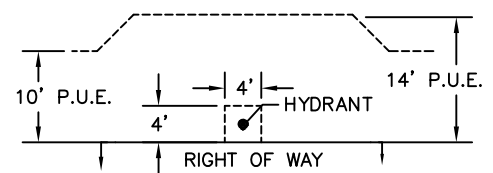
**ST-29**



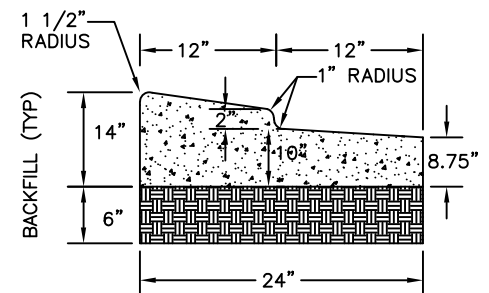
## NOTES:

- THIS ROW CROSS SECTION SHALL BE PERMITTED FOR PRIVATE ROAD CROSS SECTIONS IN THE FOLLOWING ZONES: MF-10, MF-14, MF-18, MU, NC, CC, RC, HC, OW, I, LI, MW, MR, BP, PC, AND IC.
- MAXIMUM DIFFERENCE IN ELEVATION BETWEEN CURB ON OPPOSITE SIDES OF STREET SHALL NOT EXCEED 1'-0"
- PAVEMENT DESIGN SHALL BE BASED ON A SOILS REPORT AS PER CITY STANDARDS.
- PROVIDE A MINIMUM 6" THICKNESS UTBC UNDER SIDEWALKS, DRIVEWAY APPROACHES, AND CURB & GUTTER.
- INSTALL TYPE 2 SLURRY SEAL ON ALL HMA UPON COMPLETION OF PAVING AND PRIOR TO ACCEPTANCE OF ROADS.
- HOUSES MAY FRONT ON THESE STREETS.
- MODIFIED CURB AND GUTTER MAY BE PERMITTED ONLY WHEN THE SPACING BETWEEN DRIVEWAYS IS LESS THAN 50 FEET AS MEASURED FROM EDGE TO EDGE. IF MODIFIED CURB AND GUTTER IS PERMITTED, THE TRAVEL LANES SHALL BE REDUCED TO 14' TO ACCOMMODATE LONGER CURB AND GUTTER CROSS SECTION.
- P.U.E. SHALL JOG AROUND ALL HYDRANT LOCATIONS.
- THE PAVEMENT DESIGN MAY BE, AT THE DEVELOPER'S DISCRETION, ACCORDING TO THE DEVELOPER'S GEOTECHNICAL ENGINEER'S RECOMMENDATIONS IF THE FOLLOWING DESIGN PARAMETERS ARE USED ACCORDING TO THE AASHTO 1993 PAVEMENT DESIGN PROCESS:
  - RELIABILITY = 90%
  - STD DEV = 0.45
  - INITIAL SI = 4.2
  - TERMINAL SI = 2.5
  - WHEN CALCULATING THE STRUCTURAL NUMBER, USE THE FOLLOWING LAYER COEFFICIENT DEFAULTS:
    - ASPHALT = 0.40
    - UNTREATED BASE COURSE = 0.10
    - GRANULAR BORROW = 0.08

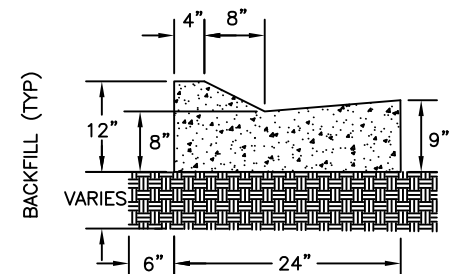
## P.U.E FIRE HYDRANT DETAIL



## MODIFIED FALL-OUT CURB AND GUTTER



## MODIFIED CATCH CURB AND GUTTER

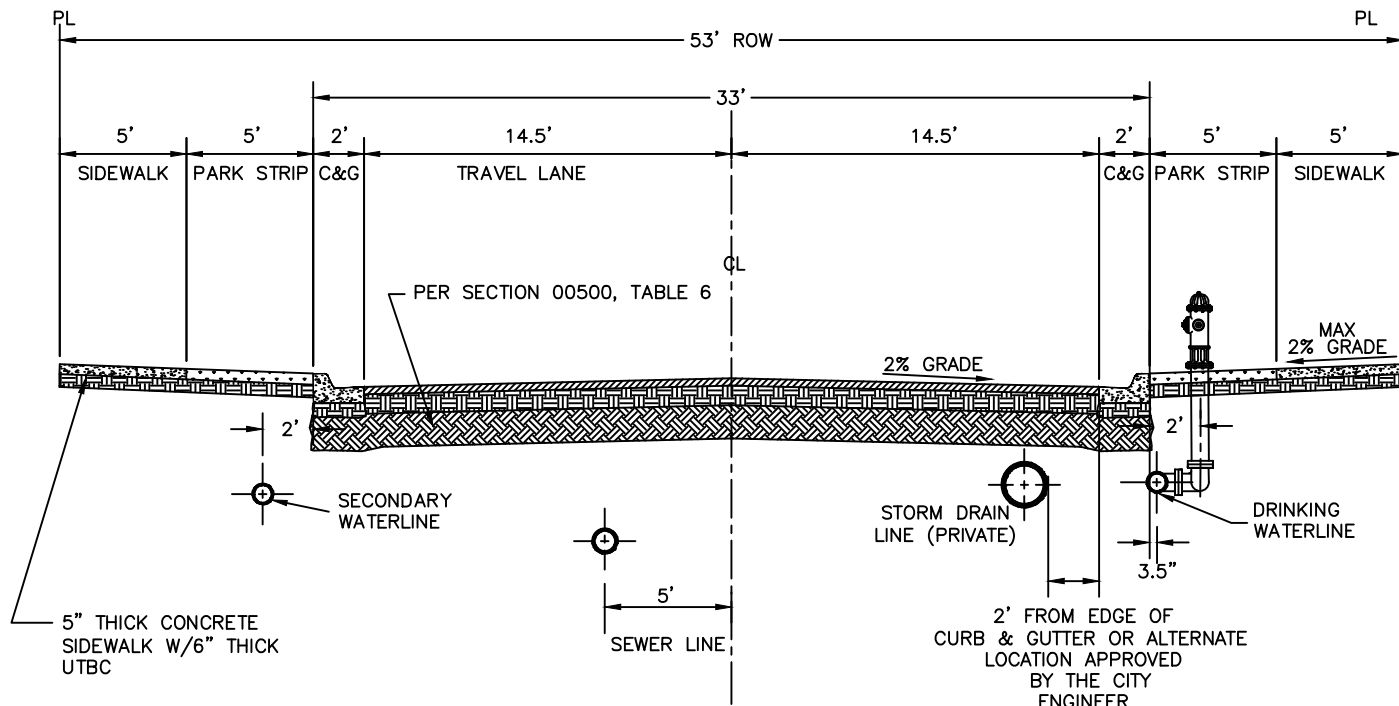


## PRIVATE ROAD 45' RIGHT-OF-WAY W/O PARK STRIP

DATE: MARCH 2022		REVISIONS	
DRAWING NAME: ST-30		REVISION	DATE BY COMMENTS
DRAWN BY: ETL			
CHECKED:	APPROVED:		
SARATOGA SPRINGS CITY		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794	



STANDARD DETAILS
STREET STANDARDS
<b>ST-30</b>



### NOTES:

1. THIS ROW CROSS SECTION SHALL BE PERMITTED FOR PRIVATE ROAD CROSS SECTIONS IN THE FOLLOWING ZONES: R1-40, R1-20, R1-10, R1-9, R2-8, R3-6, MF-10, MF-14, MF-18, MU, NC, CC, RC, HC, OW, I, LI, MW, MR, BP, PC, AND IC.

2. MAXIMUM DIFFERENCE IN ELEVATION BETWEEN CURB ON OPPOSITE SIDES OF STREET SHALL NOT EXCEED 1'-0"

3. PROVIDE A MINIMUM 6" THICKNESS UTBC UNDER SIDEWALKS, DRIVEWAY APPROACHES, AND CURB & GUTTER.

4. INSTALL TYPE 2 SLURRY SEAL ON ALL HMA UPON COMPLETION OF PAVING AND PRIOR TO ACCEPTANCE OF ROADS.

5. HOUSES MAY FRONT ON THESE STREETS.

6. THE PAVEMENT DESIGN MAY BE, AT THE DEVELOPER'S DISCRETION, ACCORDING TO THE DEVELOPER'S GEOTECHNICAL ENGINEER'S RECOMMENDATIONS IF THE FOLLOWING DESIGN PARAMETERS ARE USED ACCORDING TO THE AASHTO 1993 PAVEMENT DESIGN PROCESS:

- A. RELIABILITY = 90%
- B. STD DEV = 0.45
- C. INITIAL SI = 4.2
- D. TERMINAL SI = 2.5
- E. WHEN CALCULATING THE STRUCTURAL NUMBER, USE THE FOLLOWING LAYER COEFFICIENT DEFAULTS:

- i. ASPHALT = 0.40
- ii. UNTREATED BASE COURSE = 0.10
- iii. GRANULAR BORROW = 0.08

## PRIVATE ROAD 53' RIGHT-OF-WAY W/ PARK STRIP

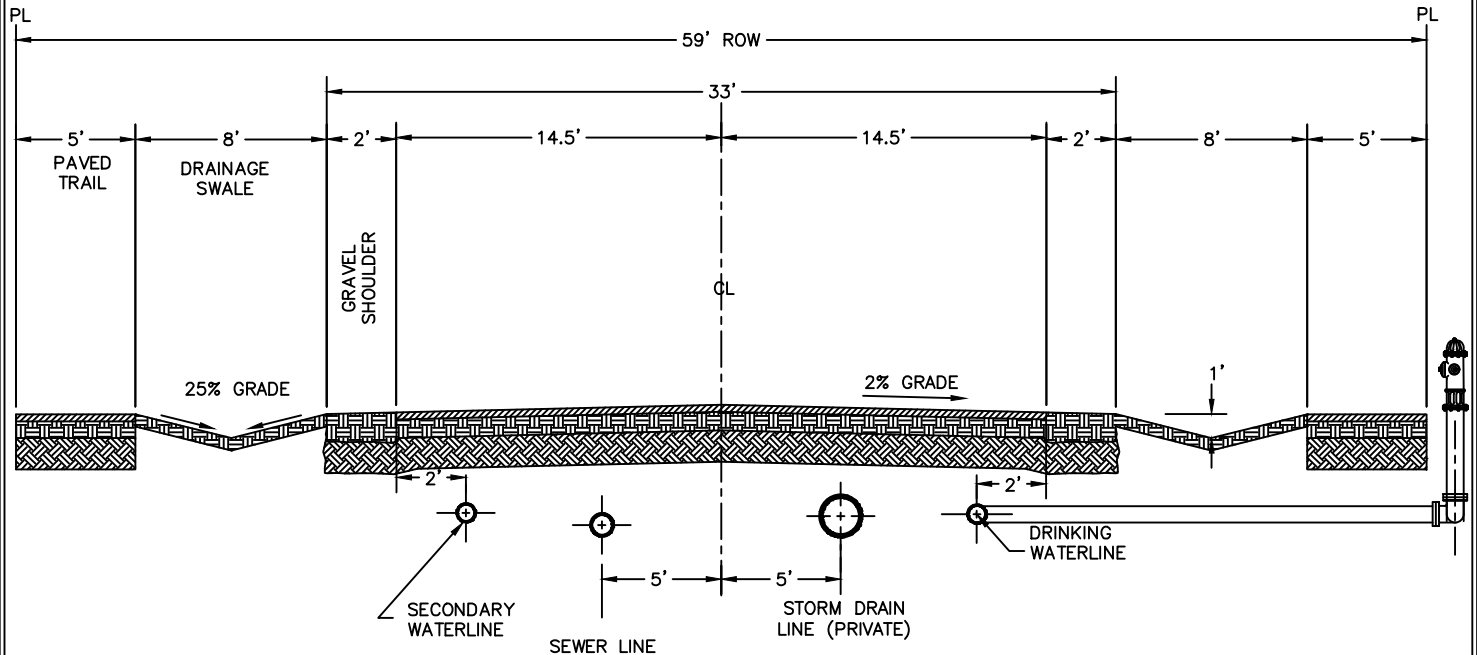
DATE: MARCH 2022		REVISIONS			
DRAWING NAME: ST-31		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:				
		SARATOGA SPRINGS CITY			
		1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794			



STANDARD DETAILS

STREET STANDARDS

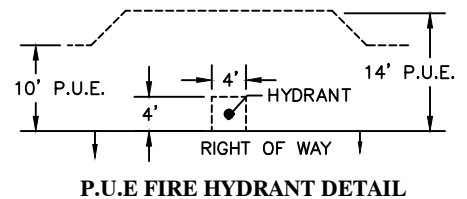
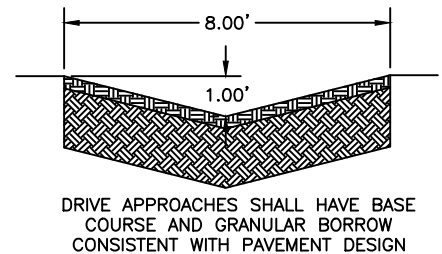
**ST-31**



### NOTES:

1. THIS ROW CROSS SECTION SHALL BE PERMITTED FOR PRIVATE ROAD CROSS SECTIONS IN THE FOLLOWING ZONES: A, RR, RA-5, AND R1-40.
2. MAXIMUM DIFFERENCE IN ELEVATION BETWEEN SWALE ON OPPOSITE SIDES OF STREET SHALL NOT EXCEED 1'-0"
3. INSTALL TYPE 2 SLURRY SEAL ON ALL HMA UPON COMPLETION OF PAVING AND PRIOR TO ACCEPTANCE OF ROADS.
4. HOUSES MAY FRONT ON THESE STREETS.
5. A FIVE FOOT ASPHALT OR CONCRETE TRAIL MUST BE PROVIDED BOTH SIDE OF THE STREET. TRAILS ARE NOT REQUIRED IN DEVELOPMENTS WITH 5 ACRE LOTS OR LARGER
6. THE PAVEMENT DESIGN MAY BE, AT THE DEVELOPER'S DISCRETION, ACCORDING TO THE DEVELOPER'S GEOTECHNICAL ENGINEER'S RECOMMENDATIONS IF THE FOLLOWING DESIGN PARAMETERS ARE USED ACCORDING TO THE AASHTO 1993 PAVEMENT DESIGN PROCESS:
  - A. RELIABILITY = 90%
  - B. STD DEV = 0.45
  - C. INITIAL SI = 4.2
  - D. TERMINAL SI = 2.5
  - E. WHEN CALCULATING THE STRUCTURAL NUMBER, USE THE FOLLOWING LAYER COEFFICIENT DEFAULTS:
    - i. ASPHALT = 0.40
    - ii. UNTREATED BASE COURSE = 0.10
    - iii. GRANULAR BORROW = 0.08

### DRIVE APPROACH SWALE CROSS SECTION



## PRIVATE ROAD 59' RIGHT-OF-WAY RURAL

DATE:  
MARCH 2022

DRAWING NAME:  
ST-32

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

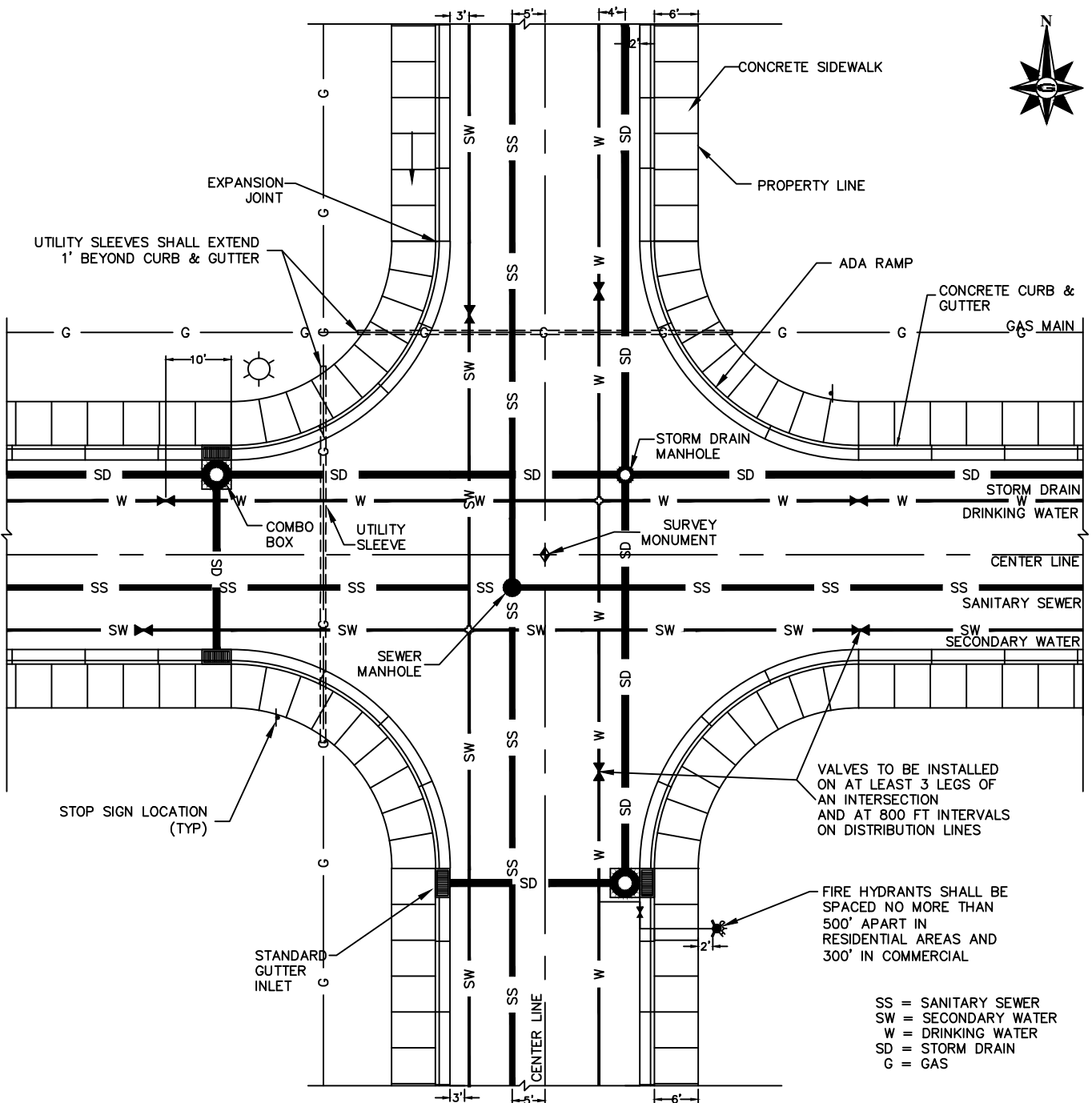
SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

STANDARD DETAILS

STREET STANDARDS

**ST-32**



#### NOTES:

1. LAND DRAINS ARE UNACCEPTABLE UNLESS EXPLICITLY ALLOWED BY CITY ENGINEER. WHEN ALLOWED, PIPES SHALL NOT BE PERFORATED OR DESIGNED TO ACCEPT WATER WITHIN THE STREET RIGHT-OF-WAY.
2. CURB RADIUS ON LOCAL AND COLLECTOR RIGHT-OF-WAYS SHALL BE 25', ON MINOR ARTERIALS IT SHALL BE 35', AND ON MAJOR AND PRINCIPAL ARTERIALS SHALL BE 40' AS MEASURED FROM FACE OF CURB.
3. CHECK ALL CITY STANDARDS FOR UTILITY LOCATIONS.
4. STREET LIGHTS ARE TO BE PLACED AT INTERSECTIONS AND EVERY 300 FEET, ALTERNATING SIDES OF STREET.
5. WHERE INLET CONFLICTS WITH VALVE LOCATION, PLACE VALVE 10' BACK FROM POINT OF CURVATURE.

