

TOPOGRAPHIC SURVEY

Topographic survey shall contain all of the following items below:

General drawing requirements

- (1) Topographic survey to extend 100 feet beyond the project limits and to include the far side of adjacent roadways and railroads, including utilities and drainage features, regardless if such improvements extend beyond such survey limits. In the case of lines that drain by gravity, Surveyor to also include information for the first manhole that extends beyond the project/survey limits (both upstream and downstream), regardless if they extend beyond such project/survey limits. Topographic limits shall also include a minimum of 200 feet, in all directions, from road intersections on or adjacent to the site. Surveyor to contact the appropriate local jurisdictions to verify that this coverage will meet the requirements for development of the project based on local ordinance and plan review requirements and shall be responsible for including such additional coverage in the scope of services.
- (2) Scale (including graphic), generally not exceeding 1 inch equals 50 feet, such that the survey is legible.
- (3) North orientation of plat (toward top of drawing preferred)
- (4) Legend detailing all symbols, linetypes and abbreviations used on the survey when not otherwise noted on the survey
- (5) Vicinity map (with nearby highways and major intersections) with site shown downloaded from the Internet or obtained from a mapping program and augmented with street or other labels to clearly indicate the location of the property.

Topographic Information

- (1) The boundary of the property based on prior survey, plat, or deed with mathematical dimensions and directions, including curve data (arc length, delta, radius, chord and chord bearing). Include record boundary description on the survey and the recording information, including date, for the description. Topographic data to be tied to controlling physical monuments along the boundary or to monuments on or beyond the surveyed premises on which establishment of the boundary of the surveyed premises are dependent, when at least two controlling monuments are not found along the boundary of the property. Topographic survey to be based on local state plane coordinates or other basis as may be required by the local jurisdictions.
- (2) A detailed description of benchmarks and their datum, along with the source benchmark and datum used for the survey, including the conversion factor between datums, such as NGVD 1929 and NAVD 1988. Benchmarks shall generally be provided along roads or railroads adjacent to the property at approximate 1000-foot intervals, with a minimum requirement of two (2) benchmarks along each road/railroad. A minimum of three (3) benchmarks shall be provided at all sites and shall be located on or immediately adjacent to the site. Acceptable benchmarks include crosses cut in concrete surfaces that are anticipated to remain on the site after development, railroad spikes or minimum 2-inch long nails (such as PK) in poles, or 5-foot long T-posts (fence posts) driven to within 6-inches of the ground surface. Rebar or other similar monuments driven into the ground are not acceptable as permanent benchmarks. Benchmark elevations to be published to nearest 0.01 feet.
- (3) Certification that vertical closure on level loops used on the project does not exceed $0.033 \times \text{SQRT}(L \times 0.0003)$, where L is the length of the level loop in feet.
- (4) Where existing topographic data is available adjacent to or within the survey area, match all new work to existing survey maps to provide topographic continuity. Surveyor must verify the present day accuracy of all data prior to incorporation into their work.
- (5) A list showing all the control points used for the survey. Show the north and east ground coordinates, elevation, and a description for each control point.

