Clark County Water Reclamation DISTRICT

The "Clean Water Team"

CAD Standards Manual

July 2018 **Version 2**

www.cleanwaterteam.com







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PART 1 - GENERAL

1.1 INTRODUCTION

This manual is a guide for consultants performing, or desiring to perform, engineering design and/or drafting services for the Clark County Water Reclamation District (District). Guidelines and examples presented in this manual will help consultants produce drawings that are consistent with the District's format, appearance, and professional standard. These standards are to be implemented in accordance with the requirements of the contract.

The purpose of this manual is to standardize drawing information and improve electronic data sharing between disciplines at the District and from consultants working for the District. It should not be considered a substitute for good communication between the team members involved. Effective communication between the consultant's staff and the District's engineering Project Manager, Project Engineer, and the CAD support staff, will help ensure production of concise, accurate and complete drawings – on schedule.

It is recognized that some work performed for the District may need to be submitted to other governmental agencies. Those submittals will need to conform to the reviewing agencies' standards. However, all submittals to the District must comply with this manual unless District staff grants an exemption.

1.2 CAD PROJECT QUALITY ASSURANCE / QUALITY CONTROL

As a long-term owner of public property, the District will utilize project documents for long-term operations and maintenance of the facility and as a starting point for future projects. As a result, the District expects a high level of accuracy in the prepared documents with a robust Quality Assurance / Quality Control (QA/QC) process used to ensure product quality.

At this time, the District expects to utilize 2D CAD drawing formats for procurement of construction services until the industry is better able to utilize Building Information Model (BIM) formats. Therefore, all drawings generated utilizing BIM technologies must also be thoroughly checked using a reliable QA/QC process prior to delivering 2D CAD drawings and associated models to the District.

A. CAD Projects Quality Assurance

Thoroughly check all drawings using a reliable QA/QC process prior to delivering them to the District. The drawings are typically checked to verify geometric accuracy such that all curves are tangent, elements are drawn on proper layers and on the correct coordinate system, and that additional requirements covered in this manual are met.

The Consultant shall provide sample electronic drawings to the District at various stages in the design process. Milestones for CAD file QA review by the District include:

1. Once the first drawing is set up that represents how all the drawings will be provided, the Consultant shall send the sample drawing (CAD file) to the District Project Engineer. This will allow the District to provide feedback at the start of the project to establish that this design guide is being followed.
2. At 30% Design Development, and at each subsequent submittal prior to the bid stage, the Consultant shall submit sample electronic drawings from each discipline, and from each sub-consultant, to the District Project Engineer to ensure that all CAD and reprographic standards are being met.

B. BIM Projects Quality Assurance

Modeling in three dimensions (3D) is not required. However, the District recognizes the value of these models and intends to implement procedures for 3D modeling of District projects at a future date.

1.3 DOWNLOADING AND INSTALLING SUPPORT FILES

A. The District standard design CAD drawings are available on the District website at www.cleanwaterteam.com/engineering.html.

PART 2 - GENERAL REQUIREMENTS

2.1 SOFTWARE REQUIREMENTS

All production design drawings must be completed using Autodesk software and of a version within 2 years of the most recent release at the signing of the contract. Any files converted from previous versions of AutoCAD, or from other formats, shall conform to the current District CAD Standards as outlined in this Manual.

A. Drawing Setup

1. The District utilizes the drawing setups outlined in this Manual for all CAD projects. The District will not accept drawings with alternate symbols, text height, font style, layer names and settings, or other deviations from the standards described herein without prior approval from the District Project Manager.
2. Full size production drawings shall be 22”x34” (ANSI D). Half size drawings shall be produced at exactly one-half scale of the full size drawings, to 11”x17” (ANSI B).
3. Unless otherwise approved by the District Project Manager, drawing title blocks shall be located along the right edge of each drawing.
4. The North arrow shall point up or to the left. The District Project Manager must approve any deviation.
5. All text is to be oriented to be read from the bottom and right, unless otherwise approved by the District Project Manager.
6. Alignment stationing direction shall run from left to right on production drawings, unless otherwise approved by the District Project Manager.
7. Drawing unit insertion scale shall be set to either “Unitless” or “U.S. Survey Feet”.
8. UCS shall be set to “World”.
9. The District allows the use of multiple layout tabs for Production Drawings. However, it is up to the consultant to provide files of a reasonable size. It is recommended that each file is limited to approximately ten (10) tabs within a single file. Files must use the maximum reasonable number of tabs to avoid an unnecessary number of separate files.

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PART 3 - FILE FORMAT

3.1 DRAWING TEMPLATE

A. All .dwg files created for any District project must use the CCWRD CAD template.

B. The latest version of the drawing template available at project start shall be used. The template includes layer names, annotation styles, standard District blocks, District line types, and object styles.

3.2 CAD DRAWINGS

A. In addition to the standard template, the following standard design CAD drawings are available for download on the District website at www.cleanwaterteam.com/engineering.html, and shall be used for all District projects:

1. Drawing Title Block
2. Cover Page
3. Abbreviations/Symbology
4. District Notes

3.3 PLOT GUIDELINES

A. Named Plot Style

The District has created an AutoCAD Plot Styles Table file (CCWRD.stb) in order to standardize plotting. This named plot style is designed to be used with all drawings that are to be submitted to the District, and is used in conjunction with the District drawing template. This file is available for download on the District website at www.cleanwaterteam.com/engineering.html.

B. Line Width Plotting

The following table defines the widths used in the CCWRD.stb file, and are considered sufficient for the majority of drawings. When the plotted drawing size is reduced to half size, the listed line widths will need to decrease proportionally.

	Plotted Line Width	
Line thickness	mm	in
Extra Fine	0.13	0.005
Fine	0.18	0.007
Thin	0.25	0.010
Medium	0.35	0.014
Wide	0.50	0.020
Extra Wide	0.70	0.028
XX Wide	1.00	0.039
XXX Wide	1.40	0.055

Table 1 Plotted Line Widths

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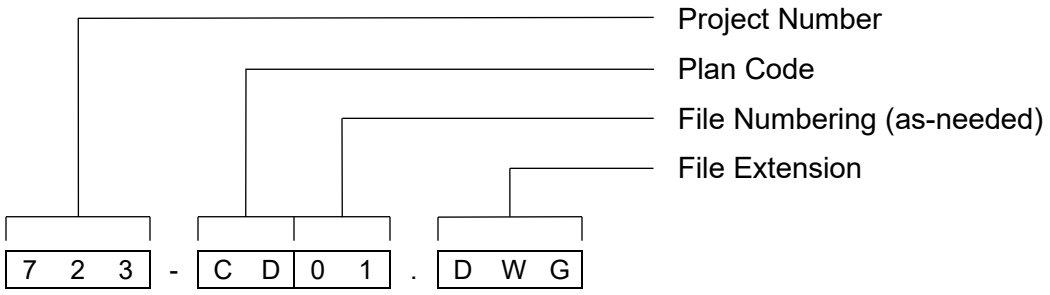
PART 4 - FILE NAMING CONVENTIONS

4.1 PRODUCTION DRAWINGS

A. The following naming convention shall be met for all production drawing files submitted to the District.

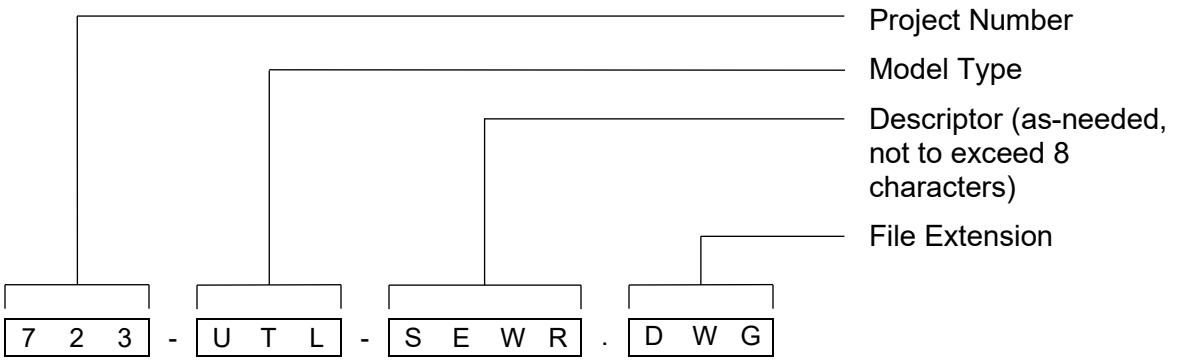


Plan Code	Plan Type	Description
G	General Sheets	Cover page, symbology, abbreviations, notes, etc.
HC	Horizontal Control Plan	Alignment control data
RW	Right-of-Way Plan	
DR	Demolition/Removal Plan	
GR	Grading Plan	
BP	Bypass Plan	
CI	Civil Plan	Master utility or on-site civil plan
CP	Civil Plan and Profile	
CD	Civil Details	
UT	Utility Plans	
MU	Master Utility Plans	
D	Process Plan	Process plan and details
OP	Operation Plan	Operations plan and details
ST	Structural Plan	Structural plan and details
M	Mechanical Plan	
MD	Mechanical Details	
E	Electrical Plan	Electrical plan and details
P	Plumbing Plan	Plumbing plan and details
RP	Roadway Plan	
RD	Roadway Details	
A	Architectural Plan	Architectural plan and details
L	Landscape Plan	Landscape plan and details

