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FINAL REPORT

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Judy Brooks of the Center for Research on Economic Development helped with the final preparation of this report, and Marjorie MacKenzie typed it.

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Sources of Supplies Information

In the preparation of the materiel included in the tables, a number of catalogues were used to specify the exact item desired, or one most closely approximating the item needed. We strongly urge that, insofar as feasible, as many items as possible be obtained from a single supplier, not only for reasons of economy, but particularly for uniformity of maintenance, ease in training Guinean operation and maintenance personnel, and simplicity of ordering replacement parts.

We strongly recommend that all equipment be supplied with both maintenance and repair manuals, and that these manuals be forwarded to the AID/Conakry Project Manager with French translations.

We cannot emphasize too strongly the absolute necessity that every single piece of equipment furnished be accompanied by a quantity of replacement parts sufficient to provide continuous operation under Guinean conditions for the expected life of the equipment or ten years, whichever is the greater. No spare parts or consumable items can be obtained locally.

In event some ambiguity exists about certain supply items or questions about the applicability of items offered for use under Guinean conditions, we stand ready to offer additional explanations.

When a catalogue number is specified, the first one to three letters refer to the following catalogues:

A - S. L. Allen & Co., 5th and Glenwood Avenue, Philadelphia or Swanson Machine Shop, 24-26 East Columbia Ave., Champaign, Illinois 61820

B - Beckman Instruments, Inc., Catalog 7304, 1977 Fullerton, Calif. 92634

BT - Baker & Taylor Educational Products, 1976 Catalog 5005 National Drive, Knoxville, Tennessee 37914

CP - Cole Parmer Instrument Co., 1977 Catalog 7425 North Oak Park Ave. Chicago, Illinois 60648

D - Day-Timers, Allentown, Pa. 18001

DZ - Dietzgen, 2425 North Sheffield Ave., Chicago, Illinois 60614

F - Fisher Scientific Co., Catalog 77 711 Forbes Ave., Pittsburgh, Pa. 15129

FOK - Farwell, Ozmun, Kirk & Co., Catalog 10 St. Paul, Minn. 55101

FS - Forestry Suppliers, Inc., Catalog 22 Box 8397, Jackson, Mississippi 39204

IR - Irrometer Co., 1971 Price List P.O. Box 2424, Riverside, Calif. 92506

N - Nasco 1976-1977 Farm and Ranch Catalog 132 901 Janesville Ave., Fort Atkinson, Wisc. 53538

RB - Rain Bird Irrigation Equipment, Catalog 1970 2152 Altorfer Drive, Peoria, Illinois 61614

S - Sears, Roebuck & Co., Spring/Summer 1977

SA - Science Associates, Catalog 8 (1971) Box 230, Princeton, N.J. 08540

SC - Sensation Corp., 3601 North 16th Street Omaha, Nebraska 68110

SE - Seedburo Equipment Co., Catalog 76 1022 W. Jackson Blvd., Chicago, Ill. 60607

SISCOMA- Société Industrielle Sénégalaise de Constructions Mécaniques et de Matériels Agricoles - BP 3214, Dakar, Sénégal

SO - Soil Moisture Equipment Co.

SS - Spraying Systems Co., Price List 93, Catalog 35, 1967
3201 Randolph Street, Bellwood, Illinois 60104

ST - Soil Test, Inc. - General Catalogue 1974
2205 Lee Street, Evanston, Ill. 60202

T - Turtox '76 Catalog
8200 S. Hoyne, Chicago, Illinois 60620

UFH - Union Fork and Hoe Company
500 Dublin Avenue, Columbus, Ohio 43216

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A. INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE DE FOULAYA (INRAF) AND FACULTE D'AGRONOMIE DE FOULAYA

I. New Research Laboratory Building and Related Activities

1. General

We concur with the overall dimensions and general architecture of the building.

2. Disciplines

Since the time when the Project Proposal was developed and the A & E Report was prepared, participants were selected by GOG in disciplines slightly different from those originally mentioned. The new labs are to support the activities of the participants upon their return in the areas of their specializations. Therefore, we recommend that the four labs in the new building be for the following activities: (1) Plant Breeding and Genetics; (2) Soil Fertility and Science; (3) Plant Protection and Pesticides; (4) Agricultural Biology (Nematology, Entomology, and Plant Pathology).

We recommend equipping the labs according to these four described disciplines.

3. First Floor Plan

The plan shown in FOU 14 of the A & E Report was not changed from the original outside dimensions; however, the internal arrangement was modified as shown in Figure 1. The large entrance has been reduced to more modest dimensions in order to increase usable laboratory space. The Plant Breeding and Genetics section has been placed in the southwest corner, and

the Soil Fertility and Science section placed in the southeast corner. The north side of the building has been reserved for utility rooms where ground level access is essential for agricultural field research. The staircase could be easily eliminated as little traffic is involved and laboratory and office space will be gained. If this were done, the toilets on the second floor could be separated, one adjacent to each end staircase. In view of the American practice of keeping research personnel in their laboratories or fields, the office space in the A & E Report is overly generous since it provides for eight desks on this floor. Such a practice leads to unproductive conversation. We believe strongly that the research scientists should office in close proximity to each other but have single offices for planning, reading and writing. Technicians should always remain in the labs or fields and sit-down desk space is provided for bench work. Scientist office space is provided on the second floor as more ground floor space is needed for utility rooms with outside access.

All labs should have hot and cold water taps, color coded, double, similar to F-91-476, at each sink. Stills should be wall mounted over the wall bench sinks. Electrical circuits should be color coded 220V and 110V, flush mounted, on all benches, tables and islands. Two outlets every 6 feet is the minimum spacing. The 220V outlets should be U.S. and European style or supplied with single style plugs to be affixed to each piece of equipment. Gas outlets should be every 6 feet on the wall

benches and islands and connected to 10 Kg gas cylinders stored under the benches and islands. There is no need for lines for distilled water, air, vacuum or steam.

4. Plant Breeding and Genetics Laboratory.

Figure 2 outlines the bench space, hood, 3 sitdown spaces, 3 island double benches and 4 self contained coolers. Enough wall space has been provided for stand-alone equipment, i.e. refrigerators and freezers. The two outside islands have been set with sinks toward the south wall. The middle island has the sink toward the center of the room and should contain the eye wash sink and overhead emergency shower, both above a center floor drain. Budget limitations may suggest substituting one or two Durate covered tables for the outside islands. The tables should be large and immovable for specimen work. This laboratory can easily support five fulltime people. Space has been provided for four pre-packaged cool storage units, (two for seed storage, one for live reproductive plant material and one for conditioning fruit and vegetable products). All four are essential for a plant breeding program in a tropical climate. It is possible to place the fruit and vegetable conditioning cooler in the general area now occupied by the unrehabilitable sweet water cool room in the existing east laboratory building. This would permit the placing of the second floor office, No. 4 (Figure 4) in the space vacated by the cooler. Furnishings and equipment are listed in Table 1.

5. Sample Drying Room

The sample drying room (Figure 7) is to be used for drying

2 Kg or larger fresh plant samples. The 15 x 15 ft^2 room contains; (1) a 3 ft W x 9 ft L concrete bench 37 inches high, concrete legs every 3 ft to form 3 bins under the bench; (2) concrete bins 3 x 3 x 3 ft floor to ceiling. The 2 side by side dryers, each 4 1/2 ft W x 9 ft deep x 8 ft high are situated over an expanded metal floor similar to the floor of a grain dryer. The chamber under the expanded metal false floor is connected to a pressure chamber feeding in hot air. The chamber must be able to dry 270 ft^3 of green plant material containing 85% moisture down to 15% moisture in 24 to 36 hours. The ceiling air of each dryer should be exhausted to the outside. Heaters and blowers outside the building should have an open sided tin roof to protect against rain. The inside walls of the drying room should be firewall construction. This room should be supervised by the senior Plant-Breeder.

6. <u>Soil Fertility and Science Lab</u>

Figure 3 outlines the bench space, hood, 3 sit-down spaces 3 island double benches and wall space for stand-alone equipment. The two outside islands have been set with sinks toward south wall. The middle island has been set similar to the middle island in the Plant Breeding lab. Budget limitations may suggest substituting one Durate covered heavy table for one of the outside islands. This laboratory can easily support seven people for chemical work. Special-use rooms have been provided for activities requiring outside access, such as heavy dust accumulation and mud from plant washings. Furnishings and equipment, except for shared items, are listed in Table 2.

7. Sample Storage Room

Dried bottled samples awaiting analysis or disposal will be stored in this room, 15 ft x 27 ft, with 2 ft x 2 ft x 2 ft bins around the perimeter, floor to ceiling. A back-to-back similiar set of bins are in the center of this room containing about 240 bins. This room (Figure 8), should be supervised by the senior Soil Scientist.

8. Soil Sterilizing Room

This room, (Figure 9), should be under the supervision of the Nematologist. The equipment will sterilize and store small quantities of soil and inoculated soil for experiments. There should be a double door to the outside to allow for carting large loads of soil. The 37 inch high concrete bench on the west wall should have bins built under the bench with a wall from the floor up 12 inches high in front. Bins about 3 feet wide should be completely separated from each other by a solid wall. Harness tack hooks on the north half of the east wall should hold shovels and field equipment. Put the sterilizer on an 8 inch high concrete base, 6 ft long in N-S direction and 40 inches wide in E-W direction, with electricity nearby. The room needs water, a concrete tub and a floor drain.

9. Green Plant Washroom

This room, (Figure 10), should be under the supervision of the Plant Pathologist. Green plant material from the field plots will be washed, sorted and prepared for further analysis. This room needs hot and cold water in a mixing faucet at each sink, equipped with a Pyrex tap. The concrete lab bench on the

west wall is 37 inches high and 36 inches wide. Harness tack hooks will hold gardening tools.

10. Dry Plant and Sample Grinding

This room, (Figure 11), should be supervised by the Soil Scientist. The 37 inch high concrete bench supports a Wiley mill situated near the outside wall so dust can be exhausted by a 7-9 inch kitchen fan. Hardware cloth should enclose the 3 ft x 3 ft x 3 ft concrete bins to exclude rats and mice. These bins are on the east wall, floor to ceiling. The 37 inch high and 36 inch wide x 8 ft long concrete bench is on west wall, north end. Shelving bins 12 inches high, 24 inches wide and 24 inches deep, floor to ceiling, fill the remaining wall space. It would be possible to switch this room with the office on the second floor, No. 5, (Figure 4)

11. Soil Grinding Room

This room, (figure 12), should be supervised by the senior Soil Scientist. Its purpose is to provide space for air and oven drying, grinding and sieving of soil samples. The room opens to the outside only because much dust is generated during processing. There is a 37 inch high and 36 inch wide concrete bench on north and west wall with bins underneath. Bins, 3 ft x 3 ft x 3 ft, floor to ceiling, are on the south wall. Harness tack hooks are on the east wall with the hooded exhaust (5 to 6 feet long) on the north wall.

12. Second Floor Plan

The internal arrangement as shown in FOU 15, A & E Report, is modified as shown in Figure 4. Space has been provided for three single-person offices over the foyer. Two other offices, Nos. 4 and 5, have been provided and discussed in Sections 4 and 10. The Agricultural Biology laboratory has been placed in the southwest corner and Plant Protection laboratory placed in the southeast corner. The north side of the building has been reserved for special purpose rooms. The foyer has been reduced in size to match the reduction in the first floor foyer size. Elimination of the center staircase would provide additional work space.

13. Agricultural Biology Laboratory

Figure 5 describes the bench space, islands and stand-alone equipment spaces. Refer to Section 4 for the same general comments except that space is provided here for one prepackaged Nor-Lake cooler for preservation of diseased specimens and causative organisms. Furnishings and equipment, except for shared items, are listed in Table 3.

14. Specimen Storage Room

This room, (Figure 13), should be supervised by the Plant Pathologist. Steel cabinets are situated around the walls with a large work table in the center of the room. Entrance door and windows should be constructed so that the room can be fumigated from time to time, as the room is used for the storage and study of dried specimens that are subject to destruction by termites and other insects.

15. Sterile Room

This room, (Figure 14), should be supervised by the Plant Pathologist. Sterile culture media and containers are prepared in a room under ceiling ultraviolet and incandescent lighting. Windows are not needed unless sealed to the outside wall. The east wall contains a wall assembly with a sink, hot and cold water, gas and electricity. Utilities, 3 ft above the floor, should be mounted in three places on the west wall for servicing the autoclave that rests on the floor. A floor drain is needed.

16. Plant Protection Laboratory

Figure 6 outlines this laboratory arrangement of benches, islands and stand-alone equipment spaces. Refer to Section 6 for the same general comments except special use rooms do not

require outside access. Furnishings and equipment, except for some shared items, are listed in Table 4. Space has been provided for freezer and refrigerator storage of different categories of pesticides and other organic products.

17. Chemical Storage Room

This room, (Figure 15), is under the supervision of the Soil Scientist. Concrete bins, 2 ft x 2 ft x 2 ft, floor to ceiling on outside walls, provide bins for non-volatile storage. Bulk containers are placed on the floor in the middle of the room. One cold water tap, wall mounted and a floor drain serve as the first aid facility. No containers should be opened in this room and no opened containers should be left in this room.

18. Organic Solvent Laboratory

This room, (Figure 16), is under the supervision of the Plant Protection scientist. A chemical work bench is on the west wall; the north half of the bench has a sink and a fume exhaust hood. The fume exhaust should have a medium speed 7 to 9 inch continuous running fan and a high speed 7 to 9 inch fan on manual operation. Explosion proof wiring for outlets and illumination is required. Bins, floor to ceiling, 2 ft x 2 ft x 2 ft are on the north end of the east wall. Bulk containers of organic volatiles and liquid pesticides are placed on the floor.

19. Dark Room

This room, (Figure 17), is under the supervision of the Plant Breeder, although space for three persons is provided. The entrance is a labrinth and curtain-covered on the inside.

No windows are permitted so a 4,000 BTUH air conditioner is provided in the northwest corner. Ceiling fixtures should include separate circuits for incandescent, red and yellow lights. A signal light on the outside of the door is needed to indicate that work is going on inside. A special sink, 6 ft long x 30 inches wide by 8 inches high with slatted insert and false bottom is provided. Photographic chemicals and supplies are stored in the bench and wall cabinets.

20. Laboratory Chemical Supplies

The necessary supplies of chemicals to equip all laboratories and special rooms are listed in Table 5. All chemicals ordered should be in "tropical seal" air-tight containers. Small units have been specified, whenever possible, rather than more economical bulk units, in order to extend useable shelf life in a warm, humid, tropical climate.

21. Office Equipment

Table 6 lists standard U.S. scientists' office equipment. Electronic calculators and chairs for sit-down technicians have been provided in the laboratories.

22. Laboratory Equipment Tropicalization

All analytical, mechanical, electrical and electronic equipment should be tropically treated. This includes all motors, circuits and control panels.

23. Climatological Measurements

The existing climatology station needs some additional equipment. A fully functional station is essential to interpret field and plot performance of species, soils, varieties

and breeds. Items listed in Table 7 replace some non-functioning equipment and add other essential instruments.

24. Plant and Soil Field Research Equipment

The research scientists in the new laboratory building need to do much plot and field work with the land presently available. Each scientist will conduct personal trials as well as do cooperative research with one or more staff in another discipline. Large power units and farm machinery are available for preparing large plots of land in a short period of time. Irrigation equipment is now functioning on a modest scale to permit dry-season plot work and to supplement wet-season research. We suggest some modest supplements to the machinery and irrigation equipment, in order to make small plot field research possible. We have provided information, in Table 37 which should make operation of the upgraded irrigation system more accurate, beneficial and economical. In addition, in Table 8, we provide some surveying tools necessary for small plot irrigation and layouts, and the hand tools and equipment necessary for field research.

25. Fertilizers and Pesticide Supplies

An essential part of the soil research program will involve the correlation of plant response to fertilizer treatments with laboratory determination of soil characteristics. All fertilizers and other amendments must be imported. We believe a programmed scheme should be yearly-based to make the best use of the 300 metric tons of macro and micro nutrients in Table 9. The returning scientists will need to use the first two years of trials to better plan the last three years, as no data are

presently available to give direction to the research program. They may find that some of the proposed items need increased support while others are less critical and the volume can be reduced. Some new fertilizer and pesticide formulations may be available three to four years hence that do not now have FDA or EPA release approval. Either agency may ban the production of one or more of the fertilizers or pesticides now suggested; therefore, flexibility in yearly reassessment by site scientists and advisors is prudent. Limestone and macro nutrients should be packed in 50 to 100 lb plastic lined, multiwall, Kraft paper bags. Micro nutrients should be packed in 10 to 25 lb plastic lined, multiwall, Kraft paper bags.

26. Seed Supplies

Genetic seed stocks needed for research labs and plots in studies of adaptation and hybridization will be selected by the AID Project Manager, returning participants, and short term consultants from germplasm banks of USDA and international crop research institutes, i.e., International Rice Institute and CIMMYT. Crops should include maize, grain, sorghum, pearl and other millets, soybeans, rice, vegetable crops, pulses, peanuts, forage legumes and grasses. Rhizobium inocula can be obtained from Nitragin Company, Milwaukee. Australian forage legumes (Stylosantheses, Desmodium, Dolichos, etc., Table 36) may have to be purchased separately from Arthur Yates and Company, P.O. Box 117, Rockhampton, Queensland, Australia 4700.

II. Research and Other Programs

27. General

The present program is hampered considerably because much of the laboratory equipment is inoperative, the modest library has few titles acquired after the mid 1960's, and land allocated to field small plot research is minimal.

In general, we recommend that the new lab building be equipped as completely as will be budgetarily feasible before attempts at remodeling or improvement of the existing lab structures or their contents be undertaken (except for rewiring lab equipment motors and heating elements, and replacing some broken elements of functioning equipment). This approach will make it possible for the participants to engage, shortly after their return, in fruitful research applicable to Guinean agricultural conditions.

28. Soil Science

We recommend that the primary emphasis of the soil science research program should be to relate nutritional requirements of crop plants for high production with soil characteristics and with crop response to fertilizers and other amendments. As a secondary, but important priority, the program should include systematic identification and mapping of soil types of INRAF holdings, so that field plots can be located on representative soil types and the research information obtained be useful for most agricultural production in that area of lower Guinea. The scientist(s) in the Soil Science research program should be able to: a) use aerial photos and satellite imagery, and relate them to soils and crops on the ground; b) map soil types and

classify them according to either the International System of Nomenclature (FAO System) or the U.S.A. Soil Taxonomy System; c) determine physical and chemical properties of soils, and interpret their probable influence on crop production; d) conduct soil fertility field trials with the major crops of the area, and relate crop fertilizer responses to soil characteristics; e) develop reasonable and viable crop and soil management schemes to fully utilize the 12 month growing season, including dryland and irrigated situations and verify their feasibility; f) in cooperation with other scientists, advise them on judicious use of soil resources and devise appropriate soil management and soil fertility recommendations.

We have provided equipment and supplies to enable the personnel of the soil research laboratory to determine bulk density, particle density, porosity, mechanical analysis, water holding capacity, pH, calcium carbonate, organic carbon, total nitrogen, conductivity, cation exchange capacity, silicon, available phosphorus, exchangeable potassium, iron, aluminum, exchange acidity, manganese, magnesium and sulfur.

We recommend that the soil science participant become familiar with present methods of soil chemical and physical analyses as they apply to tropical soils, and of tissue analysis for the primary purpose of calibrating laboratory tests with crop responses on different soils. We recommend also that all scientists involved in the project become familiar with the information in the book "Properties and Management of Soils in the Tropics", by Pedro A. Sanchez, 1976, John Wiley & Sons,

Publisher, and more recent literature. We also urge all persons involved to recognize that soil classification should identify soils in accordance with their characteristics as they exist in the field, not according to the way that some one thinks they should be. Thus, we hope that one of the results of this project will be a unification of the several soil classifications and chemical analysis systems presently in use or under consideration in Guinea. The unified single system should recognize the necessity for quantitative criteria to make management interpretations possible with relevant data. Equipment and supplies for measuring these data are supplied within the project framework, and should make possible a continuing program of data acquisition during and after this project.

29. Soil Satellite Imagery

We recommend that satellite photographs and soil maps of Guinea, most particularly of the INRAF 5,000-ha holdings at Foulaya, 5 km south of Kindia; of the Faranah campus and its 650-ha farmland; and of the projected Tindô complex, 10 km south of Faranah, be made available to the Project. We recommend that at least four prints or copies of each be furnished, so that the Project Manager and appropriate scientists can use them in soil mapping and in soil crop management planning and execution. We also recommend that international organizations active in agricultural programs in Guinea be allowed access to this material.

30. Plant Breeding

We recommend that the modest program of maize improvement

be expanded considerably. A large number (in the hundreds) of small lots of seed of inbred lines, single and crosses, and improved open-pollinated cultivars, should be imported from national, international and private sources in both temperate and tropical zones. A systematic adaptation and breeding improvement program should be developed along two parallel approaches. The first would identify those genotypes which, when allowed to cross freely, result in productive, adapted strains for immediate use by producers. The producers should be able to produce their own seed for their fields, once supplied the initial seed stock. The second approach, which should be started on a modest scale at first, should identify inbreds carrying characteristics desirable for high production of maize of desired quality and which, when crossed, will result in single, 3-way or double crosses, or improved populations adapated to Guinean conditions. Maize improvement should have the highest priority since maize is needed as food, feed and green fodder.

The crop breeder should also import and evaluate numerous lines and cultivars of crops important or potentially valuable for Guinea. These include forage and grain sorghums, rice, soybeans for protein food and feed, forage legumes (including peanuts for hay) and grasses, millets and pineapple.

Potential sources of seed include the International Rice Institute; CIMMYT; F.A.O.: International Institute of Tropical Agriculture; public and private breeders in the U.S.A. (including Puerto Rico), Australia, India and many other countries; and other research programs in sub-Sahara Africa.

When material promising for Guinean conditions have been identified in the evaluation program, decisions should be made then on whether this material should be used without modification or whether an improvement program is desirable for that crop.

Finally, the breeder will need to develop a program of production and distribution of reproductive material of improved cultivars. Serious consideration should be given to devoting a substantial portion of INRAF land to the production of seed and reproductive material of improved cultivars for distribution to agricultural producers.

31. Plant Pathology

The humid tropical climate of Guinea is highly conducive to numerous destructive infestations of crops by insects, nematodes, fungi, bacteria and viruses. We recommend that the plant pathologist identify the fungi, bacteria, viruses and other pathogens which infest the major agronomic and horticultural crops of Guinea. Simultaneously, by means of field trials and controlled laboratory tests, he should develop means of abating or controlling phytopathogenic damage. He will need to work closely with the plant breeder as the latter attempts to isolate crop genotypes resistant to diseases. He also will work closely with the soil scientist and other colleagues, since cultural, chemical and biological controls should be investigated.

32. Nematology and Entomology

In a similar vein, the nematologist-entomologist should be able, on gross pathological examination, to identify the kind

of plant-attacking organisms involved in destructive infestations. In cooperation with the plant pathologist, he will identify insect and other vectors of crop plant diseases, and crop-damaging nematodes. In some of these pests, he may have to determine life histories, if these are not described in the world literature. As the plant breeder attempts to isolate crop genotypes resistant to or tolerant of nematode and insect attacks, the nematologist-entomologist will join him in accessing damage to genotypes, in excluding pests, or insuring that specific pests are present in controlled laboratories, micro-plot or field plot situations. In cooperation with the soil scientist and other colleagues, he will develop cultural, chemical and biological procedures effective in controlling major nematode and insect pests of major crops.

33. Plant Protection

The plant protection specialist will work very closely with both the plant pathologist and the nematologist-entomologist. He will be familiar with the mode of action of the major group of compounds used in formulating insecticides, herbicides, fungicides, and other pesticides. He will know how to use these compounds safely, singly and in combination, in order to study their effectiveness in the laboratory, in field research plots and on a large scale. He will develop cost-effective, practical, integrated pest control schemes which may include chemical, biological, mechanical and cultural practices for the major crops of the country. Although he should not neglect considering and using indigenous plants of potential value for pest control,

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he can neither be trained in the short time available nor will he have time on his return to study the medicinal value of local plants; a person with clinical and pharmaceutical training would be needed for this type of activity.

34. Physiology and Chromatography

Some of the existing research programs merit continued and additional support, and their goals should be harmonized with those listed in Sections 29 through 33. We recommend that the paper chromatography laboratory receive continued support, and that its activities in pineapple and other quality control be expanded to supplement research efforts in plant breeding (e.g., amino acid content of maize and other genotypes), plant pathology, entomology and nematology. However, we feel that research with thin layer chromatography should not be initiated at this time.

35. Radioisotope Laboratory

If irradiated seed lots are needed, they can be obtained from Oak Ridge National Laboratory and other laboratories. Much meaningful agricultural research can be done with conventional chemical analyses. We recommend that a new radioisotope laboratory not be initiated at this time.

36. Cytogenetics

The present cytogenetics laboratory is small, but possessed of an excellent microscope and other good equipment. We recommend that this equipment be used in and with the new plant breeding laboratory.

37. Agricultural Climatology

The agricultural climatology station is centrally located and well operated. We recommend a modest infusion of replacement and new equipment to upgrade this facility to minimum standards for agricultural climatological stations in the U.S.A. (Table 7).

38. Irrigation

INRAF possesses a good sprinkler irrigation system with some 10 km of movable 70 mm, 90 mm and 100 mm ID aluminum pipe equipped with 1 m high 44 l/sec sprinkler heads. We observed this equipment functioning. We recommend that some of this equipment be made available, as needed, for use in the research plots. Since the sprinkler heads on hand have too large a delivery to be suitable for small research plots, we recommend supplementing the system with compatible smaller delivery sprinkler heads (Table 8).

39. Research Plot Land

The returning participants will each need to have use of and control over several hectares of land suitable for small plot research. Due to soil, crop, and problem diversity, several non-adjacent parcels probably will be necessary and may be one or more km distance from the laboratory building. Sufficient farm equipment is available at INRAF for plowing and tillage operations on experimental plots. However, small scale farm equipment suitable for individual plot work, specialized equipment, and transportation for the special plot equipment and its operators must be acquired; and these are listed in Table 8.

40. Photographic Laboratory

The existing photographic laboratory has a good enlarger and other equipment. However, the room has no entrance light shield, and it is small. We recommend that the existing equipment be moved to the new dark room in the proposed building, that supplemental equipment and supplies be furnished (Table 1), and that the new facility be made available to all qualified personnel.

41. Animal Program and Support

The general visible health condition of local cattle appeared to be excellent. Knowledgable INRAF staff stated local cattle milk yields to be 1 to 2 liters per day from once-daily milking. Grazing appeared to be adequate for one exotic herd and inadequate for the other herd (particularly larger animals). The crossbreds, N'dama Holstein and N'dama Jersey, were performing quite well during the dry season. Foraging areas appear to be the dry season limiting factor.

The poultry flocks of turkeys, geese, layers and broilers were in generally good condition, although none was on full feed. No evidence was presented to indicate any planned genetic studies or measures of performance.

An exotic fine-wool ram is now being used on the local sheep population. The crossbred lambs were in good physical condition but in need of shearing to improve the comfort index in a tropical climate. The behavior of the exotic ram, of local rams and of a Mali ram indicates that the sheep population is somewhat polyestrus. Lambs and kids of all sizes further indicate that local sheep and pigmy goats are not seasonal breeders. There is

considerable scope, both genetically and nutritionally, to improve meat and wool production in the sheep. Some consideration might be given to crossing Angora goats on local goats to produce mohair by the third generation and to further augment animal protein supplies. The sheep should be kept in high-roof, open-sided sheds when corraled; otherwise they should forage with the local sheep and goat population. The staff is being overly protective of the exotic and crossbred animals. The larger exotic animals require more feed but have greater production on a fixed area than larger numbers of smaller animals.

There is no pork on the farm, but pigs are purported to be kept in the local villages. A crossbreeding program of local black and exotic meat type pigs could be done to increase animal protein supplies.

Forage areas are more than adequate on the farms. Communal grazing probably consumes most of the available forage. Any genetic studies would require close herding of animals to prevent promiscuous breeding, particularly backcrossing with close relatives. Some green maize is available, and large supplies are possible with a 2 or 3 crop system supplemented by irrigation. An immediate increase in green fodder maize can be realized by removing the corn ear at 35% moisture, drying the ear in the sun during the dry season and cutting the green stalk for fresh fodder. The least that should be done is to cut the stalk off just above the ear and to feed it green. The green stalk contains 40% of the nutrients available in 30% moisture corn, while the dry

stalk contains only 10% of the nutrients available in 15% moisture corn. Dry season ruminant feed supplies, particularly for lactating cows, goats and sheep, can be augmented by using pit or half pit-half bunker silos. These must be constructed with open ends for drainage. Oxysol and Ferrisol soils may not require concrete bottoms in pit silos during rainy season use, but pit or bunker silos must have drainage away from the ensiled plant material.

One large cattle shed, a former fruit warehouse, appears to be quite adequate for milking cattle since the barn is open on two sides and contains feed bunks and litter gutter. The tied cattle could be made more comfortable by using rubber mats on the concrete floor by more frequent dung removal and by fixed metal bar partitions, 48 inches apart, between cows. Milk quality would be enhanced and physical injuries reduced. No equipment exists for doing routine butterfat determinations and artificial insemination. Milk measuring equipment was in use. Two-finger strip milking should be dropped in favor of full-hand squeeze. The latter method is much more rapid milking and will become essential as more high-producing crossbreds are introduced into the herds.

The exotic cow stable has a low metal roof that needs to be raised to 11 feet at the eaves. The cattle would be more comfortable if tethered under nearby trees. The newborn calves appeared to be very healthy. It is not necessary to let the calf nurse or to tie the calf near the cow to secure milk release as this is an acquired habit. The exotic herds should be improved

as purebreds, crossbreeding Jersey and N'dama only for the first three years. Most of the male calves should be castrated at 2 weeks of age or moved out into village herds as bulls; the forage saved would benefit the female breeding stock. The same situation exists for sheep and goats; the surplus intact males should be slaughtered at the beginning of the dry season.

42. Artificial Insemination

The animal equipment and supplies (Table 10) are quite adequate to collect semen from INRAF bulls and to inseminate cows with either fresh semen or semen stored in liquid nitrogen. The three nitrogen tanks allow for one-half of the frozen semen bank to be kept on a farm, the other half of the supplies at a second farm, with the third container used to obtain liquid nitrogen from the nearest reliable source.

43. Animal Health Supplies

The health supplies (Table 10) are adequate for about 250 animals for the shelf life of the supplies in a tropical climate. Biologicals allow for testing and treatment of diseases now known to exist in the country. The animals appeared healthy and probably will not require a great deal of clinical treatment until production is increased. Animals reacting to the tuberculin or brucella abortus test should be isolated, retested at 30 days and slaughtered if still positive.

44. Animal Clinical Supplies

Clinical supplies and equipment (Table 10) are adequate to do ambulatory treatment and clinical surgery for larger numbers of animals than the present herds and flocks. Most exploratory and corrective

surgery on ruminants is done with the animal in a standing position. The shelf life of the biologicals is not expected to exceed three years from the date of manufacture. Expendable supplies have been ordered in small units so that unopened units will have a longer shelf life. Ample supplies of forage grasses and legumes largely reduce the health care needs to those of an ambulatory nature.

45. Milk Testing Equipment

Equipment for monthly butterfat testing of milk has been included (Table 10). The butterfat test permits other valid assumptions as to protein, mineral and lactose content of milk. Brucella abortus ring test in milk has been included as a monthly herd test to monitor the disease since intermingling of communal cattle may suddenly infect a clean herd.

46. Forage Supplies

Ruminants must have some fiber in their diet to live comfortably. Maize as a green fodder, ensiled as green fodder or as dried grain offers a lot of promise for Foulaya. Maize culture is already practiced in the villages, and climatic conditions allow for two or three fodder crops per year. Sorghum is grown in both arid and tropical climates in Africa and seems to offer good research possibilities as a human cereal crop and as a green or dry fodder crop. The grain can be removed early as in maize and the fodder fed green or ensiled. Several of the millets also fit this double-purpose use. The peanut plant, properly dried, is an excellent source of plant protein for ruminants. Macerated cull pineapples and other fruits are good

sources of carbohydrate for ruminants and pigs. Dried blood flour and dried fish meal are excellent protein sources for all farm animals but may need to be introduced at the one percent concentrate level to minimize the strange odors. Pig diets and poultry diets should contain 15 to 20% of the two high protein products, while ruminant diets should be at the 5% level during green fodder feeding and at a 10% level during dry fodder feedin Dried maize stover is unpalatable and of low digestibility; therefore, every effort should be used to process the plant as green fodder. Some sorghums have a finer, sweeter stem and can serve as an acceptable dry fodder but are more nutritious when processed green.

47. Cattle Breed Improvement

Frozen male germplasm should be obtained from commercial a institutional organizations in the United States. Selection of sires should feature the Jersey breed for crossing on the N'dama; the Ayrshire breed for improving Ayrshire females now on hand and for crossing with the Red Steppe breed; the Holstein-Friesian breed for improving Friesians now on hand and for crossing with the Simmental breed. Three years from the start of an insemination program, particularly cross breeding on local cattle, milk supplies suddenly double or triple. This will result in a heavy burden on storage, transportation and utilization of milk. The demand for green fodder and supplemental feed will also be increase No breed improvement program should begin until adequate feed and forage supplies are available to support the sharply increased milk, meat, fiber and egg production.

Any importation of livestock should be limited to animals under 3 months of age (accompanied by 6 months supply of concentrates) and candled, fertile poultry eggs to be incubated on site. Imported young age animals should arrive via pressurized air freight in October or November, at the end of the rainy season and during the cool early part of the dry season when green forage is plentiful.

48. Poultry Improvement

A population of 4,000 layers will also result in a population of 4,000 males, unless sexed chicks are imported. The incubation of 10,000 eggs per year is required to maintain a 4,000 bird layer flock. The poultry flock should be limited to 75 percent white Leghorn type layers and 25 percent New Hampshire type heavy birds. A pure line of 500 white birds and 200 red birds should be maintained for each breed, as well as permitting some crossbreeding for broilers only. The animal breeder (82) should develop performance testing programs for the flock and supervise mating systems via trap nesting, individual bird identification, egg fertility records, and growth rates in layers and broilers.

49. Cooperative Research

The principle of a cooperative, unselfish, multi-disciplinary approach to problem-solving is well established in most U.S.A. agricultural experiment stations. In order to make most effective use of limited resources and trained personnel, INRAF staff and, in particular, the returning participants, in cooperation with A.I.D. personnel and consultants, should develop written, specific research proposals with clear-cut, limited, researchable, and achievable goals. These research projects should clearly delineate, year by year, the procedures to be followed and the responsibilities of each

cooperating investigator. They should be revised yearly, taking into consideration results achieved and problems encountered. Laboratory space, equipment and supplies, field research land, books and periodicals, and all other equipment and supplies will have to be shared harmoniously. However, any one room, piece of equipment or supply stock must be the sole responsibility of one single individual who, upon request, should instruct a potential user in the appropriate care, use, and maintenance of each item. The principle that only persons trained, qualified and authorized by the responsible scientist in the proper use of a piece of equipment or of a supply item should be inviolate and must apply to all persons, regardless of their position or other functions.

50. Spare Parts

Since INRAF personnel must do their own maintenance and repair work on all equipment, sufficient spare parts should be supplied with all new equipment for those items likely to require replacement after moderate use for research activities. Normally, this will require a 25% budgetary allocation in excess of the purchase price for the item.

51. Trouble-shooting and Repairs

Special emphasis should be given, in the U.S.A. instructional program to learning trouble-shooting and usual repair procedures for the equipment used in their discipline.

52. Sources of Puchased Equipment

We recommend that as many as possible items of laboratory and field equipment be purchased from as few suppliers as feasible. This would make maintenance and repair training simpler. Sophisticate

laboratories and equipment require first-class maintenance. Whenever possible, even at a greater initial cost, electrical equipment purchased should be wired for 220V, 50Hz current.

53. Teaching Supplies and Support

The Faculté at Foulaya now has 100 to 200 students; in September 1977, 800 to 1,000 additional students will be moved from Conakry to Foulaya. Staff residences and dormitory - classroom buildings, all under construction, were viewed and it is anticipated that they will be completed for the influx of new personnel. Present classrooms have blackboards, chalk, and desks. We recommend modest acquisitions of teaching and visual aids for classrooms, practical training, and demonstrations (Table 11). In addition, we recommend that senior scientists responsible for the research laboratories allow selected advanced students to participate in research activities under close supervision.

54. Extension Training

We recommend strongly that all participants take one course in Agricultural Extension Methods and spend a few weeks in training with an Extension specialist in their field. We recommend that, upon their return, the participants remember that research information is of little value unless it has been interpreted to its potential users in terms they can understand and has been translated into practical, relevant, sensible, and feasible action programs. Upon their return, participants should be allowed to spend at least 75% of their time in research activities. They should also spend 10% of their time in teaching within their area of specialization and 10% in extension activities. Up to 5% of their time could be devoted

to helping formulate management plans for INRAF production holdings.

55. Library Support and Operation

The library should serve the needs of research extension and teaching personnel. We recommend that the library be upgraded and supplemented with books, abstract journals and periodicals (Table 12). The library needs staffing by a trained librarian to properly index, catalogue, and shelve present holdings and acquisitions and to maintain circulation records. The library should be accessible regularly to all personnel during normal office hours and during defined study periods with limited 7-day circulation privileges extended to staff.

We recommend that a librarian be considered for participant training in the future on a work-study program.

56. Pre-independence Library Materials

We recommend that documentary material pertaining to agriculture and agricultural research in Guinea, which is available in several libraries in Paris, France, be located by competent scientists fluent in French. If possible, copies of material relev. to present Guinea agricultural conditions should be obtained for transmittal to the library at Foulaya. This should save considerable effort and time by eliminating unnecessary repetition of research activities. The University of Edinburg, Scotland, has an excellent series of courses in animal tropical diseases with associated library facilities.

III. Comments on the A & E Report, Foulaya

57. General

We have chosen to comment only in cases where we wish to supplement or suggest changes or deletions to the A & E Report.

58. Specific Comments on Construction

a. Refer FOU 17-7. Attic space insulation thickness should be specified at least 12 inches.

b. Refer FOU 17-9. Wall finish of ceramic tile, unpainted or painted stucco.

c. Refer FOU 17-10. Counter tops should be laminated plastic, including laboratory tops, as stone tops are conducive to broken glassware.

d. Refer FOU 18-13. Fume hoods will require stainless steel stacks, omit remainder of section.

e. Refer FOU 18-15. Plumbing - Pipe for acid and alkali drainage should be Pyrex, with Pyrex traps emptying to a special septic tank, separate from all other waste.

f. No termite barrier appears to have been specified. Since much lab equipment and cabinets will be wood, termite barriers should be included.

g. Safety shower(s) and safety sinks are not mentioned.

h. Ceiling height on both floors, in order to clear some equipment and mostly to allow cross ventilation, should be at least 11 feet.

i. Each laboratory and special room with cold water tap should have a floor drain, garden hose and bib for first aid and cleaning purposes.

j. Pyrex traps under all lab and special room sinks should be easily accessible for cleaning out soil, plant and other debris.

k. Services should be constructed with electrical lines above water lines and water lines above waste lines. No service line should be imbeded in concrete or plaster --- all should be readily visible and color coded.

l. Shutters should be provided that will close independently of windows, and they should be hinged at the top.

m. Do not direct wire any electrical appliances or equipment except the arc welder.

n. Is a one meter eave on the south and west sides adequate for this latitude and the expected wind-driven monsoon rain?

o. FOU 17-7. We recommend light-colored corrugated asbestos roofing that is painted black on the underside.

59. Water for Poultry Units

The water supply system should include a booster pump or portable high pressure cleaner for poultry buildings.

60. Started Engines for Diesel Engines

The diesel engines should have the possibility of a 5 HP gas engine as auxiliary starting to replace or supplement batteries.

61. Generators Instead of Alternators

Motorized equipment, stationary and mobile, should be equipped with generators or magnetos rather than with alternators. Battery failure is frequent in tropical climates, and replacement batteries are scarce.

62. Water Mains

FOU 46. Water mains should be constructed according to USPH code in relation to septic tanks and fields. Provision has been made in Table 10 for a septic tank cleaner pump and tank trailer. All septic tanks must have identifiable and accessible clean outs.

63. Standby Generator Tests

FOU 49-17. Weekly or monthly standby generator tests should be

done manually with records of date, time and the name of the engineer performing the test.

64. Electrical Demand

FOU 50-Ib. The electrical demand for all electrical equipment operating simultaneously in the labs should be determined as the operating load.

65. Swimming Pool

FOU 53. Swimming pool rehabilitation must have a low construction priority. It can only be justified as an auxiliary storage of water for fire protection, irrigation and then recreation since the pool is some distance from the student dormitories.

FOU 54. IV The chlorine gas cartridges for the pool are not justifiable in that the person responsible for the water plant purification should monitor the pool daily. Refer to FOU 40 for system and costs.

66. Butane Plant and Gas Supply

FOU 56. We do not recommend the rehabilitation of the butane plant. We do not recommend the storage tank as suggested as an alternate to the butane plant. We do recommend individual bottled gas cylinders for each lab bench in new and existing laboratories. A two-bottle system with automatic change-over valve would guarantee uninterrupted gas service. Individual bench tanks will insure monitoring of gas usage in each space, as well as save installation and maintenance costs.

67. Mineralization Room Ventilation

FOU 60. We do not recommend replacement of the ventilation system in the mineralization room in the existing lab. Two new

stainless steel hoods with stainless steel stacks and vents and wash down have been provided in the new lab building for shared use of wet lab - acid digestion. Two of the hoods in the mineralization room do not have motors, and the exhaust flues probably need to be removed. Such renovation often results in structural changes to a building.

68. Cold Room

FOU 61. We consider the abandoned cold room and sweet water plant to be unrehabilitable. We recommend a Nor-Lake packaged unit to replace the cold room system. (Paragraph 4).

69. Frost Dangers

FOU 71, paragraph 2. We concur.

70. Filters for Hazardous Substances

FOU 72, Paragraph 2, Line 7. There are few low-cost filters effective for treating hazardous substances.

IV. Participants

71. General

We met with the seven participants selected by GOG on two occasions, for about three hours each time. Six of them had started learning English in late December, 1976, and one in mid-April. We were impressed by their progress in English oral communication, their intelligence, and their positive attitude toward their upcoming study in the U.S.A.

72. Future Participant Training

We recommend that future participant training programs include practical training in the U.S.A., at both public institutions and private training centers, for: a) electronics instrument repair

technicians; b) electricians;c) tractor and farm implement technicians; d) refrigeration specialists;e) librarians.

73. Degree Programs Participation

We strongly recommend that all seven participants be allowed to pursue a Master's degree program. We anticipate that some delays may occur for some of the participants in completing the degree program in 24 months. These delays may be occasioned by the difficulties that most foreign students encounter with English and in adapting to systems of study, examinations and instruction different from the type to which they are accustomed. In addition, some of the participants may have to take courses prerequisite to the ones they must have to become acceptably competent in their discipline.

74. Participants' Degree Research Programs

We strongly recommend that the participants do not write a Master's thesis, but instead follow a non-thesis option with a minimum of 30 to 36 weeks at 3 hours/week, or equivalent, of special problems apportioned among a minimum of three different topics. These special problems should be designed to enable the participants to acquire research skills which will be useful to them in Guinea. Since the special topics should not necessarily help solve U.S. agricultural research problems but rather should emphasize the acquisition of research skills applicable to the participants' needs, we recommend that AID support each participant's major department at the rate of $1,500.00 for the series. We recommend that, whenever possible, the participants' major professors be selected from among those professionally qualified who have had some experience in

international agriculture.

75. Suggested Curriculum for Mr. Jules F. Damey, Soil Fertility and Science (based on University of Tennessee quarter system and catalogue)

A. 1) Plant & Soil Science, 3110 Soil Fertility and Fertilizers (4) Properties of soils in relation to plant nutrient availability and uptake. Methods of soil fertility evaluation and principles of fertilizer use; manufacture and properties of fertilizers. Prereq: 2130. 3 hrs and 1 lab.

2) Plant & Soil Science, 3220 Soil Management (4) Soil management for crop production including cropping systems, fertilizer use, and tillage operations for specified soil and farming conditions. Prereq: 2130. 3 hrs and 1 lab.

3) Plant & Soil Science, 3610 Interpretation of Agricultural Research (3) Statistics as applied to agriculture. Statistical methods in interpretation of research results. Prereq: Math. 1550.

4) Plant & Soil Science, 4110 Soil Chemistry (4) Colloidal systems; properties and behavior of colloidal soil materials: relations of chemical properties to plant nutrient availability. Prereq: 2130; Physics 1210. 3 hrs and 1 lab.

5) Plant & Soil Science, 4230 Soil Analysis (3) Analytical techniques used in soil chemistry and soil fertility studies; instrument trouble-shooting. Prereq: 4110, Chemistry 2140 or concurrent. Two 3-hr labs.

6) Plant & Soil Science, 4320 Soil Formation, Morphology, and Classification (4) Soil function; properties, distribution, and classification of soils; interpretation of morphology; use of soils surveys. Prereq: 2130. 3 hrs and 1 lab.

7) Plant & Soil Science, 5240 Soil Productivity and Management (3) Concepts of soil productivity and management, quantitative evaluation of factors and their interaction affecting soil management decisions, cropping systems, water control and management, tillage and fertility management. Planning and evaluation of specific soil management programs. Prereq: 3220 and 4110 or consent of instructor.

8) Plant & Soil Science, 5250 Pedology (4) Factors and processes of formation as related to the physical, chemical, and mineralogical properties of soils; soil in an ecosystem; classification of soils. Prereq: 4320 or consent of instructor. 3 hrs and 1 lab.

9) Plant & Soil Science, 5340 Soil Physics (3) Chemical and physical relationships among the solid, liquid, and gaseous phases of the soil mass; their relation to plant growth and soil management. Prereq: 4110. 2 hrs and 1 lab.

10) Plant and Soil Science. 5310 Design and Interpretation of Experiments (3) Experimental design and procedures; effect of different variables on precision of experiments; problems dealing with the analysis of data. Prereq: 3610 or equivalent.

11) Plant & Soil Science, 5370 Advanced Soil Fertility (3) Fundamental concepts and soil chemistry as they relate to nutrient absorption by plant roots; interrelation of these concepts in soil fertility and soil management. Prereq: 4110.

12) Plant & Soil Science, 5810 Crop Climatology (4) Meteorological factors affecting crop plans; crop distribution and centers of origin; general and specific climatic, weather, and vegetative systems; microclimatic influences on plant growth. Prereq: 3020, 3040; or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

13) Plant & Soil Science, 5820 Advanced Crop Physiology and Ecology (4) Historical development of research in crop physiology and ecology. Interrelationships between physiologic processes and environmental factors. Crop adaptation to specific environmental conditions. Prereq: 3020, 3040, or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

14) Geology, 3180 Mineralogy (4) Classification and identification of silicate and non-silicate minerals. Minerals as phases in natural systems. Laboratory includes hand specimen, chemical and x-ray methods of identification. Prereq: 3160; Chemistry 1110-20 or equivalent. 2 lectures and 2 labs.

15) Chemistry, 2140 Analytical Chemistry (3) Principles and practice of quantitative measurements in chemical systems. Acid-base equilibria, oxidation-reduction systems, complexometric titrimetry, elementary spectrophotometry, potentiometric methods, application of titrimetric analysis. Prereq: 1110-20-30. Coreq: 2149.

16) Chemistry, 2149 Analytical Chemistry (1) Experiments on topics discussed in 2140. Prereq or coreq: 2140. 1 lab.

17) Agricultural Extension Education, 3110 Introduction to Agricultural Extension (3) History; philosophy; organization; teaching methods; relationships with other educational agencies. Graduate credit for non-majors only.

3. Recommended institutions: North Carolina State, University of Florida; University of Tennessee - Knoxville; University of California - Davis; Virginia Polytechnic Institute.

76. Suggested curriculum for Mr. Oua N'Diaye, Plant Breeding and Genetics

(based on University of Tennessee quarter system and catalogue)

1) Plant & Soil Science, 3110 Soil Fertility and Fertilizers (4) Properties of soils in relation to plant nutrient availability and uptake. Methods of soil fertility evaluation and principles of fertilizer use; manufacture and properties of fertilizers. Prereq: 2130. 3 hrs and 1 lab.

2) Plant & Soil Science, 3610 Interpretation of Agricultural Research (3) Statistics as applied to agriculture. Statistical methods in interpretation of research results. Prereq: Math. 1550.

3) Plant & Soil Science, 4120 Principles of Crop Breeding (4) Genetic principles and techniques used in crop improvement. Prereq: 8 hrs biological science or permission of instructor. 3 hrs and 1 lab.

4) Plant & Soil Science, 5240 Soil Productivity and Management (3) Concepts of soil productivity and Management, quantitative evaluation of factors and their interaction affecting soil management decisions, cropping systems, water control and management, tillage and fertility management. Planning and evaluation of specific soil management programs. Prereq: 3220 and 4110 or consent of instructor.

5) Plant & Soil Science, 5310 Design and Interpretation of Experiements (3) Experimental design and procedures; effect of different variables on precision of experiments; problems dealing with the analysis of data. Prereq: 3610 or equivalent.

6) Plant & Soil Science, 5710 Advanced Plant Genetics (3) Importance of polyploidy in plants; detailed study of genome relationships, genetic recombination, mutation, heterosis, quantitative inheritance, heritability selection and self-incompatibility systems in relation to genetic principles. Prereq: Basic Genetics or consent of instructor.

7) Plant & Soil Science, 5720 Quantitative Genetics (3) The Genetic constitution of population and changes in gene frequency; recognition and measurement of continuous variation; estimation of variable components and genetic advance under different breeding procedures. Prereq: Basic Genetics or consent of instructor.

8) Plant & Soil Science, 5750 Advanced Plant Breeding (4) Historical development of plant breeding concepts and methods, effects of heterosis, inbreeding, hybridization and selection. Improvement of self and cross pollinated crops. Prereq: 5710. 3 hrs and 1 lab.

