

ISLAND RESOURCES FOUNDATION

CARIBBEAN ISLAND RESOURCE MANAGEMENT

*AN ANNOTATED BIBLIOGRAPHY OF SOURCE MATERIALS
FOCUSSING ON THE U.S. VIRGIN ISLANDS' EXPERIENCE
AND ITS EASTERN CARIBBEAN CONTEXT*

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FORWARD

The Territory of the United States Virgin Islands has, for an extended period of time, had access to significant levels of external funding from various federal government departments, agencies and entities (e.g., Environmental Protection Agency, Army Corps of Engineers, National Science Foundation, Department of Commerce, Department of the Interior, U.S. Geological Survey, Fish and Wildlife Service, Department of Health and Human Services, the National Oceanic and Atmospheric Administration, to cite a few). Additionally, and largely with federal funds, the Territory has had continual access to professional expertise via various local government agencies and from non-government academic and research institutions as well as major externally based consulting firms. Further, the Territory has been able to make use of nearly a dozen locally based and independently staffed consulting, planning, engineering and research firms which have emerged in the Virgin Islands within the last decade. Private sector corporate and philanthropic funds for various studies and assessments have also been utilized extensively.

The resultant contracted investigations, consulting reports, impact assessments, feasibility studies, resource management guidelines, data gathering and reporting strategies, when viewed in toto, constitute a veritable mountain of documents (only a portion of which are cited in this bibliography), and have probably cost in excess of a million dollars per year or, over the past ten years, not less than \$10,000,000 -- perhaps as much as \$20,000,000. This is a formidable investment in an information and planning base for a small multi-island community of fewer than 100,000 persons and less than 150 square miles in land area.

Viewed from an island system management perspective, one could raise the following kinds of questions:

- * What has been the effect of this input?
- * What has been learned about the acquisition, interpretation and use of resource specific data?
- * What has been its relationship to and effect upon the political process and upon the structure and effectiveness of government and local resource management policies, institutions, personnel, programs, and environmental protection strategies?

- * What evidence is there that professionally generated information about the local resource base and its descriptive, prescriptive, proscriptive or developmental aspects have, in fact, been cost effective?
- * What have been the constraints limiting the utilitarian application by and the integration of the findings into the resource management system for application to decision making processes within government?
- * Does the Virgin Islands' environmental data base and resource management historical experience offer any useful guidelines for improving research strategies, data collection, data analysis, and information management and for addressing the question of development limits, system overload, and carrying capacity in the Virgin Islands and elsewhere?

The annotated bibliography which follows is an antecedent element in a systematic approach to the overarching question: What can be learned from the U.S. Virgin Islands' experience that would be instructive to other small island systems, especially in the Caribbean, which confront similar or related growth, planning, resource development and environmental management problems? It is with this overview in mind that these source materials have been compiled and annotated.

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 September 1982

INTRODUCTION

The principal focus of this annotated bibliography is on source materials relevant to the U.S. Virgin Islands' experience in resource management over the past two decades. Its principal purpose is to facilitate an eventual analysis and assessment of how the Virgin Islands community has grappled with the problem of rapid growth and change and the concomitant environmental impact on supporting terrestrial and marine ecosystems. Surely, there is an instructive lesson in insular resource management for other off-shore oceanic island systems to be derived from a review of the successes, failures, constraints, strategies and choices implicit in the historical record of the Virgin Islands experience.

Each item cited in the bibliography is available at one or more of the following libraries located in the U.S. Virgin Islands:

- * Virgin Islands Public Library
(St. Thomas and St. Croix)
- * College of the Virgin Islands
(St. Thomas and St. Croix)
- * West Indies Laboratory (St. Croix)
- * Island Resources Foundation
(St. Thomas)
- * Virgin Islands National Park
(St. Thomas)
- * Virgin Islands Planning Office
- * Virgin Islands Department of
Conservation and Cultural Affairs.

The following categories of source materials have been excluded from the bibliography:

1. Legal Data (Territorial and Federal)
 - a. Legislation
 - b. Regulations
 - c. Acts
 - d. Executive Orders
2. Executive Budgets (published annually by the Office of the Governor, U.S. Virgin Islands)
3. Annual Reports of Virgin Islands Government Agencies, Departments, Commissions, Boards and Authorities (generally published annually)

4. Annual Reports of U.S. Federal Agencies, Departments, Commissions, Task Forces (especially the Office of the Territories, Department of the Interior, the Caribbean Fisheries Management Council, Fish and Wildlife Service, and the Army Corps of Engineers)
5. Serial runs of magazines, journals and newspapers published in the U.S. Virgin Islands
6. Serial runs of published data generally available:
 - a. Population Census
 - b. Climatology
 - c. Immigration
 - d. Customs
 - e. Vital Statistics
 - f. Tourism
 - g. Employment
7. British Virgin Islands references and data, with minor exceptions cited in Section B of the bibliography.

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A. VIRGIN ISLANDS.

1. ECOSYSTEM DATA: DESCRIPTIVE, SYSTEMATIC, TAXONOMIC, ANALYTICAL, AND BIOPHYSICAL.

- Adey, W.J., et.al. The South St. Croix Reef: A Study of Reef Metabolism as Related to Environmental Factors and an Assessment of Environmental Management. Prepared for U.S. Virgin Islands Department of Conservation and Cultural Affairs by West Indies Laboratory, Fairleigh Dickinson University, St. Croix, U.S. Virgin Islands. 1979. Functional study of reef ecosystems under stress.
- Bowden, M.J., et.al. Climate, Water Balance, and Climatic Change in the Northwest Virgin Islands. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1970. Research data collections for St. Thomas, St. John and British Virgin Islands, following same pattern as earlier St. Croix research. Collects data and discusses rainfall, rainfall variability, evapo-transpiration, water balance. Also discusses possible climatic change, seasonal and cyclic loss.
- Bowden, M.J., et.al. Hurricanes in Paradise: Perception and Reality of the Hurricane Hazard in the Virgin Islands. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. 1974. Historical review of incidence of, probability analysis of, and damage assessment of storms and flooding, followed by detailed investigations of local perceptions, reactions and adjustments. Suggestions given for increased preparedness.
- Bowden, M.J., et.al. Water Balance of a Dry Island: The Hydroclimatology of St. Croix, Virgin Islands and Potential for Agriculture and Urban Growth. Clark University, Worcester, Massachusetts. Geography Publications at Dartmouth College, No. 6, 1968. Report on rainfall, evapo-transpiration and water deficit.
- Collette, B.B. and Earle, S.A., editors. Results of the Tektite Program: Ecology of Coral Reef Fishes. Natural History Museum, Los Angeles. 1972. Paper detailing scientific results of Tektite Project relating to various ecological aspects of coral reef fishes on St. John. Baseline value. Few management factors covered.
- Donnelly, T., and Whetten, J. Field Guide to the Geology of the Virgin Islands. State University of New York, Binghamton, New York. 1968. Prepared for the Fifth Caribbean Geological Conference. Guide to geology of St. Thomas by Donnelly; field guide to geology on St. Croix by Whetten. Donnelly describes singularity of St. Thomas-St. John geology. Formations are detailed, followed by a long listing of localities of geologic interest. A similar format is presented by Whetten for St. Croix.
- Ewel, J.J. and Whitmore, J.L. The Ecological Life Zones of Puerto Rico and the U.S. Virgin Islands. Institute of Tropical Forestry and U.S. Forest Service, Rio Piedras, Puerto Rico. Forest Service Research Paper UTF-18, December 1973. Maps Puerto Rico and Virgin Islands ecosystems with gross details of soils, vegetation, climates, land-use patterns, using Holdridge system of life zones (broad bio-climatic units). Appendices give data on bio-temperature and water balances.

- Forman, R.T.T. An Introduction to the Ecosystems and Plants on St. Croix, U.S. Virgin Islands. Also in Guidebook to the Geology and Ecology of Some Marine and Terrestrial Environments, St. Croix, U.S. Virgin Islands. West Indies Laboratory Special Publ. No. 5, Fairleigh Dickinson University, St. Croix, U.S. Virgin Islands. 1974. Vegetation types in St. Croix, applicable to entire U.S. Virgin Islands.
- Garrison, L.E., et.al. Geology of the Insular Shelf South of St. Thomas and St. John, U.S. Virgin Islands. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Special Publication No. 3, 1971. Preliminary report of reconnaissance study conducted jointly by U.S. Geological Survey and the Caribbean Research Institute. Purposes were (1) to provide reconnaissance map of distribution of sediment types of shelf surface, and (2) to map gross geological structures of the shelf. Results seen as useful for avoiding irreversible destruction of beaches, for providing geologic history of area, for potential mining of marine sand deposits offshore. Maps detail shelf-edge information.
- Gladfelter, W.B., et.al. Environmental Studies of Buck Island Reef National Monument. West Indies Laboratory, Fairleigh Dickinson University, St. Croix, U.S. Virgin Islands. 1977-80. Useful baseline data from an unpolluted reef environment in St. Croix.
- Hoffman, S., et.al. Virgin Islands Beach Processes Investigation. U.S. Department of Interior, National Park Service, Washington, D.C. U.S. National Park Service Occasional Paper No. 1, 1974. Report examines relationships between surf zone processes and beach changes in reef-beach systems, emphasizing sediment exchange, with much documentation. Conclusion infers need to treat beaches as ephemeral.
- Kumpf, H.E., et.al. Charting the Marine Environments of St. John, U.S. Virgin Islands. 1961. Contribution No. 348 from the Marine Laboratory, University of Miami. In Bulletin of Marine Science of the Gulf and Caribbean, 11(4): 543-551. Landmark mapping effort to present coastal seabed features of St. John. Includes chart.
- McKinzie, W., et.al. Soils and Their Interpretations for Various Uses, St. Croix, American Virgin Islands. U.S. Department of Agriculture, Soil Conservation Service, Spartanburg, South Carolina. June 1965. Distribution, description and classification of St. Croix soils, their suitability and limitations for various purposes.
- Ogden, J.C., editor. An Ecological Study of Tague Bay Reef, St. Croix, U.S. Virgin Islands. West Indies Laboratory, Fairleigh Dickinson University, St. Croix, U.S. Virgin Islands. Special Publication in Marine Biology, No. 1, 1972. A student project to assemble data to serve as baseline for detecting future change in this coral reef. Includes individual studies of benthic algae, grazer-fishes and other fauna. Well edited and useful.

- Purcell, T.W. The Effects of Rainfall Runoff on Two Undeveloped Tropical Bays in St. John, U.S. Virgin Islands. Water Resources Research Center, Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Technical Report No. 5, June 1980. Develops baseline measurements for turbidity, nutrient levels, temperature, salinity, rainfall and watershed discharge into Lameshur and Waterlemon Bay, St. John, U.S. Virgin Islands and documents the significance on corals, water clarity and phytoplankton blooms of the damping effects of watershed vegetation and runoff intrapment as a physical buffering device for the bays. No management guidelines.
- Rogers, C.S. The Marine Environments of Brewers Bay, Perseverance Bay, Flat Cay and Saba Island, St. Thomas, U.S. Virgin Islands, with Emphasis on Coral Reefs and Seagrass Beds, November 1978 - July 1981. Government of the U.S. Virgin Islands, Department of Conservation and Cultural Affairs, Division of Natural Resources Management. January 1982. Final report with extensive quantitative data on sediment movement, deposition and impact resulting from construction of the runway extension to the St. Thomas airport.
- U.S. Government, Coast and Geodetic Survey, Department of Commerce. Geographic Dictionary of the Virgin Islands of the United States. Washington, D.C. 1925.
- U.S. Government, Department of Commerce. Generalized Estimates of Probable Maximum Precipitation and Rainfall-Frequency Data for Puerto Rico and Virgin Islands. Tech. Pap. No. 42. U.S. Government Printing Office, Washington, D.C. 1961. Series of charts.
- Weil, S. and Otsoka, C. Salt River Mangroves: A Preliminary Study. West Indies Laboratory, Fairleigh Dickinson University, St. Croix, U.S. Virgin Islands. 1974. Open File Student Reports. Useful background information on a unique area.

2. NATURAL RESOURCES DATA: ENVIRONMENTAL MANAGEMENT AND PLANNING STUDIES.

- Bechtel/Pereira Co. Incinerator Facility Project, Phase I, St. Thomas, Virgin Islands of the United States. 1968. Prepared for Government of the Virgin Islands. A study to justify an incinerator plant for solid waste disposal for St. Thomas. Recommends two 150 ton/day units.
- Black, Crow and Eidsness, Inc., a division of CH2M Hill. A Sediment Reduction Program. Report prepared for the U.S. Virgin Islands Department of Conservation and Cultural Affairs. 1979. Excellent report on erosion problems in the U.S. Virgin Islands, with recommended solutions. Much valuable data and an extensive bibliography. Maps of watersheds and coral reef subzones from aerial photointerpretation.