Table 2 Plan Codes

4.2 REFERENCE FILES

A. The external reference and source drawing file naming convention has four mandatory fields. All fields must be used and in the correct sequence.



B. There are two types of reference files. External reference files contain 2-dimensional linework, while data reference files contain 3-dimensional information used for the design of the project.

C. External Reference files (Xrefs)

1. External references are drawings created in model space that are inserted to production drawings per **Section 5.7A**.
2. Xrefs include static linework that does not change through the design process.
3. ADJ (Adjacent Linework)
   a. Includes existing underground utilities
   b. If a pipe network is created for existing utilities, the linework may be inserted into the production drawing by use of data referencing, and excluded from this file.
   c. This xref is referenced into model space.
4. BDR (Border)
   a. Includes the drawing border, as provided by the District.
   b. This fill will include the border linework, and any annotation that is constant throughout the project.
   c. This xref is referenced into paper space.
5. DTL (Details)
   a. Includes all detail linework and annotation to be placed into the Detail Sheets.
   b. This xref is referenced into model space.
6. MTR (Master Linework)
   a. Includes proposed design linework, such as building pads, structures and roadways.
   b. Includes Survey linework, such as property lines, section lines, roadway centerlines, etc.
   c. This xref is referenced into model space.

7. TOP (Existing Topographic Linework)
    a. This will include any aboveground existing feature 2-dimensional linework, such as buildings, roadways, fire hydrants, and any other visible features.
    b. Surface contours are created in the GRD data reference file. As such, they are displayed as a civil object, and are not included in this file.
    c. This xref is referenced into model space.

Model Type (Xrefs)	Description
ADJ	Adjacent underground linework
BDR	Drawing title and border
DTL	Details
MTR	Master linework
TOP	Existing topographic features

Table 3 External Reference Naming

D. Data Reference files (Drefs)

1. These are the files where the project design is performed. Data references are created from the design objects created in model space within these files. The data references are then inserted into the production drawing by use of the “Toolspace Data Shortcuts”.
2. Drefs include objects that are needed for design purposes, or are expected to change throughout the design process.
3. ALN (Alignments)
    a. This will include all alignments where design is required.
    b. Proposed pipe and roadway alignments belong in this file.
    c. If existing alignments will be used for labelling purposes, the alignment will be included here as a data reference.
    d. Alignments are used to create profile surface linework. The alignment profile data shall be created in this file.
    e. The referenced information will include alignments with existing and finished grade profiles.
4. GRD (Surfaces)
    a. It is recommended that each surface be created in its own drawing.
    b. These reference files will include existing and proposed surfaces.
    c. The referenced information will include existing and proposed contours.
    d. All design linework, such as breaklines, feature lines, 3D polylines, points, exclusion areas, and boundaries, are required to be included in this file.
    e. Contours generated from Terrestrial or Mobile LiDAR data sets shall have the associated .tin file decimated to 10% of the original point acquisition size.
5. UTL (Utilities)
    a. Includes all pipe networks, including proposed utilities, and any existing utilities created for design purposes.

b. Design information will include pipes and structures.

c. A separate UTL file should be created for each proposed and existing utility network.

Model Type (Drefs)	Description
ALN	Alignments
GRD	Existing and proposed surfaces
UTL	Pipe networks

Table 4 Data Reference Naming

E. Hyperlinks

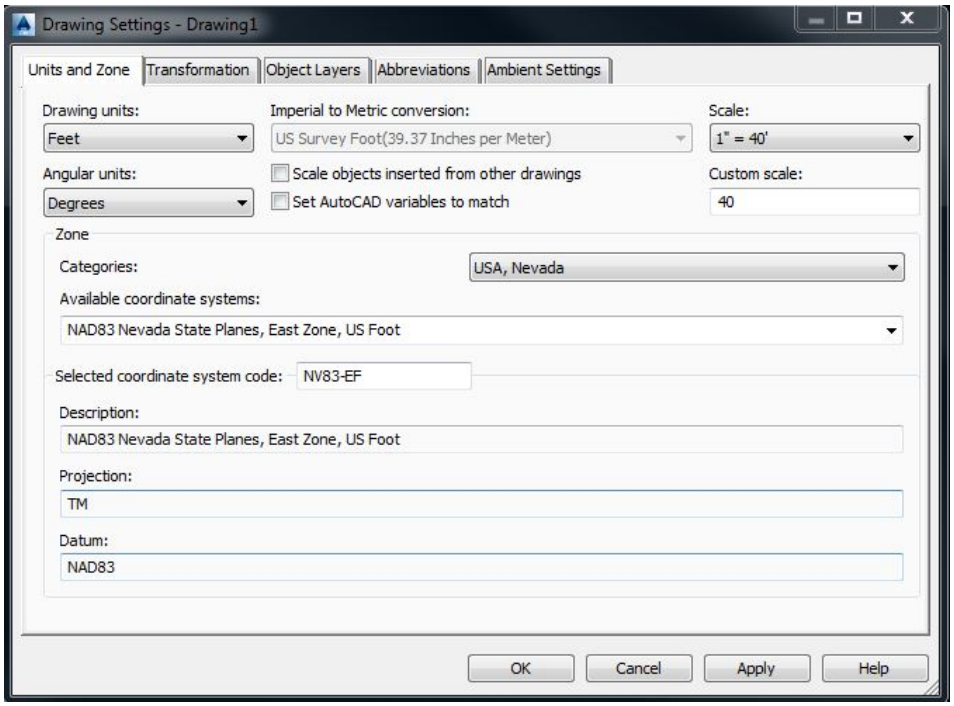
1. Hyperlinks can be added to objects within CAD, which will allow the user to open relevant records directly from the CAD file. When documents are available, they shall be hyperlinked to the appropriate objects. Documents to be hyperlinked would include utility records, deeds, easements, and any other applicable information. The hyperlink will be set to use a relative path.

PART 5 - STRUCTURE

5.1 PROJECT STRUCTURE

A. Coordinate system

1. The coordinate system shall be in accordance with the contract scope.
2. The project coordinate system shall be a project based coordinate system that is related to Nevada State Plane East (NAD 83, latest epoch, currently 2010.00).
3. The coordinate system includes a combined scale factor which is multiplied by the Northing and Easting value. Additionally, the Northing value must subtract 26,000,000.00 and the Easting must subtract 600,000.00.
4. Any information referenced in design drawings shall not be moved or rotated from the original coordinates used in the drawing, and shall be at 0, 0, 0 origin.
5. Each drawing shall be appropriately geo-referenced.



