



EAST BAY MUNICIPAL UTILITY DISTRICT  
SPECIAL DISTRICT NO. 1  
OAKLAND, CALIFORNIA

# WASTEWATER DRAFTING CAD MANUAL

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**DRAFT**

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MANAGER OF WASTEWATER ENGINEERING DIVISION  
RPE No.

# Wastewater CAD Guidelines

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# Wastewater CAD Guidelines

## Getting Started

### Introduction - District CAD Standards

It is the practice of the Engineering Department and Special District 1 of East Bay Municipal Utility District (the District) that all Consulting Agreements calling for engineering drawings, architectural drawings, or maps, shall require drawings delivered in MicroStation format, in accordance with approved Computer Aided Drafting (CAD) standards.

The approved CAD standard is one of the three approved District manuals.

- **Wastewater Drafting CAD Manual**
- Facility Drafting CAD Manual
- Pipeline Drafting CAD Manual

Consultants who produce maps or drawings for the District will be required to adhere to the guidelines presented in one or more of these manuals. The District Project Engineer or Project Manager will determine which guidelines shall be used for a specific series of drawings.

#### Wastewater Drafting CAD Manual

The purpose of this manual is to provide guidelines for the production of engineering drawings, architectural drawings, and vendor drawings that are used for the construction, modification, or record drawing recording of the District's wastewater facilities and systems.

All of the District's Wastewater Department Consulting Agreements calling for engineering drawings, architectural drawings, or maps, shall require drawings delivered in MicroStation format, in accordance with CAD standards and guidelines as identified in this document.

June 9, 2010 - Initial Release of Wastewater Drafting CAD Manual for MicroStation V8 2004.

February 2013 – Revise Wastewater Drafting CAD Manual for MicroStation V8i

# Wastewater CAD Guidelines

## Wastewater Drafting CAD Contact

The District contact for assistance in the use of the Wastewater Drafting CAD Manual is shown below. Any questions related to this manual or to the production of drawings associated with this manual may be directed to:

Alma Munoz  
Wastewater Drafting Supervisor  
Phone: (510) 287-1866  
Email: [amunoz@ebmud.com](mailto:amunoz@ebmud.com)  
or  
Derrick Yuen – Senior Drafter  
Phone: (510) 287- 1128  
Email: [dyuen@ebmud.com](mailto:dyuen@ebmud.com)

East Bay Municipal Utility District  
375 Eleventh St., MS 702  
Oakland, CA 94623

All requests for information, whether in writing or by telephone, should include the name of the project, and the name of the District Project Engineer or Manager who is responsible for that project.

# Wastewater CAD Guidelines

## File Format

The District uses Bentley System's MicroStation CAD software in the creation and modification of all Facility drawings. Consultants who produce drawings for the District shall produce CAD files that are compatible with the version of software currently in use in the specific drafting unit at the District. All drawings produced for the District shall be in MicroStation V8i (select series 2). In this manual we will use the term "V8i" to mean MicroStation V8i (select series 2). If older versions of MicroStation are used, different standards apply. Older versions of MicroStation (J and V7) are not acceptable. All MicroStation element types are acceptable except Shared Cells.

### Additional Software

The District uses ACS Title Block Manager (TBM) to populate data in the title block. This provides flexibility in modifying the title block. If the consultant do not have the software it is required that the consultant edit the text nodes that are on the title block. Common information for the whole project can reside on the xxxbdr.mst file and unique information should be active on the drawing file.

### Verification of File Format

CAD software is regularly updated, and the current version in use may change during the course of one year. Prior to beginning work on any project, the consultant shall verify the correct current software version with the [District CAD Contact](#).

### File Size (bytes)

Many factors affect the size of a CAD file. The larger the file, the slower it is to work with, modify, and display. Consultants should take care to ensure that the files they produce are not larger than necessary.

Patterning and shading on a drawing has the greatest impact on file size. Patterning and shading should be used sparingly, and only when the meaning of the drawing would not otherwise be clear. See the sections on Patterning and Shading in the CAD Standards section of this manual.

### File Checking

The Consultant shall verify file integrity before submitting the final CAD files to the District. All CAD files shall be checked for corrupted or invalid elements, utilizing EDG or an equivalent file checking software. Files with corrupted or invalid elements will not be accepted.

### Scanning

Raster images, produced by scanning or other means, are generally not acceptable. All CAD files submitted to the District shall contain only vector data. Exceptions may be made for specific projects, at the discretion of the District CAD Contact if exceptions are made the following guidelines should be followed.

### Scanning Guidelines

Raster images produced by scanning shall be created using the seed file provided specifically for the project, refer to Seed Files 2-1. Other standard setup such as global origin, working units, etc. specified in Section 2 should be followed when working on a hybrid drawing (raster/vector combination)

Location/Orientation – Raster image that has north arrow orientation should be located based on the District's Map and coordinate system if possible. Warp raster drawing border line to a vector border line 32.5" x 21.0" in size (unless otherwise specified by the Project Manager).

# Wastewater CAD Guidelines

## **Directory Structure**

All files and drawings related to a specific facility or Area number shall reside in a single directory. Files that are used as reference files shall reside in the same directory as the file to which they are attached.

## **2-D and 3-D Files**

In general drawing files and attached reference files are in 2-D files. If 3-D application software is used to create files related to a project, those 3-D files shall be maintained provided they are in MicroStation V8i format when used as part of a drawing or reference file. The original 3-D files, if any, shall also be submitted to the District as a supplemental submittal. The use of 3-D files for specific purposes may be approved by the [District CAD Contact](#) on a per project basis.

## **Database Associations**

The Wastewater Drafting Unit does not use a database in the creation of their drawings. Files submitted to the District shall not contain any database associations.

## **Translations from Other CAD Systems**

The District prefers all consultants to create drawings directly in MicroStation format. A file that is created in MicroStation format will more likely be compatible with the District's CAD system.

If a consultant chooses to create drawings in another CAD system, and translate them to MicroStation, then it is the responsibility of the consultant to ensure that the translation is complete and that no corruptions have occurred in the translated file. Regardless of the CAD system used, all guidelines presented in this manual shall apply.

# Wastewater CAD Guidelines

## Submittals and Deliverables

### Preliminary Submittal

A preliminary submittal of at least two drawings from each engineering discipline shall be submitted to the District at a time determined by the Project Manager. Generally, the preliminary submittal will occur at the 30% & 60% completion stage of a design project. The [District CAD Contact](#) will determine the specific drawings required for the preliminary submittal. The preliminary submittal will be checked for conformance with the District CAD standards contained in this manual.

### 90% Submittal of CAD Files

The consultant shall submit CAD files with the 90% design review submittal. The specific files required will be determined by the [District CAD Contact](#) and the Project Manager, and will vary with each project, but will include a minimum of two representative drawings from each engineering discipline. *Note: it is important to include the files submitted at the preliminary submittal to verify if review comments have been addressed.*

Files submitted at the 90% stage will be checked for conformance with the District CAD standards contained in this manual, and with all other drafting standards that are required by the project. All review comments made during the preliminary submittal shall be incorporated into the 90% submittal.

The consultant shall allow two weeks for the District to review and comment on the 90% submittal. All work submitted, as final contract documents will incorporate the comments made during the 90% submittal.

### Final Submittals of CAD Files

Submit the following at the 100% design stage, after the drawings have been signed by the consultant and the District.

- All CAD files associated with a project, including the file that contains the electronic signatures (in most cases the border file).
- Individual PDF files of each drawing and a multi-sheet PDF file for the drawing set.
- Hard copy of all drawings.
- Spreadsheets linked to drawings if used.
- The "Authorization for use of Electronic Signature on Drawings" spreadsheet.

Submittal of all CAD files is required at this stage, regardless of the responsibility assigned by the contract for drawing addendums and record drawing revisions. CAD files submitted at this time shall conform to all CAD standards and drafting standards, and shall incorporate all comments made during previous reviews.

The District will review all CAD files included in the Final Submittal. CAD files that do not conform to the standards outlined in this manual will not be accepted. The consultant will be required to correct any parts of the submittal that do not conform to the standards outlined in this manual, and to the comments issued during the preliminary and 90% reviews.

### Subsequent Revisions to CAD Files

If the scope of services requires the consultant to make changes to the drawings for addendums, change orders, or record drawings, then the CAD, PDF and spreadsheet files associated with these drawing revisions shall be submitted to the District after each revision is signed and issued.

# Wastewater CAD Guidelines

## **Method of Transmittal of CAD Files**

Before submitting CAD files to the District, the Consultant shall confirm the preferred method of transmittal with the [District CAD Contact](#). The requirements may vary with each project. All CAD files shall be compressed of deleted elements before they are submitted to the District. All files submitted shall be accompanied by a hard copy plot and PDF file.

Normally, files shall be submitted on compact disk (CD-R). Each CD shall be labeled with the date, project name and type of submittal (i.e. 50% Design, Final Design, etc.). A list of files contained on the CD should be included with each submittal, see [Hard Copy File Listing](#) below. Other transmittal methods may be acceptable at the discretion of the [District CAD Contact](#).

## **Final Submittal of Drawings**

Final drawings submitted to the District shall be plotted at full size. Electronic signatures are preferred. Bond paper may be used if drawings have electronic signatures. Mylar or vellum is required if drawings are "wet" signed.

The drawings shall be signed by the appropriate representatives for the consultant, and shall be ready for District review signatures. Additional requirements may be included in the Consulting Agreement or Scope of Services.

## **Hard Copy File Documentation**

A hard copy print of the Reference File Documentation sheet, as described in the "File Control" section of this manual, shall be provided with the final submittal, for each CAD drawing.

## **Hard Copy File Listing**

A complete list of all files shall be included with each submittal of electronic data. This listing shall include all files that are in the submittal, with a brief description of the purpose of that file.

## **Backup Submittal of CAD Files**

On occasion, CAD files are copied to media with errors. In order to ensure that the District has access to a good copy of each file, the consultant shall maintain a second copy of each CAD file, at their site, for a period of at least two years after the date of submittal to the District.



