Bustins Island
1995 Ground Water Study

Summary and Recommendations

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Goals:

- Analyze potential impact of future construction on the island
- Answer specific questions from the BIVC such as:
  wastewater system maintenance, upgrading, permitting
  solving bacteria contamination problems
- Provide recommendations in conjunction with Albert Frick
- Provide island residents with information to aid them in deciding how to manage their ground water resources

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Overview:

Ed Brainard (Robert G. Gerber, Inc.) - hydrogeologist

- Discussion of ground water hydrology
- Results of ground water modeling
- Review recommendations for ground water management

Albert Frick - site evaluator

- specifics of wastewater disposal systems

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WATER SUPPLY PROTECTION STUDIES

Dutchess County, NY	Ground water resource evaluation for entire county. Identified high yield aquifers; recommended county-wide protection plan; helped set up data base.
Town of Falmouth	Bedrock aquifer study and land use control recommendations.
Town of Freeport	Identified high yield aquifer zones (bedrock and sand & gravel) and proposed land use regulations for aquifer recharge area.
Town of Harpswell	Ground water protection study.
Harrison Water District	Safe yield evaluation, travel time study, and surface water infiltration evaluation.
Island Institute, Vinalhaven	Ground water resource evaluation and protection recommendations.
Town of Lamoine	Sand & gravel ground water protection study.
Town of New Gloucester	Sand & gravel aquifer protection study.
City of Portland	Performed reconnaissance and prepared ground water management plan for five islands in Portland.
Portland Water District	Recommended ground water protection plan based on travel time to Windham well field.
South Bristol	Ground water resource evaluation and protection recommendations
Southern Maine Regional Planning Commission	Investigated aquifer systems in Sanford, Kennebunk, No. Berwick, and Wells. Recommended appropriate land use controls to be applied within each aquifer recharge area.
Town of Topsham	Sand & gravel resource protection study.
Town of Verona	Ground water resource evaluation and protection recommendations.

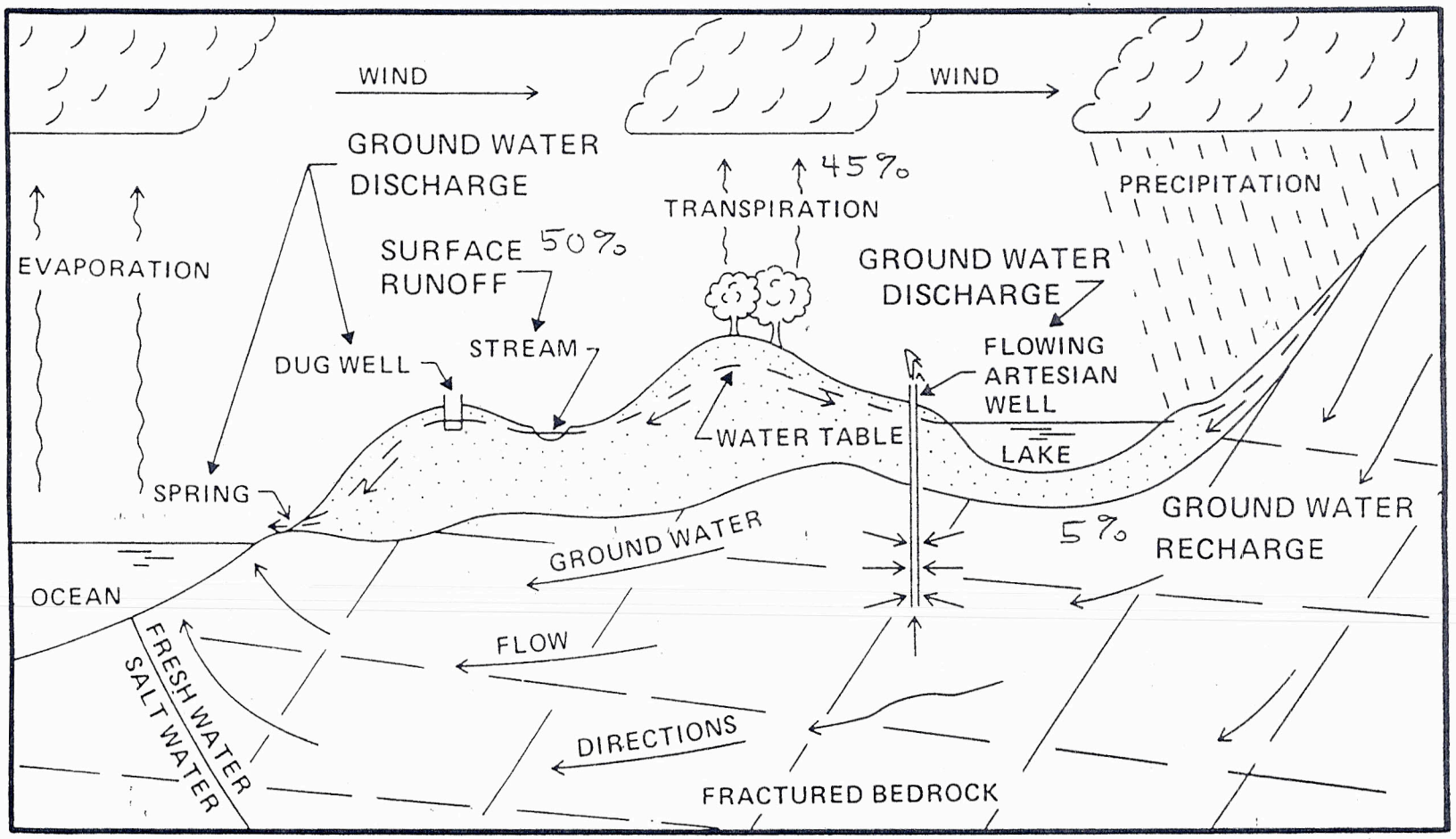
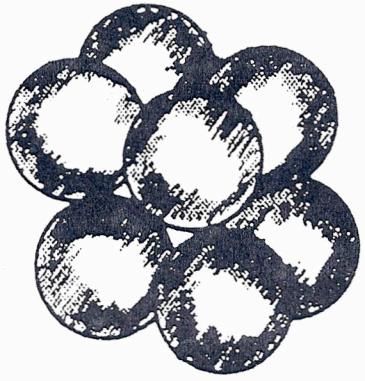
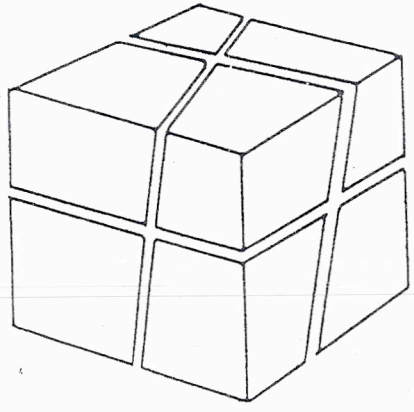