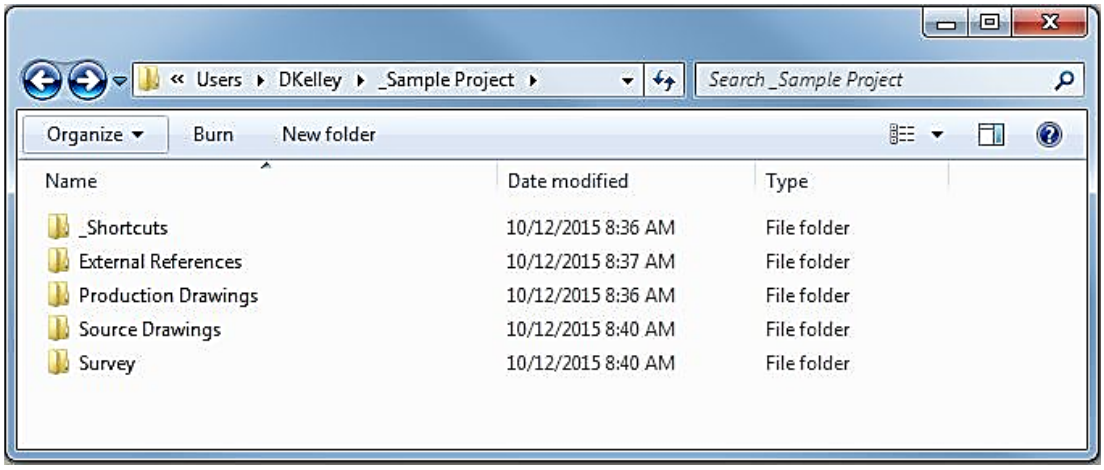
5.2 FOLDER STRUCTURE

A. The District utilizes the following folder structure, and all electronic submittals must conform to this structure:

1. The project base folder name will include the contract number and a brief description:
   a. Example: 723 CCWRD CAD Standards
2. _Shortcuts (Automatically created and necessary for AutoCAD to utilize data shortcuts. No user data should be added to this folder or it's subfolders.)
   a. Alignments

b. PipeNetworks
c. PressurePipeNetworks
d. Profiles
e. Surfaces
f. ViewFrameGroups

3. External References (Static reference files shall be stored here, such as existing feature files, survey linework files, and 2-dimensionsal files.)
   a. DGN
   b. DWF
   c. DWG
   d. Images
4. Production Drawings (Production drawings and the Sheet Set Manager (if used) are to be stored here.)
5. Source Drawings (Drawings utilizing civil objects will be stored here. Data references are created from these files.)
   a. Alignments
   b. Pipe Networks
   c. Surfaces
   d. View Frame Groups
6. Survey
   a. LiDAR point data, as applicable:
      i. Provide in .las and .txt file format with RGB values.
      ii. Do not embed in the CAD deliverable due to size constraints.
   b. Points
      i. Include all points within CAD file.
      ii. Include a .csv file in the following order:
         a) Pt#, N, E, Elev, Desc



B. The folder structure identified above is the minimum required for any project. Any deviations or additions to this folder structure must first be approved by the District Project Manager.

C. When multiple disciplines are working on a project, the folder structure can be modified to add discipline specific folders under the External References, Production Drawings, and Source Drawings folders. The disciplines should not add folders to the format shown in the figure above.

5.3 SHEET SET MANAGER

Sheet Set Managers are allowed for use by the Consultant. If a Sheet Set Manager is used, the .dst file shall be included with the electronic submittal and shall be saved with the sheets in the project folder.

5.4 SHEET STRUCTURE

A. General Requirements

1. Drawings shall be organized by discipline in a logical order. Typically, following the General and Survey drawings, this would be in the order that construction would occur for the project. The organization of **Table 2** provides a typical order in which drawings may be organized.

2. Sheet Index

   a. A sheet index will be included on the Cover Page, and will consist of three columns. The first column will be the sheet number, the second column will be the drawing number, and the third column will be the sheet title. If the sheet index cannot fit on the cover page, the entire sheet index will be placed onto the second sheet.

   b. The sheet index style shall conform to **Section 6.1E**.

SHEET INDEX

DWG	SHEET	DESCRIPTION
G1	1	COVER SHEET
G2	2	ABBREVIATIONS
G3	3	SYMBOLOGY
G4	4	GENERAL NOTES
CP1	5	CIVIL PLAN AND PROFILE 1
CP2	6	CIVIL PLAN AND PROFILE 2
CP3	7	CIVIL PLAN AND PROFILE 3
CD1	8	CIVIL DETAILS 1
CD2	9	CIVIL DETAILS 2
M1	10	MECHANICAL PLAN 1
M2	11	MECHANICAL PLAN 2
M3	12	MECHANICAL PLAN 3
MD1	13	MECHANICAL DETAILS 1
MD2	14	MECHANICAL DETAILS 2

5.5 MODEL SPACE AND PAPER SPACE

A. Model Space and Paper Space are the two separate spaces within a CAD drawing for drawing information to reside.

B. Model Space is where the geometric model is drawn in the correct coordinate system at actual scale.

C. Paper Space is a two-dimensional coordinate system used for sheet layouts.

D. No design work is permitted in Paper Space.

E. The District allows use of both spaces and multiple paper space layout tabs within each .dwg file.

5.6 REFERENCE FILES

A. All graphical information shall be generated in model space, on the correct coordinate system. Extraneous data should be deleted prior to electronic submittal.

B. All layout drawings (title block, general notes, etc.) shall be referenced into paper space.

C. Appropriate use of reference files are important in the management of file sizes.

D. External Reference Files:

1. See **Section 4.2B** for further information on External Reference files.
2. External reference files include separate files for:
   a. Title block (to be referenced into paper space)
   b. Static linework drawings (existing topography, details, etc.)
   c. Subconsultant overlays (mechanical plans, landscaping plans, etc.)
   d. Details

3. See **Section 4.2D** for further information on Source Drawings (Data Reference Files):
    a. These are design files created through the use of civil objects.
    b. Data reference files include separate files for:
        i. Alignments
        ii. Pipe Networks
        iii. Surfaces

5.7 PRODUCTION DRAWINGS:

A. External reference files shall be:
    1. Attached by reference type “Overlay”
    2. Path Type shall be set to “Relative Path”
    3. Scale shall be “1”
    4. Insertion point shall be 0, 0, 0
    5. Rotation shall be “0”
    6. Inserted onto layer ‘0’
B. Source files shall be referenced into the drawing using the “Toolspace Data Shortcuts”.
C. Production drawings shall contain the following (as applicable):
    1. North arrow and scale bar
    2. Match lines and associated text
    3. Annotation, notes, tables, and legends
    4. Title block
    5. Detail titles
    6. Revision clouds, deltas, and notes
    7. Key maps (Place in the upper right corner, if possible)
    8. Professional Stamps

5.8 VIEWPORTS

A. A viewport is a window in the Paper Space which allows the user to view the Model Space.
B. Viewports should be placed on a non-plottable layer.

5.9 DRAWING ANNOTATION

A. With the implementation of data references and the use of multiple drawing tabs, it is often practical to annotate drawing objects directly within the Production Drawing. Place object dimensions and text within model space.
B. All design and detail objects will be in model space at actual scale, following the layer conventions set forth within this document.

5.10 DRAWING NAMING

A. Drawing names shall include the Plan Code as identified in **Section 4.1A Table 2**, followed by sequential numbering, with no hyphen between the Plan Code and drawing number.

5.11 TITLE BLOCK

A. Standardized title block information ensures the uniformity of District drawings, and aids subsequent drawing storage and retrieval efforts. These title blocks shall be used on all District projects. Titles shall consist of the facility name and project title as shown on the project schedule. The project title of the drawings should also be exactly the same as the title on the accompanying specifications. Check with the District Project Manager if there is any doubt about the proper name of the project.

5.12 SCALES AND NORTH ARROW

A. The following is a list of maximum allowable scale sizes for District projects. Note that if a drawing has multiple scales, each view must be appropriately labeled. For drawings that are not drawn to scale (i.e. details), use the term N.T.S. or NOT TO SCALE in the title block's scale.