# Wastewater CAD Guidelines

## Submittal Check List

The following checklist summarizes the key items that are required for a final CAD Submittal. Consultants should review this checklist and verify that final submittals meet these minimum requirements.

- ☐ All drawing files have the correct [Global Origin](#), [Working Units](#), [Level Symbology](#), and [Color Table](#).
- ☐ All drawings that has north arrow orientation should be located based on the District's Map and coordinate system.
- ☐ File names conform to the District [file naming](#) conventions. Wastewater is in the process of creating standard procedure a sample of drawing file name will be provided upon project commencement.
- ☐ All drawings use the District customized [Font 2](#), and the correct font size. Most drawing text plots 1/10" high, with text width 80% of text height.
- ☐ All abbreviations conform to the District's standard drawing for [abbreviations](#) as specified in Standard Drawings STD-G-001 and STD-G-002.
- ☐ Section and Detail titles and cross references conform to District standard as specified in the [Standard Drawing STD-G-003](#).
- ☐ Elements are drawn on the correct level, in accordance with the [level application list](#).
- ☐ Detach all unused reference files.
- ☐ [Named views](#) were not used to attach any reference files except for borders.
- ☐ Drawing [border](#) are attached as referenced in each files at the correct [plot scale](#). All data on the title block are entered using Acs TBM (see other software) or by editing the text node.
- ☐ A complete list of every file included in the submittal is provided on hard copy, with a brief (one line) description of each file.
- ☐ All files are [drawn at full size](#), with a [plot scale](#) that matches the predominant drawing scale.
- ☐ The files do not contain [shared cells](#), or any [custom line styles](#) that are not provided by the District.
- ☐ Cells used in the drawings are from the District's [cell libraries](#), and conform to the cell size and name as found in those libraries.
- ☐ [Additional Cells](#) created by the consultant are included in the submittal in a separate cell library, and only include cells that were not available in the District's cell library.
- ☐ Schematic drawings are drawn on the 1/8" and 1/16" [grid](#), with all elements locked to the grid.
- ☐ EDG or a similar routine was used to check each file for file corruptions and invalid elements.
- ☐ All elements in the files are drawn [without color](#) (CO=O)
- ☐ The files do not contain elements or reference file attachments that are in conflict with the District's Interplot [pen table](#) and [plotting parameters](#).
- ☐ Final hard copy drawings shall be plotted on [high quality Bond](#), or as specified in the contract, and contain the [file control documentation](#), which includes file name, plot date and attached reference files in the left margin.

# Wastewater CAD Guidelines

## District Software

### List of Software

#### Requests for Software

Consultants, who have a consulting agreement with the District to provide drawings, shall obtain a copy of the Wastewater Drafting CAD Standard, which includes a diskette with the files listed below. One copy of the diskette will be provided for each consulting agreement. The Consultant may copy the software as needed, to provide additional copies for sub-consultants. The CAD Standard, diskette and all copies, shall be returned to the District at the completion of the consulting contract.

#### Contents of Diskette

The contents of the diskette, provided on 3 1/2" high-density diskette, includes the CAD files that are required to complete drawings according to the format described in this manual. The files are in MicroStation format, and can be provided in Windows NT or Windows 2000. The diskette includes the following files.

_README.doc	Read this file first
INSTALLING WASTEWATER FILES.doc	Directions for installing Wastewater files
PLOTTING.doc	Wastewater plotting information

#### **Standard CAD Drawing Files**

wCover.dgn	Project Cover Sheet Drawing
wBorder.dgn	Consultant Border Drawing
wRef_Cvr.dgn	Project Reference Cover Sheet Drawing

#### **MicroStation Seed Files**

wSeed.dgn	2D Seed File
wSeedz.dgn	3D Seed File (do not use unless 3D work is preformed)

#### **MicroStation Cell Libraries**

wBORDER.cel	Border & related cells
wCOMMON.cel	Common drafting cells
wELEC.cel	Electrical Schematic cells
wELECP.cel	Electrical Physical cells
wMECH.cel	Mechanical cells
wPID.cel	P&ID cells
wSTRUC.cel	Structural cells

#### **MicroStation Color Table**

wColor.ctb	Color Table for design files
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#### **MicroStation Line Style Files**

lines.rsc	Custom line style resource file (Facility)
wLines.rsc	Custom line style resource file (Wastewater)

#### **MicroStation Revision Cloud Macro**

cloud.ba	Macro for placing a revision cloud
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#### **MicroStation Configuration Files**

WWebmud.ucf	Wastewater Drafting user configuration file
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#### **MicroStation & Iplot Font Resource File**

wFont.rsc	Font resource file for MicroStation and Iplot
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#### **InterPlot Color Table**

wbw.ctb	Color Table for black & white plotting with InterPlot
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#### **InterPlot Configuration Files (may need to be edited)**

ip.cfg	InterPlot Client/Professional Configuration File
iplot.cfg	Interplot configuration file
iplotsrv.cfg	Interplot Server configuration file

# Wastewater CAD Guidelines

## ***Iplot Pen Tables***

scrnpen.pen	Pen Table for InterPlot (full size drawings)
scrnred.pen	Pen Table for InterPlot (reduced/half size drawings)

## ***Iplot Settings Files***

bw-full.set	Settings file for InterPlot (full size drawings)
bw-half.set	Settings file for InterPlot (reduced/half size drawings)

## ***Iplot Pattern Libraries***

wpatt.plb	Pattern library for InterPlot
wpatt100.plb	Pattern library for InterPlot
wpatt300.plb	Pattern library for InterPlot
wpatt400.plb	Pattern library for InterPlot
wpatt600.plb	Pattern library for InterPlot

## **Prototype Drawings**

Prototype drawings are drawings that may be used as a model to create design drawings for a specific project. District design projects can be similar to other previously designed projects. When this is the case, prototype drawings may be used by the consultant as a basis for their new drawings.

When using prototype drawings, it is the consultant's responsibility to verify that the CAD standards used in that drawing conform to the standards outlined in this manual. The prototype drawings are provided as a convenience to the consultant. Prototype drawings will not automatically contain the correct global origin setting, and may also contain other incorrect settings. They are not intended as a guideline for CAD standards.

The District will provide the consultant with CAD files of any prototype drawings that may be used for a project. The specific drawings used by each project, if any, will vary. Prototype drawings will be provided in MicroStation format only. Translation to other CAD formats is the responsibility of the consultant.

# Wastewater CAD Guidelines

## MicroStation File Set-up

### Seed Files

All drawings produced for the District shall be created using the seed file provided with the District Software. The seed file provides the basic set up for the design file. Files created without the correct seed file will not be accepted.

The Wastewater Drafting seed file has been set up with the following parameters. The consultant should not alter items shown in ***BOLD Italic*** typeface.

<b><i>Working Units</i></b>	Unit Names - Master Unit: Survey Feet, Label: ' Sub Unit: Survey Inch, Label: " Resolution: 96000 per Survey Foot  Working units are altered to allow for drafting multiple drawing scales on one drawing. See the section on <a href="#">Drawing Scales</a> , for additional information.
<b><i>Global Origin</i></b>	The global origin is set by the District in the seed file, and remains constant for all projects.
<b><i>Level Symbolology</i></b>	The LEVEL SYMBOLOGY and LEVEL OVERRIDES display should be set to "ON" in all files. A level symbolology table has been established to assign colors to specific levels. Actual colors are not used in design files. The level symbolology table provides a quick method for checking for correct level use.
<b><i>Font Library</i></b>	wfont.rsc
<b><i>Fonts Used</i></b>	Font 2 is the standard font, used for the majority of all text. Fonts 30 and 32 are used in the drawing border only. Font 126 is a symbol font used for automatic dimensioning and placing notes with leaders.
<b><i>Color Table</i></b>	wcolor.ctb
Text	No size set up; will be determined by user based on plot scale. See section on <a href="#">Text and Fonts</a> , in this manual.
<b><i>Dimension Styles</i></b>	Place Note - Left Margin: 0.4 Terminators - Width: 1.0, Height: 1.0, Min. Leader: 2.0 Terminator Symbols - Arrow: Symbol, Char: C, Font: 126 Stroke: Symbol, Char: S, Font: 126 Origin: Symbol, Char: O, Font: 126
<b><i>Coordinate Readout</i></b>	Coordinates - Format: Sub Units, Accuracy: 0.1234 Angles - Format: DD.DDDD, Mode: Conventional, Accuracy: 0.1234
<b><i>Grid</i></b>	Grid Master: 0:0.1250, Grid Reference: 8
Locks	Fence Mode: Inside Snap Lock: On, Mode: Keypoint, Divisor: 2, Association Lock: On <b><i>Unit - Distance: 0:0.0625</i></b>
Levels	ON = ALL (All Views)
<b><i>Right Angle Lock</i></b>	Off
Overview	Set Overview = On
Active Level	default (do not place any elements on the default level)

# Wastewater CAD Guidelines

## Grid and Unit Lock

The Grid set up (GU=, GR=) and Unit set up (UR=), is established in the seed file (see section on [Seed File](#) parameters). Grids and Units are used on Schematic drawings only. These include P&ID's, Electrical schematics such as One-Line diagrams and Interconnection diagrams, Charts and Schedules. A grid or unit lock should never be used on a scaled drawing because it may result in inaccurate placement of elements.

The Grid and Units are set in the SEED.DGN file to:

	Units	Description	Key-in
<b>Grid Master</b>	0:0.125	space between grid points	GU=0:0.125
<b>Grid Reference</b>	8	number of grid unit points per cross hair	GR=8
<b>Unit Distance</b>	0:0.0625	smallest unit available for placing elements	UR=0:0.0625

Turning on the GRID View Attributes will show the grid tick marks on the screen. The dots fall on the GRID REFERENCE points (every 1/8"). The cross hairs fall on the GRID MASTER points (every 1"). The UNIT DISTANCE points are not displayed on the screen. They fall at each 1/16" point, or on every grid mark and half way between every grid mark.

**NOTE:** The GRID and UNIT LOCKS force all elements to be placed on the grid or unit points. Always keep the GRID LOCK turned OFF, because the GRID LOCK will override the UNIT LOCK, and all elements will be forced to the 1/8" GRID rather than the 1/16" UNIT.

