



IEUA CAD MANUAL

Revised date: December 2023

Version 2.2

Approval:

Manager of Engineering
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This Guidelines document is an integral part of the IEUA ENGINEERING STANDARDS.

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INTRODUCTION

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OBJECTIVE

This manual describes the application of Computer Aided Design (CAD) standards and procedures at Inland Empire Utilities Agency (IEUA). This manual is part of an initiative to consolidate existing CAD drafting standards and to develop data standards that address the entire life cycle of facilities within the IEUA service area.

This manual assumes CAD fluency by the user. This manual is not intended to substitute for specific training in the use of CAD or related software packages.

SCOPE

The IEUA CAD Manual is intended to provide IEUA Staff and consultants with information normally required to process drawings “from cradle to grave” through design, revisions and reproducing methods necessary to communicate “on time”, clear, concise, consistent and complete information.

IEUA staff and consultants shall follow the procedures and methods defined in this manual for all projects.

It's the IEUA's intent to NOT allow deviations from the standard requirements specified and /or referenced in this Manual. However, should IEUA staff identify a project-specific deviation that appears unavoidable; the deviation request must be submitted to IEUA Engineering Division for approval. Until the approval procedure is detailed in the IEUA Engineering Policies and Procedures Manual, the requests must be submitted according to the procedure listed below.

RESPONSIBLE ORGANIZATION

The Engineering Department is responsible for the updating and maintaining of the IEUA CAD Manual. This standard is intended to be neither static nor all-inclusive and thus will be updated and enhanced as appropriate. To propose changes to this manual, submit a request in memorandum form to the IEUA Project Manager and the Engineering Department. Requests for modifications shall document (1) why the current procedure and/or standards are inapplicable or ineffective; (2) what the proposed deviation or change should be and; (3) how would it improve the CAD standards or procedures and the overall productivity. The Engineer Department and IEUA Staff will review these requests for possible inclusion in the manual.

*“When we can no longer change
a situation, we are challenged to
change ourselves.”*

Viktor Frankl

REVISED OR ADDED UPDATE PROCEDURE OF CAD MANUAL:

For Revised or Added Pages

Page indicated been revised with new dated December 2023:

Next to Page Number:

Designated with letter _____ R _____

Page newly added designated with letter _____ N _____

IEUA CAD MANUAL	1 R N	December 2023
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Note: any revisions and additional pages made to the CAD Manual shall be finalized and distributed in hard copy to the Engineering Department and IEUA Staff for update.

OVERVIEW

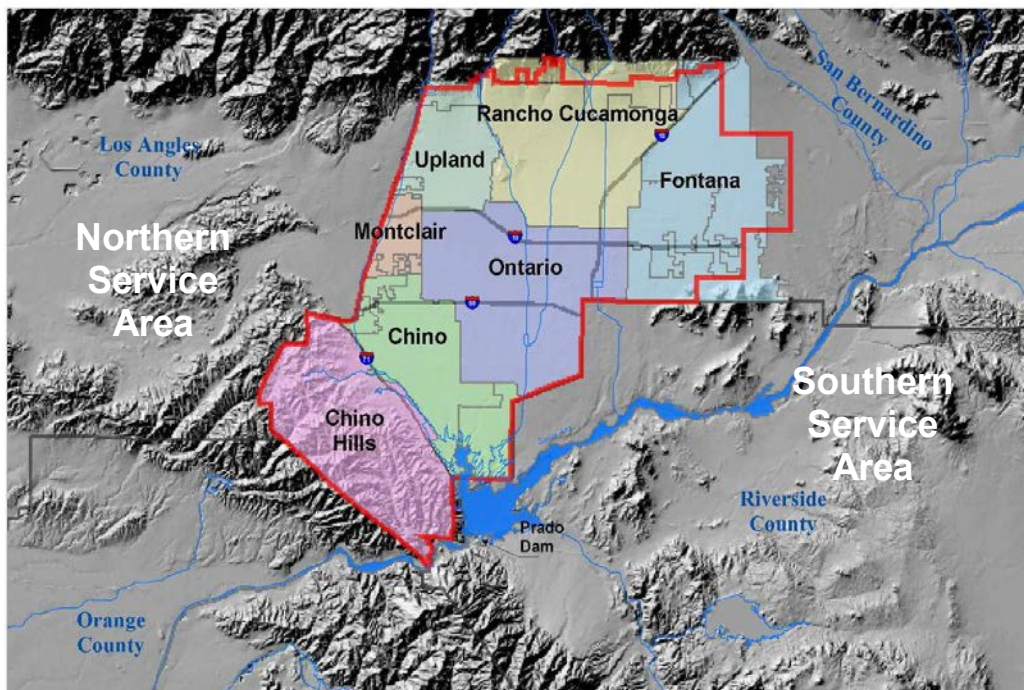
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This chapter provides an overview of IEUA's Service Area and Computer Aided Design system.

SERVICE AREA

The Inland Empire Utilities Agency is a regional sewage treatment and water agency that provides sewage treatment, solids waste handling, and recycled water to the west end of San Bernardino County. Its 242 square mile service area includes the cities of Upland, Montclair, Ontario, Fontana, Chino, Chino Hills; Cucamonga County Water District which services the City of Rancho Cucamonga; State of California correctional facilities; and the unincorporated areas of San Bernardino County, including the Chino Agricultural Preserve. Five regional water reclamation plants are used to treat sewage from the Agency's service area. They are: Regional Plant No. 1 (RP-1), located in the City of Ontario; Regional Plant No. 2 (RP-2), located in the City of Chino; Regional Plant No. 4 (RP-4), located in the City of Rancho Cucamonga; Carbon Canyon Water Reclamation Facility (CCWRF), located in the City of Chino and Regional Plant No. 5 (RP-5) Phase I, located in the City of Chino.

The Agency has two main service areas: Northern Service Area and Southern Service Area. The northern part of Riverside Drive in Ontario is referred to as the Northern Service Area and the southern part of Riverside Drive is the Southern Service area. The Northern Service area is approximately 162 square miles and it has two active treatment plants, RP-1 and RP-4, and one decommissioned treatment plant, RP-3.



COMPUTER AIDED DESIGN SYSTEMS

CAD

The CAD system at IEUA is designed to provide the greatest capabilities for all IEUA staff and consultants. The unified approach to the CAD system and CAD procedures is intended to promote coordination between different disciplines and outside consultants. This is to allow the creation of a uniformly high-quality design product and to minimize the time spent on CAD tasks.

The following are the Computer Aided Design and Drafting (CADD) Specifications for Inland Empire Utilities Agency (IEUA). The Engineering Department of IEUA currently utilizes AutoCAD Civil 3D 2022 (or higher). **All** construction documents submitted to IEUA shall be in AutoCAD 2018 and "DWG" format and PDF Files.

GIS

The Geographic Information System (GIS) at IEUA is based in the ESRI product line, including ArcGIS Desktop (ArcView and ArcInfo) and ArcIMS, all in version 9.1 or later. Unless otherwise noted in the project scope of work, GIS deliverables alone will not be accepted. All design work must be performed using the CAD applications as designated in 2022 CAD or higher.

FILE ORGANIZATION TECHNIQUES

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INTRODUCTION

This chapter details the strategies for the organization of CAD files to support the various stages of a facility cycle or on any given project. The procedures described here are used extensively in the design industry to gain the greatest productivity from CAD.

THE FACILITY MODEL

IEUA treatment facilities were built over the past 50 years, with over 10,000 engineering drawings. As each project is constructed the resulting modifications or enhancements become part of the Facility Model. A Facility Model is all information created relating to a particular facility such as RP-1, RP-2, RP-3, RP-4, RP-5, and Carbon Canyon WRF, Desalter, Pump and Lift Stations, IERCF, and HQ. IEUA utilizes the Facility Model concept to assist in Design, Construction, Operations and Maintenance activities.

Figure 0-1, describes a simplified view of the project to facility model cycle. Project one results in an addition to the facility. The project drawings are archived and the facility model(s) are updated to reflect the new construction. Project two will then utilize the revised facility model(s) as the baseline to begin the new design and thus repeat the process. Often, information in one project is the basis for developing new information for the next project. Therefore, it is critical that this information is accurate, and organized in a way that facilitates easy retrieval and reuse. Consultant must obtain the Facilities Model Base Maps from the Agency' Project Manager and/or CAD Designer.

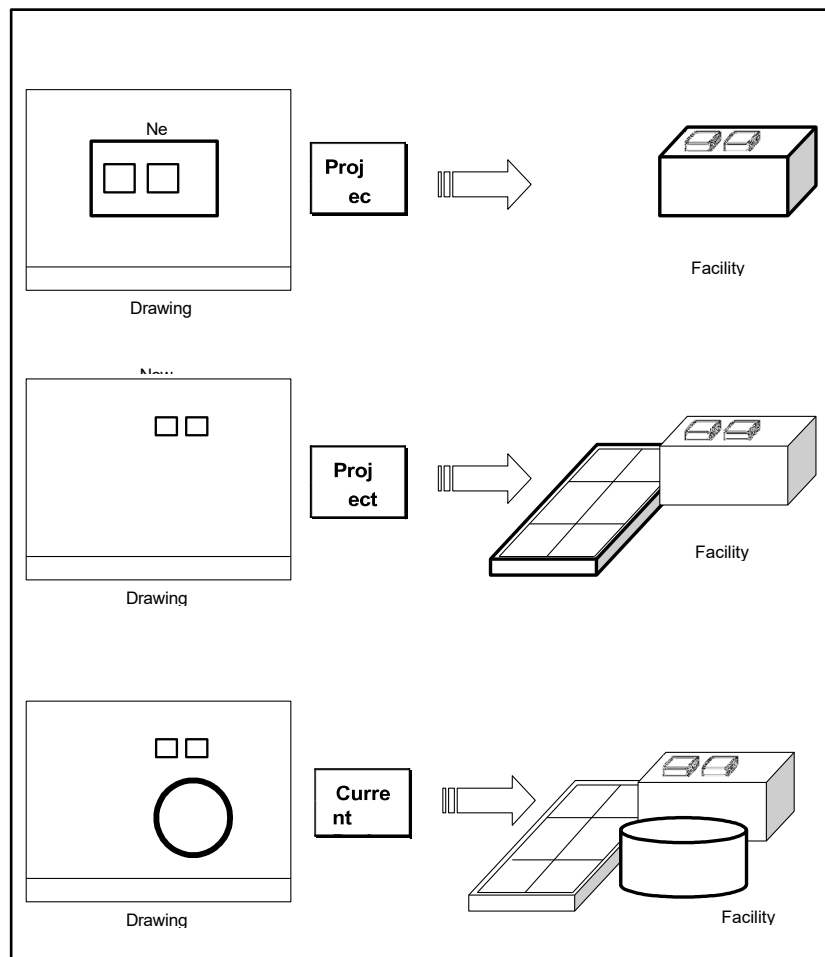


Figure 0-1

SOP UPDATE FACILITY MODEL FILE FROM THE VAULT

Figure 0-2, to support the Facility Model concept, information is organized into one Facility Model.

IEUA edits to the Facility Model File shall be after project As-built. Model located in IEUA Vault (For internal use, the model is located [\\hqafs03\AutoCAD\1-PLANT MAPS\All Facilities\Master Facilities\Facilities Master Base Files](#)).

Demolished can be moved to a demolition layer but they cannot be deleted. Items determined to be incorrect can be moved to a non-plotting layer and the corrected element is added to the Facility Model File.

