Arlington Board of Survey

Rules and Regulations Governing the Design and Installation of Streets and Utilities, Arlington, MA

Draft: March 27, 2008

General

The Board of Survey may waive strict compliance with any provision of these rules and regulations on finding that such action is in the public interest.

If a proposed development contains wetlands or extends into the wetland buffer zone, Conservation Commission approval must be obtained prior to submitting plans to the Board of Survey.

The title of plot plans must state the location, owner's name and address, scale, date and name and address of the surveyor. The plot must show north point, areas of all lots, length and bearing of all lot lines, their angles of intersection and the distance on the street line from stone bounds to the nearest lot line, radius and length of curves, ownership and location of abutting property or passageways, street lines, fences, walls, buildings, boundary monuments, natural monuments, waterways and natural drainage courses. If topography is such that it will be necessary to locate certain sewers or drains outside the street, a right-of-way shall be reserved for their location and referred to and described on the plot plan.

The Board of Survey may require that security be posted to guarantee the completion of improvements.

Names of proposed streets must be satisfactory to the Board of Survey and must have Board approval before being placed on plans.

Work done on connecting streets shall require full repaving of the entire width of the street. A trench patch will not suffice.

The sub-divider shall facilitate inspection of work by the Town Engineer and provide tests of materials by independent laboratories when requested.

If any provision of these Rules and Regulations or the administration thereof shall be held unconstitutional, invalid or void, it shall not affect any other provision of these Rules and Regulations or the administration thereof.

A Certified List of Abutters is required. It must include the names and mailing addresses of all property owners within three hundred (300) feet of the boundaries of the parcel of land being developed. Abutters must be notified at least 14 days prior to the first public hearing on the development.

All expenses for advertising and notification to abutters shall be paid by the developer.

A filing and inspection fee is required at the time plans are submitted for review.

Plans must show boundaries and character of all existing and proposed easements within or immediately adjacent to the development.

Plans must show boundaries of any existing or proposed areas dedicated to public use.

Profiles must be submitted on separate sheets from the plot plan.

Plans must show topography with contour intervals of not greater than two (2) feet. Figures of elevation to represent the natural surface may be provided in addition to contours.

Plans must show the One Hundred (100) Year Flood Profile as shown on the National Flood Insurance Program Maps issued by the Federal Emergency Management Agency (FEMA).

Plans shall be prepared, signed and sealed by a Registered Professional Engineer and/or a Registered Land Surveyor. Plans shall be legibly drawn in accordance with the recording rules adopted by the Registry of Deeds. Plans shall be at a scale of 1 inch = 40 feet or such other scale as the Board of Survey approves prior to the plan being submitted. Sheet sizes shall be 24 inches by 36 inches with margins of 1.5 inches on the left and all others 3/4 of an inch. If multiple sheets are used they shall be accompanied by an index sheet showing the entire subdivision. The plan shall be drawn in black ink on mylar or linen.

Control datum shall be clearly stated on the plans. All surveys shall originate at control monuments that have been established by the National Geodetic Survey (NGS) to the State of Massachusetts and have an accuracy of at least Second Order, as defined by NGS. All plans shall utilize the horizontal datum of the Massachusetts State Plane Coordinate System NAD83 and the NAVD88 vertical datum. All measurements shall be in feet.

Plans must show sufficient data including lengths, bearings, radii and central angles to determine the exact location, direction, and length of every street and way line, lot line, boundary line, and sufficient data to establish these lines on the ground.

A separate layout plan for each proposed street in the subdivision, at a horizontal scale of 1 inch equal to 40 feet, showing proposed exterior lines, centerlines, points of tangency, lengths of tangents, lengths of curves, intersection angles, radii of curves, and the location of permanent monuments and benchmarks, together with all lot lines, buildings and other major features within forty (40) feet of exterior street lines. The layout plan shall also show the size and location of all storm drains, water mains and sewers within the street, together with their appurtenances. All water gate-boxes, mains, and service shall be shown with tie-ins so that they may be located by measurements. Sidewalks and planting strips shall also be shown on the layout plan if proposed or required for the subdivision.

Cross section or sections of each roadway, properly located and identified by station number, at such intervals along the street as will adequately indicate any roadway variations. The sections shall show sidewalks, utilities, depth of utilities, depth of gravel, crown of road, thickness of surface and materials. Slope of the side of the roadway to the property line shall also be shown.

Directly above or below the layout plan of each proposed street, a profile shall be drawn at a horizontal scale of 1 inch = 40 feet and a vertical scale of 1 inch = 4 feet. The street profile shall show existing center line grades in fine solid lines, existing exterior right side line in fine black long dark broken lines, existing exterior left side line in fine black short dark broken lines and proposed finished center line grades in heavy solid lines. Proposed grade elevations shall be shown by figures at beginning and end points and at fifty (50) foot stations, except on vertical curves where they shall be shown at twenty-five (25) foot stations. Rate of gradient in

percentage shall also be shown. All elevations shall refer to Massachusetts Geodetic datum, unless, in the opinion of the Board of Survey, suitable benchmarks are not readily available. Alternative benchmarks must be authorized by the Board prior to the submission of the plans. Profiles shall also indicate the location of any intersecting public or private ways, the location of existing and proposed storm drains, water mains, sewer lines and their appurtenances and other utilities. The profile shall show the rates of grade for sewers, storm drains and water mains.

Plans must give material type for existing and proposed storm drains, water mains and sewers in conformance with the material specifications of these Rules and Regulations unless waived by the Board of Survey.

Utility work shall not be backfilled until the Town Engineer has inspected and approved the work and the contractor's engineer has obtained the necessary information to prepare as-built plans.

The applicant must complete road improvements up to binder course within a year from the date of plan approval and up to a wearing course within two years unless the Board of Survey approves a different schedule.

Design Standards and Specifications

A. Streets

1. Street Classification

For the purposes of these Regulations, streets shall be classified as follows:

a. Residential Access: Residential Access Streets are the lowest order streets in the street hierarchy. They provide frontage and access to residential lots and generally carry only traffic generated on the street itself. Residential Access Streets are designed to accommodate up to a maximum average daily traffic of 250 trip ends (effectively 25 single-family houses on the street.

b. Residential Sub-collector: Residential Sub-collector Streets also provide access and frontage to residential lots. They are designed to carry traffic collected from intersecting Residential Access Streets and the traffic generated from the street itself. Residential Sub-collector Streets should be designed to discourage shortcutting of through traffic by a looped lay out or in patterns that are unappealing as shortcuts. Residential Sub-collector Streets are designed to accommodate a maximum average daily traffic of a 1000 trip ends (effectively up to 100 single family houses served by the street).

c. Primary: Primary Streets shall include all higher order streets in the street hierarchy, including Residential Collector Streets (which carry traffic between lower order residential streets or local streets and higher order streets), Non-Residential Streets and Arterials.

