

Chapter 4

Selection of Projects Introduced

One of the basic conditions affecting the feasibility of the Nyeri Industrial Estate is the possibility of company location. First, it is necessary to select the industrial projects which can be realized in the Nyeri District and then decide if they can be introduced into the Industrial Estate.

Future investigations must be performed to evaluate quantitatively whether or not the local population can start the various industrial projects by themselves and sufficient profits can be assured.

4-1 Basic Conditions for Project Selection

In the establishment of industries in the Nyeri District, priority will be given to those industries which meet the following conditions:

- (1) Industries which will supply industrial products to the Nyeri District market (industries to replace imports and shipping in of products from other areas)
- (2) Industries which will process resources of the District (industries to process agricultural and forestry products)
- (3) Industries developed together with the formation of new markets (industries connected with agricultural promotion projects, industries which market agricultural products, industries concerned with the introduction of new agricultural products and their processing, etc.)
- (4) Industries connected with the expansion of existing industries (the so-called supporting industries, one example in the case of Nyeri is lumbering related industry)
- (5) Industries with the competitiveness to advance into other markets, especially in the Nairobi region (non-durable consumer goods)
- (6) Industries dispersed from the Nairobi capital region

The basic policy will be to selectively introduce those industries which meet these selection conditions, have employment capacity and can be established with a small investment.

4-2 Selection of Industrial Projects

To the industrial products and types of industry listed on the basis of the conditions mentioned above and the possibility of obtaining investment from various fields, the projects recommended by the K.I.E., I.S.P.C., I.C.D.C. and government financial leaders in the Nyeri District. This resulted in a total of 277 projects for selection.

The greatest number of these projects are of the type which produce finished products from imported raw materials, i.e. import replacement industries. The next largest number are agricultural processing industries which depend on agricultural raw materials. Many of the industrial products are intended for public consumption (28.4%) with a tendency to the replacement of imported consumer goods. In the case of industrial investment, the highest amount is for industrial

Table 4-1 List of Projects to be Selected

1	Ham and sausage	58	Cardigans, jerseys	118	Rayon staple
2	Meat processing	59	Textile processing (small items)	119	Polyester textiles
3	Butter and cheese	60	Label tape for clothing	120	Soaps, cosmetics
4	Special dairy products	61	Concrete/chip board	121	Paints
5	Egg white powder	62	Plywood, single sheets	122	Printing ink
6	Egg yolks and mayonnaise	63	Prefabricated housing	123	Insecticides, herbicides
7	Tomato catchup	64	Particle board	124	Nicotine sulfate (insecticide)
8	Dried fruits and vegetables	65	Bamboo products	125	Urea resins (adhesives)
9	Frozen fruits and vegetables	66	Coca Cola boxes	126	Pine resin refining
10	Canned vegetables (asparagus, mushrooms)	67	Wooden clothes pins	127	Ogalite (charcoal)
11	Vinegar	68	High class furniture	128	Lacquer (refined)
12	Maize powder	69	Ordinary furniture	129	Charcoal
13	Sugar plant	70	Steel pipe furniture	130	Tanning agents (plant-origin)
14	Sugar refinery	71	Steel cabinets	131	Writing ink
15	Bread and cake manufacture	72	Picture frames	132	Petroleum products
16	Biscuits and cookies	73	Kraft pulp	133	Rubber sandals (used rubber)
17	Candy and nougat	74	Wheat straw pulp	134	Plastic sandals
18	Fresh juice	75	Rice straw pulp	135	Rain boots (plastic rubber)
19	Powdered juice	76	Bamboo pulp	136	Rubber hose
20	Fruit juice (mango nectar, lime juice)	77	Pagus pulp	137	Rubber sundries
21	Alcoholic beverages (molasses, pineapple juice)	78	Waste paper pulp	138	Regenerated tires
22	Domestic animal feed	79	Waste paper pulp	139	Tanning
23	Domestic animal waste utilization (bone meal, gelatin)	80	Kraft paper	140	Footwear
24	Pet food	81	Low class paper (cardboard)	141	Leather handbags
25	Fish meal	82	Carbon paper	142	Plastic handbags
26	Corn germ oil	83	Corrugated cardboard box	143	Wild animals and leather processing
27	Cottonseed oil	84	Paper bags	144	Plate glass
28	Sunflower oil	85	Cardboard boxes	145	Mirrors
29	Castor oil, palm oil	86	Paper cups and plates	146	Glass containers
30	Bread and feed yeasts	87	Cellophane	147	Miscellaneous glass utensils
31	Black tea factory	88	Low class paper (toilet tissue)	148	Fiberglass products
32	Liquefied tea	89	Filters (for milk)	149	Light-weight porous concrete
33	Casaba products	90	Paper napkins	150	Red bricks
34	Instant noodles	91	Paper tape for packaging	151	Fiber moisture bonding
35	Malt, syrup	92	Cardboard tubes	152	Clay construction materials
36	Coffee processing	93	Printing, bookbinding	153	Sand lime brick
37	Instant coffee	94	Fertilizers	154	Ceramics
38	Oatmeal, cornflakes	95	Caustic soda	155	Ceramic insulators
39	Baby foods	96	Chlorine	156	Acoustic tiles
40	Powdered or concentrated bananas	97	Hydrochloric acid	157	Grinding materials
41	Macadamia nut products	98	Soda ash (Bogaria lake water)	158	Grindstones
42	Instant soup	99	Salt ash (Bogaria lake water)	159	Paper and cloth files
43	Wool products (spinning, dyeing)	100	Tanning agents (Cr)	160	Artificial jewels
44	Spinning, weaving	101	Sulfuric acid	161	Asbestos board
45	Nylon knitting	102	Ammonium sulfate	162	Iron making
46	Towels	103	Carbon disulfide	163	Rods
47	Men's clothing fabric	104	Sodium sulfate	164	Tin plate
48	Knitted goods	105	Fluorine compounds (Bogaria lake water)	165	Wire manufacture
49	Knit goods	106	Solvents	166	Casting plant
50	Socks, stockings	107	PVA	167	Non-ferrous metal forging
51	Decorative textiles	108	Acetic acid	168	Cans for canneries
52	Shoelaces	109	Ethanol	169	Hand tools
53	Elastic cord	110	Vinyl acetate	170	Forestry tools and parts
54	Wool treatment (scouring)	111	Formalin	171	Spoons, toothbrushes, etc.
55	Wool carpets	112	Methanol	172	Band saw blades
56	Ready-made clothes	113	Molasses derivatives (alcohol, etc.)	173	Agricultural implements (manual)
57	Ladies' clothing	114	Food coloring agents	174	Construction tools
		115	Industrial coloring agents	175	Cutlery
		116	Furfural	176	Locks
		117	Urea resins (for processing)	177	Piping parts

Table 4-1 (Continued)

178	Solar heaters	212	Motors	243	Jewel processing
179	Curtain rails	213	Transformers	244	Music boxes
180	Steel fixtures and doors	214	Switches, distribution panels	245	Plastic toys
181	Ironworks	215	Urea resin processing	246	Rubber balls, rubber toys
182	Decorative fixtures	216	Electrical appliance parts (sockets, fittings)	247	Wooden toys
183	Kitchen utensils (aluminium)	217	Household appliances (irons, water heaters)	248	Tricycles
184	Aluminium milk containers	218	Household buzzers	249	Wooden sports equipment
185	Kitchen utensils (iron, stainless steel)	219	Light bulbs (ordinary, for domestic use)	250	Leather sports equipment
186	Metal plating	220	Light bulbs (small type)	251	Pencils
187	Metal net and nails	221	Flashlights	252	Canvas
188	Barbed wire	222	Lampshades	253	Plastic stationery items
189	Welding rods	223	Road lighting equipment	254	Leather accessories
190	Bolts and nuts (general)	224	Manufacture of communication equipment	255	Interior decorations, coverings
191	Wood screws	225	TV set assembly	256	Beaded accessories
192	Machine screws	226	Computer assembly	257	Plastic buttons
193	Rivets	227	Semiconductors	258	Metal buttons, thumbtacks
194	Springs, buffer material	228	Motorcycle and scooter assembly	259	Fasteners
195	Portable Diesel engines	229	Crankshaft manufacture and repair	260	Pins, eyelets
196	Portable spray equipment	230	Manufacture of automobile parts	261	Plastic sundries
197	Cultivators (self-propelled type)	231	Bicycles	262	PVC pipe fittings
198	Small tractors	232	Bicycle parts	263	PVC leather products
199	Weeders (self-propelled type)	233	Boats	264	Plastic egg trays
200	Machine tools	234	Aircraft assembly	265	Plastic milk containers
201	Electrical machine tools	235	Bicycle carts	266	Strawberry containers
202	Cotton treatment equipment	236	Wheelbarrows	267	Fishing floats
203	Tea and coffee processing equipment	237	Rolling stock chains	268	Matches
204	Hand printing equipment	238	Weighing machine assembly, parts	269	Road signs, etc.
205	Portable irrigation pumps	239	Flowmeter assembly	270	Plastic road signs
206	Plant machinery	240	Medical equipment	271	Wigs
207	Copy machines (blue type)	241	Adhesive plaster	272	Razor blades
208	Hole punchers, staplers	242	Spectacle frames, sunglasses	273	Machine repair shops
209	Water plugs, valves			274	Electrical appliance repair shops
210	Sprinklers			275	Textile design consultants
211	Small generators			276	Wood carving design consultants
				277	Industrial consultants

raw materials (28.4%) followed by materials for sundries (20.5%), construction (8.3%) and agriculture (7.3%).

4-3 Basic Concepts of Project Selection

Only a few of the listed industries (Table 4-2) are present in the Nyeri District where the industrial estate is planned. It has been confirmed that there are now more than 200 small-scale factories in existence but it is doubtful that these can be considered as industrial companies from the standpoints of technical levels, equipment, management methods or product quality. To foster and strengthen these small-scale factories as a basis for future industrialization, more time will be needed to establish stepwise guidance and fostering policies. This should be the main work of the R.I.D.C., I.P.A., etc., in the future.

