USE OF WATER-TABLE DATA

Data in this report illustrate the approximate magnitude of annual and long-term fluctuations of the water table; how these fluctuations are related to geology, geography, and precipitation; and extent and duration of changes resulting from urban development.

Differences in altitude of the high and low water tables indicate the range of fluctuations based on available data at any particular site. To find the lowest recorded level, locate the area of interest on figure 6, sheet 3. If the location is in a blue area, use contour map on sheet 3. If the location is in a white area, use contour map on sheet 1. To find the highest recorded level, locate the area of interest on figure 7, sheet 4. If the location is in a blue area, use contour map on sheet 4. If the location is in a white area, use contour map on sheet 2.

Used in conjunction with the map showing near-surface materials and sequence of landfill operations (fig. 1, sheet 1) a rough estimate of the subsurface conditions can be ascertained for any existing or proposed excavation site. Comparison with standard Geological Survey topographic quadrangle maps or other sources of land-surface altitudes provide estimates of the depth to the water table.

The 1:6,000 contour maps may be used in conjunction with a series of 1:6,000 engineering geologic maps proposed by Kaye (1967). A preliminary map of the bedrock surface for this area is available at this scale (Kaye and others, 1970).

FUTURE WATER-TABLE CONFIGURATION

Because the water table is so close to sea level, not much natural change can be expected. Yet, over the last 50 years, since the record from which the 1929 sea-level datum was calculated, mean sea level has risen 0.2 feet. From 1923 to 1960 mean sea level rose 0.3 feet (Kaye, 1964); from 1960 to 1970 it declined 0.1 foot (Kaye, oral commun., 1972). Ground-water levels (not affected by sewers) over the entire peninsula may rise and decline by small amounts, as ground-water gradients change.

Nearly stable stages of the Charles River Basin and Muddy River, leakage from water mains, and precipitation should provide adequate ground-water recharge. Discharge into sewer and storm-drain systems may remain relatively constant, and the systems could be made to drain less ground water. New reinforced concrete sewers replacing old brick lines should result in a higher water table.

The September 1967 low water-table map may be a better indicator for future low levels than the 1936–40 low water-table map in at least two areas:

(1) Albany Street area – filling of most of old South Bay should result in a higher water table in that area.

(2) South of Beacon Street in Back Bay–the wooden sheeting, which used to hinder recharge from the Charles River Basin, may have rotted within the zone of water-table fluctuation, resulting in a higher water table in that area.

Dewatering programs associated with construction projects will continue to lower the water table temporarily in small areas. Dewatering may perch the water table in some areas where fill is underlain by silt and mud over sand and gravel (fig. 1).

SUMMARY AND CONCLUSIONS

Ground-water recharge is from sewer and water-main leaks, precipitation, the Charles River Basin, and the Muddy River.

Most ground-water discharge, particularly in the landfill areas, is to sewer and storm-drainage systems and associated underdrains. Ground water also discharges to tidewater in the northeastern section of the peninsula; minor ground-water discharge may occur in the spring to the Charles River Basin and Muddy River. Withdrawal of ground water from shallow depths usually is for dewatering construction sites and keeping leaky basements dry.

Shallow ground-water movement in most of the original land areas and most of the areas filled before 1850 is hindered by the low permeability of fine-grained and poorly sorted deposits.

The relatively high water table in most of the northeastern section of the peninsula reflects this lower permeability and topography. Along the original narrow neck of land, the high water table reflects only the lower permeability of the original fine-grained deposits and pre-1850 fill. A low water table and, except in areas of dewatering or high leakage to sewers, low ground-water gradients reflect the relatively high permeability of post-1850 fill and sand and gravel in the old Gravelly Point (fig. 1, sheet 1) and Kenmore Square areas.

Relative stability of the water table is essential in landfill areas of the Boston peninsula because structural damage to older buildings may result from deterioration of wooden foundation pilings if the water level is lowered below their tops.

The water table on September 20–21, 1967, was generally higher than the composite low water table of 1936–40. No areas in 1967 had significantly lower water levels than in 1936–40.

The water table on March 20–22, 1968, was significantly higher in at least seven areas than the composite high water table of 1936–40. This probably reflects above-average precipitation during March and changing conditions caused by man rather than reflecting longer term precipitation trends.

