

Bureau of Environmental Services (BES)

CAD STANDARDS AND GUIDELINES

BES General Standards

SOFTWARE

Use Autodesk Civil 3D, release 2021 for all CAD drawings submitted to BES.

HARDCOPY

Submit all hardcopy drawings as 22"x34" full size ("D" size). Drawings are typically reduced to half size (11"x17"). All sheet content must be legible at this reduced half size. Final drawings must be plotted on 20 lb. vellum. Preliminary drawings (up to and including the 90% submittal) may be submitted on bond paper.

CAD FILES FOR CONSTRUCTION STAKING

When requested by either the Project or Construction Manager prepare the following items that represent the final, stamped design approved for construction.

- Proposed Design CAD file (XREF drawing)
- ASCII file containing coordinates of center of proposed maintenance holes, angle points, and any other significant points needed for construction staking.

When providing these items to a Contractor or other non-City surveying company these files should be delivered with the following disclaimer displayed prominently:

Owner is providing Contractor the attached documents, dated {date} as prepared by {designer/consultant name}, for reference purposes only and without any warranty as to their accuracy or completeness. By accepting these documents, Contractor agrees to hold Owner harmless for any errors contained therein. Contractor should contact Owner before relying on these documents in order to obtain corrected or updated versions.

BASIC AUTOCAD STANDARDS

Set Layer Zero (0) to the color white with a Continuous line type. Do NOT draw any entity or text on Layer 0. Only blocks should be drawn on Layer 0 (with BYLAYER properties), then inserted on their "home" layer.

Set all entities to BYLAYER colors and line types. There are occasions where a line does not have "ByLayer" properties and a separate "short version" line type, which shows the text within the line at intervals, must be assigned for the text to appear. This is especially important for Utility and Sewer lines. After changing these line types, however, the lines should still be on the "home" layer.



TEXT HEIGHTS

Text should be at a height between 0.10" to 0.25" when plotted at full size. Use the fonts provided in the current BES AutoCAD template and tools files and as listed as follows:

Existing Features:

- 0.10" Callouts/labels for existing features, maintenance hole data, pipe size and material
- 0.12" Maintenance hole name, existing grade callout

Proposed Features:

- 0.12" Callouts/labels for proposed features and maintenance holes data
- 0.14" Maintenance hole name, pipe size, material, length and slope
- 0.175" to 0.200" Street names, profile and grid elevations, subtitles, Note titles (e.g., "Construction", "General"), Detail and Section Titles

Proposed construction features shall be shown darker (thicker lines) than existing features. Use the BES layers with assigned colors in the template. Assigned layer colors can be changed to another color to show thicker or thinner lines if needed to provide clarity. When plotting a drawing, use the Plot Style Table "BES_Full.CTB" for full sized plots and the "BES_Half.CTB" for half sized plots. These files can be found at: <https://www.portlandoregon.gov/bes/77374>

SCALES AND NORTH ARROWS

BES projects shall be drawn using standard scales. The following table contains the ranges of standard scales and their application that BES recognizes. Departure from using these scales for legibility or clarity purposes must be approved by the Project Manager.

Application/Purpose	Standard Scale
Vicinity Map	1"=2000' or larger
Sewer District or Drainage Maps	1"=100', 1"=200', 1"=400': varies according to project size and complexity
Sewer Plan	1"=20', 1"=30', 1"=50'
Sewer Profile	1"=20', 1"=30', 1"=50' Horizontal, 1"=10' Vertical
Details	Vary according to item and complexity

Use AutoCAD units that are consistent with the scale of the drawing. Use the Decimal Format set to feet when showing a Civil drawing (e.g. 1"=20'). Use the Architectural Format set to inches when showing an Architectural drawing (e.g. 3/4"=1'-0").

Bar scales and North Arrows should be on all sheets with plan views. Scales for profiles can be in text form.

Example:

PROFILE:

Horiz: 1"=30'

Vert. 1"=10'



To access the scale and north arrow blocks, download and unpack the zip files from:
<https://www.portlandoregon.gov/bes/77344>



BES Standards Setup

BES TEMPLATE

The BES AutoCAD template is online, and it should be used as a starting point for a BES Capital Improvement (CIP) project: <https://www.portlandoregon.gov/bes/77337>

Download the current copy for each project as the template gets updated periodically. The current template is AutoCAD version 2019. This template can also be used as a starting point for other CIP projects, such as Stream Restoration and Green Streets (stormwater facilities). The template has the Civil 3D styles used by BES. BES standards are further explained in this document.

