

# City of Helena

## Computer Aided Design (CAD) Standards

**Background:** The basis for the CAD Standards and AutoCAD Templates were developed through a Request for Qualifications process. Multiple firms submitted during the RFQ process and Great West Engineering (GWE) submittal was deemed the closest to the desires and look that the City of Helena requested. During use of the standards and templates, references to GWE may be encountered.

**Required Uses:** Use of these standards and templates are required for all public infrastructure, and for private infrastructure contained in an easement dedicated to the City of Helena.

**Limitations:** These standards are proprietary and as such may not be used in any manner other than the Required Uses.

### 1) Introduction

a) The City of Helena has developed CAD standards for internal and external use. These standards are to be used to ensure consistency in plan creation and efficient plan review and approval. ***The issuance of these standards does not relieve the Engineer of Record assuring all applicable local/state/federal standards are meet. These standards are not an exclusive but guidelines.***

### b) Software Requirements

- i) As the City of Helena subscribes to Autodesk software, the City may not be on the most recent version. For this reason that all electronic submittals to the City of Helena shall be in the AutoCAD 2013.dwg file format. The City of Helena reserves the right to decline **any** submittal due to incompatibility issues.
- ii) In the event a consultant is working on a later version than what the City of Helena is using then they shall use the export feature in AutoCAD rather than a “save as”.

### 2) Folder Tree

a) Please organize files according to the recommended file tree outlined below. Please keep only the most current files in the folders. All outdated material should be placed in the separate folder in the “OLD” folder. All information received or sent should be placed in a dated folders should use the following format yearmonthdate – description (20180116 – Short and concise description of item received or sent).

📁 XX-XX PROJECT NAME

📁 \_SHORTCUTS (Data Reference Files)

📁 EXHIBITS (Use separate dated folder for different agencies, meetings, etc.)

📁 20180105 Client Meeting (Example)

📁 20180107 DEQ submittal (Example)

📁 GIS

📁 DATA

📁 MAPS

📁 DESIGN

📁 OLD (Outdated exhibits, plans, etc.)

📁 SHEETS (Intended for those who wish to use sheet sets)

# City of Helena

## Computer Aided Design (CAD) Standards

📁 SURVEY

📁 XREF (Only store xref files to be used with design or construction drawings)

📁 AERIAL PHOTOS

📁 REFERENCE DWG

📁 TRANSFER

📁 DATA RECEIVED

📁 DATA SENT

📁 MISC

### 3) File Naming Guidelines

a) Drawing names need to be unique for all projects. Every drawing file will begin with the project number if assigned and a descriptive drawing name using the format and abbreviations below.

i) Typical Drawing Name Format examples Project# (4 digits City Project No.)-Name (4 Letter Abbreviation)-Sheet# (2 digits minimum)-Drawing Type (Use abbreviations below) ex. Rodney Street Reconstruction Cover Sheet: 1899-RSRC-01-CVR

(1) 1601-XXXX-01-CVR.dwg

(2) 1601-XXXX-02-SP.dwg

(3) 1601-XXXX-03-RD PP.dwg

(4) 1601-XXXX-04-SWR PL.dwg

(5) 1601-XXXX-01-VM.dwg

(6) 1601-XXXX-01-EXH-STMWTR.dwg

ii) The following abbreviations may be used for file names.

ALIGN	Alignment	RD	Road
BDR	Border	SP	Site Plan
CVR	Cover Sheet	STM	Storm
DT	Detail Sheet	SWR	Sewer
ESMT	Easement	TS	Typical Sections
FIG	Figure	VM	Vicinity Map
GP	Grading Plan	WTR	Water
PP	Plan and Profile	XS	Cross Sections
PL	Plan		

b) **One sheet or figure per drawing file unless authorized by the City Engineer.** Exceptions are anticipated especially for very small projects. It is recommended that a pre-design meeting is set up to discuss the project and work out any unique aspects of a project. This meeting could also include discussion on project specific challenges that may require a deviation or variance. This

# City of Helena

## Computer Aided Design (CAD) Standards

meeting does not take place of the processes in place but allows for a discussion among staff/consultant/develeoper/owner.

