

**METROPOLITAN SEWERAGE
DISTRICT OF BUNCOMBE
COUNTY, NC**

*Standard Specifications for Surveys for
MSD Sanitary Sewer Construction
and Rehabilitation Projects*

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STANDARD SPECIFICATIONS FOR SURVEYS FOR MSD SANITARY SEWER CONSTRUCTION AND REHABILITATION PROJECTS

SECTION 1 - INTENT AND PURPOSE

- 1.01 It is the intent and purpose of these standard specifications to provide requirements for surveys being done for MSD sewer construction and rehabilitation projects and to set forth technical standards and tolerances which those surveys shall be required to meet or exceed. They are applicable to those projects of the MSD Engineering Section for which a Surveyor is to be employed to gather data relevant to the design and right of way acquisition of sewer construction and rehabilitation projects.

It is also the intent and purpose of these standard specifications to provide guidelines for the application of the survey data in the preparation of right of way and easement maps and to specify the contents and format of such right of way and easement maps.

- 1.02 These specifications are not intended to replace or amend MSD's "*Sewer Extension*" Manual or "*Sewer Extension Procedures, Standards, and Specifications*" Manual. The Sewer Extension Manual is prepared by MSD Planning and Development Department and is for construction of public and private sewer lines by individuals and firms for eventual operation and maintenance by MSD. Contained within the Sewer Extension Manual are guidelines for easement plats and surveys. These specifications shall not alter those guidelines and requirements. The "*Sewer Extension Procedures, Standards, and Specification*" Manual sets forth sewer construction standards and guidelines. The following specifications are for survey standards and not intended for construction standards.
- 1.03 General requirements for easement maps are set forth in Section 7. All easement maps shall meet these requirements as well as the standards contained herein.
- 1.04 General surveying requirements for all types of surveys are set forth in Section 2. Specific surveying requirements for location and property surveys are set forth in Section 4. Specific surveying requirements for topographic surveys are set forth in Section 5. Specific surveying requirements for as-built surveys are set forth in Section 6.

SECTION 2 - GENERAL REQUIREMENTS FOR ALL CLASSIFICATIONS OF SURVEYS

- 2.01 All surveys shall meet or exceed the requirements as set forth in *NCGS 89C (The North Carolina Engineering and Surveying Act)* and *Title 21, Chapter 56, North Carolina Administrative Code (Board Rules)* for the appropriate class of survey. Particular attention is called to Section 21-56.1600 of the *Board Rules "Standards of Practice for Land Surveying in North Carolina"*.

- 2.02 All surveys shall be performed by or under the direct supervision of a Professional Land Surveyor duly licensed by the state of North Carolina as required in *Chapter 89C of the N.C. General Statutes*. Any firm performing work under this contract that is classified by the state statutes as “Surveying” shall be in compliance with the requirements of *Chapter 55B of the North Carolina General Statutes (Professional Corporation Act)*.
- 2.03 All surveys shall be tied to NC Grid and USGS monumentation, except where “local ties and coordinates are permitted by NCGS. All ties shall be shown and specified in the survey data and/or mapping. The Surveyor shall convert all horizontal points and coordinates to NAD83 datum to a minimum of 4 decimal places. (Note: Calculations shall be to 4 places; however, printouts may be to 2 places.) If conversion is made from NAD 27 datum, a “scale factor” shall be calculated by the Surveyor for conversion of the grid distances to scale or ground distances and shall be shown upon the map. All vertical points and elevations shall be tied to NGVD 1929, MSD manhole elevations, or other datum approved by MSD. If vertical datum is different from NGVD 1929, the Surveyor shall specify to datum reference on all maps and drawings and in the project data report.
- 2.04 The Surveyor shall research existing public records including, but not limited to, those found in the Buncombe County Tax Office and the Buncombe County Register of Deeds Office to determine the ownership of properties along the route of the survey and to establish boundaries of those properties. He shall obtain copies of tax mapping of the parcels and copies of the deeds of the properties (as recorded in the Register of Deeds office) as may be necessary for him to establish the location of property lines of parcels from which rights of way and easements are to be acquired. A copy of each deed (showing the property owner's name, tax parcel number and deed book and page reference) shall be placed in a loose-leaf notebook and shall be delivered to MSD along with the survey notes and mapping. In lieu of preparing the above referenced notebook of deeds, the Surveyor may show the location and bearing of all appropriate property lines on the survey maps and CAD drawings.
- 2.05 MSD’s typical time from beginning of project surveys to beginning of construction is approximately 18 to 36 months; however, on some projects, location surveys, right-of-way mapping and right-of-way acquisition may precede project construction by as much as 5 to 8 years.
- 2.06 The Surveyor shall install permanent markers for project traverse control points of sufficient quantity so that manhole locations and other critical project points can be re-established by MSD personnel or others.
- 2.07 All horizontal traverse control points shall be clearly indicated on the survey maps and documents. All horizontal traverse control points and backsights shall have x, y, and z coordinates tied to USGS monumentation unless otherwise directed by the MSD. Project traverse control points, which fall within a tree, creek, or other location, which cannot be occupied by the Surveyor, shall comply with paragraph (d) of 21-56.1602 of the *Board Rules*. Horizontal traverse control monuments shall be provided so that there is a “visible line of sight” between any two consecutive points but in no case shall the distance between consecutive horizontal traverse control monuments be more than 500’.

- 2.08 Vertical control monuments (benchmarks) to be used to establish grades and elevations for construction of the project shall be provided. Vertical controls shall be marked by “x” on fixed objects, such as: flange nuts on fire hydrants (not top of valve stem), nails in pavement, bolts or nails driven into tree trunks or roots or other easily identifiable markings.
- 2.09 Vertical control monuments shall not be required to be located by x, y, and z coordinates provided they are tied and referenced by distances to at least two items which are located by x, y, and z coordinates. Iron pins driven into the ground are not recommended for vertical controls, unless they are outside the project construction limits and are situated so as not likely to be “disturbed” by project activities.
- 2.10 Vertical control monuments shall be provided at intervals of not more than 500’. Where steep or severe terrain is encountered, vertical control monuments shall be spaced so that there is not more than 25’ elevation difference between any two consecutive monuments. All vertical control monuments shall be shown on the Plans with a general description of the monument and the elevation of the monument referenced to mean sea level datum.
- 2.11 Vertical control monuments shall be referenced to two readily identifiable backsights by bearings and distances. Descriptions and elevations shall be provided for all vertical control monuments.

It is imperative that the Surveyor provide durable and permanent horizontal and vertical monumentation of his survey control points and that those points be installed in locations that will remain undisturbed from the time of their installation to the time “As Built” surveys are completed. Further, the Surveyor shall maintain his records and data in a form that is easily retrievable and accessible to MSD and/or other Surveyors working on MSD’s projects until the project has been completed and Record Drawings have been made.