9) Plant & Soil Science, 5810 Crop Climatology (4) Meteorological factors affecting crop plants; crop distribution and centers of origin; general and specific climatic, weather, and vegetative systems; microclimatic influences on plant growth. Prereq: 3020, 3040; or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

10) Plant & Soil Science, 5820 Advanced Crop Physiology and Ecology (4) Historical development of research in crop physiology and ecology. Interrelationships between physiologic processes and environmental factors. Crop adaptation to specific environmental conditions. Prereq: 3020, 3040; or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

11) Plant & Soil Science, 6410 Experimental Designs (3) Principles of experimental designs used in agricultural research. Completely randomized, randomized complete block and latin square designs; the factorial experiment and confounding; lattice designs; and covariance. Prereq: 5310.

12) Botany, 5810 Cytogenetics (4) Changes in chromosomes and genes with relation to mutations, hybridization, speciation, and phylogeny. Prereq: General Genetics; 5780, or Zoology 4310. 2 hrs and 2 labs.

13) Agricultural Biology, 3130 Introductory Plant Pathology (4) Principles of plant pathology illustrated by diseases of common agricultural crop plants. Prereq: Introductory botany or Zoology. Graduate credit for non-majors only. 3 hrs and 1 lab. (See as Botany 3130.)

14) Agricultural Biology, 3210 Economic Entomology (4) Structure, life history, habits, and principles of control of important insect pests of farm, garden, orchard, and household, 3 hrs and 1 lab.

15) Agricultural Extension Education, 3110 Introduction to Agricultural Extension (3) History; philosophy; organization; teaching methods; relationships with other educational agencies. Graduate credit for non-majors only.

16) Biochemistry, 4110-20 Cellular and Comparative Biochemistry (4,4) Electrolyte behavior; chemistry and structure of proteins; enzyme behavior and biological function; catabolism and energy capture; synthetic metabolism; nucleic acid function,

protein synthesis and biochemical genetics; regulation of biological processes. Must be taken in sequence. Prereq: Chemistry 3211-21-31 and an introductory course in biology (i.e., Biology 1210-20-30 or Botany 1110-20-30). Three lectures and discussion.

B. Recommended institutions: University of Minnesota; Iowa State University; University of Tennessee - Knoxville; University of Missouri - Columbia; University of Nebraska.

77. Suggested curriculum for Mr. Namory Sidibé, Plant Pathology

(based on University of Tennessee quarter system and catalogue)

A. 1) Chemistry, 2230 Elements of Organic Chemistry (4) Brief treatment of organic chemistry with emphasis on compounds of biological interest. Prereq: one year of general chemistry. Not open to chemistry majors or minors.

2) Biochemistry, 4110-20 Cellular and Comparative Biochemistry(4,4) Electrolyte behavior; chemistry and structure of proteins; enzyme behavior and biological function; catabolism and energy capture; synthetic metabolism; nucleic acid function, protein synthesis and biochemical genetics; regulation of biological processes. Must be taken in sequence. Prereq: Chemistry 3211-21-31 and an introductory course in biology (i.e., Biology 1210-20-30 or Botany 1110-20-30). Three lectures and discussion.

3) Agricultural Engineering, 4180 Equipment and Techniques for Application of Agricultural Chemicals (3) Equipment for application of liquid, solid, and gaseous chemicals; system components; operational characteristics; safety considerations; calibration; selection and management; materials handling and disposal methods. 2 hrs and 1 lab.

4) Microbiology, 4521 Virology (3) The spectrum of bacterial, animal and plant viruses is presented with special emphasis on a comparison of the infectious cycles and the molecular concepts of replication. Prereq: 3000, 3009. Biochemistry 4110-20 or consent of instructor.

5) Botany, 5011 Mycology (4) An intensive survey of the fungi, including all major classes, utilizing lecture, laboratory and field information, Occasional field trips. Prereq: 3010 3 hrs and 1 lab.

6) Botany, 5150 Advanced Morphology of Flowering Plants (4) A consideration of vegetative and reproductive organography including regulatory physiology, floral development, pollination mechanisms, embryology and its deviations, seed and fruit development. Prereq: 3020-30 or 4120; 3210 or consent of instructor.

7) Agricultural Extension Education, 3110 Introduction to Agricultural Extension (3) History; philosophy; organization; teaching methods; relationships with other educational agencies. Graduate credit for non-majors only.

8) Plant & Soil Science, 3610 Interpretation of Agricultural Research (3) Statistics as applied to agriculture. Statistical methods in interpretation of research results. Prereq: Math 1550.

9) Plant & Soil Science, 4120 Principles of Crop Breeding (4) Genetic principles and techniques used in crop improvement. Prereq: 8 hrs biological science or permission of instructor. 3 hrs and 1 lab.

10) Plant & Soil Science, 5240 Soil Productivity and Management (3) Concepts of soil productivity and management, quantitative evaluation of factors and their interaction affecting soil management decisions, cropping systems, water control and management, tillage and fertility management. Planning and evaluation of specific soil management programs. Prereq: 3220 and 4110 or consent of instructor.

11) Plant & Soil Science, 5820 Advanced Crop Physiology and Ecology Historical development of research in crop physiology and ecology. Interrelationships between physiologic processes and environmental factors. Crop adaptation to specific environmental conditions. Prereq: 3020, 3040; or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

12) Agricultural Biology, 3130 Introductory Plant Pathology (4) Principles of plant pathology illustrated by diseases of common agricultural crop plants. Prereq: Introductory botany or zoology. Graduate credit for non-majors only. 3 hrs and 1 lab. (Same as Botany 3130).

13) Agricultural Biology, 4030 Forest and Shade Tree Entomology (3) Identification, biology, ecology, and control of forest and shade tree pests. Prereq: 3210 or equivalent. 2 hrs and 1 lab.

14) Agricultural Biology, 4010 Biology of Soil Microorganisms (4) A study of the morphology and physiology of soil organisms, decomposition or organic matter, chemical transformations, and interactions between soil organisms and higher plants. Prereq: Introductory microbiology or 3130. 3 hrs and 1 lab.

15) Agricultural Biology, 5010 Research Methods and Instrumentation in Plant Pathology and Entomology (3) Techniques for laboratory, field and greenhouse research in plant pathology and entomology. 1 hr and 2 labs.

16) Agricultural Biology, 5220 Plant Disease Control (3) Basic problems and principles involved in controlling plant diseases. Prereq: 3130.

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B. Recommended Institutions: University of Wisconsin; University of Minnesota; Ohio State University; North Carolina State; University of Florida.

78. Suggested curriculum for Mr. Aboubakar Touré, Nematologist-Entomologist

(based on University of Tennessee quarter system and catalogue)

A. 1) Chemistry, 2230 Elements of Organic Chemistry (4) Brief treatment of organic chemistry with emphasis on compounds of biological interest. Prereq: one year of general chemistry. Not open to chemistry majors or minors.

2) Agricultural Biology, 3210 Economic Entomology (4) Structure, life history, habits, and principles of control of important insect pests of farm, garden, orchard, and household. 3 hrs and 1 lab.

3) Agricultural Biology, 3220 Apiculture (3) Biology of the honey bee, with emphasis on beekeeping equipment and apiary management practices relative to pollination of crops and production of honey and beeswax. 2 hrs and 1 lab.

4) Agricultural Biology, 4010 Biology of Soil Microorganisms (4) A study of the morphology and physiology of soil organisms, decompositions, and interactions between soil organisms and higher plants. Prereq: Introductory microbiology or 3130. 3 hrs and 1 lab.

5) Agricultural Biology, 5010 Research Methods and Instrumentation in Plant Pathology and Entomology (3) Techniques for laboratory, field and greenhouse research in plant pathology and entomology. 1 hr and 2 labs.

6) Agricultural Biology, 5210 Plant Parasitic Nematodes (4) Morphology, physiology, toxonomy, and ecology of plant parasitic nematodes with emphasis on host-parasite relationships. Prereq: 8 hrs biological science or consent of instructor. 2 hrs and 2 labs. (Same as Zoology 5210.)

7) Agricultural Biology, 5230 Field Crop and Vegetable Insects (3) Taxonomy, biology, and control of insects affecting field and vegetable crops. Prereq: 3210 or equivalent course in applied entomology. 2 hrs and 1 lab.

8) Agricultural Biology, 5240 Insect Pests of Man and Animal (3) A study of the taxonomy, biology and control of those insects parasitic on domestic animals and those found in human habitation. Prereq: 3210 or equivalent course in applied entomology. 2 hrs and 1 lab.

9) Agricultural Biology, 5260 Insect Pest Management (4) Principles and applications of biological, cultural, enetic, behavioral, and chemical methods of control to maintain pest population below economic threshold levels. Prereq: 3210, Zoology 3110, or consent of instructor. 3 hrs and 1 lab.

10) Agricultural Engineering, 4180 Equipment and Techniques for Application of Agricultural Chemicals (3) Equipment for application of liquid, solid, and gaseous chemicals; system components; operational characteristics; safety considerations; calibration; selection and management; materials handling and disposal methods. 2 hrs and 1 lab.

11) Agricultural Extension Education, 3110 Introduction to Agricultural Extension(3) History; philosophy; organization; teaching methods; relationships with other educational agencies. Graduate credit for non-majors only.

12) Plant and Soil Science, 3110 Soil Fertility and Fertilizers (4) Properties of soils in relation to plant nutrient availability and uptake. Methods of soil fertility evaluation and principles of fertilizer use; manufacture and properties of fertilizers. Prereq: 2130. 3 hrs and 1 lab.

13) Plant and Soil Science, 3610 Interpretation of Agricultural Research (3) Statistics as applied to agriculture. Statistical methods in interpretation of research results. Prereq: Math 1550.

14) Plant and Soil Science, 4320 Soil Formation, Morphology, and Classification (4) Soil formation; properties, distribution, and classification of soils; interpretation of morphology; use of soils surveys. Prereq: 2130. 3 hrs and 1 lab.

15) Plant and Soil Science, 5240 Soil Productivity and Management (3) Concepts of soil productivity and management, quantitative evaluation of factors and their interaction affecting soil management decisions, cropping systems, water control and management, tillage and fertility management. Planning and evaluation of specific soil management programs. Prereq: 3220 and 4110 or consent of instructor.

16) Plant and Soil Science, 5340 Soil Physics (3) Chemical and physical relationships among the solid, liquid, and gaseous phases of the soil mass; their relation to plant growth and soil management. Prereq: 4110. 2 hrs and 1 lab.

17) Plant and Soil Science, 5810 Crop Climatology (4) Meteorological factors affecting crop plants; crop distribution and centers of origin; general and specific climatic, weather, and vegetative systems; microclimatic influences on plant growth. Prereq: 3020, 3040; or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

B. Recommended Institutions: University of Tennessee - Knoxville; University of Florida; Purdue University; Michigan State University.

79. Suggested curriculum for Mr. F. Laye Guilavogui, Plant Protection

(based on University of Tennessee quarter system and catalogue)

A. 1) Chemistry, 3211-21-31 Organic Chemistry (3,3,3) Compounds of carbon and their reactions, reaction mechanisms, spectroscopic and other physical properties. Must be taken in sequence. Prereq: 1110-20-30. Corresponding laboratory (3219-29-39) is coreq for students not having credit for laboratory.

2) Chemistry, 3219-29-39 Organic Chemistry Laboratory (1,1,1) Experiments on topics discussed in 3211-21-31. Corresponding lecture (3211-21-31) is coreq for students not having credit for the lecture.

3) Chemistry, 2140 Analytical Chemistry (3) Principles and practice of quantitative measurements in chemical systems. Acid-base equilibria, oxidation-reduction systems, complexometric titrimetry, elementary spectophotometry, potentiometric methods, application of titrimetric analysis. Prereq: 1110-20-30 Coreq: 2149.

4) Chemistry, 2149 Analytical Chemistry (1) Experiments on topics discussed in 2140. Prereq or coreq: 2140. 1 lab.

5) Biochemistry, 4110-20 Cellular and Comparative Biochemistry (4,4) Electrolyte behavior; chemistry and structure of proteins; enzyme behavior and biological function; catabolism and energy capture; synthetic metabolism; nucleic acid function, protein synthesis and biochemical genetics; regulation of biological processes. Must be taken in sequence. Prereq: Chemistry 3211-21-31 and an introductory course in biology (i.e., Biology 1210-20-30 or Botany 1110-20-30). Three lectures and discussion.

6) Agricultural Engineering, 4180 Equipment and Techniques for Application of Agricultural Chemicals (3) Equipment for application of liquid, solid and gaseous chemicals; system components; operational characteristics; safety considerations; calibration; selection and management; materials handling and disposal methods. 2 hrs and 1 lab.

7) Agricultural Engineering, 4210 Agricultural Machinery and Tractors (4) Agricultural machinery and power units; adaptation to agricultural practices; field efficiencies, capacities, adjustment and servicing. Prereq: introduction to Agricultural Engineering; General Mathematics (8 hrs). 3 hrs and 1 lab.

8) Agricultural Extension Education, 3110 Introduction to Agricultural Extension (3) History; philosophy; organization; teaching methods; relationships with other educational agencies. Graduate credit for non-majors only.

9) Plant and Soil Science, 3110 Soil Fertility and Fertilizers (4) Properties of soils in relation to plant nutrient availability and uptake. Methods of soil fertility evaluation and principles of fertilizer use; manufacture and properties of fertilizers. Prereq: 2130. 3 hrs and 1 lab.

10) Plant and Soil Science, 3610 Interpretation of Agricultural Research (3) Statistics as applied to agriculture. Statistical methods in interpretation of research results. Prereq: Math. 1550.

11) Plant and Soil Science, 3710 Principles of Weed Science (4) Basic principles of weed science, history, ecology, economic losses, means of control, types of herbicides, and specific recommendations for various crop and non-crop uses. Prereq: 8 hrs biological science and 3 hrs organic chemistry. 3 hrs and 1 lab.

12) Plant and Soil Science, 5340 Soil Physics (3) Chemical and physical relationships among the solid, liquid, and gaseous phases of the soil mass; their relation to plant growth and soil management. Prereq: 4110. 2 hrs and 1 lab.

13) Plant and Soil Science, 5820 Advanced Crop Physiology and Ecology (4) Historical development of research in crop physiology and ecology. Interrelationships between physiologic processes and environmental factors. Crop adaptation to specific environmental conditions. Prereq: 3020, 3040, or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

14) Agricultural Biology, 3130 Introductory Plant Pathology (4) Structure, life history, habits, and principles of control of important insect pests of farm, garden, orchard, and household. 3 hrs and 1 lab.

15) Agricultural Biology, 3210 Economic Entomology (4) Structure, life history, habits, and principles of control of important insect pests of farm, garden, orchard, and household. 3 hrs and 1 lab.

16) Agricultural Biology, 5230 Field Crop and Vegetable Insects (3) Taxonomy, biology, and control of insects affecting field and vegetable crops. Prereq: 3210 or equivalent course in applied entomology. 2 hrs and 1 lab.

17) Agricultural Biology, 5260 Insect Pest Management (4) Principles and applications of biological, cultural, genetic, behavioral and chemical methods of control to maintain pest populations

below economic threshold levels. Prereq: 3210, Zoology 3110, or consent of instructor. 3 hrs and 1 lab.

18) Plant and Soil Science, 5850 Mechanisms of Herbicide Action (3) Principles of the uptake, translocation, mode of action and basis of selectivity of herbicides. The effects of herbicides on plant morphology, metabolic systems and enzymatic activities will be discussed. Prereq: Botany 3210 and Biochemistry 4110 or consent of instructor.

B. Recommended Institutions: North Carolina State University; University of Georgia - Athens; University of Tennessee - Knoxville; University of Kentucky; University of Illinois

80. Animal Health Participant

The animal health participant should be able to administer routine test agents (tuberculin, brucella abortus test, milk ring test, hemorragic septicemia, black leg, anthrax) and biologicals to screen pathological problems and protect against endemic diseases. The person should be able to do gross pathological examination to determine the condition of the lungs, heart, liver, kidney and intestines in a cadaver. This will reveal the general state of health, particularly any internal parasite problems in ruminants. Some experience in inspecting meat supplies in a slaughter house would be helpful in gross pathology. Otherwise, the participant should spend 20% of his time in a post-mortem laboratory under the tutelage of an experienced pathologist; 20% of his time in ambulatory clinics; 20% in nutrition production and physiology classes; 20% in microbiology and 20% studying parasitic diseases. We strongly suggest that the participant be sent for a 24 to 30 month period so that upon his return he will feel confident in designing immunization programs, and he will be able to do gross diagnosis, gross pathology, microbiological assessments of major health problems and will supervise an ambulatory clinic and hospital. He would be able to castrate and dock the

tails of lambs; castrate, dehorn and brand cattle; treat routine mammary gland infections; administer intravenous solutions; perform emergency rumenotomies and formulate diets, forage and concentrate for ruminants and nonruminants.

81. Suggested curriculum for Mr. Gnagna Gbanamou, Animal Health, leading to a Master of Science or Master of Agriculture - Animal Health. (Number of courses, both noncredit and credit, class hours per week, on a 12-month basis)

	No. of Courses	Noncredit	Credits	Hours Per Week
1. Physiology	1	(6)		7
2. Pathology	1		4	8
3. Microbiology	2	(5)	4	9-8
4. Parasitology	2	(5)	4	9-8
5. Nutrition	4	(5)	8	6-10
6. Production	3		12	4
7. Reproduction & Lactation	1		5	6
8. Special Problems, Clinics	3		9	6
	17	21	46	

12 Months Study Program:

A. Ambulatory Clinic - 520 Hours

B. Pathology Laboratory - 520 Hours

C. Parasitology Laboratory - 520 Hours

D. Microbiology - 520 Hours

E. Nutrition - 60+15+15+60+60= 210 Hours

F. Production - Dairy, Beef, Sheep, Poultry, Swine = 250 Hours

G. Physiology - Reproduction and Lactation - 60 Hours

Total 2,600 Hours

A. Ambulatory Clinic - 2 hours daily x 5 or 10 hours per week: Respiration, rumination, mammary palpation, rectal palpation, routine immunizations, clinic treatments, pregnancy determination.

B. Pathology Laboratory - large animal emphasis - gross malnutrition, gross pathology of heart, lungs, liver, kidney, intestines; elementary microbiological tests with prepared test agents; elementary chemical tests for metal poisoning and serum analysis; elementary identification of internal and external parasites.

C. Parasitology Laboratory - 2 hours daily x 5 or 10 hours per week: Macro- and microscopic identification of common internal and external parasites of cattle, sheep, pigs and poultry, identification behavior and host of tropical internal and external parasites of farm livestock and poultry; pharmaceutical methods of interrupting the life cycle of parasites peculiar to Guinea.

D. Microbiology Laboratory - 2 hours x 5 or 10 hours per week: Micro methods of isolating and identifying common pathogens of farm livestock and poultry; disc assay of pathogens; characteristics, habitat and life cycle of soil spore forms pathogenic to farm livestock and poultry; standard plate counts; water quality; milk quality; direct microscopic counts; leucocyte counts.

E. Nutrition:

1. Basic Animal Nutrition - 60 hours.

Essential nutrients, sources of essential nutrients, calculating

rations and diets, using NRC tables of requirements for beef, dairy, poultry, sheep and pigs.

2. Pig Nutrition - 15 hours.

Essential animo acids; vitamins and minerals; ration and diet calculation for baby pigs, growing and finishing pigs, lactating sows and breeding herds; NRC table of requirements.

3. Poultry Nutrition - 15 hours.

Essential animo acids, vitamins and minerals for chicks, poults, layers, broilers and turkeys; diet and ration formulation; NRC tables of nutrient requirements.

4. Ruminant Nutrition - 60 hours.

Energy, fats, fiber, protein and mineral requirements for cattle, sheep and goats; digestion; deficiency diseases; diet and ration formulation; problem solving.

5. Forage of Livestock - 60 hours.

Species and cultivars of grasses and legumes suitable for farm livestock; cultural methods, climatic zones, soil environment; harvesting and storage; range management.

F. Production and Management - 5 hours per week.

Problem solving and management planning of beef, dairy, poultry, pig and sheep farms; feed, labor and miscellaneous expense budgets; marketing animal products; evaluation of performance; operation of breeding farms.

G. Physiology - Reproduction and Lactation - 60 hours.

Hormone control of lactation, estrus and pregnancy; physiology of the reproductive organs in the female and male; physiology of the mammary gland; artificial insemination; milk secretion.

H. Recommended Institutions: University of Minnesota, Auburn University, Iowa State University, Michigan State University, Pennsylvania State University.

82. The Artificial Insemination Participant

The artificial insemination participant should probably be called an animal breeder. His responsibilities should include data systems or performance testing of poultry, ruminants and pigs; selection of male and female germplasm on the basis of his data and international data; design breed improvement programs; collect, process, store and use fresh and frozen male germplasm; determine pregnancy in large ruminants at 60 days post-breeding; teach others the technique of artificial insemination and estrus detection in all species.

83. Suggested curriculum for Mr. Mamadi Kourouma as Animal Breeder, B.S. or M.A. (Number of courses, noncredit and credit, hours per week)

		Credit	Noncredit	Hours per Week/12 weeks
A.	1. Reproduction and Lactation	5		6
	2. Genetics		(4)	4
	3. Animal Breeding		(5)	5
	4. Dairy Cattle Breeding	4		4
	5. Adv. Animal Breeding	3		3
	6. Poultry Breeding	3		3
	7. Swine Production	4		4
	8. Dairy Production	4		4
	9. Livestock Evaluation		(2)	6

.70X

10.	Poultry Production	4		4
11.	Sheep Production	4		4
12.	Livestock and Meat Evaluation		(4)	6
13.	Dairy Cattle Evaluation		(2)	6
14.	Statistics		(4)	4
15.	Statistics	5		5
16.	Special Problems	9		9
		45	21	

AI in Turkeys, Cattle, Performance testing, Babcock testing, Dairy Herd Improvement Program, Pedigrees.

B. Recommended Institutions: University of Minnesota, Iowa State University, University of Tennessee - Knoxville, University of Kentucky, University of Missouri - Columbia.

12 Months Program

	Course	Credits	Hours per week/ 12 Weeks
1.	Genetics	4	4
2.	Animal Breeding	5	5
3.	Dairy Cattle Breeding	4	4
4.	Reproduction & Lactation	5	6
5.	Poultry Production	4	4
6.	Dairy Production	4	4
7.	Swine Production	4	4
8.	Nutrition	13	5
9.	Special Problems	8	10
10.	Practicum	0	20

V. Consultants

84. Site Engineer

We recommend that a full-time site-supervising engineer be employed rather than a half-time REDSO engineer. Equipment storag at the site must be constantly monitored; concrete and reinforcement specifications must be observed daily. It is tempting to contractors and construction workers to cut corners when not being observed.

The site engineer should not be a Guinean. He should be French-speaking, experienced, honest and of unimpeachable characte:

Service installations in the laboratory building must be exactly as planned; minor deviations will cause major headaches when equipment is installed or operated. The successful bidder on the lab benches and cooler packages should be present when their equipment is installed. The supervising engineer has equipment installation responsibilities as well as construction.

85. Scientific Consultants

We recommend four types of scientific consultants be obtained for the plant and soil aspects and two types of personnel for the livestock program. It would be highly desirable to get long-term contract scientists to fill the sporadic needs of each specialty. Serious problems develop from a continuous stream of different short-term consultants in the same specialty; slight changes in expression or emphasis confuse the advisees. A master plan for each research program must be formulated to avoid misunderstandings. Otherwise, resources of time, people and finances are negated.

86. Plant Breeding Consultant

We recommend an experienced maize breeding specialist with tropical experience be brought in on April 1 to help plan and prepare the planting of the initial maize collection. He could remain until harvest time or return August 1 for a 60 day period. In subsequent years he should be present at pollination time (30 to 45 days in June-July) and/or at harvest time to help plan the crop for the next planting. These annual or semi-annual visits should extend for a period of at least 2 years. He should also go to Tindô for consulting, as should all the other agricultural consultants.

87. Soil Science Consultants

We recommend a soil fertility specialist to help plan the field fertilizer tests and laboratory soil testing for available nutrients, and a pedologist to supervise an area-wise soil survey. The fertility person should come initially in July and August and make 2 later visits over a period of three years. The soil classification person could come any time except during the rainy season. The best time is probably September, until the soil gets too hard to take core samples. The pedologist would need one visit of three months duration. Both specialists should have had experience in tropical soils, preferably overseas, the pedologist having had large area soil survey or mapping experience.

88. Plant Protection Consultants

The third staffing group should contain a plant pathologist, a nematologist, a weed control specialist and an entomologist, each for two 2-month periods. The specialists could be on-site

simultaneously or in successive years, the tour being during a growing season - rainy or dry. A senior scientist might be found who could handle two or three phases simultaneously, but one could realistically expect more senior people to be able to handle only two specialties. Younger scientists, even with tropical experience, would not likely be able to handle more than one area.

89. Livestock Consultant

The livestock consultant could arrive at any time after contract signing. There is immediate scope for gainful activity, as no biologicals are available for immunization programs or clinical use. The fertility status of the herds and flocks could use immediate upgrading via imported germ plasm. This specialist would be needed for at least 12 consecutive months, beginning about June 15, and would return for two 2-month periods each of the next two years. The consultant must know routine preventive measures, ambulatory clinics, elementary nutritional needs and must have enough knowledge of feeds and forages to meet the basic dietary and diet supplement needs of cattle, sheep, goats, turkeys, chickens and geese. National Research Council Table of Requirements are sufficient to provide basic needs of the above classes. Tropical experience is desirable but not necessary. The main target is adequate nutrition and management techniques to obtain the maximum potential production from the crossbred cattle females that will come into production three years after the initiation of the artificial insemination program.

90. Inventory and Spare Parts Specialist

We recommend strongly that such a specialist be hired to wor

for 12 months, beginning after construction is completed and during the time when equipment and supplies arrive. He is to label, describe, inventory, classify and properly store all equipment and spare parts for about seven months at Foulaya and five months at Faranah Tindô.

91. French Language Ability

We concur that consultants should have a State Department 2+ French fluency equivalent in reading and speaking. With very few exceptions, only the returned participants, on site in one to two years, will be available for translation. Literal translation often loses or distorts important messages.

92. Housing

We recommend that one of the three-bedroom villas be set aside, for the duration of the project, and brought to U.S. standards to house the site supervising engineer, the consultants and evaluators. Each room could have 2 to 3 single beds with mosquito nets, or whole-house screening could be provided. Ceiling fans in each bedroom, two in the living-dining room, and one in the kitchen would provide adequate cooling. A 15-cu ft refrigerator and a 20-cu ft freezer would provide food storage. A 4-burner 30-inch oven, bottled-gas stove with pots and pans would feed 15 people. A 5-KW generator would supply reliable current. A 500 to 1000 gallon tank on stilts would be required to supply adequate water for the villa. The villa probably will require re-plumbing, rewiring and inside painting. A washing machine and bottled-gas clothes dryer should be provided.

If a villa cannot be reserved for the project, a house in Foulaya or in Kindia (5 km away) should be leased by the project for the duration and upgraded as above. Another alternative would be the acquisition and set-up of a house trailer similar to those proposed for Tindô.

93. Communications

We consider two-way radio communication with Conakry and other AID projects in Guinea essential, since it would greatly facilitate planning and cohesion of consultants and counterparts site engineers, contractors and project manager.

The villa should have a 5-band transistor receiver for news and entertainment. A small G.E. stereo-phonograph-tape player would supply some of the entertainment needs.

94. Food, Clothing and Incidentals

Food supplies (staple canned fruits and vegetables, dried foods, canned and frozen meats) would have to be supplied by the project from orders to the U.S. and Brussels, Belgium. The Project Manager, Conakry, would be responsible for supplying adequate food, with the Embassy commissary, Socomer store, and stores in Dakar as back-up suppliers.

Incidentals should be brought by consultants, with the possible exceptions of razor blades, soap, towels and tooth powder. Personal needs for pharmaceutical supplies would be the consultants' responsibility, with Embassy pouch privileges in an emergency. Fresh fruits and vegetables in season might be availalbe locally, but the project would have to supply the basic needs. Fresh raw milk would likely be available from INRAF

herds. Some eggs and poultry meat may be obtained from VRAF flocks. A full-time properly trained cook and house assistant would be adequate staff to prepare food, do villa and personal laundry and maintain the quarters.

All clothing needed for a warm, humid tropical climate, both dry and rainy seasons, should be brought by the consultant Clothing cannot be purchased locally.

95. Transportation

The site engineer and livestock specialist each would require personal 1/2 ton pickup vehicles. A third transport should suffice for other consultants with Embassy vehicles as back-up in the event that three or four consultants arrive simultaneously and commute between AID projects. The project manager should be able to schedule vehicles and consultants so that each person has personal transport. Some doubling could take place on cooperative projects or on adjacent sites. June, July and August may require some 4-wheel drive transport.

96. R and R

Consultants should be given three days R and R to Conakry each month when the stay is more than 30 days. Five-day R and R to Dakar, Abidjan or Freetown should be allowed for tours of more than 60 days and at 60-day intervals thereafter. Transportation should be at government expense.

97. Teaching Duties

Consultants' teaching duties should be limited to a weekly two-hour seminar and on-site instruction of pertinent Agronomie faculty, research personnel and supporting staff. The staff at

the lab bench or in the field plot need to hear the instructions directly from the instructor rather than through a verbal relay through channels. Demonstrations should be done directly to and with the person performing the task. Faculty should be instructed by the consultants, students instructed by faculty. Sensitive equipment operation instruction must be done on-site and constantly monitored and repeated.

B. FARANAH AGRICULTURAL COLLEGE

I. Classroom building and infirmary proposals

98. General Comments

We agree with the general concept in the A & E report of a 3-story classroom-office complex and a separate library. The location is appropriate, although the old administration building (10) has not been demolished. We recommend further that the building be constructed on stilts so the ground underneath can be used for the sanitary block, termite control, recreation, and most importantly, for desperately needed open air and shaded study spaces (suitable also for night-time study).

We strongly suggest (figure 18) that the classrooms be limited to three 100-student rooms and be located on the first floor. Student traffic is the principal traffic and should have precedence. Furthermore, the chemistry, plant biology and animal biology labs should be on the second floor. This relegates the office complex to the third floor where the entire campus can be under observation. Keeping the sanitary block on the ground floor would make additional office or classroom space available. Moving the wall to the backside pillars and cutting the veranda down to 1.2 m in width would

further increase space. There will be little student traffic to the third floor, so a 2 meter veranda is not needed. The inner hall in the office complex is totally uncalled for, as it separates staff and students instead of uniting them into a harmonious group. A librarian should supervise the library, not administrative personnel.

99. Specific Engineering Comments and Recommendations

FAR 7 - attic insulation should be 12 inches.

FAR - termite protection, as well as air conditioning, for the library is essential. Feasible cross-ventilation is necessary in the event of air conditioning failure. Fumigation capabilities must be provided.

FAR 10 - Counter tops of laminated plastic should be the standard, as stone is hard on glassware and equipment.

FAR 15 - Separate chemistry and biology lab wastes from other wastes because of acids and alkalies.

FAR - Hot water heaters are not needed in this climate; use solar heated water tanks for all buildings when hot water is needed.

Place electric stills over sinks in prep rooms but do not wire direct.

All service lines should be exposed and color coded, no recessed receptacles.

A clothes-washing house should be constructed north-west of building 13. It should be roofed and contain concrete scrub tablets and sinks.

Our suggestions are augmented by the enclosed sketches.

The ceiling height in the classroom building, infirmary, dormitory and library should be at least 11 feet for equipment clearance and cross-ventilation. All ceilings in all rooms should be equipped with ceiling fans. We question window screening, as maintenance is very inadequate, ventilation is reduced and repair is seldom done; thus, the buildings with screens would look worse after a year than if no screens had been provided. One hundred thirty kilograms of Aralen will protect one thousand students for 5 years from the ravages of malaria. Safety showers and face/eye wash sinks are a must for all labs. Garden hoses and bibs and floor drains are needed for each lab, classroom and dormitory for first aid and fire containment. The wall finish should be unpainted ceramic tile or painted (Lucite) stucco. The fixed louvers should be hinged at the top so they can be opened. The daytime temperatures are always near 37 C, and nighttime temperatures are seldom below 20 C. Roofing should be corrugated cement asbestos, painted black on the underside, and not metal, which rusts, reflects and radiates heat, and is a source of noise pollution during the rainy season.

We strongly recommend that all gas supplies for the teaching labs, infirmary and repair complex be supplied via 10 kg butane or propane tanks. These tanks, with regular valve and in pairs, could be placed under the benches and connected to a distribution pipe for each bench. Funds should be set aside by AID or Guinea to refill these bottles in Conakry. We suggest all units use the same system, with a monthly truck route from Tindô to Faranah - Foulaya - Conakry and return with filled bottles. Individual

bottles will monitor each unit and discourage non-project use of a scarce commodity.

100. Comments on Infirmary Proposal

We believe the proposed infirmary (25) is too large for 1000 students. We suggest a ward for 10 men, two 4-male rooms and two 4-female rooms. The major health problems are internal parasites and malaria. A potable water system should drastically reduce internal parasites. Preventive treatment via food preparation, sanitation and education should be emphasized. Only constant-care patients need hospitalization, so most short-term discomfort can be treated best in one's own bed. Anti-parasite and malaria control drugs should be provided. Bed linen should be brush scrubbed and autoclaved, for a washing machine and a dryer will have short life in the tropics and would likely be used for personal laundry. A pharmaceutical supply and drug room was not included. The men's day-room is too small for the number of patients indicated. Your attention is called to another suggested building arrangement, (figure 25).

II. Classroom Building

101. Ground Floor

We consider this addition absolutely essential, as there are no shaded, cool study spaces anywhere on the campus. The ground floor should have minimum services of incandescent lighting, a concrete floor extending 3 feet beyond the contour line of the building, study tables and chairs, a passageway to the library, a floor slightly elevated above the ground level to avoid inundation during heavy rains, a garden hose and bibs with floor

drain for first aid, cleaning and fire protection. It is suggested that the sanitary block be placed at the west end to afford some protection to the area gainst rainy season storms.

102. Recreational Facilities

Games and playing fields are less than minimal, so we strongly recommend some ping pong tables, volleyballs and nets, soccer balls, badminton and tennis sets. Recreational equipment would permit dormitory teams to be organized on an intramural basis, (Table 13).

103. First Floor Classrooms

We recommend the classrooms be located on the first floor, as 300 students will be in session simultaneously, (Figure 19). We recommend the three 100-student rooms, as smaller classes are unlikely. Each classroom should be equipped with a 16-foot chalkboard at each end; a 5 ft x 5 ft pull-down screen at the west end; a steel cabinet for visual aid supplies and map hooks over the chalkboards. We recommend a projection cart, overhead projector and film strip-slide projector for each classroom, with all teaching units sharing one 16 mm sound projector. Electrical outlets and extension cords are required for visual aids.

10. . Second Floor Teaching Laboratories

We recommend that the 100-student classes in chemistry, plant, biology and animal biology be divided into groups of 50 students with two instructors for each laboratory session. Several students can share a microscope. One person should personally supervise each lab, with a checkout system for equipment and storeroom supplies. Strict inventory of all equipment and supplies is compulsory, as

each student should check out equipment and check in the equipment and check in the equipment for each lab period. Lab periods should be a minimum of two hours in length.

105. Laboratory Layout

We concur with the majority of the ideas in FAR 18, but we recommend changes in access to the prep rooms as well as in the bench arrangement (Figure 20).

106. Chemistry Laboratory

The recommended bench and cabinet arrangement is shown in Figure 21 with contents listed in Table 15. Safety features, face/eye wash and shower have been added. The hood should have a stainless steel stack, vent and wash-down potential. See paragraph 3 for service specifications. A 12-foot chalkboard is recommended for the east wall. The prep room layout with sink and still is shown in Figure 21. Note the concrete 2 ft x 2 ft x 2 ft chemical storage bins in the prep room; these bins are floor to ceiling. Other equipment for the prep room is listed in Table 15. The north and west walls should have electrical outlets as well as the prep room.

107. Plant Biology and Animal Biology Laboratories

We recommend these labs be adjacent to the chemistry lab to form a complex (Figures 22 & 23). Equipment needed is cited in Table 16. One half of each item should go in each lab except for prep room items. Microscopes and other special equipment can be shifted by the instructors to the room needing the equipment. We expect the chemistry equipment to be available to either lab when needed and biology materials available to chemistry. These two labs share a common prep room for ease of preparation and communication. A microbiologist could teach that discipline in either

lab or in both labs at different times. We suggest lab periods be at least two hours in length and that individual student effort be stressed. Electricity in these labs should be on floor pedestals or ceiling reels, as the tables must have some flexibility of arrangement. There is a 12-foot chalk board and screen on the west wall in the animal biology lab and a 16-foot chalk board on the east wall of the plant biology lab. Those walls and both north walls should have electricity outlets.

108. Chemical Supplies

The chemicals required in the lab complex are listed in Table 17. We expect the 3 labs to share reagents and equipment. The basic supply of strong acids, alkalies and gasses should be in chemical stores, with biology lab drawing rights for their limited needs. We expect chemistry to have drawing rights to media from the biology labs. The labs are all equipped in the best manner possible when sharing is done; otherwise, limited funds of establishment and replenishment would reduce the potential wide range use of the labs. The labs are intended for student instruction and do not belong to one individual, although a single person should be solely responsible in each lab for housekeeping, safety maintenance of equipment and adequate supplies. This person should dispense all equipment and supplies and check in returned equipment.

109. Third Floor, Offices and Conference Rooms - (Figure 24)

The reduction in size of the veranda and the elimination of the inner passage have permitted additional usable space on the floor and enlarged the offices of the Dean and Assistant Dean; each is

provided with a private and public entrance to his office. The other four offices have gained additional secretarial office space. A large conference room for staff meetings and seminars has been provided. A faculty study room and lounge is now possible, as instructors need a breather or off-duty period during the day. Thick attic insulation ceiling height and ceiling fans should make the office space comfortable on hot days. Lavatories are provided for the convenience of faculty and staff. We have included modest furnishings (Table 18) for the administrative block.

III. Library

110. Library Building

We commend the general design on FAR 17 as being aesthetic and efficient. We strongly recommend the air conditioning but suggest emergency cross-ventilation via windows, doors and cupola. Three ceiling fans should be installed under 12 inches of insulation. We strongly recommend the floor be 1 to 1-1/2 feet above ground level with a complete termite barrier. The room will need frequent termite fumigation, which can be easily done by sealing doors and windows and introducing methyl bromide through an outside gas port. Steel or aluminum cased doors and windows will probably retain their shape better over time than kiln dried wood framing, as most local woods are the soft type. The breezeway between the library and the classroom building should be covered. We recommend that a portion of the hallway between the librarian and the passageway be a table or counter for checking materials in and out. The outside entrance should be a double set of spring closed doors to form an

air lock. We suggest a half dozen electrical outlets in the library for eventual microfilm or microfiche machines, as these media are already cheaper than books. A trained librarian can fabricate maps and map files from in-country sources.

Tindô personnel, Guinean and consultants, must have full access to the library, with the same checkout privileges as faculty. We recommend faculty be permitted to check out materials for 7 days, with no renewals; students be permitted overnight checkout privileges. We suggest the library remain open 12 hours per day, 5 days each week, and be open 6 hours daily over the weekend.

111. Library Supplies and Acquisitions

Book Lists (Table 20) are provided.

IV. Infirmary

112. General Comments and Recommended Plan

The project proposal and the A & E report contain references to building an infirmary. There is no reason to put up four walls and a roof without some furnishings, equipment and supplies. We think the A & E report is in error on the building size and arrangement and submit our recommendations via Figure 25. We believe the infirmary load will be low, providing preventive medicine is practiced, but we also believe that students and faculty cannot perform at their best in a body ravaged by parasites and malaria. Table 21 contains our recommendations for materials to minimally equip the infirmary. We suggest a bathtub in each lavatory for sitz baths. The shelves for clean storage could be 2 ft x 2 ft x 2 ft concrete with Lucite paint. There should be a floor drain

in each room, tiled floors, and 4 garden hoses and bibs in the hallway. We suggest the privacy drapes be omitted; portable screens would be more appropriate for the climate. Ceiling fans are a must in the rooms indicated.

The nurses station should have a dutch door with lock, a stand-up counter toward the hall and toward the waiting room and some sit-down counter space on both walls.

The examining rooms should be equipped with a table, 2 cabinets, 2 chairs, manometer, hand washing sink, soap, finger nail brush and stethoscope.

The laundry should contain only scrub tablets, laundry tubs and an autoclave for the bedding. One 220V 50Hz extractor is needed. Sodium hypochlorite or phenol products could be used to treat the washed bed linens in lieu of the autoclave.

Meal preparation will probably take place elsewhere and be transported to the patients. Ambulatory patients are expected to go to the cafeteria.

The lab is equipped to handle blood counts, hemoglobin, and parasite and malaria identification. A concrete bench 2 ft wide and 37 inches high is needed on the long wall side. Electrical service, a sink and a still are needed to complete the installation.

V. Student Housing

113. Dormitories

We concur with the A & I dormitory layout. Space is beginning to become critical on the campus as the students complete their lodgings according to the Master Plan. Multi-story construction should be considered when

the next study body increase is planned. We urge 12 inches of attic insulation, asbestos corrugated roof painted black underneath, and a ceiling of at least eleven feet. The new dorms now completed have such a ceiling height with wall louvers above the windows to permit maximum cross-ventilation. As previously stated, we question the use of screens in this climate because of high humidity and maintenance problems. The sanitary block paper towel dispensers should be replaced with towel racks, as paper towels will not be provided regularly. Hot water heaters are not necessary in this climate. Use solar heated water tanks. We recommend the window louvers be hinged at the top to allow pushing out in the hot dry season. There should be ceiling fans, 2 per room. Service lines should be exposed and color coded, and receptacles should not be recessed. One suspects the stainless steel sinks will become discolored quickly and should be replaced in the specifications by white vitreous china or site-constructed white ceramic tile or concrete sinks. The dormitory should have a 1000-gallon concrete storage tank in the attic to assure water for bathing and commodes.

114. Laundry House

A student body of 1000 students places a great deal of pressure on very scarce services. Water is still trucked to the campus from the polluted Niger river. The proposed water improvement program will make adequate water available for bathing, laundry and improved housekeeping. Students now must take laundry to the river or stream or have it carried from one of the streams. A roofed wash house with concrete tubs and scrub tables would greatly assist the students in their strong desire to improve their living environment. Some

nylon drying lines could be provided as well. Lavatory towels and infirmary bed linen could be laundered sanitarily in such a place and be treated with sodium hypochlorite or a phenol. Item L, Figure 26, is a suggested location. A water tank exposed to the sun will heat the water sufficiently for washing.

VI. Implements and Supplies Storage and Repair Shops Complex

115. Repair Shops, Tools and Spare Parts and Garage

We agree with the A & E report that the garage, implement storage and spare parts room should be combined into one building and be located at G, Figure 26. We recommend that the farm implement units be combined with other units to make a farm machinery and supplies integrated complex on the campus adjacent to G (Figure 26.) We do not see the wisdom of a secured area for all farm equipment and supplies. The herbicides and fungicides-pesticide storage should be in two separate rooms, and a third room should be used for fertilizers. The walls should be masonry and extend up to within 12 inches of the roof line, leaving space for air movement under the roof and a 3-foot overhang. The equipment storage available on the campus is not being used now, so there is no evidence that new storage space will be utilized. Usable and unusable farm equipment is parked at numerous scattered points on the campus.

We recommend that the design, as presented in Figure 27, be placed on a concrete slab base and constructed near G. The space under roof is comparable to those planned in FAR 46 plus FAR 67, and exterior walls should make for easy construction. Metal-grilled-and-louvered windows should allow good cross-ventilation. Ceiling fans could be considered for all 11-foot ceiling rooms except the

garage.

116. Carpentry Shop

We recommend a carpentry shop with one master carpenter and two apprentices. There should be permanent wood benches along the NE and NW walls with storage underneath. A carpenters wood bench has been provided for the middle of the room. Additional tools and supplies are listed in Table 22.

117. Motor Repair Shop

The motor repair shop is to be provided with permanent wood benches, as per the A & E report, on the NE and NW walls. Storage bins should be built underneath. The mechanics bench should be wood. Additional tools and supplies are listed in Table 22. The single pit should have a drainage sump.

118. Spare Parts Storage

The spare parts room should have 2 ft x 2 ft x 2 ft bins from floor to ceiling, along both SW and NE walls. The spare bin and tool crib can be controlled by one man with easy access to the mechanic on the inside and to garden tool users on the outside. The tools can be kept in floor-to-ceiling concrete bins. Open shelving and supplies are listed in Table 22.

119. Farm Hand Tool Storage

The hand tool storage rooms should have 3 ft x 3 ft x 3 ft concrete bins from floor to ceiling, on the NE wall. Along the other two walls from floor to ceiling, concrete partitions should extend three feet outward with a 6-inch lip on the front at ground level. Drainage holes should be provided under each lip. The floor should slope toward the outside door. Oil barrels can be

used to store many of the tools listed in Table 22.

120. Water Service

The carpenter's shop, motor repair shop and hand tool storage should have garden hose, bibs and floor drain for cleanliness and safety.

121. Fertilizer and Pesticides Supplies and Storage

We recommend the fertilizer and farm implement storage (Figure 28) be placed on a concrete slab with 16-foot clearance. The 3 ft x 3 ft x 3 ft concrete bins can be used to store small lots of herbicides, pesticides and fungicides. All fertilizer stored in bags MUST be placed on wooden pallets or slats to avoid bag damage and for safety reasons. Floors should all slope from the center to the outside doors with water taps on external walls. All areas in Figure 28 need lighting only.

A platform scale and a small balance have been provided in Table 22, which also includes safety equipment for chemical handlers.

We carefully considered Faranah College land resources and capabilities, and we estimated the staff could plant and harvest each year approximately 50 hectares of rice, 50 hectares of corn and 10 hectares of vegetables. The plant chemicals listed in Table 27 are provided for the growing of two crops. We assume the added financial benefits will permit Faranah College to purchase subsequent supplies.

122. Farm Implements

We recommend that Faranah College be supplied with sufficient equipment to grow and harvest row crops (maize, sorghum), rice, silage, hay and vegetables. This includes the capability to

successfully use the manure from 9,000 birds, 90 cattle and 150 pigs. Therefore, we suggest the equipment presented in Table 23. The supplies will permit the clearing of brushy Savannah and the reclaiming of needed tillable land. Ample storage has been provided in the implement storage area to properly care for the farm equipment (Figure 28).

VII. Engineering and Utilities

123. Water Supply and Distribution

The recommendation in the A & E report FAR 53 to improve the water supply is heartily endorsed, for water supply is very critical in the dry season. In view of combining the Faranah farm with the campus units, it may be necessary to drill a second well for the animal units or to increase the capacity of the planned system. The livestock units will likely require about 3000 gallons of water daily when operating at full capacity. Extra cleaning will require additional water, but this could be scheduled without undue strain on the system. The water distribution system (FAR 52) will need to be extended beyond Building 14 to the proposed new structures D, L, Pi, Po, CA (Figure 26).

124. Waste Disposal

The power take-off liquid manure tank can be used to empty septic tanks as needed. The septic tanks and drain fields from Buildings 13, D and L should be moved to the N or NE of Building D, as the new livestock units are proposed for the septic tank area. Furthermore, the area is bedrock and not suitable for drain fields. The floodplain is to the north and downgrade.

125. Electrical System

The proposed livestock facilities may require some adjustment in the electrical load, particularly as feed milling will be done in the poultry units. The other demands are routine for lighting, heat and small motors. An electric autoclave for the infirmary may require some adjustment in amperage. The arcwelder in the repair garage will draw heavily on current when used and may need to be used only at slack periods of electrical use. Your attention is directed to paragraphs 62, 63, 65, 66, 69 and 73 for details or specifications, cautions and suggestions. We do highly recommend the liberal use of ceiling fans in all units where people work or live.

VIII. Livestock Facilities

126. Cattle

As discussed previously, we strongly recommend that the cattle unit be placed on the main campus. The site of the proposed farm was unknown to Faranah College Administration and to the Inspecteur d'Academie. A site was selected after traversing on foot and by Land Rover a great deal of the area across the small river to the NE. The 2200-meter-distance location suggested by the A & E report was carefully measured on the ground, but no road or site corresponding to the description in the A & E report could be located. The site of the proposed cattle building on the farm is several hundred meters from good pasture, lacks electrical power, lacks water supplies and is on a rather steep hill. Neither students nor staff have transportation and would have to walk 2-1/2 km to do their animal practicums and

projects.

A main campus location where bedrock space is available seems to us to be very prudent, as pasture is available nearby. We believe the campus site will result in greater use of the animal facility, as well as more careful observation of the animals. One could conceive of a small slaughter house adjacent to the cattle facility for teaching purposes and sanitary processing of meat supplies. Figure 29 shows the general layout suggested for 92 animals of different age with a drive-through alley for feed handling storage and distribution. A silo pit should be constructed (Foulaya - Table 10, item 208) in an area suitable for excavation and drainage at one end; the location should be N or NW of the cattle facility.

Figure 30 shows the suggested detailed floor plan, complete with cattle stands, rubber mats, stand dividers, feed mangers and litter gutter. The sides of the barn should be open with no walls and have an eave height of 11 feet, with 3 feet of overhang. The gutter should run the length of the barn and lead to an outside, concrete-walled liquid manure pit. The building should be one foot above grade, with roof run-off channeled away from the building. Heavy cattle net fencing has been provided to assist in security and for handling of animals. Mats, individual tie rings imbedded in manger curb, tie chains, snaps and neck chains have been provided in Table 24 along with adequate hardware for housekeeping. Concrete water tanks will need to be built on site using the tank floats provided to regulate water level. The manure pit should be roofed, 20 feet away from the building, and

have dimensions of 15 ft wide x 6 ft deep x 50 ft long with a slope of one inch per 10 feet toward the pumping end. The gutters in the barn should have a slope of one inch in 25 feet toward the manure pit.

127. Pigs

The same rationale for locating the cattle barn on the main campus applies to the pig house. The general layout (Figure 31) again features an open-sided building, 11-ft eaves with 3-ft overhang, and gutters outside the building leading to a covered manure tank 20 feet away. The gates and partitions should be 1-inch unpainted pressure-treated wood. The floor should be sloped from the feed alley to the outside gutter. Watering and feeding the sows and boars should be done in a site-constructed concrete manger, with a curved bottom, 8 inches D x 12 inches W x 24 inches L. Feed should be fed as slurry with watering by garden hose. The farrowing crates and feeder-waterers are provided in Table 25, along with feeders for the nursery and finisher groups. Site-built concrete water troughs should be on the alley side of each pen so that the lower outside of each pen will become the dunging area. The dung can be easily flushed into the outside gutter. Housekeeping hardware, pig-handling equipment and essential clinical supplies have been provided. Garden hose and bibs should be provided in the finishing area (2) and in the breeding, farrowing and nursery area (4). Feed storage is along the center alley with feed mixing being accomplished in the poultry unit.