2. Location and Alignment of Streets

a. Streets shall be designed so that they will provide safe and convenient vehicular, bicycle and pedestrian travel, effective fire protection and efficient provision for utilities.

b. Streets shall be continuous, of uniform width, coordinated and aligned with each other and with the existing street system in a manner consistent with sound traffic engineering and planning practices.

c. Horizontal and vertical alignment shall be such that existing contours and natural features will be preserved to the maximum extent possible.

d. Streets shall be laid out to intersect as nearly as possible at right angles. Streets shall not intersect at less than seventy (70) degrees.

e. Minimum Primary Street design standards must conform to accepted traffic design standards in consultation with the Department of Public Works. Minimum street design standards for Residential Sub-collector and Residential Access Streets must conform to Table 1, below.

Table 1
Street Design Minimum Standards

Characteristic	**Street**	
	Residential Sub-collector	**Residential Access**
Maximum Grade	6%	8%
Minimum Grade	1%	1%
Maximum Grade of leveling area at approach of intersection (negative grade required)	2% for 100 feet	2% for 50 feet
Horizontal Alignment: Minimum radius at centerline	 500 feet	 200 feet
Vertical Alignment: K-Value	30 feet per percent change in grade, 100 feet min.	25 feet per percent change in grade, 100 feet min.
Width in all Zoning Districts: Street Width Roadway Width	 50 feet 28 feet	 40 feet 24 feet
Intersections Minimum intersection angle Minimum distance between entering streets not directly opposite each other Minimum radius: Street Sideline	 70 degrees 275 feet 25 feet	 70 degrees 275 feet 20 feet

Curb Radius Stopping Sight Distance	32 feet see **§ A.2.g.** below	27 feet see **§ B.2.i.** below
Sidewalk Width	5 feet	4 feet
Dead-End Streets Maximum length Minimum length Maximum radius of Cul-De-Sac Street Sideline Radius Minimum radius of Cul-De-Sac: Street Sideline Radius Curb Radius Island Radius		 500 feet 225 feet 70 feet 60 feet 45 feet 20 feet

f. A minimum 200 foot length tangent shall be provided between the Point of Tangency of one curve and the Point of Curvature of any following curve. Broken-back curves are prohibited.

g. Stopping sight distance must be provided as measured twenty-five (25) feet from the edge of the intersected traveled way. The stopping sight distance requirement shall be calculated using a hypothetical travel speed 10 M.P.H. greater than the posted or designed speed. A clear sight distance must be maintained from 0.5 feet to 3.75 feet above the pavement surface. Landscaping, fencing and other structures must not obstruct the required sight distances or otherwise jeopardize traffic safety.

h. Where required by topography, right-of-way widths must exceed standard street widths (from Table 1 above) whenever additional width is necessary to provide adequate earth slopes. Slopes must not exceed four-to-one.

3. Dead End Streets

a. Where a street ends before the subdivision boundary and the Board of Survey does not require its extension for access to adjoining property, it shall terminate no less than fifty (50) feet short of the boundary. However, the Board of Survey may require an easement to accommodate drainage facilities, pedestrian traffic or utilities.

b. Dead end streets shall not serve more than 25 dwelling units, nor shall existing dead ends be extended to serve more than 25 dwelling units.

c. Dead end streets shall be designed in accordance with the design standards for residential access streets as provided in these regulations.

d. An open cul-de-sac turnaround with a central island shall be provided at the end of a permanent dead-end street in accordance with the design standards of these regulations.

f. Dead end streets shall be measured from the centerline of the street from which access to the dead end is obtained to the farthest point of the turn-around right-of-way. Cul-de-sac turnarounds may be provided only at the terminus of a dead end street as a means of

reversing direction. Cul-de-sac turnarounds cannot be used to create additional lots that are not at the terminus of a dead end street.

4. Adequacy of Access

a. Streets shall connect to and be accessible from public or private ways in which the applicant has legal right of access.

b. The subdivision plan shall provide a system of pedestrian circulation to and within the subdivision. This system shall connect with existing sidewalks in the vicinity of the project.

c. For subdivisions resulting in the creation of 10 or more lots, the carrying capacity of intersections in the subdivision and within one-thousand (1,000) feet of the development site, including major intersections in close proximity to the subdivision, shall be analyzed under pre-development and post-development build-out scenarios, using Level of Service (LOS) analysis. Level of Service analysis shall conform to the criteria set forth by the Transportation Research Board of the National Research Council, as detailed in their publication *Highway Capacity Manual,* Special Report 209, 1985, or in the most recent subsequent edition or revision. For any intersection where post-development traffic carrying capacity falls below a level of service of D the applicant must propose and construct approved traffic mitigation measures.

5. Curbing

Granite curbing shall be installed in accordance with the latest Massachusetts Highway Department construction specifications on all sides of all streets including primary, residential sub-collectors and residential access streets, in all zoning districts. Granite curbing shall be vertical granite curb (VA-4). Installation of granite curbing must precede the finish course of bituminous concrete pavement.

6. Sidewalks

a. As specified in Table 1 above sidewalks shall be constructed on both sides of streets in all zoning districts within the dedicated right-of-way. A strip of grass or landscaping at least three (3) feet wide, excluding curbing, must separate sidewalks from adjacent curbs. Sidewalks shall be constructed of cement concrete. Wheelchair ramps shall be installed in accordance with Massachusetts State Law. Sidewalk construction shall be in accordance with the latest specifications of the Massachusetts Highway Department.

b. In order to facilitate pedestrian circulation between subdivision street(s) and schools, parks, playgrounds, community facilities and nearby streets, the Board of Survey may require perpetual unobstructed easements at least twenty (20) feet wide to accommodate sidewalks or walking paths. Easements shall be indicated on the Plan.

7. Walls

Where retaining walls adjoin streets, the face of the wall must be constructed in accordance with the latest Massachusetts Highway Department specifications. Retaining walls shall not be permitted within the right-of-way embankment sections of streets without the written

approval of the Board of Survey and Department of Public Works. Cemented stone masonry retaining walls are preferred.

