SACRAMENTO SUBURBAN WATER DISTRICT

AUTOCAD STANDARDS & DRAWING PRODUCTION GUIDELINES

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1 DOCUMENT PURPOSE

Sacramento Suburban Water District (SSWD) has developed AutoCAD (CAD) standards in order to establish minimum standards required by all Consultants working on all SSWD design projects. These standards are applicable to all Consultants and associated Sub-consultants completing design projects for SSWD.

The purpose of this manual is to provide specific instruction and definition for the use of SSWD standards and the associated AutoCAD seed file, which is to be used in conjunction with this manual.

2 USING SSWD PROVIDED FILES

2.1 Sheet Set Management

Use of Sheet Set Manager (SSM) and CAD design project DST files are required for all SSWD design projects. Consultants are expected to utilize the SSWD provided SSM and associated seed files.

2.1.1 Sheet Set Creation

All new projects must start with creating new project drawings starting with a SSM and its associated drawing files. Standard project files have been provided as a starter package, including a SSM seed file (sswdstandard.dst) for your use. Standard layers, styles, fonts, plot configurations and other important setup features have been preconfigured in the seed files and should be used when starting a new project from scratch.

2.1.2 Sheet Set Manager

SSWD title block requires the use of the SSM as an efficient way to organize and manage a project drawings, and reduce drawing sheet reference errors. The required use is to track drawing sheets that comprise a set of construction documents that will double as an import link for the sheet index. When the sheet index is linked to the SSM, drawing names are consistent between the sheet index of drawings and each drawing title from sheet to sheet.

2.1.3 Sheet Set File Management

As sheets are added or deleted, the SSM may not correspond to the actual file name as labeled in Windows File Explorer. It is important to edit drawing file names using the SSM so that the sheet names (as seen in the SSM) match the actual drawing file names. This task must be completed within the SSM. Drawing files containing multiple sheets shall also be managed within the SSM environment.

2.1.4 Sheet Set Fields

Sheet set fielded properties within the SSM are used to link data between the drawings and the SSM. This data is accessed through the SSM properties by 'right-clicking' on the SSM name or the sheet names listed in the project within the SSM dialog box within the AutoCAD environment.

2.1.5 DST Organization

The master sheet set DST file shall be copied into the project root folder and renamed to reflect the specific project. The project DST file must not be copied to subfolders. One DST file will maintain all files for the project drawings.

2.2 Folder Organization

This section refers to folder organization when used with the SSWD provided SSM.

Folder structure and organization is the backbone of the project and is considered critical in maintaining the sheet set. All drawing files (and x-ref files) must reside in a dedicated project folder. When creating a new project folder for project drawings, copy the drawing setup files folder and their included subfolders to a dedicated project folder. This project folder where drawing files reside is considered the "Root" folder. There should be no other files in the "Root" folder except for active drawing files and their associated support files.

- Keep folder names short as they will appear on the plot stamp on all project sheets.
- ACTIVE WORKING DRAWINGS SHALL BE LOCATED AT THE ROOT LEVEL ALONG WITH THE ASSOCIATED X-REFS. X-REFS SHALL NOT BE LOCATED IN SUBFOLDERS.

2.3 Seed Files

Seed files are provided by discipline. The intention is to copy these files over and create your set from these files. Each seed file contains the appropriate font sizes and styles, dimension styles, standard blocks, and general layer system, as well as having layouts set up for plotting full size PDFs using the SSWD-STANDARD-2019 color table. The title blocks are preloaded into a Layout tab. SSWD utilizes several seed files and they are linked to sswd-standard.dst:

- "XXXXX-A-01" Use for first architectural sheet. In Architectural units.
- "XXXXX-A-02" Use for all following architectural sheets. In Architectural units.
- "XXXXX-C-01" Use for all civil plans and plan and profiles. In Engineering units.
- "XXXXX-E-01" Use for first electrical sheet. In Architectural units.
- "XXXXX-E-02" Use for all following electrical sheets. In Architectural units.
- "XXXXX-G-01" Use for cover sheet. In Architectural units.

- “XXXXX-G02” Use for all following general sheets. In Architectural units.
- “XXXXX-I01” Use for first instrumentation sheet. In Architectural units.
- “XXXXX-I02” Use for all following instrumentation sheets. In Architectural units.
- “XXXXX-M01” Use for first mechanical sheet. In Architectural units.
- “XXXXX-M02” Use for all following mechanical sheets. In Architectural units.
- “XXXXX-S01” Use for first structural sheet. In Architectural units.
- “XXXXX-S02” Use for second structural sheet. In Architectural units.
- “XXXXX-S03” Use for all following structural sheets. In Architectural units.

2.4 Plotting Drawings (Using the SSWD-provided Setup)

SSWD has provided seed files for your use in aiding with plotting. Each discipline seed file has two-page setups included to create plots using this system. These files are designed for use with the SSWD_STANDARD-2019.ctb. Full-size and half-size plotter settings are shown below in Figures 1 and 2, respectively.

