

GUIDELINES

DIVISION OF SANITATION FACILITIES CONSTRUCTION GUIDELINES

Office of Environmental Health and Engineering
Navajo Area Indian Health Service
Window Rock, Arizona

CHAPTER 11 - Project Drawings

Section 2: As-Built Drawings

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The Division of Sanitation Facilities Construction (DSFC) goal is to have accurate, permanent and complete as-built drawings of each community sanitation facility so that they can be operated and maintained by a utility organization. With the implementation, and subsequent support by DSFC, of NTUA's computerized as-building program, the requirements of this guideline have been significantly revised with regard to NTUA operated systems. For non-NTUA operated systems, the requirements are basically unchanged.

Typically, a project's as-built drawings must describe the facilities built under the specific project as well as become part of an "overall area plan" for the entire community system. An overall area plan consists of a cover sheet, system layout sheets, rights-of-way sheets, construction layout sheets and standard detail sheets. Information on the requirements for each of these sheets is provided in the As-built Drawings section of this guideline.

The as-built drawings should be clear and understandable to the average maintenance man. The set of plans should logically show the system operator what the system consists of. The plans should start by showing the general layout and then show the more specific details.

A composited planset incorporates new project drawings with existing as-built drawings. A discussion of composite drawings is also included in the latter portion of this guideline. For NTUA operated systems, project as-building is required but compositing is not.

This guideline includes three sections. The first section entitled "As-built Drawings" provides the basic requirements for the different parts of a complete set of community as-built drawings. The second section (applies to non-NTUA operated systems only) is entitled "Composite As-built Drawings" describes how the as-built drawings for a recently completed system should be incorporated into previously existing composite as-builts for a community. Finally, the third section "Data Collection" describes how the project manager, construction inspector and NECA crew will cooperate to collect the necessary as-built data.

AS-BUILT DRAWINGS

General

- All sheets are to provide a date and "as-built" labeling in a revision block shown in the area of the title block.
- All sheets, except the title sheet, are required to have a title block with the sheet number or composited sheet number (if required), sheet title and system name.
- Provide sheet number cross-references for water and sewer lines that require more than one sheet to be shown.
- Abandoned lines are to be shown but labeled as abandoned.

Title Sheet: The title sheet shall include the following.

- Location map (total reservation) and vicinity map (with north arrow).
- System name and project number(s).
- Project manager or engineer.
- As-built date.
- Indices of all sheets. An index should be provided to number each sheet as it fits into the overall community composite drawings (if the composite set of drawings exists or is required). Sheets should be numbered as "Sheet ___ of ___". The total number (of ___) does not change as new sheets, such as 5a & 5b, are added.

Right-of-Way: A copy of the as-built rights-of-way sheet(s) is required. The dates of Bureau of Indian Affairs and other grants of easement and as-built rights-of-way submittal should be shown on the rights-of-way sheet.

System Layout: The system layout shall be a plan view showing as much of the system as possible on as few sheets as possible. For NTUA operated systems, only the portion of the system constructed under the current project is required. The selected scale should be between 1 inch = 400 feet and 1 inch = 1,000 feet depending on the density of the services provided. The system layout sheet(s) must give the following.

Water System Layout:

- For NTUA operated systems, provide a location in WGS84 latitude and longitude recorded to the nearest second for the existing mainline tap-in location(s).
- Provide "boxed-in" areas of the system, with sheet numbers, to cross-reference the appropriate construction layout sheets.
- Show north arrow, bar scale and legend (see attached standard legend).
- Provide a reference for elevation. This may be a descriptive reference.
- Show well and booster station pumphouse locations with a descriptive number and/or name.
- Show size and type of water mains with line designations.
- Show main line gate valves, PRVs, ARVs, altitude valves, control valves, flush valves and normally closed gate valves.
- At PRV locations provide number designations, sizes, elevations and pressure settings based on a full tank or highest upstream PRV setting.
- Show a brief sketch of highways, roads, streets, major drainage features and major buildings to familiarize the operator with the area.
- Show dwelling locations with house numbers. Homes with individual PRVs should be marked with an asterisk.
- Show house numbers and names of homeowners in a table. An asterisk should mark those homes with individual PRVs.
- For small community sewer systems show a brief sketch of community sewer system(s) and lagoon location(s) on the water systems layout sheet(s).
- For larger community sewer systems, a separate sewer sheet (see below) may be necessary.
- Show system connections to BIA, municipal or other installed systems. Show water storage tanks on these systems and, if available, show base and overflow elevations for water storage tanks on these other systems.
- Show identity (by owner) and approximate location of subsurface utilities encountered during construction. Emergency telephone numbers are to be noted for high pressure gaslines and other major transmission lines.
- Give dimensional data in a table for pipeline materials used (example: I.D., O.D., SDR, ASTM specification and pressure rating designation for each size and type of pipe used).
- Show storage tanks with name or tank number, base and overflow elevations, dimensions and actual capacities.

Well Data and Booster Stations: The following information is to be provided for wells and booster stations, if appropriate. For multiple well and booster station systems, it is recommended that the information be provided in a table. A separate sheet can be used, if necessary. The top of the pitless unit should be used as the depth datum.

- State power utility company name.
- State date of construction, contractor, tribal well number and surface elevation.
- State depth and size of bore hole.
- State pitless unit make and model number.

- State size, type and location(s) of installed casing(s).
- State length, location, type and slot size of screen, if applicable.
- State gradation of gravel pack, if applicable.
- State depth of grout envelope.
- State static water level and date of measurement.
- Show make, model, horsepower, voltage, phasing, full load amperage of pumps, pumping rate, pumping water level, depth setting of the pump and depth of the water level measuring device.
- State size of drop pipe and size and type of submersible cable.
- State location and type/model of check valves and centralizers, if known.
- State how pumps are controlled (e.g., radio telemetry transmitter at tank, receiver at pumps).

Sewer System Layout: Show the wastewater treatment plant location, lagoon location including number of cells, lift station location and sewer main location with indications for which homes are served.

Construction Layout Sheets

The smallest scale to be used is 1 inch = 400 feet (e.g., 1-inch = 600 feet is not acceptable). The construction layout sheets must contain the information listed below.

General

- Each sheet shall have a north arrow. Stationing is to be from left to right across the sheet. Profile and plan stationing are to be the same direction on the sheet.
- Each sheet shall have a legend and bar scale (see attached standard legend).
- Show dwelling locations with house numbers.
- Show site layouts for all tanks, PRVs, wells, pumphouses, lagoons, booster stations and lift stations which including fencing, power lines, meter poles, control panels, valves, pipe routing, access road entrance area and related appurtenances.
- A sheet number cross-reference to the appropriate detail sheet is required for all non-standard details and details for lagoons, tanks, pumphouses, booster stations, wells and vaults that require a separate sheet. Likewise, the detail shall provide a sheet number cross-reference to the appropriate construction layout sheet.
- Areas of archeological artifacts or other special restrictions shall be shown with stipulations for construction indicated in a note.

Water Systems

- Fire Hydrants
 - ◆ Show size of hydrants.
 - ◆ Show model and manufacturer of hydrants on standard detail.

