

DESIGN STANDARDS

for

CITY OF ROCKAWAY BEACH

April 2002

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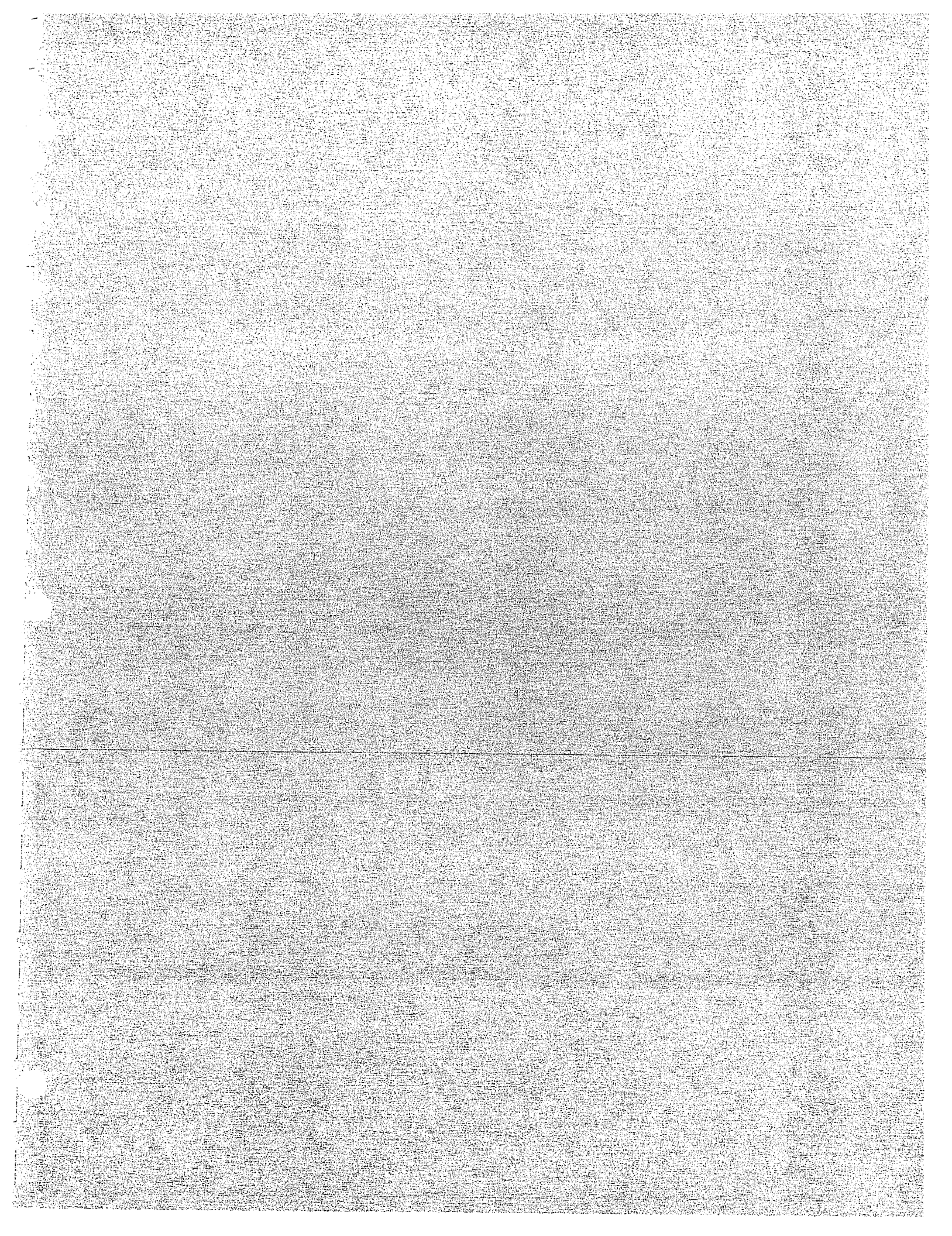
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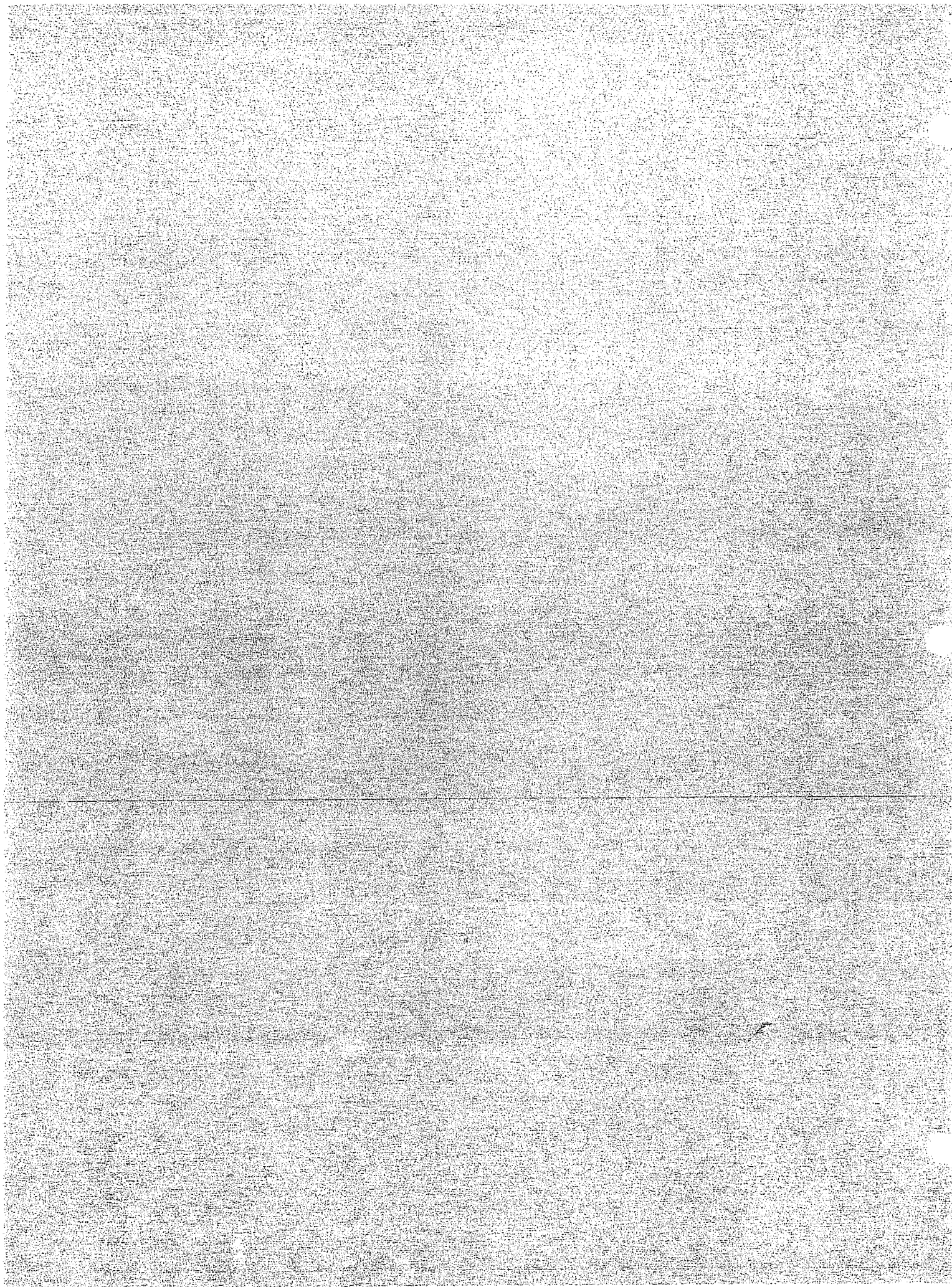
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CITY OF ROCKAWAY BEACH DESIGN STANDARDS

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STREET AND STORM DRAINAGE DESIGN STANDARDS

SECTION ONE INTRODUCTION

1.00 PURPOSE

The standards set forth below are intended to result in streets that will:

- a. Be of adequate size and grade to carry the expected traffic flow to serve the adjacent properties safely.
- b. Be of materials providing for long life and resistant to degradation.
- c. Be of proper configuration to provide safe intersections for both pedestrians and vehicles.
- d. Be economical and safe to build and to maintain.
- e. Be capable of meeting specified compaction standards for base and surfacing.

The standards set forth below are intended to result in storm drainage systems that will:

- a. Be of adequate size to carry the expected drainage flow, within their design life, and at sufficient depth to serve adjacent drainage ways.
- b. Be of materials providing for long life and resistant to erosion and degradation.
- c. Be strong enough to resist all external loads that may be imposed.
- d. Be economical and safe to build and to maintain.

1.01 REVISIONS TO THESE STANDARDS:

It is anticipated that revisions to these standards and drawings will be made from time to time. The date appearing on the title page is the date of the latest revisions. Users should determine the issue that applies to the work contemplated. The date appearing in the drawing title blocks is the dates of the latest revision.

1.02 REFERENCES:

Reference herein is made to the latest edition of the standards, test, methods and specifications of research as follows:

1. STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, prepared by Oregon Chapter American Public Work Association.
2. STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, prepared by Oregon Department of Transportation, Highway Division.
3. HYDRAULICS MANUAL, prepared by Oregon Department of Transportation, Highway Division.

1.03 APPROVAL OF ALTERNATE MATERIALS OR METHODS:

Any alternative material or method not explicitly approved herein will be considered for approval on the basis of the objectives set forth in sub-section 1.00 above. Persons seeking such approvals should make application in writing before construction. Approval of any major deviation from these Standards will normally be in written form. Approval of minor matters will be made in writing if requested by City.