- 2.12 Where USGS monumentation is not reasonably accessible, the Surveyor may provide ties to other types of datum as prescribed by *NCGS 89C* and *Title 21 Ch. 56*. In such cases, vertical ties shall be made to two or more MSD manholes giving both rim and invert elevations. The location and choice of such manholes shall be approved by MSD. One of the manholes shall be at or near the beginning project station and elevations shall be given for the existing sewer pipe invert at both the beginning and ending project stations. For horizontal controls where no right of way acquisition will be required and no property maps will be prepared for the project, the Surveyor may tie horizontal controls into two or more MSD manholes which have x, y, and z coordinates, provided the Surveyor shall clearly indicate on all maps and drawings the control origins. He shall also state on the maps and drawings that no USGS monumentation was within 2000 feet of the project limits or that the maps and drawings are not to be used for property or easement acquisition purposes.
- 2.13 A digital text or ASCII file of all control points and survey points shall be prepared and delivered to MSD. All such points shall contain x, y, and z coordinates and a brief description of the point and/or object.

- 2.14 A north arrow shall be shown on each sheet, properly referenced as per *NCGS 89C* and “*Board Rules*” requirements. North shall be to the top of the sheet. Digital files and coordinates shall not be rotated from the north orientation. The beginning station on all projects shall be 10+00 and shall be the low point of the project sewer centerline, unless designated otherwise by the MSD Project Engineer.
- 2.15 Unless otherwise directed by the MSD Project Engineer, the size and scale for any and all drawings and maps prepared under this contract shall be as follows:
- (a) 8.5” x 14” for easement maps at a scale as necessary to identify parcels and easements but no less than 1” = 50’, unless otherwise directed by MSD Right of Way Section.
 - (b) Other maps and drawings shall be 24” x 36” at a scale as necessary but no less than 1” = 50’.
 - (c) The above sheet sizes may be modified on a case by case basis upon approval by MSD and as permitted by *NCGS* and the Buncombe County Register of Deeds.
- 2.16 The Surveyor shall reduce all survey notes and point locations to an AutoCAD format drawing and shall provide MSD with a hard copy of the drawing(s). Such drawing shall connect point location data to form lines and symbols for objects located in the field such as curb and gutter, storm drainage pipes, catch basins, sewer manholes and pipes, etc. (*The Surveyor shall show in his maps and drawings a legend of all symbols and line types used on his map and drawing.*) The Surveyor shall also provide a copy of all drawings and point data on an AutoCAD file drawing (or other format acceptable to MSD). Where possible, topographic contour lines, creek top of bank, toe of slope, curb and gutter, and other similar objects shall be included on the drawing as polylines. NOTE: “AutoCAD format” shall mean the latest version of AutoCAD currently being used by MSD; however, earlier versions of AutoCAD up to and including AC 2002 may be used, with approval of MSD’s Project Engineer.
- 2.17 MSD shall have the full use of all information, maps, and documents provided by the Surveyor under the scope and intent of this proposal. Said information, maps, and documents may be used by MSD for the preparation of maps and drawings for the design and construction of the project and for the preparation of encroachment, easement, and right of way maps and documents as may be needed for the completion of this project or future projects. Further, MSD shall have the right to incorporate part or all of the data provided under this proposal into the database of its sanitary sewer system and to use such information as it deems fit or necessary
- 2.18 All surveys and changes thereto shall be coordinated through the MSD Project Engineer in charge of the Survey/Design project and only those directives of the MSD Project Engineer shall be valid and binding on MSD. The Surveyor may receive requests for changes, modifications, or additional services directly from other MSD personnel, such as MSD Right of Way Manager or Agent and/or MSD’s Legal Advisors preparing easement documents and title searches; however, when any such requests or changes are received which would involve additional costs to the project and MSD, the Surveyor shall notify MSD’s Project Engineer of such changes and shall receive approval from the

Project Engineer before proceeding with such changes. Failure of the Surveyor to notify MSD's Project Engineer and receive approval from the Project Engineer before proceeding may jeopardize the Surveyor's right to be paid for the additional services and costs.

- 2.19 MSD shall issue a Purchase Order for all survey work. No work may begin on a project until the Purchase Order has been issued and the Surveyor is notified by the MSD Project Engineer to proceed.
- 2.20 MSD and the Surveyor shall agree upon an overall time of completion for all survey work and for various phases of the survey work required for this project. All survey work shall be completed within those time schedules. Once the Notice to Proceed is issued by MSD, the Surveyor shall begin survey work on the project within 10 working days (or time specified in the Surveyor's proposal), hereinafter referred to as the "startup time", and the Surveyor shall work continuously until the tasks and surveys are completed. Should the Surveyor fail to commence work within the agreed upon "startup time" after the Notice to Proceed is issued or fail to complete any work task set forth in the proposal or contract within the agreed upon time schedule, MSD may, at its option, declare the Surveyor in default and the contract null and void. In the event the contract is declared null and void by MSD due to the Surveyor's failure to meet the above referenced time schedules, the Surveyor shall be eligible for payment of work completed to date provided he delivers copies of all maps, survey data and other supportive and research data to MSD within 15 days of notice of default of contract.
- 2.21 Notice of Entry on Private Property. The Surveyor shall notify MSD not less than 14 calendar days prior to his beginning of field work on all surveys so that MSD can provide notice to the property owner that the Surveyor's crews will be entering upon the property owner's property for the purpose of conducting field location surveys. MSD shall provide notice to the property owner by one of 3 methods: a) personal contact with the property owner (as listed in the Buncombe County Register of Deeds Office); b) mailing of a written notice of entry to the name and address of the property owner as listed in the Buncombe County Tax Department property files; or c) door hangers may be attached to the front door of the residence. All such notices shall give the name, address and phone number of the Surveyor, the MSD Project Engineer and Design Firm representative (if different from MSD). In addition, it shall contain a brief description of the project limits and goals and shall contain a statement inviting the property owner to make written or verbal comments on the project to the MSD Project Engineer.
- 2.22 Should the property owner ask the Surveyor or his employees to leave the property, he shall immediately comply with that request and shall immediately notify the Project Engineer that he has been refused access to such property or that he has been asked by the property owner to leave the property. The Surveyor shall enter in his field book of that day the names of all the Surveyor's employees on the property at the time of property owner's notice, date and time of property owner's notice, name of person giving notice and relationship to property owner (if different than property owner), extent of work done on property to date and any additional work needed to be done. The Surveyor shall provide the MSD Project Engineer a copy of the data entered in his field book. If the

property owner states a reason for his actions, such information shall be noted in the Surveyor's report.