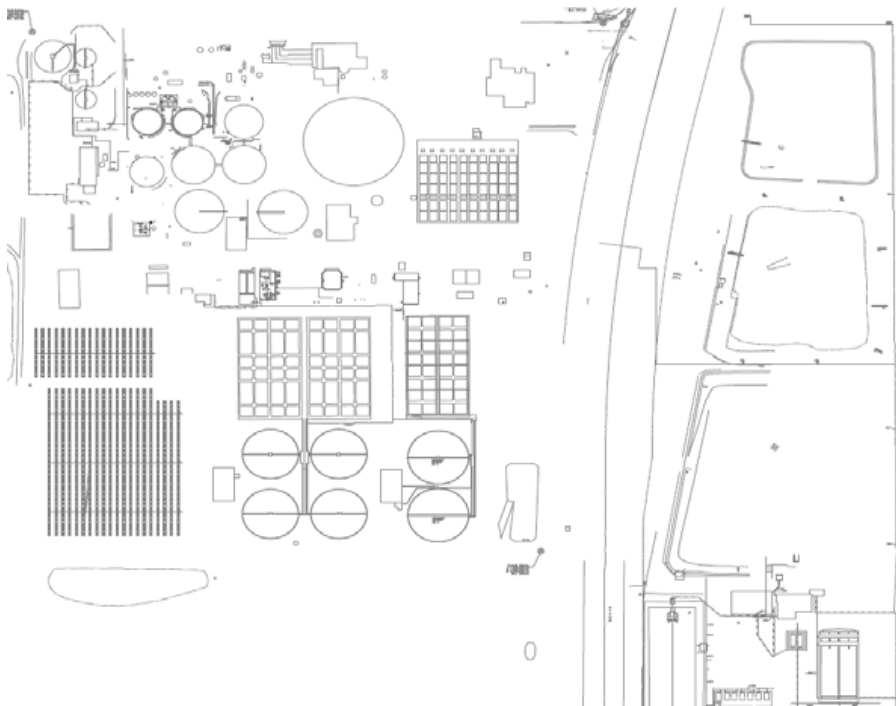
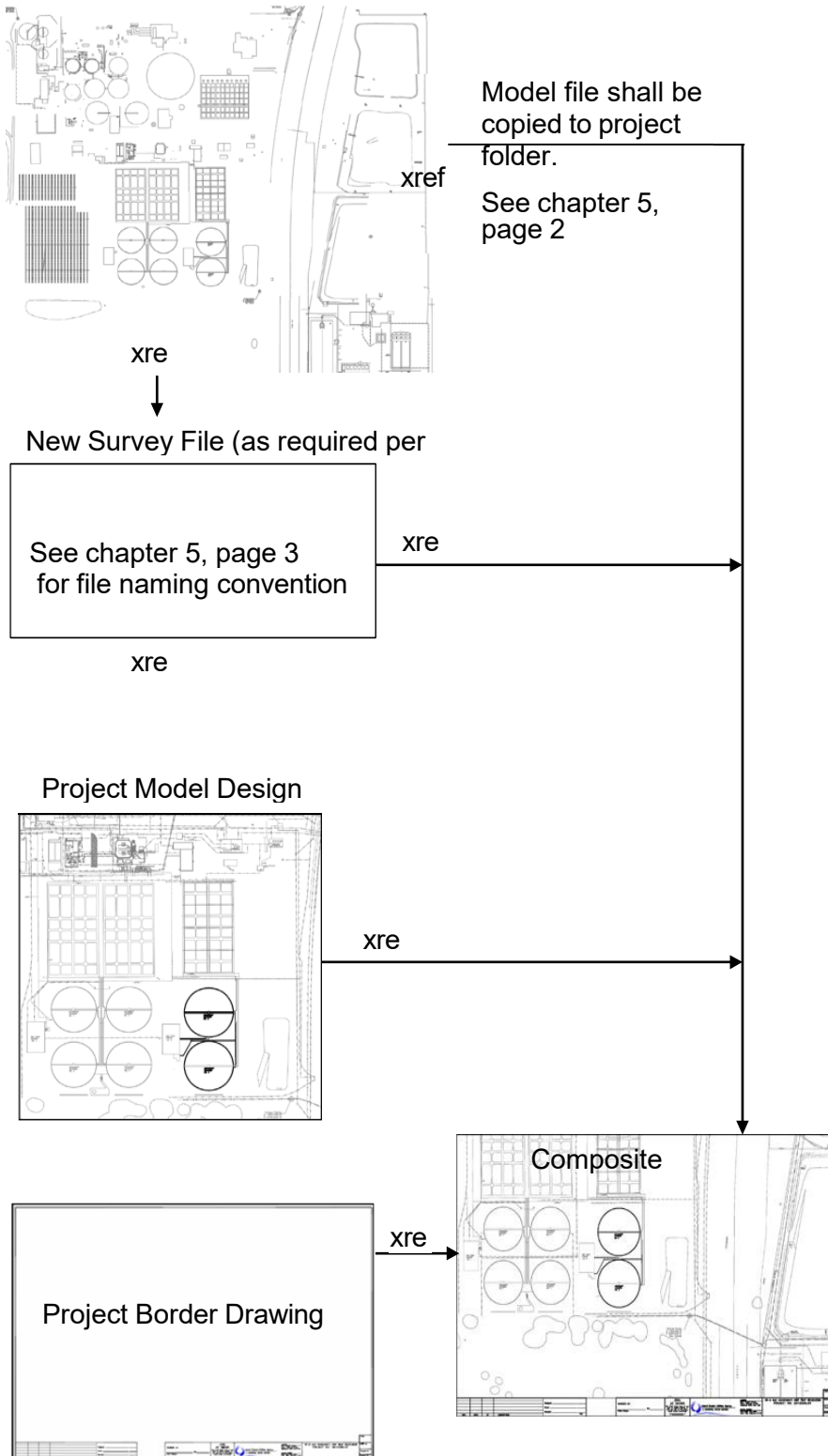


Figure 0-2

EXAMPLE OF EXISTING RP-1 FACILITY MODEL



REFERENCE FILES

Master Model Files, Project Model Files and Project Borders are reference files. Reference files are the single most powerful capability of CAD and therefore it is important to understand what they are and how they are to be used.

In computer applications, files serve as a means of packaging data. Information saved in a file can be copied and transmitted to others.

Many CAD systems support a *reference file* function. This feature allows graphic information in one file to be referenced by another file. The value in referencing files is that information can be distributed to many drawings in a project, and as the base information changes, each of the associated drawings is automatically updated.

The most obvious application of this capability is the border sheet associated with a particular project. Much of the information on each drawing (i.e. project title, project number) is identical. With this in mind, a single project border sheet is created for the whole project and referenced to each drawing in the set. If the project title is changed, for example, the change only needs to be made to the original, and it will automatically show up on all drawings which it has been referenced. A similar approach may be to incorporate parts of any design file into many different drawings with the same kind of spontaneous update. A common multi-discipline approach involves referencing the work of separate design teams to each other. As each team's work progresses, the other teams are automatically kept up to date with the latest design information. The benefit of this approach is to allow a greater degree of project coordination while minimizing the redundant design effort.

REFERENCE FILE ATTACHMENTS (AUTOCAD)

AutoCAD has two unique references file attachment options, attach and overlay.

If you attach an external reference file with a "reference type" of "attach" and that drawing itself contains an "attached" xref, the "attached" xref appears in the current drawing as a nested attachment to the first xref. Like blocks, attached xrefs can be nested.

Overlaying is similar to attaching, except that when a drawing is attached or overlaid, any other overlays nested in it are ignored and, therefore, not displayed. In other words, nested overlays are not read in. All reference files, whether attached by the "overlay" or "attach" method, are displayed based on the most recently saved version of the drawing file.

Overlaid xrefs are designed for data sharing. By overlaying an xref, you can see how the drawing relates to other drawings. Also, overlaying an xref reduces the possibility that you might create self-referencing drawings (duplicate xrefs).

*All reference files are to be attached using the "overlay" preferred method.

REFERENCE FILE PATHS (AUTOCAD)

By default, AutoCAD stores the file name and path of the drawing used to create the external reference. Each time you open the drawing or use the XREF Reload option to update the external reference, AutoCAD checks the file name and path to determine the name and location of the associated drawing file. If the name of the drawing associated with the xref has changed, or the drawing has been moved, AutoCAD cannot resolve or load the external reference. This poses significant problems when drawings are shared between IEUA and consultants due to different drive mappings, server names or directory structure in use.

To eliminate the possibility of missing references, all external reference files should utilize the system variable "PROJECTNUMBER". Project numbers makes it easier to manage xrefs when drawings are exchanged between IEUA and Consultants. The project number points to a section in the registry that can contain one or more search paths for each project number defined. Refer to the AutoCAD Help files for more information on the PROJECTNUMBER system variable. The PROJECTNUMBER should be named the same as the project number/name in the Composite Drawing naming convention (Refer to Chapter 4, page 17). Project search paths will vary between IEUA and consultants.

REFERENCE FILE PATHS (AUTOCAD)

When a reference file is attached, AutoCAD provides the opportunity to store the full path to the directory in which the reference file resides. (Saved Path is not required, see chapter 4, page 17)

SEPARATION OF INFORMATION

Each Model File and Project Model File typically contains information associated with only one discipline (i.e. Civil, Mechanical, Electrical, etc.). On a given project, it is common to find at least one Model file for each discipline contributing to the design effort. It is critical that this separation of information be maintained even when the same person is producing two different Model files. For example, if a mechanical drafter produces plans containing both mechanical and structural information he/she would create a separate model file for each, placing each file in the appropriate location. Both model files are referenced, as necessary to create Composite Drawings but the information is never combined into one model file. Refer to [Chapter 5 File Naming Convention](#) for more information on separating files.

MEASUREMENT UNITS AND COORDINATES

Model files are always drawn "Full Size", that is one inch equals one inch and one foot equals one foot. Civil plans are to use "decimal" units and architectural plans are to use "architectural" units. Model plans are always drawn so that the information contained in the file is in its proper geographic position in the Design Plane. This position is defined by X and Y coordinates values based on the California State Plane Coordinate System (NAD83, Zone 5). The Agency's standard datum is the NAVD88, (North American Vertical Datum 88) system.

For work within the plants, the X and Y coordinate values should be based on the plant grid as found in the Facility Atlas plant grid layer. (Preferred for project cover the wide range area).

Schematic drawings such as Process & Instrumentation Diagrams shall be developed using a grid. The grid is a pattern of dots that extends over the drawing area. A default grid spacing of .125 or 1/8th of inch is preferred.

ROTATION

True North in a design file is always toward the top of the design plane. When using plant coordinate grid, Plant North should always be oriented in its true relationship to True North. Whether using State Plane coordinates or Plant Coordinates, views may be rotated to create a more desirable display without affecting the actual coordinates of the design data. Model files should never be rotated from their correct coordinates. Consistent use of this strategy guarantees alignment of design data between different disciplines and different projects. View rotation does not affect the way a design file appears when referenced to another file.

The preferred location for the North Arrow is the upper left of the plan view; do not point the North Arrow downward.



DIRECTORY ORGANIZATION

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This chapter describes the organization of project file servers and folders on both workstations and servers. All IEUA workstations and servers are set up with similar folder structures and software to promote uniform system configuration. In addition, this chapter describes other means of storing data and documents such as the EDMS and Facility Atlas.

EDMS

IEUA utilizes an **Electronic Document Management System (EDMS)** to store and maintain project-related documents and drawings. All project related composite drawings are to be scanned and stored in the EDMS library. Refer to [Chapter 9 Deliverables and Data Exchange](#) for specifications regarding scanned images.

FACILITY ATLAS

The Facility Atlas is supported by ESRI's Spatial Database Engine (SDE). SDE is an object-based spatial data access engine and stores spatial data in commercial database management systems (DBMSs). Some of the Baseline Model Files are stored within SDE and are exported to CAD, and vice versus, when necessary, which results in a Project Model File.

FILE SERVERS

File Servers are setup to serve as a common storage location for many files of a certain type or files associated with a particular project. A separate project folder is designated for each project. Project numbers further separate the facility folder. Any project associated with that facility and project should have its files stored in that server location.

SUB-FOLDERS

Additional sub-folders or sub-sub-folders on workstations or servers are not authorized. Unauthorized folders will be removed without notice and the files moved to the appropriate project server location.

FILE SERVER FOLDER STRUCTURE

Each workstation is set up to automatically connect to the file server upon login. The project folders are set up with a folder structure for the storage of design files. Folder names, permissions, and descriptions are described below.

(Example CAD project folder)

PROJECT FOLDERS FOR CAD

G:\EN\EN01234

50 Design

50.6 Plan & Specifications

50.6.1 Native Format

Working CAD drawings and any reference files to build up a composite drawing must be stored in this folder. Example, DWG, PHOTOS, PDF, JPEG, BODER, WORD DOC, EXCEL, DGN, SERVEY DRAWING, FIGURE and MODEL DRAWINGS.

Additional copy of As-Built set here for reference.

New sub folder can be added under 5.6.1 Native Format, see example folders below etc.

As-Built Cad Files---*Submittal Cad files and PDFs from consultant.*

Cad Files – Subfolder

PDF Files –Subfolder

Redlines -- Subfolder

Field Photos---*sub folders can be added for different field dates.*

Old---*any files that not used in the current project: Junk files, Temp files, venders file, custom name files, and proposed Figure does not involve in final design as built. Files can be removed after As-built completed.*

Reference Information---*any records associated with the project.*

(For internal only)

MARK-UP COLOR CODE SYSTEM

For clarity between Engineers, Contractors, and CAD Operators, the mark-up color code system is required.

The designated colors are the following:

RED..... Design and mark-ups from engineers and contractors to CAD.

GREEN..... To be deleted (Not applicable for field)

BROWN OR BLUE... .. Comments or notes from all disciplines.

YELLOW (highlighted)... .. Task completed, return the original markups to the markup owner for back check.

FILE NAMING CONVENTIONS

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INTRODUCTION

This chapter details IEUA's system for naming of electronic files. This system adheres to industry standards. Files that use this system include design files, scanned files, project files and other file types normally encountered in the use of CAD at IEUA.

Naming conventions for electronic files allow CAD users to determine the contents of a drawing without actually displaying the file. They also provide a convenient and clear structure for organizing files for particular projects. The system outlined here is intended to be used on all IEUA projects.

Exceptional situations that are not easily handled with this naming convention, such as figure drawings, proposals, or sketch-ups, a file naming convention is not required.

COMPOSITE FILES

Composite Files are the drawings having borders, titles and notes and are plotted as the deliverable of a project. They are a combination of referenced master file(s), the project border file and drawing annotation. Typical graphics placed in composite files are annotation, north arrows, graphic scales, sheet titles and plan/section callouts. Project borders should always be a referenced file attachment, not live elements within the Composite File. Some title block text will be live elements on the Composite File while other title block text belongs to the Project Border File.

For each composite drawing file, a single border file is attached as a reference in Paper Space Layout, insertion point at 0.0, scale 1 to 1.

Use annotation scale to assist in the placement of text, dimensions, and General blocks. (Dimensioning can be in the model or composite files) See chapter 7 for guidance.

PROJECT BORDER FILES

There is generally a single border file for each phase of a project (i.e. study phase, preliminary design, and final design). Multiple border files for a single project phase may be required on a project that involves combining projects.

MODEL FILES

A Model file contains the bulk of the actual design information for one or more drawings. Model files are created with 3-dimensional seed files even if the elements within the files are placed as 2-dimensional. All 2-dimensional elements are to be placed on elevation zero (0) unless approved otherwise. Model files should not contain scale-specific graphics (i.e.: north arrows, graphic scales, sheet titles or labels). Each Model file typically contains information associated with only one discipline (i.e.: Civil, Electrical, Mechanical,

etc.). This separation of information must be maintained even when producing multi-disciplined drawings. Model files are always drawn "Full Size", that is, one-inch equals one inch and one foot equals one foot.

MODEL FILES- EXISTING CONDITIONS

When using existing model CAD files, the graphics created to depict existing facilities are to be created in files separate from the new proposed project model.

