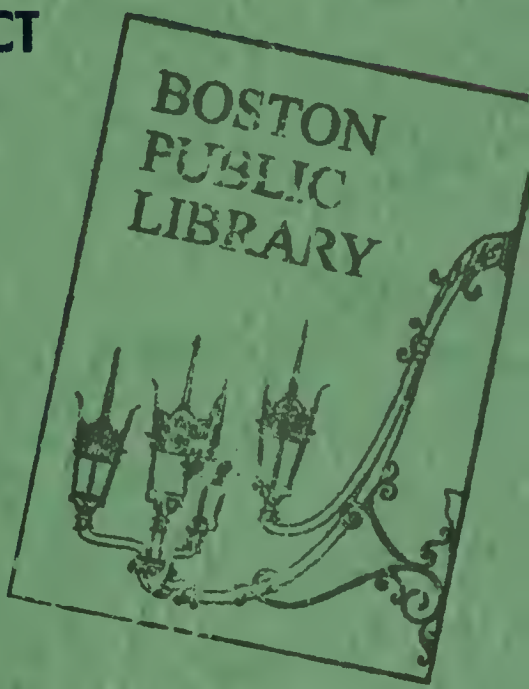
BOSTON REDEVELOPMENT AUTHORITY

ENGINEERING REPORT ON

THE PRELIMINARY DESIGN OF PROJECT IMPROVEMENTS

SOUTH END PROJECT

Project No. Mass. R-56



JULY 1965

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REPLY TO: Boston
July 15, 1965

Mr. Wallace B. Orpin, P.E.
Chief Engineer and Director of Site Development
Boston Redevelopment Authority
20 Pemberton Square
Boston, Massachusetts

Re: South End Project
Engineering Report – Part I
Application Loan and Grant

Dear Mr. Orpin:

In conformity with our authorization of April 25, 1963, we have prepared and submit herewith report entitled, "Engineering Report on the Preliminary Design of Project Improvements," and related plans of project improvements for the South End Urban Renewal Project.

Twenty-five (25) copies of the report and fifteen (15) copies of the plans and original tracings are submitted herewith in accordance with contractual requirements and by agreement with your staff.

Review comments by members of the Boston Redevelopment Authority staff have been incorporated in the report and plans.

The assistance and cooperation provided by the Engineering Division, the Project Planning Staff, the Transportation Planning Department of the Boston Redevelopment Authority, and by the Sewer, Water and Engineering Divisions of the Boston Department of Public Works, the Boston Traffic and Parking Commission, the Fire Alarm Division of the Boston Fire Department, the Police Signal Division of the Boston Police Department, the Sewer and Water Divisions of the Metropolitan District Commission, Massachusetts Bay Transportation Authority, the Massachusetts Department of Public Works, and the National Board of Fire Underwriters was invaluable to the successful completion of the Project.

The aid and assistance of the dedicated people in these agencies is acknowledged with great thanks.

We appreciate the opportunity to participate in this endeavor and look forward to serving the Boston Redevelopment Authority again in the future.

Respectfully submitted,

CHARLES A. MAGUIRE & ASSOCIATES

Gordon Bronson, Partner

GB:mt

BOSTON REDEVELOPMENT AUTHORITY

Engineering Report on
The Preliminary Design of
Project Improvements

SOUTH END PROJECT
Project No. Mass. R-56

July 1965

Charles A. Maguire & Associates

Engineers

Boston Providence Hartford

INDEX

0.0 SUMMARY

This report presents the preliminary design engineering improvements to streets, utilities and recreational areas which are proposed for the South End Project located in Boston, Massachusetts. The results of this study are summarized below, by category of improvements in the order that they appear in the text.

0.1 STREETS

The street improvement program will induce through traffic to use new and existing perimeter streets and will improve the interior streets to increase their efficiency and modernize them.

The major street improvements consist of:

1. Making Dover, Washington and Tremont Streets four lane divided roadways.

2. Construction of perimeter roadways including an Albany Street Service Road, an Extension of Herald Street and a proposal for construction of a grade separated South End Bypass along the westerly side of the project.

3. Reconstruction and some resurfacing of most of the existing street pavements in the Project.

4. Widening, straightening, and relocating or discontinuing many existing streets.

A fundamental program for staging of street improvements included here is designed to harmonize with the proposed staging of adjacent new developments and improvements to water and sewerage systems and to maintain functional traffic circulation.

0.2 PARKS AND PLAYGROUNDS

Many new parks, playgrounds and open spaces have been proposed by the project planners. They are located in areas to best serve the public, add dignity to the neighborhood streets and

to complement proposed developments. Provisions have also been made to improve existing parks and playgrounds. A construction staging program is presented in the report to coordinate with other improvements in the Project Area.

0.3 STREET AND PARK LIGHTING

Lighting levels for about 60% of the South End are inadequate. The present lighting system consists of incandescent and mercury vapor installations producing light intensities ranging from 1,000 to 20,000 lumens.

The new lighting system will provide greater safety margins for drivers and pedestrians and act as a deterrent to vandalism. The new lighting equipment will be mercury vapor, color corrected unitized luminaires ranging in intensity from 3,500 to 20,000 lumens.

Almost all streets and alleys that need it, are scheduled to have new lighting installed under the Urban Renewal Program. A small number of minor alleys will be left for future improvement.

0.4 WATER DISTRIBUTION SYSTEMS

Although the water systems are quite old and have greatly reduced carrying capacity from their original, they are fundamentally sound and adequate for present demands.

Improvements are needed, however, to eliminate deficiencies in systems that will supply proposed developments and other areas of the city, to insure adequate fire protection in proposed industrial sites to replace obsolete appurtenances and to maintain an adequate capacity for future demands. For maximum economy, the improvements are coordinated with street improvements wherever possible.

The 20-inch and 30-inch trunk mains in Dover Street and Massachusetts Avenue will be

cleaned and cement lined as will the 16-inch high service main in Worcester Square, Harrison and Massachusetts Avenues. Distribution main and appurtenance improvements are scheduled for the entire project area, based on design criteria presented in the report.

0.5 SEWERAGE

The combined sewerage system in the South End is old, generally in poor to fair condition, has ineffective tide gates, pollutes the Roxbury conduit and has an obsolete storm water pumping station at Union Park Street. Extensive improvements are necessary to eliminate the deficiencies in the system. This report proposes construction of a separate sanitary sewerage system, reconstruction of existing conduits in poor condition, revision of the storm overflow and storm conduit system in conjunction with modernization and increased capacity of the Union Park Street Pumping Station, repair and replacement of tide gates on the entire Boston Main Drainage System, reconstruction of the East Side and Roxbury Canal Interceptors, and providing a new lining in the Boston Main Interceptor in the Project Area. Improvements to the tide gates and the Union Park Street Pumping Station and reconstruction and repair of the interceptors should be given the highest priority in the entire Project Improvement Program.

The construction staging program presented herein is designed to provide a logical, orderly development of the systems arranged to be functional and to coordinate with development and street improvement staging.

It is important to note, that although vital, the improvements to the intercepting system have not been included in the Project Improvements as the result of a policy decision by the Boston Redevelopment Authority. It is strongly recommended that a source of financing this work be resolved and that this work be started as soon as possible before a serious conduit failure occurs.

0.6 POLICE SIGNAL SYSTEM

The Boston Police Signal Division, which controls and maintains the Police Signal System, reports that the system in the South End is in satisfactory working order and requires no major improvement. While most of the cables are carried in separate ducts of the New England Telephone and Telegraph Company, the Signal Division constructs manholes and ducts where telephone ducts are not available and also installs all laterals to signal boxes. Relocations and new installations required by the Urban Renewal Program should be coordinated with the street improvement program following their approval by the Boston Police Department.

0.7 FIRE ALARM SYSTEM

The Boston Fire Department's Fire Alarm Division reports that the system in the South End performs adequately. Most alarm circuits are carried in separate ducts of the New England Telephone and Telegraph Company, but the Fire Alarm Division constructs manholes and ducts where necessary and installs all laterals to alarm boxes and test posts. Fire alarm boxes in the project area have been relocated near proposed schools and public buildings. Existing circuits are adequate to accommodate anticipated additional private fire alarm service, the cost of which is the responsibility of the users. Plans for change in the present system must be consistent with Fire Alarm Division policy and must provide continuity of service; installation should be coordinated with the street improvement program.

0.8 M.B.T.A. FACILITIES

The MBTA facilities in the South End consist of a network of underground power cables, a portion of the Forest Hills-Everett elevated line, a power substation, a bus garage, and a system of bus lines. The elevated structure is currently under study by the MBTA for future

demolition. Although improvement of Washington Street should follow this demolition, the Urban Renewal Plan for the South End is not contingent on removal of this structure. The bus garage on Albany Street, together with a similar facility in the Washington Park Project Area, Mass. R-24, will be replaced by a new combined facility in the vicinity of the Inner Belt Expressway, outside the South End Project Area. The power rectifying station located at the Albany Street Garage and the power cables leading to it will be retained, and utility easements maintained as necessary, subject to final disposition of these facilities by the MBTA.

0.9 TRAFFIC CONTROL SYSTEM

Traffic projections based upon the proposed construction of the Inner Belt and of the South End Bypass System indicate that the existing arterial streets will remain as major traffic carriers. A traffic circulation plan has been prepared, reviewed, and approved by the Boston Parking and Traffic Department and the Transportation Planning Department of the Boston Redevelopment Authority, and copies of the plan have previously been distributed. Signalized intersections are proposed to accommodate projected flow patterns and allow optimum traffic usage of the streets during peak hours. A combination of local and master control provides for either independent operation or a coordinated system that can be adapted to any future requirements. The Boston Traffic and Parking Department, under the Commissioner of Traffic and Parking, is responsible for the installation and maintenance of all traffic signals and signs. Signal locations have been reviewed by the Traffic Department and the standards of the Boston Traffic Commission and the "Manual on Uniform Traffic Control Devices for Streets and Highways," published by the Bureau of Public Roads, United States Department of Commerce, in 1961, was used as the basis for the design of the traffic control system.

0.10 STREET, TRAFFIC AND DIRECTIONAL SIGNS

The standards of the Traffic and Parking Division, City of Boston, were used in estimating cost for the street name, traffic and directional signs and permanent pavement markings required for the South End Project. The street name signs will be designed by the Traffic and Parking Division, or their design consultant, to conform with the overall architectural planning for the South End.

0.11 SOILS

The South End, generally along Washington Street, was naturally formed land and was a narrow neck that led from the mainland of Roxbury to the Boston Peninsula. Over the years, the tidal areas on each side of the neck were filled, resulting in a soil profile in the man-made area of generally unstable soils. These conditions require special foundations for major utility structures in extended sections of the area. This is particularly applicable to new large sewerage conduits. Soils information, available from numerous soil borings that have been made in past years throughout the South End Project, provided a basis for development of a generalized subsurface profile in the area. Soils information, as well as the conduit foundation recommendations and the construction recommendations as discussed in Section 11.0 of this report, are of a general nature and further soils studies are recommended for each proposed conduit and future developed areas.

0.12 SUMMARY OF COSTS

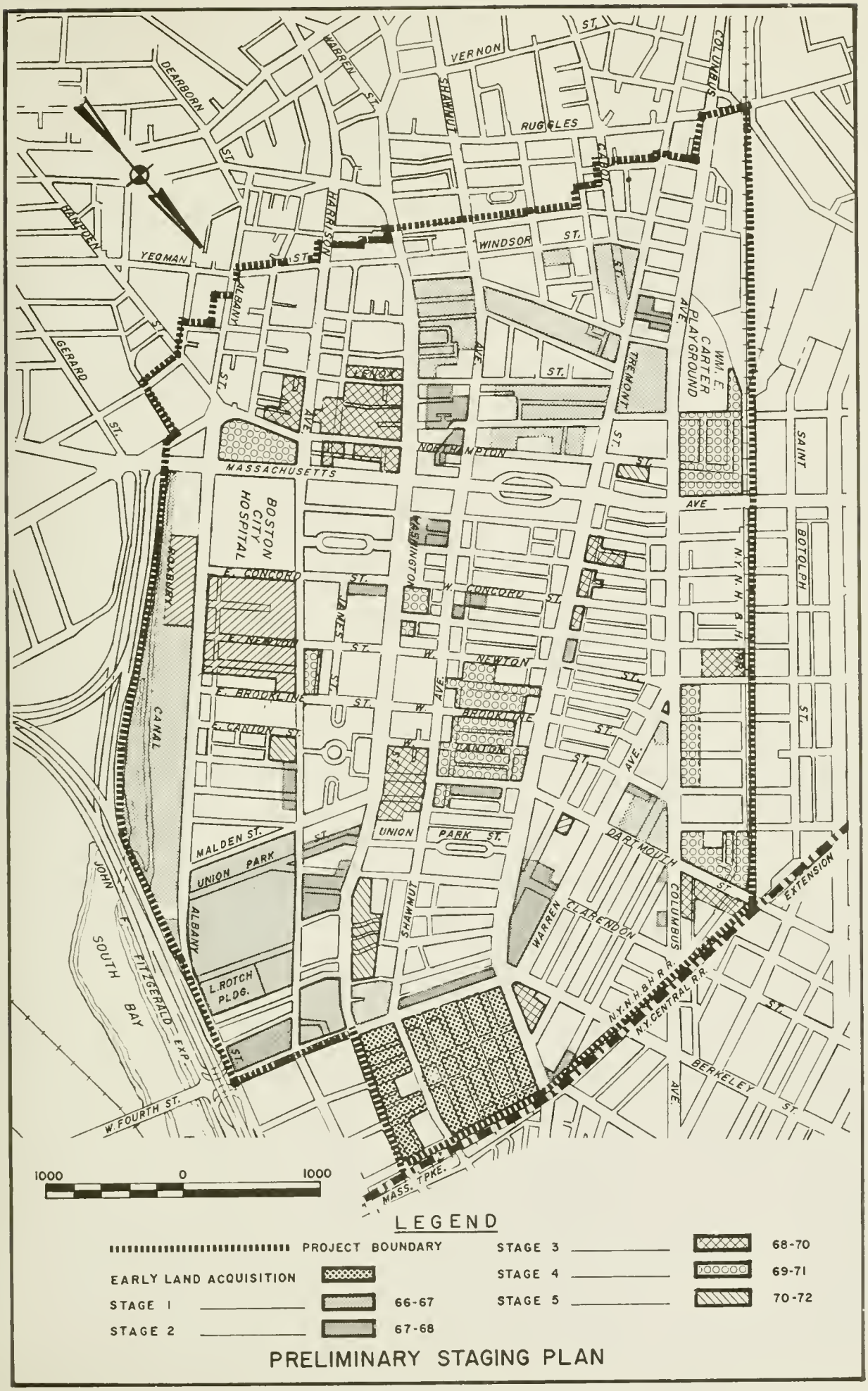
The following tabulation shows a summary of expenditures required for project improvements, subdivided by stages and held within the dictates of an established budget for the Urban Renewal Program.

