ATTACHMENT I:

CAD STANDARD DESIGN CRITERIA

CAD Standard Design Criteria

CAD/ GIS Conversion

1. File Procurement:

Client to define and verify drawings to be used for ACAD/GIS conversion and establish a timeline for submittals and deliverables. The complete deliverable process, and timeline for interim submittals, if not already established by Client, or client representative, shall be developed during this early stage of ACAD/GIS conversion development.

As part of check in/out and verifiable QA/QC process, a complete drawing list is required for ACAD/GIS Conversion. This shall be provided by Client and access to these files shall be obligation of Client via a prearranged method of dispersion. The preferred Technical transfer method shall include but not be limited to: Thumb drive, DVD, direct Client and /or Subcontractor Directory access etc. Detailed and dated Documentation (i.e. email, spreadsheets etc.) shall accompany all drawing transfers.

The Designer shall agree at this time, the version of ACAD and GIS programs to be utilized and verify they are compatible. In order to maintain version control and compatibility, all parties involved shall, at earliest opportunity, agree to notify all other project teams, when their particular program version upgrades are scheduled and implemented.

All drawing(s) shall be procured from trustworthy sources (client, reliable subcontractor, etc.). All drawings shall be pre-approved by client to assure viability. It shall be responsibility of Client, and the CAD Technician (or representative) to verify all files have been delivered and are completely operational.

If not, all parties involved shall determine reasons and solutions when and if files are unusable. Immediately upon resolution, the file source (Client etc..) or other designated entity shall resubmit complete and usable files in separate submittal. Each instance shall be documented in order to establish a "lessons learned" process for future submittals.

2. Working directory folder for Conversion drawing development:

As part of the unique working folder structure identification, the "baseline" working Directory folder name shall be labeled "ACAD/GIS conversion". Only one "baseline" working folder should be required, but a copy of untouched delivered "baseline" folder files, may be placed in a subfolder named (History), in case of file recovery is needed.

As design evolution and submittals takes place, separate folders are to be created. Folder labeled (MISC) shall be made to house *.bak (backup files), and files used for temporary needs (blocks, text, etc.). Folder labeled (SUBMITTAL) shall be made to contain each of individual submitted files. These submitted files shall be named in accordance with **SECTION 3**.

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3. Populating History and Working Folders

Copy file(s) from utilized Technical transfer method and place into "ACAD/GIS subfolder "History". Then copy all files into main working folder "ACAD/GIS Conversion".

From File Manager, or by other preferred method, uniquely rename files. Utilizing each particular System involved and an abbreviated company name. For example, if the firm name is Keish Environments (KE), rename each file (i.e., SD-Conversion-KE.dwg, or SW-Conversion-KE etc.). For submittal purposes, the submittal date shall be added as a suffix. (for example., SW-Conversion-KE-01292019.)

4. Receiving of Multiple XREF files obtained through CAD Command e-Transmit (Client Obligation)

Individual files obtained from Client may actually contain several XREFs (Overlay or Attached). Because of the native Directory structure each of the files came from, many of these files may appear as "Not Found" in XREF directory listing. *CAD Command (XR)*: Client shall supply all files associated with this particular Multi-XREF file in a well labeled "bound" ZIP file. This is obtained by running the "e-transmit" routine from ACAD pull down publishing command.

- To open drawing file(s), the extraction process can be done through File Manager. Highlight "bound" ZIP file in Base working directory. A pulldown menu will automatically appear.
- Highlight "EXTRACT ALL". A single sub folder is automatically generated that will then contain all files required to successfully open the file for utilization.
- Once all files are Extracted, MOVE all extracted files associated with file into "baseline" working folder and delete ZIP folder.

5. Open applicable ACAD drawings in Paper and Model Space

- Access ACAD from desktop (or other preferred method) to open files in "baseline" working folder.
- Using CAD Command (PS) or CAD Command: TM set to 1, proceed to Paper Space (usually borders, linework, text, tables etc.).
- Turn "ON" and "THAW" all layers – CAD Command (-LA, O (open), *, then, Thaw all layers, CAD Command (T) *. Type CAD Command (REA) to regenerate (CAD lingo for refresh). This makes visible all entities.
- Zoom Extents – CAD command (Z, E) and completely ERASE all entities with "Window" command.
- Once assured no entities are contained in Paper Space, set Zoom scale factor to 0.7 (viewport actually contains more area). Using CAD Command (LIST), create window from upper right to lower left and "Enter". There should be nothing found.