Engineering Scales	Architectural Scales	Typical Uses
1" = 1000'	--	Site Plans
1" = 800'	--	Site Plans
1" = 600'	--	Site Plans
1" = 500'	--	Site Plans
1" = 400'	--	Site Plans
1" = 300'	--	Site Plans
1" = 200'	--	Site Plans
1" = 100'	--	Site Plans, Civil Plans, Topographic Surveys of Ground only
1" = 50'	--	Geometry Plans, Topographic Surveys, As-Built Surveys
1" = 40'	--	Plan and Profiles, Utility Maps
1" = 30'	3/32" = 1'-0"	Floor Plans, Exterior Elevations, Details
1" = 20'	3/16" = 1'-0"	Floor Plans, Exterior Elevations, Details, Enlarged Utility Plans, Topographic Surveys, As-Built Surveys
1" = 10'	1/8" = 1'-0"	Floor Plans, Exterior Elevations, Details
1" = 5'	1/4" = 1'-0"	Floor Plans, Exterior Elevations, Details
--	3/8" = 1'-0"	Interior Elevations
1" = 2'	1/2" = 1'-0" 3/4" = 1'-0"	Enlarged Floor Plans, Wall Sections, Details
1" = 1'	1" = 1'-0" 1-1/2" = 1'-0"	Wall Sections, Foundation and Footing Details
--	3" = 1'-0"	Door and Window Details, Cabinet Details
--	Half Size	Door and Window Details, Cabinet Details
--	Full Size	Door and Window Details, Cabinet Details

B. Bar Scales

A bar scale identifying the drawing scale at one-half, full, and double scale shall be included on all scaled drawings. In general, proper placement of the bar scale is directly beneath the north arrow. If the bar scale is

used when there is no north arrow, or if there are separate horizontal and vertical scales, place the bar scale as close as practical to the detail title.

C. North Arrow

A North arrow shall be placed on all drawing plan views, and also on details, as applicable. The north arrow should be in the upper right of the view it is referencing. If there is more than one plan view in a drawing, use of a separate north arrow for each view is acceptable. As much as possible, north is to be towards the top or left of the sheet. Avoid pointing north to the bottom or right of the sheet.

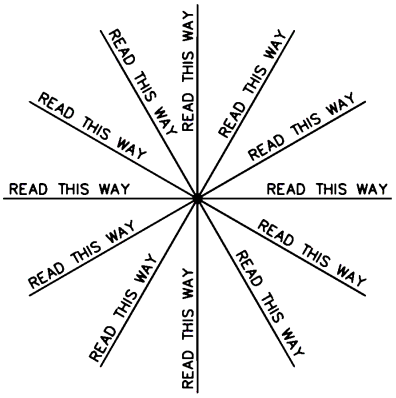
D. Key Map

Key maps should be located in the upper right corner of the sheet. Key maps shall be in the same orientation as the plan.

PART 6 - DRAWING SETUP

6.1 ANNOTATION

A. Annotation and Label Styles



1. Annotative scale shall be used for all annotation and label styles.
2. The minimum allowable text height is 0.10 inches, as plotted on full size drawings.
3. Typical font shall be RomanS.shx.
4. Title font shall be Bold.shx, and shall be 0.15 inches.
5. With few exceptions, the District does not approve the use of symbols to replace text.

B. Text Styles

1. Capital letters are required for all text.
2. Text shall be placed in line with the referenced object or perpendicular to the bottom of the page if not associated to an object. All text shall be readable from the bottom or right side of the page.
3. Text shall preferably not be placed over feature lines, hatching, or patterning. If text is placed in a hatched or patterned area, the text masking should be set to background color, or the hatching/patterning shall be clipped, so the text can be clearly read.
4. Text shall be justified in relation to the reference. Text justification depends upon the type of text being placed. For example, general numbered notes shall have upper left justification, labels appearing to the left of a feature shall have right justification, and labels appearing to the right of a feature shall have left justification.
5. Fraction auto-stacking shall be disabled.
6. Reference call-outs and cross sections shall use the blocks provided on the Abbreviation/Symbology CAD drawing.
7. When using multiline text (mtext) masking, set background mask border offset factor to 1.2.
8. When using text masking, use an offset setting of 0.2, mask type to wipeout, and text frames (tframes) to off for printing.

C. Dimension Styles

1. All dimension parts shall be either “By block” or “By layer”.
2. Dimensions shall be Annotative.
3. Closed arrowheads shall be used, and shall be of height 0.125.
4. Horizontal, vertical and aligned text should be above or below the line.

5. If a fill color is used, it should be set to 'Background'.
6. Dimension lines shall not cross each other, other text, or leader lines. When crossing is unavoidable, insert a break in the dimension line or leader line at the place of crossing.

D. Leader/Multileader Styles

1. The District prefers the use of multileaders for callouts.
2. Multileaders shall be Annotative.
3. The leader arrow head size shall be 0.125".
4. All leader part colors shall be either "By Block" or "By Layer".
5. Text shall be attached to "Middle of Top Line".
6. For multileader styles that use blocks, utilize standard blocks as practicable. Standard blocks should be to a scale of 1.
7. Leaders shall not cross each other, other text, or dimension lines. When crossing is unavoidable, insert a break in the leader line or dimension line at the crossing.

E. Table Styles

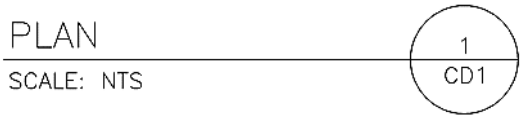
1. Table annotation shall conform to **Section 6.1B**.

F. Notes

1. Notes shall be either numerically or alphabetically ordered.
2. Notes, tables, and legends are typically located along the right side of the drawing area, below the key map.
3. Construction Notes can utilize standard blocks, multileaders or civil object layers (see **Section 7.3A**). Where practicable, use standard blocks included in the multileader styles.
4. When more than one construction note applies to an object, link the construction note identifiers in sequence and share one leader.
5. When construction notes apply to specific details on the same sheet, the notes should be located near the detail title. When multiple details on the same sheet have construction notes, the numbering shall start with "1" for each detail.

G. Detail Titles Annotation

1. Detail titles shall consist of a title, scale and callout, and be centered under each plan, detail, section, etc.



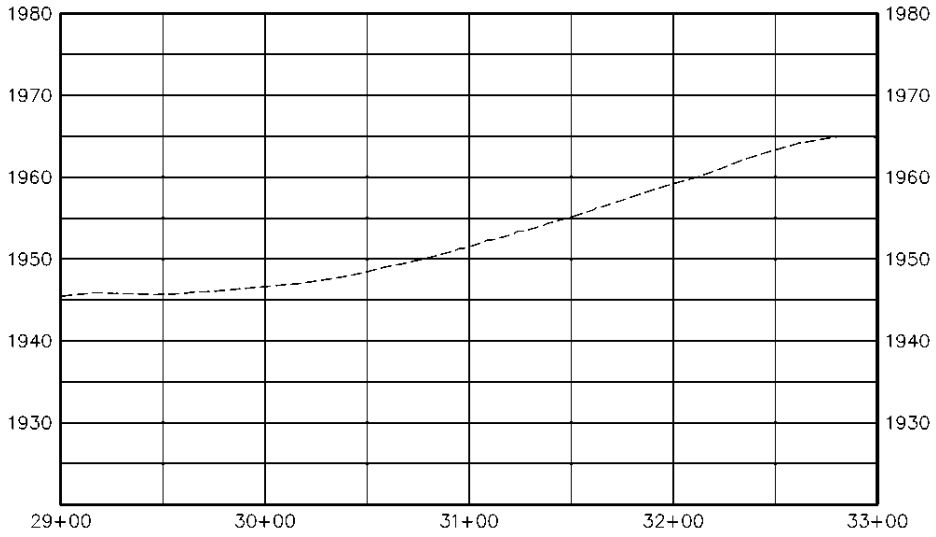
2. Number details and sections on each sheet start with the sequence number "1". Follow a right to left, from bottom to top numbering convention throughout each detail sheet.
3. For details not drawn to scale, type "NTS" where the scale is indicated.

H. Hatching

1. Standard hatches are shown in **Appendix A**.
2. The use of solid hatch is not allowed.

I. Profile Views

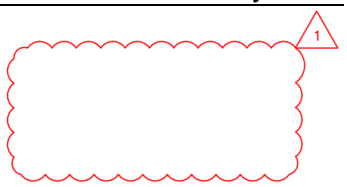
1. Horizontal Settings
   a. The maximum allowable horizontal scale for a profile view is 1” = 40’.
   b. Alignment stations shall be labeled every 100 feet.
   c. Grid lines shall be shown every 50 feet.
2. Vertical Settings
   a. The vertical exaggeration shall be 1” = 10’ maximum.
   b. Elevations shall be identified every 10 feet.
   c. Grid lines shall be shown every 5 feet.