It has been assumed that future improvements not to be included in the Urban Renewal Program will be completed by the City of Boston.

Following the tabulation of the summary of expenditures for project improvements, there is included the preliminary staging plan for construction that was developed as part of the overall renewal and rehabilitation program for the South End.

PROGRAM OF EXPENDITURES FOR PROJECT IMPROVEMENTS

Project Improvements	URBAN RENEWAL PROGRAM EXPENDITURES							Expenditures Required For Future Improvements
	Castle Square Early Land Acquisition	Stage 1 1966-67	Stage 2 1967-68	Stage 3 1968-70	Stage 4 1969-71	Stage 5 1970-72	Total	
Streets	162,000	808,900	835,700	362,700	2,093,100	228,800	$ 4,491,200	650,000
South End By-Pass System (at grade design with Herald Street Extension)	------	------	------	------	2,422,000	------	2,422,000	
Parks, Playgrounds & Open Spaces	58,000	971,300	189,900	384,900	350,000	121,900	2,076,000	
Street and Park Lighting	45,000	164,600	169,800	73,900	425,000	46,700	925,000	130,000
High and Low Service Water	28,000	310,700	134,900	128,500	286,500	41,300	929,900	195,000
Sanitary Sewers and Storm Drains	164,000	1,794,700	986,200	669,100	681,400	28,700	4,324,100	1,166,200
Intercepting Sewer System	------	------	------	------	------	------	------	2,060,500
Union Park Pumping Station	------	500,000	------	------	------	------	500,000	
Tide Gate Improvements	------	100,000	------	------	------	------	100,000	
Police, Signal & Fire Alarm Systems	30,000	13,300	13,700	5,900	34,300	3,800	101,000	
MBTA Facilities	------	325,000	7,000	------	18,000	------	350,000	
Traffic Control	------	39,800	76,900	------	168,700	6,600	292,000	
Street Traffic and Directional Signs	5,000	19,600	20,300	8,800	50,700	5,600	110,000	
TOTAL	492,000	5,047,900	2,434,400	1,633,800	6,529,700	483,400	$16,621,200	$4,201,700



PRELIMINARY STAGING PLAN

1.0 INTRODUCTION

When an Urban Renewal Program is undertaken in a community it requires that many aspects of the community must be studied. The social, economic and physical environments of the community must be examined and carefully evaluated to arrive at a total program for revitalizing an urban area. The combined efforts of many people in many specialized fields of endeavor are required to synthesize a program that will attain the common goal.

This report presents the results of engineering studies, and cost estimates of the proposed project improvements to be undertaken in the South End Project. In general, the report provides the reader with the basic concepts of the preliminary design of proposed improvements to streets, parks, lighting, water distribution, sewerage, police and fire alarm, Massachusetts Bay Transit Authority facilities, and traffic control systems. Plans of project improvements, drawn at a scale of 1 inch equal to 100 feet, are submitted with this report and are listed below. When used in conjunction with the report they will enable the reader to have at his disposal a complete reference for the improvements that are to be made under the Urban Renewal Program for the South End Project.

Urban Renewal budget limitations do not permit inclusion of all improvements that should eventually be made in the South End. Therefore, the basic plans of a comprehensive improvement program were prepared from which the improvements to be made under the Urban Renewal Program were selected on a priority basis. Supplementary "working plans" of the comprehensive program for street, water, sewerage and lighting systems, are being submitted to the Boston Redevelopment Authority for future reference and the estimates of cost for the remaining increments of work that should eventually be undertaken are included in the appropriate sections of this report.

As a reference there is included here a complete list of Project Improvement Plans.

Plan Description	Drawing No.
Streets, Parks and Playgrounds	SE 10-1 through SE 10-8
Typical Sections - Major Streets	SE 10-9
Inner Belt Expressway Tentative Design and General Alignment	SE 10-10
Street and Park Lighting	SE 11-1 through SE 11-8
High and Low Service Water	SE 12-1 through SE 12-8
Sanitary Sewers and Storm Drains	SE 13-1 through SE 13-8
Fire Alarm, Police Signal and M.B.T.A. Facilities	SE 14-1 through SE 14-8
Traffic Circulation and Signalization	SE 15-1 through SE 15-8
Traffic Circulation and Signalization Existing Signal Installations	SE 15-9

2.0 PROJECT IMPROVEMENT PROGRAM

The basic objective of the South End Plan is to provide a stable residential and industrial-commercial community. A major contributing factor for attaining this objective is the improvement of public facilities to provide an attractive, healthful, safe and efficient environment for residents of the community in future years.

Project improvements that are necessary to accomplish these objectives include the installation and construction of new facilities, and the reconstruction and repair of: (1) old deteriorated and inadequate sewerage and storm drainage systems; (2) inadequate and obsolescent water distribution facilities; (3) deteriorated and inefficient streets and sidewalks; (4) inadequate parks, playgrounds and open spaces; (5) obsolescent street lighting facilities; (6) inefficient, inadequate and obsolete traffic control systems, and other related facilities.

This report is based upon preliminary engineering studies for project improvements. Several reports and plans that were prepared previously have served as a basis for evaluation and analysis for improvement of the public facilities. These previous reports prepared for the Boston Redevelopment Authority serve as appendices to this report:

1. "Report on Preliminary Studies of Existing Utility Systems," April, 1964; by Charles A. Maguire & Associates, Engineers.
2. "Report on Water and Sewer Systems Inspection and Flow Measurements - South End Project," April, 1964; by Charles A. Maguire & Associates, Engineers.
3. "Street Condition Survey and Inventory of Streets and Utilities - South End Urban Renewal Area," October, 1963; by Charles A. Maguire & Associates, Engineers.
4. "Investigation of Subsoil and Foundation Conditions - South End Urban Renewal Area," December, 1963; by the Thompson and Lichtner Company, Inc., Engineers.

3.0 STREETS

The major intent of the proposed street improvements is to preserve the integrity of the project area by facilitating the flow of through traffic on perimeter streets, thereby reserving the interior streets for local use and to retain the majority of existing streets in their present right of way providing new pavements, curbs, and sidewalks where necessary. Several existing streets will be abandoned, however, to create new development areas. A minimum number of new streets will be created to improve the internal flow of traffic in the South End. Reference is made to drawings SE 10-1 through SE 10-10 which accompany this report.

3.1 EXISTING STREET CONDITIONS

An inventory of existing streets was made to determine the physical condition of pavements, sidewalks, curbing and other pertinent information. This was supplemented by a search of the records of the Boston Public Works Department to determine the widths of rights of way, pavements and sidewalks, and the types of pavements and bases in the streets. The inventory tabulated by streets is the subject of a supplemental report submitted to the B.R.A. in July of 1963. About 50 per cent of the streets, by existing condition alone, require reconstruction or resurfacing, while 40 per cent require repairs and 10 per cent require no action. The condition of sidewalks and curbing requires replacement of about 50 per cent.

Streets in the area were investigated to determine existing horizontal and vertical sight distance problems. Vertical sight distances are sufficient everywhere and horizontal sight distances are only a problem at certain intersections. The street improvement plans provide for increasing the radii at all corners where sight distance is inadequate and building clearance permits.

3.2 MAJOR STREET CHANGES

The South End Bypass is proposed along the western periphery of the project area. It will begin at Columbus Avenue on the north and terminate at the proposed Inner Belt. It is expected to carry most of the north-south through traffic.

On the northern border, improvements consisting of an extension of Herald Street from Tremont Street to Columbus Avenue and a widening and extension of Cortes Street from Arlington Street to Columbus Avenue (in the South Cove Area), provide a continuation of the South End Bypass to Tremont Street.

A new frontage road is proposed on the eastern border of the South End. This will provide access to the proposed Flower Market as well as interchange with the Inner Belt, and is expected to substantially reduce traffic on Albany Street.

The Inner Belt Expressway, for which the tentative design is depicted on plan SE 10-10, is proposed by the Massachusetts Department of Public Works. Final basic design studies of this roadway are in progress and its construction is expected to be complete before 1972.

The entire perimeter of the South End will therefore be encircled by a system of arterial roadways which will provide frequent points of access for local traffic.

Modifications to the internal street system will be effected by discontinuance, cross section change, and alignment changes.

East-West through traffic is expected to use three main corridors - Massachusetts Avenue, the Inner Belt System, and the widened two-way Dover Street.

3.2.1 South End Bypass System

The South End Bypass is proposed along the western periphery of the project area. It will begin at Columbus Avenue and connect with the proposed Southwest Expressway Inner Belt Interchange. It is expected to carry most of the north-south through traffic.

The tentative design is for a grade separated, divided four lane roadway. An at grade facility is provided for as a minimum workable alternative. A temporary connection from the Southwest Expressway Inner Belt Interchange to Columbus Avenue is proposed to serve until the final design of the Southwest Expressway Interchange and the Bypass is determined. (See SE 10-10).

The details of design of the roadway were dictated by land acquisition limits established by the B.R.A. planning staff. The restriction does not provide enough width for shoulders on the roadway and results in a forced profile and horizontal alignment. Adequate highway design criteria dictate that additional right of way width should be provided to permit:

a) Eight foot wide shoulders for breakdowns and emergencies.

b) Increased width of the proposed local streets that will connect between discontinued streets to the east of the Bypass.

c) Improved horizontal alignment of the ramps and the main roadway.

d) Elimination of the forced undulating profile necessitated by the right of way restriction.

The final design of the entire facility should be closely coordinated with plans by the MBTA to use the adjacent New Haven Railroad right of way for a rapid transit line.

3.2.2 Extension of Herald-Cortes Street

This improvement is necessary to provide continuity in the street pattern from Columbus Avenue to Tremont Street paralleling the Railroad and Turnpike rights of way. These frontage roads will provide an efficient terminal for the South End Bypass System.

3.2.3 Columbus Avenue

Columbus Avenue will be changed to a local street by terminating it at Walpole Street in conjunction with a cross section change which involves removal of the median and narrowing of the pavement. The change to Columbus Avenue will not be made until the South End Bypass

System is constructed. Columbus Avenue must be maintained to carry traffic at its present capacity until the Bypass can replace it as an arterial street. The possibility that the Bypass may not be constructed for many years, or after the Inner Belt Expressway construction is completed, could require use of Columbus Avenue and Tremont Street as a one way pair to carry traffic from the Inner Belt and Southwest Expressway.

3.2.4 Tremont Street

Tremont Street will remain an arterial street and have two lanes in each direction. In addition a wide linear park type median will be provided to allow for separate left turn storage lanes at major intersections. The improvement to Tremont Street will not be made until the South End Bypass System is completed, for the same reasons stated for Columbus Avenue.

3.2.5 Washington Street

Changes to Washington Street are contingent upon the removal of the M.B.T.A. elevated structure, currently under study by the M.B.T.A. When the structure is removed by the M.B.T.A. Washington Street, as the main arterial street from Hyde Park to Downtown Boston, will become a divided arterial street with two travel lanes and left turn storage lanes in each direction between Union Park Street and the Inner Belt Expressway, and a four lane undivided roadway from Union Park Street to Herald Street. The Urban Renewal Plan for the South End is not contingent on the M.B.T.A. Structure being removed.

3.2.6 Harrison Avenue and Shawmut Avenue

These streets will retain their present width and be revised to act as a one-way pair with Shawmut Avenue becoming southbound and Harrison Avenue northbound, when the Washington Street improvement is made; otherwise they will continue to function as they now do.

3.2.7 Albany Street and the New Service Road

No changes will be made in Albany Street. The construction of a one-way service road from Albany Street to Massachusetts Avenue is expected to substantially reduce traffic and congestion on Albany Street. Its northern terminus at Albany Street is subject to redesign pending final design of the Inner Belt Expressway. To complement this Service Road and provide an efficient bypass system for Albany Street, the frontage road system proposed by the Massachusetts Department of Public Works to parallel the Inner Belt Expressway and the system paralleling the Central Artery in the vicinity of Dover Street should be made a continuous system.

3.2.8 Chandler Street

Chandler Street will be realigned to intersect Columbus Avenue at right angles and the section from Berkeley to Tremont Street will be made one-way towards Tremont Street.

3.2.9 Appleton Street

Appleton Street will become one-way westbound from Tremont to Dartmouth Street and the street will be discontinued from Dartmouth Street to Columbus Avenue.

3.2.10 Warren Avenue

Warren Avenue will be discontinued from Columbus Avenue to Pembroke Street, narrowed to forty (40) feet of pavement from Pembroke to Berkeley Street and made one-way eastbound from Clarendon to Berkeley Street.