- 2.23 The Surveyor shall take precaution not to cause damage to existing trees, shrubs, bushes and other physical features on private properties. Where it is necessary to trim or cut branches and/or limbs from trees, shrubs, or bushes or to otherwise damage privately owned property, the Surveyor shall take reasonable precaution to insure that any trimming or cutting is absolutely necessary and unavoidable and that such trimmings are kept to the minimum amount necessary to perform the tasks required to complete his surveying obligations. He shall not trim, cut or otherwise damage any specimen or ornamental tree, shrub or bush without written consent from MSD or the property owner. The Surveyor shall be responsible for any damages that may occur as the result of his surveying or related activities.
- 2.24 Personnel Requirements: The Surveyor shall maintain a staff of competent employees as necessary to meet all time and work schedules as may be specified in the contract. All work shall be accomplished in a timely and efficient manner so as not to cause undue delays to the project design and completion. Should the Notice to Proceed exceed 30 days from the date of submittal, the completion schedule may be adjusted to reflect such delay.
- 2.25 Completion Schedule: The Surveyor and MSD's Project Engineer shall mutually agree upon a time schedule for completion of the various phases of the survey(s). Such time schedule(s) shall be as set forth in writing in the Surveyor's Proposal and made a condition of MSD's Purchase Order. Should the Surveyor's Proposal or MSD's Purchase Order fail to include a written time schedule for completion for each phase of the survey(s), a period of 90 calendar days from the date of the issuance of the Notice to Proceed with that phase of the survey shall be deemed applicable. The Surveyor is hereby advised that failure to provide the services as specified in the contract within the time schedule may be used as a factor in future contract awards.
- 2.26 Surveyor's Project Coordinator: During the proposal stage of the contract negotiations, the Surveyor shall designate a representative from his firm as his Project Coordinator. The Project Coordinator shall: a) represent the Surveyor at all meetings and work conferences, b) be the contact person for all questions and inquiries, and c) coordinate the survey work and other aspects of the contract with MSD's Project Engineer. The decisions of the Project Coordinator shall be binding on the Surveyor.
- 2.27 Equipment Requirements: The Surveyor shall own, lease or otherwise provide equipment as necessary to perform the surveying tasks as required under this contract and as necessary to provide the maps and documentation in a format acceptable to MSD.
- 2.28 Safety Precautions – The Surveyor shall comply with State, Federal and Local rules and regulations pertaining to work place and employee safety.
- 2.29 Any and all visible or determinable encroachments and/or easements on the property being surveyed or adjacent thereto shall be accurately located and clearly indicated in the survey. The Surveyor shall be required to research existing public records of all properties through which the project limits cross or abut to verify the existence and limits of such easements or rights of way, to the extent possible.

- 2.30 The Surveyor shall be required to research existing public records and deeds as necessary to determine current ownership, property descriptions and boundaries of all parcels and land tracts through which this project crosses or abuts. The Surveyor shall locate in the field all property corners as necessary to produce a Class “A” survey and map as to comply with the requirements of *Title 21, Chapter 56* for requirements for verification of existing property lines and monumentation. In cases where no easement acquisition is to be made (i.e. all construction is to take place within existing easements or street rights of way), the Surveyor may show properties abutting the rights of way and the names of property owners based on tax map data. In such cases, the Surveyor shall clearly state in his proposal that his work scope and fee schedule includes no allowance for field location and determination of property lines and boundaries and that no right of way map preparation is anticipated or included. He shall provide sufficient survey data to secure any NCDOT or Municipal Street work permits as may be needed and shall locate all residential and commercial structures within 50' of the street right of way limits or a width as specified by the MSD Project Engineer.
- 2.31 Where project control is determined by GPS methods, all work and surveys shall meet or exceed the requirements of *NCGS Chapter 56 Section .1607 and Section .1608*.

SECTION 3 – INSURANCE REQUIREMENTS

- 3.01 Firms that successfully negotiate contracts with MSD shall have in effect during the life of the contract and shall furnish proof (when requested) of:
- (a) Public Liability Insurance in the amount of not less than \$100,000 per project or per accident for small or medium size projects and \$1,000,000 for major projects and interceptor mains.
 - (b) Workman’s Compensation Insurance (as required by State law)
- 3.02 Firms are also requested to have in effect during the life of the contract and for a reasonable period of time thereafter, Errors and Omission Insurance of not less than \$100,000 for small or medium size projects and \$1,000,000 for major lines and interceptors. If a firm does not have Errors and Omissions Insurance, they may be requested, as part of the contract negotiations and contract documents, to execute a “Hold Harmless” agreement protecting MSD, its Board of Directors and employees from any and all claims for damages by a third party for errors or omissions in the Surveyor’s work or lack thereof.

SECTION 4 - LOCATION AND PROPERTY SURVEYS

- 4.01 Location and property surveys are to be performed to identify and locate existing sewer lines and surrounding physical objects and shall meet the requirements for Boundary Surveys, “*Urban Land Surveys (Class A)*” as set forth in *Section 21-56.1603 and 21-56.1604 of Title 21, Chapter 56*. MSD will provide a general location of its sewer lines and manholes and will identify the general limits of the survey.

- 4.02 The Surveyor shall provide all equipment and manpower necessary to locate the following existing physical objects and conditions within the survey limits as defined by MSD or within 50' of the defined survey centerline, whichever is greater.
- (a) All trees 8" or larger in diameter and "specimen" trees (show approximate diameter of trees and species in notes and on all drawings). Note: Where dense tree coverage exists, treelines may be located and only specimen trees shall be required to be located. Specimen trees shall be defined as trees over 12" in diameter, trees which are of a species not commonly found in that area of the community, trees that would be of particular interest to the property owner to retain during construction, or trees that exhibit a shape, size or other attribute of special quality or rarity. Note: On projects, which (in MSD's opinion) do not warrant the additional time and expense required to locate all "specimen" trees, MSD may allow the Surveyor to only locate trees of a larger diameter. Should the Surveyor feel that a particular project would qualify for this exemption, he may submit a verbal or written request to the MSD Project Engineer for a waiver of the 12" "specimen" tree size and shall stipulate what he feels would be an acceptable diameter. The MSD Project Engineer shall review all such requests and shall respond in written form his decision to approve or disapprove the request.
 - (b) All ornamental trees, shrubs and bushes.
 - (c) Creeks, lakes, or ponds – top of bank, toe of slope, edge of water, centerline of creek, apparent high water markings and water surface elevation at time of survey shall be included. Note: At all locations where the proposed sewer line will cross a creek or waterway, the Surveyor shall provide a field cross-section of the creek/waterway crossing which accurately depicts not only the water surface elevation but the actual creek bed (ground surface) elevations. If the location of the proposed creek crossing is not in the same location as the existing crossing, the Surveyor shall take his cross-section at the proposed location, as soon as that location has been determined.
 - (d) Existing public utilities including gas lines, water mains, sewer lines, telephone lines and cables; C.A.T.V. lines and cables, water, sewer and gas service taps, meters, fire hydrants and clean-outs. Note: The Surveyor shall utilize the services of NC ONECALL or other similar utility locating services to locate all existing underground utilities. It is hereby noted that NC ONECALL "Survey Locates" allow a 10 to 14 day locate window; therefore, the Surveyor shall allow sufficient "locate" times in his proposal and shall provide notice to NC ONE CALL a minimum of 14 days prior to his beginning of surveys. Further, should NC ONE CALL not respond within the initial 14 day time limit; the Surveyor may proceed with the locate survey; however, he shall make a second request to NC ONE CALL and shall not complete his surveys until all underground utilities have been marked and located or until the expiration of the second 14 day time limit. If no action is taken on his second attempt, the Surveyor shall notify the MSD Project Engineer for further instructions as how to determine locations of underground utilities. He shall specify in the survey data and drawings the location source of underground utilities and the phone number and project reference number of the location source. If any major Public Utilities (PSNC gas lines, Progress Energy