- Valves
 - ◆ Marker posts are used for field locating the water and sewer mains and appurtenances. Valves should have swing ties to at least two permanent points (e.g., buildings, hydrants, power poles, etc.) within 100 feet when they are located within a street or other area where the installation of marker posts is inappropriate. Tie information is to be shown on the plans.
 - ◆ State size, type, pressure rating and brand for any installed high-pressure valves (i.e., gate valves with pressure ratings greater than 200 psi, ARVs with pressure ratings greater than 150psi, etc.).
 - ◆ Provide stationing (round to nearest foot) and size labeling for gate valves.
- Water Mains, Fittings, Taps and Storage Tanks
 - ◆ Profiles are to be provided but are optional for 2-inch laterals, except for the conditions outlined below.
 - ◆ When profiles are not provided, elevations shall be provided at each PI and EOL.
 - ◆ Show all fittings in profile views, when used, as symbols without labels. Station labeling (round to the nearest foot) shall be provided in the plan view and for all fittings including beginnings and endings of crossings.
 - ◆ Profiles are required for all road crossings that require casing or a change in carrier pipe and steep sections of water lines where the slope exceeds 10%. Profiles for non-standard depth (> 42-inches) watermains are required.
 - ◆ Show location and provide labeling, stationing (round to nearest foot) and vertical separation for all encountered subsurface utilities. Intersecting utilities and culverts shall be appropriately indicated on the profile drawing.
 - ◆ Provide labeling for nominal pipe size, material, class and pressure rating (e.g., 6-inch PVC, 160 psi). This information shall be shown in the profile view when a profile view is used.
 - ◆ Provide stationing, fitting name (i.e., tees, cross, bend or reducer) and size for tees, crosses, bends and reducers (round to nearest foot). Labeling for bend angle is also required.
 - ◆ Provide stationing (round to nearest foot) and labeling for chlorination injection and pressure test taps.
 - ◆ Show storage tanks with name or number, base and overflow elevations, dimensions and capacities.
- Water Services
 - ◆ Show routing of service line using a line weight thinner than that used for the water main.
 - ◆ Individual PRVs shall be designated by an asterisk next to the house symbol.

Sewer Systems

Plan and profile views are to be provided for sewermain and forcemain construction layout sheets and shall provide the following information.

- Manholes and Cleanouts
 - ◆ Marker posts are used for field locating the water and sewer mains and appurtenances. Manholes and cleanouts should have swing ties to at least two permanent points (buildings, hydrants, power poles, etc.) within 100 feet when they are located within a street or other area where the installation of marker posts is inappropriate. Tie information is to be provided on the plans.
 - ◆ Show rim and all invert (in and out) elevations.
 - ◆ Number each manhole and cleanout. Numbering should begin at the lagoon or treatment plant and proceed through the major collection line. Manhole numbers on laterals are to be as 10-1, 10-2, 10-2-1, etc. New manholes added to an existing sewer system should be numbered based on the existing numbering scheme.

- Sewer Mains
 - ◆ The basis of stationing shall be the center of manholes and/or cleanouts.
 - ◆ Label nominal pipe size, material, and SDR for plan views (e.g., 8-inch PVC SDR 35). This information is not shown in the profile view.
 - ◆ Provide labeling for nominal pipe length (horizontal distance between outlet and inlet manhole) and percent slope in profile views (e.g., 325 ft., 2.35%).

- Sewer Services: Service wyes require location labeling by distances from the downstream manhole or by station numbers.

- Lift Stations: Provide profile view with pump type, make, capacity, full load amps, total discharge head (show both static and dynamic heads), voltage, phase and horsepower.

- Forcemains
 - ◆ Fittings are to be shown in profile view as symbols without labels. Station labeling shall be provided in the plan view only and shall be for all fittings including beginnings and endings of crossings.
 - ◆ Location and labeling, stationing (round to nearest foot) and vertical separation for all encountered subsurface utilities are required to be shown. Intersecting utilities and culverts shall be appropriately indicated on the profile.
 - ◆ Show nominal pipe size, material, class, pressure rating, etc. (example: 4-inch PVC, 60 psi).
 - ◆ Provide stationing, fitting name (i.e., bend, valve, reducer or cleanout) and size for bends, valves, reducers and cleanouts (round to nearest foot). Labeling for bend angle is also required.
 - ◆ Marker posts are used for field locating the water and sewer mains and appurtenances. Cleanouts should have swing ties to at least two permanent points (e.g., buildings, hydrants, power poles, etc.) within 100 feet when they are located within a street or other area where the installation of marker posts is

inappropriate. Tie information is to be shown on the plans.