### 4) Drawing Setup

- a) Template files will be used for the creation of all new drawings.
- b) Layers, text styles, dimension styles and page setups have been created in all of the template files. Layer colors, linetypes, lineweights, and plot styles have been configured to provide consistency in appearance. Some layers and linetypes may not be used for all projects.
- c) The sheet set manager can be used to create and manage drawing files.
- d) Acceptable sheet sizes are both full size (24" by 36") and half size (11" by 17"). The standard sizes for exhibits will be 11"x17" or 8.5"x11".
- e) The drawing units have been set to decimal and feet and decimal degrees in all of the templates. Any change shall be approved by the City Engineer.
- f) All drawings should be drawn in real world units. The standard is 1:1 foot for engineer drawings and 1:1 inch for architectural drawings and details. **All scaling will be handled in the sheet drawing layouts using viewports.**

### 5) Layer Naming

- a) A layer list has been created and the most commonly used layers have been added to the various template files. These layers should be adequate for the majority of your work. The layer naming system is simple and open to modification as needed under the following guidelines.
- b) When creating a new layer, you should use one of the following prefixes followed by a logical name.

X-Existing

F-Future

P-Proposed

ASB-As built

TEXT-Text

Z-Survey Points

DTL-Detail

PRO-Profile (Sewer lines, Water lines, Crossings, Etc.)

TB-Title Block or General sheet items (Scale bar, North Arrow, Etc.)

- c) If you are constantly creating the same layer, contact the City of Helena Engineering Division and we will consider adding the layer to the template files.
- d) The object properties: color, linetype, lineweight, and plot style should all be set to BYLAYER. This makes the drawings much more flexible and easier to manipulate. A new layer should be created and entities moved to that layer rather than changing the properties of certain entities.
- e) **You must be disciplined in the consistent placement of entities onto the proper layers.**

### 6) Colors



# City of Helena

## Computer Aided Design (CAD) Standards

iii) GWE-DETAIL-ARCH      Dimensions for architectural details

iv) GWE-EXHIBIT              Dimension for exhibits

b) The majority of dimensions should be associative. Dimensions associated with plan and profile views will be placed in the sheet drawing layouts. Dimensions associated with details will be placed with the detail.

c) Dimensions shall not be placed in the xref base files.

### 10) Standard Blocks

a) The standard symbols are located on the City Engineering directory under AutoCAD CIVIL 3D\Blocks or on the website . **City of Helena tool palettes** have been created to make it much easier to add blocks to your drawings. You have the ability to pick the block that you want to insert and the proper layer, color, linetype, lineweight, plot style, and standard scale will be set up for that symbol. Be aware that the correct layer is current only while you are placing that particular block. This is much more convenient than searching for the correct block via the insert command.

b) The standard blocks shall not be exploded. They have all been created with attributes for the easy manipulation of any associated text. Double clicking the symbol will bring up the attribute editor.

c) City of Helena has implemented the use of dynamic blocks. Any block in the tool palette with a lightning bolt is a dynamic block. These blocks can be manipulated in various ways without exploding them.

d) Blocks will continue to be added to the symbol library. If you need a block that is not provided or have ideas for additional dynamic blocks, contact City Engineering.

### 11) XREF's

a) Every project will incorporate the use external references, commonly called xrefs. Any entities that will need to be displayed in more than one drawing should be placed in an xref file.

b) Xref's shall be referenced as overlay not an attachment.

c) The file naming convention will adhere to the following guidelines.

i) Project#-Drawing Reference Type

(1) 18XX-XXXX-Existing Base.dwg      Contains only existing linework and topo information

(2) 18XX-XXXX-Existing Surface.dwg      Contains topo points imported from point database, breaklines, surface borders, and existing surfaces

(3) 18XX-XXXX-Road Base.dwg              Contains proposed linework and Civil 3D objects related to proposed road improvements