- Black, Crow and Eidsness, Inc., Water Reclamation at St. Croix, U.S. Virgin Islands. Second Interim Progress Report, June 1972 to September 1973. Environmental Protection Agency Contract No. 1101GAK, Gainesville, Florida. October 1973. Background data and information on geology, hydrology, soils and water quality in St. Croix groundwater recharge study area. Description of advanced wastewater treatment plant.
- Brody, R.W. A Study of Ciguatera Fish Poisoning in the Virgin Islands Area. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1973. Detailed report on NOAA, U.S. Office of Sea Grant Programs funded project on ciguatera in the Virgin Islands. Excellent illustrations of potentially toxic fish, data on epidemiology, toxicity factors, locational considerations and intoxication levels.
- Brody, R.W., et.al. A Study of the Water, Sediments, and Biota of Chocolate Hole, St. John, with Comparison to Cruz Bay, St. John. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 3, 1970. Report submitted to the Virgin Islands Department of Health. Baseline information.
- Brownell, W. and Rainey, W.E. Exploratory Fishing for a Source of Non-Ciguatoxic Sport and Food Fish. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Virgin Islands Ecological Research Station Contribution No. 2, July 1970. An excellent, although specialized, report on the possibility of expanding local exploitation of deep water fisheries resources.
- Brownell, W. and Rainey, W.E. Research and Development of Deep Water Commercial and Sports Fisheries Around the Virgin Islands Plateau. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Virgin Islands Ecological Research Station Contribution No. 3, August 1971. Excellent report on exploitation aspects of an underutilized local fisheries resource. Contains practical recommendations on gear and method modifications.
- CH2M Hill. A Flood Damage Mitigation Plan for the U.S. Virgin Islands. Prepared for Virgin Islands Disaster Preparedness Office, Gainesville, Florida. 1979. Excellent study of causes and remedies of storm flooding in the U.S. Virgin Islands.
- Clark, J., et.al. The Botany Bay Survey Report, Botany Bay, St. Thomas, Virgin Islands: An Inventory of the Littoral Habitats and Living Resources of Greater Botany Bay. Sandy Hook Marine Laboratory, American Littoral Society, Highlands, New Jersey. 1964-1965. Evaluates potential of site as nature study sanctuary. Investigational surveys are reported, including habitat, underwater ecology and fishes observed. Only study of this site covering floral and faunal features in systematic detail. Very useful.

- College of the Virgin Islands. Virgin Islands Forestry Research: A Problem Analysis. Virgin Islands Agricultural Experiment Report No. 9, 1976. Summary of forest resources, and an analysis of options for forest utilization, and research needs.
- Cosner, U.J. Water in St. John, U.S. Virgin Islands, with a chapter on "Alternatives of Water Supply" by Dean B. Bogart. U.S. Department of the Interior, Geological Survey, in cooperation with National Park Service and the Government of the Virgin Islands (Caribbean District open file report). 1972. Detailed investigation of ground water sources of water supply for St. John.
- Dammann, A.E., et.al. Study of the Fisheries Potential of the Virgin Islands. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Virgin Islands Ecological Research Station Contribution No. 1, 1969. Funded by the former U.S. Bureau of Commercial Fisheries. This is an extremely valuable historical document embracing a spectrum of data never previously or subsequently assembled in one source. Regretfully out of print and not readily available. Needs updating at earliest possible opportunity. Includes catch, market, and importation data on food fish, in addition to a broad view of the fishing industry of the Virgin Islands. Basic and essential.
- Dong, M., et.al. The Role of Man Induced Stresses in the Natural Evolution of Long Reef and Christiansted Harbor, St. Croix, U.S. Virgin Islands. West Indies Laboratory, Fairleigh Dickinson University, St. Croix, U.S. Virgin Islands. 1973. Useful baseline reference.
- Envirodyne Engineers, Inc. Development of a Hazardous Waste Management Plan for the U.S. Virgin Islands. May 1981. Prepared for the Government of the Virgin Islands, Department of Conservation and Cultural Affairs. Weak, suffers from lack of project direction.
- Grossman, I.G. Chemical Quality of Ground Water in St. Thomas, Virgin Islands. Geological Survey Professional Paper No. 450-B. U.S. Geological Survey, Washington, D.C. 1962. Describes chemical quality of ground water from 31 wells in shallow deposits (9-50 feet). Average dissolved solids was 1,650 ppm. Only 3 of 33 samples were less than 1,000 ppm. Wells in Charlotte Amalie had high chloride and nitrate concentrates. The most promising source of acceptable quality ground water was Turpentine Run.
- Herrnkind, W., et.al. Ecological Study for the Development of Lobster Management Techniques. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. April 1970-June 1971 (Sea Grant GH-86). Contains useful data but falls short of recommending workable management guidelines. Valuable only as historical document and research source.

- Insular Environments, Inc. Effects of Distillery Waste Discharge on the Marine Environment Near Long Point St. Croix, Virgin Islands. St. Thomas, U.S. Virgin Islands. March 1975. Preliminary descriptive survey and assessment suggesting marginal impact but recommending greater dillution of discharged suspended solids. See also later (1976) study by Sigma.
- Island Resources Foundation. Marine Environments of the Virgin Islands. Technical Supplement No. 1. 1976. Prepared for the Virgin Islands Planning Office, St. Thomas, U.S. Virgin Islands. A basic reference on coastal and marine resources of the U.S. Virgin Islands written to be understood by persons without a technical background. Useful maps and data.
- Kasperson, R.E., et.al. Decentralized Water Reuse Systems In A Water Scarce Environment: The Tourist Industry in St. Thomas, Virgin Islands. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 13, May 1971. A useful study of package sewage treatment plant process water recycling as "grey water" for landscape watering and sanitary flushing system use. Useful case studies which document how well designed but badly managed engineering systems can fail to work due to human factors and training deficiencies. Demonstrates need for close government monitoring of package plant system operation.
- Lawaetz, B. Rain Water, Virgin Islands Agriculture and Food Fair - 1974. D. Padua, editor. Virgin Islands Department of Agriculture, St. Croix, U.S. Virgin Islands. 1974. Variations in rainfall over time with graph.
- Lawaetz, B. Why the Streams Don't Run Anymore, Virgin Islands Agriculture and Food Fair - 1975. D. Padua, editor. Virgin Islands Department of Agriculture, St. Croix, U.S. Virgin Islands. 1975.
- McCrain, J. Status Report and Management Recommendations for the Vessup/Muller/Red Hook Bay Complex Area of Particular Concern (APC). Division of Coastal Zone Management, Virgin Islands Department of Conservation and Cultural Affairs, St. Thomas, U.S. Virgin Islands. July 1981. Preliminary, incomplete and of marginal use. A good example of the dangers implicit in approaching an APC with a narrow perspective and marginal scientific and public input.
- Maguire, C.E. Solid Waste Planning Program for the U.S. Virgin Islands. Providence, Rhode Island. 1972. Consulting report presented to the Government of the U.S. Virgin Islands. Has useful site analysis of specific locations and incorporates a master plan for solid waste management. Historical and contemporary value, but lacks sensitivity to special requirements and features of the coastal zone.

- Mitre Corporation. Solid Waste Resource Recovery Planning Study for the U.S. Virgin Islands. Consulting report to the Government of the Virgin Islands, Department of Public Works. February 1979. Standard EIS with some useful technical data.
- Multer, H.G., et.al., editors. Guidebook to the Geology of Some Marine and Terrestrial Environments, St. Croix, U.S. Virgin Islands. West Indies Laboratory, Fairleigh Dickinson University, St. Croix, U.S. Virgin Islands. 1974. Academic document for serious investigators. An invaluable reference for any planner as it contains baseline information, graphics, and process descriptions obtainable from no other source.
- Nichols, M., et.al. Environment, Water and Sediments of Christiansted Harbor, St. Croix. Prepared for the U.S. Virgin Islands Department of Health, Division of Environmental Health by Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 16, 1972. Excellent detailed investigation of harbor environment, including descriptions, aerial photo studies, hydrography (tides and currents), water quality, reef ecology, fisheries, bottom vegetation and sediments.
- Nichols, M., et.al. Impact of Storm Flooding in the Mangrove Lagoon. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. 1979. One of the few U.S. Virgin Islands studies with broad data on the effects of runoff water quality.
- Nichols, M., et.al. Virgin Islands Bays: Modeling of Water Quality and Pollution Susceptibility. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. April 1979. Ranking of bays in St. Thomas and St. Croix in terms of susceptibility of pollution. Useful for stress point analysis and carrying capacity planning.
- Nichols, M., et.al. Water, Sediments and Ecology of the Mangrove Lagoon and Benner Bay, St. Thomas. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. 1977. A major interdisciplinary study of the largest mangrove lagoon system in the Virgin Islands with emphasis on bathymetry, sediments, circulation, mangroves, hydrology, water quality, geology, biochemistry, eco-history and with detailed management recommendations.
- Olsen, D. Analysis of Catch Data for the Virgin Islands Commercial Fisheries. Virgin Islands Department of Conservation and Cultural Affairs, Bureau of Fish and Wildlife. Annual Report for Project No. 2-239-R-1. 1975. Excellent specialized work by a trained statistical biologist. Sound methodology. Documents failure of a local fishery due to poor management by Department of Conservation.
- Olsen, D., et.al. The Ecology of Fishes in Two Mangrove Lagoons in the U.S. Virgin Islands. Marine Resources Development Foundation, San German, Puerto Rico and Virgin Islands Department of Conservation and Cultural Affairs. 1972. Reports trapping study of fishes in Manning Bay, St. Croix and Jersey Bay, St. Thomas.

- Philibosian, R. Disorientation of Hawksbill Hatchlings, *Eretmochelys Imbricata*, by Stadium Lights, Copeia, 4:824, 1976. One not so obvious, but not uncommon, impact of development on an endangered species. Bright lights cause hatchlings to move inland on emergence from nest, thereby increasing the number killed by predators, automobiles, etc.
- Rainey, W.E. Preliminary Report on Sea Turtles in the United States Virgin Islands. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. A report on an endangered marine resource.
- Reynolds, J.R. Preliminary Study of Sewage Disposal Practices in Areas Not Served by the Public Sewage System of Charlotte Amalie, St. Thomas, Virgin Islands. Prepared for Virgin Islands Department of Health, Division of Environmental Health by Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 6, 1970. Historical value only. Needs updating. Present practices apparently are more effective and less subject to personnel failures, due to training programs for sewage plant operators. See also Shatrosky reference.
- Rivera, L.H., et.al. Soils and Their Interpretation for Various Uses, St. Thomas, St. John, Virgin Islands. U.S. Department of Agriculture, Soil Conservation Service, Kingshill, St. Croix, U.S. Virgin Islands. 1966. Distribution and classification of St. Thomas and St. John soils and their suitability and limitations for various purposes. Useful for soil runoff and erosion control.
- Rivera, L.H., et.al. Soil Survey of the Virgin Islands of the United States. U.S. Department of Agriculture, Soil Conservation Service, Kingshill, St. Croix, U.S. Virgin Islands. 1970. A summary report, useful for runoff assessment and as a basic study.
- Robinson, A.H. Natural Versus Visitor-Related Damage to Shallow Water Corals: Recommendations for Visitor Management and the Design of Underwater Nature Trails in the Virgin Islands. National Park Service, St. John, U.S. Virgin Islands. August 1973. Technical report giving summary of damage based on outside literature and National Park Service staff observation. Some generalizations are made concerning visitor management. Describes natural damage to reefs; finds visitor damage minimal but feels future management needed.
- Robinson T., et.al. Magens Bay Master Plan. Consulting report prepared by Design Collaborative, St. Thomas, for the Magens Bay Beach Commission, St. Thomas. 1970. Includes excellent summary of biological and hydrological features of the associated watershed, salt pond, mangrove beach and bay area. Has useful baseline information for future planning and management. Site specific.
- Robinson, T.M. Ground Water in Central St. Croix, U.S. Virgin Islands. U.S. Department of the Interior, Geological Survey, in cooperation with the Government of the Virgin Islands (Caribbean District open file report). 1972. Data from 237 wells including complete chemical analysis of water quality. Available water in aquifer would require desalting by electrodialysis or distillation.