Non-standard Details

Lagoons: A detail sheet(s) showing the lagoon should include the following information.

- Lagoon number or name in title block.
- Horizontal dimensions.
- Side slopes and wave protection detail.
- Number of cells, surface area per cell at high water level, maximum liquid volume per cell at high water level and depth of cells.
- Piping sizes and materials.
- Fence, gate, sign detail and access road entrance location.
- Location and lengths of inlet and outlet structures.
- Details of influent and effluent flow measuring devices.
- Locations of liquid level control structures, over-flow lines, surface water drainage ditches and sewage flow routing.
- Elevations of top of berm, lagoon floor, overflow structure and inlet(s).
- Details of complex features such as aerators and chlorinators, if required.

Water Storage Tanks: A detail sheet(s) showing the water tank should include the following information.

- Tank number or name in title block.
- Size of tank including the thickness of the floor, wall and roof. Show manufacturer and/or contractor and date of erection.
- Paint system and paint/primer brands used on tank.
- Site plan of valves, drains, fencing, gates, access road entrance and tank target location and surface drainage flow lines.
- Details of control valve or transducer vaults, as applicable.
- Details of foundation and ringwall.
- Make and model of the control valve and the differential settings, if applicable.

Pumphouse: A detail sheet(s) showing the pumphouse should include the following information.

- Pumphouse number or name in title block.
- Location of chemical feed pumps. Show make and model, throat and tailpiece.
- Details of size and type of all piping, valves, tees, elbows, water meters, etc.
- Location of building drains shown terminating to daylight or at a drainfield, as appropriate.
- Surface drainage flow lines around structure.
- Finish floor elevations and detailed structural plans of pumphouse.
- Site plan of pumphouse site (to scale) including, fence lines, gates, power lines, access road entrance location and all piping.

Electrical Systems: Electrical detail sheet(s) should include the following.

- Location designation in title block.
- Schematics for control panel(s) and, as appropriate, building wiring without materials list. The schematic shall provide labeling for voltage and phase designations and sizes of disconnects, fuses or circuit breakers, starters and heaters.
- The make and model number for any non-standard equipment installed such as a soft-start or phase converter and show their relative physical location compared to the standard panel.
- Physical layout of control panel doors.

Standard Details

Standard details should be included to show standard appurtenances or installations used throughout the system. In order to provide a cross-reference between the construction layout and appropriate standard detail sheets in a composite plan set, the sheets shall have the project number stated in the title blocks. Model numbers for control valves, injectors and chemical pumps are to be provided at the appropriate locations in the materials lists.

Water: Details for fire hydrants, air release valves, pressure reducing vaults, water service lines, thrust blocks, etc., are to be included, as appropriate. The brand names of the installed gate valves and ARVs are to be provided on the appropriate standard details.

Sewer: Details for manholes, air release valves, sewer servicelines, septic tanks, drainfields, etc., should be included when applicable.

Individual As-builts

The individual as-built shall be a visual scale site plan view with north arrow for each dwelling served and shall illustrate the following.

Water Service

- Show the curb stop, meter can and domestic stop and with ties to the dwelling corners, if within 200 feet (round to nearest foot).
- Show main line tap connection type and size.
- Provide size and name designation for main.
- Show size, pressure rating and length of service line.

Sewer Service

- Cleanout(s) should be shown and tied into dwellings corners, if within 100 feet.
- Show size and length of sewer service line.
- For mainline sewer connections show connection to and size of main and provide the station number or distance to nearest manhole (round to nearest foot).

- Show size of septic tank and material type.
- Provide ties for septic tank to at least two building corners (round to nearest foot).
- Show location of infiltrator observation ports, if installed.
- Indicate distance between drainfield lateral runs.