# City of Helena

## Computer Aided Design (CAD) Standards

- (4) 18XX-XXXX-Sewer Base.dwg            Contains proposed linework and Civil 3D objects related to proposed sewer improvements
  - (5) 18XX-XXXX-Water Base.dwg            Contains proposed linework and Civil 3D objects related to proposed water improvements
  - (6) 18XX-XXXX-Storm Base.dwg            Contains proposed linework and Civil 3D objects related to proposed storm sewer improvements
  - (7) 18XX-XXXX-Parcel Base.dwg            Contains existing and proposed linework and Civil 3D Parcels.
  - (8) 18XX-XXXX-Grading Base.dwg            Contains proposed linework and Civil 3D objects related to proposed grading activities
  - (9) 18XX-XXXX-Misc Base.dwg            Contains proposed linework and Civil 3D objects related to any proposed improvements which are not appropriate to include in any other base drawings
    - (a) 18XX-XXXX-Photo Base.dwg            Contains aerial photo background(s)
    - (b) 18XX-XXXX-Quad Base.dwg            Contains quad map background(s)
- d) Design profiles will be placed in the same xref file as the corresponding plan entities.

### 12) Data References

- a) All Civil3D objects (surfaces, alignments, pipe networks, etc.) shall be created in the appropriate xref base file. Civil3D objects will be data referenced into sheet and exhibit files using data shortcuts.
- b) The general workflow for creating data shortcuts is shown below.
  - i) You must be in the drawing file where the Civil3D objects were created.
  - ii) Right click on “Data Shortcuts” on the prospector tab of the Toolspace. Select “Set Working Folder” from the list. Browse to the appropriate project file and click the “OK” button.
  - iii) Right click on “Data Shortcuts” on the prospector tab of the Toolspace. Select “Set Data Shortcuts Project Folder” from the list. Select the CADD folder and click the “OK” button.
  - iv) Right click on “Data Shortcuts” on the prospector tab of the Toolspace. Select “Associate Project to Current Drawing” from the list.
  - v) Right click on “Data Shortcuts” on the prospector tab of the Toolspace. Select “Create Data Shortcuts” from the list. Select Civil3D objects to share and click the “OK” button.

### ***13) Record Drawings shall be distinct separate files and labeled accordingly.***

### 14) Drafting Practices

# City of Helena

## Computer Aided Design (CAD) Standards

- a) Title block – Along the right side
    - i) Owner
    - ii) Name of the project
    - iii) Engineering firm information and Engineer's seal – Original signature shall be placed across the seal in blue ink.
    - iv) Sheet title
    - v) Sheet number
    - vi) Revision(s) table
  - b) All plans shall be tied to City of Helena coordinate system.
  - c) All objects shall be drawn to its actual size/scale unless authorized by the City Engineer.
  - d) The use of color is not allowed. Each feature in a drawing shall be distinguished by linetype and lineweight.
  - e) All text shall be oriented to be read from left to the right.
  - f) Stationing shall be oriented from left to right (unless otherwise approved by the City Engineer) and labeled every 100 feet and tick marks every 50 feet at a minimum.
  - g) Matchlines shall be used with consistent even stationing.
  - h) Drawing files shall only have one (1) layout tab (unless otherwise approved by the City Engineer).
  - i) All drafting shall be completed in model space, in decimal units and the text scaled appropriately.
  - j) North arrow shall be shown on each plan view sheet. North arrow shall always point either up or to the right.
  - k) Borders should never be rotated and scaled to a plan view. The plan should be rotated and scaled within the viewport to create the desired view.
  - l) Alignment stationing should be west to east or south to north. (with the exception of gravity pipeline stationing)
  - m) Plan view scale clearly shown on each plan view sheet.
    - i) Acceptable drawing scales: 1"=1', 1"=10', 1"=20', 1"=30', 1"=40' and 1"=50'. Unless authorized by the City Engineer.
  - n) Profiles should be stationed from left to right and match the plan view scale.
  - o) Profile vertical exaggeration should be 10 times the horizontal scale whenever possible.
  - p) Gravity pipeline alignments should be stationed from downstream to upstream. In other words, these profiles should start from the low point just as the gravity pipeline will be constructed.
  - q) Plan and profile must be shown on the same sheet, with profiles on the bottom half of the sheet.
  - r) Final Grades – shall be shown as a solid line with a bold lineweight and called out specifically
  - s) Existing Grade – shall be shown as a dashed line in a subdued lineweight and called out specifically
  - t) Legend relevant to each sheet shown all special symbols, linetypes and hatch used
  - u) Street names labeled on existing and proposed streets.
  - v) Rights-of-way labeled and dimensioned.
  - w) Lot & block numbers and/or ownership information shown for all lots.
  - x) Easement information with dimensions.
  - y) Caution notes shown when working next to any existing utilities (public and/or private).
- 15) Recommended Order of Sheets – (The following is not intended to be a definitive list of all the sheets or information required to be on each sheet or information required to be submitted for plan approval or a list of design requirements.)
- a) Cover Sheet
    - i) Project Location
    - ii) Vicinity map