## PRIVATE ROAD INTERSECTION & UTILITIES

DATE:  
MARCH 2022

DRAWING NAME:  
ST-33

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

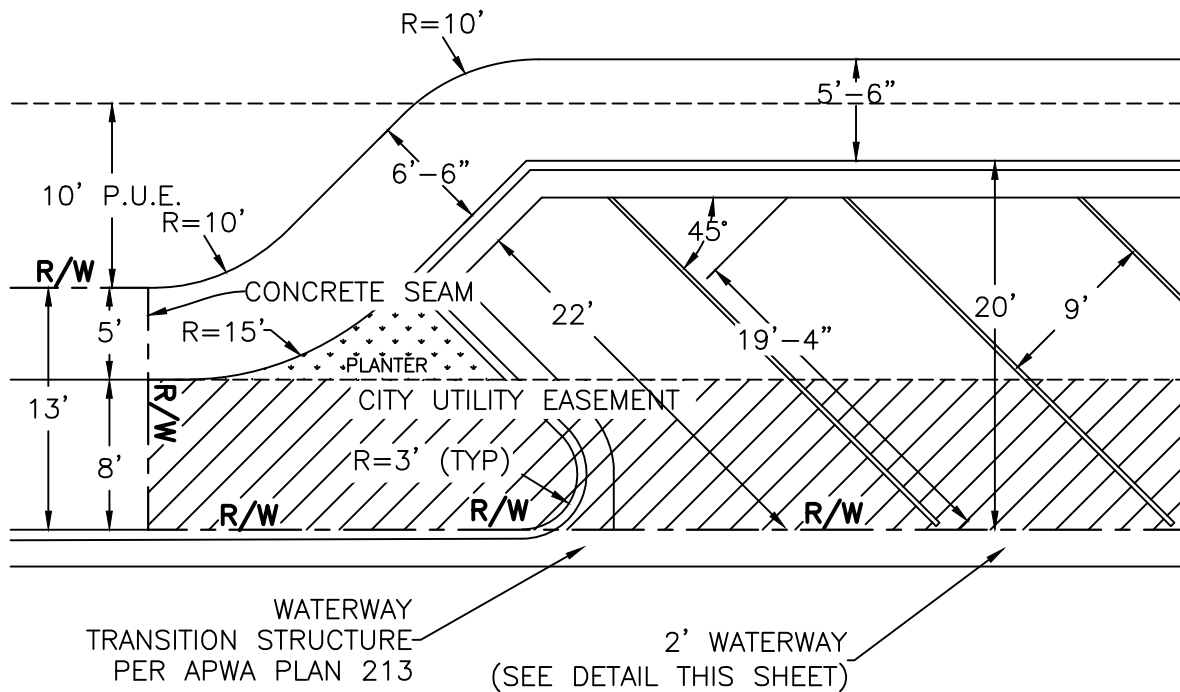
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STANDARD DETAILS

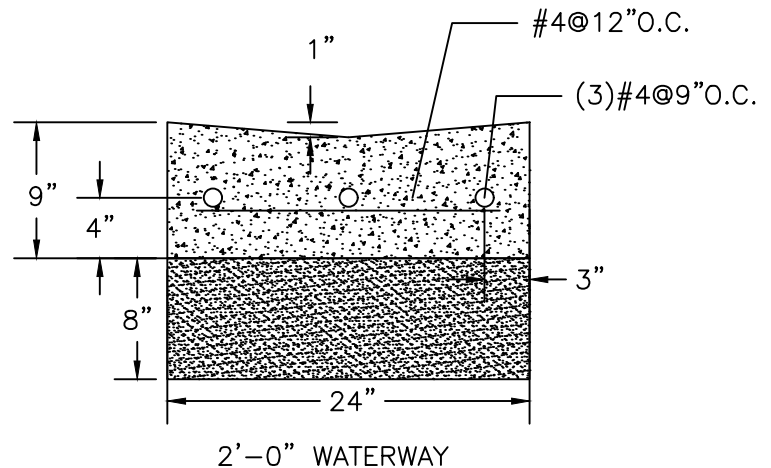
STREET STANDARDS

**ST-33**



#### NOTES:

1. ALLOWED ONLY IN THE MIXED RESIDENTIAL (MR) AND MULTI-FAMILY (MF) ZONE ON LOCAL STREETS.
2. THE PAVEMENT DESIGN IN THE PARKING AREA CAN BE PER THE DEVELOPER'S GEOTECHNICAL ENGINEER'S RECOMMENDATIONS.
3. THE BUILDING SETBACK SHALL BE MEASURED FROM THE CONTINUED PROJECTION OF THE ROW.
4. A MAXIMUM OF NINE STALLS.



## ANGLED ON-STREET PARKING

DATE:  
MARCH 2022

DRAWING NAME:  
ST-35

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

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SPRINGS CITY

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#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794

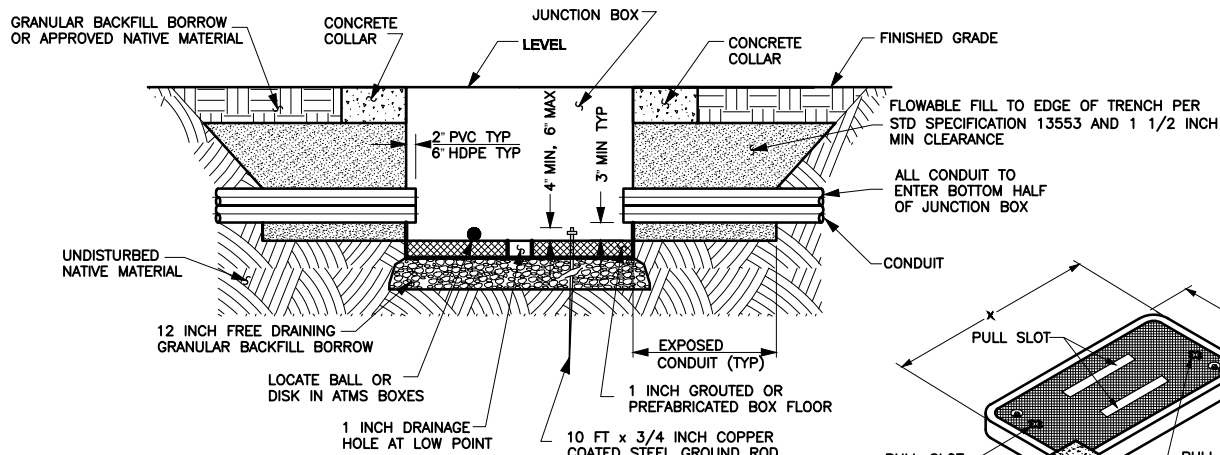


STANDARD DETAILS

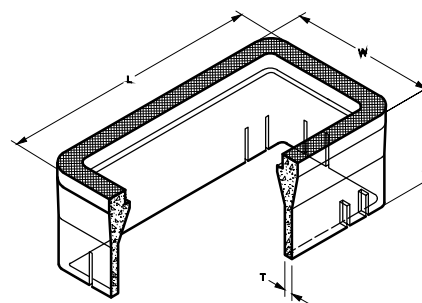
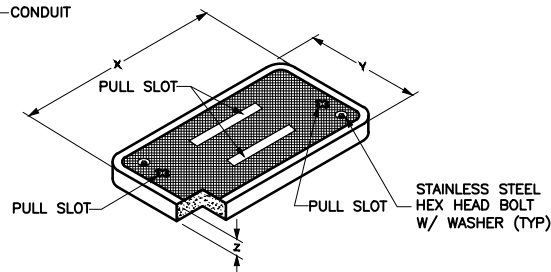
STREET STANDARDS

**ST-35**



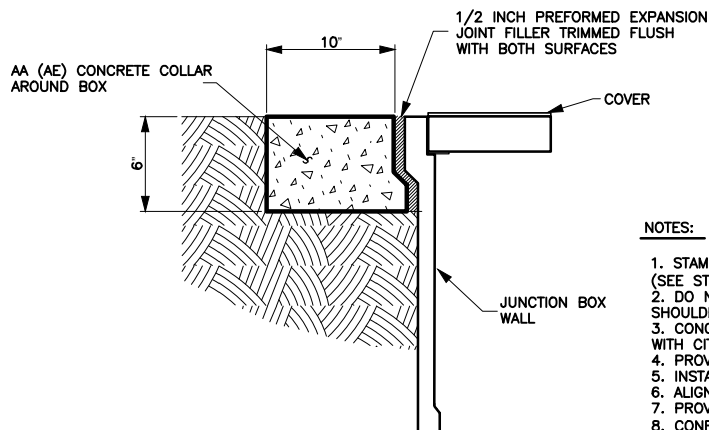


**JUNCTION BOX CONDUIT  
PENETRATION DETAIL**



**BOX AND LID DIMENSION**

BOX TYPE	"H" Inch	"L" Inch	"T" Inch	"W" Inch	"X" Inch	"Y" Inch	"Z" Inch
I-PC	24	25	1 1/2	16	23 1/2	13 1/2	2
II-PC	24	37 1/2	1 1/2	26	35 1/2	24	3
III-PC	24	49 1/2	2	32 1/2	47 1/2	30 1/2	3



**JUNCTION BOX CONCRETE COLLAR DETAIL**

**NOTES:**

1. STAMP BOX AND LOGO INTO THE LID FROM THE FACTORY. (SEE STANDARD SPECIFICATION 05133)
2. DO NOT PLACE JUNCTION BOXES IN THE TRAVELED WAY OR ON THE FREEWAY SHOULDERS.
3. CONCRETE COLLAR WIDTH VARIES WHEN ADJACENT TO OTHER IMPROVEMENTS. CONSULT WITH CITY INSPECTOR AS REQUIRED.
4. PROVIDE CONCRETE COLLARS EXCEPT WITHIN CONCRETE PAVED AREAS.
5. INSTALL CONDUIT PLUG PER STANDARD SPECIFICATION 05133.
6. ALIGN ATMS CONDUIT BY COLOR ON EACH SIDE OF THE JUNCTION BOX.
7. PROVIDE TYPE III-PC JUNCTION BOXES WITH A SPLIT LID.
8. CONFORM TO ANSI/SCTE-77 2007 SPECIFICATION FOR UNDERGROUND ENCLOSURE INTEGRITY TIER 22 LOADING FOR ALL JUNCTION BOXES.

**POLYMER CONCRETE  
JUNCTION BOX**

DATE: MARCH 2022		REVISIONS			
DRAWING NAME: ST-39		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
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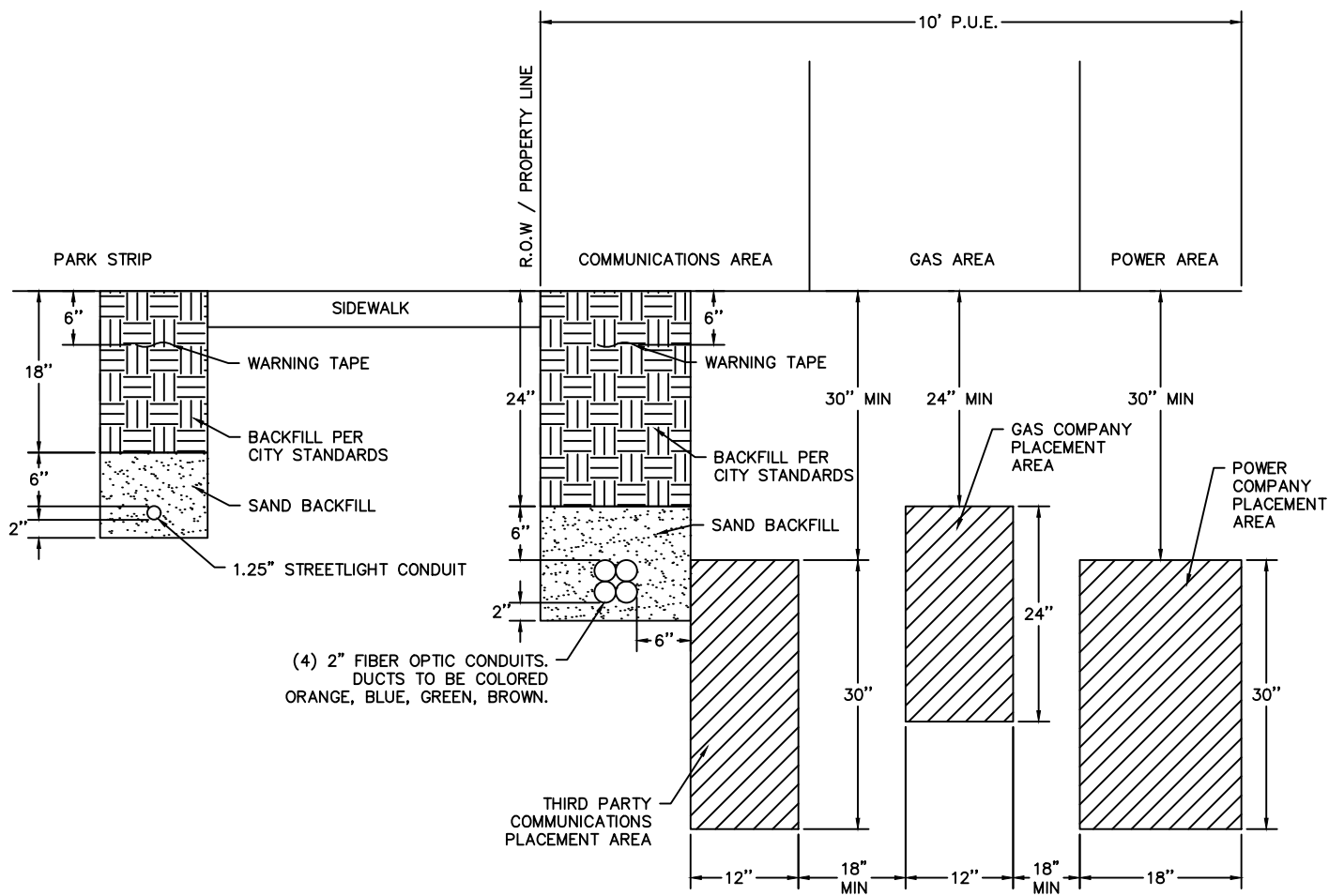


STANDARD DETAILS

STREET STANDARDS

**ST-39**





## CONDUIT: FIBER OPTIC/COMMUNICATION

DATE:  
MARCH 2022

DRAWING NAME:  
ST-40

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

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SPRINGS CITY

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FAX: 801-766-9794



STANDARD DETAILS

STREET STANDARDS

**ST-40**

# STANDARD STREET LIGHT DETAILS

## INDEX:

<b>LP-1</b>	<b>NOTES</b>
<b>LP-1A</b>	<b>14' LOCAL STREET LIGHT</b>
<b>LP-1B</b>	<b>CONCRETE BASE FOR LOCAL STREET LIGHT</b>
<b>LP-2A</b>	<b>20' COLLECTOR STREET LIGHT</b>
<b>LP-2B</b>	<b>20' COLLECTOR STREET LIGHT W/ BANNER ARM FOR COLLECTOR ROADS AND COMMERCIAL AREAS</b>
<b>LP-2C</b>	<b>CONCRETE BASE FOR COLLECTOR STREET LIGHT</b>
<b>LP-3A</b>	<b>28' ARTERIAL STREET LIGHT</b>
<b>LP-3B</b>	<b>28' ARTERIAL STREET LIGHT WITH BANNER ARM</b>
<b>LP-3C</b>	<b>CONCRETE BASE FOR ARTERIAL STREET LIGHT</b>
<b>LP-4</b>	<b>LOCAL STREET LIGHT CONNECTION</b>
<b>LP-5</b>	<b>COLLECTOR AND ARTERIAL STREET LIGHT CONNECTION</b>
<b>LP-6</b>	<b>LIGHT POLE BELOW GRADE BOXES INSTALLATION</b>
<b>LP-6A</b>	<b>MONOPOLE</b>

**STREET LIGHT  
DETAILS**

DATE: AUGUST 2022		REVISIONS			
DRAWING NAME: LP-0		REVISION	DATE	BY	COMMENTS
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STANDARD DETAILS

STREET LIGHTS

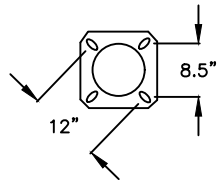
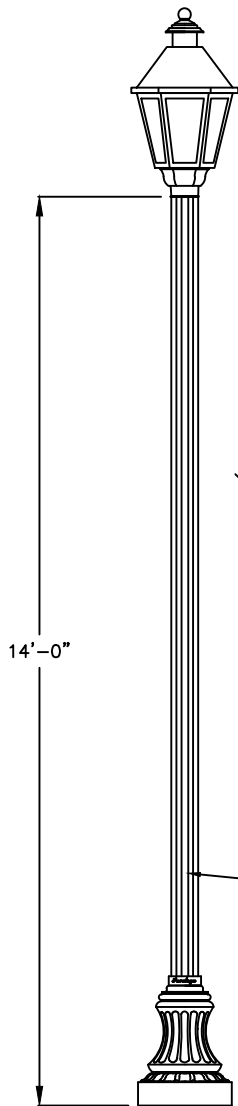
**LP-0**