- (6) Provide contours at 1-foot intervals, except in areas where the slope is greater than 2:1, where the contours can be shown at 5-foot intervals, with error not to exceed one-half of the contour interval. Provide spot elevations on paving and other hard surfaces to the nearest 0.01 foot. Provide spot elevations on other surfaces to the nearest 0.1 foot. Provide spot elevations, covering the entire survey limits showing high points, low points, grade changes, and at sufficient intervals to represent the general character of the terrain, including, but not limited to, the following locations: (1) along all grade break points and lines, (2) in areas where the slope is less than 5:1 on a 50-foot square grid, (3) on the top (at back) and bottom (at face/gutter) of curbs, and on both sides of walks, at 50-foot intervals and appropriately at breaks in grade, (4) on roadways and driveways at the crown and at other cross-slope grade breaks, at 50-foot intervals, (5) on railroads at 100-foot intervals at the centerline of track and top of rail, in addition to appropriate grade breaks. Contours and spot elevations shall be constructed at their actual elevation. Spot elevations and points shall be appropriately sized and oriented such that they are legible on a printed copy of the survey.
- (7) The topographic survey shall include a 3D digital terrain model (DTM) of the site and all adjacent areas included in the survey. Contours and elevations shown on the plan shall be on their actual elevation and represented properly in the DTM. The Surveyor shall utilize modeling software that is compatible with the current software utilized by Owner and shall include all breakpoints, breaklines, slopes, grades, and elevations in the DTM. The DTM shall exclude all points that are not representative of the ground surface (i.e. manholes, utility boxes, fences, monuments, etc.). The DTM shall be submitted to Owner and any errors in the DTM shall be corrected by the Surveyor. In the event that the topographic survey is generated by aerial mapping, the survey shall include the DTM used in the mapping to generate the contours and topographic information and shall include a digital orthorectified photograph in the drawing on the same coordinate basis as the survey.
- (8) Provide extent and area of offsite watershed draining onto or through the property based on available USGS or local GIS mapping and site inspection as may be necessary.
- (9) Provide locations of structures and slabs, including all corners. Provide elevations for each floor, and at each entrance of the structures, and at corners of slabs. Include items such as retaining walls, bridges, culverts, street or road paving, entrance drive openings, tanks, fences, ramps, guardrails, miscellaneous structures, driveways, or other obstructions and sidewalks.
- (10) Show mean elevation and extent of water in excavations, wells, and bodies of water. Show lakes, rivers, streams, drainage courses, and legal or regulated drains on or near the surveyed parcel.
- (11) Show all miscellaneous features, including signs, lights, parking lot striping, benches, waste receptacles, bicycle racks, etc.
- (12) Provide utility information and show locations and elevations of overhead and underground utilities. The following items (below) are to be shown based on record utility information and on survey measurements of accessible utility appurtenances. In the event that elevation information is not provided from those sources, then the Surveyor shall obtain them through a private utility locating service. The surveyor shall contact the state underground locating service (and include the dig ticket number and date on the survey) or the utility company (when they are not part of the state underground utility locating service) and obtain all relevant mapping and markings, including those which may be within adjoining public rights-of-way. Available utility maps and utilities shown on a local GIS shall also be included with appropriate notes or indications as to the source of the information. Generally, utility companies do not keep records of private utilities on private property and may not mark locations on site. In that case or in the event that a known utility line is not marked, the Surveyor shall contract with a private utility locating service in order to sufficiently locate the lines (location and elevation) and show them on the survey.
- (13) Location, description, elevation, size, and direction of flow of sanitary sewers, storm sewers, combination sewers, storm drains, culverts, and their appurtenances. Include manholes and other structures such as culverts, headwalls, catch basins and clean-outs. Provide rim elevations of each catch basin and manhole, including the bottom of sumped structures, and the invert elevation of each pipe. When inverts are not accessible (i.e. hooded), so note, and provide the water level in the structure.
- (14) Location, description, elevation, and size of water, gas, steam, condensate, and chilled water lines, and their appurtenances. Include water valves, standpipes, regulators, fire hydrants, markers, gas valves,

meters, and gas line markers, steam manholes and vaults, etc. Provide rim elevation and top of pipe elevations at valves, meter pits, and other appurtenances where these utilities are accessible.

- (15) Location, description, elevation, and characteristics of power, communication, cable television, lighting, petroleum, and traffic control, and their appurtenances. Include power poles, guy wires, anchors, vaults, telephone poles, manholes, boxes, transformers, lamp poles, light boxes, etc.
- (16) Name of the operating authority, including contact person and phone number, for each utility indicated above. Include lines connecting all structures and markers for each utility indicated above.
- (17) Location and elevation of the 100 year floodplain based on available mapping, if applicable, for the surveyed parcel, including the mapped floodway, based on FEMA maps or modeling done by an appropriate state agency based on an inquiry by the Surveyor with said agencies. The elevation component of this item is not applicable for areas without a mapped flood elevation.
- (18) Location, elevation, and area of swamps, or wetland limits based on available mapping or if determined by other experts.
- (19) Location of visible rock formations.
- (20) Show test boring locations or monitoring wells and the elevation at the top of the holes/wells.
- (21) Show perimeter outline, only, of woods and thickly vegetated areas, unless otherwise instructed by Owner. Show individual trees when they are required by a local jurisdiction, caliper measured 3 feet above the ground, including the caliper and canopy size. Include other trees when they have been flagged by the Owner or Owner. Surveyor to contact the appropriate local jurisdictions to verify whether a tree coverage survey is needed and that this survey will meet the requirements for development of the project based on local ordinance and plan review requirements.
- (22) Provide a description of any natural features and note the type of ground cover/vegetation within the extents of the survey.
- (23) Names of streets and highways abutting or adjoining property, including jurisdiction, width, and type of pavement and address numbers assigned to the parcel, as applicable
- (24) On railroads, the drawing shall indicate the rail data (raised lettering on the side of the rail) for the entire limits of the topographic survey.
- (25) Widths of known or recorded Rights-of-way (if variable, indicate as "variable" and provide appropriate dimensions to define it) along with source of information
- (26) Platted setback or building restriction and easement lines recorded on subdivision plat, restrictive covenants, or on other record documents delivered to the surveyor
- (27) Upon completion and acceptance by Owner, furnish one reproducible mylar, three prints, an Adobe Reader (.pdf) and AutoCad (.dwg) compatible with the current versions of Owner's software. The drawing shall utilize layer naming conventions, line types, and line weights such that each identifiable item is on a unique layer. There shall be no entities on layer zero. The drawing shall be purged of all unused blocks, layers, linetypes, and fonts before submittal.