128. Poultry

The Faranah Administration had previously decided to place the poultry unit near the main campus, and we concur with that decision. The Administration did increase the number to 4000 layers and added 5000 broilers. We suggest an equal number of layers and broilers, as 50% of any hatch will be males. Initially, sexed layers may be purchased or imported, but the unit should be self-sufficient. Therefore, an incubator room, an egg room and a feed mill are provided (Figure 32).

The two buildings will each handle 4000 birds, with the egg and incubator room on the layer side and the slaughter room on the broiler side. Entry into each section should be from the interior court, only with no doors between sections. A fence with a double gate should enclose the compound. Both sets of birds should be housed on litter (rice straw shavings) about 6 inches deep. Scoops have been provided (Table 26) to turn the litter each day. Roosts are not necessary if lights are on for 18 hours daily. Waterers, feeders and nesting will be provided for 4000 birds in each unit. Milling equipment can service the pig and cattle units as well as the poultry units. Essential medicinal supplies are provided. Each poultry unit section should be cleaned and disinfected between sets of birds; therefore, wagons, trailers and a manure spreader have been provided to apply spent litter directly to crop areas. The 11-foot eave with a 3-foot overhang will keep rain out of the sections. The 2-foot outside wall and the concrete floor should be built about 12 inches above grade and sloped toward the center court.

129. Breeding Stock

Faranah College has not requested frozen semen supplies or equipment from AID. They have stated that N'Dama cattle would be purchased locally. We recommend that Faranah College cooperate with INRAF in the storage of semen, the use of supplies and the training of inseminators. Crossbreeding the N'Dama with Jersey and Hereford germ plasm would increase milk and meat supplies. Oxen from either cross would do well for draft purposes. Faranah would need an Apollo X-34 Nitrogen jug for on-site semen storage with the spare INRAF jug replacing the liquid nitrogen every two months (Table 10, item 141 and others).

The pigs are supposed to be purchased locally and are available. Some 2-month-old meat type boar pigs should be imported to upgrade the local black pigs. A 6-month supply of feed should be shipped to arrive with the pigs. Local supplies of plant protein, animal protein and mineral and vitamin supplements are scant; thus, provision should be made for a 2-year supply to be imported when pigs are made available to the project. The performance of the local pigs in a desirable environment and with excellent nutrition is not known and should be the first research project undertaken.

Poultry breeding stocks are in short supply, and it will likely be necessary to import either fertile eggs or day-old sexed pullets. Incubators have been supplied to provide a capacity of 1100 chicks per month. We recommend the shipment of 3 cases of eggs of white Leghorn laying strains (30 doz) each month for 8 months (24 cases) when the poultry units are completed and services are functional.

IX. Other Comments on A & E Report

130. Roads

Since we recommend that the livestock and implement units be located on the main campus, we see no need to upgrade the proposed farm road. Instead, we recommend the macadam be extended from building 10 to building 14 and that it include the proposed ring road to provide all-weather access to the livestock units and to buildings G and G2. The total distance is approximately 1300 meters.

131. Equipment and Building Maintenance

We strongly concur with the A & E recommendations in FAR 112 and FAR 113 relative to frequent inspection and evaluation of the training program and adherence to project outline and principles. We feel that the equipment will be short-lived unless training is instituted to qualify a master mechanic, a master plumber, a master electrician, a master carpenter, a master maintenance engineer, a master painter and a visual aid technician.

132. Solid Waste Disposal

We agree with the A & E report that litter disposal is casual. We suggest an incinerator for combustibles and a compost pit for biodegradable materials (paper, vegetable offal, leaves). The compost is badly needed for garden plots and flower beds.

C. RESEARCH SUB-STATION AND AGRO-PROTEIN DEMONSTRATION FARM AT TINDÔ

133. General Comments

We commend the objectives proposed in the establishment of Tindô (spelled incorrectly on many maps) as a pilot project

emphasizing the necessity of cooperation in the teaching, research and extension arms of agriculture. The triple approach, therefore, requires a single administrative head to keep all arms moving in the same direction and at the same speed. Slackness in one arm reduces the other arms at the same level.

We believe that Tindô, Faranah and INRAF can complement each other; therefore, we have based our recommendations on the sharing of expertise and equipment among the units. Seldom-used but essential equipment and supplies greatly reduce initial capital costs and maintenance needs. The artificial insemination of cattle is a prime example whereby all units can benefit greatly from a relatively small expenditure of resources in an integrated program.

134. Land Resources

We agree that Tindô represents the land resources in the area. The alluvial floodplain seems admirably suited to the growing of post-rainy season, high-yielding crops (rice, maize, vegetables) and to irrigating similar crops in the dry season. The upland portion appears typical of regenerated, burned-over, tall-tree savannah with thick underbrush. Cassava was the last cultivated crop on the campus site. We do not know how typical the sandy surface soil near the roadway is in regard to the entire station and region.

135. A & E Development Plan

We agree with the A & E development plan (TIN 7) as the general layout for the farm. The proposed campus plan (TIN 13) is acceptable. We were not able to locate the bench marks

indicated in the A & E report but estimated our approximate position from the map by pacing distances. We suggest strong consideration for the plan shown in Figure 37 to get the training dormitory on higher ground and the office-laboratory building on the highest ground, overlooking upland and floodplain. We have combined the cattle, sheep, broilers, layers, feed milling and feed storage buildings into one unit, as the feed will be used by the livestock units.

We do not agree with the A & E report that feed storage and chemical storage should be adjacent. We recommend a similar equipment and repair situation as at Faranah. Since the pesticide, herbicide and fertilizer requirements are similar to those at Faranah, the unit was nearly duplicated.

We have suggested one strand of electric fencing for the entire farm as a much cheaper and more effective way of fencing out nomadic stock, protecting the dike and containing domestic livestock. There will be "accidents" with the electric fence, but these will be easier and faster to repair quickly and more cheaply than cut barbed wire. The signal controllers will indicate tampering so that an immediate investigation can be made.

The A & E report did not suggest a sequence of events for establishing the physical plant; therefore, we suggest that a 4-bedroom home similar to the Guinean technicians' home for the site manager and that a 6-bedroom home on the same plan for the consultants, project supervisor, inspectors and supervising site engineer be constructed immediately on the signing of the

100X

contract. The quarters could be ready by the time other building materials and equipment arrive at the site. AID area engineers could get this underway. Trucks, bulldozer, tractors and site-clearing machinery should be on the site when the Farm Manager and the staff arrive. The houses could be lardered by the Embassy from Dakar or the U.S.A.

We do not agree with the A & E report on the sequence of farm development. This decision should be left up to the Project Director, the Farm Manager and the consultants and will depend on the season of the year.

136. Uniformity of Equipment

Bids for farm machinery and lab equipment should be accepted only from a firm that could supply all the trucks or all the tractors and farm machinery or all the stills or all the dryers. The equipment should be uniform for INRAF, Faranah and Tindô. The successful bidder on any line of equipment should be required to furnish spares needed for 10 years of Guinean operation and Guinean maintenance of the equipment.

137. Office and Laboratory Building

The two units have been combined (Figure 33), and a seminar room and a loading dock for wet plant samples and soil samples have been added. Equipment for the offices and lab is listed in Table 28. We do not see the wisdom of a separate toilet and office for the lab, as the resident technicians have been provided with an office. One of the secretaries could double as a receptionist. Field equipment, research plot equipment

and agricultural implements are listed in Table 28. The Nor-Lake cooler (Figure 34) is intended for seed storage. The laboratory is equipped with lab benches, tables for seed packaging capability, a large sink for green plant washing, soil sampling and grinding, and small-lot herbicide handling facilities. The lab will accommodate three people.

The covered breezeway connects the lab to the office complex, as the technician in charge of the lab is expected to have his office there. Ceiling fans should be in each room with 11-foot ceilings. There should be electrical outlets on two walls in each office and in the seminar-conference room and every 6 feet on all walls or benches in the lab. Lab outlets should be equipped for U.S. and Guinean plugs. The lab needs neither a fume hood nor gas. One hot water roof tank should be sufficient for the lab and the lavatories. The layout shown in Figure 37 is our impression of how the campus should be arranged in order to locate the office and dormitory buildings so a panoramic view of the floodplain and the farm can be had from the campus area.

138. Guinean Houses

We have not investigated the ten houses for Guinean technicians, but the plans appear acceptable to us as being equal or superior to Guinean middle class quarters.

139. Training Room and Dormitory Complex

We did not prepare a specific table of equipment for the training room and dormitory complex. We suggest using French type specifications (Section B II and B V) for the training room furnishings. Visual aids (Table 32) include projection equipment

but do not include transparencies and similar materials, which should be obtained on a share basis from the generous supply of charts, models, film strips and slide sets at Faranah and INRAF. Library shelving should be built into two walls of the dining room and training room. The duplex office for the two training consultants should be increased a bit at the expense of that for the resident instructor. Additional furniture similar to that listed in Table 28 is suitable for these offices. Both rooms need electrical outlets and ceiling fans. Concrete shelves should be placed in the closets, storerooms and kitchen with 10 kg cylinders supplying gas for cooking. We question the need for distilled water when a chlorinated water system is operating.

Our suggestion to move the campus a bit farther west would include clearing rangeland toward the river for a clear view, thus allowing rangeland expansion to the north. We believe the natural drainage to be toward the north; a survey might prove our observation to be incorrect. Rainy season storms are often intense, so attention should be paid to surface drainage.

140. Laborers' Quarters

We concur with the A & E report on the quarters and location. We suggest a roof over the common area if it is concreted. An outdoor fireplace might be worthwhile here, since most of the cooking is done outdoors. A fireplace would permit the use of large pieces of firewood.

141. Cattle Shed

The suggested floor arrangement (Figure 35) changes the A & E report suggestions to get all livestock and feed supplies

under one roof and away from the chemical stores. Sheep pens have been provided in the event this species becomes a reality. The floor of the sheep pens, calf pen and platform scale should be sloped toward the gutter for drainage to the pit. The pens should be built of 2 inch x 6 inch fir planking, pressure treated.

We disagree with the A & E report and recommend a concrete floor, cattle stands, rubber mats and individual ties for the cattle, since a dirt floor would be a filthy mud hole in the rainy season. Guinean custom is to tether the cattle at night in congested area. Table 31 provides cattle net fencing to encl the livestock area for security and handling purposes. The cattle chute gate should be placed in the fence line with 2 inch x 6 inch fir boards to restrain cattle for treatment and examination. Sufficient medicinal units have been included to last for 3 years, the shelf life of the drugs.

The cattle shed is open on all sides with 11-foot eaves and a 3-foot overhang. The rubber mats eliminate the need for bedding, although the mats could be omitted and rice straw be used instead. The manure pump and wagon from Faranah can be used once or twice a year to pump out the manure pit.

142. Poultry Operation

The laying flock has been increased to 250 birds to allow for frequent starting of small units of layers and broilers, thus providing a more uniform supply of eggs and meat. The kerosene incubator is efficient, effective, low in cost and could easily be a village project. The initial poultry stock should

come via the monthly fertile-egg shipment to Faranah. This small flock should have only one layer strain, as the roosters make excellent, lean broilers and the old cull hens are excellent for stewing. Some slaughter equipment has been included, as well as nests, feeders and waters (Table 30).

The incubator should be kept in the open-space part of the mixing alley. There likely will be free space in the pens as well. The medicinal supplies, minerals, vitamins and supplements should last for 3 years. Suitable diets will be provided by the consultant. Chicken wire surrounds the pens and should be used on the ceiling.

The broiler unit has been reduced to the size of the layer flock, as cull layers are an excellent source of poultry meat. Some of the males from the broiler flock could be sold to villages or offered as special prizes to upgrade the poultry flocks. Chicken wire and a 2-ft concrete baseboard are the only sides required.

143. Repair Shop, Machinery, Tool and Spare Parts Storage

The repair unit and machinery storage are combined with enclosed, secure repair and service shops and an open-sided machinery storage. The arc welder will require up to 200 amperes. Please refer to paragraphs 115, 117, 118, 119, 120, 121 and 122 for general discussion.

144. Feed Mixing and Storage

Feed mixing and feed storage are combined with the poultry unit, where most of the feed will be consumed. A screw augur has been suggested to elevate grain into the bins and to unload

grain into the grinder or feed mixer. Frequent grindings and mixing (2 to 3 times per week) are more desirable in a hot, humid climate. An additional concrete grain-drying floor is needed nearby on the campus for rice, maize and other grains. Butler bins on legs could be used to replace the bins suggested in the A & E report. The ends of the mixing area are to be left open to reduce dust and noise level when the grinder is operating.

145. Silo Pit

The pit silo should be located as suggested in the A & E report, but the size should be increased to 15 tons as per the INRAF pit. It is increased in size to assist the better processing of the crop and since more silage will be used in the future as soon as the benefits are noted. The maize ear could be harvested when at 25 to 30% moisture; the green stalk should be fed as green fodder or ensiled. Dry corn fodder is poor feed. We do not expect any appreciable hay-producing forage unless forage sorghums, pearl millet, etc. are planted to replace the elephantgrass. None of the forages in the project proposal are suitable for hay, although a poor-quality silage is possible. Brazilian forage literature should be consulted for tropical grasses.

146. Fencing

We have included electric fencing (Table 31) for the entire farm and for 12 individual cattle grazing plots. Woven wire is provided around the sheds as a catch pen and for security. These fences are supplementary to excellent native wood enclosures.

147. Dike

The floodplain is probably eluvial soils and appears

admirably suited for high yields of food and feed crops. It is splendid for small-plot crops research and can be developed into a 12-month culture when water is excluded in August and September. The plain can be used for furrow irrigation and sprinkler irrigation when a companion drainage system is planned. We concur with the A & E report (TIN 95), for we have no way to verify other statements, and GOG has not ascertained flood level over the years. We agree with the A & E report that the water contact area should be rip-rap. The dike should be fenced on the river side to keep cattle from climbing the bank. Common Bermuda grass from Arizona should be sown on the dike for rapid soil cover at a rate of 90 kg/ha. of seed plus 600 kg/ha. of 17-17-17 fertilizer. There must be a dike drainage ditch into the inside and an overflow ditch to the outside. We agree with the A & E report on the general method of constructing the dike; it is essential that soils engineer test the available materials.

148. Pumping, Irrigation and Drainage Systems

The irrigation system must provide sufficient water for 30 ha. of floodplain within the dike and for at least 20 ha. of upland crops adjacent to the floodplain. If evapotranspiration is assumed to be 0.3 inch/day, the water needed is 150,000 cu ft per day, or 25,000 gal/day or 1100 hectoliters/day. The system must be able to do furrow irrigation via gated pipe during the dry season. Sprinkler irrigation is required for 10 ha. of upland each week and to supplement the furrow irrigation. Dry season water supply needs must be studied, as no data are available to us. A line to the Niger River will have to be

800 to 900 meters long and should be able to withstand either flooding or removal each year. A pump can be installed at point P-1 (Figure 37) where electrical current will be available; otherwise a diesel engine will be required. Another choice would be a well at P-1 and/or at P-2 for irrigation on the upland area. A third choice is a larger pump and well system on the main campus and a gravity-booster pump with 900 m of pipe to the edge of the floodplain.

We are not competent in irrigation engineering to design a viable, practical, economical system, and we recommend an irrigation specialist be employed. We are willing to discuss the matter with him and show him our slides. The specialist need not go to Tindô to design the system. There are no data on grades, percolation rates, water-holding capacity of the soil, soil structure, or soil texture description of each horizon to water table at several points. We provided no irrigation or drainage system equipment.

149. Clearing of Uplands

These soils are Alfisols, Oxysols and Ultisols, the major agricultural soils in the area. The local system of slash and burn every 5 to 6 years and return to brush after 1 to 2 years cultivation should provide the basic impetus to the research program. The major problem is to improve the system or to find a substitute system so that more crop and livestock production is possible. We strongly urge that upland clearing be limited to a total of 20 ha. in parcels G and H at this time. Furthermore, we suggest alternating 1/2 of G and 1/2 of H nearest the floodplain.

We suggest clearing 10 ha. on the east side of parcel E in order to furnish some grazing land immediately. Plans for development and study of cultural, management and rotational systems on the remaining 1/2 of the cropland and 3/4 of the rangeland should be left to careful thought by the staff and consultants. The different systems must be developed according to a long-term plan. Clearing all the upland at one time would negate one of the main reasons for the establishment of the research station and demonstration farm.

We cannot caution too strongly against clearing of the upland areas with bulldozer and other heavy machinery. All upland clearing of land to be used for crops (20 ha.) and pasture (10 ha.) should be done by usual local hand methods of slash and burn, using bulldozers only for the firebreaks and roads. Recent research work in several tropical countries, including some in Africa, indicates that mechanical clearing severely compacts some tropical soils, results in destruction of organic matter and leads to higher fertilizer requirements for the subsequent crop than burning (Properties and Management of Soils in the Tropics, by Pedro A. Sanchez, 1976, John Wiley & Sons). Investigation of such questions should be one of the first orders of research at Tindô.

We think the reservation or earmarking of specific areas for specific crops is presumptuous at the least. One should not allocate open space for one crop without knowledge of growth responses.

Other major research thrusts should bear heavily on species and cultivars already adapted as major crops. Studies on the

response to soil fertility amendments on specific soil types should be done cooperatively with INRAF. The forage system on upland should be to increase milk and meat. The land clearing costs estimated in the A & E report appear reasonable and quite adequate.

150. Land Leveling

Land leveling with the land plane provided should be limited to the floodplain, and exclusively for facilitating irrigation and drainage. We agree with the A & E report that the floodplain, with supplemental irrigation outside the dike, can be double or triple cropped.

151. Roads

The planned road may need extending by means of using local gravel. Fire lanes should be cleared around all the uncleared areas to prevent accidental burning. The brush should be cleared 20 feet away from each side of the road and at least 100 feet behind all living quarters. The cleared space can be used for gardens or small animals and will serve as a firebreak. The bulldozer can serve to shape the roads, perhaps to level the cassava beds and to clear firebreak trails to facilitate human and vehicular traffic in an emergency. The roadway berms should be seeded with low-growing forage grasses, such as Bermuda grass, to improve the esthetics and provide grazing for small livestock. We were not able to assess the rainy season condition of the Oxysols and Ultisols along the road, but would suspect some water sprinkling on unpaved roads would reduce dust during the latter part of the dry season.

110X

152. Water System

The elevated tank capacity and the pump capacity are too meager to support any major irrigation effort. We suggest this phase of the engineering be delayed until the irrigation consultant has expressed his judgment on the irrigation and drainage problems. Concrete stock tanks should be built at several locations on the controlled grazing plots, and several garden hose-serviced tank floats have been provided in the cattle supplies. Buried PVC lines could be run to several locations to be supplemented by short lengths of garden hose. One of the stock tanks should be within the net cattle enclosure.

153. Seed Stock, Fertilizers and Pesticides

Any requests for seed stocks should refer to Paragraph 26. INRAF has one of the world's foremost collections of improved mangoes and many different citrus varieties, so fruit stock can be obtained from their supplies. The site selection for fruit trees should await complete soil analysis and evaluation and farm plan development (Paragraphs 148 and 157), as this item is particularly important for citrus. Both citrus and bananas need supplemental water for 12-month production. See Table 33 for fertilizer and pesticide supplies.

154. Engine and Electrical Maintenance

We strongly recommend manual testing of all motor and electrical standby systems, as wasps and other insects often deactivate relays. See Paragraphs 62, 64, 66, 67 and 69.

155. Consultant Housing and Perquisites

Reference has already been made to the consultants' and

site manager's quarters. Guinean villas are quite comfortable and require a minimum of upgrading to be acceptable to U.S. personnel. We suggest a technician quarters' house be increased by 50% and be U.S. equipped, as a small hostel for Guinean and U.S. transient personnel. A fixed charge for room, board and laundry could be made for those on per diem or permanent party.

A 4-bedroom Guinean villa could be built for the manager and his family; the house should contain the communications system and office, with one or two rooms for transient guest overflow.

Each of these two structures could be built for considerably less money than the Porta-homes or Mobile homes suggested in the A & E report. These mobile homes are acceptable except for the costs of delivery. The villas would be suitable for Guinean use after the project is closed. Villas mainly need screening, cooking and refrigeration. Ceiling fans could suffice easily instead of air conditioning when an 11-foot ceiling is provided. Each room could contain a sink and commode with a couple of separate shower stalls elsewhere. Washer (wringer), dryer (electric), ping pong table, stereo, croquet court, basketball court with concrete floor, volleyball court, garden area and radio, are the kind of items that must be provided for sustaining the morale of consultants.

Our suggestions for logistical support are in Paragraphs 92, 94, 95, and especially 96. Since health services are limited to ambulatory care, provision must be made for regular medical consultation by either evacuating personnel or flying in medical

expertise. The Embassy nurse is able to do a great deal but needs back-up assistance; a small infirmary with emergency surgery and bone-setting capabilities and X-ray equipment would be advisable. Faranah has twice-weekly air service, and helicopters are available for emergency flights.

We fail to see any reason why wives of consultants, knowledgeable and experienced overseas, should be officially discouraged by the U.S. government officials from accompanying their spouses, as long as they can be self-sufficient in areas with limited resources and can cope cheerfully with local conditions. ..Speaking from experience, since Mrs. Williams was able to share our last two weeks in Conakry, they can add immeasurably to the welfare and comfort of consultants. Obviously, consultants and wives should be thoroughly briefed several weeks before departure by persons who have been in Guinea and know the prevailing living conditions.

156. Gas Supplies and Engineering

We have not commented on gas supplies for Tindô but suggest that 10 kg butane tanks with regulator be the only consideration for a supply of gas.

The use of screens in Guinean houses, except for consultant personnel, is useless unless U.S. maintenance is done on all the quarters.

Some considerations could be given to operating the cafeteria on Food for Peace supplies of staples. A Nor-Lake cooler would assist storage of green vegetables and meat while two 27 cu ft freezers could store considerable quantities of frozen meat and vegetables. This may be important in view of the farm broilers

and egg production units, as supplies may be erratic. Fresh eggs can be broken and frozen whole, or as yolks and egg whites.

Ceiling fans are urged for sleeping rooms, work rooms and door recreation areas. We suggest the use of asbestos corrugated roofing, painted black on the underside, as the rainy season noise level is less with asbestos than with metal roofing.

157. Initial Research Thrust

We strongly recommend that initial research programs be centered around locally grown crops, namely rice, maize, millet and peanuts. New crops that fit the climatic environment are forage and grain sorghums that serve as food, pasture, silage and hay. We feel the peanut is being neglected in the current research proposals and should be studied thoroughly, for it supplies food, high edible-oil content, excellent supplemental protein food and feed, and excellent forage protein in the vine. The floodplain should be able to grow large crops of potatoes (storable without refrigeration), carrots and other vegetables, particularly with a bit of supplemental irrigation. We believe that other oil crops and fruit trees should be tried only after several years of refining and defining research needs with staple crops. Improved rice seedstocks are already available internationally, as well as many sources of improved open pollinated maize that can be carried along by the villager. Hybrid maize production is a low, meticulous task requiring expertise and capital the villager does not possess. Crop and cultivar selection can go along with soil identification and management and amendment definitions, each dependent on the other for success.

158. Consultants

We generally agree with the type of consultants needed for Tindô and suggested in the project proposal. However, we suggest that the Farm Manager should have management experience and come from the disciplines of animal, plant or soil sciences. The manager should be a production-oriented, extension specialist type person, with experience in economic analysis, or a former branch experiment station superintendent. He should have a 3+ French language rating, as he will be required to converse in all areas of research and demonstration.

The Agronomist should also be an extension specialist, production type person, but he must have sufficient experience to lay out, randomize and replicate research plots, keep records and analyze data. This person must have a Master's degree or have been especially trained for two years in research plot work and laboratory analysis. Either the Farm Manager, the Agronomist or the Agricultural Engineer should have some irrigation experience, since irrigation and drainage will be very important activities at Tindô. The Agronomist must have control over water use, all crop land, the floodplain, and he will cooperate with the livestock man on the range project. The Agronomist would need a 2+ rating in French.

The Livestock Consultant must know basic nutrition and management of cattle, sheep, goats, chickens and pigs. He could have specialized in ruminant or non-ruminant nutrition but must have had production experience in all classes of farm livestock. He will be responsible for training the animal husbandry staff at Faranah and Tindô, as their expertise in animal science is

minimal. He should decide the carrying capacity of the range, prepare diets, do the silage and hay making and direct animal health and clinical programs. The staff and students should come to him in the field rather than have him engage in formal classroom teaching. He will need a 2+ French capability and will need to direct data systems, plan breedings of all animal species, select sires, and cull unprofitable poultry and livestock.

The Agricultural Engineer should be responsible for installing and maintaining the irrigation and domestic water supply but bow to the Agronomist on water use. He has similar duties at Faranah. He is responsible for maintenance and repair of farm equipment at both sites. He should spend very little time in the classroom, as his laboratory is the machinery in the field. Guineans will need a lot of personal instruction in how to use, maintain and repair equipment properly. Flat tires keep many of their tractors out of service. Battery failure is common, and alternator-equipped vehicles cannot be started by hand pushing. Maintenance is a problem when no one person is responsible for a tractor which is used largely to pull trailer loads of people.

A Farm Manager with agronomic experience could help the Agronomist in planning the research projects; in developing crop rotation plans, cultivar selection, soil management and soil mapping; in preparing plant and soil samples for chemical testing at Foulaya; in obtaining seed stocks from the USDA, fruit grafts from Foulaya and both kinds from international organizations. A 3+ French rating is probably needed for classroom instruction, so the manager must be versatile. He should see that his staff

instructs Faranah staff and all counterparts in the ABCs (Agricultural Basic Competencies) in their specialty; the staff then instructs the students in the classroom. The specialists should do all the practicum demonstrations until counterparts are adequately trained. The Farm Manager or the Agronomist must cooperate with project leaders at INRAF, since Foulaya is responsible for chemical analysis of plant and soil samples, for the identification of plant and soil pests and for suggesting control methods.

D. SEQUENCE OF IMPLEMENTATION OF PHASE II

159. Construction and Equipment

We recommend that facilities be started at Tindô first; at Farsnah next, or simultaneously with Tindô, and last at Foulaya.

At Tindô, we recommend the following sequence: 1) transportation, 2) clear land for campus and road only; 3) utilities and housing; 4) dike, irrigation and drainage system (note that work on dike can be started only after flood waters have receded after October and should be completed by the succeeding June; a standing crop of rice might be partially damaged by construction work starting before February); 5) tool rooms, repair shops, fertilizer and pesticide storage; 6) bring in farm machinery and tools; 7) office and laboratory building; 8) clear 20 ha. of upland for crops and 10 ha. for pasture; 9) livestock facilities; 10) training facility.

At Faranah, we recommend the following sequence: 1) utilities; 2) infirmary; 3) repair shops, tool rooms and fertilizer and pesticide storage; 4) farm machinery and tools; 5) classroom building; 6) library; 7) livestock facilities; 8) dormitory.

At Foulaya, we recommend the following sequence: 1) utilities; 2) laboratory building; 3) consultants' housing; 4) transportation; 5) laboratory and field research equipment.

160. Timing of Arrival and Service by Consultants

The Project Director in Conakry should be on the job from the beginning of the project through the five years to its conclusion.

At Tindô, the Farm Manager and the Agricultural Engineer should start mid-way through the first year, or as soon as construction or land clearing starts, and should remain for the fou succeeding years. The Agronomist and the Livestock Specialist should be at Tindô starting with the beginning of the second year through the fifth year.

The Inventory Specialist should be retained for the second year of the project, to initiate his activities when the buildings are completed and as equipment, supplies and spare parts arrive on site. We estimate 7 months at Foulaya, 3 months at Faranah, and 2 months at Tindô.

At Foulaya, no consultant should arrive until all building has been completed and equipment and supplies have been received and indexed. Then, as equipment is ready to be activated, consultants should arrive. The Livestock Specialist could start his activities as soon as the two livestock participants have returned. There is no point in the other consultants being at Foulaya until the five participants have returned and are on the job.

The Plant Breeder should be at Foulaya for six months during the 3rd year, two months during the 4th year and one month the last

year. The Soil Fertility Specialist should be there for two months in year 3, three months in year 4 and two months in year 5. The Pedologist should be planned for three months during the 3rd year. The Entomologist, the Nematologist, the Plant Pathologist and the Weed Control Specialist should each be at Foulaya for two months on two separate occasions, once in year 3 and once in year 4. All consultants at Foulaya should be expected to counsel at Faranah and Tindô, probably for 25% of their time during each visit.

E. CONCLUSIONS

1. We generally agree with the Project Design and with the A & E report that Guinean human and land resources are sufficient to warrant activating the project. We were impressed by the apparent sincerity and desire of the Ministry of Education, of Faculty personnel and research staff and of student bodies to improve the nutrition and health of the country by increasing the quantity and quality of food available to the villager. We believe a teaching, research and extension project can be brought to active status in five years.

2. We believe ten years are needed to develop a self-sustaining project that will give a permanent uplift to the agricultural villager. Indepth evaluation after five years should determine the suitability of granting further sophisticated equipment that is not deemed essential at this time.

3. We recommend that the U.S. consultants do not assist in teaching classes but teach subject matter to staff on the farm and in the field. We recommend that Guinean staff for each subject matter bring students and others to the consultants for discussions and

demonstrations. A consultant should teach all of a course or definite subject matter but not assist (as mentioned in the Project proposal).

4. We strongly recommend the Farm Manager, Tindô, be an agronomy or soil fertility production man rather than an agricultural economics and farm management discipline graduate.

5. We suggest the following manpower and man-months for U.S. personnel and consultants:

Position	Man-month Project Year 1	2	3	4	5	M.M. Total	Sub Total
A. Conakry:							
Project Director	12	12	12	12	12	60	60
B. Tindô and Faranah:							
Farm Manager	6	12	12	12	12	54	
Agronomist		12	12	12	12	48	
Livestock Specialist		12	12	12	12	48	
Agricultural Engineer	6	12	12	12	12	54	
Inventory Specialist		5				5	
	12	53					209
C. Foulaya							
Plant Breeder	0	0	6	2	1	9	
Soil Fertility Specialist	0	0	2	3	2	7	
Soil Classification Specialist	0	0	3	0	0	3	
Entomologist	0	0	2	2	0	4	
Nematologist	0	0	2	2	0	4	
Weed Control Specialist	0	0	2	2	0	4	
Plant Pathologist	0	0	2	2	0	4	
Livestock Specialist	0	0	12	2	2	16	
Inventory Specialist	0	7	0	0	0	7	
							58
							327

1207

6. We recommend a single supplier of each category of supplies and equipment. All the transport vehicles should be from one manufacturer with one size of engine (400 cu in) with the same fanbelts, same generators or magnets rather than alternators, no air conditioners, no heaters, no radios, etc. All electrical equipment should be 220V 50Hz, if possible.

We suggest International Harvester for tractors, as they have an office with spares in Dakar. We strongly suggest that AID/Washington ask for a waiver to exclude some Russian-made tractors sold in the United States in any bidding, since the Guineans have 2,500 Universal 650 machines, mostly inoperative.

7. The consultants should be housed equally to the Guinean technicians at Tindô. Both should have ceiling fans without air conditioning. A major problem with long-term consultants is the great disparity in salaries and perquisites when these become patently obvious. GOG counterparts have pride, which should be respected. Some attention should be paid to the adaptability of wives to a severe situation. Spouses and children should be acceptable under certain conditions, but ostentatious living and possessions should be discouraged.

8. We concur with the Guineans in that good, long-life equipment with simple maintenance and repair be the only equipment purchased; they stated that they do not want frills. The survival rate of the materials and equipment will be the final evaluator of this project. We suggest ALL equipment and supplies be "tropic treated." Equipment known to have a long life in the southern half of Louisiana, in Central America and on the north coast of Puerto Rico represents

the quality needed in Guinea, as the operational expertise is minimal, the maintenance is sub-par, the climate is hot and humid and speedy repair is doubtful.

9. We recommend the Guinean Co-Project Director visit the participants after they have been 12 months at their study site. He should spend 3 to 4 days at each institution to consult with the participants, their advisors and the International Student Office. He should attend classes and laboratories with the students to get the feel of the participants' environment. A visit sooner than 6 months is inadvisable, as it will take that long for the participants to get adjusted to the U.S. system of higher education and U.S. society.

10. Consultants must be furnished a copy of this report and a list of everything ordered. The consultants should be contracted several months before they are needed on the site so that each specialist can go over the lists for missing essential items, order them, or take them along as unaccompanied baggage. We have, without doubt, missed some essential items of supplies in particular; therefore, we recommend a 10% contingency fund to provide for our ommissions.

11. We recommend the Project Manager participate in the selection. AID/Washington or a contractor should do the recruiting on the basis of the same person in each discipline for the duration of the contract. Overseas technology is not effective when three different people advise in each of three different years in a single discipline. It is possible, however, for a senior consultant to prepare a master plan for the discipline on his first visit and delegate qualified junior scientists to advance the project in

future years.

12. Basic concepts will not change, but the availability of certain pesticide chemicals may change as FDA and EPA exert their statutory authority. A similar situation exists in the animal health field. These reasons make it essential that deliveries of pesticides and fertilizers have some yearly flexibility in the specific orders.

13. We recommend that consultants be on site in pairs, since the Project Manager will be required in Conakry most of the time and the consultants probably will be the only Americans present at the sites. Embassy personnel are too occupied otherwise to provide much help and particularly social interface. The presence of wives, even on short-term assignments, is extremely beneficial, although not too pleasant an experience for the wife. There is no substitute for home cooking and a compatible spouse in a pleasant situation, so it becomes doubly important in severe environments.

14. We recommend the employment, at 50% of the consultant's fee, of French-speaking agricultural graduate students to serve two non-French-speaking consultants, should French-speaking consultants with necessary language competency be impossible to find. If consultants are not provided, the project should be halted, as we do not recommend funding any discipline without AID consultants.

15. AID should pay transportation and per diem to enable each participant studying in the United States to attend the annual meeting of the scientific society in his discipline.

16. AID should use, in all documents, the correct names and

spellings for each of the institutions and locations.

Located at Foulaya are the "Institut National de la Recherche Agronomique de Foulaya," abbreviated as INRAF, and the "Faculté d'Agronomie." To describe these units in the text, we have used both "INRAF" and Foulaya."

Located at Faranah is what used to be the Agricultural Junior College, recently renamed "Faculté d'Agronomie de Faranah." We have referred to this unit as "Faranah."

Near the village of Tindô (incorrectly spelled on some maps as Tindou) is where it is proposed to locate the Research Sub-station and Agro-Pastoral Demonstration Farm. We have called this complex "Tindô."

17. Journal, periodical and reference material requests in French should be addressed to the cultural sections of the French and Belgian Embassies and to USIS.

18. The Livestock Specialist at Tindô should be provided with funds to purchase and train three pairs of oxen for draft and transport use. The Guineans have seldom used cow power to reduce manual inputs, and should first make the transition from hand-power to cow- and horse-power before high-cost, imported sophisticated fossil fuel units are used in providing food for the villager and his family. Oxen equipment can be fabricated locally with hand tools and supplies on hand, while initial equipment could be purchased from Siscoma.

19. We do not recommend any refurbishment of the gas plant at INRAF. We suspect the plant was in reality a kerosene or diesel atomized and pressurized system similar to those common in

European laboratories prior to the use of butane and propane. There are such systems still in use in the world, and AID engineers might want to investigate their potential value as a fuel source for the labs at Foulaya. We do not recommend anything but butane or propane 10 kg cylinders for Faranah and Tindô, as fuel requirements are small.

GOG will oppose anything but a central system for Foulaya on the grounds that the 10 kg bottle system is unreliable. GOG staff believed that the butane was produced in Conakry by a GOG enterprise. The situation is that each major Guinean enterprise imports a large pressurized container of liquid butane from Dakar, stores it at the GOG facility and pays the facility to refill the 10 kg containers and store them until needed. We maintain that the Ministry of Education can do the same as everyone else and transport the bottles by jeep or truck as needed. This is the only way to control and monitor the unit use of this expensive and scarce commodity.

20. We have not knowingly included anything in our recommendations that should be used for commercial production except for the hand tools and the initial supply of fertilizers and pesticides at Faranah. All other equipment and supplies are to be used only for teaching, research and extension. The expendable agricultural chemicals (fertilizer, pesticides) should be delivered in phases over the duration of the project to insure a continuous supply for research. Some supplies have been limited due to short shelf life. We have limited Faranah to a 2-year supply of expendables for the commercial unit, as the increased product sales resulting from

the supplied inputs should allow Faranah to purchase on their own after two years. Lab chemicals should all be tropicalized; we have purposely specified small lots to increase the shelf life of unopened containers in the tropics.

21. We recommend that funds be allotted the Project Director, Conakry, to purchase liquid nitrogen outside Guinea to maintain the frozen germ plasm bank for artificial insemination of cattle at all three locations.

22. We strongly recommend that Tindô be funded entirely or not at all. Priorities are established for all units, but Tindô is the one opportunity that AID has to show GOG how to establish, plan and effectively operate a teaching, research and extension facility. The other units have some units in a semi-functional state and have buildings and land. Tindô, though not virgin land, is to be started from scratch.

23. We recommend the serious consideration of purchasing in Dakar tools, implements, furniture, food, tranasportation, FACIT hand calculators, dry goods, feed, fertilizers and other supplies that are available there.

We further recommend that AID inform all consultants to the project about the presence in Dakar of standard quality household wares and equipment, pharmacies, toy stores, book-stores, sewing machines, two large supermarkets with fresh meats, canned products of all sorts, cheese, bread, ice cream, breakfast cereals, notions, dry cleaning, tires, tailors, photographic supplies and Vespa motor scooters. Expensive, yes, but probably cheaper than the 100% additional cost for freight

1264

from the United States.

24. We recommend that an irrigation engineer be contracted to design the irrigation and drainage system at Tindô and to specify the needed equipment. We would be happy to supply him with slides and personal observations so the task could be performed without leaving the United States.

25. We recommend these priorities:

A. Faranah Teaching Program and Facilities

We consider the minimum funding for Faranah to be: water, electricity, sewer, infirmary and laundry, teaching classrooms and laboratories, library and tools.

B. Tindô in its entirety

Tindô should have the lab increased to a full Plant and Soil Science lab if such facilities are not funded at Foulaya. Should Foulaya not be funded and the Tindô lab not be increased to a fully functioning unit, then drop Tindô altogether since the entire success of the project depends on the analysis of plant and soil materials. We consider the minimum essential funding to be the services, the dike, the dormitory-training building, the office-lab building and the technicians' quarters.

C. Foulaya (INRAF)

In view of the existing sound buildings at Foulaya, we recommend the priorities of services, laboratories, field equipment, fertilizers and pesticides, livestock

improvement and health as essential elements to operate a research unit.

D. Priorities of declining importance when considering all three units:

a. Faranah farm implements, repair shop, spare parts

b. Tindô poultry, units, feed mixing and feed storage

c. Faranah third floor offices in classroom building

d. Tindô cattle barn and fertilizers

e. Tindô laborers' quarters

f. Faranah, reduce poultry to 2,000 layers only

g. Tindô machinery shed

h. Faranah cattle barn, silo and manure pit

i. Faranah pig barn and manure pit

j. Faranah implement shed

k. Foulaya cold room in existing lab building

l. Faranah car garage

m. Foulaya swimming pool

E. The units at all three locations are expected to produce enough income to generate all necessary operating funds. Reducing the farm equipment and hand tools would reduce potential at Faranah. We do not agree with the philosop that new technology results in immediate increase in economic benefits, but we know that new teaching, resear and extension programs produce great returns in future years. Hybrid corn seed was available in the United States for many years before the seed was effectively

used throughout the country.

F. We believe the 10 laborers in the Tindô work force are about half enough for the combined research facility and demonstration farm, unless the eight Guinean technicians work on field equipment and plots. We suggest 20 laborers and a corresponding housing allotment increase.

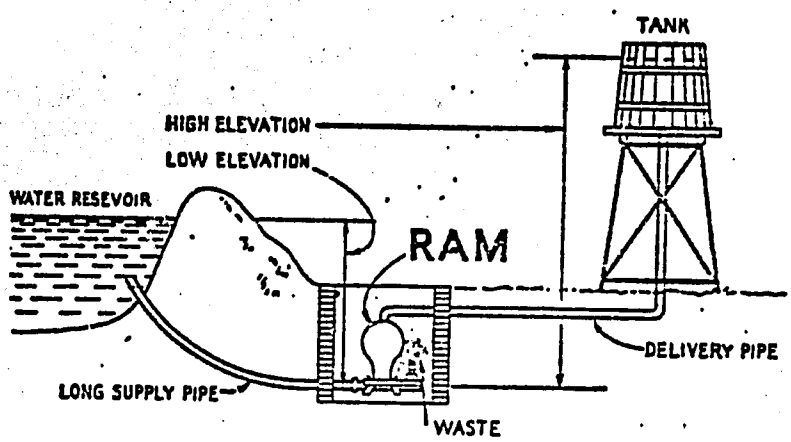
26. We recommend that the engineer designing the water system consider the possibility of a hydraulic ram, as described on the next page, for the irrigation system. This kind of device, which could be envisaged not only for Tindô, but also for Faranah and Foulaya, might supplement the electrical pumps for water storage tanks.

27. We strongly commend Mr. A. "Joe" Hartman, AID Project Manager, Conakry, and Mr. Foumba Kourouma, Ministry of Education Co-Director, GOG, for having everything in readiness for our arrival. We were able to go directly to the field sites, meet the staff at each, and return promptly to Conakry to prepare the draft of this report. Both persons were available constantly to clarify or amplify statements made to us by others. The project would be in the best possible hands should these men be able to continue in their present positions. At the least, they should be made available for consultation and guidance to any new leadership.

IMPROVED HYDRAULIC RAM

Inventor: Harlon D. Sells
Alpine, Tennessee

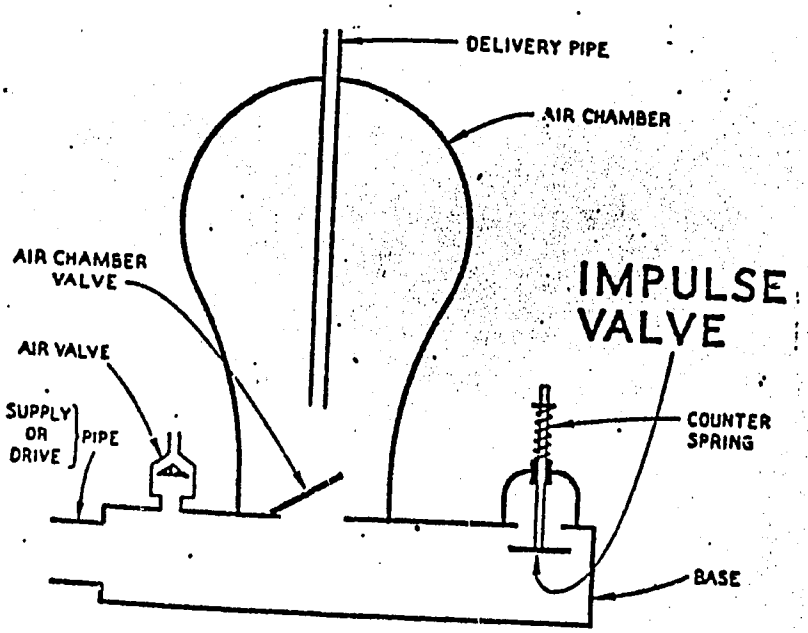
What is a hydraulic ram? A hydraulic ram is a device for raising water from a lower level to a higher level.



A hydraulic ram puts the energy of moving water to work. The energy possessed by the water is due to its momentum. This energy is utilized to force some of the water to a higher elevation. The water working the ram is supplied through a sloping pipe. With a long supply pipe the ram becomes more energetic, forcing water to higher elevations.

How does a hydraulic ram work? At the beginning of the cycle, when the air chamber valve closes, the column of water in the supply pipe rebounds thereb removing the pressure from the impulse valve and permitting it to open of its own weight. The vacuum thus created causes the air valve to open admitting a small amount of air into the base of the ram.

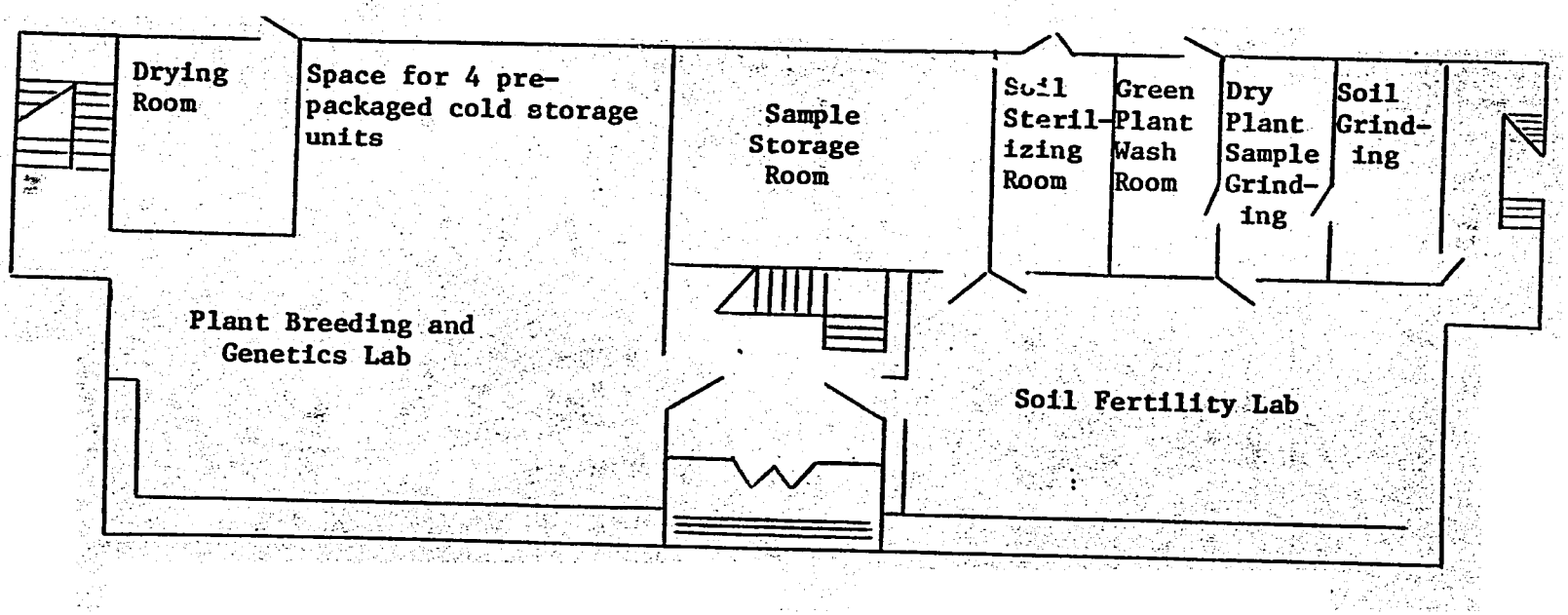
Water starts flowing to waste through the impulse valve gradually increasing in velocity until it finally slams the impulse valve shut with great rapidity.



The sudden shutting off of the passage of escape creates tremendous pressure in the base of the ram. Since it is impossible to stop the flow of water instantly, it immediatel finds another path through the air chamber valve and gradually comes to rest. The inflow of water compresses air in the air chamber which cushions the impulse and forces water out through the delivery pipe. The cycle is then repeated.