Figure 1. The hydrologic cycle.[3]



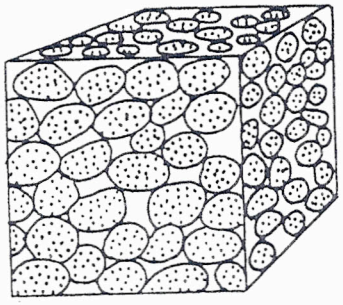
Porous Material



Fractured Rock

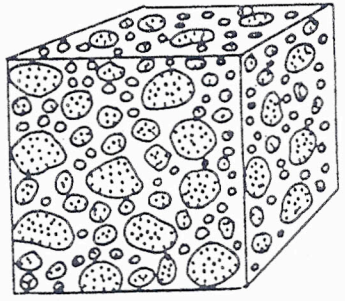
Figure 1. Composition of Rocks Near the Earth's Surface

Primary Openings



Well-Sorted Sand

25%

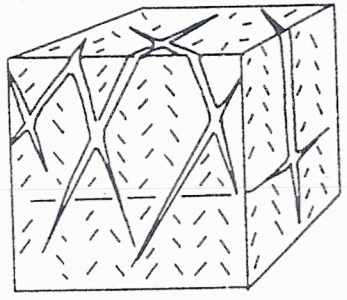


Poorly-Sorted Sand

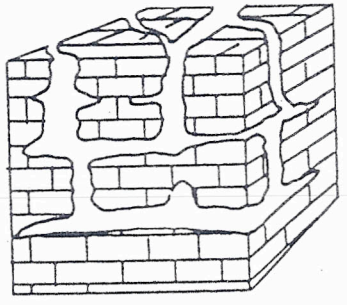
15%

Secondary Openings

1%

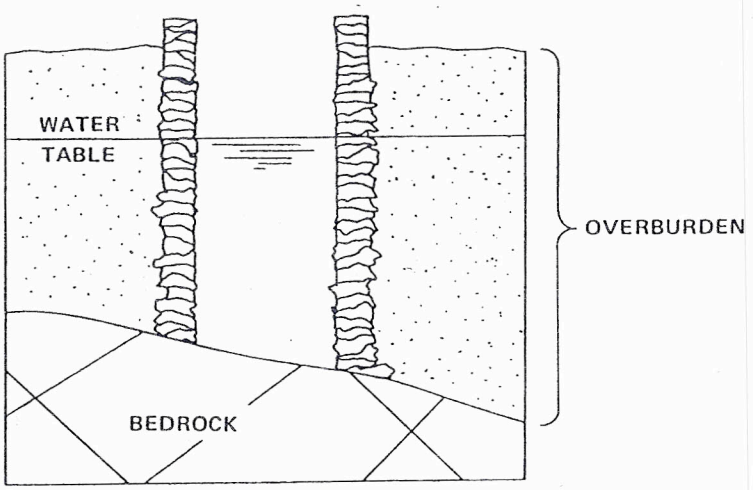


Fractures in Granite

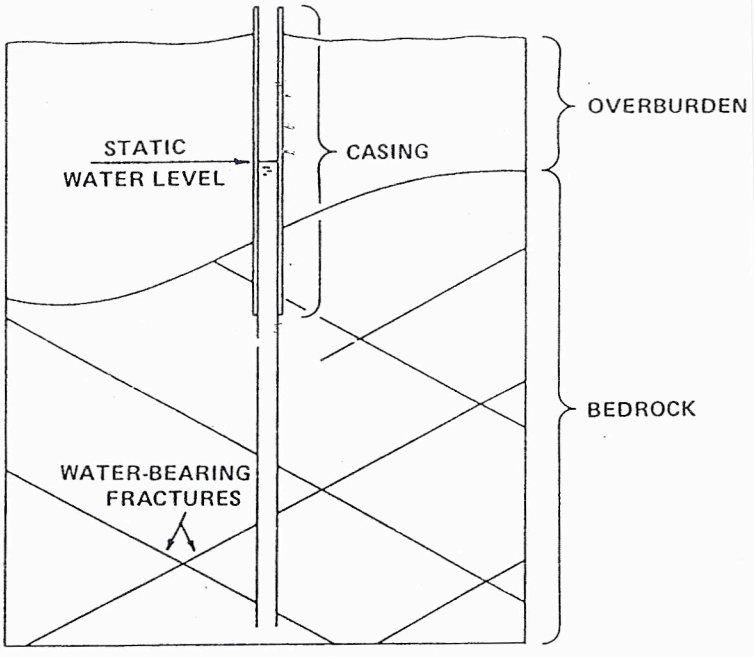


Caverns in Limestone

Figure 2. Different Kinds of Voids in Rocks



A. DUG WELL



B. DRILLED WELL

Figure 24. Cross-sections of a typical dug well and drilled well.