3.2.11 Montgomery Street

Montgomery Street will be discontinued from Union Park Street to Tremont Street.

3.2.12 Dover Street

Dover Street will be widened to a two-way divided street between Tremont Street and Albany Street. A study of the Expressway ramp locations and frontage and local roads in the vicinity of Dover Street at the Expressway, should be made to resolve the traffic congestion that now occurs daily during peak hours on the frontage roads at Dover Street on each side of the expressway.

3.2.13 Berkeley Street

Berkeley Street will be widened from Tremont Street to the bridge over the Massachusetts Turnpike, and continue to function as a one-way street in that direction.

3.2.14 Clarendon Street

Clarendon Street will be discontinued from Warren Avenue to Tremont Street and made one-way southbound to Warren Avenue where traffic will turn left to Berkeley Street. Clarendon and Warren will thereby function as the return movement of Berkeley Street.

By agreement with the Boston Traffic Commission, the discontinuance of Clarendon Street between Warren Avenue and Tremont Street will be tentative and subject to reopening if traffic movements cannot be adequately handled by the new circulation pattern.

3.2.15 Dartmouth Street

Dartmouth Street will be widened between Columbus Avenue and the bridge over the Massachusetts Turnpike. Existing West Dedham Street, a continuation of Dartmouth Street, will be discontinued between Shawmut Avenue and Washington Street, but like the Clarendon Street discontinuance, it will be tentative subject to its effect on traffic.

3.2.16 Northampton Street

This street will be relocated between Washington Street and Shawmut Avenue to divert through traffic from the westerly section of Northampton to Camden Street.

3.2.17 The Inner Belt

The design of the proposed Inner Belt from Massachusetts Avenue along the southern periphery of the area is tentative pending completion of the Massachusetts Department of Public Works' Studies. It is scheduled to be under construction by the D.P.W. within two years in the approximate location shown on drawing SE 10-10.

Several new minor streets are proposed to facilitate traffic circulation and provide access to proposed new developments. In addition, improvement and widening of other minor streets will be undertaken.

Many streets will be reconstructed due to the extensive public utility construction required in the area and the anticipated added deterioration of pavements that will result from demolition and heavy construction activity.

3.3 TRAFFIC VOLUMES

The traffic pattern and resulting street designs are based on projected 1975 traffic volumes for the South End as developed by the Boston Redevelopment Authority. The following is a tabulation of same and indicates the anticipated twenty-four (24) hour two-way traffic volumes on major streets:

S.E. Bypass	30,000 to 40,000	Albany Street and Service Road	20,000
Columbus Avenue	5,000 to 7,000	Dover Street	30,000

Tremont Street	20,000 to 22,000	Dartmouth Street	8,000 to 10,000
Shawmut Avenue	12,500	Newton-Brookline Streets	12,000
Washington Street	8,000	Massachusetts Avenue	18,000 to 23,000
Harrison Avenue	10,000		

3.4 PROPOSED PAVEMENTS

Streets which require new or reconstructed pavements and are in areas where heavy traffic volumes are expected, such as arterial streets and those in industrial areas where heavy and frequent wheel loadings will be likely to occur, are proposed to be constructed with a pavement consisting of 2-1/2" of bituminous concrete laid in two 1 1/4" courses, on a 6" penetrated macadam base, on 12" of rolled bank gravel.

On all other streets where new or reconstructed pavement is required, a reduction of 2" in the macadam base and 2" in the bank gravel is recommended.

Resurfacing is proposed to consist of 2 1/2" of bituminous concrete laid in 2-1 1/4" courses with an added average allowance of 1/2" thickness for leveling. This applies where the existing surface is to be removed from a rigid base and also when resurfacing is constructed on existing pavement.

Sidewalk pavements are proposed as the City's standard 4" thick Portland cement concrete on an 8" bank gravel base.

The previously mentioned street inventory report, while used as a basic implement to determine which streets required reconstruction was augmented by the B.R.A. site plan. Example: In some cases the street inventory shows the pavement and sidewalk in fair condition in need of only resurfacing or repair. If considerable site development is proposed on the site adjacent to this street, the street improvement is upgraded to be reconstructed. This is based on the

assumption that demolition or heavy construction equipment will do considerable damage to the sidewalks and pavement. Required improvements to other streets are upgraded from the inventory classification because of the amount of trenching needed to construct sewerage and water systems. Altogether, these factors result in the upgrading of the treatment from the original recommendations as stated in the street inventory of approximately seventy-five per cent of the streets to be improved in the Project Area.

3.5 PROPOSED CONSTRUCTION STAGING

The following schedule for proposed construction staging on streets to be improved under the Urban Renewal Program in the South End Project was developed to harmonize with the staging of adjacent developments and improvements to water and sewerage systems and to maintain functional traffic circulation. A preliminary staging plan of developments is also included here for reference.

The following warrants for staging refer to the Street Improvement Staging Schedule on the following pages:

A = Coordinated with Adjacent Development

B = Coordinated with Water or Sewer System

C = To maintain functional traffic circulation

D = To follow removal of MBTA elevated

E = To be staged after construction of South End Bypass which because of the need for coordination with various agencies and indefinite status will, for this purpose, be assumed to be Stage 4.

STREET IMPROVEMENT STAGING SCHEDULE

STREET	FROM	TO	STAGE	WARRANT	TREATMENT
Albany	Mass. Ave.	East Newton	5	A	Resurface
Albany	East Newton	Malden	1	A	Resurface
Albany	Malden	Randolph	1	A	Resurface
Albany	Randolph	Dover	2	A	Resurface
Andrews	East Canton	East Dedham	5	A	Reconstruct
Appleton	Berkeley	Tremont	3	A	Resurface
Ball	Shawmut Ave.	Washington	1	A	Reconstruct
Berkeley	Tremont	South End Bypass	2	C	Reconstruct
Braddock Park	Alley No. 539	Columbus Ave.	4	A	Reconstruct
Bradford	Waltham	Shawmut Ave.	5	A	Reconstruct
Burke	Columbus Ave.	Tremont	2	A	Reconstruct
Camden	Columbus Ave.	Tremont	1	A	Reconstruct
Camden	Tremont	Shawmut Ave.	1	A	Reconstruct
Cazenove	South End Bypass	Chandler	2	A	Reconstruct

STREET	FROM	TO	STAGE	WARRANT	TREATMENT
Chandler	Columbus Ave.	Clarendon	2	C	Resurface
Chandler	Clarendon	Berkeley	2	C	Resurface
Chandler	Berkeley	Tremont	2	C	Resurface
Clarendon	Columbus Ave.	Warren Ave.	2	BC	Reconstruct
Columbus Ave.	Walpole	Mass. Ave.	4	E	Reconstruct
Columbus Ave.	Mass. Ave.	W. Newton	4	E	Reconstruct
Columbus Ave.	W. Newton	Dartmouth	4	E	Reconstruct
Columbus Ave.	Dartmouth	Clarendon	4	E	Reconstruct
Concord Place	Worcester	Concord Sq.	3	A	Reconstruct
Concord Square	Columbus	Tremont	3	A	Reconstruct
Coventry	Columbus Ave.	Tremont	4	A	Reconstruct
Cunard	Tremont	Cabot	2	A	Reconstruct
Dartmouth	South End By Pass	Columbus Ave.	4	A	Reconstruct
Dartmouth	Columbus Ave.	Warren Ave.	4	A	Reconstruct
Dartmouth	Warren Ave.	Montgomery	5	A	Reconstruct
Davenport	Columbus Ave.	Tremont	1	A	Reconstruct
Dover	Albany	Washington	2	BC	Reconstruct
Dover	Washington	Tremont	2	BC	Reconstruct
Drapers Lane	Upton	Upton	4	A	Reconstruct
East Brookline	Public Alley No. 710	Harrison Ave.	4	A	Resurface
East Brookline	Harrison Ave.	Albany	5	A	Reconstruct

STREET	FROM	TO	STAGE	WARRANT	TREATMENT
East Canton	Harrison Ave.	Albany	5	A	Resurface
East Concord	Washington	Harrison Ave.	2	A	Reconstruct
East Concord	Harrison Ave.	Albany	5	A	Reconstruct
East Dedham	Andrews	Albany	2	A	Reconstruct
East Lenox	Washington	Harrison Ave.	3	A	Reconstruct
East Lenox	Harrison Ave.	Fellows	3	A	Reconstruct
East Newton	Public Alley No. 710	Harrison Ave.	4	A	Resurface
East Newton	Harrison Ave.	Albany	5	A	Reconstruct
Fellows	Randall	Northampton	3	A	Reconstruct
Hammond	Tremont	Shawmut Ave.	1	A	Reconstruct
Harrison Ave.	Treadwell Court	Mass. Ave.	3	A	Reconstruct
Harrison Ave.	Mass. Ave.	E. Newton	4	A	Reconstruct
Harrison Ave.	E. Newton	Msgr. Reynolds Way	2	AB	Reconstruct
Harrison Ave.	Msgr. Reynolds Way	Dover	2	AB	Reconstruct
Holyoke	Alley No. 542	Columbus Ave.	4	A	Resurface
Kendall	Tremont	Shawmut Ave.	1	A	Reconstruct
Lawrence	Dartmouth	Clarendon	4	A	Reconstruct
Lenox	Tremont	Shawmut Ave.	1	A	Reconstruct
Malden	Harrison Ave.	Albany	1	A	Reconstruct
Mass. Ave.	Shawmut Ave.	Washington	3	A	Reconstruct
Mass. Ave.	Washington	Harrison Ave.	3	A	Reconstruct

STREET	FROM	TO	STAGE	WARRANT	TREATMENT
Mass. Ave.	Harrison Ave.	Albany	4	A	Reconstruct
Milford	Tremont	Shawmut Ave.	4	A	Reconstruct
Msgr. Reynolds Way	Washington	Harrison Ave.	1	A	Reconstruct
New Albany Street Frontage Road	Mass. Ave.	New E. Brookline Street Extension	1	A	New
New Albany Street Frontage Road	New East Brookline St. Extension	New Malden St. Extension	1	A	New
New Albany St. Frontage Road	New Malden St. Extension	Albany	1	A	New
New 60' St. New Malden St. Extension	Albany	New Albany St. Frontage Road	1	A	New
New 50' St. New East Brookline St. Extension	Albany	New Albany St. Frontage Road	1	A	New
New 50' St.	Plympton	Wareham	2	A	New
New 50' St. (Northampton St. Relocated)	Shawmut Ave.	Northampton	2	A	New
New 50' St. (E. Lenox St. Extension)	Fellows	Albany	3	A	New
New 60' St.	Malden	Randolph	1	A	New
New 24' Alley	East Brookline	Thorn	5	A	New
New 24' Alley	Northampton Between Tremont and Shawmut Avenue	Northampton	1	A	New

STREET	FROM	TO	STAGE	WARRANT	TREATMENT
Newcomb	Washington	Reed	1	A	Reconstruct
Northampton	Columbus Ave.	Tremont	5	A	Reconstruct
Northampton	Tremont	Shawmut Ave.	1	A	Reconstruct
Northampton	Comet Place	Washington	2	A	Reconstruct
Northampton	Washington	Harrison Ave.	3	A	Reconstruct
Northampton	Harrison Ave.	Albany	4	A	Reconstruct
Parmelee	Northampton	Trask	3	A	Reconstruct
Perry	Washington	Harrison Ave.	4	A	Resurface
Private Alley 80' West of Tremont	Rutland Sq.	West Newton	2	A	Reconstruct
Private Alley	West Springfield St. Between Columbus Ave. and Tremont	Priv. Alley 90' East	3	A	Reconstruct
Private Alley	West Canton St. Between Warren Ave. & Appleton St.	Dartmouth	2	A	Reconstruct
Private Alley No. 813	Alley No. 814	340' West	5	A	Reconstruct
Private Alley No. 814	Northampton	Private Alley No. 813	5	A	Reconstruct
Public Alley No. 539	West Newton	Braddock Park	4	A	Reconstruct
Public Alley No. 542	Braddock Park	Holyoke	4	A	Reconstruct
Public Alley No. 543	Holyoke	West Canton	4	A	Reconstruct

STREET	FROM	TO	STAGE	WARRANT	TREATMENT
Public Alley No. 710	East Newton	East Brookline	4	A	Reconstruct
Randall	Fellows	Albany	3	A	Reconstruct
Randolph	New 60' St.	Albany	1	A	Reconstruct
Reed	Thorndike	East Lenox	1	A	Reconstruct
Ringgold	Waltham	Hanson	4	A	Reconstruct
Rutland Sq.	Tremont	Private Alley West	3	A	Reconstruct
Rutland	Tremont	Shawmut Ave.	2	A	Reconstruct
Rutland	Thawmut Ave	Washington	4	A	Reconstruct
St. Charles	South End Bypass	Chandler	2	A	Reconstruct
Savoy	Washington	Harrison Ave.	2	A	Reconstruct
Shawmut Ave.	Sterling	Mass. Ave.	2	AB	Resurface
Shawmut Ave.	Mass. Ave.	West Newton	2	AB	Resurface
Shawmut Ave.	West Newton	Union Park	4	A	Resurface
Shawmut Avenue	Union Park	Dover	4	A	Resurface
Thorndike	Washington	Reed	1	A	Reconstruct
Trask	Parmelee	Harrison Ave.	3	A	Reconstruct
Tremont	Weston	Mass. Ave.	4	E	Reconstruct
Tremont	Mass. Ave.	West Newton	4	E	Reconstruct
Tremont	West Newton	Dartmouth	4	E	Reconstruct
Tremont	Dartmouth	Dover	4	E	Reconstruct
Tremont	Dover	South End Bypass	4	E	Reconstruct