8. Sideslopes

Areas beyond the side lines of streets shall be sloped no steeper than four to one (4:1) grading to a point precisely coinciding with the surrounding ground or abutting lawns and properties. Sideslopes shall be loamed, seeded and rolled in accordance with the latest specifications of the Massachusetts Highway Department.

B. Stormwater and Surface Water Drainage and Management

1. A system of storm drains, culverts, ditches and related installations, including catch basins, gutters and manholes, shall provide adequate surface water disposal in terms of quantity and quality, including flooding and erosion and sediment control, subject to approval by the Board of Survey.

2. By means of site planning, source controls, pollution prevention and DEP Best Management Practices, the disposal of stormwater from streets, roofs or other impervious surfaces will eliminate adverse impacts on abutting or downstream properties.

3. By reference, the Massachusetts DEP Stormwater Management Policy Handbook and Best Management Practices Standards and Regulations are incorporated into these Subdivision Rules and Regulations. The Stormwater Management Standards apply as provided in the DEP Handbook.

4. To the satisfaction of the Town Engineer and the Department of Public Works, the proposed subdivision will minimize the concentration, velocity and volume of runoff from the subdivision to adjoining properties. The plan will detain stormwater on-site to the maximum extent practicable using natural site features and Best Management Practices, including groundwater infiltration. These standards shall apply as provided in item 3 above.

5. Technical design and construction standards for detention/retention basins, infiltration structures, groundwater separators, outlet control structures, sediment forebays, emergency overflow spillways, waterways and splashpads, shall conform to the latest specifications, design assumptions and standards of the Massachusetts Highway Department, consistent with DEP Stormwater Management Standards.

6. When development would increase runoff to downstream properties a detention/retention area shall be constructed. Detention areas will be designed to handle a 100 year storm as determined by the flood routing procedure described in the U.S.D.A., Soil Conservation Service National Engineering Handbook, HYDROLOGY, Section 4. Sideslopes shall not exceed three to one (3:1) and shall be loamed, seeded, rolled and designed in accordance with the latest technical specification of the Massachusetts Highway Department.

7. In addition to control of stormwater runoff, aesthetics should be factored into the design of detention/retention basins. To the maximum extent feasible, detention/retention basins shall

be located on a separate drainage lot away from homes and lots adjacent to the proposed subdivision. Design that conveys a natural appearance, such as a freeform shape with flat sideslopes, is preferable to a "swimming pool" shape. Box configurations should be avoided. Detention/retention basins shall be integrated with the natural landscape. Aesthetic design will conform to the requirements of the Board of Survey. Fencing of part or all of detention areas may be required.

8. An Operation and Maintenance Plan shall provide for the proper maintenance of the stormwater drainage system and ensure that systems function as designed and in accordance with DEP Best Management Practices. Detention/retention basins shall initially be the sub-divider's responsibility, transferring to the homeowner's association for long-term maintenance of both the structure and the landscaping around it. Basins and appurtenances shall be guaranteed from defect in construction and operation for a minimum period of three years for twenty percent (20%) of the value of improvements.

9. The biological and chemical properties of receiving waters must not be degraded by stormwater run-off from the development site. Provision for attenuating run-off pollutants and for ground water recharge shall be incorporated into stormwater management design. These standards shall apply as provided in item 3 above.

10. Proposed stormwater systems shall be properly connected shall with existing drains in adjacent streets or easements. The Department of Public Works will determine the adequacy of the system and the Town must have maintenance access. Where property adjacent to the subdivision is not subdivided, provision shall be made for the projection of the drainage system by continuing drains to subdivision boundaries.

On the Definitive Plan, the applicant must show the size and location of stormwater facilities to which the new subdivision will connect. If drainage provisions should be found inadequate, because of conditions encountered during construction, the Board of Survey shall require additional drainage facilities at the sub-divider's expense. Stormwater field changes must be approved by the Department of Public Works and the Town Engineer and shall be identified on As-Built Plans

11. Infiltration structures shall be placed only in type A or type B soils as designated by the United States Soil Conservation Service. Systems must be sized according to permeability rates attained in the field.

12 All construction shall conform to the latest specifications of the Massachusetts Highway Department.

13. Drain pipe size shall conform to the approved Definitive Plan and shall not be less than twelve (12) inches in diameter, except as provided in Paragraph 5 of this Section.

14. Double catch basin gratings, within a single frame, shall be installed where the roadway slope directly above the basin is four percent (4%) or greater, or as designated by the Board of Survey. Catch basin gratings must not be hazardous to bicycle traffic and designed according to the assumption that they are fifty percent (50%) clogged. The height of water above them shall not exceed five (5) inches.

15. Lots shall be graded to prevent low spots that flood and create a public nuisance and to prevent excessive erosion. Where low spots cannot be avoided, they shall be drained by a pipe at least twelve (12) inches in diameter to the nearest street drains. A minimum thirty foot wide easement shall be provided to the Town. Lot grading shall conform to Appendix B.

The sub-divider must dig test holes to determine the high ground-water elevation pattern throughout the subdivision for the purposes of road and utility design and building elevation.

Structures on land subject to seasonal flooding or high water table must be built at an elevation conforming to Board of Health, Town Engineer and Building Department requirements.

16. Catch basins must be located so that maximum surface flow shall not exceed two-hundred-fifty (250) feet. Catch basins shall be closer than 250 feet as required by the Board of Survey.

Manholes must be located where drain pipes change direction or slope. Catch basins shall be installed at low points on both sides of the roadway near the upper point of curvature of curb roundings of intersecting streets. Catch basins must not be installed at driveways. Catch basins shall be connected to manholes and not to other catch basins.

17. Portland cement concrete or stone masonry headwalls shall be built at open ends of drain pipes and shall conform to the latest specifications of the Massachusetts Highway Department.

18. Open brooks or tributary ditches within the subdivision shall be shaped to a cross-section and gradient approved by the Board of Survey. Sideslopes shall be no steeper than three to one (3:1) and shall be loamed, seeded and rolled in accordance with the latest specifications of the Massachusetts Highway Department. Riprap is required where flow velocity will exceed four (4) feet per second and on sideslopes at outer edges of curvature, at changes in direction and adjoining headwalls. Riprap shall be placed, rather than dumped, where it is visible to the public.

19. Drainpipe slopes shall be designed to provide the following minimum velocities for pipes flowing full.

Pipe Diameter (inches)	**Minimum Design Velocity (feet per Second)**
12 - 42	3
48 - 54	4
60 - 66	5
72 and larger	6

20. The quantity of storm water in the drainage system shall be based on the following criteria.

a. Run-off estimation shall be made as follows (subject to DEP Stormwater Management Policy):

1. Methods of run-off estimation for detention basins, open drainage and for pre/post-development run-off comparisons shall reference United States Department of Agriculture, Soil Conservation Service, National Engineering Field Manual, Chapter 2, revised 1971, based on 24 hour rainfall using a one-hundred (100) year design for storm frequency or return period.