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6. Establish ACAD/GIS area with a PLINE Border outline in Model Space

- Open drawing in Model Space – Zoom Extents – CAD command (Z,E)
- Make new layer called "G-OUTLINE". Using ACAD Command for PLINE (PL) draw a line a maximum distance of 25' from pre-established project boundaries. Both PLINE thickness and color shall be easily visible from Model Space Zoom Extents perspective. (See **Section 11** relating to Plotting)

7. Removal of nonessential layers, entities and blocks.

Take note of which of the remaining layer(s) contain elements of required system(s). Using Layer Manager, set current layer to "0". Turn "OFF" required system layer(s) and Boundary Outline layer. All that should remain will be non-essential (Electrical, Mechanical, Structural, Architectural etc.) layers, hatches, entities and blocks not required for this exercise. Remove them all with ERASE window command. Purge all unused and removed entities, layers, linetypes, etc. and then regen all CAD Command (REA). The screen should be black and empty.

To reverify everything not essential to this exercise has been removed from both inside and outside Boundary Outline layer, Zoom extents. Set Zoom scale factor to 0.7 (viewport contains more area). Using *CAD Command (LIST)*, create window from upper right to lower left and "Enter". There should be nothing found.

If so, locate entities, (usually it is a stray comma, a piece of line etc., or residual text describing XREF's not found at 0,0 location). Remove it and redo until nothing is found during List command search

From Layer Manager, Turn ON required system layer(s) and Border outline. The screen should only contain required system(s) and Border outline.

8. Reducing Blocks into individual linework

Pertinent system linework may contain blocks, (Manholes, casings etc.). These will need to be "exploded" using *CAD Command (E)*. This process breaks up "block" linework into individual entities though still maintaining block configuration.

Once all pertinent entities have been located, Create a simple layering and colorization convention.

9. Adding XREF files (for clarification)

Once all previous associated files have been removed and purged from drawing it may be quite difficult to establish bearings as to location. Adding a viable XREF such as an alignment file is very much encouraged. To add XREF's, first verify it was part of initial drawings delivered by Client to assure its compatibility. Add layer G-XREF, color 7.

Make sure XREF file has first been cleaned out using purge routines, all linework colors and linetypes are BYLAYER and is located in "baseline" working directory. In order to not be confused with original

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file, each XREF file shall be renamed to include prefix "Z-" (i.e. Z-X-ALIGNMENT.DWG). This will place XREF(s) at bottom of directory listings, make much easier to locate and will not interfere with any previously named version making it unique to current project needs.

Make sure Model space UCS is set to World (W) and insertion point is at 0,0. Depending on origination (or Discipline) of file, the insertion scaling will be either 1, or 12. This XREF file should overlay System linework. Using Layer Manager, layer G-XREF should then be locked so as to avoid any change in file orientation, size or location.

Since file linework is "BYLAYER" you shall be able to adjust the color of this XREF's linework to display according to preferences (Backgrounds are usually colored grey (8), other systems can vary according to suggested options shown in **Section 11**)

10. Layering, Colorization, Linetypes

NOTE: All associated layer coloring _**SHALL**_ to be "BYLAYER"

Since the entities and associative layers involving this manual pertain to water (i.e. blue) it is still a good idea to place other system elements on separate layers and colors (BYLAYER). Though not a requirement for ACAD/GIS conversion itself, it is a good idea to associate each system with vibrant clearly visible colors when plotted. For example, yellow (and related shades) generally looks adequate when shown in ACAD, but has a tendency to not plot with enough visibility to warrant it's use.

NOTE: all associated layer coloring _**SHALL**_ to be "BYLAYER"

With very large project areas the line thickness is vital for visibility. Some experimenting may be required to develop perfect plot, but generally a line thickness of 5 – 10 should give a good indication as to linework legibility and visibility for particular size of project. Line thickness can always be manipulated until desired affect is obtained, just maintain linework, and colors BYLAYER.