STREET	FROM	TO	STAGE	WARRANT	TREATMENT
Union Park	Montgomery	Tremont	2	A	Reconstruct
Upton	Newland	Shawmut Ave.	4	A	Reconstruct
Walpole	Columbus Ave.	Tremont	4	A	Reconstruct
Waltham	Tremont	Shawmut Ave.	4	A	Reconstruct
Waltham	Shawmut Ave.	Washington	5	A	Reconstruct
Warren Ave.	Columbus Ave.	Dartmouth	4	A	Reconstruct
Warren Ave.	Dartmouth	Clarendon	4	A	Reconstruct
Warren Ave.	Clarendon	Berkeley	2	C	Reconstruct
Warwick	Windsor	Hammond	1	A	Reconstruct'
Washington	Sterling	Mass. Ave.	4	D	Reconstruct
Washington	Mass. Ave.	East Newton St.	4	D	Reconstruct
Washington	East Newton	Msgr. Reynolds Way	4	D	Reconstruct
Washington	Msgr. Reynolds Way	Dover	4	D	Resurface
Washington	Dover	Herald	4	D	Reconstruct
West Brookline	Tremont	Shawmut Ave.	4	A	Reconstruct
West Brookline	Shawmut Ave.	Washington	1	A	Resurface
West Canton	South End Bypass	Columbus Ave.	4	A	Resurface
West Canton	Columbus Ave.	Warren Ave.	2	A	Resurface
West Concord	Tremont	Shawmut Ave.	2	A	Resurface
West Concord	Shawmut Ave.	Washington	4	A	Resurface
West Dedham	Tremont	Shawmut Ave.	4	A	Resurface

STREET	FROM	TO	STAGE	WARRANT	TREATMENT
West Newton	South End Bypass	Columbus Ave.	4	A	Resurface
West Newton	Columbus Ave.	140' East	4	A	Reconstruct
West Newton	Tremont	Alley 90' North	2	A	Resurface
West Rutland Square	South End Bypass	Columbus Ave.	3	A	Reconstruct
West Springfield	Tremont	Concord Place	3	A	Reconstruct
Windsor	Cabot	Shawmut Ave.	2	A	Reconstruct
Worcester	Tremont	350' West	3	A	Reconstruct
Yarmouth	South End Bypass	Columbus Ave.	4	A	Resurface

3.6 ESTIMATE OF CONSTRUCTION COST

Estimated construction costs for the street improvements within the South End Project are as follows:

a) Street improvements to be made as part of the Urban Renewal Program, which will improve traffic circulation while at the same time add to the dignity of the old neighborhoods and complement the proposed developments. The cost for these improvements is $4,329,200, exclusive of any costs for the South End Bypass. It is important to note that the grade separated design of the South End Bypass, if constructed as shown on the plans, would cost an estimated $5.3 million.

b) Street improvements to be made within the Castle Square Project by the City of Boston Public Works Department are estimated by the Boston Redevelopment Authority to cost $162,000. This cost is not included in category a) above.

c) Street improvements which are not included in the Urban Renewal Program, but should eventually be undertaken by the City of Boston will cost approximately $650,000.

3.7 RECOMMENDATIONS

1. The South End Bypass should be constructed as a grade separated dual roadway of first class cross section and a wider right of way than now proposed in order to function effectively and to preserve the original concept of the street network proposed for the project area.
2. Improvements to Columbus Avenue should not be undertaken until the South End Bypass is constructed.
3. The following should be given high priority in the design of the Inner Belt:
   a) Extend the New Albany Street Frontage Road through the Rotary of Massachusetts Avenue and complement it with a one-way frontage road on the easterly side of the Inner Belt and extending northerly to connect with the northbound frontage road along the Central Artery.
   b) Modify the Central Artery ramps and local streets at Dover Street to reduce the volume of through traffic at that intersection.
4. Make no changes in the cross section of Massachusetts Avenue (i.e. left-turn storage lanes) until the Inner Belt and frontage roads are constructed in operation and a need is established.
5. Consideration should be given to establish proper right of way to accomplish the following at some future date:
   a) A more direct connection of Hammond Street with Davenport Street at Tremont Street.

b) A widening on the south side of East Lenox Street between Harrison Avenue and Fellows Street.

c) A more direct connection of Msgr. Reynolds Way with Malden Street at Harrison Avenue.

6. Provide adequate setback provisions in parcel disposition controls to permit future widening of narrow streets when other existing buildings are removed at some future date.

4.0 PARKS AND PLAYGROUNDS

The Project Area is and will be in the future basically a residential area with a high per capita density. This in itself is warrant enough to provide proper recreational areas.

Parks and playgrounds have been located in areas to best serve the public, to add dignity to the neighborhood streets and to complement proposed developments.

Provision has also been made to improve existing parks and playgrounds. Reference is made to drawings SE 10-1 through SE 10-8 which accompany this report.

4.1 PROPOSED CONSTRUCTION STAGING

Construction of parks and playgrounds has been staged to be in a sequence coordinated with other improvements proposed for the Project Area as shown in the following table.

DISPOSITION PARCEL NO.	DESCRIPTION	STAGE
PB-1 & 2	Mackey School Playground	2
PB-3	Dartmouth Street School Playground	1
PB-4	Junior High and Elementary School Playground	4
PB-10	Bates School Playground	3
PB-12	Williams School Playground	5
P-1	Warren Avenue Linear Park	4
P-2	Dartmouth Street Open Space	2
P-3	Columbus Avenue Linear Park	4
P-3A	West Canton Street Park	4
P-4	Columbus Square Park	1

DISPOSITION PARCEL NO.	DESCRIPTION	STAGE
P-5	Columbus Avenue Linear Park	4
P-6A	Dover Street Linear Park	1
P-6B & C	Dover Street Linear Park	2
P-7	West Dedham Street Linear Park	4
P-8	Pembroke Street Park	4
P-10	Tremont Street at Camden Street Open Space	4
P-11	Tremont Street at Hammond Street Park	1
P-12	Windsor Street Open Space	2
P-13	Tremont Street Median	4
P-14	Washington Street Median	4
P-15	Worcester Street Park	3
P-16	Cathedral Park	3
P-17	New Rotch Playground	1
P-18	Monsignor Reynolds Way Park	1
P-21	Arnold Street Playground	1
	Improvements to Existing Parks and Playgrounds	1 - 5

4.2 ESTIMATE OF CONSTRUCTION COST

Estimated cost for construction of parks and playgrounds in the South End Project are as follows:

a) Parks and playgrounds to be constructed, and improvements to existing facilities,

both to be done as part of the Urban Renewal Program. This amounts to $2,018,000.

b) Parks and playgrounds to be constructed within the Castle Square Project by the City of Boston, Public Works Department and have been estimated by them to cost $58,000.

5.0 STREET AND PARK LIGHTING

Lighting levels for about 60% of the Project Area are generally inadequate. The importance of adequate street lighting is emphasized by a statistic from the Boston Traffic Department's Annual Report of 1962, which states that of 58 fatal accidents in Boston in 1962, 63% occurred during darkness. Adequate levels of lighting would tend to reduce the percentage of fatal accidents occuring after darkness.

The proposed improvements as shown on the drawings will provide the project with a modern and adequate lighting system. Reference is made to drawings SE 11-1 through SE 11-8 which accompany this report.

5.1 EXISTING LIGHTING

All the street lighting in the Project Area is owned, operated, and maintained by the Boston Edison Company. Policies and standards are set by the City in cooperation with Boston Edison Company.

The present lighting system in the South End consists of incandescent and mercury vapor installations producing light intensities ranging from 1,000 to 20,000 lumens. With minor exceptions all lighting is served by underground cable. Street lighting for about 40 per cent of the area is adequately provided by modern incandescent and mercury vapor installations. Lighting levels throughout the remainder of the area are generally inadequate.

5.2 DESIGN STANDARDS

The policy of the City Lighting Division is that mercury vapor color corrected luminaires will be used in all new installations. The lighting will conform to the standards of the Lighting Division, Boston Public Works Department. All poles will be the same for either single or twin unit, and

lamp brackets will be either 6 or 12 feet in length. The lighting units will be luminaires with unitized 150 to 450 watt mercury vapor lamps with built-in ballasts and photo cells. The standards of lighting intensity utilized in the design of the system are based upon the following rating values by classes and upon the "American Standard Practice for Roadway Lighting."

Class	Description	Lumens Per Lin. Ft.	Mercury Vapor Lumens
A	Very heavy vehicular and/or pedestrian traffic, bus routes four or more traffic lanes	250-300	20,000
B	Moderate to heavy vehicular and/or pedestrian traffic, bus routes	40-90	11,000
	MINOR STREETS		
A	Residential streets, average business districts, public buildings used at night, heavy tree foliage, moderate to heavy vehicular and/or pedestrian traffic, bus routes, continuous apartment type dwellings	30-60	7,000
B	Residential streets, private ways, alleys, strictly residential in use, all residential streets not included in Class A	12.5-26	3,500

5.3 PROPOSED CONSTRUCTION STAGING

Improvements to street and park lighting is staged to be done concurrentally with the street and park improvements.

5.4 ESTIMATE OF COST

The following assumptions were made in the preparation of the cost estimate.

a) All lighting standards and fixtures in the South End will become the property of the City of Boston. No cost has been assigned to cover this acquisition by the City.

b) There is an Edison power supply available for cable connection at each street intersection.

c) An average allowance of lateral conduit and cable was made for each lighting standard. The amount varies with spacing and layout of the standards within the general range of 50 feet to 150 feet for each standard.

d) Alleys and minor streets will have lighting improvements made under the Urban Renewal Program to the extent that funds are available.

The cost of street and park lighting improvements within the South End Project are as follows:

a) Improvements to be made as part of the Urban Renewal Program will cost an estimated amount of $880,000 excluding the Castle Square Project.

b) Improvements to be made within the Castle Square Project by the City of Boston, Public Works Department, are estimated by them to cost $45,000.

c) Improvements in existing and new park lighting are not shown on the plans since park designs are not yet effected. Lighting costs are therefore included as part of the parks and playground unit costs.

d) Improvements which are not included in the Urban Renewal Program, but which should eventually be completed by the City of Boston at a future date will cost approximately $130,000.

6.0 WATER DISTRIBUTION SYSTEMS

Although the water systems in the project area are quite old in general and tuberculation has greatly reduced their original carrying capacity, they are for the most part structurally sound, adequate for present demands and would function properly under a moderate increase in future demand.

However, improvements are needed to eliminate deficiencies in systems supplying other areas, proposed developments, replacing obsolete appurtenances, to insure adequate fire protection in proposed industrial sites and to maintain an adequate capacity for future demands.

For a program of maximum economy, these improvements have been coordinated with street improvements wherever possible. Reference is made to drawings SE 12-1 through SE 12-8 which accompany this report.

6.1 EXISTING SYSTEMS

The South End Project Area is presently served by the Southern Low Service and the Southern High Service. These services are supplied by the Metropolitan District Commission (M.D.C.) which connect to City of Boston trunk mains at several locations outside the Project Area. The present M.D.C. sources of supply are reported to be adequate until the year 1980.

The low service extends throughout the entire South End Project Area, delivering approximately 90 percent of the total water consumed. The high service provides service to only localized portions of the Project, supplying about 10 percent of the total water consumed in the Area. Most high and low service mains in the Project were installed prior to 1930 and are unlined cast iron pipe.

6.1.1 Tests on Existing Systems

A program of hydraulic tests was undertaken in the Project Area to aid in evaluating the adequacy and/or hydraulic condition of the existing mains. A separate report entitled "Water and

Sewer Systems Inspection and Flow Measurements" by Charles A. Maguire and Associates, dated April 1964, presents the details of that program. Water systems improvements are based primarily upon the results of that program and in addition upon the conclusions and recommendations drawn from another report of the same date entitled "Report on Preliminary Studies of Existing Utility Systems."

6.1.2 Adequacy of Existing Systems

The high and low service trunk systems serving the Project Area are generally structurally sound and adequate in size for present demands and for moderate increases in the future. Although tuberculation has greatly reduced the original carrying capacity of both the trunk and distribution system, the large diameters of existing mains together with frequent interconnections with other mains, provide strong flows and adequate fire protection for present land use. However, improvements are required to eliminate deficiencies in the trunk system supplying other areas, and to improve the distribution mains which supply proposed developments within the Project Area. As concluded in the previously referenced reports, it is essential to the success of the Urban Renewal Program to conduct a complete study of the trunk main systems to eliminate deficiencies that can only be identified by such a comprehensive study.

6.2 TRUNK MAIN IMPROVEMENTS

The 20 inch and 30 inch low service trunk mains in Dover Street and Massachusetts Avenue require cleaning and cement lining throughout their length to improve the low service pressure and supply to the eastern sections and the high elevations of South Boston. Cleaning and cement lining the 16 inch high service main in Worcester Square, Harrison Avenue and Massachusetts Avenue is essential to improve the high service supply to the eastern part of the city and to provide that area with higher residual pressures.

The section of the 20 inch low service main in Dover Street that is located within the Project limits delivers 95 percent of its flow to areas east of the South End; therefore, only 5 percent of its improvement cost is assigned to the South End Project. The 30 inch low service main in Massachusetts Avenue and the 16 inch high service main in Worcester Square, Harrison Avenue and Massachusetts Avenue deliver 80 percent of their flows to areas east of the Project Area; therefore, only 20 percent of their improvement costs are assigned to the South End.

Further studies in Areas that adjoin the South End may indicate a need to rehabilitate other trunk mains in the Project Area as indicated in the previously mentioned reports. Engineering data to serve as a basis for confirming the need for these other improvements are not available, because of the complex nature of the systems outside the Area.