130

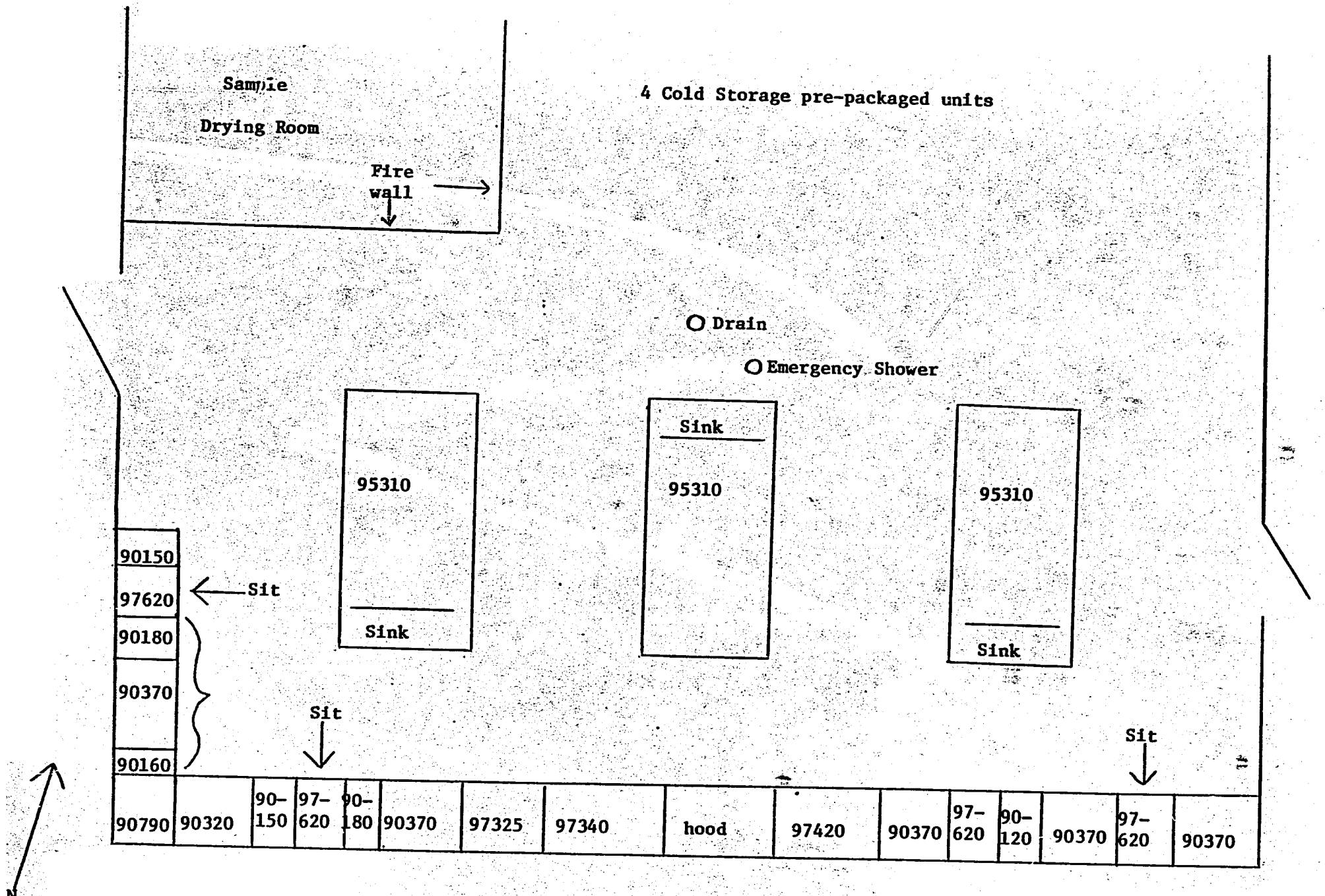
INRAF - Lab Building - First Floor Plan



1 cm = 2 m

N

Figure 1



INRAF - Lab Building - Plant Breeding Lab

Figure 2

138

INRAF - Lab Building - Soil Fertility Lab

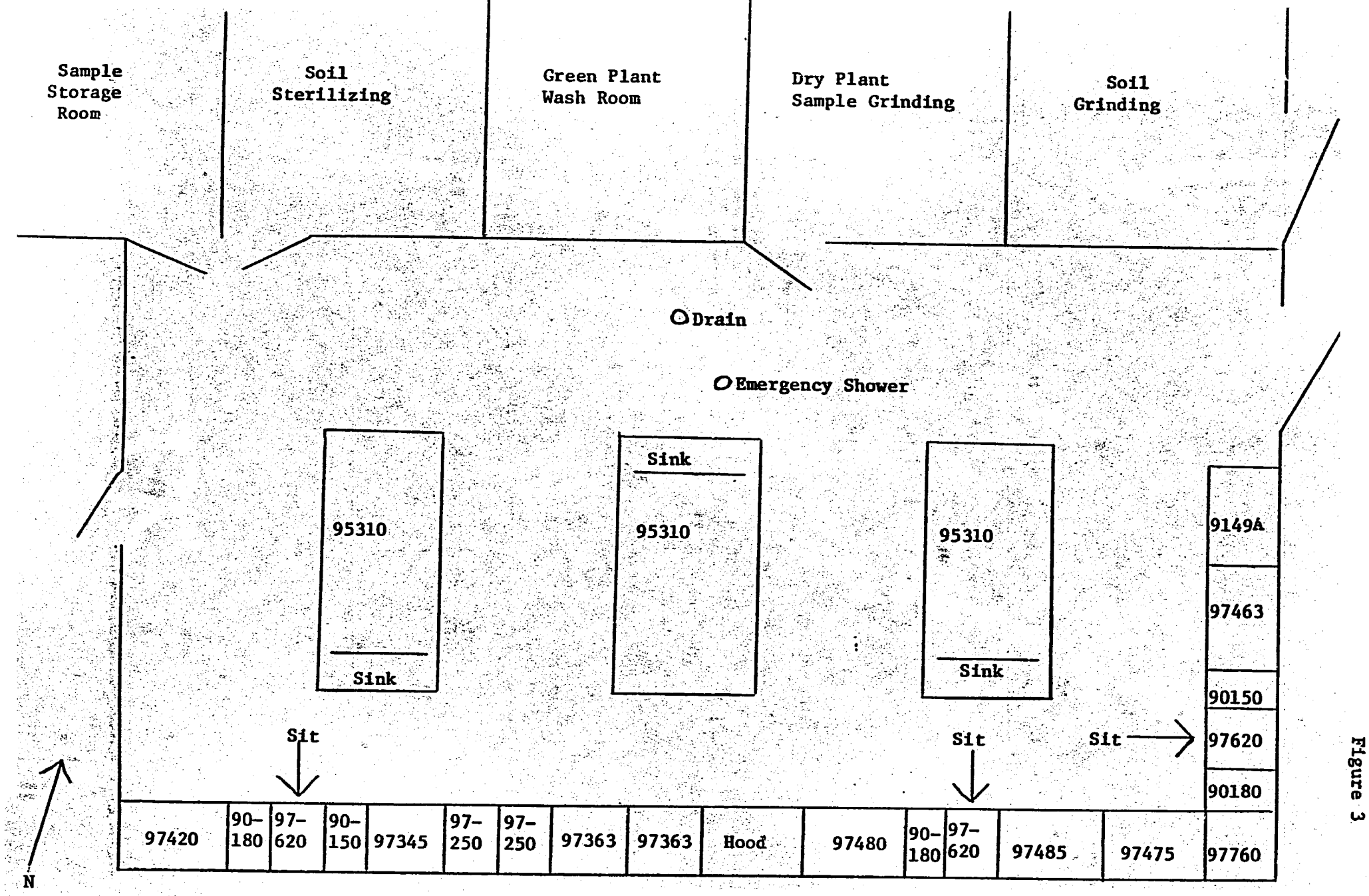
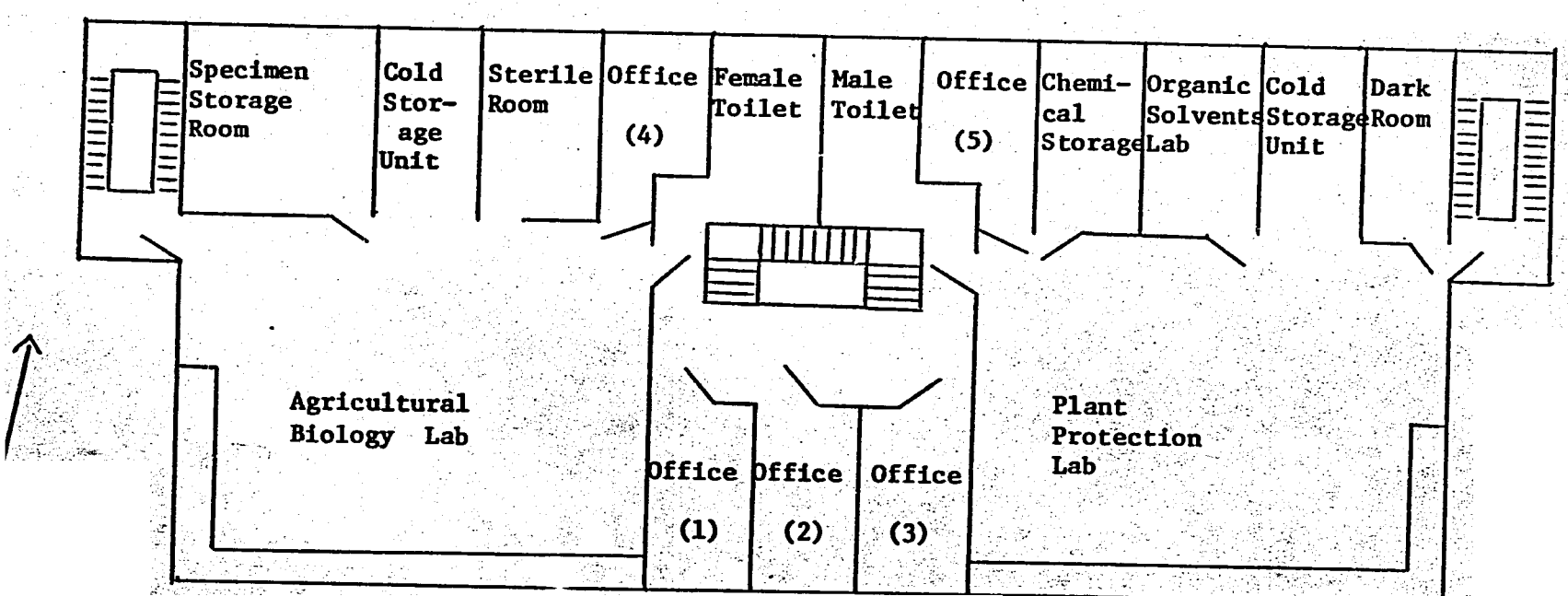


Figure 3

133

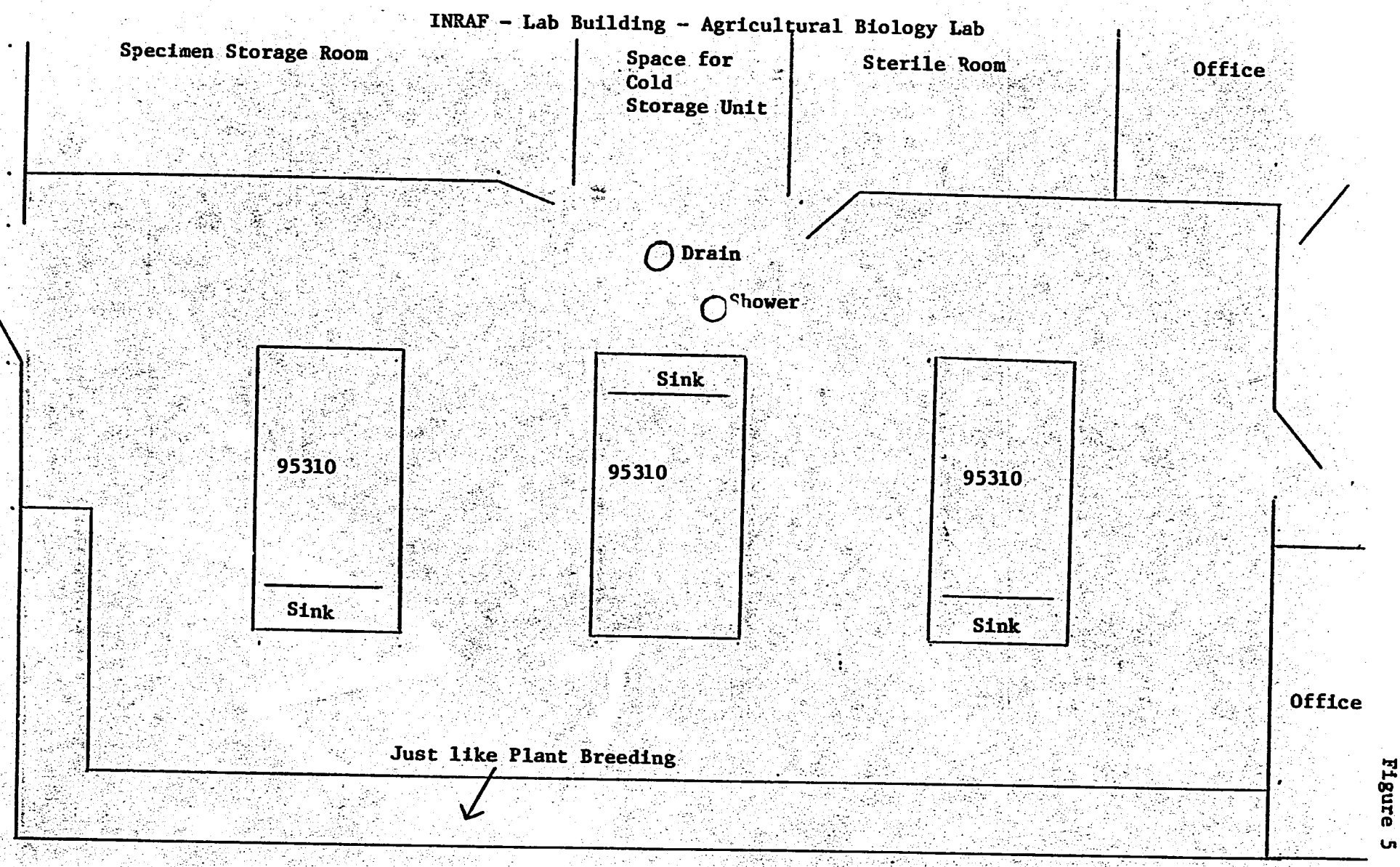
INRAF - Lab Building - Second Floor Plan



1 cm = 2 m

Figure 4.

134x



Same Cabinets and Stands as Plant Breeding Lab

Figure 5

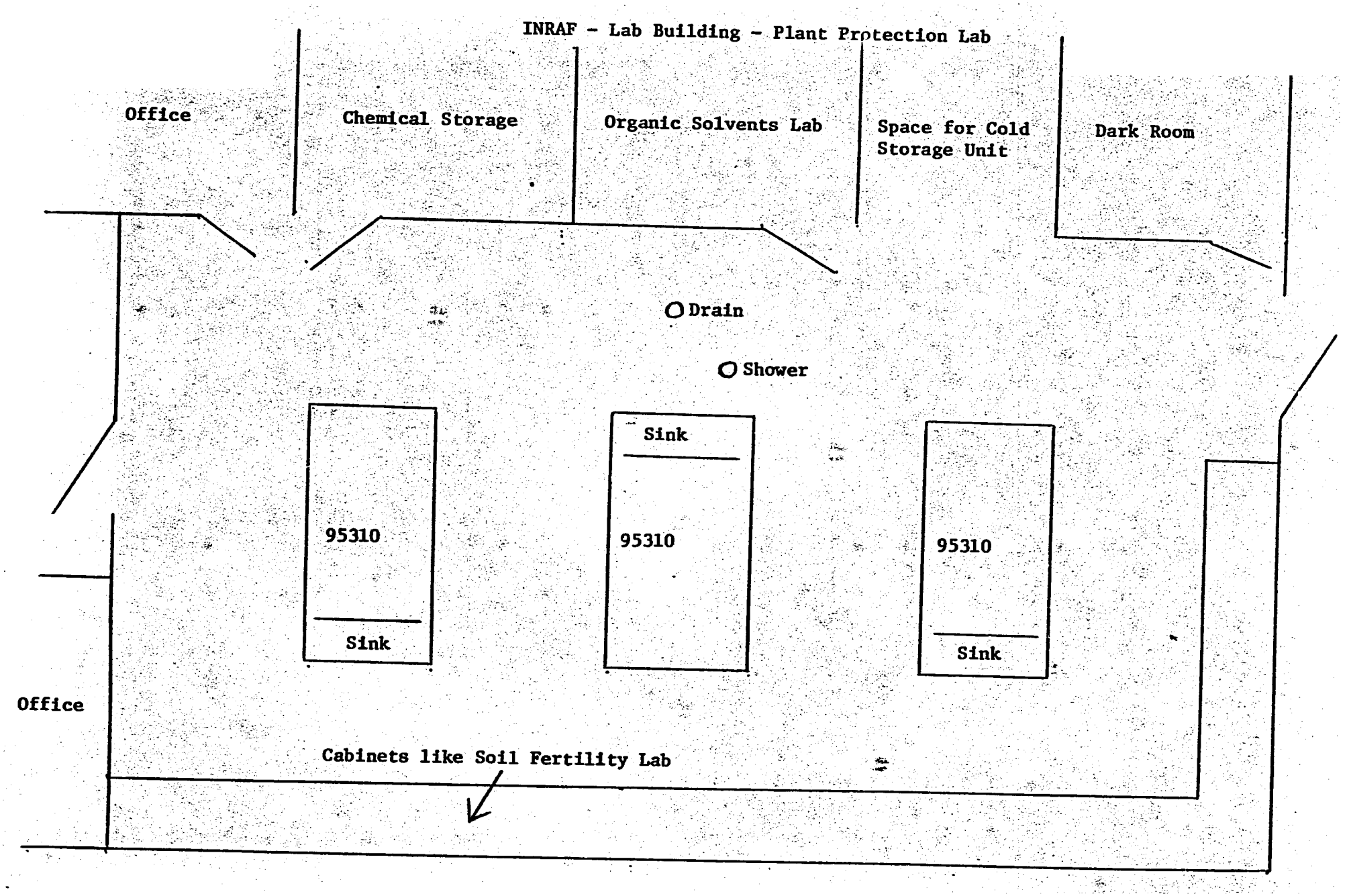
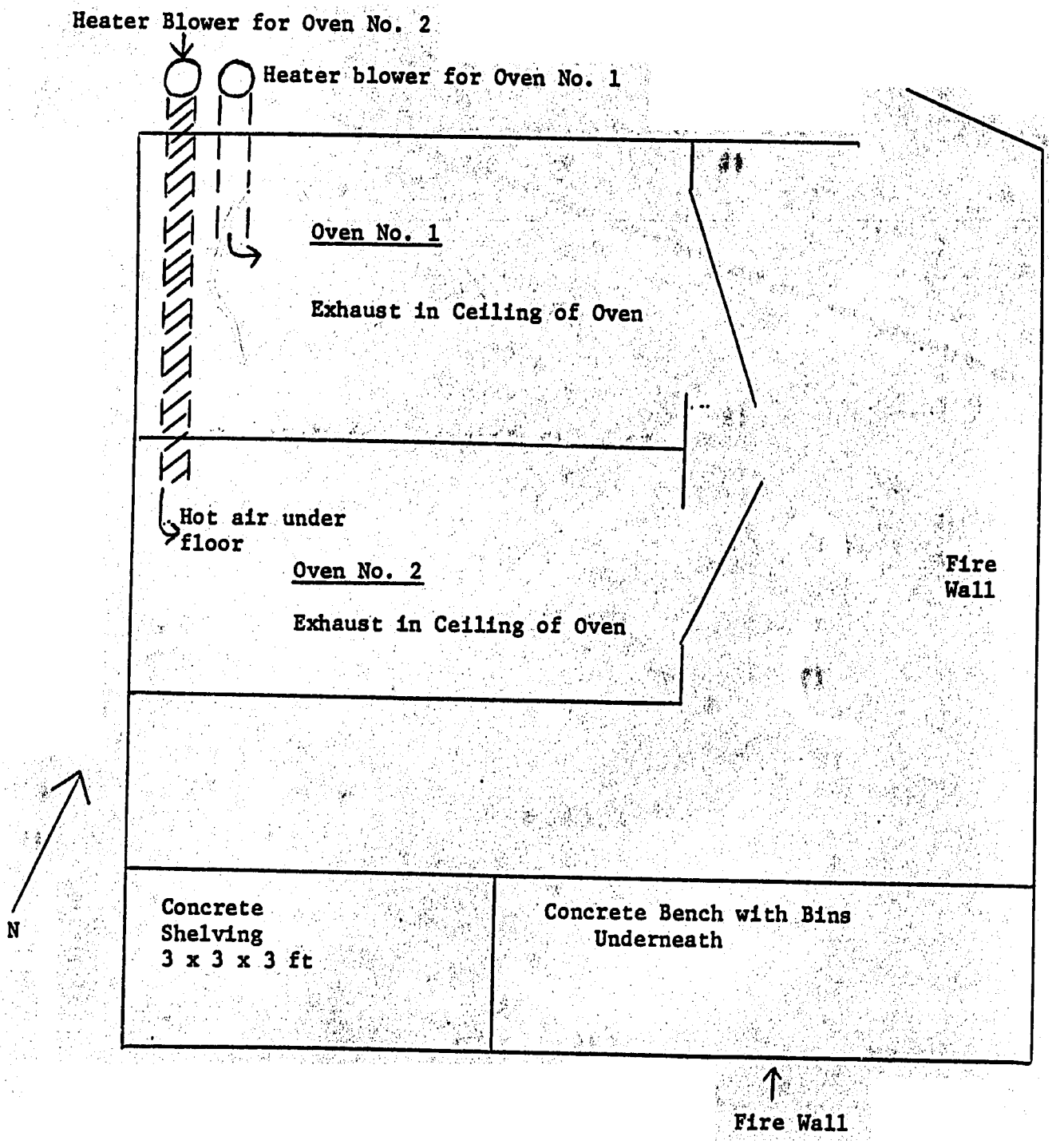

INRAF - Lab Building - Plant Protection Lab
Office
Chemical Storage
Organic Solvents Lab
Space for Cold Storage Unit
Dark Room
Drain
Shower
Sink
95310
Sink
95310
95310
Sink
Office
Cabinets like Soil Fertility Lab

Figure 6

Figure 7

INRAF - Lab Building - Sample Drying Room

15 ft x 15 ft

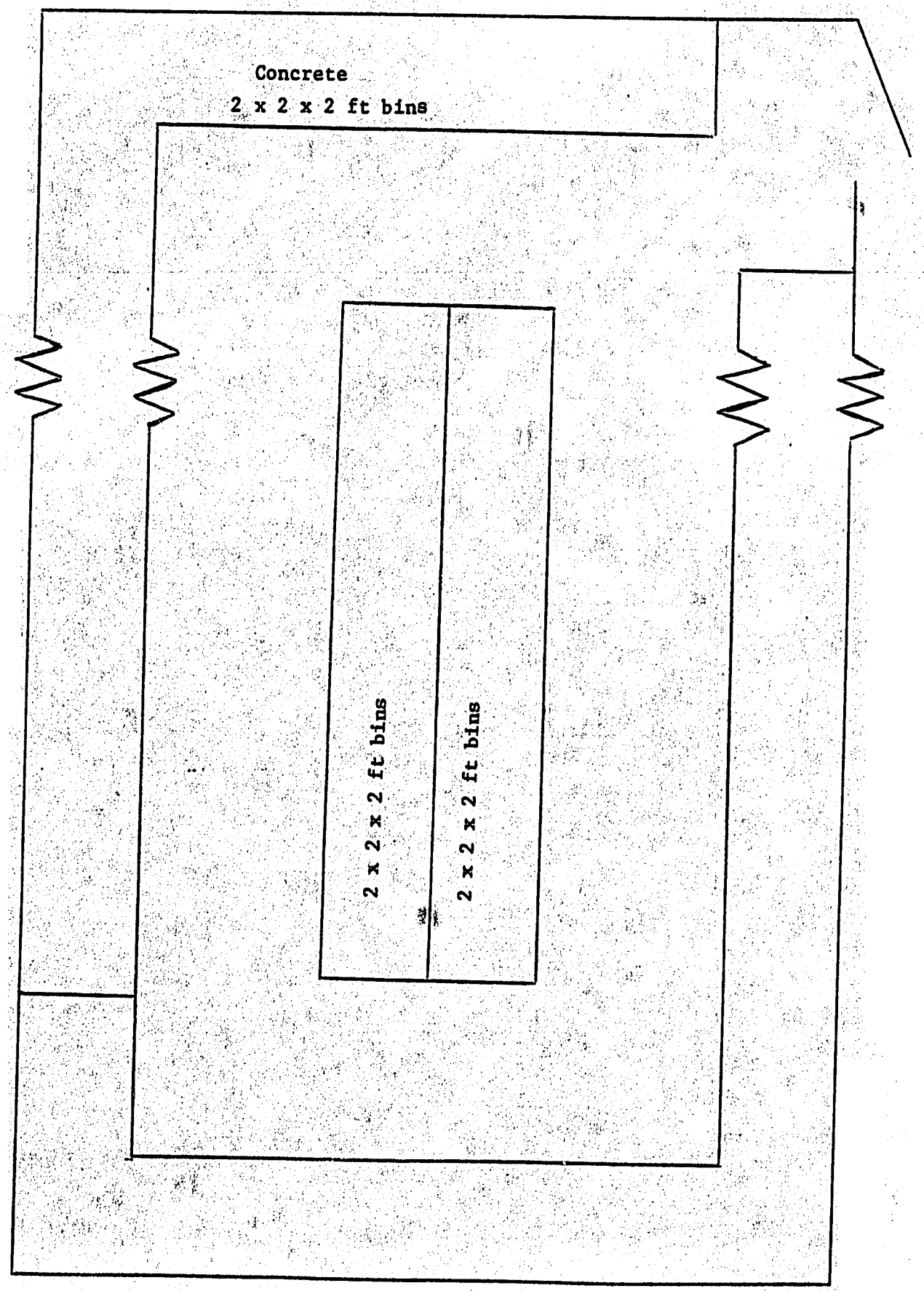


1 cm = 1 foot

Figure 8

INRAF - Lab Building - Sample Storage Room

27 ft x 15 ft



1 cm - 1 foot

1358X

Figure 9

INRAF - Lab Building - Soil Sterilizing Room

12 ft x 15 ft

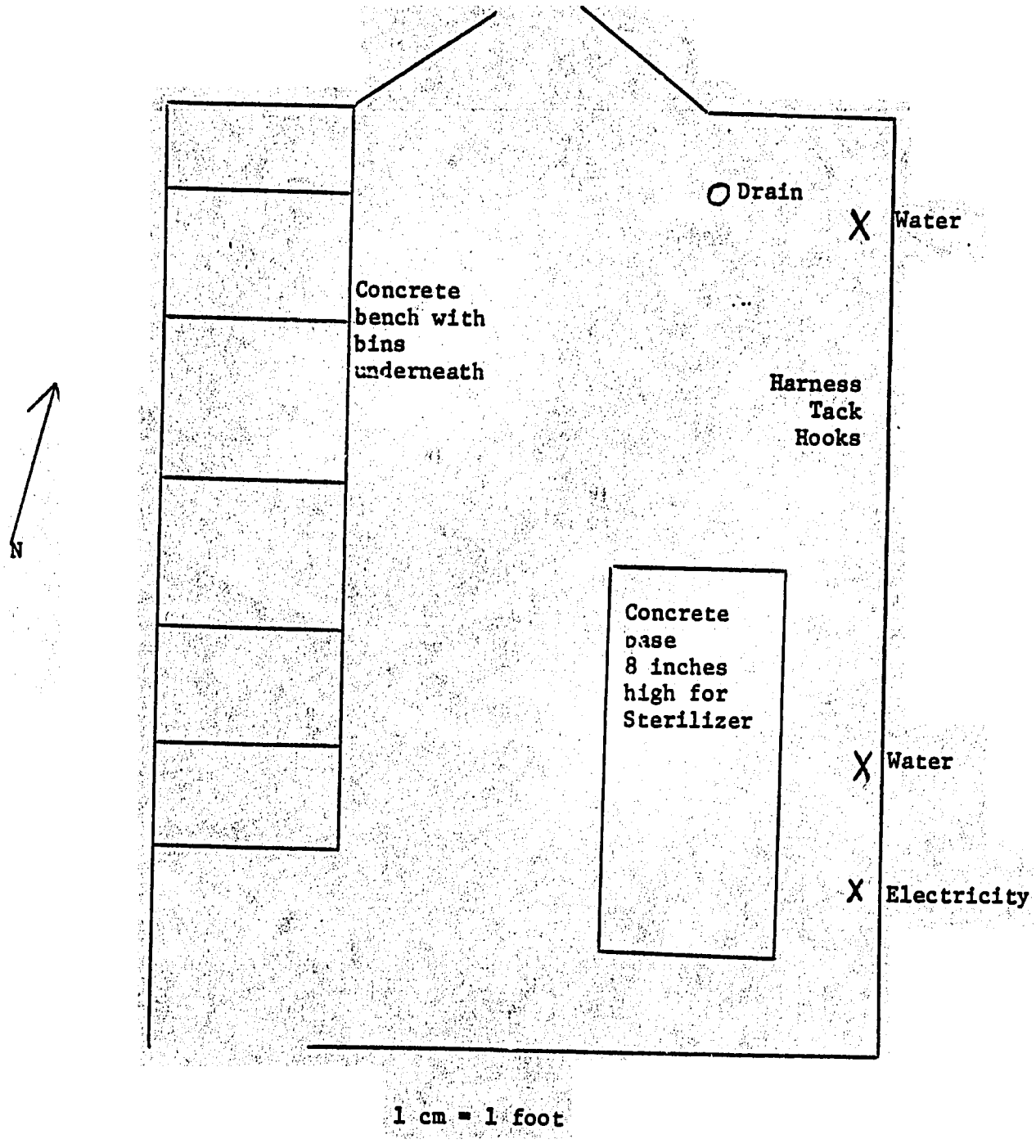
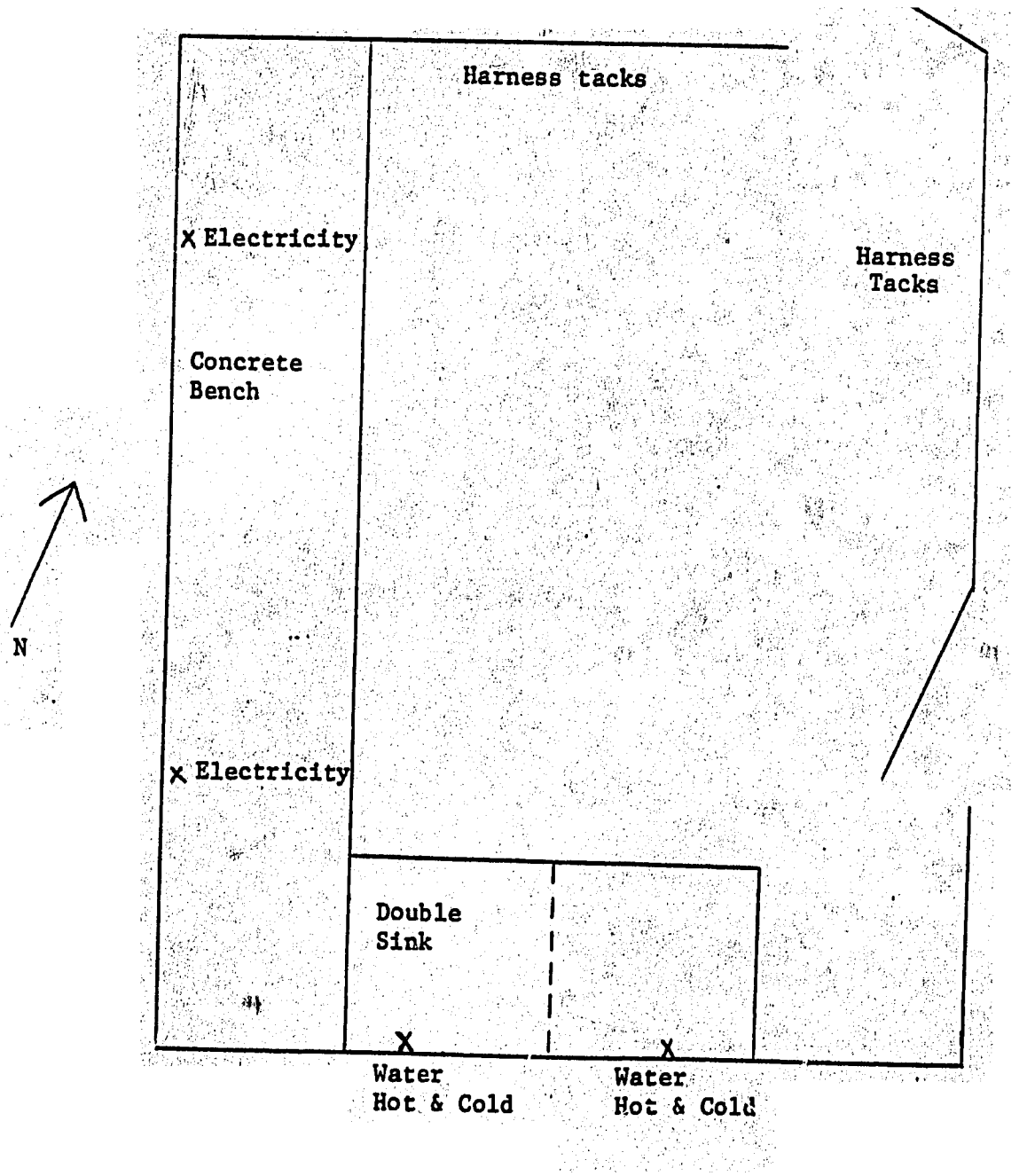


Figure 10

INRAF - Lab Building - Green Plant Wash Room

12 ft x 15 ft



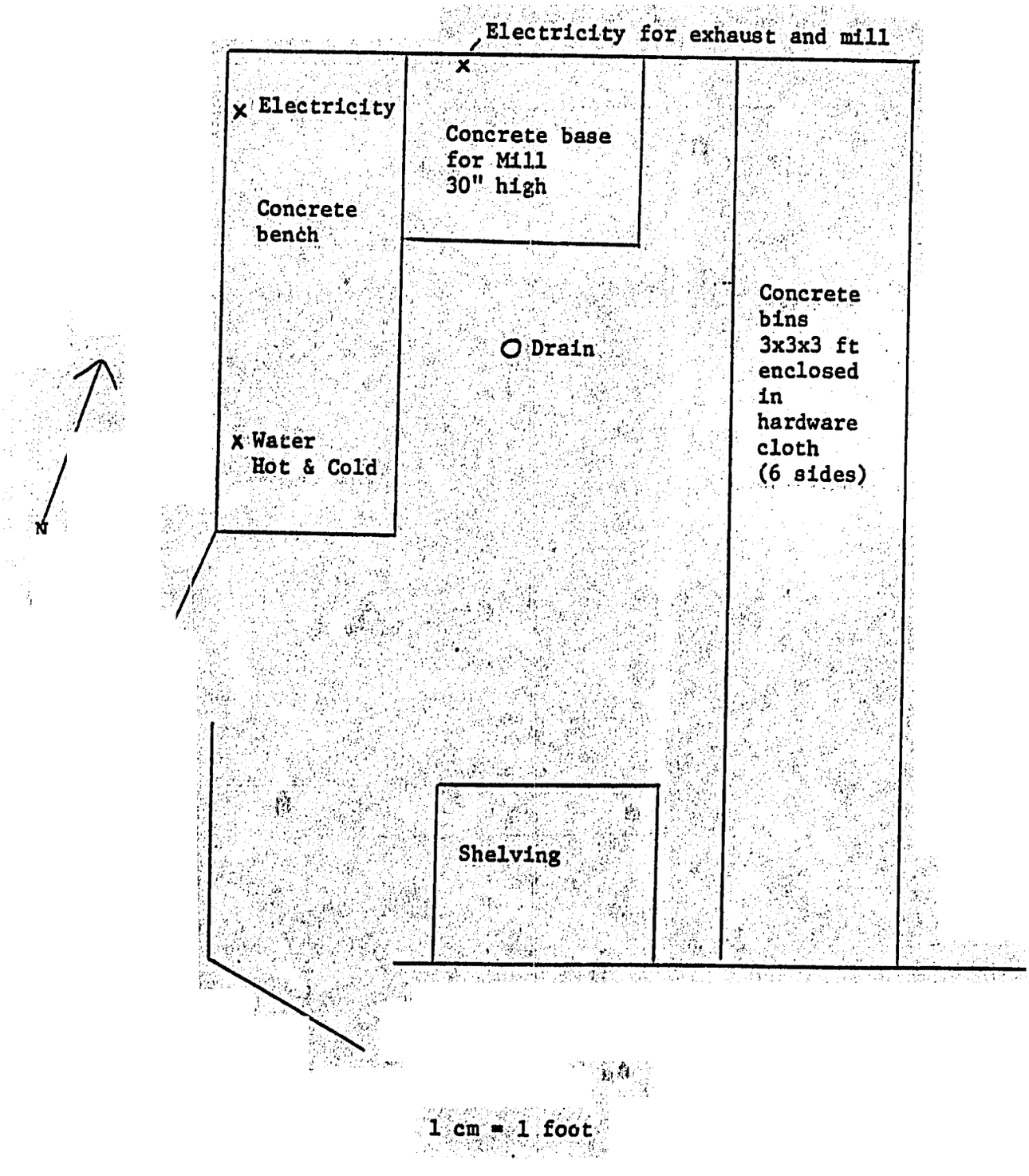
1 cm - 1 foot

140

Figure 11

12 ft x 15 ft

INRAF - Lab Building - Dry Plant Sample Grinding Room

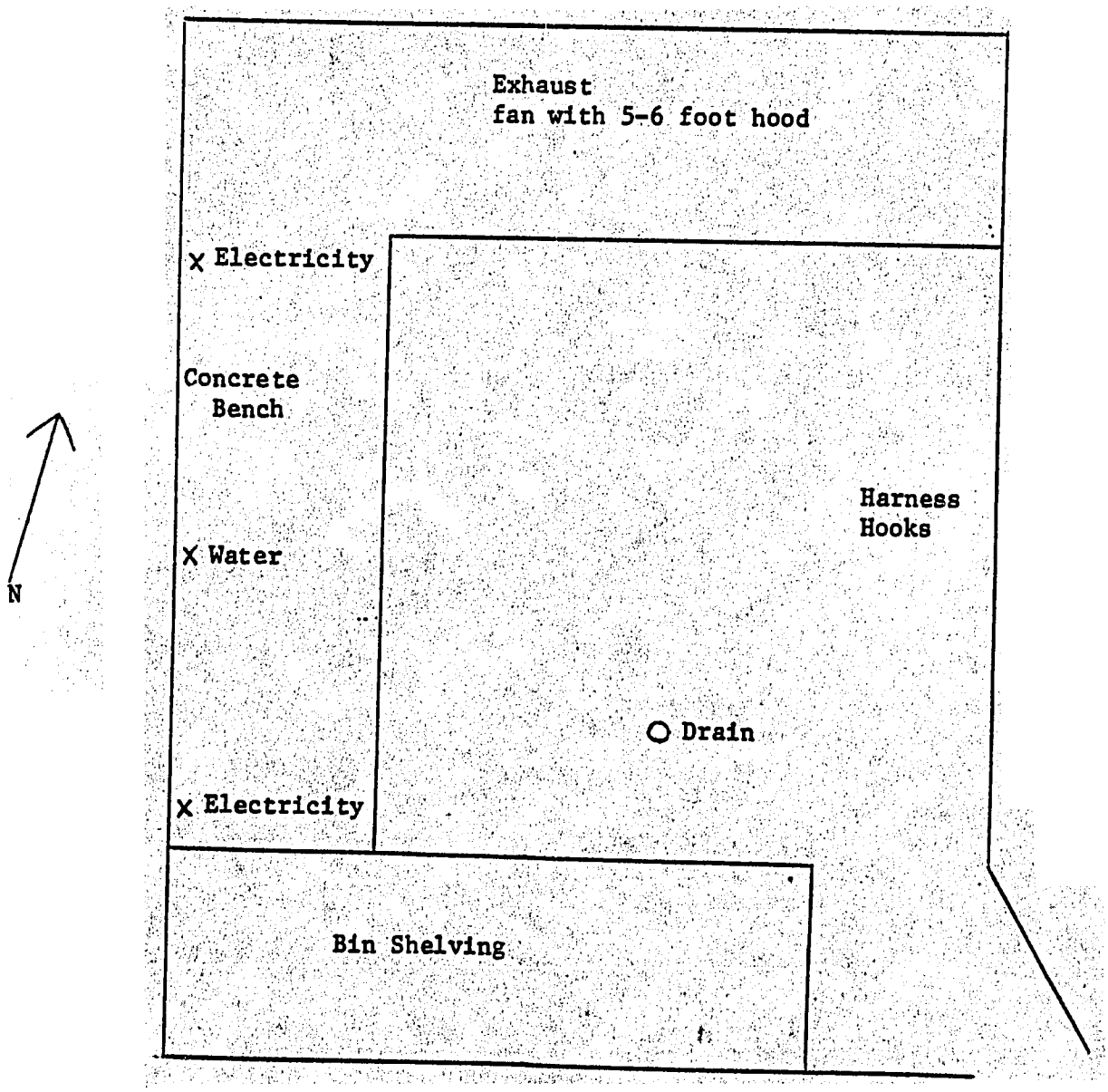


1 cm = 1 foot

Figure 12

INRAF - Lab Building - Soil Grinding Room

12 ft x 15 ft



1 cm = 1 foot

142X

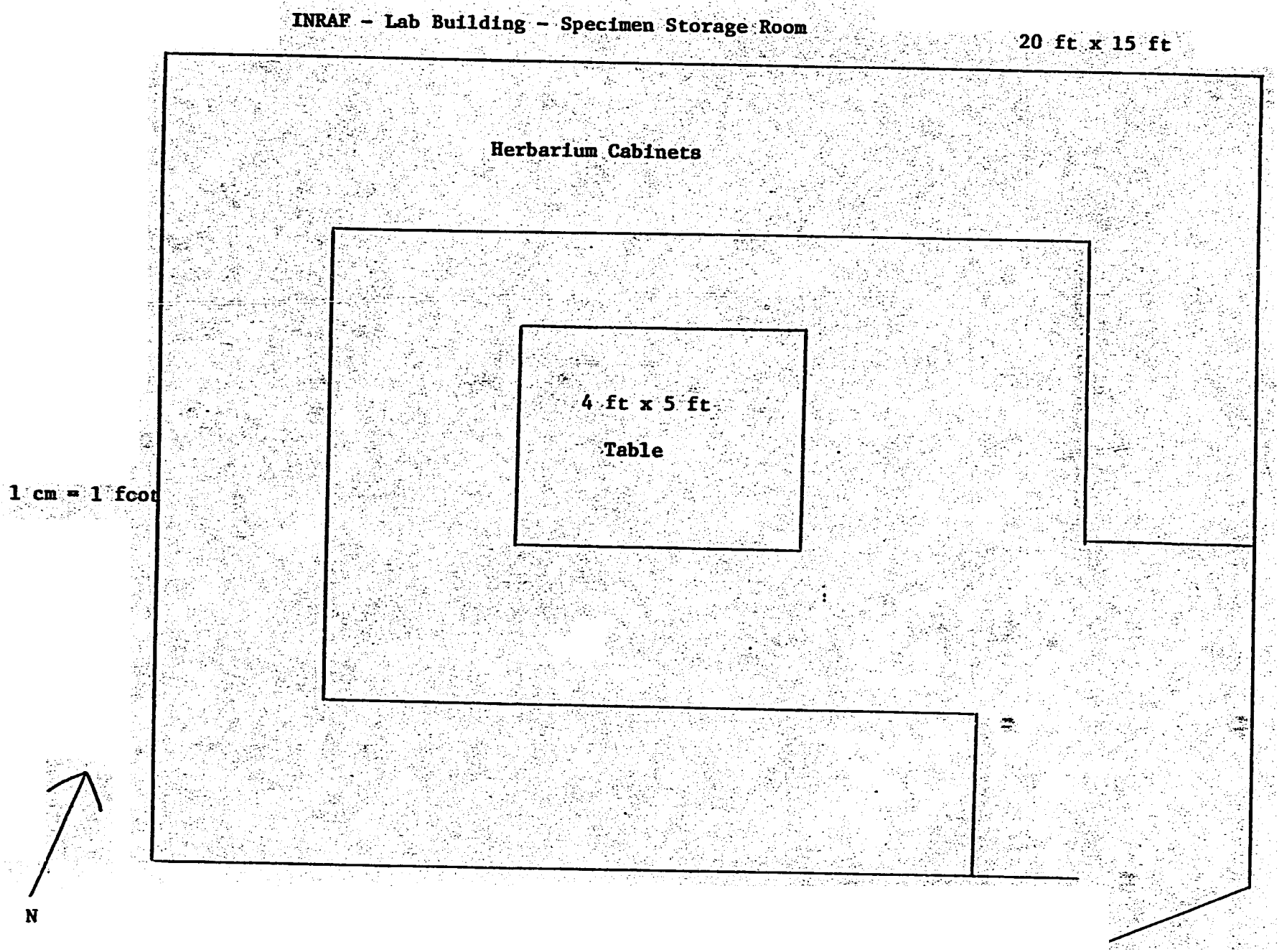


Figure 13

143

Figure 14

INRAF - Lab Building - Sterile Room

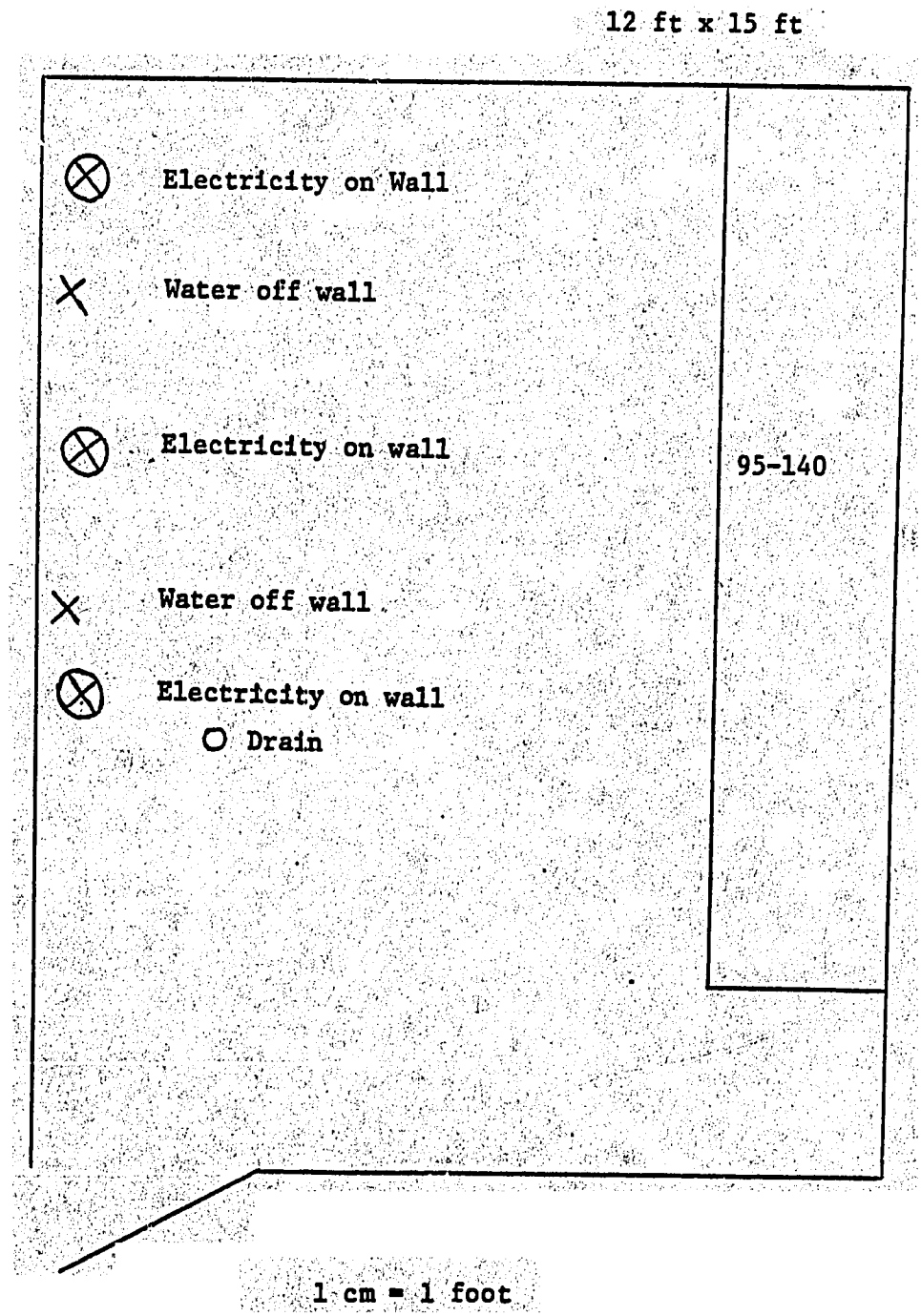


Figure 15

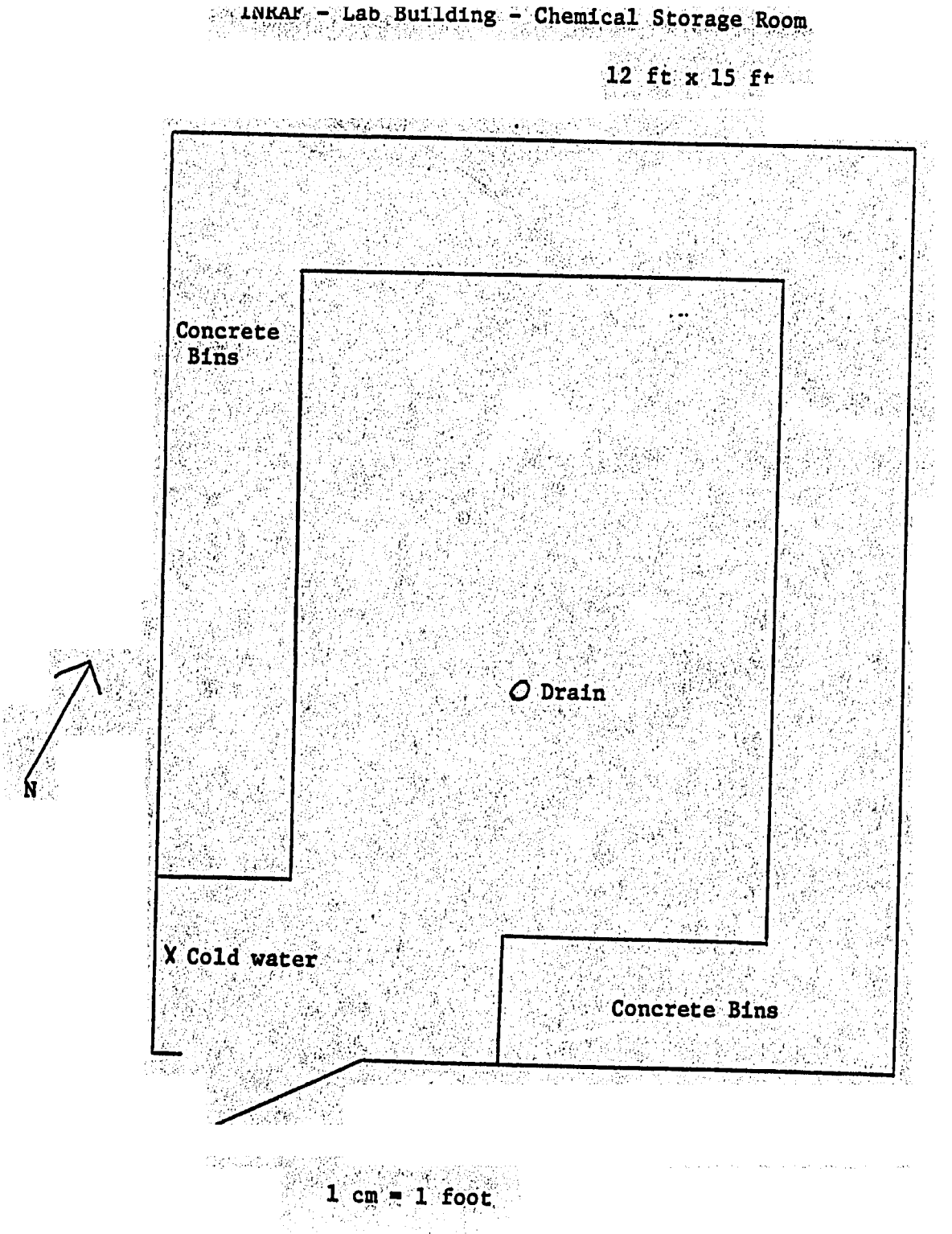
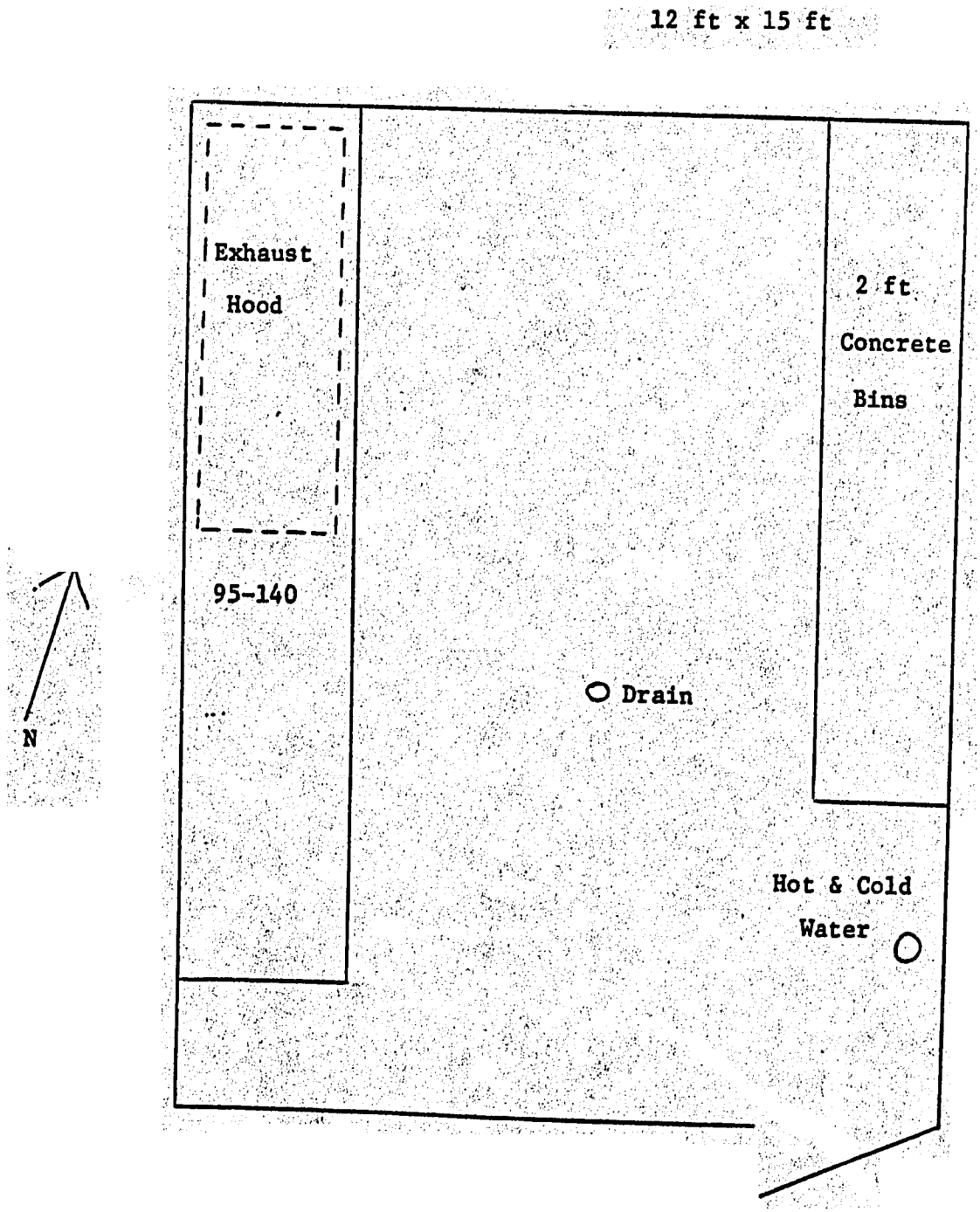