**SECTION TWO
PLANS AND SPECIFICATIONS**

2.00 GENERAL:

Prior to submitting construction plans and specifications for a public improvement project, or any project to be constructed in a public right-of-way, the Developer shall comply with the following:

1. Obtain a copy of the Public Improvement Design Standards and Standard Details from the City of Rockaway Beach.
2. The Developer and the Developer's Project Engineer shall schedule and participate in a pre-submittal conference with the City of Rockaway Beach staff, including the Public Works Superintendent and City Manager. Such pre-submittal conference will normally be scheduled after any Planning Commission approvals have been granted for the project. The topics to be discussed at the pre-submittal meeting will include: schematic methods for meeting the conditions of approval for the project, off-site public improvements and project impact thereto, on-site public improvements, the development agreement, project construction and inspection requirements.
3. The construction plans shall demonstrate compliance with all approvals by other approval agencies, such as the City of Rockaway Beach Planning Commission.
4. The Project Engineer or Developer shall submit the construction plans and specifications to the City of Rockaway Beach together with the required plan review fee. Simultaneously, the Project Engineer or Developer shall submit the plans and specifications to all other required approval agencies. Those agencies may include, but shall not be limited to:
 - A. Sanitary Sewer: Oregon Dept. of Environmental Quality (DEQ)
 - B. Water Mains: Oregon State Health Division (OSHD)
 - C. Erosion Control: Oregon Dept. of Environmental Quality (DEQ)
 - D. Wetlands: Oregon Division of State Lands (DSL) and US Army Corps of Engineers

Three copies of the construction plans and specifications for the project together with the plan review fee shall be submitted to the City of Rockaway Beach. The Public Works Superintendent shall review the plans for conformance with the City's Design Standards and for overall project conformance with the conditions of approval. The Public Works Superintendent shall either approve the plans as submitted or return the plans with requested plan revisions and comments. It is the responsibility of the Developer to submit to the City copies of all plan approval letters from all required agencies.

Once the plans and specifications are approved by all required agencies, the City and the Developer shall enter into a Development Agreement prepared by the City that shall state the requirements and conditions that the Developer shall follow in the construction of the planned improvements. No construction shall commence on the project until plans have been submitted to the City of Rockaway Beach and the City of Rockaway Beach grants approval in writing.

Throughout the course of the construction work on the project, the Project Engineer shall be responsible that the project is constructed in compliance with the approved plans and specifications. The Project Engineer shall make all such inspections and observations as may be necessary to assure such compliance with the approved plans and specifications. At a minimum, the Project Engineer shall visit the project site

on a weekly basis and shall file a weekly written progress report with the City of Rockaway Beach Public Works Department. Such report shall note the conditions of work observed by the Project Engineer, the progress achieved during the previous week and the progress anticipated during the coming week.

The Public Works Staff of the City of Rockaway Beach may conduct separate site observations of the construction work in progress. Any such observations by the City of Rockaway Beach shall not relieve the Project Engineer of the primary responsibility of ensuring and certifying compliance with the approved plans and specifications.

Upon completion of the project and prior to acceptance of the streets and storm drainage system by the City of Rockaway Beach, the Project Engineer shall prepare and submit the following to the City of Rockaway Beach:

One reproducible set, three blackline sets, and an electronic copy on CD of "as-built" plans shall be submitted to the Public Works Department.

The Project Engineer shall prepare and submit a letter of certification that the project was constructed in accordance with the approved plans and specifications.

If the public improvements are a part of a subdivision or partition of land, the Developer shall submit to the Public Works Superintendent a draft of the final subdivision or partition plat showing all required utility easements on the face of the final subdivision or partition plat.

The Project Engineer or Developer shall request in writing that the City of Rockaway Beach accept the street and storm drainage system as a part of the public improvements, subject to a 1-year written warranty provided by the Developer (or Developers) of the project improvements. The City may require an extended warranty length under special circumstances. The project improvements will only be accepted by the City of Rockaway Beach based upon a City Council resolution to accept jurisdiction of the right-of-way and the public improvements therein.

2.01 STREET PLANS:

Three copies of the construction plans and specifications for the project shall be submitted for review and approval to the City of Rockaway Beach. The plans shall be submitted on standard size sheet of either 18"x 24" or 24"x 36". The scale used shall be a standard engineering scale, i.e. 1"=100', 1"=50', etc.

All plans for streets and storm drainage systems shall be prepared by the Project Engineer, a Professional Engineer registered in the State of Oregon, and shall bear a suitable title showing the name of the project and the City of Rockaway Beach. The plans shall show the scale in feet, the North point, date, and the name of the Project Engineer, the Project Engineer's signature and the imprint of the Project Engineer's registration stamp.

2.01.01 Profile - A profile of the centerline of all proposed streets shall be shown. Included on this profile shall be the profiles of the original ground at centerline. A profile of the centerline of existing streets for a distance of 50 feet each way of an intersection of a proposed street with the existing street shall be shown. Show in plan view detail of connection to existing roads. An extension of the profile of a proposed street that stops at the boundary of the project shall be provided for at least 200 feet to show either the tie into an existing street or to show the profile of a future street extension. Details and spot elevations of the top of curb (or edge of pavement) shall be shown for all curb (or edge of pavement) returns at intersections and around cul-de-sacs, etc. Both plan and profile of the storm sewers and ditches shall be provided. Provide details of

ramps for curb and sidewalk. The profile shall show existing grade and finished grade elevations at minimum of 50 foot intervals. All slopes and vertical curves shall be labeled.

2.01.02 North Arrow and Scale - A north arrow shall be shown with the scale of the drawing immediately below the arrow.

2.01.03 Street Names and Stationing shall be shown on all maps. Generally, stationing shall increase from the North to the South and from the West to the East. Plan views shall show stationing on centerline of the right-of-way. Show equations of each intersection.

2.01.04 Curve Radii shall be shown for all centerline curves and for all curb return radii at intersections, cul-de-sacs, etc.

2.01.05 Bench Marks - The location and elevation of a National Geodetic Survey, United States Geological Survey, State Highway, or Tillamook County bench mark shall be shown. Any other datum proposed shall be submitted to and approved by The City of Rockaway Beach prior to use and shall be used only if the United States Coast and Geodetic Survey, United States Geodetic Survey, United States Geological Survey, State Highway, or Tillamook County bench mark is not within one-half mile of the boundaries of the project. All temporary bench marks shall be shown on the plans.

2.01.06 Street Barricades - The location of street barricades to be constructed shall be noted on the plans.

2.01.07 Typical Roadway Section shall be shown on the plans. Show pavement and shoulder widths.

2.01.08 Excavation Limits and limits of fill slope shall be shown on the plans. The developer is responsible for obtaining easements for excavation or earthwork that extends outside the right-of-way.

2.01.09 Underground Utilities that are proposed for new developments shall be shown on separate plans, including power, telephone and cable TV. Separate utility plans shall show the location of all underground utilities and the location of those utilities in relationship to the street right-of-way. All utility easements shall be shown on the plans. Street lighting shall be provided in all new developments of partitions or subdivisions.

2.02 STORM DRAINAGE PLANS & CALCULATIONS:

2.02.01 Storm Drainage - All storm sewers on the plans shall be stationed. Generally, stationing shall begin at the lower end of each drainage project and increase upslope. The stationing shall continue on the main line. Storm sewer stationing shall be mathematically equated to road stationing.

2.02.02 Tributary Storm Sewer Lines connecting to the main line shall begin with 0+00 where the new line connects with the main storm sewer line and increase upslope. Supplementary identification may be used on these lines if necessary, such as lateral A, B, etc..

2.02.03 The profile of the storm sewer shall show the rim elevation and invert elevation at the inlet and outlet of each run of pipe and shall also show the gradient of the pipe in percent. The type of pipe and type of backfill to be used shall be shown on the storm drainage trench and pipe section detail.

2.02.04 The location of drainage facilities (inlets, pipe, ditches, etc.) shall be shown on the plans with offset and station. A typical section of all pipelines and ditches to be constructed shall be provided. Show all invert and rim elevations of all facilities.

2.02.05 Calculations and Worksheets used to determine design capacity of the drainage system within the development and adequacy of the downstream facilities shall be submitted with the Drainage Plans for approval.

2.02.06 Topographic Map of the entire project site shall be provided for subdivisions. Maximum contour interval shall be 2 feet.

2.03 SPECIFICATIONS:

Three copies of the complete technical specifications for the construction of streets and storm drainage, and all appurtenances, shall accompany the plans. Reference to the City of Rockaway Beach's Technical Specification is acceptable. Deviation from the City of Rockaway Beach's Technical Specification must be submitted in detail and approved prior to construction of the project.

2.04 EROSION CONTROL PLANS:

The Developer shall submit a description of erosion control and sediment control methods for all site improvements.

The Developer shall prepare an erosion control plan on all developments required by the current regulations of the Oregon DEQ to have such a plan. When an Erosion Control Plan is required by Oregon DEQ, the Developer shall submit the DEQ 1200-C permit application and Erosion Control Plan to the City of Rockaway Beach for approval, together with the Oregon DEQ approval letter of the same permit application and plans. All erosion control work and all maintenance related to such erosion control work shall be shown in the plans, following the requirements set forth in Oregon DEQ 1200-C permit application and subject to State approval.

2.05 REVISION TO APPROVED PLANS:

Any deviations from approved plans or specifications affecting capacity, drainage, etc. shall be approved in writing before such changes are made. Plans or specifications so revised should, therefore, be submitted well in advance of any construction work that will be affected by such changes to permit sufficient time for review and approval. Minor structural revisions or other minor changes not affecting capacities, drainage, or street design will be permitted during construction without approval.

**SECTION THREE
MINIMUM DESIGN CONSIDERATIONS**

3.00 GENERAL:

The information contained within these Standard Specifications is considered minimum standards for streets and storm sewer systems.

3.01 ROADBED:

3.01.01 Horizontal and Vertical Alignment - The alignment of the centerline of improvement shall normally be parallel to and coincidental with the centerline of the right-of-way. Offset centerlines may be approved by the City of Rockaway Beach as an exception under specific circumstances, such as wide bicycle pathway or on street parking along one side of the street, etc. The angle of intersection of streets shall be kept as nearly to 90 degrees as possible and in no case shall it be less than 60 degrees.