electrical lines, Duke Energy electrical lines, Cable TV and Communications lines, AT&T underground phone and fiber optic lines, Asheville Water Authority water lines, MSD sewer lines, and other Municipal water and sewer lines) are not marked by NC ONECALL, the Surveyor shall note on his survey any major public utility that was not so located, so MSD's Project Engineer may make appropriate investigations as to if they do exist or why they were not marked. Where known or determinable private underground utilities can be determined to exist or can be marked by the private utility or owner, the Surveyor shall take appropriate steps to have such private utilities located.

- (e) Existing storm drainage facilities and structures, including catch basins, headwalls, pipes, riprap outlets, and junction boxes (inverts shall be shown for all pipes and structures as well as pipe lengths, pipe diameters and type of pipe).
- (f) Fences, walls, sidewalks, and paths.
- (g) Structures, including residential dwellings, outbuildings, barns.
- (h) Bridges and culverts.
- (i) Pavements, pavement markings, stop signs, and other traffic control features (width of pavement and type of pavement shall be indicated, traffic signal support cables and poles shall be shown as dotted lines with signal heads indicated with number of heads and direction).
- (j) Gravel areas and driveways shall be located and shown.
- (k) Lawn areas, mail boxes and newspaper boxes shall be located and shown.
- (l) Limits of wetlands and flood plains shall be shown to the extent they are identifiable. Where the Surveyor is not able to identify the limits of the wetlands, he shall indicate that they are present and should be determined by more detailed studies. The Surveyor shall indicate the limits of all floodways and flood plains as shown on the latest edition of the F.I.A. Floodway and F.I.R.M. maps. The Surveyor shall include in his survey data and shall show on all maps and drawings, the classification of all streams within 100' of the project limits.
- (m) Railroad tracks with distances to nearest milepost, width of track(s), number of tracks and railroad right of way widths.
- (n) Flower gardens and planters.
- (o) Wells and individual water supply systems
- (p) Existing MSD or private sewer systems, lines, and manholes including right of way and easement widths and limits.
- (q) Top of banks, toe of slopes, high point of peaks, low point of depressions, and other significant ground changes.

- (r) Pipe encasements and/or tunnels
 - (s) Existing property irons and corners as necessary to identify and determine property boundaries and lines. Note: It may be necessary for the Surveyor to go outside the survey limits to locate some property corners. The Surveyor shall locate any and all property corners as necessary to meet the criteria set forth in *NCGS 89C* and/or *Title 21 Chapter 56* for property surveys and plats thereof.
 - (t) Riprap outlets and ditches.
 - (u) Natural or manmade swales and ditches, F.I.A. designated floodplains and floodway limit shall be determined based on the latest H.U.D. maps.
 - (v) Other items as may be necessary or desirable for the design of the renovated sewerage system.
- 4.03 Where proposed work or improvements (such as a street widening project) are known by the Surveyor or are public information and where such improvements are determinable, the Surveyor shall make a reasonable effort to tie such improvements to the project point database. Where such public information is known or available but not determinable in the field, the Surveyor shall include in his notes and on his drawings a reference that such improvements are being proposed but that field information was not available to identify their location on the ground.
- 4.04 Format of Data: For projects that are to be designed by MSD staff personnel, all location survey data shall be provided in drawing form on AutoCAD format so that all point data may be imported into MSD's current AutoCAD program drawing file and used to prepare the necessary maps and drawings for the project design and construction. (Note: See Section 2, General Requirements, for further reference.) In addition, a digital copy of all data shall be furnished showing point numbers, coordinates, elevations and descriptions for each point or object in the location survey. Unless specific approval is granted by MSD, the Surveyor shall not dump all points onto one layer. Where data is provided in AutoCAD format, the various objects shall be drawn or the points representing the objects shall be on separate layers as described above in black or grey colors only. Existing storm drainage, sewer, water, and notes shall be in black; all other objects shall be in number 253 grey. North shall be to top of sheet, unless otherwise approved by MSD.
- 4.05 All mapping provided on AutoCAD format shall meet the requirements set forth in *Title 21 Chapter 56* and *NCGS 89C* and shall contain a legend of lines and symbols used in the drawing.
- 4.06 The location survey drawing shall show the following listed items:
- (a) Property lines, street rights of way, pavement limits, existing utilities, trees, shrubs, bushes, survey centerlines, centerline of proposed sewer, meter boxes and services, sewer clean-outs and services, easements and rights of way, structures, houses, outbuildings, garages, fences, and other items located in the field.

- (b) Name of individual property owners, tax reference numbers, PIN numbers, deed references, bearings and distances for property lines and other information for each parcel.
- (c) Title block, north arrow, vicinity sketch and sheet border.
- (d) General notes and legends for line types and symbols shall be added to the drawing as necessary to clarify, explain, or to give additional information about individual items or the overall survey. The survey data shall give x, y, and z coordinates for each point. Ground shots and horizontal control points shall be listed in such a manner so that existing ground profiles along the centerline of the proposed alignment may be plotted by MSD for centerline profile surveys. For strip topography map alignments, the Surveyor shall compute the topo grid and contours and shall show on the map those contours in 2' intervals with each 10' interval having a heavier line weight. Contours shall be polylines.
- (e) Certifications, seals, and signatures as may be required by *NCGS*, or *MSD Specifications*. The Surveyor may also attach disclaimer notices as may be needed by the Surveyor to clarify or limit his liabilities and responsibilities as permitted by the Contract Agreement. An electronic media note may be attached to the AC file drawing stating:
- (1) That the user of the data shall accept full and complete responsibility for any use of the data outside the scope of this contract;
 - (2) That the user shall not amend or revise any of the base survey data as prepared by the Surveyor;
 - (3) That should the user make any revision or amendment to the base survey data, the user shall assume any and all liabilities the Surveyor may have had for the accuracy of that particular item and its relationship to other project items; and
 - (4) That the Surveyor shall not be responsible for the accuracy of any additions to the base survey data prepared by the Surveyor except where such additions are based on erroneous information contained in the base survey data prepared by the Surveyor.
 - (5) "Electronic Media" notes, if attached to the drawing file, shall be on a layer called "electronic media" which may be turned on or off by normal AC routines.
- (f) Specific requirements of location surveys to be used for sanitary sewer designs shall include:
- (1) **No colors – use black and grey only**
 - All existing utilities – black
 - Roads and driveways – black