- Robinson, T.M., et.al. Water Records of the Virgin Islands, 1962-1969. U.S. Department of the Interior, Geological Survey. 1973. Covers surface water, quality of water and ground water records of Virgin Islands (stream flow, chemical and physical characteristics of water and ground water levels).
- Shatrosky, E.L., vanEepoel, R.P. and Grigg, D.I. Operating Characteristics of Package Sewage Plants on St. Thomas, Virgin Islands, January-June 1972. Prepared for Virgin Islands Department of Health. 1972. A classic study of management failure.
- Sigma Environmental Sciences. Oceanographic and Biological Data In and Adjacent to the Discharge from Virgin Islands Rum Industries, Ltd., St. Croix, U.S. Virgin Islands. Report prepared for Virgin Islands Rum Industries, Ltd., Frederiksted, St. Croix, U.S. Virgin Islands. August 1976. Provides quantitative data on water quality during normal conditions and when the distillery is operating with a 40,000 gpd discharge rate. Describes sessile benthic communities, associated fauna and currents in discharge area. Confirms negligible impact and rapid diffusion of lees or spent molasses liquor.
- Sverdrup and Parcel. Feasibility Report Summary for a Fresh Water Pipeline from Eastern Puerto Rico to Culebra and St. Thomas, U.S. Virgin Islands. September 1981. Prepared for the U.S. Department of the Army, U.S. Army Engineer District, Jacksonville, Florida. Renders a useful idea impractical by unjustified expansion of the original concept.
- Swingle, W.E., Dammann, A.E., and Yntema, J.A. Survey of the Commercial Fishery of the Virgin Islands of the United States. Proceedings of the Twenty-second Annual Session, Gulf and Caribbean Fisheries Institute, pp. 110-121. University of Miami, Rosenstiel School of Marine and Atmospheric Sciences. 1969. Summary of information available in Dammann, et.al., (1969) on Virgin Islands commercial fisheries.
- Teytaud, A.R. A Management Plan for the St. Thomas Mangrove Lagoon Area of Particular Concern. Virgin Islands Department of Conservation and Cultural Affairs, Division of Coastal Zone Management, St. Thomas, U.S. Virgin Islands. 1981. Environmental data and land use recommendations for what is probably the best studied coastal ecosystem in the U.S. Virgin Islands. An obvious choice for a case study area. Summary of previous studies, extensive bibliography, historical trends, land capability/development suitability analysis.
- Teytaud, A.R. Development on Steep Slopes. Virgin Islands Department of Conservation and Cultural Affairs, Division of Coastal Zone Management, St. Thomas, U.S. Virgin Islands. Technical Circular #3, 1981. Recommendations for controlling impacts from erosion, with suggested standards in terms of slope gradient and soil type for buildings, roads, and septic tanks in the U.S. Virgin Islands.

- Teytaud, A.R. Guidance Plan for the St. Croix Coral Reef System Area of Particular Concern. Virgin Islands Department of Conservation and Cultural Affairs, Division of Coastal Zone Management. 1981. Contains valuable recommendations and extensive bibliography on coral reef management and erosion control.
- Teytaud, A.R. Guidance Plan for the Salt River Bay Area of Particular Concern, St. Croix. Virgin Islands Department of Conservation and Cultural Affairs, Division of Coastal Zone Management. 1981. Environmental data and land use planning recommendations for a specific area.
- Teytaud, A.R. Preliminary Report on Potential Significant Natural Area (SNA) sites. (Unpublished draft report.) Virgin Islands Department of Conservation and Cultural Affairs, Division of Coastal Zone Management. 1980. Summary of field work to appraise and systematically rank all remaining areas in the U.S. Virgin Islands with high natural resource value. Useful for stress point analysis and carrying capacity planning. Lacks detailed documentation.
- Tippetts, Abbett, McCarthy and Stratton. Master Plan: Christiansted Harbor, St. Croix, Virgin Islands. Prepared for the Government of the Virgin Islands. November 1958. Out of date, historical value only.
- United States Government, Department of Agriculture. Virgin Islands of the United States Resource Conservation and Development Project. U.S. Department of Agriculture, San Juan, Puerto Rico. 1973. Of some value, but better data summaries exist. Useful for policy statements and recommendations of government in early 1970's.
- United States Government, Department of Agriculture, Soil Conservation Service. Soil Loss Prediction Guide for Construction Sites in the Virgin Islands. U.S. Department of Agriculture, San Juan, Puerto Rico. 1971. Outdated. See U.S. Department of Agriculture, undated, Universal Soil Loss Equation, for revised version.
- United States Government, Department of Agriculture. Universal Soil Loss Equation, A=RKLSLCP. Caribbean Area Technical Notes. Soil Conservation Service, San Juan, Puerto Rico. Theoretical basis for computing soil losses when vegetation cover is altered. Revised from earlier version. Note that the cumulative precipitation curve for the south coast of Puerto Rico (also used for the U.S. Virgin Islands) is incorrect.
- United States Government, Department of the Army, Corps of Engineers. Flood Hazard Information, St. Thomas, U.S. Virgin Islands. September 1977. Very useful maps, storm frequency and risk summaries and shoreline flooding historical chronology.

United States Government, Department of the Army, Corps of Engineers. Flood Plain Information, Tidal Areas, St. Thomas, St. Croix and St. John, U.S. Virgin Islands. Prepared for Office of the Governor of the U.S. Virgin Islands, Virgin Islands Planning Office. Jacksonville, Florida. 1975. Provides (1) historical data on hurricanes and related flooding and (2) future flooding predictions for major storms of 100 year frequency plus worst possible flood. Plates are fold out maps of coastline showing areas of expected flooding.

United States Government, Department of Commerce (NOAA). The Virgin Islands Coastal Management Program and Final Environmental Impact Statement. Office of Coastal Zone Management, Washington, D.C. 1979. The background and expected impacts of the CZM legislation in the Virgin Islands.

United States Government, Department of the Interior, Federal Water Pollution Control Administration. Biological Aspects of Marine Water Quality, St. Thomas, St. Croix and St. John, U.S. Virgin Islands. 1967. Historical value only.

United States Government, Department of the Interior, Fish and Wildlife Service. Endangered, Threatened, and Extinct Birds and Mammals of the Virgin Islands. 1977. List of endangered, threatened and extinct birds and mammals, with causes of decline and habitat notes. Development is the major cause of extinction through habitat destruction.

United States Government, Environmental Protection Agency. Water Quality in the Virgin Islands. EPA Region II Surveillance and Analysis Division. Edison, New Jersey. May 1973. Data report and analysis of sea water and sediment chemistry. Marginally useful status report.

vanEpoel, R.P., et.al. Notes on Some Oceanographic Marine Factors in the U.S. Virgin Islands. Prepared for Virgin Islands Water and Power Authority by Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Institute's Special Publication No. 2, 1971. Despite the title, this is a report on the definition of a suitable medium depth route for a submarine electric (40 megawatt) cable linking St. Croix and St. Thomas. Contains useful oceanographic data summaries and bathymetric graphics on the submarine features between the two islands separated by a relatively deep trench except to the eastward where a route appeared feasible.

Virgin Islands Government, Department of Conservation and Cultural Affairs. U.S. Virgin Islands Water Quality Management Plan (WQMP). 1980. Data on water quality and demand for drinking water and coastal waters.

Virgin Islands Government, Department of Conservation and Cultural Affairs, Division of Natural Resources Management. Virgin Islands Water Quality Monitoring, 1970-75. 1975. Departmental report summarizing statistical data and problems of island growth and pollution, pollution monitoring and abatement programs, and improvements in water quality.

Virgin Islands Government, Planning Board. Conservation of Beaches: A Study of Problems, Needed Policies, Resources and Actions Required of Private Enterprise, Citizens, and the Government of the United States Virgin Islands (revised draft). St. Thomas, U.S. Virgin Islands and Cambridge, Massachusetts; report prepared by Reginald Isaacs. 1967. Study of beach problems, government policies and proposed management planning.

Virgin Islands Government, Planning Office. Land Use and Housing Elements, U.S. Virgin Islands. Government of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1977. Land use maps are most comprehensive available, but report suffers from poor documentation of methods and poor data analysis and presentation. Nevertheless, much useful information.

Virgin Islands Government, Planning Office. Public Attitudes Towards Coastal Development. Technical Supplement No. 2, 1977. A report on two surveys of public perceptions and attitudes, undertaken in the process of developing the Virgin Islands Coastal Zone Management Program.

Wolf, E.G. and Peterson, R.E. Environmental Characterization of the Southern Insular Shelf of St. Thomas, U.S. Virgin Islands. Science Applications, Inc. 1979. Environmental profile of the south shore marine environment in the area of the proposed sand dredging project. A useful summary of oceanographic and biological factors.

Zube, E.H. The Islands: Selected Resources of the United States Virgin Islands and Their Relationship to Recreation, Tourism and Open Space. University of Massachusetts, Department of Landscape Architecture. Prepared for the Department of the Interior. 1968. Provides basic resource inventory data for governmental agencies.

3. SOCIO-ECONOMIC DATA: PLANNING, DEVELOPMENT, POPULATION, PRODUCTION, RESOURCE USE, PUBLIC PARTICIPATION, STATISTICAL STUDIES AND SUMMARIES.

Bandler, B.G., editor. Our Troubled Environment - Can We Save It? Proceedings of Conference on the Virgin Islands, May 10-11, 1974. Sponsored by the Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1974. Varied conference discussions, ranging from air and water to manpower training and economics to environmental research and land use. Emphasizes the lack of local goals for research and development, lack of government leadership and need for improved planning and resources management strategies.

- Bellante, Clauss, Miller and Nolan. Feasibility Study for the Development of the Fountain Valley Property, St. Croix, U.S. Virgin Islands. Scranton, Pennsylvania. January 1970. Prepared for Boise Cascade Properties, Inc. under contract to Walter Kidde Constructors International.
- Brin, Darlan. *Shoreline Environmental Problems and Recommended Policies for the U.S. Virgin Islands* (unpublished). Paper prepared for a course taken at University of California, Berkeley. Issues of the Virgin Islands coastal environment discussed with relevancy to tourist industry, conservation and management coordination of planning and shoreline policy. Makes detailed recommendations for development of a coastal zone management program for the Virgin Islands.
- Creque, D. and Geoggal, H. A Study of the Tourist Industry in the U.S. Virgin Islands. U.S. Division of Trade and Industry. 1964. Valuable for historical data.
- DeJong Associates. Main Street Mall Urban Design Study. St. Thomas, U.S. Virgin Islands. 1974. Prepared for the Virgin Islands Planning Office. A very imaginative model; a well designed, locally produced study that was before its time.
- Greiner (J.E.) Company, Inc. Summary: Feasibility Study, Improvements for Harry S. Truman Airport, St. Thomas, Virgin Islands. Prepared for the U.S. Virgin Islands Port Authority. 1974. Summary of feasibility study for improvements at Harry S. Truman Airport, short and long term program, costs and scheduling.
- Herrick, T.R. Economic Study of the Submerged Lands of the Virgin Islands. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1966. Deals principally with sand resources and sand dredging. Historical value only.
- Kasperson, R.E. Decentralized Water Reuse Systems in a Water Scarce Environment: The Tourist Industry in St. Thomas, Virgin Islands. Caribbean Research Institute, College of the Virgin Islands, St. Thomas. Water Pollution Report No. 13, 1971. Brief survey of impact of tourism on water supply and sewage disposal in St. Thomas. Estimates costs of water and sewage treatment at major hotels.
- Lopez, P.F. Outdoor Recreation in the Virgin Islands, Executive Summary: A Guide to Assist in the Implementation of the Comprehensive Island-Wide Outdoor Recreation Plan, 1973-1988. Prepared for the Government of the U.S. Virgin Islands, Department of Conservation and Cultural Affairs. 1973. Contains useful graphic presentation of annual rainfall and monthly temperature records, plus a preliminary analysis of use patterns and preferences for marine recreation sites.