2. Method of run-off estimation for drain pipes, infiltration structures and other closed systems shall use the "**Rational Method**" based on a twenty-five (25) year design for storm frequency or return period.

21. Building Grades: No cellar or garage floor connected to a public drainage system shall be set at an elevation less than two and twenty-five one-hundredths (2.25) feet above the top of the main drain line. Such floors shall be a minimum of one foot above the high ground-water table. Pipe size shall be six (6) inches minimum with a slope of two percent (2%).

22. Foundation Drains: Foundation drains must be provided and connected to the Town's storm drainage system or to an open outlet on the lot. No foundation drainage shall be directed to the street or Town sewer.

C. Sanitary Sewers

1. The municipal sewer system shall be evaluated to determine if adequate capacity exists for the proposed subdivision at the point of connection.

2. Sanitary sewers and appurtenances shall be constructed as shown on the approved subdivision plan to provide adequate sewage disposal capacity for subdivision lots and to provide adequate connection to the municipal sewer system. Pipe sizes, materials, grades and locations shall be shown on the plan. Sanitary sewer construction methods, materials and testing requirements shall conform to the latest specifications of the Massachusetts Highway Department.

3. There shall be adequate capacity in the proposed sewer system for discharge from all future subdivision development, taking into account service to other approved development.

4. Quality standards for wastewater accepted into the municipal sewer system shall conform to the latest specifications of the Massachusetts Highway Department and shall meet applicable Massachusetts Water Resources Authority and Department of Environmental Protection Standards.

5. Where connection to the municipal system requires an easement through land owned by others, evidence of an easement shall be required prior to approval of affected portions of a sewer system.

6. The permitting of service connection shall require application to the Department of Public Works and payment of a fee. The proposed discharge and treatment works will conform to

effluent limitations specified in the permit, local regulations, receiving water standards and any comprehensive plans adopted by the Board of Public Works.

7. House connections shall have a minimum slope of two percent (2%).

8. Manholes shall be constructed at changes in slope or direction and shall not be separated by more than two-hundred-fifty (250) feet.

9. Prior to approval of a proposed system, an internal TV inspection will be required, at the developer's expense, as directed by the Department of Public Works. Manholes shall be vacuum and pressure tested for water-tightness.

10. Infiltration allowance for a proposed sewer system shall meet applicable Massachusetts Water Resources Authority and Department of Environmental Protection Standards.

11. Dry Sewers: Dry sewers shall be planned and installed in a subdivision when required by the Board of Survey and the Department of Public Works.

12. Pipe sizes and locations shall conform to the American Society of Civil Engineers Manual of Practice No. 37 as approved by the Board of Survey and the Department of Public Works. Minimum pipe size is eight (8) inches.

13. The minimum allowable slopes for sanitary sewers shall be as follows:

Pipe Size (inches)	**Minimum Slope (feet per foot)**
8	See table below
10	0.003
12	0.002
15	0.0015
18	0.0012
21	0.0009
24	0.0008
27	0.0007
30	0.0006
36	0.0005

Minimum Slope For 8 Inch Pipe	**Number of Service Connections**
0.030	10 or less
0.020	11-20
as directed by D.P.W.	21 or greater

13. Increasing Size: When sewer size is increased, or when a smaller sewer joins a larger one, the invert of the larger sewer should be lowered to maintain the same energy gradient. An approximate method for securing this result is to place the 0.8 depth-point of both sewers at the same elevation.

14. Alignment: Sewers must be laid with uniform slope and alignment between manholes.

15. High Velocity Protection: Where sewer slope and volume produce velocities of 15 feet per second at average flow, special provisions shall be made to protect against erosion and shock.

16. Drop Type Manhole: A drop pipe should be provided for a sewer entering a manhole at an elevation above the manhole invert.

17. Sewer pump stations shall be placed on separate, unoccupied lots and shall be the responsibility of the sub-divider initially and subsequently of the homeowner's association. Pump stations and appurtenances shall be guaranteed from defect in construction and operation by a performance guarantee for a minimum of twenty (20) years for an amount not to exceed twenty percent (20%) of the value of improvements.

18. Inverted Siphons: Inverted siphons shall be prohibited unless approved by the Department of Public Works.

D. Water System

1. Water mains, laterals, hydrants, gate valves and other fittings and appurtenances shall be constructed and installed to provide subdivision lots with adequate water supply for domestic use and fire protection. Water supply shall be adequate for future development of the subdivision in terms of quantity, quality flow and pressure, taking into consideration service to other approved developments.

2. Provision shall be made for projection of the system to the exterior boundaries of the subdivision by continuing water mains. The size and arrangement of mains shall be approved by the Board of Survey and the Department of Public Works.

3. Water mains, laterals, hydrants, service connections, gate valves and appurtenances shall comply with the latest American Water Works Association standards and with standards and specifications for water installation, construction and materials as currently set forth by the Massachusetts Highway Department.

4. Hydrants shall be no more than 500 feet apart and shall be located as near the street sideline as possible and behind sidewalks. Hydrants shall be located on lot boundary lines wherever possible. Hydrants shall be painted according to Public Works Standards.

5. Water mains shall be looped and installed and tested according to current Massachusetts Highway Department specifications. The Department of Public Works may waive the requirement for looping of water mains and may require other water system improvements to assure reliability of supply and adequacy of fire flow.

6. The adequacy of the water supply shall be determined by the Department of Public Works with the concurrence of the Board of Survey.

7. Dry Water System: Dry water pipes shall be planned and installed in a subdivision when required by the Board of Survey and the Department of Public Works.

E. Street Construction

Subdivision streets shall be constructed to conform to Department of Public Works standards and shall not deviate from such specifications without specific written permission from the Department of Public Works and the Board of Survey.

1. General

Subdivision streets and portions thereof shall be constructed and brought to finish grade as indicated on the approved Definitive Plan and in accordance with the requirements of this section.

The sub-divider shall furnish and maintain grade stakes and such temporary structures as may be necessary or required by the Board of Survey for marking and maintaining points and lines for road and utility installation throughout the construction of the subdivision.