- Buildings and structures – black
 - Benchmarks and control points – black
 - Contours (interim) - #253 (light grey)
 - Contours (index) - #252 (darker grey)
 - Spot elevations – #253 (light grey)
- (2) Show all existing utilities as a single line with a **“0” width – different line types for different utilities.**
 - (3) Sanitary sewer shown from **center of M.H. to center of M.H.**, with a single line, “0” line width, and unique line type.
 - (4) All Text shall be MultiLine Text (known as **M Text**) with exception to “points” that have an attribute elevation, and contour labels. As we need to show Plan and Profile on each sheet we will rotate (change the UCS) the view in each viewport and as such need to rotate the text to be square with that viewport. This task is too cumbersome when single line text (Dtext) is used.
 - (5) Use **two layers only for contours (interim and index)**. Elevations shall be assigned to each contour line.
 - (6) **Points** should be **on either a points or 3D points layer**. All points shall have **elevations** assigned.
 - (7) All properties shall list the **Owner’s name, Property Identification Number and Deed Reference (Bk. & Pg.) and Plat Book / page reference (if applicable)**.

For clarification or additional information concerning these requirements, contact Dave Nisbeth, MSD Drafting Supervisor at telephone number 828-225-8279; email address: dnisbeth@msdbc.org

SECTION 5 - TOPOGRAPHIC SURVEYS AND MAPPING

- 5.01 All topographic maps and surveys shall conform to *Section 21-56.1605 and 21-56.1606 of the Board Rules for Class A surveys.*
- 5.02 All topographic surveys for sewer construction and rehabilitation projects shall be to a 2’ contour interval unless otherwise required by the MSD Project Engineer at the time of contract negotiations. Topographic contour lines shall be indicated as polylines on AC drawings.
- 5.03 All topographic surveys shall include data and information as required for location surveys. Any and all benchmarks and control datum shall be shown on the drawings and maps.

- 5.04 Aerial surveys may be used to prepare topographic surveys. All photography shall be of sufficient detail to identify all objects required in the location surveys or shall be supplemented by ground surveys as necessary to provide the detail required for location surveys. Aerial surveys shall show all ground control monuments as may be established and necessary for this project. Ground control shall have x, y, and z coordinates, be identifiable points set on easily recognized and fixed objects, and shall be tied to USGS monumentation. Aerial photographic surveys may not be used where existing tree coverage would limit the detail to the extent that creeks, buildings, roads, sewer manholes, and major trees cannot be distinguished. The Surveyor shall specify in his proposal if he will be using aerial photography for topographic and/or location surveys. All aerial photography used to prepare topographic mapping and surveys shall be flown and completed by certified and licensed personnel in the field of photogrammetry. A digital copy of the aerial topography maps (in AutoCAD format) shall be provided to MSD as part of the project data. If topographic maps are made from aerial photography, all creek crossings must be supplemented by actual field cross-sections showing the creek bottom profile.
- 5.05 All topographic surveys shall be signed and sealed by a Professional Land Surveyor duly registered in the State of North Carolina.

SECTION 6 – AS-BUILT SURVEYS AND DRAWINGS

- 6.01 MSD may require “as built” surveys and drawings to be prepared by the Surveyor upon the completion of construction on the project. As Built surveys shall be provided by the Surveyor upon request by the MSD Project Engineer; however, the Surveyor shall include in his proposal a fee to be charged should “as built” surveys be necessary. The following data shall be secured by the Surveyor from physical surveys of the completed construction:
- (a) The location of all manholes (center of manhole ring and cover with x, y, z coordinates)
 - (b) Any changes to existing utilities, roadway pavements, ditches, etc. that varied from project plans.
 - (c) Location of service laterals and taps for water and/or sewer installed under project construction. “As-Built” surveys are to be made only upon approval by MSD and the issuance of a Purchase Order for such work.
- 6.02 MSD’s Construction Management Division shall provide construction “mark-up” drawings for the Surveyor’s use in performing “as-built” drawings; however, MSD shall not be responsible for the accuracy of such drawings. As-Built data provided by the Surveyor shall be in the form of an ASCII file of manhole numbers and x, y & z coordinates.
- 6.03 At the completion of the project construction, the MSD Project Engineer or Engineer of Record shall review the project construction and issue a Certificate of Conformance to project Plans and Specifications. Such certification shall state that the project was constructed in substantial conformance to the project Plans as approved by the NCDENR

or shall list all known areas where changes were made from the approved project plans and specifications or to NCDENR rules and regulations.

SECTION 7 - GENERAL REQUIREMENTS FOR EASEMENT MAPS

- 7.01 All maps and drawings prepared for easement acquisition of MSD's sewer lines or other improvements shall meet *N.C.G.S. 47-30*, and *NC Board Rules* for record maps and Class "A" surveys and shall be signed and sealed by a Professional Land Surveyor duly licensed by the State of North Carolina.
- 7.02 In addition to information required by the Buncombe County Register of Deeds, State Statutes and surveying standards of practice, easement maps shall comply with all items shown below. Separate maps shall be prepared for each parcel unless otherwise directed by the MSD Right of Way Section and shall be of a map size and scale as specified in paragraph 2.15.
- (a) Show record owner(s) of subject parcel, including PIN number and Deed reference.
 - (b) Show record owner(s) of any adjoining parcels, including PIN numbers and Deed references.
 - (c) Show the limits of the property from which the easement is to be acquired along with bearings and distances sufficient to describe the parcel boundary. If the property is large or some property lines are indeterminable without extensive surveying and those lines are not involved in the determination of the easement limits, the Surveyor may show such lines as "unsurveyed lines" provided they are so indicated on the map and meet the standards set forth in *NCGS 89C* and *Title 21 Chapter 56*.
 - (d) Show the limits of the easement to be acquired along with bearings and distances sufficient to describe the limits and areas of the easement. Surveyor may use line tables for all bearings and distances OR show bearings and distances around each line segment if scale and room on the drawing allows for clear reading of information. However, do not mix the two methodologies; use one or the other. If use of a line table is employed, number the corresponding line segments, or "L" numbers (or "C" numbers) in ascending order from the beginning point of the permanent easement and continue in one direction around the permanent easement(s), then the temporary construction easement(s). Do not switch directions.
 - (e) All other lines relevant to the property or easement description shall have bearings and distances shown on the plat.
 - (f) Show all existing, known and/or recorded easements and rights of way crossing or within 50' of the proposed MSD easement.
 - (g) The Title Block shall be titled "*Easement across the Property of (owner's name)*" and shall show a scale, date of survey, date of map, name of surveying firm,

address and phone number of firm, and other data as may be necessary or required. The title block shall also include an area and format for map revisions including a short description of the revision and the date of such revision.