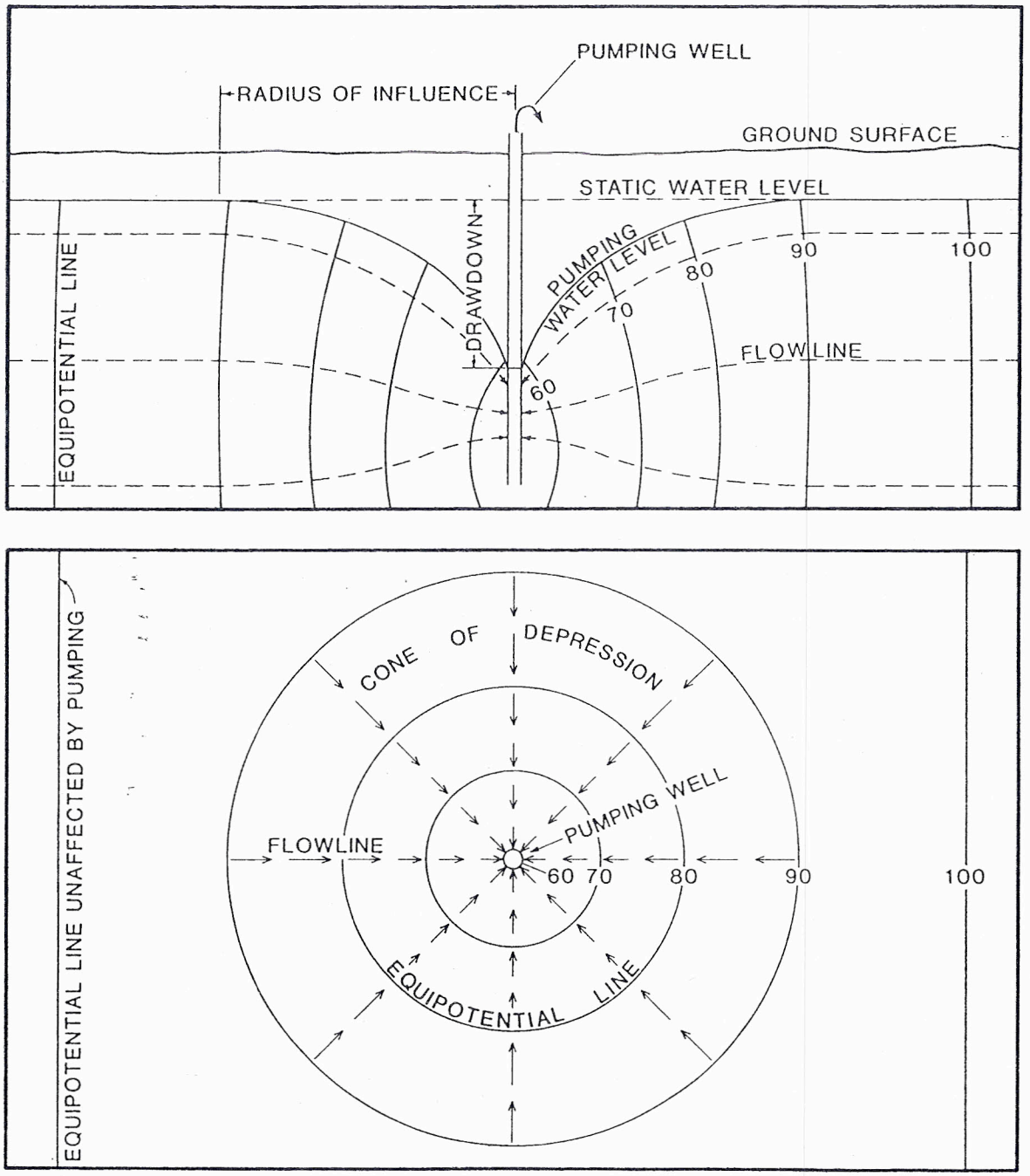


Figure 21. Cross-sectional and map views of the cone of depression around a pumping water-table well in a homogeneous and isotropic (ideal) aquifer where the regional water table gradient is nearly flat.