INRAP - Lab Building - Chemical Storage Room
12 ft x 15 ft
Concrete Bins
Drain
N
X Cold water
Concrete Bins
1 cm = 1 foot

Figure 16

INRAF - Lab Building - Organic Solvent Lab

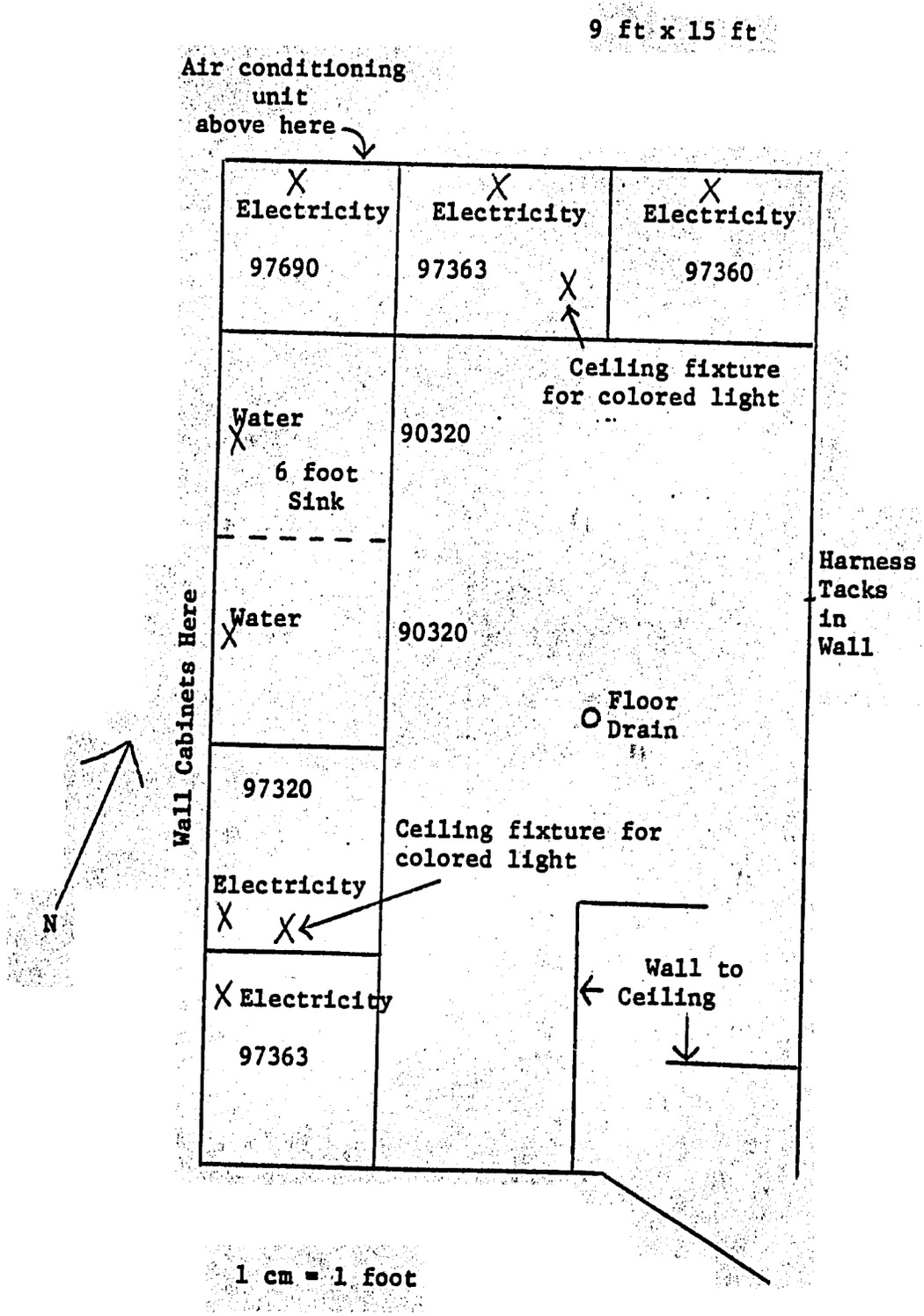


1 cm = 1 foot

146X

Figure 17

NRAF - Lab Building - Dark Room



Faranah - Classroom Building - Cross Section

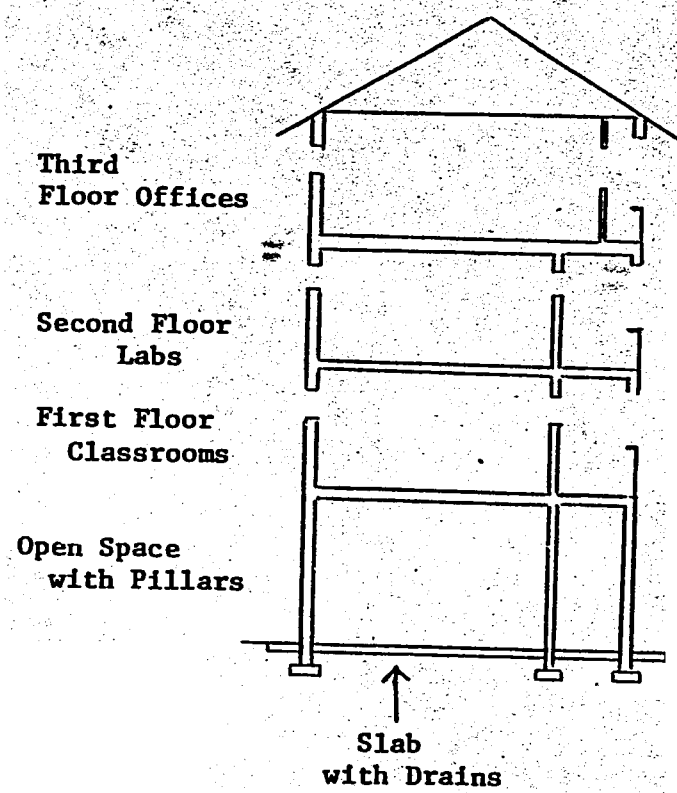


Figure 18

Faranah - Classroom Building - First Floor Plan - Classrooms

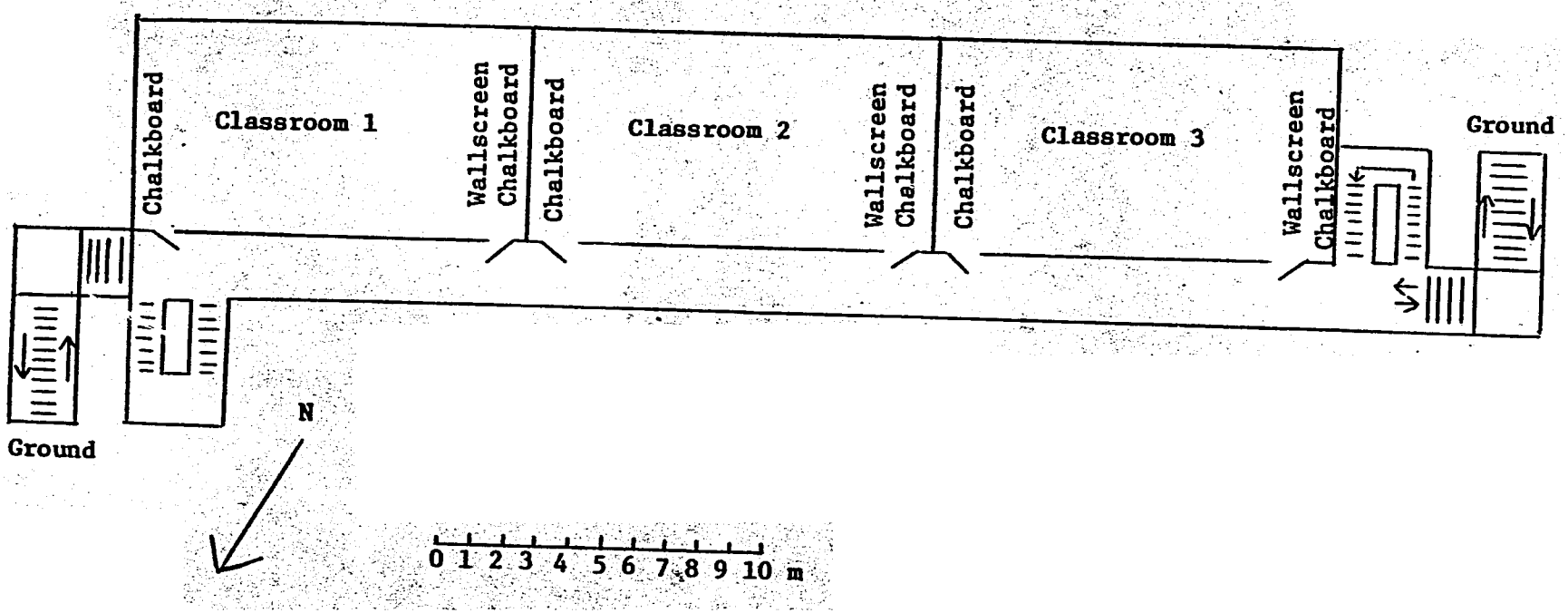
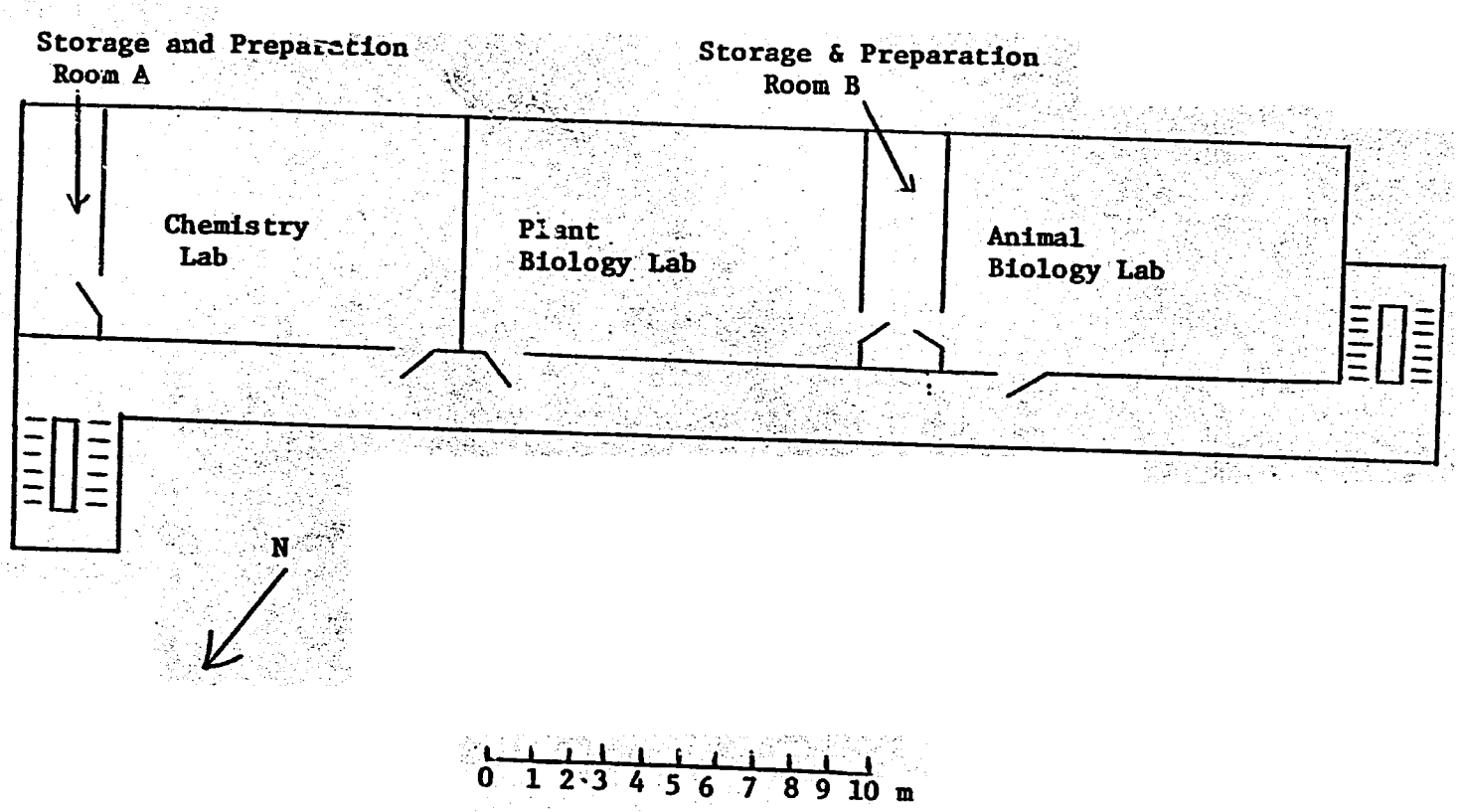


Figure 19

Figure 20

Fairman - Classroom Building - Second Floor Plan - Laboratories



XCI

Faranah - Classroom Building - Chemistry Teaching Lab

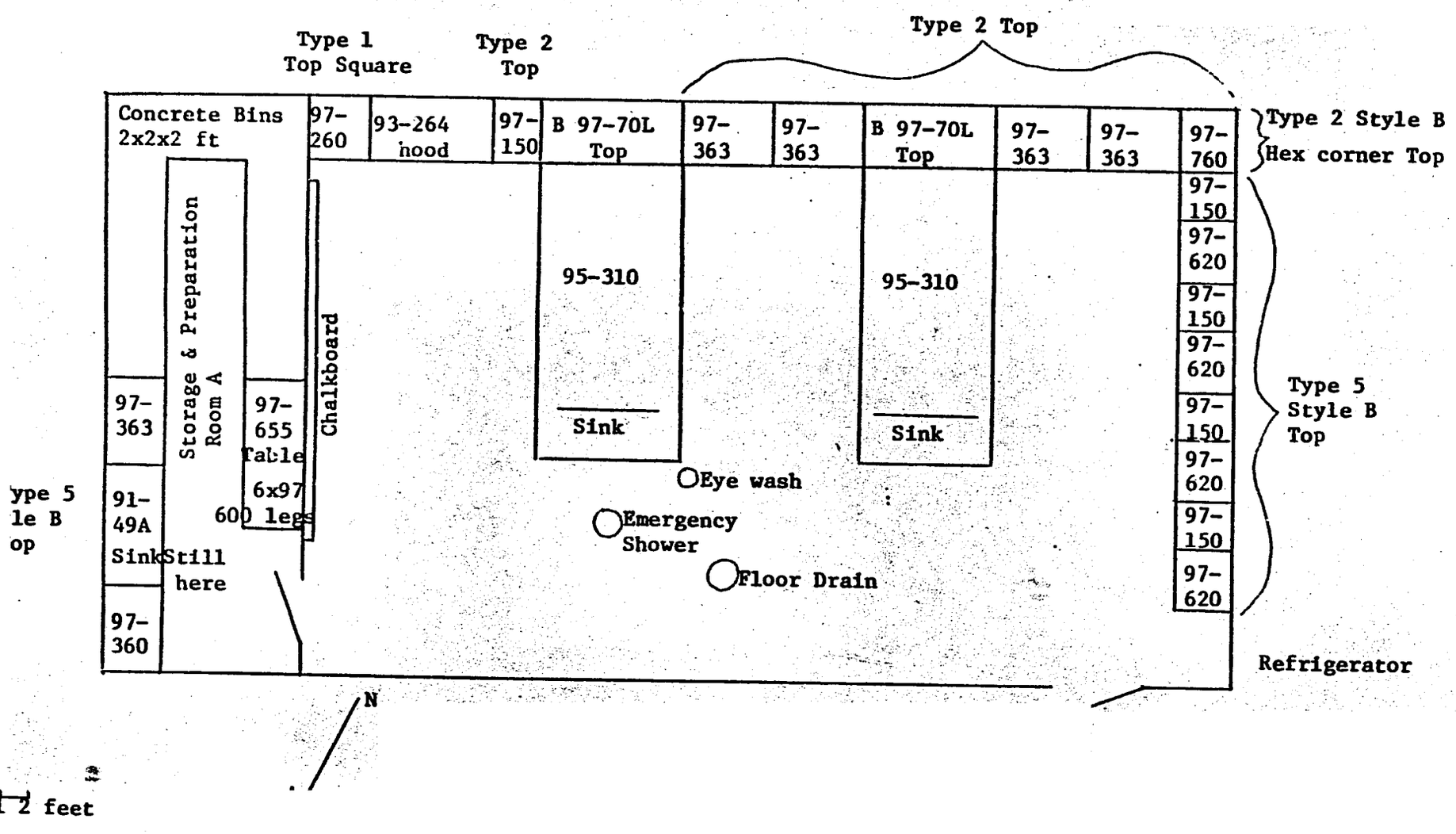


Figure 21

Faranah - Classroom Building - Plant Biology Teaching Lab

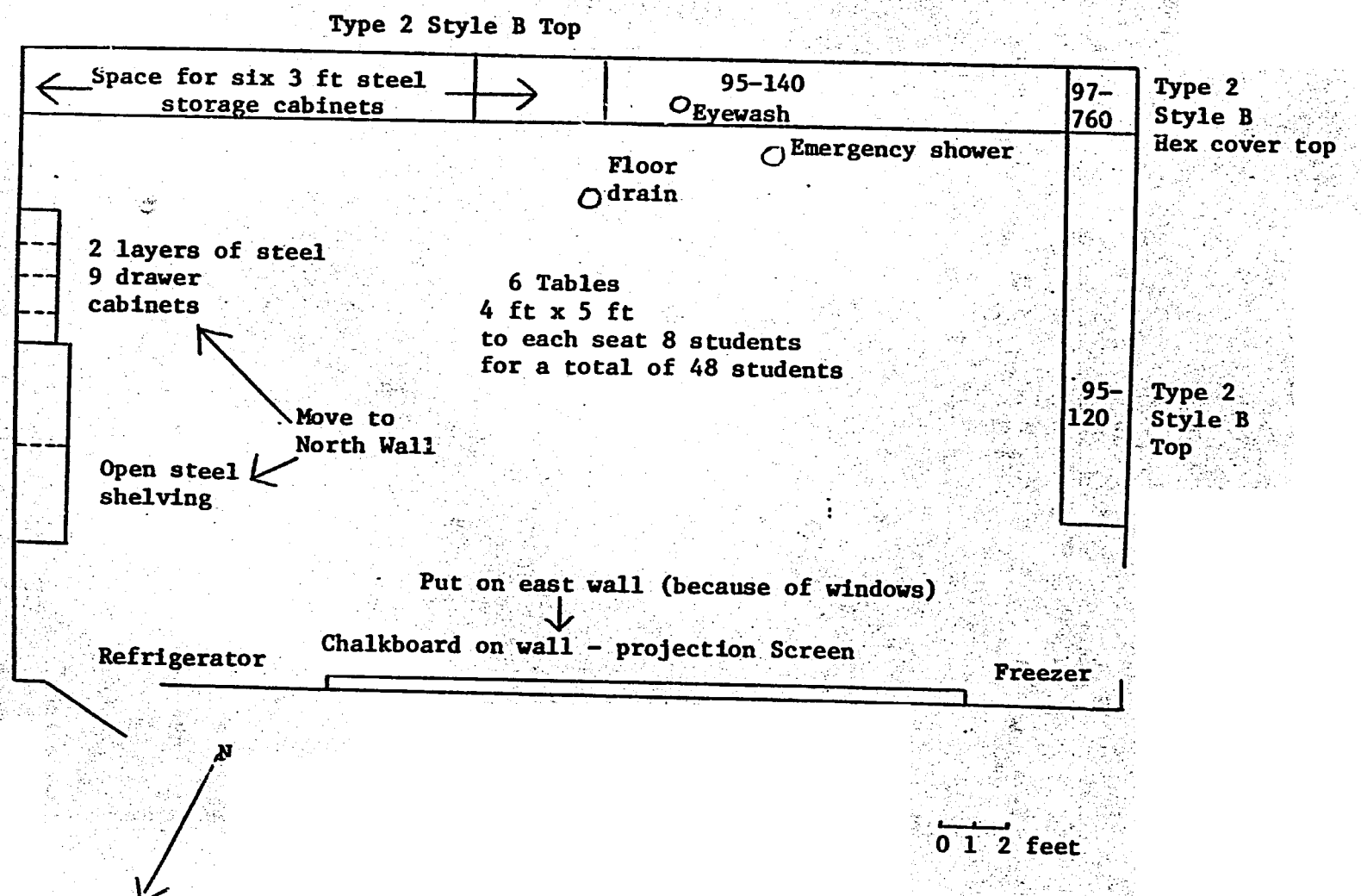


Figure 22

Faranah - Classroom Building - Animal Biology Teaching Lab

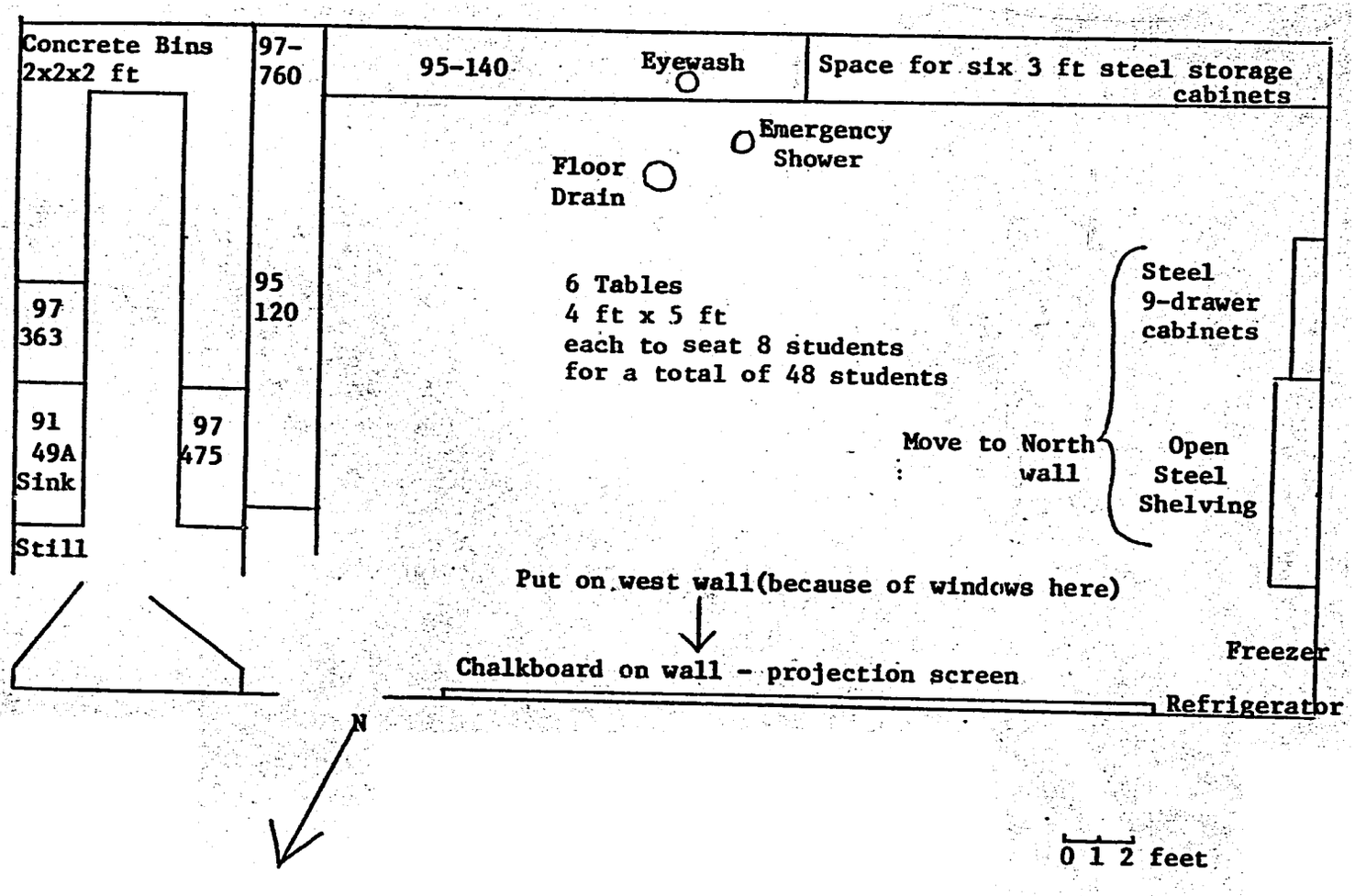


Figure 23

Faranah - Classroom Building - Third Floor Plan - Offices

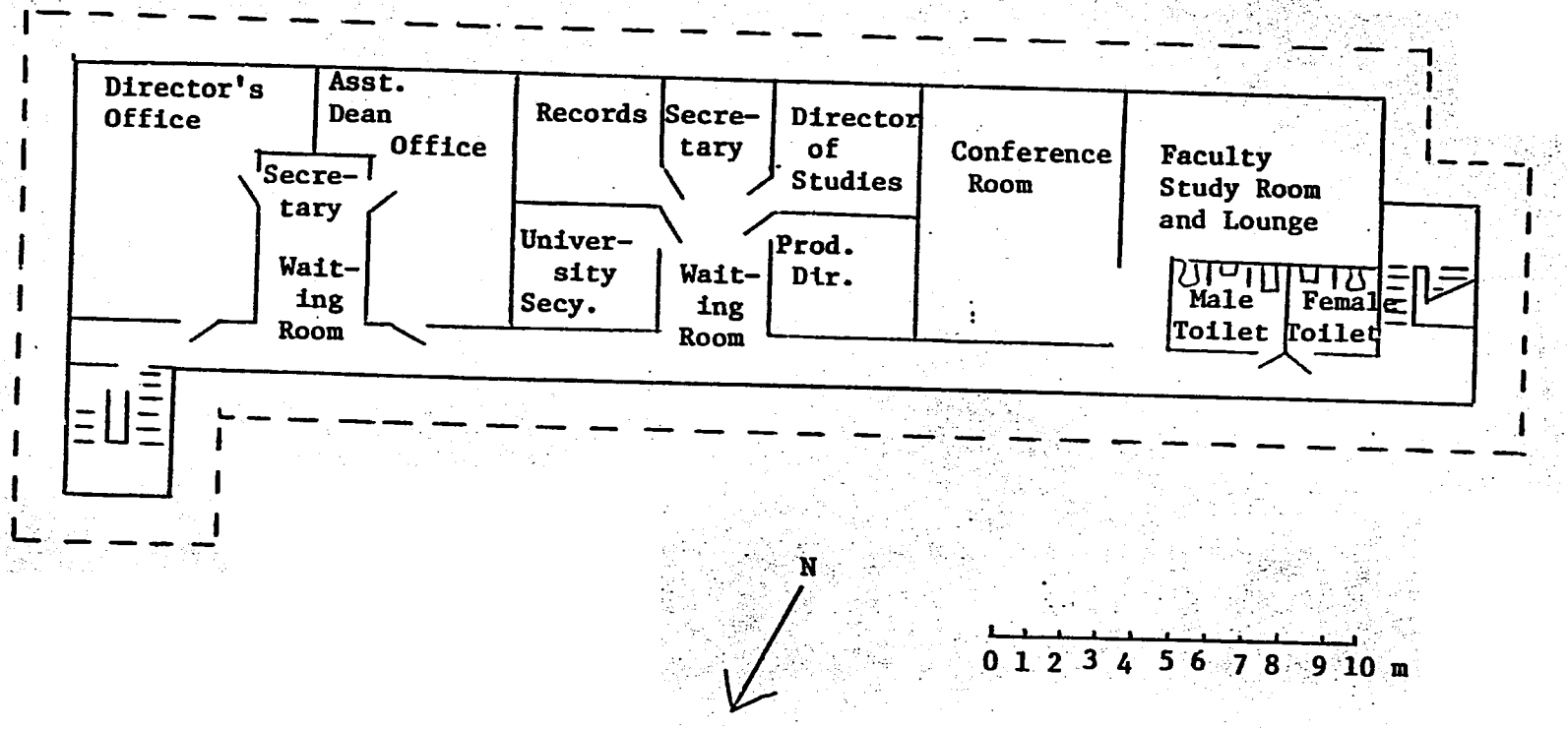
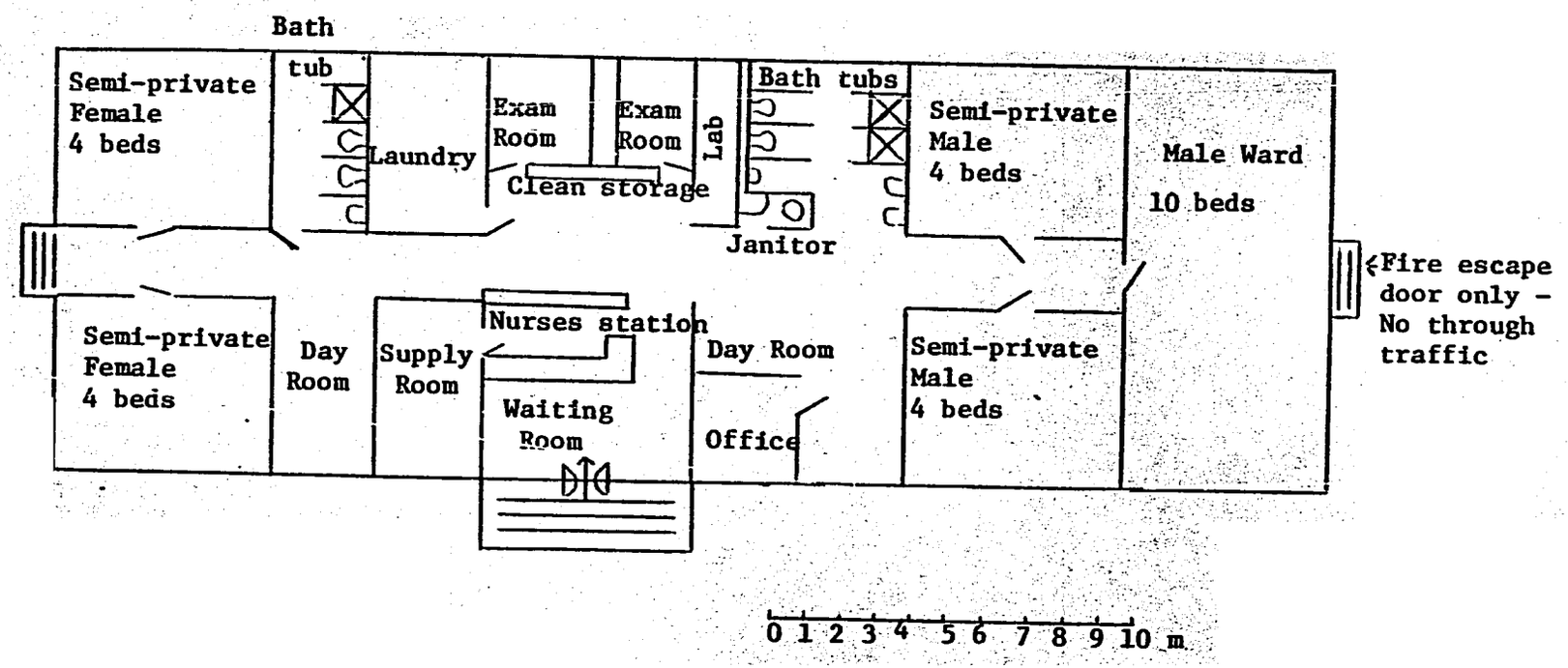


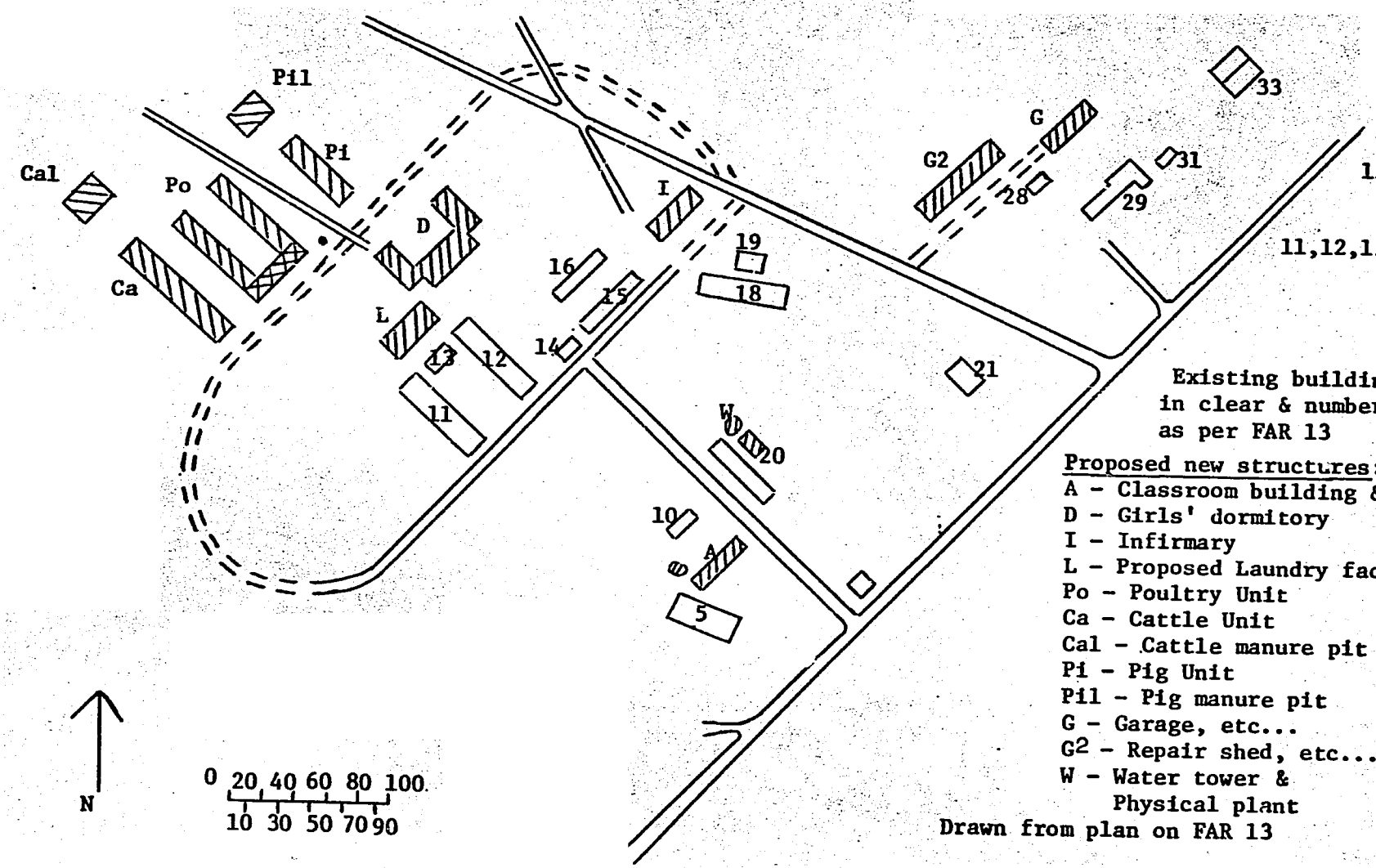
Figure 24

Figure 25

Faranah - Infirmary



Faranah Site Plan



15 - Present dorm and imfirmary at one end

11,12,13 - In use in April, 1977

Existing buildings in clear & numbered as per FAR 13

Proposed new structures:

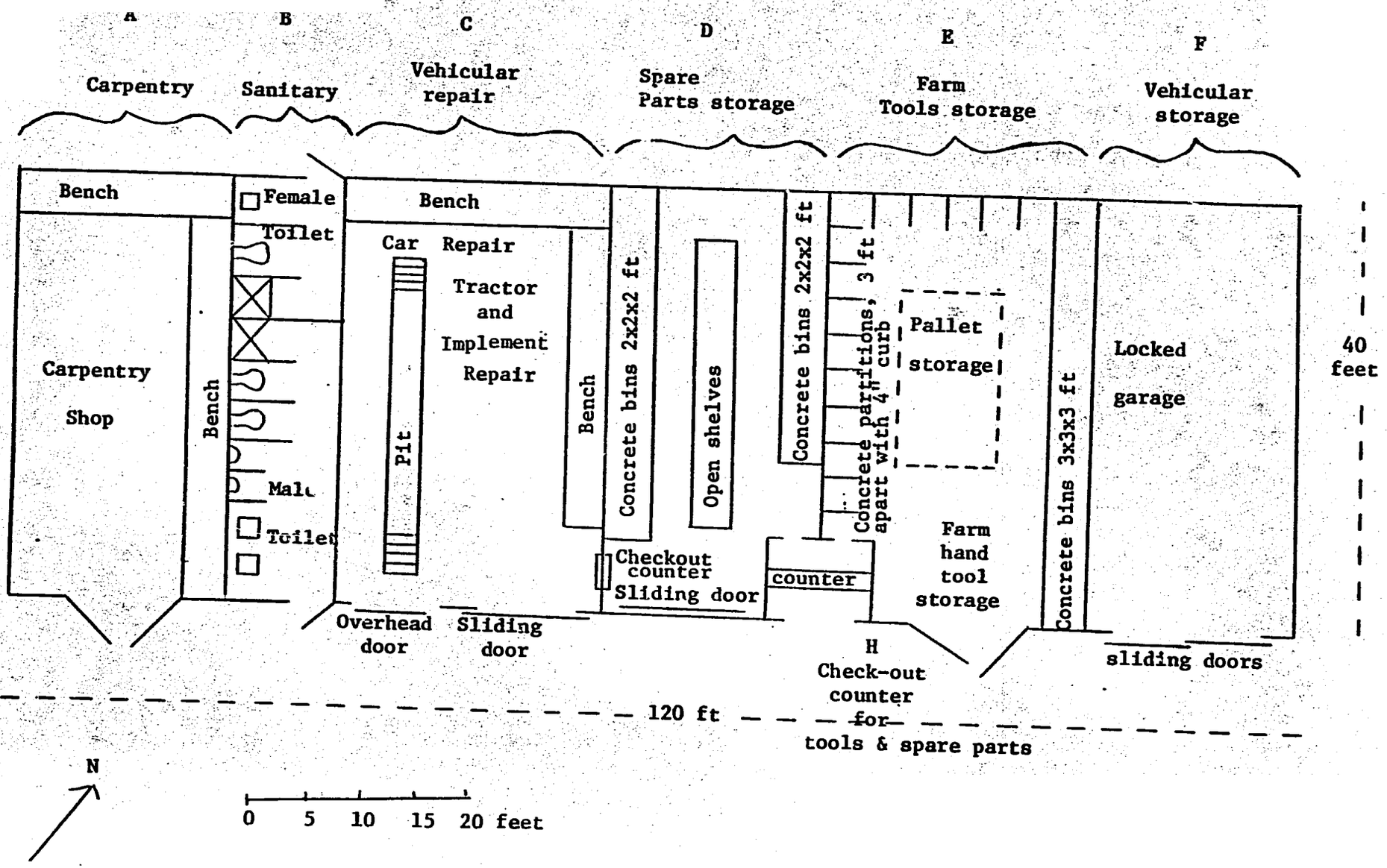
A - Classroom building & libra
D - Girls' dormitory
I - Infirmary
L - Proposed Laundry facilities
Po - Poultry Unit
Ca - Cattle Unit
Cal - Cattle manure pit
Pi - Pig Unit
Pil - Pig manure pit
G - Garage, etc...
G2 - Repair shed, etc...
W - Water tower & Physical plant

Drawn from plan on FAR 13

15(a)

Figure 27

Faranah – Repair and Supply Center (Building G of Figure 26)



Building G2 (on Figure 26)

Faranah - Fertilizer, Pesticide, and Farm Implements Storage

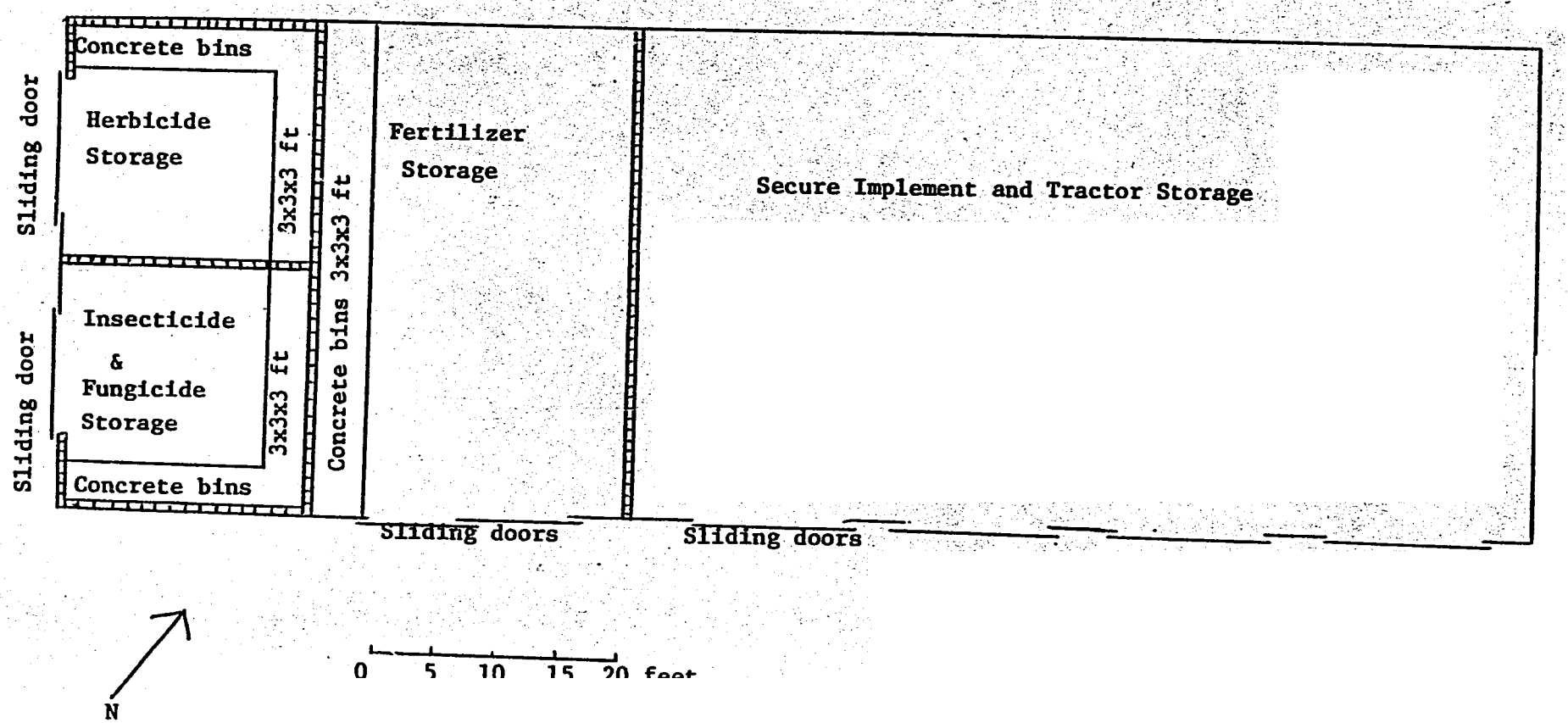
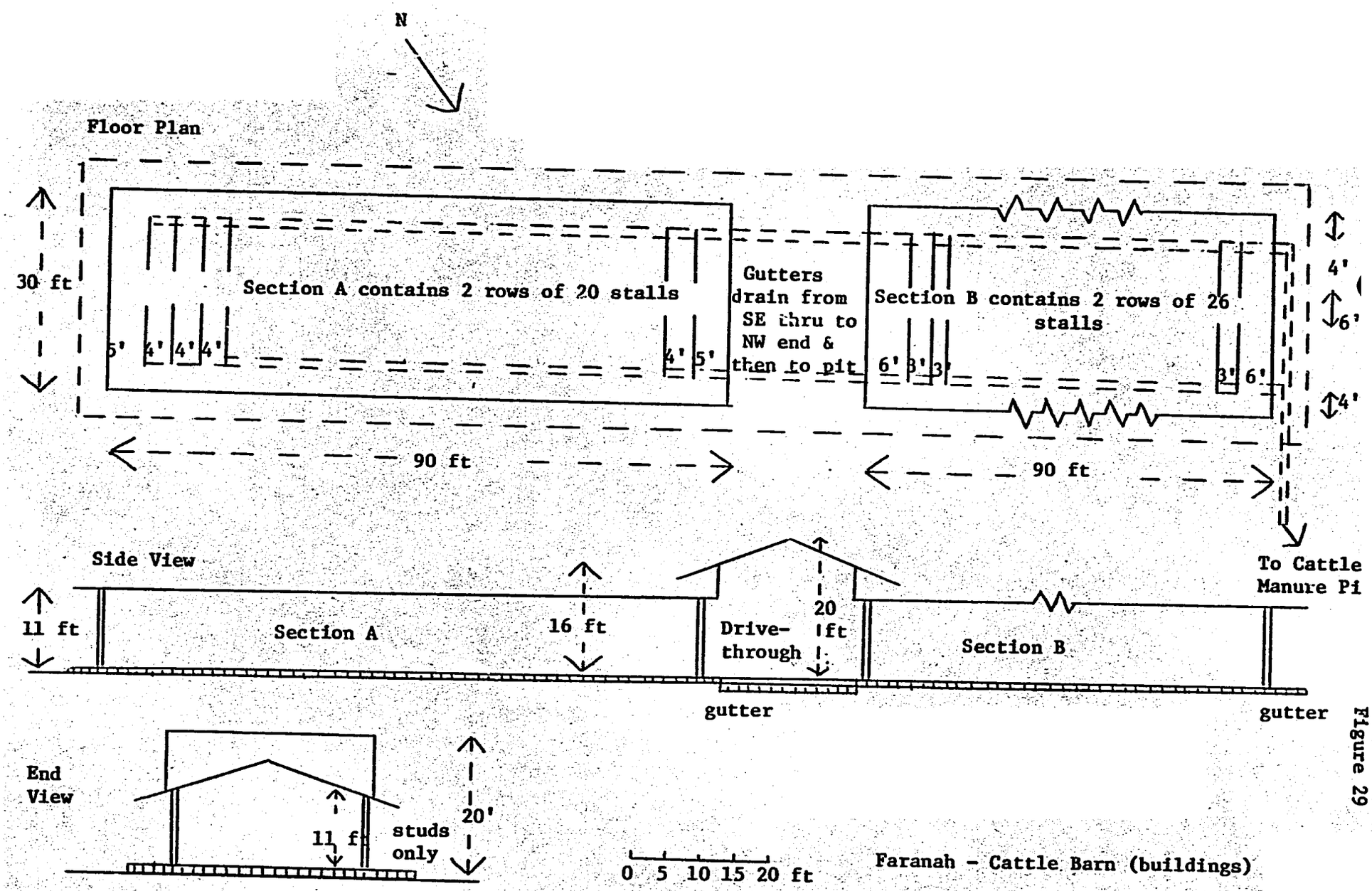