- (h) All public streets and rights of way shall be shown and properly labeled. The name of streets and state road numbers (where applicable) shall be shown. The recorded or assumed street right of way width shall be shown.
- (i) The following notes shall be included on the plat:
 - 1) All distances are NC Grid distances unless otherwise noted.
 - 2) All bearings are based on N.C. Grid bearings.
 - 3) Combined grid distance factor used to calculate grid coordinates is _____.
 - 4) No corners were set unless otherwise noted.
- (j) Label the width of the permanent easement and the width of the temporary construction easement. Do not combine the widths. Distinguish between the proposed sewer line and any existing sewer line(s) shown on the drawing either by distinguishing line styles or symbology.
- (k) A legend shall be provided on the map for all line types and symbols.
- (l) A vicinity sketch shall be shown on all easement maps. The vicinity sketch shall contain a north arrow and shall show sufficient detail to determine the general site location and area. If drawn to scale, the scale shall be shown in the vicinity sketch block or if not drawn to scale, shall show the statement "not to scale" or "no scale".
- (m) The method of calculation of all areas shown on the map shall be indicated.
- (n) An area table shall be included showing only the square footage/acreage of the permanent easement and temporary construction easement depicted. Specific language for said table is shown below:

Permanent Easement = *(insert square footage)* OR *(insert acreage)*

Temporary Construction Easement = *(insert square footage)* OR *(insert acreage)*

If the Permanent Easement and/or the Temporary Construction Easement is very small, contact the MSD Project Engineer to determine if the sewer centerline can be shifted to avoid the parcel.

- (o) If the MSD Project Engineer directs that existing easement areas are to be netted out of any new permanent easement areas, the "Net New Easement Areas" form, attached to these standards is to be used in calculation of said areas. The MSD Project Engineer will determine, based on MSD's locations of the existing lines, which parcels, if any, are to be netted. Any questions regarding the calculation and use of this form are to be directed to MSD's ROW Manager.

- (p) At least one corner of the subject property OR permanent easement shall be tied to NC State Plane Coordinate system. If tying to a property corner, the bearings distances from that property corner and the beginning point of the permanent easement shall be provided.
- (q) All houses and structures within 50 feet of the proposed sewer center line shall be shown unless otherwise directed by the MSD Project Engineer. Where houses or structures would fall within the limits of the proposed permanent or temporary construction easements, the Surveyor shall notify the MSD Project Engineer and shall adjust the limits of the easement so that the structure is not within the limits of the easement unless directed otherwise. In such cases, the limits of the easement shall be no closer than 1' from the building footing. The map shall show the width of the easement (from centerline easement to outside boundary) for both temporary construction and permanent easements. Unless directed otherwise by the MSD Project Engineer, no easement line shall be shown bisecting or going through a residential dwelling.
- (r) A north arrow shall be shown with north being to the top of the sheet unless otherwise agreed by the MSD ROW Manager. The datum source for the project north orientation shall be shown on the map.
- (s) Other items shall be shown on the easement or property map as directed by MSD and as needed to satisfy property owner's requirements and negotiation. Be clear and consistent using the same line styles, colors, symbology, etc. for all plats. Review all plats for errors BEFORE submittal to MSD.
- (t) MSD's project name and project number shall be shown on each plat.
- (u) The Surveyor shall place on the easement map the following certifications plus those required by state statutes for maps to be filed and recorded in the Register of Deeds Office of Buncombe County:

(1) CERTIFICATION OF REVIEW OFFICER

State of North Carolina
 County of Buncombe

I, _____, Review Officer of Buncombe County, certify that the map or plat to which this certification is affixed meets all statutory requirements for recording.

 Review Officer

Date: _____

(2) SURVEYOR'S STATEMENT

This plat represents an actual field survey that meets or exceeds the requirements of a Class "A" Survey in accordance with the Standards of Practice for Land Surveying in the State of North Carolina.

(Signature of Surveyor)

(NC License Number)

- 7.03 The Surveyor shall provide a unit price per parcel for easement maps and related survey work.
- 7.04 During the easement acquisition phase of the project, MSD Right of Way Section may request that the easement limits be staked across certain properties so that the property owner can identify the location of the sewer line and the area of taking. When requested by MSD Right of Way Section, the Surveyor shall stake the centerline at control points, manholes, and 50' intervals (25' intervals may be required on some projects) of sewer lines across those parcels as requested. Such staking shall also include placing survey stakes or other markers at the limits of the permanent and temporary construction easements when necessary to identify the easement areas across each parcel where easement staking is requested. Where easement limits are in close proximity to homes and dwellings, survey markers shall be placed so as to readily identify the limits of the easement in the vicinity of the homes or structure. All stakes shall be "flagged" with colored flagging tape and shall contain sufficient markings so as to clearly identify the station number and the type and width of the easement. The Surveyor shall provide an item in his proposal entitled "Assistance During Easement Acquisition" for work done under this provision and shall specify an hourly rate, estimated hours per parcel and cost not to exceed per parcel. Payment for services under this item shall be on an hourly basis at the specified hourly rate but the total cost per parcel shall not exceed maximum fee per parcel as quoted in the proposal. All flagging of properties for easement acquisition shall be coordinated through the MSD Project Engineer and the MSD Right of Way Section's project representative.
- 7.05 On most projects, some additional locations and/or staking will be required due to property owner requirements during easement negotiations. Where such locations are of items that should have been located during the initial location or alignment surveys, such locations shall be considered, as incidental to the survey contract and no additional compensation shall be allowed. However, where such surveys are the results of changes made to the original alignment or easement boundaries or a significant amount of re-staking, the Contractor may request additional compensation. Such compensation shall be negotiated and approved prior to beginning the additional work.
- 7.06 The Surveyor shall provide one preliminary easement map of each parcel for review and approval by the MSD Project Engineer and MSD Right of Way Manager. Upon approval, three (3) original, signed and seals maps for each parcel, along with one original net new sheet (if applicable) shall be forwarded to the MSD Right of Way Manager for use in preparation of legal documents and easement acquisition. Should revisions be necessary to the map, additional copies of the revised map shall be provided as follows:

- (a) For revisions involving alignment changes or major map revisions caused by MSD or property owner design changes, copies and distribution of revised maps shall be the same as above.
 - (b) For revisions involving clerical changes such as name of owners, correction of bearings or distances, correction of spelling errors, etc., map revisions shall be sent directly to MSD Right of Way Manager.
- 7.07 A total of up to five (5) copies of the easement maps shall be included in the Surveyor's cost per parcel for plats and shall be provided at no additional cost to MSD. When more than five (5) copies of the original map and revised maps for any one parcel are needed, the Surveyor may charge for such additional copies at the cost of reproduction, provided he has included within his survey proposal and fee schedule a "contingency allowance for additional map reproduction". Where additional copies of maps and drawings are needed to correct errors and/or omissions made by the Surveyor, those copies shall not be included within the five (5) copy limit and no additional compensation shall be due the Surveyor for the cost of those copies.