6.3 DISTRIBUTION MAIN IMPROVEMENTS

Hydraulic tests indicate that local distribution mains (those less than 16 inches) installed prior to 1930 have lost 50 percent or more of their original carrying capacities from tuberculation. This loss of capacity is the principal deficiency of the local distribution system. The equivalent size of many existing mains is significantly less than sizes that would be used for design of a new system for the South End or for any other area of the City.

The criteria for evaluating and improving distribution mains, summarized and presented below have been applied throughout the Project. Cost and priority analysis dictate that improvements to be made under the Urban Renewal program must be reserved for only those streets scheduled to undergo major improvements. Modifications to the water system on this basis will protect street improvements and insure that adequate capacity will be available for future increased domestic and fire flow demands. In addition, six and eight inch low service mains in Windsor, Thorndike and Fellows Streets will be replaced with new twelve inch diameter mains to provide a loop equivalent in capacity to those mains discontinued by proposed development sites and the proposed Inner Belt Expressway.

The cost of replacing lead service pipe with copper is included wherever water main improvements are made in streets to undergo major improvement; and only to those buildings which will remain under the Urban Renewal Program.

6.3.1 Appurtenances

Observations made in opening and closing hydrants and gate valves during the water systems testing program, confirm that the older ungated "wet break" post hydrants must be replaced throughout the Project Area. Other general criteria regarding improvement of appurtenances have been applied to streets scheduled to undergo major improvements.

The high service system will be extended to areas presently served by the low service to insure adequate sprinkler and fire protection for proposed industrial sites, to be located along the eastern border of the Project Area, and to provide a secondary emergency source of supply for the medical complex to be located adjacent to the City Hospital.

6.3.2 Design Criteria

The criteria used for evaluating and improving the distribution main systems in the South End Project Area are summarized below. Existing appropriate policies of the City of Boston Water Division are incorporated in these criteria. The criteria have been applied in all streets to undergo major improvements, except where noted.

6.3.2.1 Mains

a. Replace 6" mains installed before 1930 with 8" mains.

* b. Replace 8" mains installed before 1900 with 8" mains.

c. Replace 10" & 12" mains installed before 1880 with 12" mains.

* Based on replacing lead service pipe with new copper

** d. Replace 6" and 8" mains not interconnected at 600' intervals with 12" mains.

e. Cement line 10" & 12" mains installed from 1880 to 1900.

6.3.2.2 Hydrants

a. Replace all ungated wet break hydrants with dry break hydrants in all streets throughout the Project Area.

b. Replace wet break hydrants.

c. Install gate valves in hydrant connections, where none exist.

d. Replace hydrant connectors and gates to all mains to be replaced.

e. Place hydrants more than 1-1/2 ft. from edge of curb.

f. Maximum area to be served per hydrant is 70,000 to 80,000 sq.ft. for engine streams.

6.3.2.3 Gate Valves & Boxes

a. Replace all gate valves and boxes on mains to be replaced.

b. Not more than 3 gate valves at a cross or more than 2 at a tee.

c. When there is a choice of position, locate gate valve in small main.

d. No length of main greater than 800 ft. should be left without gate valve control.

6.4 CONSTRUCTION STAGING

The following schedule for staging water systems improvements was developed as part of the overall renewal and rehabilitation program for the South End. For maximum economy, the staging of improvements to the water system is to be concurrent with the staging of the street improvement program. Some exceptions exist, however, due to the interdependency of the systems in one project to another; they are summarized as follows:

** On principal street and for all long lines not cross-connected at frequent intervals, 600 ft., 12 inch and larger mains are required.

Size Main	Street	From	To	Stage Const. Street	Stage Const. Water	Reason
16" HS	E. Brookline	Harrison	Albany	5	1	To complete the high service supply to the proposed industrial projects fronting Albany and Malden Streets scheduled to undergo construction in Stage 1.
16" HS	Albany	Randolph	Dover	2	1	To complete the high service loop to the proposed industrial projects fronting Albany and Malden Streets scheduled to undergo construction in Stage 1.
12" LS	Cunard	Tremont	Cabot	2	1	To provide adequate supply and fire protection to the proposed residential project fronting Cunard and Windsor Streets scheduled to undergo construction in Stage 1.
12" LS	Windsor	Cabot	Shawmut	2	1	

Plugging and/or capping water mains, by others outside the South End Project Area in the vicinity of the Inner Belt Expressway is not shown on the plans since the geometrics and location of this proposed roadway are not final, and it is assumed that the discontinuance of these mains will be accomplished by the Massachusetts D.P.W. at the time of construction of the Inner Belt.

6.5 MATERIALS AND SPECIFICATIONS

Specifications which follow are City of Boston standard practice:

a. New Mains 16 inches in diameter or less will conform to the specifications of the Public Works Department, City of Boston, and will be cement lined, tar coated cast iron pipe conforming to the Federal Specifications WW-P-42 lb Type I (caulk joint), or Type II (push on joint).

b. New mains 30 inches in diameter and greater will be steel and conform to the AWWA Standard Specification C201-50.

c. The cement lining will conform to the ASA Standard Specification for cement mortar lining for cast iron pipe A21-4-53.

d. New cast iron fittings 16 inches in diameter or less will be cement lined, tar coated and conform to the AWWA Standard Specification C100-55 for cast iron pressure fittings Class "D" or the ASA Standard Specification A21-10-52. Specifications for mechanical joint cast iron pressure fittings shall conform to the ASA Standard Specification A21-11-53. The cement lining will conform to the ASA Standard Specification for cement mortar lining for cast iron fittings and pipe A21-4-53.

e. New gate valves will be New York Pattern, Metropolitan type and conform to AWWA Standard Specification C500-61.

f. New hydrants will conform to Specifications of the Public Works Department, City of Boston, conforming in general to the AWWA Specification C502-54 with 6 inch gated connections and open to the right.

6.6 ESTIMATE OF COST

The estimated cost for the construction of the water systems for the South End Project Area consists of three parts:

a. The water system improvements that will be made as part of the Urban Renewal Program to eliminate existing deficiencies, and to conform with new street construction and/or reconstruction of existing streets to avoid future excavation. The cost for this work is estimated to be $901,900 and is presented in detail in the Project Improvements Report, Volume II.

b. The work to be done under the Castle Square Project is estimated to cost $28,000.

c. Water systems improvements which are not required for the completion of the Urban

Renewal Projects, but that should be undertaken in the future. Approximate costs for this work are summarized and presented as follows:

8,200 FT.	8" C.I. Pipe (cement lined) in place	=	$ 73,800
3,200 FT.	12" C.I. Pipe (cement lined) in place	=	44,800
25	8" Gates and Boxes - complete	=	4,250
10	12" Gates and Boxes - complete	=	3,500
25	Hydrants	=	7,500
650 FT.	6" Hydrant Connector	=	4,550
75	Hydrant Gates	=	9,750
700 FT.	10" C.I. Pipe Cleaned and Cement Lined	=	4,900
1,000 FT.	12" C.I. Pipe Cleaned and Cement Lined	=	7,000
2	Blow-offs	=	400
			$ 160,450
Contingencies, Unit Cost Increase, Engineering - 21%			33,144
TOTAL			$ 194,144

USE $ 195,000

6.7 RECOMMENDATIONS

1. Clean and cement line the twenty inch and thirty inch low service trunk mains in Dover Street and Massachusetts Avenue to improve the low service pressure and supply to the eastern sections and the high elevations of South Boston.

2. Clean and cement line the sixteen inch high service trunk main in Worcester Square, Harrison Avenue and Massachusetts Avenue to improve the high service supply to the eastern part of the city and to provide that area with higher residual pressures.

3. Improve the distribution system mainly in those streets scheduled to undergo major improvements.

4. Replace lead service pipe with copper when water main improvements are made in streets scheduled to undergo major improvements.

5. Replace all ungated wet-break hydrants throughout the Project Area.

6. Extend the high service system to provide a secondary emergency source of supply for the proposed medical complex to be located adjacent to the City Hospital; and to provide adequate sprinkler and fire protection for the proposed industrial projects to be located along the eastern border of the Project Area.

7. Replace six and eight inch low service mains in Windsor, Thorndike and Fellows Streets with new twelve inch mains to provide a loop equivalent in capacity to those mains discontinued by proposed development sites and the proposed Inner Belt Expressway.

8. Undertake a comprehensive program of testing and analysis of the trunk main systems throughout the city.

7.0 SEWERAGE

The project area is now served almost entirely by a combined sewerage system which is more than 80 years old and is in fair to poor physical condition. Most tide gates are in poor condition which results in surcharging of the system by tide water. This reduces the system's effective capacity and causes sewage discharges into the tidal estuaries.

The effluents discharged into the Roxbury Canal pollute the water and are a health menace.

Extensive improvements and modifications to the system are needed to eliminate deficiencies, and health hazards and to provide capacity for future demands.

Wherever possible, to maintain a program of maximum economy, these improvements have been coordinated with the street improvements. Existing systems generally will be converted to act as storm drains. This will minimize construction costs and add flexibility in the conversion to separated sanitary and storm drainage systems. Drawings entitled Sanitary Sewers and Storm Drains and numbered SE 13-1 through SE 13-8 accompany this report.

7.1 EXISTING SYSTEMS

Storm flows of the combined system outlet at low tide to the Roxbury Canal and at high tide are pumped to the Roxbury Canal by the Union Park Street Pumping Station. Connections from the combined sewers to the Boston East Side Interceptor and the Boston Main Interceptor, which pass through the area, dispose of dry weather (sanitary) flows.

The majority of the combined system within the South End is in fair to poor condition as determined by visual, photographic, and closed circuit television inspection program conducted and reported upon previously. The Union Park Street Pumping Station has adequate design capacity;

however the pumps are obsolete, inefficient and irreparable. The tide gates on storm overflows from the area to the Roxbury Canal are mostly inoperable and result in surcharging of the system by entrance of tide waters during high tide, thus reducing the capacity of the entire sewerage system.

7.1.1 Major Interceptors

There are four major trunk sewers in the Project Area. They are the Boston Main Interceptor in Camden Street and Massachusetts Avenue; the East Side Interceptor in Albany Street; the Roxbury Canal Interceptor in Albany Street, south of Massachusetts Avenue; the Stony Brook Interceptor in Tremont Street, south of Camden Street. The Boston Main Drainage Relief Sewer recently constructed by the Metropolitan District Commission Sewerage Division will intercept the Stony Brook and Boston Main Interceptors at Camden and Tremont Streets and will provide relief to Boston's intercepting system when the new M.D.C. system goes into operation late this year.

The Boston Main and East Side Interceptors are of major importance to the South End Area; but are of prime importance to the major part of the City. They are the main outlets for the existing sewerage systems. Conduit inspections in the South End showed that both interceptors are in poor condition and are in need of replacement and major repair.

The Roxbury Canal Interceptor, is inadequate in capacity and only in fair condition at its outfall at Massachusetts Avenue and in Albany Street.

The Stony Brook Interceptor is in good condition and has adequate capacity.

7.1.2 Local Systems

Inspection of the conduits indicated that many need replacement or repairs. Specific conduits were reported upon in the inspection program report of April, 1964. Most of the conduits

in poor condition are scheduled for replacement under the Urban Renewal Program.

Most of the existing buildings in the South End have combined sanitary and storm water (roof drains) connections to the combined sewerage system. An inventory of these buildings is not available and existing records do not indicate this distinction in most cases. Furthermore, many buildings have plumbing systems arranged in a manner that prohibits separating sanitary from storm flows short of a major revision of the plumbing in the building. It is therefore considered to be impractical to expect that broad scale separation of drainage from existing buildings can be effected during the Urban Renewal Program. For this reason, existing combined sewers must continue to function as such for years to come. However, installation of sanitary sewers will be accomplished now to receive sanitary flow from new buildings and from those that now have separate sanitary connections. Over a period of years other buildings will be rehabilitated or demolished and as a matter of course the combined sewerage system will carry less and less sanitary flow and will ultimately be converted to a storm drainage system.

7.2 PROPOSED STORM AND SANITARY SYSTEMS

A Master Plan for the improvement of the sewerage system has been developed for the entire South End Project Area. Budget limits require that only those parts of the system to be included as Urban Renewal Project Improvements are where (1) major street improvements are required; (2) sewer construction is necessary to adequately serve the Urban Renewal Developments; and (3) major components must be built to provide a basic workable system. The remainder of the system can be built by the City of Boston over a period of many years as the need arises and funds permit. Working design drawings of the entire system are submitted with this report to supplement the Urban Renewal plans.

The sewer construction included as a project improvement will provide effective separate systems for about 60% of the area of the South End that is now served by combined sewers, and provides trunk systems to facilitate further separation in the future.

The elevations of both the storm and sanitary sewers will permit eventual separation of storm and sanitary flows from house connections. There may, however, be individual existing buildings where pumping units would be required for draining the sanitary or storm flows to the street mains with the option of leaving the building with a combined outlet. This condition occurs where construction of a storm drain and/or sanitary sewer at a greater depth than generally necessary for an area would be econimically unfeasible for a single connection.