When working on a schematic drawing, proceed with these steps:

- Turn GRID View Attributes on
- Turn UNIT LOCK on
- Turn GRID LOCK off

All schematic type drawings should be created using the Unit Lock and Grid View Attributes. All cells for P&ID's and electrical schematics have been designed to fall on even grid points of 1/16".

Care should be taken to keep all line work on the grid. Schematic drawings that are not drawn on the grid and unit points will not be accepted.

# Wastewater CAD Guidelines

## Global Origin

### What is a Global Origin?

The Global Origin defines the range of the X,Y,Z coordinates in the design file. The Global Origin is actually the lower left corner of the design plane (or cube for 3D files). The Global Origin command (GO=xxx, yyy, (zzz)) establishes the coordinate values at the global origin (the lower left corner). When you key in GO=\$, the value given is the distance from the Global Origin (the lower left corner) to the coordinates XY=0,0

The value of the Global Origin is directly related to the working units set in the design file. Since the working units determine the size of the design plane, the Global Origin must be set relative to the working units. See the section on Working Units, for more information.

The default global origin readout for Wastewater Drafting (GO=\$) is:

**GO=-6066849.3320,-2124907.6050**

# Wastewater CAD Guidelines

## Working Units

The default working units for Wastewater Drafting are as follows:

	Unit Name	Label
<b>Master Unit</b>	Survey Feet	'
<b>Sub Unit</b>	Survey Inch	"
<b>Resolution</b>	96000 per	Survey Foot

The selection of Working Units is somewhat arbitrary. However, once standard units have been selected, it is very difficult to change to a new standard. These working units were selected for older versions of MicroStation, and were selected at that time because they provided an adequate size of working area without sacrificing drawing accuracy. The data can be input in both decimals of a foot and inches.

Working units control the size of an object in a design file. An object that measures 10'-0" in one working units, will not measure the same in different working units. By manipulating the working units, we are able to create design files with multiple drawing scales. See the section on [Drawing Scales](#) for more information.

All CAD files produced for the District shall use the standard working units provided in the seed file. Drawings that are created using non-standard working units will not be accepted.

### **Survey Feet vs. International Feet**

MicroStation V8I introduces the option of working in Survey Feet or International Feet. In V8I, all files are actually stored in Meters, regardless of the Working Units settings. Each time a file is opened it is converted to the units specified in the RESOLUTION setting. All MicroStation drawings produced for the District shall be in Survey Feet. International Feet shall not be used.

In order to use Survey Feet, you must use the UNITS.DEF file that is provided in the Wastewater CAD Software. Without this unit definition file, Survey Feet will not be available.

# Wastewater CAD Guidelines

## Level Symbolology Overrides

Wastewater Drafting utilizes the Level Symbolology Overrides to keep track of levels in the CAD design file. The WSEED.DGN file has been set up to include a level symbolology override definition for each level. The override is set to display COLOR only. The line weight and line style is not activated.

Level Symbolology Override causes the elements on each level to appear as a specific color. When the user places the elements, they are all placed without color (CO=0). However, with the level symbolology display turned on, the elements appear to have color.

Each level has a color assigned to it. Because it is difficult to differentiate between more than 30 colors, the same color may be re-used many times for different levels in a design file. By utilizing the level symbolology override display, it is immediately apparent when an element is placed on the wrong level because it will appear with a different color.

Level Symbolology Override uses the color table in the display of color for each level. In order to see the correct colors on each level, the color table provided by the District must be attached to the file.

### **Level Symbolology for Reference Files**

When a file is attached as a reference file, and the level symbolology display is turned off for that reference file, the reference file will appear all white. When the reference file display is white, it is immediately apparent to the user which elements are in the active file, and which is in the reference file.

### **Changing The Level Symbolology Table**

Occasionally, it is necessary to modify the default level symbolology table.

A user may want to modify the default level symbolology table because two levels, with the same color, are used extensively in a drawing. When this occurs, it is difficult to tell which level is the active level. By changing the color display for one of the levels, it is easier to work on the correct levels.

When several reference files are attached to one design file, all of the reference files will appear white. This may make it difficult to differentiate between reference files. It is preferred that the level symbolology table be turned off or changed for the reference file attachments so that each file displays in a different color. For example, the first file may display all white, the second, all yellow, and the third, all green.

The user may modify the level symbolology table for any design file, if the result will make the file easier and clearer to work in. Changes to the level symbolology table should only be required in special situations. Every effort should be made to keep level symbolology table changes to a minimum.



# Wastewater CAD Guidelines

## Color Assignment Table

The standard color table for Wastewater Drafting is WCOLOR.CTB. This color table should be used in all MicroStation files. Other color tables have been provided, that are used only for plotting. They are not attached to the design files.

This color table should be attached to the SEED.DGN file, and all files produced for the District. The color table controls the appearance of the design file, and is necessary for the correct display of the level symbology.

The following is a list of the colors in WCOLOR.CTB. The red-green-blue values for each color are indicated.

COLOR NUMBER	DESCRIPTION	RED VALUE	GREEN VALUE	BLUE VALUE
		"R"	"G"	"B"
0	OFF WHITE	210	224	210
1	MEDIUM BLUE	85	85	235
2	GREEN	0	204	0
3	RED	204	0	0
4	GREEN-YELLOW	214	214	10
5	PURPLE	145	95	205
6	ORANGE	255	125	55
7	GREY	125	125	125
8	LAVENDER	255	125	200
9	MAGENTA	235	35	185
10	SALMON	255	115	95
11	BURGUNDY	190	75	100
12	LIGHT ORANGE	255	145	35
13	DARK ORANGE	235	70	30
14	LIGHT YELLOW	225	235	135
15	MEDIUM YELLOW	235	235	85
16	TURQUOISE	35	235	185
17	DARK TURQUOISE	55	185	135
18	LIGHT GREEN	85	245	85
19	DARK GREEN	20	135	20
20	TAN	255	185	95
21	BROWN	145	125	70
22	BEIGE	255	190	145
23	DARK BEIGE	185	110	90
24	LIGHT LAVENDER	235	185	235
25	BLUE-VIOLET	155	115	255
26	LIGHT BLUE	85	235	245
27	DARK BLUE	35	135	145

## Wastewater CAD Guidelines

COLOR NUMBER	DESCRIPTION	RED VALUE	GREEN VALUE	BLUE VALUE
		"R"	"G"	"B"
28	PINK	255	150	195
29	ROSE	185	75	135
30	DARK GRAY	85	85	85
31	WHITE	255	255	255
32	NAVY BLUE	0	0	80
33	GRAY	125	125	125
34	BLUE GRAY	135	150	150
35-99	DARK GRAY	85	85	85
100	LIGHT GRAY	185	185	185
101-133	DARK GRAY	85	85	85
134	LIGHT GRAY	185	185	185
135-149	DARK GRAY	85	85	85
150	LIGHT GRAY	185	185	185
151-229	DARK GRAY	85	85	85
230	WHITE	255	255	255
231	GRAY SHADE 1	232	232	232
232	GRAY SHADE 2	216	216	216
233	GRAY SHADE 3	200	200	200
234	GRAY SHADE 4	184	184	184
235	GRAY SHADE 5	136	136	136
236-239	DARK GRAY	85	85	85
240	WHITE	255	255	255
241	GRAY SHADE 1	232	232	232
242	GRAY SHADE 2	216	216	216
243	GRAY SHADE 3	200	200	200
244	GRAY SHADE 4	184	184	184
245	GRAY SHADE 5	136	136	136
246-253	DARK GRAY	85	85	85
254	BLACK	0	0	0
255 (BACKGROUND)	BLACK	0	0	0

# Wastewater CAD Guidelines

## File Control

### File Names and Drawing Numbers

#### The Discipline Based Numbering System

- The Discipline Based drawing numbering system is used for the majority of Wastewater Drafting drawings. The Discipline Based system is used for any project that is associated with a specific District facility or structure.

All drawing CAD file names under this system use one of the following three formats:

<b>wnnxxayyyd.ext</b>	Used for Facility/Area specific drawings (i.e. w2510m101d.r01)
<b>sdnnnayyyd.ext</b>	Used for General drawings that apply to multiple facilities/areas (i.e. sd316g0011.r01)
<b>stdayyyd.ext</b>	Used for Wastewater Standard drawings (i.e. stdm001.r01)

**Bold** fields are mandatory and non-bold fields are used when needed.

- Where "**sdnnn**" stands for the SD (Special District) project number followed by a 3-digit numeric, assigned by SSD Design Group.
- Where "**std**" stands for a Wastewater Standard Drawing.
- Where "**wnn**" stands for the 3-character area code, assigned by Wastewater Maintenance Group.
- Where "xx" stands for sub-structure number for area that has multiple structures.
- Where "**a**" stands for the drawing discipline. See below for a partial listing and WWESP 100.2 for a complete listing of valid discipline codes.
- Where "**yyy**" stands for a 3-digit drawing number. In most cases, this number will have 3 digits. The fourth digit is used as an insertion number.
- Where "d" stands for optional drawing insertion characters (i.e. "1" for an inserted sheet and/or "D" for a Demolition drawing).

Where "**.ext**" is a period plus a 3-character extension, which follows the guidelines outlined in the [File Name Extensions](#) section.

All dashes and periods used in the drawing number are omitted in the file name.

Examples of Discipline Based Drawing Numbers:

<b>Project Drawing Number</b>	<b>CAD File Name</b>	<b>Area Code</b>	<b>Sub-Area Code</b>
SD316-G-001	Sd316g001.r00	none	none
STD-G-003.1	stdg0031.r02	none	none
W36.05-E-303.1D	w3605e3031d.r02	W36	05

Digester Area Code W36 and Digester #5 sub-area is .05

NOTE: The first example represents a drawing in the general area and the second example is a Standard Drawing and the third example is a drawing specifically for Digester #5. The first three characters represent the area code followed by a period and then the sub-structure.