J. Revisions

1. Revisions made during the design process are not noted in the Revision Block or treated in any special way.
2. Revisions made after the project has been advertised for bid are specifically identified in the following ways:
   a. Addendum (changes prior to bid opening)
   b. As-bid (with incorporation of addendum changes up to award of contract)
   c. Contract changes (changes during construction)
   d. Record drawings (incorporating all design changes)
3. Record the first revision number starting in the top row of the Revision Block.
4. Subsequent revisions are placed below the previous revision number.
5. All revisions shall be identified on each sheet being revised.
6. Minimum revision cloud arc lengths shall be 0.25.
7. Initial revision submittals shall be clouded red. Once approved, the revision cloud and delta shall be changed to black prior to submittal.

8. A numbered delta shall be placed next to each revision cloud. The delta should be located close to the upper right portion of the revision cloud, if possible.



REVISION BLOCK			
1	12/12/2015	REVISION DESCRIPTION	
NO.	DATE	DESCRIPTION	APP

Specific Revision Description
Revision Submittal Date
District Representative Initials
Revision Number

6.2 OBJECT LINETYPES

A. See **Section 3.3B** for plot style lineweights.

B. Features that close, such as pads, buildings, and easements, shall be closed polylines.

C. As much as practicable, all linework shall be constructed of continuous polylines.

D. The following typical plot styles and linetypes are to be used for the following objects.

1. Existing features and annotation
   a. Plot Style - Thin 60 (0.25 mm, 60% Screening)
   b. Linetype – HIDDEN2
2. Proposed features and annotation
   a. Plot Style – Medium (0.35 mm)
   b. Linetype – CONTINUOUS
3. Hatches
   a. Plot Style – Thin-60 (0.25 mm, 60% Screening)
   b. Pattern, see **Appendix A**.
4. Key Maps
   a. Plot Style – Thin (0.25 mm)

E. The District template includes a more comprehensive list of plot styles and linetypes.

LINETYPES

DESCRIPTION	LINETYPE	APPEARANCE
CENTERLINE	CENTER2	
PROPOSED	CONTINUOUS	
EXISTING	HIDDEN2	
RIGHT-OF-WAY	PHANTOM2	
PROPERTY LINE	DIVIDE2	

6.3 SYMBOLOGY

A. Commonly Used District Plan Symbols

1. Commonly used plan symbols for use on District projects are provided in the Abbreviation/Symbology drawing, available for download on the District website at www.cleanwaterteam.com/engineering.html, in CAD format.
2. If additional Symbology is used, it must be added to the Symbology legend.
3. See **Appendix A** for standard Symbology.

6.4 ABBREVIATIONS

A. With few exceptions, the District does not allow for use of symbols to replace text.

B. See **Appendix B** for Abbreviation List.

C. See **Appendix C** for Facility Code abbreviations.

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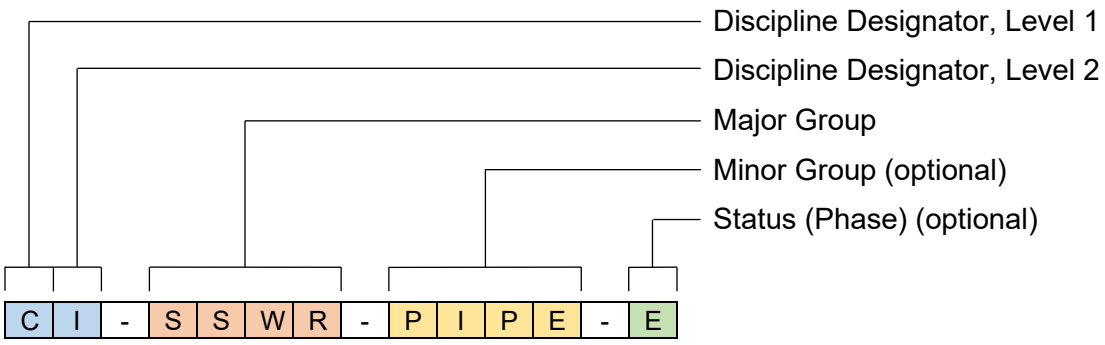
PART 7 - DRAWING LAYERS

7.1 LAYER NAMING

A. The District utilizes US National CAD Standard-V6 (NCS) naming conventions for layer naming format. Layers included in AutoCAD with the initial download are acceptable. This format organizes the layer name by four distinctly defined fields. A hyphen (-) is used to separate each field.

B. The District requires that surface and subsurface objects be on separate layers. For example, a surface sewer manhole would be on layer C-SSWR-MHOL-N, and the subsurface piping would be on layer C-SSWR-PIPE-N.

C. The fields identified below are common field names, and shall be used on all District projects. However, the list below is not all-inclusive, and layers can be created as necessary to maintain organization within the drawings. The created layers shall conform to the requirements below. Refer to the NCS for additional naming guidelines.



1. The Discipline Designator identifies the category. This is a two-character field. The first character identifies the discipline, and the second character is an optional modifier.

   a. Discipline Designator, Level 1: denotes the category of subject matter of the layer.

Common Level 1 Discipline Designators	
A	Architectural
B	Geotechnical
C	Civil
D	Process
E	Electrical
G	General
H	Hazardous Materials
L	Landscape
M	Mechanical
O	Operations
P	Plumbing
S	Structural
V	Survey

b. Discipline Designator, Level 2: an optional second character used to further define the discipline character. As an example, the Civil Level 2 designators are shown below.

Civil Level 2 Discipline Designators	
D	Demolition
D	Survey (Site)
G	Grading
P	Paving
I	Improvements
T	Transportation
U	Utilities

2. The Major Group is a four-character field that identifies a major building component.

Common Major Groups	
ANNO	Annotation
ROAD	Roadway
SSWR	Sanitary Sewer
STRM	Storm Sewer
TOPO	Topography
WATR	Water System

3. The Minor Group is an optional, four-character field to help further define the Major Group. A second minor group may be added, as necessary.

a. Common Minor Group names:

Common Minor Groups	
CNTR	Centerline
FORC	Force Main
LATL	Lateral
MHOL	Manhole
PIPE	Pipeline
STRC	Structure
TABL	Table

b. Subsurface Utility Engineering (SUE) Quality Levels can also be identified with the use of Minor Groups. Refer to the ASCE *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data,* 2003, for SUE Standards and Definitions.

SUE Minor Groups	
QL-A	Quality Level A
QL-B	Quality Level B
QL-C	Quality Level C
QL-D	Quality Level D

4. The Status (Phase) is an optional single-character field that defines the status of the layer object.

Status Field Codes	
A	Abandoned
D	Existing to demolish
E	Existing to remain
F	Future work
M	Items to be moved
N	New work
T	Temporary work
X	Not in contract
1-9	Phase numbers

7.2 DEFPOINTS

A. This is a special layer that is created and used by AutoCAD for dimension properties. Nothing shall be placed on this layer.

7.3 CIVIL OBJECTS

A. Civil 3D allows for the use of object labels for civil objects. These include points, surfaces, parcels, grading objects, alignments, pipe networks, profiles, profile views, sections, section views, catchment areas, corridors, and view frames. Label styles shall conform to **Section 6.1 - Annotation**.

B. Civil object styles graphically represent design features. These styles shall conform to **Sections 6.2 - Object Linetypes, 6.3 - Symbology** and **7.1 - Layer Naming**.

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PART 8 - ARCHITECTURAL, STRUCTURAL, MECHANICAL AND ELECTRICAL STANDARDS

To maintain consistency between different disciplines, all of the Standards listed in the previous Sections are applicable.

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PART 9 - SUBMITTAL REQUIREMENTS

9.1 SUBMITTAL REQUIREMENTS

A. Submittals shall be made in accordance with the contract scope.

B. Submittals shall be identified with “100% DRAWINGS”, “BID SET”, or “CONFORMED DOCUMENTS”, as applicable.

C. Electronic files will be submitted with the final design drawings, and as identified in the project contract.

D. Electronic submittals will include the entire folder structure, as identified in **Section 5.2 - Folder Structure**. Production drawing reference files shall be set to “Relative Path”. Do not use eTransmit to bind the reference files to the production drawing.

