

## **Section 6 - Drawings, Record Drawings and Valve Guides**

- I. Introduction – HRSD has in excess of 40,000 Record Drawings in an electronic form which are archived in a records management system. Many older drawings are in scanned (raster) format. Most of the recent drawings and all valve guides are in AutoCAD format. Some drawings are hybrid images. HRSD accepts Record Drawings only in AutoCAD format unless otherwise approved by the HRSD GIS Manager. Record Drawings must be provided in full-scale paper copy, Adobe Acrobat (PDF), and AutoCAD format up to the latest release used by HRSD at the time Record Drawings are received. The latest release is provided in each Request For Proposal (RFP). To provide some uniformity and to assist HRSD with its records management system, certain criteria have been established as described in the Section. The FIRM must submit an electronic copy of the conformed plans in .PDF to HRSD at the time of pre-construction meeting. This will allow HRSD to enter the plans into the records management system, verify compliance with HRSD standards and print copies for internal use during the construction phase of the project. HRSD has not adopted a mandatory layering system for contract drawings. However, the FIRM must submit a listing of the proposed layering system to HRSD for review prior to beginning drawing preparation. Layers containing new or improved HRSD infrastructure must only contain such infrastructure and must be clearly identified in the layer listing (the FIRM is encouraged to use a prefix of HRSD\_ for layers representing new or improved HRSD infrastructure). Due to the frequent need to modify valve guides, the layering system listed in the Valve Guide section below must be used in the preparation of valve guides. The FIRM must submit an electronic copy of the final record drawings in .DWG and .PDF at the final project completion stage. Once Record Drawings are received, approved and inputted, the advertised set will be deleted from the records management system.
- II. Drawings
  - A. Size - Use 24 inch x 36 inch sheets. Prefer to limit actual area used to 22 inches x 34 inches to allow for true scale half size printing on an 11 inch x 17 inch page.
  - B. Scale - Use a scale for the plan view of gravity sewers and force mains of one-inch equals 20 feet for urban areas and one-inch equals 40 feet for rural areas or as appropriate. Indicate vertical scale on each profile view.
    1. Pipelines
      - a. 1 inch = 40 feet in rural or low development areas
      - b. 1 inch = 20 feet in urban or high development areas
      - c. Use small scale for details

2. Pump Stations and Treatment Plants – Site plans shall be at one inch = 20 feet
3. Fonts - Use minimum letter size of one-tenth (1/10) inch to allow for good resolution when viewing drawings and for drawing use at half-size.
4. Units - Drawings shall be prepared using English units (non-metric).

C. Title Block

1. Locate across the bottom or right-hand margin with the sheet number in the extreme lower right-hand corner.
2. Information – Include:
  - a. Project title
  - b. Drawing title
  - c. Sheet number
  - d. FIRM's name
  - e. Scale and graphical scale reference for one inch
  - f. Revision block

D. Required Sheets - Provide required sheets in the order listed as follows:

1. Cover Sheet – Refer to Standard Details section in this manual.
2. Location and Vicinity Map Sheet – Include datum and coordinate system used for design.
3. Drawing Index Sheet – Index may be placed on cover or location sheet if the project includes less than 20 drawings. The Index Sheet must include the drawing number (ex: C-1), sheet number (a consecutive numbering scheme beginning with 1), and a drawing description (ex: “Yard Piping – Demolition Plan”).
4. Legend Sheet – Include of all abbreviations and symbols used for design. Refer to Section 29 Treatment Plant in this manual for required plant process abbreviations.
5. Schedule Sheets – Compile equipment schedules, door schedules, hardware schedules, cable and conduit schedules, panel board schedules etc., and place schedule sheets at front of respective sections of work.

6. Electrical point to point diagrams – refer to Section 30 Electrical and Instrumentation in this manual.
7. Hydraulic Profile – For treatment plant projects plot the hydraulic grade line for each condition considered during design.
8. Detail Sheets – Compile civil details, electrical details, mechanical details, structural details, etc., and place detail sheets at end of respective sections of work.