- Madigan-Praeger, Inc. Report on Plans for Seaport Development and Relocation for the Virgin Islands Port Authority. New York. 1974. Specialized study of St. Croix port facilities with references to containerized logistics, upgrading, berth utilization, cruise ship traffic and a master plan for Christiansted and Frederiksted. Very useful statistical data.
- McElroy, J.L. and Caines, J.E. Consumer Expenditure Patterns: A Survey of St. Thomas, U.S.V.I., 1975-1976. University of Florida. 1980. Highlights difference between Virgin Islands economy and larger continental metropolitan systems. Statistics review of literature for U.S. Virgin Islands.
- McElroy, J.L. Economic and Social Impacts of the Virgin Islands Coastal Zone Management Program. Virgin Islands Planning Office, St. Thomas, U.S. Virgin Islands. Technical Supplement No. 4, 1978. Much useful data.
- McElroy, J.L. The Virgin Islands Economy: Past Performance and Future Projections: Summary. Virgin Islands Planning Office, St. Thomas, U.S. Virgin Islands. 1975. Data and historical trends on population, labor force, employment and economic performance, with projections for future.
- McElroy, J.L. Virgin Islands Food Imports and Exports: An Analysis. In Proceedings: A Community Conference on Food and Nutrition Policy Planning, Marva S. Browne, editor. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. 1980 (pp. 24-27). Paper presented at the Community Conference on Food and Nutrition Policy Planning sponsored by Island Resources Foundation and funded by the National Science Foundation. Statistics and historical trends.
- Menasco-McGuinn Associates. Virgin Islands Highway Functional Classification and Needs Study: Summary Report. Prepared for the Government of the Virgin Islands, Department of Public Works in cooperation with the U.S. Department of Transportation, Federal Highway Administration, Helena, Montana. August 1973. Includes more than 30 maps developed by the contract firm from aerial photographs and field investigators and officially accepted by the Public Works Department. In addition to inventories and traffic counts, standards are established for design, pavement, present and anticipated use, routes, capital improvements, continuing data collection, and transportation planning.
- Miller, R.W. The Economy of the U.S. Virgin Islands. U.S. Department of the Interior. 1979. Useful analysis and data.
- Olsen, D.A. Socioeconomic Survey of Recreational Boating and Fishing in the U.S. Virgin Islands. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. Contract report for the National Marine Fisheries Service. 1979. Useful statistics.

- Painter, A., editor. Energy Self-Sufficiency and the Virgin Islands: Proceedings of a Conference. Ecological Research Center, Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. December 1978. A quality report that addresses insular energy strategy options for the Territory.
- Pflaum, P., Editor. U.S. Virgin Islands Data Book. College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1980. Compilation of statistics and graphs on U.S. Virgin Islands population, economy, social characteristics, with policy alternatives and guidelines, and a functional analysis of the Virgin Islands government. A basic reference.
- Pebbles, R.W., et.al. Waterplan: A Comprehensive Water Management Framework for the U.S. Virgin Islands. Caribbean Research Institute, Water Resources Center, College of the Virgin Islands, St. Thomas, U.S. Virgin Island. Technical Report No. 2, 1979. Water in the U.S. Virgin Islands in terms of supply, demand, distribution, quality, wastewater, economics, social factors, statistical data and law.
- Posner, B., et.al. Economic Impact Analysis for the Virgin Islands National Park. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. Contract report for U.S. Department of the Interior, National Park Service. 1981. Important new approach which develops experimental economic assessment methodology adapted to an insular area. Establishes quantitative dimensions of a positive multiplier for investment in the establishment of multi-purpose park systems in island areas with a tourism sector.
- Towle, E. Solid Waste Management in the Eastern Caribbean: A Status Report and Planning Study for a Solid Waste Management Workshop. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. 1982. Prepared for U.S. National Commission for UNESCO, Man and the Biosphere Program. Major study with detailed local and regional solid waste policy and management suggestions, research recommendations and maps of solid waste disposal sites in the Eastern Caribbean. Some detail on the evolution of the U.S. Virgin Islands' and Puerto Rican approaches to solid waste management since 1970. Contains an action plan regarding waste recycling and energy extraction from selected solid wastes.
- United States Government, Federal Maritime Commission. Virgin Islands Trade Study: An Economic Analysis. 1979. Useful analysis and data on economy, ports, ocean transportation, etc.
- Virgin Islands Government, Department of Commerce. U.S. Virgin Islands Growth Statistics. 1979. Excellent summary of trade in various economic indicators between 1960-1979.

Virgin Islands Government, Department of Conservation and Cultural Affairs, Division of Planning. Virgin Islands Comprehensive Outdoor Recreation Plan, Executive Summary. 1974. Contains useful tabular data on the recreational value, size, and accessibility of offshore cays, island wise recreational demand factors, and maps of facilities and sites.

Virgin Islands Government, Housing Authority. Housing at a Glance. 1979. Summary report on public housing in St. Croix and St. Thomas. Useful statistical data.

Virgin Islands National Park. Assessment of Alternatives, Solid Waste Study. National Park Service Center, Denver, Colorado. October 1977. A superior model solid waste planning study which combines assessment and planning recommendations for both the National Park and the entire island of St. John and its rural residential and commercial/urban areas.

Wilbur Smith Associates. Virgin Islands Mass Transit Study. Columbia, South Carolina. 1976. Detailed survey and transit development plan, including assessments of inter-island marine transportation and coastal nodal points. Excellent data.

4. ENVIRONMENTAL AND DEVELOPMENT POLICY DATA: GUIDELINES, REGULATIONS, STUDIES AND REPORTS.

Beller, W.S., editor. The U.S. Virgin Islands and the Seas. Report to the Governor. Released by the Office of the Lieutenant Governor, Government of the U.S. Virgin Islands, St. Thomas. October 1970. Citizens' report makes clear that the Virgin Islands' only major environmental resource, its marine assets, must be carefully used and actively protected. Recommendations aimed at formulating policy are made for environmental quality, living/nonliving resources, industry, recreation, Caribbean relations, education and government.

Heyman, I.M. and Gralnek, D.O. Authorities and Organization: Legal Analysis and Recommendations for Implementing a Coastal Zone Management Program. Virgin Islands Planning Office, St. Thomas, U.S. Virgin Islands. Technical Supplement No. 3, 1977. Review of laws and legal authorities relevant to coastal zone management in the U.S. Virgin Islands.

McLaughlin, M. A Handbook for Coastal Homebuilders and Developers. Virgin Islands Department of Conservation and Cultural Affairs, Division of Coastal Zone Management, St. Thomas, U.S. Virgin Islands. 1981. Explains coastal zone management permit process and provides guidelines for various categories of development. Economic, environmental, social and aesthetic considerations are discussed. Very useful.

United States Government, Department of Agriculture, Virgin Islands Soil and Water Conservation District. Environmental Protection Handbook: A Guide to Assist in the Implementation of the Environmental Protection Act of the United States Virgin Islands. Kingshill, St. Croix, U.S. Virgin Islands. 1971. Standards and specifications for soil erosion control, slope control practices, and water conservation for persons applying for "Earth Change" permits. Includes seven page glossary.

United States Government, Environmental Protection Agency. Quality Criteria for Water. 1976. Gives standards for water quality.

Virgin Islands Government. Virgin Islands Coastal Zone Management Act of 1978. Title 12, Chapter 21, Virgin Islands Code. 1978. An important and controversial environmental management statute.

Virgin Islands Government. Virgin Islands Zoning Law. Title 29, Chapter 3, Virgin Islands Code. 1972. One of the major existing controls on land use in the U.S. Virgin Islands, but has serious shortcomings in terms of natural resources management. See Teytaud, A., Management Plan for the St. Thomas Mangrove Lagoon Area of Particular Concern, and Development on Steep Slopes, for discussion of deficiencies and recommended solutions.

Virgin Islands Government, Department of Commerce, Economic Development Council. Economic Development Policy Guidelines. Volumes I, II and III. St. Thomas, U.S. Virgin Islands. 1979. Very useful data and analysis of options for economic development in the U.S. Virgin Islands.

Virgin Islands Government, Department of Conservation and Cultural Affairs. Environmental Laws and Regulations of the Virgin Islands. Reprinted from Titles 12 and 19 of the Virgin Islands Code and the Virgin Islands Rules and Regulations. 1979. A useful compilation of environmental laws.

5. ENVIRONMENTAL IMPACT DATA: ASSESSMENTS AND STUDIES (SITE, SECTOR AND USE SPECIFIC).

Adams, J.B., et.al. Incident and Reflected Solar Radiation in a Tropical Environment. Final report. Caribbean Research Institute, College of the Virgin Islands. St. Thomas, U.S. Virgin Islands. February 1972. Useful vegetation managing data, including species distribution for selected test sites on St. Croix.

- Adams, J., et.al. Potential National Natural Landmarks. West Indies Laboratory, Fairleigh Dickinson University, St. Croix, U.S. Virgin Islands. Report for the National Park Service. May 1975. Descriptive environmental data on fourteen specific sites on St. Croix, St. John and St. Thomas. Maps.
- Bristol, Childs, Crowder and Associates. Proposed Master Plan and Feasibility of Development of the Cruz Bay - Enighed Pond Areas, St. John, U.S. Virgin Islands. Coral Cables, Florida. February 1975. Some routine baseline information but of largely historical value. Includes maps of shoreline configurations and use.
- Brown and Root, Inc. Environmental Impact Assessment Report for Construction of a Single Point Mooring Terminal and Submarine Pipeline System, South Coast, St. Croix, U.S. Virgin Islands. 1974. Prepared for Hess Oil Virgin Islands Corporation. Extensive technical data on marine and shoreline ecology of the south coast, oceanography and climatology and their relationships to probable oil spills. Deficient in ocean current information.
- Candelas, G. Ecological Study of the St. Thomas Harbor and Adjoining Channels. July 1971. Prepared for the West Indian Company, Ltd.. Old but nonetheless useful for some baseline biophysical data. Includes BOD, plankton and primary productivity information derived from sampling and laboratory work at the University of Puerto Rico.
- Dalton, Dalton, Little and Newport, Inc. Draft Environmental Impact Statement. Proposed improvements to the Highway from Veteran's Drive Near the Windward Passage Hotel to Centerline Road at the Top of Raphune Hill, Charlotte Amalie, St. Thomas, U.S. Virgin Islands. Prepared for the Government of the Virgin Islands and the U.S. Department of Transportation. 1975. A perfect example of a controversial large scale engineering approach to a problem requiring a community planning solution for historical, cultural and strategic factors, namely, the optimization and re-routing of traffic flow through the urban waterfront area of Charlotte Amalie, St. Thomas.
- Engineering Science, Inc. Water Resources Study for the Virgin Islands of the United States/Water Reclamation Study. October 1968. Prepared for Government of the U.S. Virgin Islands. Reviews water supply problems and investigates feasible reclamation programs for individual islands. Describes direct reuse for irrigation, industrial and sanitary uses and indirect reuse via ground water recharge.
- Environment Consultants, Inc. Beach Enhancement, Marina Development, and Land Use at Tamarind Reef Hotel Property, St. Croix, V.I. St. Thomas, U.S. Virgin Islands. 1970. Marginally useful but some site specific data.

- Environment Consultants, Inc. Beach Erosion Survey, Forrest Waldo Property, La Grande Princess, St. Croix, Virgin Islands. St. Thomas, U.S. Virgin Islands. 1970. Contains beach profile changes since 1950, plus some shoreline erosion data.
- Environment Consultants, Inc. Beach Improvement and Development, Watergate Village, Bolongo Bay, St. Thomas, U.S.V.I. St. Thomas, U.S. Virgin Islands. August 1970. Impact assessment with data and some managing of coral reefs. Shoreline profile configurations and erosion phenomenon.
- Environment Consultants, Inc. Environmental Study of the Green Cay Development Property, St. Croix, U.S.V.I. St. Thomas, U.S. Virgin Islands. November 1969. Impact assessment of wave action, shoreline and lagoon systems, corals, sea grasses, with very detailed mapping of coastal and underwater features, with photos.
- Environment Consultants, Inc. Environmental Survey of Lemontree Bay Property, St. Croix, Virgin Islands, Christiansted, St. Croix. St. Thomas, U.S. Virgin Islands. 1970. Identifies sources of water, air pollution, and suggests solutions where possible. Also makes recommendations regarding surface drainage, ground water, soils, vegetation, beach and shore development.
- Environment Consultants, Inc. Environmental Survey of Sapphire Bay Resort, St. Thomas, U.S.V.I. St. Thomas, U.S. Virgin Islands. c1969/1970. Useful data on St. John Bay, Red Bay, Prettyklip Point. Some shoreline and benthic maps.
- Environment Consultants, Inc. Report on Beach Enhancement, Marina Development and Land Use, Tamarind Reef Hotel Property, St. Croix, Virgin Islands. St. Thomas, U.S. Virgin Islands. June 1969. Some useful baseline information especially regarding beach profiles.
- Greiner Engineering Sciences, Inc. Harry S. Truman Airport Master Plan, St. Thomas, Virgin Islands: Environmental Impact Assessment Report. Prepared for the Virgin Islands Port Authority. August 1974. Statement of project to expand Truman airport, details expected impact on Lindbergh Bay marine ecosystems, on other areas by dredging, impacts on water quality, soils, air, noise, surface transportation, both temporary and long term. See also revised 1975 version.
- Grigg, D.I., et.al. Marine Environment of Brewers Bay, St. Thomas, Virgin Islands With a Summary of Recent Changes. Prepared for Virgin Islands Department of Health, Division of Environmental Health by Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 15, 1972. Covers turbidity and sediment changes associated with dredging in the bay. Describes increase and decrease of turbidity during and after dredging as well as sediment character in the dredged hole. Useful summary data on Brewers Bay. See also subsequent studies on the environmental impact of St. Thomas airport expansion.