Figure 1. Full-size plotting with SSWD seed files

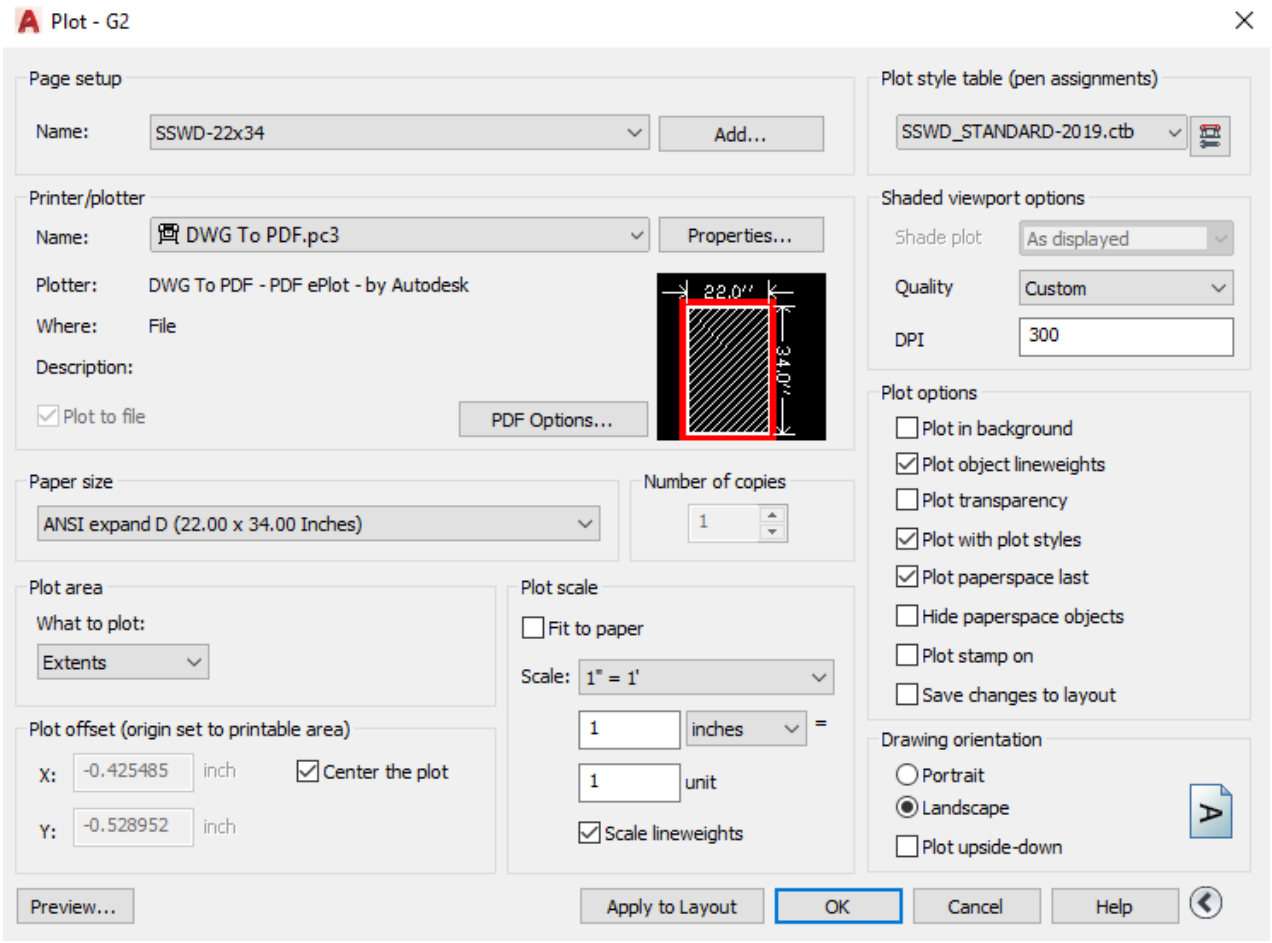
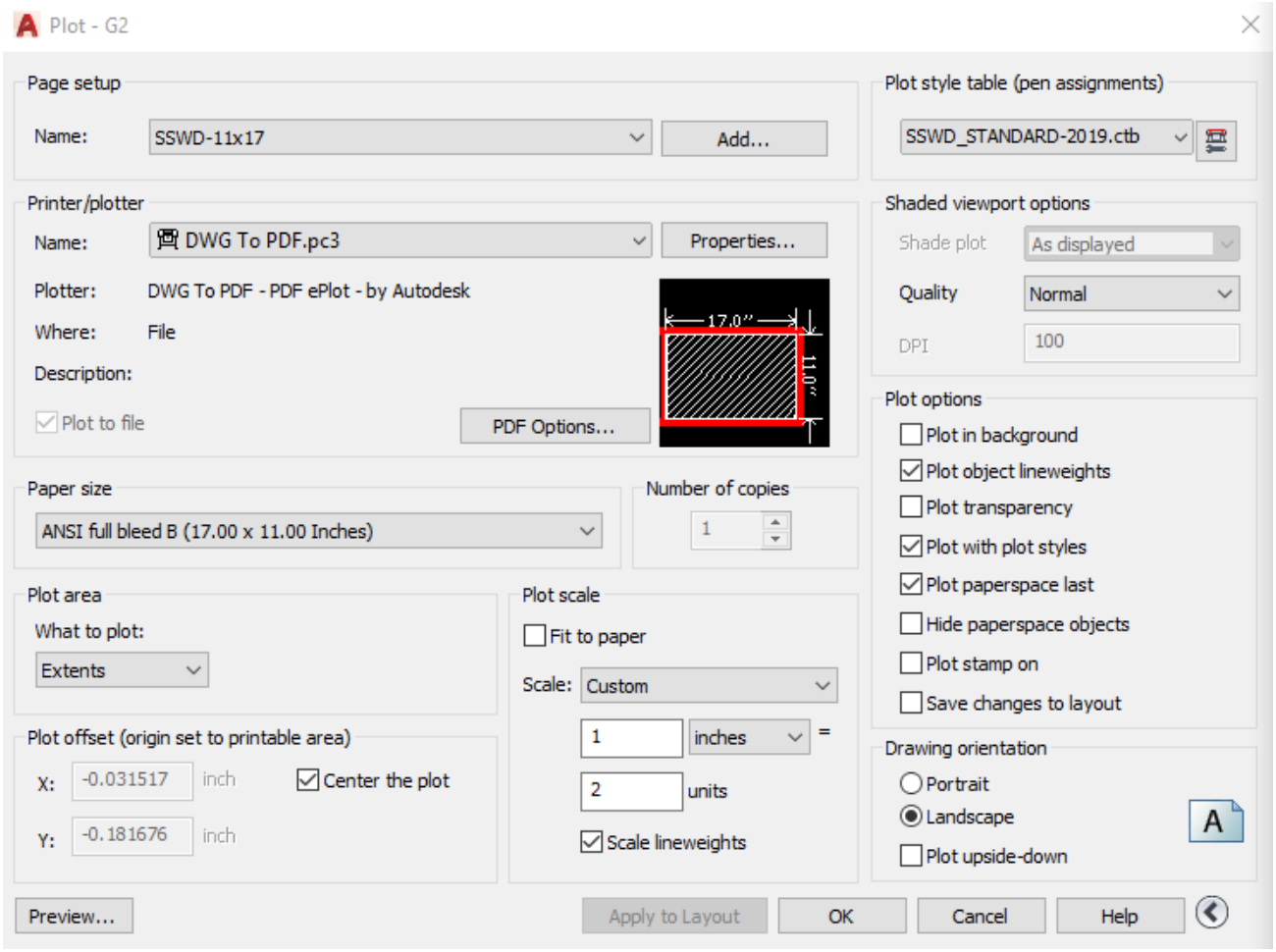