All streets shall, as far as practicable, be in alignment with existing streets by continuation of the centerlines thereof.

The minimum radius for the right-of-way returns at intersections shall be 15 feet, except returns at intersections with collectors streets shall be 25 feet. The minimum radius for curb (or edge of pavement) returns at intersections and at returns at cul-de-sacs shall be 25 feet. The minimum right-of-way radius for cul-de-sacs shall be 50 feet and the minimum curb or street radius shall be 45 feet for cul-de-sacs. A cul-de-sac shall be as short as possible and shall in no event be more than 200 feet long. The length of the cul-de-sac shall be measured along the centerline of the roadway from the near side of the intersecting street right-of way to the farthest point of the cul-de-sac right-of-way.

The minimum street centerline gradient shall be 0.4 percent. The minimum width of right-of-way and street improvements, maximum gradients, minimum horizontal curve radii, and minimum stopping sight distance for the various classifications of streets are shown in TABLE A. Additional right-of-way or slope easements shall be provided when necessary to meet terrain or other conditions of design and construction.

Street Classification	Minimum R/W Width	Minimum Road Base Width	Road Surface Width	Maximum Centerline Grade %	Minimum Horizontal Radius at Centerline	Minimum Stop Sight Distance
Cul-de-sac (CL to center)	40'	37'	34'	12%	100'	160'
Residential Street	40'	24'	20'	12%	100'	160'
Collector	60'	40'	36'	10%	200'	200'
Commercial/ Industrial or Arterial	60'	40'	36'	6%	300'	240'
Residential Lane	25'	22'	20' w/ curbs each side	12%	100'	100'

Slopes may be increased to 15 percent for a limited distance with the written approval of the Rockaway Beach Fire Chief and the Superintendent of Public Works.

3.01.02 Structural Section

3.01.02A - The acceptable structural sections for the various street classifications without obtaining soil tests are shown in the Standard Drawings. Additional base rock is required where compressible soils or wetland conditions are known to exist as shown on the standard Sections. These hazard areas are identified in the City of Rockaway Beach Comprehensive Plan.

3.01.02B - If the Public Works Superintendent or the City Engineer has reason to believe that the soils in a particular project may be unable to handle the Standard Structural Street Section, the Public Works Superintendent or the City Engineer may require the Developer to have soil tests made to determine the soil's capability. The street section shall then be designed in accordance with the street classification shown in TABLE B and the soil capability.

Street Classification	Design ADT	% Trucks	Truck Weight	Design Traffic No.
Cul-de-sac	500	2	15,000	1
Residential Street	1,000	4	20,000	6
Collector	3,000	5	20,000	25
Commercial-Industrial-Arterial	3,000	10	48,000	180

3.01.03 Typical Section - The typical section to be used for each street classification is shown in the standard drawings. All collector streets that lie within the commercial and industrial street classification shall include curb and sidewalk on each side of the street.

Where, due to terrain, it is not possible to construct a street section with the curbs on each side of the street at the same elevation, the offset crown typical section as shown in the Standard Drawings may be used.

3.01.04 Barricades - The Developer shall provide and install street barricades, as detailed in the standard drawings, at the end of streets that "stub off" at the project boundary.

3.01.05 Signs - The Developer shall provide and install street name signs and posts necessary as required by the street construction specifications.

3.02 WALKS, RAMPS, DRIVEWAYS AND CURB CUTS:

All ramps, sidewalks, curbs and driveways within the public right-of-way shall be constructed in accordance with guidelines outlined in the Americans with Disabilities Act, with the relating standard specifications included in the Street and Storm Drainage System section of this manual, and with relating standard drawings found at the end of this manual.

Sidewalks shall consist of a minimum 4 inches of concrete over 2 inches of base rock. At driveways, the minimum concrete thickness shall be 6 inches. The standard minimum width of sidewalk shall be 48 inches. Handicap ramps shall have a maximum slope of 1 horizontal to 12 vertical and shall be textured per ADA requirements. Ramp construction shall also consist of 4 inches of concrete over 2 inches of base rock.

All driveway aprons within the public right-of-way shall be constructed in accordance with the following specifications.

Curb openings for driveways shall align with the driveway on private property and driveways shall approach at right angles to the centerline of the street. Driveway openings shall be at least 5 feet from the side property line extended. No two residential driveway openings shall be less than 20 feet apart when

constructed on the same lot. Driveway openings on corner lots shall be located a minimum of 5 feet from the ends of curb radius returns. All driveway aprons shall be paved a minimum of 20 feet from the road surface back into the driveway.

On roadways where driveway culverts are necessary the minimum size shall be 12-inch double wall corrugated HDPE culvert pipe. Alternate materials shall include concrete pipe and fittings. Metal pipe will not be allowed.

3.03 DRAINAGE

3.03.01 Rainfall Intensities - Storm Sewers shall be designed according to the rainfall intensity chart for 25-year frequency periods for various duration of storms contained in the Oregon Department of Transportation "Hydraulic Manual", 1990.

3.03.02 Runoff Coefficients to be used in the design of drainage facilities shall be based on the expected future development of the drainage shed area.

3.03.03 Inlet or Time of Concentration - The inlet time or concentration time varies considerably and must be calculated in order to determine the intensity from the rainfall chart.

3.03.04 Areas to be considered in designing or checking the adequacy of storm sewers shall include all areas that will be tributary to the storm sewer being designed.

3.03.05 Size and Life of Storm Sewers - The design and construction of all drainage facilities within a project shall be of sufficient size and quality to receive and transport, during a 25-year interval storm frequency event, all surface drainage and natural drainage course waters coming to and passing through the project from the contributing watershed or watersheds, when the lands located in such are a full planned development, according to the Comprehensive Land Use Plan.

In those areas located in the 100-year flood plain, the design and construction of all drainage facilities shall be of sufficient size and quality to receive and transport the 100-year storm without raising the flood plain elevation. The drainage facilities may be designed to pass less than a 100-year storm provided retention or detention of the runoff is designed and that such retention or detention does not raise the flood plain upstream.

The minimum design service life for storm sewer materials under pavement sections shall be 100 years and not under pavement sections shall be 50 years.

3.03.06 Coefficient of Roughness (N) - The values of the coefficient of roughness for the various types of pipes shall be in accordance with the manufacturer's specifications.

3.03.07 Location of Storm Sewers - All storm sewers shall be located within a public right-of-way or within a utility easement granted to the City of Rockaway Beach

3.03.08 Manholes shall be placed at the following locations:

1. Change in grade or alignment of storm sewers
2. Point of change in size or elevation of storm sewer
3. Intersection or junction of storm sewer
4. Upper end of lateral storm sewers
5. Maximum spacing of 500 feet.

All manholes shall be accessible to City maintenance vehicles.

Catch basins or curb inlets, either standard or oversized may be used in lieu of manholes at locations approved by the City of Rockaway Beach.

3.03.09 Catch Basins Inlets - Connections from the inlets to the storm sewers may be made by installing a standard tee connection in the storm sewer pipe, or may be made into a manhole. The tee connection may be used if the length of pipe from the tee to the inlet is less than 50 feet. Unprotected open pipes shall be connected to storm drains only at catch basins, not with a standard tee.

Catch basins as shown in the Standard Drawings for catch basins shall have a maximum height from grate to flowline of pipe of 3'-6" and shall be used with a maximum pipe size of 18 inches in diameter. Catch basins shall be used on street gradients up to 6 percent.

Curb inlets as shown in the Standard Drawings for curb inlet shall have the same restrictions as catch basin above except that curb inlet shall be used on street gradients over 6 percent.

Area drains, parking lot inlets and catch basins subject to vehicle leakage shall be quipped with submerged outlets or scum-control outlets.

3.03.10 Ditches - If a natural drainage course is altered as a result of the development of the project, the drainage shall either be enclosed in a storm sewer system or carried by a constructed open drainage ditch. Open drainage ditches shall only be allowed in common areas of a development that are owned and maintained by a Homeowners Association or a like Organization. The drainage ditches shall be constructed such that they have sufficient size and slope to carry the runoff as set forth in these specifications. The ditch side slope shall be 2 horizontal to 1 vertical or flatter.

