

2. CONTRACT (Proc. Inst. Ident.) NO. **AOT-0800-C-00-2060-00** 3. EFFECTIVE DATE
April 7, 1992

5. ISSUED BY **Agency for International Development
 Office of Procurement
 Division A, AOT Branch
 Washington, D.C. 20523-1425** CODE **PD-ABJ-375**
ISA 90417 6. ADMINIST **Same**

7. NAME AND ADDRESS OF CONTRACTOR (No., street, city, county, State and ZIP Code)
Mr. Robert A. Bisson
Bald Peak Colony Club
Melvin Village, NH 03850
TIN: 002-34-5148
Bisson
69 PARKER PLACE (Box 277)
LACONIA NH 03241
MAILING - Box 431
FAIRFAX VA. 22030

8. DELIVERY FOB ORIGIN OTHER (See below)
 9. DISCOUNT FOR PROMPT PAYMENT
 10. SUBMIT INVOICES (4 copies unless otherwise specified) TO THE ADDRESS SHOWN IN: **12.**

11. SHIP TO/MARK FOR CODE FACILITY CODE
 12. PAYMENT WILL BE MADE BY CODE
Agency for International Development
Office of Financial Management, FA/FM/CMPD/DC
Room 700, SA-2, Washington, D.C. 20523-0209

13. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION:
 10 U.S.C. 2304(c) 41 U.S.C. 253(c)
 14. ACCOUNTING AND APPROPRIATION DATA
See Section G of the Contract

15A. ITEM NO.	15B. SUPPLIES/SERVICES	15C. QUANTITY	15D. UNIT	15E. UNIT PRICE	15F. AMOUNT
	The contractor shall perform the services in Section C according to the terms, conditions, and specifications attached hereto. BEST AVAILABLE COPY				
15G. TOTAL AMOUNT OF CONTRACT					\$165,000

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CONTRACTING OFFICER WILL COMPLETE ITEM 17 OR 18 AS APPLICABLE

17. CONTRACTOR'S NEGOTIATED AGREEMENT (Contractor is required to sign this document and return 3 copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all the services set forth or otherwise identified above and on any continuation sheets for the consideration stated herein. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award/contract, (b) the solicitation, if any, and (c) such provisions, representations, certifications, and specifications, as are attached or incorporated by reference herein. (Attachments are listed herein.)

18. AWARD (Contractor is not required to sign this document.) Your offer on Solicitation Number _____ including the additions or changes made by you which additions or changes are set forth in full above, is hereby accepted as to the items listed above and on any continuation sheets. This award consummates the contract which consists of the following documents: (a) the Government's solicitation and your offer, and (b) this award/contract. No further contractual document is necessary.

19A. NAME AND TITLE OF SIGNER (Type or print) **ROBERT A. BISSON**
 19B. NAME OF CONTRACTOR BY *Robert A. Bisson*
 (Signature of person authorized to sign)
 19C. DATE SIGNED **April 6, 1992**
 20A. NAME OF CONTRACTING OFFICER **James C. Athanas**
 20B. UNITED STATES OF AMERICA BY *James C. Athanas*
 (Signature of Contracting Officer)
 20C. DATE SIGNED **APR 8 1992**

SECTION B

SERVICES AND COSTS

B.1. SERVICES

For the period specified in Section F of this contract, the Contractor shall provide the services described in Section C, D, F, and H of this contract, for the firm fixed price shown below.

B.2. FIXED PRICE

- (a) The firm fixed price of this contract is \$165,000.
- (b) Payment shall be made according to the schedule set forth in Section F.3. following inspection and acceptance (see Section E of this contract) of all of the services described in Sections C.2. and C.5. and all of the deliverables described in Section C.4. of this contract.

End of Section B

SECTION C

STATEMENT OF WORK

C.1. Objective

On the basis of his work in the U.S. and at the designated sites, the contractor shall prepare a summary-type prefeasibility study of the appropriateness of employing new technologies to determine the extent and prospects for tapping fractured-bedrock water resources in the target areas of Botswana and Ethiopia. In Ethiopia, the primary goal will be to improve water access for refugees and people in otherwise economically viable sections for the southeastern and northeastern areas (Ogaden and, possibly Eritrea). In Botswana, the focus will be primarily on the northern area of the country that is within the influence of the Okavango and Chobe river systems (the Okavango Delta and its environs, with particular emphasis on the environmental impact of alternative approaches to water resource exploration, development and use.

C.2. Scope of Work

As preparation for developing the required prefeasibility report, the contractor shall perform the following tasks relative to the Ogaden (and possibly Eritrea) region of Ethiopia and the Okavango Delta area in Botswana:

- C.2.a. Conduct interviews and review appropriate reports and literature so the contractor will be adequately apprised of current political, social, environmental, and economic conditions in the target study areas;
- C.2.b. Review recent water exploration, water resources planning, water use policy, and development activities in the target areas to develop an understanding of near term water needs and potential supply and use issues;
- C.2.c. Collect and assess maps, aerial photographs, satellite imagery, logs, and other relevant inputs to establish the potential feasibility of applying the mega-watershed exploration model to better define fractured-bedrock water resources, drainage systems, and recharge capacities influencing the target areas;
- C.2.d. Survey local, and if necessary, regional resources of potential commodity, equipment, professional, technical

and other essential supplies or services to determine their basic appropriateness and availability for supporting a subsequent and more detailed program (Phase II) of assessment, exploration, and water resource definition (including, as appropriate, the drilling of some test wells in Phase II) to confirm the viability and cost-effectiveness of the megawatershed exploration techniques, and projected ranges of water quality and sustainable yields;

C.2.e. Discuss the technology and potential program with local USAID staff, NGOs, other donors, and relevant Host Country agents (public and private), so knowledge can be exchanged and the potential interests (programmatic, technical, including environmental impact, financial) of these other parties in subsequent planning and exploration activities determined;

C.2.f. Identify opportunities, approximate costs, and possible risks with the implementation of a Phase II technology application and test drilling program. Also the contractor shall consider the relevance and cost-effectiveness of using Geographic Information System (GIS) technology to enhance the utility of the mega-watershed concept for planners and implementors;

C.2.g. Refine all of the foregoing information into a prefeasibility report which will give insights about the potential pros and cons of proceeding with a more advanced (Phase II) program. This prefeasibility report will include a program and resource plan for a Phase II endeavor, if appropriate, and make recommendations as to basic technical and physical objectives, resources, costs, implementation steps and issues, program outputs, and activity performance measures.

C.3. At A.I.D.'s request, the contractor agrees to be available to travel to Ethiopia and/or Botswana to brief USAID and/or Host Country officials on the reports, its conclusions, and the details of its work. The costs for such travel and services, if requested by A.I.D., shall be negotiated and paid separately from this contract.

C.4. Reports and Deliverables

C.4.a. Upon completion of preliminary U.S.-based research and assembly of documents needed to support field work, the contractor shall submit to A.I.D. a workplan and schedule for completing field work, subsequent assessments, and the drafting of the prefeasibility report.

- C.4.b. The contractor shall submit to the cognizant project officer 3 copies of the draft prefeasibility report as more fully described in the contractor's unsolicited proposal.
- C.4.c. Upon completion of all activities described above, the contractor shall submit 5 copies of the final prefeasibility report to the A.I.D. cognizant project officer.
- C.5. The contractor's unsolicited proposals dated October 31, 1991 and December 6, 1991 are incorporated herein by reference.

End of Section C

SECTION D

PACKAGING AND MARKING

D.1. REPORTS

Pursuant to the clause of this contract entitled "Reports" (AIDAR 752.7026), the cover page of all reports prepared by the Contractor (see Section F of this contract) shall include the project name, the project number, and the contract number.

D.2. 52.252-2, CLAUSES INCORPORATED BY REFERENCE (JUN 1988)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request the Contracting Officer will make their full text available.

A.I.D. Acquisition Regulation (78 CFR Chapter 7) Clauses

752.7009, Marking (APR 1984)

752.7026, Alternate 70, Reports (JUN 1987)

END SECTION D

SECTION E

INSPECTION AND ACCEPTANCE

E.1. RESPONSIBLE OFFICIAL

In accordance with the clauses of this contract entitled "Inspection of Services - Fixed Price" (FAR 52.246-04) and "Limitation of Liability - Services" (FAR 52.246-25), inspection and acceptance of all services and supplies required hereunder shall be made only by the cognizant AID Project Officer (see Section G of this contract). Inspection and acceptance of services and supplies by the cognizant AID Project Officer shall form the basis for payments to the Contractor.

End of Section E

SECTION F

DELIVERIES OR PERFORMANCE

F.1. PERIOD OF CONTRACT

The effective date of this contract is April 7, 1992 and the estimated completion date is June 16, 1992.

F.2. REPORTS

The services called for hereunder shall be delivered in accordance with the report schedule included in Section C.4.

F.3. PAYMENT PROVISION

For completion of tasks set forth in Section C.2. and C.5. and upon inspection and acceptance of the deliverables described in Section C.4., the Contractor shall be paid according to the following schedule:

- a. Upon acceptance of the workplan and schedule, the contractor shall be paid 30% of the firm fixed price.
- b. Upon acceptance of the draft report, the contractor shall be paid 20% of the firm fixed price.
- c. Upon acceptance of the final report, the contractor shall be paid the balance (50%) of the firm fixed price.

F.4. TECHNICAL DIRECTIONS

Performance of the work hereunder shall be subject to the technical directions of the cognizant A.I.D. Project Officer. As used herein, "Technical Directions: are directions to the Contractor which fill in details, suggest possible lines of inquiry, or otherwise complete the general scope of the work. "Technical Directions" must be within the terms of this contract, shall not change or modify them in any way, and shall not constitute changes (as described in the clause of this contract entitled "Changes - Fixed Price" (FAR 52.243-01, Alternate I), which may only be accomplished by the Contracting Officer.

F.5. KEY PERSONNEL

- a) The key personnel which the Contractor shall furnish for the performance of this contract are as follows:

Mr. Robert Bisson

- b) The personnel specified above are considered to be essential to the work being performed hereunder. The listing of key personnel may be amended only with prior written approval from the Contracting Officer.

End of Section F

SECTION G

CONTRACT ADMINISTRATION DATA

G.1. COGNIZANT A.I.D. PROJECT OFFICER

The cognizant A.I.D. Project Officer is Frank Kenefick, C/AID, or his designee.

G.2. PAYMENT OFFICE

The payment office is the Agency for International Development, Office of Financial Management, FA/FM/CMPD/DC, Room 700, SA-2, Washington, D.C. 20523-0209.

G.3. POST-AWARD CONTRACT ADMINISTRATION OFFICE

The contract administration office is the AOT Branch, Division A, Office of Procurement, Directorate of Finance and Administration, Washington, D.C. 20523-1425.

G.4. ACCOUNTING DATA

Funds currently obligated in this contract are chargeable as follows:

PIO/T NO.:	2681800
Appropriation No.:	72-1121021.3
Budget Plan Code:	EDNA-92-16820-KG-11
Allotment No.:	243-38-099-00-20-21
Amount:	\$165,000
Funding Source:	AID/W

End of Section G

SECTION H

SPECIAL CONTRACT REQUIREMENTS

H.1. EMERGENCY LOCATOR INFORMATION

The Contractor agrees to provide the following information to the USAID Executive Officer on or before the arrival in the Cooperating Country of every contract employee or dependent:

- a) The individual's full name, home address, and telephone number.
- b) The name and number of the contract, and whether the individual is an employee or dependent.
- c) The Contractor's name, home office address, and telephone number, including any after-hours emergency number(s), and the name of the Contractor's home office staff member having administrative responsibility for the contract.
- d) The name, address, and telephone number(s) of each individual's next of kin.
- e) Any special instructions pertaining to emergency situations such as power of attorney designees or alternate contract persons.

H.2. LOGISTIC SUPPORT

The Contractor shall be responsible for providing or arranging for all logistic support required for performance hereunder.

End of Section H

SECTION I- CLAUSES FOR FIXED PRICE CONTRACTS FOR SUPPLIES OR SERVICES

CONTRACT CLAUSES

I.1. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES

52.252-02 - Clauses Incorporated by Reference (JUN 1988)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available.