# City of Helena

## Computer Aided Design (CAD) Standards

- iii) Client Name
- iv) Sheet Index – Statement identifying that the latest edition of MPWSS and City Standards that will apply to the project
- b) General Sheet(s)
  - i) General and Construction Notes
  - ii) Abbreviations
  - iii) Legend
- c) Plat/Approved Site Plan
- d) Key Map – Drawn to scale
- e) Horizontal Control Sheet – Drawn to scale
  - i) City of Helena control points used and any project control points
  - ii) Basis of Bearing
  - iii) All bench marks control elevation points
  - iv) Property lines and ownership and zoning (where applicable)
- f) Typical Sections Sheet – Dimensioned and Drawn to scale
  - i) Label Rights-of-way
  - ii) Pavement section including placement of utilities
  - iii) Compaction requirements
  - iv) Backslopes/Cross-slopes
  - v) Curb & Gutter, Sidewalks, Boulevard and Non-motorized Facilities – where required
  - vi) Station limits
- g) Demolition Plan Sheet(s)
  - i) Extents of demolition
  - ii) Areas/infrastructure to be protected
  - iii) Specific items called out to be removed
- h) Erosion Control Plan Sheet(s)
  - i) Existing and proposed contours clearly shown/labeled
  - ii) Existing and proposed storm lines and inlets shown
  - iii) List the total disturbed acreage including offsite and delineate limits of construction
  - iv) Appropriate BMP's used and identified
  - v) Phasing of BMP's with construction activities listed/described
  - vi) Areas to be sodded or seeded shown and specified with permanent perennial vegetation
  - vii) Areas of permanent erosion control (other than vegetation) clearly shown
- i) Post Construction Storm Water Quality Plan Sheet(s)
  - i) Proposed contours clearly shown/labeled
  - ii) Drainage areas and sub areas delineated and labeled
  - iii) Proposed storm water conveyance systems such as storm lines, storm inlets, grass channels, and vegetated swales shown
  - iv) Flow arrows for surface drainage shown
  - v) Proposed non-structural and structural post-construction (permanent) BMPs to address post-construction run-off identified
  - vi) Wetlands delineated where applicable
  - vii) Description of long-term operation and maintenance of BMPs
- j) Grading Sheet(s)
  - i) Both onsite and offsite existing/proposed contours shown clearly labeled
  - ii) Date and name of firm who prepared geotechnical report with corresponding note stating: “Work shall be done in accordance with the Geotechnical Report by \_\_\_\_\_, dated \_\_\_\_\_.”
  - iii) Drainage clarified by flow arrows, high points, sags, ridges, and valley gutters
  - iv) Show driveway locations for all lots adjacent to storm inlets
  - v) Positive overflow provided at all low points, easements dedicated as needed
  - vi) Cross-sections and flow data for all swales and open channels provided