SECTION 8 – SUPPLEMENTAL INFORMATION AND CONDITIONS

- 8.01 NAD 27 / NAD 83 Datum: MSD's GIS Division is converting their sewer mapping data base and files to NAD 83 datum.
- (a) All new surveys, maps and drawings for projects beginning after February 1, 2009 shall be required to be on NAD 83 datum
 - (b) All surveys, mapping and drawings for projects that began prior to February 1, 2009 shall be in the NAD 27 datum.

Note: For surveys not within 2000' of a USGS monument, "Local" datum may be used as permitted by NCGS and when approved by MSD's Project Engineer.

All mapping and files, regardless of their date of preparation, shall clearly indicate which datum (NAD 27 or NAD 83 or otherwise) they are based.

- 8.02 AutoCAD Files and Drawings: MSD's Survey Specifications requires all data to be in AutoCAD 2002 (or later format) prior to delivery to MSD's Engineering Design section. Projects done in MicroStation format and converted to AutoCAD format, do not provide a true AutoCAD 2002 format and the drawings are not to the usual AutoCAD 1:1 dimensionless scale. (I.e. A line that was supposed to be 40' in length will measure 480' when measured by the "List" or "Distance" command of AutoCAD. Needless to say, conversion and calculation of measurements is a great problem. Therefore, **if the Surveyor does not do his initial data input and base drawing in true AutoCAD programming, he shall be required to inform MSD prior to doing the work and shall be required to take whatever steps necessary to provide MSD with a True AutoCAD Format drawing.** See Section 2.16 for the acceptable versions of AutoCAD.

- 8.03 Drawing Layers: Most Surveyors use data collectors with preset layers for various types of structures and other items. In some cases, there are layers created for each type of structure and the total number of layers may exceed 100 or 300 layers (many of which are not used). MSD does not propose to tell the Surveyor how to set up his data collection procedure or his drawing layer system; however, MSD does not want a drawing with 300 (or even 100) layers in it. Surveyor may be requested to “purge” un-used layers or to consolidate layers so that the total number of layers is manageable and reasonable. Again, if Surveyor has an unusual layer system or a system that utilizes a large number of layers, it is suggested that he discuss that issue with the MSD Project Engineer and the Design Supervisor during or before contract negotiations and definitely before beginning their work. The Survey Specifications require that the Surveyor give MSD a written copy of their layer system and what MSD might expect on each layer. This has not been required for most surveys; however, it will be required if the Surveyor’s drawing comes in with a large number of layers or an unusual layer system so MSD can determine which layers they need to work with. **MSD’s Specifications shall be revised to limit the number of layers in a drawing file to 50 layers for small projects and 75 layers for large projects, unless specifically approved otherwise by MSD’s Project Engineer.**
- 8.04 On projects that do not, in the opinion of the MSD Project Engineer, warrant the level of survey and data collection as specified above, the MSD Project Engineer may waive some of the above requirements and items to be included in the surveys, except those required by State Bidding and Procurement Statutes or NC Board of Registration Rules, Regulations and/or Standards and further provide that such exceptions are noted in the Engineer’s RFP, in the Surveyor’s written Proposal and are made a part of the Purchase Order conditions and provisions.

SECTION 9 - SURVEY AND FEE PROPOSAL

- 9.01 The Surveyor shall submit a proposal setting forth the tasks he considers necessary to make and complete the surveys and mapping as required by MSD for the project design, right of way acquisition, and project construction. Note: Staking of project for construction shall not be a part of this proposal as that work will be required to be provided by the successful general contractor as part of the cost of construction. (The Surveyor may negotiate with the general contractor for surveying services related to staking of the project for construction; however, those services shall be outside the scope and payment of this proposal. The Surveyor shall complete any and all obligations to MSD, except for “as-built surveys” before entering into any agreement with the General Contractor and shall have no further contracts with MSD pertaining to this project, so as not to present any conflict of interest or appearance of a conflict of interest.)
- 9.02 The Surveyor shall specify the amount of compensation for each task and the time required to complete each task. In general, the tasks shall be as follows:
- (a) General project research including walking property, deed research, and preparation of list and addresses of property owners by parcels, also including research to identify and locate USGS and NC Grid control monuments and ties.
 - (b) Staking of survey base line and ties to USGS/NC Grid monumentation.

- (c) Locations and elevations along baseline.
- (d) Conversion of survey data to MSD formats and mapping, including plots of all points and objects in location/baseline surveys. Maps to be in AutoCAD 2002 (or later) format showing sewer line, manholes, creeks, trees, shrubs, bushes, roadways, structures, utilities and property corners. Approximate property lines shall be shown.
- (d) Preparation of easement maps for each parcel that will be affected by the project. Fee should be on a per parcel basis with the total number of plats anticipated to be needed shown. Where MSD's negotiations with the property owner results in major revisions to the right of way maps and drawings, such work shall be considered as "Extra Work" and the Surveyor shall be eligible for additional compensation provided that any and all additional fees and services are approved by the MSD Project Engineer and appropriate Change Orders and Purchase Orders have been issued prior to the commencement of such work. Failure of the Surveyor to secure approval by the MSD Project Engineer and have all necessary Purchase Orders issued prior to commencement of any work that he considers as Extra Work, may affect his ability to secure additional compensation for such work. Major revisions to the right of way maps and drawings shall be defined as those changes that:
 - (1) Are not changes needed to correct errors or omissions made by the Surveyor on the initial map or survey; or
 - (2) Are not changes to the property owner name, deed references and property addresses; and
 - (3) Cause significant redrawing of the map or plat; and
 - (4) Were caused by significant sewer alignment changes; or
 - (5) Were caused by significant changes to the easement boundaries (shifting of easement limits to remove easement from houses and structures are not considered as major changes to easement boundaries).

All changes that are not considered as "major revisions" shall be considered as incidental to the contract and shall be included in the Surveyor's fee per parcel for the easement plats and maps.
- (f) Extra Work - This item shall be on a negotiated basis or at an hourly basis to be determined at the time such services are needed. The Surveyor shall specify an hourly rate that may be used on extra work items.
- (g) The Surveyor's fee for "Extended Surveys" and "Court Surveys" as defined.

9.03 Setting of Property Corners Disturbed by Construction: The restoration of property corners disturbed by construction shall be the responsibility of the general construction contractor. The Surveyor shall not include this item in his proposal unless specifically

requested by MSD. The Surveyor shall provide sufficient information in the project survey data so that any existing property corner located and found in the field may be replaced using the project control monumentation.