E. Electronic signatures will not be required for drawings submitted electronically.

F. If conformed drawings are produced, electronic versions of the conformed drawings will be provided in both .dwg and .pdf format.

G. If record drawings are produced, electronic files of the as-built drawings will be provided in both .dwg and .pdf format.

9.2 ELECTRONIC FILES

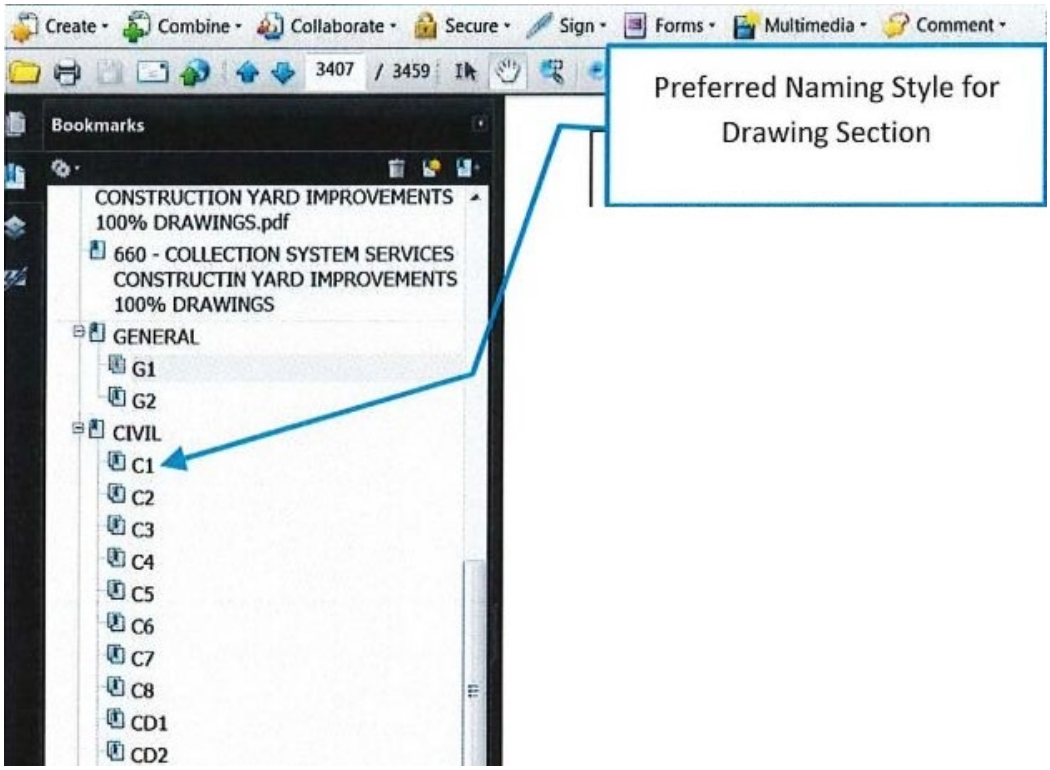
A. File transfers

1. File transfers shall be made in accordance with the contract scope.
2. The District requires that CAD files be submitted in the format that was available at the time of the project start, unless otherwise specified in the contract scope.
3. All drawings should be purged of unused blocks, line types, fonts, proxy graphics, or similar elements, and audited, with layers in the correct state for publishing (frozen/thawed) prior to delivery to the District.
4. Production drawings shall be saved with paper space set as the current view, zoomed to the extents of the drawing sheet.
5. Consultants using other software are responsible for confirming, prior to delivery to the District that all CAD files comply with the District standards.
6. The Consultant shall also scan files with the latest anti-virus detection software to ensure clean file transfers.
7. Documentation is expected to accompany all file transfers. Include project name and contract number on both hard copy documentation and CD.

B. Electronic files shall include the following:

1. Production drawings, external references, source drawings, images, custom line types, non-standard fonts, plot style files, and any other pertinent files or information.
2. Production drawings shall have all external references in their proper folder and properly attached to the drawing. External references are NOT to be bound into the drawing.

3. A bookmarked pdf copy of the design drawings will be included for each volume of drawings. The bookmark will be named according to the bookmark number. Do not include the particular drawing name.



9.3 GIS DATA MANAGEMENT (UNDER DEVELOPMENT)

9.4 REPRODUCTION

A. Sheet Size

Sheet size shall be 22” x 34”. A larger sheet size may be used only with prior approval from the District Project Manager.

B. Paper Type

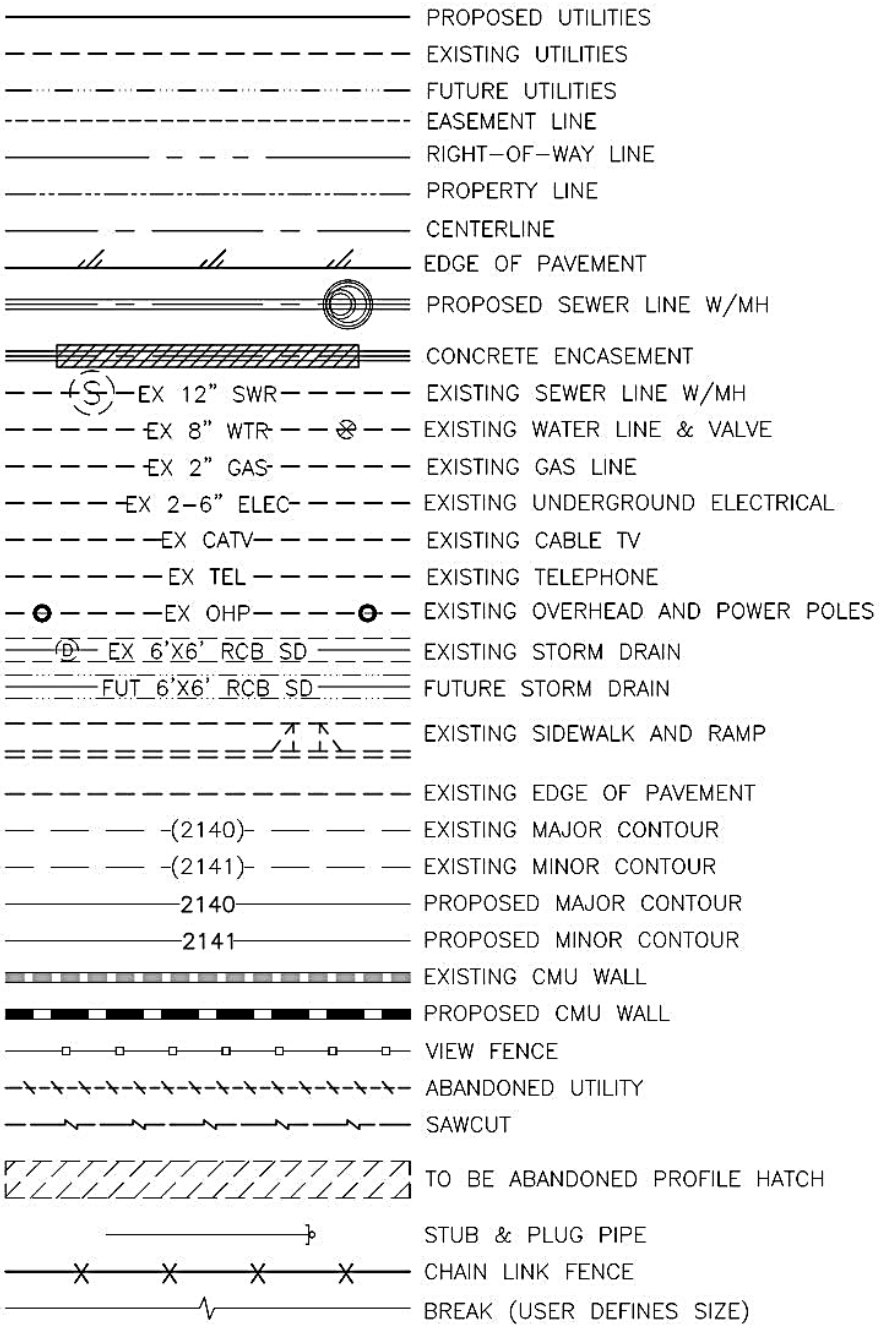
1. Paper type shall be 24# bright white (92 or better).
2. Mylar drawings will NOT be required for District submittals.