# City of Helena

## Computer Aided Design (CAD) Standards

- vii) Street Flow Computation Table provided for all public streets for 10-yr and 100-yr events
- viii) Inlet Interception Computation Table provided for all public inlets for 10-yr and 100-yr events
- ix) Pipe Hydraulics Computation Table provided for all public lines for 10-yr and 100-yr events
- x) Provide electronic copies of all hydraulic computations on CD or digital media
- k) Construction – Plan and Profile Sheet(s)
  - i) Roadway Plan Sheet(s)
    - (1) Plan View
      - (a) For streets, centerline stationing at a minimum of every 100', bearings and curve data labeled (R, D, L, PC and PT stationing)
      - (b) Proposed new construction including paving width and limits, curb and gutter, valley gutters, double gutters, sidewalks, and pedestrian ramps
      - (c) Existing and finished grades with finished grade slopes
      - (d) Existing and proposed utilities
      - (e) Intersection, driveway and island curb radii labeled
      - (f) All sidewalks and barrier free ramps shown, labeled and dimensioned
      - (g) Existing, proposed, future streets and drives shown and labeled
      - (h) Rights-of-way and sight visibility easements provided if required
      - (i) Storm inlets identified with paving stations and top of curb elevations at center of inlet.
      - (j) Drainage clarified by flow arrows at crests, sags, ridges, intersections, and valley gutters
      - (k) Show driveway locations for all lots adjacent to storm inlets and intersections
    - (2) Profile View
      - (a) Show and label existing and proposed centerline, left, right curb lines, if not the same
      - (b) Proposed top of curb line superimposed in the profile view
      - (c) Any required utility adjustments
      - (d) Top of curb/pavement elevations labeled at every 50 foot stations
      - (e) Vertical Curve stationing and elevations including PVC, PVI, PVT, crest/sag location, curve length, algebraic grade difference, and “K” values shown at a minimum
      - (f) Street grades shown to the nearest 0.01'. Max and min grades per engineering standards
  - l) Utility Improvement Plan Sheet(s)
    - i) Plan View
      - (1) Show, label and dimension location of all mains, services, manholes(with rim elevations), inlets, meters, fire hydrants, valves, fittings, FDC locations, back-flow prevention cleanouts, or other proposed infrastructure and spacing from other utilities
      - (2) Show, label and dimension location of all private utilities shall be shown
      - (3) Dimension location of all mains from other utilities
      - (4) Show and label water line leading to fire sprinkler systems as “fire line” where applicable
      - (5) Show location for all utility services and stub-outs labeled with size, slope, and length
      - (6) Show stationing from roadway centerline stationing
      - (7) Show and label all easements
      - (8) Curve data and stationing provided as necessary
      - (9) Label valves with paving station near barrier free ramps or ADA routes
    - ii) Profile View
      - (1) Profile all proposed utility mains
      - (2) Existing and proposed ground line at centerline of pipe shown and labeled correctly
      - (3) Label station and flowline elevations for all fittings, manholes, cleanouts, and crossings
      - (4) Indicate length, type/class, slope and size of all lines

# City of Helena

## Computer Aided Design (CAD) Standards

- (5) Indicate the type and diameter for all manholes
- (6) All utility crossings and parallel sewer/storm lines shown in profile
- (7) Indicate length, type and size of encasement as needed
- m) Lighting Sheet(s)
  - i) Show all street light locations, consideration should be given to electrical layout from utility company
  - ii) Show all stop signs and traffic related signage locations
  - iii) Street lights located on opposite side of street from Stop Sign
  - iv) Verification of fire hydrant placement relative to street lights and stop signs (3' clear zone)
  - v) If symbols used in plan, include appropriate legend for clarification
- n) Signing and Striping Sheet(s)
  - i) Sign installation schedule
    - (1) Show and dimension all existing and proposed signing and striping
    - (2) Label all proposed signs and striping with sizes and type
  - ii) Signing and Striping Notes
  - iii) Sign Details
- o) Signal Sheet(s) – if applicable
  - i) See section 5.9 of the Engineering and Design Standards
- p) Traffic Control Plan Sheet(s)
  - i) Design site specific traffic control plan, MDT standard alone is inadequate
  - ii) Indicate posted speed limit or design speed
  - iii) Show all sign designation, sign graphic, and sign size
  - iv) Show channelization device type, locations, and spacing
  - v) Show all traffic barricades and indicate type
  - vi) Show all detour routes and detour signage
  - vii) Show flagger locations where applicable
  - viii) Show message boards with text for two phases where applicable
  - ix) Show flashing arrow boards where applicable
  - x) If symbols used in plan, include appropriate legend for clarification
- q) Landscaping & Reclamation Sheet(s)
  - i) Proposed method of restoration of all areas disturbed during construction
- r) Construction Detail Sheet(s)
- s) Cross-sections