Public utilities, developers, or contractors must notify the Department of Public Works, Engineering Department and Board of Survey, in writing, at least three (3) days prior to starting a job and by telephone call to the Town Yard on the morning work starts.

2. Procedure

A schedule for the completion of all work shall be provided to the Department of Public Works for review and approval. The Public Works inspector on the job must approve each step of the schedule.

3. Clearing and Grubbing of Right-of-Way

The right-of-way shall be cleared according to the requirements of the standard road cross-section, prior to any other work. Trees of aesthetic value over four (4) inch caliper may remain provided they are located at least five (5) feet from the proposed side line of the finished roadway and are approved by the Tree Warden and the Board of Survey. If fill is to be placed around trees, a tree well shall be constructed to Department of Public Works specifications beforehand.

4. Excavation and Sub-grade Preparation

Loam and other yielding material shall be removed from streets to a depth of four (4) feet or greater below the finished sub-grade and replaced with an approved material as required by the Department of Public Works. Loam, peat, organic matter or other soft material shall not be used below sub-grade, which must be thoroughly compacted before applying the gravel surface. Ledge and large boulders anywhere in the full cross-section of the roadway must be cleared to a minimum depth of eighteen inches (18") below the finish surface.

Excavate or fill and fine grade the sub-grade to conform to the cross-section on the approved plan for the entire street and sidewalk width. The sub-grade and trenches shall be

thoroughly compacted by rolling or water tamping before any gravel surface is applied as directed by the Public Works inspector.

Roadways shall be brought to finish grade as shown on the Typical Cross Section Plans and on the profile of the approved plan with at least the top twelve (12) inches consisting of gravel base, properly compacted, as specified herein. Bituminous concrete shall be applied in the following manner: A binder course two and one half (2 1/2) inches thick, compacted, followed by a finish course one and one-half (1 1/2) inches thick and compacted. The bituminous concrete mixture shall conform to the specifications for Class I Bituminous Concrete pavement of the Massachusetts Highway Department in quality of materials and methods of application.

5. Gravel Base

Gravel base shall consist of crusher-run gravel conforming to Massachusetts Highway Department Standard Specification for Processed Gravel, M1.03.1. Before the gravel is spread, the roadbed shall be shaped to a true surface conforming to the proposed cross-section of the road. Bank gravel for the base shall be spread in two layers and rolled true to lines and grades with an approved three wheel roller or approved equal, weighing not less than ten (10) tons to yield a ten inch (10") depth after rolling. Layers shall be compacted to not less than ninety-five percent (95%) of the maximum dry density of the material as determined by the Standard A.A.S.H.T.O. Test Designation T99 compaction test, method C at optimum moisture content. Any depression that appears during or after the rolling shall be filled with bank gravel and be re-rolled until the surface is true and even. When required by the Department of Public Works, samples of the gravel to be used shall be tested for gradation by sieve analyses and shall be tested for compaction. All tests are at the sub-divider's expense.

F. Utility Services

Utility services, including drains, shall be installed to a point two (2) feet beyond the street sideline prior to placement of asphalt concrete course. A plan showing the location of utility stubs shall be provided.

G. Underground Utilities

1. Utilities servicing new developments, including electricity transformers, telephone, cable and other communication lines, both mains and laterals, shall be provided by underground wiring within easements or within proposed dedicated public rights-of-way, installed in accordance with prevailing standards and practices of companies providing such services.

2. Lots that abut existing easements or proposed public rights-of-way where overhead utilities have previously been installed may be supplied with service from those overhead lines, but the service connections from the overhead lines must be underground. Where a road

widening, extension of service or other condition related to a subdivision requires the replacement or relocation of utilities the work must be underground.

3. Where overhead lines are permitted by waiver, the placement and alignment of poles must mitigate the visual impact of overhead lines. Alignments and pole locations shall be carefully routed to avoid location along horizons; clearing swaths through treed areas shall be avoided by selective cutting and a staggered alignment of trees shall be planted in open areas and at key locations to minimize the view of poles and lines; utilities shall follow rear lot lines and existing alignments.

4. The looping of utilities is encouraged.

5. A separate plan showing the location of telephone, electric and other utility wires, showing wiring for street lighting shall be furnished to the Board of Survey, Building and Wiring Inspectors, Town Engineer and the Department of Public Works. The Wiring Inspector and Board of Survey shall be notified in writing three (3) days prior to the installation of wires so that their installation may be properly supervised.

H. Fire Protection

1. Fire Alarm System

A fire alarm system shall be installed underground in accordance with the specifications and requirements of the Arlington Fire Department as promulgated and amended from time to time.

2. Fire Protection Water Supply

a. The number, location and maintenance of fire hydrants shall conform to the requirements of the Arlington Fire Department.

b. Water pressure and volume must meet minimum Federal and State standards for fire protection.

I. Granite Bounds and Markers

Granite bounds 6" x 6" x 4' with a 3/8 inch drill hole in the center must be furnished and set on both sidelines of all points of change of direction or curvature of streets, and points of tangency, and at the intersection of the sideline and sidelines of existing streets. In addition, all lot corners shall be delineated with three (3) foot high iron pins of no. 8 re-bar. All granite bounds and iron pins along right-of-way sidelines shall be set to the satisfaction of the Town Engineer.

Granite bounds shall be accurately set in the ground with the top flush with the adjacent finish grade unless otherwise specified by the Town Engineer. The sub-divider shall dig a hole large enough to place granite bounds and thoroughly tamp excavated material around them to hold them securely in position. If excavated material is not satisfactory for backfill, in the opinion of the Town Engineer, then the holes must be filled with gravel.

J. Street Signs

Street name signs shall be furnished and set in accordance with Department of Public Works specifications and erected at all street intersections prior to the occupancy of any house on the street.

K. Driveway Entrances

Driveways shall be offset from each other and from all intersections to eliminate potential traffic conflicts and other hazards. The apron shall be constructed to the latest specifications of the Massachusetts Highway Department. The grade shall be as determined by the Department of Public Works, but in no case shall the slope of the driveway cause adverse impact due to drainage sheeting onto the subdivision roadway. The driveway shall be designed to provide proper transition between the sidewalk and the driveway for safe pedestrian passage. All proposed driveway entrances and proposed grading shall be shown on the approved Plan and shall be constructed as shown. In no case shall the road surface be laid until the sub-base has been inspected and approved. The maximum driveway opening is twenty-four (24) feet.

L. Street Tree Plantings

1. Existing trees over four (4) inches in diameter within the proposed right-of-way shall be retained to the greatest extent feasible.