C. Plotting

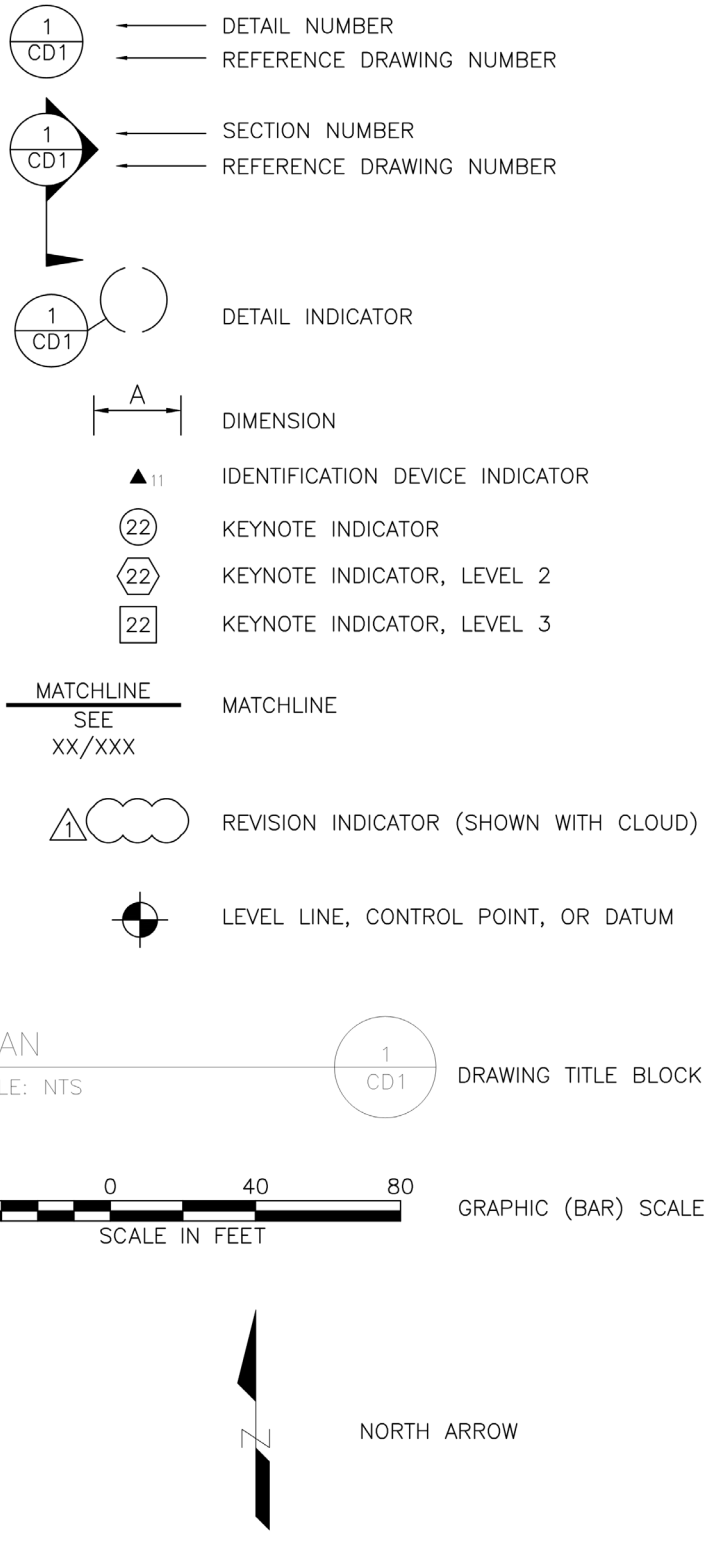
1. All drawings shall be plotted to scale.
2. The District Project Manager may determine that a plotter’s output does not adequately show halftone and sold line definition. If so, the Project Manager will direct the Consultant to use the District’s reprographic vendor for plotting services.
   a. Consultant shall check drawings for print quality and standards prior to submitting them to the District.
3. In general, all half-sized drawing sets are plotted full sized, and then reduced to half size for the printing process. All half size drawings shall be to scale.

APPENDIX A - SYMBOLOGY

SITE SYMBOLS - GENERAL



DRAWING SYMBOLS



SITE SYMBOLS - IMPROVEMENTS


EXISTING BUILDING STRUCTURE


FIRE TRUCK ACCESSIBLE ROUTE


CONCRETE WALKWAY AND DRIVEWAY


GRAVEL WALKWAY

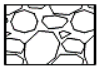

COMPACTED GRAVEL FILL


EXISTING ASPHALT


APPROXIMATE PAVEMENT RESTORATION

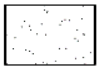

OPEN SPACE/VEGETATION

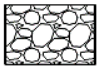
SITE SYMBOLS - EARTHWORK


EARTH, CRUSHED ROCK GRAVEL


EARTH, UNDISTURBED


EARTHWORK, COMPACTED FILL


SAND


EROSION AND SEDIMENTATION CONTROL, FILTRATION BED

APPENDIX B - ABBREVIATIONS

&	And
∠	Angle
°	Degrees
Δ	Delta
ø	Diameter
"	Inch (es)
'	Foot / Feet
A/C	Air Conditioning
A/E	Architect / Engineer
AB	Anchor Bolt
ABAN	Abandon(Ed)
ABC	Aggregate Base Course
AC	Asphaltic Concrete
ACP	Asbestos Cement Pipe
ADA	Americans with Disabilities Act
ADDL	Additional
AGG	Aggregate
ALT	Alternate
ANSI	American National Standards Institute
APPD	Approved
APN	Assessor Parcel Number
APPROX	Approximate
ASCE	American Society of Civil Engineers
ASME	American Society Mechanical Engineers
ASPE	American Society Plumbing Engineers
ASPH	Asphalt
ASSN	Association
ASSY	Assembly
ASTM	American Society for Testing and Materials
AUX	Auxiliary
AVE	Avenue
AWG	American Wire Gauge
BC	Back Of Curb
BCR	Beginning Of Curb Return
BE	Bell End
BLDG	Building
BLM	Bureau of Land Management
BLVD	Boulevard
BM	Benchmark
BOT	Bottom
BRG	Bearing
BVC	Beginning Of Vertical Curve
BW	Both Ways
C&G	Curb & Gutter
CATV	Cable Television
CB	Catch Basin
CBC	City of Boulder City
CC	Clark County
CCRFCD	Clark County Regional Flood Control District
CCSD	Clark County School District
CCTV	Closed Circuit Television
CCWRD	Clark County Water Reclamation District
CF	Cubic Feet
CFS	Cubic Feet per Second
CHDPEP	Corrugated High Density Polyethylene Pipe
CI	Curb Inlet
CIP	Cast Iron Pipe
CIR	Circle
℄	Centerline
CL2	Chlorine
CLR	Clear
CLSM	Controlled Low-Strength Material
CLV	City Of Las Vegas
CM	Centimeter
CMP	Corrugated Metal Pipe
CMU	Concrete Masonry Unit
CNLV	City Of North Las Vegas
CO	Clean Out
COH	City Of Henderson
COMM	Communication
CON	Concentric
CONC	Concrete
CONST	Construct / Construction
CONT	Continue or Continuous
COORD	Coordinate
CPLG	Coupling
CPVC	Chlorinated Polyvinyl Chloride Pipe
CT	Court
CTR	Center
CTV	Cable Television
CU	Cubic
CU FT	Cubic Feet
CU IN	Cubic Inch
CU YD	Cubic Yard
CY	Cubic Yard
CYL	Cylinder