1. LIGHT POLES AND LUMINAIRES SHALL CONFORM TO 05540 OF THE CITY STANDARDS AND SHALL BE ACCEPTABLE TO THE CITY ENGINEER.
2. ALTERNATIVE PRODUCT ASSEMBLIES MAY BE SUBSTITUTED IF DEEMED TO BE EQUAL AND APPROVED IN WRITING BY THE CITY
3. **ALL PRIVATE STREET LIGHTS SHALL BE MASTER-METERED AT PRIVATELY OWNED SERVICES**
4. **ALL PRIVATE STREET LIGHTS SHALL NOT BEAR ANY SORT OF CITY IDENTIFICATION, SUCH AS THE CITY LOGO**
5. ALL STREET LIGHTS SHALL BE 120 VOLTS NOMINAL TO GROUND.
6. DUCT SEAL SHALL BE USED AT CONDUIT OPENINGS
7. WIRE MUST BE PULLED USING POLY PULL TAPE BY ACCEPTABLE INDUSTRY STANDARD METHODS
8. TERMINATE CONDUIT IN BOXES WITH GLUE ON CONDUIT END BELLS ATTACHED TO END OF CONDUITS
9. CONDUIT ENTRY SHALL BE IN THE BOTTOM OF THE BOX. SIDE ENTRY SHALL NOT BE PERMITTED
10. STREET LIGHTS SHALL BE LOCATED AT ROADWAY INTERSECTIONS (NEAR FIRE HYDRANTS WHERE POSSIBLE), PLACED EVERY 300' ON ALTERNATE SIDES OF THE STREET, AND AT OTHER REQUIRED LOCATIONS PER CITY STANDARDS.
11. MARK JUNCTION BOX LIDS **"STREET LIGHTS"**
12. INSTALL 1.25" TRADE SIZE SCH40 PVC CONDUIT WITH 24" COVER AND SAND BEDDING
13. WIRES BELOW GRADE SHALL BE SINGLE CONDUCTOR (NOT CABLE ASSEMBLY) #6 AWG XHHW-2 COPPER UNLESS OTHERWISE NOTED. WIRES IN POLE TO BE #12 THHN SINGLE CONDUCTOR STRANDED WIRES. WIRE SHALL CONSIST OF CONTINUOUSLY COLORED INSULATION IN COLORS NOTED ON DETAIL (PHASE TAPE COLOR IDENTIFICATION NOT PERMITTED.) WIRE SIZE SHALL BE UPSIZED AS NEEDED FOR NEC COMPLIANCE. SHOW VOLTAGE DROP CALCULATIONS UPON REQUEST.
14. CONTRACTOR TO INSTALL POD JUNCTION BOX WITH FUSE. BOX TO BE LOCATED 4' MINIMUM AND 10' MAXIMUM FEET FROM RMP SOURCE. PROVIDE 2" SCH 40 PVC CONDUIT TO RMP SOURCE. PROVIDE CONDUCTORS LONG ENOUGH TO REACH RMP POWER SOURCE PLUS 5'. CONTRACTOR SHALL SUPPLY PULL STRING IN CONDUIT.
15. POD GROUNDING ELECTRODES AND GECS SHALL BE COMPLIANT WITH NEC STANDARDS. IF GROUND RODS ARE USED, TWO SHALL BE REQUIRED PER NEC. REFER TO DETAIL DRAWINGS.
16. POD AND SERVICE CONDUCTOR/CONDUIT INSTALLATION REQUIREMENTS ARE BASED PRIMARILY ON RMP STANDARDS. CONFIRM INSTALLATION REQUIREMENTS WITH RMP REPRESENTATIVE AND PACIFICORP'S LATEST SIX STATES ELECTRICAL SERVICE REQUIREMENTS DOCUMENT.
17. CONNECT EQUIPMENT GROUND WIRE TO METAL SHELL OF LIGHT POLE. BOND ALL METAL PARTS AS PER NFPA 70.250
18. EACH INDIVIDUAL STREET LIGHT SHALL HAVE A JUNCTION BOX WITH A FUSE LOCATED WITHIN 4' OF STREET LIGHT BASE. FUSE ASSEMBLIES SHALL BE BUSSMAN KTK 5 AMP. IF MORE THAN ONE POLE IS BEING SUPPLIED, POD SHALL BE MINIMUM OF KTK 10 AMP AND MAXIMUM OF KTK 30 AMP AND LIGHT POLE FUSES SHALL BE KTK 5 AMP. FUSES SHALL NOT BE PERMITTED IN POLE HAND HOLE
19. FUSE ASSEMBLIES SHALL BE (1) BUSSMAN HEB-JJ, WITH (2) BUSSMAN 2AO660 INSULATION BOOTS. NO SUBSTITUTIONS.
20. " SQUID" TERMINAL BLOCK ASSEMBLY SHALL BE BLACKBURN USB33S OR USB43S. NO SUBSTITUTIONS.
21. POD, STREET LIGHT (FUSE), JUNCTION, AND PULL BOXES SHALL CONSIST OF (2) CARSON BROOKS 12" DEEP STANDARD SIZE BOXES BOLTED TOGETHER 'CLAMSHELL' STYLE. DRILL 1/4" HOLES IN EVERY CELL OF LOWER (FLOOR) LID TO ALLOW DRAINAGE. INSTALL BOX ASSEMBLY ON 4" OF 3/4" GRAVEL. NO SUBSTITUTIONS.
22. STREET LIGHTS ARE TO BE CENTERED IN PARK STRIP.
23. IF FIXTURE IS NOT INDICATED FOR INSTALLATION WITH CURRENT CONTRACT, ONLY CONDUIT IS REQUIRED. SOME CONDUCTORS INDICATED MAY BE REQUIRED WITH FIXTURE UPGRADES.
24. POLES FOR OUTDOOR LIGHTING FIXTURES FOR THE ILLUMINATION OF PARKING AREAS AND LOCATED DIRECTLY BEHIND PARKING SPACES, OR WHERE THEY COULD BE HIT BY SNOW PLOWS, SHALL BE PLACED A MINIMUM OF FIVE (5) FEET OUTSIDE PAVED AREAS OR TIRE STOPS, OR PLACED ON CONCRETE PEDESTALS AT LEAST THIRTY (30) INCHES HIGH ABOVE THE PAVEMENT.
25. ADDITIONAL REQUIREMENTS MAY APPLY IN UDOT RIGHT OF WAYS.
26. WHERE OVERHEAD POWER LINES ARE PRESENT, POLE HEIGHT MAY REQUIRE REDUCTION IN HEIGHT TO OBSERVE MINIMUM CLEARANCE REQUIRED BY POWER UTILITY.
27. ALL STREET LIGHT CONDUIT IS TO BE PLACED WITHIN 1 FT OF THE FRONT OF THE SIDEWALK IN THE CITY ROW.
28. PHOTOCELL WILL FACE NORTH. VERIFY LUMINAIRE DIRECTION.

DATE: MARCH 2020		<table border="1"> <tr> <th colspan="4">REVISIONS</th> </tr> <tr> <th>REVISION</th> <th>DATE</th> <th>BY</th> <th>COMMENTS</th> </tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </table>				REVISIONS				REVISION	DATE	BY	COMMENTS																
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REVISION	DATE	BY	COMMENTS																										
DRAWING NAME: LP-1																													
DRAWN BY: JRP																													
CHECKED:	APPROVED:	<div style="text-align: center;"> <h1>SARATOGA SPRINGS CITY</h1> </div>			1307 N. COMMERCE DR. #200, SARATOGA SPRINGS, UT 84045 PHONE: 801-766-9793 FAX: 801-766-9794																								



**LP-1**



ANCHOR BASE DETAIL

12" BOLT CIRCLE

ANCHOR BOLTS: 3/4" x 18"

4 BOLTS AT 90° 3/4" DIA. X 18" LONG X 3" HOOK BOLTS TO HAVE A 3 1/2" PROJECTION OUT OF THE CONCRETE. BOLTS TO BE GE GALVANIZED.

#12 STRANDED SINGLE  
WIRE FOR LIGHT

FINISH:  
BLACK

## 14' LOCAL STREET LIGHT

DATE:  
MARCH 2022

DRAWING NAME:  
LP-1A

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

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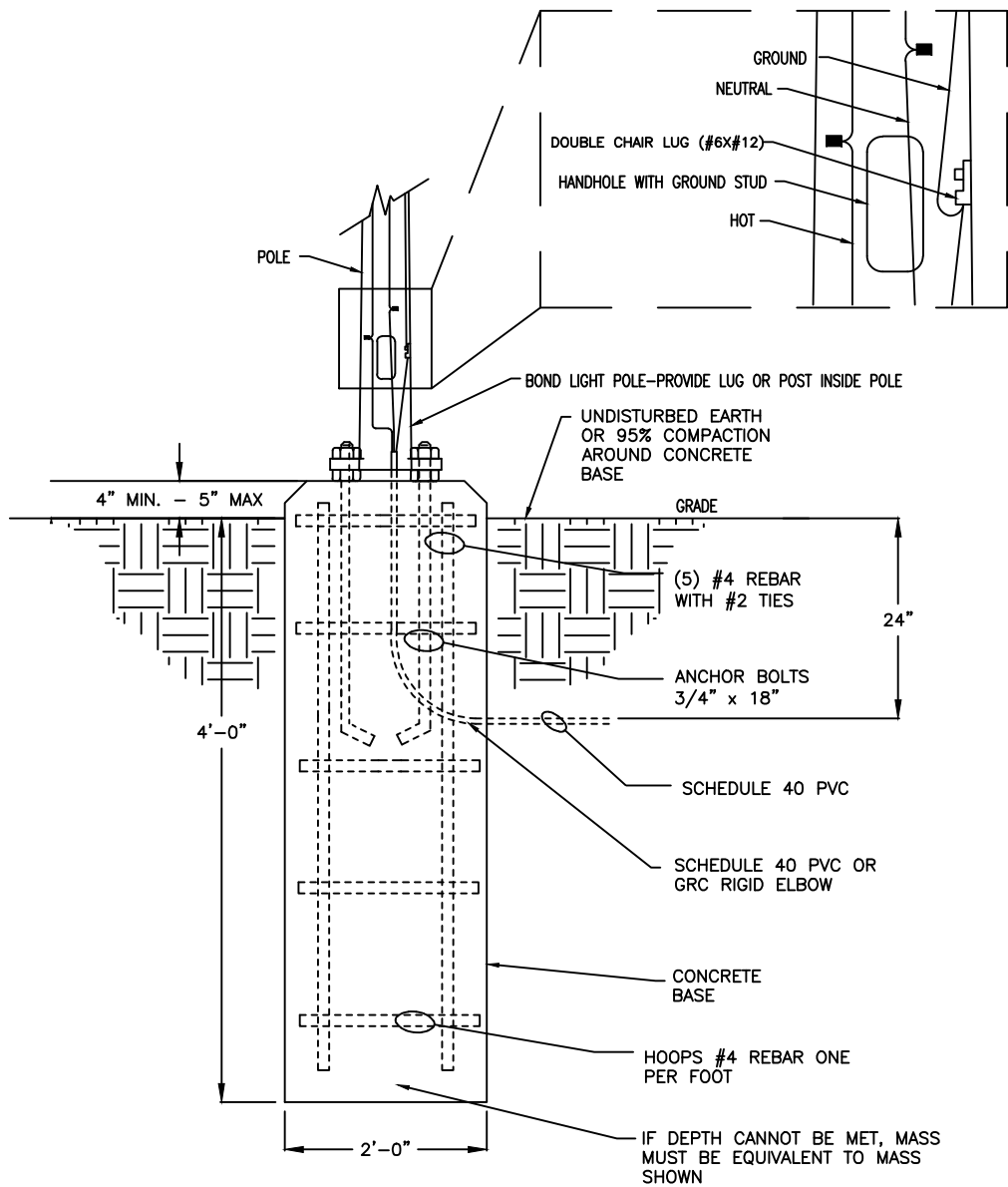
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STANDARD DETAILS

STREET LIGHTS

**LP-1A**



SEE GENERAL NOTES FOR ADDITIONAL REQUIREMENTS

# CONCRETE BASE FOR LOCAL STREET LIGHT

DATE:  
AUGUST 2022

DRAWING NAME:  
LP-1B

DRAWN BY:  
JRP

CHECKED: APPROVED:

## REVISIONS

REVISION	DATE	BY	COMMENTS

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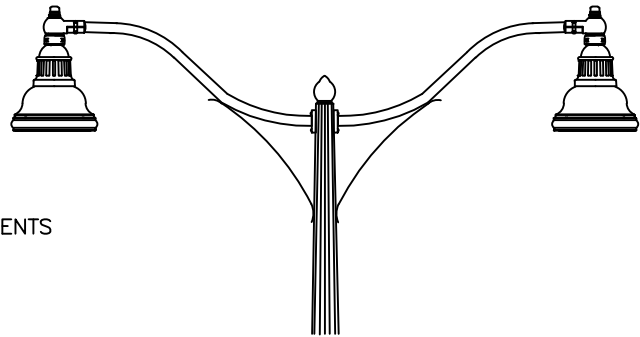


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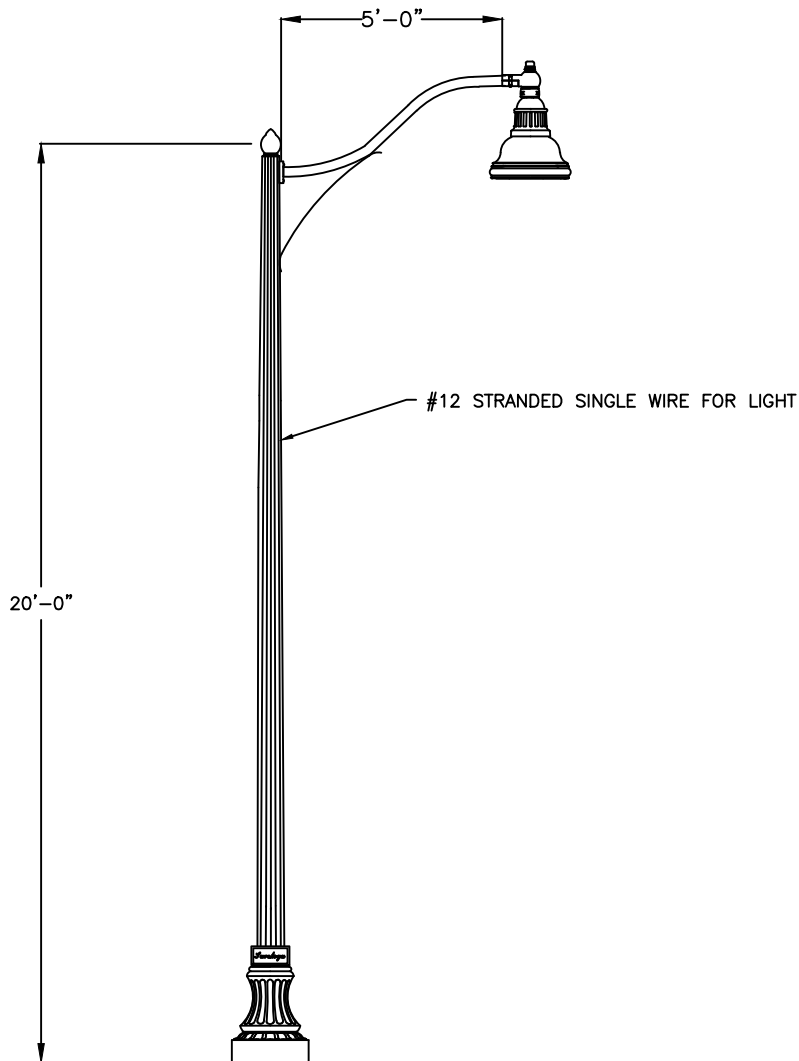
STREET LIGHTS

LP-1B

SEE GENERAL NOTES FOR ADDITIONAL REQUIREMENTS



SHOWN WITH  
DOUBLE FIXTURE



4 BOLTS AT 90 DEGREES  
3/4" DIA x 18" LONG x 3"  
HOOK BOLTS TO HAVE A 3.5"  
PROJECTION OUT OF THE  
CONCRETE. BOLTS TO BE  
GALVANIZED



ANCHOR BASE DETAIL 12"  
BOLT CIRCLE 7/8" x 1"  
HOLES TO ACCOMMODATE  
UP TO 3/4" DIA BOLT

ANCHOR BASE

FINISH: BLACK

## 20' COLLECTOR STREET LIGHT

DATE:  
AUGUST 2022

DRAWING NAME:  
LP-2A

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

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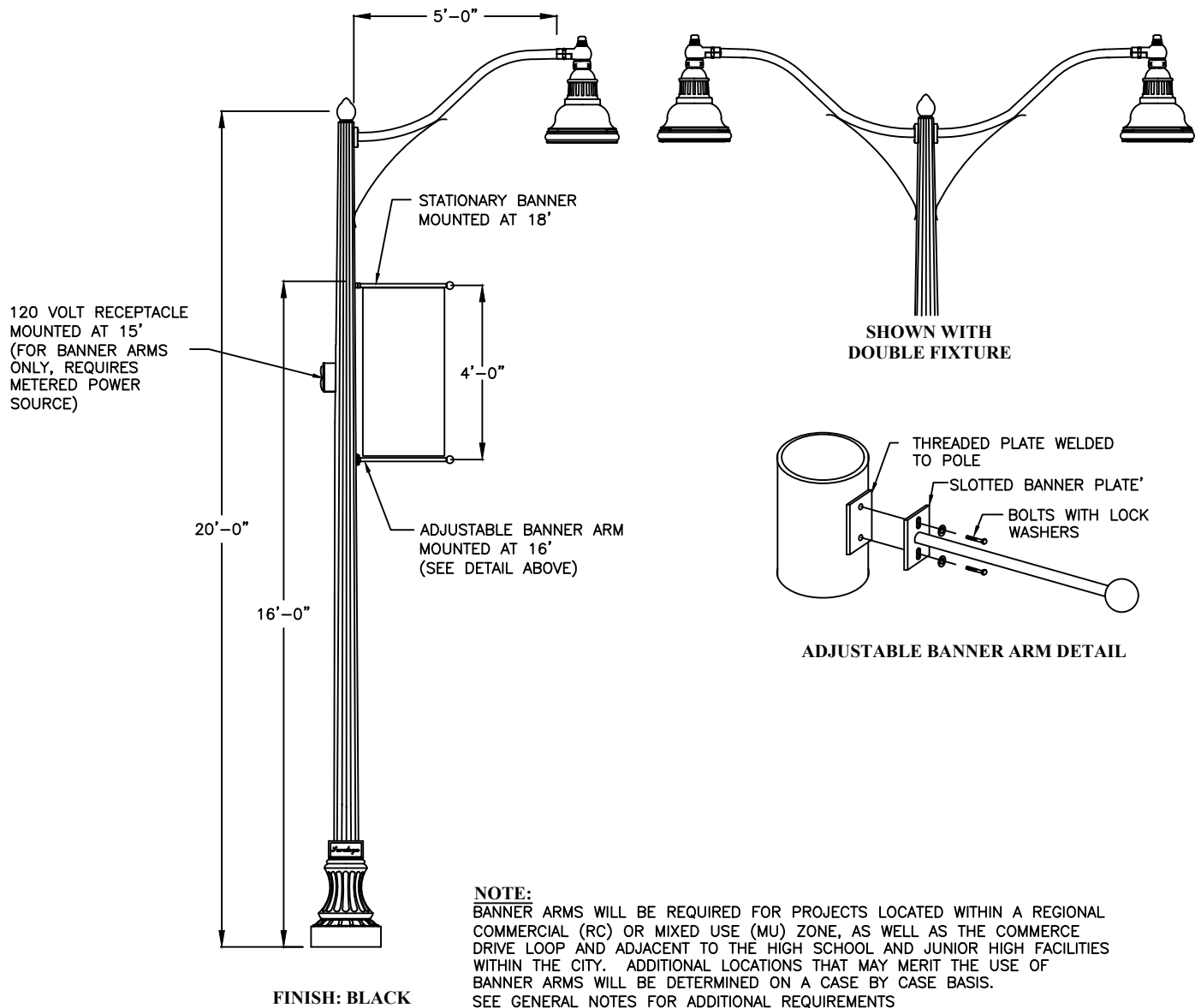
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STANDARD DETAILS