When new line work is to be applied, all Line work should be drawn on appropriate Layer as a PLINE. This will minimize the number of entities and be easier to manipulate. Line thickness will vary according to size of plot. The smaller the plot size the thinner the required line thickness.

Generally, line types to be used will be CONTINUOUS. Depending on needs of engineer, other linetype such as dashed, hidden, phantom can be utilized. However, as with line thickness, and color selection, these embellishments are of no consequence for ACAD/GIS conversion. It is only to supply team with an easy to view multisystem check verification on a physically plotted drawing despite viewport scale.

11. Plotting

The CAD Technician will be supplied a CTB table named **"Color Full size -Exhibit.ctb"**. In it, plots can be colorized using several various combinations, in order to be uniquely visible to a long plot.

- Colors 1-7 generally always plot black with a slightly varied thickness.

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- Colors 8,9 generally always plot a light and slightly darker shade of grey.

These particular colors may be sufficient with a relatively small project area (2-300 feet) with one or two viewports on a D or E size drawing. But when a project is miles long this limited color range is not practical.

Besides the nine colors listed above, a line, plotted using Color Full Size-Exhibit.ctb file from associated color pallet will plot as follows:

30 = orange

81 = light green

96 = dark green

131 = cyan

151 light blue

160 = dark blue

180 = magenta

200 = purple

240 = red

12. Prepare a Paper space border with viewport(s) and time stamp.

Depending on requirements of engineer(s) and plotter capability, a basic ANSI D size (22"x34") or E-size (34"x 44") border line shall be utilized. As a general rule, the actual paper size for each is about an inch larger at borders in order to will allow an approximate 1" bleed area within paper limits. (D=24x36, E=36x48).

In reality however, if a long plot is used, the length of border can be up 10' or more. Engineers shall determine drawing scale, which will determine the length. Though engineers may need to see various scaling options (and dwg sizes) to verify actual requirement. Using *CAD Command OFFSET*, any length can be obtained. The primary driving factor, however, is limited to width of paper used in plotting.

Engineers will also decide title block variations, but, they usually appear, within a block in bottom right corner with desired text inserted as a block. Drawing title, number, dates, engineers' names and company names or logos may apply. Paper space drawing title block text can range .125 and .250 for to .5 or larger for other portions of drawing. A graphic scale, may be desired, depending on viewport scale, but an accurately colorized and labeled legend should always be utilized and located near Border text.

Add an existing border block or create a border using dimensions shown above using new Layer G-BDR, color blue (5). Also create layer G-VP color (30) and assign the "No Plot" option from within Layer Manager (small icon of a red lined printer).

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Make G-VP layer current and type: MVIEW. Depending on size of border utilized, create a viewport layer either as a 4-corner rectangle or multiple points, so various cuts and corners can be developed. Once the number of viewports and settings have been established, "Lock" G-VP layer so viewports setting cannot be altered.

At all times, not just during submittals, verify, thru established best CAD practices that files are clean, purged, Zoomed to Extent, closed in paper space (if border is present) closed in layer "0", legible, no stray markings and all entities are "BYLAYER". Make sure all XREF and Viewport layers are locked so no accidental pan or zoom with make unwanted scaling adjustments.

Always practice good ACAD housekeeping! Make sure only files pertinent to drawings for submittal in "baseline" working directory. All other files need to be relocated to another folder (History, MISC etc.)

13. Submittal(s)

Once files have been developed to satisfaction of engineers, it is now time for a submittal. Open file. For extra good measure key in *CAD command (SAVE)*. Then, from ACAD Top ribbon, save file using pulldown "SAVE AS" option. (As indicated in **Section 3**, save file using existing file name, but add date). **Save** and **Close** file with Paper Space Border.

With newly renamed and dated file open, remove everything in Paper space and Remove all XREF's and Purge all unused entities. All that should remain is system linework in Model Space. Close out in Model Space.

Based upon submittal requirements established at beginning of project, package within preferred pre-arranged media (Thumb Drive, DVD etc.) along with documentation relaying required information.