2. On each side of the street one tree shall be planted for every thirty (30) linear feet of street frontage and not less than two trees per residential house lot. The Board of Survey may grant a waiver to this requirement only if there are shade trees growing along the right of way or on an abutting property that in the opinion of the Board of Survey meet the intent of these regulations.

3. The distance between trees shall not exceed forty-five feet (45').

4. Trees or shrubs shall not be planted at street corners or intersections where they could become a traffic hazard by obstructing vision or otherwise compromising safety.

5. Final grades shall be established before plantings are installed.

6. Trees shall be a minimum of 2 1/2 - 3 inches caliper when planted and shall be a mixture of varieties suitable as street trees.

7. Trees must be planted approximately ten to twelve feet (10' - 12'), but not more than twenty feet (20'), from the street line and/or in the berm in Zoning District R-4. Whenever possible, trees should be planted at least four feet (4') from a paved surface.

8. The Tree Warden shall be notified when trees are being planted.

9. The tree pit shall be dug one-third larger than the earth-ball of each plant. Spoils shall be removed and organic topsoil shall be used for the planting medium.

10. Trees shall be staked in three directions with #12 wire coated by an insulating material where the wire encircles the tree.

11. Utility and transformer boxers shall be suitably screened on all sides with shrubs at least 18 inches tall, when planted and which are expected to grow to at least the height of the object they are screening.

12. The sub-divider shall be responsible for watering all shrubs and trees until established or until the homeowner or homeowner's association assumes responsibility.

13. Where a median center strip or cul-de-sac island is proposed or required by the Board of Survey, the applicant shall provide a planting plan designed and stamped by a registered landscape architect. Within thirty days of the planting, the landscape architect must certify that the islands or median strip have been planted in accordance with the plan.

14. The sub-divider shall guarantee the health and good condition of trees and required landscaping for two (2) years after the time of planting. To ensure the establishment of landscaping, the developer shall post a two-year landscape bond. The landscape maintenance/defect bond shall equal twenty percent (20%) of the value of the landscaping improvements. If seasonal conditions should prevent the installation of plantings prior to the request for lot release, the developer shall post a landscape bond for the full cost of required plantings. Performance guarantees and maintenance/defect guarantees shall conform to Section VI herein.

15. The Tree Warden shall certify compliance with this section and the acceptability of street tree plantings prior to the acceptance of a street by the Town.

M. Exterior Lighting

1. The developer shall provide and install street lighting, bases, poles, wiring and fixtures as shown on the Plan. Exterior lighting shall be adequate for the safe use of the subdivision in nighttime hours in accordance with the standards set forth in the latest applicable edition of the Illuminating Engineering Society "Lighting Handbook."

a. Lighting must be provided at street intersections, pedestrian walkways and crossings and recreation areas.

b. Spacing of light standards shall be equal to approximately eight to ten times the height of the standard unless otherwise directed by the Board of Survey and Town Engineer. Light standards shall be located on the projections of lot sidelines where possible, terminating with a standard at the end of a cul-de-sac where applicable.

c. The maximum height of standards is twenty-five (25) feet.

d. The height and shielding of lighting standards shall provide proper lighting without hazard to drivers or nuisance to residents.

e. The design of lighting standards shall be consistent with the character of the development and the Town as directed by the Board of Survey.

N. Protection of Utilities

A sub-divider shall protect all utilities and appurtenances installed under these standards from any and all damage until the ways are accepted by the Town. Any damage to utilities and appurtenances prior to acceptance by the Town shall be repaired in a manner satisfactory to the Department of Public Works with the full cost of repairs being borne by the sub-divider. Materials failing to meet DPW standards shall be replaced by the sub-divider at his expense.

O. Easements

Utility easements across, under or above lots or centered on rear or side lot lines, shall be provided as required by the Board of Survey and shall be at least thirty (30) feet wide. The department of Public Works may require a wider easement. Where a subdivision is transected by a water course, drainage way, channel or stream, the Board of Survey shall require an easement substantially as wide as the water course, at least fifteen (15) feet wide and within ten (10) feet of the top of slope of the water course. The grade and size of the easement must allow the safe passage of Town of Arlington maintenance vehicles.

P. Natural Features and the Environment

1. During construction existing landscaping will be preserved in its natural state as far as practical and natural features adding attractiveness and value to the property shall be preserved.

a. The subdivision shall preserve the natural topography and landscaping and minimize grading and filling to the maximum extent possible.

b. To the maximum extent possible, the subdivision plan will take into account and preserve the scenic or natural beauty of the area, significant trees, vistas, topography, historic sites and rare or irreplaceable natural or manmade assets.

c. Wherever possible, buildings shall be sited to take maximum advantage of solar exposure and care shall be taken to protect solar access of existing structures.

2. The subdivision plan will reflect the natural capabilities of the site to support development. Environmentally sensitive areas, wetlands, watercourses, steep slopes, floodplains, wildlife habitat areas and unique natural features will be maintained and preserved to the maximum extent possible.

a. The subdivision will avoid adverse impacts including air pollution, soils and surface or ground water resource pollution.

b. The subdivision will avoid adverse impacts affecting water bodies, water courses or wetlands and wildlife habitats including pollution, erosion, flooding, destruction of natural features and change to ground-water tables such that a dangerous or unhealthy condition results.

c. The subdivision will not cause the natural resource carrying capacity for fresh and drinking water to be exceeded.

Q. Erosion and Sediment Control

1. The developer shall control erosion and sediment and shall stabilize exposed soils during construction and land disturbance activities. Erosion control shall conform to the practices and procedures required by Municipal Boards and State agencies set forth in the Massachusetts EOEA document, *The Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas.*

2. Development shall avoid adverse erosion impacts that would result in dangerous or unhealthy conditions.

3. During construction and land disturbance activities, the sub-divider will minimize soil erosion and sedimentation to watercourses and water bodies or wetlands by an active program meeting the requirements of the Department of Environmental Protection Best Management Practices and shall conform to any Order of Conditions of the Conservation Commission.

4. Sloped areas will be terraced to avoid severe cuts and fills and the need for retaining walls.

R. Community Context

1. Supplemental landscaping and perimeter buffer yards shall provide a physical and visual separation of the subdivision from adjacent uses, define street edges, enhance the appearance of the subdivision and protect abutting properties from adverse impacts of the subdivision. The Board of Survey may require a no-development, no-cut zone of up to 30 feet.

2. The subdivision shall be designed with sensitivity to existing development in order to minimize the impact to abutting uses.

