

8. Vertical Alignment (Profiles).

a. Cover Over Pipeline.

- 1) Normal depth for sewer pipelines is eight (8) to ten (10) feet measured from the lowest profile grade or ground line.
- 2) Provide a minimum of three (3) feet of cover over sewer pipelines and SHCs, measured from the lowest profile grade or ground line, except at manholes, see Part Two, Section 19 (Manhole Depth Design).
- 3) Deep Sewers. WSSC considers any sewer pipeline over twenty-two (22) feet of cover as a deep sewer.
 - a) Considerations for sewer pipelines over twenty-two (22) feet of cover.
 - (1) Pipe material.
 - (a) For sewer pipelines 12-inch and smaller, specify DIP or PVC AWWA C900 DR 14 pipe, see Standard Details W/6.0 and W/6.1.
 - (b) For sewer pipelines larger than 12-inches, specify DIP or RCP, see Part One, Section 3 (Selection of Pipe Material (Gravity Sewers)).
 - (2) Manholes.
 - (a) See Part Two, Section 18 (Manhole Depth Design) for diameter and fall prevention requirements.
 - (b) Design the alignment so that the manhole depth is less than twenty (20) feet or see the requirements under Part Two, Section 18 (Manhole Depth Design).
 - (3) Sewer House Connection (SHC), design the SHC out of the deep sewer area using one of the following:
 - (a) Re-locate the SHC to another area.
 - (b) Design parallel sewer to connect the SHC.
 - (c) Consider a Drop House Connection (DHC) for the SHC. See Part Two, Section 28 (Sewer House Connections (SHC)).
 - b) Additional considerations for sewer pipelines with twenty (20) to twenty-five (25) feet of cover.
 - (1) Additional right of way due to the excavation requirements for deep pipe, see Part Three, Section 2 (Rights of Way and Construction Strips).
 - (2) Locate SHCs out of deep areas where possible.



- (3) Choose a sewer alignment so that it is less than 20 feet of cover or provide a special design.
 - (a) Special designs include the following:
 - [1] Design parallel sewer for future use.
 - [2] Provide a casing around the sewer pipeline.
 - [3] For proposed developments, redesign the proposed grading to eliminate the deep sewers.
 - [4] Design the sewer to extend into another drainage area.
 - [5] Consider first floor service for specific cases.
 - [6] Design for pressure sewer systems.
 - (4) Re-evaluate the site grading to eliminate deep sewers.
 - (5) Evaluate proximity to existing utilities/structures
- c) Additional considerations for sewer pipelines with over twenty-five (25) feet of cover.
 - (1) Redesign the sewer alignment out of the deep area or provide a special design.
 - (a) Special designs include the followings:
 - [1] Design parallel sewer for future use.
 - [2] Provide a casing around the sewer pipeline.
 - [3] For proposed developments, design the proposed grading to eliminate the deep sewers.
 - [4] Design the sewer to extend into another drainage area.
 - [5] Consider first floor service only.
 - [6] Design for pressure sewer systems.
 - (2) Additional right of way due to the excavation requirements for deep pipe, see Part Three, Section 2 (Rights of Way and Construction Strips).
 - (3) Re-evaluate the site grading to eliminate deep sewers.
 - (4) Evaluate proximity to existing utilities/structures.
 - 4) For pipelines crossing under streams, ditches, etc., provide the following cover over the pipe.
 - a) Crossing a stream with a sewer pipeline, design the pipe material as DIP for smaller than 21-inch sewer pipelines and DIP or RCP for 21-inch and larger sewer pipelines.
 - (1) For RCP, label in profile and include in the General Notes with the pipe class required and minimum lay length of twelve (12) feet. For design of pipe class for RCP, see Part Two,



Section 3 (Selection of Pipe Material - Gravity Sewers).

- b) Provide a minimum cover at the stream invert of three (3) feet or 1.5 times the OD of the crossing pipeline (whichever is greater). If unable to provide this cover requirement, provide a design according to Part Two, Section 2 (Pipeline Sizes and Materials (Gravity Sewer) for special pipe and Part Three, Section 4 (Buoyancy of Pipelines) and Section 9 (Pipeline Stream Crossings).
 - c) Show invert/bottom elevation of the crossing stream, ditch, etc on the profile.
 - d) When designing the horizontal and vertical alignment at stream crossings, the designer should try to minimize the number of pipeline stream crossings, take into account stream meandering and maintain a minimum horizontal distance from the stream. Base the distance from the stream upon requirements set by the agencies having jurisdiction over the area around the stream or at the stream crossing.
 - e) Contact agencies having jurisdiction over stream crossing areas to review all requirements and to discuss the impact of the design on their requirements. Obtain written response and approval of horizontal and vertical alignment from agencies having jurisdiction prior to issuance of the design.
- 5) Design of gravity sewer pipelines upstream of a wastewater pumping station. If a surcharge could occur in the gravity sewer pipeline upstream of the pumping station due to high wastewater level in the pumping station at the design flow, provide a plot of the HGL on the profile. Identify the location and elevation of wastewater overflow points, as well as frame and cover elevations and basement elevations, as a result of an inoperative wastewater pumping station.
 - 6) Plot the HGL on profile for the following:
 - a) Gravity sewer pipelines, which may operate under surcharged conditions.
 - b) All gravity sewer pipelines 15-inch and larger diameter.
 - 7) Check pipe flotation for PVC sewer pipelines within high ground water, see Part Three, Section 4 (Buoyancy of Pipelines).
 - 8) When determining depths of sewer pipelines for improved lots, see Part Two, Section 27 (Sewer House Connections).
 - 9) For pipeline clearances with other pipelines and utilities, see Part Three, Section 3 (Pipeline Crossings and Clearances).
 - 10) For the design requirements for structures in profile, see Part Two, Section 11 (Design of Structures).