- (X) 52.202-01 Definitions (APR 1984)
- (X) 52.203-01 Officials Not to Benefit (APR 1984)
- (X) 52.203-03 Gratuities (APR 1984)
- (X) 52.203-05 Covenant Against Contingent Fees (APR 1984)
- (X) 52.203-07 Anti-Kickback Procedures (OCT 1988)
- (X) 52.203-11 Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions
- (X) 52.203-12 Limitation on Payments to Influence Certain Federal Transactions (Jan 1990)
- (X) 52.209-5 Certification Regarding Debarment, Suspension, Proposed Debarment, and Other Responsibility Matters.
- (X) 52.212-13 Stop-Work Order (AUG 1989)
- (X) 52.212-15 Government Delay of Work (APR 1984)
- (X) 52.215-01 Examination of Records by Comptroller General (APR 1984)
- (X) 52.215-02 Audit-Negotiation (DEC 1989)
- (X) 52.215-22 Price Reduction for Defective Cost or Pricing Data (JAN 1991)
- (X) 52.215-33 Order of Precedence (JAN 1986)
- (X) 52.219-08 Utilization of Small Business Concerns and Small Disadvantaged Business Concerns (FEB 1990)
- (X) 52.219-13 Utilization of Women Owned Small Businesses (AUG 1986)
- (X) 52.220-03 Utilization of Labor Surplus Area Concerns (APR 1984)
- (X) 52.222-03 Convict Labor (APR 1984)
- (X) 52.222-21 Certification of Nonsegregated Facilities
- (X) 52.222-22 Previous Contracts and Compliance Reports
- (X) 52.222-25 Affirmative Action Compliance
- (X) 52.222-26 Equal Opportunity (APR 1984)
- (X) 52.222-29 Notification of Visa Denial (APR 1984)

- (X) 52.244-01 Subcontracts (Fixed-Price Subcontracts)
(JAN 1986)
- (X) 52.244-05 Competition in Subcontracting (APR 1984)
- (X) 52.246-04 Inspection of Services - Fixed-Price (APR 1984)
- (X) 52.246-25 Limitation of Liability - Services (APR 1984)
- (X) 52.247-63 Preference for U.S.-Flag Air Carriers (APR 1984)
- (X) 52.249-01 Termination for Convenience of the Government
(Fixed-Price) (APR 1984)
- (X) 52.249-08 Default (Fixed-Price Supply and Service) (APR
1984)
- (X) 52.249-04 Termination for Convenience of the Government
(Services) (Short Form) (APR 1984)
- (X) 52.251-01 Government Supply Sources (APR 1984)

52.252.04 ALTERATIONS IN CONTRACT (1984)

Portions of this contract are altered as follows:

- (1) The clause prescribed in 52.203-1 refers to United States Officials.
- (2) The following supplemental coverage is added to the clause specified in 52.228-3:
 - (a) The Contractor agrees to procure Defense Base Act (DBA) insurance pursuant to the terms of the contract between AID and AID's DBA insurance carrier unless the Contractor has a DBA self insurance program approved by the Department of Labor or has an approved retrospective rating agreement for DBA.
 - (b) If AID or the Contractor has secured a waiver of DBA coverage (see AIDAR 728.305-70(a)) for contractor's employees who are not citizens of, residents of, or hired in the United States, the contractor agrees to provide such employees with worker's compensation benefits as required by the laws of the country in which the employees are working, or by the laws of the employee's native country, whichever offers greater benefits.
 - (c) The Contractor further agrees to insert in all subcontracts hereunder to which the DBA is applicable, a clause similar to this clause, including this sentence, imposing on all subcontractors a like requirement to provide overseas workmen's compensation insurance coverage and obtain DBA coverage under the AID requirements contract.
- (3) The clause prescribed in 52.229-06 refers to United States taxes.

I.2. A.I.D. ACQUISITION REGULATION (48 CFR CHAPTER 7) CLAUSES

- (X) 752.202-01 AID Definitions Clause -- General Supplement for Use in All AID Contracts (JAN 1990)
- (X) 752.202-01(b), Alt. 72 AID Definitions Clause - Supplement For AID Contracts Involving Performance Overseas (DEC 1986)
- (X) 752.203-01 Officials Not to Benefit (APR 1984)
- (X) 752.219-08 Utilization of Small Business Concerns and Small Disadvantaged Business Concerns (APR 1984)
- (X) 752.7001 Biographical Data (DEC 1988)
- (X) 752.7004 Source and Nationality Requirements (APR 1989)
- (X) 752.7005 Language, Weights, and Measures (APR 1984)
- (X) 752.7006 Notices (APR 1984)
- (X) 752.7008 Use of Government Facilities or Personnel (APR 1984)
- (X) 752.7010 Conversion of U.S. Dollars to Local Currency (APR 1984)
- (X) 752.7013 Contractor - Mission Relationships (OCT 1989)
- (X) 752.7015 Use of Pouch Facilities (APR 1984)
- (X) 752.7025 Approvals (APR 1984)
- (X) 752.7026 Reports (OCT 1989)
- (X) 752.7027 Personnel (DEC 1990)
- (X) 752.7029 Post Privileges (DEC 1990)
- (X) 752.7032 International Travel Approval and Notification Requirements (JAN 1990)
- (X) 752.7033 Physical Fitness (DEC 1990)

End of Section I

Bisson Exploration Services Company

Post Office Box 431 • Fairfax, Virginia 22030-0431

Agency for International Development
Office of Financial Management
FA/FM/CMPD/DC, Room 700, SA-2
Washington, DC 20523-0209

Telephone: (703) 352-8658

INVOICE NUMBER 1001

Date: April 14, 1992

Agency for International Development
Office of Financial Management
FA/FM/CMPD/DC
Room 700, SA-2, Washington, D.C. 20253-0209

REF: Contract #AOT-0800-C-00-2060-00

For completion of deliverables, in accordance with payment provisions set forth in Section F.3.a of the above referenced fixed-price contract:

"...upon acceptance of the workplan and schedule, the contractor shall be paid 30% of the firm fixed price."

Since the total fixed price of the contract is \$165,000., this invoice is requesting a disbursement of \$49,500.

Please pay this amount by wire transfer to the account of:

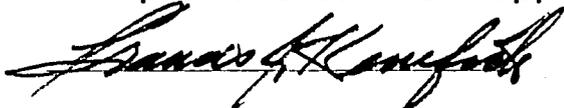
ROBERT A. BISSON
FIRST VIRGINIA BANK (FALLS CHURCH, VIRGINIA 22042)
Account #05600 1118 5061 3839 0128

Sincerely,

Robert A. Bisson
Contractor

<u>Contract Amount</u>	<u>Invoiced</u>	<u>Unbilled Balance</u>
\$165,000	49,500	\$115,500

Workplan and schedule approved by USAID Project Officer



16

Telephone: (703) 352-8658

April 14, 1992

Mr. Frank Kenefick, C/AID
Agency for International Development
Office of Financial Management
FA/FM/CMPD/DC, Room 700, SA-2
Washington, DC 20523-0209

Ref: Contract #AOT-0800-C-00-2060-00
PIU/T #2681800

Dear Mr. Kenefick,

Per the statement of work description of Reports and Deliverables, Section C.4.a., of contract number AOT-0800-C-00-2060-00, dated April 7, 1992, I have enclosed my work plan and schedule for completing field work, subsequent assessments and the drafting of the prefeasibility report.

Further, I have completed the preliminary US-based research and have assembled the documents needed to support the field work described herein. This US-based work included interviews with experts from my project team and key outside specialists on environmental problems in Botswana and refugee issues in the Ethiopia region. In order to update and fine-tune the work plan, I have also met with key individuals from Botswana (who visited me in DC) and from the IUCN team, as well as FHA and OFDA officials.

Sources of useful data have been identified and substantial amounts of documentation assembled and preliminarily reviewed including several dozen Landsat image scenes covering much of Botswana and Africa's Horn, as well as large format camera coverage, aerial photographs and substantial mapped information of vegetation, climate, rainfall, geology, geophysical data and scientific papers covering much of the regions under investigation. We now actually are in possession of most of these materials and are prepared to employ them during the coming weeks, in the process of preparing the prefeasibility study report/phase II exploration plan for Botswana and Ethiopia.

I have also had discussions with Martin Beyer and several outside team member experts concerning the test drilling component of the project and expect to meet with Ethiopian and Botswanan government officials, NGOs and private drilling contractors regarding the timing and logistical requirements, along with possible cooperation from these entities in the financing and implementation of the drilling part of Phase II testing.

Telephone: (703) 352-8658

April 14, 1992
Letter, Page 2

My recent conversations with key people at OFDA and IUCN strongly indicate that time is of the essence on this project and that near-term completion of this prefeasibility study is high priority to US AID. At the same time, the response I have received from my team and interested parties in Botswana and Ethiopia, along with the very substantial amount of valuable data currently in our possession, gives me great encouragement. I believe the project's goals can and will be met in a timely fashion and look forward to working with you and your US AID colleagues toward that worthy end.

Sincerely,



Robert A. Bisson

RAB:rms

Enclosures

18



U.S. AGENCY FOR
INTERNATIONAL
DEVELOPMENT

April 15, 1992

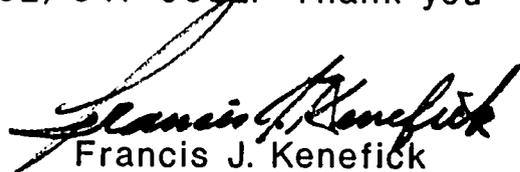
TO WHOM IT MAY CONCERN:

REF: A.I.D. Contract #AOT-800-C-00-2060-00

Mr. Robert Bisson, president of Bisson Exploration Services, and a team of water resources scientists and technologists are going to be working under contract with A.I.D. to review the applicability of new satellite-based technology in the location of better water resources in Ethiopia and Botswana and nearby areas where water problems and drought conditions are in evidence. This new technology might be helpful to recipient governments, private sector entities, and voluntary organizations as they struggle to respond to current and future water shortages.

Because the team's travel through or within a particular country will be necessary to assess the feasibility of this technology, any assistance or consideration that can be given to them, such as in processing visas or other needed documentation, will be greatly appreciated.

Funding for this prefeasibility study is being provided by A.I.D.'s Bureau for Food and Humanitarian Assistance. If you have any questions about this technical assistance activity, please contact me at (202) 647-9662. Thank you for your help in these regards.


Francis J. Kenefick
Contract Technical Officer

AGRICULTURE

MAP 2

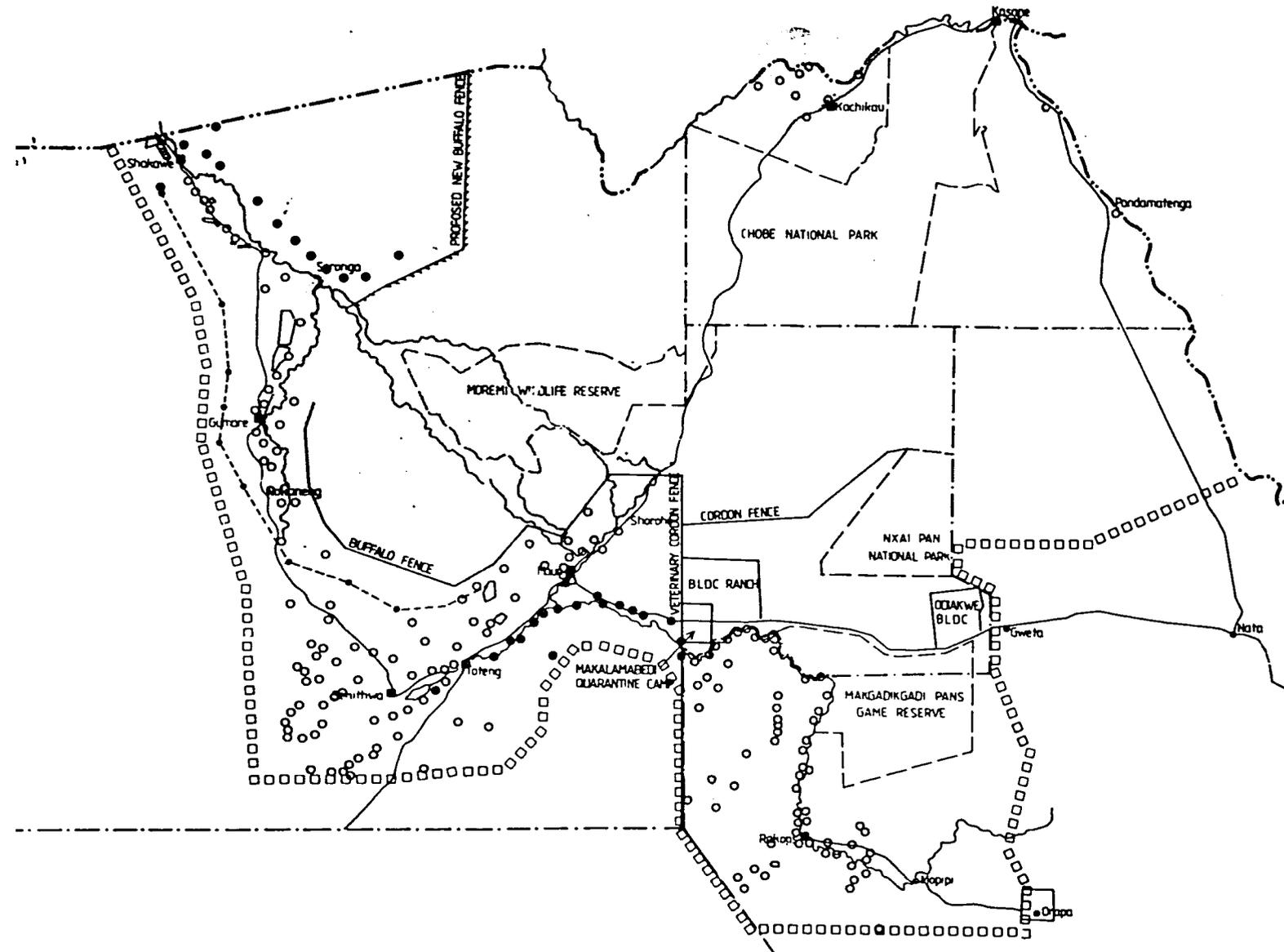
LIVESTOCK INFRASTRUCTURE

LEGEND

- Fence lines, including "bush fences"
- Proposed fence
- - - Proposed trek route with borehole
- (o) Cattle crush (location approximate)
- ▲ Abattoir
- Livestock advisory centre

Note: Some cattle crushes could not be mapped as their locations were unknown, or their names were not as shown on reference maps.

