PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Fencing and gate materials.
B. Concrete.
C. Fence and gate installation.
D. Electrical grounding.

1.02 MEASUREMENT AND PAYMENT

A. General: Measurement and payment for chain link fences and gates will be either by
the lump-sum method or by the unit-price method as determined by the listing of the
bid item for chain link fences and gates indicated in the Bid Schedule of the Bid
Form.

B. Lump sum: If the Bid Schedule indicates a lump sum for chain link fences and gates,
the lump-sum method of measurement and payment will be in accordance with
Specifications Section 01 20 00, Price and Payment Procedures, Article 1.02,
entitled “Lump-Sum Measurement.”

C. Unit price: If the Bid Schedule indicates a unit price for chain link fences and gates,
the unit-price method of measurement and payment will be as follows:

1. Measurement:
   a. Chain link fences will be measured for payment by the linear foot of each type
      and height complete in place, parallel to finished grade, from center to center
      of end posts.
   b. Gates, including gate hardware, will be measured for payment by the number
      of each type and size of gate installed complete in place.
   c. Earthwork, grout and concrete, barbed wire, fence closures to ground, and
      electrical grounding will not be measured separately for payment, and all
      costs therefore will be considered to be included in the measurements for
      chain link fences and gates.

2. Payment: Chain link fences and gates will be paid for at the indicated Contract unit
prices for the computed quantities as determined by the measurement method
specified in Article 1.02.C.1, entitled “Measurement,” herein.
1.03 FENCE CLASSIFICATIONS AND STANDARDS

A. Fence Code: Type of fence, dimensions, components, gates, and accessories are indicated on the Contract Drawings in accordance with the “Fence Code” on the Civil Standard Drawings and/or the Contract Drawings.

B. Fence Types: Chain link fencing shall be of the types indicated as follows unless otherwise specified in the Contract Documents:

1. Type CL Zinc-coated steel fence fabric with galvanized steel posts, rails, caps, hardware, and fittings.

2. Type VCL Polyvinyl chloride (PVC) coated steel fence fabric with vinyl-coated and factory-painted steel posts, rails, caps, hardware, and fittings in selected color.

3. Type RP Type CL fence with redwood slats or pickets inserted vertically in the fence fabric.

C. Area Fence Standards:

1. Line Fencing: Materials, dimensions, and components of fencing are indicated on the Contract Drawings by means of a “Fence Code.” If no code is indicated, the fence shall be galvanized chain link fabric, posts, and accessories, as follows: fabric shall be 84 inches wide, secured at the top and bottom to tension wire, with three strands of barbed wire carried on extension arms above the fabric for an additional 12 inches, for a total height above ground of 96 inches.

2. High Voltage Facilities, Shops, and Yard Fencing: Materials, dimensions, and components of the fencing are indicated on the Contract Drawings. The fence shall be galvanized chain link fabric, posts, and accessories, as follows: fabric shall be 108 inches high, secured at the top and bottom to galvanized pipe rail, plus three strands of barbed wire carried on extension arms above the top rail, for a total height of 120 inches above ground.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

2. ASTM A121 Standard Specification for Metallic-Coated Carbon Steel Barbed Wire


5. ASTM A392  Standard Specification for Zinc-Coated Steel Chain Link Fence Fabric
6. ASTM A491  Standard Specification for Aluminum-Coated Steel Chain Link Fence Fabric
7. ASTM A824  Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence
8. ASTM B117  Standard Practice for Operating Salt Spray (Fog) Apparatus
9. ASTM F567  Standard Practice for Installation of Chain Link Fence
10. ASTM F626  Standard Specification for Fence Fittings
11. ASTM F668  Standard Specification for Polyvinyl Chloride (PVC), Polyethylene and Other Polymer Coated Steel Chain Link Fence Fabric
14. ASTM F1083  Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
15. ASTM A653/A653M  Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process


C. Federal Specifications:
1. RR-F-191/2E  Fencing, Wire and Post, Metal (Chain Link Fence Gates) (Detail Specification)
2. RR-F-191/4F  Fencing, Wire and Post, Metal (Chain Link Fence Accessories)
1.05 **SUBMITTALS**

A. **General:** Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. **Product Data:** Submit manufacturer’s product data and specifications of the specified chain link fencing and gates.

C. **Shop Drawings:** Submit detailed Shop Drawings of the fences and gates layout, including installation details of the fencing, posts, gates, hardware, and accessories for review.

D. **Samples:** If PVC-coated fencing is indicated or specified, submit manufacturer’s color chart of available colors and physical sample of selected color.