Figure 26

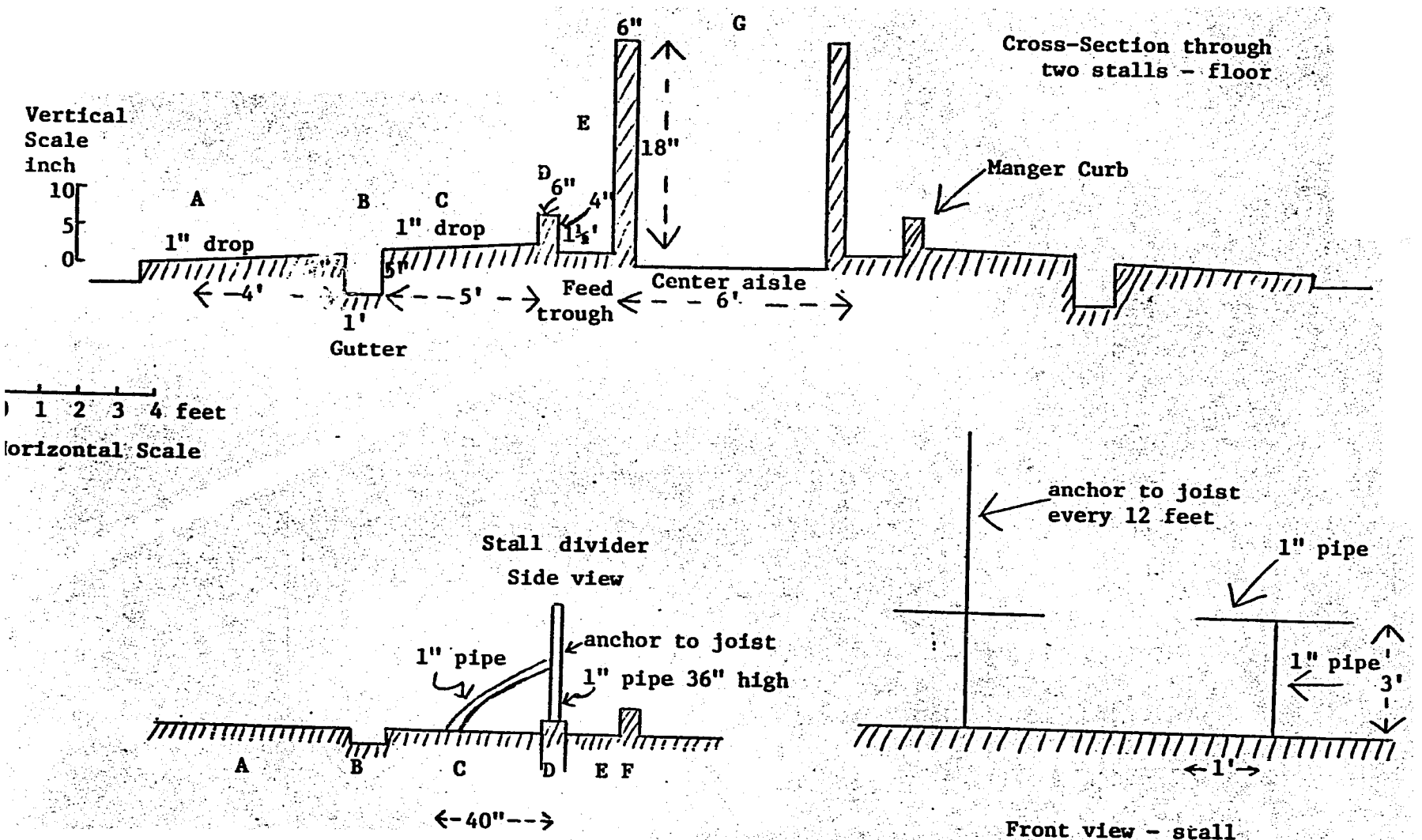
158X



Faranah - Cattle Barn (buildings)

Figure 29

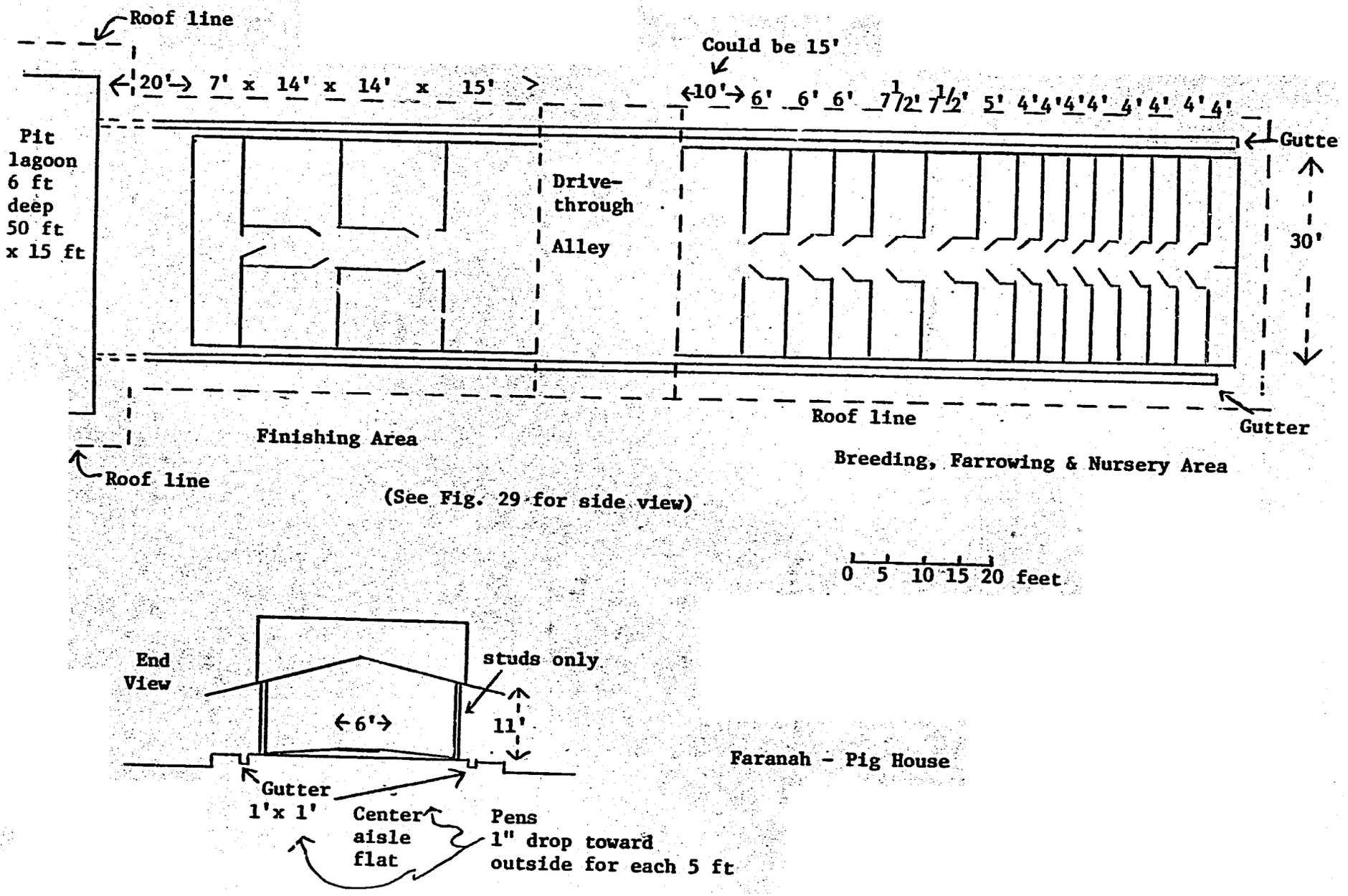
159



Faranah - Cattle Barn (floor and troughs detail)

Figure 30

160X



Faranah - Pig House

Figure 31

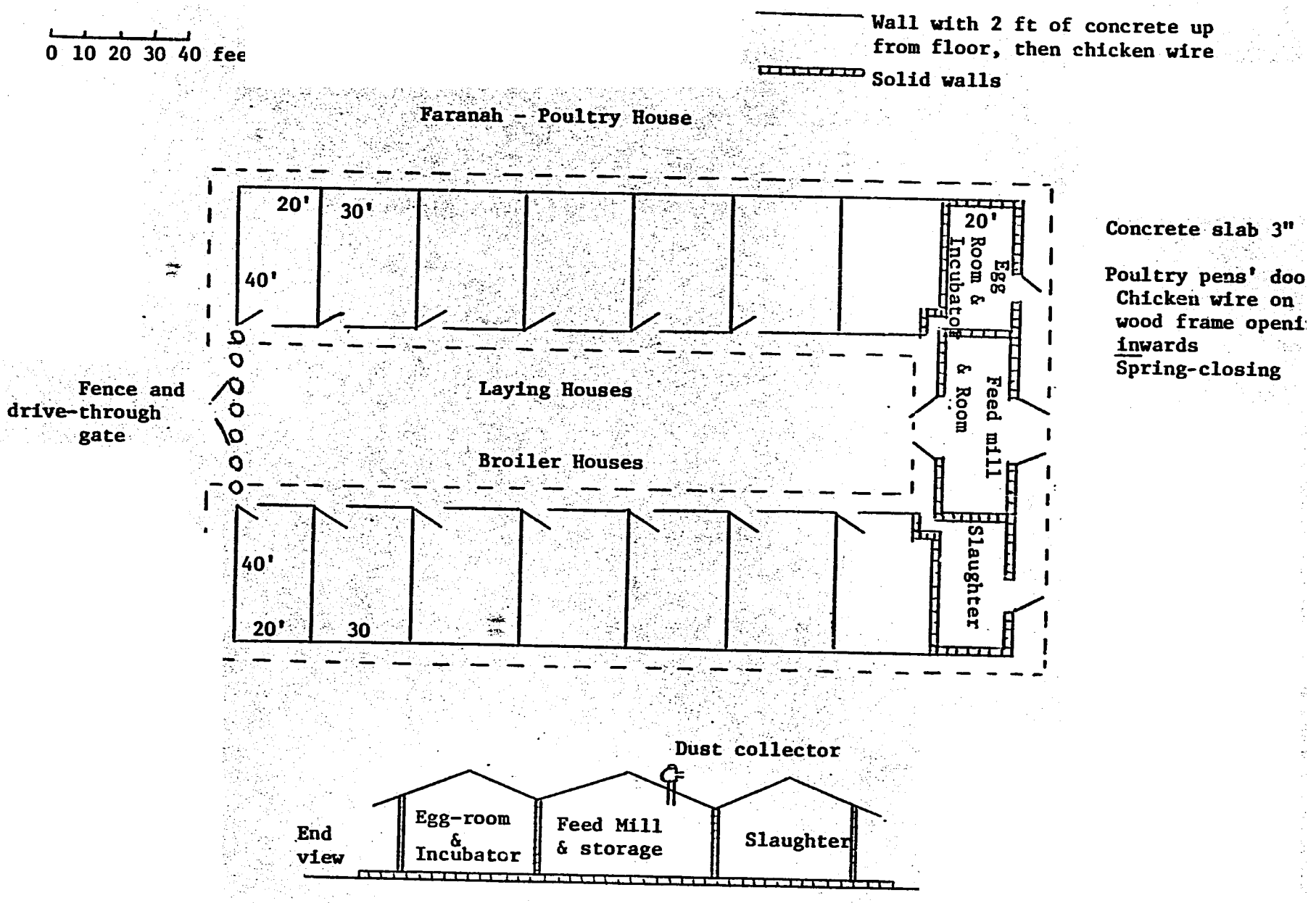
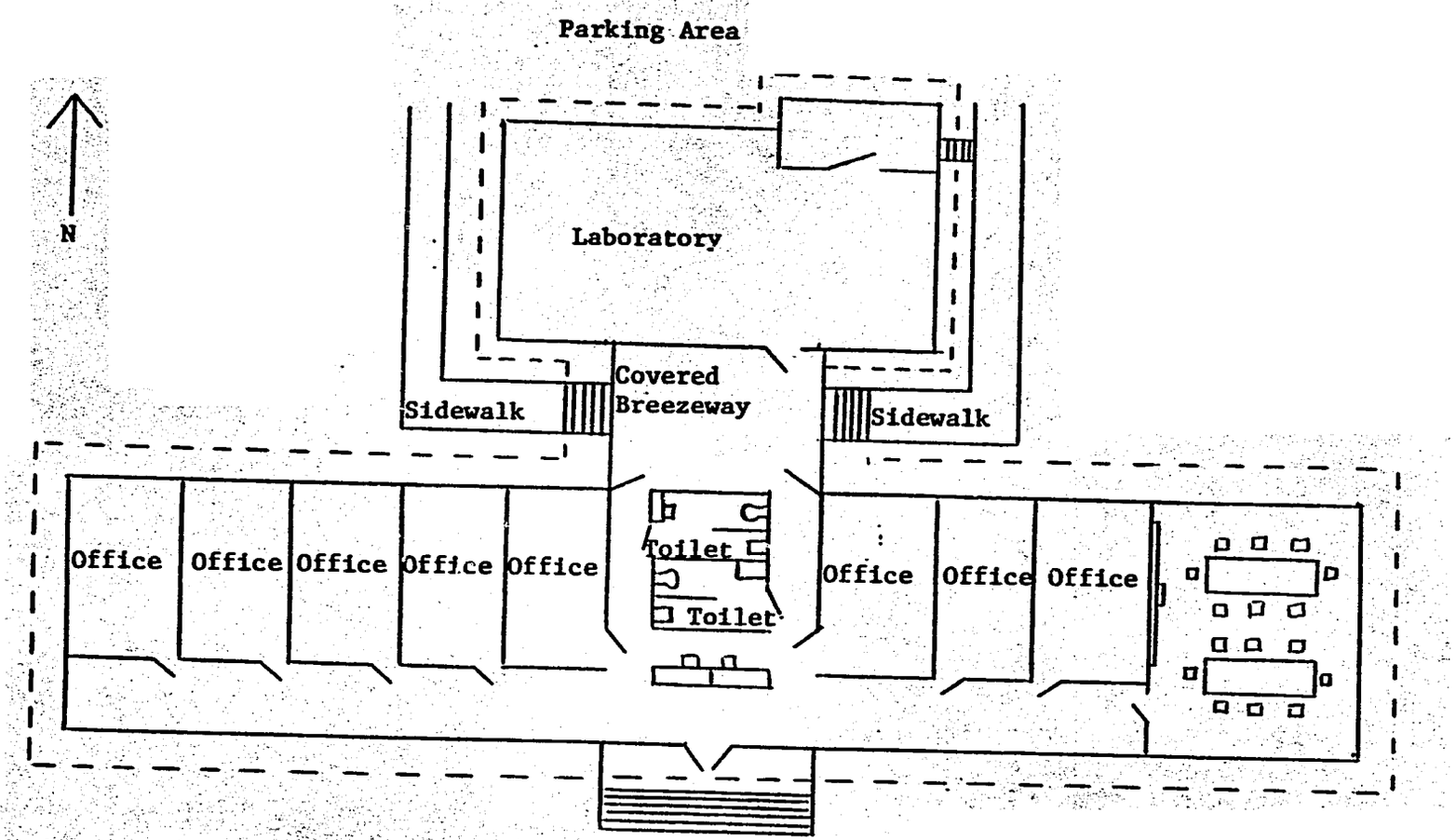

0 10 20 30 40 fee
Wall with 2 ft of concrete up from floor, then chicken wire
Solid walls
Faranah - Poultry House
20'
30'
40'
20'
Egg Room & Incubator
Feed mill & Room
Slaughter
Concrete slab 3"
Poultry pens' doo
Chicken wire on wood frame openi
inwards
Spring-closing
Fence and drive-through gate
Laying Houses
Broiler Houses
40'
20'
30
Dust collector
End view
Egg-room & Incubator
Feed Mill & storage
Slaughter

Figure 32

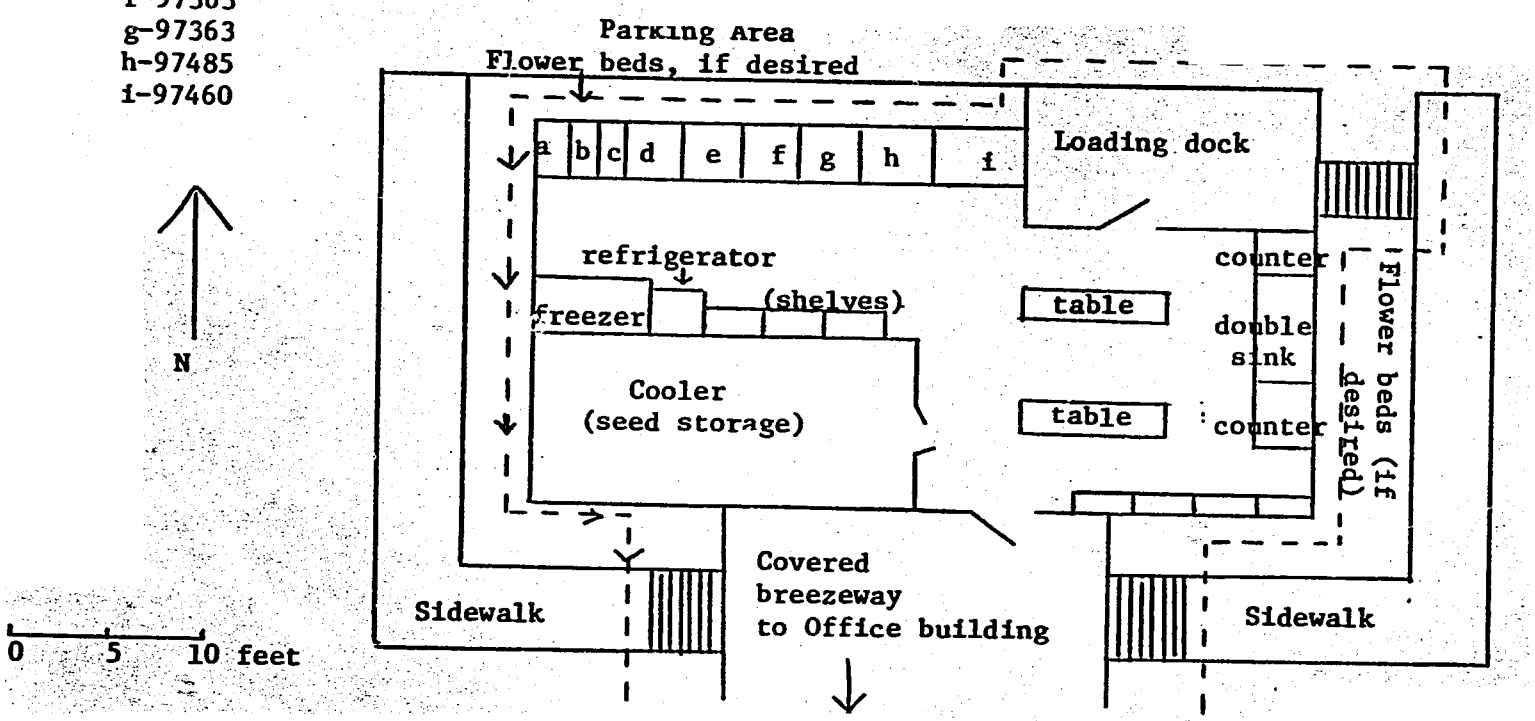
Figure 33

Tindô - Office and Laboratory Building Plan



a-90150
b-97620
c-90160
d-97340
e-97363
f-97363
g-97363
h-97485
i-97460

Tindô - Laboratory Floor Plan



Left

Tindô - Livestock Center Plan

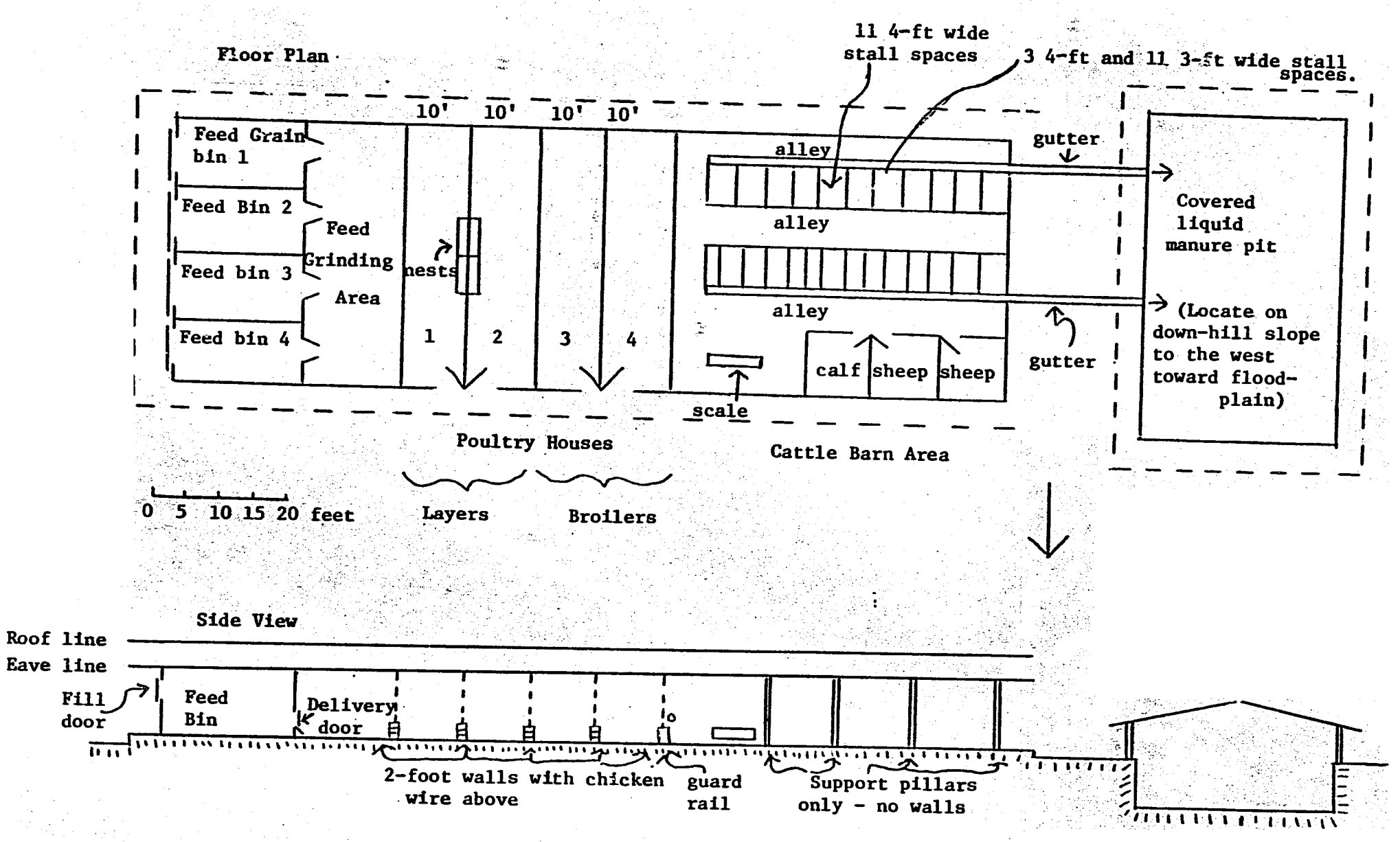
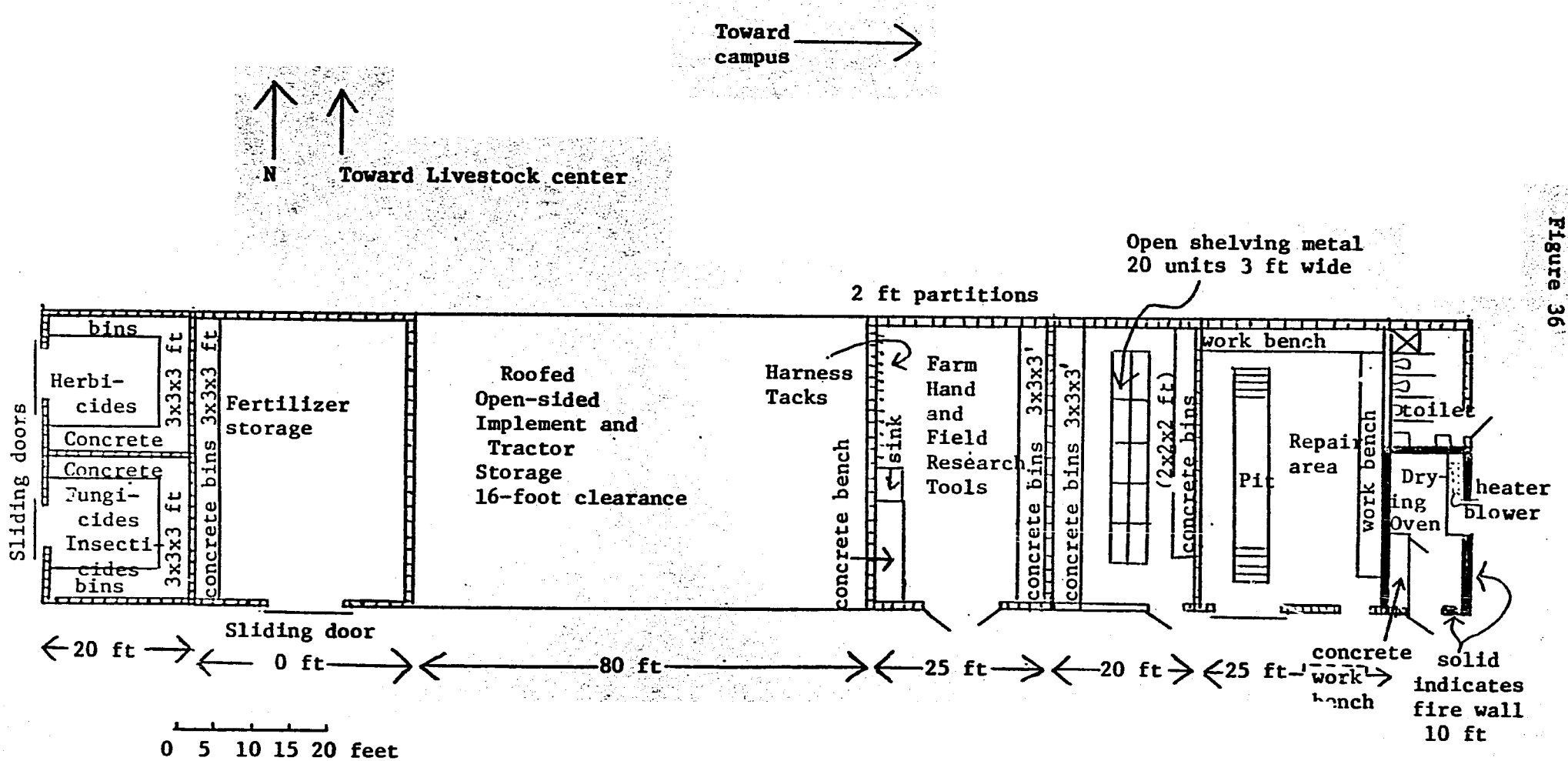
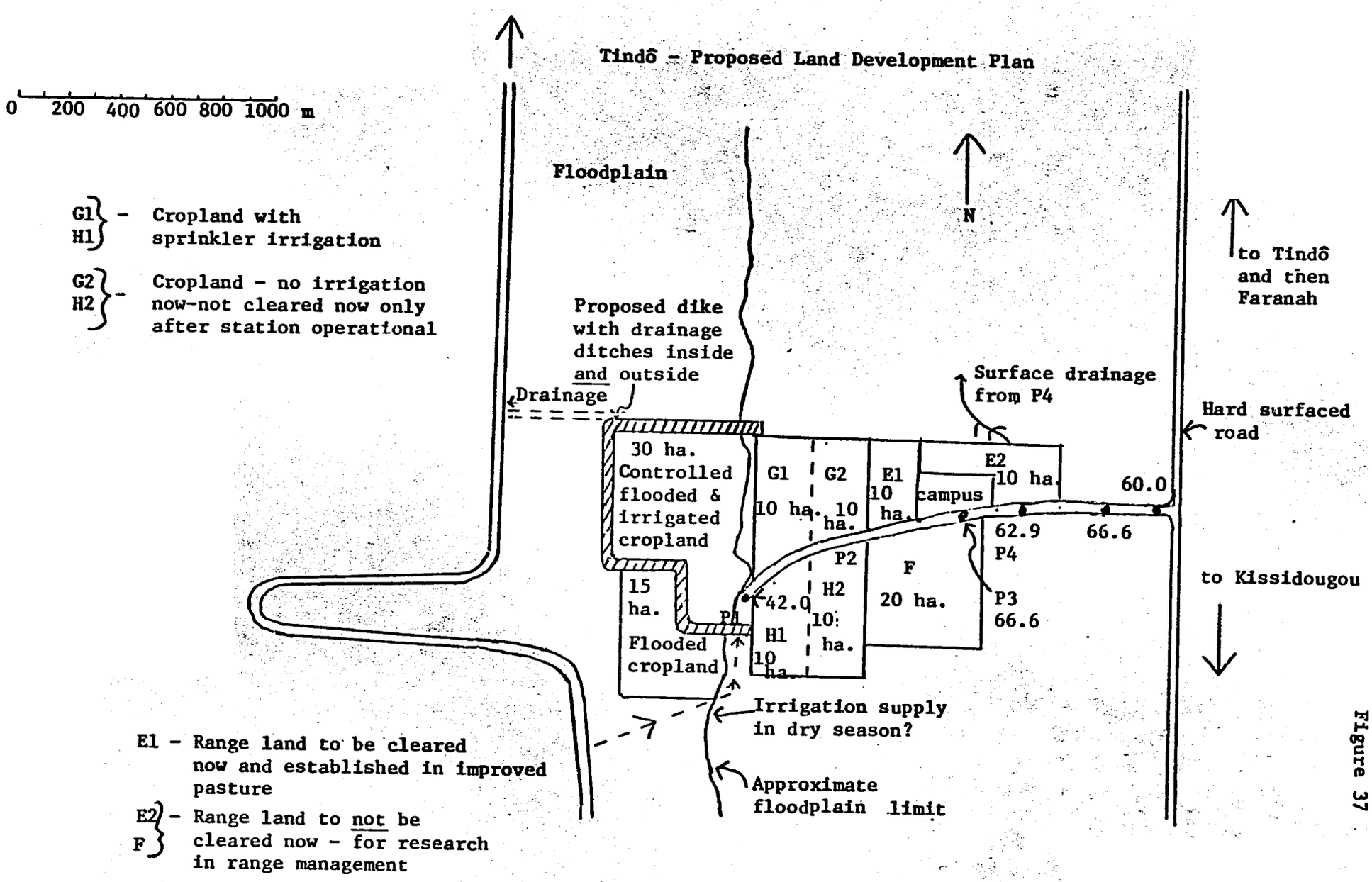


Figure 36

Tindô - Machinery and Supply Sheds and Repair Shops



1/6



E1 - Range land to be cleared now and established in improved pasture

E2, F - Range land to not be cleared now - for research in range management

Campus - located so point P3 is at highest point nearest to Niger River for view, ventilation, and away from surface drainage draw - P3 is on N-S axis of Office-Laboratory-Dormitory axis.

Figure 37

List of Tables

Table		
1	INRAF	- Plant Breeding and Genetics Lab Equipment
2	"	- Soil Fertility and Science Lab Equipment
3	"	- Agricultural Biology Lab Equipment
4	"	- Plant Protection and Pesticides Lab Equipment
5	"	- Laboratory Chemicals
6	"	- Lab Building Offices Equipment
7	"	- Climatology Equipment
8	"	- Plant and Sòil Field Research Equipment
9	"	- Fertilizers and Pesticides for Field Researcl
10	"	- Animal Equipment and Supplies
11	Faculté	- Foulaya - International Equipment and Supplies
12	INRAF	- Library Acquisitions
13	Faranah	- Recreational Equipment
14	"	- Classroom Equipment and Supplies
15	"	- Chemistry teaching Lab Equipment
16	"	- Plant Biology and Animal Biology Teaching Lab Equipment
17	"	- Chemical Supplies for Teaching Labs
18	"	- Third floor Office Equipment
19	"	- Library Equipment
20	"	- Library Acquisitions
21	"	- Infirmary equipment and supplies

Table

22	Faranah	- Repair Shops, Tools & Spare Parts
23	"	- Agricultural Implements
24	"	- Supplies for Cattle Barn
25	"	- Supplies for Pig House
26	"	- Supplies for Poultry Houses
27	"	- Fertilizers and pesticides
28	Tindô	Office and Laboratory Equipment and furnishings, Research Equipment and Field
29	"	- Agricultural Implements
30	"	- Poultry Equipment and Supplies
31	"	- Cattle Equipment and Supplies
32	"	- Training Center Equipment

Table 5

FOULAYA CHEMICALS

1	F-A-38-S	10	Acetic Acid, Glacial; ACS-Pk of 6g	52.00	520.00
2	F-A-669-S	10	Ammonium Hydroxide, ACS PK of - 6g	29.67	296.70
3	F-468	1	Acetacrihyde, 500gr	17.40	17.40
4	F-A-40	2	Acetone, Pisticide grade PK of 4g	56.00	112.00
5	F-A-18	1	Acetone, ACS PK of 55gal	220.00	220.00
6	F-A-360	1	Agar PK of 6x11 lbs	136.00	136.00
7	F-A-399	1	Alcohol, Butll PK of 4g	44.60	44.60
8	F-A-414	2	Alcohol, Isopropil PK of 4g	45.00	90.00
9	F-A-412	1	Alcohol, Methyl 55gal	163.95	163.95
10	F-A-407	1	Alcohol, Ethyl 55gal	224.00	224.00
11	F-A-661	1	Ammonium Chloride PK of 6	44.88	44.88
12	F-A-637	4	Ammonium Acetate PK of 6	33.30	133.20
13	F-A-656	1	Ammonium Carbonate PK of 6	27.00	27.00
14	F-A-613	1	Aluminum Sulphate 6x1 1b	33.90	33.90
15	F-A-702	2	Ammonium Sulfate 6x1 1b	40.50	81.00
16	F-A-676	1	Ammonium Nitrate 6 x 1 1b	42.00	42.00
17	F-A-714	1	Ammoniun Vanadate 6 x 1	29.70	29.70
18	F-A-674	2	Ammonium Molybdate 500g	15.81	31.62
19	F-A-665	2	Ammonium Flouride 1 1b	20.70	41.40

Table 5

FOULAYA - CHEMICALS

20	F-A-684	1	Ammonium Phosphate, Mono 6x1 lb	31.80	31.80
21	F-M-54	1	Anhyclrous Magnesium Perchlorate 1 lb	11.50	11.50
22	F-M-274	1	Ammonium pur purate pk 6	28.50	28.50
23	F-A-686	1	Ammonium Di Basic Phosphate 6 x 11	84.48	84.48
24	F-A-967	1	Aniline Blue 25g	9.70	9.70
25	F-10-599-5	1	Aux. Valve Pk of 3	16.35	16.35
26	F-A-73	5	Boric Acid PK of 4	48.00	240.00
27	F-B-30	1	Barium Carbonate 6	61.00	61.00
28	F-B-34	2	Barium Chloride 6	29.10	58.20
29	F-A-65	1	Benzoic Acid ACS 6	49.20	49.20
30	F-A-68	1	Benzoic Acid, STD 6	17.16	17.16
31	F-B-330	1	Bismuth Chloride Crystals	59.00	59.00
32	F-B-24	1	Barium Acetate 6x1	54.90	54.90
33	F-B-245	1	Benzene 55g	233.10	233.10
34	F-B-68	1	Barium Sulphate 6x1 lb	49.20	49.20
35	B-1363	1	Bromo Cresol Green 5g	23.30	23.30
36	F-B-388	1	BromoThiomol Blue 5g	11.25	11.25
37	B-393	1	Bromo Cresol Purple 5g	8.50	8.50
38	F-B-38	2	Barium diPhenylamine Sulfonate	18.50	37.00

Table 5 FOULAYA - CHEMICALS

39	F-C-19	2	Cadium Sulfate 6	28.75	57.50
40	F-C-64	2	Calcium Carbonate 6	50.40	100.80
41	F-C-109	1	Calcium Nitrate 6x500 g	29.40	29.40
42	F-C-140	3	Calcium Sulphate 6xl	25.38	76.14
43	F-C-371	1	Cobalt Chloride 6xl	26.40	26.40
44	F-A-92	2	Carbolic Acid 1 lb	13.75	27.50
45	F-C-187	3	Carbon Tetrachloride 5 gal	80.00	240.00
46	F-C-298	1	Chloroform 6xl	98.00	98.00
47	F-A-940	1	Citric Acid 6xl	23.70	23.70
48	F-C-386	3	Cobalt Sulfate	19.05	57.15
49	F-C-407	2	Collodion 6xl	27.00	54.00
50	F-C-495	1	Cupric Sulfate 6 xl	72.00	72.00
51	F-C-135	1	Calcium DiBasic Phosphate 6xl lb	36.00	36.00
52	F-C-121	1	Calcium Mono Basic Phosphate 6xl lb	26.00	26.00
53	F-A-402	1	Caprylic alcohol 6 pts	34.80	34.80
54	F-C-211	1	Celite 300 gr	20.00	20.00
55	F-C-112	1	Calcium Oxalote 6xl	25.86	25.86
56	F-C-218	1	Cement, Alundum 5 lbs	24.25	24.25

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Table 5

FOULAYA - CHEMICALS

57	F-C-170	1	Carbon, Decolorizing 6x1	25.20	25.20
58	F-C-581	3	Crystal Violet 10g	7.25	21.75
59	F-C-580	1	Congo Red 25g	28.75	28.75
60	F-A-795	1	Congo Red 1 lb	21.95	21.95
61	F-C-610	1	Cresol Red 30g	44.40	44.40
62	F-6-66517	2	Cheesecloth, Grade #10, 24 PK	64.00	128.00
63	F-10-599E	4	Carbon Dioxide gas	24.00	96.00
64	F-S-374	1	DiSodium Phosphate 6x1/4 lb	17.10	17.10
65	F-105	3	Diphenyl Amine 100g	8.60	25.80
66	F-D-16	3	Dextrose 6x1	21.60	64.80
67	F-A-480	1	DeVarda's Metal pk 6	90.00	90.00
68	F-D-90	2	Dithizone 10g	13.90	27.80
69	F-D-86	1	Diphenylcarbazone 30g	39.60	39.60
70	F-E-138	2	Ether, Ethyl 4x1	64.00	128.00
71	F-E-178	2	Ethylene glycol 6x1	18.30	36.60
72	F-E-478	1	EDTA 6x1 lb	66.00	66.00
73	F-E-511	1	eosin 6x10 g	13.80	13.80
74	F-E-514	2	eosin B 25g	12.95	25.90
75	F-E-512	1	erichrome black 6x25g	21.60	21.60
76	F-10-599 i	8	Ethylene Gas	25.00	200.00

Table 5

FOULAYA - CHEMICALS

77	F-I-88	1	Ferric Chloride 6xl	30.60	30.60
78	F-I-77	1	Forrous Ammonium Sulfate 6xl	31.20	31.20
79	F-F-79	6	Formaldehyde 15 gal	29.30	175.80
80	F-S-O-F-6	1	Fehlings, Sol A 6xl	13.20	13.20
81	F-S-O-F-4	1	Fehlings, Sol B 6xl	25.20	25.20
82	F-F-98	1	Fuchsin Basic 10g	4.45	4.45
83	F-G-85	2	Gum Arabic, Acacia PK of 1 lb	12.95	25.90
84	F-G-33	1	Glycerin 4xl gal	154.00	154.00
85	F-G-8	1	Gelatin, A 6xl lb	62.10	62.10
86	F-G-7	1	Gelatin "B" 6xl lb	46.50	56.50
87	F-G-13	3	Gentian Violet 1/4 lb	13.50	13.50
88	S-9A-69292	12	Garden Hose, vinyl-rubber 50 ft rolls 5/8 I.D.	11.99	143.88
89	F-A-144-S	10	Hydrochloric Acid, ACS PK OF - 6g	35.00	350.00
90	F-H-292	1	Hexane 4xl gal	56.00	56.00
91	F-A-147	1	Hydroflouric Acid 12 lb	52.80	52.80
92		12	Hydrogen commercial peroxide - 30% 4 gal	30.00	360.00
93	F-H-329	1	Hydroquenone 6xl lb	15.90	15.90
94	F-H-330	1	Hydroxyl Amine Hydrocloride 6xl	29.76	29.76

95	F-10-599L	2	Hydrogen Sulphide gas	27.00	54.00
96	F-10-599-10	1	Hose Connection PK of 3	3.80	3.80
97	F-I-37	2	Iodine Crystals 1/4 lb	9.20	184.00
98	F-1-62	1	Iron Powder 1 lb	9.40	9.40
99	F-I-166	1	Indigo Carmen 25g	10.30	10.30
100	F-I-180	4	Indicator Sol. Color Chart	2.40	9.60
101	F-I-166	1	Indigo Carmen 6x25 g	49.50	49.50
102	F-L-33	1	Lead Acetate 6x1	30.60	30.60
103	F-A-162	1	Lactic Acid 6x1	63.00	63.00
104	F-L-5		Lactose 6x1	28.50	28.50
105	F-690	1	Maleic Acid 500g	9.00	9.00
106	F-M-75	1	Maltose 6x1/4 lb	41.94	41.94
107	F-M-113	1	Manganese Sulfate 6x1 lb	37.50	37.50
108	F-M-155	1	Mercuric Chlorid 600g	66.00	66.00
109	F-M-141	1	Mercury 6x1 lb	135.00	135.00
110	F-M-282	1	Methyl Cellulose 6x1 lb	88.20	88.20
111	F-M-208	2	Methyl Ethyl Ketone 4x1 gal	37.20	74.40

Table 5

F.OULAYA - CHEMICALS

112	F-M-29	1	Magnesium Carbonate 6x1 1b	94.20	94.20
113	F-M-33	1	Magnesium Chloride 6x1 kg	73.20	73.20
114	F-M-51	1	Magnesium Oxide 6x1/4 1b	54.60	54.60
115	F-M-65	1	Magnesium sulfate 6x1 1b	45.60	45.60
116	F-A-170	2	Malonic Acid 100 g	11.65	23.30
117	F-O-119	3	Mineral Oil qt	5.25	15.75
118	F-M-46	1	Magnesium nitrate 6x1 1b	30.00	30.00
119	F-M-108	1	Manganlse di-oxide, powder 6x1 1b	45.00	45.00
120	F-O-120	3	Mineral Oil qt	6.40	19.20
121	F-M-290	1	Malachite Green 25g	5.30	5.30
122	F-M-199	1	Meta Cresol Purple 5g	27.30	27.30
123	F-M-225	2	Methylene Blue Powder 1/4 1b	10.15	20.30
124	F-MBMX 1540	1	Methyl Diolet Solvent 25g	3.45	3.45
125	F-M-216	2	Methyl Orange 6x1 oz	19.80	39.60
126	F-M-296	2	Methyl Red 6x10 g	27.70	55.40
127	F-M-225	4	Methyl Blue 1/4 1b	10.15	40.60
128	F-MBNX 1545	1	Methyl Violet sB 10g	10.00	10.00
129	F-M-291	1	Methylene Blue 6x25 g	27.00	27.00

130		100	Masking Tape 1/2 inch, 100 ft	1.00	100.00
131	F-A-200-S	10	Nitric Acid, ACS PK of 6g	45.00	450.00
132	F-N-134	1	Napthaline 6x1 lb	22.50	22.50
133	F-N-54	3	Nichel Chloride 1 lb	15.75	47.25
134	F-S-O-N20	2	Nestler Reagent 6x1 qt	34.86	69.72
135	F-A-219	1	Oxalic Acid 6x1 lb	34.80	34.80
136	F-O-267	1	Orange G 6x25 g	16.50	16.50
137	F-10-599R	2	Oxygen Gas	23.50	47.00
138	F-P-277	1	Potassium Periodate 6x1 oz	36.60	36.60
139	F-P-313	1	Potassium Tartrate 6x1 lb	60.00	60.00
140	F-A-229	3	Perchloric Acid 12 lb	102.00	306.00
141	F-E-139	4	Petroleum Ether 4x1 gal	35.40	141.60
142	F-A-242	3	Phosphoric Acid 4x1 gal	84.00	252.00
143	F-P-171	1	Potassium Acetate 6x1 lb	34.50	34.50
144	F-P-243	1	Potassium Acid Phthalate 11/21b 4x1/4 lb	24.00	24.00
145	F-P-184	2	Potassium Bicarbonate 6x1 lb	20.40	40.80
146	F-P-304	1	Potassium Sulphate 6x1 lb	27.00	27.00
147	F-P-188	1	Potassium Clichromate 6x1 lb	31.80	31.80
148	F-P-410	1	Potassium Iodide	27.00	27.00

Table 5 FOULAYA - CHEMICALS

149	F-P-263	1	Potassium Nitrate 6x1 lb	30.00	30.00
150	F-P-279	3	Potassium Permaganate 6x1 lb	31.50	31.50
151	F-P-232	1	Potassium Ferri Cyanide 6x 1/2 lb	19.50	19.50
152	F-P-217	1	Potassium Chloride 6x1 kg	43.32	43.32
153	F-P-317	1	Potassium Thrio Cyanate 6x 1/4 lb	23.10	23.10
154	F-P-220	1	Potassium Chromate 6x1 lb	30.00	30.00
155	F-P-285	1	Potassium Phosphate 6x1 kg	28.80	28.80
156	F-P-236	1	Potassium Ferro Cyanide 6x1 lb	43.20	43.20
157	F-P-238	3	Potassium Flouride 1 lb	14.70	44.10
158	F-T-610	4	Parrafin Tissue Prep case	18.40	73.60
159	F-P-186	2	Potassium Dichroniate 20 lbs	48.00	96.00
160	F-P-250	2	Potassium Hydroxide 20 lbs	53.00	106.00
161	F-C-228	2	Pyseal Cement 12 box	6.50	13.00
162	F-S-O-B-99	2	PH4 Concentrate qts pk 6	48.90	97.80
163	F-S-O-B-106	2	Ph6 - pint pk 6	37.74	75.48
164	F-S-O-B-109	2	PH 7 qt pk 6	79.20	158.40
165	F-S-O-B-97	2	Ph 3 pts pk 6	18.00	36.00

166	S-O-B-102	2	Ph 5 qts pk 6	30.54	61.08
167	S-O-B-112	2	Ph 8 pts pk 6	18.00	36.00
168	F-P-74	1	Phenol 6x5 g red	48.00	48.00
169	F-P-79	4	Phenolphtolein 6x1 oz	16.80	67.20
170	F-P-70	1	Phenanthrolein Ortho 6x1 g	21.00	21.00
171	F-P-69		Phenanthroline-Ferrous 6x1 oz	16.02	16.02
172	F-10-569	2	Regulator, gas	40.50	81.00
173	F-A-300-S	20	Sulfuric Acid, ACS PK of 6g	45.00	900.00
174	F-S-421	1	Sodium Sulphate 6x1 lb	15.90	15.90
175	F-S-445	1	Sodium thio sulphate 6x1 lb	18.00	18.00
176	F-S-369	1	Sodium phosphate 6x1 kg	87.78	87.78
177	F-S-435	1	Sodium Tartrate 6x 1/4 lb	21.00	21.00
178	F-S-181	1	Silver sulfate 6 oz	59.40	59.40
179	F-T-142	3	Stannous Chloride 500 g	19.05	57.15
180	F-A-286	1	Selenius Acid 1/4 lb	27.30	27.30
181	F-A-277	1	Salicylic Acid 6x1 lb	34.50	34.50
182	F-S-181	1	Silver nitrate 6 oz	59.40	59.40

179

183	F-S-196	1	Soda Lime 6x1 lb	21.60	21.60
184	F-S-209	1.	Sodium Acetate 6x1 kg	60.60	60.60
185	F-S-233	4	Sodium bicarbonate 6x1 lbs	13.80	55.20
186	F-S-264	3	Sodium Carbonate 6x1 lb	14.40	43.20
187	F-S-271	1	Sodium Chloride 6x1 lb	12.60	12.60
188	F-S-279	1	Sodium Citrate 6x1 lb	26.40	26.40
189	F-S-280	1	Sodium Cobalti Nitrate 6x 1/4 lb	43.20	43.20
190	F-S-318	10	Sodium Hydroxide 20 lbs	44.80	448.00
191	F-S-O-S-290	2	Sodium Hypochlorite 6x1 qt	18.90	37.80
192	F-S-343	1	Sodium Nitrate 6x1 kg	73.20	73.20
193	F-S-356	1	Sodium Oxalate 6x4 1/2 lb	25.50	25.50
194	F-S-340	1	Sodium Perborate 6x1 lb	19.50	19.50
195	F-S0441	1	Sodium Thiocyanate 6x1 lb	50.40	50.40
196	F-S-516	1	Starch, Soluble 6x1 lb	33.90	33.90
197	F-S-5	3	Sucrose 6x1 lb	27.00	81.00
198	F-S-591	1	Sulfur, sublimed 6x1 lb	20.70	20.70
199	F-S-445	1	Sodium Thio Sulphite 6x1 lb	18.00	18.00
200	F-A-297	1	Sulfo Saligylic 6x 1/4 lb	34.20	34.20

FOULAYA - CHEMICALS

201	F-S-264	2	Sodium Carbonate 6x1 lb	14.40	28.80
202	F-S-310	1	Sodium dithionite 6x 1/4 lb	18.00	18.00
203	F-S-361	1	Sodium Para Periodate 1/4 lb	31.50	31.50
204	F-S-387	1	Sodium-Potassium Tartrate 6x1 lb	42.00	42.00
205			Sodium dithionate 6x1 lb		
206	F-A-314	3	Tartaric Acid 1 lb	12.50	37.50
207	F-T-324	4	Toluene 4x1 gal	32.00	128.00
208	F-E-478	1	Tthylenediamine Acetic Acid pk of 6	66.00	66.00
209	F-T-407	3	Tri Ethanol Amine pts	8.50	25.50
210	F-4-320-1	1	Tri Sodium Phosphate 100 lbs	69.00	69.00
211	F-T-416	1	Thyniol Blue 5g	12.75	12.75
212	F-1091	1	Thimalphthylein 10g	6.65	6.65
213	F-U-15	1	Urea 6x1 1/4 kg	25.08	25.08
214	F-10-599-15	1	Wire stand, pk of 3	10.80	10.80
215	F-I-146	1	Zerrous Sulphate 6x1	32.70	32.70
216	F-X-5	4	Zylene 4x1 gal	31.60	126.40
217	F-Z-33	1	Zinc Chloride 6x 1/4 kg	44.58	44.58

181.