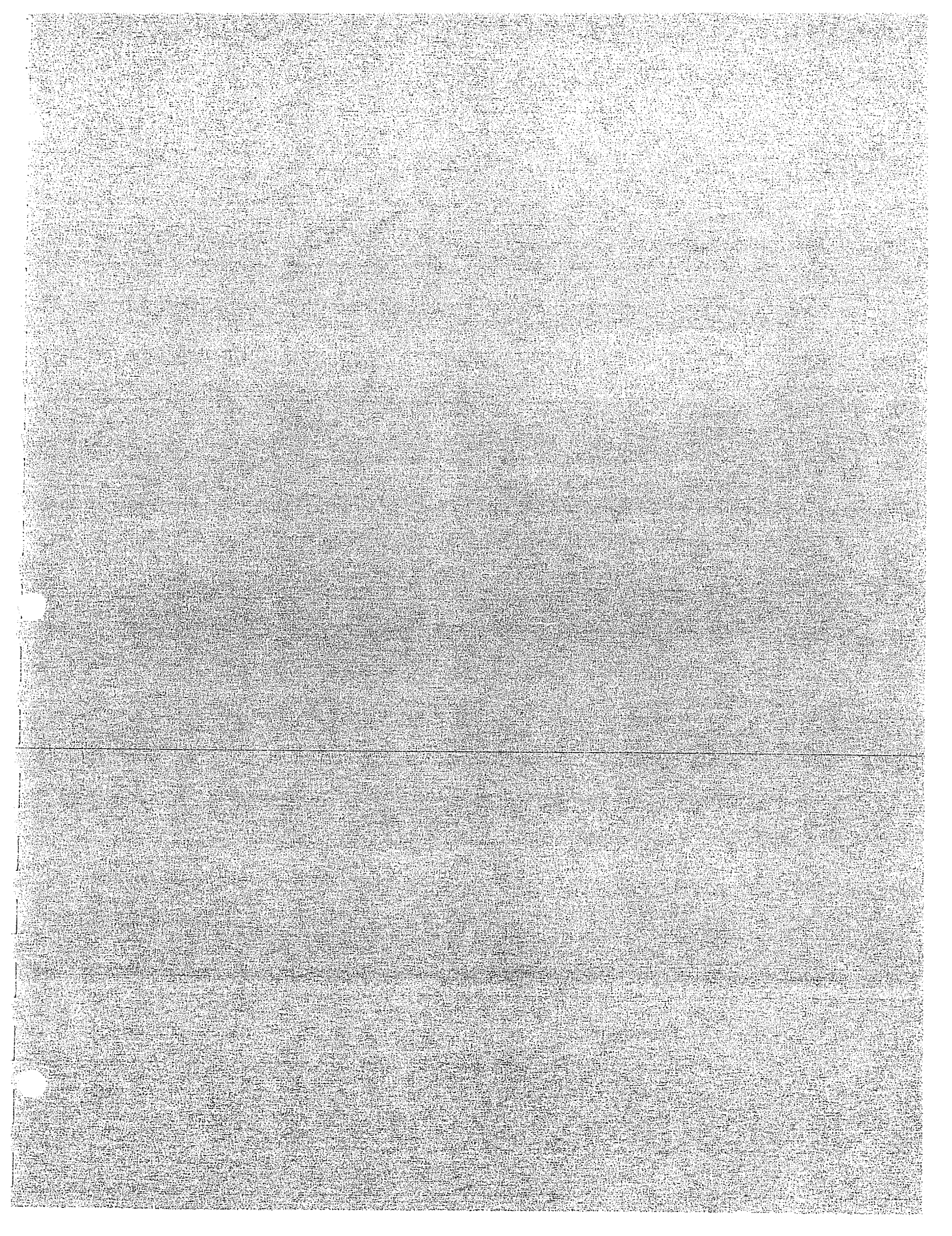
3.03.11 Drainage Easements - When, due to topographical or other reasons, all or any portion of the water collected in the project must be discharged at the boundary of the project, such that it is concentrated and must run across other private property before reaching a natural or existing drainage course, the developer shall make all necessary arrangements to obtain all required easements with the affected property owner or owners.

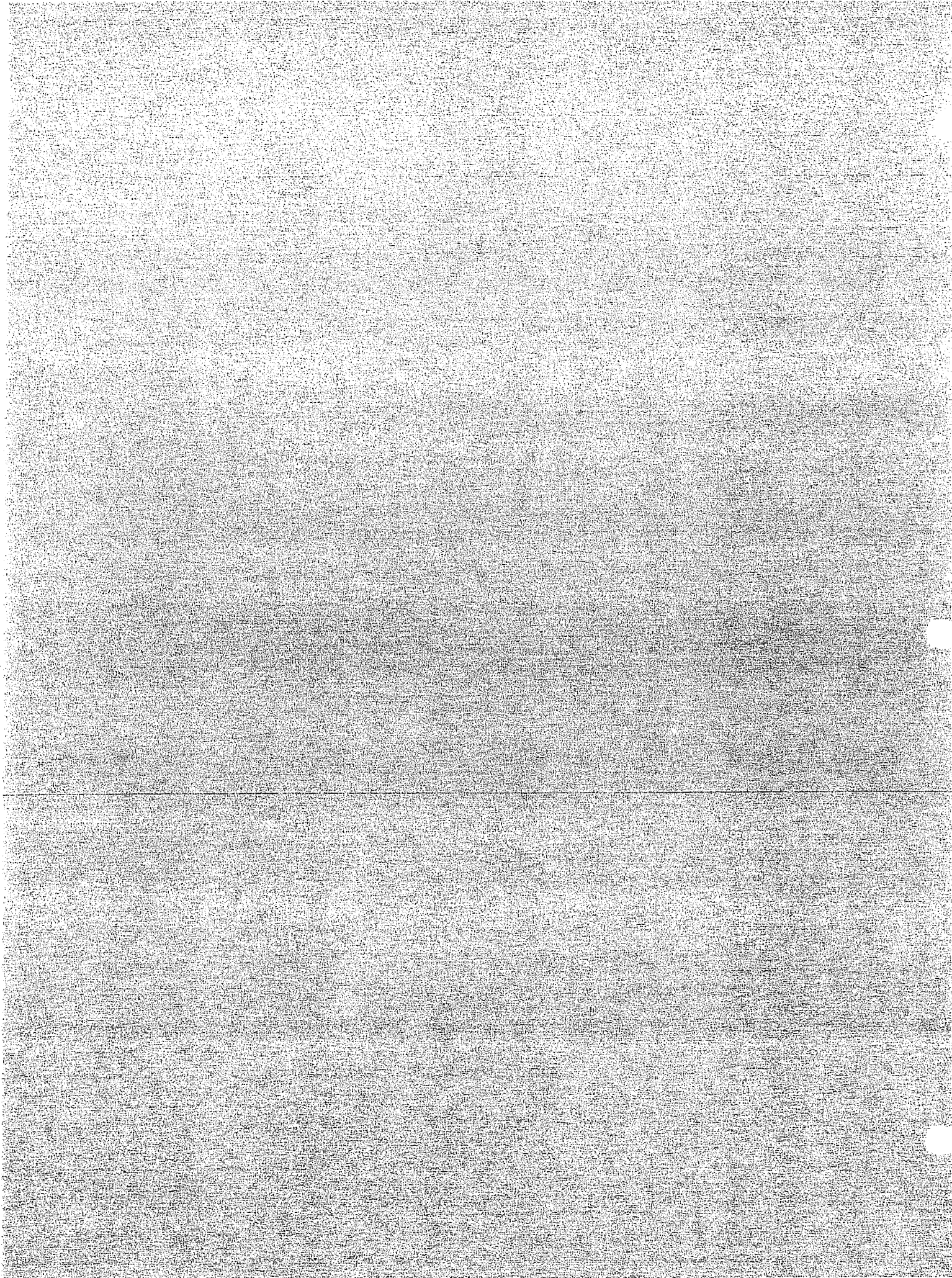
If it is necessary to carry water across portions of the land being developed, which are not to become public, and a satisfactory easement has not been provided in the official plat of the area, the developer shall prepare and cause to be executed a proper easement to the public for such purpose.

3.03.12 Connections to Roadside Ditches - Where drainage is to be connected to an existing roadside ditch, the ditch shall not be deepened so as to produce a finished ditch more than 6 inches below the finished surface of street at edge of pavement of the adjacent road. Should it be necessary to deepen beyond the maximum 6-inch depth, the developer shall cause to be constructed a proper size storm sewer line.

All steps necessary shall be taken to prevent erosion of the existing ditch and shoulder of road i.e., rip-rap, splash walls, pipe elbow, etc.

3.03.13 Downstream Channels – All downstream culverts (and ditches) be checked to determine adequacy for increased flow rates.





**WATER DISTRIBUTION SYSTEM
DESIGN STANDARDS**

**SECTION ONE
INTRODUCTION**

1.00 GENERAL:

The design standards set forth below are intended to result in a water distribution system which will:

- a. Provide sufficient capacity to maintain minimum pressure during periods of maximum use and to provide sufficient volumes of water at adequate pressures to provide the expected average daily consumption plus fire flow.
- b. Be of material strong enough to resist all expected loads, both internal and external, and able to preserve the purity and potability of the water supply.
- c. Be economical and safe to build and to maintain.

1.01 REVISIONS TO THESE STANDARDS:

It is anticipated that revisions to these standards will be made from time to time. The date appearing on the title page is the date of the latest revisions. Users should determine the issue that applies to the work contemplated.

1.02 REFERENCES:

Reference herein is made to the latest edition of the standards, test, methods and specifications of research as follows:

1. STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, prepared by Oregon Chapter American Public Work Association.
2. CONSTRUCTION STANDARDS OF THE OREGON STATE HEALTH DIVISION.
3. CITY OF ROCKAWAY BEACH WATER MASTER PLAN
4. UNIFORM FIRE CODE

1.03 APPROVAL OF ALTERNATIVE MATERIALS OR METHODS:

Any alternative material or method not explicitly approved herein will be considered for approval on the basis of the objectives set forth in sub-section 1.00 above. Persons seeking such approvals should make application in writing. Approval of any major deviation from these Standards will normally be in written form. Approval of minor matters will be made in writing if requested.

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1. Obtain a copy of the Public Improvement Design Standards and Standard Details from the City of Rockaway Beach.
2. The Developer and the Developer's Project Engineer shall schedule and participate in a pre-submittal conference with the City of Rockaway Beach staff, including the Public Works Superintendent and City Manager. Such pre-submittal conference will normally be scheduled after any Planning Commission approvals have been granted for the project. The topics to be discussed at the pre-submittal meeting will include: schematic methods for meeting the conditions of approval for the project, off-site public improvements and project impact thereto, on-site public improvements, the development agreement, project construction and inspection requirements.
3. The construction plans shall demonstrate compliance with all approvals by other approval agencies, such as the City of Rockaway Beach Planning Commission.
4. The Project Engineer or Developer shall submit the construction plans and specifications to the City of Rockaway Beach together with the required plan review fee. Simultaneously, the Project Engineer or Developer shall submit the plans and specifications to all other required approval agencies. Those agencies may include, but shall not be limited to:
 - A. Sanitary Sewer: Oregon Dept. of Environmental Quality (DEQ)
 - B. Water Mains: Oregon State Health Division (OSHD)
 - C. Erosion Control: Oregon Dept. of Environmental Quality (DEQ)
 - D. Wetlands: Oregon Division of State Lands (DSL) and US Army Corps of Engineers

Three copies of the construction plans and specifications for the project together with the plan review fee shall be submitted to the City of Rockaway Beach. The Public Works Superintendent shall review the plans for conformance with the City's Design Standards and for overall project conformance with the conditions of approval. The Public Works Superintendent shall either approve the plans as submitted or return the plans with requested plan revisions and comments. It is the responsibility of the Developer to submit to the City copies of all plan approval letters from all required agencies.