**PART 2 – PRODUCTS**

2.01 **MATERIALS**

A. **Requirements:** Fencing shall include fabric covering, framework, barbed wire, razor coil when specified in the Contract Documents and supporting arms, concrete footings, gates, hardware, and all appurtenances and accessories as required for a complete installation. Heights of fences shall be as indicated in Contract Documents. When not indicated, line fencing, high voltage facility, shops and yard fencing shall conform with the Area Fence Standards specified herein in Article 1.03.

B. **Fence Fabric:**

1. **Type CL Fence Fabric:** Zinc-coated steel fabric conforming to ASTM A392 with Class 2 coating. Mesh size one-inch square fabricated No. 9 gauge wire unless otherwise specified in the Contract Documents.

   a. The Contractor may furnish aluminum-coated steel fence fabric conforming to ASTM A491, with one-inch square mesh size fabricated No. 9 gauge wire unless otherwise specified in the Contract Documents.

2. **Type VCL Fence Fabric:** Type CL fence fabric, PVC-coated in accordance with ASTM F668. Class 1, Class 2a, and Class 2b wire and fabric types are acceptable. Mesh size one-inch square fabricated No. 9 gauge wire unless otherwise specified in the Contract Documents. Color shall be as selected by the Engineer from manufacturer’s standards, as specified in ASTM F934.

3. **Type RP Fence Fabric:** Type CL fence fabric, mesh size two-inch square, with California redwood slats inserted vertically through the mesh pattern. Redwood fence slats shall be nominal one inch by three eighths inch in size, and shall have stain applied to all surfaces in color as selected by the Engineer. Slats shall be one piece, full height of fence fabric.
4. Selvages: Twisted and barbed at top and bottom selvages when barbed wire is used; knuckled at both selvages when barbed wire is not used; unless otherwise indicated.

C. Pipe Framework for Type CL and RP Fencing and Gates: Posts, braces and rails shall be standard weight galvanized steel pipe conforming to ASTM F1083. Provide sizes specified in Civil Standard Drawing CS01 Chain Link Fence or as indicated. Posts shall include galvanized bolted fittings to properly secure rails and braces to posts.

D. Under BART’s direction, Alternate Pipe Framework for Type CL and RP Fencing as shown below may be used:

1. Pipe for Posts and Rails: Posts and rails shall be high-strength pipe manufactured from steel conforming to ASTM A1011/A1011M, cold-formed, high frequency or induction welded, and having a minimum yield strength of 50,000 pounds per square inch.

2. Posts and Rails and Braces: Sizes and weights shall be as specified in 2.01 C. Pipe Framework for Type CL and RP Fencing. Posts shall include galvanized bolted fittings to properly secure rails and braces to posts.

3. External Pipe Coating: External surface shall be triple coated with one ounce plus or minus 0.1 ounce of zinc per square foot, 30 plus or minus 15 micrograms of chromate per square inch, and a high-performance polymer. Pipe shall demonstrate the ability to resist 1,000 hours of exposure to salt spray with a maximum of five percent red rust when tested in accordance with ASTM B117.

4. Internal Pipe Coating: Internal surface of pipe shall be coated, after welding, with a zinc-rich based organic coating having a 91 percent zinc powder loading capable of withstanding 650 hours of exposure to salt fog with a maximum of five percent red rust when tested in accordance with ASTM B117. All coatings shall be applied inside and out after welding.

E. Pipe Framework for Type VCL Fencing: Post and rails shall be vinyl-clad steel with color-coated EMV (epoxy modified polyvinyl chloride) chemically bonded to heated standard weight ASTM F1083 galvanized steel pipe, as specified, by electrostatically applied powder coating process. Protective vinyl coating thickness shall be 10 to 14 mils, according to pipe diameter. Pipe vinyl coating shall have the following properties: specific gravity of 1.32 to 1.37; tensile strength of 2,000 pounds per square inch; minimum elongation of 180 percent; tear strength at 15 mils -0.36 pounds per mil; hardness of coating of 87 to 92 Shore A Durometer. Color shall match fence fabric color. Sizes and weights shall be as specified for Type CL fence or alternate high-strength pipe framework.