IEUA DISCIPLINE CODES

The following characters define the file's engineering discipline: (Sheet Drawing)

G	General Sheets (starting with cover).....	G-1
D	Demolition Sheets.....	D-1
C	Civil/Yard Piping Sheets.....	C-1
A	Architectural Sheets.....	A-1
S	Structural Sheets.....	S-1
M	Mechanical Sheets.....	M-1
H	HVAC Sheets.....	H-1
P	Plumbing Sheets (If extensive – otherwise use M-sheets).....	P-1
E	Electrical Sheets.....	E-1
I	P&ID Sheets.....	I-1
L	Landscaping Sheets.....	L-1

IEUA EXISTING MASTER BASE FILE NAMES

IEUA Treatment facilities consisting of six main facilities RP-1, 2, 3, 4, 5 and CCWRF. The master base CAD files are continuously maintained and updated throughout the life of the plants.

New Project

A copy of Master Base Model Files shall be placed in the project folder and renamed to the current project drawing number for referencing.

(See page 27 for issued drawing number)

(Original from the master vault)	(Example: saved to project folder and added DXXXX number in font)
RP-1 Master Base.....	DXXXX -RP-1 Master Base
RP-1 Master Topo.....	DXXXX -RP-1 Master Topo
RP-2 Master Base.....	DXXXX -RP-2 Master Base
RP-3 Master Base.....	DXXXX -RP-3 Master Base
RP-4 Master Base.....	DXXXX -RP-5 Master Base
RP-5 Master Base.....	DXXXX -RP-5 Master Base
CCWRF Master Base.....	DXXXX -CCWRF Master Base
20topo.....	DXXXX -20topo

The information in the Master Facility Base files located in project folders shall be as is per the time that project had started; it can be updated by request from the project manager.

Note: Model drawings transferred from previous projects shall be renamed to current project drawing number. (See page 4)

Example old model number: (EX-Utili-xxx) to current project drawing number: DXXXX-EX-Utili-xxx, to be used exclusively for current project only. (See page 4)

NAMING FOR SURVEYS MODEL FILE NAMES

Copy original file in the project folder and add DXXXX in front of survey model.

For example:

Original Survey file 13000_R2

Add DXXXX in front:

New Survey file name: DXXXX-13000_R2.

This system tag will help to recognize when, where, and project survey mode is being done.

PROJECT MODEL FILE NAMES

File names for Project Model (see page 20) are derived from the project number, discipline and the type of information contained in the files as follows:

Drawing Number Drawing # is the IEUA Project Number. Number may exceed the number of characters shown. (See page 27 for drawing number issued)

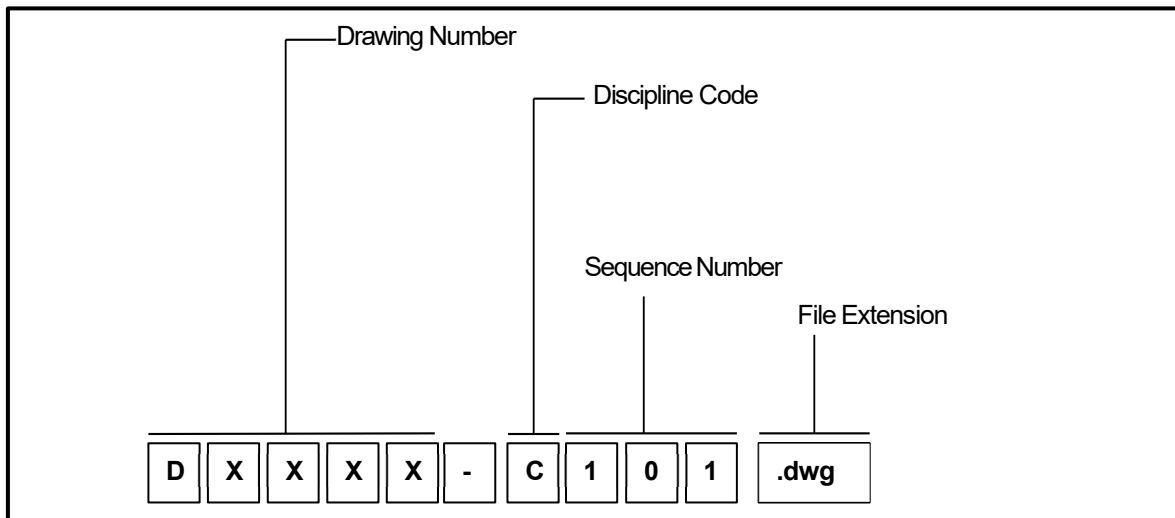
Discipline Code:

G	General	H	HVAC
D	Demolition	P	Plumbing
C	Civil/Yard Piping	E	Electrical
A	Architectural	I	P&ID
S	Structural	L	Landscaping
M	Mechanical		

Sequence Number: 101 – 999

File Extension: File extensions will adhere to the design software used to create drawing (.DWG).

Examples: DXXXX-C101.dwg
(*Typical to all disciplines*)



PROJECT BORDER FILE NAMES

File names for the Project Border (see page 20) are derived from the project number and drawing size.

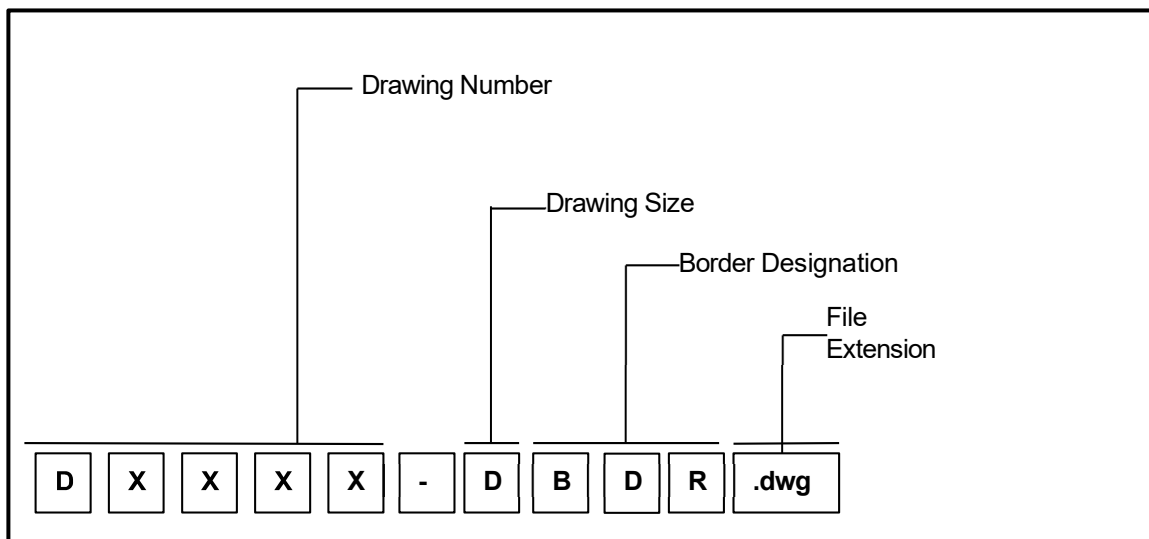
Drawing Number: Drawing # is the IEUA Project Number. Number may exceed the number of characters shown (See page 27 for project number issued)

Drawing Size:		
	B	11" x 17"
	D	22" x 34"
Border Designation:	BDR	

File Extension: File extensions will adhere to the design software used to create drawing (.DWG).

Examples: DXXXX-DBDR.dwg

Note: if more than one border is to be used in same project, the second border shall be DXXXX-DBDR1.dwg



COMPOSITE FILE NAMES

File names for Composite Drawings (see page 20) are derived from the project number, discipline and the type of information contained in the files as follows:

Drawing Number: Drawing # is the IEUA Project Number with hyphens. Number may exceed the number of characters shown.
(See page 27 for project number issued)

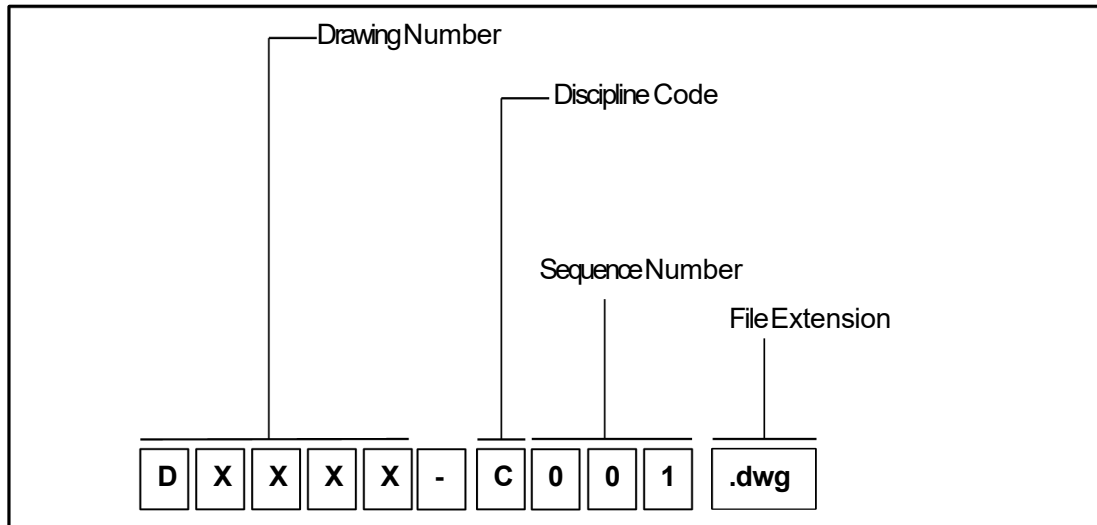
Discipline Code:

G	General (starting with)	H	HVAC
D	Demolition	P	Plumbing
C	Civil/Yard Piping	E	Electrical
A	Architecture	I	P&ID
S	Structural	L	Landscaping
M	Mechanical		

Sequence Number: 001 – 100 (Only one number per sheet. Do not used multiple Layouts per Sheet)

File Extension: File extensions will adhere to the design software used to create drawing (.DWG).

Examples: DXXXX-C001.dwg (Typical to all disciplines)



FOR DRAWING NUMBER ISSUED:

Requested by.....

Project Number:..... (example EN1234).....

Project Name.....

Type of Project: (check one)

D1000	General Administrative
D2000	Potable Water
D3000	NRW System
D4000	Regional System
D5000	Recycled Water
D6000	Waste Water Treatment Plants
D7000	Desalination Plants
D8000	Basin Projects

Data Base Entry

Date:..... Drawing

Number Issued:.....D6XXXX Issued

By:.....

Date:.....

.....

(For IEUA issue only)

LAYER CONVENTIONS

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INTRODUCTION

This chapter defines the layer conventions currently in use at the Agency. The layers defined in this chapter should be used for all Agency CAD work, whether work is produced in-house or by an outside contractor or consultant. All layer names are to be upper case.

These layer names follow The American Institute of Architects (AIA) CAD Layer Guidelines, Second Edition and are organized by discipline. It may prove necessary to add or revise layer names for certain unique types of drawings. Additional layer names may be created as needed as long as they are consistent with the AIA CAD Layer Guidelines, a brief description is provided. The use of additional layer names should be documented and reported to the IEUA Project Manager and CAD Manager.

See example shown on page 3 thru 14 for general guideline only.

Note: Do not force objects Linetype, Lineweight, Transparency, and Color.

All objects shall be per bylayer. (linetype, lineweight, and color/transparency)

AIA LAYER GUIDELINES

The layer naming convention typically incorporates three components – a discipline designator, a major element category designator, and a minor element category designator. In some cases, the names are divided into four components, where the last item is a status field.

Discipline Code

The discipline code is two-character field with the second character being a hyphen. The defined discipline codes are the same for both layers and files names. Refer to [Chapter 5, File Naming Convention](#) for a list of discipline codes.

Major Group

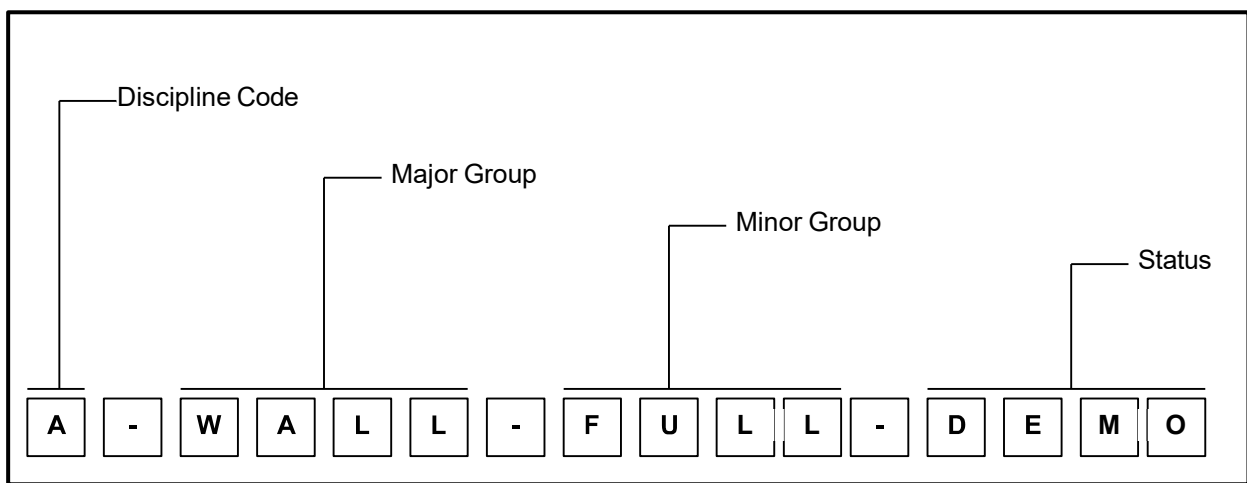
The major group designation identifies the building system. Although major groups are logically grouped with specific discipline codes, it is possible to combine major group codes with any of the discipline codes.

Minor Group

This is an optional, four-character field for further differentiation of major groups. The minor group field can be defined by the user, which allows additional layers to be added to accommodate special project requirements. This should only be done if a defined layer does not apply to a project.