Once the plans and specifications are approved by all required agencies, the City and the Developer shall enter into a Development Agreement prepared by the City that shall state the requirements and conditions that the Developer shall follow in the construction of the planned improvements. No construction shall commence on the project until plans have been submitted to the City of Rockaway Beach and the City of Rockaway Beach grants approval in writing.

Throughout the course of the construction work on the project, the Project Engineer shall be responsible that the project is constructed in compliance with the approved plans and specifications. The Project Engineer shall make all such inspections and observations as may be necessary to assure such compliance with the approved plans and specifications. At a minimum, the Project Engineer shall visit the project site on a weekly basis and shall file a weekly written progress report with the City of Rockaway Beach Public Works Department. Such report shall note the conditions of work observed by the Project Engineer, the progress achieved during the previous week and the progress anticipated during the coming week.

The Public Works Staff of the City of Rockaway Beach may conduct separate site observations of the construction work in progress. Observations by the City of Rockaway Beach shall not relieve the Project Engineer of the primary responsibility of ensuring and certifying compliance with the approved plans and specifications.

Upon completion of the project and prior to acceptance of the streets and water system by the City of Rockaway Beach, the Project Engineer shall prepare and submit the following to the City of Rockaway Beach:

One reproducible set, three blackline sets, and an electronic copy on CD of "as-built" plans shall be submitted to the Public Works Department.

The Project Engineer shall prepare and submit a letter of certification that the project was constructed in accordance with the approved plans and specifications.

If the public improvements are a part of a subdivision or partition of land, the Developer shall submit to the Public Works Superintendent a draft of the final subdivision or partition plat showing all required utility easements on the face of the final subdivision or partition plat.

The Project Engineer or Developer shall request in writing that the City of Rockaway Beach accept the water system as a part of the public improvements, subject to a 1 year written warranty provided by the Developer (or Developers) of the project improvements. The City may require an extended warranty length under special circumstances. The project improvements will only be accepted by the City of Rockaway Beach based upon a City Council resolution to accept jurisdiction of the right-of-way and the public improvements therein.

2.01 WATER SYSTEM PLANS:

All plans for water system extensions shall be prepared by the Project Engineer, a Professional Engineer registered in the State of Oregon, and shall bear a suitable title showing the name of the project and the City of Rockaway Beach. The plans shall show the scale in feet, the North point, date, and the name of the Project Engineer, the Project Engineer's signature and the imprint of the Project Engineer's registration stamp.

Three copies of the construction plans and specifications for the project shall be submitted for review and approval to the City of Rockaway Beach. The plans shall be submitted on standard size sheet of either 18"x 24" or 24"x 36". The scale used shall be a standard engineering scale, i.e. 1"=100', 1"=50', etc.

2.01.01 Profile and Layout - A profile of the centerline of the water system shall be shown including the elevation of proposed and /or existing streets, original ground surface, all sanitary sewer and storm drainage crossings, type of pipe and type of backfill to be used.

The layout or plan view should contain at least, but not limited to, the following:

- a. Adjacent streets and property lines, utility easements and references thereto.
- b. Location of both existing and proposed water mains and appurtenances. Each fitting and branch line shall be stationed to facilitate coordination in locating appurtenances.
- c. Size, material and length of main between fittings. Type of fittings and type of each joint.
- d. Location of adjacent sanitary sewers and storm drains (invert elevations, above mean sea level, indicated as necessary), all stream and railroad crossings, culverts and underground power or telephone, whenever possible.

- e. Appurtenances - detailed drawings shall be included for all appurtenances, including typical trench cross-section, water services, hydrants, valves, valve boxes, thrust blocking, connections to existing mains, blowoffs, air release valves, etc.
- f. Show horizontal and vertical separation between water and sewer pipes. Callout clearances at all water/sewer crossings.
- g. Provide written construction and testing sequence, including water charging, chlorine injection and flushing. As required, address possible shutdown of existing services or mains.

2.01.02 North Arrow and Scale - A north arrow shall be shown with the scale of the drawing immediately below the arrow.

2.01.03 Stationing shall be shown on all maps. Generally, stationing shall increase from the point of connection to the existing supply source and shall be mathematically equated to the road stationing, wherever appropriate.

Optionally, road stationing may be used to reference the station and offset of all water main fittings, pipe and appurtenances.

2.01.04 Bench Marks - The location and elevation of a National Geodetic Survey, United States Geological Survey, State Highway, or Tillamook County benchmark shall be shown. Any other datum proposed shall be submitted to and approved by the City of Rockaway Beach prior to use and shall be used only if the United States Coast and Geodetic Survey, United States Geodetic Survey, United States Geological Survey, State Highway, or Tillamook County bench mark is not within 1/2 mile of the boundaries of the project. All temporary benchmarks shall be shown on the plans.

2.02 SPECIFICATIONS:

Three copies of the complete technical specifications for the construction of water systems, and all appurtenances, shall accompany the plans. Reference to the City of Rockaway Beach's Technical Specification is acceptable. Deviation from the City of Rockaway Beach's Technical Specification must be submitted in detail and approved prior to construction of the project.

2.03 REVISION TO APPROVED PLANS:

Any deviations from approved plans or specifications affecting capacity, pressure, alignment, etc. shall be approved in writing before such changes are made. Plans or specifications so revised should, therefore, be submitted well in advance of any construction work that will be affected by such changes, to permit sufficient time for review and approval.

**SECTION THREE
MINIMUM DESIGN CONSIDERATIONS**

3.00 GENERAL:

The requirements contained within these Standard Specifications are considered minimum Standards for Water Distribution Systems. In general water distribution system should be designed to care for maximum development of the service area.

3.01 CAPACITY (sizes):

Design capacities shall be determined by consideration of the following factors and assumptions:

1. Area to be served, both immediate and adjacent.
2. Current and projected population within the areas to be served.
3. Current and projected land use within the areas to be served.
4. Commercial, industrial, or institutional users to be served.
5. Changes in any of the above factors that are likely to occur within a foreseeable time period.

In the absence of consumption data or other reliable information, the following factors may be assumed:

1. Average demand for single family dwelling is 2 gpm (for design purposes).
2. Average demand for typical commercial user to be as for single family dwelling.
3. Demand for unique commercial installations, industrial users, and institutional concerns will be calculated on an individual basis.
4. Absolute minimum fire flow in hydrants shall be 1000 gpm at 20 psi residual pressure.

The City of Rockaway Beach has adapted the Uniform Fire Code; water line size and fire hydrant placement should be placed by the standards and recommendations described within the latest version.

The latest Water Master Plan completed for the City of Rockaway Beach shall also be consulted as a guideline for the determination of design capacities. These factors may be used to estimate the minimum, average, and peak demands. Submission of design calculations will not ordinarily be required, but designers should be prepared to substantiate pipe size, layout, population estimates, land uses, or other design assumptions.

Main Sizes:	
4"	Not to be used as part of the distribution system.
6"	May be used for unreinforced mains not forming a part of the fire protection grid and not to exceed 400 feet in unreinforced length nor for service to more than twenty residences.*
8"	Standard sized lateral water main for grid (looped) system, not to exceed an unreinforced length of 800 feet. Wherever possible, looping of the distribution grid to be about every 600 feet.
10"	Minimum size for permanently dead-ended mains supplying fire hydrants and for minor trunk mains.
12"	And larger - As required for trunk (feeder) mains.

* No fire hydrants will be supplied by this size main nor will it be used to close a loop in the distribution grid.

All dead-end mains shall terminate with a blow-off assembly. Permanent dead-ends may have a blow-off assembly as per the Standard Drawings. Dead-ends which can conceivably be extended at some later date shall have a blow-off assembly as per the Standard Drawings.

3.02 LOCATION AND GRID:

3.02.01 Location - The standard location for water mains shall be within the public streets and roads and shall be 7 feet from the property line of such streets and roads and preferably on the South and West sides of street centerlines. Exceptions to these requirements may be made in order to avoid cutting and replacing pavement, to avoid conflicts with other existing underground facilities, and to permit sanitary sewers to be installed on the low sides of streets. As nearly as practical, mains shall be installed on a particular street with the distance from the property-line of the street varied as little as possible. Wherever possible, mains shall be installed a minimum clear distance of 10 feet horizontally from sanitary sewers and shall preferably go over the top of such sewers with 18 inches of clearance at intersections of these pipes. The minimum spacing between water mains and storm sewers, gas lines and other underground utilities, excepting sanitary sewers, shall be 3 feet horizontally. The standard minimum cover over buried water mains shall be 30 inches. Mains shall not be installed in alleys and the installation of mains with easements across privately owned property is to be done only when absolutely necessary, such as the avoidance of dead-end conditions. Such easements, when required, shall be a minimum of 10 feet in width and the conditions of the easement shall not be used for any purpose which would interfere with the unrestricted use for water main purposes. All easements must be furnished to the City after recording.

3.02.02 Grid Network - The distributions system mains shall be looped wherever possible. The installation of permanent dead-end mains and dependence of relatively large areas on single mains is to be avoided.

3.03 VALVES:

3.03.01 Sizes - In general, the valve sizes shall be the same as the mains in which they are installed. Special valves such as plug or ball valves may be a size smaller than the main depending upon the special conditions involved.

3.03.02 Location - Wherever possible, distribution system valves shall be located at the intersection of the main with a property line. There shall be a sufficient number of valves so located that not more than four and preferably three valves must be operated to effect any one particular shutdown. The spacing of valves shall be such that the length of any one shutdown in high value areas shall not exceed 800 feet nor 1,200 feet in other areas.