- Grigg, D.I., et.al. Report on the Status of Water Quality in Cruz Bay and Chocolate Hole, St. John. Prepared for the Virgin Islands Department of Health, Division of Environmental Health by Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 9, 1971. Follow-up on prior study; see Brody reference on Cruz Bay. Useful baseline data.
- Grigg, D.I., et.al. Some Effects of Dredging on Water Quality and Coral Reef Ecology. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. Occasional Paper No. 22, 1975. Summarizes types of damage to reef areas caused by various types and methods of dredging. Outlines procedures for reducing impact.
- Grigg, D.I., et.al. The Status of the Marine Environment at Water Bay, St. Thomas. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 7, 1970. Useful baseline information concerning a controversial dredging project and its impact on coastal processes at Water Bay.
- Grigg, D.I., et.al. Water Quality and Benthic Biology Within the Thermal Plume from Harvey Alumina, Virgin Islands Plant. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. June 1972. Description of suspended solids, transparency, dissolved oxygen and sea bottom communities in area of thermal plume.
- Grigg, D.I., et.al. Water Quality and Environmental Status of Benner Bay - Mangrove Lagoon, St. Thomas. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 10, 1971. One of the many sectoral site specific studies, containing useful baseline data. Marginal use to planners.
- Grigg, D.I., et.al. Water Quality and Marine Environment of Vessup Bay, St. Thomas. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 8, 1970. The only study of this site. Useful baseline data.
- Howard, Needles, Tammen and Bergendoff, Inc. Environmental Impact Assessment Report: Proposed Offshore Crude Oil Terminal and Submarine Pipeline, St. Croix, U.S. Virgin Islands. Hess Oil Virgin Islands Corporation, St. Croix, U.S. Virgin Islands. 1975. Summary of economic, social, and environmental data for the south coast of St. Croix and the entire island.
- Insular Environments, Inc. An Investigation of the Site Proposed for an Ocean Outfall at Cruz Bay, St. John, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. September 1972. Prepared for the Government of the Virgin Islands, Department of Health, Division of Environmental Health. Site specific consulting report.

Insular Environments, Inc. Description of the Proposed Virgin Islands Refinery Corporation Site, St. Croix, U.S. Virgin Islands: Terrestrial Biota and Pelagic Marine Macro-Fauna. St. Thomas, U.S. Virgin Islands. September 1973. Prepared for R. Weston. Standard background study for EIA.

Insular Environments, Inc. Draft Environmental Impact Statement, Harbor and Marine Terminal Expansion Port of St. Thomas, Virgin Islands. St. Thomas, U.S. Virgin Islands. July 1973. Prepared for Virgin Islands Port Authority. Site specific consulting report.

Insular Environments, Inc. Draft Environmental Impact Statement, Marine Sand Dredging, Christiansted Harbor, St. Croix, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. June 1973. Prepared for Virgin Islands Port Authority. Site specific consulting report.

Insular Environments, Inc. Draft Environmental Impact Statement, Marine Sand Dredging, Red Hook-Vessup Bays, St. Thomas, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. July 1973. Prepared for Virgin Islands Port Authority. Site specific consulting report.

Insular Environments, Inc. Environmental Study Report for A 35 Megawatt Electric Generating Plant at Krause Lagoon on the South Coast of St. Croix, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. July 1975. Prepared for Virgin Islands Water and Power Authority. Preliminary study of energy installation within an already stressed area.

Insular Environments, Inc. Environmental Study Report for Proposed Docks, Bulkhead and Walkway at Benner Bay on the South Coast of St. Thomas, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. 1975. Useful turbidity measurements, maps and water quality data.

Insular Environments, Inc. Marine and Environmental Factors in Red Hook Bay, St. Thomas. St. Thomas, U.S. Virgin Islands. April 1972. Prepared for P.F. Lopez Associates, St. Thomas, U.S. Virgin Islands. Site specific consulting report.

Insular Environments, Inc. Preliminary Environmental Evaluation of Proposed Development at Fish Bay, St. John. St. Thomas, U.S. Virgin Islands. May 1973. Prepared for Cocoloba Development Association, St. John, U.S. Virgin Islands. Site specific consulting report.

Insular Environments, Inc. Marine Environment of Canegarden Bay, St. Croix, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. June 1973. Prepared for R. Weston, Inc., Westchester, Pennsylvania. Proposed oil refinery site assessment.

Insular Environments, Inc. Status of the Marine Environment of the South Coast of St. Thomas: Crown Bay to Perseverance Bay. St. Thomas, U.S. Virgin Islands. July 1974. Useful coastal water quality data, including heavy metals analysis for four sample sites.

- Insular Environments, Inc. The Potential Environmental Impact of the Construction of a Submarine Pipeline and Deepwater Tanker Mooring and Unloading Terminal in the Caribbean Sea off Limetree Bay, St. Croix, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. April 1973. Prepared for Hess Oil Virgin Islands Corporation, St. Croix, U.S. Virgin Islands. Site specific consulting report.
- Insular Environments, Inc. Water Quality and Benthic Environment in the Area of the Municipal Sewer Outfall at Red Point, St. Thomas, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. March 1973. Prepared for the Virgin Islands Government, Department of Health, Division of Environmental Health. A model initial outfall study (see, however, subsequent reports on same site).
- Insular Environments, Inc. and Sigma Environmental Sciences, Inc. Environmental Assessment Report, Proposed Land Reclamation and Harbor Improvements, St. Thomas, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. 1976. Consulting report for the West Indian Company, Ltd., St. Thomas, U.S. Virgin Islands (proprietary). Useful data.
- Insular Environments, Inc. and Sigma Environmental Sciences, Inc. St. Thomas Sewage Treatment Plant Submarine Discharge Site Evaluation. St. Thomas, U.S. Virgin Islands. September 1975. Prepared for Virgin Islands Government, Department of Conservation and Cultural Affairs, Division of Natural Resources Management. Describes benthic communities and water quality in area of sewage effluent diffuser in 65-70 feet of water after nearly two years of discharge.
- Jacobsen, A.R. A Study of the Pollution of the Harbor Waters of the Virgin Islands. Government of the Virgin Islands, Department of Health, St. Thomas, U.S. Virgin Islands. 1951. Early survey resulting from Department of Health concern about pollution from sewage, industrial waste and night soil disposition. Historical value only.
- Lopez Associates, P.C. Feasibility Report: Pillsbury Marine Commercial Center. May 1972. Prepared for Pillsbury Marine Development Corporation. A study asserting feasibility of developing a marine center/shopping center at an existing salt pond site at Red Hook, St. Thomas, Virgin Islands.
- McComb Engineering. Environmental Assessment Report for Installation, Connection and Operation of Three Desalination Plants at the Virgin Islands Water and Power Authority Facility at Krum Bay, St. Thomas, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. December 1979.
- McComb Engineering. Environmental Assessment Report for Installation, Connection, and Operation of Two 0.55 MGD Desalination Plants at the Virgin Islands Water and Power Authority Facility at Christiansted, St. Croix, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. 1979.

- McComb Engineering. Environmental Assessment Report for Resort, Residential and Marina Development at Mandahl Bay, St. Thomas and Great Hans-Lollik Island. St. Thomas, U.S. Virgin Islands. January 1980. Only detailed study of area. Good map and useful baseline data.
- McNulty, J.K., et.al. Departmental Study Team Report and Recommendations on Proposed New Jet Airport, St. Thomas, U.S. Virgin Islands. U.S. Department of the Interior, Washington, D.C. 1968. Accepts as fact the proposed development of the St. Thomas mangrove lagoon for a new airport site. Use with caution.
- Michel, J.F., et.al. A Study of the Biological and Coastal Engineering Aspects of the Proposed Jet Airstrip at Jersey Bay. Part II, Coastal Engineering Considerations. University of Miami, Institute of Marine Sciences. 1968. Contains valuable baseline data; otherwise useful only as an historical document on earlier development planning methodology with narrowly defined terms of reference. See Tabb and Michel (1968) for Part I.
- Michel, J.F. A Study of the Hydrodynamic Effects of the Proposed Airport at Long Beach Point, St. Thomas, Virgin Islands. University of Miami, Rosenstiel School of Marine and Atmospheric Sciences. 1970. Consulting report to the Virgin Islands Port Authority. Useful for site specific data; otherwise of largely historical value.
- Nichols, M., et.al. Circulation, Water Quality and Environmental Resources of Perseverance Bay, St. Thomas. Island Resources Foundation, St. Thomas, U.S. Virgin Islands. November, 1977. Final report prepared for Department of Conservation and Cultural Affairs, Division of Natural Resources Management. Site specific report.
- Olsen, E.J. Hydrographic Review, Harry S. Truman Airport, St. Thomas, V.I. Report by Florida Coastal Engineers to Greiner Environmental Sciences. July 1974. Routine study with some useful tables synthesizing previous data.
- Owen, W. and Konrad, M. Thermal Survey: Harvey Alumina Discharge, St. Croix, Virgin Islands. Prepared for Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands by Vast, Inc., Frederiksted, St. Croix, U.S. Virgin Islands. Study of thermal plume of bauxite refining plant formerly owned by Harvey Alumina Corporation (now Martin Marietta), southwest of former Krause Lagoon area, St. Croix. Only study of its kind in Virgin Islands waters. Useful for baseline data and methodology.
- Percious, D.J., vanEepoel, R.P. and Grigg, D.I. Reconnaissance Survey of St. Thomas Harbor and Crown Bay, St. Thomas, Virgin Islands. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No 18, 1972. Useful survey with synoptic site specific data. Principally historical value.

- Sigma Environmental Sciences. Biological and Physical Assessment of the Municipal Ocean Outfall at Manning Bay, St. Croix. St. Thomas, U.S. Virgin Islands. September 1977. Prepared for the Government of the U.S. Virgin Islands, Department of Conservation and Cultural Affairs, Division of Natural Resources Management.
- Sigma Environmental Sciences. Environmental Assessment Report: Channel Dredging and Docking Improvements Cruz Bay Harbor, St. John. St. Thomas, U.S. Virgin Islands. June 1978. Prepared for the Virgin Islands Port Authority.
- Sigma Environmental Sciences. Environmental Assessment Report: Proposed Dock and Pilings at Parcels 35, 44, and 134, Estate Frydenhoj, St. Thomas, (US) Virgin Islands. St. Thomas, U.S. Virgin Islands. October 1976. Site specific coastline data for the Mangrove Lagoon, St. Thomas.
- Sigma Environmental Sciences. Environmental Report: Proposed Dock Improvements and Shoreline Fill at Lagoon Marina, St. Thomas. St. Thomas, U.S. Virgin Islands. 1978. Permit application by Harms' Lagoon Marina.
- Sigma Environmental Sciences. Feasibility and Impacts of Flushing a Closed Salt Pond and of Constructing a Small Dock in the Bay at Parcel No. 270 Estate Chocolate Hole, St. John. St. Thomas, U.S. Virgin Islands. June 1977. Some useful baseline data.
- Smith, Henry. Sequential Use of Reclaimed Wastewater Destined for Aquifer Recharge. Water Resources Research Center, Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. June 1979. Some cost data. Shows coastline impact on static water levels from re-injection strategy for treated wastewater.
- Tabb, D.C. and Michel, J.F. A Study of the Biological and Coastal Engineering Aspects of the Proposed Jet Airstrip at Jersey Bay, St. Thomas, U.S. Virgin Islands. Part I, Biological Considerations. University of Miami, Institute of Marine Sciences. 1968. Contains valuable baseline data; otherwise useful only as an historical document. See also Michel, et.al. (1968) for Part II.
- Tabb, D.C. Report of Investigation: The Biological and Ecological Effects of Dredging for Sand in the Water and Brewers Bay Areas of St. Thomas, U.S. Virgin Islands. University of Miami, Institute of Marine Sciences. 1967. Consulting report prepared for Office of the Governor, Government of the U.S. Virgin Islands. Very general appraisal based on brief site observations (apparently of shorelines only). Recommends allowing dredging of Brewers Bay. List of some organisms observed in rocky shoreline habitat.