Information compiled from
 LUO, Ngamiland
 DOL, Chobe
 Veterinary Department, Gaborone
 Bendsen & Gelmoth, 1983



PROGRAMME FOR THE PLANNING OF
 RESOURCE UTILIZATION IN THE
 OKAVANGO DELTA REGION

DEPARTMENT OF TOWN AND REGIONAL PLANNING

swedepian

MINISTRY OF LOCAL GOVERNMENT AND LANDS
 PRIVATE BAG 0042, GABORONE

DATE: DEC 1988

1:2 000 000

50 100 150 200 KM

□□□□ STUDY AREA BOUNDARY

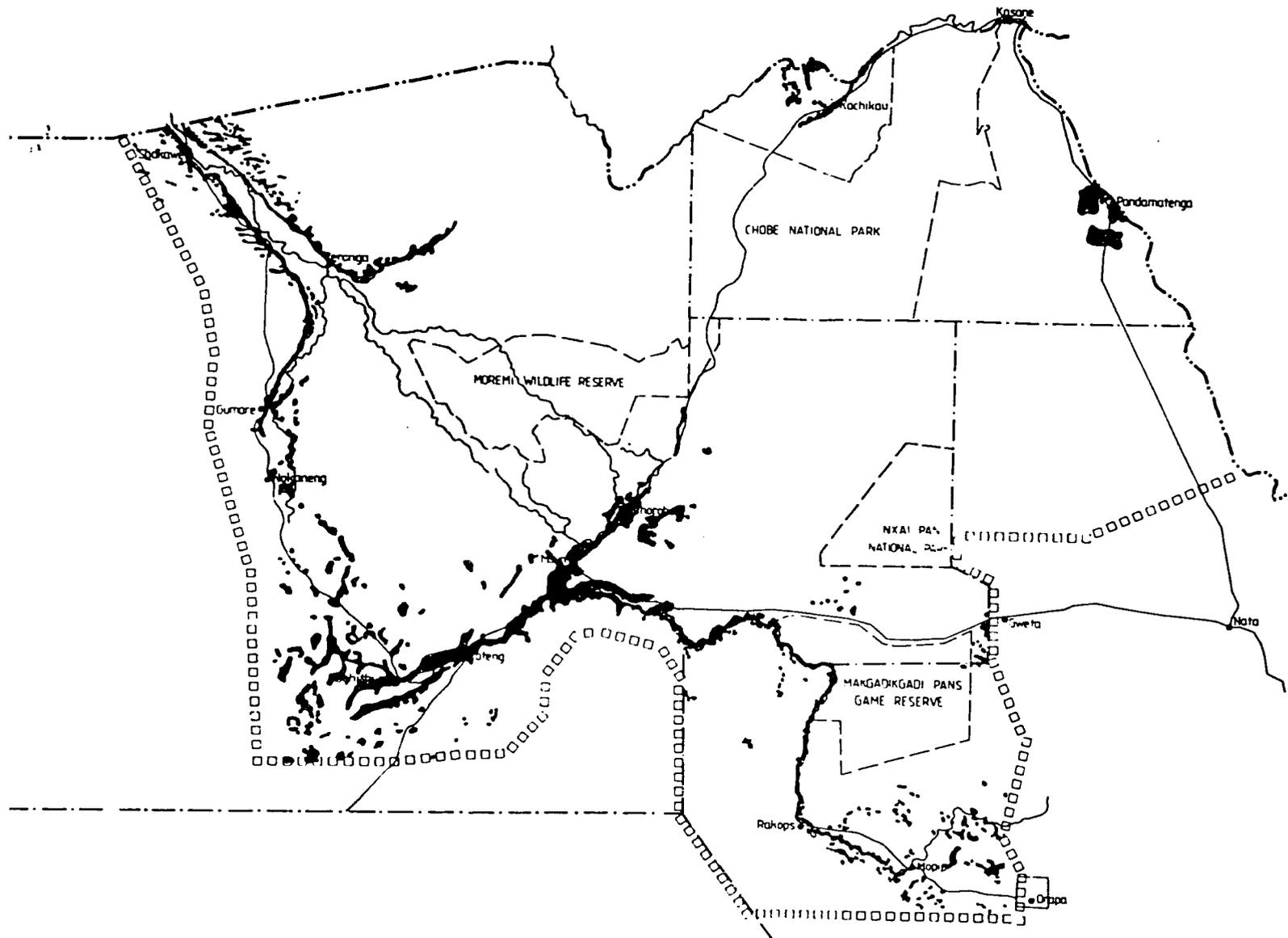
AGRICULTURE

MAP 1
AREAS OF CULTIVATION

LEGEND

 Areas within which cultivation occurs

Note: The percentage of area cultivated within each demarcated zone varies widely. Both dryland and molapo cultivation is covered. For more detailed information see 1:50 000 scale maps at Ministry of Agriculture, Gaborone and Maun. For Ngamiland and Chobe, MLGL Gaborone and Serowe for Boteti. For details on latest cultivation at Pandamatenga see D.A. Chobe.



PROGRAMME FOR THE PLANNING OF
RESOURCE UTILIZATION IN THE
OKAVANGO DELTA REGION

DEPARTMENT OF TOWN AND REGIONAL PLANNING

 swedeplan

MINISTRY OF LOCAL GOVERNMENT AND LANDS
PRIVATE BAG 0042, GABORONE

DATE: JAN 1989



1:2 000 000

--- STUDY AREA BOUNDARY

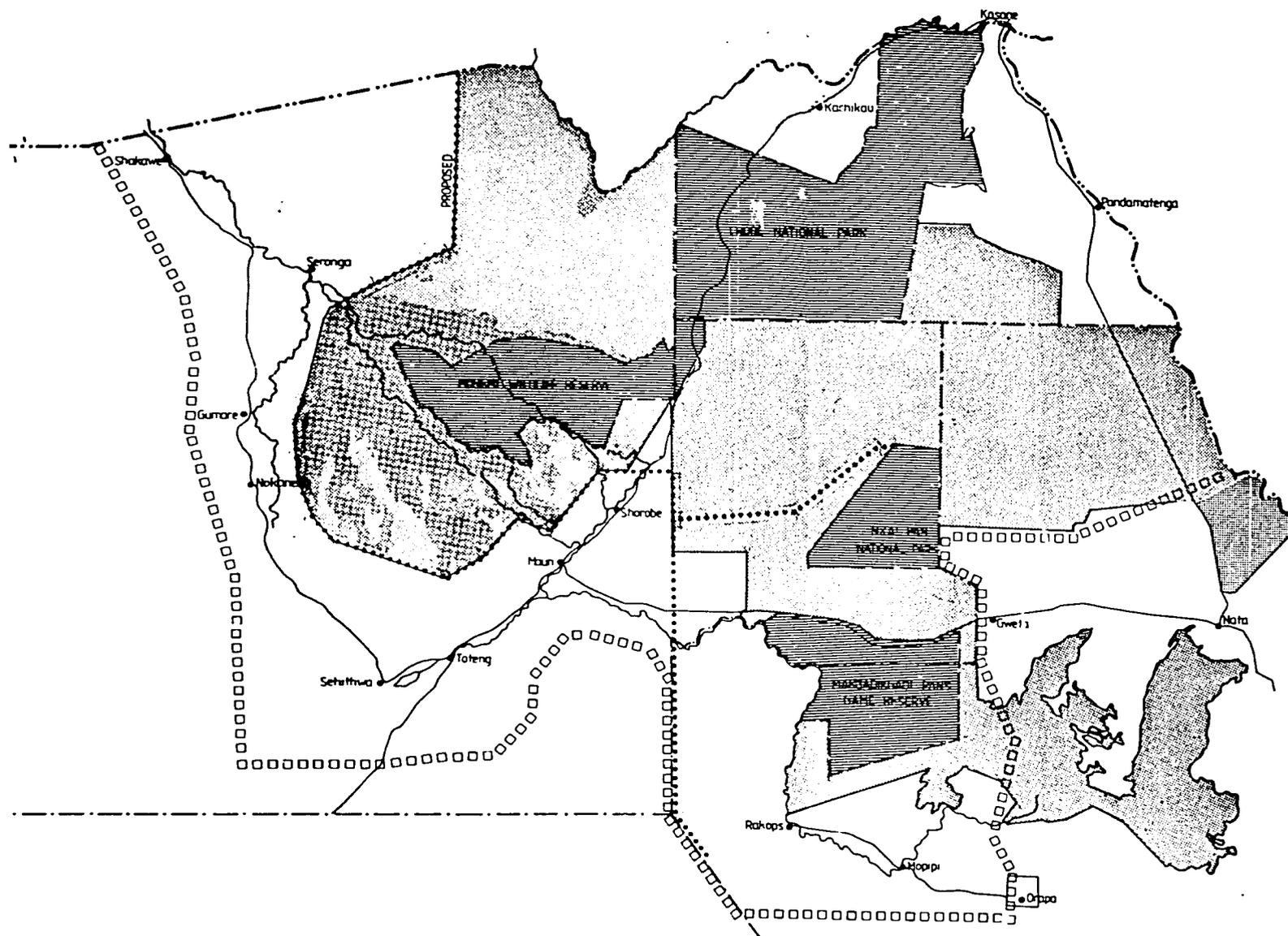
WILDLIFE UTILIZATION

MAP 2 NATIONAL PARKS, GAME RESERVES AND WILDLIFE MANAGEMENT AREAS

(MODIFIED FROM MLGL, NATIONAL LAND USE MAP (1987))

LEGEND

-  National Parks and Game Reserves
-  Proposed Wildlife Management Areas
-  Fences



PROGRAMME FOR THE PLANNING OF
RESOURCE UTILIZATION IN THE
OKAVANGO DELTA REGION

DEPARTMENT OF TOWN AND REGIONAL PLANNING

 swedeplan

MINISTRY OF LOCAL GOVERNMENT AND LANDS
PRIVATE BAG 0042, GABORONE

DATE: DEC 1988

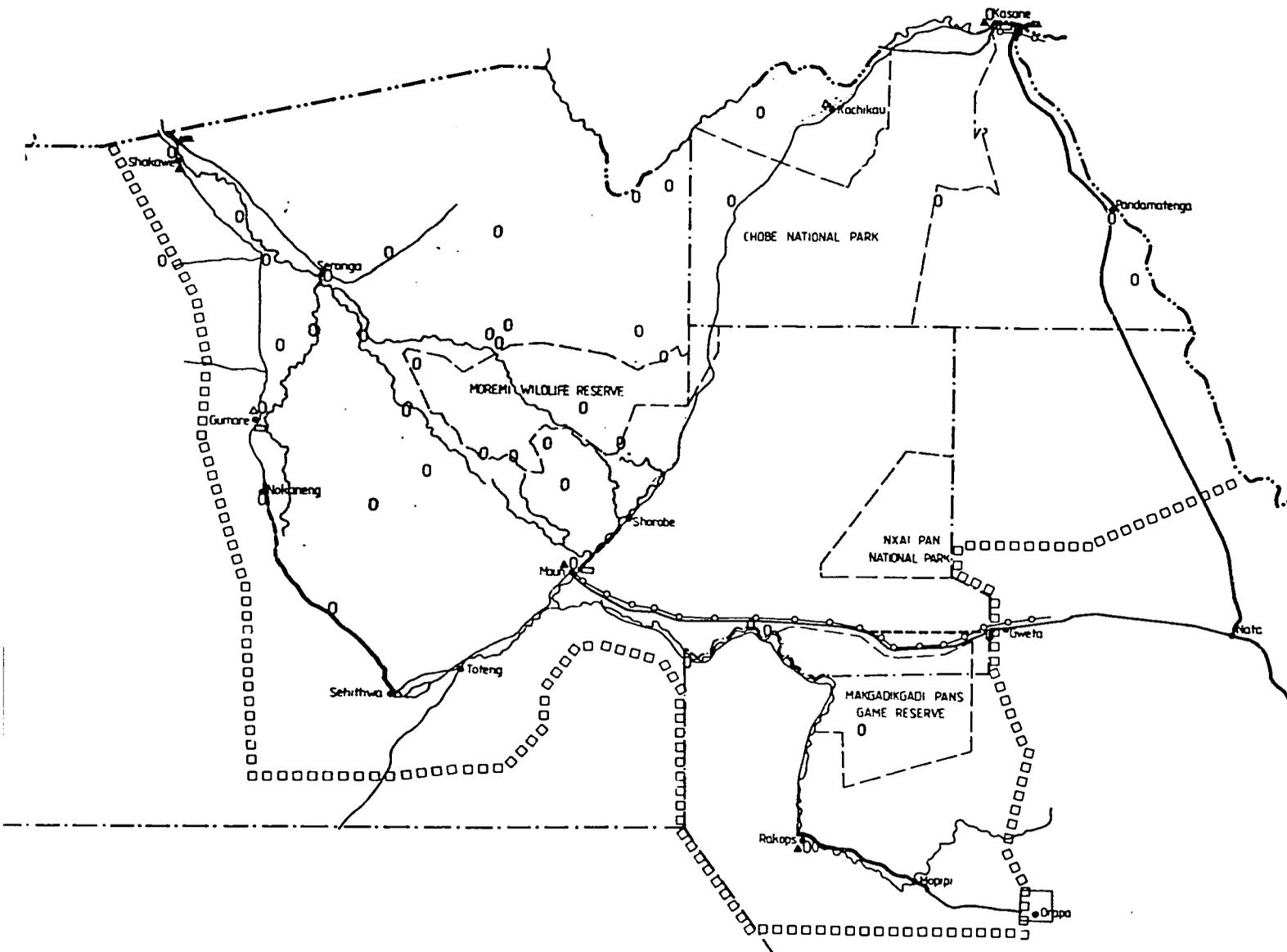


1:2 000 000

50 100 150 200 KM

□□□□ STUDY AREA BOUNDARY

INFRASTRUCTURE



LEGEND

- Tamed (planned) road
- Gravel road
- Earth/sand road
- Power distribution
- Air strip
- Telecommunication line
- ▲ Post office
- ▲ Postal agency
- ▣ Ferry