F. Tension Wire: Tension wire for top and bottom edge support of fence fabric shall be No. 7 gauge marcelled wire, conforming to ASTM A824, Type II Zinc-Coated Class 5-2.0 oz/sf with minimum tensile strength of 80,000 pounds per square inch. For type VCL fencing, provide tension wire coated with PVC, matching fence fabric in color.
G. Post Caps and Fittings: Manufacturer’s standard, pressed steel or malleable iron post caps, fittings, and accessories, meeting requirements of ASTM F626 and Federal Specification RR-F-191/4F, galvanized for Type CL and RP fencing, and PVC coating by the thermal-fusion-bond process, in color matching posts, for Type VCL fencing. Post caps shall be designed to fit securely over the posts to exclude water and to carry the top pipe rail and extension arms, where indicated. All other required fittings and hardware shall be provided to fasten to the pipe posts or concrete in the manner indicated.

H. Truss Rod Assembly: In compliance with ASTM F626, 3/8 inch diameter steel truss rod with a pressed steel tightener or self tightening turnbuckle, minimum zinc coating of 1.2 ounce per square foot, assembly capable of withstanding a tension of 2,000 pounds. Truss tightener must have a strap thickness of at least 1/4 inch.

I. Tension Bars: In compliance with ASTM F626. Galvanized steel one-piece length 2 inch less that the fabric height. Minimum zinc coating 1.2 ounce per square foot.

1. Bars for mesh size 2-inch square shall have a minimum cross section of 3/16 inch by 3/4 inch.

2. Bars for mesh size 1-inch square shall have a cross section of 1/4 inch by 3/8 inch.

J. Tension and Brace Bands: Galvanized pressed steel complying with ASTM F626 with a minimum steel thickness of 12 gauge (0.105 inch), minimum width of 3/4 inch, and minimum zinc coating of 1.20 ounce per square foot. Tension bands shall be spaced not greater than 12 inches on center.

K. Accessories: Provide miscellaneous materials and accessories, clips, tie wires (9 gauge), anchors, eye bolts, hog rings, and fasteners as required for a complete installation. All items shall be galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M as applicable. Accessories for Type VCL fencing shall be vinyl-coated or painted to match color of fence fabric.

L. Barbed Wire Extension Arms: Pressed steel conforming to ASTM A653/A653M, hot-dip galvanized after fabrication, minimum zinc coating of 1.2 ounce per square foot, capable of supporting a vertical 250 lb load, complete with provision for anchorage to end, corner, and pull posts and for attaching three rows of barbed wire to each arm. Arms shall be 45-degree angle or vertical as indicated, for three strands of barbed wire. Arms shall be integral with post top weather cap. Intermediate arms shall have hole for passage of top tension wire. Arms shall be capable of withstanding 300 pounds downward pull at outermost end of arm without failure. Arms for Type VCL fencing shall be vinyl-coated or painted to match color of fence fabric.

M. Barbed Wire: Three-strand, zinc-coated, 12-1/2 gauge steel wire with 14 gauge, four-point steel barbs spaced 5 inches apart, conforming to ASTM A121. Zinc coating shall be Class 3, 0.80 ounce per square foot for 12-1/2 gauge wire and 0.65 ounce per square foot for 14-gauge wire.
N. Gates: Gates shall be swinging type or sliding type as indicated, furnished complete with all hardware and accessories as required for a complete installation.

1. Gate Frames: Frames shall be fabricated from zinc-coated steel pipe members (to match posts in Type CL and RP fencing). Sizes shall be specified in the Civil Standard Drawing CS01 Chain Link Fence or as indicated.

2. Fabrication: Conform to applicable requirements of ASTM F900, Federal Specification RR-F-191/2E, and the following:

   a. Assemble gate frames by welding or with fittings and rivets for rigid connections. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges, and tie wires at top and bottom edges. Attach stretcher bars to gate frame at not more than 15 inches on center. Attach hardware with rivets or by other means that will provide security against removal or breakage.

   b. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories.

   c. Provide diagonal cross bracing consisting of minimum 3/8 inch diameter adjustable length truss rods on gates where necessary to provide frame rigidity without sag or twist.

   d. For Type VCL fencing, gate components shall be PVC-coated or painted in color matching fence fabric.

   e. For pre-engineered gates, stamped and signed calculations shall be provided by the manufacturer to verify gate design is adequate.

3. Gate Hardware:

   a. Swinging Gates:

      1) Provide gate hinges, latch, stop, and keeper for each gate leaf, conforming to applicable requirements of ASTM F900 and Federal Specification RR-F-191/2E. Provide latch with provision for locking gate with padlock. If locking provisions include chain, chain shall be hardened steel chain, bolt cutter resistant, tested to at least 9 tonnes of cutting force unless otherwise specified in Contract Drawings.