# Wastewater CAD Guidelines

## Listing of Discipline Codes

G	General drawings, list of drawings, project location map
A	Architectural
S	Structural
C	Civil
M	Mechanical
E	Electrical & Instrumentation
I	Process & Instrumentation Diagrams (P&ID's)
L	Landscaping

## Guidelines for Naming Files

File names should always relate to the drawing number. The guidelines outlined below provide a system for naming files so that they can easily be associated with a drawing. The file names assigned to CAD files make them easier to find and use. With thousands of files active at one time, it would be very easy to "lose" a file. By following these guidelines for CAD file names, the likelihood of losing a file will be greatly reduced.

File names should be unique. Never reuse a file name. For example, rather than naming a file exstsite.mst, it would be better to name it w3600csite.mst where "w36" is the area code and "00" is the sub-number. This will make this existing site file unique from all others.

CAD file names have three parts. A file name, a period (.), and an extension. The first part is the filename. The period falls between the filename and the extension.

# Wastewater CAD Guidelines

## File Name Extensions

All CAD files produced by consultants shall use the file name extensions shown below.

Extension	Description
.dgn	Used for general graphics files, CAD development, department forms, sketches, etc. ".dgn" files are never project-drawing files.
.r00	Stands for Revision 0, and is used for the initial issue of a drawing. "r00" is the most commonly used CAD filename extension.
.r01	Stands for Revision 1, and will be used for the first revision to a project drawing. All subsequent revisions shall follow this format, (i.e., "r02", "r03", etc.).
.mst	Stands for "Master File" which is used as a base file for project drawings. The master file is not a drawing by itself, but is used as a reference file to a drawing. The master file name always relates to the Facility/Area or the drawing it is used with. The .mst file is always the current version of the Master File and will be reference to project drawing. A typical master file would be the background topography for a site plan. Master file names begin with the Facility/Area code.
.m00	Stands for the older version of Master File it is a saved version of the original .mst file before the master file is revised for update. This file will be used for the original version (.r00) of a drawing file. All subsequent revisions shall follow this format, (i.e., "m02", "m03", etc.).
.txt	Occasionally ASCII text files are created for insertion into drawings. These may be used for long lists of notes or drawings. Text files are always named with the same name as the CAD design file name they were created for. The extension of "txt" indicates that the file is an ASCII text file.
.cit	Used for scanned images of the original drawings. These drawings should be kept in the "ref" sub-directory with a file name that matches the drawing number that it is attached to.
.c00	Stands for Revision 1, and will be used for the first scanned image revision. All subsequent revisions shall follow this format, (i.e., "c02", "c03", etc.).
.tif	Used for scanned images of the original drawings. These drawings should be kept in the "ref" sub-directory with a file name that matches the drawing number that it is attached to.

# Wastewater CAD Guidelines

## Reference Files

A reference file is a type of overlay. Information in one drawing can be overlaid on a different drawing, eliminating the need to redraw information. Proper use of reference files will result in significant time savings and greater coordination of drawings.

Reference files are most commonly used as background information. Generally, a project will have a master site plan, depicting the existing site features and topography. This master site plan is then used as a reference file, whenever existing site information is needed.

Another typical use for a reference file is the outline of a structure. The structural floor plan may be used as a reference file on the Mechanical and Electrical floor plans. This results in all plan drawings having identical backgrounds. Any revisions to the building are made in the Structural drawing only, and are immediately reflected in the other plans. Conflicts and interferences become readily apparent.

### **Reference Files Are Part of the Project**

A file used as a reference file is a part of the project. Drawings from other projects should never be used as permanent reference file attachments except for master files provided by the [District CAD Contact](#). Generally, the only files used as reference files are other drawings in the same project, and one or two master files. The master files are not actual drawings, but usually provide background information such as topography or existing structures. As an example, the Wastewater Treatment Plant existing site plan called w2000xsite.mst, this file may not be in the same project directory but you do not need to "remember full path" when referencing this file, see note below.

**Note:** When referencing master drawings provided by the District such as existing site consultant should never rename these files and should not be included in the final CAD submittal. If the consultant find that the master files provided by the District does not reflect the existing condition based on field investigation they should create a separate MicroStation file as an overlay to the master file to show the changes then submit to the [District CAD Contact](#) for master file update. The District will then provide the consultant with the updated file.

### **Deciding Which Reference Files to Use**

It is very important to select reference files carefully and logically. Although it is possible to attach 32 or more reference files, working with more than 4 or 5 reference files becomes confusing and difficult.

When selecting files to use as reference files, follow these basic principles:

- Whenever possible, an item should be drawn in only one place, and referenced to all other drawings where it is shown.
- Mechanical equipment should always be drawn on the main mechanical floor plan, and referenced on all other plans.
- Ventilation equipment should be drawn on the HVAC plan.
- Electrical lighting and equipment should be drawn on the main Electrical plan.
- Building outline is usually drawn on the Structural floor plan. In some special circumstances, the building outline can be drawn on the Mechanical plan. In either case, there should only be one place where this information is drawn.
- The existing site topography should be drawn in the XSITE master file.

# Wastewater CAD Guidelines

All drawings that has north arrow orientation should be located based on the District's Map and coordinate system if possible. All other discipline base plans should be created to match the District's Map and coordinate system so that they line up with each other without requiring that the reference file be moved or rotated.

Reference files can also be temporarily attached to a design file, to aid in creating a drawing. For example, when drawing exterior building elevations, attach the building sections and framing as reference files, to coordinate and verify all dimensions.

Before creating a new drawing, research any existing drawings, to see if coordination is required. If a file already exists, such as the sections or framing elevations in the example above, attach those files as a temporary reference file. All new work should be drawn on top of the existing work in the reference files. By superimposing related graphics on top of each other, the final product will be more accurate and any conflicts will be noticed more easily. **Temporary reference files should always be detached before the drawing is exited.**

## Reference File Names

Reference Files are either project drawings or a master file. All reference files are named either with a project drawing file name, or with a project code and descriptor.

Examples:

- The structural floor plan drawing is used as a reference file for the background to the mechanical drawing. The structural floor plan file name is "W36S003.R00". This same file becomes the reference file to the mechanical drawing, and retains the same name.
- The existing site topography covers a large area, and is used as the background for several drawings that make up the site plans. Since the existing site topography is not a project drawing, it does not have a project drawing number. However, it should still have the area code identification (first three characters of file name). In this example, the reference file would be named "w2000xsite.mst".

The section on File Names describes the composition of file names and file name extensions. All file names shall fall within the parameters set by that section of the manual.

## Reference File Logical Names

Each reference file attachment should be given a logical name. The logical name should be an abbreviation of the full file name. For example, when attaching the file w36s003.r00 as a reference file, the best logical name to use is s003. If the drawing were attached to the file twice, then the logical names would be s003a and s003b.

Logical Names control the way the reference file is plotted. Specific prefixes are used to aid in plotting. The prefixes "SC", "X", "L", and "LL" are used to obtain specific [screening effects](#) when plotting. See the section on plotting for a complete description of reference file logical names and their effects on plotting. All CAD files produced for the District should follow this logical name convention, regardless of the software used for plotting.

## Named Views and Reference Files

Reference files should **never** be attached using the saved/named view method. If a saved view is used to attach a reference file, it is impossible to reattach it in exactly the same location. Drawings with reference files attached by named view will not be accepted.

# **Wastewater CAD Guidelines**

NOTE: Exception of the reference files attached by names views will be the border file. Border file is attach by name views assigned commonly base on the drawing discipline

## **Drawing Borders in Reference Files**

It is preferred that drawing borders are reference, and the data fields in the title block shall be placed in each drawing file filled with the correct information for that drawing.

## **Reference File Levels**

When a reference file is attached to a file, all levels should be turned OFF, except for the specific levels that are required. Any levels that are blank should be turned OFF. This will eliminate the problem of elements unintentionally "appearing" on a drawing when the reference file is modified.

## **Reference File Attachments**

When using reference files; try to avoid moving, scaling, or rotating the reference file. If it is necessary to move and/or scale the file, try to simplify the process by selecting an even number of feet for the move, or an obvious rotation or scale point. .

If a reference file is attached to several different project drawings, and is rotated and/or scaled in each of those drawings, then the scale point and rotation point should be consistent throughout each drawing and throughout the entire project.

## **Use Level G-SPCL-REFR-NPLT for Reference File Documentation**

Some reference file attachments are very complex and the description provided by the reference file documentation cell, REFDOC, is not adequate to fully describe the attachment. In these cases, level G-SPCL-REFR-NPLT (level #131) may be used to show additional information about the reference file attachment. Other reference file documentation such as excel spread sheet or word doc is also accepted.

Level G-SPCL-REFR-NPLT (level #131) may be used to show the clipping boundary of the reference file, the rotation or scale point of the reference file, or any other information that will help in reconstructing the attachment.

## **Save Setting With Reference Files**

Always leave a CAD file with the correct reference files displayed. A file should never be "saved" with the reference file display turned off, with temporary reference files attached or with extra levels turned on. The intent is to leave a file so that the next user can work on it without having to do any set up.



# Wastewater CAD Guidelines

## **Reference File Documentation**

Each reference file attachment shall be documented in the design file where it is attached. If a file is attached more than once to a file, it should be documented for each attachment. Place the cell, [REFDOC](#), from the Common Cell Library, at the right side of the drawing border at the same scale as the plot scale, in every file where a reference file is used. This provides a form where all information about the reference files can be entered. The form contains data fields for entering all information.

The documentation form includes the following information for each reference file attachment.

- File name of reference file
- Logical name of reference file
- Description of reference file
- Levels used
- Scale used
- Rotation angle used
- Point of rotation
- Amount reference file was moved
- Clip boundary information
- Comments

Any information required to reconstruct the reference file attachment should be included in the documentation. The user should assume that someone who is completely unfamiliar with the project will have to reconstruct the drawing, and the documentation should make that process as easy as possible.

## **Hard Copy of Reference File Documentation**

A hard copy plot of each reference file documentation sheet shall be submitted with the final submittal of the CAD files.

# Wastewater CAD Guidelines

## Drawing Revisions

The term "Drawing Revision" refers to modifications that are made to a drawing after it has been signed and issued. The first revision to a drawing takes place after the initial issue of the drawing is signed and released for bid or construction. "Drawing Revision" does not refer to changes made to a drawing prior to completion and signing.