7.2.1 Storm Drain System (Ref. flow diagram on next page)

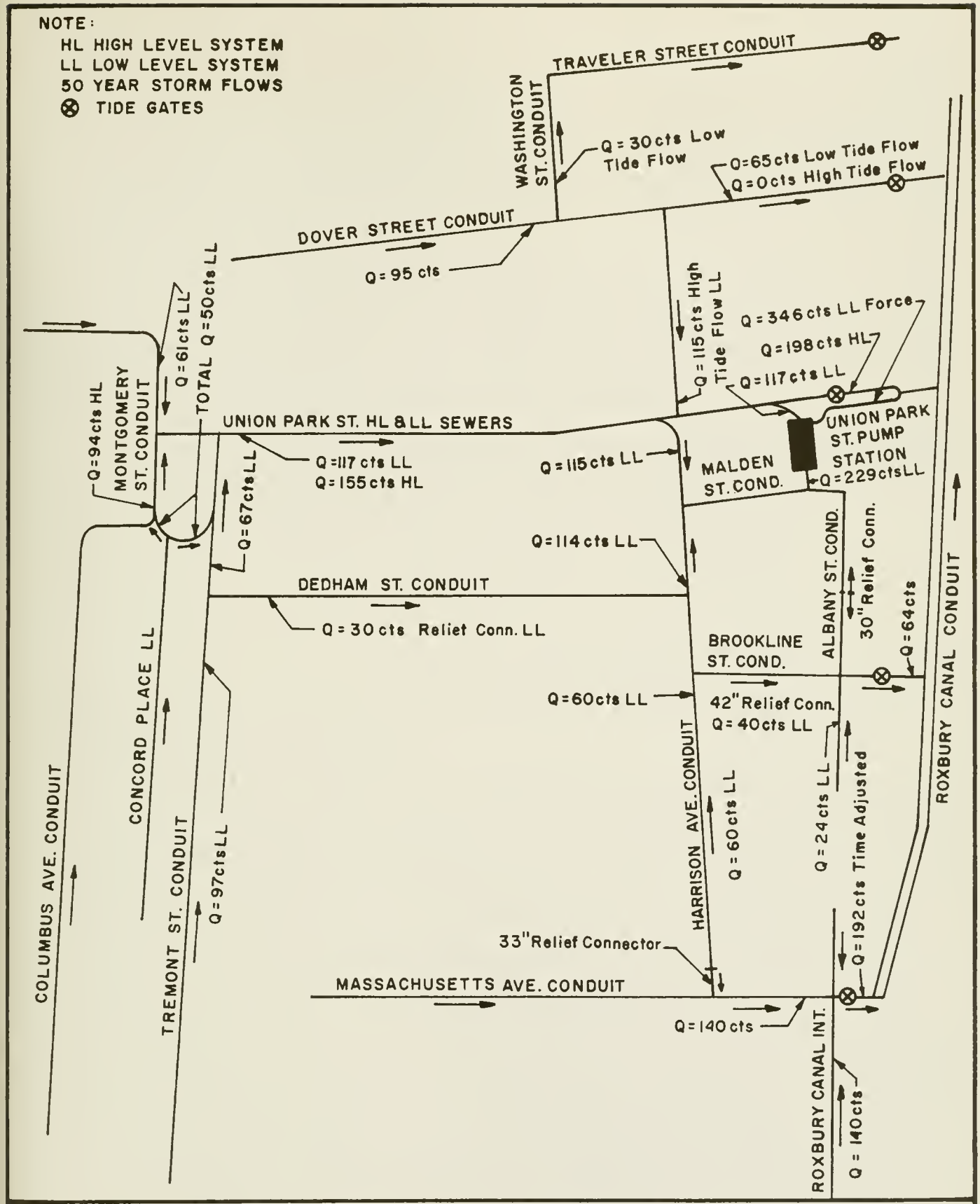
The new storm drain system is designed primarily around the existing High and Low Level Sewers in Union Park Street and the Union Park Street Pumping Station, thereby providing for discharge into the Roxbury Canal at all tide levels.

In effect, all major conduits will be connected to the Union Park Street Pumping Station either directly, or indirectly via storm drainage relief conduits which will function to permit discharge from the system when high tide levels prevent gravity flow to the Roxbury Canal conduit.

The following basic modifications of the system will be employed to accomplish this.

a) The Dover Street conduit will be reconstructed due to its poor condition. In conjunction with this, a relief conduit will be constructed in Harrison Avenue to discharge to the Low Level conduit at Union Park Street where the existing Low Level conduit flow will be diverted to a new conduit in Harrison Avenue.

b) The Harrison Avenue conduit will be reconstructed due to its poor condition and inadequate size. It will receive a quantity of storm flow from the Dedham Street conduit which



SCHEMATIC FLOW DIAGRAM OF DESIGN CAPACITIES

MAJOR STORM DRAINAGE SYSTEM

SOUTH END PROJECT

MASS. R – 56

will be retained westerly of Harrison Avenue and function as a relief conduit for the Tremont Street conduit and the low level conduit. A new conduit will be installed in Malden Street to carry flow from the Harrison Avenue conduit and the diversion of the low level flow from the Union Park Street conduit.

c) The Dedham Street conduit will be discontinued due to its poor condition easterly of Harrison Avenue and the Concord Street conduit will be discontinued due to its poor condition and in its entirety from Tremont Street to the Roxbury Canal.

d) A new conduit will be constructed in East Brookline Street. It will discharge storm flows from the Harrison Avenue conduit during low tide to the Roxbury Canal conduit and a relief conduit will be provided for its downstream section to permit discharge via the Union Park Street Pumping Station during periods of high tide.

e) In general where elevations permit, storm drainage will be diverted via local connections from the low level system to the high level system to minimize pumping requirements at the Union Park Street Pumping Station.

The existing tide gates on the major overflows from this area will be replaced as necessary to insure proper functioning of the system and prevent flooding of the pumping station. A major problem during construction could be the frequent flooding of the sewerage systems by tide water backing up into the system through the many faulty and inoperative tide gates on the Boston Main Drainage System. To prevent this, thereby reducing construction costs in this Project Area as well as others adjacent to the waterfront, all the tidegates and overflow conduits that are faulty should be repaired or replaced. A review by Sewer Division Maintenance personnel of this need on individual tidegates provided the basis for estimating the cost for this work at $100,000.

7.2.1.1 Design Criteria

The design of the storm drain system conforms with the minimum requirements of the City of Boston D.P.W., consisting of the following criteria:

Branch Storm Drains	10 year storm frequency
Main Storm Drains	15 year storm frequency
Outfalls and Major Trunk Lines	50 year storm frequency

The design runoff has been determined by the "Rational Method" using a coefficient of runoff .80 for the area. Since the majority of the combined sewers within the area are of adequate size to meet the minimum storm frequency requirements and can be modified with minimum costs to acceptable condition, the existing combined system will be utilized as the future drainage system where possible, with cleaning and repair recommended as required. This will minimize the construction of large storm drains, and permit flexibility in stage construction of a separated sanitary system, since the existing system must function partly combined until complete separation can be accomplished, which will be over a period of many years.

Catch Basin connections have a minimum diameter of 10" and storm drains a minimum diameter of 12".

7.2.2 Sanitary System

The sanitary system will be primarily new construction since conversion of the existing combined sewers to sanitary sewers is not practical. All combined sewers will be provided with dry weather connections to the sanitary system and overflow weirs will be installed at several points to prevent flooding of the sanitary system. Two major trunk sanitary sewers will be constructed and will discharge flows into the East Side and Boston Main Interceptors.

The major trunk sewers are as follows:

A. A sanitary sewer in Dover Street that will discharge flow to the East Side Interceptor.

B. A sanitary sewer in Tremont Street that will discharge flow to the M.D.C. diversion structure on the Boston Main Interceptor at Camden Street and will extend upstream to Concord Square, extend westerly in Concord Square to Columbus Avenue then extend northerly on Columbus Avenue to Warren Avenue, and then extend northerly in Warren Avenue to Dartmouth Street.

The entire South End will be sewered by a gravity system except for one low area bounded on the north by Dover Street; on the south by Dedham Street; on the west by Tremont Street; and on the east by Shawmut Avenue. This area consists of 57 acres and requires construction of two (2) small pumping units, (the first pump will lift the sewage over the existing Union Park Street Storm Lines and into the sanitary sewer proposed for Shawmut Avenue, the second located at Dover Street and Shawmut Avenue will discharge to a high level sanitary sewer proposed in Dover Street.)

If the above area were to be served by a gravity system, the trunk sewer in Dover Street would be at such a low elevation that surcharging from the East Side Interceptor would be continual, thus causing low velocities, sedimentation and eventually continual maintenance problems.

7.2.2.1 Design Criteria

The design of the sanitary system is based on the growth and water consumption records for the area projected to the year 2000. The population of the area is expected to increase to 42,000 persons or 23% over the present population. Reflecting the above growth, the future average dry weather flow is expected to 105 gpd/capita, with peak flows of 136 gpd/capita.

Sewers located in planned industrial and commercial areas are designed on the basis of average flows of .027 cfs/acre, with peak flows of .037 cfs/acre, as determined by studies of representative Industrial and Commercial areas presently located in the South End Area.

All sanitary sewers, as proposed, have a 10" minimum diameter.

7.3 UNION PARK STREET PUMPING STATION

The Union Park Street Pumping Station houses three (3) 36" pumps and one 26" pump. The total rated capacity of the existing station is 236.4 cfs or 151 MGD. With one 36" pump regarded as a spare, the normal capacity is, therefore, considered to be 168.7 cfs of 105 MGD. The pumping station was originally fully automatic with the first pump actuated at elevation 1.33', the third pump at elevation 2.00' and the fourth pump at elevation 2.33'. The pumps and all related mechanical electrical equipment are obsolete, highly inefficient and require complete replacement.

Hydraulic analysis of the station when the Low Level Sewer is flowing full, Q = 110 cfs, indicates the velocities of flow in the pumping chamber, screen chamber, the Low Level Sewer are low (V - 1.5 to 2.5 per second). The head losses are, therefore, low in the order of 0.5'±. The crown of the Low Level Sewer opposite the pumping station is at elevation 1.5'±, but the water surface elevation in the pumping chamber, with Q = 110 cfs, is about 2.33'. Therefore, with Q = 110 cfs in the pumping chamber, the Low Level Sewer would be surcharged while the pumping and screen chambers would be flowing under gravity conditions.

The combined sewerage system tributary to the pumping station will eventually be completely separated. The pumping station will, therefore, carry only storm flow. In addition to the flow from the Low Level Sewer, the pumping station will also receive flow from a new storm drain to be installed in Malden Street. The total capacity of the storm drain system will ultimately be 346 cfs,

and the pumping station must be modified accordingly.

If the entire flow were to be forced to enter the station via the existing inlets, hydraulic analysis with Q=346 cfs indicates that the velocities in the pumping chamber would be about 7 ft. per second, in the Low Level Sewer 10 ft. per second, and in the screen chamber about 3 to 4 ft. per second. The head losses with these conditions would be about 2 to 3 ft. With Q=346 cfs and the water surface in the pumping chamber at elevation 2.33', the screen chamber would be submerged and the Low Level Sewer would be surcharged.

For the existing pumping station to adequately carry the future flow (Q = 346 cfs), it is recommended that an additional screen chamber be constructed adjacent to the existing station at the opposite end of the pumping chamber. In this way, the head losses through the pumping station will be reduced by division of storm flow to the pumping chamber. Due to the limited storage capacity of the pumping chamber, it is recommended in selecting new pumps, that vari-speed pumps be considered.

Model tests of the station should be conducted in the selection of new pumps to insure the proper matching of the pumps to the pumping chamber characteristics, thereby preventing damage to the pumps after installation by cavitation.

The structural condition of the building is apparently sound and with minor modifications can probably be utilized in its present form. However, adequate property should be reserved adjacent to the station to permit its expansion for a possible additional pumping chamber and a necessary additional screen chamber both of which would require more property on the southerly and westerly sides of the building. A minimum of 40 feet clearance from the existing structure in those areas is recommended.

The improvement to this pumping station is vital to the success of the sewerage improvement program and therefore must be given highest priority.

7.4 PROPOSED CONSTRUCTION STAGING

The storm drain and sanitary sewer systems considered necessary as part of the project improvement are extensive and costly; therefore, staging of construction with completion scheduled by 1972 concurrent with the completion at the South End redevelopment program of construction.

The major components of both systems have been staged to follow the stages of construction as proposed for redevelopment. The primary factors considered in developing the staging program are: service of new developments, sewer construction to precede street construction and, to provide the basic system necessary for proper functioning and to provide immediate relief in problem areas. The recommended stages of construction are indicated in the following table which precedes a listing and functional description of the major components and is keyed to the table with reference numbers.

The repair and replacement of tide gates and faulty overflow conduits on the Boston Main Drainage System should be given first priority over all sewer construction.

CONSTRUCTION STAGING OF STORM DRAINS AND SANITARY SEWERS

Location	From	To	Facility SS or SD	Stage	Description Ref. No.
Albany St.	East Brookline St.	Union Park St.	SD	1	1
Camden St.	150 ft. west of	Shawmut Ave.	SS	2	2
Clarendon St.	Tremont St.	Columbus Ave.	SS	2	3
Clarendon St.	Warren Ave.	Columbus Ave.	SD	2	4
Columbus Ave.	Camden	Coventry St.	SD	1	5

Location	From	To	Facility SS or SD	Stage	Description Ref. No.
Columbus Ave.	Walpole St.	Coventry St.	SS	1	6
Columbus Ave.	Concord Sq.	Warren Ave.	SS	4	7
Concord Sq.	Tremont St.	Columbus Ave.	SS	3	8
Coventry St.	Columbus Ave.	Tremont St.	SS	1	9
Dartmouth St.	Warren Ave.	Montgomery St.	SD	2	10
Dover St.	Albany St.	Tremont St.	SS & SD	1	11
East Brookline St.	New Albany St. Frontage Road	Harrison Ave.	SD	2	12
East Concord St.	Albany St.	Washington St.	SS & SD	2	13
East Dedham St.	Albany St.	Harrison Ave.	SS & SD	2	14
East Newton St.	Albany St.	Harrison Ave.	SS	2	15
Harrison Ave.	Dover St.	East Dedham St.	SS & SD	1	16
Harrison Ave.	Massachusetts Ave.	East Dedham St.	SD	2	17
Molden St.	Harrison Ave.	Albany St.	SD	1	18
Massachusetts Ave.	Roxbury Canal	Shawmut Ave.	SD	3	19
Tremont St.	Dover St.	Union Park St.	SD	2	20
Tremont St.	Camden St.	Concord Sq.	SS	2	21
Tremont St.	At East Dedham Street		SD	4	22
Union Park St. Pump Station	Washington	Tremont St.	SD	1	23

Location	From	To	Facility SS or SD	Stage	Description Ref. No.
Warren Ave.	Columbus Ave.	Union Park St.	SD	2	24
Warren Ave.	Columbus Ave.	Dartmouth St.	SS	4	25
Washington St.	Concord St.	Union Park St.	SD	4	26
Washington St.	Dover St.	Traveler St.	SD	1	27
West Concord St.	Washington St.	Tremont St.	SS & SD	2	28

Ref. 1 This conduit is a new 30" storm drain and sanitary sewer to provide adequate service to the area tributary to Albany Street and is to be coordinated with street construction. This storm drain provides a relief connection to the Union Park Street pumping station from the proposed Brookline Street overflow.