As was described previously, the investment incentives for industrial projects in the Nyeri District, which is to be industrialized, are low from an objective standpoint when compared with areas such as Nairobi, Mombasa, Nakuru, Kisumu and Eldoret where industrial estates have already been constructed. Therefore, our task in this survey is to single out as many projects as possible with a high possibility of starting based on the creation of the administrative incentives (overall aid measures for establishment of the industrial estate) required for promotion of indus-

Table 4-2 Company Distribution According to Main Market, Type of Industry and Scale
(Number of firms with ten employees or more)

No.	Type of industry	Name of City										Scale of firms								
		Nairobi	Mombasa	Nyeri	Nakuru	Kisumu	Eldoret	Kisii	Kericho	Kakamega	Embu	Other	Total	Small (5-49 person)	%	Medium/large	%			
243	Clothing	66(61)	27		2	3	1							1	8	108	83	77	25	23
260	Furniture, interior goods	62(69)	11		1	6	1								8	90	80	89	10	11
280	Printing, etc.	60(70)	11	1	1	6	1								6	86	77	90	9	10
251	Lumbering	14(18)	4	1	8	2	8								41	79	44	56	35	44
350	Metal processing	42(62)	19		2	2									3	68	49	72	19	28
390	Misc. industries	42(62)	14								1				57	47	47	82	10	18
205	Cereal processing	15(38)	5		3	4	2								9	39	34	87	5	13
206	Bread and cakes	12(33)	5	1	1	4	2				1				8	36	32	89	4	11
319	General chemicals	30(91)	2		1										33	25	25	76	8	24
360	Machinery	22(67)	2		1	7									1	33	29	88	4	12
209	General foods	17(65)	3		3						1				2	26	23	88	3	12
339	Non-metals	14(61)	5		1										3	23	18	78	5	22
383	Automobiles	18(78)	1			3	1								4	23	21	91	2	9
199	Non-metal industries	17(74)	2												20	13	65	7	35	
272	Paper and cardboard	13(65)	7												1	17	13	76	4	24
315	Soap	8(47)	5		1	2									13	9	69	4	31	
300	Rubber products	10(77)	1		1	1									12	6	50	6	50	
244	Textile products	6(50)	5		1										1	12	12	100	-	-
122	Metal mining	7(58)				1	1				1				2	11	7	64	4	36
202	Dairy products	4(36)			2	1	2								5	11	2	18	9	82
203	Fruit and vegetable canning	4(36)			2										1	11	10	91	1	9
241	Footwear	5(45)	3		1						1				6	10	6	60	4	40
207	Sugar production and refining	0(0)	1			1									1	10	7	70	3	30
214	Cooled beverages and soda water	2(20)	4	1		1									10	9	90	1	10	
299	Fur and leather products	10(100)													10	5	50	5	50	
370	Electrical machinery and tools	10(100)													10	5	50	5	50	
Total		510(59)	137	4	32	44	22	4	2	5	1	110	871	676	78	195	22			

trial development so that the profitability of investments for the future will be demonstrated and it will become practical to start more companies in the future.

4-4 Project Selection Sequence

Because of the large number of projects among those to be selected, it was first necessary to make a selection based on a qualitative evaluation. The first step is a selection according to market factors and the second stage is a selection in accordance with competition with existing industries, location trends, procurement of raw materials and obtaining personnel.

After screening for these two stages, project names or product names listed at random were adjusted and the number of projects was narrowed down. Finally, a final overall evaluation was performed in accordance with socio-economic factors in the Nyeri District.

[Project list based on selection policies]	
↓	
[Projects recommended by the KIE, ISPC, ICDC and Nyeri political and business leaders]	277 projects
↓	
[First selection based on market factors]	125 projects
↓	
[Second selection based on competition, location trends, procurement of raw materials and obtaining personnel]	99 projects
↓	
[Adjustment of industry and product names]	43 projects
↓	
[Overall evaluation according to socioeconomic factors]	30 projects
↓	
[Suitability evaluation for standard factory sheds]	
↓	
↓	
[Suitable projects for standard factory sheds]	17 projects
↓	
[Suitable projects for free design area]	13 projects

4-5 Projects Selected According to Market Factors (First Selection)

The most important key to the success of an industrial project size of the possible effective market. At the stage where production costs are not clear, the markets concerned were broken down as follows and decisions were made according to qualitative potentiality.

(1) International market

Industrial products which can be produced for the international market are as follows:

- a. Conventional international products for export.
- b. Products which can be newly developed on the basis of international market needs.
- c. Products which can be exported on the basis of future changes in the international production structure.

Products corresponding to a. include black tea, processed Dalmatian insect powders, processed leather goods and soda ash. Those corresponding to b. include processed primary industrial products (especially processed agricultural and forestry products). In the case of c., potential products include labor intensive products and raw material oriented products such as textile processed products (sewn products), lumbering and plywood and sundries.

On the basis of Kenya's current foreign trade, there is unbalance between imports and

exports with the main trading partners and it is desirable to further promote exports to remedy this unbalance. It will be important to stress as much as possible measures for the development and sales of products directed to these countries with which there is an unfavorable balance of trade.

(2) Total domestic market and neighboring countries

Conventionally, Kenya has maintained an extremely profitable position in trade with East African countries. From this market standpoint, exports to these countries can be considered as an extension of the domestic market. However, in accordance with conventional preferential relations, it is also important to consider these markets as part of the international market and therefore, price competition with other countries becomes stronger. Regional predominance with respect to exports to neighboring countries involves Mombasa in the case of Tanzania and Western cities such as Kisumu, Eldoret and Kitale in the case of Uganda because of market distance. However, if the predominance of production costs compensate for the inferior conditions with respect to market distance, exports from other regions are naturally also possible. The characteristics of these markets is that there is no necessity of production intended only for exports because the goods in circulation are almost all common and are supplied to both the domestic and export markets. The important point concerning this project is to establish the major items of the sales market in the domestic market and consider the export market as a buffer for the domestic market. Therefore, the market in neighboring countries has been placed in the category of the total domestic market.

Estimation of the competition in the domestic market in Kenya should be possible by investigating Nairobi, the capital and the site of more than 60% of the country's industrial companies. Currently, the number of companies in Kenya which can maintain a predominant marketing position throughout the country are few since there are no monopolies, and it is risky to set a company scale with the total potential domestic purchasing power as the total effective market. In setting the scale of the domestic market, it is necessary to perform a careful investigation of the product marketing structure, distribution methods (transport network), inventory control and distribution costs, final pricing policies, etc.

Projects which can be considered for this market must meet the following conditions:

- a. There must be no competing companies in the country (or around the major domestic markets).
- b. The products must be able to compete with imports with respect to both price and quality.
- c. It must be possible to assure a market base which is not unfavorable with respect to location even when other companies are established in Kenya in the future.

If there are any uncertain points concerning the above conditions, it is necessary to reduce the market size accordingly.

(3) Regional markets (partial domestic market)

In practice, there is constant competition in the market and such competition is not simple in form. It is also rash to think that competition is always impossible because there are many companies of the same type. Designs differ even for products of the same type and price and there are usually slight differences in quality and the impression given. The amount purchased also differs according to the purpose of the pur-

chaser. Therefore, these coexisting companies have a form of sharing via a sales strategy for a share of the same market. Market classification in some cases would be more suitable expressed in the form of a market share rather than a regional classification.

When evaluating a project on the basis of this concept, it is important to estimate future demand for the products concerned and that there not be too many existing companies. However, products for which there is already excessive competition and products which are supplied exclusively by large companies should in principle be avoided. Therefore, potential projects in this category involve products where the scale of the existing companies are about the same as the planned scale, the market is not saturated (there are imports) and it is expected that demand will increase in the future. However, in this case, it appears that it will generally be impossible to avoid an unfavorable location unless competition with existing companies in the capital region around Nairobi involves some favorable conditions with respect to production costs for raw materials, etc. Conversely, if there is regional superiority with respect to production costs, there should also be a possibility of market encroachments in other areas because of the superior price differences.

(4) Local market

The local market is small from the standpoint of scale and therefore, it is necessary to keep projects limited to cases where economic production is possible on a small investment scale or the industry is of the type which will fit the local market from the beginning (local industrial financing, etc.). However, it can be considered that there is a sufficient market to the north of Nyeri.

Among the projects which can be considered as belonging to this category are types of industry with a strong tendency to be scattered in regional cities with respect to the existing companies in Kenya and companies of the type which do not currently exist in Kenya.

Fig. 4-1 shows the first stage project selection process described above.

4-6 Second Selection

For the various projects selected in the first selection, a second selection was made with the main stress on lightening the competition in cases where companies of the same type already exist in Kenya, especially in the Nyeri District; and such problems as general location superiority and the obtaining of raw materials and personnel. Table 4-4 shows the results.

4-7 Adjustment of Selected Projects

The projects selected in the second selection (99) were adjusted by combining various products as shown in Table 4-5 since there was a jumbled mixing of items considered as planned for the same project with respect to product properties and manufacturing processes. The final results are compiled in Table 4-6.