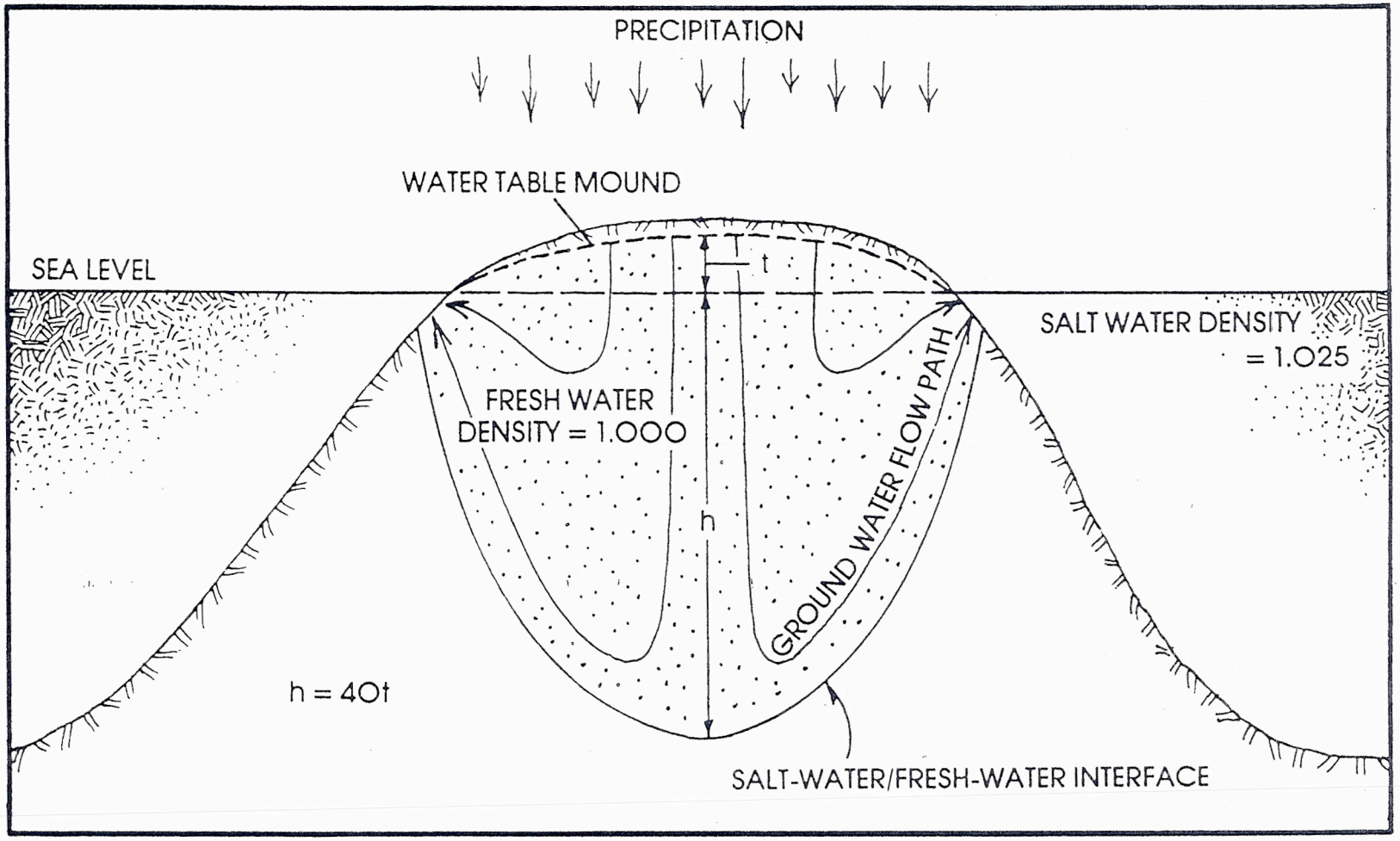


Figure 37. Schematic cross-section of oceanic island showing lens of fresh water. The depth of fresh water below sea level (h) is 40 times greater than the height of fresh water above sea level (t). The water table mound is maintained by precipitation.

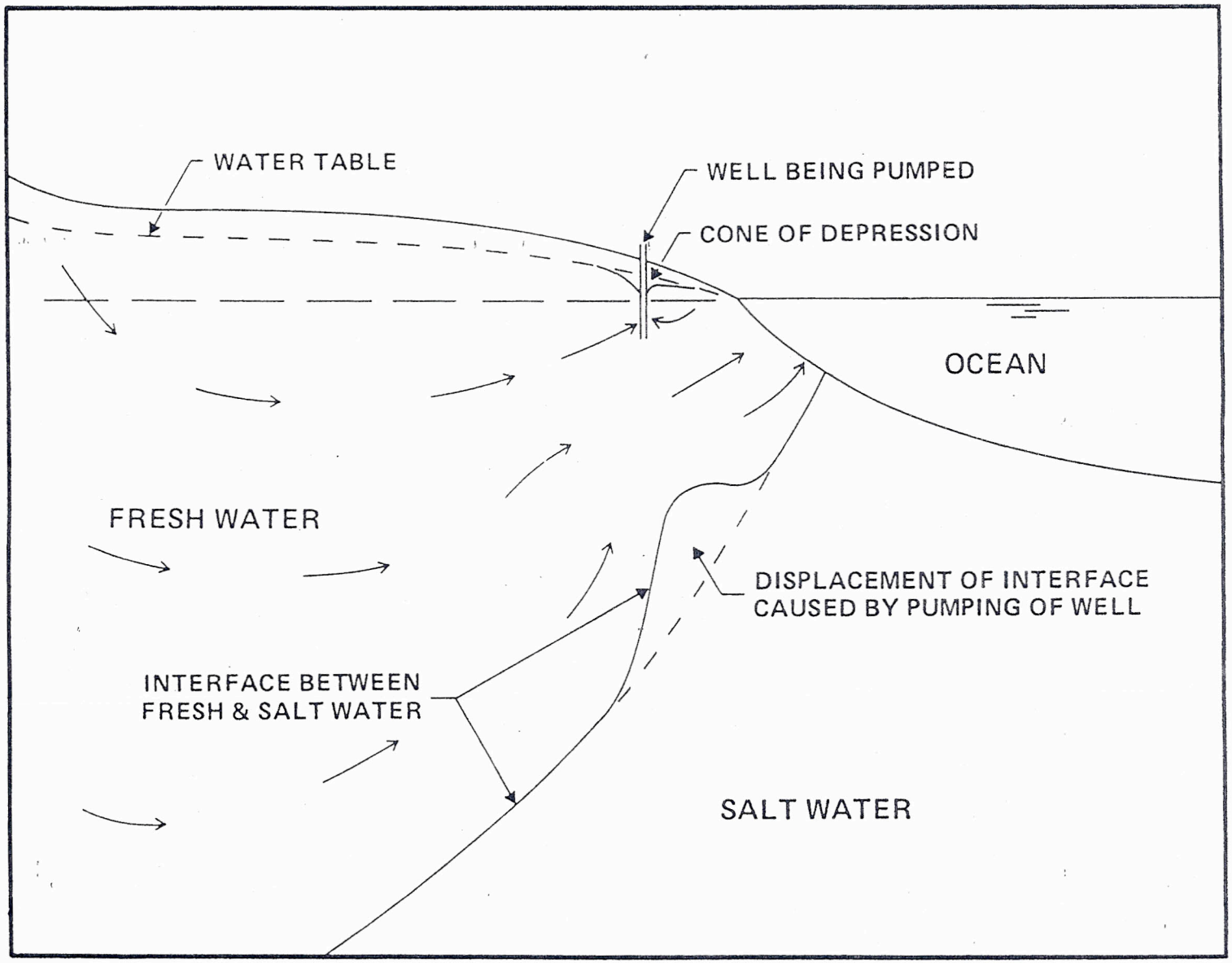


Figure 38. Idealized ground water flow near the fresh-water/salt-water interface.[3]