E 1:2 000 000

50

100

150

200 KM

□□□□ STUDY AREA BOUNDARY

PROGRAMME FOR THE PLANNING OF
RESOURCE UTILIZATION IN THE
OKAVANGO DELTA REGION

DEPARTMENT OF TOWN AND REGIONAL PLANNING

 swedeplan

MINISTRY OF LOCAL GOVERNMENT AND LANDS
PRIVATE BAG 0042, GABORONE

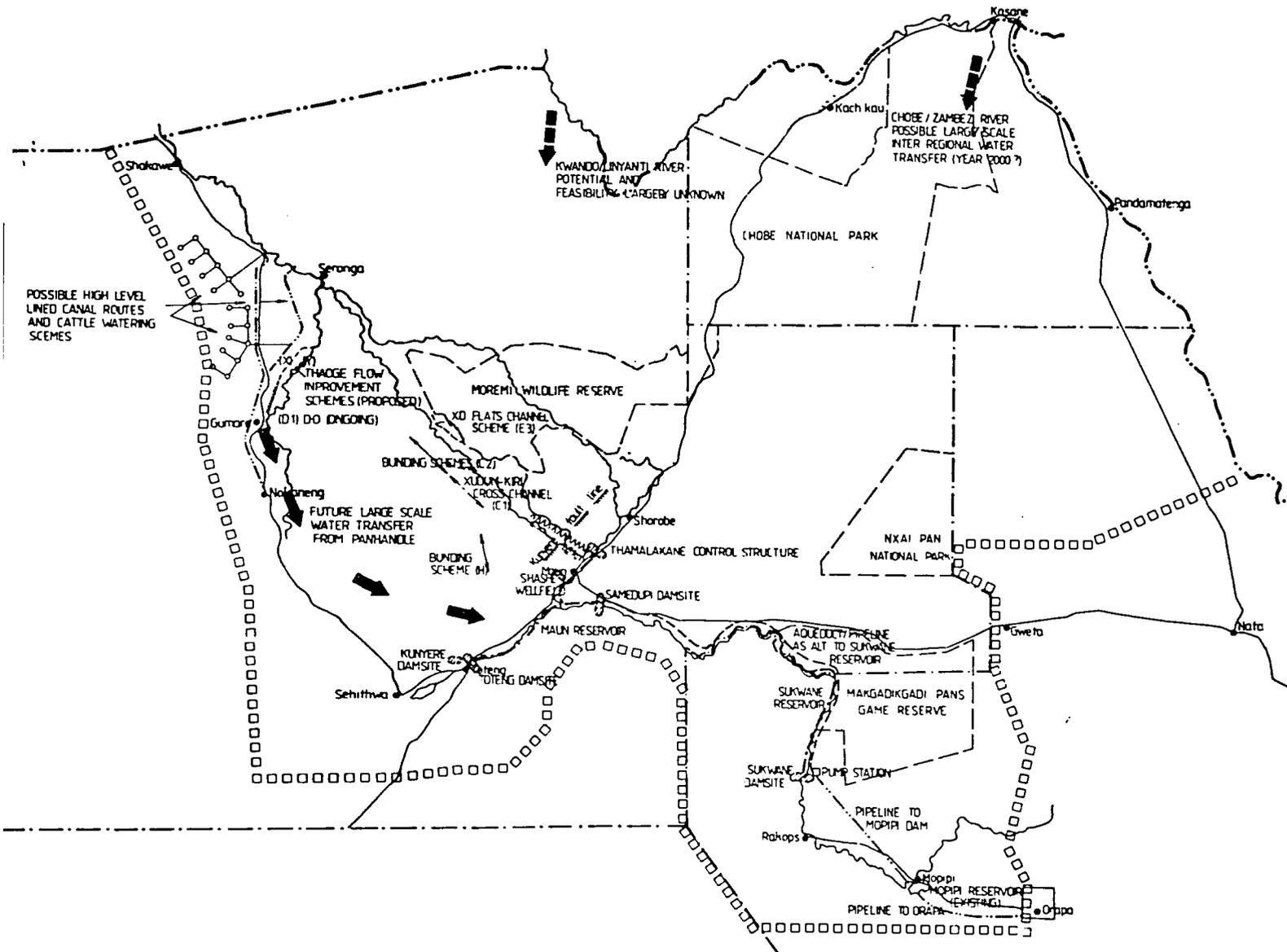
DATE: JAN 1989

WATER USE AND TRANSFER

LEGEND

-  Proposed damsites/control structures
-  Planned/investigated transfer schemes
-  Ongoing transfer scheme (compl. approx. first half 1988)
-  Planned/investigated transfer
-  Possible transfer
-  Proposed dredging
-  Wellfield
-  Planned reservoir

Information compiled from
SMEC 1987, 1987a
VIAK 1984



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SCALE 1:2 500 000

0 50 100 150 200 KM

□□□□ STUDY AREA BOUNDARY

CLIMATE

MAP 1

RAINFALL, AGRO-CLIMATOLOGICAL ZONES

LEGEND

- ⊕ Synoptic station
- ⊖ Agricultural research station
- Climatic station
- ⊙ Rainfall station
- △ Evaporation pan
- Automatic weather station
- 983 m - height A.M.S.L.
1926-87 - period of record
524 mm, 925, 243 - mean, max, min annual rainfall
63, 50, 28, 17, 7, 5 - mean annual number of days with rainfall
≥0,1, ≥1, ≥5, ≥10, ≥20 (mm)
192 - maximum daily rainfall
- 1050 m
1971-86* - significant gaps in records
474 mm* - adjusted
- Agro climate zone line
- Average annual rainfall
- 1^b 2 Agro climatic zones

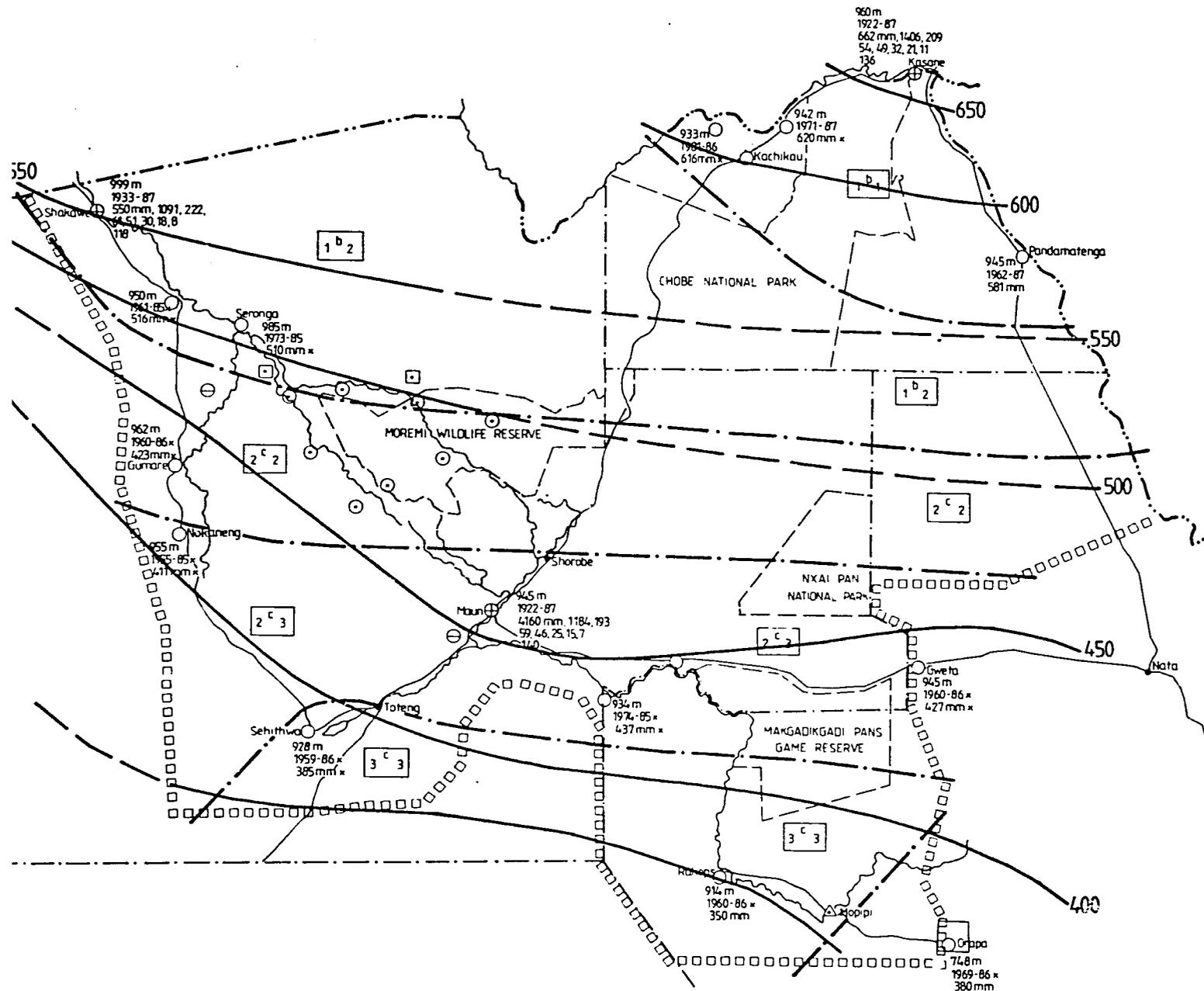
Length of season		Number of dry days within the season	Length of humid period	
Duration (days)	Frequency (%)		Duration (days)	Frequency (%)
1. 101-120	75-100	a. 0-10 b. 11-20 c. 21-30 d. 31-40 e. 41-50	1. 41-60	75-100
2. 81-100	75-100		2. 20-40	50-74
3. 61-80	75-100		3. 20-40	25-49
4. 41-60	75-100		4. 20-40	≥25
5. 41-60	75-100		5. 41-50	