Ground water in March 1968 along the Southeast (Fitzgerald) Expressway southwest of East Berkley Street may not have adjusted to landfill operations completed on September 30, 1967.

There will be no drastic long-term change in the water table on the Boston peninsula unless man causes the change. Short-term lowering of the water table will occur in small areas by dewatering during building or roadway construction. The water table in the old Gravelly Point area is likely to become perched during nearby dewatering operations.

MEAN SEA LEVEL AND OTHER DATUM PLANES

See sheet 1 for further details

	feet
Sea-level datum, Commonwealth Pier 5, 1921-23	0.00
Mean tide level, Commonwealth Pier 5, 1929	-.12
Mean low water, Boston Harbor, 1929	-4.84
Boston low water datum, 1929	-4.87
Boston City Base	-5.65
Metropolitan District Commission (sewers)	-105.62

SCALE 1:6 000

1000 500 0 1000 FEET

250 125 0 250 METRES

WATER-TABLE MAP, MARCH 20-22, 1968

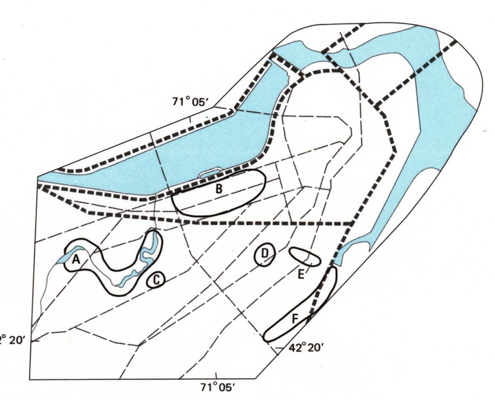
This map represents high water-table conditions in spring, 1968. Ground water discharged into the upper Muddy River (area A, key map).

The water table in Back Bay (B) along Storrow Memorial Drive was approximately the same altitude as the Charles River Basin. Scattered, plus 3-foot contours indicate that the nearly horizontal water table sloped gently toward the basin.

The water table was lower in March 1968 than in September 1967 along Forsyth Street (C), indicating increased discharge to sewers and(or) the brook conduit.

Discharge to Tremont Street sewers was greatest between Clarendon and Dartmouth Streets (D); this is where sewers drain and join with the major gravity sewer that flows southeastward along Union Park Street. A water-table low may have extended along East Berkeley Street (E) as well, but the wells that were used to define the low on the 1936–40 maps have been destroyed.

Even though filling of South Bay (F) had been completed 6 months before the March measurements, and the heavy March rains had occurred only 2 to 4 days before, the water table along Albany Street from East Brookline Street to the southwest had not risen much since September 1967. This might be explained by leakage into the older brick sewers, rapid ground-water movement through backfill around the two new reinforced concrete conduits along the former course of South Bay, or large-scale ground-water movement northeastward through the entire landfill area.



KEY MAP TO AREAS MENTIONED IN TEXT

EXPLANATION

● 2365 — **Observation well**
Number is well with hydrograph shown on sheet 3

Observation well not used because it was plugged or had poor hydraulic connection

Water-table contour
Shows altitude of water table. Dashed where approximate; hachured indicates depression. Contour interval is 1 foot. Sea level datum of 1929

→ **Direction of ground-water movement near shores of the Charles River Basin and Muddy River**

Channel of Muddy River under roadways

Artificial pond (perched)

○ **Pumping station**

City of Boston major sewer and storm drain distribution system
Where two intersecting lines are solid, sewers or drains are interconnected; where two lines cross but are not interconnected, the solid line overlies the interrupted line. Only major sewers and drains are shown; minor ones underlie most streets but are not shown.

P — **Metropolitan District Commission combined sewer and storm drain. P, pressurized line**