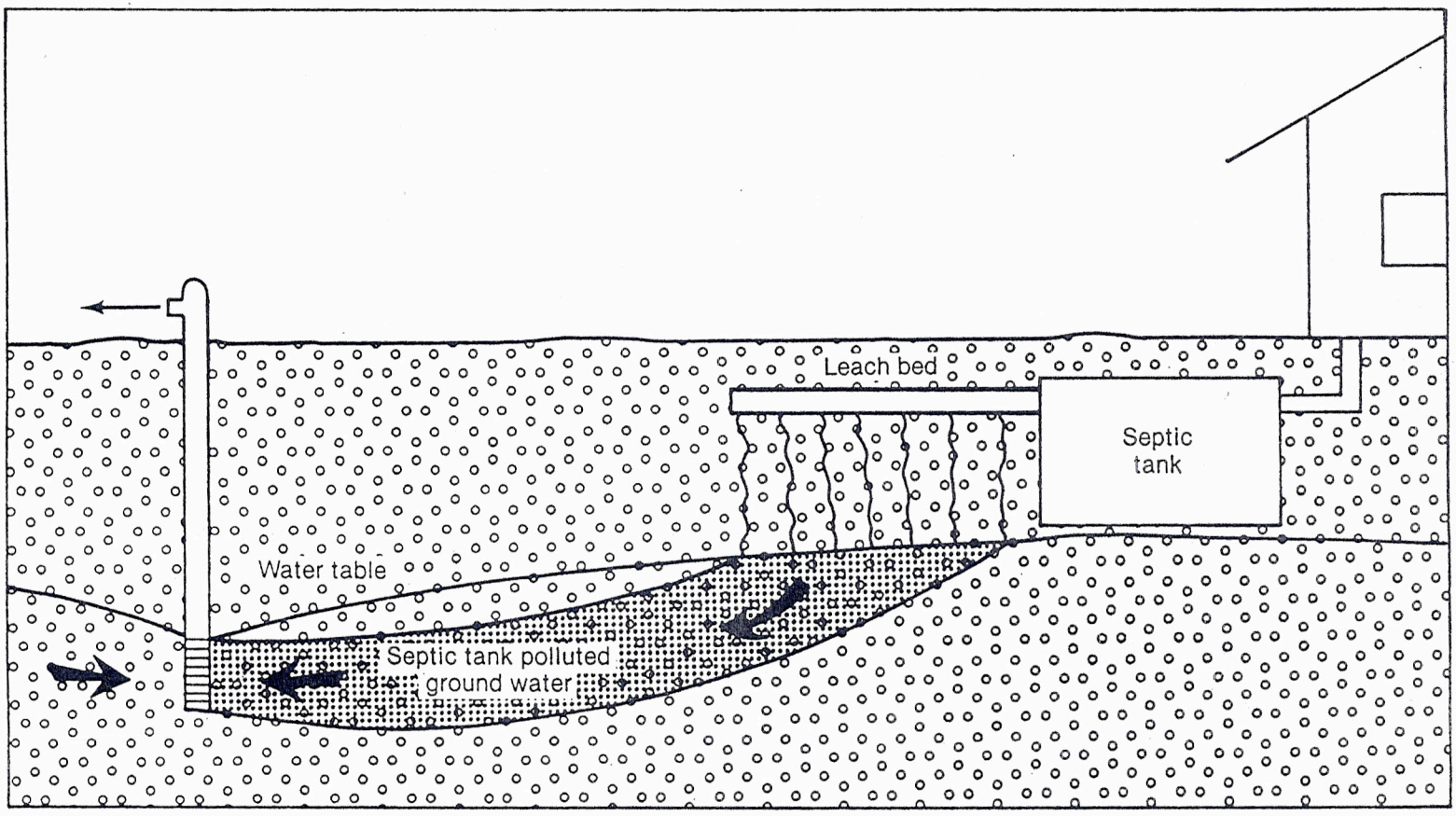
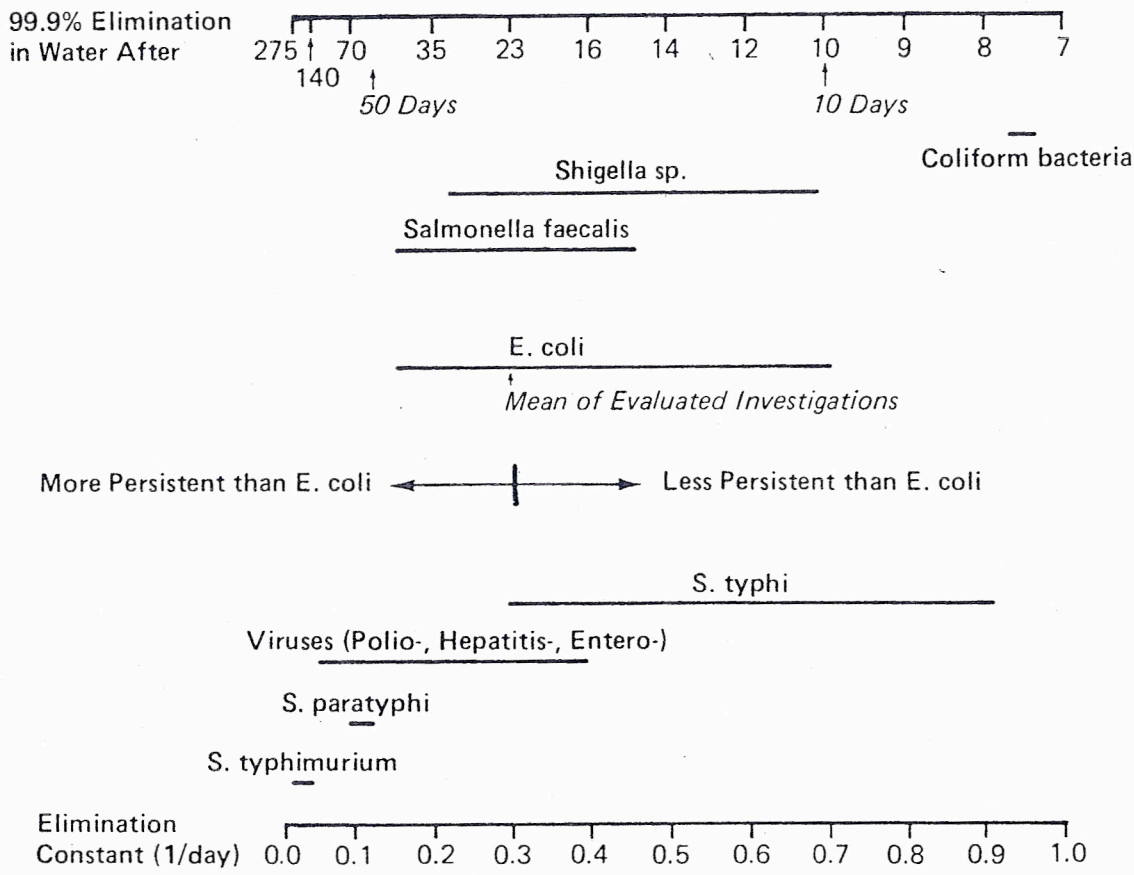


Figure 126. Percolation Through Zone of Aeration. Most of the Natural Removal or Degradation Processes Function Under These Conditions.