E. Electronic Drawing Format

1. All design drawings shall be prepared in an electronic format using AutoCAD (.DWG) format. The release number is identified in the Request for Proposals (RFP). The FIRM shall review with HRSD any proposed deviation in the version of AutoCAD to be used and any other third party or proprietary software programs which will be used to prepare the design drawings. HRSD reserves the right to reject any variation in the version of AutoCAD to be used, non-standard AutoCAD format or specialty software program proposed by the FIRM.

Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – “HRSD Building Information Model (BIM) Requirements”.

2. HRSD does not require the use of a standard layering scheme for the preparation of electronic Record Drawings. The FIRM shall provide a file listing each layer name, description and color (pen weight) with each electronic file provided. Layers containing new or improved HRSD infrastructure must only contain such infrastructure, and must be clearly identified in the layer listing (the FIRM is encouraged to use a prefix of HRSD\_ for layers representing new or improved HRSD infrastructure). Line widths shall be designated by layer and not by color. Provide the associated .CTB file with each project/drawing.

Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – “HRSD Building Information Model (BIM) Requirements”.

3. The use of x-referencing when preparing electronic drawings is acceptable. Prior to the submission of any electronic drawing to HRSD, each x-referenced dwg file associated with a drawing shall be bound to that file. Referenced images (TIFF, JPEG, etc....) within the electronic drawing must also be embedded. Unbound electronic drawings will be returned to the FIRM for revision. The final delivered bound AutoCAD files must be of a manageable size

for use in Adept (files should not exceed 20MB). Also refer to section C.1.j. for clarification in regard to file size for individual sheets.

4. The use of stick-on maps, diagrams or sketches shall not be allowed. All information shown on the paper copy drawing should correspond to the electronic file provided as part of the Record Drawing submission.
5. The FIRM shall provide to HRSD all font files used within the electronic drawings. The use of non-standard AutoCAD fonts is strongly discouraged.
6. For pipeline projects, at the conformed stage, the FIRM shall provide to HRSD a single AutoCAD file (.DWG) containing the proposed HRSD infrastructure (also referred to as a “seamless file”); the .DWG file must capture the proposed HRSD infrastructure at its true State Plane Coordinates (as specified herein). Proposed Valve Guide locations should also be shown in this single AutoCAD file; the proposed Valve Guide locations should be represented as squares/rectangles in their true coordinate location, estimating the extent of the areas to be represented by the Valve Guide. This AutoCAD file will serve as an early coordination tool to determine eventual line number(s) and Valve Guide number(s).

#### F. Drawing and Electronic File Naming

1. Each drawing shall be provided with both a sheet number and a drawing number. A sheet number is a consecutive numbering scheme beginning with 1. A drawing number is an alphanumeric numbering scheme beginning with the discipline designation and a consecutive number (i.e.; C-1, M-12, S-93, etc.)
2. Each electronic drawing file shall be named as follows:
  - a. Index sheet – Index.dwg
  - b. All other sheets – SHEETNUMBER.dwg (i.e., Sheet 05 of 35.dwg)
3. In the case of Adept ‘hybrid’ drawings, each referenced file shall be named in correspondence to the drawing within which it is referenced. (i.e., a referenced image file would be named “Sheet 05 of 35 A.tiff” if it is x-referenced in Sheet 05 of 35.dwg)

#### G. Miscellaneous

1. Labels and Symbols

- a. Identify and label all existing facilities and underground utilities.
  - b. Use standard symbols and terminology consistently throughout drawings.
  - c. Shading, stippling or cross-hatching is acceptable only if drawing clarity on half size prints is approved by HRSD. The use of solid fills for shading is not acceptable.
2. Drawing Orientation
- a. North arrow orientation should be up or to the right on each drawing.
  - b. Pipeline stationing should be left to right on each drawing.
3. Piping and Hydraulic Structures
- a. Indicate pipe sizes and materials at transitions between different pipe sizes and materials.
  - b. Indicate elevations and grades of gravity sewers including pipe inverts at manholes, manhole rims, and other key points along the gravity sewer.
  - c. Indicate elevations of force mains including pipe inverts at changes in grade and other key points along the force main.
  - d. Indicate elevations of hydraulic structures including floor elevations and water surface elevations.
  - e. Prepare line diagrams for process systems and isometric schematics for complicated piping systems.
  - f. For pipeline projects tying into existing pipelines, such as repairs or relocations, the connecting point between the new and existing pipelines must reference the stationing from the original drawings.
  - g. Indicate pipeline stationing based on the pipeline centerline. Stations should be indicated on both the plan and profile views.
  - h. For pipeline projects, a profile and related data should be shown on the bottom half of the plan sheet, indicating the pipeline stationing on accented vertical grid lines. The profile should be shown at true pipeline centerline length and

projected above to the plan view in as close a relationship as possible.