- TetraTech. Magnetometer Survey of Crown Bay, St. Thomas, U.S. Virgin Islands. April 1981. Prepared for Virgin Islands Port Authority. Some interesting historical use and condition data for Crown Bay.
- TetraTech. Oceanographic Engineering Study for the Proposed Runway Extension at Harry S. Truman Airport, St. Thomas, U.S. Virgin Islands. September 1977. Final Report (TC-863). Prepared for Parsons Pan-American Corporation, Pasadena, California.
- Tobias, W.J. Environmental Impact Assessment for a Private Dock Facility at Sugar Beach, Christiansted, St. Croix, U.S. Virgin Islands. 1977. Prepared for Sugar Beach, Ltd. in connection with submerged lands application to the Government of the Virgin Islands for construction of small pier to serve condominium complex.
- United States Government, Department of the Army, Corps of Engineers. Crown Bay Channel, St. Thomas Harbor, Virgin Islands: Feasibility Report (on) Channel Improvement for Navigation. (Draft) Undated, circa 1979. Very useful compendium of basic data on Crown Bay area with excellent maps.
- United States Government, Department of the Army, Corps of Engineers. Draft Environmental Impact Statement, New Port Facility in Charlotte Amalie, St. Thomas, Virgin Islands. December 1979. Standard EIS information. Good maps and aerial photographs included.
- United States Government, Department of the Army, Corps of Engineers. Final Environmental Impact Statement, New Port Facility in Charlotte Amalie, St. Thomas, V.I. December 1981. Permit application by the Virgin Islands Port Authority. Standard EIS with some useful technical data.
- United States Government, Department of the Army, Corps of Engineers. Draft Environmental Impact Statement. The West Indian Company, Ltd. (Permit), St. Thomas, V.I. August 1977. Draft EIS for dredging, landfill and port improvement. Routine EIS based on good prior site work and investigations.
- United States Government, Department of Commerce, NOAA. The St. Thomas National Marine Sanctuary and Draft Environmental Impact Statement. 1981. Data on the St. Thomas Mangrove Lagoon and adjacent marine areas.
- vanEepoel, R.P. and Grigg, D.I. Effects of Dredging at Great Cruz Bay, St. John. Prepared for the Virgin Islands Department of Health, Division of Environmental Health by the Caribbean Research Institute, College of the Virgin Islands. St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 5, 1970. Historical and technical value. See other studies of Cruz Bay under Brody, et.al. (1969), Section A.2., and Grigg, et.al. (1971), this section.

- vanEpoel, R.P. Report on Effects of Dredging in Water Bay, St. Thomas. Prepared for Virgin Islands Department of Health, Division of Environmental Health by Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 2, November 1969. A controversial study with some continuing instructive value on how not to dredge close inshore and why.
- vanEpoel, R.P. and Grigg, D.I. Survey of the Ecology and Water Quality of Lindberg Bay, St. Thomas. Prepared for the Virgin Islands Department of Health, Division of Environmental Health by Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 4, January 1970. Baseline value (see other parallel studies of dredged and stressed sites in Cruz, Water, Benner, Vessup and Brewers Bays and Christiansted Harbor).
- vanEpoel, R.P., et.al. Water Quality and Sediments of Lindberg Bay, St. Thomas. Prepared for Virgin Islands Department of Health, Division of Environmental Health by the Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. Water Pollution Report No. 11, June 1971. Historical and technical value with observations on the still depauperate dredge hole and marginal recolonization.
- Virgin Islands Government, Department of Health, Division of Environmental Health. A Report on the Environment Surrounding the Hess-Harvey Alumina Plants on St. Croix. 1971. In-house report. Air, water and marine biological observations. Description of industrial plant processes. Mostly qualitative descriptions of environmental impacts associated with plant construction and operation.
- Virgin Islands Port Authority. Environmental Assessment Report, Port Improvement Project, Crown Bay, St. Thomas, U.S. Virgin Islands. St. Thomas, U.S. Virgin Islands. July 1981. Some useful data but some cost/benefit projections appear less than reliable. Very helpful regarding use levels of a waterfront/coastal area.
- Virgin Islands Army National Guard. Environmental Assessment Report: Proposed National Guard Armory, St. Thomas, U.S. Virgin Islands. 1978. Incomplete and inadequate assessment for the site selected.
- Weston, R.F., Inc. Environmental Assessment Study for a Two Hundred Thousand BPCD Refinery, St. Croix, U.S. Virgin Islands. Westchester, Pennsylvania. 1975. Detailed study of area background setting (socio-economic, land use, natural areas, landmarks, climate, oceanography, ecology), expected impacts and means to alleviate impacts, particularly oil spill prevention alternatives.

6. MISCELLANEOUS VIRGIN ISLANDS REFERENCES (*PRIMARILY UNANNOTATED*)

- Black, Crow and Eidsness, Inc. A Water Management Plan for St. Croix, U.S. Virgin Islands. Consulting Engineers, Gainesville, Florida. 1976.
- Black, Crow and Eidsness, Inc. Preliminary Engineering Design of Cross Road Culverts and A Cursory Evaluation of Potential Dam Locations for Selected Sites in the U.S. Virgin Islands. Supplement to Virgin Islands Water Resources Maps. Prepared for Government of the Virgin Islands, Department of Conservation and Cultural Affairs, Division of Natural Resources Management.
- Buros, O.K. Groundwater in the Virgin Islands and the Caribbean. Presented at Desalination Operations - 1975, International Desalinization and Environmental Association. Black, Crow and Eidsness, Inc., Gainesville, Florida.
- Buros, O.K. Resource Management through the Use of Reclaimed Water for Groundwater Recharge. Presented at Desalination Operations - 1975, International Desalinization and Environmental Association. Black, Crow and Eidsness, Inc., Gainesville, Florida.
- Buros, O.K. Utilization of Wastewater for Beneficial Purposes. Virgin Islands Agriculture and Food Fair. D. Padda, editor. Virgin Islands Department of Agriculture, St. Croix, U.S. Virgin Islands. 1975.
- Buros, O.K. Wastewater Reclamation in St. Croix. A paper presented at the WPCF 48th Annual Conference. Miami, Beach, Florida. October 5-9, 1975.
- Buros, O.K. Water Reclamation and Reuse. A paper presented at the Conference on Water Resource Problems and Research Needs in the Virgin Islands. Christiansted, St. Croix, U.S. Virgin Islands. October 30, 1974.
- Buros, O.K. Water Resource Maximization in an Island Environment. A paper given at the Special Symposium on Water Resource Problems at the Tenth American Water Resources Conference. Las Croabas, Puerto Rico. November 18, 1974.
- Buros, O.K. Water Resource Planning and Wastewater Reclamation in the Virgin Islands. A paper presented at the Workshop on Augmenting the Virgin Islands Water Supply sponsored by the Water Resources Research Center, Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. May 9, 1975.
- Buros, O.K. Water Reuse in the Virgin Islands. A paper presented at the AWRA-FPCA 25th Annual Conference. Miami Beach, Florida. November 10-13, 1974.
- Cabrite Development Co. Environmental Assessment Report Proposed Beach Construction at Muller Bay, St. Thomas. St. Thomas, U.S. Virgin Islands. February 1979.

- Camp, Dresser & McKee, Inc. Facilities Planning Report on Relocating and Upgrading the Charlotte Amalie Wastewater Treatment Facilities. Government of the Virgin Islands, Department of Conservation and Cultural Affairs, Division of Natural Resources Management. 1977.
- Camp, Dresser & McKee, Inc. Facilities Planning Report on Wastewater Treatment and Reuse for St. Croix. Government of the Virgin Islands, Department of Conservation and Cultural Affairs, Division of Natural Resources Management. 1976.
- Camp, Dresser & McKee, Inc. Mangrove Lagoon/Turpentine Run Facilities Planning Report on Wastewater Treatment and Reuse. Prepared for Government of the Virgin Islands, Department of Conservation and Cultural Affairs, Division of Natural Resources Management. July 1976.
- Camp, Dresser & McKee, Inc. Report on Infiltration/Inflow Analysis for the Charlotte Amalie Sewage System. May 1978. Two volumes.
- Cederstrom, D.J. Geology and Ground Water Resources of St. Croix, Virgin Islands. U.S. Geological Survey Water Supply Paper 1067. 1950.
- Cederstrom, D.J. Memorandum Re the Underground Water Supply of St. Croix and St. Thomas, Virgin Islands. U.S. Geological Survey Caribbean District open-file report. San Juan, Puerto Rico.
- Church, G. A Report on the Water Supply and Sewerage in the Virgin Islands. A report to the Governor (Virgin Islands). St. Thomas, U.S. Naval Station. August 16, 1917.
- Cosner, O.J. Water in St. John, U.S. Virgin Islands. U.S. Geological Survey Caribbean District open-file report. San Juan, Puerto Rico. 1972.
- Defenback, J.A. Audit of Potable Water Supply and Distribution. Department of Public Works, Government of the Virgin Islands of the United States. July, 1971, through October 31, 1973. St. Thomas, U.S. Virgin Islands. 1975.
- Deubig, J.R. and Reimold, R.J. Selected Baseline Environmental Parameters, St. Croix. Tropical Field Ecology (WI858). West Indies Laboratory, Fairleigh Dickinson University, St. Croix, U.S. Virgin Islands. 1972.
- Evans-Hamilton. Current Velocity Analysis and Pollutant Transport Study for the South Coast St. Croix Island. Prepared for Roy F. Weston, Inc. by Evans-Hamilton, Inc., Bethesda, Maryland. 1973.
- Hendrickson, G.E. Ground Water for Public Supply in St. Croix, Virgin Islands. U.S. Geological Survey Water-Supply Paper 1663-D. 1963.
- Ichiye, T. Oil Spill Dispersion Prediction Off Southern St. Croix Island. See TerEco (1973) below.

- Johnson, A.F. Water Supply for the Towns of Christiansted and Frederiksted, St. Croix, Virgin Islands of the United States. U.S. Bureau of Reclamation, Sante Fe, New Mexico. 1936.
- Jordan, D.G. A Survey of the Water Resources of St. Croix, Virgin Islands. U.S. Geological Survey open-file report. San Juan, Puerto Rico. 1975.
- Jordan, D.G. A Survey of the Water Resources of St. Thomas, Virgin Islands. U.S. Geological Survey (Caribbean District). San Juan, Puerto Rico. 1975.
- Jordan, D.G. Land-Use Effect on the Water Regimen of the U.S. Virgin Islands. U.S. Geological Survey Prop. Paper 800-D. 1972.
- Little, Arthur D., Inc. Financial Feasibility of New Terminal Facilities at Crown Bay, St. Thomas, U.S. Virgin Islands. June 1980.
- MacLean, W.P. Reptiles and Amphibians of the Virgin Islands. Published for the Virgin Islands Conservatin Society by Macmillan Education Limited, London. 1982.
- McGuinness, C.L. Additional Water Development on St. Thomas, V.I. with an Addendum on St. Croix. U.S. Geological Survey Caribbean District open-file report. San Juan, Puerto Rico. 1951.
- McGuinness, C.L. Memorandum Concerning Hydrological Studies Needed in the Virgin Islands with an Addendum on Puerto Rico. U.S. Geological Survey Caribbean District open-file report. San Juan, Puerto Rico. 1951.
- Nobles, R.W. *Forestry in the U.S.V.I.* J. Forestry, 58(7): 524-527, 1960.
- Olsen, D.A., et.al. Environmental Impact Assessment of Proposed Modifications to Gallows Bay Commercial Harbor Facilities St. Croix, U.S. Virgin Islands. Submitted to Virgin Islands Port Authority by the Island Resources Foundation, St. Thomas, U.S. Virgin Islands. 1978.
- Olsen, D.A. and Grigg, D.I. with Franks, R. and Schmidt, M.T. Biological and Physical Assessment of the Municipal Ocean Outfall at Red Point, St. Thomas. Prepared for Government of the U.S. Virgin Islands, Department of Conservation and Cultural Affairs, Division of Natural Resources by Sigma Environmental Sciences, St. Thomas, U.S. Virgin Islands. 1977.
- Praeger, Kavanaugh and Waterbury Engineers. Evaluation of Underground Water Supply - St. Croix Development, St. Croix, Virgin Islands. Report to the Foundation River Co., New York. December 10, 1964.
- Pratt, A.E. The Water Economy of a Low Flush Toilet in a Water Deficient Region. Technical Report No. 3, Water Resources Research Center, Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. July 1979. Of very little use; a marginal study of a marginal problem.