Figure 2-5
Elimination Constant and 99.9% Elimination of Some Relevant Bacteria and Viruses in Ground Water



SOURCE: Matthess, et al., 1985

Ground Water Modeling Methods

- Analyze risk of ground water contamination from wastewater disposal
- Analyze risk of saltwater intrusion
- Look at three scenarios
    - Present cottages and water use
    - Full build-out of potential buildable lots with moderate water use
    - Full build-out of potential buildable lots with high water use

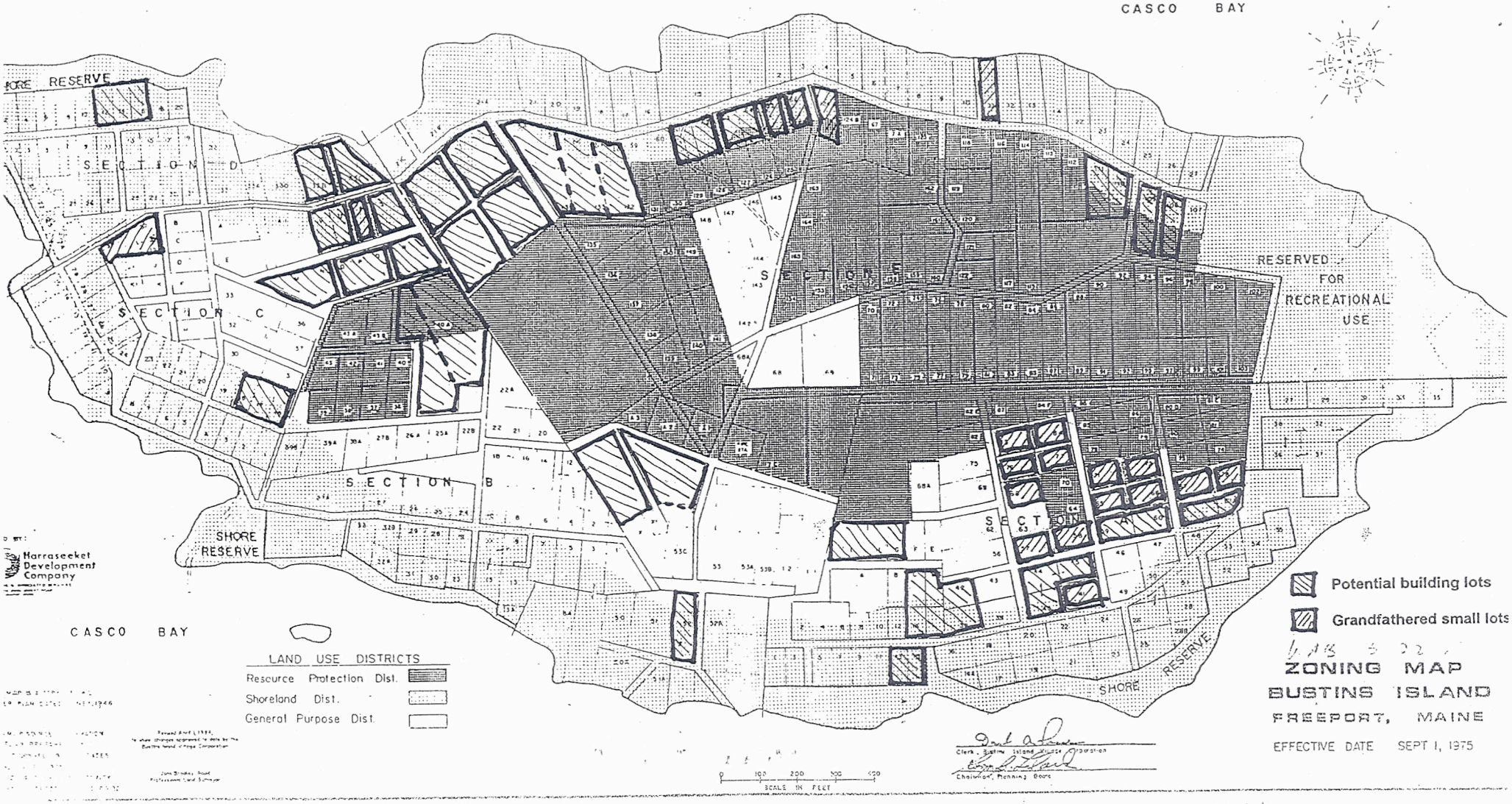

CASCO BAY
SHORE RESERVE
SECTION D
SECTION C
SECTION B
SECTION E
SECTION F
RESERVED FOR RECREATIONAL USE
SHORE RESERVE
SHORE RESERVE
CASCO BAY
Harraseeket Development Company
LAND USE DISTRICTS
Rescurce Protection Dist.
Shoreland Dist.
General Purpose Dist.
Potential building lots
Grandfathered small lots
ZONING MAP
BUSTINS ISLAND
FREEPORT, MAINE
EFFECTIVE DATE SEPT 1, 1975
SCALE IN FEET