STREET LIGHTS

**LP-2A**



**20' COLLECTOR  
STREET LIGHT  
W/ BANNER ARM FOR  
COLLECTOR ROADS &  
COMMERCIAL AREAS**

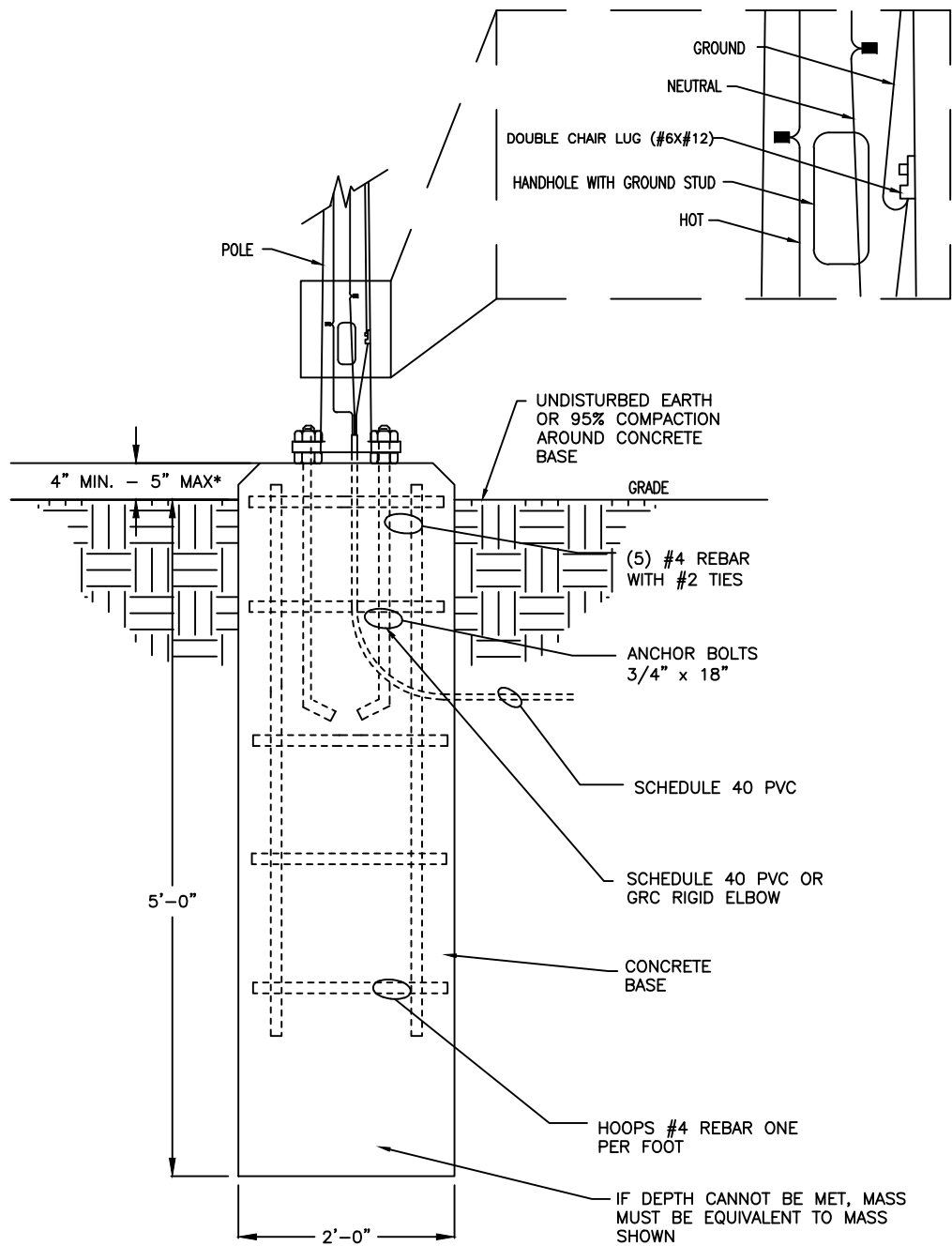
DATE: AUGUST 2022	
DRAWING NAME: LP-2B	
DRAWN BY: ETL	
CHECKED:	APPROVED:

REVISIONS			
REVISION	DATE	BY	COMMENTS
1	08-31-17	RM	ADDED CALLOUTS AND NOTES
2	05-15-20	JRP	REMOVED NOTES
SARATOGA SPRINGS CITY			

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
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FAX: 801-766-9794



STANDARD DETAILS
STREET LIGHTS
<b>LP-2B</b>



SEE GENERAL NOTES FOR ADDITIONAL REQUIREMENTS

# **CONCRETE BASE FOR COLLECTOR STREET LIGHTS**

DATE:  
AUGUST 2022

DRAWING NAME:  
LP-2C

DRAWN BY:  
ETL

CHECKED: APPROVED:

## REVISIONS

REVISION	DATE	BY	COMMENTS
1	08-31-17	RM	DELETED WIRING AND CALLOUTS, NOTES
2	11-15-18	KS	ADDED CALL-OUT FOR DOUBLE CHAIR LUG

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SPRINGS CITY

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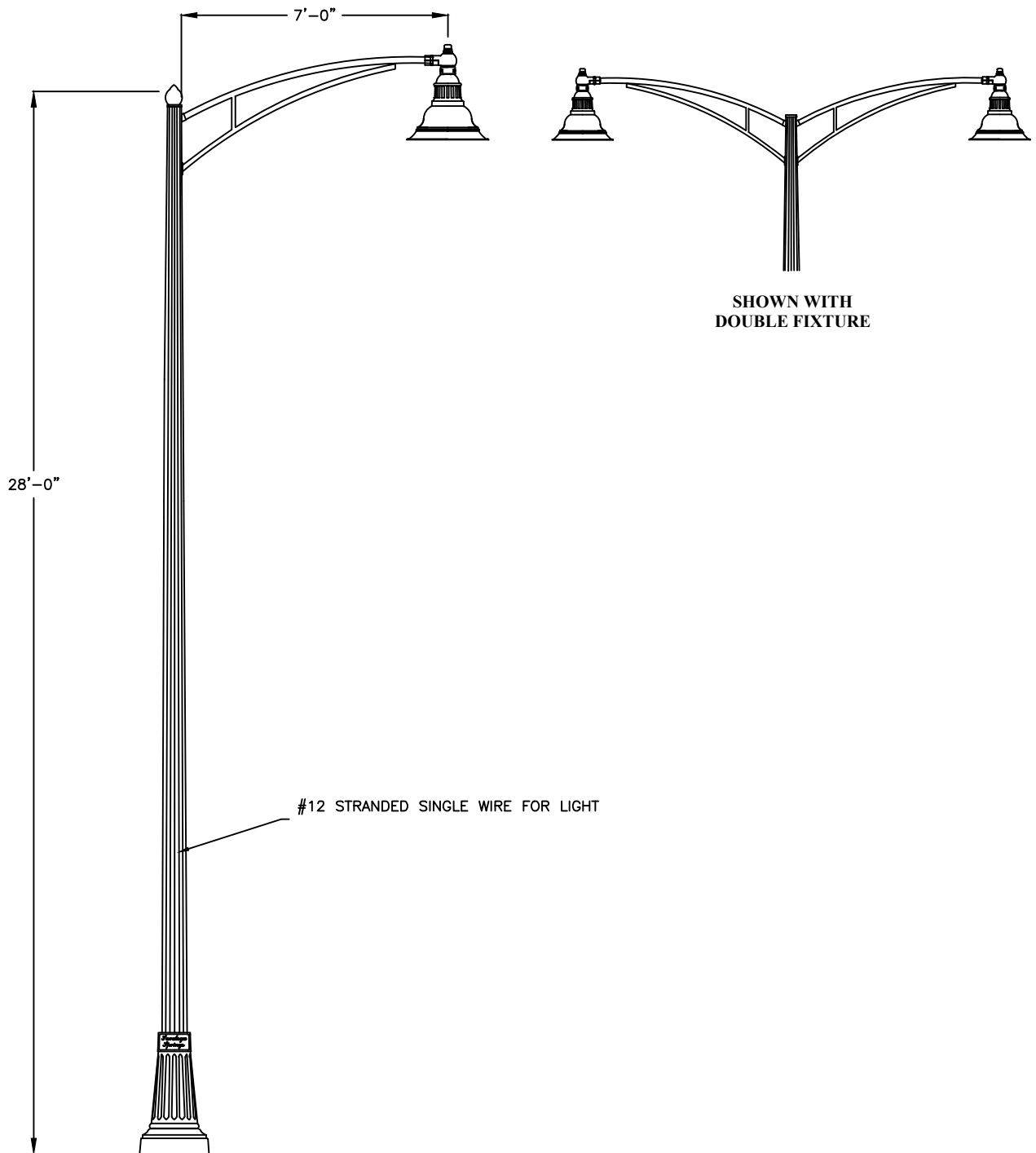


STANDARD DETAILS

STREET LIGHTS

**LP-2C**





FINISH: BLACK SEE GENERAL NOTES FOR ADDITIONAL REQUIREMENTS

## 28' ARTERIAL STREET LIGHT

DATE:  
AUGUST 2022

DRAWING NAME:  
LP-3A

DRAWN BY:  
ETL

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS
1	08-31-17	RM	ADDED CALLOUTS AND NOTES
2	05-15-20	JRP	REMOVED NOTES

SARATOGA  
SPRINGS CITY

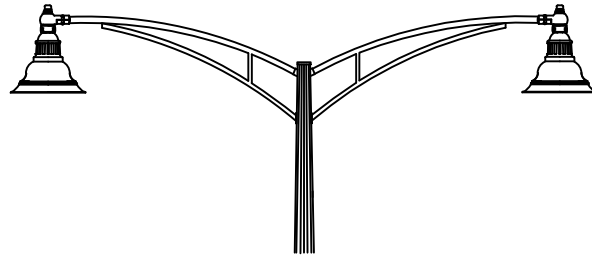
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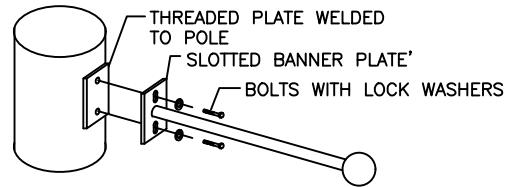
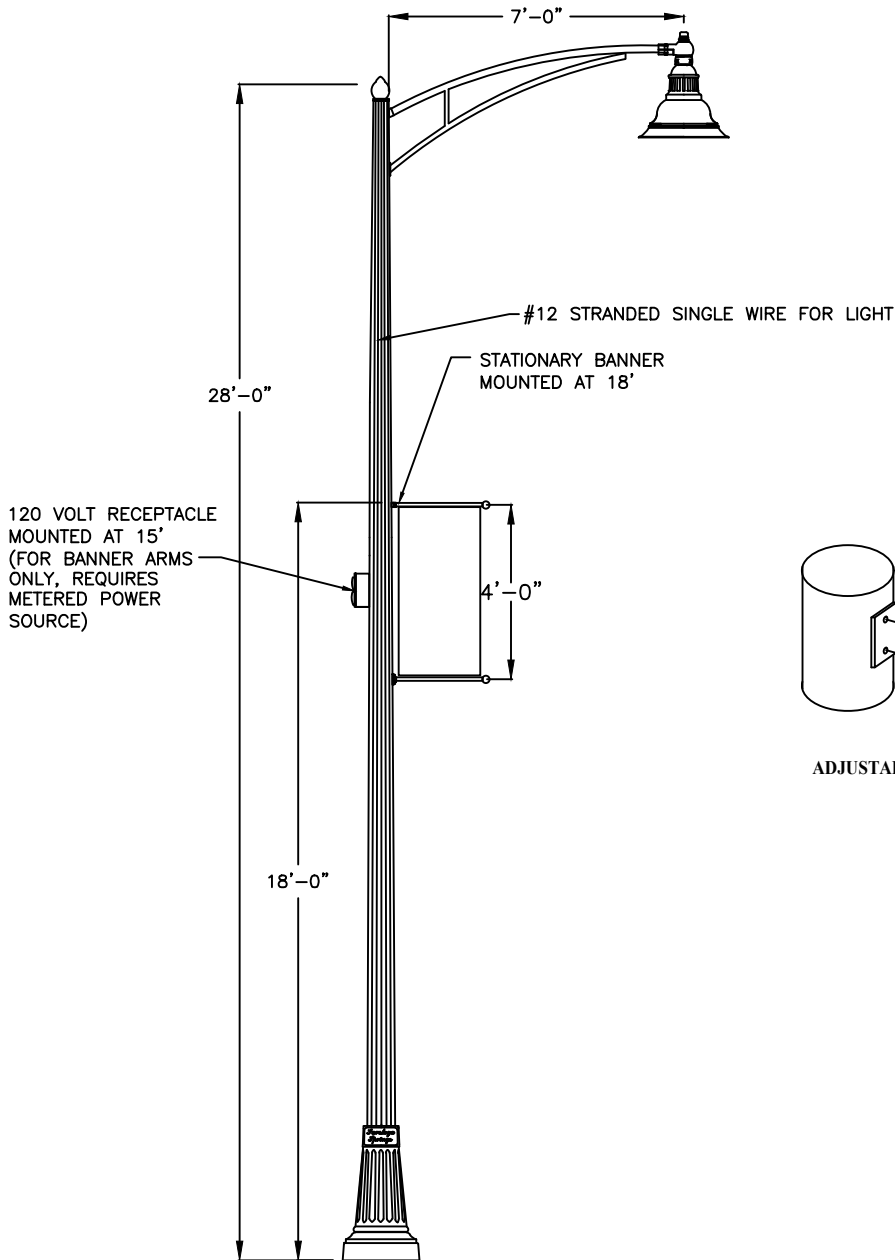
STANDARD DETAILS

STREET LIGHTS

**LP-3A**



SHOWN WITH  
DOUBLE FIXTURE



ADJUSTABLE BANNER ARM DETAIL

SEE GENERAL NOTES FOR ADDITIONAL REQUIREMENTS

## 28' ARTERIAL STREET LIGHT WITH BANNER ARM

DATE:  
AUGUST 2022

DRAWING NAME:  
LP-3B

DRAWN BY:  
ETL

CHECKED: APPROVED:

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REVISION	DATE	BY	COMMENTS
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2	05-15-20	JRP	REMOVED NOTES

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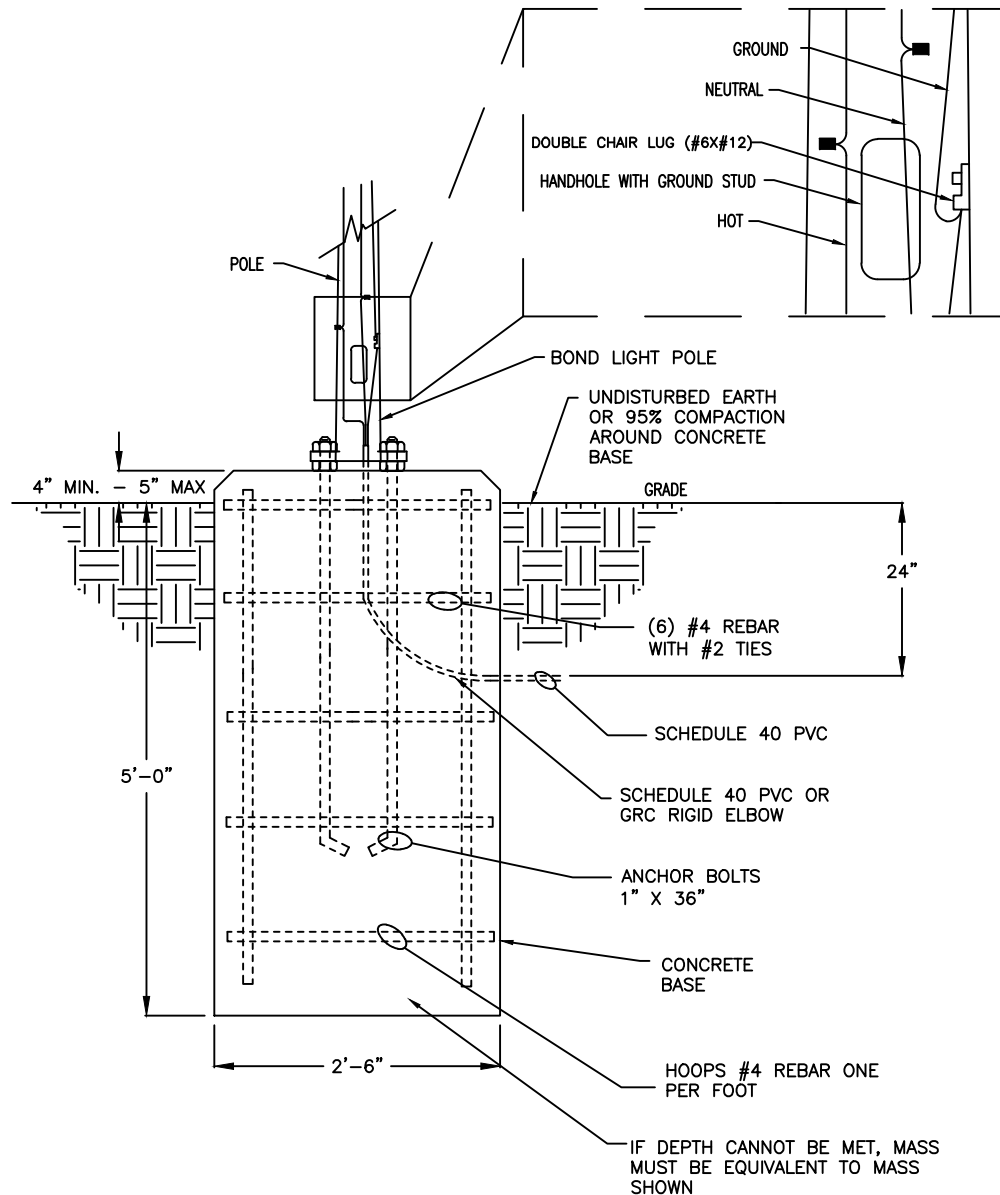
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STANDARD DETAILS