COORDINATES AND CITY DATUM

All CAD drawings prepared for BES CIP projects shall use the Oregon State Plane Coordinate system, North American Datum of 1983-1991 (NAD 1983-91). Use the City of Portland vertical datum.

Label this information in the lower right corner of the cover sheet as “CITY OF PORTLAND DATUM AND NAD 1983-91”.

BES TITLE BLOCK

Use the BES Title Block located at <https://www.portlandoregon.gov/Bes/article/798821> for all drawings. Do not explode these Title Blocks. Title Blocks may be altered ONLY with prior approval of Project Manager.

BES_Title_block.dwg has 2 visibility states:

- Cover sheet – used for the cover sheet (or title sheet) and includes space for signatures.
- C sheets – used for plan and profile sheets, detail sheets, and erosion control sheets.

This file includes attributes for defining title block items such as title, project number, sheet number, users, and quarter section. It contains fields that are managed by the Sheet Set Manager. The Project Manager will provide the Project Title information and number. Choose a title line series that fits the project requirements. Titles up to five lines are allowed.

The Title Block is formatted for 22”x34” paper size and is to be inserted on layer 0 in Paper Space at 1:1 scale.

BES – PBOT JOINT TITLE BLOCK

For BES and PBOT joint projects use the Title Block “BES_Title_block – Joint_PBOT.dwg” located at: <https://www.portlandoregon.gov/Bes/article/761213>

BES_Title_block – Joint_PBOT.dwg has 4 visibility states:

- Approval BES – for use when BES Chief Engineer signature is required
- Approval PBOT – for use when PBOT City Engineer signature is required
- Approval BES PBOT – for use when both Bureau’s signatures are required
- Bureaus Logo – for use when no signatures are required



SHEET SETUP

After inserting the Title Block into Paper Space, use the Model Space View (“MVIEW” command) to view your drawings and XREFS that are in model space. All drawings and XREFS in model space are to be drawn full size. The scale is determined by setting your MVIEW scale in Paper Space. Put your viewport on layer “_MVIEW” and make sure it is set to NOT plot. Line work, text, dimensions, callouts and other annotations for plans, profiles and details are to be in Model Space. Only General Notes, Construction Notes list, bar scales, North arrows and other items that are not directly part of the drawing are to be in paper space.

Stationing for sewer projects always start from the lowest system or segment elevation. This point (e.g. pipe invert at center of maintenance hole) would be assigned station 0+00. Station 0+00 can be used for the start of each consecutive pipe segment as long as the system flow proceeds from the lowest to the highest point. See the following link for further explanation on sheet layout:

<https://www.portlandoregon.gov/bes/article/696942>

Regardless of project type, number sheets consecutively starting with sheet C01.

Overlap sheets on sewer plan and profile sheets at maintenance holes; match lines are not acceptable unless approved by the Project Manager. Orient the drawing so that the North Arrow **NEVER POINTS DOWN**. The following document provides an explanation about North Arrow placement as it relates to sheet layout. <https://www.portlandoregon.gov/bes/article/696942>

Every sheet shall have a Date Stamp (i.e. Mtext with fields) or a Plot Stamp printed on it. The text should include the file directory, the file name, the date and time plotted, and the User’s initials (“Last saved by” field). The placement for this information is that it shall be vertically oriented, outside the border on the lower left hand corner of a sheet. An example Date Stamp is provided in the BES Template.

Example:

Q:\CAD_Projects\E10489_SE 23rd Ave\E10489_C01.DWG 7/28/14 2:26:28 PM JOHND

XREF DRAWINGS

XREFs should be used for items in a set of drawings that are repeated throughout a project or that are referenced on multiple sheets. However, a proposed design XREF is necessary for ALL projects, even if it occurs only within one sheet. The Design drawing is needed for PBOT to do their construction staking. Never use nested XREFs. Attach all XREFs as “overlays”, not “attachments”.