Figure 7

Simulated Average Annual Groundwater Potential

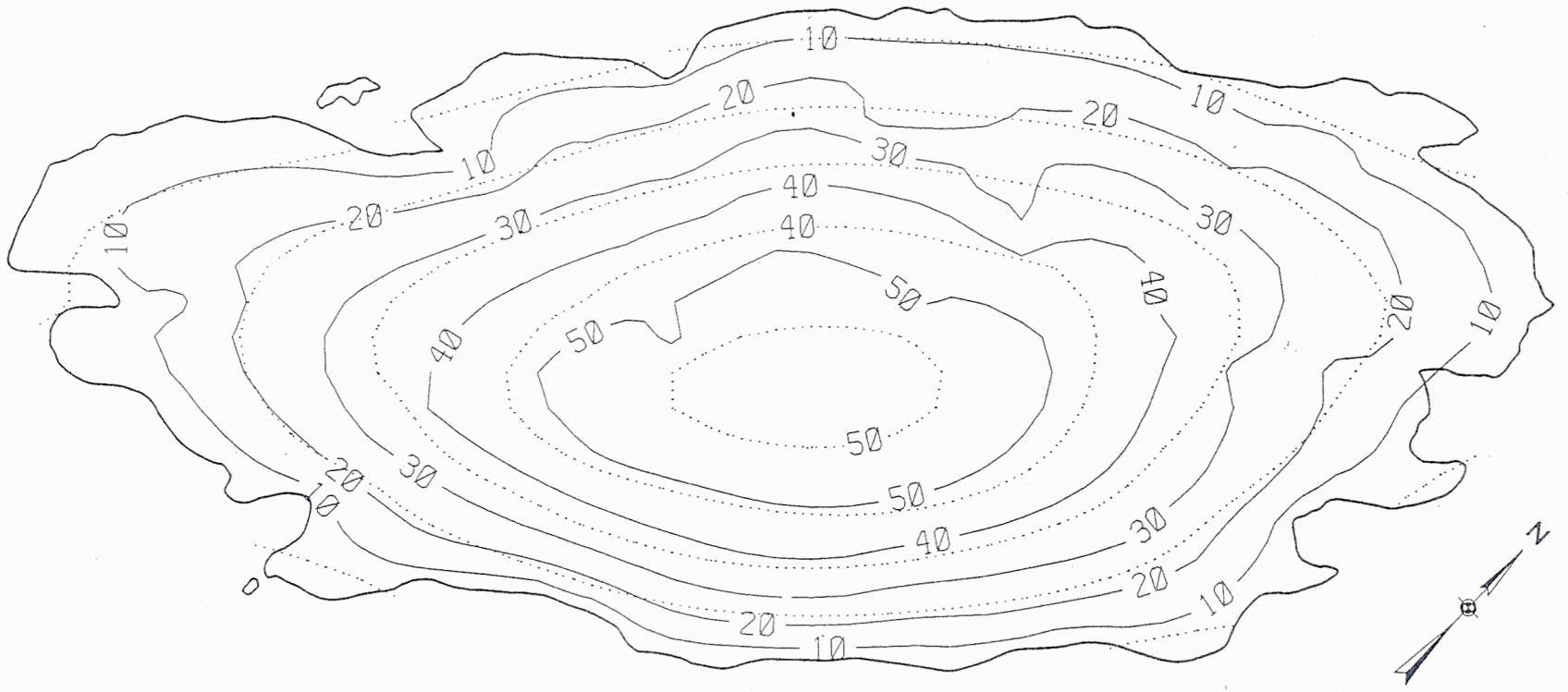


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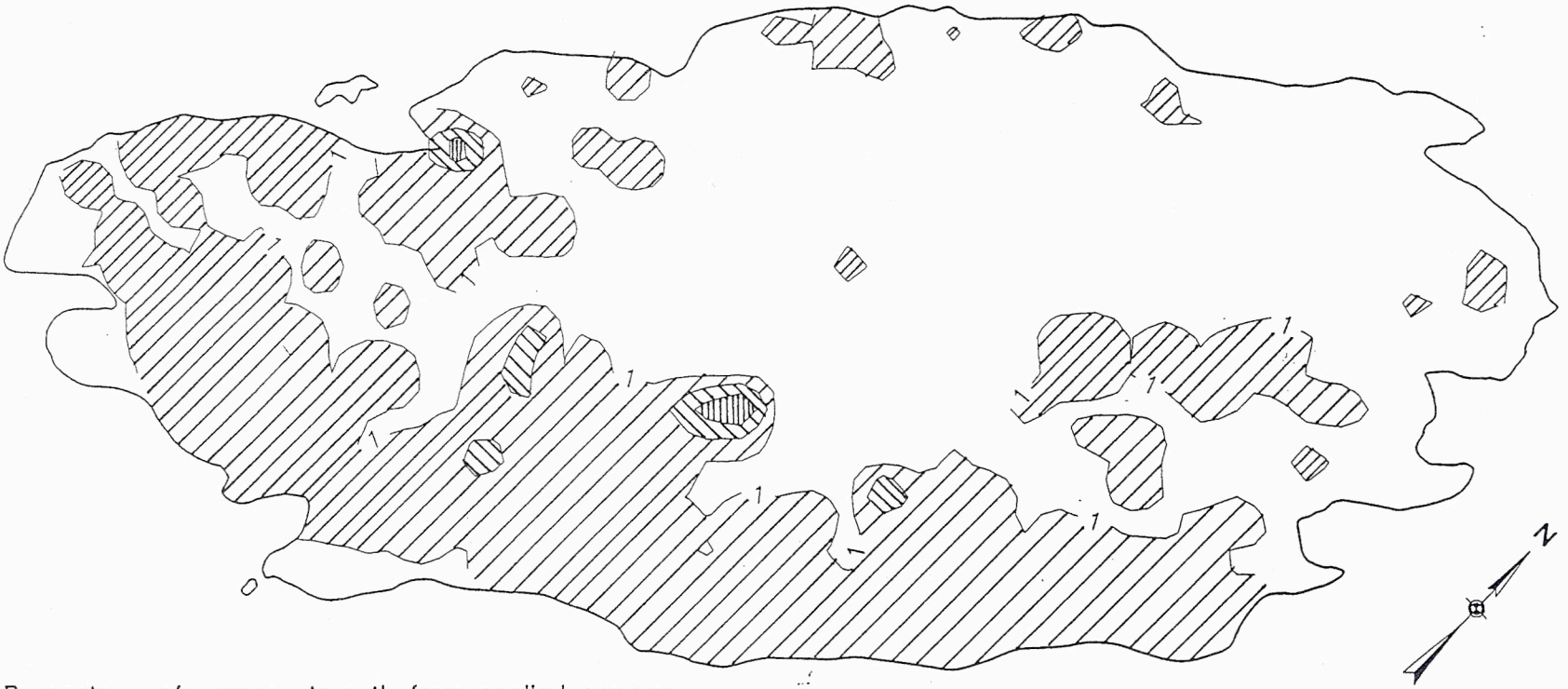
Figure 6