File name extensions indicate the current drawing revision. The initial issue of a drawing has a file name extension of .r00. Subsequent drawing revisions have CAD file names of .r01, .r02, etc. The file name extension number shall match the actual drawing revision number.

Once a drawing has been signed, the corresponding CAD design file becomes a record document. As such, it should not be modified in any way. All reference files attached to that file are part of the document and they also can not be modified.

When a revision to a CAD drawing is required, the following procedures apply

- Copy the CAD drawing file to the next Revision extension number. The actual file name remains the same, only the extension changes.
- Determine which files are attached as reference files, and make sure that the most current revision of each reference file is attached. The revision number of each reference file will not necessarily match the revision number of the drawing.
- The reference file attachments should be modified to reflect the new revision of all attached files.
- If a master file is one of the drawing reference files, you will continue to work in the .MST file, but a record copy of that master file should be saved as part of the old drawing revision. The record copy of the master file will have the same name as the original, with the extension of .ms0, .ms1, .ms2, etc. (verify with [District CAD Contact](#)).
- For drawings manually signed, type all previous signatures on the CAD file, as they appear on the original signed drawing. Use initials when the actual signature used initials. Use full names when the actual signature used full names.
- Type the signature date of the previous revision on the CAD file. This may be the initial issue, or a revision.
- Add the cell, RECOPY, from the Common cell library, to the drawing, as close to the signature and revision block as possible.
- Bubble all drawing revisions to the drawing, using a WT=4, LC=0, LV=60 curve string, and the cell, REV., at each revision. The revision number is inserted in the data field of the cell.

# Wastewater CAD Guidelines

## Revisions to Manually Drafted Drawings

On occasion it is necessary to revise an existing manually drafted District drawing. When revisions are made to manually drafted drawings, the following guidelines shall apply.

- On Mylar or linen originals, black ink shall be used for all drafting.
- On vellum originals, graphite pencil shall be used for all drafting.
- Lettering shall be vertical block lettering, a minimum of 1/8" high.
- Line weights and line styles shall match the line weights and styles on the existing drawing.
- All drafting on drawings shall be dark and capable of reproduction by photo copy techniques.
- Every revision to the drawing, whether it is an addition to the drawing or an erasure, shall be bubbled with a heavy line. The bubble should be placed on the back of the sheet for Mylar drawings, and on the front of the sheet for vellum or linen drawings. The bubble should be broken when it crosses other line work or text.
- Modifications to the drawings that were made to indicate as built conditions should not be bubbled as revisions.
- A revision bullet symbol, with the revision number, shall be placed next to each bubble.
- The revision block shall be filled in with the revision bullet and a description of the revision. The date shall be the date the revision is signed.
- Generally, revision bubbles and bullets from previous revisions shall be removed. However, if the previous revision is still under construction, then the bubbles and bullets should remain on the drawing.

# Wastewater CAD Guidelines

## Levels

### About Levels

#### Standard Level Applications for Wastewater Drafting

The following level assignments have been established for Wastewater Drafting. Level assignments have been split into groups of related items. These level applications should be followed for all drawings. The proper relationship between drawings and disciplines depends on the consistent use of levels. Any modification to the level applications should be approved in writing by the District CAD Contact.

Levels also control the appearance of hard copy plots. See the section on Plotting for additional information.

Within each group, spare levels are available to accommodate unusual drawing requirements. Spare levels may be used as required, but should be used to depict items in the same category. When a consultant uses any spare levels, the use of these levels should be consistent from one drawing to the next. An updated level application list shall be submitted at the completion of each project, indicating how spare levels were used for that project.

#### Levels are stored in DGNLIB files

The Wastewater Drafting standard MicroStation V8i configuration will automatically attach a set of level DGNLIB files to each file. These DGNLIB's contain all of the levels required for all drawings. Creation of new levels is restricted. No new levels should be added without approval from the [District CAD Contact](#).

#### Civil levels are used for both Existing and Proposed

On most projects both the existing site plan and the proposed site plan are drawn in separate reference files. Those files are attached to one or more drawings. This can be referred to as the "existing site master file" and the "new site master file". Both the existing and new site plans share the same set of CIVIL levels. Since they are drawn in separate files, there is no conflict.

# Wastewater CAD Guidelines

## Standard Level Applications

### SUMMARY OF STANDARD LEVEL APPLICATIONS FOR FACILITY DRAFTING

For a complete list of District Wastewater Drafting level assignments an EXCEL spreadsheet listing of all levels is provided in the DGNLIB folder. Levels can also be viewed using Level Manager from within the design file. When the District's CAD software is properly installed on your system, you will automatically have all District levels available. Do not create any new levels.

The general categories (filters) of levels are:

Level Number	Description
101 thru 181	General levels, borders, notes, non-plot levels
201 thru 209	boring holes, boring logs
221 thru 225	Cathodic protection
401 thru 420	Structural
401 thru 405	Concrete
406 thru 408	Wood
409 thru 411	Steel
412 thru 420	Miscellaneous
421 thru 437	Landscape and Irrigation
440 thru 450 & 1701 thru 2012	Mechanical
451 thru 485	Architectural
461 thru 472	Architectural Furniture and Casework
490 thru 498	Electrical
591 thru 594	Electrical Schematic Drawings
632 thru 651	P&ID's
632 thru 637	Instrumentation
642 thru 651	Process
1001 thru 1676	Civil (Survey and Site)
1011 thru 1047	Controls and Alignments
1051 thru 1065	Property
1071 thru 1155	Topography and Profiles
1201 thru 1287	Site
1300 thru 1329	Miscellaneous (demolition, unidentified items)
1401 thru 1676	Utilities

# Wastewater CAD Guidelines

## CAD Standards

### Line Styles

#### Standard Line Styles

MicroStation uses eight standard line styles. These line styles, numbered 0 through 7, provide an adequate variety of line types for most drawings. An example of these line types is shown below.

#### Sample of Standard Line Styles

MicroStation is delivered with eight standard line styles (LC 0 through LC 7). The District uses styles 0 through 6 as they are delivered. Style 7 is modified by the IPLOT pen table, during plotting, to create a centerline line style. See the related topic in the [Pen Table](#) section.

LC = 0	—————
LC = 1	.....
LC = 2	-----
LC = 3	-----
LC = 4	-----
LC = 5	-----
LC = 6	-----
LC = 7	-----

# Wastewater CAD Guidelines

## Custom Line Styles

### Custom Line Styles

The District uses a number of custom line styles that are provided in the line style resource file that is included with the District software. Only District provided custom line styles shall be used unless the [District CAD Contact](#) has approved additional custom line styles

Link to: [Sample Custom Line Styles](#)

## Screened Lines

Screened lines are grayscale lines that appear lighter than other lines on the drawing. Screened lines do not appear screened in the CAD file, but rather are produced by the plotting software.

Screened lines are used to show either existing features, features that are not a part of the specific drawing discipline, or features that are not in the contract. Examples of the use of screened lines follow:

- Site plans almost always show the existing site features, trees, contours, roads, etc., with screened lines. Only the new features that are part of the proposed construction are shown with bold lines.
- A mechanical plan view of an existing pumping plant generally shows the building outline in screened lines. Other non-mechanical equipment (electrical equipment, etc...) may be shown screened for reference. Only the new mechanical features, piping, valves, etc. are shown with bold lines.
- A lighting plan shows the background of the building in screened lines, including all structural and mechanical features. Only the new lighting and wiring are shown with bold lines.

# Wastewater CAD Guidelines

## Line Weights

The District uses seven line weights in the production of all drawings. These line weights are numbered 0 through 6, with 0 being the lightest line and 6 the heaviest. Line weights 5 and 6 are rarely used.

The InterPlot Pen Table defines the thickness of each line. Consultants are required to use InterPlot for plotting final drawings. Consultants who do not use IPLOT for plotting final drawings shall modify their plotting software or pen tables to emulate the line weights used at the District. If necessary, request a sample of line weights from the [District CAD Contact](#).

## Line Style and Weight Chart

### Use of Line Style and Line Weights

The scale of a drawing and the density of the detail often governs the use of line weights and line styles. The consultant should apply standard industry drafting practices for each drafting discipline, in determining which line styles and weights to use.

This chart provides a guideline for selecting line weights and line styles. The most commonly used items are listed on this chart. The line weights and styles shown on the chart should be followed where possible.

DESCRIPTION	WEIGHT	STYLE
index contours	3	0
intermediate contours	1	0
top of cut, toe of fill	2	3
ditch flow lines	0	7B
tree or shrub lines (usually patterned)	0	0
paved roads	1	0
dirt or gravel roads	1	2
fence lines (usually patterned)	0	0
underground site utilities, piping, conduit	2 (3 or 4)	0
building outlines	1	0
hidden building outlines	1	2
footing lines (hidden in plan view)	1	3
handrails	1	6
concrete outline in section	1	0
steel members (double line)	1	0
steel members (single line)	3	0
reinforcing bars	3	0
conduit (exposed)	3	0
conduit (hidden)	3	2
	2	0
wiring and cabling (exposed)		
wiring and cabling (hidden)	2	3
ground wiring	2	4
piping (double line)	1 (or 2)	0
piping (single line)	3 (or 4)	0
duct work, outlines	1	0
revision "bubble" (use a curve string)	4	0
dimension lines, leaders, and arrows	0	0
center lines	0	7
future	1	6



## Wastewater CAD Guidelines

relocated	1	3
match lines	4	matchline
Detail Callout, Limit of Work	3	detail_callout
Property Line	3	property_line
Easement	2	easement

<b>SCHEMATIC DRAWINGS</b>	<b>WEIGHT</b>	<b>STYLE</b>
wiring on electrical schematics	2	0
equipment outlines on schematics	1	6
shield and shield wires on electrical schematics	1	5
major piping on P&ID's	5	0
secondary piping on P&ID's	2	0
signal lines on P&ID's	2	2

# Wastewater CAD Guidelines

## Text and Fonts

Drawings consist of a variety of text styles (called fonts) and text sizes. Specific text parameters have been established for use in all CAD files. Notes consisting of multiple lines (Text Node) should not be dropped.