Figure 2. Half-size plotting with SSWD seed files



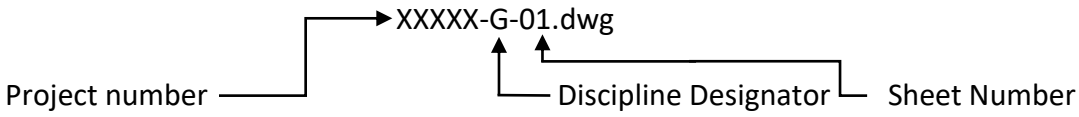
3 CAD GUIDELINES

3.1 File Naming

Based on the National CAD Standards (NCS) file standards naming system. Consultants are expected to name their files according to the project needs. Below is a guide to the NCS standardized file naming system.

3.1.1 Sheet File Names

- Each construction design drawing file layout tab shall be named with the drawing number indicated.
- The file names must consist of the following designators:
  - The project numbers – Consultant may use their project number for the first part of the file name.
  - A discipline designator letter, consisting of one alphabetical character and a hyphen or two alphabetical characters.
  - A sheet sequence number, consisting of two numerical characters.



3.1.2 Base File Names

Base files are the models that are referenced into the sheet file. The naming shall follow a specific system which may be project dependent. The files shall work as overlays, such that they work together, and no work is repeated. The file naming system is outlined below:

- First letter indicates Discipline, with X used for existing base files. The discipline letter is followed with a dash.
  - X- for existing base file (including survey). These layers will all appear screened. No new construction information shall be added to these base files. File layer may be manipulated for ease of use with other disciplines (freezing removal layers, as an example).
  - C- for civil base files. These include pipelines and utilities, site structures and roads, grading and drainage, and yard piping.
  - A- for architectural base plans. These include interior layouts and elevations.
  - S- for structural base plans. These include floor plans, structural plans, and sections.

- M- for mechanical base plans. This includes the equipment and piping in a structure in plan and section view.
- E- for electrical base files. This includes electrical equipment location, lighting, and conduit routing.

- The next four letters indicate type of file in the case of civil (such as GRAD or PIPE for grading or piping, respectively), or location of structure in the other disciplines (such as or RESV or BLDG for reservoir or building, respectively). The type/location letters are preceded with a dash.
- There are instances in which a third set of four letters are required, such as when there are multiple buildings or sites. These letters are preceded with a dash.
- Typical sample file names are:
  - X-SITE (site survey)
  - C-GRAD (civil site grading plan)
  - C-SITE (civil site improvements plan)
  - C-YARD (civil yard piping)
  - C-PIPE (plan and profile piping)
  - S-BLDG-ELEC (structural electrical building plan)
  - S-TANK-PLAN-BOTT (structural tank bottom plan)
  - S-TANK-PLAN-TOPP (structural tank top plan)
  - M-WELL-NO03 (mechanical plan of well no. 3)

3.2 Base File and Sheet File Setup

This section describes setting up base files and sheet files to create design drawing files.

- Sheet files are the files that are plotted to create a project design drawing set.
  - Most of these files will have a title block referenced into layout, with base files referenced into model space at 1:1. In some cases, such as general sheets, schedules, and standard details, all items may be located in layout. See Layout and Model Space below.
  - Viewports on a non-plotting layer shall be created to view the base files at scale. A title shall be placed below each viewport in the drawing with the scale indicated and a north arrow (if required) provided in the upper right of the drawing. If the item is a detail or section, the title shall contain a reference bubble. Bubbles shall indicate the reference letter or number and referred drawing number.

- Base files are the drawings of the actual design. This may include the project site plan, floor plans, structure sections, or other project components.
  - All base files shall be drawn at 1:1.
  - Structure Work
    a. Floor plan and section base files may include more than one plan or section or may each contain only one floor or section. This is based on the needs of the project.
    b. Structure work is often composed of a series of base files that work together. These are usually based on the discipline. The structure itself shall be the base file. Piping, HVAC, and electrical may be on a separate files. All files shall have the same insertion point.
    c. Structure work (tanks, buildings, etc.) shall be completed using architectural scales (the base unit of the drawing is one inch).
  - Site Plans
    a. Site plan drawings are generally composed of a series of base files that work together. In general, there shall be a survey showing existing field conditions and a file containing proposed improvements. Depending on the scope of the project, a proposed grading and drainage plan, yard piping plan, or other plan may be required. Each should be separate but work together to form cohesive drawings. All related base files shall have the same insertion point. Surveys should never be moved from the coordinates provided by the surveyor.
    b. Site plan work shall be completed using engineering units (the base unit of each plan shall be one foot).

3.3 Layout and Model Space

This section provides a description of the use of Layout and Model Space within the drawing file.

3.3.1 Layout

Items in layout are outlined below:

- All drawings shall contain the following in layout: title block, dimensions, text and leaders, notes, standard symbols, and viewports.
- Specific drawings with symbols and legends, abbreviations, standard details, general or discipline notes, schedules, schematics, single line and wiring diagrams, P&IDs, and other similar drawings lacking scale may be entirely in layout. Images may also be placed in layout.

- Attributed text blocks shall be inserted as blocks into each layout if DST files are not used.

3.3.2 Model Space

Model space shall be used for inserting base files and should be set up such that all files of the same base unit (Engineering or Architectural) line up with the same insertion point.

- Base files and drawing details to be scaled.
- Files of differing scale types can be inserted and rotated using a specific insertion point and a layer indicating rotation. This is typically used to insert structures into a site plan.

3.4 External Reference Files

This section is a discussion of external reference files.

- External reference files shall be attached using overlay to avoid circular referencing.
- The project title block shall be XREF'ed into all drawings at insertion 0,0.
- Project base files shall be XREF'ed into model space at a 1:1 scale.
- Other reference file types may be used as required. Sizes shall be appropriate for the item to be clearly read on a printed half-size scale drawing.
  - Images. Photos in JPEG or TIFF format may be used. They may be placed in either model space or layout at the drafter's discretion.
  - Old Project Drawings. PDFs and TIFF of previous projects may be used with SSWD's approval. Care must be taken to ensure readability and scale.
  - OLE. Object linking must include the linked file in the folder with the sheet file. All linked files using text shall adhere to the text style and requirements of the drawing (Arial at 0.10").