Fig. 4-1 Project Selection on the Basis of Marketability

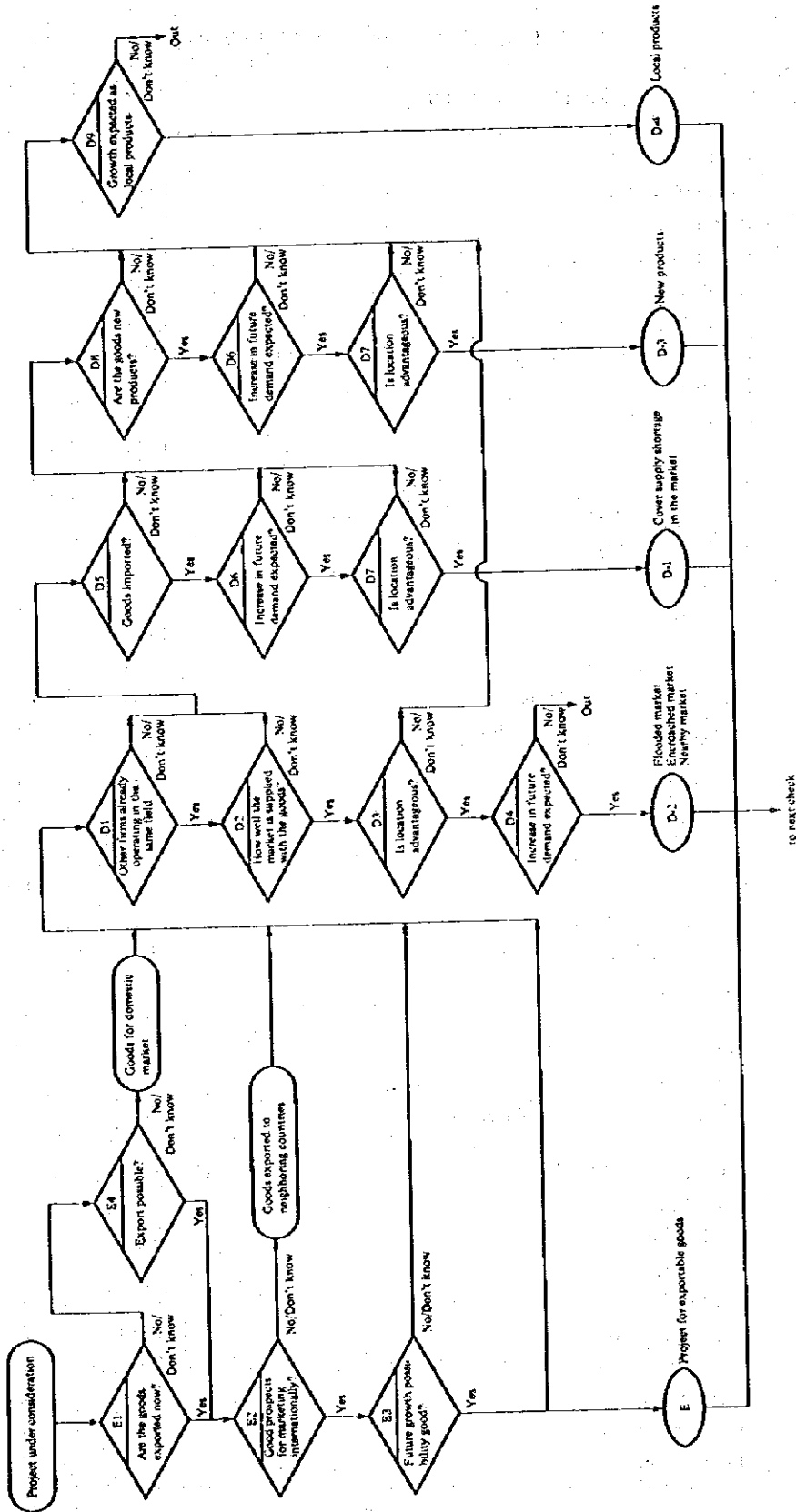


Table 4-3 First Selection Project and Selection Factor

List Number	First Selection Project	U.S.I.C.	Selection Factor (from Fig. 4-1)
1	Ham and sausage	1811	D-2
2	Meat processing	1811	D-2, E
3	Butter and cheese	1812	D-1, (D-2), E
4	Special dairy products	1812	D-1, E
8	Dried fruits and vegetables	1831	(D-2), E
22	Domestic animal feed	1891	D-1, E
23	Domestic animal waste utilization (bone meal, gelatin)	1891	D-3, E
25	Fish meal	1892	E
26	Corn germ oil	1911	D-2, E
27	Cottonseed oil	1911	D-2, E
28	Sunflower oil	1911	D-2, E
30	Bread and feed yeasts	1921	D-1
31	Black tea factory	1922	D-1, (D-2), E
33	Casaba products	1923	D-3, E
35	Malt, syrup	*1927 (1924)	D-1, E
36	Coffee processing	1931	(D-2), E
41	Macadamia nut products	1931	E
43	Wool products (spinning, dyeing)	*2023 (2063)	D-1, E
46	Towels	2041	D-4
48	Knitted goods	205	(E)
49	Knitt goods		(E)
50	Socks, stockings	2054	D-4
51	Decorative textiles	208	D-4, E
54	Wool treatment (scouring)	2091	D-4, E
55	Wool carpets	2096	D-1, E
56	Ready-made clothes	211	D-4, E
57	Ladies' clothing	2112	D-4
58	Cardigans, jerseys	2112	D-4, E
59	Textile processing (small items)	*215 (2141)	D-4, E
61	Concrete/chip board	222	D-4
62	Plywood, single sheets	2222	D-1, E
64	Particle board	2224	D-1, E
65	Bamboo products	2231	D-4
66	Coca Cola boxes	2233	D-4
68	High class furniture	2311	E
69	Ordinary furniture	2311	D-2
72	Picture frames	2394	D-1, E
74	Wheat straw pulp	241	D-3
76	Bamboo pulp	241	D-3

List Number	First Selection Project	J.S.I.C.	Selection Factor (from Fig. 4-1)
81	Low class paper (cardboard)	2422	D-1
82	Carbon paper	2499	D-1
89	Filters (for milk)	2499	D-4
90	Paper napkins	2499	D-4
91	Paper tapé for packaging	2499	D-1
93	Printing, bookbinding	*253 (254)	D-4
98	Soda ash (Bogaria lake water)	2621	E
100	Tanning agents (Cr)	2629	D-1, E
105	Fluorine compounds (Bogaria lake water)	2629	E
117	Urea resins (for processing)	2637	D-4
123	Insecticides, herbicides	2693	D-4
125	Urea resins (adhesives)	2696	D-4
126	Pine resin refining	2698	D-1, E
127	Ogalite (charcoal)	2698	D-4
128	Lacquer (refined)	2698	D-3, E
129	Charcoal	2698	D-4
130	Tanning agents (plant-origin)	2698	E
137	Rubber sundries	2833	D-1
138	Regenerated tires	2894	D-4
139	Tanning	2911	D-1, E
140	Footwear	2941	E
141	Leather handbags	2971	E, D-1
142	Plastic handbags	2971	D-4
144	Plate glass	3011	E
147	Miscellaneous glass utensils	3016	D-1
149	Light-weight porous concrete	3023	D-4
150	Red bricks	3032	D-4
152	Clay construction materials	3039	D-4
153	Sand lime brick	3039	D-4
154	Ceramics	3042	E, D-1
155	Ceramic insulators	3044	E, D-1
156	Acoustic tiles	3046	E, D-1
166	Casting plant	3163	D-4
173	Agricultural implements (manual)	3327	D-1
174	Construction tools	*3329 (3341)	D-4
176	Locks	3329	D-4
177	Piping parts	3331	D-4
179	Curtain rails	3341	D-4
180	Steel fixtures and doors	3342	D-4
181	Ironworks	3343	D-4
182	Decorative fixtures	335	D-1

List Number	First Selection Project	J.S.I.C.	Selection Factor (from Fig. 4-1)
184	Aluminium milk containers	3352	D-4
186	Metal plating	3357	D-4
187	Metal net and nails	*3369 (3361)	D-4
188	Barbed wire	3369	D-4
191	Wood screws	3371	D-4
195	Portable Diesel engines	3413	D-1
196	Portable spray equipment	3421	D-3
197	Cultivators (self-propelled type)	3421	D-4
198	Small tractors	3421	D-4
199	Weeders (self-propelled type)	3421	D-4
203	Tea and coffee processing equipment	3461	D-2
205	Portable irrigation pumps	3471	D-1
206	Plant machinery	3478	D-1
207	Copy machines (blue type)	3492	D-4
210	Sprinklers	3492	D-1
211	Small generators	3511	D-4
214	Switches, distribution panels	3513	D-4
215	Urea resin processing	*3514 (3953 3969)	D-3
216	Electrical appliance parts (sockets, fittings)	3514	D-3
217	Household appliances (irons, water heaters)	3521	D-3
218	Household buzzers	3521	D-3
220	Light bulbs (small type)	3531	D-3
222	Lampshades	3532	D-4
229	Crankshaft manufacture and repair	3613	D-4
235	Bicycle carts	3691	D-3
236	Wheelbarrows	3691	D-1
245	Plastic toys	393	D-3
246	Rubber balls, rubber toys	393	D-3
247	Wooden toys	3931	D-3
249	Wooden sports equipment	3934	D-3
250	Leather sports equipment	3934	E, D-1
251	Pencils	3943	E
253	Plastic stationery items	3949	D-4
254	Leather accessories	3951	D-3
255	Interior decorations, coverings	3951	D-4
256	Beaded accessories	3951	D-4
257	Plastic buttons	3953	D-3
258	Metal buttons, thumbtacks	3954	D-4
261	Plastic sundries	396	D-3
262	PVC pipe fittings	3961	D-4

List Number	First Selection Project	J.S.I.C.	Selection Factor (from Fig. 4-1)
263	PVC leather products	3968	D-4
264	Plastic egg trays	3969	D-4
266	Strawberry containers	3969	D-4
273	Machine repair shops	8311	D-4
274	Electrical appliance repair shops	8312	D-4

Table 4-4 Second Selection

Ref. No.	Project Name	I.S.I.C.	Classification	Competition	Location	Raw Materials	Personnel	2nd Selection Result	
1	Ham and sausage	1811	Food and tobacco production					○	
2	Meat processing	1811							○
3	Butter and cheese	1812			X				
4	Special dairy products	1812			X				
8	Dried fruits and vegetables	1812			X				
22	Domestic animal feed	1891							○
23	Domestic animal waste utilization (bone meal, gelatin)	1891							○
25	Fish meal	1892				X			
26	Corn germ oil	1911							○
27	Cottonseed oil	1911					Δ		○
28	Sunflower oil	1911					Δ		○
30	Bread and feed yeasts	1921					Δ		○
31	Black tea factory	1922			X				○
33	Casaba products	1923					Δ		○
35	Malt, syrup	*1927 (1924)							○
36	Coffee processing	1931		X					
41	Macadamia nut products	1931			X				
43	Wool products (spinning, dyeing)	*2033 (2063)	Textile industry (excluding textile products such as clothes)					○	
46	Towels	2041				Δ			○
48	Knitted goods	205				X			
49	Knitted goods					X			
50	Socks, stockings	2054				Δ			○
51	Decorative textiles	208				Δ			○
54	Wool treatment (scouring)	2091							○
55	Wool carpets	2096							○
56	Ready-made clothes	211							○
57	Ladies' clothing	2112					Δ		○
58	Cardigans, jerseys	2112	Clothes and other textile products			Δ		○	
59	Textile processing (small items)	*215 (2141)							○
61	Concrete/chip board	222	Wood and wood products	X					
62	Plywood, single sheets	2222							○
64	Particle board	2224			Δ				○
65	Bamboo products	2231							○
66	Coca Cola boxes	2233	Furniture and fixtures					○	
68	High class furniture	2311							○
69	Ordinary furniture	2311			Δ				○
72	Picture frames	2394			Δ				○
74	Wheat straw pulp	241	Pulp, paper and paper products					○	
81	Bamboo pulp	241							○
76	Low class paper (cardboard)	2422							○
88	Low class paper (toilet tissue)	2499					Δ		○
89	Filters (for milk)	2499					Δ		○
90	Paper napkins	2499					Δ		○
91	Paper tape for packaging	2499					Δ		○