3. Supplemental landscape plantings and treatments shall screen utility boxes, pump stations and similar structures and help integrate detention/retention basins and other drainage systems within the aesthetics of the subdivision.

4. Where appropriate, walking trails shall be established or preserved and incorporated into the subdivision plan to provide linkages to an existing or potential trail network.

S. Cleaning Up

The subdivision must be final cleaned to maintain a neat and orderly appearance, free from debris, excessive slopes, deep holes and objectionable materials. On completion of work, the sub-divider shall remove temporary structures, rubbish and surplus materials from roadways and adjoining properties.

T. Work Notification and Inspections

The Town of Arlington Public Works Dept., Engineering Department and Board of Survey must be notified at least thirty-six (36) hours in advance of any road, municipal service or utility construction. The Fire Department shall be notified at least three (3) days before the installation of any work on the fire alarm system. Utilities shall not be backfilled without written approval from DPW and Engineering, or the Fire Department in the case of the fire alarm system. Backfill approval does not constitute acceptance of utilities by the Town of Arlington. The sub-divider shall, at his own expense, have utilities located in three dimensions, by a Registered Land Surveyor or Professional Engineer, and proof of location, including field notes, shall be presented to the Town Engineer for approval prior to back-filling. The sub-divider will provide "As-built" plans, with ties to all utility structures, as required in these Rules and Regulations.

STORM DRAINAGE

11.1 General Requirements

Storm water run-off shall be disposed of through a combination of storage and controlled release. Drainage systems shall be designed according to the following principles and criteria:

1. **Peak Flows:** Property shall be developed to maximize storm water recharge on-site and to minimize run-off onto adjoining streets and into watercourses. Peak flows at subdivision boundaries must match pre-development levels.

2. **Capacity:** Using the following methods, drainage systems shall have capacity to handle all storm water run-off presently flowing through a subdivision and dispose of run-off generated by proposed development up to and including run-off from a one hundred (100) year storm:

    a. Storm water drainage facilities will be designed to handle flows generated from a twenty-five (25) year storm of twenty-four (24) hours duration. Wherever possible, flows shall follow natural drainage patterns and maintain the run-off to infiltration ratio present under natural conditions.

    b. Detention facilities shall be provided for run-off exceeding the percolation capacity of the site, up to and including the run-off generated from a one hundred (100) year, twenty-four (24) hour storm. Proposed detention facilities must be reviewed by the DPW Superintendent prior to submission of a Definitive Subdivision Plan. The sub-divider shall provide the DPW Superintendent and Board of Survey with applicable design standards and capacity information relating to such a facility. The proposed design must be stamped by a Registered Professional Engineer when a Definitive Subdivision Plan is filed.

3. **Release Rate:** The combination of storage and design release rate shall not result in storage duration greater than seventy-two (72) hours. Storm water retention areas shall have a maximum depth of four (4) feet. Detention area side-slopes shall conform to natural land contours with grades of ten (10%) percent or less wherever possible.

4. **Outlet Structures:** Outlet control structures shall be designed as simply as possible and shall require little or no maintenance for proper operation.

5. **Emergency Overflow:** Storm water detention areas shall be equipped with emergency overflows for storms exceeding one hundred (100) year frequency.

6. **Natural Patterns:** Natural drainage courses shall be used wherever possible. Existing watercourses shall remain open unless prior approval to close them is

obtained from the Conservation Commission. Watercourses shall be appropriately seeded, sodded, paved or rip-rapped.

7. **Alteration:** Alteration of existing patterns of drainage shall not adversely affect properties outside the subdivision by increasing total flow or rate of peak flow.

8. **Structured Systems:** A structured drainage system shall be used where soil conditions or topography make natural drainage impractical and where existing drains in adjacent streets and easements will carry run-off from a subdivision.

   The sub-divider must provide engineering documents to DPW for leaching or detention systems prior to submitting the Definitive Subdivision Plan to the Redevelopment Board.

   Catch basins are required on both sides of a street on continuous grade at intervals of not more than three hundred (300) feet, at low points in streets and at corners of intersecting streets.

9. **Calculations:** Hydraulic calculations, prepared by a Registered Professional Engineer, shall be submitted to validate proposed drainage systems design features. Run-off calculations shall be made in accordance with standard engineering practice, acceptable to the Town Engineer and Board of Survey and the method of calculation shall be noted.

10. **Drainage Easements:** Where drainage must flow across lots within a subdivision, storm water easements shall be provided, of sufficient width and construction to accommodate the volume and velocity of run-off. In no case shall easements be less than twenty (20) feet wide.

    When a drainage system proposes to carry water to an approved outfall across land outside subdivision boundaries, the sub-divider must secure appropriate drainage rights and reference these rights on the Definitive Subdivision Plan.

11. **Miscellaneous Criteria:**
    Detention structures shall not be constructed and maintained within the layout of a proposed way, whether private or public.

    Proposed storm water systems shall not discharge untreated storm water in a manner that causes wetland erosion and contamination of surface water or groundwater.

    Annual groundwater recharge shall be maintained by means of infiltration measures to the maximum extent practicable. The annual recharge from the post-development site should meet or exceed pre-development recharge.

    Storm water management systems must comply with the Department of Environmental Protection's (DEP) Storm Water Management Policy and the

requirements of these Rules and Regulations, regardless of whether the proposed subdivision is subject to the Wetlands Protection Act. Storm water management systems must be designed to remove 80% of the average annual load of total suspended solids. To achieve this standard, suitable nonstructural practices for source control and pollution prevention shall be implemented; Best Management Practices (BMP) shall be implemented and maintained as designed.

The use of infiltration measures without pretreatment is prohibited, except that roof run-off may be separately discharged into groundwater without pretreatment.

Erosion and sediment controls must be implemented to prevent detrimental impacts to drainage structures during construction.

Storm water management systems must have operation and maintenance plans to ensure that they function as designed. Such plans shall include identification of the party(s) responsible for operation and maintenance, an inspection and maintenance schedule and a list of routine and non-routine maintenance. Permitted confined spaces must be registered with the Fire Department pursuant to OSHA 1910.146.

Connection of footing drains, roof drains, sump pumps or storm drains to a sanitary sewer is prohibited.

For reasons of safety or aesthetics, the Board of Survey may require a fence or vegetated barrier or other safety feature for detention ponds and retention areas.