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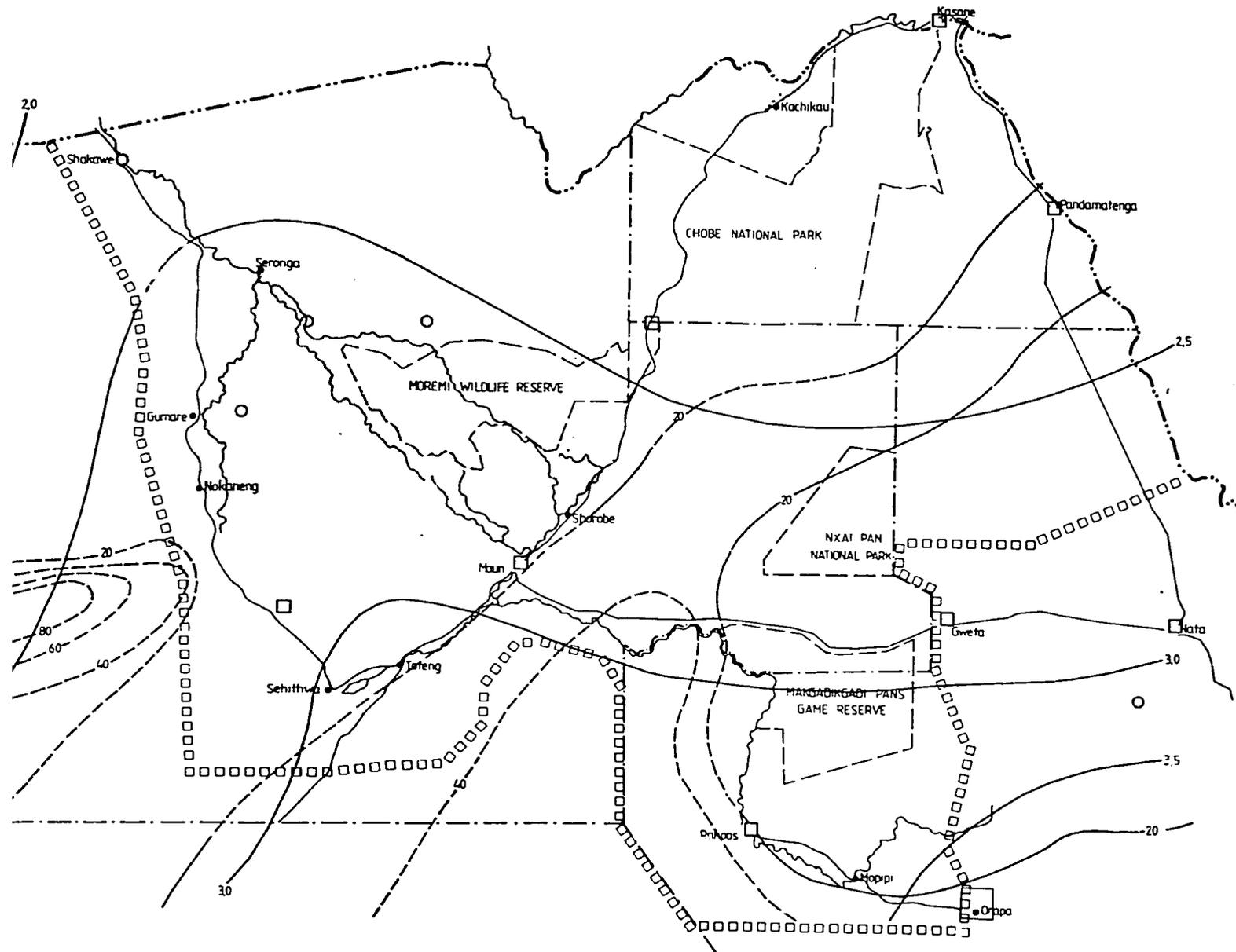


02

CLIMATE

MAP 2

WINDSPEED



LEGEND

- 2.0 — Windspeed m/s
- Anemometer H=10 m
- Anemometer H=2 m
- - - 20 - - - Depth to ground water surface

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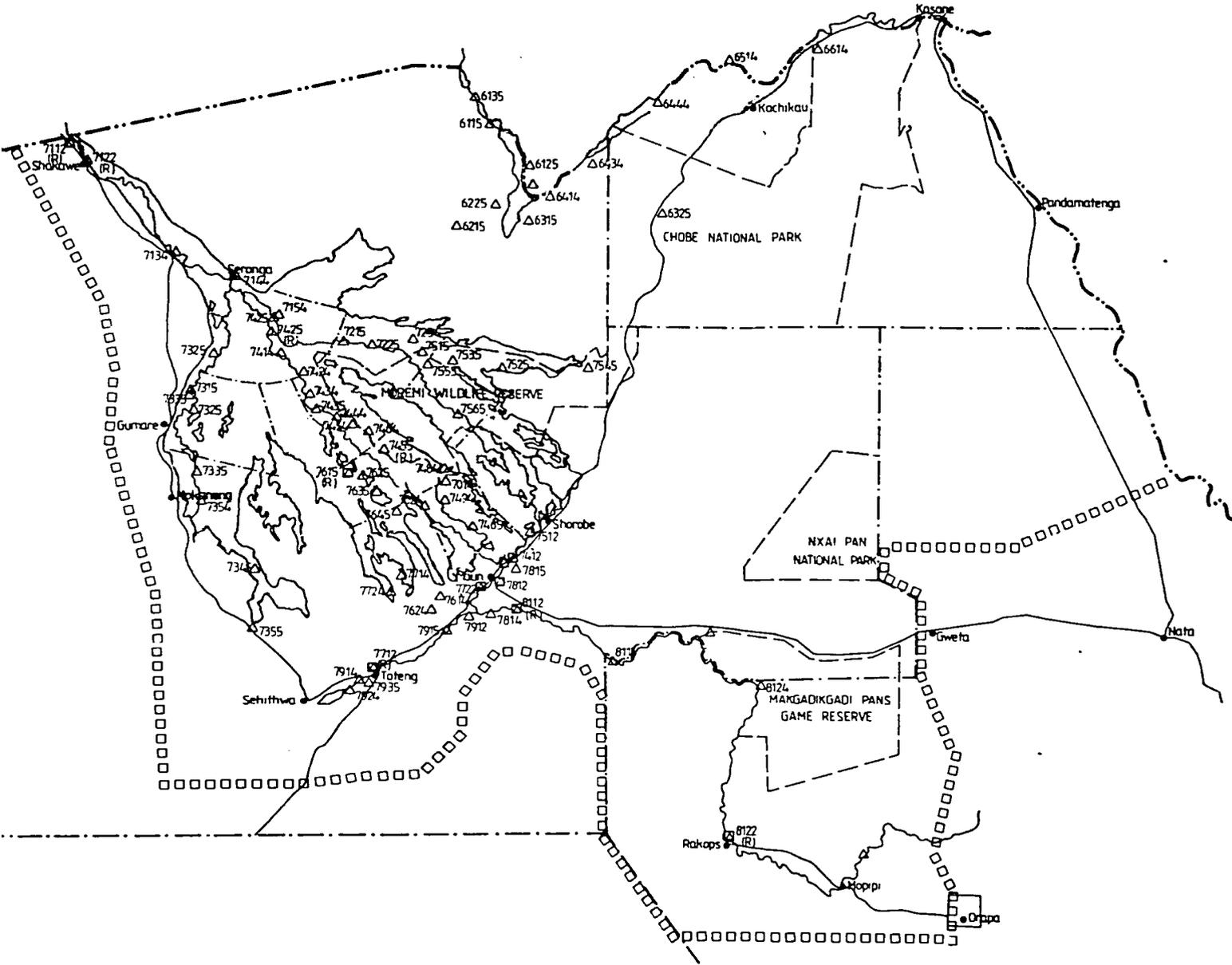
27

HYDROLOGY

HYDROLOGICAL CELLS AND STATIONS

LEGEND

- ◻ Water level data and discharge measurements
- Discharge measurements
- △ Water level data
(R) = Automatic recorder
- 7112 Station number (D.W.A. code)
- - - Cell division line (for hydrological model)
-  Approximate extent of seasonal flooding, for more detailed information on areas liable to flooding and dry land inside the delta see 1:350 000 or preferably 1:50 000 maps.



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GEOLOGY

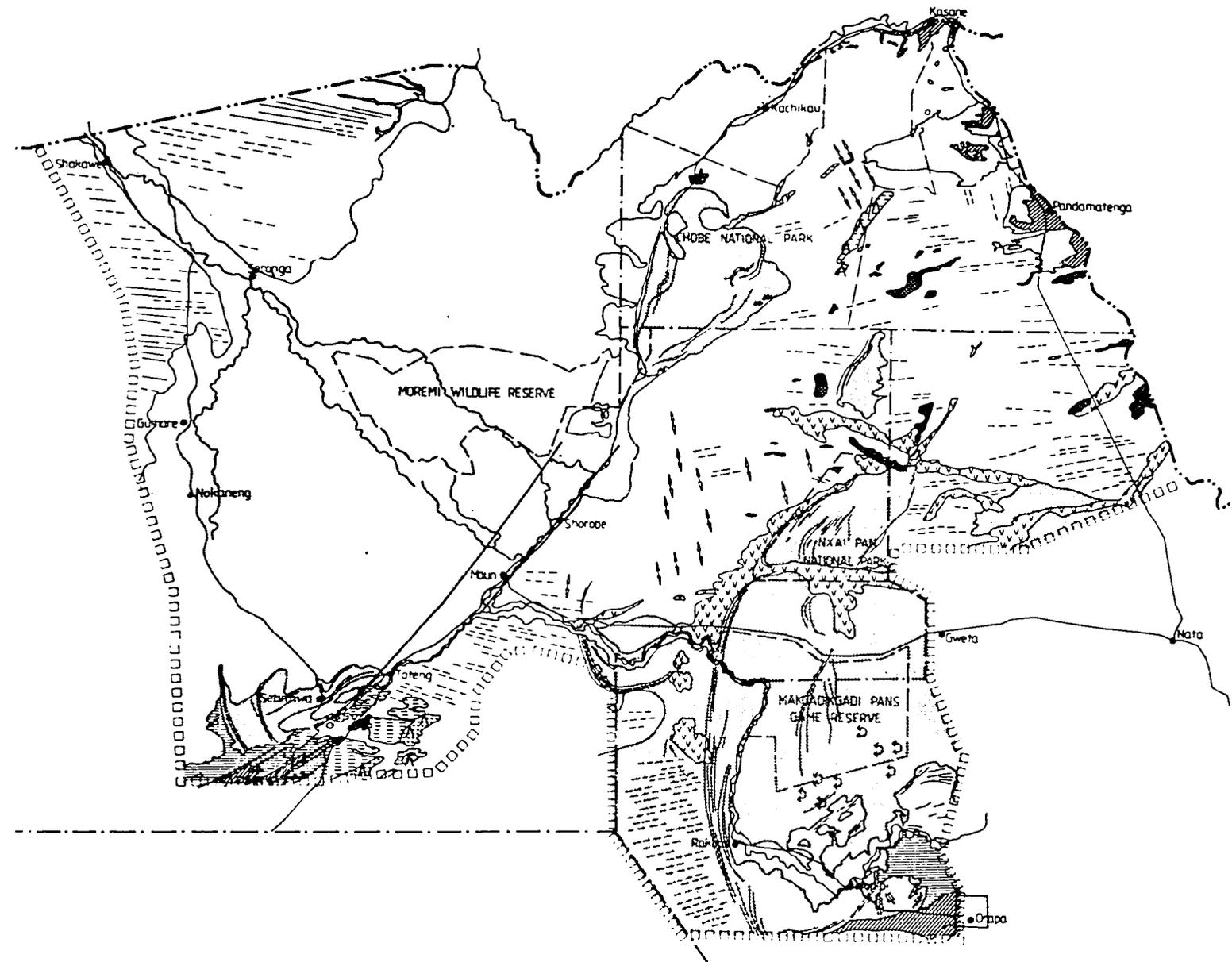
MAP 4

SUPERFICIAL GEOLOGY

(MODIFIED FROM PHOTOGEOLOGICAL MAP OF BOTSWANA, 1978)

LEGEND

-  Kalahari sand (aeolian). Ckr - Reddened Kalahari sand
-  Valley and depression deposits; mainly alluvium in the Okavango and in the east; alluvium and wind-blown silty sands on calcrete in Kalahari desert.
-  Pan and lake deposits
-  Mounds and wide ridges of Kalahari sand - including ridges of reworked lacustrine deposits in the Makgadikgadi Depression.
-  Basalts
-  Clastic sediments
-  Calcrete (Cc) and silcrete (Cs), for the most part with a thin sand cover.
-  Kgwebe formation - acid porphyres and volcaniclastic sediments.
-  Ghanzi group - sandstones, shales and limestones.
-  Hills
-  Fault
-  Kalahari beds - dune crest, shore lines.
-  Kalahari beds - inter-dune hollows; undifferentiated aeolian sand morphology trends
-  Kalahari beds - generalised dune crest trends in dune-fields