STREET LIGHTS

LP-3B



SEE GENERAL NOTES FOR ADDITIONAL REQUIREMENTS

# **CONCRETE BASE FOR ARTERIAL STREET LIGHT**

DATE:  
AUGUST 2022

DRAWING NAME:  
LP-3C

DRAWN BY:  
ETL

CHECKED: APPROVED:

## REVISIONS

REVISION	DATE	BY	COMMENTS
1	08-31-17	RM	DELETED WIRING AND CALLOUTS, NOTES
2	11-15-18	KS	ADDED CALL-OUT FOR DOUBLE CHAIR LUG

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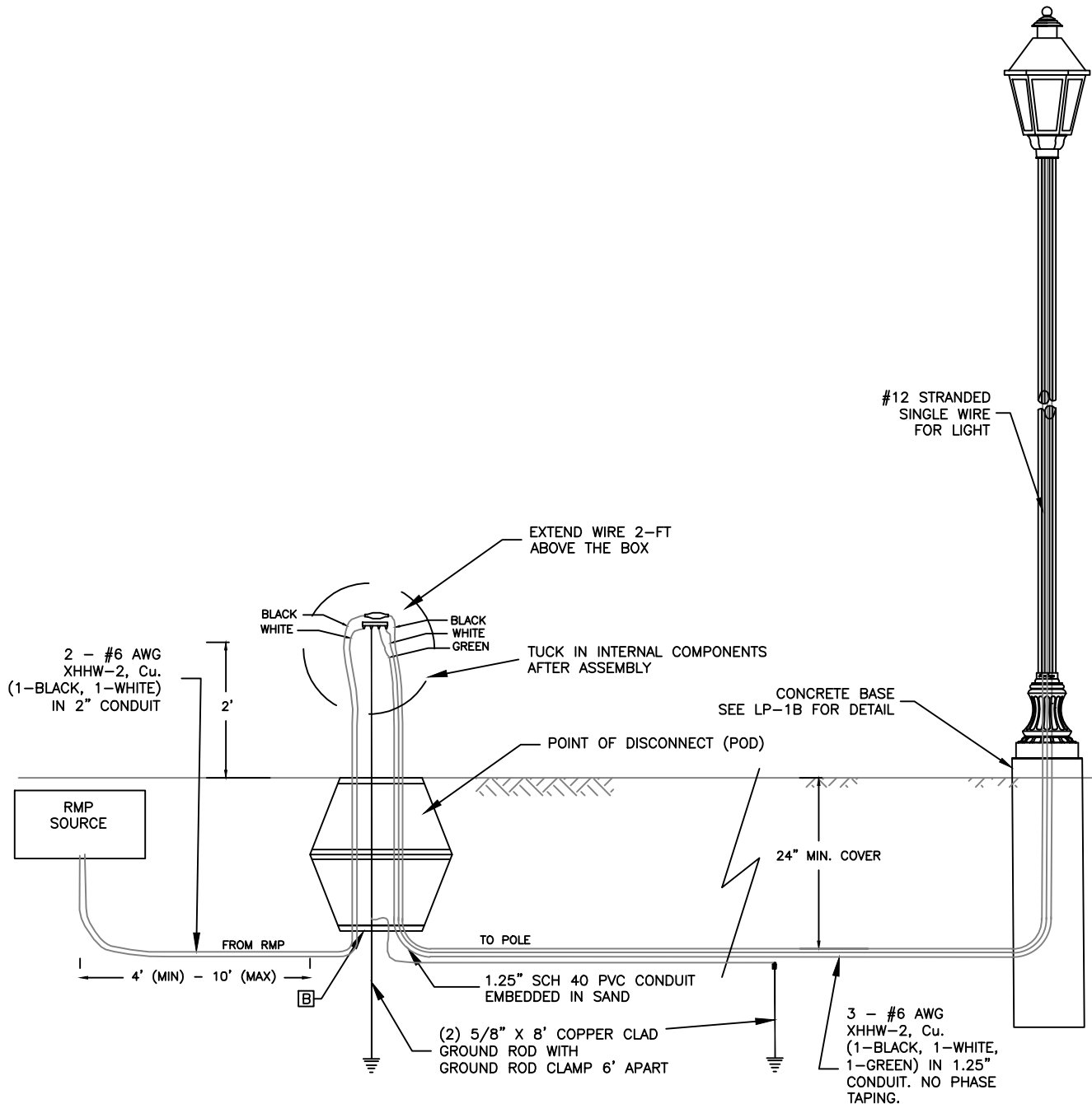


STANDARD DETAILS

STREET LIGHTS

**LP-3C**

SEE GENERAL NOTES FOR ADDITIONAL REQUIREMENTS



# **LOCAL STREET LIGHT CONNECTION**

DATE:  
AUGUST 2022

DRAWING NAME:  
LP-4

DRAWN BY:  
JRP

CHECKED: APPROVED:

## REVISIONS

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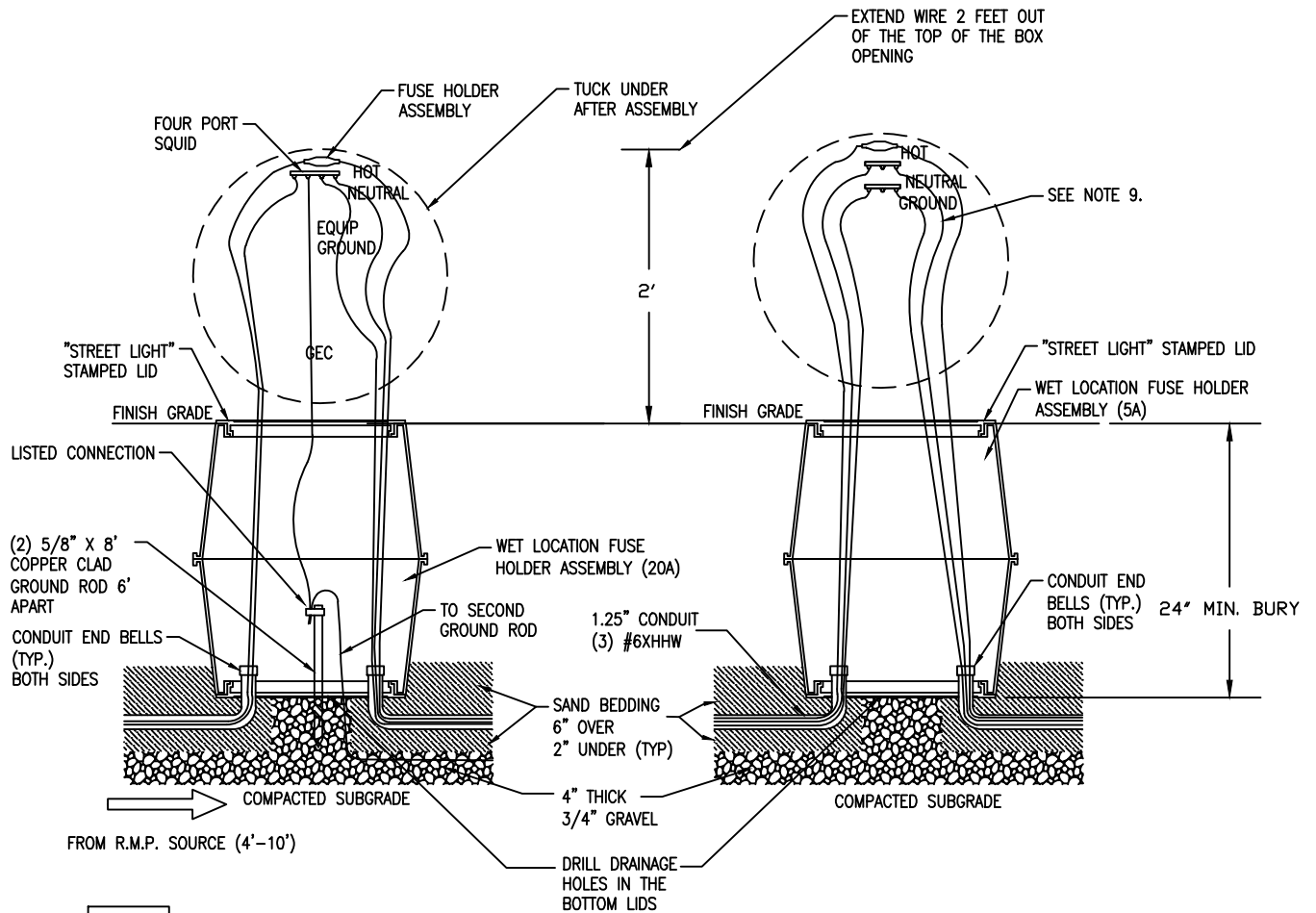


STANDARD DETAILS

STREET LIGHTS

**LP-4**





**A**

**POINT OF DISCONNECT (POD) DETAIL**

**B**

**LIGHT POLE FUSE BOX DETAIL**

SEE GENERAL NOTES FOR ADDITIONAL REQUIREMENTS

## LIGHT POLE BELOW GRADE BOXES INSTALLATION

DATE:  
AUGUST 2022

DRAWING NAME:  
LP-6

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

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SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
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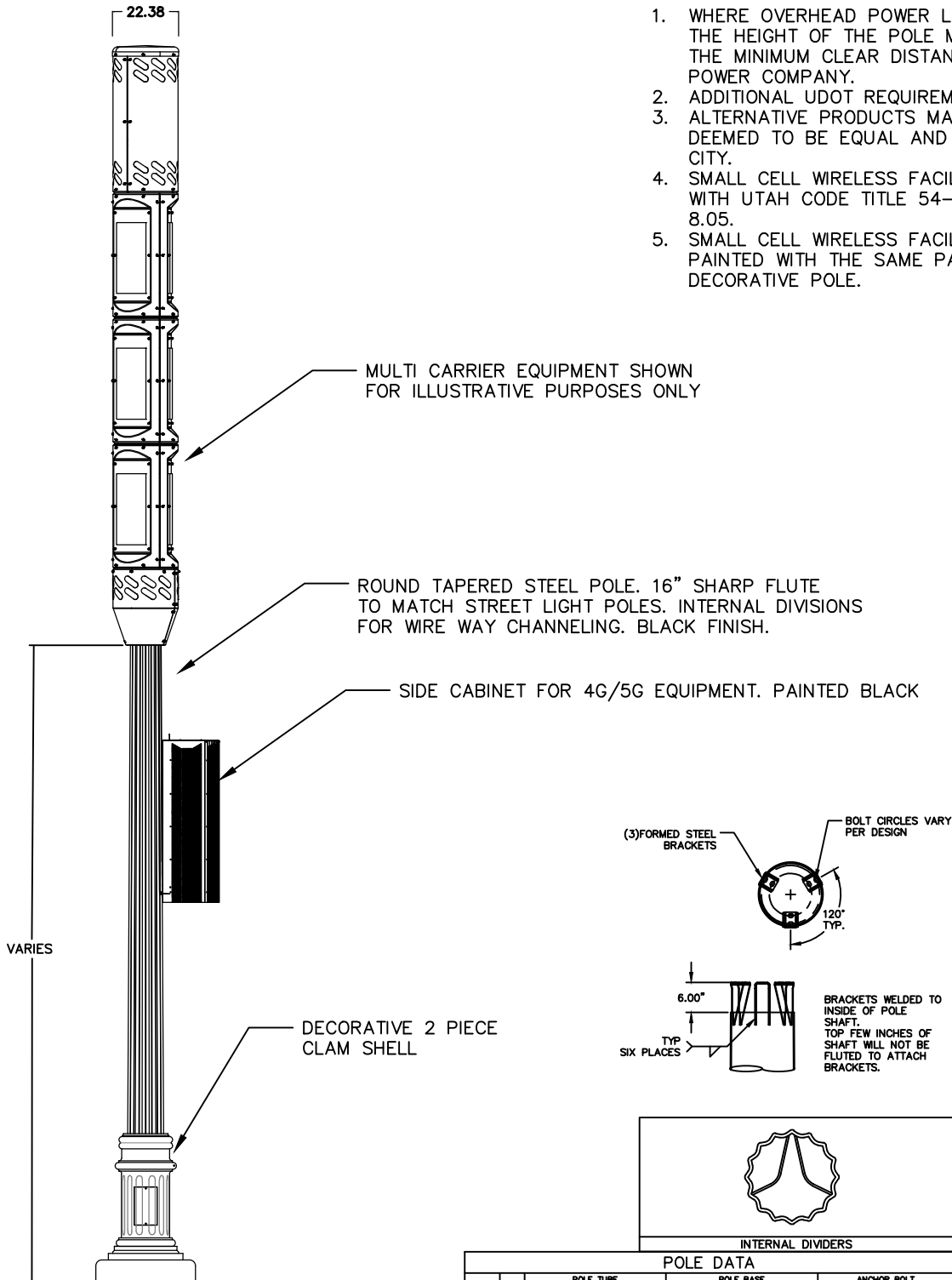
STANDARD DETAILS

LANDSCAPING

**LP-6**

# NOTES:

1. WHERE OVERHEAD POWER LINES WILL REMAIN, THE HEIGHT OF THE POLE MAY BE REDUCED TO THE MINIMUM CLEAR DISTANCE SPECIFIED BY THE POWER COMPANY.
2. ADDITIONAL UDOT REQUIREMENTS MAY APPLY.
3. ALTERNATIVE PRODUCTS MAY BE SUBSTITUTED IF DEEMED TO BE EQUAL AND APPROVED BY THE CITY.
4. SMALL CELL WIRELESS FACILITIES TO COMPLY WITH UTAH CODE TITLE 54-21 AND CITY CODE 8.05.
5. SMALL CELL WIRELESS FACILITIES SHALL BE PAINTED WITH THE SAME PAINT AS THE DECORATIVE POLE.



INTERNAL DIVIDERS													
POLE DATA													
		POLE TUBE			POLE BASE					ANCHOR BOLT			
ITEM	QTY.	BASE DIA. (N)	TOP DIA. (N)	LENGTH (FT)	GAUGE OR THK. (N)	SQUARE "S" (N)	BOLT CIRCLE "M" (N)	THK. "M" (N)	HOLE "Z" (N)	DIA. "H" (N)	LENGTH "J" (N)	HOOK OR THREAD "H" (N)	THREAD LENGTH "U" (N)
1	1	13.00	10.20	20.00	7	18.00	17.00	1.50	1.50	1.25	42.00	6.00	6.00

**WIRELESS SUPPORT  
STRUCTURE-MONOPOLE  
FOR SMALL CELL  
WIRELESS FACILITIES**

DATE:  
MARCH 2022

DRAWING NAME:  
LP-6A

DRAWN BY:  
JRP

CHECKED: APPROVED:

## REVISIONS

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STANDARD DETAILS

STREET LIGHTS

**LP-6A**

# STANDARD LANDSCAPING DETAILS

## INDEX:

- LS-1 SPRINKLER SYSTEM MAINLINE ISOLATION VALVE 4" & LARGER
- LS-2 SPRINKLER SYSTEM QUICK COUPLER VALVE
- LS-3 SPRINKLER SYSTEM REMOTE CONTROL VALVE
- LS-4 METER & CONTROLLER STAINLESS STEEL ENCLOSURE
- LS-5 SATELLITE STAINLESS STEEL CONTROLLER ENCLOSURE
- LS-6 SPRINKLER SYSTEM LARGE ROTARY HEAD
- LS-7 MEDIUM & SMALL AREA SPRINKLER HEAD
- LS-8 SPRINKLER SYSTEM MANUAL DRAIN
- LS-9 SPRINKLER SYSTEM SLEEVING
- LS-10 SPRINKLER SYSTEM PIPE/TRENCH
- LS-11 SPRINKLER SYSTEM PIPE AND WIRE TRENCH
- LS-12 SPRINKLER SYSTEM AUTOMATIC DRAIN
- LS-13 TREE STAKING AND PLANTING
- LS-14 VINYL FENCE WITH MOW STRIP
- LS-15 CONCRETE MOW CURB
- LS-16 DRIP IRRIGATION

**LANDSCAPING DETAILS**

DATE:  
MARCH 2022

DRAWING NAME:  
LS-0

DRAWN BY:  
JRP

CHECKED: APPROVED:

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STANDARD DETAILS

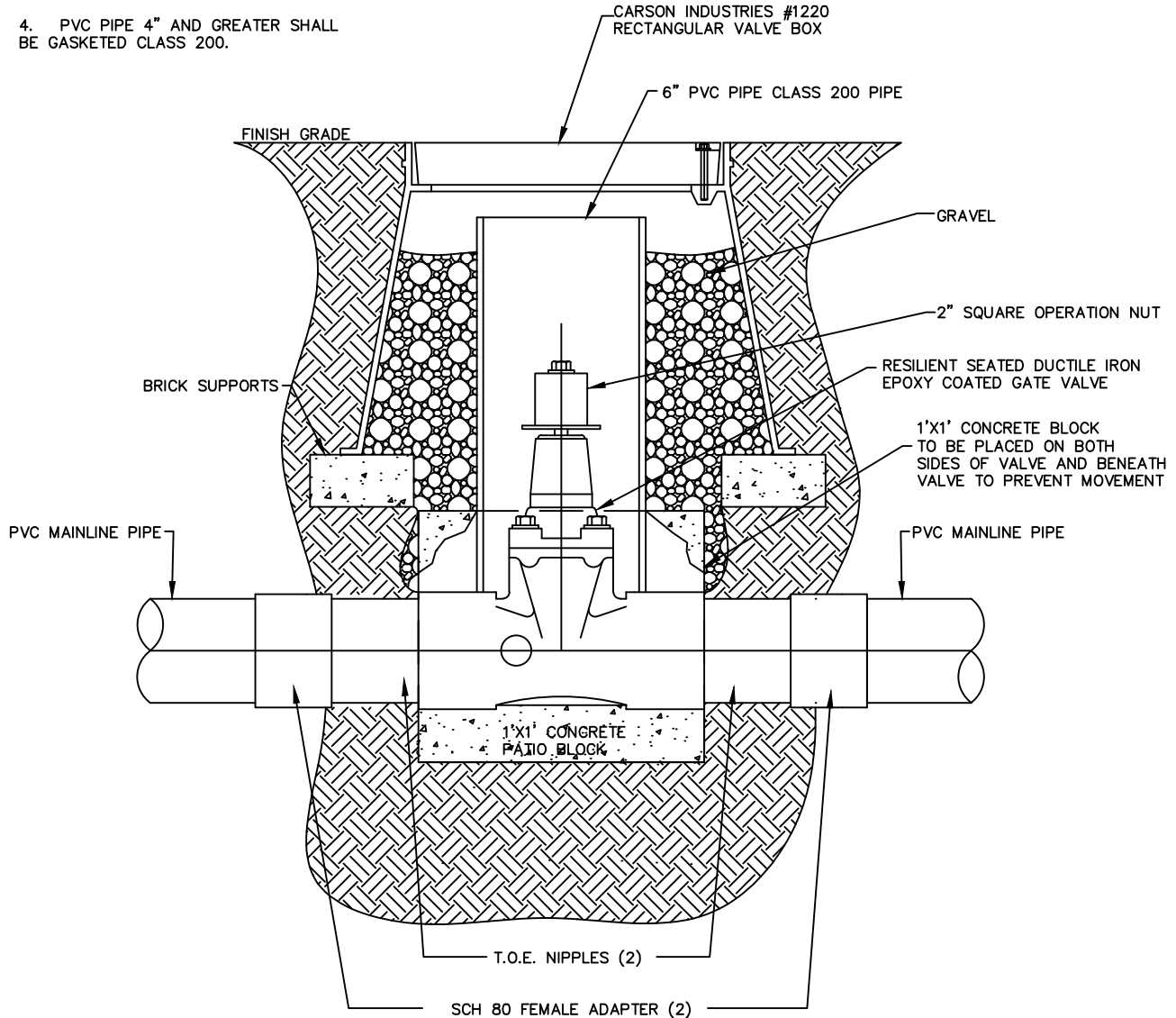
LANDSCAPING

**LS-0**



**NOTE:**

1. GATE VALVE SHALL MATCH NOMINAL SIZE OF MAINLINE PIPE.
2. NO MALE ADAPTORS.
3. VALVES SMALLER THAN 4 INCHES SHALL BE BRASS FULL THROAT GATE VALVES.
4. PVC PIPE 4" AND GREATER SHALL BE GASKETED CLASS 200.