In general, a tee-intersection shall be valved in three branches and a cross-intersection shall be valved in four branches. Major trunk water mains shall have valves at not more than 2,000 foot intervals and preferable 1,300 foot intervals. Hazardous crossings, such as a creek, railroad, and freeway crossings, shall be valved on each side.

3.04 FIRE HYDRANTS:

Distribution of hydrants shall be based upon the required fire flow, the average area served not to exceed that given in TABLE 1 as reproduced herein from the Insurance Services Offices, 160 Water Street, New York, NY 10038. Preferred coverage will normally result in hydrant spacing of 500 feet in residential areas and 300 feet in high-value districts. Hydrants stubs may be approved for installation in areas of currently minimum development.

TABLE 1 - STANDARD HYDRANT DISTRIBUTION

Fire Flow Required, gpm	Average Area per Hydrant, square feet
1,000 or less	160,000
1,500	150,000
2,000	140,000
2,500	130,000
3,000	120,000
3,500	110,000
4,000	100,000
4,500	95,000
5,000	90,000
5,500	85,000
6,000	80,000
6,500	75,000
7,000	70,000
7,500	65,000
8,000	60,000
8,500	57,500
9,000	55,000
10,000	50,000
11,000	45,000
12,000	40,000

Hydrants shall be located as nearly as possible at street intersections.

3.05 SERVICE LINES:

The term "service line" is meant to be used only for the water line extending from the distribution main to the using meter, hydrant, or sprinkler system.

All service lines must be installed in accordance with AWWA C 800 and the Uniform Plumbing Code (Ch.10).

3.05.01 Sizes - The sizes of service lines which may be used are 3/4", 1", 2", 4", 6", 8", 10", and 12" IPS (iron pipe size).

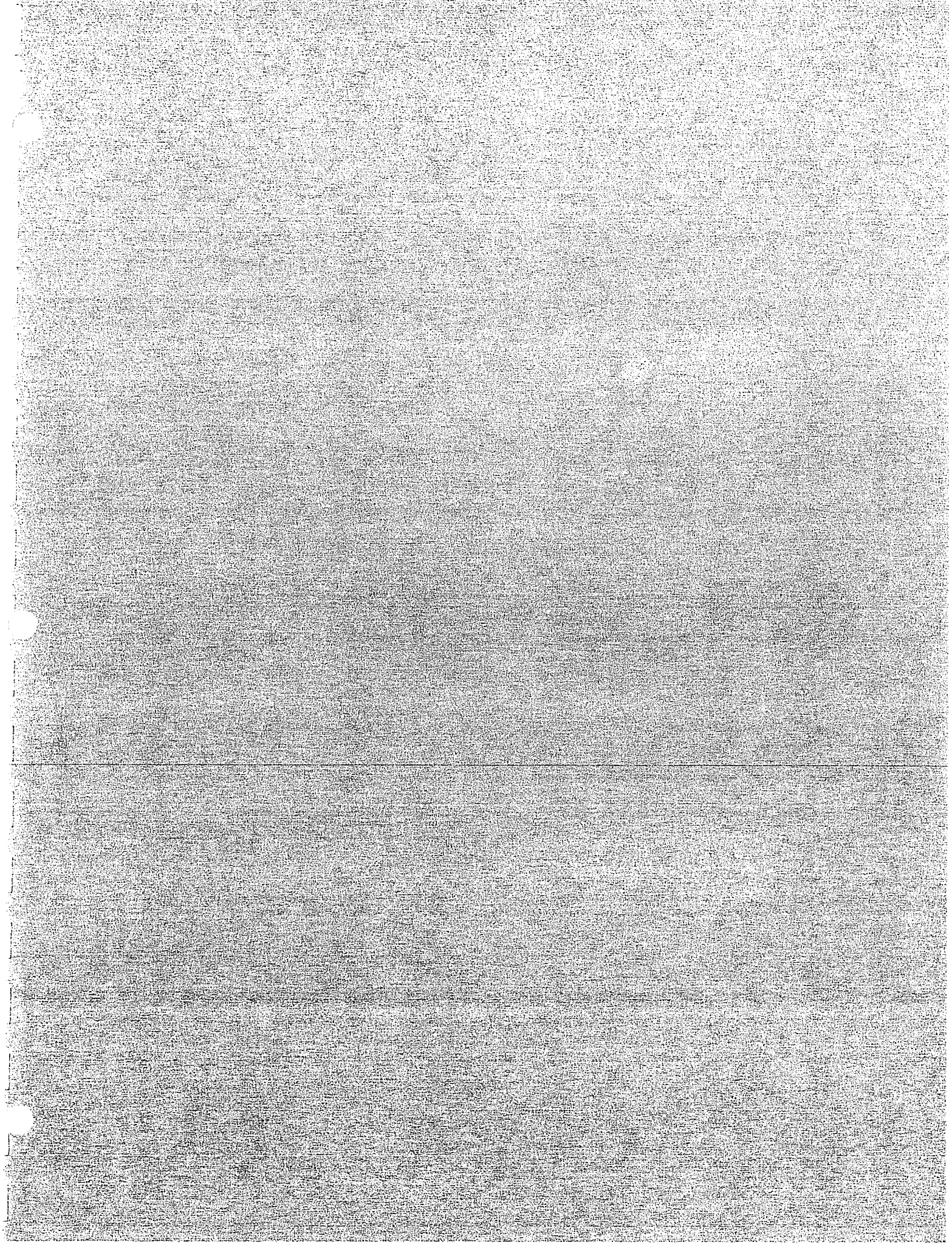
3.05.02 Materials and Layout - Service lines shall have a corporation stop at the main. An angle meter stop shall be provided on the main side of the meter.

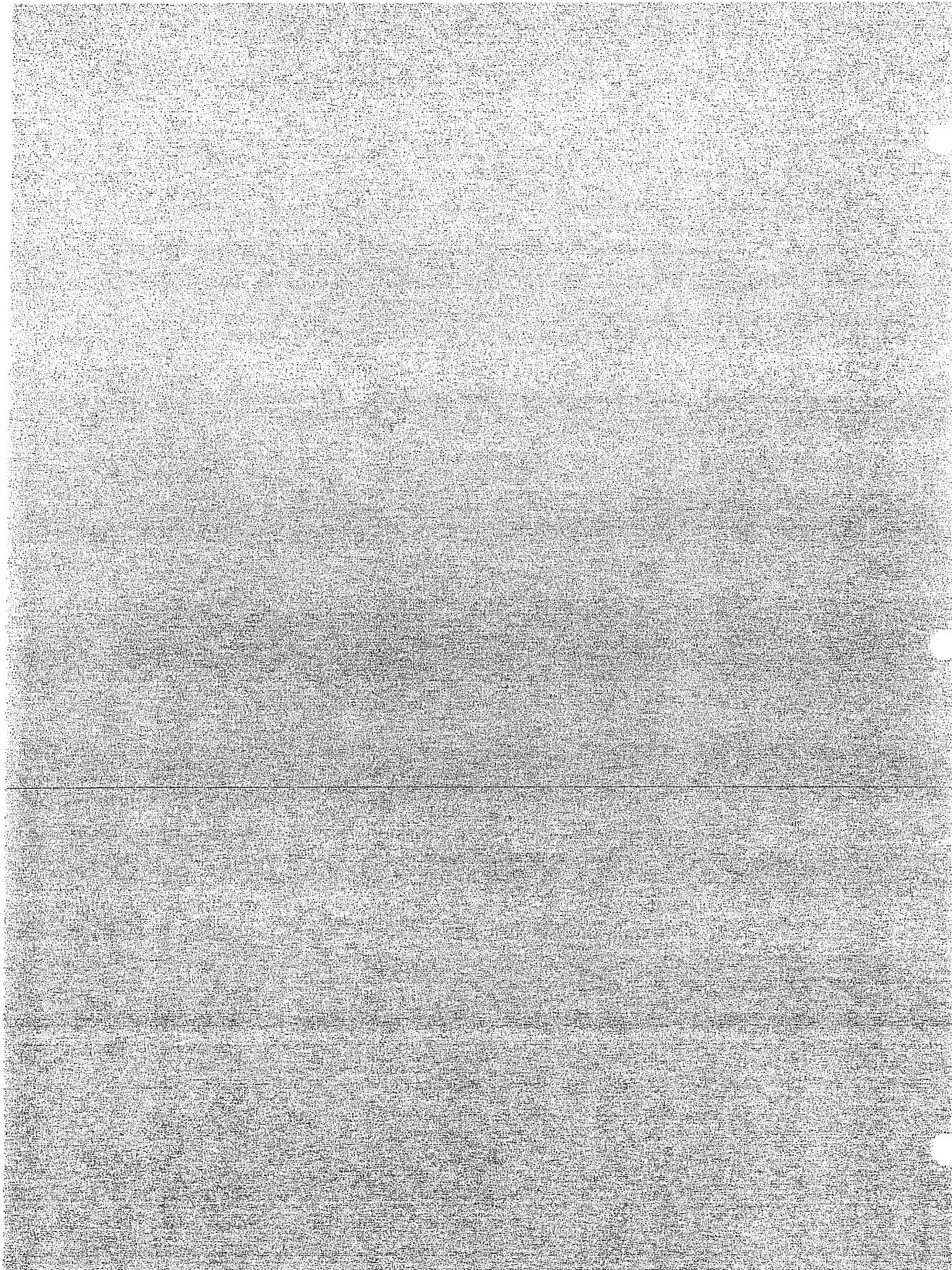
Two service lines may be installed in the same trench with a minimum clear distance of 8 inches between lines. Two or more meters may not be served by common service line. When the service is extended to the house, an Oregon State Health Division approved double check valve assembly or reduced pressure backflow prevention device shall be installed at each service on the customer side of meters.