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SOILS

SOIL SURVEYS

LEGEND

Scale 1:50 000

- 1. Okavango Delta
- 2. Ngami/and District

Staring 1978
TGLP Soil map

Scale 1:250 000

- 3 Maun
- 4 Toteng
- 5 Savuti
- 6 Kasane
- 7 Basutos
- 8. Lake Ngami

FAO Soil Survey Team
Paul, 1983, FAO Soil Survey Team
Siderius 1971

9 Shorobe area

Scale 1:100 000

- 10 Chobe enclave Area

Baert, 1987, FAO Soil Survey Team

- 11. Western Fringe

SMEC 1987

- 12 Ngamaseri, Shakawe River Terrace

Rhebergen, 1988, FAO Soil Survey Team

Scale 1:50 000

- 13 Lake Ngami, the Nhabe and Boteti River

Rhebergen, 1986, FAO Soil Team

- 14 Boro - Shorobe area

Rhebergen, 1986, FAO Soil Team

- 15 Pandamatenga, northern plain

Remmelzwaal, van Wavere and Moganane, 1988, FAO Soil Survey Team

- 16 Lower Boteti

Breyer 1983

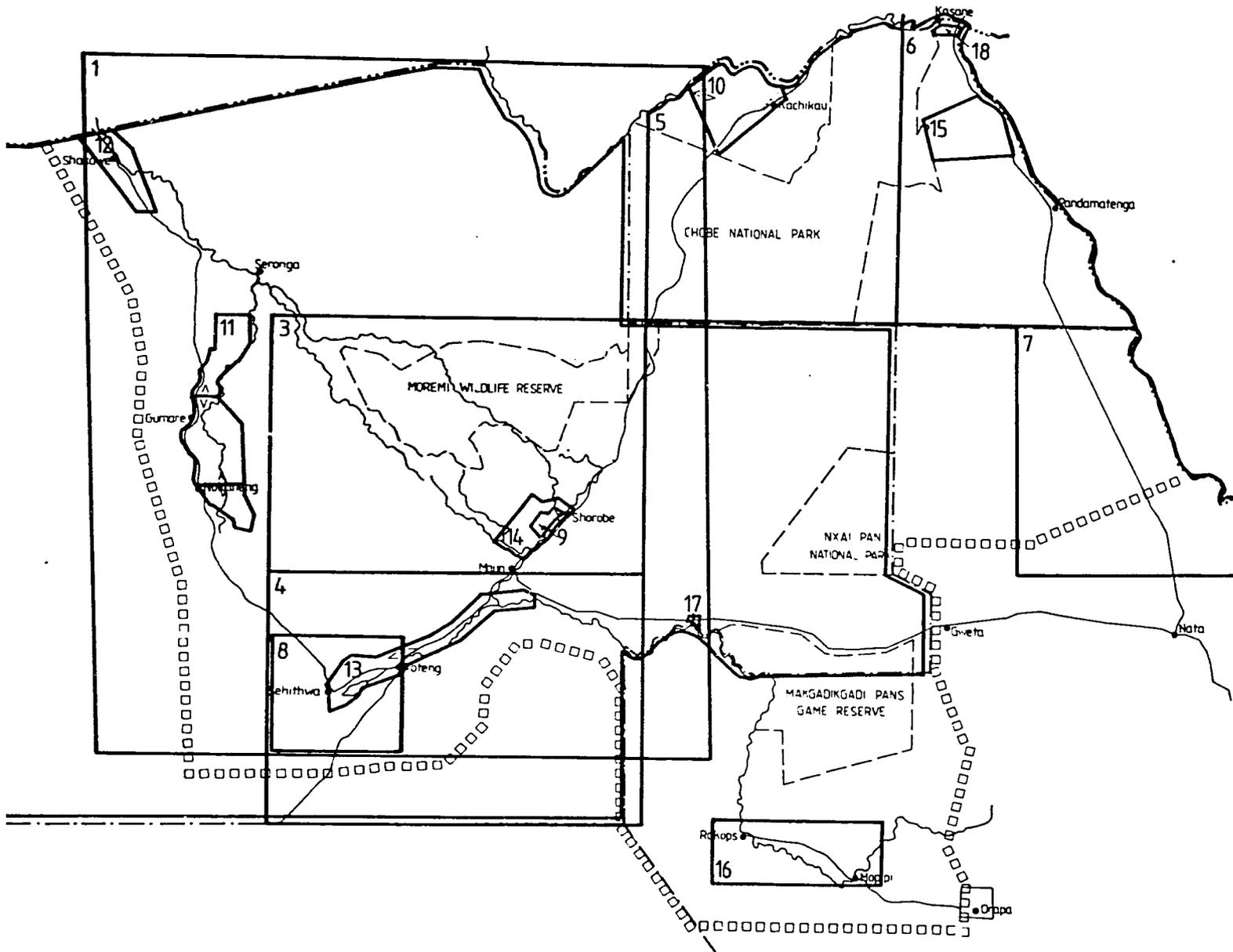
Scale 1:10 000

- 17 Motopi

Siderius 1970

- 18 Kasane - Kazungula

Siderius 1970



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BOTANY

MAP 1 VEGETATION MAP

(MODIFIED FROM WEARE AND YALALA 1971)

LEGEND

PHYSIOGNOMIC CLASSIFICATION

1. SHRUB SAVANNA		
a) Arid Shrub Savanna	.....	1(a)
b) Southern Kalahari Bush Savanna	.....	1(b)
c) Central Kalahari Bush Savanna	.....	1(c)
2. TREE SAVANNA		
a) Molopo Thornveld	.....	2(a)
b) Northern Kalahari Tree and Bush Savanna	.....	2(b)
c) Tree and Bush Savanna with Mopane	.....	2(c)
d) North-West Tree Savanna	.....	2(d)
e) <i>Acacia giraffae</i> Tree Savanna	.....	2(e)
f) Semi Sweet Mixed Bushveld	.....	2(f)
g) Arid Sweet Bushveld	.....	2(g)
h) <i>Combretum imberbe</i> Bushveld	.....	2(h)
i) <i>Acacia nigrescens</i> / <i>Combretum apiculatum</i> Tree Savanna	.....	2(i)
j) Mopane Bushveld	.....	2(j)
k) Mixed Mopane Bushveld	.....	2(k)
l) close tree, mopane dominant	.....	2(k-N)
m) mixed mopane/ <i>Acacia</i> trees	.....	2(k-N)
N) mixed mopane/ <i>Acacia</i> low tree Savanna	.....	2(k-N)
o) thicket woodland, mopane dominant	.....	2(k-N)
p) Mopane Sour Bushveld	.....	2(l)
m) Mixed mopane tree and bush Savanna	.....	2(m)
n) Ghanzi Bush Savanna	.....	2(n)
o) Ngamiland Tree Savanna	.....	2(o)
3. CLOSE TREE SAVANNA ON ROCKY HILLS		
a) <i>Croton</i> / <i>Combretum</i> association	.....	3(a)
4. SEMI ARID SHRUB SAVANNA		
a) <i>Acacia</i> Shrub Savanna	.....	4(a)
5. GRASS SAVANNA		
a) Mababe Grassland	.....	5(a)
b) Lake Ngami Savanna Grassland	.....	5(b)
c) Delta Grassland	.....	5(c)
d) Fringing Pan Grassland	.....	5(d)
6. AQUATIC GRASSLAND		
a) Vlei Grassland	.....	6(a)
b) Swamp Grassland	.....	6(b)
7. DRY DECIDUOUS FOREST		
a) Chobe Forest	.....	7(a)
8. RIPARIAN FOREST		
a) Okavango Fringe Forest	8(a)
9. WOODLAND		
a) Riparian Woodland	9(a)

Tree Savanna with Mopane

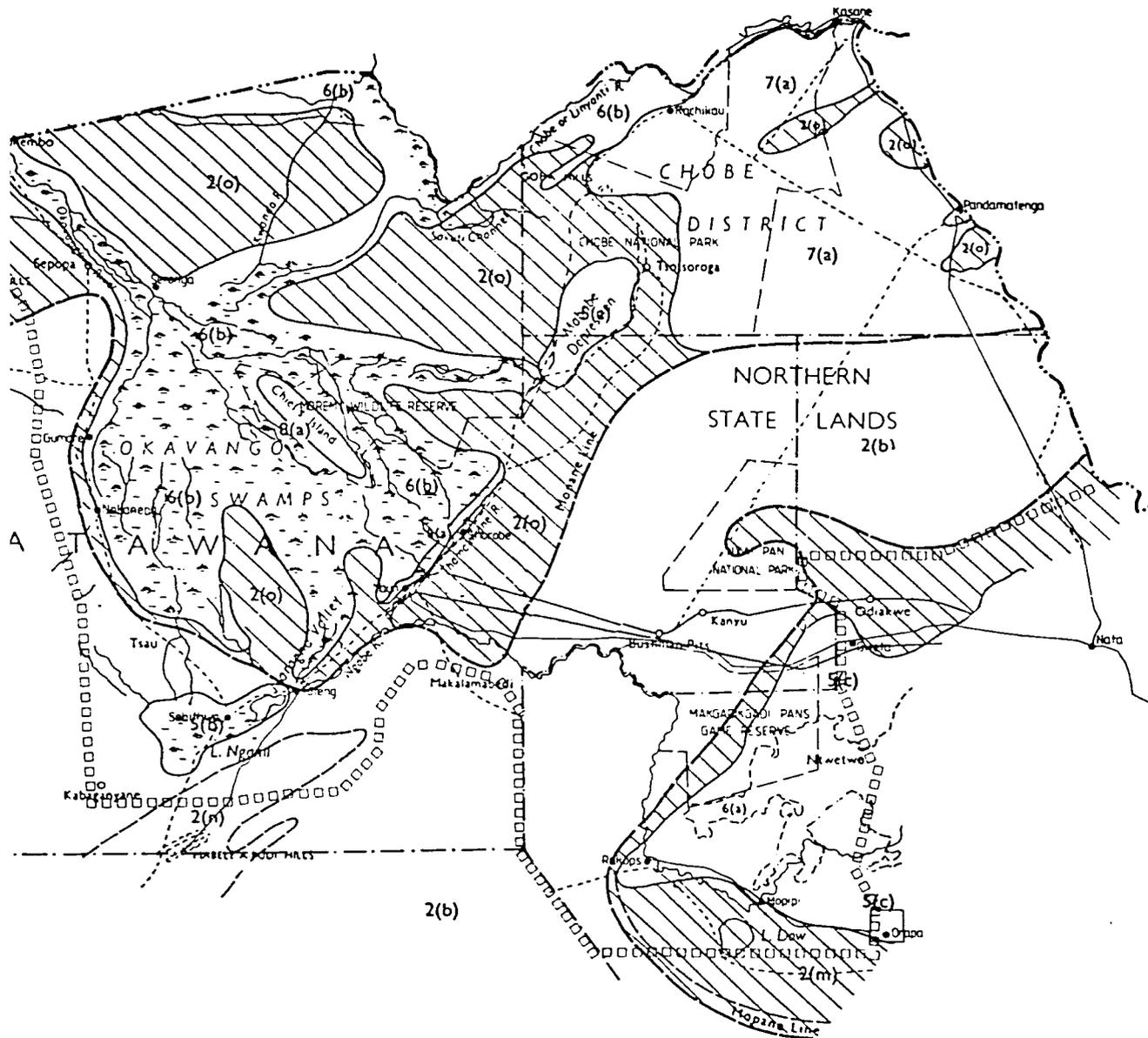
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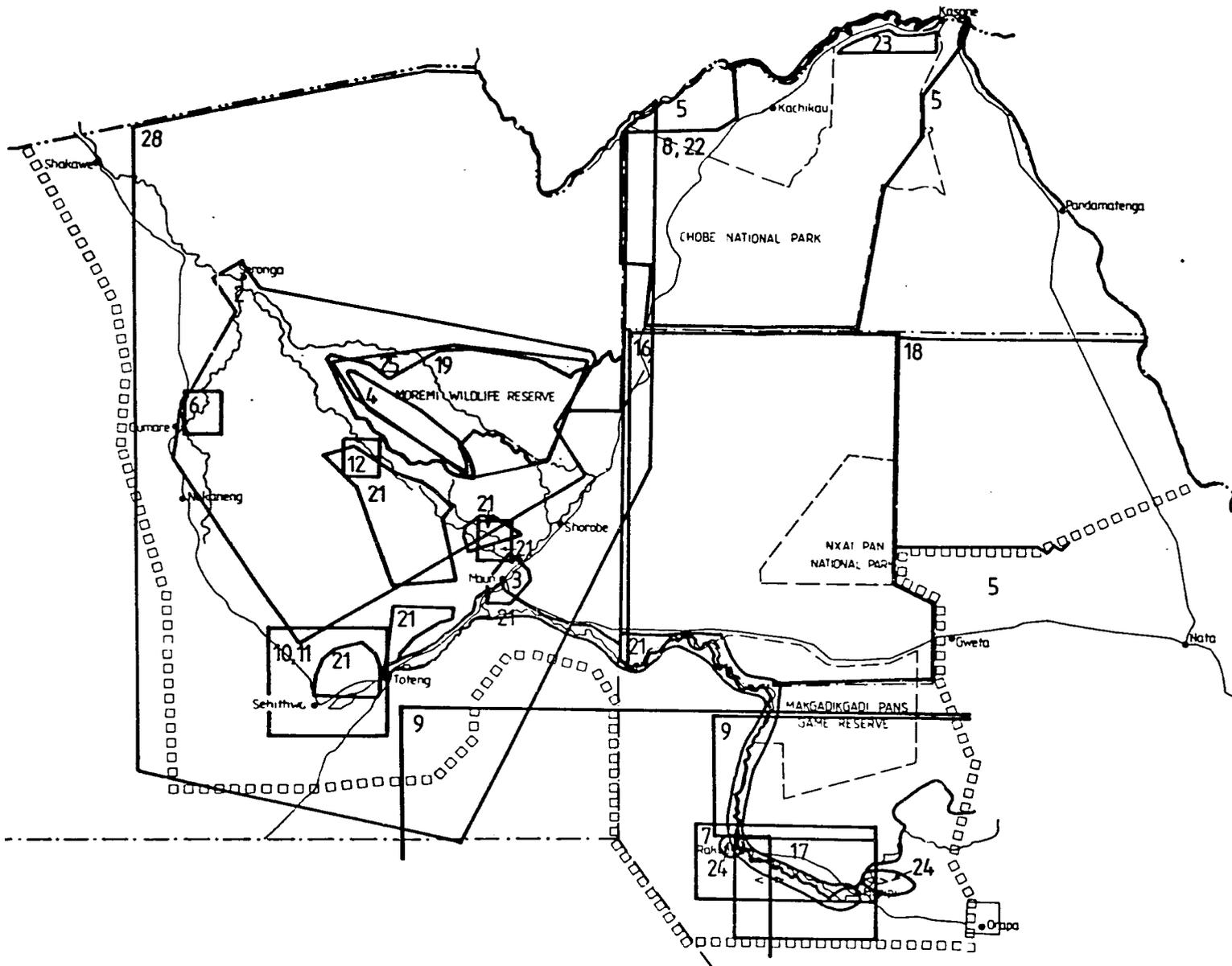
DATE: DEC 1988