### Fonts

A Font Library is attached to each design file. The font library provided by the District is called "WFONT.RSC". It should be assigned as the default font library when working on CAD files for the District.

### Standard Fonts

The standard font for all drawing text is Font 2. No other fonts shall be used in the body of the drawing. Font 2 is a custom District font, and is not the same as the Font 2 that is supplied with MicroStation software.

Font 30 is used in the drawing border only, for the District name and address. This font is a bit-stream font. The characters are more complex, and the font displays much more slowly than Font 2. Font 30 shall not be used in the body of a drawing. If the consultant does not have the software required to plot a bit-stream font, then it is acceptable to replace the Font 30 characters in the drawing border with Font 2 characters.

Font 126 is a symbol font. This font provides the arrow heads, diameter symbols, and slash symbols that are used in automatic dimensioning. As an alternate, the consultant may use the District's cell library for arrow heads and slashes, and Font 2 for the diameter symbol. See the section on Seed File parameters for the automatic dimensioning setup, and the section on Line Terminators for use of cells as terminators.

### Text Standards

Specific text sizes and weights have been established for Wastewater Drafting. All text shall follow these parameters. Text should never be scaled up or down, stretched, or compressed, to fit a specific situation.

- The standard text heights are: 1/10", 1/8", 5/32", 3/16".
- Text width is always 80% of the text height.
- Line spacing is always 50% of text height except in the Drawing Index. Line spacing in the Drawing Index should be increased (equal or 125% of the text height) for clarity.
- Text shall be a minimum of 1/10" high, so that it will be legible when a drawing is reduced to half size. Generally, the largest text used is 3/16".
- All multi-line notes shall be placed using a "Text Node".

### Text Applications

SIZE	HEIGHT, WIDTH	WEIGHT	APPLICATION
1/10"	.1000", .080"	0	Most text in the body of a drawing, dimension, notes
1/8"	.1250", .100"	0	Electrical equipment callouts, column headings on charts and schedules, building callouts on site plans
5/32"	.1563", .125"	2	The heading "NOTES" for general notes, titles for charts and schedules, subtitles on drawings, match line text, street names, contour labels
3/16"	.1875", .150"	2	Titles for plans, sections, details, etc.

# Wastewater CAD Guidelines

## Text Size in CAD Files

Text shall be placed in the file at the appropriate size for the drawing plot scale. Depending on the scale of the drawing, the size of the text placed in the file will vary. Since all CAD files are drawn at full size (1"=1"), the size of the text and cells in the file are adjusted so that the final plot will have the correct size text. See the section on drawing scales for additional information.

## Examples of 1/10" Text Sizes for Various Scales

Plot Scale	Scale Factor AS=	TEXT HEIGHT TH=	TEXT WIDTH TW=	LINE SPACING LS=
1"=1" (full)	1	0.10"	0.08"	0.05"
3"=1'-0"	4	0.4"	0.32"	0.2"
1 1/2"=1'-0"	8	0.8"	0.64"	0.4"
1"=1'-0"	12	1.2"	.96"	0.6"
3/4"=1'-0"	16	1.6"	1.28"	0.8"
1/2"=1'-0"	24	2.4"	1.92"	1.2"
3/8"=1'-0"	32	3.2"	2.56"	1.6"
1/4"=1'-0"	48	4.8"	3.84"	2.4"
3/16"=1'-0"	64	6.4"	5.12"	3.2"
1/8"=1'-0"	96	9.6"	7.68"	4.8"
3/32"=1'-0"	128	12.8"	10.24"	6.4"
1"=5'	60	0.5'	0.4'	0.25'
1"=10'	120	1'	0.8'	0.5'
1"=20'	240	2'	1.6'	1'
1"=30'	360	3'	2.4'	1.5'
1"=40'	480	4'	3.2'	2'
1"=50'	600	5'	4'	2.5'
1"=60'	720	6'	4.8'	3'
1"=100'	1200	10'	8'	5'
1"=200'	2400	20'	16'	10'
1"=500'	6000	50'	40'	25'
1"=1000'	12000	100'	80'	50'

## Data Fields

Data Fields are used for text placement in the drawing border, and in cells that require text entries. They are also used on charts and schedules. Data Fields provide the set up for the text, including font, size, level, weight, and justification. The Data Field display should be turned ON in all files, so that the user can see where data fields are available. Text should never be placed on top of an enter data field.

# Wastewater CAD Guidelines

## Special Characters

Font 2 includes some customized characters that are commonly used on engineering drawings. The keyboard characters shown in the chart below can be used to represent specific engineering symbols. The display on the screen will show the correct appearance of the symbol, providing that the font library is attached and Font 2 is used.

<u>CHARACTER</u>	<u>SYMBOL</u>	<u>DESCRIPTION</u>
`	⌀	centerline symbol
~	⌞	structural steel plate symbol
!	∠	structural steel angle symbol
^	°	degrees symbol
{	±	plus-minus symbol
}	∅	diameter symbol
	≥	greater than or equal symbol
\	≤	less than or equal symbol
?	△	delta symbol

# Wastewater CAD Guidelines

## Drawing Scales

### Plot Scale

Every drawing has a base scale, or plot scale. Before any text or cells can be placed in a design file, the user must determine the plot scale. The plot scale should be the predominant drawing scale. The plot scale should always be one of the scales used on the drawing, and it should be displayed in the file in large letters above the drawing border (data field on the upper left)..

Whenever possible, a CAD file should be limited to just one scale. Multiple drawing scales in the same CAD file are more complex and difficult to work with. It is preferable to limit the majority of drawings to just one scale, and to consolidate multiple scale details on separate detail sheets. .

### All Drawings are “Full Size”

All CAD drawings are created "full size". That means that a 50-foot long structure measures fifty feet in the design file. At the same time, all drawings are plotted at the finished paper size of 22"x34". In order to accomplish this, the border of the drawing (a cell) is placed in the CAD file at a scale factor relative to the desired plot scale.

For example: a building plan drawing will be 1/8"=1'-0" after it is plotted. It's "plot scale" is 1/8"=1'-0". The building is 100' long and 40' wide. In the CAD file, the building measures it's full size of 100'x40'. On the plot however, the building measures 12.5"x5". That is because the scale of 1/8"=1'-0" is used to represent the size of the building. The 22"x34" border that represents the edges of the paper plot, is placed in the file at a scale factor that makes the border 272 feet long and 176 feet wide.

In summary: All physical items (walls, pipes, pumps, lights, doors, etc.) are drawn full size in every file. CAD drawings are annotated with non-physical items. These include text, line terminators, and various cells (north arrow, section cut arrows, drawing border, etc.). The non-physical items are always placed in the file at a size or scale factor that relates to the finished drawing scale.

### Scale Factor and Working Units

The size of an object in the design file is directly related to the working units setting of the design file. The default working units resolution is 96,000 per Survey Foot). All scale factors and cells are based on these units. See the section on Working Units for additional information.

### Drawing Accuracy

The use of CAD provides the means to draw extremely accurate drawings. At times changes in the design call for dimension changes on the drawings that are so small that they would not be visible on the hard copy plots. The District requires all drawings to be precisely to scale, regardless of how small the difference might be. Even differences that are not visible to the eye are important to the CAD file.

### Scale Factor Table

The scale factor is the active scale used when placing non-physical cells and terminators in the design file. It also applies to text size. A scale factor of 1 (AS=1) would create a symbol that is actual size. If a north arrow were 2 inches long, then the scale factor of 1 would place it in the CAD file as 2 inches long.

# Wastewater CAD Guidelines

However, if the plot scale of the file is 1/4"=1'-0", then the north arrow must be placed at a different scale factor, so that it will appear to be 2 inches long on the final plot. The correct scale factor for placing the north arrow in the 1/4" scale drawing is AS=48.

A complete list of scale factors for each common plot scale is show below.

PLOT SCALE	SCALE FACTOR
FULL SIZE	AS=1
3"=1'-0"	AS=4
1 1/2"=1'-0"	AS=8
1"=1'-0"	AS=12
3/4"= 1'-0"	AS=16
1/2"= 1'-0"	AS=24
3/8"= 1'-0"	AS=32
1/4"= 1'-0"	AS=48
3/16"=1'-0"	AS=64
1/8"= 1'-0"	AS=96
3/32"=1'-0"	AS=128
1"=5'	AS=60
1"=10'	AS=120
1"=20'	AS=240
1"=30'	AS=360
1"=40'	AS=480
1"=50'	AS=600
1"=100'	AS=1200
1"=500'	AS=6000
1"=1000'	AS=12000

## Multiple Scales On One Drawing

Multiple scales can be used on the same drawing by manipulating the working units. By changing the resolution, details can be drawn at a scale other than the plot scale. The resolution setting can be changed temporarily, while a detail is drawn, so that it can easily be drawn full size. If a third different scale is required on the same drawing, the resolution can once again be changed for drawing that detail. By manipulating the resolution, there is no need to calculate a conversion for multiple scales on a drawing.

Changing the resolution setting in a file is always temporary. The units should be set back to the default of 96000 before the drawing is exited. All text, dimensions and cells should be placed at the plot scale, using the default resolution of 96000.

See the table [Resolution Table for Multiple Scales on Drawings](#), in PDF format. It shows the correct resolution setting for scales other than the plot scale. The Master Units and Sub Units are never changed. The values on this table represent the resolution per Survey Foot. That number would then be entered into the resolution setting in the working units.

A tool is provided with the EBMUD custom application that will automatically set the resolution to the correct value for drawing details.

# Wastewater CAD Guidelines

## Guidelines for Area Patterning and Shading

Patterns such as concrete patterns, shading, and cross hatching are time consuming to place in a CAD file, cause the file to redraw more slowly, and take excessive disk space to store.

On District drawings, patterning should be used sparingly, and only when the meaning of the drawing or detail would not otherwise be clear. Often patterning is not required at all. Consultants should take care to limit the use of patterning and shading on District drawings.