Ref. No.	Project Name	J.S.I.C.	Classification	Competition	Location	Raw Materials	Personnel	2nd Selection Result	
98	Soda ash (Bogaria lake water)	2621	Chemical industry		X				
100	Tanning agents (Cr)	2629					Δ		○
105	Fluorine compounds (Bogaria lake water)	2629				X			
117	Urea resins (for processing)	2637							○
123	Insecticides, herbicides	2693			X				○
125	Urea resins (adhesives)	2696							○
126	Pine resin refining	2698					Δ		○
127	Ogalite (charcoal)	2698							○
128	Lacquer (refined)	2698					▲		
129	Charcoal	2698			X				
130	Tanning agents (plant-origin)	2698		X					
141	Leather handbags	2971	Leather and leather products, furs					○	
142	Plastic handbags	2971							○
144	Plate glass	3011	Ceramics and pottery products		X			○	
147	Miscellaneous glass utensils	3016							○
149	Light-weight porous concrete	3023							○
150	Red bricks	3032			Δ				○
152	Clay construction materials	3039			Δ				○
153	Sand lime brick	3039			Δ				○
154	Ceramics	3042			Δ				○
155	Ceramic insulators	3044							○
156	Acoustic tiles	3046							○
166	Casting plant	3163		Iron and steel					○
173	Agricultural implements (manual)	3327					Δ		○
174	Construction tools	*3329 (3341)							○
176	Locks	3329							○
177	Piping parts	3331							○
179	Curtain rails	3341							○
180	Steel fixtures and doors	3342					Δ		○
181	Ironworks	3343							○
182	Decorative fixtures	335							○
184	Aluminium milk containers	3352			X				○
186	Metal plating	3357						○	
187	Metal net and nails	*3369 (3361)		X					
188	Barbed wire	3369		X					
191	Wood screw	3371		Δ		Δ		○	
195	Portable Diesel engines	3413	General machinery and tools			Δ		○	
196	Portable spray equipment	3421							○
197	Cultivators (self-propelled type)	3421			Δ		Δ		○
198	Small tractors	3421			Δ		Δ		○
199	Weeders (self-propelled type)	3421			Δ		Δ		○
203	Tea and coffee processing equipment	3461							○
205	Portable irrigation pumps	3471							○
206	Plant machinery	3478							○
209	Water plugs, valves	3492							○
210	Sprinklers	3492							○

Ref. No.	Project Name	J.S.I.C.	Classification	Competition	Location	Raw Materials	Personnel	2nd Selection Result					
211	Small generators	3511	Electrical machinery and tools	Δ				○					
214	Switches, distribution panels	3513											
215	Urea resin processing	*3514 3953 (3969)							Δ	○			
216	Electrical appliance parts (sockets, fittings)	3514							○				
217	Household appliances (irons, water heaters)	3521							○				
218	Household buzzers	3521							○				
220	Light bulbs (small type)	3531							○				
222	Lampshades	3532							○				
229	Crankshaft manufacture and repair	3613							Transport machinery and tools		Δ		○
235	Bicycle carts	3691											
236	Wheelbarrows	3691	○										
245	Plastic toys	393	○										
246	Rubber balls, rubber toys	393	○										
247	Wooden toys	3931	○										
249	Wooden sports equipment	3934	○										
250	Leather sports equipment	3934	○										
253	Plastic stationery items	3949	○										
254	Leather accessories	3951	○										
255	Interior decorations, coverings	3951	Other manufacturing industries	X			○						
256	Beaded accessories	3951											
257	Plastic buttons	3953						○					
258	Metal buttons, thumbtacks	3954						○					
261	Plastic sundries	396						○					
262	PVC pipe fittings	3961						○					
263	PVC leather products	3968						○					
264	Plastic egg trays	3969						○					
266	Strawberry containers	3969						○					
273	Machine repair shops	8311						Other repair industries	Δ			○	
274	Electrical appliance repair shops	8312											

Notes: a. Competition

According to the relation with existing companies in the region and large domestic companies, and the estimated market scale.

x : Unfavorable with respect to competition or resulting in competition.

Δ : Some apprehension but methods for resolving the problems can be considered.

b. Location

x : Clearly unfavorable

Δ : Comparatively unfavorable but not always a decisive factor

c. Raw materials

Δ : Uncertainty concerning procurement of raw materials

▲ : Possibility of raw material development unclear

Table 4-5 Adjustment of Project Items

Ref. No.	Project Name	Adjusted Project Name	Remarks
30	Bread and feed yeasts	Fermentation industry	Stated because of the high possibility of realization
35	Malt, syrup		
26	Corngerm oil	Plant oil industry	Same as oil expression process. Necessary to start cultivation of sunflowers
27	Cottonseed oil		
28	Sunflower oil		
43	Wood products (spinning, dying)	Carpet industry	Planned for overall carpet production
54	Wool treatment (scouring)		
55	Wool carpets		
56	Readymade clothing	Readymade clothing industry	
57	Ladies' clothing		
58	Cardigans, jerseys		
62	Plywood, single sheets	Plywood industry	
64	Particle board		
68	High class furniture	Furniture industry	
69	Ordinary furniture		
74	Wheat straw pulp	Cardboard industry	Planned on basis of raw material which can be obtained cheaply (wheat straw, bamboo). Currently, wheat straw is the most promising raw material. Total production plant from raw material to cardboard planned.
75	Rice straw pulp		
76	Bamboo pulp		
78	Waste paper pulp		
81	Low class paper (cardboard)		
88	Low class paper (toilet tissue)	Pulp products	Imported pulp/waste paper as raw material
117	Urea resins (for processing)	Thermosetting resin industry	215 and 257 will be realized first using imported raw materials. However, manufacture of raw materials will start gradually as plywood industry is developed.
125	Urea resins (adhesives)		
215	Urea resins processing		
257	Plastic buttons		
137	Rubber sundries	Rubber sundries	
138	Regenerated tires		
246	Rubber balls, rubber toys		
150	Red bricks	Kiln industry	Common use of kilns is possible.
154	Ceramics		
155	Ceramic insulators		
156	Acoustic tiles		
149	Light-weight porous concrete	Soil/stone construction materials	
152	Clay construction materials		
166	Casting plant	Ironworks	Total plant for sheet processing, weldings, machining, forging and casting. T.S.C. correlation investigation necessary.
177	Piping parts		
181	Ironworks		
206	Plant machinery	Ironworks	Total plant for sheet processing, weldings, machining, forging and casting. T.S.C. correlation investigation necessary.
229	Crankshaft manufacture and repair		
173	Agricultural implements (manual)	Agricultural implements	
235	Bicycle carts		
236	Wheelbarrows		
174	Construction tools	Construction fixtures	Locks assembled from imported parts
176	Locks		
179	Curtain rails		
180	Steel fixtures and doors		
182	Decorative fixtures	Processing of decorative metal parts	Plating equipment (small type) ordered from abroad
186	Metal plating		
258	Metal buttons, thumbtacks		
197	Cultivators (self-propelled type)	Agricultural equipment assembly	By foreign tie-ups
198	Small tractors		
199	Weeders (self-propelled type)		
195	Portable Diesel engines	Irrigation equipment assembly	By foreign tie-ups. Pumps are plunger type.
203	Portable irrigation pumps		
211	Small generators		
196	Portable spray equipment	Valve industry	
209	Water plugs, valves		
210	Sprinklers		
214	Switches, distribution panels	Electrical parts industry	Sockets and fittings purchased by urea resin processing companies
216	Electrical appliance parts (sockets, fittings)		
222	Lampshades		
217	Household appliances (irons, water heaters)	Domestic electrical industry	
218	Household buzzers		
245	Plastic toys	Plastic processing	Import of used metal molds is economical
253	Plastic stationery items		
261	Plastic sundries		
264	Plastic egg trays		
266	Strawberry containers		
249	Wooden sports equipment	Sporting goods	
250	Leather sports equipment		
247	Wooden toys		

4-8 General Evaluations on Selected Projects and Investigation of Suitability for the Industrial Estate

The following classifications and investigations were performed for the 43 projects obtained from the results of the third selection.

(1) Main products and applications

Classification of the main products, by-products and their applications (refer to Table 4-6).

(2) Project property classification

The following is a regrouping of the project properties obtained by consolidation of the points employed when the projects were originally selected.

- A. Industrial products based on regional raw materials
 - A-a. Existing raw material processing
 - A-b. Existing unutilized raw material processing
 - A-c. Existing raw material added value improvement
 - A-d. Processing of newly developed raw materials
- B. Waste utilization products
 - B-a. Agricultural waste utilization products
 - B-b. Domestic waste utilization products
- C. Import replacement products
 - C-a. New national industries
 - C-b. Market sufficiency production (import replacement promotion)
 - C-c. New products (new products on the Kenyan market)
 - C-d. General replacement products (merchandise or technical replacement)
- D. Export products
 - D-a. Improvement of existing export industries
 - D-b. New exports
- E. Industrial investment
 - E-a. Investment in existing industries
 - E-b. Investment in new industries
 - E-c. New investment
- F. Other goods for general market within the region

These properties are listed for the 43 projects selected as a result of the second selection in Table 4-7.