BOTANY

MAP 3

VEGETATION SURVEYS



LEGEND

1. Orapa and environs	Allen 1978
2. Okavango Delta	Astle 1977
3. Maun Village Dev. Area	Bendsen 1987
4. Chiefs Island	Biggs 1976
5. Northern State Lands	Blair Rains and McKay 1976
6. Lower Baro + Gumare	Blyther 1988
7. Lower Boteti	Breyer 1983
8. Chobe N.P.	Child 1968
9. Eastern Makgadikgadi	DHV 1979
10. West of Lake Ngami	Heemstra 1976 a
11. Tsau-Toteng	Heemstra 1976 b
12. Xudum Area	Heemstra 1976 c
13. Chobe Forest Block	Henry 1966
14. Western Ngamiland	Mbano 1984
15. Chobe Forest	Miller 1939
16. Ngamiland State Land	KCS 1987 a
17. Lake Xau	Parry 1984
18. Nata Stateland	Ecosurv 1988
19. Moremi G.M.	Robbel and Child 1976
20. Along Chobe River	Simpson 1975
21. Lake Ngami, S. Okav., Boteti	SMEC 1987
22. Chobe N.P.	Sommerlatte 1976
23. Chobe River front	Sommerlatte 1976
24. Rakops - Mopipi Area	Thalen 1981
25. Moremi W.R.	Tinley 1966
26. Ngamiland District	TGLP 1977
27. Lower Okavango	Vujakovic 1985
28. Okavango Delta	Williamson 1974

NOTE:

1, 13, 14, 15, 20, 26 and 27 not shown on map

6 — Survey area

2 — " "

For further description of surveyed areas see text page

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ZOOLOGY

MAP 1

WILDLIFE MIGRATION

LEGEND

○ DWNP Office

△ DWNP Wildlife camp

← Wildlife migrations, SUM: summer, WIN: winter

B Buffalo

E Elephant

El Eland

L Lechwe

W Wildebeest

Z Zebra

x Allocated wildlife waterpoints

Information compiled from

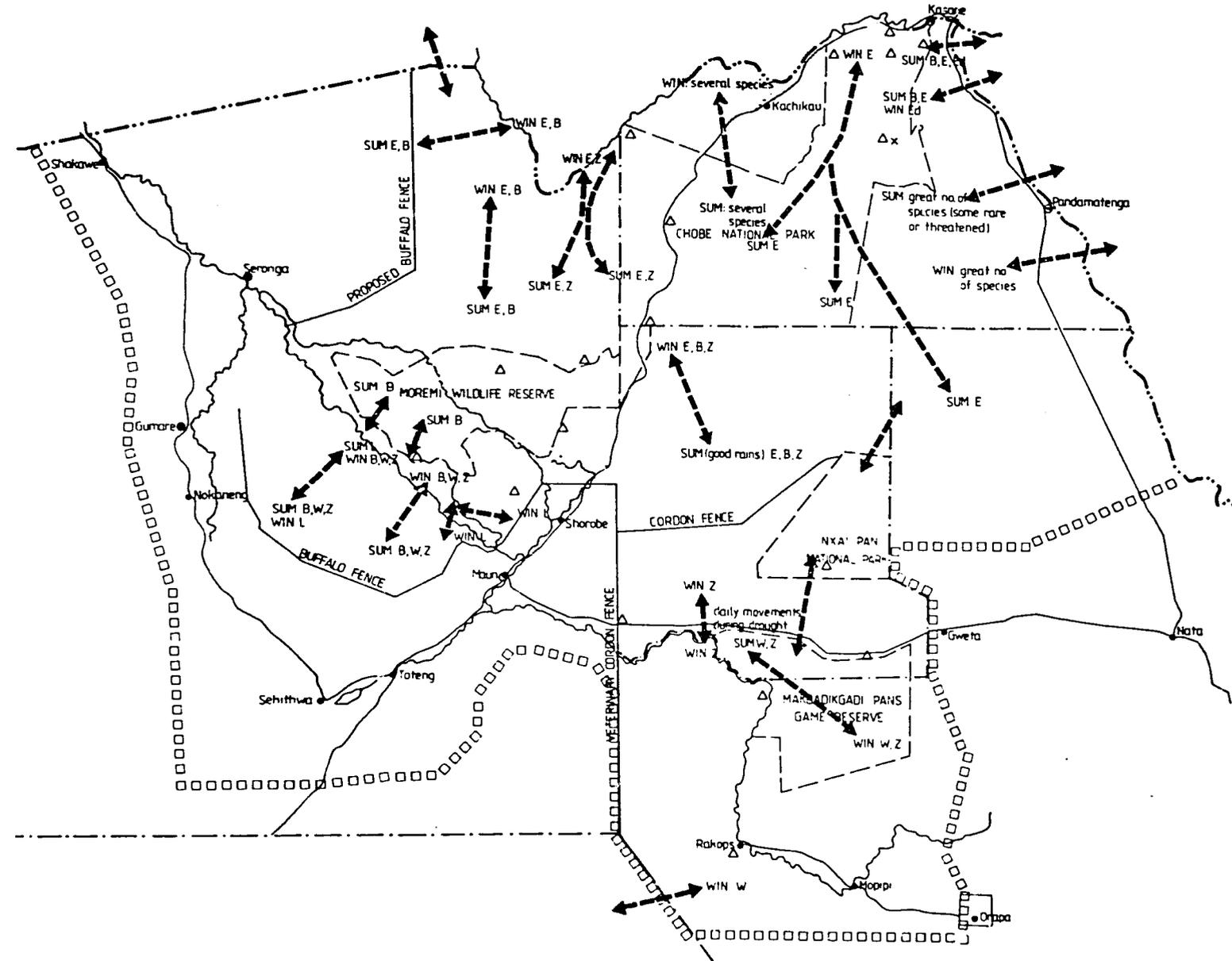
Anderson 1985

KCS 1984, 1985 b, 1987 a + b

Parry 1988

SMEC 1987

Sommerlatte 1986



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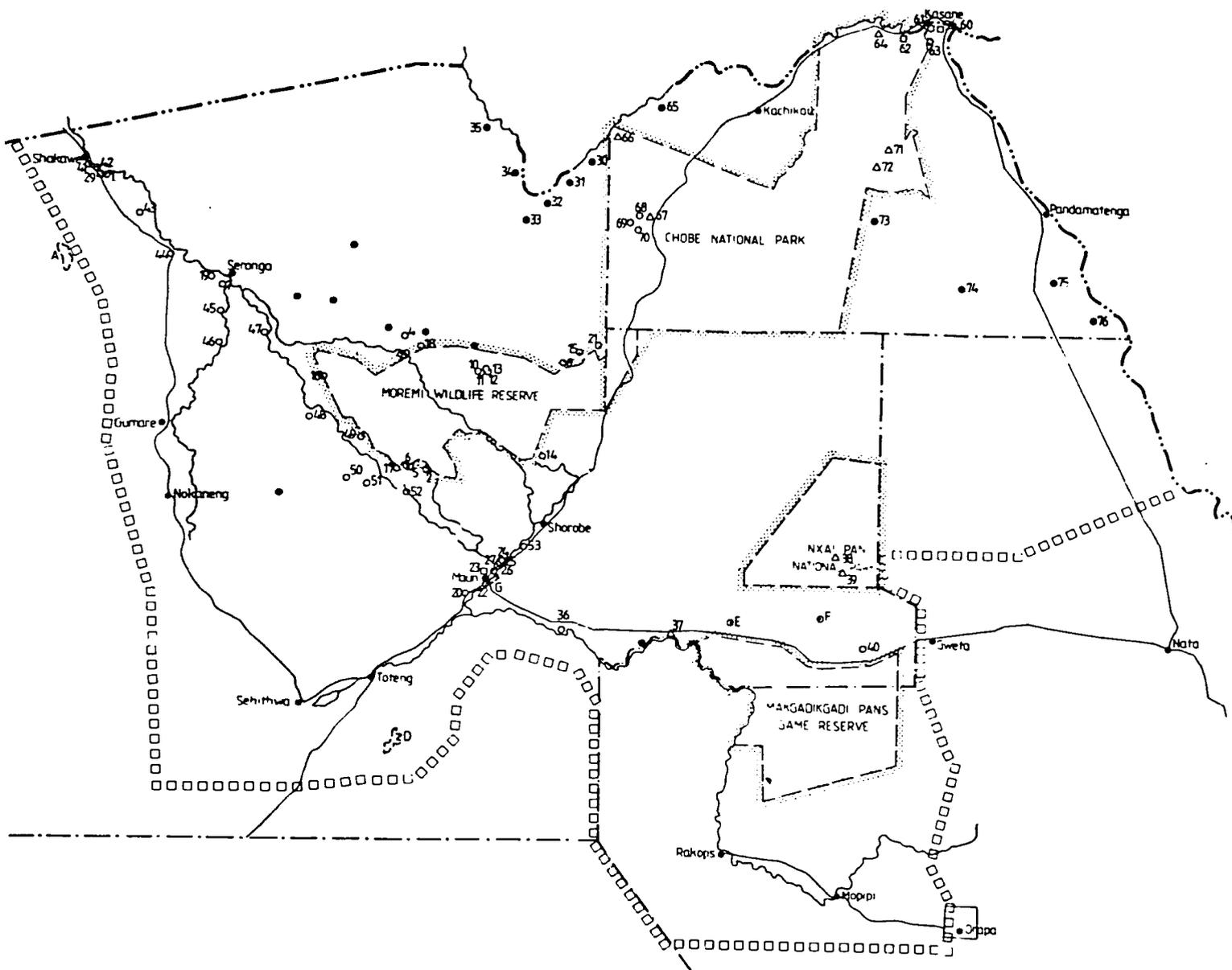
SITES OF SPECIFIC INTEREST AND TOURIST FACILITIES

LEGEND

- Hotel
- Lodge/camp
- △ Camping sites
- Hunting camp
- Site of specific interest
- ⊞ Other area of interest

1 A Figures and letters referring to table

- | | |
|--------------------------------|-------------------------|
| 1 XARO | 48 TXECHIRA |
| 2 NTSWI | 49 TCHAU CAMP |
| 3 AFRICAN SKIMPER (RIVER BOAT) | 50 PDM PDM CAMP |
| 4 XUGANA | 51 XUKURANAKA |
| 5 ODOBALLS | 52 KIRI CAMP |
| 6 DELTA CAMP | 53 KORO SAFARI LODGE |
| 7 ETSATSA | |
| 8 TSARO LODGE | |
| 9 CAMP OKAVANGO | |
| 10 CAMP MOREMI | |
| 11 XAXANAKA (MOR SAF) | |
| 12 XAXANAKA (SAF UNL) | |
| 13 OKUTI | |
| 14 SANTAWANI | 60 KUBU LODGE |
| 15 KWAI RIVER LODGE | 61 CHOBE SAFARI LODGE |
| 16 HAAXWA | 62 CHOBE GAME LODGE |
| 17 XAXABA | 63 CHOBE CHILWERD LODGE |
| 18 SHINDI | 64 SERONDELA |
| 19 UKUWE ISLAND | 65 SAILE |
| 20 SITATUNGA CAMP SAF | 66 LINYANTI |
| 21 MACHABA | 67 SAVUTI |
| 22 THAMALAKANE S LODGE | 68 LLOYD'S CAMP |
| 23 RILEY'S HOTEL | 69 ALLAN'S CAMP |
| 24 OKAVANGO RIVER LODGE | 70 SAVUTI SOUTH |
| 25 KUBU CAMP | 71 NOGATSAA |
| 26 ISLAND SAFARI LODGE | 72 JINGA |
| 27 ROCODILE CAMP | 73 SHINAMBA |
| 28 DROTSKY'S CABINS | 74 BOTTLE PAN |
| 29 SHAKWE FISHING CAMP | 75 NUNGA |
| 30 JINYANTI SAFARI LODGE | 76 JARWE |
| 31 KINGS POOL | |
| 32 CHOBE HUNTING CAMP | |
| 33 MOTSAUDI | |
| 34 JAMES CAMP | |
| 35 KWANDO CAMP | |
| 36 CYGA | |
| 37 MOTOP | |
| 38 NXAI PAN NORTH | A TSOO'LO HILLS |
| 39 NXAI PAN SOUTH | B AHA HILLS |
| 40 SEKAKA | C DROTSKY'S CAVE |
| 41 FISH EAGLE LODGE | D KWEBE HILLS |
| 42 LLOYD'S PLOT | E BUSHMAN PITS |
| 43 NXAMASERI FISHING CAMP | F BAINE'S BAOBAB |
| 44 SEPOPA CAMP | G MAUN GAME SANCTUARY |
| 45 NGUMA LAGOON | |
| 46 MOMB CAMP | |
| 47 JEDIBE | |