INSPECTION PROCEDURES

12.1 General Requirements

The sub-divider shall be responsible for requesting inspections as improvements are installed. Inspections are required for major construction stages and prior to the reduction in or release of a performance guarantee. Inspections are required at the commencement of the following work:

1. Site layout and controls.

2. Sub-base and roadway layout/preparation.

3. Rough grading, fine grading and compaction.

4. Installation of water, storm drainage, sewer facilities and their appurtenances.

5. Installation of other underground utilities such as electric, telephone, gas, cable T.V., and fire alarm distribution lines and services.

In no case shall utilities be backfilled until the Inspector of Buildings has inspected installation.

Installations performed without the sanction of the Inspector of Buildings must be uncovered by the sub-divider before additional improvements can proceed. No work will be accepted without inspection by the Town of Arlington's Inspector of Buildings, Town Engineer or DPW Superintendent.

In addition to those cited above, inspections shall be required to verify the adequacy of the following: binder/finish paving of roadways, sidewalks, curbing, monuments, way signs, loam and seed, tree planting, site cleanup and as-built drawings. Sewer and water lines must be air tested by an independent testing company to verify the operational performance of these services. Sewer manhole structures must be water tested.

Field changes to approved Definitive Subdivision Plans are prohibited, no matter how minor. The sub-divider must immediately report any discrepancies in field work or conditions to the Town Engineer, the Board of Survey and other Town departments with jurisdiction relating to the discrepancy, for their review, inspection and approval. Changes must be submitted to the Board of Survey for review and may require the filing of an Amended Definitive Subdivision Plan pursuant to Section 7.2 of these Rules and Regulations.

Certification by a Registered Land Surveyor is required to verify monuments and the proper installation of water, sewer and drainage facilities. Certification by the Fire Chief is required for fire alarm installation. Certifications must be filed in duplicate with the Board of Survey.

The sub-divider shall provide complete and safe access to the Inspector of Buildings. Forty-eight (48) hours advance notice is required for inspection requests.

Inspections will be performed between the hours of 9:00 a.m. and 4:00 p.m., Monday through Friday, unless prior permission is obtained from the DPW Superintendent or Town Engineer to allow inspections during alternative hours. If inspections are required on evenings or weekends, the sub-divider will bear the full cost of the Inspector of Building's time, four (4) hours minimum.

REQUIRED MATERIALS FOR USE IN UNDERGROUND UTILITIES

SUMMARY OF SPECIFICATIONS

I. Storm Drainage

Structures – Pre-cast concrete sections. Concrete barrel blocks allowed for shallow structures must be parged. All holes shall be filled with appropriate non-shrink grout.

Brick - #1 common red brick, water struck, hard burned, or sewer brick for height adjustment. 6 courses maximum, 2 courses minimum.

Castings – Manholes – LeBaron LT 105 or equal, 8" high frame, round cover embossed "DRAIN".

Catch basins – LeBaron LF 248-2 or equal, 8" high frame, square grate (24" x 24") waffle type (bicycle safe).

Manhole steps – 12" x 12" x ¾" Aluminum at 12" on center.

Leaching manholes – Cover for H-20 lading, ¾" perimeter stone and Marafi 140 fabric or equal.

Pipe – Minimum 12" diameter, reinforced cement concrete, bell and spigot. Pipes shall be laid at a constant slope. Any change of horizontal or vertical direction shall be done with a manhole.

Under-drain – Perforated metal pipe, asphalt coated or SDR 35 perforated PVC.

Note: Oil separator snouts and four (4) foot deep sumps are required for each catch basin. Manhole inverts may be brick or poured concrete.

If it is necessary to remove material around the frame to adjust the structure, concrete will not be allowed as a replacement for reconstructing to match the surrounding roadway.

II. Sanitary Sewer and Services

Structures – Pre-cast concrete sections, made watertight with 2 bituminous coats both inside and out.

Brick - #1 common red brick, water struck, hard burned, or sewer brick for height adjustment. 6 courses maximum, 2 courses minimum.

Castings – LeBaron LT 105 or equal, 8" high frame, round cover embossed "SEWER".

Cross Country man hole. 6" height allowed.

Manhole steps – 12" x 12" x ¾" Aluminum at 12" on center.

Pipes - Gravity – PVC sewer pipe schedule SDR 35 minimum for gravity sewers from main to 10 feet from foundation. Within 10 feet of foundations the Board of Health has jurisdiction. Typically 6" ductile iron under foundation or 4" schedule 40 PVC in normal fill situations. Special criteria govern when 10 feet or closer to water service or main.

All pipe shall be laid at constant slope. Any change in horizontal or vertical direction shall be done with a manhole.

Force Main – Pipes either PVC SDR 18 or ductile iron class 52.

High Point to have air release valve.

Note: At drop sewer manholes, the drop shall be installed outside the manhole and be completely encased in concrete. Inverts and tables shall be made of brick.

If it is necessary to remove material around the frame to adjust the structure, concrete will not be allowed as a replacement for reconstructing to match the surrounding roadway.

III. Water Service and Mains

Mains – Sizes to be approved by the Board of Survey and the DPW Superintendent typically 8" mains. Mains shall be looped.

Pipe Main - Cement lined ductile iron water pipe class 52, or shall meet AWWA* standards for water mains. Cement lining will be inspected by the Town before installation. Concrete thrust blocks are required at each bend. Boulders are not permitted as thrust blocks.

Service-type K copper tubing, ¾" minimum.

Fittings – All fittings shall conform to State DPW Standards and AWWA* specifications. All gates shall open left.

Placement of gates shall be reviewed by DPW and Engineering.

Hydrants – Type Kennedy K-11 Guardian, or equivalent, with open rotation to the left, with concrete thrust blocks at hydrant and main, set 500 feet apart maximum. There shall be a hydrant at the end of every cul-de-sac.

* American Water Works Association

IV. Relation of Water Lines to Sewer Lines

Horizontal Separation - Whenever possible, sewers should be laid at least 10 feet, horizontally, from any existing or proposed water mains. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:

1. It is laid in a separate trench.

2. It is laid in the same trench with the water main located at one side on a bench of undisturbed earth.

3. In either case, the elevation of the crown of the sewer is at least 18" below the invert of the water main.

Vertical Separation - Whenever sanitary sewers must cross under water mains, the sanitary sewer shall be laid at such elevation that the top of the sanitary sewer is at least 18" below the bottom of the water main. When the elevation of the sanitary sewer cannot be buried to meet the above requirement, the water main shall be relocated to provide this separation or reconstructed with slip-on or mechanical joint ductile iron pipe for a distance of 10 feet on each side of the sanitary sewer. One full length of water main shall be centered over the sanitary sewer so that both joints will be as far from the sanitary sewer as possible.