(3) Investigation of suitability for the estate (prototype factory building)

The evaluation was performed on the basis of suitability factors for the estate (space occupied, properties of raw materials, type and number of personnel, characteristics of processing, characteristics of product, type of industry and environment). Four levels of suitability were used as shown in Table 4-8. These levels are defined as follows:

- A: No problem for the estate
- B: Some problems but not impossible
- C: Some problems and entry difficult
- D: Entry not suitable

(4) Socioeconomic evaluations

The following items have been evaluated qualitatively. (Refer to Table 4-9.)

- A. Contribution to local society

Table 4-6 Main Products and Applications

	Product and by-products		Product applications					
	A Main product	B By-product	Agriculture	Dairying	Industry	Construction	Domestic	Others
1	Meat processing	Bacon, ham sausage			B		A	
2	Domestic animal feed	Compound feeds						
3	Plant oils	Edible oils (plant oil)	B	B	AB		A	
4	Fermentation products	Feed yeast, bread yeast, glucose, starch sugar		A	A		A	
5	Starch	Casaba starch, corn starch		B	A		B	
6	Carpets	Folkcraft carpets					A	
7	Towels	Bath towels					A	A
8	Socks	Socks, stockings					A	A
9	Readymade clothing	Uniforms (for school and office) ordinary readymade clothing					A	A
10	Small textile goods	Folkcrafts, handkerchiefs, tablecloths, scarfs, etc.					A	
11	Flywood	Single sheets, plywood, particle board			AB	A		
12	Bamboo and wood products	Bamboo baskets, wooden boxes, picture frames	A		A		A	A
13	Furniture	Ordinary, standard and high class furniture					A	A
14	Cardboard	Various types of cardboard, straw waste paper pulp			AB			
15	Pulp products	Toilet paper, tissue paper					A	
16	Adhesive tape	Packing tape, cello tape, insulation tape			A	A	A	A
17	Tanning agents (Cr)	Chrome tanning agents			A		A	
18	Urea resins	Adhesives, processing raw materials, various processed products			A	A	A	A
19	Pine resin refining	Natural resin			AB			
20	Sawdust fuel	Charcoal (ogalite), wood fuel					A	
21	Rubber sundries	Regenerated tires, packing, belts			A	A	A	A
22	Tanned skins	Various types of tanned skins, dyed skins			A			
23	Leather products	Bags, personal effects					A	
24	Glass sundries	Tableware, ashtrays, folkcrafts					A	A
25	Kain products	Red bricks, table ware, lavatory fixtures, insulators, tiles			A	A	A	
26	Soil/stone construction materials	Foamed concrete, clay materials				A		
27	Ironworks	Cast and forged products, machining, piping parts, plants	A	A	A	A	A	A
28	Agricultural implements	Agricultural implements, bicycle trailers, wheel barrows	A	A				
29	Construction fixtures	Door locks, curtain rails, steel fixtures, etc.				A	A	
30	Decorative metal goods	Decorative metal fixtures, plating, metal buttons			A		A	
31	Wood screws	Wood screws for carpentry			A			
32	Agricultural equipment assembly	Cultivators, tractors, weeders	A					
33	Irrigation equipment	(Portable) engines, pumps, generators	A		A	A	A	A
34	Valve products	Portable sprayers, sprinklers, valves, nozzles	A			A	A	
35	Electrical parts	Switches, distribution panels, fittings, lampshades			A	A	A	
36	Household appliances	Irons, water heaters, buzzers					A	
37	Small light bulbs	Bulbs for flashlights, Christmas tree bulbs					A	
38	Plastic products	Toys, stationery goods, egg trays, strawberry boxes, other sundries	A				A	A
39	Sporting goods	Leather and wooden sporting goods, toys, game implements					A	
40	PVC leather products	Gloves, hats, etc.					A	
41	Room and outdoor fixtures	Various types of interior and exterior fixtures				A	A	
42	PVC pipes and fittings	Various types of PVC pipes and fitting	A		A	A		
43	Machine repair shops		A	A	A	A	A	A

A: Main product application

B: By-product application

Table 4-7 Project properties

		A				B		C				D		E			F	
		a	b	c	d	a	b	a	b	c	d	a	b	a	b	c		
1	Meat processing	○							○									
2	Domestic animal feed	○	○		○	○			○						○	○		
3	Plant oils	○			○				○						○	○		
4	Fermentation products	○		●				○	○						○	○	○	
5	Starch	○			○				○					○		○		
6	Carpets	○		○				○		○				○				
7	Towels	●							○						○			
8	Socks	●							○									
9	Readymade clothing	●							○									○
10	Small textile goods	●							○									○
11	Plywood	○		○		○			○			○		○	○			
12	Bamboo and wood products	○	○		○			○		○	○			○				
13	Furniture	○							○									○
14	Cardboard	○	○			○	○	○	○	○					○			
15	Pulp products								○									
16	Adhesive tape				○				○						○			
17	Tanning agents (Cr)		●		○			○	○						○			
18	Urea resins				○			○	○		○					○		
19	Pine resin refining		○					○	○	○				○	○			
20	Sawdust fuel		○	○		○		○		○	○							○
21	Rubber sundries		○			○			○		○				○			○
22	Tanned skins	○		○					○			○				○		
23	Leather products	○		○					○			○						
24	Glass sundries		○		○				○									
25	Kiln products		○		○				○						○			
26	Soil/stone construction materials		○	●	○				○		○				○			○
27	Ironworks								○						○			○
28	Agricultural implements		○			○			○	○	○				○		○	○
29	Construction fixtures							○	○	○	○				○			
30	Decorative metal goods								○		○				○			
31	Wood screws								○		○				○			
32	Agricultural equipment assembly								○	○	○				○			
33	Irrigation equipment							○	○	○	○				○		○	
34	Valve products							○	○	○	○				○		○	
35	Electrical parts				○				○						○			
36	Household appliances							○	○									
37	Small light bulbs				○			○	○					○				
38	Plastic products							○	○		○				○	○		
39	Sporting goods	○		○				○		○				○				
40	PVC leather products	●							○		○							○
41	Room and outdoor fixtures	●							○		○				○			
42	PVC pipes and fittings								○		○				○			○
43	Machine repair shops								○		○				○			○

- a. Industrial promotion
- b. Industrial development
- c. Employment promotion
- B. Contribution to the national economy
 - a. Added value
 - b. Introduction of foreign currency
 - c. Conservation of foreign currency

4-9 Final Project List

The 43 projects obtained as a result of the selections in the preceding sections were classified on the basis of the entry suitability for the estate after readjustment based on Table 4-4. With consideration given to the evaluations in Table 4-6, the projects finally selected are as follows:

Projects Suitable for the Estate

Primary Potential Projects (A projects)

1. Carpet manufacturing
 2. Towel manufacturing
 3. Readymade clothing manufacturing
 4. Urea resin processing
 5. Rubber sundries manufacturing
 6. Leather secondary processing
 7. Leather products manufacturing
 8. Ironworks
 9. Agricultural implements manufacturing
 10. Construction fixtures manufacturing
 11. Pulp products manufacturing
 12. Electrical parts manufacturing
 13. Plastics sundries manufacturing
 14. Sporting goods manufacturing
- ###### Secondary Potential Projects (B projects)
15. Bamboo processing and wood products manufacturing

16. Glass sundries manufacturing
17. Machinery repair shops

Projects Unsuitable for the Estate (C projects)

18. Meat processing
19. Plant oil manufacturing
20. Urea resin raw material manufacturing
21. Sawdust charcoal manufacturing
22. Kiln products manufacturing
23. Irrigation equipment manufacturing

(D projects)

24. Livestock feed manufacture
25. Fermentation products manufacturing
26. Starch manufacturing
27. Plywood industry
28. Overall cardboard industry
29. Pine resin refining
30. Skin tanning (primary)

4-10 Location of the Selected Projects in the Industrial Estate

The final project list selected previously has been classified for convenience in accordance with entry suitability on the basis of the industrial estate plans with prototype factory building.

The projects which most effectively match the goals of industrial development in the Nyeri District were actually often placed in the groups of projects unsuitable for the estate in accordance with the evaluations in Table 4-9. These unsuitable projects either could not be accommodated in the currently proposed prototype factory buildings or sites or were not good for the site environment. Therefore, it is desirable to promote the realization of priority industries which will be effective in regional development by various methods in parallel with site preparation and promotion of the entering companies.

It is extremely unfortunate with this site plan that the area is so small that the prototype factory building are limited to 10 and the free design area cannot be assured. As reported in other chapters, if it would be possible to expand to the neighboring areas by crossing the Nyeri municipality border fixed for the site, it would not only be possible to construct the free design site by adopting many of the unsuitable projects in the selected project list, but also to increase the intensive effects of the site construction project.

Table 4-8 Evaluation of Suitability for The Estate

		Suitability for the estate					Evaluation	Remarks	
		Space occupied	Raw materials	Personnel	Process	Products			Environment
1	Meat processing	X		X				C	
2	Domestic animal feed	X			X	X		D	
3	Plant oils				X	X		C	
4	Fermentation products	X		X	X			D	
5	Starch	X	X	X	X	Δ	X	D	
6	Carpets							A	
7	Towels							A	
8	Socks							A	
9	Readymade clothing							A	
10	Small textile goods							A	
11	Plywood	X	X				X	D	
12	Bamboo and wood products							B	
13	Furniture	Δ				Δ		B	Yard necessary
14	Cardboard	X	X	X	X	Δ	X	D	
15	Pulp products	Δ		Δ	Δ		Δ	C	
16	Adhesive tape							A	
17	Tanning agents (Cr)		X			Δ	X	D	
18	Urea resins	Δ					Δ	C*(A)	*Entry of only processing
19	Pine resin refining	X		Δ	Δ	Δ		D	
20	Sawdust fuel						Δ	C*(B)	*In case of fuel equipment
21	Rubber sundries							A	
22	Tanned skins	X	X				X	D*(A)	*Only secondary processing
23	Leather products							A	
24	Glass sundries			Δ				B	
25	Kiln products	Δ		Δ	Δ			C	
26	Soil/stone construction materials	Δ				X		C	
27	Ironworks	Δ						B*(A)	*Gradual increase in facilities
28	Agricultural implements							A	
29	Construction fixtures							A	
30	Decorative metal goods							A	
31	Wood screws							A	
32	Agricultural equipment assembly	X	Δ			X		D	
33	Irrigation equipment	Δ	Δ			Δ		C	
34	Valve products							A	
35	Electrical parts							A	
36	Household appliances	Δ			Δ			C	
37	Small light bulbs							B	
38	Plastic products							A	
39	Sporting goods							A	
40	PVC leather products							A	
41	Room and outdoor fixtures							A	
42	PVC pipes and fittings							A	
43	Machine repair shops	Δ						B	