b. Labeling Pipeline in Profile.

- 1) Label all existing and proposed pipe sizes, manhole/structure numbers, location and type of all structures and appurtenances, and fittings on profile and provide pipeline stations and invert elevation as required in this section. Show the following on the profile: pipe slope, type of pipe and pipe strength, class, etc., if not noted in General Notes. For additional information, see Part Two, Section 5 (General Horizontal Alignment) and Section 11 (Design of Structures).



- 2) Provide class of DIP, PVC AWWA C900/C905 and RCP due to changes required under Part Two, Section 2 (Pipeline Sizes and Materials (Gravity Sewer)) and Section 3 (Selection of Pipe Material). Show on profile the limits and class of pipe.

c. Profile Grade Lines.

- 1) Pipelines within or adjacent to a roadway.
 - a) Existing roadway show the following:
 - (1) Centerline of Existing Paving from field surveys.
 - (2) Existing Ground over Centerline Pipeline, from field surveys. If the ground elevation differs by one (1) foot or more, show both the centerline of existing paving and the existing ground over centerline of pipeline.
 - (3) Existing Established Centerline Roadway Grade from approved street grade drawing.
 - (4) If the roadway does not have an established roadway grade, provide the following:
 - (a) Contact the agencies having jurisdiction over the existing roadway and submit for approval all necessary designs and drawings. Show the established roadway grade on profile, labeling it, Established Centerline Roadway Grade.
 - (b) At the option of WSSC, show only the design of the roadway improvements on profile, labeling it, Possible Future Centerline Roadway or Possible Future Grade.
 - b) New or proposed roadways show the following:
 - (1) Centerline of Finished Roadway Grade.
 - (2) Finished Grade over Centerline Pipeline, if the grade elevation differs by one (1) foot or more show both the centerline of finished roadway grade and the finished grade over centerline of pipeline.
 - (3) Finished Grade, is the proposed elevation over the pipeline during or after pipeline construction.
- 2) Outfall - across property, show the following.
 - a) Existing Ground over Centerline Pipeline.
 - b) Finished Grade over Centerline Pipeline.
- 3) Pipeline parallel to existing or proposed streams, ditches, etc. and within 10 feet of the bank or slope, the Designer should show the bottom of the ditch, stream, etc. on the profile. The depth of the pipeline in profile should be such as to provide for future connections and/or extensions crossing the stream, ditches, etc. Provide preliminary design of future connections crossing the streams, ditches, etc.



- 4) Indicate grade/ground lines on the profile as follows:
 - a) Centerline of existing roadway - solid line.
 - b) Established or possible future centerline of roadway - dashed line.
 - c) Existing ground or grade over centerline of pipeline - solid "freehand" line.
 - d) Proposed grade over centerline of pipeline - dashed "freehand" line.

d. Length of Profile.

- 1) Show grade or ground lines, entire length of the pipeline.
- 2) When connecting to existing mains or ending the pipeline, show an additional two hundred (200) feet of the following:
 - a) Existing and proposed grade or ground lines and the existing pipeline from the new pipeline or past the limits of the new pipeline when ending with a stopper.
 - b) Proposed pipeline that will be extended in the future and the basement elevations of all existing houses.
- 3) Sufficient future extension of the pipeline design must be shown to assure proper depth of the alignment. The amount of additional length will be determined on a case by case basis.

e. Pipeline Stationing.

- 1) Measure the pipeline stations along centerline of the pipeline in the horizontal plane.
- 2) Pipeline within or adjacent to a roadway.
 - a) For horizontal stations on the baseline of the profile, show the centerline of the roadway with the location of the pipeline manholes, structures, etc., projected onto the centerline of the roadway. The horizontal distances between structures cannot be scaled accurately on the profiles where they are not entirely parallel to the centerline.
 - b) Distances noted on the drawings between manholes, structures, etc., on the pipeline profile are to be the actual distances measured horizontally along the pipeline, see Part Two, Section 15 (Pipe Slope and Manhole Distance).
- 3) Outfall - across property. Horizontal distances and stations on the profile represent the centerline distances and stationing along the pipeline.