Service connections with meters 3-inch and larger shall have a by-pass with normally closed gate valve so that the meter may be removed for servicing without discontinuance of service to customers. If the service is used all or in part for fire protection, the by-pass shall be full size, otherwise it can be one size smaller than the meter size. By-pass valves 4-inch and larger shall be equipped with a position indicator post which will permit locking the valve position in place.

3.05.03 Location - The service lines shall normally extend from the main to the property line behind the curb and sidewalk with the curb stop, meter and meter box being located at the termination of the service connection. As nearly as possible, the service line shall terminate at edge of the public right-of-way. In general, service connections shall terminate in front of the property to be served. All meters shall be set in the right of way within 1 foot from the property line.

3.05.04 Installation - Unless otherwise approved, installation of service lines shall comply with all respects to requirements set forth in these standards.





SANITARY SEWER SYSTEM DESIGN STANDARDS

SECTION ONE INTRODUCTION

1.00 PURPOSE:

The design standards set forth below are intended to result in sewers that will:

- a. Be of adequate size to carry the expected flow, within their design life, and at sufficient depth to serve the adjacent properties.
- b. Have sufficient grade to maintain a minimum velocity of 2 feet per second when flowing half full.
- c. Be strong enough to resist all external loads that may be imposed.
- d. Be of materials resistant to both corrosion and erosion.
- e. Be economical and safe to build and to maintain.
- f. Prevent infiltration or inflow of ground and surface waters.

1.01 REVISIONS TO THESE STANDARDS:

It is anticipated that revisions to these standards will be made from time to time. The date appearing on the title page is the date of the latest revisions. Users should determine the issue which applies to the work contemplated.

1.02 REFERENCES:

Reference herein is made to the latest edition of the standards, test, methods and specifications of research as follows:

1. STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, prepared by Oregon Chapter American Public Work Association.
2. OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY DESIGN GUIDELINES
3. UNIFORM PLUMBING CODE, I.A.P.M.O.

1.03 APPROVAL OF ALTERNATE MATERIALS OR METHODS:

Any alternate material or method not explicitly approved herein will be considered for approval on the basis of the objectives set forth in sub-section 1.00 above. Persons seeking such approvals should make application in writing. Approval of any major deviation from these Standards will normally be in written form. ~~Approval of any major deviation from these standards will normally be in written form.~~ Approval of minor matters will be made in writing if requested.

1.04 SPECIAL SITUATIONS:

The design of the following are considered special situations and are not covered in detail in these standards:

1. Pump or Lift Stations (Lift station to have generator backup and telemetry)
2. Force Mains
3. Inverted Siphons
4. Relining of Existing Sanitary Sewers
5. Internal Sealing of Existing Sanitary Sewers
6. Energy Dissipators
7. Regulating Devices
8. Flow Measurement Devices

The Design Engineer should consult with City Staff on any of the above special situations

SECTION TWO
PLANS AND SPECIFICATIONS

2.00 GENERAL:

Prior to submitting construction plans and specifications for a public improvement project, or any project to be constructed in a public right-of-way, the Developer shall comply with the following:

1. Obtain a copy of the Public Improvement Design Standards and Standard Details from the City of Rockaway Beach.
2. The Developer and the Developer's Project Engineer shall schedule and participate in a pre-submittal conference with the City of Rockaway Beach staff, including the Public Works Superintendent and City Manager. Such pre-submittal conference will normally be scheduled after any Planning Commission approvals have been granted for the project. The topics to be discussed at the pre-submittal meeting will include: schematic methods for meeting the conditions of approval for the project, off-site public improvements and project impact thereto, on-site public improvements, the development agreement, project construction and inspection requirements.
3. The construction plans shall demonstrate compliance with all approvals by other approval agencies, such as the City of Rockaway Beach Planning Commission.
4. The Project Engineer or Developer shall submit the construction plans and specifications to the City of Rockaway Beach together with the required plan review fee. Simultaneously, the Project Engineer or Developer shall submit the plans and specifications to all other required approval agencies. Those agencies may include, but shall not be limited to:
 - A. Sanitary Sewer: Oregon Dept. of Environmental Quality (DEQ)
 - B. Water Mains: Oregon State Health Division (OSHD)
 - C. Erosion Control: Oregon Dept. of Environmental Quality (DEQ)
 - D. Wetlands: Oregon Division of State Lands (DSL) and US Army Corps of Engineers

Three copies of the construction plans and specifications for the project together with the plan review fee shall be submitted to the City of Rockaway Beach. The Public Works Superintendent shall review the plans for conformance with the City's Design Standards and for overall project conformance with the conditions of approval. The Public Works Superintendent shall either approve the plans as submitted or return the plans with requested plan revisions and comments. It is the responsibility of the Developer to submit to the City copies of all plan approval letters from all required agencies.

Once the plans and specifications are approved by all required agencies, the City and the Developer shall enter into a Development Agreement prepared by the City that shall state the requirements and conditions that the Developer shall follow in the construction of the planned improvements. No construction shall commence on the project until plans have been submitted to the City of Rockaway Beach and the City of Rockaway Beach grants approval in writing.

Throughout the course of the construction work on the project, the Project Engineer shall be responsible that the project is constructed in compliance with the approved plans and specifications. The Project Engineer shall make all such inspections and observations as may be necessary to assure such compliance with the approved plans and specifications. At a minimum, the Project Engineer shall visit the project site on a weekly basis and shall file a weekly written progress report with the City of Rockaway Beach Public Works Department. Such report shall note the conditions of work observed by the Project Engineer, the progress achieved during the previous week and the progress anticipated during the coming week.

The Public Works Staff of the City of Rockaway Beach may conduct separate site observations of the construction work in progress. Observations by the City of Rockaway Beach shall not relieve the Project Engineer of the primary responsibility of ensuring and certifying compliance with the approved plans and specifications.

Upon completion of the project and prior to acceptance of the streets and sanitary sewer system by the City of Rockaway Beach, the Project Engineer shall prepare and submit the following to the City of Rockaway Beach:

One reproducible set, three blackline sets, and an electronic copy on CD of "as-built" plans shall be submitted to the Public Works Department.

The Project Engineer shall prepare and submit a letter of certification that the project was constructed in accordance with the approved plans and specifications.

If the public improvements are a part of a subdivision or partition of land, the Developer shall submit to the Public Works Superintendent a draft of the final subdivision or partition plat showing all required utility easements on the face of the final subdivision or partition plat.

The Project Engineer or Developer shall request in writing that the City of Rockaway Beach accept the street and sanitary sewer system as a part of the public improvements, subject to a 1 year written warranty provided by the Developer (or Developers) of the project improvements. The City may require an extended warranty length under special circumstances. The project improvements will only be accepted by the City of Rockaway Beach based upon a City Council resolution to accept jurisdiction of the right-of-way and the public improvements therein.

2.01 SANITARY SEWER PLANS:

All plans for sanitary sewer extensions shall be prepared by the Project Engineer, a Professional Engineer registered in the State of Oregon, and shall bear a suitable title showing the name of the project and the City of Rockaway Beach. The plans shall show the scale in feet, the North point, date, and the name of the Project Engineer, the Project Engineer's signature and the imprint of the Project Engineer's registration stamp.

Three copies of the construction plans and specifications for the project shall be submitted for review and approval to the City of Rockaway Beach. The plans shall be submitted on standard size sheet of either 18"x 24" or 24"x 36". The scale used shall be a standard engineering scale, i.e. 1"=100', 1"=50', etc.

2.01.01 Sewer Layout and Plans - Plans for sewer lines should contain at least the following information:

1. Adjacent streets and property lines, utility easements and references thereto.
2. Location of sewer and appurtenances. Each manhole, cleanout and service lateral shall be stationed to facilitate checking the plans with the profiles.
3. Location of adjacent water courses, wells, stream and railroad crossings, water mains, storm drains, culverts and underground power, or other utilities wherever possible.
4. Show a table of all sewer service laterals with lateral station, distance from downstream manhole to service tee, length of service lateral, and depth of lateral at property line.
5. Appurtenances - detailed drawings shall be included for manholes, cleanouts, typical trench section and typical service connections.
6. Show horizontal and vertical separation between water and sewer pipes. Call out clearances at all water/sewer crossings.

2.01.02 Sewer Profiles - Profiles for the individual sewer lines should contain at least the following information:

1. Location of manholes and other appurtenances with each manhole numbered or stationed as in item (2.01.01) above.
2. Continuous profile of ground surface and sewer invert with elevations calculated and listed at 50-foot intervals.
3. Size, slope, type of pipe and length of sewer pipe between consecutive manholes.
4. Elevation of original ground, finished grade, rim elevations and sewer inverts at each manhole.

2.01.03 Appurtenances - Detailed drawings should be included for all sewer appurtenances, including manholes, pumping stations, inverted siphons, etc. The City of Rockaway Beach's Standard Drawings may be used and shown on the plans.

2.01.04 North Arrow and Scale - A north arrow shall be shown with the scale of the drawing immediately below the arrow.

2.01.05 Bench Marks - The location and elevation of a National Geodetic Survey, United States Geological Survey, State Highway, or Tillamook County benchmark shall be shown. Any other datum proposed shall be submitted to and approved by the City of Rockaway Beach prior to use and shall be used only if the United States Coast and Geodetic Survey, United States Geodetic Survey, United States Geological Survey, State Highway, or Tillamook County bench mark is not within 1/2 mile of the boundaries of the project. All temporary benchmarks shall be shown on the plans.

2.01.06 Stationing shall be shown on all maps. Generally, stationing shall start at the point of connection to the existing sanitary sewer lines and/or the lowest elevation. Sewer stationing shall be mathematically equated to road stationing, as appropriate.

2.01.07 Test Pits - Where the sewer main or manhole is located in unknown subsurface conditions, the City of Rockaway Beach may require the Project Engineer to excavate test pits to determine the subsurface conditions. When required by the City of Rockaway Beach, test pits shall be dug within 25 feet of each manhole more than 8 feet deep and at intervals of not more than 250 feet along sewer mains. Plans shall show the location of the test pits and a profile of each pit showing the ground water level, soil types encountered and date of excavation.