A: suitable B: somewhat suitable C: problems D: unsuitable

Table 4-9 Socioeconomic Evaluation

	Contribution to regional society			Contribution to national economy		
	Industrial promotion	Industrial development	Employment promotion	Added value	Obtaining foreign currency	Conserving foreign currency
1		○	○			
2	○	○		○		
3	○	○		○		
4		○		○		○
5	○	○	○		○	
6		○	○	○	○	
7		○				○
8						
9			○			
10			○	○		
11		○		○	○	
12		○	○	○		○
13		○	○			
14	○	○		○		○
15						
16						○
17	○			○		○
18	○		○			○
19	○		○	○	○	○
20		○		○		
21			○	○		○
22	○	○	○	○	○	
23	○		○	○		○
24		○	○	○		○
25		○		○		○
26		○		○		
27	○	○	○			○
28		○	○	○		○
29		○	○			○
30	○		○			
31		○				○
32		○				○
33	○	○				○
34		○				○
35	○		○			○
36			○			○
37	○		○	○		○
38		○	○			○
39			○	○	○	
40			○			
41			○			
42		○				○
43	○	○	○	○		

Table 4-10 Rough Assessment and Priority of the Projects

		Intended market	Factors for the rough assessment			Rating			
			Market-ability	Suitability of the site	Socioeconomic aspect				
1	Projects suitable for A type industrial estate (candidates of the primary order)	Manufacture of carpets	Domestic	B	A	A	E	○	OUT
2		Manufacture of towels	Domestic	A	B	B	F	○	
3		Manufacture of socks and stockings	Domestic	B	B	C	L	X	
4		Manufacture of ready-made apparel	Within the area	A	A	C	D	○	
5		Working of small textile goods	Domestic	B	B	B	K	Δ	
6		Manufacture of adhesive tapes	Domestic	B	B	C	L	X	
7		Working of urea resins	Domestic	A	B	A	C	○	
8		Manufacture of rubber sundry goods	Within and outside the area	A	A	A	A	○	
9		Secondary working of leather	Within the area	A	A	A	A	○	
10		Manufacture of leather goods	Domestic	B	A	A	E	○	
11		Iron works	Within the area	A	A	A	A	○	
12		Manufacture of agricultural machinery and equipment	Within the area	A	A	A	A	○	
13		Manufacture of architectural metal products	Within and outside the area	B	A	A	E	○	
14		Manufacture of decorative metal fixtures	Within and outside the area	B	B	B	K	Δ	
15		Manufacture of wood screws	Within and outside the area	C	B	B	M	X	
16		Manufacture of pulp products	Within and outside the area	A	A	B	B	○	
17		Manufacture of electrical parts	Domestic	A	A	A	A	○	
18		Manufacture of plastic sundry goods	Domestic	A	B	A	C	○	
19		Manufacture of sporting goods	Export	B	A	A	E	○	
20		Manufacture of products of vinyl chloride	Within the area	B	B	C	L	X	
21		Manufacture of interior and exterior decorative items	Within and outside the area	B	B	C	L	X	
22	Projects suitable for B type industrial estate (candidates of the second order)	Manufacture of P.V.C. pipe fittings	Within and outside the area	B	A	B	H	Δ	OUT
23		Manufacture of woodwork and bamboo work	Within and outside the area	B	A	A	E	○	
24		Manufacture of furniture	Within and outside the area	B	A	C	J	Δ	OUT
25		Manufacture of sawdust fuel materials	Within the area	B	A	B	H	Δ	OUT
26		Manufacture of glass sundry goods	Domestic	A	B	A	C	○	
27		Manufacture of small lamps	Domestic	B	B	A	I	Δ	OUT
28		Machine repair shops	Within the area	A	A	A	A	○	
29		Meat processing	Domestic	A	A	C	D	○	
30	Projects suitable for C type industrial estate	Manufacture of vegetable oils & fats	Domestic	A	A	A	A	○	OUT
31		Manufacture of pulp products	Domestic	B	B	C	A	X	
32		Manufacture of materials for urea resins	Within and outside the area	A	A	A	A	○	
33		Manufacture of sawdust charcoal	Within the area	A	A	B	B	○	
34		Manufacture of ceramic products	Domestic	B	A	A	G	○	
35		Manufacture of clay and stone building materials	Within the area	B	A	B	H	Δ	
36		Manufacture of irrigating machinery and equipment	Domestic	A	A	A	A	○	
37		Manufacture of electrical home appliances	Domestic	C	B	B	M	X	
38	Projects not suitable for D type industrial estate	Manufacture of animal feedstock	Domestic	A	A	A	A	○	
39			Domestic	A	A	A	A	○	
40		Manufacture of starch	Within the area/ export	A	A	A	A	○	
41		Plywood industry	Domestic/export	A	A	A	A	○	
42		Integrated production plants of paperboard	Domestic	A	A	A	A	○	
43		Manufacture of chromium tanning agents	Domestic	B	B	A	I	Δ	
44		Refining of turpentine resins	Domestic/export	A	A	A	A	○	
45		Leather tannery (primary)	Within the area/ export	B	A	A	E	○	
46	Automatic assembly of agricultural machinery and equipment	Domestic	C	B	B	M	X		

If it is impossible to expand the current site, an alternative might be to obtain a detached site for the free design industrial areas which could be administered by the K.I.E., but it would be rather difficult to obtain such good alternate land on the basis of the current land utilization conditions in the Nyeri District. In any case, this will be a problem which the K.I.E. will have to decide in the future and it is an essential factor for regional development by promotion of industrialization in the Nyeri District. Therefore, it is desirable not to restrict the type or scale of industries to be introduced in accordance with the free concept of an industrial site and to handle the problem on the basis of the concept of intensification of various types of industry. This is an especially important problem in Nyeri, an area of industrial relocation.

4-11 Industrial Companies Existing in the Region and Types of Industries to be Introduced into the Estate

(1) Existing regional industry and industrial development

1) Types of industry and number of companies

When the manufacturing industry currently existing in the Nyeri District was classified into companies on an industrial scale and companies on the household industry scale, there were very few companies on the industrial scale. The most important types of industry were lumbering, dairy products processing, manufacture of refrigerated beverages, ironworks, vegetable processing (dried vegetables), black tea manufacture, printing and bookbinding.

The number of household type industries has risen to several hundred. No data have been available recently but according to a survey report* from 1972, the type and numbers of such companies were as shown in Table 4-12. These companies tend to increase every year as shown in Table 4-13 and it is estimated that they have increased considerably by now.

* Rural Enterprise Survey in Nyeri District, Kenya - A Report of the Consultants to DANIDA - February 25, 1972

2) Problem of small existing companies and industrial development

Various problems can be pointed out concerning these small companies and various debates have also been held on future guidance and fostering. However, these debates have brought the problems to the fore and they have been found to exist in almost every country in different forms. In any case, an environment in which there are many small companies gives the impression that there is a certain type of good sense and desire concerning industrial investment via small-scale manufacturing investment.

However, in the promotion of regional industrial development, deliberation on whether or not these small companies should be given some form of administrative guidance is an extremely important problem. The history of industrial development in one country is a course of industrial promotion and an industrial revolution via improvements in industrial scale, production organization and technology. Therefore, it is often unavoidable that in the course of such development, there will be local socioeconomic confusion and suffering.

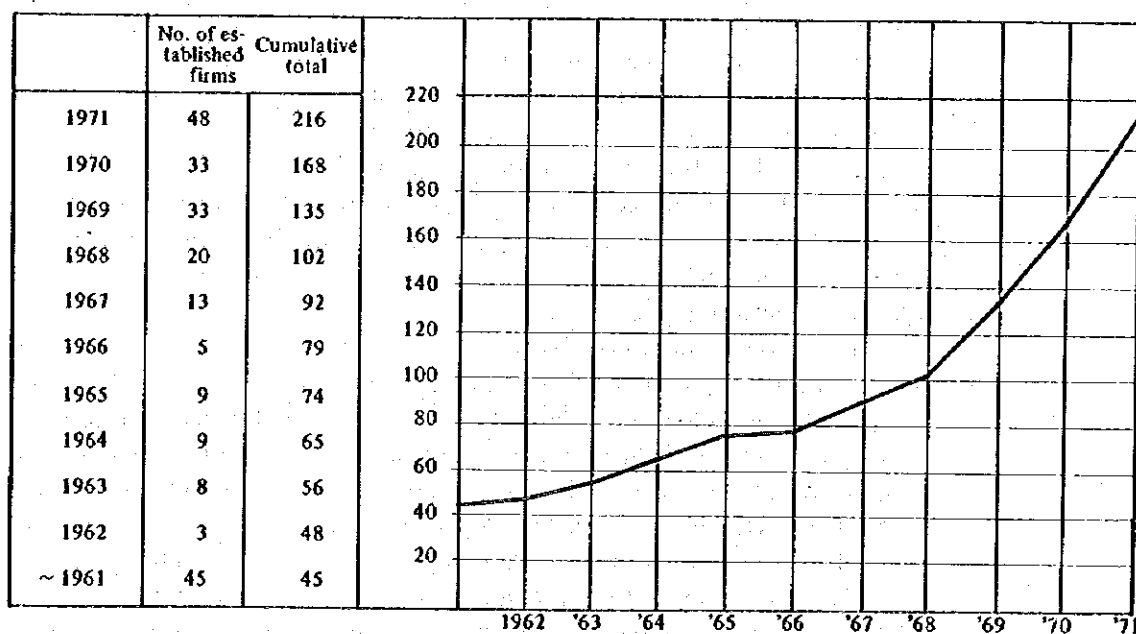
Therefore, the important point administratively is to promote desirable industrialization while keeping this transitional social confusion to a minimum. There must be a positive recognition of the intended industrial investment aims of the companies which have sprung up spontaneously and incorporating them in a form which can be harmonized in the direction of the changed industrialization level which should arise from appropriate guidance and assistance. This theme