- 9.04 As-Built maps and drawings: The Surveyor shall include in his fee proposal an optional item and fee for "as-built surveys". At the conclusion of construction, MSD shall evaluate the need for an as-built survey and shall notify the Surveyor if such work is needed.
- 9.05 The Surveyor shall specify the "Time of Completion" in calendar days in which he shall be completed with all services provided under this contract and the total fee for all services except for "Extra Work" items. The Surveyor shall commence work on this project within 10 days of receipt of the Notice to Proceed. The "Time of Completion" of the services provided under this contract shall begin on the date of issuance of the Notice to Proceed and shall run continuously from that date. Should the Surveyor feel that inclement weather has affected his completion date and schedule, he may request an extension of the "Time of Completion" provided he can show justification for such an extension.
- 9.06 The Surveyor shall designate a representative from his firm as Project Coordinator.
- 9.07 The Surveyor shall list in his proposal his Professional Land Surveying registration number and corporate registration number (if an incorporated firm).
- 9.08 The Surveyor shall list in his proposal the name of his firm, the mailing and office address, the phone number of his office along with any cellular or mobile phones, beeper numbers, fax number and pager numbers.
- 9.09 The Surveyor shall list in his proposal the name and title of key personnel to be used on this project along with their approximate years of professional experience and any special qualifications or certifications.
- 9.10 The Surveyor shall specify the version of AutoCAD or other CAD drafting program and the type of surveying equipment he will be using on the project.
- 9.11 The Surveyor shall specify the type of surveys that are to be performed (ie. aerial photography, radial locations, centerline stakeout with incremental levels, etc.).
- 9.12 The Surveyor shall include in his fee proposal a section for "Staking of Easements and Rights of Way during Rights of Way Acquisition Phase". This item shall include surveys required under Section 6 and shall include an hourly rate, estimated number of hours per parcel, and a cost not to exceed per parcel. MSD Right of Way Section shall determine the location and parcels where such staking is needed. Payment shall be based on the hourly rate and number of hours involved in the staking surveys with the maximum allowable payment being the "not to exceed" amount per parcel.

SECTION 10 – LOGISTICAL PROCEDURES

10.01 Upon award of contract, the following shall be done:

- (a) Surveyor shall immediately begin deed research and secure other data necessary to begin the surveying process. Surveyor to prepare a list of all property owners (with mailing addresses) along route of survey alignment (listing on County Tax Mapping may be used for this listing).
- (b) Surveyor shall notify property owners of the beginning of the project survey.
- (c) Surveyor shall enter upon property to perform location surveys. Surveyor shall establish survey baseline and tie to USGS monumentation. Surveyor shall perform location survey using baseline as datum reference.
- (d) Surveyor shall prepare maps of survey location data showing all items as located (AutoCAD format).
- (e) Surveyor shall submit map and data to MSD Project Engineer in preliminary form for review and analysis.
- (f) MSD Project Engineer shall select preliminary sewer construction alignment.
- (g) MSD shall schedule a public meeting (as deemed necessary or needed by MSD) to inform general public and property owners of the impact of the project upon public and private properties and to gather public comments and recommendations on the project scope and design. Plans and Specifications shall be modified (as deemed necessary or needed by MSD) to accommodate appropriate public comments.
- (h)
 - (1) Surveyor to stake out alignment in field, setting control points and profiling centerline. Additional location shall be made as needed; or
 - (2) Surveyor shall prepare a strip topographic map from the data collected from the field location survey and shall show the sewer centerline alignment on the topographic map; or
 - (3) Surveyor shall prepare a strip topographic map from photogrammetric data secured from aerial surveys. Horizontal and vertical controls for such surveys shall be established on the ground using easily recognized and fixed objects approved by MSD. X, y and z coordinates of all ground control monuments shall be established by normal surveying procedures or GPS and tied to USGS monuments. For coordinates established by GPS methods, such surveys shall meet *NCGS* statutes for accuracy and ties. All aerial surveys shall be of sufficient detail to identify objects as specified for the location surveys.
- (i) Surveyor shall prepare maps of new data secured by alignment or topographic survey and deliver to MSD.

- (j) MSD shall prepare project design maps and drawings.
- (k) Surveyor shall make additional field surveys as necessary to prepare right of way and easement maps for each parcel from which right of way or easements are to be acquired.
- (l) Surveyor shall prepare property maps for acquisition of rights of way and easements. Copies of all maps are to be delivered to MSD Project Engineer for review and approval prior to delivery to MSD Right of Way Section.
- (m) MSD Right of Way Section shall have the full use of all easement maps and plats for preparation of right of way documents, legal descriptions of “taking” and negotiations with property owners. MSD Right of Way Section shall notify the MSD Project Engineer of revisions to maps as necessitated by right of way negotiations. Surveyor shall make all revisions authorized by MSD Project Engineer and shall deliver copies of revised mapping to MSD Project Engineer for approval and delivery to MSD Right of Way Section. (See routing instructions in Section 7). Where MSD’s negotiations with the property owner resulted in major revisions or alignment changes to the right of way maps and drawings, such work shall be considered as “Extra Work” and the Surveyor shall be eligible for additional compensation provided that any and all additional fees and services are approved by the MSD Project Engineer and appropriate Change Orders and Purchase Orders have been issued prior to the commencement of such work. Major revisions to the right of way maps and drawings shall be defined as those changes that:
 - (1) Are not changes needed to correct errors or omissions made by the Surveyor on the initial map or survey; or
 - (2) Are not changes to the property owner name, deed references and property addresses, except where such changes are necessitated by changes in property ownership occurring after the original map or plat had been approved by the Project Engineer; or
 - (3) Cause significant redrawing of the map or plat; or
 - (4) Were caused by significant sewer alignment changes; or
 - (5) Were caused by significant changes to the easement boundaries (shifting of easement limits to remove easement from houses and structures are not considered as major changes to easement boundaries).

All changes that are not considered as “major revisions” shall be considered as incidental to the contract and shall be included in the Surveyor’s fee per parcel for the easement plats and maps. The map revisions may be requested directly from MSD Right of way Section and the Surveyor may correspond directly with MSD Right of way Section for those corrections.

- (n) Should survey work be required for additional location surveys, property boundary surveys, project staking, and/or topographic surveys outside the scope and limits of this contract, these surveys and work shall be considered as “Extra Work” and further negotiations shall be required to determine the scope, limits and compensation for such work.
- (o) The work described above shall be included in the “Basic Survey” phase of the project. Should condemnation of properties for easements and rights of way be necessary or should right of way negotiations proceed to the point that formal right of way appraisals are needed, MSD Right of Way Section shall contact the Surveyor and request that he submit a fee proposal to perform the surveys and mapping as necessary for the “Appraisal/Condemnation Easement Maps” and “Court Easement Maps”. Such surveys shall be in addition to the “Basic Survey” fee and shall include additional surveys and mapping as necessary to provide the details and information as may be required and enumerated by MSD Right of Way on a plat by plat basis.

SECTION 11 - ATTACHMENTS

11.01 The following items are being attached to these specifications for the Surveyor’s use and reference:

Attachment "A" - Sample copies of easement maps and location formats are hereby attached for the Surveyor’s guidance and information. The final maps produced by the Surveyor shall be in substantial conformity with the contents, format and appearance of these example drawings.

Attachment "B" - MSD Easement Width Chart showing easement width requirements for sewer line diameter vs. trench depth.

Attachment “C” - Net New Easement Form.