3.5 Viewports and Scale Setup

Drawing scale(s) shall be determined by viewport scale.

- Viewports shall be created in layout showing all of, or a portion of, one or more models located in model space.
  - Viewports are created on a non-plotting layer.
  - The model may be rotated through the viewport as required to provide the best scale and fit for the presented area. The north arrow shall reflect this rotation.
- Drawing scale shall be a standard AutoCAD scale, and designed to be read with either an Architectural or Engineering scale. Very large and very small scales are to be avoided.

- Acceptable Architectural scales are: 1/8”=1’-0”, 1/4”=1’-0”, 3/8”=1’-0”, and 1/2”=1’-0”. On rare occasions, 3/4”=1’-0” and 1”=1’-0” may be used.
- Acceptable Engineering scales are: 1”=10’-0”, 1”=20’-0”, and 1”=40’-0”. On rare occasions and with SSWD approval, 1”=30’-0”, 1”=50’-0”, and 1”=60’-0” may be used.
- For overall plans, it is acceptable to use 1”=100’-0” or 1”=200’-0”.

3.6 Layers

The Consultant shall use a version of the NCS/AIA CAD layer system. Consultants are expected to adhere to this system and have items on the correct layer. Some layers have already been provided in the SSWD files. New layers may be created but need to be consistent with the system. The NCS/AIA CAD layer system is an 11-character system following the standard D-MAJR-MINR-S as described below.

- Discipline Designator. The first character is the discipline designator and corresponds to the discipline work of the drawing, except general items which may be on any drawing. The designators are as follows:
  - A – Architectural
  - C – Civil
  - E – Electrical
  - G – General
  - M – Mechanical
  - I – Process and Instrumentation Diagrams
  - S – Structural
- Major Group Designator. The next four characters are the Major Group. The major group describes the primary part of the drawing element being incorporated. Examples include C-ROAD, S-WALL, and C-PIPE.
- Minor Group Designator. The next four are the Minor Group. The minor group describes the major group in more detail. Examples of this usage include C-ROAD-CURB, M-EQPM-PUMP, and S-FNDN-PILE.
- Status Designator. The final letter is the Status Designator. Status field codes are useful for setting layer filters. Status codes are as follows:
  - A – Abandoned
  - M – Items to be moved
  - D – Existing to be demolished
  - E – Existing to remain
  - F – Future work
  - N – New work
  - 1-9 Phase number

3.7 Annotation Text

- Text/Font styles shall be kept to a minimum number.
  - Arial is the required text style due to its ubiquity, ease of reading, and compact nature. One font style should be used for all notes and callouts in a plan set and drawing disciplines.
  - The SSWD provided seed files include the text style Arial, which is required to be used as the default text style throughout the plan set.
- Text height shall be set in Mtext, not by style.
  - Title text shall be 0.18” height. All titles shall be standard blocks provided by SSWD.
  - Subtitle text shall be set to 0.14” height.
  - Room/area text shall be set to 0.12” height.
  - Callouts, dimensions, and note text shall be set to 0.10” height.
- Mtext shall be used to place text.
- Annotation appearance requirements are outlined in Section 3.4.3.

3.8 Leaders

- Leaders shall be consistent throughout the plans and drawing disciplines.
- Leaders shall be straight, 3-point, with a closed filled arrowhead.
- Leader appearance requirements are outlined in Section 3.4.3.2.

3.9 Dimensions

- Dimensions style settings
  - Dimension arrowheads shall be closed filled arrows.
  - Dimensions shall use the same text style as the text in the drawing.
  - Dimension text shall be placed above and centered on the baseline.
  - Dimension text shall be aligned with the dimension line.
  - Dimensions shall be set to scale dimension to layout.
  - Dimension units shall be Architectural for most drawings and Decimal or Engineering for site plans.
- Dimension styles have been created in the SSWD provided files.
- Dimension appearance requirements are outlined in Section 3.4.4.

3.10 Blocks

Discipline specific blocks are to be provided by the Consultant in accordance with accepted industry standards for each discipline.

- Blocks should be created on layer 0 with color and linetype set by layer.
- Block attributes shall conform to drawing text font and size.
- Dynamic blocks may be used.

3.11 Plotting

- Plots shall be provided in PDF format.
- Plot size:
  - For project design drawings, both full-size (34”x22”) and half-size (11”x17”) sets shall be required at various points during the submittal process. The project contract should specify the size and number of all deliverables, both hard copy and electronic.
- Half-size plots shall have the lines scaled at half that of the full-size plot (scale line weights to be checked).
- Plots shall leave a 1 ½” margin on the left side of the drawing at full-size. All other margins are to be ½” at full-size.
- Plot stamps shall be used at the Consultant’s discretion but is encouraged by SSWD.

4 DRAWING SET AND SHEET APPEARANCE

4.1 Overall Drafting Consistency and Appearance

Consultants are expected to use a consistent set of standards throughout the project drawing set. A standard project setup of drawings (Drawing Seed file) have been provided as a starter package and is further discussed in Section 1 – Using SSWD Provided Files. Standard layers, styles, fonts, plot configurations, and other important setup features have been preconfigured within the Drawing Seed file and will be used when starting a new project from scratch. This includes, but is not limited to the following:

- Proposed/new project items depicted on a specific drawing shall stand out from background items.
  - When working with existing information; i.e. ground contour surveys and existing structures, use a screened background for existing conditions. Dark lines will be used for all proposed work.
  - If screened items are used, they need to be dark enough to photocopy.
  - Proposed project items in a particular discipline shall stand out over proposed project items from other disciplines used as a background. This shall be attained by using thinner lines for the disciplines used as background and heavier lines for the discipline presented.
- The drawing shall be presented at a standard scale that is easy to read.
  - Large site areas can be broken into smaller sections using match lines, if required.
  - Crowded site plans shown at an appropriate scale shall be separated into separate drawings showing the same area but depicting different work.
  - Crowded floor plans shall have areas set apart in partial plans.
  - Very large floor plans shall be broken into separate drawings using match lines.
- All text shall have a consistent font style (Arial). Text height shall be consistent per use (annotation, titles, or subtitles).
- All dimension styles shall be consistent in size and style across the entire plan set and disciplines.
- General blocks shall be consistent in their use and placement rules, including: plan, section, and detail titles; north arrow placement and size; section cut styles, and location.
- A consistent set of symbols shall be used throughout the drawing set and across all disciplines. Consultants are expected to provide their own symbol block sets in accordance with accepted industry practice, but will be consistent across the entire drawing set.
- A consistent set of abbreviations shall be used throughout the plan set.