Ref. 2 This sewer provides a sanitary outlet to the Boston Main Interceptor for serving the area south of Camden Street scheduled for early redevelopment.

Ref. 3 The existing combined sewer is inadequate and in poor condition. The conduit is to be part of a new sanitary system.

Ref. 4 Construction of new storm drains is required to provide adequate capacity as part of the storm drain system.

Ref. 5 Systems in this area are now separated, but are combined at the outfall system. Construction of the proposed storm drain will effect complete separation for the southwest corner of the South End Project.

Ref. 6 Same as Ref. 5 except pertaining to sanitary system.

Ref. 7 This sewer provides the necessary sanitary trunk for the Northwestern section of the South End area.

Ref. 8 This sewer provides the sanitary outlet for the sanitary sewer under Ref. 7.

Ref. 9 Same as Ref. 6

Ref. 10 This conduit replaces the existing combined sewer which is in poor condition with a new storm drain.

Ref. 11 This system replaces the old brick and wood combined sewer which is in poor condition and provides new storm and sanitary lines of adequate capacity. The storm drain will consist of a 42" pipe from Shawmut Avenue to Washington Street, a 66" pipe from Washington Street to Harrison Avenue, and a 60" pipe from Harrison Avenue to Albany Street.

The reduction in size at Harrison Avenue is possible since the 60" diameter portion of the storm drain will operate only at low tides when the flows will be reduced by a 42" relief connection at Washington Street to the existing 60" storm drain in Traveler Street. At high tides when the 42" connector is inoperative, all flows will go to Harrison Avenue where a new 66" storm drain in Harrison Avenue will carry the storm flows to the Union Park Street Pumping Station.

Construction of the new trunk sewer includes the construction of the sanitary pumping station at Shawmut Avenue and Dover Street. This trunk sewer will serve the

previously mentioned 57 acre low area.

Construction of a gravity sewer on the North side of Dover Street from the East side Interceptor to Emerald Way serving the Castle Square area, and other areas north of Dover Street.

Ref. 12 Construction of a 42" RCP diversion line for the Harrison Avenue Storm Drain and a 48" RCP outfall to the Roxbury Canal Conduit will divert flow from the Harrison Avenue storm drain and, therefore, from the Union Park Street pumping station at low tides.

Ref. 13 Construction of a new storm drain and sanitary sewer will replace the existing combined sewer, and allow closing of the existing outfall to the Roxbury Canal.

Ref. 14 Same as Ref. 13, in order to close the Dedham Street combined sewer and outfall to the Roxbury Canal.

Ref. 15 This will provide the sanitary outlet for portions of Harrison Avenue in order that the sanitary sewers in Harrison Avenue can be built during the proposed storm drain construction.

Ref. 16 Construction in Harrison Avenue consists of the following:

A new 54" storm drain is necessary in Harrison Avenue, from Malden Street to intercept the existing East Dedham Street combined sewer--to be abandoned from Harrison Avenue easterly.

A new 72" relief storm drain is necessary in Harrison Avenue from the Union Park

Street low level sewer to Malden Street. This relief system will provide the necessary ccpacity in the existing low level sewer in Union Park Street to receive the added storm flows from the Dover Street storm drain via a new 66" diameter storm drain from Dover Street to Union Park Street. Refer to Ref. 11.

Ref. 17 A new storm drain will be built including a 33" relief connection for the Massachusetts Avenue storm drain system, removal of the present connection at East Concord Street and Harrison Avenue, and diversion of the flow in the Harrison Avenue conduit from the south of Massachusetts Avenue into the storm drain in Massachusetts Avenue.

Ref. 18 This involves construction of a 6' x 7' RC Box connection of the major outfalls in Harrison Avenue, and diversion of flows from the Union Park Street Low Level Sewer to the Union Park Street Pumping Station. Reference to Ref. No. 16.

Ref. 19 New storm drains are required consisting of a 72" line from Albany Street to Harrison Avenue; 48" line from Harrison Avenue to Washington Street to Shawmut Avenue, and a new 84" outfall from Albany Street to the Roxbury Canal with replacement of tide gates and regulators. To ultimately complete the new storm drain system tributary to Massachusetts Avenue, new connections to the above storm drains is required os follows:

(a) A 30" storm drain in Washington Street from Northampton to Massachusetts Avenue.

(b) A 30" RCP in Washington Street from Springfield to Massachusetts Avenue.

(c) A 36" RCP in Shawmut Avenue from Northampton Street to Massachusetts Avenue.

Ref. 20 This conduit replaces the existing combined sewer which is old and in poor condition with a new storm drain.

Ref. 21 This is the major sanitary trunk sewer to provide the outfall for the sanitary systems under Ref. No. 7, 8, and 24.

Ref. 22 Construction of a 33" RCP connector to the existing Dedham Street combined sewer to limit flows in the Dedham Street sewer which is to become part of the new storm drain system. Includes removal at the existing flap gate and regulator at the same location.

Ref. 23 Modernization of the Union Park Street Pumping Station is necessary as a first step in the sewer construction program. It will require the installation of new pumping units with a minimum rated capacity of 220 mgd which is greater than the existing rated copacity of 151 mgd.

Ref. 24 Via an easement, the new storm drain construction is to replace an existing combined sewer which is in poor condition and has inadequate capacity.

Ref. 25 Further extension of the sanitary sewer system as proposed in Columbus Avenue under Ref. No. 7.

Ref. 26 Construction of a new storm drain replacing the existing combined sewer and changing the outfall from the Union Park low level to the high level sewer.

Ref. 27 Construction of a new 42" RCP connector from the Dover Street storm drain to the

existing 60" storm drain in Traveler Street. Refer to Ref. No. 11.

Ref. 28 Same as Ref. 13, except the existing connection to the Tremont Street storm drain to be closed preventing flows into the existing Concord Street combined sewer to be abandoned.

The preceding table does not cover staging for all the storm drains and sanitary sewers under the Project Improvement Program. However, each stage provides for construction of the major storm drains and sanitary sewers necessary for expansion of the systems into other areas being developed during the same period. Upon completion of all sewer construction proposed during the South End Project, the basic storm and sanitary systems will be available for expansion of the systems over many years to cover the entire South End area.

Other storm drains and sanitary sewers not listed in the preceding staging program should be built preceding or during the stages of construction proposed for the street in which it is located.

The existing overflows to the Roxbury Canal at East Concord and East Dedham Streets may be abandoned at the completion of the above Items 13, 14, 16, 17, 18, 22, 27, and 28. Closing of the overflows and repair of tide gates will minimize tidal fluctuation within the system, therefore reducing construction problems for the remainder of the system and surcharging at the Union Park Street Pumping Station.

7.5 ESTIMATE OF COST

The estimated cost for the construction of separate storm and sanitary systems for the South End Project Area consists of four items.

1. The work that is included under the Urban Renewal Program to establish the two (2)

systems, conforming with new street construction and/or reconstruction of existing streets to avoid future excavation. Detailed cost estimates for this portion of the work are included in the Project Improvement Report Volume II.

2. The estimated cost of constructing the remaining storm and sanitary systems for completing the sewerage systems in the South End Project Area; which are not required for the completion of the Urban Renewal Project but which should eventually be undertaken in the future.

3. The estimated construction cost of work which is considered mandatory for proper operation, rehabilitation and reconstruction of the major interceptors within the project limits.

4. The cost of sewerage improvements for the Castle Square Project as determined by the Boston Redevelopment Authority, given as $164,000.

The cost estimate for items 2 and 3 above are contained herein and are as follows:

COST FOR REMAINDER OF STORM AND SANITARY SYSTEMS, item 2, above.

Item	Quantity	Unit Cost	Total
10" VC	26,550 LF	21.30	$ 565,515
10" RC	3,000 LF	6.00	18,000
12" RC	3,000 LF	14.00	42,000
15" RC	3,970 LF	14.90	59,153
18" RC	2,450 LF	15.80	38,710
21" RC	1,700 LF	17.60	29,920
24" RC	1,450 LF	19.00	27,550
27" RC	500 LF	21.00	10,500
66" RC incl. piles	450 LF	152.00	68,400
Manholes	140 Ea	350.00	49,000
Catch Basins	100 Ea	350.00	35,000

Item	Quantity	Unit Cost	Total
Misc.	LS		20,000
			963,748
Contingencies, Unit Cost Increase, Engineering - 21%			202,387
TOTAL			$ 1,166,135
	USE $1,166,200		

MANDATORY IMPROVEMENTS TO INTERCEPTING SYSTEMS, ITEM 3 ABOVE

East Side Interceptor - Dover St. to Mass. Ave.

Replace existing with new 72" RCP, complete	$ 1,217,300

Boston Main Interceptor - South End Bypass to Albany St.

Repair existing conduit (assume relining)	$ 1,154,300

Roxbury Canal Interceptor - Hamden St. to Mass. Ave.

Replace existing with new 66" RCP, complete	$ 121,600
TOTAL (including 21% increase)	$ 2,493,200

Total Cost of Items 2 & 3

Item 2, Completion of Separate Systems	$ 1,166,200
Item 3, Interceptor System	$ 2,493,200
TOTAL	$ 3,659,400

7.6 RECOMMENDATIONS

1. Repairs to the Boston Main Interceptor should be initiated after the Boston Main Relief Sewer is in operation.

2. The East Side Interceptor and the Roxbury Canal Interceptor should be replaced following o comprehensive analysis of the Boston Main Drainage System.

3. All faulty Tide Gates on the Boston Main Drainage System should be repaired as a first priority.

4. The Union Park Street Pumping Station should have new pumps and related equipment installed and be modified as a first priority.

The recommendations and improvements set forth in this report and shown on the plans which accompany this report should be carried out to insure dependable, properly functioning systems. Benefits that will be obtained if these recommendations are properly carried out are as follows:

1. Provision of basic components for separate storm and sanitary systems for the South End Area.

2. Reduction of tidal fluctuations in the Boston Main Drainage System.

3. Provision of adequate storm and sanitary service to low level areas.

4. Relief of the Low Level Sewerage System by diversion of storm flows from the higher areas into the High Level System.

5. Provision of a storm drainage system adequate for a fifty (50) year storm frequency regardless of tide levels.

8.0 POLICE SIGNAL AND FIRE ALARM SYSTEMS AND MASSACHUSETTS BAY TRANSIT AUTHORITY FACILITIES

The police signal, fire alarm and Massachusetts Bay Transportation Authority facilities that this report deals with consist primarily of underground conduit and cable systems, together with related appurtenances such as manholes and alarm boxes. Their locations and modifications are shown on drawings SE 14-1 through SE 14-8, which accompany this report.

8.1 POLICE SIGNAL SYSTEM

The Police Signal System in the South End is in satisfactory working order as reported by the Boston Police Signal Division. The cables are carried, in most cases, through separate ducts of the New England Telephone & Telegraph Company. The Boston Police Signal Division constructs and maintains their own manholes and ducts where telephone ducts are not available. They also construct all laterals from ducts and manholes to signal boxes. Wiring, signal boxes and appurtenances are owned and maintained by the Police Signal Division, Boston Police Department. Relocations and new installations required for the Urban Renewal Program should be made consistent with the policy and approval of the Boston Police Department. Changes to the system, as designated on the plans, should be coordinated with construction under the street improvement program. The system is in adequate working order and requires no major modernization or improvement according to officials of the Police Signal Division.

8.2 FIRE ALARM SYSTEM

The Fire Alarm Division, Boston Fire Department, reports that the South End system is in satisfactory condition. The cable system was installed in sections, some of which have been replaced. Fire alarm boxes have been abandoned and new boxes have been added through the

years to provide adequate service.

Alarm circuits are carried normally in separate ducts of the New England Telephone & Telegraph Company. The Boston Fire Alarm Division constructs and maintains their own manholes and ducts where telephone ducts are not available. They also construct the necessary laterals from ducts and manholes to Fire Alarm boxes and test posts. Wiring, alarm boxes, test posts, cable boxes and appurtenances are owned and maintained by the Fire Alarm Division, Boston Fire Department. Fire alarm boxes on discontinued streets in redevelopment areas have been relocated as shown on the plans. Fire alarm boxes have been provided at or in close proximity to proposed schools and public buildings. Additional fire alarm service will probably be required for individual buildings in redeveloped business and industrial areas. Existing alarm circuits are adequate to accommodate such service. The installation, maintenance and cost of such private service is the responsibility of the user. Policy requires that for modifications and/or changes to fire alarm circuits continuity of service must be maintained, and that new circuitry must be completely installed and tested before any segment of an alarm circuit may be discontinued. All relocations and new installations required for the Urban Renewal Program must be consistent with the policy and have approval of the Boston Fire Department and should be coordinated with the staging of construction under the street improvement program.