Table 4-11 Distribution of Workers by Industry and Location

	Local (33)		Rural (3)		Urban (2)		Total		Average of the number of employees	Tendency toward concentration or dispersion
	Number of enterprises	Number of employees	Number of enterprises	Number of employees	Number of enterprises	Number of employees	Number of enterprises	Number of employees		
Blacksmith	4	10	3	9	12	43	19	62	3.3	
Sawing (including furniture)	1	8	2	46	9	250	12	304	25.3	City-concentrated
Carpentering	2	5	4	9	31	142	37	156	4.2	City-concentrated
Tailoring and dress-making	55	78	6	13	16	33	77	124	1.6	Locally dispersed
Bicycle repairing	2	2	3	9	5	18	10	29	2.9	Locally dispersed
Automobile repairing	0	0	2	5	6	25	8	30	3.8	City-concentrated
Radio and clock repairing	1	1	0	0	4	6	5	7	1.4	City-concentrated
Shoe stores	11	19	5	11	12	25	28	55	2.0	Locally dispersed
Maize mills	10	24	1	2	2	7	13	33	2.5	Concentrated on resource producing districts
Leather dealings	2	30	1	2	1	4	4	16	4.0	Locally dispersed
Others	5	105	1	4	5	71	11	180	16.4	
	93	262	28	110	103	624	224	996	4.45	

Source: Rural Enterprise Survey in Nyeri District, Kenya, 25 Feb., 1972

Table 4-12 Starting Years of Firm



Source: Rural Enterprise Survey in Nyeri District, Kenya, 25 Feb., 1972

has been considered through the activities of the center organized previously by the R.I.D.C. but in the future, it is hoped that more positive administrative guidance will be realized with a changed environment by a drastic increase in Nyeri District industrialization which will be conducive to further industrial estate development.

The problem points concerning the existing small companies are as follows:

a. Low technical and product quality levels

There are several reasons for this but the main ones include poor facilities and equipment due to insufficient investment, low production and technical levels (lack of suitable training and insufficient technical knowledge), no market unless prices are low (if it is cheap, it is bad—low purchasing level), lack of design development and insufficient research on product applicability.

b. Insufficient investment

The investment scales for these small companies are as follows:

200 shillings or less	35.3%	} 65.8%	} 87.4%
200– 1,000 shillings	30.5%		
1,000– 2,000 shillings	7.8%		
2,000– 4,000 shillings	4.2%		
4,000– 10,000 shillings	9.6%		
10,000 shillings and over	12.6%		

Among these small companies, 87.4% have an investment of less than 10,000 shillings (US\$1,250) and 65.8% have less than 1,000 shillings, and it is doubtful that they can be called industrial companies. However, the actual interpretation should be that, even though the capital is small, the manufacturing industry has been realized by the capital capacity which is possible.

c. Insufficient marketing capacity

Most of these companies (70%) perform marketing by the direct sales system and there is almost no utilization of distribution facilities. However, some of the companies serve as subcontractors for large companies outside the region (ex. tanners).

d. Excessive competition

These small manufacturing companies are characterized by being intended almost entirely for the local market and there is a tendency for investment concentration in the same types of industry because the types of industry which can be industrialized with such small capital is limited. Therefore, excessive competition naturally occurs.

In any case, not only it is rather difficult for these small companies to make progress under current conditions but in some cases, they could also cause social problems in the future. Therefore, it is urgent that the authorities take various measures to raise the business and technical levels of these companies but this will have to be incited beforehand by raising the local level to that of a more industrialized society in the future and efforts must be made to clarify policies and obtain understanding so that they will not just be received as meaningless announcements by the local population. In any country, considerable friction is experienced at the time of organizational

changes and technical revolutions in industry and the status of these small companies will also be changed by such friction. Therefore, administrative guidance for such companies should not stop simply at technical advisory services but should also include means to improve the organization of integration of companies (subcontracting structure, division of labor, cooperation, development of new products, etc.). Efforts should be made to provide policies and assistance so that these companies will be able to cope with a progressively industrialized society. Already, it is said that furniture manufacturers in Karatina have formed a cooperative organization and are undertaking cooperative purchases and sales. A high value should be placed on such activities as a first step in bringing together petty investment to make it more healthy in the future. In such cases, consideration should be given to positive assistance from the government and the bringing out of spontaneous incentive.

(2) *Relations between existing regional industry and the industrial estate .*

As was described previously, industrialization in the Nyeri District is behind that in the other important urban areas of the country. There is also nothing remarkable about the type, scale and quantity of existing industry and future development is expected.

The construction of industrial estates and the development of new manufacturing projects are important as first steps but at the time of selection of the types of industry to be introduced, it is essential to understand the correlation with existing industry as much as possible and consider the development of existing industry on the basis of this correlation. Efforts must also be made to new small scale correlated industries which will be necessary as industrialization expands in the region.

However, it is also important to remember that overly-protective guidance for only such existing small industries might be a disturbing factor in the industrialization strategy in some cases. The realization of a series of industrial projects including an industrial estate in the case of industrialization of a region should involve projects based on independent strategy and brought together or the consideration of the elemental themes of the program until there is enough small companies with some sort of relation. These should be considered as problems within the large industrial organization.

4-12 Project Grouping and Integration

When industrial estate and independent industries are developed under current conditions in Nyeri, a region of industrial depopulation, there should be a major impact on the socio-economic and industrial structures. Table 4-13 shows the major correlations between the various selected projects shown below and other industries or projects. This is shown more simply in Fig. 4-2.

In these investigations, the selected projects were divided into the following groups for convenience. Because of project correlations these groupings are based project groups and similar types of industry so that the contents are as complete as possible.

Classification symbol	Classification type
A	A ₁ : Agricultural processing
	A ₂ : Leather industry
	A ₃ : Pulp and paper industry
B:	Forestry industry
C:	Kiln industry
D:	Textile industry
E:	Chemical industry
F:	Plastics and rubber industries
G:	Machinery and metal industries

In the above classification, A consists of a group of projects which have an especially higher industrial correlation. A, B and C are all projects which mainly use regional raw materials. D consists of projects for which the raw materials can be obtained from within the country (from other regions) and E, F and G consist mainly of projects for which raw materials must be obtained abroad. Fig. 4-13 shows a simplified relation of the raw materials and products for the A group (A₁, A₂ and A₃).

From the socioeconomic standpoint, the integration of groups of projects with as diverse correlations as possible generally increases the overall added value but when there is an excessive bias of the correlated fields, structural fragility tends to be exposed. The stability of fields which supply products and industries which are raw material sources must be especially stable. Therefore, efforts towards product development and stable production (stable raw material supplies) in the agricultural and dairying industries which are raw material sources for the agricultural processing, leather and pulp and paper (cardboard) industries, which require the highest levels of integration of their mutual correlations among the selected projects, are the basic conditions for support of these industries.

However, for the stable procurement of these raw materials, it is necessary to provide incentives (stable dealings, prices, etc.) from the industrial side for these industries. Therefore, these raw materials and manufacturing industries can be supported by the stable growth of the markets for the industrial products.

The construction of regional industries which serves as a prerequisite for industrialization also requires control in the correlation with industry (supply of industrial raw materials, supply of personnel, infrastructure, etc.) and it is also necessary to change product development and product type selection in accordance with raw material supply conditions. Therefore, many difficulties arise in industrial development when efforts are limited to one industrial field and it is highly desirable to establish a development strategy based on a balance among all types of industry.

From the above, it is desirable that, at the project planning stage, an economic scale balance involving:

- (1) Selection and procurement of raw materials, possibility of future development (price, quality, procurement methods, etc.)
- (2) Product marketability investigations and product selection
- (3) Economic integration among projects be considered for potential products including the selected projects.