Simulated Shallow Water Quality - Full Build-Out High Water Use



Percentage of source strength from applied sewage

- Concentration 1% < C < 5% of source strength
- Concentration 5% < C < 10% of source strength
- Concentration 10% < C < 50% of source strength

SCALE

0 250 500 1000 ft

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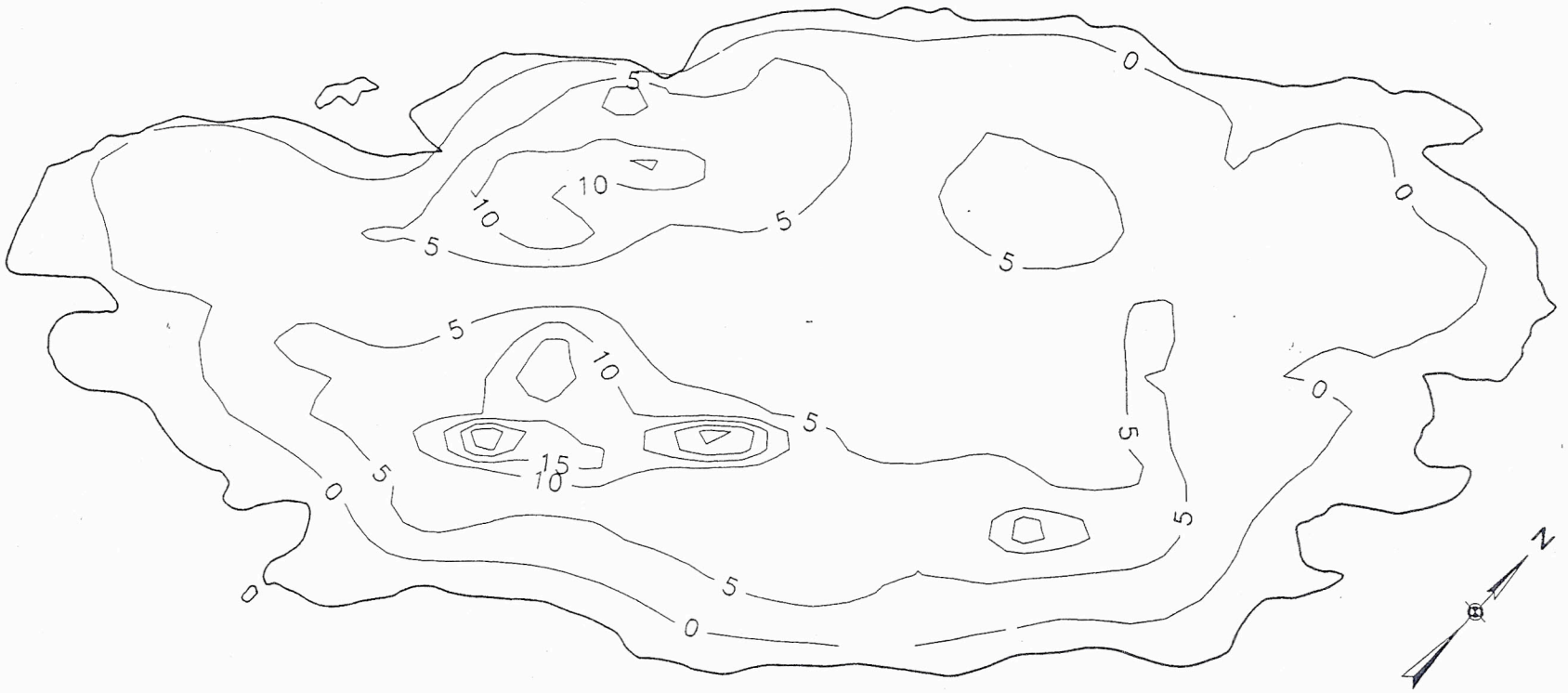
Figure 9

Drawdown Model Layer 5 - Full Build-Out High Water Use



Simulated drawdown for the end of August
Contour interval 5 feet

SCALE

0 250 500 1000 ft

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Freeport, Maine

Ground Water Modeling Results

- Due to seasonal use of the island, simulations do not show a significant degradation of ground water quality from wastewater disposal.
- There is the potential for saltwater intrusion, and the lowering of the water table.
- Bacteria contamination problems should be addressed at existing wells and wastewater disposal systems, and by prudent planning for future systems.

Recommendations

1. Maintain existing wastewater disposal systems (see Albert Frick's report)
2. Upgrade grandfathered wastewater disposal systems to meet present Wastewater Disposal Rules (see Albert Frick's report)
3. Install sanitary seals for dug wells
   a. Secure cover for well
   b. Seal well from 2-3 feet below ground to 2 feet above ground
4. Develop public education program for water conservation. Example issues are:
   a. Information on water conserving devices for sinks, showers, and toilets
   b. Prudent use of high water demand devices (such as clothes washer and garbage disposals)
5. BIVC Board may restrict watering of lawns and landscaping during drought conditions
6. Approval of new wastewater disposal systems
   a. Rely on state Wastewater Disposal Rules for regulations
   b. Allow for local input when granting variances from the Wastewater Disposal Rules
   c. For discharging wastewater disposal systems strive for minimum 100 foot separation distance from well on lot and any neighbor's wells as outlined in the Wastewater Disposal Rules. This would require granting variances for the separation distance only when supported by scientific analysis indicating a low risk of contamination to the well.
   d. Suggest water conservation steps as outlined above
7. Develop ongoing program to test water quality at selected wells
   a. Measure bacteria, nitrate, sodium, chloride, and hardness
   b. For community wells test annually
   c. Voluntary testing of private wells, with request for home owners to forward results to the Board
   d. Require testing of new wells as a permit requirement
8. Try to locate new drilled wells at least 200 feet from the high water mark and limit the depth of new wells to prevent salt water contamination