**MAINLINE ISOLATION VALVE**

**SPRINKLER SYSTEM  
MAINLINE ISOLATION  
VALVE 4" AND LARGER**

DATE:  
MARCH 2022

DRAWING NAME:  
LS-1

DRAWN BY:  
JRP

CHECKED: APPROVED:

REVISIONS

REVISION	DATE	BY	COMMENTS

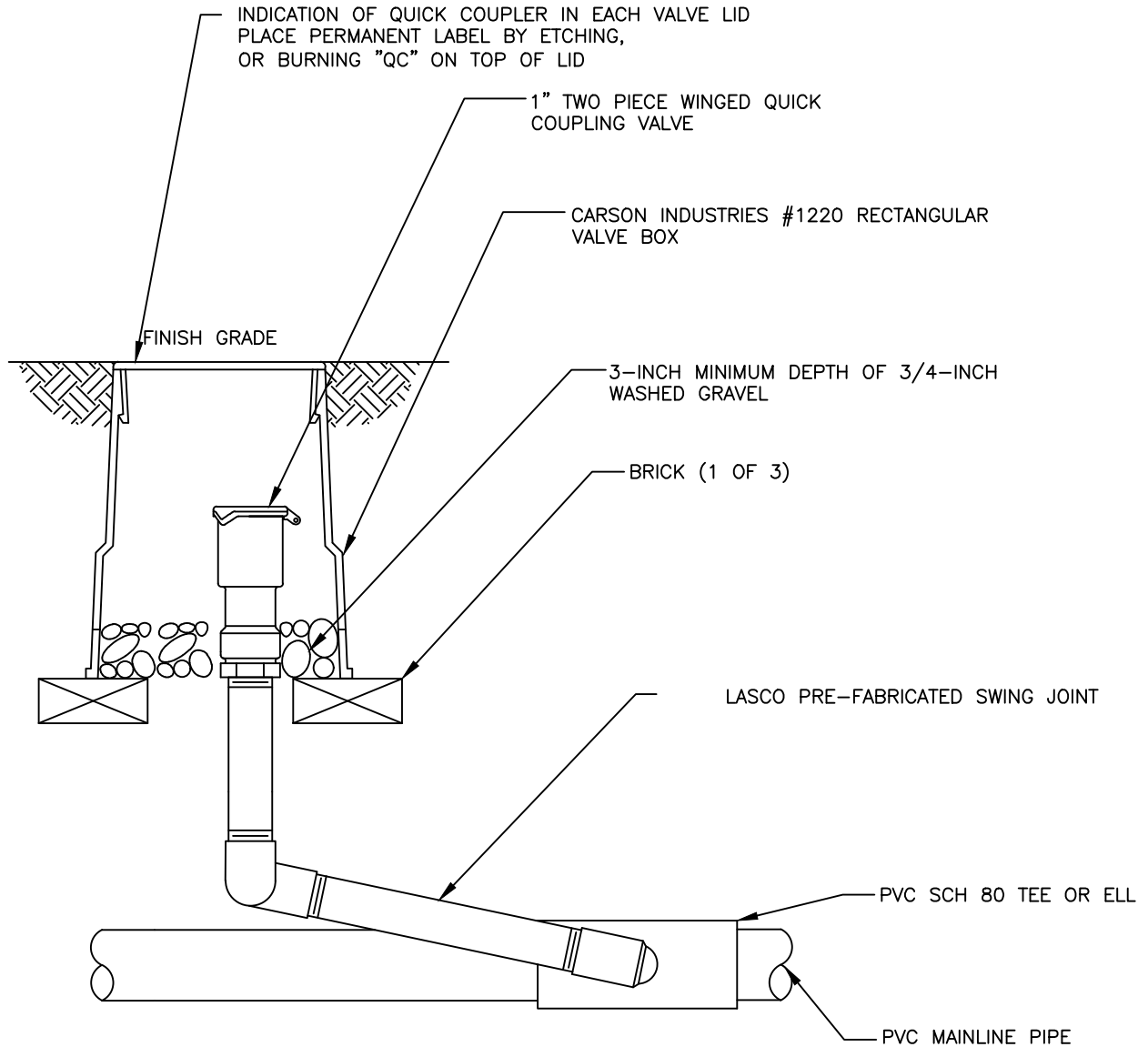
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STANDARD DETAILS

LANDSCAPING

**LS-1**



# **SPRINKLER SYSTEM QUICK COUPLER VALVE**

DATE:  
MARCH 2022

DRAWING NAME:  
LS-2

DRAWN BY:  
JRP

CHECKED: APPROVED:

## REVISIONS

REVISION	DATE	BY	COMMENTS

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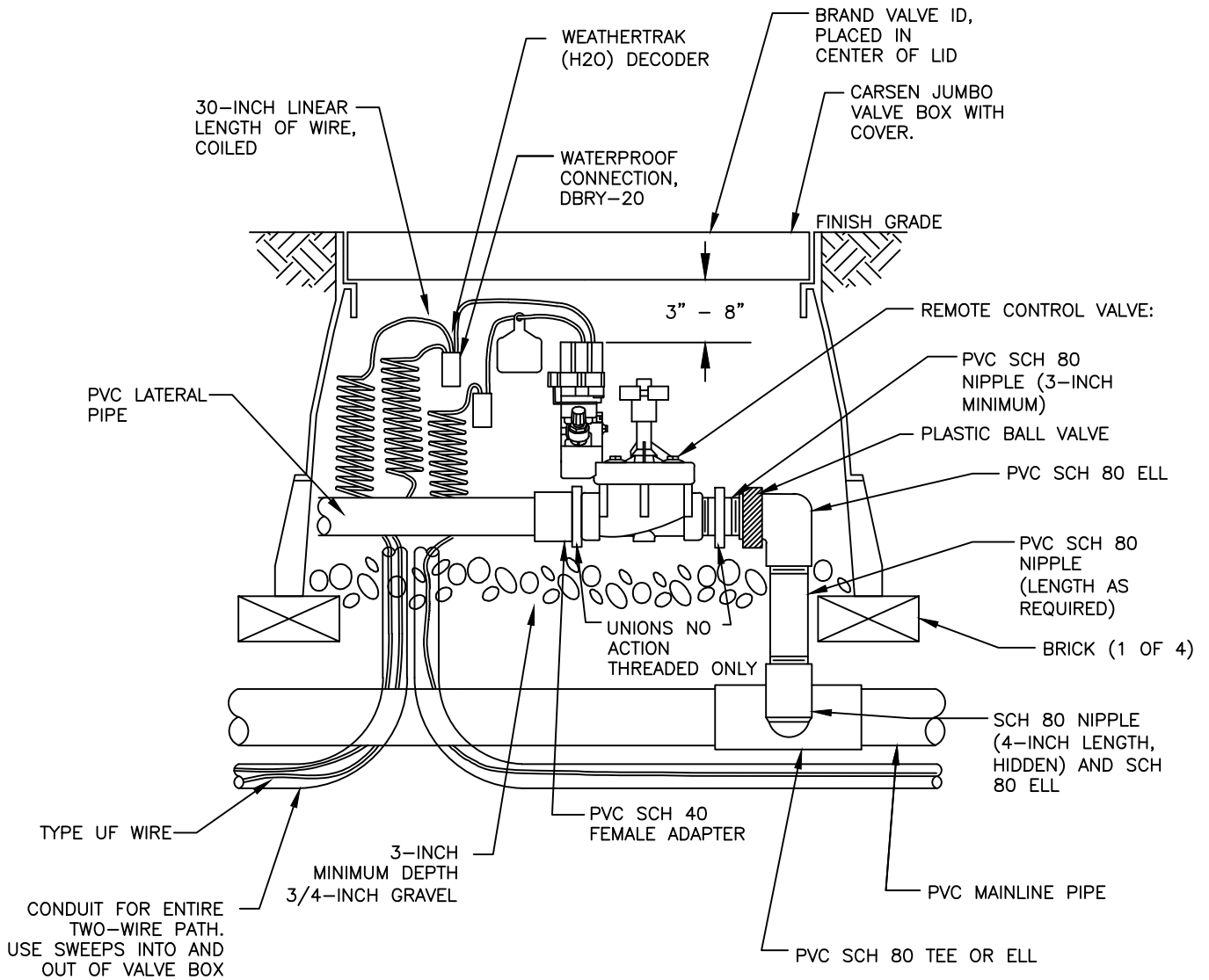
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STANDARD DETAILS

LANDSCAPING

**LS-2**



#### NOTES:

1. NO MALE ADAPTORS.
2. 1 VALVE PER BOX.
3. PLACE 3 FEET OF EXTRA WIRE IN EVERY VALVE BOX FOR EASIER SERVICING
4. VALVE ID:  
 VALVE = V - (ZONE#)  
 QUICK COUPLER = QC  
 GROUNDING = G  
 ISOLATION VALVE = ISO  
 HYDROMETER = HM  
 MASTER VALVE = MV  
 WIRE JUNCTION BOX = JB

## SPRINKLER SYSTEM REMOTE CONTROL VALVE

DATE:  
MARCH 2022

DRAWING NAME:  
LS-3

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS
1	08-31-17	RM	EDITED NOTES AND CALLOUTS

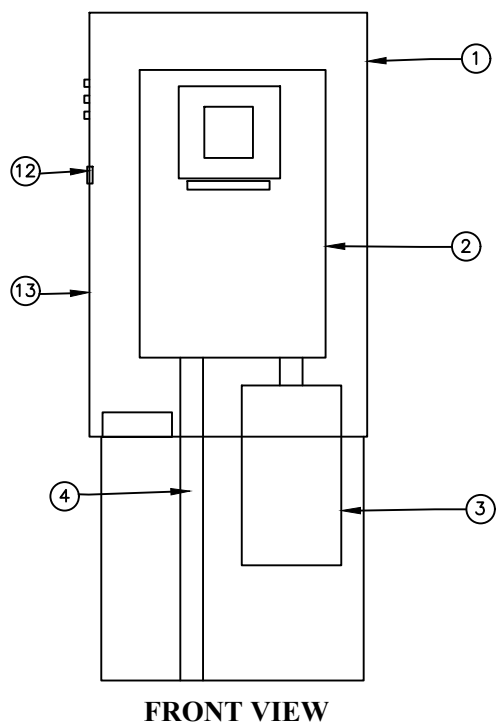
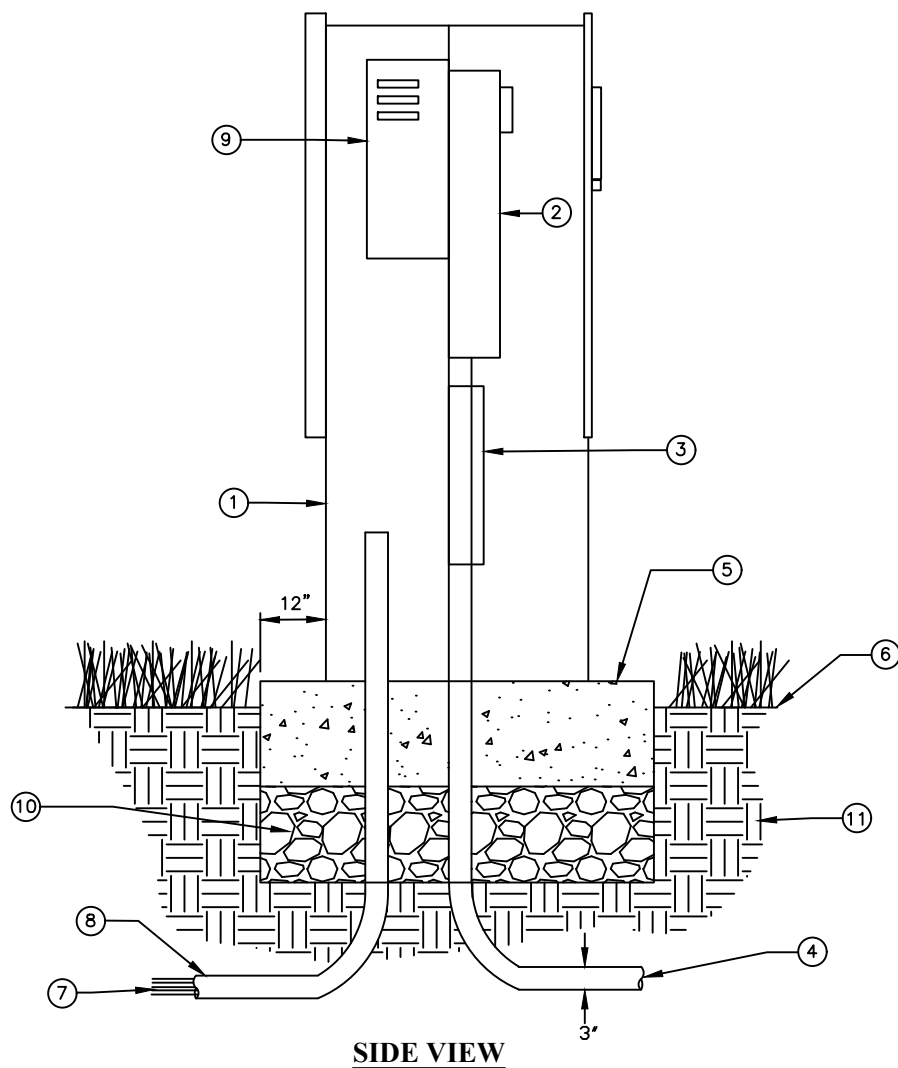
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STANDARD DETAILS

LANDSCAPING

LS-3



**NOTE:**

GROUND LOW  
VOLTAGE WITH 3  
GROUND ROD GRID 8  
FEET APART

- |  |  |
|--|--|
| <p>① METERED CONTROLLER ENCLOSURE, MUST BE RMP APPROVED</p> <p>② METER SOCKET WITH TEST BLOCKS</p> <p>③ LOAD CENTER</p> <p>④ CONDUIT (NOT SUPPLIED) FOR LINE FEED INTO METER; 3" (MIN) SCH 40 GREY</p> <p>⑤ POURED CONCRETE BASE 4" MIN. THICKNESS, EXTEND 12" BEYOND OUTSIDE DIMENSIONS OF ENCLOSURE WITH 0.5% MIN. SLOPE FOR DRAINAGE</p> <p>⑥ FINISH GRADE</p> <p>⑦ DIRECT BURIAL CONTROL WIRES TO CONTROL VALVES</p> | <p>⑧ PVC LONG SWEEP ELL – USE ONE SWEEP 3" ELL PER CONTROLLER INSTALL ONE EXTRA 3" ELL FOR FUTURE USE</p> <p>⑨ AUTOMATIC CONTROLLERS – REMOVE FRONT DOORS OF CONTROLLERS AND PLACE SIDE BY SIDE; HUNTER ACC W/ ALL IMMS RADIO CONTROL AND COMMUNICATION DEVICES</p> <p>⑩ 6" MIN. ROAD BASE</p> <p>⑪ SUBGRADE COMPACTED TO 95%</p> <p>⑫ INSTALL SMART PORT THROUGH WALL OF STRONG BOX.</p> <p>⑬ ENCLOSURE TO BE STAINLESS STEEL STRONG BOX, OR ACCEPTABLE EQUAL</p> |
|--|--|

**METER & CONTROLLER  
STAINLESS STEEL  
ENCLOSURE**

DATE:  
MARCH 2022

DRAWING NAME:  
LS-4

DRAWN BY:  
JRP

CHECKED: APPROVED:

REVISIONS

REVISION	DATE	BY	COMMENTS

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STANDARD DETAILS

LANDSCAPING

**LS-4**

FIELD SATELLITE CONTROLLER,  
LOCKING CONTROL BOX

AUTOMATIC CONTROLLER;  
WEATHER TRAK PRO 3 H<sub>2</sub>O  
CONTROLLER

STAINLESS STEEL STRONG BOX ENCLOSER,  
MODEL # SB-18 SS WEATHERTRAK  
OR ACCEPTABLE EQUAL

INSTALL WEATHER TRAK  
PEDESTAL PER CITY STANDARDS

4" THICK CONCRETE PAD W/  
6" ROAD BASE

FINISH GRADE

3-INCH PVC SCH 40 CONDUIT,  
FITTINGS AND SWEEP ELL

DIRECT BURIAL CONTROL WIRES  
TO REMOTE CONTROL VALVES 2  
WIRE JACKET

1-INCH PCV SHC 40 GREY  
CONDUIT, FITTINGS AND SWEEP  
ELL TO POWER SUPPLY

1-INCH PVC SCH 40  
CONDUIT, FITTINGS AND SWEEP  
ELL FOR ETHERNET WIRE

1-INCH PVC SCH 40 CONDUIT,  
FITTINGS AND SWEEP ELL FOR  
#6 GROUND WIRE

#### NOTE:

INSTALL WEATHER TRAK PRO 3, WITH ALL COMPONENTS  
FOR CENTRAL CONTROL AND 2 WIRE DECODER OPERATION  
(PRO 3, 2 WIRE SINGLE STATION DECODER).