XREF Naming:

Name XREFs, using the BES job number combined with an abbreviated reference file. XREF names should be concise, contain fewer than 14 characters, and follow the BES naming convention. Limit the number of XREFs in a drawing to 3 or 4; NEVER use more than 6 in any sheet. This is the limit of what can be added to the Title block.



XREF Naming Examples

Name	Description
E10489_XDSGN	Proposed Design file. Includes plan and profiles
E10489_XSURV	Existing Survey file
E10489_XBMAP	GIS base map. Use with Survey XREF
E10489_XPBOT	Base provided by PBOT with Transportation design

For large or complex projects it may be necessary to use more than one design XREF. These can be separated into groups with NO OVERLAPPING PROJECT ASSET INFORMATION. Project pipe, with maintenance holes, for instance should be wholly found on a single design XREF. Make sure not to show the same information on multiple sheets as this can be confusing for the Contractor and when estimating, and can also add to error when information needs to be updated in multiple locations. When planning your design XREFs, keep all pipes within the same drainage basin. Other XREFs, such as survey and base maps, can be separated into groups also.

Examples:

- E10489XDSGN_NW
- E10489XDSGN_NE
- E10489XSURV_NW
- E10489XSURV_NE
- E10489XBMAP_NW
- E10489XBMAP_NE

The base map (e.g. “E10489_XBMAP”), in addition to typical topographic features and utilities, must include the following:

- Building Outlines
- Street Addresses
- Parcel Lines
- Right-of-Way (ROW) Lines
- Curb Lines



BES Drawing Name Convention

BES requires three key items to name CAD drawings. These items are used to name each sheet in the project set.

1. BES Project Number
2. Sheet Category
3. Consecutive number sequence for each sheet in a category

BES PROJECT NUMBER

BES assigns each CIP project a unique 6-character reference number. The following string is an example. E10489

SHEET CATEGORY

BES recognizes the following categories for defining the various disciplines or technical information that could be included in a project. Each project sheet must be assigned to one of the following categories. Each category is assigned an abbreviation to be used in the naming of sheets.

Discipline/Technical Information	Abbreviation Assigned to Category
Architectural	A
Civil	C
Civil Details	CD
Civil Erosion Control	CE
Civil Traffic Control	CT
Demolition	D
Electrical	E
General (such as Cover Sheet)	G
Instrumentation and Controls	K
Landscaping	L
Mechanical	M
Process & Instrumentation	P
Structural	S
Stormwater Facility	SF
Stormwater Facility Details	SFD
XREF drawing	X
Water Quality	WQ

SHEET NAMES

- Each sheet within a BES project is assigned a name. This name is shown at the lower right corner of the sheet. This SHEET Name is the one that is referenced within the project.

Examples:

- G01
- C01
- CD01
- CE01



DRAWING NAMES

The drawing name is the name of the CAD file. Use the BES job number combined with the Sheet Name (No.) to name CAD files.

Examples:

- E10489_G01.dwg
- E10489_C01.dwg
- E10489_CD01.dwg
- E10489_CE01.dwg

Drawing names can also be grouped into drawings with layout tabs of the Sheet number.

Examples:

- E10489_G-Sheets.dwg (with layout tabs G01, G02, etc.)
- E10489_C-Sheets.dwg (with layout tabs C01, C02, etc.)
- E10489_CD-Sheets.dwg (with layout tabs CD01, CD02, etc.)
- E10489_CE-Sheets.dwg (with layout tabs CE01, CE02, etc.)

This method has the advantage of being more flexible with projects that undergo many additions and deletions of sheet files when using Sheet Manager.

SHEET NAME AND NUMBER

In the lower right corner of each title block is the “Sheet No. Box.” This box includes the sheet name on top and the consecutive number of the sheet and the total number of sheets below.

Example:

C09
11 of 28

In the example above, “C09” is the sheet name, “11” is the consecutive number of the sheet in particular, and “28” is the total number of sheets in the project.

SHEET SET MANAGER

BES typically uses AutoCAD Sheet Set Manager to set up and organize sheets on large projects. Sheet Set Manager is a powerful time-saving tool which allows you to open, review and batch plot drawing files. It also makes it easy to change common sheet elements, such as page numbers, sheet titles, dates and custom fields without having to open up individual drawings. You can find a starting sheet set example at this location: <https://www.portlandoregon.gov/bes/77375>