Status Field

The status field is a four-character designator that differentiates new construction from existing. The status field is optional and is only needed when phases of work must be differentiated. Refer to the AIA Layer Guidelines for more information.



COMMON LAYERS

Annotation Layers

Layer Name	Color	Linetype	Description
ANNO-TEXT			Text
ANNO-REDL			Redline
ANNO-SYMB			Symbols
ANNO-LEGN			Legends and schedules
ANNO-DIMS			Dimensions
ANNO-TTLB			Border and Title Block
ANNO-NOTE			Notes
ANNO-NPLT			Construction lines, non-plotting info
ANNO-KEYN			Key notes
ANNO-REVS			Revisions
ANNO-XREF			Referenced model files

GENERAL

Layer Name	Color	Linetype	Description
G-PLAN			General plan
G-SITE			General site plan
G-GRID			Column grid and tags
G-SPLN			Strategic plan scenarios
G-STAG			Staging area
G-WRKA			Work area
G-AQMD			AQMD permit sites
G-NFPA-DIV1			NFPA division 1 hazardous area classification

DEMOLITION

Layer Name	Color	Linetype	Description
D-PLAN			General plan
D-SITE			General site plan
D-GRID			Column grid and tags
D-SPLN			Strategic plan scenarios
D-STAG			Staging area
D-WRKA			Work area
D-AQMD			AQMD permit sites
D-NFPA-DIV1			NFPA division 1 hazardous area classification

CIVIL

Layer Name	Color	Linetype	Description
C-DETL			Details
C-SECT			Sections
C-SECT-PATT			Textures and hatch patterns
C-TOPO-MAJR			Proposed major contour lines
C-TOPO-MNOR			Proposed minor contour lines
C-TOPO-TEXT			Contour elevations
C-SPOT			Proposed spot elevations
C-SURV			Benchmarks, survey control lines
C-BORW			Borrow/spoil area
C-ALGN			Horizontal alignment
C-AREA			Area code boundary (process areas)
C-BLDG			Bldg., primary structures
C-DEMO			Demolition
C-EROS			Riprap, breakwaters, dikes, jetties
C-PAVE			Edge of pavement
C-PKNG			Parking lots
C-PKNG-DRAN			Parking lot drainage slope indicators
C-PKNG-ISLD			Parking islands
C-PKNG-STRP			Parking lot striping, handicapped
C-PROP			Property lines, survey benchmarks
C-PROP-BRNG			Bearing and distance labels
C-PROP-ESMT			Easements, right-of-ways, setbacks
C-PTIC			Plant coordinate grid ticks
C-RAIL			Railroad outlines, centerlines
C-ROAD			Roadways
C-ROAD-CNTR			Center lines
C-ROAD-CURB			Curbs
C-SITE			Fences, handrails, ramps, signs
C-STAG			Construction staging
C-STIC			State plane grid ticks
C-STRM			Storm drainage, catch basins, inlets
C-STRU			Structures
C-SURV			Benchmarks, primary feature align
C-TOPO			Major/minor contours, cut/fill slopes
C-TRCK			Trickling filter clarified effluent
C-TUNL			Tunnel outlines
C-TUNL-CNTR			Tunnel centerlines
C-TUNL-LADD			Tunnel access points
C-UTIL			Power lines, telephone poles, hydrants
C-VEGE			Vegetation
C-WRKA			Work area, project boundary
C-DRAN			Drains
C-GUYW			Down guy wires
C-HOTW-RETN			Hot water return
C-HOTW-SUPP			Hot water supply
C-HOTW-UNKN			Unknown water
C-INTR			Interplant sewers
C-IWTR			Industrial water
C-OUTF			Ocean outfall

ARCHITECTURAL

Layer Name	Color	Linetype	Description
A-CLNG			Ceiling information
A-CLNG-GRID			Ceiling grid
A-DETL			Details
A-SECT			Sections
A-SECT-PATT			Textures and hatch patterns
A-ELEV			Interior & exterior elevations
A-AREA			Area calculation boundary lines
A-AREA-IDEN			Area calculations, room numbers
A-AREA-PATT			Area cross hatching
A-COLS			Columns
A-DOOR			Doors
A-DOOR-JAMB			Door jamb
A-DOOR-OTLN			Door outlines
A-EQPM			Equipment
A-EQPM-IDEN			Equipment identification numbers
A-FLOR			Floor plan information
A-FLOR-IDEN			Room numbers, names, etc.
A-FLOR-OTLN			Floor or building outline
A-FURN			Furniture
A-GLAZ			Windows, glazed partitions
A-GRID			Planning grid or column grid
A-HVAC			Heating, ventilation and air cond.
A-LITE			Light fixtures
A-PMFN			Materials and finish plan
A-POCC			Occupancy plan
A-STRS			Stairs
A-WALL			Exterior/Interior walls
A-WALL-CNTR			Wall centerlines
A-ROOF			Roof information
A-ROOF-OTLN			Roof outline

STRUCTURAL

Layer Name	Color	Linetype	Description
S-DETL			Details
S-SECT			Sections
S-SECT-PATT			Textures and hatch patterns
S-ELEV			Interior & exterior elevations
S-BEAM			Beams
S-COLS			Primary & secondary columns
S-DEMO			Demolition
S-FNDN			Footings, grade beams, piles
S-GRAD			Elevated grading, floor grading
S-GRAT			Elevated grating, catwalks
S-GRID			Grid lines, column tags
S-HNDR			Handrails
S-JOIN			Construction joints, expansion joints
S-METL			Miscellaneous metal
S-OPNG			Opening
S-RBAR			Rebar
S-SLAB			Slab outline, control joints
S-SPPT			Miscellaneous fasteners, anchor bolts
S-STRS			Stair control joints, ladders
S-WALL			Concrete walls, CMU walls

MECHANICAL

Layer Name	Color	Linetype	Description
M-CHEM-UNKN			Unknown chemical
M-CHLR			Chlorine solution
M-CSTC			Caustic Solution
M-FCL2			Ferrous chloride
M-FCL3			Ferric chloride
M-H2O2			Hydrogen peroxide
M-HCL_			Hydrochloric Acid
M-NAOC			Sodium hypochlorite
M-NAOH			Sodium Hydroxide
M-POLY			Polymer
M-AIR_-UNKN			Unknown air system
M-CMPH			High pressure compressed air
M-CMPL			Low pressure compressed air
M-FOUL			Foul air
M-INST			Instrument air
M-O2			Gaseous Oxygen
M-DETL			Details
M-SECT			Sections
M-SECT-PATT			Textures and hatch patterns
M-ACET			Acetylene
M-GAS_-UNKN			Unknown gas
M-HPDG			High pressure digester gas
M-LPDG			Low pressure digester gas
M-NGAS			Natural gas
M-PGAS			Propane gas
M-EQPM			Equipment
M-EXHS			Exhaust system
M-MISC			Unknown system
M-SAMP			Sample
M-FUEL			Fuel oil
M-OIL_-UNKN			Unknown oil
M-DGSL			Digester sludge
M-DGSN			Digester supernatant
M-GRIT			Grit
M-PEFF			Primary effluent
M-PIFF			Primary influent
M-PRSL			Primary sludge
M-RASL			Return activated sludge
M-SCUM			Scum
M-SLDG-UNKN			Unknown sludge, scum or grit
M-WASL			Waste activated sludge
M-STEM			Steam systems
M-STEM-UNKN			Unknown steam

HVAC

Layer Name	Color	Linetype	Description
H-DATA			Data line
H-EQPT			Equipment
H-INST			Insert any data table
H-LEAD			Leader line
H-SIG			Signal
H-TEXT			General text and note
H-XREF			Reference files

PLUMBING

Layer Name	Color	Linetype	Description
P-DATA			Data line
P-EQPT			Equipment
P-INST			Insert any data table
P-LEAD			Leader line
P-SIG			Signal
P-TEXT			General text and note
P-XREF			Reference files

ELECTRICAL

Layer Name	Color	Line type	Description
E-DETL			Details
E-SECT			Sections
E-SECT-PATT			Textures and hatch patterns
E-ALRM			Alarm systems
E-AUXL			Auxiliary systems
E-CCTV			Closed circuit TV
E-COMM			Fiber optic cable, telecommunications
E-COMM-VALT			Fiber optic vaults, telecommunications
E-DATA			Data outlets
E-DUCT			Electrical conduit, duct bank
E-ELCT			Electrical cable tray
E-ELCT-VALT			Electrical vaults
E-GRND			Ground system
E-LITE			Lighting
E-NFPA-DIV1			NEC NFPA 820 Hazardous area classifications, division 1
E-NFPA-DIV2			NEC NFPA 820 Hazardous area classifications, division 2
E-POWR			Power
E-SERT			Security
E-SOUN			Sound/PA Systems
E-PLAN			Site plan
E-POWR-EQPM			Major power equipment
E-POWR-EXTL			External of outdoor power systems
E-LITE-EQPM			Major lighting equipment
E-LITE-PNLS			Lighting panels
E-LNWK-FINE	1 (red)		Schematic line work using the Fine line thickness
E-LNWK-THIN	2 (yellow)		Schematic line work using the Thin line thickness
E-LNWK-MEDM	3 (green)		Schematic line work using the Medium line thickness
E-LNWK-WIDE	4 (cyan)		Schematic line work using the Wide line thickness

P&ID (INSTRUMENTATION)

Layer Name	Color	Linetype	Description
N-DATA			Data line
N-EQPT			Equipment
N-INST			Insert any data table
N-LEAD			Leader line
N-SIG			Signal
N-TEXT			General text and note
N-XREF			Reference files

Note: the general layers above for guidelines only. Additional layers per smart P&ID system and logical control by P&ID Engineers.

LANDSCAPE

Layer Name	Color	Linetype	Description
L-DETL			Details
L-SECT			Sections
L-SECT-PATT			Textures and hatch patterns
L-IRRG			Irrigation piping
L-DEMO			Demolition
L-PLNT			Plant and landscape materials
L-SITE			Site improvements
L-WALK			Walks and steps
L-HYDR			Hydro seeding, seed, sod
L-TURF			Mulching outline
L-SEED			Seed, sod

GRAPHIC/FILE STANDARDS

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INTRODUCTION

This chapter contains examples of the graphics and symbols available for use on IEUA projects. This is a palette of graphics from which the drafter/designer may produce a completed drawing.

“There are no shortcuts
to anyplace worth going”
-Beverly Sills

WEIGHTS

The six primary and three optional line weights defined in Table 0-1, are considered sufficient and should not be expanded unless an appreciable improvement in drawing clarity or contrast can be realized. The AutoCAD color column represents the primary color, for additional colors using the same line weight refer to page 52.

Table 0-1					
Line Thickness	AutoCAD Color			In.	Line Weight Sample
Fine	1 (Red)	-	-	.006	
Thin	2 (Yellow)	-	-	.006	
Medium	3 (Green)	-	-	.0118	
Wide	4 (Cyan)	-	-	.0200	
Extra Wide	5 (Blue)	-	-	.0220	
Option 1	6 (Magenta)	-	-	.018	
Option 2	7	-	-	.02	
Thin	8 (50%Screen)	-	-	.004	
Option 3	9 (70%Screen)	-	-	.006	Not preferred

The following are typical usage for the line widths shown:

- Fine (.006) Fine lines should be used sparingly, mostly for poche/hatching (this line thickness typically does not reproduce well in blue-line format and/or photocopies).
- Thin (.006) Thin lines should be used for depicting dimension lines, dimension leader/witness lines, note leader lines, line terminators, phantom lines, hidden lines, center lines, long break lines, schedule grid lines, and other object lines seen at a distance.
- Medium (.008) Medium lines should be used for depicting minor object lines, dimension text, text for notes, callouts, and schedule text.
- Wide (.0118) Wide lines should be used for major object lines, cut lines, section cutting plane lines, and titles.
- Extra Wide (.0177) Extra wide lines should be used for minor title underlining, schedule outlines, large titles, and object lines requiring special emphasis. Extra wide widths are also appropriate for use as an elevation grade line, building footprint, or top of grade lines on section/foundation details.

Note: all objects line weight, line type, or color shall be drawn as default by layer (do not force line weight, type, or color in the same layer).

The use of AutoCAD Polylines with a defined width is discouraged. However, if they are used the polyline widths must be uniform throughout the extent of the line. Variable line width polylines do not translate into other CAD packages.

LINE TYPES/STYLES

The line styles defined in Table 0-2 are considered sufficient and should not be expanded unless an appreciable improvement in drawing clarity or contrast can be realized. For AutoCAD the global linetype scale factor (LTSCALE) for all drawings should be set to .5 or $\frac{1}{2}$ of the plotted scale. The paper space linetype scaling (PSLTSCALE) should be assigned a value of 1.

Table 0-2		
AutoCAD Line Type	MicroStation LineStyle	Example
Border	SAME	
Center	SAME	
Continuous	SAME	
Dashdot	SAME	
Dashed	SAME	
Divide	SAME	
Hidden	SAME	
Phantom	SAME	
Fence	SAME	
Electrical	SAME	

The following are typical usage for the line widths shown:

Note: all objects line type/styles shall be drawn as default by layer (do not force line type/styles in the same layer).

- Border line type should be used to delineate city or county boundaries.
- Center line type should be used to depict the centerline of a street or piece of equipment.
- Continuous line type is the most common and is used for all object lines, dimension lines, extension lines, leader lines, and other visible lines.
- Dashdot line type should be used sparingly. (Line types with dots typically do not reproduce well in blue-line format and/or photocopies).
- Dashed line type should be used for existing/screen features such as utilities, edge of pavement, and curbs. For future proposed feature shown in black.
- Divide line type should be used to depict flow lines, rivers, streams and other water features.
- Hidden line type should be used to show hidden features of an object or feature.
- Phantom line type should be used for right of way lines, property boundaries, outline, and match lines.