DCSWCS	Design and Construction Standards for Wastewater Collection Systems, latest edition
DEMO	Demolition
DEPT	Department
DET	Detail
DEV	Development
DG	Decomposed Granite
DI	Drop Inlet
DIA	Diameter
DIAG	Diagonal
DIM	Dimension
DIP	Ductile Iron Pipe
DIST	Distance
DIV	Division
DL	Dead Load
DR	Drive
DWG	Drawing
DWY	Driveway
E	East / Easting
EA	Each
ECC	Eccentric
ECR	End of Curb Return
EF	Each Face
EFF	Effluent
EG	Existing Grade
ELEC	Electrical
ELEV	Elevation
EMBK	Embankment
ENGR	Engineer
EP	Edge of Pavement
EPA	Environmental Protection Agency
EQUIP	Equipment
ESMT	Easement
EST	Estimate
EVC	End of Vertical Curve
EW	Each Way
EX	Existing
EXC	Excavate
FABR	Fabrication / Fabricated
FB	Fiber
FC	Face of Curb
FD	Floor Drain
FEMA	Federal Emergency Management Agency
FF	Finish Floor
FG	Finished Grade
FH	Fire Hydrant
FIG	Figure
FL	Flow Line
FLG	Flange
FM	Force Main
FND	Found
FO	Fiber Optic
FPC	Flexible Pipe Coupling
FPM	Feet per Minute
FPS	Feet per Second
FPVC	Fusible Polyvinyl Chloride
FRP	Fiberglass Reinforced Polymer
FT	Foot / Feet
FTG	Footing
FUT	Future
GA	Gauge
GAL(S)	Gallon
GALV	Galvanized
GAS	Natural Gas
GB	Grade Break
GC	General Contractor
GIS	Geographic Information System
GND	Ground
GPD	Gallons per Day
GPH	Gallons per Hour
GPM	Gallons per Minute
GRD	Grade
GM	Gravity Main
GV	Gate Valve
HDPE	High Density Polyethylene
HEX	Hexagonal
HH	Hand Hole
HORIZ	Horizontal
HP	High Point
HPI	Horizontal Point of Intersection
HR	Hour
HT	Height
HWL	High Water Level
HWY	Highway
ICC	International Code Council
ID	Inside Diameter
IN	Inch (es)
INF	Influent
INST	Install
INV	Invert
IP	Iron Pipe
IRR	Irrigation

JB	Junction Box
K	Kips
KG	Kilogram
KM	Kilometer
KSF	Kips Per Square Foot
KSI	Kips Per Square Inch
L	Left
LAT	Lateral
LB	Pound
LEN	Length
LF	Linear Feet (Foot)
LP	Low Point
LS	Lift Station
LT	Light
LVVWD	Las Vegas Valley Water District
LWL	Low Water Level
M	Meter
MAX	Maximum
MB	Meter Box
MEAS	Measurement
MECH	Mechanical
MFR	Manufacturer
MG	Million Gallons
MGD	Million Gallons per Day
MH	Manhole
MIN	Minimum
MISC	Miscellaneous
MJ	Mechanical Joint
ML	Mortar Lined
MLC	Mortar Lined & Coated
MM	Millimeter
MON	Monolithic
MSDS	Material Safety Data Sheet
MU	Masonry Unit
MW	Monitoring Well
N	North / Northing
N/A	Not Applicable
NAOCL	Sodium Hypochlorite
NATL	National
NAVD	North American Vertical Datum
NBC	National Building Code
NCS	Nevada Coordinate System
NDOT	Nevada Department of Transportation
NIC	Not In Contract
NO	Number
NPS	Nominal Pipe Size
NRS	Nevada Revised Statutes
NTS	Not To Scale
NVE	NV Energy
NWL	Normal Water Level
OC	On Center
OD	Outside Diameter
OFF	Offset
OH	Overhead
OHP	Overhead Power
OHT	Overhead Telephone
ORIG	Original
OSHA	Occupational Safety and Health Administration
OZ	Ounce
P	Pole
P&ID	Process and Instrumentation Diagram
PIP	Poured in Place
ℙL	Property Line
PB	Pull Box
PC	Point Of Curvature
PCC	Point Of Compound Curvature
PCF	Pounds per Cubic Foot
PCP	Polymer Concrete Pipe
PE	Polyethylene
PERM	Permanent
PERP	Perpendicular
PI	Point Of Intersection
PL	Plate
PLS	Professional Land Surveyor/Private Lift Station
PO	Push-On
POT	Point of Tangency
PP	Power Pole
PPM	Parts Per Million
PRC	Point of Reverse Curvature
PRELIM	Preliminary
PROJ	Project
PROP	Proposed
PSF	Pounds per Square Foot
PSI	Pounds per Square Inch
PT	Point
PVI	Point Of Vertical Intersection
PVMT	Pavement
PVC	Polyvinyl Chloride Pipe
PWR	Power

Q	Rate of Flow
QTR	Quarter
QTY	Quantity
R	Right
RAD	Radius
RCB	Reinforced Concrete Box
RCP	Reinforced Concrete Pipe
RD	Road
RECT	Rectangular
REF	Reference
REINF	Reinforced
REL	Relocate (D)
REM	Remove (D)
REQD	Required
RES	Residential
RET	Return
REV	Revision
RP	Radius Point
RPM	Revolutions per Minute
RPS	Revolutions per Second
RR	Railroad
RTC	Regional Transportation Commission of Southern Nevada
R/W	Right-Of-Way
S	South
SCH	Schedule
SD	Storm Drain
SDWK	Sidewalk
SDMH	Storm Drain Manhole
SDS	Safety Data Sheets
SEC	Section
SEG	Segment
SF	Square Foot
SY	Square Yard
SHT	Sheet
SID	Special Improvement District
SNWA	Southern Nevada Water Authority
SP	Siphon
Spec(S)	Specification(S)
SQ IN	Square Inch
SS	Sanitary Sewer
SSMH	Sanitary Sewer Manhole
SST	Stainless Steel
ST	Street
STA	Station
STD	Standard
STL	Steel
STLT	Street Light
STRUCT	Structure / Structural
SUPP	Supplement (Al)
SYM	Symbol
TAN	Tangent
TC	Top of Curb
TEL	Telephone
TEMP	Temporary
THK	Thick (Ness)
THRD	Thread(Ed)
THRU	Through
TMH	Top of Manhole
TOP	Top of Pipe
TP	Telephone Pole
TS	Traffic Signal
TV	Television
TYP	Typical
UDACS	Uniform Design and Construction Standards for Water Distribution Systems, Latest Edition
UFC	Uniform Fire Code
UG	Underground
UGP	Underground Power
UGT	Underground Telephone
UL	Underwriters Laboratories
UP	Utility Pole
UPC	Uniform Plumbing Code
UPRR	Union Pacific Railroad
USD	Uniform Standard Drawings for Public Works Construction, Offsite Improvements, Clark County Area, Nevada (Latest Edition)
USGS	United States Geodetic Survey
UTIL	Utility (ies)
VAR	Varies
VC	Vertical Curve
VCP	Vitrified Clay Pipe
VEL	Velocity
VERT	Vertical
VG	Valley Gutter
VOL	Volume
W	West
W/	With
W/O	Without

WL	Water Line
WLD	Welded
WM	Water Meter
WP	Working Point
WS	Water Surface
WSP	Welded Steel Pipe
WT	Weight
WTR	Water
WV	Water Valve
YCO	Yard Cleanout
YH	Yard Hydrant
YLD	Yield

APPENDIX C – FACILITY CODES

BDTP	Blue Diamond Treatment Ponds
DBWRC	Desert Breeze Water Resource Center
FWRC	Flamingo Water Resource Center
ISTF	Indian Springs Treatment Facility
LWRC	Laughlin Water Resource Center
MVTF	Moapa Valley Treatment Facility
STP	Searchlight Treatment Ponds
LS #2	Laughlin LS 2 Lift Station, Laughlin NV
LS #3	Laughlin LS 3 Lift Station, Laughlin NV
LS 03	Lincoln Lift Station
LS 04	Pebble II Lift Station
LS 06	Quarry Lift Station
LS 08	Pecos Lift Station
LS 09	Casa Buena Lift Station
LS 11	Metro II Lift Station
LS 13	Metro I Lift Station
LS 15	Regency Lift Station
LS 18	Highland Lift Station
LS 19	North Point Lift Station
LS 21	Museum Lift Station, Overton NV
LS 22	Searchlight Lift Station, Searchlight NV
LS 25	Main Lift Station, Moapa Valley NV
LS 26	Indian Springs Lift Station, Indian Springs NV
LS 26A	Creech AFB Lift Station, Indian Springs NV
LS 27	Whitney Lift Station
LS 28	Mountains Edge Lift Station
LS 30	Paradise Springs Lift Station
LS 33	Symphony Lift Station
LS 35	Sunrise Ranch Lift Station