- i. For pipeline projects, the drawings shall show the anticipated pipe trench width on the ground surface based upon the construction and installation of new and/or rehabilitated pipelines.
- 4. Electrical – FIRM to confirm that these requirements are included in the Bid Documents for Contractors.
  - a. Process and Instrumentation Diagrams (P&IDs) – The FIRM shall prepare the P&IDs.
  - b. Loop Drawings – The Contractor shall be required to provide loop drawings.
  - c. Conduit and Cable Schedules – The FIRM shall provide on the drawings or in the specifications. Contractor shall provide as-built conduit and cable schedules.
  - d. Point to Point Drawings – Contractor to provide.
- 5. Underground Utilities – FIRM to indicate the location of all underground utilities installed or encountered during the project.
- H. The record drawings must indicate the location of any non-sewer utilities installed, relocated, or encountered while installing the HRSD facilities.
  - 1. Horizontal and Vertical Controls
    - a. For all outfalls provide the following:
      - (1) Longitude and latitude for the beginning and end of the diffuser.
      - (2) Longitude and latitude for the point where the outfall enters the body of water.
      - (3) Longitude and latitude at all pipe deflections.
      - (4) Distance in feet from the end of the diffuser to the shoreline.
      - (5) Provide layout information tied to the Virginia State Plane coordinate system. For pipeline projects a minimum of two Virginia State Plane coordinates should be indicated on the drawing. Horizontal datum

including the realization (also known as the adjustment) used should be referenced on the cover sheet. (e.g. NAD83(CORS96)).

- (6) Indicate location of bench marks and use elevations based on the NAVD88 vertical datum, unless otherwise approved. Vertical datum reference should be indicated on each profile view.
- (7) Provide Virginia State Plane horizontal coordinates and NAVD88 elevations for valve boxes, air vents, manholes, pipeline bends, and other critical items.

I. Drawing Designations – The following drawing designations shall be used:

- 1. General
- 2. Index
- 3. Civil
- 4. Structural
- 5. Architectural
- 6. Electrical
- 7. I & C
- 8. Mechanical
- 9. HVAC – Plumbing

III. Record Drawings

A. General

- 1. Indicate revised dimensions, annotations, coordinates, and elevations as specified in this section. Only dimensions, coordinates, and elevations depicting as-built conditions to appear on the final Record Drawings. Record Drawings are not to contain “mark-ups”, text strikethrough, etc. (only final as-built conditions).
- 2. Indicate added and/or revised construction details. Only final version of construction details are to be included in the Record Drawings.
- 3. Indicate location of easements and labeled to include each acquisition’s recorded instrument number.

4. Remove wording and annotations on drawings that do not relate to the as-built conditions (such as "Proposed") as appropriate.
5. Revise all drawings to reflect as built conditions of all equipment or other schedules.
6. Label drawings as "Record Drawings" and indicate last revision date.
7. Prepare and submit a full-scale set of black line drawings.
8. Submit CAD drawing files (including the listing of all layer names as specified herein, and font files) compatible with AutoCAD Release (as specified in the RFP) software. Later editions cannot be accepted without prior written agreement from HRSD.
9. Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – "HRSD Building Information Model (BIM) Requirements".
10. Submit PDF format file copies of the CAD drawing files.
11. An engineer's seal is not required on the Record Drawings.
12. A single drawing file shall be provided for each sheet of the Record Drawings. Delete all extraneous parts of the project from the drawing file except what pertains to the immediate sheet. This reduces the file size and works better in HRSD's records management system. No individual file should exceed 20MB.
13. Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – "HRSD Building Information Model (BIM) Requirements".

B. Construction Information

1. List Contractor name, address, telephone number and point of contact on the cover sheet.
2. For pipeline projects list suppliers and model numbers/designations of all major items of construction.