218	F-Z-45	1	Zinc Nitrate 6x1 lb	51.30	51.30
219	F-Z-68	1	Zinc sulfate 6x1 kg	61.80	61.80
220	F-Z-16	2	Zinc granules 30 mesh 1 lb	9.50	19.00
221	F-Z-11	1	Zinc, powder 6x1 lb	40.20	40.20

Table 13

Recreational Equipment

1	S-6A15215N2	1	Barbell, dumbell, 100 lb set	25.99	25.99
2	S-6A15216N3	1	Barbell, dumbell, 160 set	39.99	39.99
3	S-6A18775	4	Basketball backboard	48.88	195.52
4	S-6A18773	4	Bracket mounting	9.99	39.96
5	S-6A1818	8	Basketball	15.00	120.00
6	S-6A18716	1	Pump	2.89	2.89
7	S-6A18702	12	Soccerballs, rubber	7.89	94.68
8	S-6A26052	4	Table tennis set	9.97	39.88
9	S-6A26171	2	Balls pk of 100	13.97	27.94
10	S-6A25923N	4	Tables, tennis	85.97	343.88
11		6	Javelin		
12		6	Discus		
13		6	Shot put		
14		3	Horseshoes, set of 4		
15		1	Lawn bowling set		
16	S-9A79442	3	Garden hose	14.94	44.82

Table 14

FARANAH CLASSROOMS

1	S-3A-5996	1	Mimeograph, Hand Operated Stencil 8 1/2 x 14 inch.	149.99	149.99
2	S-3A-4001	60	Stencils, Box of 24	4.99	299.40
3	S-3A-3621 L	100	Paper, 20 lb, white, Memeo opaque, 8 1/2 x 14 inch pkgs	51.95	
4	S-3A-4210	50	Ink, black, Mimeo, 1 lb check for adequate quantity for paper supplier	3.69	184.50
5	S-3A-4217	5	Ink pads, standard, Pk of 6	4.79	23.95
6		1	Cleaner, Iso butyl, 6x1 liter	10.00	10.00
7		1	Typewriter Manual, French letter keyboard 14 inch carriage, desk size, less than equal 10 digits, plus,minus, slash, grater than, comma, period, power of 2, squareroot, infinity, parenthesis, brackets, colon, apostrophe, semi-colon, alpha,beta,gamma, upper & lower case sigma, integral sign, lambda pi		
8		3	Stylos and protecting sheet		
9		24	Triangle, lettering sets Protractor	3.00	72.00
10		1	Projector, 16 mm Movie,sound, Singer 220V, 50Hz		400.00

Table 14

11	N-SA4762P-V25	3	Projector,Film Strip and 2x2 slides, 500W, 220V 50Hz Viewlex		133.95
12	N-SA1346P-Y290	3	Manual Slide carrier	10.95	10.95
13	N-SA1293P	1	Projector Case	19.95	19.95
14	N-SA4764 P-31-0036000(DAK)	12	Lamps, Replacement	7.50	45.00
15		4	Lamps, 16 mm Movie	15.00	15.00
16	N-SA2184P-15710 L C	3	Projector, OVER head Besele R, 220 V 50 Hz	202.70	202.70
17	N-SA2203P-625 32-09	18	Lamps, 75 hour	12.25	122.50
18	N-SA 2186P-15899 CC	3	Dust Cover	6.00	6.00
19	N-SA4782P	12	Screen, Lewticular, 60"x60" - For tropical use, Tripod	81.65	81.65
20	N-SA47712P-7414	3	Acetate sheets, clear 10 1/2x10 1/2 In., Pk of 50	14.25	57.00
21	N-SA-144P	3	5x5 ft. wall screen	25.00	25.00
22	N-9-802P (A)	16	Pens, Visual AID, Washable Ink Black	0.75	6.84
23	N-9-802P (B)	12	Pens, washable Ink Red	0.57	6.84

Table 14

24	N-9-802P (C)	12	Pens, washable ink Blue	0.57	6.84
25	N-9-802P (G)	12	Pens, Washable ink Green	0.57	6.84
26	N-OT251P	11	Transparencies, overhead cecres		4.50
27	N-25515P-SGE	1	Transparencies, 18 pc set engine:		64.50
28		10	White chalk, box		
29		3	Erasers, Box of 12		
30	N-OT25P	1	Cow genital transparencies	4.50	4.50
31	N-OT26P	1	" " "	4.50	4.50
32	N-OT1266P	1	Cattle breeding set	9.90	9.90
33	N-OT979P	1	Animal cell	10.50	
34	N-OT1303P	1	Animal Mitosis-Miosis	3.50	
35	N-OT1190P	1	DNA Transp.	6.50	
36	N-OT1192P	1	Protein Synthesis Tran.	5.50	
37	N-OT1301P	1	Sex inheritance	4.50	
38	N-OT247P	1	Cattle injections	5.50	
39	N-OT248P	1	Sheep and Hogs	5.50	
40	N-OT1331P	1	Sheep Liner Huke	4.50	
41	N-OT1337P	1	Beef tape worm	6.50	
42	N-OT1350P	1	ASCARIS	4.50	

Table 14

43	N-OT1351P	1	Hookworm	5.50
44	N-OT1128P	1	Dicot Root Cross section	5.50
45	N-OT1207P	1	Dicot Root dev	5.50
46	N-OT1208P	1	Mono cot root	4.50
47	N-OT1209P	1	Stem tip	2.50
48	N-OT1210P	1	Herbaceous Dicot Stem	4.50
49	N-OT1211P	1	Woody Dicot Stem	7.50
50	N-OT1212P	1	Monocot Stem	4.50
51	N-OT1213P	1	Dicot Stem Deve	4.50
52	N-OT1216P	1	Leaf Anatomy	7.50
53	N-OT1217P	1	Stomate	4.50
54	N-OT1219P	1	Wood Anatomy	5.50
55	N-OT1220P	1	Leaf Variations	5.50
56	N-OT1127P	1	Specialized Stems	3.50
57	N-OT13P	1	Seed Parts	3.50
58	N-OT1041P	1	Angio Sperm Flower	5.50
59	N-OT1042P	1	" Spermlife History	6.50
60	N-Z5547P	1	Wood Technology set	71.50
61	N-OT919P	1	Grafting and Budding set	19.25

Table 14

62	N-OT1941P	1	Spec, Stem Prop. set	15.75
63	N-OT1943P	1	Cutting prop. set	6.25
64	N-OT1944P	1	Seed prop, set	9.45
65	N-OT1342P	1	Grass hopper anatomy	5.50
66	N-OT1344P	1	" " life cycle	4.50
67	N-OT1390P	1	Honey Bee life cycle	4.50
68	N-OT1391P	1	Fly life cycle	4.50
69	N-OT1396P	1	Army Worm Life	4.50
70	N-OT1361P	1	Insect Mouth parts	5.50
71	N-OT1399P	1	Aphid Life cycle	4.50
72	N-OT2P	1	Internal Parts cow	5.50
73	N-OT3P	1	Internal parts hen	4.50
74	N-OT41P	1	Egg parts	5.50
75	N-OT42P	1	Egg parts and feeds	4.50
76	N-OT5P	1	Sheep parts	4.50
77	N-OT4P	1	Hog parts	4.50
78	N-OT1294P	1	Plant mitosis	6.50
79	N-OT1287P	1	" miosis	13.75
80	N-OT1362P	1	Di-Hybrid Cross	6.50
81	N-OT1293P	1	Mono-hybrid cross	3.50

Table 14

82	N-OT1363P	1	Mendelian segregation	5.50
83	N-OT1368P	1	Plant crossing	4.50
84	N-OT1372P	1	Hybrid corn	3.50
85	N-OT976P	1	Leaf and photo synthesis	4.50
86	N-OT978P	1	Plant cell	10.50
87	N-OT975P	1	Mono-cot seed germination	4.50
88	N-OT974P	1	Di-cot seed germination	4.50
89	N-OT1203P	1	Photo Synthesis	5.50
90	N-OT1204P	1	Fruit development	5.50
91	N-OT1205P	1	Seed dispersal	4.50
92	N-OT1735P	1	Land classification, water	13.50
93	N-OT1736P	1	Water control	8.50
94	N-01620P-438	1	Using the level	2.15
95	N-03259P-159-1	1	Reading the Rod	7.80
96	N-02344P	1	Tractor mainteance set	77.60
97	N-0793P-15	1	Tractor operation set	37.10
98	N-02908P-442	1	Sprayer calibration	5.95
99	N-02909P-443	1	Granular application	4.55
100	N-03647P-SF417	1	Maintenance electric motor	5.75

Table 14

101	N-0200P	1	Legume innoculation	5.00
102	N-01218P-731A	1	Corn planting	6.55
103	N-0201P	1	Cattle heat	7.50
104	N-01348P	1	Uterus recovery	6.50
105	N-03252P-137-1	1	Calf prenatal dev.	5.40
106	N-0365P	1	Cattle diseases Part 1	7.00
107	N-0403P	1	" " " II	7.00
108	N-0370P-78	1	Septicemia	7.00
109	N-02243P-208A	1	Cows udder	5.40
110	N-03246 P-105 -1	1	Cattle castration	5.40
111	N-01408P	1	Insect orders set	65.50
112	N-01351P-63	1	Hand sprayers and dusters	9.50
113	N-02041P	1	Plant Pathology set	50.00
114	N-03679P	1	Nutrient def sets corn	9.50
115	N-03683P	1	" " orange	5.50
116	N-03687P	1	" " Tomato	12.50
117	N-0181P-1102	1	Culling poultry	9.50
118	N-03253P-135-1	1	Poultry brooding	5.40
119	N-01590P-222	1	" respiratory	20.00

Table 14

120	N-01219P-713	1	Soil texture	2.95	
121	N-01614P-708	1	" color	5.35	
122	N-0787P-703	1	" sampling	1.60	
123	N-01225P-712	1	" structure	2.50	
124	N-03248P-148-1	1	Broad sow and litter	6.00	
125	N-0367P-75	1	Swine diseases	7.00	
126	N-0323P	1	Round worms - Swine	4.50	
127		200	Plant mounts, cardboard & plstic, 8x10 inch		
128	N-SA2151P-M85B	6	Microscope, Stereo, Swift	233.00	1,398.00
129		6	Black chalk boards, 16 ft with movable map books, chalk tray	150.00	
130	N-01409P-27	1	Tractor Fuel Set	19.75	19.75
131	N-01449P	1	Hammer Mills	15.50	15.50
132	N-0478P-20	1	Electric Motors	16.80	16.80
133	N-03632P	1	Electric Motors	9.35	9.35
134	N-03633P	1	Electric Motors	11.25	11.25
135	N-01791P-434	1	Concrete Units	2.15	2.15
136	N-0411P-21	1	Bldg. foundations	7.80	7.80
137	N-03260P-162-1	1	Irrigation	9.00	9.00

Table 14

138	S-3A649444N	6	Cabinets 4 shelf	87.95
139			3-Dimensional cut-away reduced size models of engines & tractors (from manufacturer selected to supply field work tractors)	
140		3	50 ft extension cord to fit receptacles & projection equipment	10.00
141	S-34A-9052C	6	Ceiling fan, 52 inch 220V, 50 Hz	130.00
142		12	Typewriter, ribbon, nylon, black for typewriter item No 7	2.60
143	S-9A79442	3	Garden hose	14.94
144	ST-F-203-S	1	Slide set. Portland cement	

Table 15

CHEMICAL LABORATORY - FARANAH

1	F-95-310	2	Islands Assembly	4,041.75	8,083.50
2	F-97-150	50	Bench		
3	F-97-620	4	Bench		
4	F-97-363	4	Bench		
5	F-97-260	1	Bench		
6	F-93-264	1	Hoad, S.S.	2,850.00	2,850.00
7	F-97-760	1	Bench	6,600.00	6,600.00
8	F-B97-70L	2	Tops		
9	F-91-580	1	Eye wash sink	122.55	122.55
10	F-14-294-5	1	Shower	60.15	60.15
11	F-97-655	2	Table Tops	100.00	200.00
12	F-97-600	6	Table Legs		
13		1	16- feet chalkboard, wall	150.00	150.00
14	F-11-926	2	Carts, lab wagon, S.S.	115.00	230.00
15	S-46-A-6740-1	1	Refrigerator, 14 cuft, 220V	249.00	249.00
16	F-9-026B	1	Still, 220v, Barnstead, pred	546.00	546.00
17	97-360	1	Bench, 3ft	600.00	600.00
18	97-363	1	Bench, 3ft	600.00	600.00
19	91-49A	1	Sink, S.S.	400.00	400.00
20	97-655	1	Table	100.00	100.00
21	97-600	3	Table Legs		
22	91-251	4	Stool Metal	35.00	135.00
23	F-1-915	1	Voland 200 gr bal	395.00	395.00
24	F-2-224A	1	Weight Set	142.00	142.00

Table 15

25	F-Z-173-45	6	Prescription bal	44.00	264.00
26	F-Z-174	6	School Balance	25.00	150.00
27	F-2-276	12	Weight set, student	5.00	60.00
28	F-2-190A	15	Balance dish	2.75	41.25
29	F-2-540H	4	Beakers, 100ml PK of 48	31.20	124.80
30	F-2-540K	4	" 250 "Share"	28.80	115.20
31	F-2-540P	1	" 1000 "Share" PK of 24	41.76	41.76
32	F-2-620	8	Tongs, beaker, asbestos	8.00	64.00
33	F-10-060	8	Flask Tongs	5.25	42.00
34	F-2-923K	2	Carboy, PE - 2gal PK of 6	35.80	71.60
35	F-3-000A	1	Dropping Bottles PK of 24	27.22	27.22
36	F-3-409-10D	2	Wash Bottles, PK of 18	36.29	72.58
37	F-3-422E	1	Weighing bottles PK of 6	24.60	4.60
38	F-3-541	1	Beaker Brushes PK of 12	32.40	32.40
39	F-3-578A	1	Flask Brush, PK of 12	15.00	15.00
40	F-3-727B	2	Burettes, 50ml PK of 2	63.46	126.92
41	F-3-844B	3	Acid burette - Share	51.70	155.10
42	F-11-928	2	Lab baskets	114.00	228.00
43	N-SA4477P	1	Centrifude, Hand	49.70	49.70
44	F-5-705	2	Periodic chart	9.50	190.00
45	F-7-578-3A	6	Drierite 16	3.00	18.00
46	F-8-549-21D	2	Graduated cylinders, PK of 24	44.88	89.76
47	F-8-552-4F	1	Graduated cylinders, 1000ml PK of 4	52.80	52.80
48	F-10-322D	1	Funnels PK of 48	56.64	56.64
49	F-9-810E	50	Filter Paper N°2, whatman	1.35	67.50

Table 15

50	F-10-040D	2	Erlenmeyer, narrow 125m PK of 48	34.50	69.00
51	F-10-040F	2	Erlenmeyer, 250m PK of 48	35.52	71.04
52	F-10-040H	2	Erlenmeyer, 500ml PK of 6	6.30	12.60
53	F-10-248E	1	Volumetric, 250ml PK of 6	83.76	83.76
54	F-11-286C	2	Manometer, Mercury	12.00	24.00
55	F-11-312B	1	Glass Beads, 1 lb	12.00	12.00
56	F-11-365E	1	Tubing, Imm O.D. glass	58.75	58.75
57	F-11-365H	1	Tubing, 10mm O.D. glass	58.75	58.75
58	F-14-1691L	1	Tubing, 6.4.mm, ID, Tygon	35.05	35.05
59	F-14-1691S	1	Tubing 9,5mm, ID, tygon	45.55	45.55
60	F-11-375A	1	Glass rod 3mm	18.60	18.60
61	F-14-3315B	2	Hydrometer, Soil	8.85	17.70
62	F-12-976	1	Mortart Pestle	62.00	62.00
63	F-13-25810A	1	Oven 230v	230.00	230.00
64	F-13-380C	1	Wax pencils, red PK of 6 Box	23.85	23.85
65	F-13-650B	1	Pipettes, vol. 1ml-100 (12)	17.75	17.75
66	F-14-071	1	Rubber bullbs PK of 12	19.95	19.95
67	F-15-590C	4	Wire Gauze PK of 12	8.50	34.00
68	NH 1630N	3	Soil Augur, 3 inch	18.95	56.85
69	N-H1626N	3	Soil Augur, 1 1/4	13.10	39.30
70	N-H1633N	6	Soil Sampler	3.79	22.74
71	N-H1805N-H3902	1	Sieves, set, soil	85.00	85.00
72	N-H-1877N	3	Soil Color charts	35.10	105.30
73	N-H-661N-UDS16	6	Soil Sampling Spade	10.00	60.00

Table 15

74	N-H-1889N-151	12	Soil Ph testor	2.40	28.80
75	N-H-1890N-160-49	24	Soil Test paper refills	2.40	57.60
76	N-H-1850N-21878	1	Soil Thermometer	16.00	16.00
77	N-H-1886N-107	2	Ph meter probe	138.90	277.80
78	N-H-1886N-107	6	Mercury batteries for 107	1.00	6.00
79	N-H2004P-802	12	Abney Hand lenels	19.90	238.80
80	N-H1042P-F2200	12	Cadet pocket transit	5.70	68.40
81	N-C5893N-AW451	25	sample jars, 4oz PK of 12	1.40	35.00
82	F-14-782	1	Dram board, prep room	35.00	35.00
83	S-34A-9052C	2	Ceeling fan, 52 inch B 50hz 220v	130.00	260.00
84	S-25A-6390	1	Thread, quilting PK of 6	2.66	2.66
85	F-13-745	4	Porcelain plate PK of 6	14.75	59.00
86			Bunsen burners		
87	F-7-785	2	Stoppers cork	8.00	16.00
88			Stoppers, rubber		
89	F-7-7865	1	Sharpener, corkbarer	10.00	10.00
90	F-7-7845E	1	Barer, cork	18.50	18.50
91	F-8-624B	2	Desicator	48.91	97.82
92	F-8-641C	1	Desicator plates	42.27	42.27
93		1	Table II Sameast N°145	500.00	500.00
94		4	Same as 146		
95		4	Same as 147		
96		8	Same as 148		
97		4	" 149		
98		1	" 150		

99		1	Table II same as 151		
100		1	" 15z		
101		2	" 153		
102	F-13-650-5J	1	Pipette, val 10ml PK of 18	44.10	44;10
103	N-C5941N-1929-01	1	Long Ring Timer	6.25	6.25
104	F-10-035E	1	Boiling Flask PK of 6	11.82	11.82
105	F-10-248G	1	Volumetric flasks, PK of 6	62.94	62.94
106	F-11-392	1	Asbestos Floves - pr	12.75	12.75
107	F-14-141J	4	Stoppers rubber N°7	23.75	95.00
108	F-16-141K	5	Stoppers Rubber N°8	23.75	118.75
109	F-14-141N	2	Stoppers Rubber N°9	4.35	8.70
110	F-3-902P	4	Burners	16.00	64.00
111	F-3-962P.	24	Burners, Bunsen	9.00	216.00
112	F-3-995B	1	Flame Spreader PK of 10	7.50	7.50
113	F-5-732	2	Clamps Box of 12	48.60	97.20
114	F-5-754	2	Holders Box of 12	22.80	45.60
115	F-5-769	1	Holder Share Box of 12	57.00	57.00
116	F-5-809	1	Thermo Clamps Box of 12 Share	51.60	51.60
117	F-5-773	1	Clamps, Burette Box of 12	4.30	4.30
118	F-14-670B	1	Stands, cast Iron Box 12	70.20	70.20
119	F-5-871A	2	Pinch Cocks PK 10	6.25	12.50
120	F-5-850A	2	Pinch Cock PK 12	6.10	12.20
121	F-14-198A	1	Tubing Clamps PK 10	4.85	4.85
122	F-11-499 D	1	Hot Plate, Ind. Lindbergh	230.00	230.00
123	F-14-317-5	1	Sink matting 50ft	90.00	90.00

Table 15

124	F-15-239-2	1	Trays, safety acid PK 6	99.90	99.90
125	F-4-664A	1	Safety cans, PK of 6	91.80	91.80
126	F-4-664-12	6	Funnels spouts	16.68	100.08
127	F-11-931	1	Keik Step Stool	31.00	31.00
128	F-14-357	2	Scoopla Pk of 6	2.20	4.40
129	F-14-050D	1	Rings PK of 12	43.20	43.20
130	F-14-050B	2	Rings Pk of 12	32.40	64.80
131	F-14-743	2	Pipette supp	22.50	45.00
132	F-14-740	6	Funnel supp	5.40	32.40
133	F-14-792-3	4	Test Tube parts	9.00	36.00
134	F-14-792-9	2	Test tube parts	10.50	21.00
135	F-14-955E	4	Test tube pyrex PK 576	65.09	260.36
136	F-14-955L	2	Test tubes Pyrex PK 192	51.84	103.68
137	F-15-300A	8	Burnes tripods PK of 3	10.80	86.40
138	F-14-98310C	8	Thermometers, Imm 150°C	5.40	43.20
139	F-15-22310C	1	Files triangle PK 12	15.10	15.10
140	F-15-315A	1	Connectors, st, PK 12	6.50	6.50
141	F-15-319C	1	T Shape Conn PK 12	7.30	7.30
142	F-15-319D	1	T shape PK 12	8.06	8.06
143	F-15-321A	1	Conn PK 6	11.75	11.75
144	F-15-321B	1	Conn PK 6	11.75	11.75

Table 15

145	F-3-661	2	Camelhair brush-pk of 12	32.40
146	F-5-841	3	Test tube clamps - pk of 12	8.10
147	S-9A79442	1	Garden hose	14.94
148	ST-ES-555	3	Hardness, rock set	
149	ST-A-28	3	Mursell Tropical soil chart, set of2	
150	N-H1877N	3	Mursell Soil color charts	35.10

Table 16

PLANT AND ANIMAL BIOLOGY LABS

1	F-95-140	2	Wall Assembly	2,560.00
2	F-95-120	2	Wall assembly	2,368.30
3	F-97-760	2	Cabinet, corner	400.00
4	F-91-580	2	Face, eyewash	122.55
5	F-14-294-!	2	Shower	60.15
6	F-97-655	2	Tables	100.00
7	F-97-605	24	Table legs	
8	F-97-600	24	Table legs	
9		2	12 ft chalk boards	
10	S-3A64944N	12	Cabinets, 4 shelf, steel	87.95
11	S-3A64946C	12	Extra shelf	6.49
12	S-3A6365L	16	Cabinet, 9 drawer	34.95
13	S-3A7978L	4	Steel shelving by 72x36x18 inch	17.99
14	S-3A7924C	4	Shelves, pk of2	8.99
15	S-46-A-6740-1	2	Refrigerators, 14 ft 3	249.00
16	S-49A1723N	2	Freezer, 15 ft 3	259.95
17	F-9-026B	1	Still, 220V, Barnstead, prep	546.00
18	F-11-926	4	Carts, lab wagon, S.S.	115.00
19	F-97-363	1	Bench, 3 ft. prep room	600.00

Table 16

20	F-97-475	1	Bench, 4 ft. Prep room	800.00
21	F-91-49A	1	Sink, S.S. prep room	400.00
22	N-SA144	2	Screen, wall mounted, 60 x 60 inch	25.00
23	F-91-251	96	Stools, metal	35.00
24	F-97-640	4	Tables	100.00
25	F-90-605	4	Table legs	
26	F-1-915	1	Volland 200 gr Bal	395.00
27	F-2-224A	1	Weight set	142.00
28	F-2-173-45	4	Prescription Bal	44.00
29	N-SA4387P-750S	8	Ohaus T-B Bal.	44.00
30	N-SA4482P-707	4	Alt. Set. Wts.	10.00
31	SE-No 7	50	Sample Pan, Al 5x6 inch	1.95
32	SE No. 64	20	Sample Pan, Al	5.00
33	SE No. 33	6	Sample Pan, Al	8.90
34	SE 44-2	25	Sample Pan, Round, 2 qts.	.90
35	F-9-017	50	Sterilizing pan, enamel, 12x1 1/2 inch	4.20
36	SE 45	30	Magnifier, tripod	2.85
37	SE 191A	5	Hand lens, XXX Mag 10X	21.00
38	F 2-276	4	Student weight set	5.00
39	F-2-198	5	Balance Dish	2.75

Table 16

40	F-2-540K	8	Beakers, 250 Ml Pk - 48	28.80
41	F-2-620	2	Beakers, tongs	8.00
42	F-10-060	2	Flask tongs	5.25
43	F-2-923K	4	Carboy, 2 gal Pk of 6	35.80
44	F-3-000A	2	Dropping bottles Pk of 24	27.22
45	F-3-409100	2	Wash bottles, Pk of 18	36.29
46	F-3-541	2	Beaker Brushes, Pk of 12	32.40
47	F-3-578A	2	Flask brushes, Pk of 12	15.00
48	F-3-727B	2	Burettes, 50 ml, pk of 2	63.46
49	F-7-578-3A	6	Drierite 1b	3.00
50	F-8-54921B	2	Graduate Cylinders, Pk of 24	44.88
51	F-10-322D	1	Funnels Pk of 48	56.64
52	F-9-810E	50	Whatman Paper No. 2	1.35
53	F-10-040F	1	Erlenmeyer, 250 ml pk of 48	35.52
54	F-10-040H	1	Erlenmeyer, 500 Pk of 6	6.30
55	F-10-248E	1	Volumetic Flask, 250 ml Pk of 6	83.76
56	F-11-695B	2	Incubator, Gravity	360.00
57	F-1-801-1B	1	Autoclave,220V, 50 Hz	880.00

Table 16

58	F-13-380C	2	Wax pencils, Red Pk of 6 Box	23.85
59	F-13-650B	4	Pipette, 1 M, in 1/100th, Pk of 12	17.75
60	N-C-5893N-AW451	50	Sample jars, 4 oz, pk of 12	1.40
61	F-14-782	1	Drain Board, Prep room	35.00
62	S-34A9052C	4	Ceiling Fans, 52 in. 220V, 50Hz	130.00
63	F-7-785	2	Stoppers, cork, assort	8.00
64	F-14-141E	1	Stoppers, rubber - 5 lbs No 4	23.75
65	F-7-905	10	Counter	8.90
66	F-8-450	1	Grinder, Hand	34.50
67	F-8-455	1	Wet grinding plates	14.50
68	F-8-624B	2	Desicator	48.91
69	F-8-641C	1	Desicator Plates	42.27
70	N-SA4450P-5500	100	Dissecting Kits	3.45
71		400	Plant Mounts, Cardboard	
72	N-SA2151P-M85B	12	Microscope, Stereo, Swift	233.00
73	N-SA2145P-M2241B	12	Microscope, MONO, Swift, 220V	177.75
74		24	Microscope Cabinets	10.00
75		1	Microscope sets, prepared	500.00
76	N-SA4432P	3	Glass sample vials, 100/box	27.50
77	NZ5540P-W0000	3	Arc Welding Set Transp	142.50

Table 16

78	F-8-816	4	Slide staining dish, pk of 12	43.20
79	F-12-367	1	Oil Immersion Kit	4.00
80	N-S-84640	10	Tropical, coverglass	2.40
81	N-SA-4466P-80	24	Slide box - 100	2.95
82	N-SA 4463P-CSL	10	Slides, Micro - 77	2.45
83	F-13-650-5-J	2	Pipette, volume 10 ML Pk of 18	44.10
84	F-13-700	1	Dropper, Med Pk of 144	9.25
85	N-C5941N-1929-01	2	Long ring timer	6.25
86	N-Z2216N-384	10	Germination paper Pk of 100	16.85
87	N-Z2429N	1	Sieves idoc age, comm. corn	9.65
88	N-Z2432N	1	Sieves, Fine	9.65
89	N-Z2435N	1	Sieve, Small chess	10.00
90	N-Z2440N	1	Sieve, soybean	9.90
91	N-Z2441N	1	Sieve, Round	9.65
92	N-Z2447N	1	Sieve, Solid Bottom	4.45
93	N-C6531N	3	Corn Sheller, Hand	2.55
94	N-Z141N	1	Sieve, set of 12	71.70
95		1	Paper cutter, 15x15	50.00
96	F-4-245A	3	Lamp, glass alcohol pk of 12	23.33
97	F-4-250	1	Lamp wicks, case of 298	32.25

Table 16

98	F-7-895	1	Colton sterile 25 lbs	100.00
99	F-8-757-12	4	Petri dishes, Pk of 500	33.00
100	F-10-126-2B	1	Culture flasks, Case of 500	144.41
101	F-10-248G	1	Vol etric flasks Pk of 6	62.94
102	F-11-996	20	Lens paper Pk of 12	5.00
103	F-3-465	2	Sterilizer, pipettes	10.00
104	F-13-102C	1	Loops Box of 10	76.50
105	F-11-392	1	Asbestos gloves, pr	12.75
106	F-14-141F	2	Stoppers Rubber No. 5	23.75
107	F-14-141G	3	Stoppers " No. 6	23.75
108	F-8-965A	4	Needles, dissecting, 144	18.90
109	N-SA2726P-3115	1	Plant Press	16.65
110	N-SA3150P	5	Insect	4.85
111	N-SA 4438P	12	Insect Case	2.60
112	N-SA4459P-5055	2	Spreading boards	5.90
113	N-SA7731	24	Killing jar	0.95
114	N-SA4451P-584	1	Black wax 1 lb	0.98
115	N-SA7823P-B820	10	Insect Pins Pk of 100 Size D	1.10
116	N-S-7826P-B821	10	Insect Pins " Size 1	1.10

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117	N-S 7828-B823	10	Insect Pins Size B	1.10
118	N-S 7829-B825	10	" Size 5	1.10
119	F-3-902P	4	Burners	16.00
120	F-3-962P	12	Bunsen Burners	9.00
121	F-5-732	2	Clamps Box of 12	48.60
122	F-5-754	2	Holders Box of 12	22.80
123	F-5-773	1	Clamps, Burette, Box 12	4.30
124	F-14-670B	1	Stand, Cast Iron Box 12	70.20
125	F-5-871A	2	Pinch corks Pk 10	6.25
126	F-5-850A	2	Pinch corks Pk 12	6.10
127	F-14-198A	1	Tubing clamp Pk 10	4.85
128	F-8-572E	1	Cylinders, Grad. Nal 250 ML Pk 12	52.15
129	F-11-46676	2	Hot Plate, Gen 230V	129.00
130	F-11-499D	1	Hot Plate, Lindbergh 230V	230.00
131	F-14-317-5	2	Sink malting 50 ft	90.00
132	F-4-664A	2	Safety cans Pk of 6	91.80
133	F-4-664-12	12	Funnel Spouts	1.68
134	F-11-931	2	Kick step stool	31.00
135	F-14-275A	4	Shears, 15 cm	8.00
136	F-14-357	4	Scoop LA Pk of 6	2.20
137	F-14-050D	2	Rings Pk of 12	14.20

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138	F-14-050-B	4	Rings Pk of 12	32.40
139	F-14-743	4	Pipette Supp	22.50
140	F-14-740	6	Funnel Supp	5.40
141	F-14-792-3	4	Test Tube racks	9.00
142	F-14-792-9	2	Test tube racks	10.50
143	F-14-955E	4	Test tube, Pyrex Pk of 576	65.09
144	F-14-955L	2	Test tube, Pyrex Pk of 192	51.84
145	F-15-300A	8	Burner Tripods Pk of 3	10.80
146	F-14-98310C	8	Thermometers, Inm 150° C	5.40
147	F-18-22310C	1	Files, Triangle Pk 12	15.10
148	SA-303	1	Barometer	32.00
149	SA-208	1	Sling Psychrometer	9.00
150	SA-208	1	Extra wisks Pk 12	1.00
151	SA-503	1	Guage, Rain, Metric	75.00
152	SA-504	1	Support for guage	8.50
153	SA-176	1	Instrument shelter with legs	130.00
154	SA-111	1	Max-min Therm metric set/supp	42.50
155	SA-112C	1	Max thermometer, metric	9.50
156	SA-113C	1	Min thermo, metric	9.50
157	SA-140	1	Soil thermo 4 inch, metric	32.50
158	SA-140	1	Soil thermo 20 inch, metric	51.25

Table 16

159	SA-140	1	Soil thermo 2 1/4 inch, metric	30.00
160	SA-140	1	Soil thermo 40 inch, metric	63.75
161	S-34A-9052C	4	Ceiling fans, 52 inch, 220V 50Hz	130.00
162	F-3-661	1	Camel hair brush pk of 12	32.40
163	F-5-841	2	Test tube clamps pk of 12	8.10
164	S-9A79442	2	Garden hose	14.94
165	F-10-423-20D	1	Funnels, Separatory Pk of 4	72.52
166	SE-page 62	1	Tetrazolium test kit	75.00
167		1	Solutions for above No. 164	10.00

Table 17

CHEMICAL SUPPLIES FOR LABORATORY FARANA

1	F-A-38-S	1	Acetic Acid, Glacial: ACS- Pk of 6g	52.00
2	F-A669-S	3	Ammonium Hydroxide, ACS Pk of 6g	29.67
3	F-A-144-S	3	Hydrochloric Acid, ACS Pk of 6g	35.00
4	F-A-200-S	1	Nitric Acid, ACS Pk of 6g	45.00
5	F-A-300-S	4	Sulfuric Acid, ACS Pk of 6g	45.00
6	F-A18	3	Acetone Pk of 4g	36.00
7	F-A-73	5	Boric Acid Pk of 4	48.00
8	F-A-360	6	Agar Pk of 6x11 lbs	136.00
9	F-A-399	1	Alcohol, Butll Pk of 4g	44.60
10	F-A-414	1	Alcohol, Isopropyl Pk of 4G	45.00
11	F-A412	3	Methyl Pk of 4g	28.40
12	F-A407	4	Ethyl Pk of 4g	32.40
13	F-A661	1	Ammonium Chloride 16	8.00
14	F-A637	1	Ammonium Acetate Pk of 6	33.30
15	F-A656	2	Ammonium Carbonate 1 lb	9.00
16	F-B-34	1	Barium Chloride 6	29.10
17	F-A65	3	Benzoic 1 lb	25.00
18	F-C64	1	Calcium Carbonate 6	50.40
19	F-A-613	1	Aluminum Sulphate 6x1 lb	33.90
20	F-A-702	1	Ammonium Sulfate 6x1 lb	40.50
21	F-C-109	1	Calcium Nitrate 6x500g	29.40

Table 17

22	F-C-140	1	Calcium Sulphate 6x1	25.38
23	F-S-421	1	Sodium Sulphate 6x1 lb	15.90
24	F-S-445	1	Sodium thio sulphate 6x1 lb	18.00
25	F-S-369	1	Sodium phosphate 6x1 kg	87.78
26	F-S-374	1	DiSodium Phosphate 6x 1/4 lb	17.10
27	F-P-313	1	Potassium Tartrate 6x1 lb	60.00
28	F-C-371	1	Cobalt Chloride 6x1	26.40
29	F-S-181	1	Silver sulfate 6oz	59.40
30	FC-371	3	Cobalt chloride 1 lb	5.00
31	F-105	1	Diphenyl Amine 100g	8.60
32	F-M-75	1	Maltose 6x1/4 lb	41.94
33	F-M-113	1	Maganese Sulfate 6x1 lb	37.50
34	F-M-155	1	Mercuric Chlorid 600g	66.00
35	F-M-141	1	Mercury 6x1 lb	135.00
36	FM-113	3	Manganese Sulfate lbs	7.00
37	FM-141	1	Mercury lb	23.00
38	FM-282	3	Methyl Cellulose lb	15.00
39	F-A-219	1	Oxalic Acid 6x1 lb	34.80
40	F-N-54	1	Nickel Chloride lb	15.75

Table 17

41	F-A-242	1	Phosphoric Acid 4x1 gal	84.00
42	F-P-171	1	Potassium Acetate 6x1 lb	34.50
43	F-P-243	2	Potassium Acid Phthalate 1 1/2 lb 4x 1/4 lb	24.00
44	F-P-184	1	Potassium Bicarbonate 6x1 lb	20.40
45	F-P-171	3	Potassium Acetate lbs	6.00
46	F-P-188	1	Potassium Clichromate 6x1 lb	31.80
47	F-P-410	1	Potassium Iodide	27.00
48	F-P-304	3	Potassium Sulfate lb	5.00
49	F-P-279	3	Potassium Permaganate 6x1 lb	31.50
50	F-A-277	1	Salicylic Acid 6x1 lb	34.50
51	F-P-263	2	Potassium Nitrate lb	5.00
52	F-S-196	1	Soda Lime 6x1 lb	21.60
53	F-A277	1	Salicylic Acid lb	6.00
54	F-S-264	1	Sodium Carbonate 6x1 lb	14.40
55	F-S209	1	Sodium Acetate Kg	10.00
56	F-S-279	1	Sodium Citrate 6x1 lb	26.40
57	F-S-280	1	Sodium Cobalti Nitrate 6 x 1/4 lb	43.20
58	F-S-318	10	Sodium Hydroxide 20 lbs	44.80
59	F-S-279	1	Sodium Citrate lb	5.00
60	F-S-356	3	Sodium Oxalate 6x4 1/2 lb	25.50
61	F-S-340	1	Sodium Perborate 6x1 lb	19.50

Table 17

62	F-S-343	2	Sodium nitrate Kg	15.00
63	F-T-324	1	Toluene 4x1 gal	32.00
64	F-U-15	1	Urea 6x 1 1/4 kg	25.08
65	F-X-5	4	Zylene 4x1 gal	31.60
66	F-Z-33	1	Zinc Chloride 6x 1/4 kg	44.58
67	F-Z-45	1	Zinc Nitrate 6 x 1 lb	51.30
68	F-Z-68	1	Zinc Sulfate 6 x 1 kg	61.80
69	F-Z-33	3	Zinc Chloride 250g	8.00
70	F-Z-45	2	Zinc nitrate	9.00
71	F-Z-68	3	Zinc sulfate 1 kg	11.00
72	F-P-217	1	Potassium Chloride 6x1 kg	3.32
73	F-P-217	2	Potassium Chloride kg	7.50
74	F-C-298	1	Chloroform 6 x1	98.00
75	F-A-940	1	Citric Acid 6x1	23.70
76	F-C-386	3	Cobalt Sulfate	19.05
77	F-C-298	3	Chloroform gal	17.00
78	F-C-495	1	Cupric sulfate 6x1	72.00
79	F-D-16	3	Dextrose 6x1	21.60
80	F-C-495	3	Cupric sulfate lb	12.00
81	F-I-77	1	Forrous Ammonium Sulfate 6x1	31.20
82	F-F-79	6	Formaldehyde 15 gal	29.30
83	F-G-33	1	Clycerin 4x1 gal	154.00

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Table 17

84	F-H-292	1	Hexane 4x1 gal	56.00
85	F-A-147	1	Hydroflouric Acid 12 lb	52.80
86	F-G-33	1	Glycerine Pk of 6 qt	65.70
87	F-A-162	1	Lactin Acid 6x1	63.00
88	F-L-5	2	Lactose 6x1	28.50
89	F-M-29	2	Magnesium Carbonate 6x1 lb	94.20
90	F-M-51	1	Magnesium Oxide 6 x 1/4 lb	54.60
91	F-M-29	3	Magnesium Carbonate lb	16.00
92	F-M-33	2	Magnesium Chloride Kg	12.50
93	F-M-51	3	Magnesium oxide 1/4 lb	9.00
94	F-A-480	3	DeVarda's Metal Pk 6	90.00
95	F-Z-11	1	Zinc Powder lb	6.50
96	F-S-O-N20	1	nestler Reagent 6x1 qt	34.86
97	F-B-245	1	Benzene 4x1 gal	41.40
98	F-C-135	1	Calcium DiBasic Phosphate 6x1 lb	36.00
99	F-C-121	1	Calcium Mono Basic Phosphate 6x1 lb	26.00
100	F-D-90	1	Dithizone 10 g	13.90
101	F-G-7	1	Gelatin "B" 6x1 lb	46.50
102	F-H-329	2	Hydroguinone lb	2.75
103	F-T-407	3	Tri Ethanol Amine pts	8.50
104	F-M-46	3	Magnesium Nitrate 6x1 lb	30.00
105	F-M-108	3	Manganese Dioxede lb	7.50

106	F-C-112	1	Calcium Oxalote 6x1	25.86
107	F-C-218	6	Cement, Alundum - 300g 5 lbs	24.25
108	F-A-686	1	Ammonium Di Basic Phosphate 6x1	84.48
109	F-S-O-F-6	1	Fehlings, Sol A 6x1	13.20
110	F-S-O-F-4	1	Fehlings, Sol B 6x1	25.20
111	F-P-186	1	Potassium Dichroniate 20 lbs.	48.00
112	F-P-250	2	Potassium Hydroxide 20 lbs	53.00
113	F-S-387	1	Sodium-Potassium Tartrate 6x1 lb	42.00
114	F-C-228	2	Pyseal Cement 12 box	6.50
115	F-S-O-B-99	1	PH4 Concentrate qts pk 6	48.90
116	F-S-387	3	Sodium Potassium Tarbrate lb	7.00
117	F-C-581	3	Crystal Violet 10 g	7.25
118	F-M-290	1	Malachite Green 25 g	5.30
119	F-M-199	1	Meta Cresol Purple 5 g	27.30
120	F-E-511	1	Eosin 6x10 g	13.80
121	F-T-416	1	Thyniol Blue 5 g	12.75
122	B-1363	1	Bromo Cresol Green 5 g	23.30
123	F-B-388	1	BromoThiomol Blue 5 g	11.25
124	B-393	1	Bromo Cresol Purple 5 g	8.50
125	F-P-74	1	Phenol 6x5 g red	48.00
126	F-P-79	1	Phenolphtholein 6x1 oz	16.80
127	F-C-580	1	Congo Red 25 g	28.75

Table 17

128	F-D-86	3	Diphenylcarbazone 30 g	39.60
129	F-I-180	4	Indicator Sol. Color Chart	2.40
130	F-O-267	1	Orange G 6x25 g	16.50
131	F-6-665-17	2	Cheesecloth, Grade !10, 24 pkgs	64.00
132		10	Masking Tape - 1/2 inch, 100 ft	1.00

Table 18

OFFICE EQUIPMENT FARANAH

1	S-3A-7744N	2	Conference Desks, steel	179.95	359.90
2	S-3A-7735N	4	Executive Desks, steel	149.95	599.80
3	S-3A-7700N	2	Mini desk, steel	64.95	129.90
4	S-3A-6023N	2	2 Drawer, legal filing cabinet	89.95	179.90
5	S-3A-7521N	2	Secretary chair	49.95	99.90
6	S-3A-7597N	1	Exec. swivel chair	189.95	189.95
7	S-3A-7705N	1	Exec. swivel chair	84.95	84.95
8	S-3A-7707N	4	Arm chair	64.95	259.80
9	S-3A-7722N	10	Arm chair	47.95	479.50
10	S-3A-64944N	6	Cabinets, 4 shelf	87.95	527.70
11	S-3A-6076N	18	Cabinet, filing, 4D, legal	112.95	2,033.10
12	S-3A-6401N	5	Table, folding 6'x2 1/2	52.95	
13	S-3A-6402N	5	Table, folding 8'x2 1/2	59.95	
14	S-21A-1122L	50	Chair, steel, folding, Box of 2	15.98	799.00
15	S-3A-3063C	2	Table, typing	9.99	19.98
16		12	Waste basket, steel	7.50	90.00
17		10	Paper sorter, 3 shelf	10.00	100.00
18	S-34A-9052C	15	Ceiling fans, 52", 220V 50Hz	130.00	1,950.00

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LIBRARY

Table 19

1	S-3A-79-78L	12	Shelves, 6 ft x 3 ft x 18"	17.99	215.88
2	S-3A-7976C	15	Shelves, 6 x 3 x 1 foot	13.99	209.85
3	S-3A-3998	35	Book ends, steel, Pk of 6	2.69	40.35
4		1	Card catalog file, 100 drawers	700.00	700.00
5	F-90-180	6	Base Unit) To construct (2) stand up	400.00	2,400.00
6	F-90-230	6	Base unit) - work tables with ATLAS storage	400.00	2,400.00
7	F-90-655	2	Table top) under Dictionaries.		
8	S-3A-6402N	4	Table, folding 8 x 2 1/2	59.95	239.80
9	S-21A-1122L	20	Chairs, steel, folding, Box of 2	15.98	319.60
10	S-3A-7700N	1	Desk, mini, steel	64.95	64.95
11	S-3A-3063C	1	Table, typing	9.99	9.99
12	S-3A-6076N	2	Cabinet, 4D, legal	112.95	225.90
13		12	Typewritter ribbons, nylon, black	2.60	31.20
14		1	Typewriter, manual 14 with French alphabet and all digits in Sears T3A5423	400.00	
15		50	Library cards for item !4, Pk 100		
16		6	Waste basket, steel	7.50	45.00
17		2	Paper sorter, 3 shelf	10.00	20.00
18	S-3A-63052	2	2 drawer steel card file, 3x5	14.95	29.90

Table 19

19		5	Cards 3x5 - Box of 1000	5.00	25.00
20	S-34A-9052C	3	Ceiling fans, 52 inch 220V 50Hz	130.00	390.00
21		10	Methylcromide, case of 12 lb cans	12.00	120.00
22		6	Methylcromide applicators	3.00	18.00
23	N-SA-5149P-3817	3	Literature Storage center	74.95	224.85

Table 22

FARANAH - REPAIR SHOPS, TOOLS & SPARE PARTS

1	S-9A20685-N3	1	Jointer-Planer, 220V, 50Hz	329.95
2	S-9A21372-N2	1	Drill press, 15 1/2", 220V, 50Hz	319.95
3		2	Bits, Drill press, wood	50.00
4	S-9A29843N4	1	Table saw, 10 inch, 220V, 50Hz	319.92
5	S-9A3231	1	Universal Jib	22.99
6	S-9A24355NA	1	Band Saw-Sander, 220V, 50Hz	289.95
7	S-9A-26595	1	Blades, Pk. 5	14.20
8	S-9A-26596	1	Blades, Pk. 5	14.20
9	S-9A-26641	1	Blades, Pk. 5	14.20
10	S-9A-26572	1	Blades, Pk. 5	14.20
11	S-9A-26234	1	Blades, Pk. 5	14.20
12	S-9A-36505C	1	Miter Box	109.95
13	S-9A-6674	2	Glue clamp, Pk. of 4	5.82
14	S-9A-6675	2	Glue clamps, Pk. of 4	4.92
15	S-9A-66674	6	"c" clamps 4 in.	3.57
16	S-9A-66676	6	" 6 in.	5.37
17	S-9A66678	6	" 8 in.	7.17
18	S-9A66639	4	Glue Clamps ea.	8.52
19	S-9A66614	1	Corner clamps set	11.97
20			Glue	
21	S-9A17369	1	Router, 220V, 50Hz	59.99

Table 22

22	S-9A25517	1	Router Bits 10 pc	22.49
23	S-T9A10231N	1	Carpenter Bench, 78"	279.95
24	Assorted	100	Wood screws, flat head lbs.	
25	Assorted	100	Wood screws, Round Head lbs.	
26	Assorted	100	Carriage Bolts, Round Head lbs.	
27	Assorted	100	Carriage Bolts, Hex Head lbs.	
28	Assorted	100	Stone Bolts lbs.	
29	Assorted	100	Metal Screws lbs.	
30	Assorted	400	Assorted Nails lbs.	
31	Assorted	100	Machine Bolts lbs.	
32	Assorted	100	Eye Bolts lbs.	
33	Assorted	100	"U" Clamps lbs.	
34	5 Feet	4	Pipe, 3/4" threaded 12" each end	
35	3 feet	4	Pipe 3/4" threaded 12" each end	
36	3 feet long	4	Pipe 1/2" threaded 12" each end	
37			Carpentry tool Kit, 200 pc	500.00
38	S-9A65233N2	1	Mobile Tool cart	500.00
39	S-9A6517C	2	Carpenter Tool Box	26.75
40	S-9A65228L	1	Machinist Chest	64.75
41		2	Bits, drillpress, metal	100.00

42	S3A7978L	12	Shelves, steel	17.99
43	S-9A43397C	1	Mechanics, Set 190 pc.	299.00
44	S-9A33013	1	Socket set, metric, 46 pc.	62.00
45	S-9A44442	1	Tongue wrench	59.50
46		24	Files, assorted	
47			Valve grinding set	
48			Ring changing set	
49			Tractor wheel puller	
50	S-9A5181C	2	Vise - 6 inch jaw	59.50
51			Forge & tool	
52			Planes, Hand	
53	9A-65395	4	Bin organizer	14.99
54	N-Z322N-D2000	1	Differential chain hoist, 2-ton	107.30
55	N-C6616N-7929	1	Trolley for gantry, 2-ton	113.55
56	N-C6491N-100540	2X	Log chain, 5/16" x 14 ft.	14.40
57	N-Z4520N-903157	1	Gantry A frame, 2-ton	497.00
58	S-9A20176	1	Arc welder, 220V, 50Hz	179.00
59	S-9A1129	1	Drill, 1/2, Electric, 220V, 50Hz	50.00
60	S-9A1145	1	Drill, 3/8, Electric, 220V, 50Hz	40.00