- Notes shall be consistent in location, numbering, and heading. For example, if key notes are used in a drawing set, they shall be used on all sheets across all disciplines.
- All tables shall be in CAD table format. Tables shall have headings.
- It is expected that the Consultant will adhere to basic rules of drafting, including but not limited to:
    - Leader lines shall not cross each other.
    - Leader lines shall not cross over text or dimension lines (crossing dimension extension lines are okay).
    - Dimensions shall be aligned.
    - Callouts shall be located for clarity and ease of plan reading.
    - Detail/Section callouts shall be aligned and left/right justified.

4.2 Title Blocks (Project Border Sheet)

All projects shall have project border sheets or title blocks. The purpose of all border sheets is to identify the project, the responsible parties, and the purpose and identification of each drawing.

4.2.1 Construction Design Borders

Construction design borders shall be 34”x22”. **36”x24” will not be accepted.** Title blocks shall have one or more attributed text blocks to fill fields in the title block. Project design drawings will incorporate borders that are approved by SSWD and shall include the following elements:

- SSWD project number
- Date (of submittal)
- Drawing title and designation
- Sheet number and total sheet count
- Project title
- Discipline/drawing title
- SSWD logo
- Consultant(s) logo
- Design submittal level
- Engineers stamps, as appropriate
- Drawing scale
- Full size plot indicator
- Responsibility block (designed by, drawn by, and approved by)
- Revision block area
- North arrow

4.3 Drawing Set Order and Numbering

4.3.1 Drawing Discipline Order

Drawing discipline order shall follow the National CAD Standards. Not all disciplines shall be used on all projects. Use shall be based on project type and size. For SSWD construction design projects, the drawing order shall be as follows:

- General (G)
- Demolition (D)
- Civil (C)
- Architectural (A)
- Structural (S)
- Mechanical (process piping and equipment) (M)
- Process and Instrumentation Diagrams (I)
- Electrical and Communications (E)

4.3.2 Drawing Numbering Guidelines

Drawing set numbering may vary by Consultant standards and set size. However, the following elements shall be true for all project designs.

4.3.2.1 Project Design Sheet Numbering

- For pipeline design sets, the drawing numbering shall be consecutive (C-01, C-02, etc.) and drawing titles shall reflect the separate lines as necessary.
- For drawing sets in which there are multiple sites/structures (such as multiple sites covered in one project), each site/structure shall have a two- or three-letter identifying abbreviation to distinguish that site/structure on all discipline drawings. Consultants shall work with SSWD to determine the acceptable identifying abbreviation.

If the design project is very small (three (3) to eight (8) drawings and/or upon approval of SSWD) and is a set with small or unrelated items not needing specialty engineering, the entire set may be considered general drawings and shall be numbered consecutively.

4.4 Drawing Organization

4.4.1 Layout of Plans, Sections, and Detail Sheets.

4.4.1.1 Schematics and Diagrams

- Civil site plans shall be shown at the beginning of the discipline.
- Mechanical schematics, when shown, shall be shown at the beginning of the discipline.
- Electrical diagrams. Load diagrams are shown at the beginning of the discipline set.

4.4.1.2 Plans

- All plans shall have a north arrow, plan title, and scale.
- Single plans on a sheet shall be centered on the sheet.

- For existing structures, only plan levels on which work occurs shall be shown. Partial plans may be acceptable if the area of the structure is clear.
- All plans of a particular structure or area shall be covered before moving to sections.

4.4.1.3 Schedules

Schedules can appear in a variety of places depending on the discipline.

- For civil and mechanical items, they shall be located at the beginning of the discipline set or in the general drawings, depending on schedule type and project size.
- For structural, they shall be located with sections and/or details to which they relate.
- For electrical, the conduit schedules shall be located with the notes, but may be located where most appropriate for the design. Panelboard schedules shall be located with the single line diagram or with the notes and schedules.

4.4.2 Orientation of Plans

Plans shall be oriented with north oriented to the top of the page if possible. If not, then north shall be oriented toward the binding edge.

4.4.3 Annotation

It is standard practice in engineering to use all capital letter in all parts of the annotation, except as required for symbols. Style of annotation is required to be used throughout the plan set. Callouts shall be aligned/justified to increase readability.

4.4.3.1 Placement of Sheet Notes and Key Notes

- Individual sheet specific notes shall be located on the upper right section of the sheet. A five-inch margin may be reserved on each drawing for sheet notes. Sheet notes shall be identified as either “sheet notes” or “notes.”
- If key note tags are used, the notes shall be located below the sheet notes.

4.4.3.2 Placement of Callouts, Tags, and Leaders

- Callouts shall be placed next to the item on the outside of the plan to the extent possible. Callouts shall be lined up neatly to enhance readability. This includes detail callouts and pipe and equipment tags.
- Leaders shall come off the center of the top line of text when pointing to the left of the callout or tag, and shall come off the center of the bottom line of text when pointing to the right of the callout or tag.

4.4.3.3 Orientation and Justification of Text

- Text shall be oriented horizontally, and shall read left to right, top to bottom. The exception is street names on civil plans and maps. Those shall be oriented along the line or curve of

the street. In those cases, text shall read from the left if perpendicular to center. Avoid placing text at an angle 10-degrees left of vertical.

- All text shall be left justified except in the following cases:
  - Room, structure, and area designations shall be top-center or middle justified and underlined. They shall be located as close as possible to the center of the room, structure, or area they designate.
  - Large equipment and panel names shall be top-center or middle justified. They shall be located inside the equipment or panel outline.

4.4.4 Dimensioning

Dimensions style shall be set such that dimension arrows or tick marks and have text centered and above the baseline.

Civil drawings shall have dimensions that read in decimal feet. Civil dimensions shall be aligned with the dimensioned objects.

Structural and all other drawings shall have dimensions that read in feet and inches. Structure dimension callouts shall align. Do not repeat structure dimensions on other disciplines.