DRAWING SCALES

Typical drawing scales for inch-pound measurements are shown in Table 0-3.

Table 0-3			
Drawing Type	Preferred Drawing Scale		Model Linetype Scale
Site plans	1" = 10'		5
	1" = 20'		10
	1" = 40'		20
	1" = 100'		50
	1" = 1000'		150
	1" = 1mile		½ mile
Floor plans	1/4" = 1' – 0"		
	1/8" = 1' – 0"		
Plan and Profiles	Horizontal 1" = 40'	Vertical 1" = 4'	
Sections	1/4" = 1' – 0"		24
	3/8" = 1' – 0"		16
	1/2" = 1' – 0"		6
	3/4" = 1' – 0"		4
Details	1/4" = 1' – 0"		
	3/8" = 1' – 0"		
	1/2" = 1' – 0"		
	3/4" = 1' – 0"		
	1" = 1' – 0"		
Schematics	Not To Scale		1
Sheet			Set LTscale @ .5 or 1

TEXT STYLES/FONTS

Contrasting text styles or fonts are used within a drawing to delineate types of information. IEUA adheres to the five fonts shown in Table 0-4 for AutoCAD. If consultants desire to use fonts in addition to those listed, they should first submit a request to IEUA in writing and receive written authorization to do so. Consideration shall be given to adding new non-proprietary fonts to this standard where deemed necessary. In such cases these fonts shall have been developed by the consultant or in the public domain. IEUA shall not be held liable for copyright violations resulting from a consultant's intentional or inadvertent use of a proprietary font not known to IEUA, nor shall IEUA be responsible for assuring that the consultant obtains proper licensing for the proprietary fonts. For AutoCAD both the ASCII (.SHP) and the compiled binary (.SHX) files shall be provided.

PRIMARY TEXT STYLE/ FONT

Text Font	Romans (for general notes, callouts, dimensions)
Text Color	Green (do not force color)
Text Height	0.10
Dim Leader	Red
Arrowhead Size	0.125

Secondary Text Style/ Font

- Monotext font. This font creates text characters that are evenly spaced. Monotext font should be used where text fields need to be aligned such as in schedules or, in some cases title blocks.
- Proportional font. This font creates text where the characters are proportionally spaced. It is appropriate for labels or title blocks.
- Slanted font. A slanted font is used where text needs to be easily distinguished from other text. Using the proportional font with the obliquing angle or slant set to 21 degrees creates the desired effect.
- Filled font. Filled fonts are used primarily for titles and on cover sheets. The recommended AutoCAD font is the Swiss TrueType font (Note: the TEXTFILL system variable needs to be set to "1").
- Outline font. Outline fonts are used to label an open space or area. The recommended AutoCAD font is the Swiss TrueType font.

Table 0-4		
Monotext Font	Style Name: Monotext	Font Name: Monotxt.shx
		
Proportional	Style Name: Standard	Font Name: Simplex.shx
		
Slanted	Style Name: Slanted (Oblique Angle = 21)	Font Name: Simplex.shx
		
Filled Font	Style Name: Bold	Font Name: Swis721 BT
		
Outline Font	Style Name: Outline	Font Name: Swis721 BdOut BT
		

Table 0-4	
Proportional	Font: 0
	ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz
Slanted	Font: 0 (Slant: 21)
	<i>ABCDEFGHIJKLMNOPQRSTUVWXYZ</i> <i>abcdefghijklmnopqrstuvwxyz</i>
Filled Font	Font: 43
	ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz
Outline Font	Font: 42
	ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz

TEXT HEIGHTS

Table 0-5 lists text sizes using inch-pound scales.

Table 0-5				
Drawing Scale	Scale Factor	0.10	0.175	0.250
Text Sizes in Inches				
1/8" = 1' – 0"	96:1	9.6	16.80	24.00
1/4" = 1' – 0"	48:1	4.8	8.40	12.00
3/8" = 1' – 0"	32:1	3.2	5.60	8.00
1/2" = 1' – 0"	24:1	2.4	4.20	6.00
3/4" = 1' – 0"	16:1	1.6	2.80	4.00
1" = 1' – 0"	12:1	1.2	2.10	3.00
1" = 10'	120:1	12.00	21.00	30.00
1" = 20'	240:1	24.00	42.00	60.00
1" = 40'	480:1	48.00	84.00	120.00
1" = 100'	1200:1	120.00	210.00	300.00
1" = 1000'	12000:1	1200.00	2100.00	3000.00
1" = 1mile	63360:1	6336.00	11088.00	3801.60
Full	1:1	0.10	0.175	0.250

The following are typical usage for the text heights shown:

- 0.10 text height is used for loop diagrams and control logic diagrams.
- 0.10 should be used for call outs, dimensions, and general notes.
- 0.175 text height is used when a slightly larger label is necessary such as street names, city or county names.
- 0.250 text height is generally used in conjunction with the bold text style and is used for titles.

AUTOCAD PLOTTING PARAMETERS

Table 0-6 maps the color to pen number used for plotting.

Table 0-6					
Color No.	Pen No.	Pen Weight			
		IEUA.ctb			IEUA-Half.ctb
		MM	Inches		
1		.1524	.006	For production of half size. Also, used IEUA.ctb See page 16 for set up samples, or it can be reduced from full 22x34 PDF to half 11x17 PDF.	
2		.1524	.006		
3		.2032	.008		
4		.29972	.0118		
5		.44958	.0177		
6		.4572	.018		
7		.508	.02		
8		.1016	.004		
9		.1524	.006		
10		.65024	.0256		
12		.29972	.0118		
14		.2032	.008		
15		-	.008		
20		-	.008		
21		-	.008		
26		-	.008		
30		-	.008		
31		-	.008		
36		-	.008		
46		-	.008		
50		-	.008		
52		-	.008		
54		-	.008		
60		-	.008		
61		-	.008		
66		-	.008		
70		-	.008		
71		-	.008		
76		-	.008		
80		-	.008		
82		-	.008		
84		-	.008		
90		-	.008		
91		-	.008		
96		-	.008		
100		-	.008		
101		-	.008		
106		-	.008		
116		-	.008		
126		-	.008		
130		-	.008		
132		-	.008		
134		-	.008		
140		-	.008		

Table 7-6 (Continued)			
Color No.	Pen No.	Pen Weight	
		IEUA.ctb	
		MM	Inches
141		.2032	.008
146		-	.008
150		-	.008
151		-	.008
156		-	.008
166		-	.008
170		-	.008
172		-	.008
174		-	.008
180		-	.008
181		-	.008
186		-	.008
190		-	.008
191		-	.008
196		-	.008
206		-	.008
210		-	.008
212		-	.008
214		-	.008
220		-	.008
221		-	.008
226		-	.008
230		-	.008
231		-	.008
236		-	.008
246		-	.008
250		-	.008
251		-	.008
252		-	.008
253		-	.008
254		-	.008

PLT PLOTTING PARAMETERS

IEUA utilizes PLT from AutoCAD to process plot requests. With this plotting environment, you can plot the active drawing or plot multiple drawings. The plotting environment utilizes certain default parameters.

Setting Files

The PLT settings file is used with AutoCAD plotting to provide a way to plot hard copy or PDF, review line weight sample on Chapter 7, page 2 per prior to start layout design drawings. **Notice: please do not modify IEUA.ctb template file!**

(See pages 15 and 16 for plot samples full and half)

Settings File	Parameter	Folder Path to pen table
IEUA.ctb	Pen_table	G:\EN\1 Design Standards & Details Back Up Folder\IEUA Civil 3D Project Folder\AutoCad Plot Styles
IEUA-half size 11x17	See sample page 16	

Pen Tables

To ensure plotting consistency, the Agency has created a standard pen table. The pen table symbolizes elements from the design file as are processed for plotting.

Text	Text elements on specific levels are set to plot a specified line weight. For specific information refer to the pen table.
File name tag	A special character string placed in the Agency standard border is replaced at plot time with the full path specification and file name of the plotted design file.
Plot date tag	A special character string placed in the Agency standard border is replaced at plot time with the date the plot was submitted for plotting.
Plot time tag	A special character string placed in the Agency standard border is replaced at plot time with the time the plot was submitted for plotting.
User name tag	A special character string placed in the Agency standard border is replaced at plot time with the user ID of the person submitting the plot.

BORDER SHEETS

Sheet Sizes

Table 7.8.1 indicates the standard sheet sizes and their typical uses:

Table 0.7		
Size	Designator	Typical Uses
11 x 17	B	Reduced drawings from D Size originals, Supplemental Drawings, Mock-up sheets, loop diagrams.
22 x 34	D	Construction drawings.

Cover Sheet

The cover sheet area is that portion of the sheet containing project, client, designer, sheet identification, and sheet management information needed by the user of the sheet. The guidelines for the cover sheet area provide criteria for the location of like information shown in data blocks within the title block area for easy and consistent retrieval and filing of drawings. Data blocks include the following:

Vicinity Map (a general location of the project within the IEUA's service area)

Project Location Map (a specific location of the project within a plant, facility or residential/commercial area)

IEUA Logo

Project Name

Project Number

Date

Approval signature block for Department Manager, Principal Engineer, and Project Manager

The following other items are permitted based on the Project Manager or the Project's preference:

Volume number to tie the plans with other the project documents such as technical specifications (i.e. Vol. 2 of 2 Plans)

Dig-Alert logo

Basis of Bearing

Benchmarks

Index for drawing sheets (if small enough to fit within the cover sheet)

Sheet Identification Block

The Sheet identification block (Figure 7.9) contains the sheet identifier, sheet count, job number and drawing number. The sheet identifier or Drawing Number is composed of the discipline code/designator, the sheet type designator, and the sheet sequence number described in [Chapter 8, Drawing Set Organization](#). The "1" pertains to the sheet identification number. "XX" refers to the total number of sheets for the entire drawing set. "EN1234" refers to the consultant's job/project number, and "DXXXX-001" refers to IEUA's drawing number.

Designer Identification Block

The designer identification block (Figure 7.10) contains the logo or name of company that designed the sheet. This space also includes an area to accommodate the placing of a professional seal when required.

Management Block

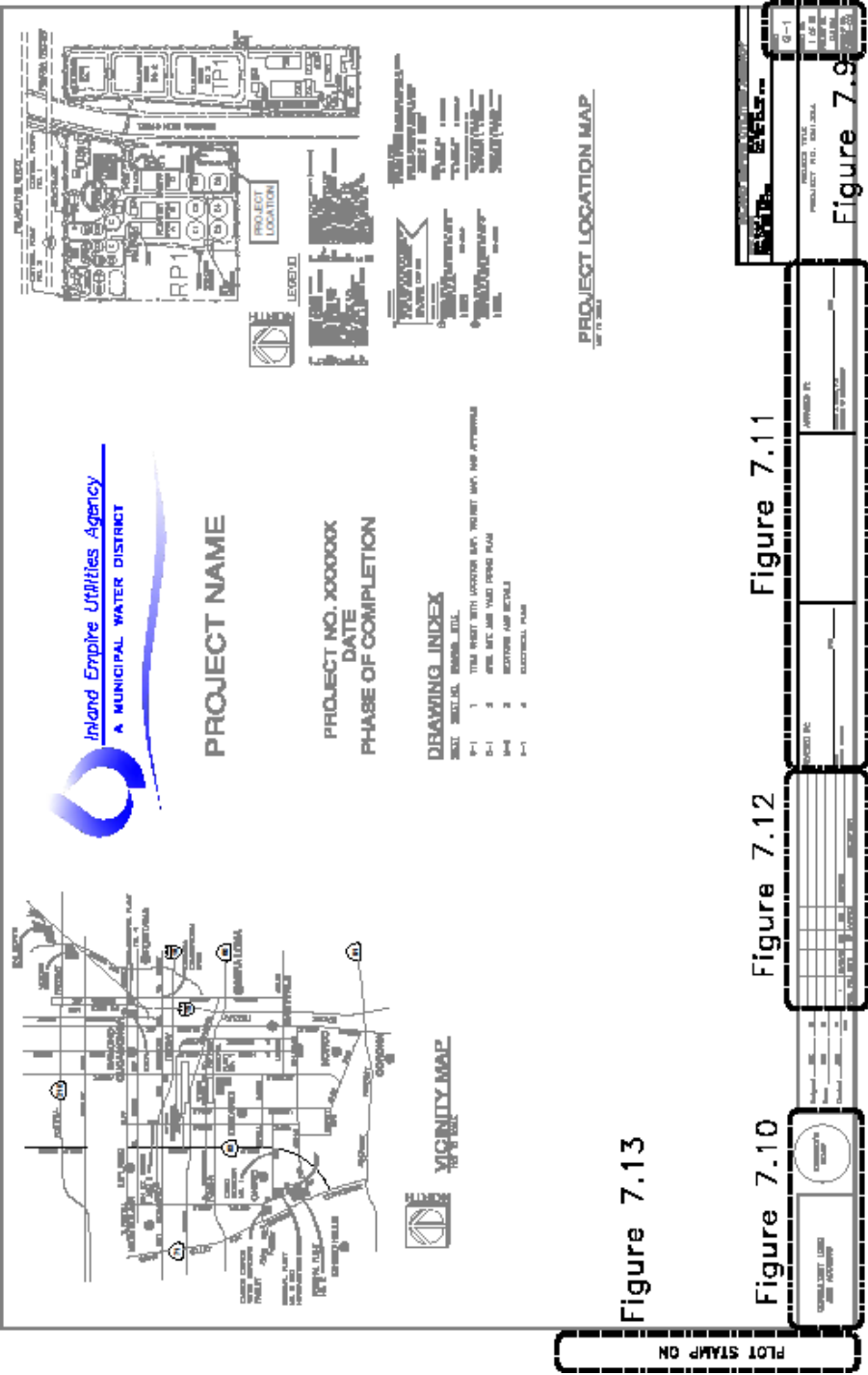
The management block (Figure 7.11) contains information Approval signature block for Department Manager and Deputy Manager. This will only be applicable to the front cover sheet. (insertion point @ 0,0)