8.3 MASSACHUSETTS BAY TRANSIT AUTHORITY FACILITIES

The MBTA facilities in the South End consist of a network of underground power cables, a portion of the Forest Hills- Everett elevated line, a power substation, a bus garage, and a system of bus lines. The elevated structure is scheduled for demolition at a future date through the action of the MBTA and is currently under study by them. The improvement of Washington Street will follow this demolition. It should be noted, however, that the Urban Renewal Plan

for the South End is not contingent on the MBTA elevated structure being removed.

The bus garage on Albany Street will be replaced in conjunction with the replacement of a similar facility in the Washington Park Project Area, Mass. R-24. A new combined facility will be located in the vicinity of the Inner Belt Expressway, outside the South End Project Area.

The power rectifying station located at the Albany Street garage and the power cables leading to it will be retained if required by the final plans of the MBTA. Accordingly, utility easements will be maintained as necessary subject to final disposition of these facilities by the MBTA.

An allowance for possible relocation of the MBTA power sub-station and the conduits leading to it, are included in the estimate of costs.

8.4 ESTIMATE OF COST

Costs for improvements to the Police Signal & Fire Alarm Systems are $71,000 for that work that is to be done under the Urban Renewal Program and $30,000 for improvements to be made within the Castle Square Project.

Costs for improvements to MBTA facilities are estimated to be $350,000.

9.0 TRAFFIC CONTROLS

Traffic Circulation and signalization for the Project Area is shown on drawings SE 15-1 through SE 15-9.

Six streets now carry heavy traffic through the project area in a northeast-southwest direction: Albany Street, Columbus Avenue, Harrison Avenue, Shawmut Avenue, Tremont Street and Washington Street. The principal arterial streets in the southeast-northwest direction are Massachusetts Avenue and Berkeley-Dover Streets with considerable traffic filtering through local streets running in this direction.

Substantial traffic desires are expected between the Hyde Park-Roslindale area and downtown Boston in the northeast-southwest direction and between the Inner Belt-Southeast Expressway and the commercial complex in the Prudential Center - Copley Square area.

Traffic projections based upon the proposed construction of the Inner Belt and the proposed construction of the South End Bypass System indicate that the existing arterial streets will remain as major traffic carriers although volumes are expected to be somewhat lower than present.

9.1 CIRCULATION

Rights of way are to be temporarily reserved on existing Clarendon Street between Warren Avenue and Tremont Street, and on West Dedham Street from Shawmut Avenue to Washington Street to provide connections to Monsignor Reynolds Way. The development of future traffic patterns will predicate the necessity for utilizing these right of ways as streets.

A traffic circulation plan has been prepared, reviewed, and approved by the Boston Parking and Traffic Department and the Transportation Planning Department of the Boston Redevelopment Authority, and copies of the plan have previously been distributed. Major changes in

traffic flow, discontinuances of streets and new streets to be constructed are discussed in Section 3.0 of this report.

9.2 SIGNALIZATION

Signalized intersections are proposed to accommodate projected flow patterns and allow optimum traffic usage of the streets during peak hours. All signalized intersections will have "Walk-Don't Walk" pedestrian signals and a local controller which will be connected by cable, to be installed in Boston Edison Company conduit, with the master controller in the Boston Traffic and Parking Department building located at 112 Southampton Street.

Traffic signal installations will have fixed time local controllers, but will be interconnected to provide for flexibility and use in a progressively-timed signal system for major traffic flows. Some signal installations will be operated as isolated intersections on a fixed time basis. This combination of local and master control provides for either independent operation or a coordinated system that can be adapted to any future requirements.

The Boston Traffic and Parking Department under the Commissioner of Traffic and Parking is responsible for the installation and maintenance of all traffic signals and signs. Signal locations have been reviewed by the Traffic Department and the standards of the Boston Traffic Commission and the "Manual on Uniform Traffic Control Devices for Streets and Highways," published by the Bureau of Public Roads, United States Department of Commerce in 1961 were used as the basis for the design of the traffic control system.

9.3 ESTIMATE OF COST

Unit costs for improvements to the traffic control system have been reviewed with the Boston Traffic and Parking Department. The total construction cost of improvements to be made in the South End Project is $292,000.

10.0 STREET, TRAFFIC & DIRECTIONAL SIGNS

The standards of the Traffic & Parking Division, City of Boston, were used in estimating cost for the street name, traffic and directional signs and permanent pavement markings required for the South End Project. The street name signs will be designed by the Traffic and Parking Division or their design consultant to conform with the overall architectural planning for the South End.

10.1 ESTIMATE OF COST

The Estimated cost for street, traffic and direction signs and permanent pavement markings to be installed is $105,000.

Those improvements to be made within the Castle Square Project by the City of Boston, Public Works Department, and have been estimated by the Boston Redevelopment Authority to cost $5,000 in addition to the above cost.

11.0 SOILS

Historically the South End, generally along Washington Street, was naturally formed land and was a narrow neck that led from the mainland of Roxbury to the Boston Peninsula. Over the years, the tidal areas on each side of the neck were filled, resulting in a soil profile in the man made area of generally unstable soils. These conditions require special foundations for major utility structures in extension sections of the area. This is particularly applicable to new large sewerage conduits. Many existing structures and sewer conduits were built on piles or other special foundations. Old records of sewer conduit construction seldom show limits or details of the special foundations used, however.

11.1 GENERALIZED SUBSURFACE PROFILE

Soils information available from numerous soil borings that have been made in past years throughout the South End Project Area provided a basis for development of a generalized subsurface profile in the area. The soils and rock strata from existing ground surface downward are as follows:

a. Two (2) to thirty (30) feet of "man made" fill varying in character from very loose rubbish and cinders to medium-dense sand and gravel.

b. Either one (1) to thirty five (35) feet of river bottom or flood plain deposited organic silt, peat and/or mud; or one (1) to twenty (20) feet of sand and gravel. An Exhibit follows that indicates the approximate limits of the organic soils beneath the fill.

c. Either one (1) to sixty (60) feet of glacial till consisting of sand, gravel, and clay, or up to one hundred twenty (120) feet of stiff to very soft fluvio-glacial deposits of "Boston Blue Clay"

d. Cambridge slate bedrock formation consisting of soft to hard slate, shale, and siltstone rock.

e. The effects of the tide levels in the Roxbury Canal influence the water table at this site. The ground water varies between El. + 1 and El. + 13.

11.2 GENERAL CONDUIT FOUNDATION RECOMMENDATIONS

A. 42" to 72" diameter reinforced concrete conduits.

1. In those areas where the invert of the conduits immediately overlie substantial thicknesses of organic soil and/or compressible clay, it is recommended that these conduits be supported on timber piles with an allowable bearing capacity of twelve (12) tons per pile. The piles could develop their bearing capacities either as end bearing piles driven to refusal in stiff clay or granular soil, or as friction piles penetrating a minimum of twenty (20) feet into the soft Boston Blue Clay stratum. Where a proposed conduit is replacing an existing pile supported conduit of similar size, the existing piles should be utilized. However, an investigation of the piles must be made to determine the condition of the timber above the water table, before they can be incorporated into a new foundation system.

For any major conduit construction within the limits of the Roxbury Canal, timber pile support is recommended. The foundation design should reflect the load induced on the underlying soil by the new sewer construction plus the anticipated load and subsequent negative skin friction placed on the piles as the result of settlement of any future superimposed embankment.

An Exhibit follows that indicates the general areas where timber pile foundations are indicated.

2. In those areas where the proposed conduits immediately overlie relatively thin layers of soft, compressible soil, it is recommended that these materials be excavated and replaced with compacted granular fill carried not less than one fourth (1/4) the outside diameter of the conduit above the bottom of the pipe to insure proper bedding. A minimum of one foot of compacted granular bedding should be placed beneath the conduit invert.

3. In those areas where the conduits immediately overlie substantial thicknesses of stiff clay or non-cohesive soil they may be placed on existing soil, after the "in place" soil has been adequately tamped.

4. Reinforced concrete cradles may be required in special areas where small differential settlements are not tolerable, and where pile support is not practical.

B. 10" to 42" reinforced concrete or vitrified clay conduits.

In general all conduits 42" diameter and smaller can be supported on either suitable "in place" soils or compacted granular fill. In some areas over excavation or organic material beneath the conduit invert and replacement with compacted granular fill will be necessary.

Where vitrified clay pipe is to be placed over consolidating soils, the use of lock jointed extra strength pipe is recommended.

C. Individual conduit foundation system requirements.

The above general recommendations are based upon bearing capacity and settlement studies made for idealized soil profiles at various depths of cut. Each proposed conduit line must be evaluated on the basis of existing soil conditions and induced loads in order to design a safe, economical foundation. In many instances it may be feasible to support a single line on several types of foundation.

11.3 GENERAL CONSTRUCTION RECOMMENDATIONS

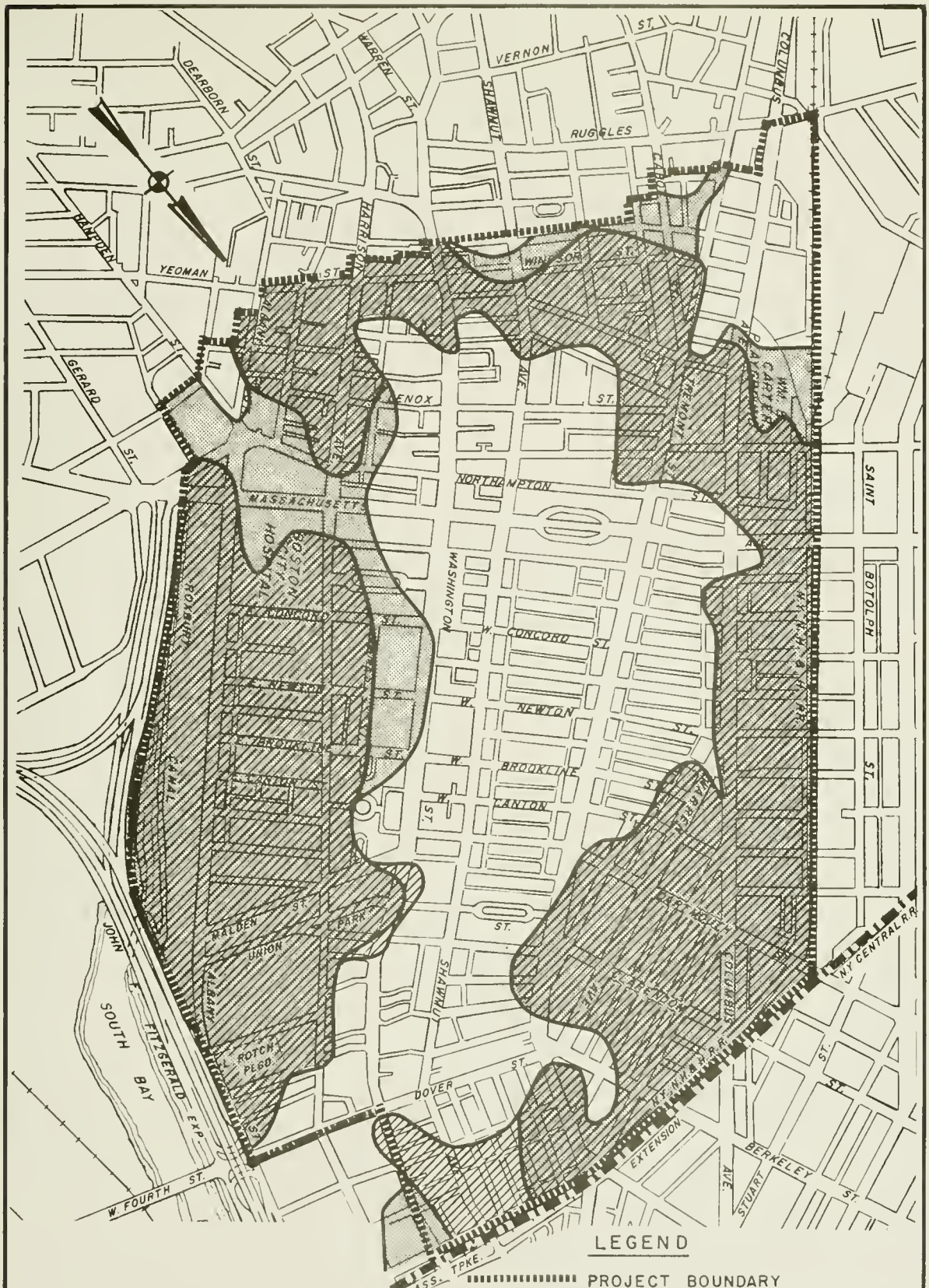
A. Open cut excavations carried below high tide water level may require a system of well points to control the flow of water into the open excavations, and/or a system of perforated pipe underdrains and sumps beneath the proposed conduit to control water within the excavations.

B. Sheet piling will be required to protect all excavations below the high tide water level. It is recommended that interlocking 2" to 3" thick wood sheeting and required bracing be used to protect open cuts up to twenty (20) feet deep. Preliminary earth pressure studies indicate that MP 115 steel sheet piling and required bracing is needed for open cuts over twenty (20) feet deep.

In general the sheet piling will be reusable; however, it may be necessary to leave the sheet piling in place in areas where pulling the piling would cause detrimental settlements of adjacent utilities and structures.

C. The possibility exists in the South End Project Area that during and after construction of the proposed conduit system a lowering of the permanent ground water table could occur, causing subsequent settlements of existing structures. It is suggested that a series of piezometric observation wells be constructed throughout the project area, prior to any future conduit construction, to facilitate the observation of ground water behavior.

D. Extensive pile driving operations in the immediate vicinity of existing brick conduits can cause failure of these old conduits. Use of displacement piles should be minimized in these areas and replacement of conduits in poor structural condition should take place before piles for nearby buildings are driven.



GENERALIZED SOIL CONDITIONS FOR SEWER CONDUIT FOUNDATIONS

M21E

South End Project

project No. Mass R-56

DATE	ISSUED TO