4.4.4.1 Section and Detail Referencing

- Section Referencing:
  - Sections shall be referenced with a section cut shown on the plan.
  - All sections shall be identified with a section title and scale. The order of the sections shall be identified with a letter and continue alphabetically. The letters I and O shall not be used.
  - The section cut bubble shall list the section letter on the top portion, and the bottom portion shall refer to the drawing on which the section is shown.
  - Sections shall be shown in order on the page from left to right, top to bottom. The same scale shall be used for each section through a particular structure.
  - It is preferred to group like sections onto the same sheet, such as typical wall sections.
  - Care must be taken to ensure section matches the section cut location, jogging the section cut may be required.
  - Standard section cut and section title blocks are provided by SSWD.

- Detail Referencing
  - Details specific to the project set shall go after the sections. All specific details (and standard details if separate tag is not used) shall be identified with a detail title and scale. The order of the details shall be identified with a number and continue numerically on each sheet.

- Standard details shall be at the end of a discipline set. It is acceptable for Consultants that use a separate standard detail tag to use those with approval from SSWD.
- Details shall be referenced with a detail bubble on the plan or section best-oriented to the detail.
- Details shall be shown in order on the page from left to right, top to bottom. The same scale shall be used for all sheet details as appropriate.
- The detail bubble shall list the detail number on the top portion, and the bottom portion shall refer to the drawing on which the detail is shown.
- Standard detail bubble and detail title blocks are provided by SSWD.

4.4.4.2 Mixed Sheets

- Sections and details may be shown on the same sheet when covering the same structure or piping system.
- Partial plans and associated sections should be kept together when possible.

4.4.5 Blocks

Standard general blocks are provided by SSWD. Discipline specific blocks are to be provided by the Consultant in accordance with accepted industry practice for each discipline.

4.4.5.1 Block Scale

- All blocks that are not scalable shall appear at the same scale throughout the project drawing set.
- Where standard blocks are to be used for scaled items, they shall conform to the actual size as depicted in the drawing. For example, all equipment included in the design will be scaled to meet American National Standards Institute (ANSI) and American Water Works Association (AWWA) standards for the manufacturer equipment laying length and pipe diameter.

5 REQUIRED ELEMENTS FOR DRAWINGS

5.1 Cover Sheet

The purpose of the cover sheet is to identify the project specific information. Additionally, the index of drawings may be located on the cover sheet, as well as a map indicating the project location. Information on cover drawing shall include:

- SSWD logo, project title, SSWD project number, SSWD Approval signature block, and consultant's logos and stamp/signature area.
- Vicinity Map (greater area) and Location Map (project location shown with routing from nearest highway). Scale is dependent on area covered. Highways must show correct symbol and number. Major and minor road names shall be clearly legible.
- For small projects, the index of drawings may be located on the cover sheet.

5.2 General Drawings

The purpose of general drawings is to identify the project scope and provide information pertinent to the entire project set. The number of sheets and organization is dependent on the project size but shall flow in the order listed below. Information on general drawings shall include:

- List of Drawings. For larger projects, the index of drawings shall be located on the first sheet after the cover sheet. If the full sheet is not necessary, it shall be located on the right side of the second sheet.
- General Notes for Project. Includes basis of survey, supporting documentation references (such as geotechnical reports), previous project references (if required), construction sequencing information, 811 info, contractor requirements and/or limitations, etc.
- Standard Symbol Legends. Description of how to read section and detail callouts, piping designation tags, and equipment designation tags.
- Symbols. Symbols shown on general drawings are usually civil and mechanical symbols (line type, piping, and valves). Symbols for architectural, structural, electrical and instrumentation, shall be included as part of those discipline sets.
- Abbreviations. Abbreviations shown on general drawings are usually civil and mechanical. Abbreviations for structural, architectural, electrical and instrumentation, shall be included as part of those discipline sets. (See SSWD provided setup seed files for example.)
- Required Items. Project site plan for reference if no explicit site plan work is to be performed.

5.3 Demolition Drawings

Demolition drawings indicate existing items to be demolished, removed, or abandoned in place.

- Plans and Sections. Demolition plans shall be at the same scale and orientation as the site plan and/or structure plan that shall be used for any new work.
- Photos. Photos may be used to indicate the extent of structure, equipment, piping, and appurtenance removal. Location of photo vantage point and direction shall be indicated on a plan for reference with photo number indicated.
- Details and Schematics. For smaller items or parts of larger items, such as parts of pumps or sections of small piping assemblies, a detail or schematic may be required. Details may also be necessary to show repair of items damaged due to equipment or structure removal, and to describe pipe and/or casing abandonment procedures.
- Demolition and Abandonment Hatching. Items to be demolished or removed and salvaged are shown on plans, sections, and photos with a diagonal hatch. Items to be abandoned are shown on plans, sections, and photos with a crosshatch. Hatch and crosshatch scale and weight shall be as shown on the symbol sheet and shall be consistent throughout the set.
- Callouts and Notes. The extent and phasing of items to be removed or demolished shall be clearly identified on the plans. Identify the items to be salvaged and returned, demolished and disposed of at contractor expense, or abandoned in place using any specific techniques for abandonment.

5.4 Civil Drawings

Civil drawings show work performed outside of any structure. This includes site information, underground piping, grading, and paving. The required elements include:

5.4.1 Survey Information

Surveys shall be performed by surveyors with current licenses in the State of California.

- All civil plan drawings shall be provided in the California State Plane Coordinate System NAD 83, Zone 2, unless the project requires otherwise and/or with SSWD approval. If the project is very small, local survey or use of previous project surveys if available may be allowed.
- Basis of bearing, basis of elevation, and benchmarks shall be provided for all survey information in the project general notes (see general notes under general drawings above).
- Surveys shall show all visible existing information including, but not limited to, the following:
  - Structures – buildings, basins, slabs, retaining walls, enclosures, walkways, etc.
  - Paved areas – edge of pavement, curbs and gutters, medians, and striping.

- Grading – shown with contours, grade breaks, and spot elevations.
- Fixtures – fences, guardrails, signs, light poles, power poles, bollards, etc.
- Utility information – USA paint markings, utility boxes, pull boxes, valve pots, manholes, catch basins, gravity system pipe inverts, traffic loops, above-grade piping, etc.
- Landscaped or graveled areas.
- Survey shall be scaled at 1"=20' at 1' contours.