IV. Bid Documents

- A. Provide final Bid Documents with all incorporated addenda in a PDF format file for incorporation into Adept Software.

V. Valve Guides



A. Introduction

1. HRSD uses Valve Guides to locate critical facilities in the interceptor system. The goal of each Valve Guide is to provide a location diagram and valve information for operations, maintenance and emergency shutdowns.
2. Valve Guides are prepared for valves, air vents, leak detectors, meter installations, cathodic protection test stations, and other corrosion control equipment. Manholes used in sanitary sewer systems do not require the preparation of a Valve Guide.
3. Valve Guides are prepared in an electronic drawing format for records management and internal use by HRSD.

B. Specific Instructions

1. Valve Guides shall be prepared at 8.5 inch x 11 inch size drawings with the drawing limits set to 8.5 inch x 11 inch (See Attachment A in this section for examples). All elements to be drawn in model space. A Valve Guide Template file including the appropriate paper space layout to be provided by HRSD.
2. Pipeline size and material to be annotated. Abandoned pipelines/valves/etc. that remain in place to be indicated as abandoned.
3. Provide only enough information to locate the valve(s) and/or air vent(s). Additional information should not be provided.
4. Provide a minimum of two (2) and preferably three (3) tie-down dimensions, from the valve or air vent to an adjacent, permanent fixture.
5. Valve Guides are identified using a sequential numbering system. The FIRM must coordinate with HRSD for the determination of interim and final Valve Guide numbers. Each valve, air vent, etc. are also numbered using a sequential numbering system within each Valve Guide. In cases where an existing Valve Guide is being updated, the FIRM must coordinate with HRSD for the determination of interim and final valve numbers.
6. Valve Guide drawings shall be prepared in an AutoCAD (.DWG) format (release as referenced in the RFP). Any associated files (font, compression, etc.) should be included with the drawings.
7. A single drawing file shall be provided with each individual Valve Guide.

## C. CAD Standards

1. 0 Layer - Information appearing on the 0 layer shall conform to the following established standards:
  - a. Layer Color - White (No. 7)
  - b. Valve Guide Drawing Sheet/Information Block
  - c. North Arrow (North Arrow HRSD Standard)
  - d. Pen Width = 0.012 inches
2. Text Layer - Information appearing on the Text Layer shall conform to the following established standards:
  - a. Layer Color - Cyan (No. 4)
  - b. Valve Guide Information
    - (1) VG Number
      - Height - .20
      - Font - Romant
    - (2) Location (General area of valve)
      - Height - .10
      - Font - Romand
    - (3) Drawing (Line no., contract title and sheet no.)
      - Height - .10
      - Font - Romand
    - (4) Line Number Symbol (Place in or near Drawing Title)
  - c. General
    - (1) Dimensions are considered to be text and shall be drawn on the text layer.
    - (2) Text font and height for valve information (Valve No., Size, Turns, etc.) is established in information block and operator shall be prompted for insertion of data.

- (3) Street Names
  - Height - .20
  - Font - Romand
- (4) Stations Number (0+00)
  - Height - Minimum .08
  - Font - Romand
- (5) Notes
  - Height - Minimum .08
  - Font - Romand
- (6) Distance Table (If required on VG)
  - Height - Minimum .08
  - Font - Simplex
- (7) Dimension Text
  - Height - Minimum .08
  - Font - Simplex
  - Location - (Place dimension text on top if space allows; otherwise use a break.)

- 3. Topo Layer - Information appearing on the Topo Layer shall conform to the following established standards:
  - a. Layer Color - Dark Gray (No. 8)
  - b. General – Information drawn on the Topo Layer shall include the following:
    - (1) Power Poles (Include identifying numbers)
    - (2) Fire Hydrants
    - (3) Other utilities only if they are relevant to the location of the valve or air vents, such as gravity manholes when used as a measurement marker.