- Sigma Environmental Sciences. Environmental Site Survey and Planning Guidelines: Coral World Project Coki Point, St. Thomas. Prepared for Coral World, (V.I.) Inc., St. Thomas, U.S. Virgin Islands. 1976.
- Sylvester, J.A., Dammann, A.E., Olsen, D.A., and Yntema, J.A. Offshore Bottom Fishing in the V.I. Annual Report, U.S. Bureau of Sport Fisheries and Wildlife Project. 1972.
- TerEco. A Bio-Environmental Study of the Southern Aspect of St. Croix, U.S.V.I. Prepared for Brown and Root, Inc. by TerEco Corporation, College Station, Texas. 1973.
- TerEco. An Updating of Selected Aspects of TerEco's 1973 Bio-Environmental Study of St. Croix's South Coast. Prepared for Howard, Needles, Tamman and Bergendoff by TerEco Corporation, College Station, Texas. 1975.
- Tippetts, Abbett, McCarthy and Stratten, Inc. Potable Water Supply for St. Croix, Virgin Islands. New York. 1959.
- Tippetts, Abbett, McCarthy and Stratten, Inc. Potable Water Supply for St. Thomas, Virgin Islands. New York. 1958.
- Towle, E., et.al. Shipwrecks of the Virgin Islands: An Inventory (1523-1825). Island Resources Foundation, St. Thomas, U.S. Virgin Islands. December 1976.
- United States Congress. History of Non-immigrant Alien Labor Program in the U.S. Virgin Islands. A report by the House Subcommittee on Immigration, Citizenship, and International Law, Rep. Joshua Eilberg, Chairman. Washington, D.C. 1975.
- Vaughan, T.W. and Kidwell, C.H. The Ground Water Resources of the West Indian Islands, Saint John, Saint Thomas, Culebra and Vieques, and the Eastern End of Puerto Rico. A report to the Commission on Navy Yards and Naval Stations. U.S. Geological Survey, Department of the Interior, Washington, D.C. 1920.
- Virgin Islands Government, Department of Conservation and Cultural Affairs. The Virgin Islands Territorial Plan for Certification of Commercial and Private Applicators of Restricted Use Pesticides. St. Thomas, U.S. Virgin Islands. 1976.
- Virgin Islands Government, Planning Office. Population, Economic Activity and Water Use Projections for the U.S. Virgin Islands. Office of the Governor, St. Thomas, U.S. Virgin Islands. 1974.
- Virgin Islands Government, Planning Office. United States Virgin Islands Preliminary Housing Market Study. Office of the Governor, St. Thomas, U.S. Virgin Islands. 1974.

Virgin Islands Water and Power Authority. Amendatory Water Supply Agreement-Virgin Islands Water and Power Authority and Government of the Virgin Islands. December 2, 1974.

Ward, P.E. and Jordan, D.G. Water Resources of the Virgin Islands, a Preliminary Appraisal. U.S. Geological Survey Caribbean District open-file report. San Juan, Puerto Rico. 1963.

Warfield, R.M. Report on Water Supply, Virgin Islands. A Report to the Secretary of the Navy, Washington, D.C. March 29, 1924.

B. SELECTED MISCELLANEOUS CARIBBEAN/REGIONAL REFERENCES RELEVANT TO THE VIRGIN ISLANDS.

Anonymous. Conservation in the Eastern Caribbean: Proceedings of the First Eastern Caribbean Conservation Conference, St. John, U.S. Virgin Islands, October 1-4, 1965. Prepared by the Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1965. Participants of widely varying interests and disciplines assessed island resources and planning. A resolution was passed to establish the Caribbean Conservation Association. Includes papers on government planning, resources management, economic factors, parks and reserves, and historic sites. Marginal coverage of coastal and marine elements but useful for regional variations on role of island planner, problem identification.

Beller, W.S., editor. Environmental Management and Economic Growth in the Smaller Caribbean Islands, Proceedings of Conference. Barbados, September 17-21, 1979. U.S. Department of State Publication 8996. Washington, D.C. November 1979. Overview papers and discussion of contemporary socio-economic and environmental problems of the Caribbean islands. The papers by Snaggs (p. 42), Jackson (p. 57), Demas and St. Rose (p. 88), and Putney (p. 98) are particularly relevant.

Bryden, J.M. Tourism and Development. A case study of the Commonwealth Caribbean. Cambridge University Press. 1973. Standard text on the impact of international tourism on Eastern Caribbean microstate economies.

Carlozzi, C.A. and Carlozzi, A.A. Conservation and Caribbean Regional Progress. Antioch Press. 1968. Survey of natural resources and conservation options in Windward and Leeward islands. Historical interest.

Chernick, S.E. The Commonwealth Caribbean: The Integration Experience. A World Bank Country Economic Report. John Hopkins University Press. 1978. Discusses problems and prospects of economic integration among small developing countries, focussing on population, manpower, employment, transportation, agriculture, tourism and industry.

- Cintron, G., et.al. Mangroves of Arid Environments in Puerto Rico and Adjacent Islands. Biotropica, 10(2) : 110-121, 1978. Data on mangrove ecosystem applicable to the U.S. Virgin Islands.
- Coulianos, K.E. Concepts for Eco-developmental Tourism for Small Caribbean Islands. Masters Thesis, University of Michigan. 1980. Alternative approaches to Caribbean tourism based on an integration of ecology, economics, conservation, and development. Includes area from U.S.V.I. to Grenada. Important work.
- Deane, C., Thom, M. and Edmunds, H. Eastern Caribbean Coastal Investigations, 1970-73. 5 volumes. British Development Division in the Caribbean, Trinidad. Detailed review of West Indian natural coastal processes, dredging, sand extraction potential, covering also associated environmental problems and management components. A valuable basic study of an endemic Caribbean island problem - sand resources management.
- Eastern Caribbean Natural Area Management Program (ECNAMP) and the Government of the British Virgin Islands. A System of Marine Parks and Protected Areas for the British Virgin Islands. Tortola, British Virgin Islands. 1981. An excellent model planning document with maps of resource data base and development and management recommendations prepared through a participatory strategy using a composite working committee of local and external experts and representatives of prospective user groups.
- Eastern Caribbean Natural Area Management Program (ECNAMP). Preliminary Data Atlas. University of Michigan/UNEP. 1980. Series of Resource Data Maps for Eastern Caribbean islands showing rainfall, land use capacity, coastal currents, terrestrial life zones, important marine habitats, endangered and locally important species, population density, present land use, marine resource use, transport systems, natural features, cultural attractions, pollution, key watersheds, parks and protected areas, land ownership, areas recommended for special management strategies. To date, maps available for Anegada, Anguilla, Antigua, Aruba, Barbados, Barbuda, Bonaire, Curacao, Dominica, Grenada, Grenada Grenadines, Guadeloupe, Martinique, Montserrat, Nevis, Saba, St. Barthelémy, St. Eustatius, St. Kitts, St. Lucia, St. Martin/Sint Maarten, St. Vincent, St. Vincent Grenadines, Tortola and Virgin Gorda.
- Frankenhoff, C.A., et.al. Environmental Planning and Development in the Caribbean. Results of an environmental planning workshop sponsored by the Graduate School of Planning of the University of Puerto Rico. May 1974. Contains sections written by Cruz Matos, John McEachern, Edward Towle, C. Frankenhoff, and L. Guilini. Useful regional overview.

- Garcia-Zamor, J.C. The Ecology of Development Administration in Jamaica, Trinidad and Tobago, and Barbados. General Secretariat, Organization of American States. 1977. An analysis of the "Creole Bureaucracy" and development administration in Caribbean countries in general. Takes the view that "...while in developed societies it is appropriate to view development as a cause of environmental problems, in the developing countries it becomes essentially a cure for their major environmental problems."
- Jackson, I. Study of the Pleasure Boat Industry in the British Virgin Islands with Emphasis on Charter Boats. Prepared under contract with the World Tourism Organization for the Government of the British Virgin Islands. 1981. First and only detailed assessment of the boating industry. Includes environmental guidelines and management suggestions.
- Kohlemainen, S.E. Siltration Experiments on Corals in Situ. 1973. Final Report. Mission 8. Puerto Rico International Underwater Laboratories, San German.
- Lewsey, C.D. Assessing the Environmental Effects of Tourism Development on the Carrying Capacity of Small Island Systems. The Case for Barbados. Ph.D. Thesis, Cornell University. 1978. Useful for the discussion of the general problems facing a small developing island, and as an example of methodology.
- Loya, Y. *Effects of Turbidity and Sedimentation on the Community Structure of Puerto Rican Corals.* Bull. Mar. Sci., 26: 450-466, 1976.
- Macpherson, J. Caribbean Lands - A Geography of the West Indies. Longmans, London. 1963. Excellent brief discussions of natural resources, climate, and socio-economic factors of all Caribbean islands. See latest edition.
- Martinez, R., et.al. Mangroves in Puerto Rico: A Structural Inventory. Department of Natural Resources, San Juan, Puerto Rico. 1979. Basic structural and functional data on mangrove ecosystems.
- McElroy, J.L. Internal and External Policy Constraints in the Small Island Context. College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1978. Good discussion of the limited set of options available to micro-states.
- Putney, A.D. A Strategy for the Conservation of Living Marine Resources and Processes in the Caribbean Region. Final Report to IUCN by Eastern Caribbean Natural Area Management Program, St. Croix, U.S. Virgin Islands. 1979. Details of strategic planning process for the Caribbean as it relates to the IUCN World Conservation Strategy. Reports for specific projects such as a data atlas, bibliography, study area profiles.

- Putney, A.D. Overview of Conservation in the Caribbean Region. Transactions 45th North American Wildlife and Natural Resources Conference. 1980. Discusses the diversity of resources, major obstacles to conservation, importance of Caribbean conservation to the U.S., recent conservation advances, and gives some general guidelines for conservation programs.
- Putney, A.D. Survey of Conservation Priorities in the Lesser Antilles. Draft Final Report to Caribbean Conservation Association by Eastern Caribbean Natural Area Management Program, St. Croix, U.S. Virgin Islands. 1981. Discussion of methods used in the preparation of the Preliminary Data Atlas and summary of remaining samples of major ecosystems, resources of economic value, priorities, and program development.
- Rainey, W.E. and Pritchard, P.C.H. Distribution and Management of Caribbean Sea Turtles. 1972. Transactions of the Technical Session on Marine and Coastal Resources at the 37th North American Wildlife and Natural Resources Conference, sponsored by the Wildlife Management Institute, Mexico City, Mexico, March 12-15, 1972. Summarizes the regional resource management problems of the species, Chelonia mydas.
- Rogers, C. The Response of a Coral Reef to Sedimentation. Ph.D. Dissertation, University of Puerto Rico. 1977. Stresses ecology of reefs in Puerto Rico.
- Rundel, P.W. An Annotated Bibliography of West Indian Plant Ecology. Published for the Island Resources Foundation, St. Thomas, U.S. Virgin Islands by the Virgin Islands Department of Conservation and Cultural Affairs, Division of Libraries and Museums. 1974. Result of Foundation sponsored research. Primarily useful as a research reference guide.
- United States Government, Department of the Interior, U.S. Geological Survey. Geohydrologic Descriptions of Selected Solid Waste Disposal Sites in Puerto Rico. 1982. Open-file report 81-490. Prepared in cooperation with the Environmental Quality Board of Puerto Rico. Useful methodology for reconnaissance of waste disposal sites and potential leachate and water quality problems.
- Villamil, J.J. Size and Survival: Planning in Small Island Ecosystems. College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1974. General discussion of impacts of growth on small islands, and options for development.
- Westermann, J.H. Conservation in the Caribbean. Foundation for Scientific Research in Surinam and the Netherlands Antilles, Utrecht, Netherlands. Publication No. 7, 1952. Reviews conservation problems and programs in agriculture, soil, water and wildlife conservation. Reviews contemporary views on the population problem.
- Zube, E., editor. Social Sciences, Interdisciplinary Research and the U.S. Man and the Biosphere Program. Workshop Proceedings. November 1980. Note especially, E. Towle paper, Collaboration Among Social and Natural Scientists on Caribbean Island Projects. Other papers very instructive on process and methodology options for cross-disciplinary investigations.