Brook conduit

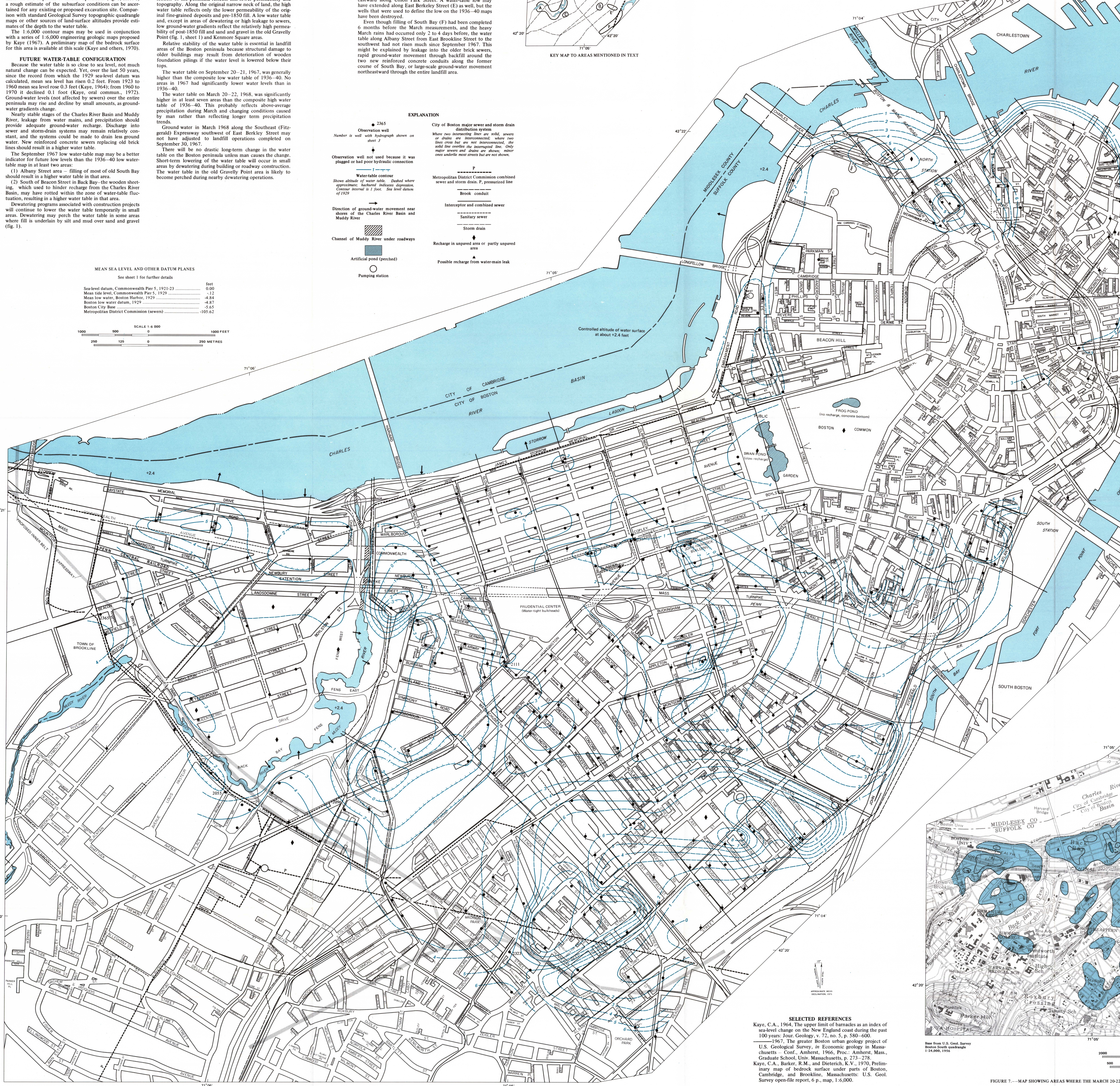
Interceptor and combined sewer

Sanitary sewer

Storm drain

◆ **Recharge in unpaved area or partly unpaved area**

▲ **Possible recharge from water-main leak**



Base from Boston Redevelopment Authority
1:9,600 city base, March 1969

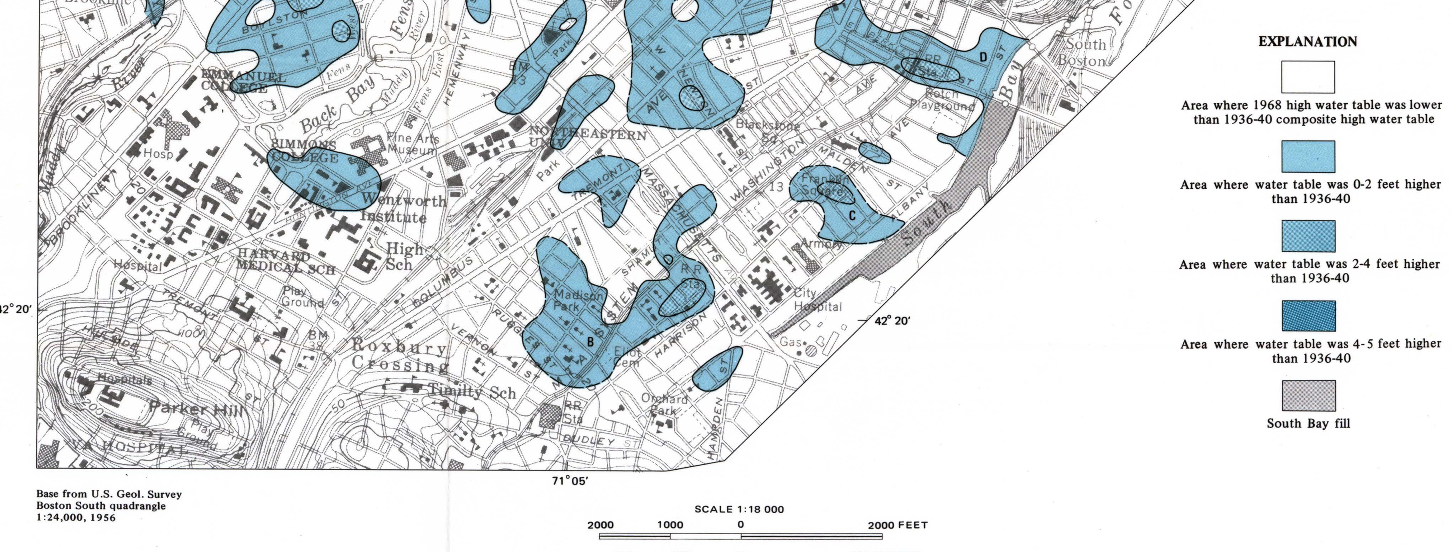
HIGH WATER-TABLE COMPARISON (1936–40 and 1968)

The March 1968 water table was higher in many areas of the Boston peninsula (fig. 7) than the 1936–40 composite high water table. Heavy rains 2 to 4 days before the measurements may have caused the water table to be somewhat higher than average at this time of year. However, significant change is indicated in several broad areas. This conclusion is supported by 1967 data because the water table in September 1967 was higher in some of these areas than it was on the composite high water-table map for 1936–40.

A large area of higher water table in Back Bay (A) suggests the possibility that the wooden sheeting on each side of the Metropolitan District Commission sewer has rotted permitting more recharge from the Charles River Basin. This possibility could also explain a higher water table in September 1967. The southern side of this area does not generally extend south of Boylston Street except east of Berkley Street. The subway along Boylston Street may act as a dam to southward ground-water movement.