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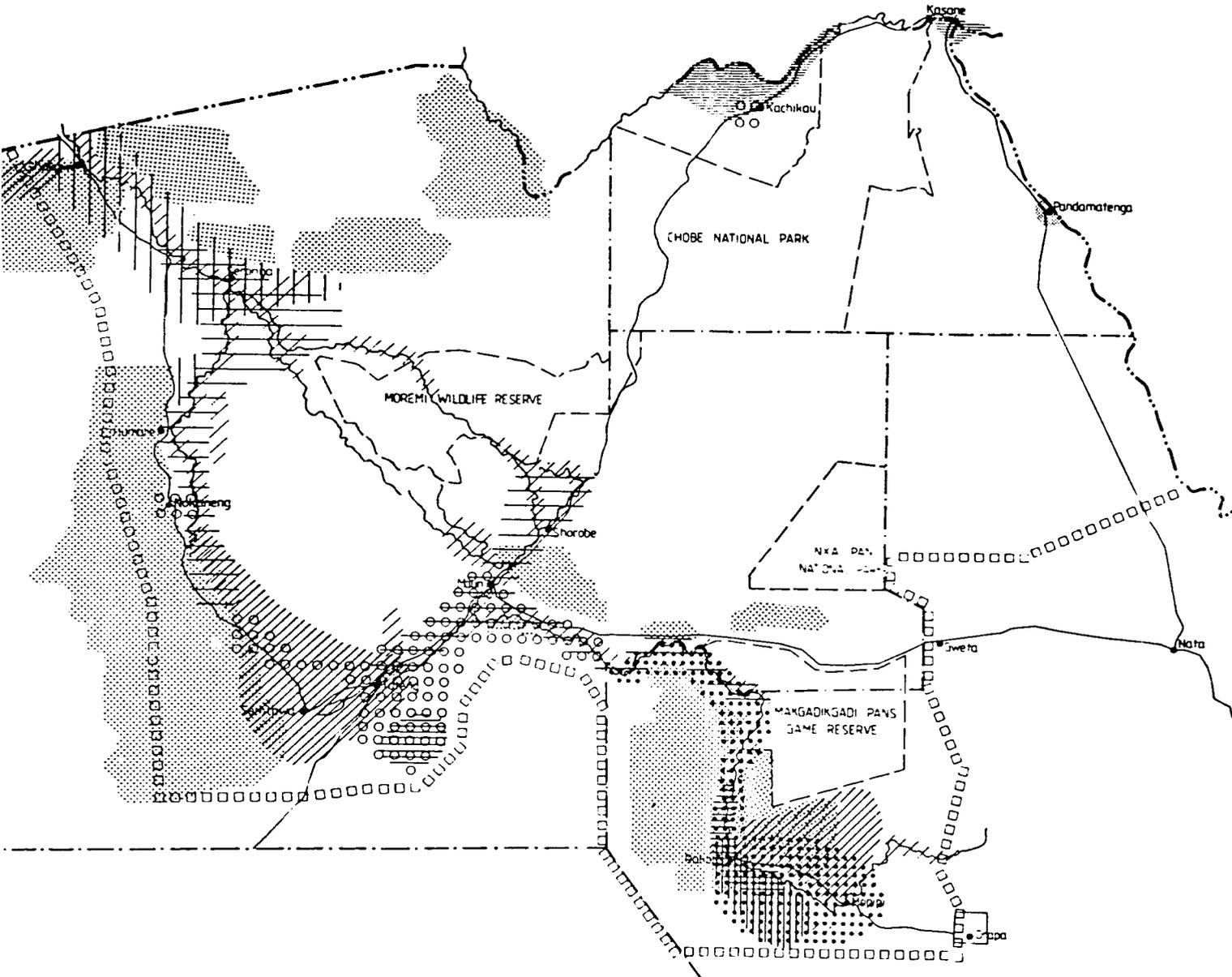
POPULATION AND SETTLEMENT

MAP 1

ETHNIC POPULATION DISTRIBUTION

LEGEND

-  Mbukushu
-  Yei
-  Herero / Mbandera
-  Kurutshu
-  Kgalagadi
-  Tswana
-  Mixed Ndebele, Kalanga, Tswana
-  San
-  River San
-  Subiya
-  Kalanga



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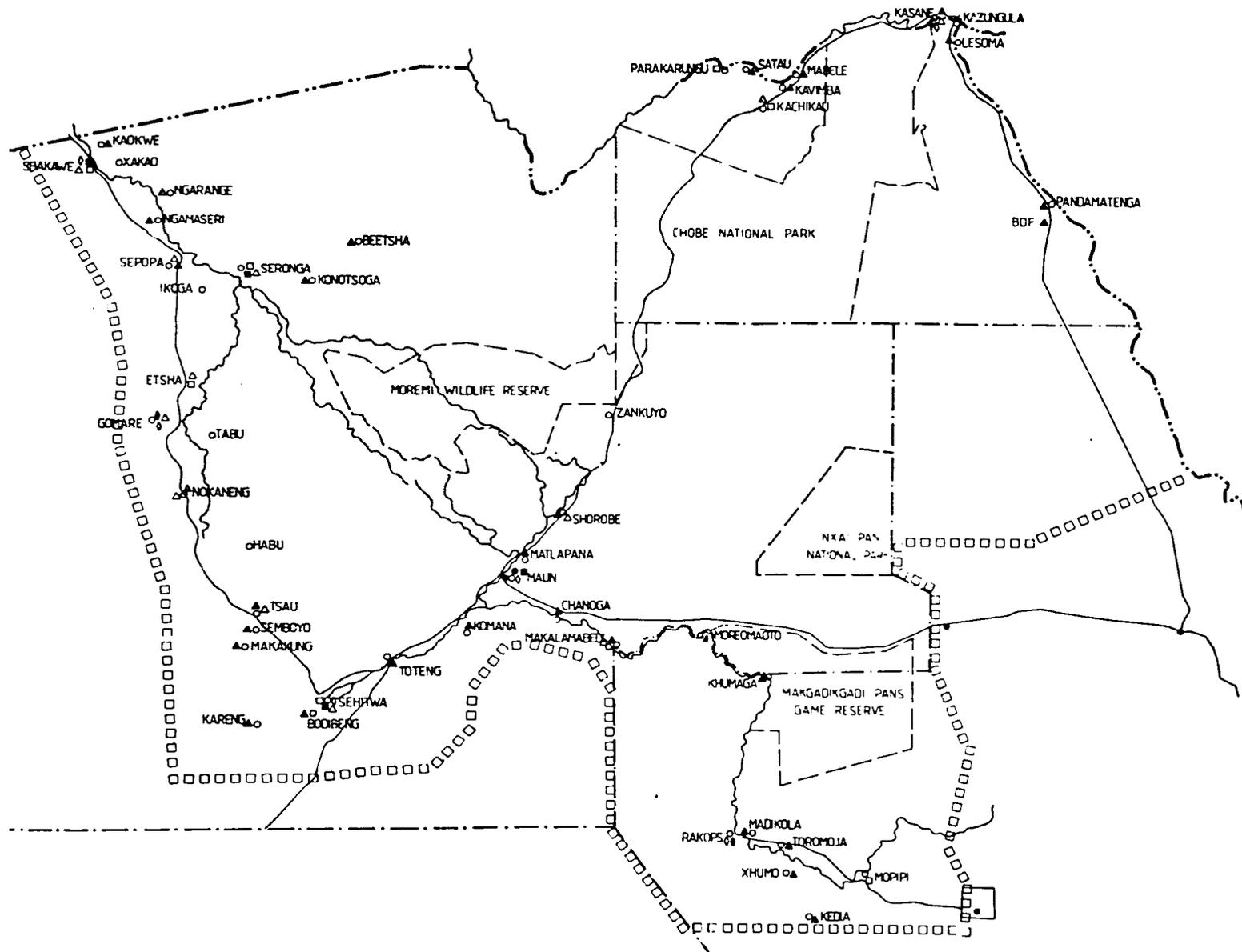
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POPULATION AND SETTLEMENT

MAP 2
SOCIAL INFRASTRUCTURE

LEGEND

- Police station
- Hospital
- ◐ Health centre
- ◑ Health clinic
- ▲ Social & Community development
- ▲ Health post
- Primary school
- ◊ Secondary school
- Brigade



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Copy for Bob Bisson

Date: 24 April 1992
Page 1 of 2 pages

To Mr. Rupert Talbot, Chief, Water/Sanit.
UNICEF
Addis Ababa, Ethiopia
FAX No. 011-251-1-511-628

From: Martin G. Beyer
84 Jefferson Road
Princeton, NJ 08540-3301, USA
Telephone 1-609-683-1762
Fax 1-609-497-2989

Dear Rupert:

USAID Project for Megawatershed Analysis - Bob Bisson ETA

As I indicated in my previous fax of 21 April to you, Mr. Robert (Bob) Bisson, intends to visit Addis Ababa and UNICEF there in the company of Mr. Joseph Ingari, within a few days. I am now pleased to confirm Bob Bisson's ETA in Addis Ababa on Thursday, 30 April 1992, Lufthansa flight 246, God Willing and Weather Permitting, scheduled in at 1955 hours.

Bob Bisson will contact you ASAP on his arrival. In fact, following my strong recommendations, you are the key person for discussing the application and followup on his and Joseph Ingari's co-ordination of the analysis of shuttle images.

Personally, knowing some of Bisson's work from earlier years, I find this exercise highly innovative. The combination with well siting and corroboration through water well drilling as supported by UNICEF and other major organizations in Ethiopia hopefully will convince larger parts of USAID (including WASH) of the potential and usefulness of this methodology.

Bob Bisson's efforts are backed up technically by Earth Satellite Corporation of Washington, DC, a major enterprise, which apparently is taking this opportunity for getting some part in the famous but elusive "peace dividend". Bisson tells me that with their computer enhancement technology, they can reach a power of resolution of 5 (five!) feet (1.5 meters). Good old Landsat is down, I believe to ten meters. The excellent SPOT satellite has five meters. Bisson will bring samples of the pertaining material, so you'll see for yourself.

Along with that he will have some interesting proposals, which would not affect UNICEF budgeting or overall plans, but which may entail some commitment for co-operation, which I believe all parties concerned, notably UNICEF and AID would benefit from. Not to speak of the savings and bolstered morale of the

4/1

As an adviser to Bob Bisson (along with a few other small but innovative enterprises), I have strongly urged him to begin his work in Addis Ababa, by availing himself of UNICEF's, including your personal experiences and contacts with the relevant government and other organizations.

Judging from my co-operation in past years with USAID (mainly as Senior Advisory Consultant to WASH), I also hope that a successful outcome of this project will help redirect AID to helping developing countries with their water resources problems. The United States did so until the mid-1980s through the United States Geological Survey. Their International Hydrological Office did a lot of highly useful, cost-effective work, until it all of a sudden was abolished due to overall budget cuts, which often rather hit really useful activities than those which could be cut down. Sounds rather familiar, does it? Now there is a real chance to revive the spirits over the water in USAID (which organization still has not quite overcome its part of the GOBI syndrome).

You may note that the present project will be carried out on behalf of both the AID Office for Disaster Relief Assistance and their Africa Bureau. Inofficially it seems to me that another side benefit internally in USAID might be to bring these two units closer to each other, but this need not concern us.

Bob Bisson, following your and my talk this morning, is now trying to reschedule his Africa travel, and is aiming, if possible, to arrive in Addis Ababa already around Thursday 30 April. This would give him more time with you. Plans are for his being joined in Addis by a consulting hydrogeologist/geophysicist, Joseph Ingari, from Hydrosorce Associates of Ashland, New Hampshire. Ingari knows Ethiopia and was last there in 1986.

They will present more of their interest to you, not the least in reviewing possibilities for corroborating their findings, and how then to bring them to good use for planning and implementation of future drilling activities in the country.

As to Eritrea, I realize that the new situation might require them to deal separately with that area, but I am sure that you and other colleagues in Addis would have some good background to give to Bisson and Ingari. - In the meantime, my warmest regards to your family and to whosoever in UNICEF and of the Ethiopian colleagues still might be around, whom I met in earlier years. - Kind regards.


Martin G. Beyer, Former Senior Adviser, Water and Sanitation, UNICEF, and Executive Secretary, Safe Water 2000 (UNDP)

ATTACHED: PROJECT PROPOSAL FROM BISSON EXPLORATION TO USAID