C. GENERAL REFERENCES

(SELECTED FOR RELEVANCE TO THE VIRGIN ISLANDS
AND THE EASTERN CARIBBEAN)

1. RESOURCE SYSTEMS MODELING STRATEGIES AND TECHNIQUES.

- Bennett, J.W. A Simple Model of Resource Utilization and Conservation. American Association for the Advancement of Science Symposium on Social and Technical Management in Dry Lands. 1977. Useful as an approach.
- Bishop, A.B., et.al. Carrying Capacity in Regional Environmental Management. U.S. Environmental Protection Agency. 1974. General discussion of carrying capacity concepts and their application in regional modeling studies.
- Boyden, S. An Integrative Approach to the Study of Human Settlements. UNESCO/MAB Technical Notes No. 12. 1979. Conceptual models and checklists of indicators for the study of man/environment relationships.
- Brookfield, H.C., editor. Population - Environment Relations in Tropical Islands: The Case of Eastern Fiji. UNESCO/Man and the Biosphere Program Technical Notes No. 13. 1980. Report on the results of a high budget approach to the problems of small tropical islands, utilizing a complex simulation model. Useful for comparative purposes in assessing the effectiveness of alternative approaches.
- Governor's Steering Committee on Carrying Capacity Studies. An Approach for Developing, Assessing, and Utilizing Carrying Capacity Concepts and Criteria for Growth Management. Government of the State of Hawaii. 1979. Proposed research plan with valuable discussion of procedures and problems. Relevant to the U.S. Virgin Islands.
- Gutierrez, E., et.al. Open Systems Planning: Preliminary Analysis. University of Puerto Rico. 1971. Implications of system "openness" for modeling the economics of small countries. Technical.
- Hart, W.J. A Systems Approach to Park Planning. International Union for Conservation of Nature and Natural Resources (IUCN), Morges, Switzerland. 1966. Basic methodology useful.
- Holling, C.S., editor. Adaptive Environmental Assessment and Management. International Institute for Applied Systems Analysis. John Wiley & Sons, Inc., New York. 1980. Primary reference. Very useful, creative and important.
- Proudman, C.L. ISLANDS. A simulation game. 1973. A board game for six teams of players simulating conditions of economic development. Useful for workshop activities and public participation.

United States Government, Department of Interior, Fish and Wildlife Service. A Systems Approach to Ecological Baseline Studies. U.S. Department of the Interior. 1978. Written primarily for use in preparing baseline studies for energy projects in the western United States, this manual has wider applicability in designing baseline studies in other areas.

Williams, E.R. and House, P.W. The State of the System (SOS) Model: Measuring Growth Limitations Using Ecological Concepts. Environmental Protection Agency. 1974. Technical discussion of simulation modeling of ecosystems.

2. ECOSYSTEM DYNAMICS AND ELEMENTS

Antonius, A. New Observations on Coral Destruction in Reefs. Harbor Branch Foundation Laboratory. Fort Pierce, Florida. 1973. Some potential application in a Virgin Islands context.

Clark, J. Coastal Ecosystems: Ecological Considerations for Management of the Coastal Zone. The Conservation Foundation, Washington, D.C., in cooperation with the National Oceanic and Atmospheric Administration, Office of Coastal Environment, U.S. Department of Commerce. 1974. Good system and process illustrations for public education purposes.

Clark, J.R. Coastal Ecosystem Management. John Wiley & Sons, Inc., New York. 1977. A basic reference, emphasizing linkages between terrestrial, marine, and human subsystems. Information on thresholds, performance standards, development guidelines. Required reading.

Expert Panel. Ecology and Rational Use of Island Ecosystems. UNESCO/Man and the Biosphere Program. 1973. A summary (to 1973) of MAB-7 Directorate work on island ecosystem dynamics. All topics discussed are directly relevant to current MAB-7B initiatives regarding island carrying capacity and resource management planning. A basic reference.

Gill, A.M. and Tomlinson, P.B. Studies on the Growth of Red Mangrove (*Rhizophora mangle* L.). Biotropica, 3(2), 1971. Technical value only.

Heald, E.J. and Odum, W.E. The Contribution of Mangrove Swamps to Florida Fisheries. Proceedings of the Twenty-second Annual Session, Gulf and Caribbean Fisheries Institute. University of Miami, Rosenstiel School of Marine and Atmospheric Sciences. 1970. Summary of ecosystem energetics. Useful for the Virgin Islands.

Johannes, R.E. Pollution and Degradation of Coral Reef Communities in E.J.F. Wood and R.E. Johannes, editors, Tropical Marine Pollution. Elsevier, Amsterdam. 1975. Effects of various types of pollution on coral reefs.

- Lugo, A.E. Stress and Ecosystems in J.H. Thorp and J.W. Gibbons, editors, Energy and Environmental Stress in Aquatic Systems. National Technical Information Service. 1978. Review of literature on the effects of stress on ecosystems, including a model of the energetics of stress patterns. Useful for modelling effects of development on ecosystems.
- Lugo, A.E. and Snedaker, S.C. The Ecology of Mangroves in Annual Review of Ecology and Systematics, Volume 5. 1974. A summary of structural and functional ecology of mangroves, with extensive bibliography.
- Millas, J.D. Hurricanes of the Caribbean and Adjacent Regions 1492-1800. Academy of the Arts and Sciences of the Americas, Miami, Florida. 1968. An historic summary based on an intensive search of sources. Useful for the researcher, but of little use to the planner.
- Odum, H.T. Environment, Power and Society. John Wiley & Sons, New York. 1971. A more technical version of Energy Basis for Man and Nature.
- Odum, H.T., et.al. Coastal Ecological Systems of the United States. Conservation Foundation, Washington, D.C. 1974. Contains energy flow models of several tropical coastal systems.
- Odum, H.T. and Odum, E.C. Energy Basis for Man and Nature. McGraw Hill, New York. 1976. Introductory text on general systems theory and net energetics for the general public, politicians, and students, including basic laws of energy, linkages and conversion factors between ecology and economics. A very important reference.
- Onuf, C. Annotated Bibliography on the Biological and Ecological Effects of Oil Pollution in Tropical Waters. Office of International Programs, Smithsonian Institution, Washington, D.C. 1973. A very useful reference of a technical nature (see also Freeman, 1974 in Section C.3. below).
- Ray, G.C. Critical Marine Habitats, Definition, Description, Criteria and Guidelines for Identification and Management. International Union for Conservation of Nature and Natural Resources (IUCN), Morges, Switzerland. 1976. Expanded version of 1975 paper. See especially, Summary Guidelines for Protection and Ecological Approach to Planning.
- Stursa, M.L. Florida Keys Coral Reef Workshop, Proceedings. Sponsored by Florida Coastal Coordinating Council, State of Florida, Department of Natural Resources. 1974. Practical, management oriented report with some discussion of stress, tolerance, mortality and research needs.
- Wace, N. The Character of Oceanic Islands and the Problem of Their Rational Use and Conservation. International Union for Conservation of Nature and Natural Resources (IUCN), Morges, Switzerland. 1978. Useful principally for energy flow models of various island ecosystems and for the large bibliography (Pacific emphasis).

Zieman, J.C. Tropical Seagrass Ecosystems and Pollution in E.J.F. Wood and R.E. Johannes, editors, Tropical Marine Pollution. Elsevier, Amsterdam. 1975. Effects of various types of pollution on a major marine resource.

3. ENVIRONMENTAL GUIDELINES AND RESOURCE MANAGEMENT PLANNING STUDIES.

Freeman, P.H. Coastal Zone Pollution by Oil and Other Contaminants: Guidelines for Policy, Assessment and Monitoring in Tropical Regions. Smithsonian Institution, Washington, D.C. 1974. The best overview on the management aspects of oil pollution in tropical island areas. Basic planning reference.

Interagency Task Force. Lake Tahoe Environmental Assessment: Executive Summary. Western Federal Regional Council. 1979. Example of an exceptionally clear assessment. Excellent graphics.

Leopold, L.B. Hydrology for Urban Land Planning -- A Guidebook on the Hydrologic Effects of Land Use. Geological Survey Circular 554. U.S. Geological Survey, Washington, D.C. 1968.

McEachern, J. and Towle, E. Ecological Guidelines for Island Development. International Union for Conservation of Nature and Natural Resources, Morges, Switzerland. 1974. Useful general planning recommendations. Designed as companion volume to Dasman, et.al. (1973); see Section C.4.

National Academy of Sciences. Waste Management Concepts for the Coastal Zone: Requirements for Research Investigation. Washington, D.C. 1970. A comprehensive evaluation of the scientific and engineering aspects of coastal wastes management with special emphasis on physical processes, chemical and biological factors, and recommended studies.

Odum, W.E. Ecological Guidelines for Tropical Coastal Development. IUCN Publ. New Ser. No. 42. International Union for Conservation of Nature and Natural Resources, Morges, Switzerland. 1976. Useful throughout Caribbean.

Salm, R.V. Guidelines for the Establishment of Coral Reef Reserves. Final Draft Report to World Wildlife Fund/IUCN. 1980. A comprehensive discussion of the need for coral reef reserves, planning and management, criteria for selection and size. Excellent.

United States Government, Environmental Protection Agency. Water Quality Criteria Data Book, Effects of Chemicals on Aquatic Life. (Vol.3) Battelle's Columbus Laboratories. 1971.

Wilimovsky, N.J. Perspectives on Minimal Data Requirements for Aquatic Resource Management in Developing Countries. Draft paper for a workshop on tropical small scale fish stock assessment. 1979. Concepts are applicable to management of other types of resources as well.

4. SOCIO-ECONOMIC STUDIES AND GUIDELINES.

- Bennett, J.W. Social and Interdisciplinary Science in U.S. MAB: Conceptual and Theoretical Aspects. 1980. Draft paper. Useful mainly for Table of MAB Expert Panel Reports on Man-Biosphere Systems.
- Dasmann, R.F., et.al. Ecological Principles for Economic Development. The Conservation Foundation, Washington, D.C. 1973. General reference with excellent sections on tourism and humid tropics and a review of the interdependence of conservation, development, and planning. See especially Chapter 2 on carrying capacity, diversity versus simplicity, community resilience, and survival thresholds. Basic planning reference.
- de Kadt, E. Tourism - Passport to Development? A World Bank - Unesco Study. Oxford University Press. 1979. Analysis of social and cultural effects of tourism in developing countries in general, with case studies from Africa, Bermuda, Tunisia, Bali, Cyprus, Malta, Senegal, and Mexico.
- Dommen, E. Islands. Special issue of World Development (Vol. 8, No. 12). 1980. Ten overview articles, with statistical summaries, on socio-economic issues in developing island states of the world. Useful comparative data.
- Jones-Hendrickson, S.B., editor. Forecasting in Microstate Economies. Seminar Proceedings. Social Research Center, Caribbean Research Institute, College of the Virgin Islands, St. Thomas, U.S. Virgin Islands. 1978. Valuable paper methodology.
- Lugo, A.E. and Brinson, M.M. Calculations of the Value of Salt Water Wetlands. Proceedings of the National Symposium on Wetlands, American Water Research Association. Minneapolis, Minnesota. 1978. Discusses six methods for calculating the value of salt water wetlands. Includes rates of primary productivity for mangroves. Important paper for methodology can be applied to other types of ecosystems as well.
- Towle, E.L. The Role of the Travel-Tourism Industry in International Marine Recreation Development. Presented at the Ninth Annual Marine Technology Society Conference, Washington, D.C. 1973. Also, Island Resources Foundation, St. Thomas, U.S. Virgin Islands, Occasional Paper No. 19. Background for recreation planning, stressing need for educational dimension.

5. ENVIRONMENTAL PERCEPTION.

- Brookfield, H.C. On the Environment As Perceived in Progress In Geography. 1969. Methodology for studies of the perceived environment. Old, possibly still useful.

- Craik, K.H. and Zube, E.H. Issues in Perceived Environmental Quality Research. National Science Foundation. 1975. Covers development of scenic and recreational environments, residential and institutional environments, air/water/sonic environments.
- Redding, M.J. Aesthetics in Environmental Planning. U.S. Environmental Protection Agency (600/5-73-009). 1973. Basic, well organized, thoughtful and systematic study suggesting alternative methodologies and implementation strategies for adding aesthetic concepts to public and private sector planning. Appendix contains useful examples of environmental planning done by various federal agencies that incorporate attention to aesthetic impacts.
- Renard, Yves, editor. Perceptions of the Environment: A selection of interpretive essays. Caribbean Conservation Association, Barbados. 1979. An excellent series of grass roots, in depth studies.
- Whyte, A.V.T. Guidelines for Field Studies in Environmental Perception. UNESCO/MAB Technical Notes #5. 1977. An exhaustive discussion of techniques and design of field studies. Important work.
- Zube, E.H., editor. Studies in Landscape Perception. Institute for Man and Environment, University of Massachusetts. 1978. Covers cross-cultural perceptions, physical measures, prediction of science resource values.