5.4.2 Site Plans

Site Plans shall be in an acceptable survey system, and drawings with new work shall include:

- Coordinate tagging of all proposed structures and fixtures as outlined below:
  - Direct tagging of coordinates.
  - Coordinate tagging with coordinate numbers, referring to a table of coordinates with coordinate number, northing, easting, elevation, and description.

- Grading, paving, and yard piping can be shown on combined or separate drawings as the level of detail and scope of work requires.
  - **Site Plan**. Site plans indicate the layout and extents of the property. Elements of the site plan indicate:
    a. Property lines (existing and proposed).
    b. Utility and other easements (existing and proposed).
    c. Survey with all existing items to remain on-site.
    d. Proposed structures and fixtures shown and identified (exteriors only - footprint).
    e. Fencing (existing and proposed).
    f. Trees, vegetation, and landscaped areas (existing and proposed).
  - **Grading**. Grading shall be shown in a manner reflecting the slope and complexity of the site.
    a. Grading shall be shown at appropriate contour intervals. Contours shall be at 1-foot intervals, with a major contour shown at 5-foot intervals. Flatter sites might be at 6-inch intervals, with major contours shown at every 1-foot.
    b. Spot elevations shall be provided at structure and slab-at-grade corners. This may be incorporated into the coordinate table if one is required. Spot elevations shall be provided at high and low points of site, and along edge of pavement, and grade breaks.
    c. Grade breaks shall be clearly delineated.

- **Paving**
    a. Asphalt paving shall be shown with a shaded pattern. New and existing pavement shall be clearly identifiable by screening back all existing improvements.
    b. Coordinates and/or dimensions shall be used as appropriate to locate pavement edge, curbs and gutters, valley gutters, aprons, medians, and walkway locations.
- **Yard Piping**. Yard Piping Plans indicate the pipes below grade.
    a. Buried pipes shall be shown as a dashed line.
    b. Above grade pipe shall be shown as a solid line.
    c. Larger pipes shall be shown as a double line. Double line pipes shall be shown when lines depicting pipe are 1/8" or greater on the plotted drawing. All other pipes shall be shown as single line.
    d. When grading and drainage drawings are shown separately, culverts, storm drainage pipes, and appurtenances are shown on the yard piping plan.
    e. All fittings, curves, and tie-in points shall have coordinate information provided as listed above.
    f. If separate yard piping profiles are not provided, elevations shall be provided at all fittings, curves, and tie-in points.

5.4.3 Plan and Profile Drawings

Plans shall show the new pipeline(s) horizontal location on the survey background with and alignment and stationing. Profiles shall indicate the pipeline in double line. Elements shall include:

- Drawing Layout
    - Plans shall be located on the top half of the plan sheet.
    - Profiles shall be located below plans.
    - Notes shall be at the right-top or across the bottom of the plan sheet.
- Scale. Drawing plans shall be scaled at 1 inch = 20 feet (1"=20'). Profiles will generally be at a 10-times vertical exaggeration. For example, if the plan is 1"=20', the profile shall be at 1"=2'.
- Plan and Profile Orientation. Pipeline drawings shall be oriented such that north is up or to the left. However, orientation depends on what is being constructed. Pipelines are usually constructed from the lowest point to the highest point. Therefore, pipelines are usually stationed with the beginning (STA 10+00) at the low point.
- Stationing. Stationing shall be in 100-foot increments with ticks at 50+00 increments.

- Curve and Coordinate Callouts
  - Coordinates shall be called out (either directly or with table) at all changes in pipe direction. The angle of the bend shall be called out. The bends shall be standard fittings, unless otherwise approved.
  - Coordinates shall be called out at the beginning and end of all horizontal and vertical curves. Curve data shall be given either directly or in tabular form.
- Key Plan Index. A key plan index shall be provided for drawing sets larger than three drawings.
  - Key plan scale shall be determined by the area covered.
  - All plan and profile drawings shall be delineated and identified on the key plan.

5.4.4 Civil Details

Civil details may include trenches, thrust blocks, pipeline restraints, typical pads, pipe supports, manholes, catch basins, culvert head walls, signs, bollards, sidewalk details, curb and gutter details, fencing, non-structural retaining or other walls, and non-structural slab on grade.

5.5 Architectural Drawings

Architectural plans show the non-structural elements of a building including: building layout, roof, windows, doors, interior finishes, and exterior finishes.

5.5.1 Elevations

Architectural interior and exterior elevations are completed for all sides of a building, oriented in the direction they face. They show the building material and finishes for siding finish, roofing, window and door locations, gutters and downspouts, building mounted exterior light fixtures, and any architectural features.

5.5.2 Plans

Architectural plans show the structure of the building with finishes. They also show locations of interior architectural items, such as cabinets, partitions, workbenches, bathroom fixtures, etc. Architectural features shall be dimensioned. One plan shall be presented for all applicable floors and the roof. Roof plan shall show all penetrations.

5.5.3 Schedules

Architectural schedules shall be used on more complex buildings. Typical items include door, window, hardware, and finish schedules. Door and window numbers shall match those indicated on the plans and elevations.

5.6 Structural Drawings

Structural drawings shall be prepared and stamped by a structural engineer licensed in the State of California. Structural drawings are designed in accordance with the codes set in the International Building Code (IBC) and California Standards Building Code (CSBC). Structural drawings or details shall be created for all structures, slabs, walls, or enclosures that meet the criteria established in the IBC and CSBC.

5.6.1 Abbreviations

- Structural drawings shall have a separate set of abbreviations with their drawings.

5.6.2 Notes

- Structural notes are project specific and provide information on design loads and materials with references to pertinent code sections and specifications.

5.6.3 Major Mechanical and Electrical Items

- Major items are shown on structural drawings but shall be shown screened back. This is important where the structure is affected by equipment placement and requirements. Typical examples are equipment pads, pump supports, and pipe penetrations.

5.6.4 Dimensions and Elevations

- Structural drawings will show all elements of a structure's size, including wall thicknesses, slab thicknesses, room sizes, and overall building size, etc. These dimensions should be shown only on the structural drawings. Dimensions shall be complete for every plan level. Sections will include slab elevations in decimal feet and thicknesses in feet and inch dimensions.

5.6.5 Plans

Structural plans delineate the extent of the interior and exterior of a structure. Separate plans are created for each level of design.