GROUND ROD AND PLATE SEPARATED BY 8'. FOLLOW  
WEATHER TRAK STANDARDS FOR INSTALLATION.

## SATELLITE STAINLESS STEEL CONTROLLER ENCLOSURE

DATE:  
MARCH 2022

DRAWING NAME:  
LS-5

DRAWN BY:  
JRP

CHECKED: APPROVED:

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REVISION	DATE	BY	COMMENTS

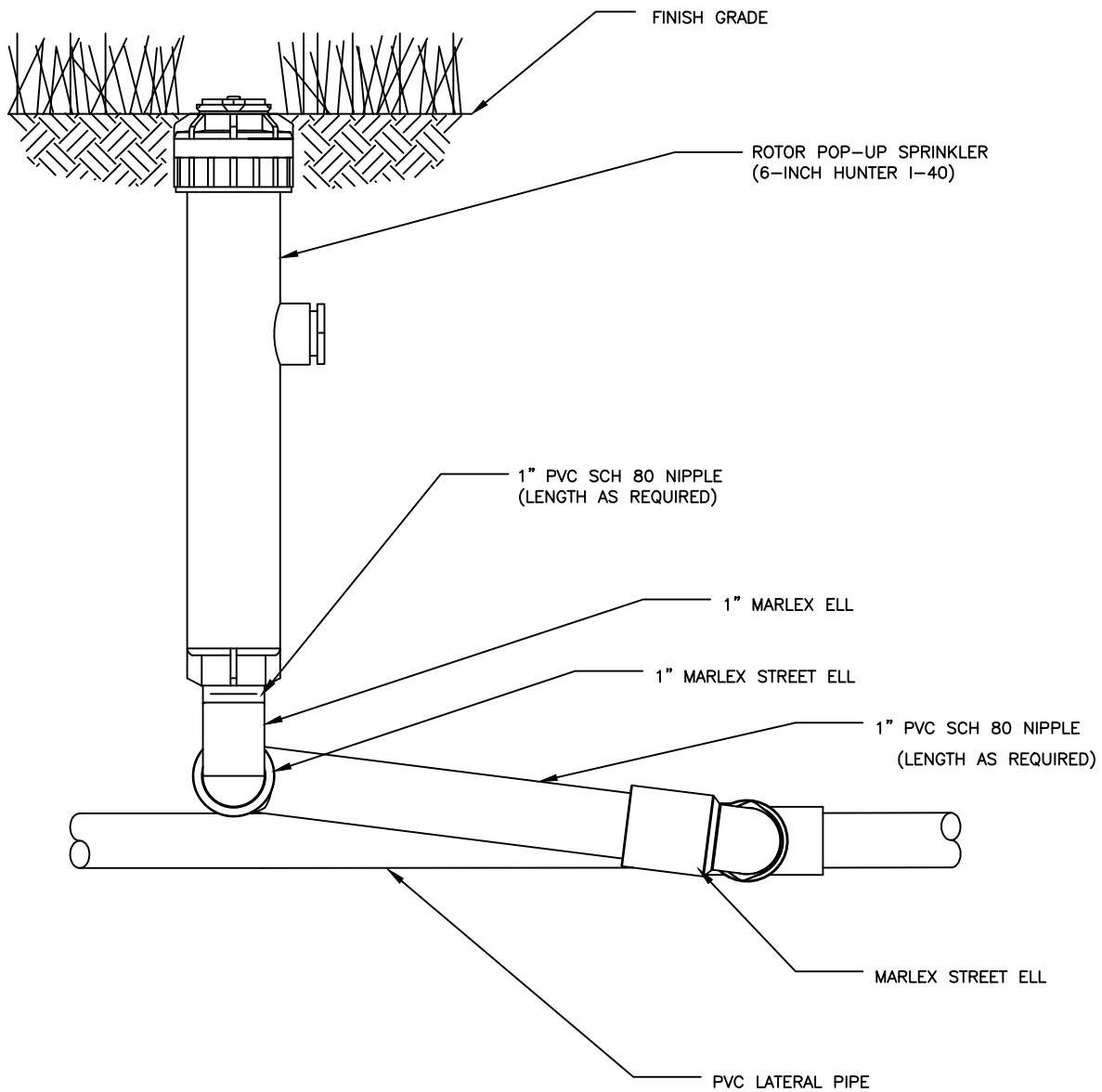
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STANDARD DETAILS

LANDSCAPING

**LS-5**



**NOTE:**

1. USE MARLEX STREET ELL
2. USE OF TEFLON TAPE OR PIPE DOPE IS NOT PERMITTED ON MARLEX STREET ELLS

**SPRINKLER SYSTEM  
LARGE AREA  
ROTARY HEAD**

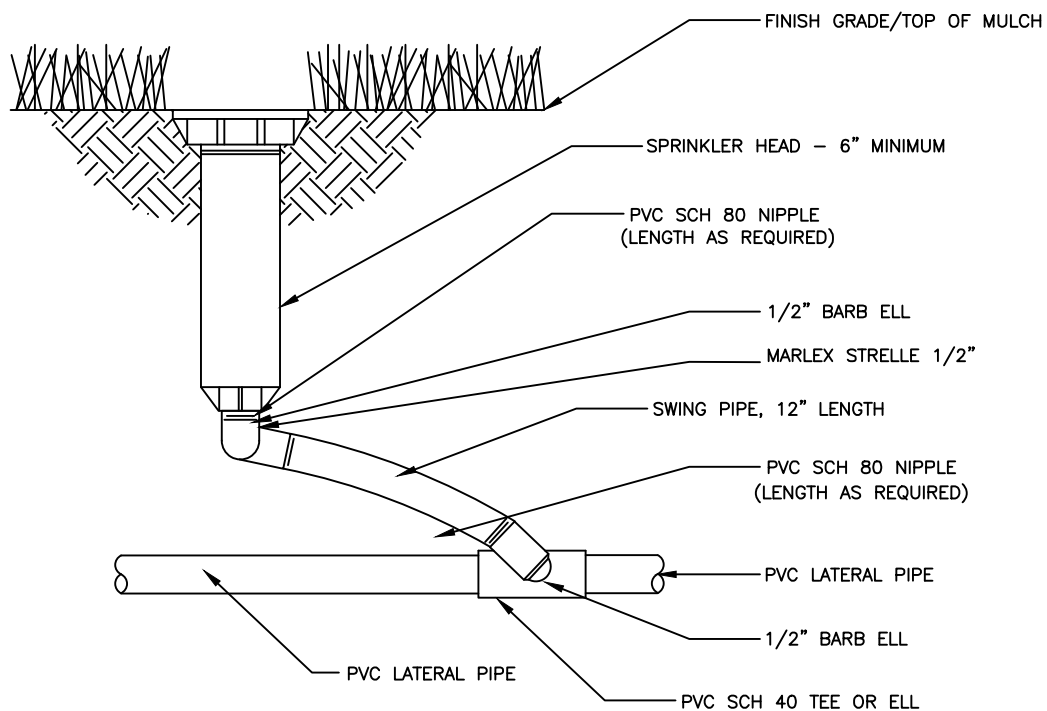
DATE: MARCH 2022		REVISIONS			
DRAWING NAME: LS-6		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:	SARATOGA SPRINGS CITY			
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STANDARD DETAILS

LANDSCAPING

**LS-6**



### ROTORS FOR MEDIUM AND SMALL AREAS:

HUNTER I-20 @ 30' MAXIMUM SPACING.

### SPRAY HEADS FOR SMALL AREAS:

6" HUNTER PRS 40-CV FOR TURF AREAS, 12" PRS 40-OCV FOR SHRUB BEDS.

## MEDIUM AND SMALL AREA SPRINKLER HEAD

DATE:  
MARCH 2022

DRAWING NAME:  
LS-7

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

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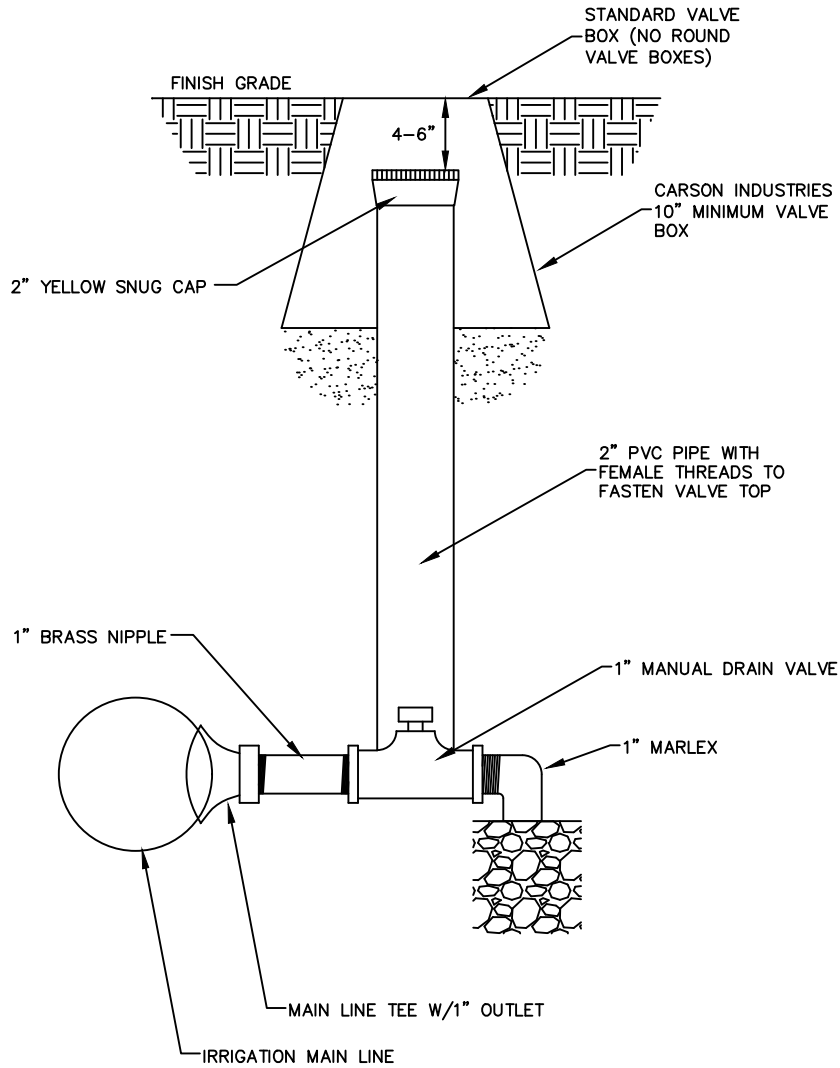
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STANDARD DETAILS

LANDSCAPING

**LS-7**



## SPRINKLER SYSTEM MANUAL DRAIN

DATE:  
MARCH 2022

DRAWING NAME:  
LS-8

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

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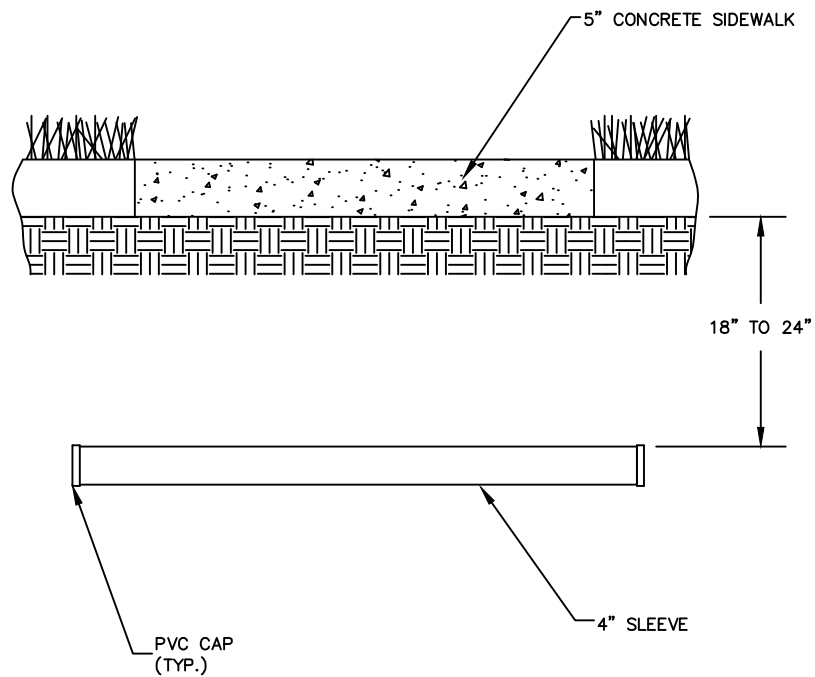
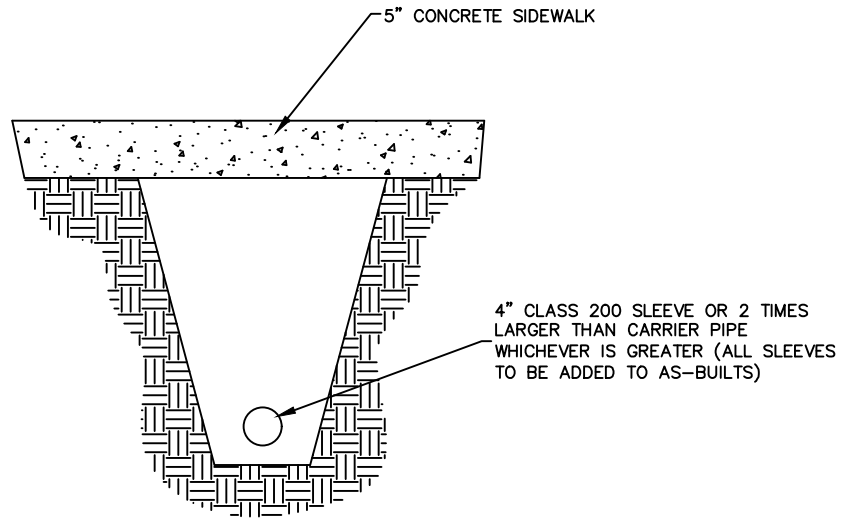


STANDARD DETAILS

LANDSCAPING

**LS-8**





**NOTES:**

1. ONE WATER LINE PER SLEEVE.
2. ELECTRICITY AND WATER NOT TO SHARE SLEEVES.

**SPRINKLER SYSTEM  
SLEEVING**

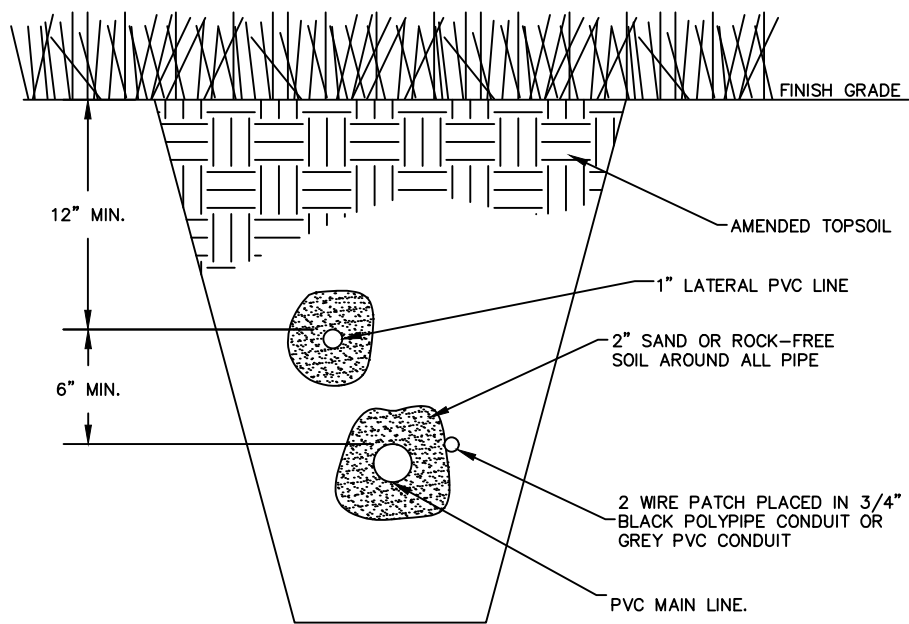
DATE: MARCH 2022		REVISIONS			
DRAWING NAME: LS-9		REVISION	DATE	BY	COMMENTS
DRAWN BY: JRP					
CHECKED:	APPROVED:	SARATOGA SPRINGS CITY			
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STANDARD DETAILS

LANDSCAPING

**LS-9**



#### NOTES:

1. 6" MINIMUM DISTANCE BETWEEN MAIN LINE AND CONDUIT.
2. 6" MINIMUM DISTANCE BETWEEN MAIN LINES IN THE SAME TRENCH.
3. 6" MINIMUM DISTANCE BETWEEN MAIN LINE AND LATERAL LINE.
4. 4" MINIMUM DISTANCE BETWEEN ALL LATERAL LINES.

## SPRINKLER SYSTEM PIPE/TRENCH

DATE:  
MARCH 2022

DRAWING NAME:  
LS-10

DRAWN BY:  
JRP

CHECKED: APPROVED:

#### REVISIONS

REVISION	DATE	BY	COMMENTS

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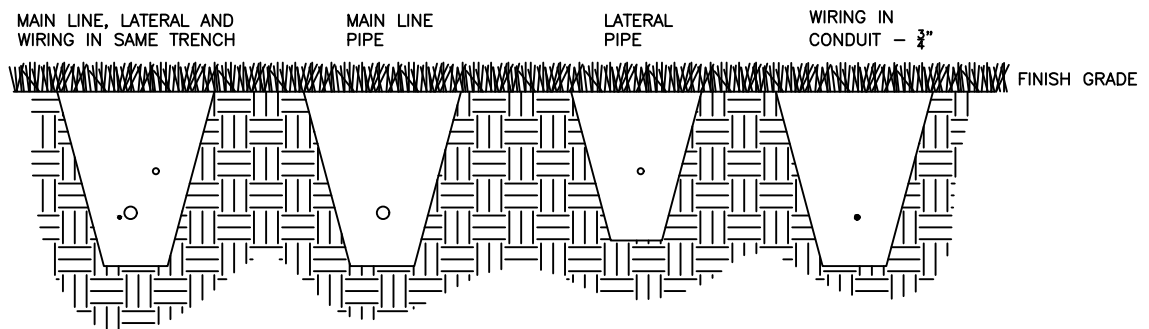


STANDARD DETAILS

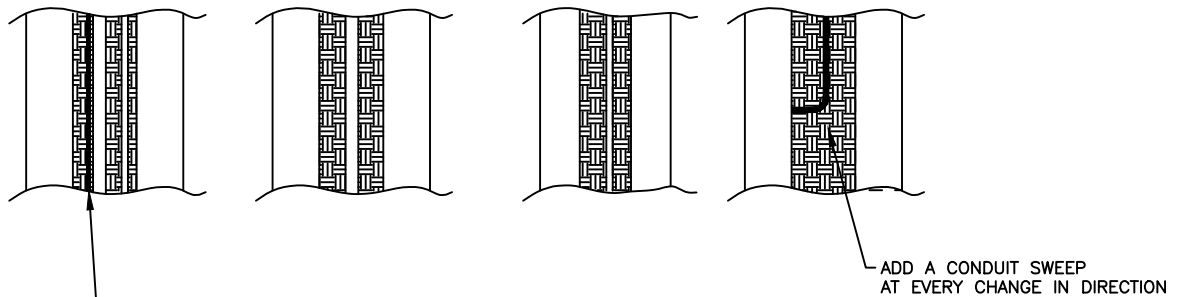
LANDSCAPING

**LS-10**

### SECTION VIEW



### PLAN VIEW



RUN WIRING BENEATH AND BESIDE MAIN LINE. BUNDLE AT 10' INTERVALS IN CONDUIT.