A higher water table near Massachusetts and Harrison Avenues (B) may reflect the slowness of ground-water movement of the March rain recharge through fine-grained deposits to sewers. Along East Dedham Street (C), the higher water table may reflect the filling of South Bay. If this were true, however, a greater change should also occur along Union Park Street.

The apparent higher water table along East Berkley Street (D) may not be real because the wells used to define the "trough" on the 1936–40 maps have been destroyed. Now there is a water table in that part of old South Bay filled since 1940, but no water-level data are available for this area.



Base from U.S. Geol. Survey
Boston South quadrangle
1:24,000, 1956

SCALE 1:18 000

2000 1000 0 2000 FEET

500 250 0 500 METRES

FIGURE 7.––MAP SHOWING AREAS WHERE THE MARCH 20-22, 1968, WATER TABLE WAS HIGHER THAN THE 1936-40 COMPOSITE HIGH WATER TABLE

SELECTED REFERENCES

Kaye, C.A., 1964, The upper limit of barnacles as an index of sea-level change on the New England coast during the past 100 years: Jour. Geology, v. 72, no. 5, p. 580–600.

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Kaye, C.A., Barker, R.M., and Dieterich, K.V., 1970, Preliminary map of bedrock surface under parts of Boston, Cambridge, and Brookline, Massachusetts: U.S. Geol. Survey open-file report, 6 p., map, 1:6,000.

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GROUND–WATER LEVELS ON BOSTON PENINSULA, MASSACHUSETTS

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1975