      2) Gate hinges shall be of adequate strength for the gate, and shall have large bearing surfaces for clamping or bolting in position. Hinge action shall be such that gates may be easily opened and closed by one person. Hinges shall provide for full 180 degree swing of gate leaf. Hinges shall be tack welded to post and gate after adjustment.

   b. Sliding Gates:

      1) Provide manufacturer’s standard rubber-tired rollers and roller track for floor-supported sliding gates, conforming to applicable requirements of ASTM F1184. Include intermediate rollers or casters where required to prevent gate sag or deflection.

      2) Provide locking device and padlock eyes as part of latch for locking gate with padlock.
3) Bottom of gate shall be guarded by a skirt around wheels and cantilever supports to maintain maximum allowable clearance under gate and around gate sides.

c. Padlocks to be furnished by the District.

O. Pipe Sleeves: Pipe sleeves for fence post embedment in concrete curbs, barriers, and walls shall be fabricated from steel pipe conforming to ASTM A53/A53M and galvanized in accordance with ASTM A123/A123M, sized to receive and support fence posts.

2.02 CONCRETE

A. Provide concrete footings for fence posts under this Section. Concrete for posts shall have a minimum compressive strength at 28 days of 3,000 pounds per square inch, using one-inch maximum size aggregate and five sacks of cement minimum per cubic yard, with a maximum slump of four inches. Concrete and grout materials, placing, and curing shall conform to the applicable requirements of Section 03 30 00, Cast-In-Place Concrete, and Section 03 61 11, Non-Shrink Grout, respectively.

PART 3 – EXECUTION

3.01 PREPARATION

A. Installation of fencing shall not be started until final grading has been completed.

B. Locate fencing correctly as indicated.

C. Where posts are indicated or required to be embedded or set in concrete curbs, traffic barriers, or retaining walls, coordinate the installation of fencing closely with the installation of concrete as specified under Division 3 Concrete.

D. Furnish galvanized steel pipe sleeves for fence posts, as applicable, for installation in formwork at time required. Supervise installation of sleeves during formwork and placing of concrete to maintain exact dimensions according to template.

3.02 INSTALLATION

A. Install fencing and gates as indicated, in accordance with approved Shop Drawings, and applicable requirements of ASTM F567 and CLFMI Standards for Chain Link Fence Installation. Site fabricate as required to complete the fence installation.

B. Posts shall be plumb and rigid after installation. Gap between post and adjacent infrastructure shall be less than 2 inches. Rails shall be straight and tight. Chain link fabric shall be smooth and uniformly stretched tight and straight. Tension wires and barbed wires shall be pulled taut. Fabric shall be secured to the line post with tie wires spaced no greater than 12 inches on center and to rail spaced no greater than 18 inches on center. Turn ends of tie wire two-360 degree wraps around fabric. Tip to tie wire shall face away from public. Secure fabric to the tension wire with hog
rings spaced no greater than 18 inches apart. Redwood slats in Type RP fence shall be straight and plumb.

C. Drill holes for post footings in firm, undisturbed or compacted soil. Footing holes shall be not less than required dimensions of post footings per approved design. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.

D. Where posts are indicated or required to be embedded or set in concrete curbs, traffic barriers, or retaining walls, grout or seal posts in sleeves as indicated.

E. Gates shall be installed plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate. Sliding gates shall operate smoothly and easily under minimum pressure.

F. Locate and install safety and restriction signs securely as indicated on the Contract Drawings.

G. Locate and install safety and restriction signs securely as indicated on the Contract Drawings.

H. Welds shall be protected by applying zinc rich paint in accordance with ASTM practice A780.

3.03 CONCRETE

A. Handling and placing of concrete shall conform to the applicable requirements of Section 03 30 00, Cast-In-Place Concrete.

B. Place concrete around posts in a continuous pour. Check each post for plumb and vertical and top alignment, and hold in position during placement and finishing operations.

C. Trowel finish tops of footings, and slope or dome to direct water away from posts. Set keepers, stops, sleeves, tracks, eye bolts, and other accessories into concrete as required. Wheel rolling area for sliding gates shall be steel-trowel smooth finish concrete.

3.04 ELECTRICAL GROUNDING

A. Ground fences and gates and perform other electrical grounding as indicated. Coordinate with the requirements of Section 26 05 26, Grounding and Bonding for Electrical Systems.

B. Install grounding material and access boxes in secure side of fences and gates.

END OF SECTION 32 31 13