### NOTES:

1. SLEEVE BELOW ALL HARDSCAPE ELEMENTS WITH CLASS 200 PVC TWICE THE DIAMETER OF THE PIPE OR WIRE BUNDLE WITHIN.
2. FOR PIPE AND WIRE BURIAL DEPTHS DETAILS. SEE SPECS.
3. ELECTRIC AND WATER NOT TO SHARE SLEEVES.

## SPRINKLER SYSTEM PIPE AND WIRE TRENCH

DATE:  
MARCH 2022

DRAWING NAME:  
LS-11

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS
1	08-31-17	RM	EDITED CALLOUTS

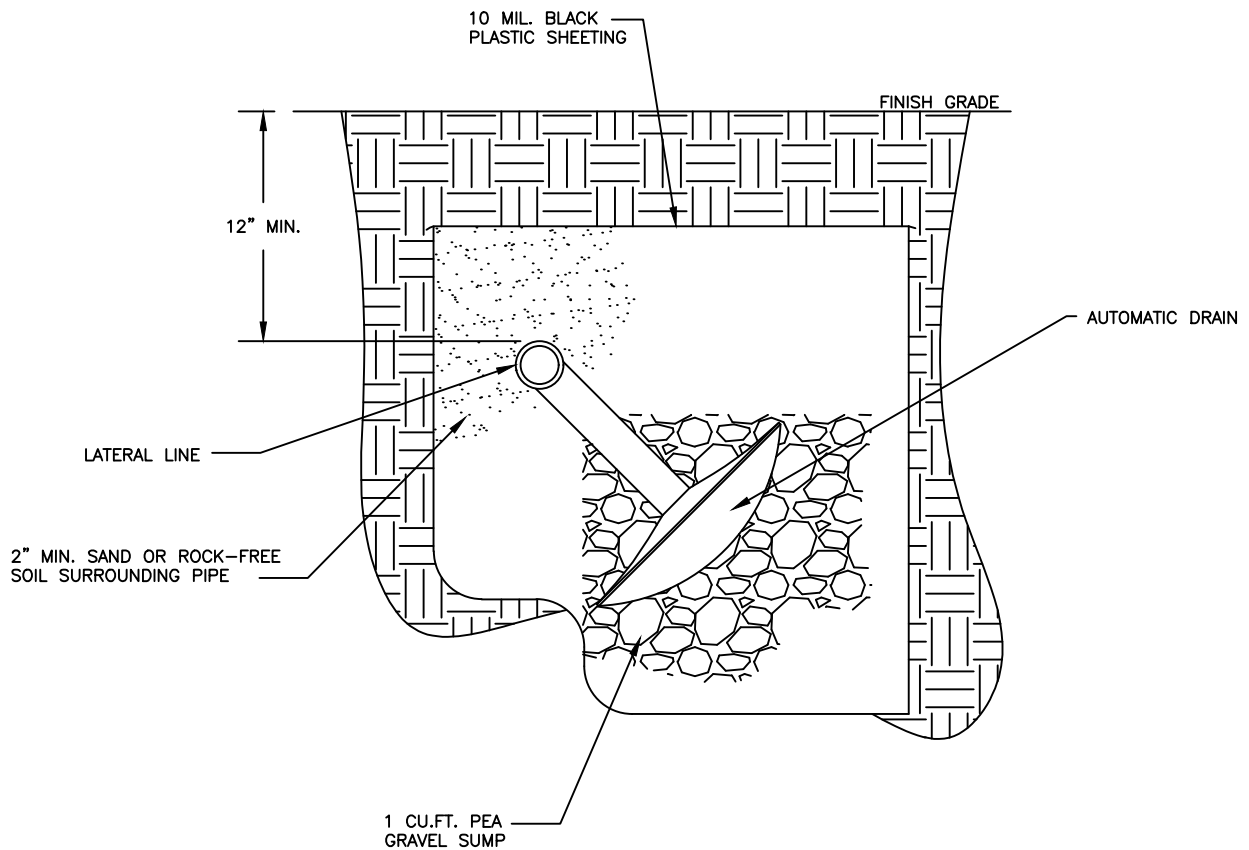
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STANDARD DETAILS

LANDSCAPING

LS-11



**NOTE:**

1. USE ONLY AT LOW POINTS OF LATERAL LINES.  
DO NOT USE IN VALVE BOXES.
2. DO NOT USE ON MAIN LINE

**SPRINKLER SYSTEM  
AUTOMATIC  
DRAIN**

DATE:  
MARCH 2022

DRAWING NAME:  
LS-12

DRAWN BY:  
JRP

CHECKED: APPROVED:

REVISIONS

REVISION	DATE	BY	COMMENTS

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STANDARD DETAILS

LANDSCAPING

**LS-12**

## NOTES:

1. INSTALLATION INCLUDES REMOVAL OF STAKES AND WATERING RING ONE YEAR AFTER INSTALLATION.
2. SHAPE SOIL SURFACE TO PROVIDE 3' DIAMETER WATERING RING.
3. MULCH TREE PIT MIN 5'-0" LENGTH x FULL PLANTING STRIP WIDTH BETWEEN CURB AND SIDEWALK (FOR PLANTING STRIPS LESS THAN 6'-0" WIDE.) PROVIDE 5'-0" Ø MULCH RING FOR PLANTING STRIPS WIDER THAN 6'-0".
4. TREE PIT DEPTH = ROOTBALL DEPTH (MEASURE BEFORE DIGGING TO AVOID OVER EXCAVATION).
5. GRANULAR FERTILIZER PLACE AFTER PLANT HOLE IS BACKFILLED. QUANTITY BASED ON TREE GROWERS RECOMMENDATIONS.
6. DO NOT PLANT STREET TREES WITHIN 70' OF STOP SIGNS.

STAKE TREE WITH (2) TREATED 2" Ø LODGEPOLE PINE DOWELED TREE STAKES (8'-0" LENGTH) LOOP EACH TIE AROUND HALF TREE LOOSELY TO PROVIDE 1" SLACK FOR TRUNK GROWTH

"CHAINLOCK" OR EQUAL TREE TIE MATERIAL (1" WIDTH) NAIL OR STAPLE TREE TIE MATERIAL TO STAKE TO HOLD VERTICALLY. LOOP EACH TIE AROUND HALF TREE LOOSELY TO PROVIDE 1" SLACK FOR TRUNK GROWTH

2"-3" MULCH DEPTH (TAPERED AT TRUNK)

SIDEWALK

ROUGHEN SIDES OF PLANTING HOLE MAXIMIZE EXCAVATED AREA WITHOUT UNDERMINING ADJACENT PAVING/CURB OR GRASS

18" DEEP ROOT BARRIER (TYP. WITHIN 10' OF PAVING)

REMOVE ALL WIRE & STRING, AND REMOVE ALL BURLAP FROM TOP 1/2 OF ROOTBALL

NATIVE BACKFILL SOIL AMENDMENT WITH 25% (1/3 CU YD) DECOMPOSED ORGANIC MULCH AMENDMENT FOR ENTIRE TREE PIT AREA X ROOTBALL DEPTH

MIN WIDTH OF TREE PIT=2 TIMES ROOTBALL DIAMETER OR 5'-0", WHICHEVER IS GREATER

MULCH AREA TO BE CLEAR OF GRASS, WEEDS, ETC. TO REDUCE COMPETITION WITH TREE ROOTS

SEE NOTE 1

SEE NOTE 2

SET TOP OF ROOT CROWN 2" ABOVE ADJACENT CURB & SIDEWALK GRADE

RETENTION SOIL BERM 3" MINIMUM

DRIVE STAKES 6" TO 1'-0" INTO UNDISTURBED SOIL BELOW ROOTBALL AT EDGE ROOTBALL (TYP)

ENSURE NO VOIDS OR AIR POCKETS UNDER AND AROUND ROOTBALL

UNDISTURBED SUBGRADE (PROVIDES FIRM BASE SO THAT ROOTBALL WILL NOT SINK)

## TREE STAKING AND PLANTING

DATE:  
MARCH 2022

DRAWING NAME:  
LS-13

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

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STANDARD DETAILS

LANDSCAPING

LS-13

### 2-RAIL FRONT VIEW

**PRIVATE/SEMI-PRIVATE FRONT VIEW**

### POST TOP VIEW

### MOW STRIP TOP VIEW

### MOW STRIP TYP. CROSS SECTION

**NOTES:**

1. ALL ATTACHMENT SCREWS TO BE ZINC PLATED
2. FENCING SUB-CONTRACTOR TO PROVIDE SHOP DRAWINGS FOR ALL FENCING
3. GLUE ON CAPS WITH CLEAR PVC CEMENT
4. EXTEND RAIL AND STIFFENER INTO EACH POST 1 ½" MINIMUM.
5. MAXIMUM DISTANCE FROM CENTER OF POST TO CENTER OF POST IS 7'.
6. PROVIDE 12" MINIMUM CIRCUMFERENCE HOLE FOR POST WITH A MINIMUM BURY DEPTH OF 24".
7. USE WET MIX CONCRETE ONLY. ALLOW TO SET FOR 5 DAYS BEFORE SETTING RAILS. MINIMUM 3,000 PSI MIX.
8. USE VERTICAL U-CHANNEL ON ALL PRIVACY FENCING POSTS TO SUPPORT FENCE PANELS. ON SEMI PRIVATE FENCING USE WHERE PANELS ARE ADJACENT TO POSTS. SCREW SPACING ON U-CHANNELS TO BE 18" MAX. WITH A MINIMUM OF 2 SCREWS PER SEGMENT.
9. ATTACH ALL RAILS TO POSTS WITH FULL SHANK THREADED, ZINC PLATED, WOOD SCREWS (2"). "CRIMPED ENDS" ON RAILS NOT ACCEPTABLE. SECURE SCREW THROUGH POST AND INTO RAIL FROM UNDERNEATH THE HORIZONTAL RAIL EXCEPT ON BOTTOM RAIL WHERE SCREW CAN BE INSTALLED FROM THE TOP.
10. MATERIALS, CONSTRUCTION, AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH CITY'S STANDARD SPECIFICATIONS.
11. COMPACT NATIVE SOIL BELOW MOW STRIP TO 90%.
12. FENCING COLOR TO BE DETERMINED UPON FINAL PLAT APPROVAL.

Privacy Fence			
	Post	Horizontal Rail	Vertical Planks
Wall thickness	0.15"	0.09"	0.06"
Dimension	5"x5", 6' tall above grade	1 1/2" X 5 1/2"	3/8" X 6"
Reinforcement Steel/Alum.	NO	Bottom Rail only	NO
Type	Square	rectangular	T & G rectangular
Spacing	7' on Center	N/A	0"
Semi-Private			
	Post	Horizontal Rail	Vertical Planks
Wall thickness	0.15"	0.09"	0.06"
Dimension	5"x5", 6' tall above grade	1 1/2" X 3 1/2"	3/8" X 3"
Reinforcement Steel/Alum.	NO	Bottom rail only	NO
Type	square	Rectangular	Rectangular
Spacing	7' on center	Approx. 2" from top of post	1" Gap
Two Rail Fence			
	Post	Horizontal Rail	Vertical Planks
Wall thickness	0.15"	0.125"	N/A
Dimension	5"x5", 3' tall above grade	2" X 6"	N/A
Reinforcement Steel/Alum.	NO	NO	NO
Type	square	rectangular	rectangular
Spacing	7' on center	aprox. 16" apart	N/A

## VINYL FENCE WITH MOW STRIP

DATE:  
MARCH 2022

DRAWING NAME:  
LS-14

DRAWN BY:  
JRP

CHECKED:	APPROVED:
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## REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

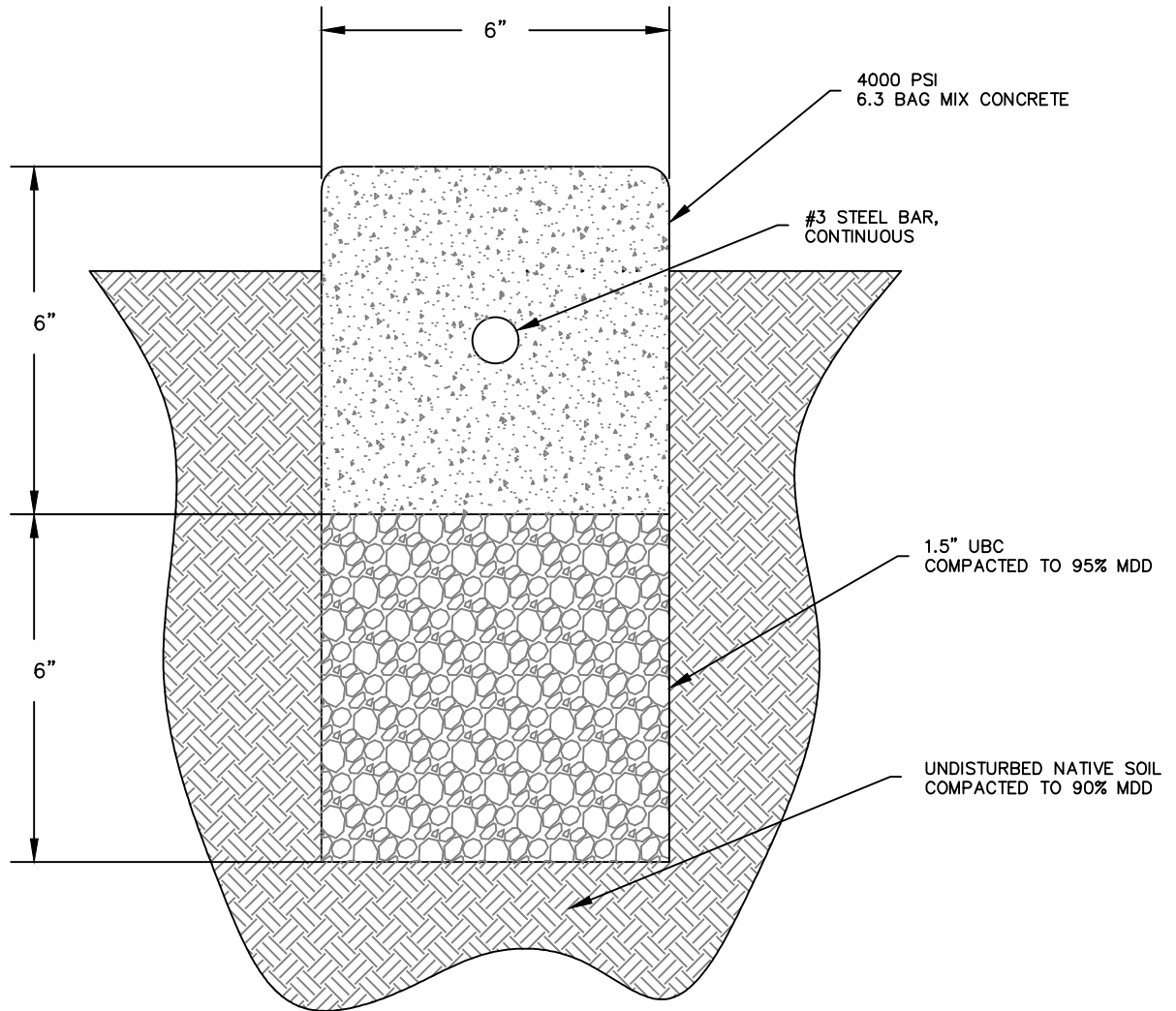
1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
FAX: 801-766-9794



STANDARD DETAILS

## LANDSCAPING

LS-14



**NOTE:**

1. SCORE CURB 1.5" EVERY 5'

**CONCRETE  
MOW CURB**

DATE:  
AUGUST 2022

DRAWING NAME:  
LS-15

DRAWN BY:  
ETL

CHECKED: APPROVED:

REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
UT 84045  
PHONE: 801-766-9793  
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STANDARD DETAILS

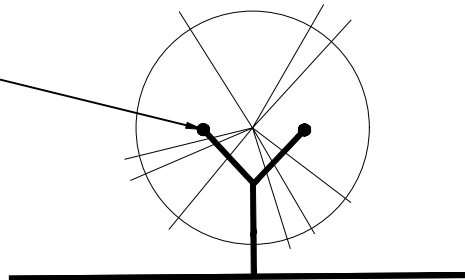
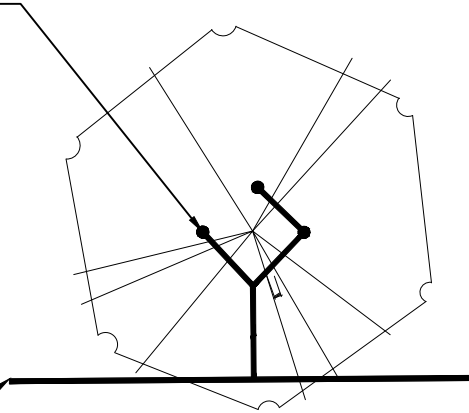
LANDSCAPING

**LS-15**

3 1806 WITH PCN NOZZLES  
(0.25 GPM EACH NOZZLE)

LATERAL LINE

2 1806 WITH PCN NOZZLES  
(0.25 GPM EACH NOZZLE)



## DRIP IRRIGATION

DATE:  
MARCH 2024

DRAWING NAME:  
LS-16

DRAWN BY:  
JRP

CHECKED: APPROVED:

### REVISIONS

REVISION	DATE	BY	COMMENTS

SARATOGA  
SPRINGS CITY

1307 N. COMMERCE DR.  
#200, SARATOGA SPRINGS,  
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FAX: 801-766-9794



STANDARD DETAILS

LANDSCAPING

**LS-16**