The following guidelines can be used to determine when and how to use patterning.

- Use patterns only when the detail or drawing is not otherwise clear.
- Use the minimum area of patterning that is needed to clarify the drawing.
- Patterning is almost never needed to shade the walls that are in section on a floor plan.
- Patterning is not needed to shade concrete for rebar detailing.
- Steel members, in section, are often clear without steel patterning.
- When patterning is needed to shade a wall in section, a roof line, grating, decking, etc., only a small area of patterning should be placed in one or two corners.

### **Guidelines for using Linear Patterning**

The use of linear patterning is also discouraged. Linear patterns break long lines into small pieces. It is very difficult to modify or measure a line that has been patterned. If an alternative to linear patterning is available to depict features, then the alternative should be used. For example, rather than labeling piping on a site plan by breaking the line and inserting text, it is better to place the text above or below the line, leaving the line of the pipe unbroken.

The District has provided custom line styles to be used in place of linear patterns. See the sections on [Custom Line Styles](#) for more information.

Linear patterns are commonly used for some types of lines, such as property lines and fence lines. When linear patterns are used, care should be taken to ensure that the "pattern ghost line", (the line that appears when the pattern display is turned off), is maintained in the file with the pattern elements. The ghost lines should not be deleted or moved.

The District will provide user defined line styles to be used in place of all linear patterns.

# Wastewater CAD Guidelines

## Cells

A CELL is a group of elements that are tied together by a cell header. Cells are stored in Cell Libraries, where they can be recalled for use at any time. Cells are generally used for standard symbols, drawing borders, and commonly used drawing components.

Cells either depict graphical symbols such as a north arrow, section cut mark, or electrical schematic symbol, or they depict physical items such as trees, doors, and structural steel members. Cells that depict graphical symbols are referred to in this manual as "symbolic" cells. These cells are always placed at a scale factor relative to the drawing scale. See the Section on [Drawing Scales](#) for information on setting the scale factor for symbolic cells. Cells that depict physical items are referred to in this manual as "physical" cells. These cells are usually placed at a scale factor of one, because the size of the cell is the actual size of the physical object. In some cases, such as with the tree cells, the scale factor is a multiple of the actual size of the object. See the cell library documentation for each physical cell for information on setting scale factors.

Several general guidelines should be followed when using cells. These guidelines help to ensure that the finished drawings will have a consistent appearance, and will be easily modified by all CAD Drafters.

- Do not DROP the status of a cell.
- Place a cell at the proper plot scale only. Do not use other scales for placing cells.
- Line terminators (arrow heads) and item callouts should be placed on the correct levels, according to the level application list.
- Schematic symbols (electrical and P&ID) should always be placed on the 1/16" unit or grid points. The Unit Lock should be ON at all times, when placing cells in schematic drawings. For more information, see the section on Grid and Unit Lock.

### Cell Libraries

The following Cell Libraries are available for use. A Cell Library has been created for each type of drawing discipline. These include:

WCOMMON.CEL	symbols used on all types of drawings
WELEC_SCHEMATIC.CEL	symbols for Electrical Schematic drawings
WELEC_PHYSICAL.CEL	symbols for physical Electrical drawings (plans)
WP&ID.CEL	symbols for Process and Instrument Diagrams
WSTRUCTURAL.CEL	symbols for Structural drawings (steel and rebar)
WMECHANICAL.CEL	symbols for Mechanical drawings
WBORDER.CEL	standard drawing borders and title blocks



# Wastewater CAD Guidelines

## **Cell Levels**

Most cells are designed to fall automatically on the correct level. Exceptions to this include cells that may be used for more than one purpose. For example, the cell that depicts a pipe end-section may be used for many types of pipes and round structures. Therefore, that cell must be placed "Relative" with the active level set to the correct level. The level symbology display helps to detect cells that are not on the correct level, because they are displayed with a different color.

Cells in all cell libraries have been developed to conform to the Standard Level Applications list. When a different level list is used, the cells may not fall on the correct level. The consultant shall verify that all cells used are placed on the correct level for the project.

## **Point Cells**

Point cells can be identified in the cell libraries by their cell name. In the Wastewater Drafting cell libraries, all point cell names use a period character "." as the last character of the cell name.

Point cells take on the active level, weight, color, and line style that is set in the design file. In order to use point cells correctly, the user must set the level, weight, color, and line style to the desired settings before placing the point cell.

## **Line Terminators**

The most common line terminator is an arrowhead. District line terminators are usually point cells, and must be placed with the correct active level and weight setting. Line terminators are placed using an active terminator scale (TS= ). The terminator scale is always the same as the active scale factor (AS= ), as defined in the section on drawing scales.

## **Shared Cells**

Shared Cells shall not be used. The "Use Shared Cells" box in the "Cell Library" dialog box should not be checked when placing cells.

## **Dropping Cells**

The term "dropping cells" means converting the symbol to its simple elements or components. A dropped cell cannot be converted back into a cell.

Cells should never be dropped. There are a few exceptions to this rule. Some cells, such as the Drawing Border, are used as a starting point for creation of the final border. Drawing Border cells may be dropped in order to make project specific changes. Similarly, some electrical schematics cells, primarily the ladder diagram cells and some of the miscellaneous devices cells as found on the matrix menu, are intended to be used as a starting point. These cells may be dropped, so that they can be modified for the specific drawing. The size and spacing of the elements within these cells should not be modified.

## **Creating New Cells**

The consultant shall use cells from the District's cell libraries for all drawings. On occasion, it may be necessary to create new cells for items that are not included in the District's cell libraries. The consultant may create new cells as required, and shall create these cells on the correct levels to conform to District CAD Standards. The consultant shall provide a separate cell library and documentation for each cell that was created.

# **Wastewater CAD Guidelines**

## **Drafting Standards**

### **Overview of Drafting Standards**

Drafting Standards are used to provide a uniform appearance to drawings. Consistent use of drafting standards throughout a set of drawings, and from one project to another, makes the drawings easier to read and understand. The District has established drafting standards to govern the appearance of its drawings. These drafting standards should be used in combination with the CAD standards outlined in this document.

The term "Drafting Standards" refers to the way items are placed on drawings. It may refer to line styles or line weights, abbreviations, etc. The topics covered in this chapter are not unique to the CAD system requirements, but would apply to drawings produced by any CAD system or to manually drafted drawings. Unlike many of the CAD standards, these specific standards are always visible on the hard copy plots.

# Wastewater CAD Guidelines

## Drawing Border and Title Block

The standard District drawing border measures 22" X 34" at the cut lines. This standard size drawing border shall be used for all projects unless the contract specifically authorizes a different drawing size.

The drawing border can be found in the cell library "WBORDER.CEL". The border cell shall be placed in a master file and referenced to a design file at the same scale as the drawing plot scale. A master file with the drawing Borders should be requested from the [District CAD Contact](#).

The "WBADATA" cell in the "WBORDER.CEL" library shall be placed into the design file at the same scale as the drawing plot scale. This cell contains data fields that set the correct text size, weight, font, and level for all title block entries. These data fields shall be used when adding drawing information to the title block. The consultant's drawing border contains an empty box at the lower margin that is reserved for the consultant's logo. This box may be resized as needed. An example of the drawing border and title block is included in this document.

Click here for Sample of [Drawing Border](#) and Example of [Drawing Title Block](#).

For additional information, refer to [District Engineering Standard Practice \(ESP\) 208.1](#), Title Block Format

### **Drawing Numbering System**

The [Drawing Number](#) topic details the requirements for numbering District Facility drawings. For additional information and clarification, refer to [District Engineering Standard Practice \(ESP\) 120.6](#), "Drawing Numbering System for Structure Related Projects".

# Wastewater CAD Guidelines

## Abbreviations

The District has established standard abbreviations that shall be used on all drawings. For drawings related to Facility Drafting, the abbreviations may be found on EBMUD Standard Drawings. A copy of that drawing is included in the [Standard Drawings](#) section.

Abbreviations shall be used consistently throughout a drawing set. In general, if a word is abbreviated in one place, then the abbreviation shall be used for all occurrences of that word. Abbreviations are generally not used in general drawing notes, but only in the body of the drawing and on schedules.

District abbreviations do not have periods. The only exception to this rule is for abbreviations that can also be complete words. For example, the abbreviation for NUMBER is NO., since NO is itself a word.

# Wastewater CAD Guidelines

## List of Drawings Sheet

The first sheet of each project, after the project cover sheet, shall be an "Index of Drawings and General Information" sheet. For large projects, more than one sheet may be required. This sheet shall contain the following information.

- "Location Map" of the San Francisco bay area, with the location of the project marked.
- "Vicinity Map" showing the major streets approaching the project site, with the exact location of the project clearly marked.
- "Site Map" showing the construction area, entry and egress and contractor staging/storage areas.
- "General Notes" with information pertaining to the entire project.
- "Index of Drawings", including project drawings, reference drawings, and EBMUD Standard Drawings. The drawing numbers and titles on the "Index of Drawings" shall match the actual titles and numbers found on each sheet.

# Wastewater CAD Guidelines

## Cross Reference Drawings

### Sections and Details

The District has established specific guidelines for designating sections and details on drawings. CAD cells have been provided in the common cell library (WCOMMON.CEL) for section cut marks and section and detail titles. [EBMUD Engineering Standard Practice \(ESP\) 208.2](#) establishes the practice for designating sections and details.

Details are shown with a circle, ellipse, or shape with rounded corners surrounding the area of the detail. The circle, ellipse, or shape shall be drawn at weight 4 and custom line style "DETAIL\_CALLOUT". A leader line of weight 2 and line style 0 shall connect the detail "bubble" to the detail call-out.

Sections are always designated with sequential letter names, A through Z, excluding I and O. Details are always designated with sequential numbered names, 1, 2, 3, etc. Sections and details are defined on the drawings as a fractional symbol or a detail bubble. The numerator identifies the section letter or detail number. Numbers and letters in the numerator are not to be duplicated in the view captions on any one sheet. However, the same numbers or letters may appear on any other sheet in the set. The denominator is the drawing cross reference number.