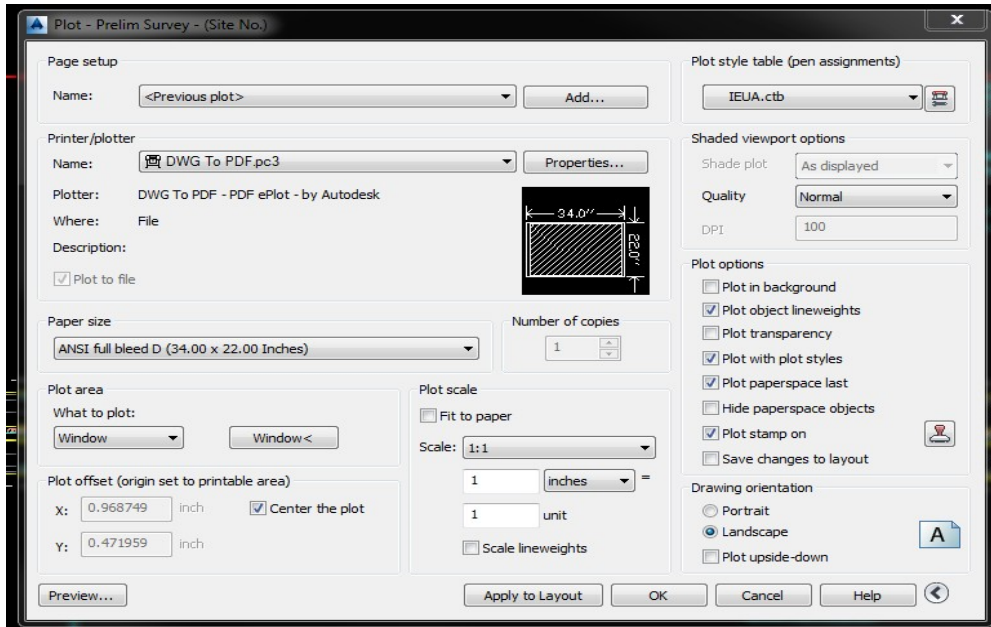
Issue Block

The issue block (Figure 7.12) contains a history of revisions, addenda, and/or clarifications to the sheet. The first entry should be placed on the lower left-hand line of the issue block and subsequent entries should be made above it.

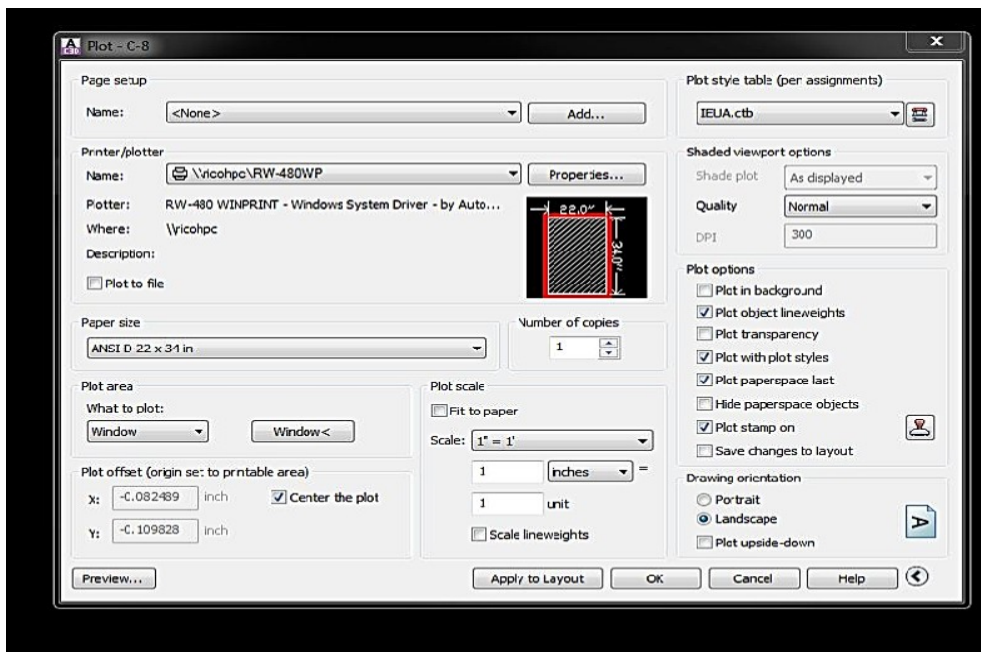
Production Data Block

The production data block (Figure 7.13) contains management information concerning the production of the sheet. Data that is assigned to this area includes file project path, file name, and date. The production data block is located along the binding strip outside the border vertically on the lower left side



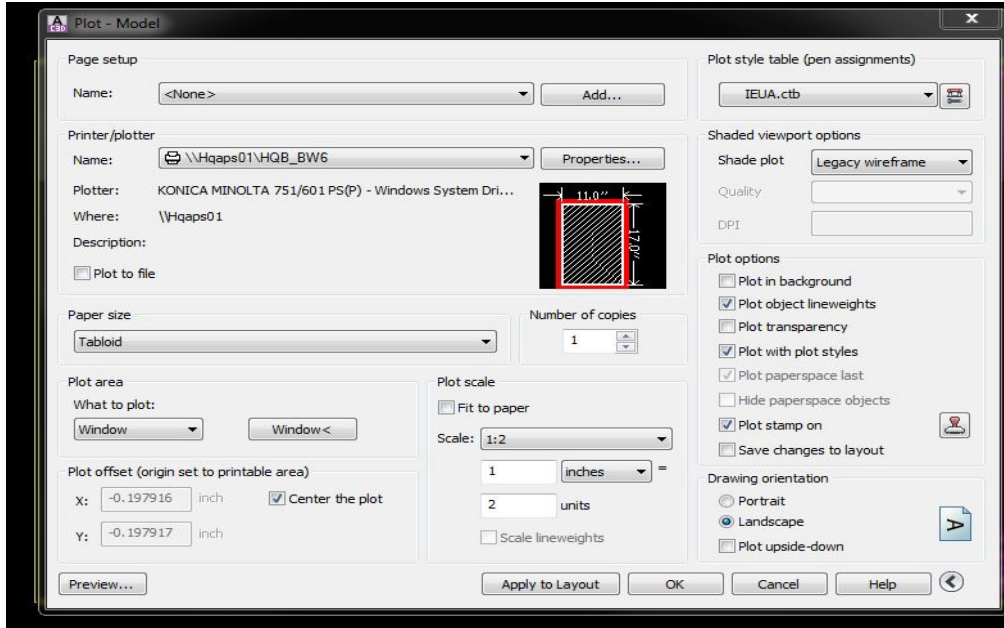


PLOTTING FROM AUTO CAD TO 22" X 34" HARD COPY:

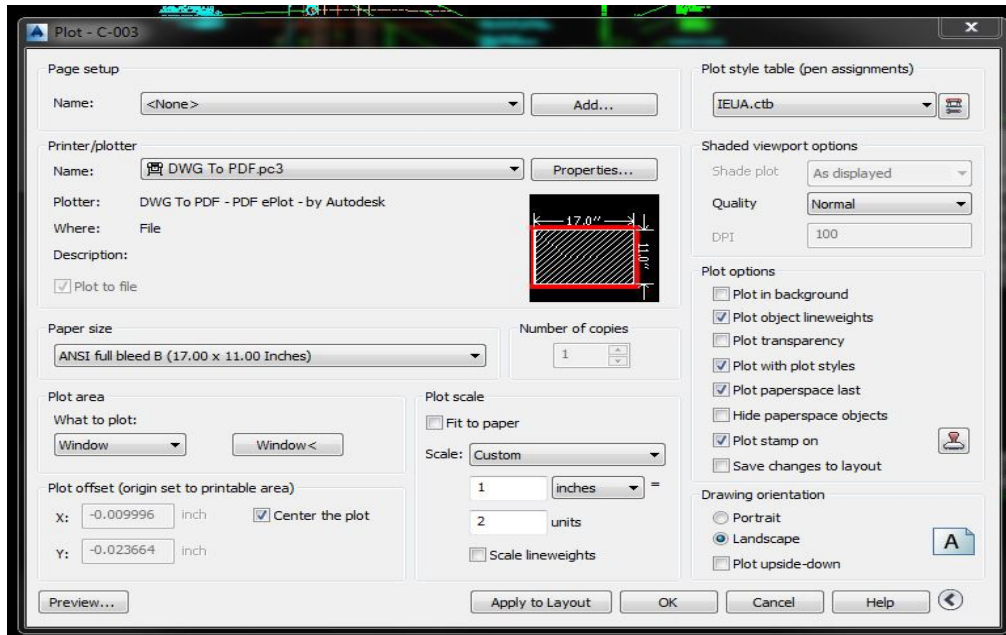


OPTIONAL HALF SIZE PLOT

PLOTTING FROM AUTO CAD TO 11" X 17" HARD COPY:



PLOTTING FROM AUTO CAD TO 11"X17" PDF:



DRAWING SET ORGANIZATION

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DRAWING SET ORGANIZATION

This chapter details IEUA's system for organizing a set of drawings. The organization of a drawing set is designed to support the requirements and facilitate the production efforts of the design and construction team. The following methodology is used:

- Segregate the information by discipline (both design and construction) to form subsets of the total drawing package.
- Order the subsets to correspond to the natural sequence of construction, closely associating disciplines where topics are similar.
- Collect and present each drawing (plan, elevation, section, etc.) on a sheet dedicated to that drawing type.
- Present information within each subset from general to specific.

SET SHEET SEQUENCE

Following the cover sheet, sheets should be organized into subsets by discipline in the order illustrated in Figure 8-1. All of the subsets (discipline) may not apply, or more specific additional categories may be required depending on the size, scope and complexity of the project. The Landscape plan for each discipline shall be the last drawing within the discipline.

See Chapter 5 for letter description sheets identification.

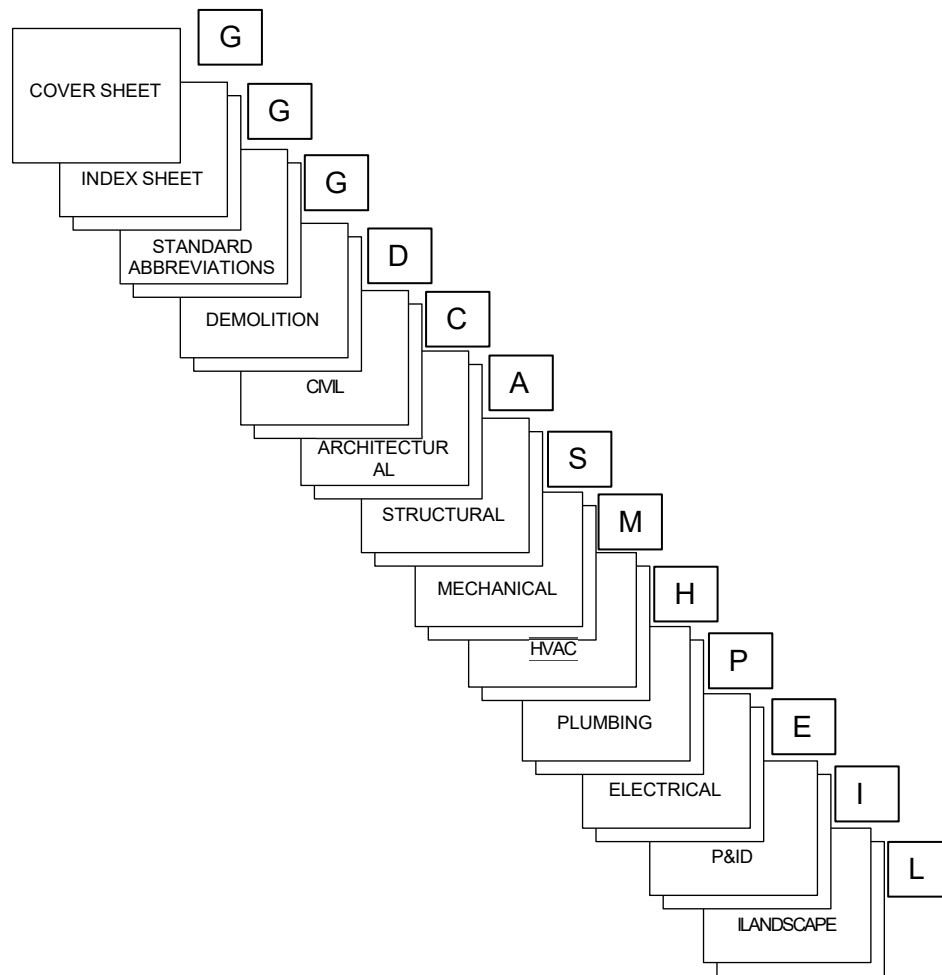


Figure 8-1

DELIVERABLES AND DATA EXCHANGE

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DATA FORMAT 65

CAD Files 65

PDF Files 65

DOCUMENTATION 66

This chapter describes the standard deliverables and data exchange formats required to exchange digital data (drawing files and database information) between IEUA and consultants.

DELIVERY MEDIA

Digital media shall be delivered according to Table 9-1

Table 9-1	
Submittal	Media
Preliminary Design Report (30% Design)	FTP Site Folder and Flash Drive
60% Submittal	
90% Submittal	
100% Submittal	
Conformed Drawings	
Record Drawings	

When digital media are exchanged, an external label must contain, at a minimum, the following information:

- Project number
- Project title
- Submittal date
- Format and version (e.g., Auto CAD Version, and PDF-format on FTP site and Flash Drive) of the operating system on which the media was created, as.
- A short description of contents.

In addition, a transmittal sheet must accompany the media containing, at a minimum, the following information:

- List of filenames and file descriptions on each media.
- Instructions for restoring/transferring the files from the media.
- Certification that all delivery media is free of known viruses, including the name of the virus scanning software used and the date the virus scan was performed.