Table 22

61	S-9A19462C2	1	Bench Grinder, 220V, 50 Hz	89.99
62	S-9A6680	1	Bit Sharpener	13.99
63			Electricians Tool Kit	
64			Plumbers Kit, Metric	
65	S-9A1325		Helmet	12.95
66			Goggles, Welding	
67	S-9A-20471	1	Electrode assortment for Welder	29.95
68	S-9A-20698	1	Receptable for Welder	3.99
69	S-9A-20284C	1	Rods, Contact, 25lb. pk	19.95
70	S-9A-20285C	1	Rods, Contact, 25lb pk	19.95
71	S-9A-20273C	1	Rods, deep penetrating, 25lb pk	29.95
72	S-9A-20274C	1	Rods, deep penetrating, 25lb pk	19.95
73	S-9A-20275C	1	Rods, deep penetrating, 25lb pk	19.95
74		12	Glue, Elmers, 2 qt. bottle	
75		12	Putty, 1 pt.	
76	N-H1353N-MM-212R	1	Mini-mule hoist puller, 2-ton	38.65
77	N-C6492N-100550	1	Log chain, 3/8"	20.50
78	N-C6493N-100590	1	" " 1/2"	35.65
79	N-C6673N-377	2	Self-priming barrel pump for non-corrosive use	9.95
80	N-C6674N-565	2	Vol-u-matic hi-pressure lubricator	34.25

Table 22

81	N-H1473N-154	1	Grease fitting assortment	5.95
82	N-Z130N-061H	1	Bufco light forge, with half hood	111.00
83	N-C6595N-100AS	1	Cast steel anvil	199.15
84	N-C5048N-06502	2	Blacksmith tongs, 24"	19.35
85	N-C7248N-VB32	1	Blacksmith Hanner, 32oz	6.90
86	N-C7249N-VB40	1	" " 40oz	7.40
87	N-C6596N-VB48	1	" " 48oz	7.90
88	N-H1167N-6-51122	2	Hydraulic jack, 3 ton	18.60
89	N-H1169N-6-1125	1	" " 12 ton	31.45
90	N-H2098N-HL48	1	Hi lift 48" mechanical jack	36.95
91	S-28-A-4955	5	Grease Gun, Manual	5.69
92	S-28-A-59074C	10	Grease, multi purpose, 5lb can	3.99
93		2	Planet Jr Corn Planters	
94		4	Calcium chloride for tractor tires 100 lb Bag	
95	S-32-A-29755N	2	Tiller compact, briggs and stratton, 5 HP, Chain drive	277.95
96		1	Charger, battery, heavy duty 220V 50Hz, commercial for 6 or 2 volt batteries, 30 Amp	100.00
97	N-H2200N-35MV-36C	10	Single B, T Axe	10.95
98	N-C6637N-25908	5	Sledge Hammers	10.75
99	N-H2204N-302015	3	Wedge	3.50

Table 22

100	N-H2201N-300	4	Brush Hook	9.95
101	N-H1944N-1519	3	Cant Hook	27.60
102	N-H1940N-763	2	Timber Carrier	25.10
103	N-H1378N-394	1	Metric Measuring Wheel	52.50
104	N-H1265N-406ME	5	Meter Tape	36.65
105	N-H1933N-577	1	Tape Repair Kit	48.80
106	N-H285N-M414	10	Maylan Pruning Saw	23.00
107	N-H181N-8	10	Pruner	6.90
108	N-H2178N-T78	10	Anvil Pruner	3.75
109	N-H2181N-T222	10	Wiss Lopping Shears, Teflon	9.60
110	N-H2176N-230	10	Corona Lopper	12.50
111	N-H464N-RHB14	25	Garden Rake	6.35
112	N-H668N-E4DSD	15	English Spading Task	10.10
113	N-H660N-UGSUD	25	Garden Spade	8.65
114	N-H663N-RL248	25	Garden Shovel	7.90
115	N-H661N-UDS16	25	Long Blade Spade	10.00
116	N-H665N-RL2UD	25	GP Shovel	7.25
117	N-H467N-RHSBT7	25	Nursery Hoe	5.60
118	N-H2191N-N2 1/2	25	Narrow Hoe	5.95
119	N-H1523N-1001B	2	Garden Seeder	35.25
120	N-H2094N-HWC243	10	Cultivator	39.95

Table 22

121	N-H678N-42G	10	Scythe Blades	8.35
122	N-H679N-42W	10	Scythe Blades	8.35
123	N-H1622N-8B	10	Snath	7.85
124	N-H675N-GH12	50	Grass Hook	3.50
125	N-H959N-35/1	15	Wheelbarrow	43.35
126	N-H57N-882Y	10	Gratting Knife	6.60
127	NC2300NRHAB34 1/2	10	Fork, Hay, 3 Tinc	9.00
128	N-C440N-1515	50	Pail, Galv., 15 qt	4.60
129	NC7122N-150-R	10	Baskets, Gal., 1 1/2 Bu	7.65
130	N-C6413N-86	5	Digger, Auger, Post Hole	11.35
131	S-30A17064N	1	Air Compressor, 240V	269.99
132	S-C6714N-J1911	50	Stone, Gen Purpose	1.35
133	N-C4488N-117	25	Husking Peg	.55
134	N-C6522N-12XG	25	Husking Hook	1.10
135	N-C6530N-2A	3	Cyclone Seeder	10.70
136	N-H760H-210SS	10	Disston Teflon Saw	8.60
137	N-H761N-250SS	10	Teflon Pruning Saw	12.85
138	N-H777N-33	10	Disston Cured Saw	11.45
139	N-H256N-900	2	Tree Trimmer	29.65
140	N-H257N-975	2	Extra Center Extension	6.75

Table 22

141	N-H583N-925	6	Replacement Spring	.85
142	N-H-584N-950	3	Replacement Blade	4.70
143	N-H585N-970	1	Replacement Head	6.45
144	S-9A5081	10	Mattock	7.64
145	S-9A5122C	30	Handle, Mattock	3.77
146		10	Picks	10.00
147		30	Pick Handles	
148		25	Watering cans, 3 gal.	
149	N-H84NN-6220	20	Sprayer, 3 gal.	19.45
150	N-Z4494N-413132-A03	1	Scales, Toledo, Metric	323.00
151	N-C7003N-600	4	Scoops	2.00
152	SE-750-S	1	Scale	47.50
153	SE-707	1	Weight set	12.50
154	SE-703-S	1	Scoop	24.00
155	SE-1101	1	Scroop	9.00
156	N-H-122N-6802	4	Duster Roto, Hudson	66.00
157	F-11-394-6C	3	Gloves, Rubber, Size 9, pair share	2.03
158	F-11-394-6E	3	Gloves, Rubber, Size 11, Pair share	2.39
159	F-11-394-30B	2	Gloves, Rubber, size 11, pair	7.00
160	F-13-994-15	2	Respirator, Toxic dusts share	7.75
161	F-13-994-17	2	Filter, Rep. Pk of 12	4.50

Table 22

162	F-13-995-11	2	Respirator, Vaport Share	15.00
163	F-13-995-13	2	Cartridges, Rep PK of 6 boxes	
164	F-11-408-5	1	Goggles Share PK of 12	14.25
165	F-91-580	4	Deck, eye face, wash to be mounted on Center Island	
166	N-H79N	50	Grafting wax, lb.	2.50
167	N-H90N-60	10	Grafting tape, roll	2.40
168	N-H78N-620	10	Budding Strips lb	4.85
169	N-H78N-516	10	Budding Strips lb	5.15
170	N-H74N-1108	10	String spool	3.60
171	S-9A79442	3	Garden hose, soft	14.94
172	SE-464	1	Seed cleaner, 220V, 50Hz, with screen for maize, rice, sorghum, millet	275.00
173	Allan Machine Shop, Amer.	20	Corn hand planters	
174	SISCOMA	6	Paddy thrasher, pedd driven	335.00
175		1	Chalk board, 12 ft.	
176		1	Screen, wall mount 5x5	

Table 24

CATTLE FARANAH

1	N-C1450N	150	Chain, Tag, Ring, Blue	0.90
2	N-C900N	50	Rings	0.13
3	N-C657N	2	Pliers	.90
4	N-C2094N	1	Tatoo set, 5 digit	12.10
5	N-C1357N	3	Ink, 2 oz. Black	0.75
6	N-C988N-31	10	Bull Rings, 2 1/2 inch	1.05
7	N-C5249N-1D421B	2	Bull Leader	5.30
8	N-2847N-830	150	Swivel eye Snaps, tie	.80
9	N-C242N-105P	2	Hoof parer	7.70
10	N-C123N-18962	2	Horn rasp	2.85
11	N-C600N	2	Hoof Knife, Right	3.85
12	N-C603AN	2	Hoof Knife, Left	3.85
13	N-C5615N-WGV-68	4	Water control valves	11.50
14	N-C5865N-20230-1	1	Chutegate	170.00
15	N-C5119AN-800B	1	Livestock scale	698.00
16		50	Plastic Buckets, 12 qt	0.50
17	NC6369N-842	1	Hanson scale	13.45
18	NC6387N-8930	1	Hanson Scale	17.70
19	N-C7003N-600	4	Scoop	2.00
20	N-C2300N-RHAB34 1/2		Pitchford, 3 tine	9.00

21	N-C862N-A54	4	Manure Fork, 5 tine	10.00
22	N-C865N-E10	2	Silage Fork	20.00
23	N-3115N	4	Weighing Tape, CMS	1.42
24	N-C5986N-C20BL	2	Gutter scoops	9.25
25	C6537N-AL10WGS	4	Aluminum Scoops	12.00
26	N-C5987N-2158	2	Scraper	12.00
27		100	Chains, Tie, 2 ft long, inbedded in concrete manger curb, cow side	500.00
28	N-C5984N-010-14	4	Barn Brooms	4.15
29	N-C6025N-017	8	Handles	1.60
30		100	Dividers, Stall, 90°, 1" bended steel, inbedded in concrete	600.00
31	N-C5872N-25808	100	Cross clamps	4.00
32	N-C5333N	10	Triple Bacterin, 250 ML	2.65
33	N-C5337N	10	Nitrofurazone, 6 oz	2.10
34	N-C5745N	10	Oxy-tet 50, 500 Ml	8.00
35	N-C5339N	10	Vit ADB 12, 250 Ml	12.55
36	N-C5347N	5	PL-3, 100 Ml	26.10
37	N-C6927N-D845	10	Triple sulfa	10.95
38	N-C563N	20	Sulfa 4, 500 Ml	2.65
39	N-C5194N-7490	20	Combiotic, 100 Mil	5.40
40	N-C6925N-D860	10	Scour tablets	8.95

41	N-C638N-V2505	1	Stethoscope	4.85
42	N-C598N-CT5H	4	Thermometer	4.85
43	N-C6271N	10	Glove, plastic, Pk	4.80
44	N-C308N-856N	1	Trocar	4.95
45	N-C299N9	1	Dose Syringe	8.65
46	N-C4127N-512	1	Syringe, 12cc/needle, Pk 100	20.00
47	N-C4125N-506	1	Syringe, 6cc/needle, Pk 100	19.00
48	N-C4124N-503	2	Syringe, 3 Ml, needle, Pk 100	10.45
49	N-C335N-915N	1	Obstet Chain	1.70
50	N-C1014N-1032	1	Obs. chain handle	3.30
51	N-C285N-V200C	1	Emasculator	64.35
52	N-C996N-2572	1	Castrating Knife	2.45
53	N-C232N	1	Elastrator	13.00
54	N-C233N	10	Elastrator rings Pk 50	.70
55	N-C181N-10418	1	Dehorner	7.25
56	N-C194N4	5	Pol Dehorner	2.35
57	N-C2234N	52	Cow mats	48.10
58	N-C1279N	40	Cow mats	59.85
59	S-32A10952N	10	Fence, cattle, 45" roll	59.99
60	S-32A10405N	225	Posts, steel, 7 ft	2.79

Table 24

61	S-32A21945N	8	Anchors, Post, 6 in	6.19
62	S-32A21902C	1	Driver, Post	11.49
63	S-32A21914	1	Stretcher, Hoist	16.59
64		1	Thibenzlade 100 lb	
65		1	Pit-cum-bunker silo	
66	S9A79442	4	Hose, garden, 50 ft.	14.95

Table 25

SUPPLIES FOR PIG HOUSE, FARANAH

1	N-C769N-D-212	1	Hog catcher	5.80
2	N-C595N	1	Castrating holder	5.95
3	N-C751N-100	2	Pig castrating kit	2.05
4	N-C255N-V-362	2	Pig teeth snippers	4.90
5	N-C31N	2	Ear notcher	7.20
6	N-C1831N-83	4	Farrow crate feeders	11.45
7	N-C4486N-F3	6	Baby pig feeders	8.40
8	N-Z6164N-2G	5	Finisher feeders	68.00
9	N-Z6174N-C5	4	Farrowing crates	113.00
10	N-C1635N	1	Set of yellow rototags, numbered 1 to 500	43.00
11	N-C1634N	2	Rototag pliers	6.75
12	N-C7003N-600	4	Scoop	2.00
13	N-C6392N-890	1	Scale	3.20
14		20	Plastic buckets, 14 qt	1.00
15	N-C1546N	2	Weighing tape	1.29
16	N-C5986N-C2DBL	2	Gutter scoop	9.25
17	N-C6537N-AL10WGS	2	Aluminum Scoops	13.10
18	N-C5984-N-010-4	4	Barn Broom	4.15
19	N-C6025N-017	8	Handles	1.60

Table 25

20	N-C5745N	5	Oxytet, 500cc	8.00
21	N-C5339N	5	Vit ADB-12, 250cc	12.55
22	N-C7252N	10	Tylan 200, 250cc	25.65
23	N-C5384N	10	Cry-Mune C, 100cc	3.25
24	N-C5355N	5	Leptocon, 100cc	4.35
25	N-C5390N	10	Ferro-Mycin 100	7.65
26		100	Stabilized Vit A,D,E, lb	1.50
27	N-C6927N-D845	5	Triple sulfa	10.95
28	N-C5194N-7490	10	Combiotic, 100cc	5.40
29	N-C6271N	1	Plastic globes roll	4.95
30	S9A79442	4	Garden hose, 50 ft	14.94
31		25	Ferrous sulphate lb	
32		2	Soybean meal, 50%, ton	
33		2	DiCalcium phosphate, ton	
34		2	Ground Limestone, ton	
35		100	Multi-amino acids lbs	
36		100	B-complex vitamins lb	

Table 26

POULTRY FARANAH COLLEGE

1	N-Z5578N-A100	1	Debeaker, 220V 50 cycle	49.25
2	N-C6372N-32	1	Candler	42.50
3	N-C6373N-11107	3	Rep. Lamps	2.00
4	N-C6371N-215Z	15	Round egg baskets	2.90
5	N-C6362N-JWS-517	2	Egg scale	6.16
6	N-C6360N-635	3	Fowl catcher	1.35
7	N-C6361N	15	Holding funnel	2.00
8	N-C5914N-5715	12	Poultry thermometers	3.98
9	N-C5235N-S128	12	Poultry sticker	2.35
10	N-Z59N-300-E	1	Incubator, 230V 50Hz	133.00
11	N-Z60N-416-E	2	Incubator, 230V 50Hz	263.00
12	N-C5610N-666	30	Plastic water fount	00.50
13	N-C5611N-750	30	Base, water fount	0.50
14		50	Plastic buckets, 12 qt	1.00
15	N-C6537N-ALioWGS	4	Scoops	13.10
16	N-C5984N-010-14	4	Barn broom	4.15
17	N-C6025N-012	8	Broom handles	1.60
18	N-C5987N-2158	4	Scraper	12.00
19			Hammer, 220V 50Hz	
20			Dust collector	

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Table 26

21			Bagger	
22		100	Bags, Burlap	
23	S-P32A45005N	1	Power sprayer, 300 PSI	379.95
24	S-9A79442	6	Hose, garden, 50 ft	14.94
25		1	Coccidio stat 1000 lbs	
26	SE-1234V	1	Feed mixer, 220V, 1200 lb	901.40
27			Waterer	
28			Feeders	
29			Nests	
30		25	Fertile eggs, Leghorn, 30 dozen per case, to be delivered at the rate of 3 cases per month, shipped by air in pressurized temperature-controlled plane to Faranah	30.00

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Table 28

Office and Laboratory Equipment and Furnishings and

Field Research Equipment

1	S-3A-64944N	12	Cabinet, 4-shelf, gray	87.95
2	S-3A-64946C	12	Shelf, gray	6.49
3		12	Waste baskets	7.50
4		10	Paper sorter, 3 shelf	10.00
5	S-3A-7735N	8	Desk, executive, steel	149.95
6	S-3A-7722N	8	Chair, side arm, black	47.95
7	S-3A-7700N	2	Mini-desk, steel	64.95
8	S-3A-6023N	2	2-drawer, legal filing cabinet	89.95
9	S-3A-7521N	2	Secretary chair	49.95
10	S-3A-6076N	9	Cabinet, filing, 4-drawer, legal	112.95
11	S-3A-6402N	3	Table, folding, 8' x 2 1/2'	59.95
12	S-21A-1122L	12	Chair, steel, folding, box of 2	15.98
13			Chalkboard, 12-ft, with tray	
14			Projection screen, wall-mounted	
15		6	Chalk, box	
16		2	Chalk erasers	
17	S-3A-3063C	2	Table, typing	9.99
18		2	Typewriter	
19	S-34A-9052C	11	Ceiling fans, 52-inch, 220V, 50Hz	130.00

Table 28

Office and Laboratory Equipment and Furnishings and

Field Research Equipment

20	F-90-150	1	Bench, Tech Top, Type II, Style B	
21	F-97-620	1	Bench, Tech Top, Type II, Style B	
22	F-90-160	1	Bench, Tech top, Type II, Style B	
23	F-97-340	1	Bench, Tech top, Type II, Style B	
24	F-97-363	3	Bench, Tech top, Type II, Style B	
25	F-97-485	1	Bench, Tech top, Type II, Style B	
26	F-97-460	1	Bench, Tech,top, Type II, Style B	
27	S-47A1782N	1	Freezer, 27 ft, 220V-50z	419.95
28	S-46A67401N	1	Refrigerator, 14 ft, 220V, 50 Hz	249.00
29	S-3A7978 L	3	Shelving	17.99
30	S-3A7924C	3	Shelf	8.99
31	F-97-640T	4	Table, 4 ft sq. Tech top Type II, Style B	
32	F-97,605	4	Sets	
33	F-91-251BR	1	Stools	50.00
34	F-91-250	2		36.00
35	F-91-250BR	1		53.00
36		1	Nor-Lake Cooler	7,000.00
37		1	Sink, 2 compartment, concrete, 4 feet x2x2 ft	
38	SE-64	6	Seed Pans	5.20

Table 28

39		50	Moth Balls lbs	1.00
40		100	PDB Cakes ea	.30
41		1	Oven-as described in Sec 5	500.00
42	Bemis Bag Co	300	Cotton bags cotton duck 8 50 cm mounth x 75 cm, approx.	.75
43		500	Cotton bags cotton duck 8 25 cm months x 40 cm, approx.	.50
44	SE-33	2	Seed sample pan 8 1/2" x 12" x 1 1/2"	9.75
45	D-B63124	1	Bostich numbering, 607 with 2 ink pads, 2 bottles drk 14 cuft manual	40.00
46		1	Electric heaters with pressure fans, grain-drying units for dressing ovens	500.00
47		1	Washer, dark room	
48	N-Z3101N	1	Test Plot thrasher, gasoline	605.00
49	SE-4481M	1	Toledo Beam scale, metric	331.00
50	SE-4030	1	Toledo grain scale, metric	765.00
51	SE-32490	1	Weight set for No 4030	37.80
52	F-14-241A	4	Scoops, AL 13mm share	3.00
53	N-C5941N-1929-01	1	Timer, Long ring	6.25
54	N-Z5161N	1	Steinlite Moisture tester, 400G, 220V	625.00
55	N-Z2456N	1	Hand operated cleaner	390.00
56	N-Z2457N	14	Screens for corn, rice, sorg. forage, millet soybean, peanut, alfalfa	8.25

Table 28

57	N-Z4851N	1	Germinator, 220V - 50 cycle	365.00
58	N-Z2216N-384	3	Germination Paper 21x15 inch pk of 100	16.85
59	N-Z2429N	1	Sieves idock age, comm, corn	9.65
60	N-Z2432N	1	Sieves, Fine	9.65
61	N-Z2435N	1	Sieve, small chess	10.00
62	N-Z2440N	1	Sieve, soybean	9.90
63	N-Z2441N	1	Sieve, Round	9.65
64	N-Z2447N	1	Sieve, Solid Bottom	4.45
65	N-H1623N	1	Corn sheller	37.00
66	N-C6531N	3	Corn Sheller, hand	2.55
67	N-Z141N	1	Sieve, set of 12	71.70
68	F-13-258-13E	1	Blue-em conhection oven	580.00
69	F-7-905	4	Counter share	8.90
70	F-8-845	1	Kit, Disecting	19.25
71	F-2-032-30	1	Ohaus Triple Beam Bolawo 72D	63.50
72		1	Toledo Scale, 20 Kg/1g Room drying	540.00
73	F-2-122	2	Metric Dial Scale Room Drying	544.00
74	F-2-301-5B	1	Weight, Ohaus Set	10.50
75	F-2-923E	4	Bound bottles, Nalgene 500ml case of 48	25.42
76	F-2-893-5C	8	Wide mouth bottles, Nalgene, case of 72	27.38

Table 28

77	F-2-540H	1	100 Ml Beakers Pk 12	
78	F-2-540K	1	Beakers, 250 Ml Pk 12	8.04
79	F-2-540M	2	Beakers, 600 Ml, Pk 6	6.00
80	SE for 117	2	Aux. Lens 3 1/2x	4.50
81	IR1004	20	Gerometer Fluid, Bottle	1.00
82	IR1003	1	Test Pump	15.50
83	IR-1002	1	Test Pump Service Unit	16.50
84	IR-124	5	Gerometer Moisture Indicator	18.00
85	IR-118	5	Gerometer Moisture Indicator	17.50
86	IR-112	10	Gerometer Soil Moisture Indicator	17.00
87	SA-290(1)I	20	Soil Moisture Cells, Colman	8.00
88		6	Mercury Batteries	1.00
89				
90	F-10-180E	1	Erlenmeyer flasks 500ml pk of 6	22.62
91	SA-290(1)A	1	Colman Soil Moisture Meter	210.00
92	N-H-1937P-620005	1	Polar Plenimeter, M	99.40
93	N-H1907P-817950	1	Pocket Stereo Scope	22.65
94	N-H2020P	2	Photo Carrier	7.70
95	N-H1950P	2	Combination Dot Sg Grid	1.00
96	N-H1529P-24260	1	Transit, pocket	21.75

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Table 28

97	N-H1914P-19-1400	2	Jacob Staff	12.00
98	N-H1913P-40-1400	6	Foresters Compass Model A	65.00
99	N-H2004P-802	2	Abney Hand Levels	19.90
100	N-H1850N-21878	1	Soil Thermometer	16.00
101	N-H661N-UDS16	2	Spade, Soil Sampling	10.00
102	N-H1877N	1	Soil color charts	35.10
103	N-1805N-H3902	1	Sieves, Soil	85.00
104	N-H1633N	12	Soil Sampler	3.79
105	N-H1629N	2	Extension, Augur	2.85
106	N-H1628N	1	Handle, Augur	2.95
107	N-H1627N	2	Bit, Augur	9.95
108	N-H1626N	2	Augur, 1 1/4 inch	13.10
109	N-H1632N	2	Augur Extension	2.20
110	N-H1631N	2	Augur soil 4 inch	21.00
111	N-H1630N	2	Augur, Soil 3 inch	18.95
112	N-C5897N	200	Caps, Bakelite, 4 oz Jar, Pk of 12 Share	.85
113	N-C5893N	400	Jars, Sample, 4 oz Share Pk of 12	1.40
114	F-8-556H	1	Cylinders, graduate, red, 200ml Pk of 4	85.92
115	F-13-380C	1	Pencils, Wax red case of 6 boxes, Share	23.85
116	F-12-961C	1	Mortar case of 8, Ceramic 130ml	33.84

Table 28

117	F-12-976	1	Mortor: and Pestle, Iron	62.00
118	F-14-331-5B	1	Hydrometer, Soil	8.85
119	F-9-522-10	1	Voltmeter, Vom Share	65.00
120	F-9-497F	1	Converter, Voltage, 230 to 115V	100.00
121	F-8-336-10	1	Wiley cutting Mill Model 4, 230V with steel beaker	1,566.00
122	F-3-40910d	2	Wash bottles Pk 4	4.48
123	F-2-961A	1	Carboy, Nalgene, 5 gals. (Case of 4) Share	55.76
124	N-SA3151P	1	Bags, Insect Net	2.10
125	N-SA4459P-5055	4	Board Spreading, Adj.	5.90
126	N-SA7731P	1	Jar, Killing	.95
127	N-SA4451P-584	4	Black Wax, lb	.98
128	N-S7825P	1	Pins, Insect Size No. 0 . Pk of 100	1.10
129	N-S7826P-B821	12	Pins, Insect Size No. 1	1.10
130	N-S7828P-B823	1	Pins, Insect Size No. 3	1.10
131	N-S7829P-B825	2	Pins Insect Size No. 5	1.10
132		2	Herbarium Cases	300.00
133	F-97655	2	Tables, 60x22 inchs.	100.00
134	F-97605	1	Legs, Table, Mounted together with Rustic top to make table 60x44 in.	
135	N-H847N-6220	1	Hudson Sprayer, Hand	19.45

Table 28

136	N-H283N-6364	1	Trombone sprayer	62.50
137	N-H-1218N	1	Indian Sprayers, S.S.	88.00
138	N-H-2093N-67367	3	Supreme sprayers	64.50
139	N-SA2726P-3115	2	Plant Press	16.65
140	N-SA4438P	2	Insect Case	2.60
141	N-SA3150P	2	Insect Net	4.85
142	F-9-998B	1	Cots, Thumb, Asbestos, Pk of 12 Share	6.00
143	F-1-801-1B	1	Sterilizer, Vertical, 230V	880.00
144	F-11-983-27	1	Tube, Rep for UV 11-983-20	83.50
145	F-BL31-33-05-01	2	Nicholas Illuminator, BL31 Share	
146	F-BL-31-05-63-02	1	Eye Piece, 20K	77.00
147	F-12-544E	1	Cover glass, Med think, 10 oz, Rectangular	27.90
148	F-2-923K	3	Carboy, 2 gal, Nalgene Share case of 6	35.80
149		2	Luminous Insect Trap Funnels	50.00
150	F-14-983-10C	3	Thermometers, Share Immersible (-20to150°C)	5.40
151	F-14-647-52	1	Stop watch Share	40.00
152	F-15-223-10C	1	File, Triangular, 15 cm Share Pk of 12	15.10
153	F-15-223-2	1	File, Round, 15cm Pk of 12 Share	20.00
154	F-15-223	1	File, metal, flat Share Pk of 12	21.60
155	F-15-227-2	1	Plier, adjustable 18cm Share	4.95

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156	F-15-227-10	1	Plier, Combination share	2.85
157	F-15-227-20	1	Plier, needle nose Share	6.95
158	F-15-227-25	1	Plier, side cutting Share	8.40
159	F-15-229C	1	Wrench Crescent 25 cm Share	9.00
160	F-15-228-12	1	Wrench opened, 6pc Share	21.00
161	F-15-229-10A	1	Wrench, Allen Share	2.50
162	F-11-394-6C	2	Gloves, Rubber, Size 9, Pair - Share	2.05
163	F-11-394-6E	2	Gloves, Rubber, Size II, Pair Share	2.39
164	F-11-394-30B	1	Gloves, Rubber, Size II, pair	7.00
165	F-13-994-15	2	Respirator, Toxic dusts Share	7.75
166	F-13-994-17	2	Filter, Rep. Pk of 12	4.50
167	F-13-995-11	2	Respirator, Vaport Share	15.00
168	F-13-995-13	1	Cartridges, Rep Pk of 6 boxes	71.50
169	F-11-408-5	1	Goggles Share Pk of 12	14.25
170	F-11-409-2	2	Headgear, Safety Share	7.45
171	F-11-409-1	2	Visor, Safety Share	2.75
172	F-12-007-105	1	Liner, Bench and Drawer Share Pk of 2	78.73
173	F-4-664-A	2	Can, Safety, 1 gallon Share Pk of 6	91.00
174	F-4-664-12	2	Funnel Spouts for safety can Share	1.68
175	F-11-931	1	Kik-Step stool Share	31.00

Table 28

176	F-14-275A	3	Shears, 15cm Share	8.00
177	F-14-357	1	Scoopula Pk of 6 Share	2.20
178	F-2-923G	2	Bottle Polyethylene, 1/2 Gal Share Pk of 6	16.04
179	F-11-499D	4	Hot Plate, Industrial, Lindbergh Share	230.00
180		2	Durite	
181	F-A-407	1	Alcohol, Ethyl 55gal	224.00
182	S-9A-69292	2	Garden Hose, vinyl-rubber, 50 ft rolls 5/8 I.D	11.99
183	F-6-665-17	2	Cheesecloth, Grade 110, 24 Pks	64.00
184	F-A-407	1	Ethyl Alcohol Pk 4 gal	32.40
185	F-A18	2	Acetone Pk 4 gal	36.00
186	F-M-208-S	2	Methyl Ethyl Ketone Pk gal	13.65
187	SE-464	1	Seed cleaner, 220V, 50Hz with screens for rice maize, sorghum, millet	275.00
188		3	Picks with handles	10.00
189	S-9A5081	3	Moltoch Handle	10.00
190	S-9A5122C	3	Moltoch Handle	3.77
191		1	Cross Cut saw, 6 ft.	50.00
192		1	Cross Cut Saw, 4 ft.	50.00
193		1	Wheel Puller	
194	S-9A-20275C	1	Rods, deep penetrating, 215 lb pk	19.95

Table 28

195	S-9A-20273C	1	Rods, deep penetrating, 25 lb pk	29.95
196	S-9A-20285C	1	Rods, Contact, 25 lb pk	19.95
197	S-9A-20284C	1	Rods, Contact, 25 lb pk	19.95
198	S-9A-20698	1	Receptacle for welder	3.99
199	S-9A-20471	1	Electrode assortment for welder	29.95
200		2	Goggles, welder	
201	S-9A-1325	1	Helmer, welder	12.95
202	S-9A-20176	1	Welder, Arc 82 amp. 220V-50Hz, 3 phase	179.00
203	S-9A-6682	1	Sharpenter, bit, 220V	26.99
204	S-9A-6705	1	Bits, drill, twist, 29pc Share	49.99
205	S-9A6708	1	Bit, drill, twist 60pc Share	32.99
206	S	1	Electrician's tool kit (metric)	150.00
207	S-	1	Carpenter's tool kit (metric)	150.00
208	S-	1	Plumber's tool kit (metric)	150.00
209	S-	1	Mechanic's tool kit (metric)	150.00
210	S	1	Plane table, with tripod	35.00
211		1	Slide rule calculator with trig functions	50.00
212		1	Compto meter	
213		1	French curve	
214		1	Squares, YM & PM	

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Table 28

215		1	Protractor	
216		2	60 cm Ruler	
217		2	Meter Stick	
218	N-H1903 N-596	1	Carrying ring	
219	N-H1902 N-593	1	Surveyors Stakes Set of 11	9.40
220	N-Z4679N-7CZ	1	Bostrom Transit 7	411.00
221	N-H2063 N	1	Rod, Transit	40.00
222	N-H2067 N	1	Target	8.00
223	S-28-A-59074C	10	Grease, multi purpose, 5lb can	3.99
224	S-28-A-4955	2	Grease Gun, Manual	5.69
225	N-H2098N-HL48	1	Hi lift 48" Mechanical jack	36.95
226	N-H1169N-6-1125	1	Hydraulic jack, 12 ton	31.45
227	N-H1167N-6-51122	2	Hydraulic jack, 3 ton	18.60
228	N-C6709N-645	1	Nilton 640 homeshop vise	42.50
229	N-C6596N-VB48	1	Blacksmith Hammer 48oz	7.90
230	N-C7249N-VB40	1	" " 40oz	7.40
231	N-C7248N-VB32	1	" " 32 oz	6.90
232	N-C5048N-06502	2	Blacksmith tongs, 24"	19.35
233	N-C6595N-100AS	1	Cast steel anvil	199.15
234	N-Z130N-061H	1	Bufco light forge, with half hood	111.00

Table 28

235	N-H1473N-154	1	Grease fitting assortment	5.95
236	N-C6674N-565	1	Vol-u-matic hi-pressure lubricator	34.25
237	N-C6673N-377	2	Self-priming barrel pump for non-corrosive use	9.95
238	N-C6466N-RB	1	Bent tip pump oiler	2.40
239	N-C6493N-100590	4	Log chain, 1/2"	35.65
240	N-C6492N-100550	4	" " , 3/8"	20.50
241	N-C6491N-100540	8	Log chain, 5/16" x 14 ft	14.40
242		2	Log chain, 1" diameter chain, 50 ft long	
243	N-H1353N-MM-212R	1	Mini-mule hoist puller, 2-ton	38.65
244	N-C6616N-7929	1	Trolley for gantry, 2-ton	113.55
245	N-Z322N-D2000	1	Differential chain hoist, 1-ton	107.30
246	N-Z4520N-903157	1	Gantry A frame, 2-ton	497.00
247	N-Z2887N-G-S3	1	Grindstone, Amherst 220V 50Hz	212.70
248	N-H-1990N-DP 4	10	Load Binder	10.00
249	S-64-A-7535N2	1	Cement mixer, with manual handle for power. Seed Treatment with chemicals	190.00

Table 28

250	SA-303	1	Barometer	32.00
251	SA-208	1	Sling Psychrometer	9.00
252	SA-208	1	Extra wicks Pk 12	1.00
253	SA-503	1	Guage, Rain, Metric	75.00
254	SA-504	1	Support for Guage	8.50
255	SA-176	1	Instrument Shelter with metal legs	130.00
256	SA-111	1	Max-min Thermo Metric set/supp	
257	SA-112C	1	Max Thermometer, Metric	9.50
258	SA-113C	1	Min Thermo, Metric	9.50
259	SA-140	1	Soil Thermo 4 Inch, metric	32.50
260	SA-140	1	Soil Thermo 20 Inch, Metric	51.25
261	SA-140	1	Soil Thermo 2 1/4", Metric	30.00
262	SA-140	1	Soil Thermo 40 inch, Metric	63.75
263	F-91-831	5	Cabinets, wall	145.00
264	N-H1877N	1	Mussell Soil color chart	35.10
265	ST-A-28	1	Mussell Tropical soil chart, Set of 2	
266	ST-LT-17	100	Soil moisture cans	
267	Allan Machine Shop	8	Hand corn planter	
268		1	Chalk board, 12 ft	

Table 28

269		1	Screen, wall mount, 5x5 ft.	
270	SISCOMA	2	Paddy thrasher, pedal driven	335.00
271		1		
272	A-60	1	Solv-Bridge	
273	A-54	1	Conductivity cell	
274	A-56	1	Conductivity Cell	
275	A-58	1	Conductivity Cell	
276	A-30		Soil Sodium-Salinity Test Kit	

Table 29

TINDO Agricultural Implements

1	1	Fertilizer spreader, 8 ft.
2	1	Middle Buster
3	1	Sub-soiler
4	1	Lister
5	1	Cultivator shovels 5-8 inch
6	1	Cultivator shovels 5-6 inch
7	1	Bush Hog, PTO-3, extra belts and 1 extra blade
8	1	Harrow, disc, tandem
9	1	Harrow, Bush, hog
10	1	Harrow, St. tooth, 3 gaug
11	1	Lane plane
12	1	Brillion seeder with extra spacers (30 3 pt hitch
13	1	Roller, trailer
14	2	Planet Jr. corn planters
15	2	4-Wheel trailer, 5-ton flatbed
16	1	2-wheel flat bed trailer, 8 ft wide, 14 ft long, tail gate loading
17	4	Calcium chloride 100 lbs.
18	1	Lawn mower, sensation, 20^4, gas, 4 cycle motor rotary 4 collecting baskets, 2 sets of 4 extra wheels, 2 spare blades. 250.00
19	1	Lawn mower tractor, gravely, sickle bar head, 1 extra sickle bar, 2 sets extra knives, 1 set extra guards

Table 29

20	S-32-A29755N	2	Tiller compact, Briggs & Stratton, 5 HP, chain drive.	277.95
21		1	Charger, battery, heavy duty 220V 50Hz, commercial for 6 or 2 volt batteries, 30 Amp	100.00
22		2	Tractor, 100 BHP, diesel, 4 wheel, PTO, hydraulic, Front end lift with bucket, no lights, lifetime battery, umbrella, 4 frame weights	
23		1	Tractor, 100 BHP, diesel, crawler, PTO, hydraulic, Front end blade, bucket, umbrella	
24		1	Truck, 3/4 Ton, Oversize Bed, 350HPV8, gas Trailer hitch on bumper, manual shift, 4 speed aluminum or fiberglass camper cover, no radio, no air-conditioner, 2 outside oversize mirrors, 2 spare tired with tubes, tube patching kit, tire pump, tire irons, tire plugs, oil bath air filter, spare fan belt, full filters, oil filters, 3-5 gallon Jerry cans for gasoline mechanics repair manual, alternator, 5 yr. battery, extra set of brake shoes, no heater, chain supported tail gate, 4 extra shock absorbers, relay.	9,000.0
25		2	Trucks, diesel, 2 1/2 ton rating, 350 HP, no heater no hydraulic lift, no air conditioner, 2 speed rear anle, 5 forward speeds, 5 year battery, overload, springs, without beds, no radio, 2 outside oversize mirrors, 4 tires with tubes, 4 spare tires, 8 spare tubes, tire tools, tire patching kit, oil bath air cleaner, mechanics repair manual.	
26		1	Stake body for above, short bed.	
27		1	Grain body for above, short bed.	
28		1	Grain binder, string tie	
29			Balls of twine	

Table 29

30		2	PTO centrifugal pumps with 3 point pick-up with spraying barrels, 10 foot Boom, pressure regulator, pressure gauge, agitator, _____ assorted nozzles.	
31		1	Manure spreader, PTO, 75 bushel	
32		1	Stationary, thrasher, trailer mounted.	
33		1	Liquid manure wagon-500 gal, gravity flow	
34		1	Liquid manure pump, PTO	
35		1	Corn sheller, PTO	
36		1	Grain Drill, 8 ft	
37		1	Flail type field shopper - 5 ft	
38		1	One row corn picker	
39		1	Side mount sickle bar mower 5 1/2 ft	
40		1	2-row, corn-soybean, milo planter	
41		1	Moldboardplow, 2 bottom, Integral	
42	N-H-1366N	1	McCullough, 7-10-, with chain, chain saw, 16 "	319.95
43	N-H-1526N-44	1	Chain saw, sharpenter	13.95
44	N-H-939N-56697	4	Files, chain saw	1.00
45	N-H-946N-60950	1	File guide	4.40
46	N-H-949N-64198	1	Depth gauge	.95
47	N-H-950N-64359	1	Depth gauge	.95
48		3	Replacement chain	.50
49	N-H-954N-85705	10	Oil, 16 oz can	1.10

50		5	Spark plugs	1.50
51		1	Replacement guide bar	20.00
52	N-H1933N-577	1	Tape Repair Kit	48.80
53	N-H1265N-406ME	3	Meter Tape	36.65
54	N-H1378N-394	1	Metric Measuring Whee	52.50
55	N-H1940N-763	2	Timber carrier	25.10
56	N-H1944N-1519	3	Cant Hook	27.60
57	N-H2204N-302015	3	Wedge	3.50
58	N-H2201N-300	4	Brush Hook	9.95
59	N-C6637N-25908	2	Sledge Hammers	10.75
60	N-H2200N-35MV-36C	3	Single B, T Axe	10.95
61	N-H528N-51	6	Extra Blades	2.70
62	N-H22N-9	2	Bow Saw	4.55
63	N-H330N	2	KBC Plating Bar	13.25
64	N-H84N	100	Wood Pot Labels Pk of 100	1.85
65	N-H9559N-35/1	2	Wheelbarrow	43.35
66	N-H675N-GH12	6	Grass Hook	3.50
67	N-H1622N-8B	2	Snath	7.85
68	N-H679N-42W	2	Scythe Blade	8.35
69	N-H678N-42G	2	Scythe Blades	8.35
70	N-H2094N-HWC243	1	Cultivator	39.95
71	N-H1523N-1001B	2	Garden Seeder	35.25

Table 29

72	N-H2191N-N2 1/2	3	Narrow Hoe	5.95
73	N-H467N-RHSBT7	3	Nursery Hoe	5.60
74	N-H665N-RL226D	3	GP shovel	7.25
75	N-H661N-UDS16	3	Long Blade spade	10.00
76	N-H663N-RL248	3	Garden shovel	7.90
77	N-H660N-UGSUD	3	Garden Spade	8.65
78	N-H668N-E4DSD	3	English Spading task	10.10
79	N-H464N-RHB14	3	Garden Rake	6.35
80	N-H2176N-230	1	Corona Lopper	12.50
81	N-H2181N-T222	1	Wiss Lopping Shears, Teflon	9.60
82	N-H2178N-T78	1	Anvil Pruner	3.75
83	N-H181N-8	1	Pruner	6.90
84	N-H285N-M414	1	Maylan Pruning Saw	23.00
85	N-H7[illegible]7N-33	1	Disston Cured Saw	11.45
86	N-H761N-250SS	1	Teflon Pruning Saw	12.85
87	N-H760H-210SS	1	Disston Teflon Saw	8.60
88	N-C6530N-2A	4	Cyclone Seeder	10.70
89	N-C6522N-12XG	3	Husking Hook	1.10
90	N-C4488N-117	3	Husking Peg	.55
91	N-C6536N	1	Bag Holder	35.35
92	S-C6714N-J1911	10	Stone, Gen Purpose	1.35

Table 29

93	S-30A17064N	1	Air Compressor, 240V	269.99
94	N-C6413N-86	4	Digger, Auger, Post Hole	11.35
95		1	Autopsy Scale, Chatillion 6kg 2 kg dial, 10g divisions	100.00
96	N-C6085N-K270MD	2	Milkscale, Chatillion	75.00
97	NC7122N-150-R	4	Baskets, Gal, 1 1/2 Bu	7.65
98	N-C440N-1515	10	Pail, Galv. 15qt.	4.60
99	N-C6370N-8	2	Scoop with chain	8.65
100	N-C2300NRHAB34 1/2	6	Fork, Hay, 3 Tine	9.00
101	S-9A43397C	1	Mechanics, Set 190 pc	299.00
102	S-9A33013	1	Socket set, metric, 46 pc.	62.00
103	S-9A44442	1	Tongue wrench	59.50
104		24	Files, assorted	
105		1	Valve grinding set	
106		1	Ring changing set	
107		1	Tractor wheel puller	
108	S-9A5181C	1	Vise - 6 inch jaw	59.50
109	9A-65395	2	Bin Organizer	14.99
110	S-9A1129	1	Drill, 1/2, Electric, 220V, 50Hz	50.00
111	S-9A19462C2	1	Bench Grinder, 220V, 50Hz	89.99
112		3	Picks	10.00

113		3	Pick Handles	
114		2	Bits, drill presses, metal	100.00
115	N-H57N-882Y	5	Gratting Knife	6.60
116	N-H283N-6364	1	Trombone sprayer	62.50
117	N-H-1218N	1	Indian Sprayers, SS	88.00
118		1	Rake, Side delivery, Trailer type, 8 feet wide, dog drive	
119		1	Soil chisel	

Table 30

TINDÔ FARM POULTRY

1	N-C6371N-215Z	3	Round egg basket	2.90
2	N-C6360N-635	1	Fowl catcher	1.35
3	N-C6361N	2	Holding Funnel	2.00
4	N-C5914N-5715	1	Poultry Thermometer	3.98
5	N-C5235N-S128	1	Poultry sticker	2.35
6	N-Z57N-65-K	1	Leathy Kerosene Incubator	78.00
7	N-C5610N-666	8	Plastic water fount	.50
8	N-C5611N-750	8	Base, water found	.50
9	N-6369N-842	1	Hanson Scale	13.45
10	N-C7003N-600	2	Scoop	2.00
11		8	Mash Feeders - 60 inch	
12		8	Waterers - 60 inch	
13		2	Nests, set of 12	
14	SE-Viking-2HP	1	Hammer Mill, 220V, 1/2", 50Hz	429.50
15		1	Dust collector and bagger	
16		1	Mixer, 220V, 50Hz, 700 lbs.	
17		100	Coccidiostat lb.	
18		200	Vitamin A, D-3, E lb	
19		8	Chick Feeders, 30"	
20		3	DiCalcium Phosphate Ton	

Table 30

21		4	Ground Limestone tons	
22		5	Soybean Meal tons	
23		200	Vitamin Supplements lb	
24		200	Mineral Supplements lb	
25	S-9A79442	2	Garden Hose	14.95
26	N-C6537N-AL10WGS	2	Scoop !10	12.00
27	N-Z5578N-A100	1	Debeater, 220V 50Hz	49.25
28	N-C6372N-32	1	Candler, 12 Volt	42.50
29		1	Egg Scale	6.16
30		10	Plastic buckets 14 qt.	1.00
31	SEViking-Pg 13	1	Screen, 1/16th, Hammer Mill	11.50
32	SEViking-Pg 13	1	Screen, 1/4", Hammer Mill	11.50
33		1	Wheelbarrow	
34		100	Sacks, Burlap, 100 lbs.	
35		1	Grain augur, 20 ft, 1-HP, 220V, 50Hz 4" Screw conveyor, 1" Shaft With-2 bushel Hopper	500.00

CATTLE NEEDS Tindô

Table 31

1	N-C1279N	14	Rubber Mats	59.85
2	N-C2234N	11	Rubber Mats	48.10
3		30	Rings, Curb imbedded	1.00
4	N-2847N-830	30	Snaps, Swivel, eye	.80
5		30	Tie chains, 2 ft long	5.00
6	N-C1450N	50	Neck chain, clip, red No. 1 thru 50	.90
7		28	Stand Dividers, 90°, 1"	6.00
8	N-C5984N-010	2	Broom	4.15
9	N-C6025N-017	4	Broom handles	1.60
10	N-C5986N-C2DBL	1	Scoop - 10"	9.25
11	N-C6537N-AL10WGS	1	Scoop - No. 10	12.00
12	S-9A79442	1	Garden Hose, 50 feet	14.94
13	N-C988N-31	5	Bullrings	1.05
14	N-C285N-V200C	1	Burdizzo	64.35
15	N-C700-3N-600	1	Scoop	2.00
16	N-C5249N-1D421B	1	Cattle Leaders	5.30
17	N-C5865N-202301	1	Squeeze gate	170.00
18	N-C657N	1	Pliers	.90
19	N-C2094N	1	Tattoo Set, 5 Digit	12.10
20	N-C1357N	2	Ink, Tattoo, Black	.75

Table 31

21	N-C242N-105P	1	Hoof Parer	7.70
22	N-C123N-1896N	1	Horn Rasp	2.85
23	N-C600N	1	Hoof Knife Right	3.85
24	N-C5615N-WGV-68	3	Water Control Valves	11.50
25	N-C2300N-RHAB 34 1/2	2	Pitch Fork, 3 tine	9.00
26	N-C862N-A54	2	Manure, 5 tine	10.00
27	N-C865N-E10	1	Silage, Fork	20.00
28	N-3115N	2	Weighing tapes, CMS	1.42
29	N-C5987N-2158	2	Scraper	12.00
30		50	Cross clamps, Divider	4.00
31	N-C5333N	3	Triple Bacterin, 250 Ml	2.65
32	N-C5337N	3	Nitro Furazone, 6 oz.	2.10
33	N-C5745N	3	Oxy-tet 50, 500 Ml	8.00
34	N-C5339N	3	Vit. A,D,B-12, 250 Ml	12.55
35	N-C5347N	2	PL-3, 100 Ml	26.10
36	N-C6927N-D845	3	Triple Sulfa	10.95
37	N-C563N	5	Sulfa 14, 500 Ml	2.65
38	N-C5194N-7490	5	Combiotic, 100 Ml	5.40
39	N-C6925N-860	5	Seour Tablets	8.95
40	N-C638N-V2505	1	Stethoscope	4.85

Table 31

41	N-C598N-CT5H	2	Thermometer	2.10
42	N-C6271N	2	Glove, Plastic, Pk	4.80
43	N-C308N-856N	1	Trocar	4.95
44	N-C299N9	1	Dose Syringe	8.65
45	N-C4127N-512	1	Syringe, 12 Ml/needle, 100	20.00
46	N-C4125N-506	1	Syringe, 6 Ml/needle, 100	19.00
47	N-C4129N-503	1	Syringe, 3 Ml/needle, 100	10.45
48	N-C335N-915N	1	Obstetrical chain	1.70
49	N-C1014N-1032	1	Obs. chain handle	3.30
50	N-C181N-1d418	1	Dehorner	7.25
51	S-32A10952N	5	Fence Cattle, 45' Roll	59.99
52	S-32A10405N	110	Posts, Steel 7 ft.	2.79
53	S-32A21945N	6	Anchors, Post, 6 in.	6.19
54	S-32A21902C	1	Driver, post	11.49
55	S-32A21914	1	Stretcher, Hoist	16.59
56		1	Thihenzole 100 lbs.	
57		1	Pit, Silo	
58	N-C5119AN-800B	1	Platformscale, Kg	698.00
59		1	Wheelbarrow	
60	N-C5735N-900	5000	Fenceposts, Fiberglass	1.00

Table 3~~2~~1

61	S-32A22033	1	Solid state, indoor mount electronic Fence charge, 55 charges per minute up to 25 Miles	45.99
62	S-32A22037	4	Replacement Fuse, Pk of 12	1.59
63	N-C3178N-4312B	2	Fence chargers, 12 Volt battery operated up to 15 miles.	37.00
64	S-23A4305N	2	Five year rechargeable 12 Volt batteries	46.99
65	S-32A22058C	40	Wire, 14 gage, electric fence, 1/4 mile reel	13.99
66	S-32A22165	24	Gate handles eac.	.89

Table 32 Tindô Training Center Equipment

1	1	Projector, Movie, Sound, 16 MM, 220V 50Hz
2	5	Projector bulbs for above.
3	1	Film strip-slide projector with case, 220V 50Hz
4	5	Projector lamps for above
5	1	Portable screen, 60x60"
6	2	Pulldown screens, dining room and training room.
7	1	Table, 2 shelf, Projection
8	1	Projector, Overhead
9	1	Chalkboard, 12 feet
10	1	Peg Board, Cork
11	10	Chalk, White, box
12	3	Erasers, dozen
13	1	Flip top easel
14	4	Fillers, easel