COMPOSITE AS-BUILT DRAWINGS (non-NTUA systems only)

"Composite" as-builts would be defined as a complete set of drawings or a system of drawings that describe a complete water and/or sewer system. To maintain a composite as-built drawing requires that the drawings for a recently completed project be combined with the existing system of drawings so that the composite drawings are updated with the completion of the new project. The individual composite set of drawings should also be logically organized within itself. Although the set may represent more than one project, the sheets should be combined so that the right-of-way sheets for all the projects would be together within the set, as well as standard details, construction layout sheets, etc. This will require, in many cases, the inserting of additional sheets from a recently completed project into the previously existing composite drawings. In order to avoid wholesale re-numbering of the entire set of composite as-builts when sheets are inserted, the new sheets can be numbered using sub-lettering under the original sheet numbering system. For example, if the right-of-way drawing in the original composite set of drawings was sheet 3 of 45, the right-of-way sheet for the just completed project should be inserted as sheet 3A of 45. However, the index should be redone each time a new sheet is added and the cover sheet updated with each new project.

The planning for how the composite set of as-builts will be updated should be part of laying out the original construction drawings. The obvious first choice in developing new construction drawings would be using sheets from the existing composite as-builts drawings and simply show the proposed construction on those sheets. This greatly simplifies the work required to up-date the composite as-builts after project completion.

The last choice in developing new drawings would be to have the new drawings overlap the area covered by the composite as-built sheets. At the as-built stage, the new drawings would have to be updated to show the older part of the system and the old composite drawings would require updating to show the new part of the system. The more that two separate sheets overlap, the more work is required to update the composite as-builts.

For situations when systems or new projects may be difficult to layout for composite as-built drawings, layout should be discussed with the operating utility as part of the "concept review" before the project drawings are developed.

The primary purpose of proposed construction drawings must also be kept in mind while preparing drawings. The actual construction crew has no interest in composite drawings but needs a clear concise set of drawings to show what is to be built. The

construction drawings need to make sense by themselves, even if the sheets will eventually be incorporated into a composite set of drawings.

DATA COLLECTION

This guideline requires the collection of a substantial amount of as-built data as project construction proceeds. For this reason, it is required that data be collected in one as-built data book that is kept on the job site during construction. The information recorded in the book will then be used to finalize the as-built drawings.

Since the project manager is responsible for providing complete and accurate as-builts drawings, he or she and the inspecting technician are responsible for insuring that the data is collected accurately and completely on a daily basis. Since the manager and/or the technician will not be on the job site at all times, the NECA crew should assist in collecting data.

At the pre-construction conference the manager, technician and NECA foreman shall discuss and agree on how the as-built data book will be kept on the job, who will enter data and when it will be entered. The project manager will be responsible for providing the book and insuring that proper data is being entered in the data book as construction progresses.

The front of the book should be labeled with the following information:

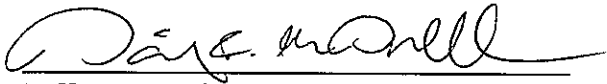
Project Name	Foreman's Name
Project Number	Inspector's Name
Book No. (e.g., 1 of 3)	Manager's Name

The inside cover of the book should have a "if found, please return to " address in case the book is misplaced (you may also want to offer a reward). The first four pages should be titled "Index" so they can set aside a space for an index or table of contents.

Finally, the individual facilities proposed layout forms should be kept with the book so they can be marked-up as installations are completed.

As-built information will be recorded in this book as items are installed. A typical entry would include the date at the top of the page, weather, page number, location information such as line number and stationing for a valve, sketch and tie-in locations as required. A list of materials should be provided which list the individual items used in the installation, such as: "cast iron tee, 4"x4"x2", plain end PVC and 2" Kennedy cast iron gate valve, PVC ends, 2' cast iron valve box, two marker posts" for a gate valve installation or " 1,000-gallon polyethelene septic tank, 50' of 4" solid pipe, 350' of perforated sewer pipe, three PVC 4" tees and four PVC 90 degree elbows" for an individual waste disposal system.

APPROVED BY:



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Attachment A - Standard Legend

Attachment B - Individual As-Built Form