- Foundation Plan. The foundation will show designed interior and exterior wall foundation and footings.
- Roof Plan. The roof plan will show roof truss design, truss design details, sheathing, membranes, and a nailing schedule.
- Additional reinforcing bars in slabs around openings will be shown on the plans unless it is covered adequately in the details.

- Notation and dimensioning for non-structural elements shall be included on structural plan drawings. These may include hatches, grating, checker plate, ladders, platforms, guardrails, and handrails.

5.6.6 Sections

Structural sections show the section through buildings and structures. Architectural finishes (siding, shingles, built-up roofing) are typically not shown.

- Concrete and masonry structure reinforcement and dimensions shall be shown on the sections and referenced details.
- Framed structures shall show all framing materials and dimensioned.
- Elevations shall note all slab heights, wall heights, and other components as necessary.
- Structure base and sub-grade material shall be shown and dimensioned.
- Door, window, hatch, and other openings shall be shown and dimensioned as clear openings.
- Notation and dimensioning for non-structural items are typically covered on structural section drawings. These may include hatches, grating, plate, ladders, platforms, and guardrails and handrails.

5.6.7 Details

- Structural details are to be referenced on the plans and sections.

5.7 Mechanical (Process) Drawings

Mechanical drawings show all piping and equipment. For some small projects, these may all be shown on the civil plans. Depending on the type and size of the project, HVAC may be a separate drawings. Major and minor electrical panel locations and instrument locations shall be shown and identified, but not detailed.

5.7.1 Schedules

- Equipment schedules identify the equipment type with the equipment number.
- Piping schedules identify the pipe materials, application, and coatings for different process flow piping.

5.7.2 Plans

Mechanical plans show the equipment, piping, and valves that make up all process systems. The building structure shall be shown but screened back.

5.7.3 Sections

Mechanical sections showing equipment, piping, valves, and appurtenances will be required. The sections will show above grade and below grade.

5.7.4 Details

Details are separated into project specific details and general standard details.

5.8 Electrical Drawings

Electrical drawings shall include power, lighting, grounding, alarms, security, and communication as applicable to the project.

Electrical drawings shall be prepared and stamped by an electrical or control systems engineer licensed in the State of California. Electrical drawings are designed in accordance with the National Fire Protection Code (NFPA 70), National Electrical Code (NEC), the Institute of Electrical and Electronics Engineers (IEEE), and the International Building Code (IBC).

5.9 Process and Instrumentation Diagrams

The purpose of process and instrumentation drawings (P&IDs) is to provide an overall view of how the flow process or processes are controlled. Instrumentation drawings include process and instrumentation diagrams, and programmable logic controller (PLC) and supervisory control and data acquisition (SCADA) interface.

Instrumentation drawings shall be prepared and stamped by an electrical or control systems engineer (EE or CS) licensed in the State of California. Instrumentation drawings are designed in accordance with the standards set by the International Society of Automation (ISA).

6 SUBMITTAL/PROJECT CLOSEOUT REQUIREMENTS

6.1 Contract Drawings Requirements

Drawing submittals shall be at 30%, 60% 90%, and 100% (final) levels of completion or as indicated in the Consultants contract with SSWD. The following describes the expectations for the level of detail required for each submittal level.

6.1.1 30% Drawing Requirements

- All sheets to have a 30% SUBMITTAL - NOT FOR CONSTRUCTION stamp prominently displayed.
- Cover with complete index sheet (may be on separate sheet).
- Legends, symbols, and abbreviations.
- Site plan with existing utilities and major improvements shown.
- Pipeline plan and profile sheets set up with horizontal alignments.
- Building floor plans with major equipment and piping shown.
- Project specific sections, elevations, and details as necessary.
- Single line diagram(s).
- P&IDs.
- QA/QC performed on design and drawings.

6.1.2 60% Drawing Requirements

- All sheets to have a 60% SUBMITTAL - NOT FOR CONSTRUCTION stamp prominently displayed.
- 30% level SSWD comments incorporated.
- Appropriate additions and revisions to the 30% design drawings.
- Pipeline plan and profile sheets with horizontal and vertical alignments.
- All design drawing sheets with allocated space and labelled sections and details.
- All standard details incorporated.
- All design references incorporated.
- QA/QC performed on design and drawings.

6.1.3 90% Drawing Requirements

- All sheets to have a 90% SUBMITTAL - NOT FOR CONSTRUCTION stamp prominently displayed.
- 60% level SSWD comments incorporated.
- Appropriate additions and revisions to the 60% design drawings.
- All design drawing sheets with complete section and detail content.
- All design references incorporated.
- QA/QC performed on design and drawings.

6.1.4 100%/Final/Bid set Drawing Requirements

- 90% level SSWD comments incorporated.
- Appropriate additions and revisions to the 90% design drawings.
- QA/QC performed on design and drawings.
- All drawings to be stamped, signed, and dated by engineer of record.
- CAD files shall be provided to SSWD including all reference files and images, EXCEPT stamps, signatures, and consultant company logos.

6.2 Addenda

Addenda are created during the bid period. Drawings shall be modified per requirements of addendum. Only those drawings affected by a particular addendum are changed.

- All changed areas (additions and deletions) shall be clouded and labelled with a numbered revision triangle.
- The revision area of the title block shall contain the corresponding revision triangle, the date, responsible engineer, and a brief description of the work (including the Addendum or RFI reference number).
- All submitted addenda drawings to be stamped, signed, and dated by engineer of record.

6.3 Conformed Drawings

Conformed drawings are created at the end of the bid period and prior to commencement of construction. This shall be the construction set.

- All addenda shall be incorporated into the drawing set. Remove all revision triangles and clouding.

- Label drawings Conformed Set in the revision block.
- All drawings to be stamped, signed, and dated by engineer of record.
- CAD files may be required per contract to be provided to SSWD, including all reference files and images, EXCEPT stamps, signatures, and consultant company logos.

6.4 Record Drawings

After construction a Record Drawing set shall be produced from the Conformed Set.

- Incorporate all change orders and contractor redlines.
- If contracted, a field visit may be required.
- Label drawings Record Set in the revision block.
- All record drawings to have stamps and signatures removed.
- CAD files shall be provided to SSWD including all reference files and images, EXCEPT stamps, signatures, and Consultant company logos.