- (4) Pavement limits, edge of pavement symbols, sidewalks, residences when such use will assist in location, trees and shrubbery, fences, HRSD easements, property lines if at PS locations, cross streets, dirt roads, and other pertinent data which will aid the locating of valve or air vent. A minimum number of symbols should be used where trees or shrubbery lines exist.
- (5) Text
  - Height - Minimum .08
  - Font - Simplex
- (6) Line Types
  - Continuous - Pavement limits, sidewalks, cross street roadway limits, building limits.
  - Hidden 2 - Dirt Roads
  - Phantom - Property and Easements
  - -... - ... - Ditch
  - -x - x - Fences
- c. Pen Width = 0.002 inches
4. FM Layer - Information appearing on the FM Layer shall conform to the following established standards:
  - a. Layer Color – Green (No. 3)
  - b. General – Information drawn on the FM Layer shall include the following.
    - (1) HRSD force mains, air vents, valves, other force mains which connect directly to valved outlets or tapping saddles, valve vaults, pipe encasements, leak detectors, cathodic protection symbols, and check valves.
    - (2) Line type
      - HRSD FM - Continuous Polyline

- Other FM - As indicated.
- (3) Line width
- HRSD FM - .047" (for largest diameter on VG sheet. Vary width where FM reduces in size.)
  - Others - Size smaller than HRSD according to difference in diameter.
- (4) Symbols - Standard HRSD symbols for valves, air vents, leak detectors, etc. Size valves relevant to diameter of force main.
- c. Pen Width = 0.016 inches
5. Detail Layer - Information appearing on the Detail Layer will conform to the following established standards:
- a. Layer Color - White (No. 7)
- b. General
- (1) Information drawn on the Detail Layer should include:
- If required, a more detailed drawing of connection to the HRSD force main showing fittings, changes in elevation, and any special related conditions.
  - Text related to the detail shall be drawn on the detail layer. Text shall be minimum .08".
- (2) Line Types as indicated in the above CAD Standards.
- (3) Font - Romand (Use Simplex if contrast in style is necessary.)
- c. Pen Width = 0.012 inches
- D. Abbreviation, Fonts and Standard Symbols
3. Abbreviations - The following list of abbreviations are required for use on all HRSD Valve Guides.

Item Description	Abbreviation
Air Vent	AV
Asbestos Cement Pipe	AC
Bulkhead	Bhd
Building	Bldg
Boulevard	Blvd
Cast Iron	CI
Cast Iron Mechanical Joint	CIMJ
Cable Antenna Television	CATV
Chemical	Chem
Clockwise	CW
Concrete	Conc
Corner	Cor
Corporation	Corp
Counterclockwise	CCW
Center	Ctr
Concrete Pipe	CP
Department	Dept
Department of Public Works	DPW
Diameter	Diam
Drive	Dr
Ductile Iron	DI
Ductile Iron Mechanical Joint	DIMJ
Fire Hydrant	FH
Elevation	Elev
Electric	Elec
Flanged	Flg
Force Main	FM
Interceptor Force Main	IntFM
Foot	Ft
Gallon	Gal
Government	Govt
Gravity	Grav
Height	Hgt
High Density Polyethylene Pipe	HPDE
Highway	Hwy
High School	HS
Horizontal	Horz

Item Description	Abbreviation
Horizontal Gate Valve	HGV
Inch	In
Invert	Inv
Light Pole	LP
Limit	Lim
Maximum	Max
Mechanical	Mech
Mechanical Joint	MJ
Mile	Mi
Minimum	Min
Outside Diameter	O.D.
Overhead Electric	OHE
Private	Priv
Property	Prop
Polyvinyl Chloride	PVC
Power	Pwr
Power Pole	PP
Reinforced Concrete	RC
Reinforced Concrete Cylinder Pipe	RCCP
Restrained Joint	RJ
River	Riv
Residence	Res
Right Of Way	ROW
Railway	Rwy
Railroad	RR
School	Sch
Sheet	Sht
Station	Sta
Steel Pipe	SP
Welded Steel Pipe	WSP
Surface	Sur
Valve Guide	VG
Vertical	Vert
Vertical Gate Valve	VGW
Underground	U/G
Underground Electrical	UGE
Without	W/O

VI. Attachments

A. VALVE GUIDE FORMAT AND EXAMPLES

1. Standard Font
2. Valve Guide Example – AT-1019
3. Valve Guide Example – NA-3029
4. Valve Guide Example – VIP-7012

**End of Section**