2.02 SPECIFICATIONS:

Three copies of the complete technical specifications for the construction of sewer systems, and all appurtenances, shall accompany the plans. Reference to the City of Rockaway Beach's Technical Specification is acceptable. Deviation from the City of Rockaway Beach's Materials and Installation Specification must be submitted in detail and approved prior to construction of the project.

Because of high ground water that is prevalent in many areas, excessive infiltration will occur unless extreme care is taken in the laying and lifting of sewer lines. Excessive infiltration results in increased construction and operation costs of sewage treatment plants and interferes with the efficiency of

operation. It is necessary, therefore, that the amount of infiltration be kept as low as possible. For this purpose, the specifications should cover in detail the method of laying pipe and construction joints. Strict supervision shall be provided during construction to make certain of specifications compliance. In general, the sewer specifications shall cover pipe materials, excavation, laying of sewer pipe, jointing, backfilling, testing, etc.

2.03 REVISION TO APPROVED PLANS:

Any deviations from approved plans or specifications affecting capacity, drainage, etc. shall be approved in writing before such changes are made. Plans or specifications so revised should, therefore, be submitted well in advance of any construction work that will be affected by such changes to permit sufficient time for review and approval.

2.04 INSPECTION DURING CONSTRUCTION:

The Project Engineer shall be responsible to provide an adequate amount of site inspection during the course of the work to assure and certify that the work was accomplished according to the approved plans and specifications. The City may require active full-time inspection on the part of the Project Engineer when it is deemed necessary by the City. Full time inspection shall be required on:

1. Critical areas with poor soil conditions.
2. Construction in and around wetlands and creek crossings.
3. Adjacent to existing structures.
4. When trench dewatering equipment is necessary.
5. Unique and unusual construction techniques or details.
6. Other circumstances such as when the City finds that the construction is not in accordance with the approved plans and specifications.

The City may require sewers to be removed or replaced if plan or specification deviations occur without prior approval.

SECTION THREE
MINIMUM DESIGN CONSIDERATIONS

3.00 GENERAL:

Sanitary sewers should be designed to remove the domestic sewage from houses, business buildings and other public and private establishments, but not the street or roof drainage. Storm water, including street, roof, or footing drainage, shall be removed by a system of storm sewers or by some other method separate from the sanitary sewer system. Unpolluted cooling waters and swimming pool drains should be kept out of sanitary sewers wherever possible.

In general sewer systems should be designed to care for future loads which may reasonably be expected within a period of 50 years, and for ultimate development of the specific drainage area concerned.

Specific approval of lift or pump stations shall be required.

3.01 CAPACITY:

Design flows shall be determined by consideration of the following factors;

1. Drainage basin area to be served.
2. Population within the areas to be served.
3. Land use within the areas to be served.
4. Per capita sewage flow.
5. Commercial, industrial, or institutional users to be served.
6. Infiltration allowance.
7. Changes in any of the above factors that might reasonably be expected to occur during the design life of the sewer.

In the absence of consumption data or other reliable information, the following factors may be assumed:

- Per Capita Daily Flow 300 to 350 gpcd (lateral sewers)
- Per Capita Daily Flow 250 gpcd (trunk sewers)

It is recommended that design calculations include estimates of average maximum and minimum daily flows. The submission of design calculations will not ordinarily be required but designers should be prepared to substantiate pipe sizes, layout, population estimate, land uses or other design assumptions.

3.02 SIZE:

Main line sewers shall be at least 8 inches inside diameter except that the upstream section of a lateral sewer that will never be extended may be of 6-inch inside diameter. The length of such a 6- inch line may not exceed 250 feet.

3.03 MINIMUM GRADE:

All sanitary sewer shall be laid on a grade which will produce a mean velocity, when flowing full or half full at least 2 feet per second, based upon coefficient of roughness values depending upon the type of pipe used. The minimum grades for various sizes of pipe with an "n" value of 0.013 are listed below:

MINIMUM GRADES FOR PIPE	
Inside Pipe Diameter (Inches)	Grade (Feet per 100 feet)
6	0.60
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06

In general, slopes greater than those shown above are desirable and are particularly recommended on the upper ends of lateral sewers.

Slopes slightly less than those shown above may be considered if substantial justification can be demonstrated. In cases where flatter slopes are considered and sewers are less than 15 inches inside diameter, there must be enough live sewer interceptions to ensure that the average depth of sewage flow will be 30 percent of the pipe inside diameter. Engineers are cautioned not to specify sewers of sizes that are obviously larger than are necessary for satisfactory carrying capacity but which are specified in order to meet grade requirements.

3.04 ANCHOR WALLS:

Sewers on slopes of 20 percent or more shall be secured by anchor walls in accordance with the following:

1. Not over 35 feet center to center on grades 20 percent and up to 35 percent.
2. Not over 25 feet center to center on grades 35 percent and up to 50 percent
3. Not over 15 feet center to center on grades 50 percent and over.

3.05 MINIMUM DEPTH:

All sewers shall be laid at depth sufficient to drain basements and to be protected against damage by frost and traffic. Sewers laid in areas subject to wheel load shall have a minimum cover of 3 feet measured from top of pipe to finished grade or be otherwise protected from damage by traffic.

Under normal conditions, mainline sewers in residential areas without basements should be laid at a depth of 6 feet. Services to adjacent properties from such sewers should normally be laid so that the depth of the service line at property line is at least 4 feet. Depths are measured to the sewer or service line invert from finished grade.

3.06 LOCATION:

3.06.01 Relation to Water Lines and Wells - No sanitary sewers should be less than 10 feet from any well, spring, or other source of domestic water supply. All sanitary sewers or parts thereof which are located within 50 feet from any such source of domestic water supply shall be constructed of pressure rated pipe with watertight joints. Sanitary sewers and domestic water lines shall not be laid in the same trench. Parallel water and sewer lines wherever possible should be located at least 10 feet apart horizontally when there is less than 18 inches of vertical clearance between water and sewer. When physical conditions render this spacing impossible or impractical, then pressure rated pipe with watertight joints or concrete encasement is required for the sewer line. Wherever it is necessary for sewer and water lines to cross each other, the crossing should be at an angle of approximately 90 degrees. Additionally, the sewer shall either be located 18 inches or more below the water line or be constructed of cast iron water pipe with watertight joints for a distance of 9 feet on both sides of the water line.

3.06.02 Sewers in Streets or Easements - Under normal conditions sewers should be located in street right of way within 5 feet of the street centerline. When it is necessary to locate sewers in easements such easement shall be at least as wide as twice the maximum depth of the sewer or a minimum of 15 feet in width. Sewers 24 inches in diameter or larger may require wider easements. Easements shall be provided to the City prior to final acceptance of project.

3.07 ALIGNMENT:

Sewer lines should be laid on straight alignment and uniform grade between consecutive manholes. Horizontal and vertical curves in sewers are not recommended. However, in cases where justification can be shown, limited use of such designs may be considered. Radii of curvature must be of sufficient length to minimize joint opening and positively maintain watertightness. This should be considered early in the system design. Complete and accurate records must be kept of the exact location of such curved sewers for future reference.

3.08 INCREASING SIZE:

When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

3.09 HIGH VELOCITY PROTECTION:

Where velocities greater than 15 feet per second are attained, special provision shall be made to protect against displacement by erosion and shock.

3.10 MANHOLES AND CLEANOUTS:

3.10.01 Details - See Standard Drawings.

3.10.02 Manhole Construction - Construction shall be watertight. If ground water or surface drainage can be expected to flood the top of the manhole, watertight covers shall be used. For

non-reinforced rigid pipe, there shall be standard joint or flexible coupling installed at the inlets and outlets of each manhole. These should be at a distance of no more than one pipe diameter from the outside surface of the manhole wall for pipes over 12 inches inside diameter, and no less than 12 inches from the wall. Tracer wire placed along all mains and laterals shall penetrate at manhole mortar stubout and loop up with enough length to be extended through manhole lid. Tracer wire shall be tied onto manhole steps for easy access.

3.10.03 Manhole Location - Manholes shall be located as follows:

1. Every change in grade or alignment of sewer.
2. Every point of change in size or elevation of sewer.
3. Each intersection or junction of sewer.
4. Upper end of lateral sewers, except as provided in Section 3.10.05.
5. At intervals of 500 feet or less.*

* Spacing may be increased for sewers in excess of 36 inches diameter.

3.10.04 Flow Channel - The flow channel through manholes should be made to conform in shape and slope to that of the sewers.

3.10.05 Cleanouts will not be approved as substitutes for manholes, except at the upper end of lateral sewers 250 feet or less in length.

3.10.06 Drop Manholes - Outside drop assemblies shall be provided for pipes 12 inches in diameter and smaller when entering a manhole at a distance of more than 24 inches above the invert of the manhole. Larger pipe should be introduced into the manhole at the manhole invert. Inside drop assemblies may be approved by the City if conditions so warrant.

3.11 SEWER JOINTS AND INFILTRATION:

The method of making joints and the materials used should be included in the specifications. Sewer joints shall be designed to minimize infiltration and to prevent the entrance of roots.

Leakage test shall be required as specified in the Materials and Installation Specifications. House or building sewers shall also be tested. The use of television camera or other visual methods for inspection prior to placing the sewer is recommended.

3.12 BUILDING SEWERS:

As a minimum criterion, construction of the house or building sewers shall be the same quality and meet the same requirements as the public sewer with regard to materials, water tightness and location. In addition, these sewers shall conform to the state and local plumbing codes and restrictions. No road, surface, foundation, or other storm water drain lines shall be connected to the public sewers. See Standard Drawings.

3.13 DOWNSTREAM PIPES:

Downstream pipes be checked to determine adequacy for increased flow rates.