DATA FORMAT

All files necessary to produce the drawing set (base maps, project model files, Xrefs, plot styles, etc.) are to be delivered in both native CAD format and in PDF format according to the Engineering Design Guidelines and the Scope of Work.

CAD Files

All CAD files shall be delivered in a format that is directly readable and compatible with the Agency's CAD environment, as described in [Chapter 2, page 6, Section CAD](#), and without conversion. Before a file is placed on the delivery media, the following procedures must be performed:

- Remove all extraneous graphics outside the border area and set the active parameters to a standard setting or those in the seed/prototype file.
- Make sure all reference (external reference) files are attached with the appropriate project name variable and do not use device or directory specifications.
- Compress or purge all files using the appropriate utility. A digital media copy of the decompression utility should be provided with the deliverable media, if appropriate.
- Include all files, both graphic and nongraphic, required for the project (e.g., plot styles, color tables, pen tables, font libraries, cell/block libraries, user command files, plot files, etc.)
- Make sure that all support files such as those listed above are in the same directory and that references to those files do not include device or directory specifications.
- Include all standard sheets (i.e. abbreviation sheets, standard symbol sheets, etc.) necessary for a complete project set.

PDF Files

All PDS files shall be delivered in a format that is directly readable and compatible with the Agency's PDS environment. Before a file is placed on the delivery media, the following procedures must be performed:

- Compress Design File to remove all the elements from the undo/redo buffer and all items marked for deletion in the design file.
- File Design to save the parameters defined within the current session.
- Propagate all design files. Drawings must propagate without errors and minimal warnings.
- Provide PDF report "Drawing Index for Active Project". This report contains drawing number, drawing title, file name, process area number and modification status for the currently active PDF project.
- Image size at least 5000 pixels, resolution at least 150, document size 34 x 22 square inches. **No exceptions.**
- All PDF documents should incorporate bookmarks within the document.

DOCUMENTATION

Unless otherwise specified in the project scope of work, the following media types will be submitted with the appropriate submittal as listed in Table 9-2

Table 9-2		
Submittal	CAD Files	PDF
Preliminary Design Report	X	X
30% Submittal	X	X
60% Submittal	X	X
90% Submittal	X	X
100% Submittal	X	X
Conformed Drawings (per Project Manager request)	X	X
Record Drawings (per Project Manager request)	X	X

Hardcopy media types must meet the following specifications:

- 60% Submittal CAD files for IEUA to review CAD standard and QC.
- Submittal PDF shall be in project folder 50.6 Design and the stages of submittal.
- After IEUA receives final CAD files, all previous versions shall be moved to folder: Old.

CAD STANDARD IMPLEMENTATION TOOLS

TABLE OF CONTENTS	PAGE
AUTO CAD TEMPLATES.....	68
AUTOCAD BATCH STANDARDS CHECKER.....	68
MASKING TECHNIQUE TO BLOCK OUT AREAS AND TEXT.....	69

IEUA recognizes the need for customized shortcuts or utilities to facilitate efficient production of architectural and engineering CAD documents. To meet this demand, IEUA has developed standard files. These files consist of:

AUTOCAD TEMPLATES

A template file contains standard settings. When several files need to be created that use the same conventions and default settings, a customized template file can be used instead of specifying the conventions and default settings each time you start a new file. IEUA has created several discipline specific template files. These files have the following conventions and settings included:

- Unit type and precision
- Title blocks, borders, and logos
- Layer names
- Text styles

Template files have a .dwt file extension and are included in the IEUA CAD Standards folder.

AUTOCAD BATCH STANDARDS CHECKER

The Batch Standards Checker audits a series of drawings for standards violations and creates an XML-based summary report detailing all violations. To use the Batch Standards Checker, a series of standards files that define a set of common properties for named objects such as layers and text styles are required. IEUA has created several discipline specific standards files based on the templates described in Section 0, ***AUTOCAD TEMPLATES***.

Standards files have a .dws file extension and are included in the IEUA CAD Standards folder.

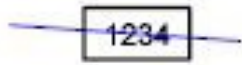
MASKING TECHNIQUE TO BLOCK OUT AREAS AND TEXT

Use masks to block out areas of a surface and prevent them from being displayed or to render a section of the surface using a specified render material are **discouraged**. However, if things be high blocking need to be delete or correction, please fix the background areas to correct manor.

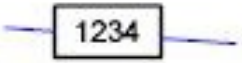
Due to the unstable of reproduction hard copies from submittal PDFs, when masking technique involved. IEUA no longer provide set of hard copies to public, only set of PDF will be provided VIA website to different agencies and clients.

Use a background mask for Text and Referenced Text components to mask the background of a label component. Exceptional when contour line grade elevation needed to be shown as example below.

without mast



with mask



INSTRUMENTATION AND CONTROL

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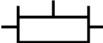
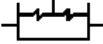
DRAWING/AREA CONNECTOR..... 76

SUMMARY OF INSTRUMENT TYPE & LOCATION77

LEGEND AND SYMBOLS

All symbols will be provided to a Consultant by the Agency's CAD Designer.

FOR INTERNAL USE ONLY : Symbols library is located ([LINK](#))

MECHANICAL EQUIP. SYMBOLS	VALVE AND GATE SYMBOLS
 PUMP: PLUNGER	 VALVE: GATE
 COMPRESSOR: RECIPROCATING	 VALVE: GLOBE
 PUMP: VERTICAL TURBINE	 VALVE: BALL
 PUMP: PROGRESSIVE CAMTY	 VALVE: THREE WAY
 PUMP: RECIPROCATING	 VALVE: FOUR WAY
 PUMP: DIAPHRAGM	 VALVE: DIAPHRAGM
 PUMP: CENTRIFUGAL	 VALVE: BUTTERFLY
 PUMP: ROTARY	 VALVE: FLAPPER CHECK
 PUMP: SCREW	 VALVE: PLUG
 PUMP: SUBMERSIBLE	 VALVE: PLUG 3-WAY
 ROTARY CHEMICAL FEEDER	 VALVE: AIR RELIEF
 PUMP: METERING	 VALVE: ANGLE
 BLOWER	 VALVE: NEEDLE
 ELECTRIC MOTOR	 VALVE: BALL CHECK
 MIXER	 VALVE: SWING CHECK
 AIR OR CHEMICAL DIFFUSER	 VALVE: PRESSURE RELIEF
	 VALVE: TELESCOPING
	 PRESSURE-REDUCING REGULATOR SELF-CONTAINED
	 BACKPRESSURE REGULATOR SELF-CONTAINED
	 PRESSURE-REDUCING REGULATOR W/EXTERNAL PRESSURE TAP
	 BACKPRESSURE REGULATOR W/EXTERNAL PRESSURE TAP

VALVE AND GATE ACTUATOR SYMBOLS



DIAPHRAGM



CYLINDER



SOLENOID



ELECTRIC MOTOR



ELECTROHYDRAULIC



ACTUATOR WITH MANUAL RESET

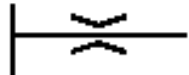


ACTUATOR WITH POSITIONER

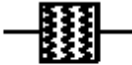
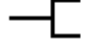
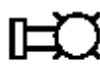
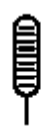
THE FOLLOWING ADDITIONAL DESIGNATIONS MAY BE UTILIZED ADJACENT TO SOME VALVE OR GATE SYMBOLS.

FC FAILS CLOSED
FIP FAILS IN LAST POSITION
FO FAILS OPEN
LC LOCKS CLOSED
LO LOCKS OPEN
NC NORMALLY CLOSED
NO NORMALLY OPEN

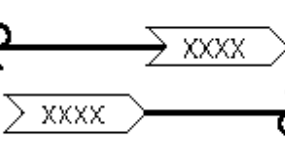
PRIMARY ELEMENT SYMBOLS

	BUBBLER TUBE BUBBLER ASSEMBLY
	LEVEL PROBE
	ORIFICE PLATE
	VENTURI TUBE
	FLUME
	WEIR
	PROPELLER (P) OR TURBINE (T) METER
	AVERAGING PITOT TUBE
	MAGNETIC FLOWMETER
	THERMAL FLOWMETER
	SONIC FLOWMETER
	ULTRASONIC LEVEL METER
	ROTAMETER
	FLOAT TYPE LEVEL SWITCH

MISCELLANEOUS SYMBOLS

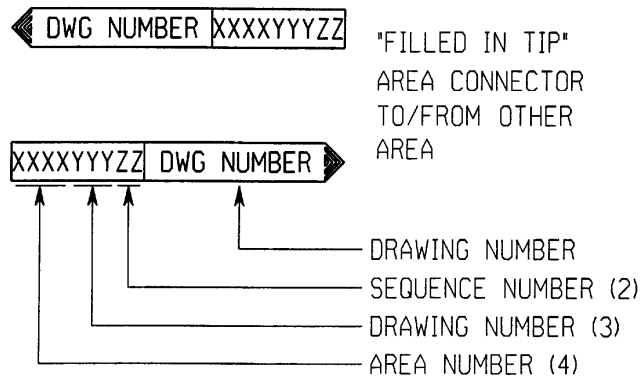
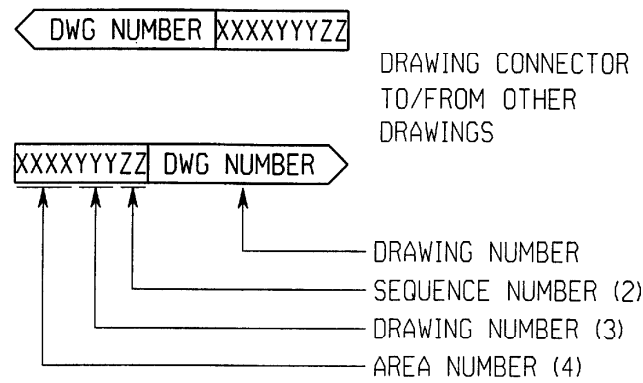
	FILTER
	AIR-HIGH PRESSURE QUICK CONNECTION
	AIR VENT
	CHEMICAL SEAL - DIAPHRAGM
	CHEMICAL SEAL - ANNULAR
	REDUCER - CONCENTRIC
	REDUCER - ECCENTRIC
	PULSATION DAMPENER
	RUPTURE DISK
	DRAIN
	PURGE ASSEMBLY
	IN-LINE STATIC MIXER
	FIELD DEVICE INSTRUMENT AIR SUPPLY
	FIELD DEVICE HIGH PRESSURE AIR SUPPLY
	ROTATING BEACON
	CALIBRATION COLUMN
	HORN
	DAMPERS, VANES
	EXPANSION JOINT

LINE SYMBOLS

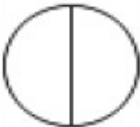
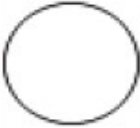
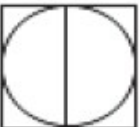
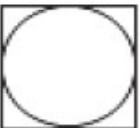
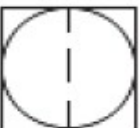
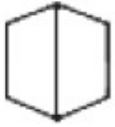
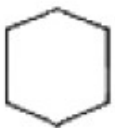
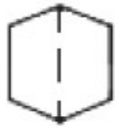
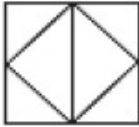
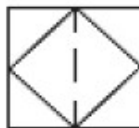
	MAJOR PROCESS PIPING OR FLOW CHANNEL
	SECONDARY OR MISCELLANEOUS PROCESS PIPING
	INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
	ELECTRIC SIGNAL OR SOFTWARE
	DATALINK
	RADIO DATALINK
	HYDRAULIC SIGNAL
	PNEUMATIC SIGNAL
	CAPILLARY TUBING
	ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
	UNDEFINED SIGNAL
	INSTRUMENTATION DIRECTION ARROW (ANALOG I/O)
	INSTRUMENTATION DIRECTION ARROW (DIGITAL I/O)
	INSTRUMENTATION SIGNAL LINES: CONNECTION AND CROSSOVER
	PROCESS FLOW ARROW
	PROCESS LINES: CONNECTION AND CROSSOVER
	CONTINUATION DRAWING REFERENCES (PROCESS AND INSTRUMENTATION)
	FUTURE (IN LIEU OF SOLID)
	FUTURE (IN LIEU OF BROKEN)
	EXISTING (SCREENED)

DRAWING/AREA CONNECTOR

DRAWING/AREA CONNECTORS



Summary of instrument type & location

	Accessible to the Operator; Primary Location on the Main Control Panel	Mounted in the Field	Not Normally Accessible to Operator, Behind the Panel
Distinct Elements			
Shared Display Shared Control in Distributed Control System			
Computer Logic Function			
Programmable Logic Control			