### Drawing Cross Reference Number

In a parent view, the drawing cross reference number identifies the drawing where the section or detail view is drawn. A hyphen shall be used when the section or detail is drawn on the same sheet as the parent view. "TYP" shall be used for typical details that are referenced from multiple drawings.

In the caption of a section or detail view, the drawing cross reference number identifies the drawing on which the parent view is shown. Where there is more than one parent view, the denominator will contain numbers, separated by commas, referring to each drawing showing a parent view.

When the drawing numbers that contains the parent view and the section or detail view both have the same structure number or same "W" number, then only the discipline code and the sequential drawing number are required in the drawing cross reference number. If the parent view and the section or detail view are on drawings that have different structure numbers or "W" numbers in the drawing number box, then the full drawing number shall be shown.

The full drawing number shall always be used when typed in the NOTES.

# **Wastewater CAD Guidelines**

## **Drawing Signatures**

### **Drawing Signatures**

Consultant drawings are signed by the consultant and by the District. The drawing border contains slots for the titles and Professional Engineer registration numbers for each engineer signing the documents. The actual signatures and titles will vary from one project to the next, and may also change during a project. The Consultant shall request verification of the exact wording and placement of the signature titles, in writing, before the 90% review submittal of the drawings.

### **District Signatures**

Each drawing shall contain the title and P.E. number of the Project Manager and/or Engineer, and the Senior Engineer(s). The project cover sheet shall be signed by the Division Manager and Director of Wastewater. Each drawing shall also be stamped, signed and dated, in the lower right corner, with the Professional Engineer stamp of the Project Engineer, Project Manager, or Senior Engineer. Other titles may be required at the discretion of the Project Manager or Engineer. See the sample title block for an example of the District's signature titles.

### **Consultant Signatures**

Every drawing requires the consultant's signatures or typed names. The minimum signatures or typed names required on each drawing include the Designer, the Design Checker, and the Project Manager or Engineer (with California P.E. number). Each drawing shall also be stamped, signed and dated, in the lower right corner, with the Professional Engineer stamp of the Project Manager or the Principal-in-Charge. Other signatures are optional, and may be added to the drawing at the discretion of the consultant.

### **Electronic Signatures**

The District permits the use of electronic signatures on drawings. The consultant shall obtain approval from the District's Project Manager or Project Engineer before using electronic signatures.

# Wastewater CAD Guidelines

## Plotting

### Plotting

Plotting processes control the appearance of the drawing. Through the use of plotting software and pen tables, various effects can be applied to the drawing to produce the final hard copy appearance. The appearance of the CAD file on the computer screen does not necessarily reflect the appearance of the plot.

The District uses Bentley Systems InterPlot software and a 600 dot per inch laser plotter to produce all final plots. A consultant may use other plotting software and hardware, but the final plot should simulate the appearance of the District's plots.

The Consultant shall review the plotting parameters, and ensure that files submitted to the District do not contain elements or reference file attachments that conflict with these parameters. If files have elements that are in conflict with the pen table parameters, then the District will not be able to correctly plot the files.

### Paper / Plotting Media

Final plots submitted to the District for signature shall be plotted on bond media. In most cases the Consulting Agreement will contain specific requirements for the final plot media and size. If the consulting agreement does not contain any specific requirements, then all final drawings shall be submitted on high quality bond, at the size of 11"x17".

### File Control Cell/Data

All plots should include the CAD file control documentation cell, "WBADATA". This cell is located in the "WCOMMON.CEL" cell library. This cell contains three groups of elements:

- A plot shape (level=G-NPLT-01; color=200; line style=2; weight=1) at the cut line (22"x34").
- Text strings for user name, date and time plotted, file name, plot scale, and attached reference file names in the drawings left margin.
- Data Fields for the title block information in the lower right portion of the drawing.

The InterPlot pen table provides the instructions necessary to automatically plot the user name, date and time plotted, file name, plot scale, and reference file names, whenever the drawing is plotted.

If a consultant does not have the means to automatically plot this information, then the consultant shall contact the [District CAD Contact](#) to discuss other options. The "WBADATA" cell should be left in the file, and will plot as a series of dollar signs and text.



# Wastewater CAD Guidelines

## Pen Tables

The District software includes three InterPlot settings files and three pen tables to use when plotting full size, half size, and PDF plots. These pen tables define the appearance of the plot. Within a settings file and pen table, instructions are provided to the plotter to modify the appearance of specific types of elements.

The consultant should review the features of these files pen table, outlined below, and ensure that all elements in CAD files do not conflict with the pen table parameters. When elements fall within the search parameters of the pen table, they will be plotted according to the customized instruction in the pen table.

### **Pen Table Parameters**

#### ***File Control Cell***

The pen table will fill in the fields in the File Control Cell (WBDATA), to automatically indicate the user name, date and time plotted, file name, plot scale, and attached reference file names.

#### ***Element Weights***

The pen table defines the weight for all elements of weight 0 through 6. Weights higher than weight 6 should not be used. The pen table also plots weight 0 text elements slightly darker (at weight 1) than other weight 0 elements.

#### ***Point Elements***

All point elements (zero length lines) are ignored during plotting and will not plot.

#### ***Line Styles***

The Pen Table has redefined all line styles to help create a consistent look when plotting half size and full size plots.

#### ***Screening***

See the section [Screening via Plotting](#) for information on screening elements.

# Wastewater CAD Guidelines

## Grayscale Shading via Plotting (\*\*REVISE\*\*)

### Area Fill Patterning via Plotting and Pattern Libraries

IPLOT software provides the ability to plot areas with user defined area patterns. Through the use of a pattern library and the pen table, the user can select specific patterns to be used on the plots. The pattern library must be attached to the IPARM file (plot parameter file used by the IPLOT software) in order to plot patterns from that library.

The specific pattern is selected by placing a closed shape (ellipse, block, complex shape) on level G-ANNO-PATT-IPLT. The weight and line style of the shape defines the pattern. The pen table searches for shapes on level G-ANNO-PATT-IPLT that are a specific weight and line style, and it assigns an area fill pattern to that shape. The level G-ANNO-PATT-IPLT outline of the shape does not plot. See the "Sample Pattern Library" examples, in this section.

### To fill an area with patterning

- Verify that IPLOT software is available for plotting, and that the IPLOT configuration files have been edited to include the Facility Drafting pattern libraries.
- Place a shape, complex shape, circle, or ellipse on level G-ANNO-PATT-IPLT, and modify the weight and line style to match the desired pattern.
- The shape will not be visible on the plot.

Click here for [Pattern Samples](#).

# Wastewater CAD Guidelines

## Screening via Plotting (REVIEW\*\*)

### Screening vs. Dithering

The term "screening", as used in this manual, is used interchangeably with the term "dithering". Generally, screening and dithering is generally produced as a grayscale value.

### What is Screening (dithering) used for?

"Screening" is a process that plots background information with a grayscale value, rather than a solid black line. This allows the screened portion of the drawing to appear lighter, or less important, than the solid portions. Screening is generally used to indicate existing structures or topography. Screening can also be used to show background information from one discipline, on a drawing of a different discipline. For example, when drawing a "Conduit And Power Plan", it is preferable to screen the building outline and all mechanical equipment, so that the conduit shows clearly on the drawing.

Screening can also be used to indicate "Future" installations. Care should be taken not to mix screening to indicate existing elements, with screening to indicate future work. If a project requires both types of elements, then the future work should be shown with a standard line code, such as line code 6.

### Are there other options?

Occasionally it is necessary to lighten the appearance of elements in a file, without actually screening the elements. This is not often required on drawings, but may be needed on complex site plans or on projects where staged construction is shown. The pen table provides two options for lightning elements.

### Pen Table Summary

The pen table allows the user to selectively screen files, screen levels within files, or lighten files. The control lies in the logical name given to the reference files. This pen table works in the following manner:

#### **Active and Reference Files**

- The Active and Reference files will always plot screened on levels 122, 160-169, 510-509, 541, 591, 631, 635-637, 641, 646-649 & 651, and solid on all other levels.

#### **Reference Files**

- You can control your reference files by the logical names you give them.
- To **SCREEN ALL LEVELS** in a reference file, name your reference file with any logical name that begins with the letters "SC", upper or lower case. **Example:** SC302 or SCsite
- To **LIGHTEN ELEMENTS** by one weight on all levels in a reference file, without screening them, name your reference file with any logical name that begins with the letter "L", upper or lower case. **Example:** Lc301 or Lxsite
- To **LIGHTEN ALL ELEMENTS** to **WEIGHT = 0**, name your reference file with any logical name that begins with "LL", upper or lower case. **Example:** LLc301 or LLxsite

## Wastewater CAD Guidelines

# **Standard and Sample Drawings (REVIEW\*\*)**

## **Standard Drawings**

The following buttons provide links to standard drawings. These drawings are in Adobe Acrobat PDF format. Adobe Acrobat Reader must be installed on your PC in order to view these files.

[General - Abbreviations, sheet 1 of 2 \(STD-G-001\)](#)



[General - Abbreviations, sheet 2 of 2 \(STD-G-002\)](#)

[General - Legends, Section, Detail, Elevation, Photo, and Piping System Designation \(STD-G-003\)](#)

[General – Equipment Tag, Area Codes for Wastewater Treatment Plan \(STD-G-004\)](#)

[General – Equipment Tag, System Codes, Colors, and Signage Details \(STD-G-005\)](#)

[General – Equipment Tag, Equipment Type Codes](#)

[Mechanical – Symbols, Designations, and Notes \(STD-M-001\)](#)

[Mechanical – Symbols and Legends, Abbreviations, and Notes \(STD-M-002\)](#)

[Electrical - Legend and Symbols \(STD-E-001\)](#)

[Instrumentation - General Legend, Symbols, and Abbreviations for P&ID Drawings \(STD-I-001\)](#)

## **Sample Drawings and Electronic Signature Documents**

The following buttons are links to sample drawings for each drawing discipline, in PDF format. These samples demonstrate typical use of District CAD and drafting standards. Adobe Acrobat Reader is required to view these drawings.

[List of Drawings and General Information](#)



[Civil - Site Plan W20](#)