SAMPLE DRAWINGS

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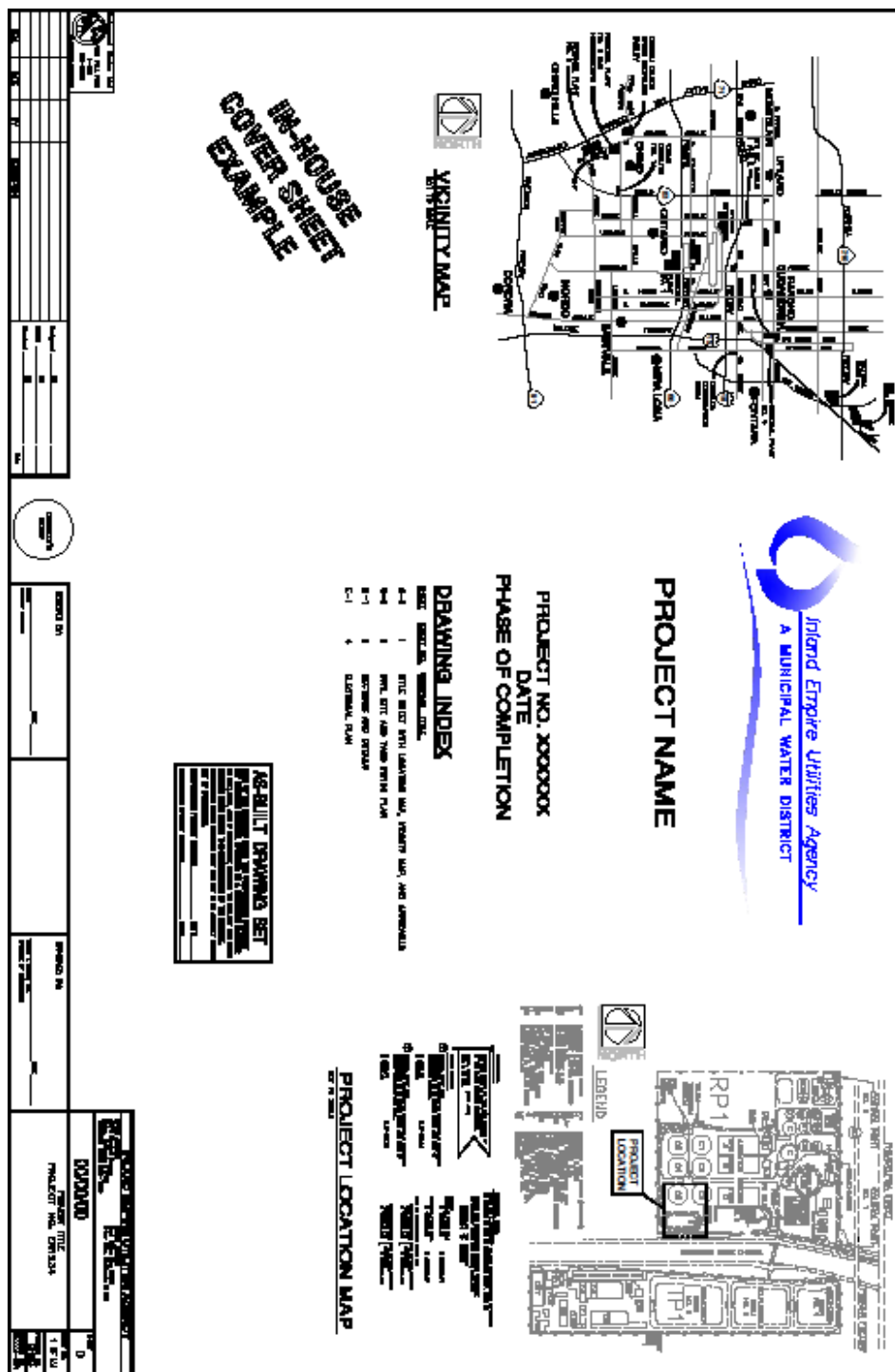
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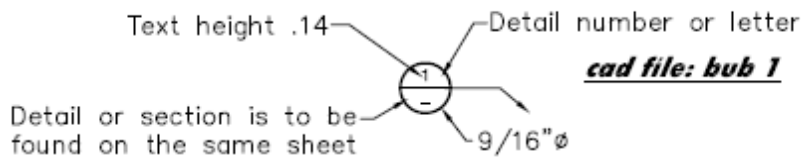
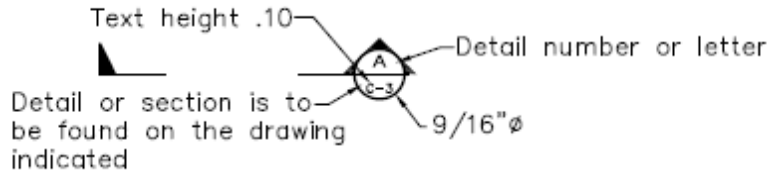
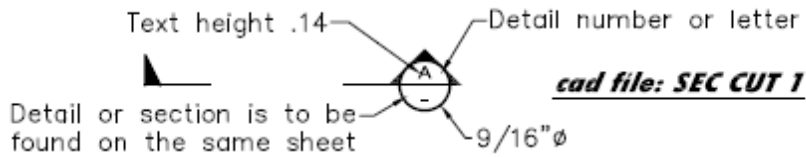
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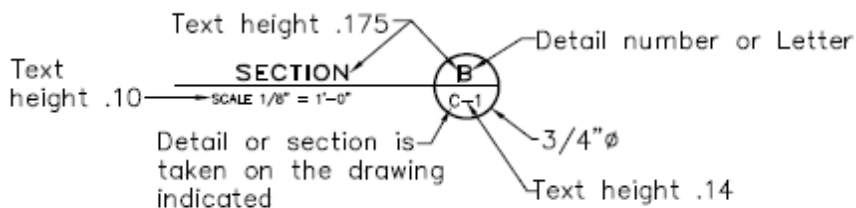
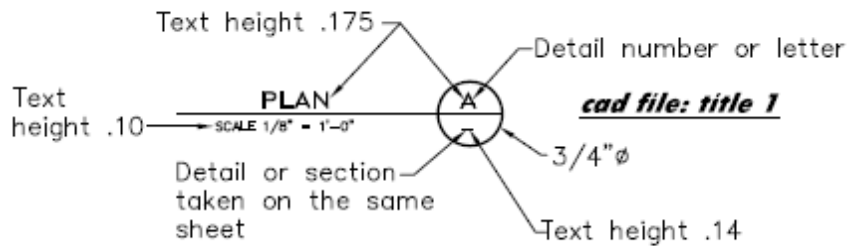
IN-HOUSE BORDER



PLAN, SECTION, AND DETAIL IDENTIFICATION



AT CROSS REFERENCE



AT TITLE

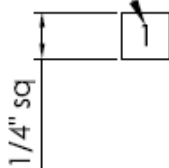
North Arrow And Key Note Details



cad file: IEUA-NORTH-ARROW

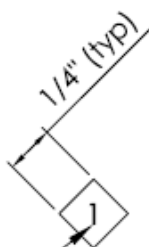
IEUA north arrow symbol

Text height .10
color cyan (typ)



cad file: COOR KEY NOTE

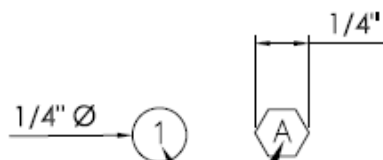
Coordinate control data key note



cad file: KEY NOTE 1

Key note

Text height .10



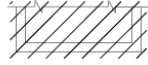
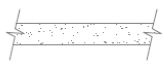
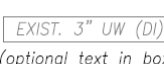
cad file: COLUMN KEY NOTE 1

Column key notes

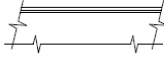
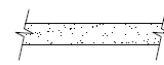
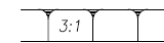
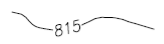
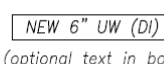
Text height .10

FACILITIES LEGEND

EXISTING FACILITIES

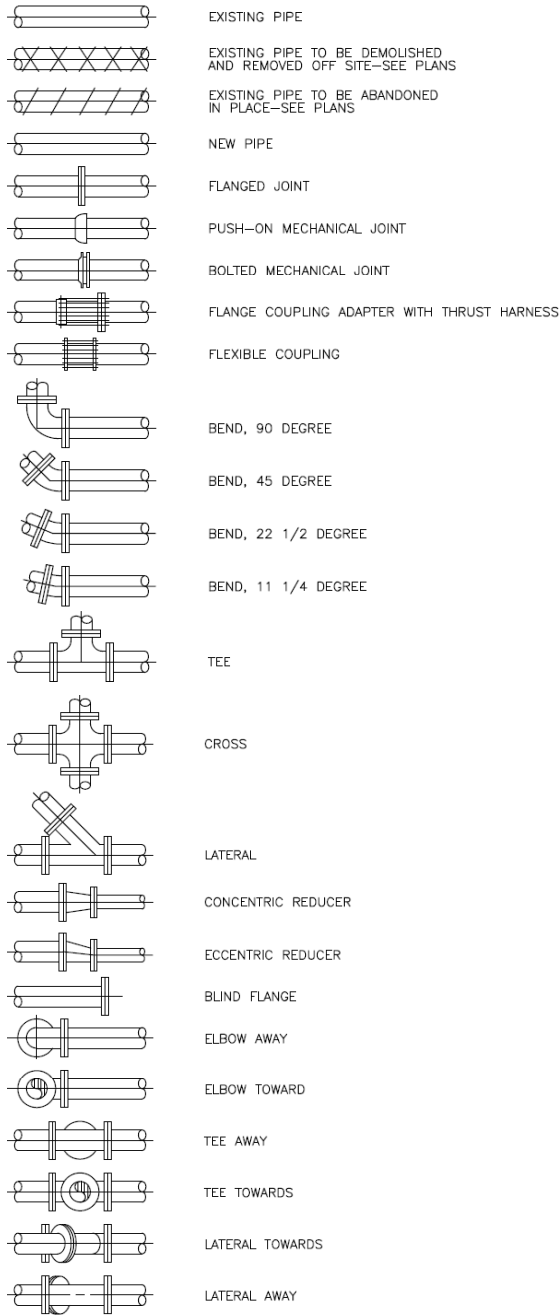
	A.C. PAVEMENT
	BUILDING OR STRUCTURE — HATCHING DENOTES IF DEMOLITION OCCURS — ALSO APPLIES TO ALL MECHANICAL EQUIPMENT TO BE DEMOLISHED
	CONCRETE CURB, PAVEMENT, WALKWAY OR WALL
	CONCRETE RETAINING WALL
	EXISTING EMBANKMENT — SLOPE AS INDICATED
	DRAINAGE WAY OR DITCH
	CONTOUR LINE
	SPOT ELEVATION
	PIPELINE IDENTIFICATION BOX—DENOTES SIZE, TYPE AND MATERIAL OF PIPELINE
	ABOVE GROUND PIPING—CIVIL PLANS ONLY—SEE PIPELINE CALLOUT FOR SIZE & TYPE
	BELOW GROUND PIPING—CIVIL PLANS ONLY—SEE PIPELINE CALLOUT FOR SIZE & TYPE

FACILITIES TO BE CONSTRUCTED

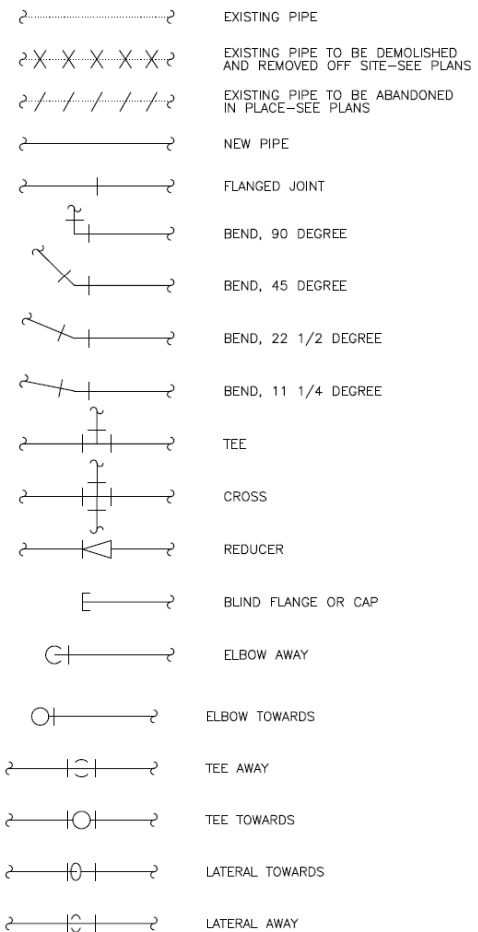
	A.C. PAVEMENT
	BUILDING OR STRUCTURE
	CONCRETE CURB, PAVEMENT, WALKWAY, WALL OR VALLEY GUTTER—SEE PLANS FOR EXACT DESCRIPTION
	CONCRETE RETAINING WALL
	NEW EMBANKMENT — SLOPE AS INDICATED
	DRAINAGE WAY OR DITCH
	CONTOUR LINE
	SPOT ELEVATION
	PIPELINE IDENTIFICATION BOX—DENOTES SIZE, TYPE AND MATERIAL OF PIPELINE
	ABOVE GROUND PIPING—CIVIL PLANS ONLY—SEE PIPELINE CALLOUT FOR SIZE, TYPE AND MATERIAL
	BELOW GROUND PIPING—CIVIL PLANS ONLY—SEE PIPELINE CALLOUT FOR SIZE, TYPE AND MATERIAL

PIPE AND PIPE FITTING SYMBOLS

DOUBLE LINE PIPING

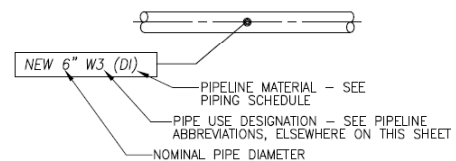


SINGLE LINE PIPING



PIPING DESIGNATION

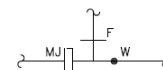
EXAMPLE:



PIPE AND FITTING PATTERNS

B BELL	MJ MECHANICAL JOINT
F FLANGE	PE PLAIN END
GE GROOVED END	S SPIGOT

EXAMPLE:



**ADDENDUM, CONFORMED, RECORD, AND AS-BUILT
DRAWINGS**

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See Cad Specifications

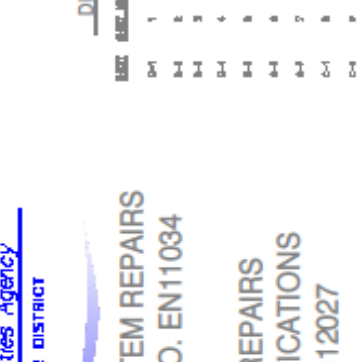
EXAMPLE ADDENDUM DRAWING



Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

EXAMPLE ADDENDUM

AUGUST, 2013



VICINITY MAP
SHEET NO. 1

DRAWING INDEX

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PROJECT LOCATION MAPS

EXAMPLE CONFORMED DRAWING



EXAMPLE AS-BUILT DRAWING