Fig. 4-2 Industrial Interrelations Among Selected Projects

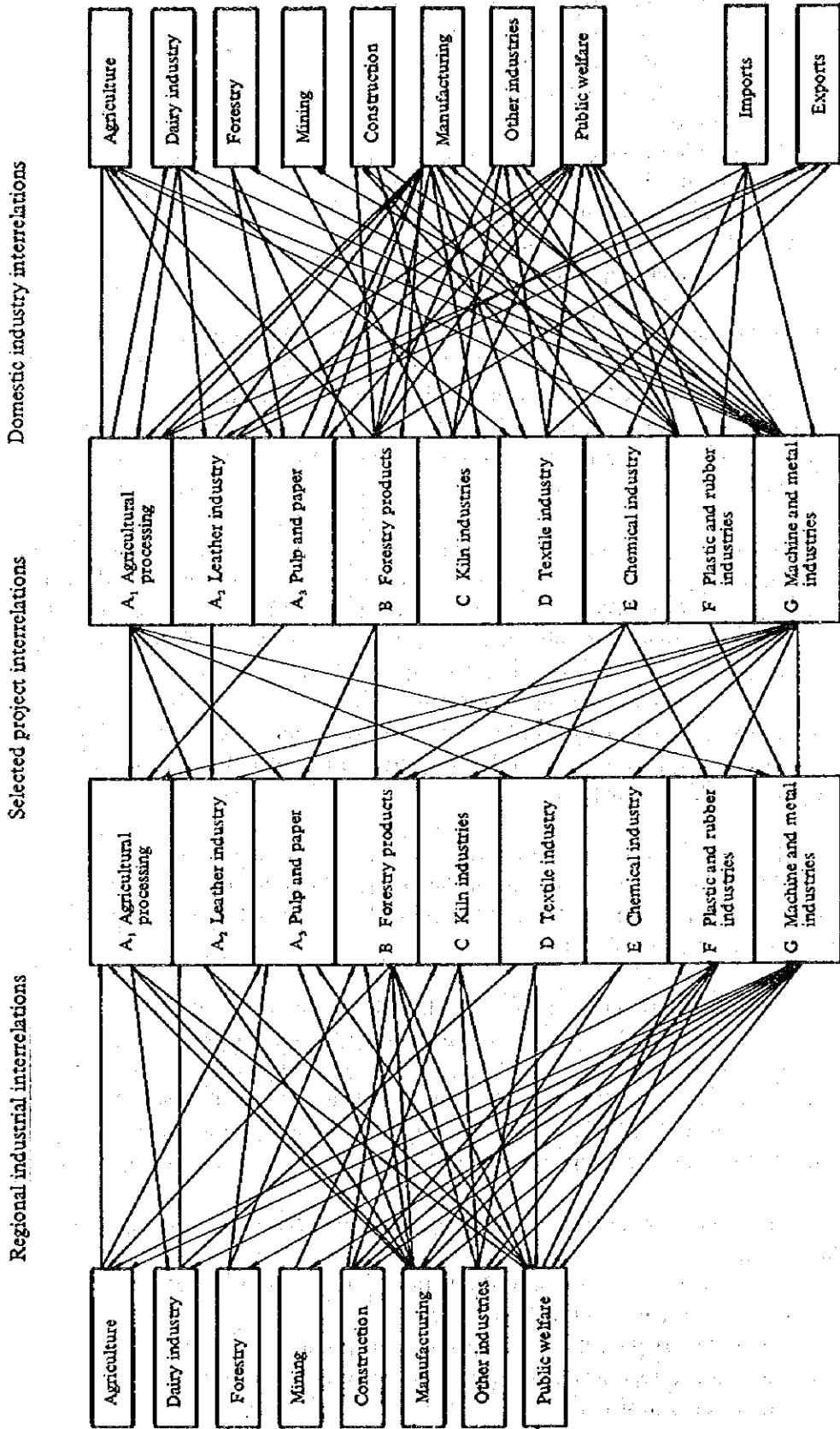
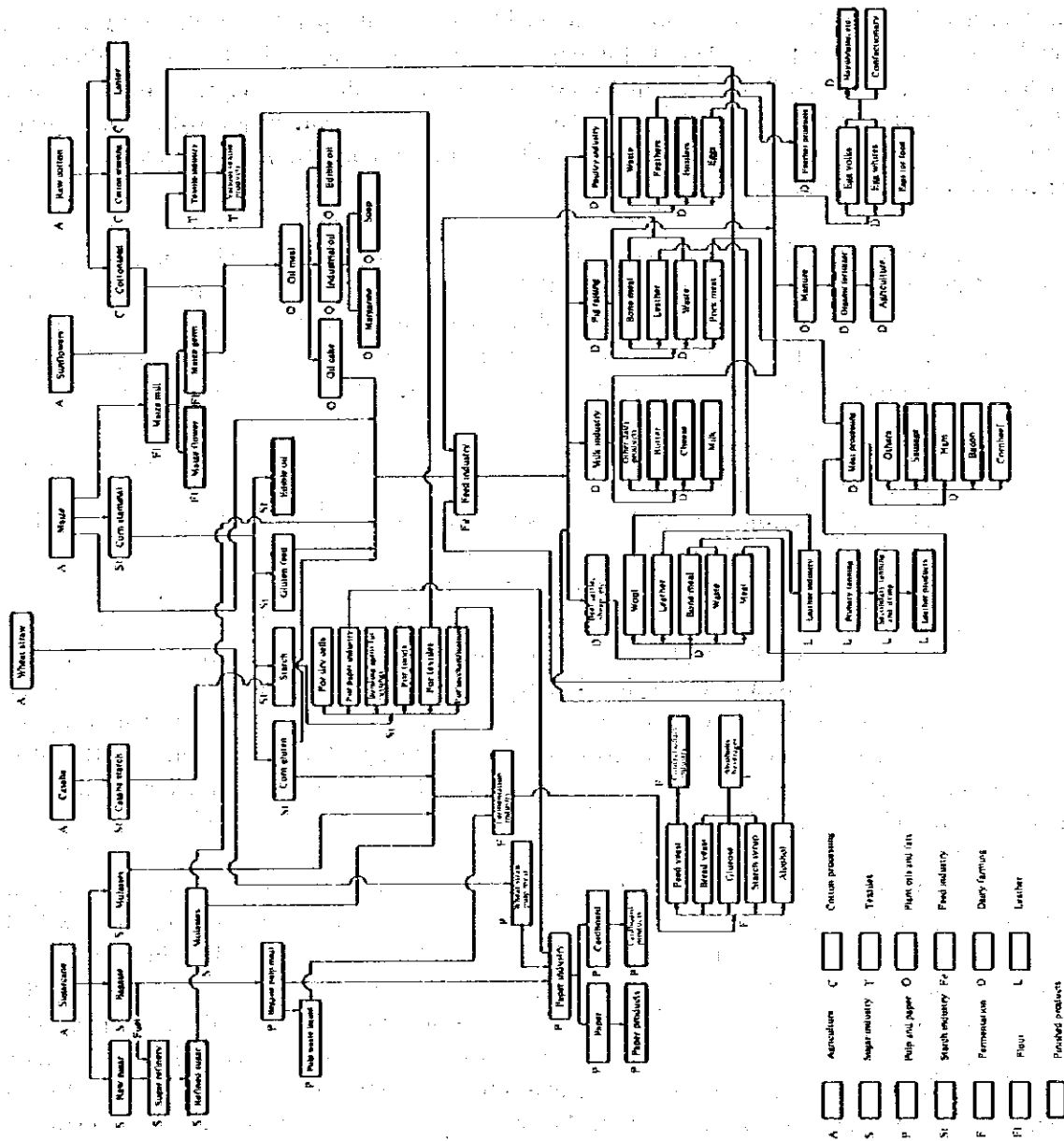


Table 4-13 Project Group Classification and Related Industries

Classification	Type of industry	Project name	Raw material procurement		Destination of main and by-products		
			Main raw material	Source	Products	Destination	
A	Agricultural processing	Meat processing	Pigs, chickens, cows	Dairy farming, slaughterhouses	Processed meat products, bone meal, etc.; Waste	Public welfare, feed industry (A1)	
		Plant oils and fats	Sunflowers, maize, jam, cottonseed	Agriculture, maize meal	Plant oil Oil cake	Public welfare, oil and fat industry, feed industry (A1)	
		Domestic animal feed manufacturing	Maize, sorghum, miscellaneous grains, oil cake, bonemeal, etc. fish meal, shells	Agriculture (A1) Domestic movement	Concentrated food	General dairy farming	
		Fermentation products	Starch, sawdust, pulp waste liquid	Starch industry (A1) (A1)	Bread yeast, starch syrup, feed yeast	Public welfare, confectionary and bakery industry, dairy farming	
		Starch industry	Maize, casaba	Agriculture	Starch, corn gluten, gluten feed edible oil	Food and textile industries, fermentation industry (A1), etc., feed industry (A1), public welfare, oil and fat industry	
	A2	Leather industry	Primary tanning	Untanned skins, tanning agents	Dairy farming—slaughterhouses, tanning agent industry (domestic)	Stored processed tanned leather, tanned leather for domestic use	Export, leather industry (A2)
			Secondary industry	Tanned skin	(A2)	Processed (gluing and dyeing) leather	Leather product processing (A1)(A2)
			Leather products	Processed leather, decorative fixtures	(A2) Metal processing industry	Bags, other products	Public welfare
			Sporting goods (dyed leather)	Processed leather	(A2)	Baseball equipment, poles	Public welfare, export
	A3	Paper and pulp industry	Cardboard manufacturing	Wheat, rice straw, bamboo, waste paper, lumber chips	Agriculture, public welfare, lumber industry	Various types of cardboard	Cardboard processing
B	Forestry industry	Plywood industry	Soft and hardwood logs, lumbering, sawdust	Forestry, lumber industry	Single sheets (front and glue lamination boards)	Furniture industries for export	
			Urea adhesives, melamine	Urea formalin imports, adhesive manufacture (E)	Plywood, particle board, decorative board	Construction and furniture industries	
		Bamboo processing, woodworking, sawdust fuel, pine resin refining	Bamboo, hardwood, lumbering, sawdust, crude resin	Forestry, lumbering, plywood industries (B), forestry	Agricultural containers, handicrafts, sawdust fuel, refined pine resin, turpentine	Agriculture public welfare, tourism, public welfare, paper and rubber industries, etc. Chemical industry	

Classification	Type of industry	Project name	Raw material procurement		Destination of main and by-products	
			Main raw material	Source	Products	Destination
C	Kiln industry	Kiln products	Clay, sand, etc.	Mining	Bricks, toilet fixtures, tableware	Construction, public welfare
		Glass sundries	Sand, etc., soda ash	Mining, domestic movement	Glass sundries	Public welfare and tourism
D	Textile industry	Towel manufacturing, readymade clothing	Cotton spinning cloth	Domestic movement	Various types of towels, various types of clothing, children's and ladies' clothing	Public welfare, tourism offices, schools, public welfare
		Carpets	Wool	Dairy farming	Various types of carpets	Public welfare, tourism
E	Chemical industry	Urea resin manufacturing	Urea formalin	Imports	Urea adhesives	Plywood (B) and furniture industries, chemical industry, etc.
					Melamine	Molding, plywood (B) (other same as above), molded products (F)
					Urea resins for molding	
F	Plastic and rubber industries	Urea resin processing	Urea resins for molding	(E)	Electrical and machinery parts	Parts industry
		Plastic sundries processing	Thermoplastic resins	Imports	Sundries for public welfare Various types of industrial materials	Public welfare Various industries
		Rubber sundries processing	Waste rubber, synthetic and natural rubber	Local procurement, imports	Sundries for public welfare Regenerated tires, rubber belts and packings	Public welfare Public welfare, industry, industry
G	Machinery and metal industries	Irrigation machinery	Iron and steel, parts	Imports	Small pumps Small engines, generators	Agriculture Agriculture, public welfare
		Ironworks	Iron and steel, parts	Imports	Industrial plant	Various types of industry
		Agricultural implements	Welding rods, gas, etc.	Domestic movement	Boiler making, general processing	Public welfare, industry
			Iron and steel, parts	Imports	Agricultural implements	Agriculture
		Steel scarp		Domestic movement	Bicycle trailers, wheelbarrows	Agriculture
		Construction fixtures	Iron and steel, non-ferrous metals, parts, etc.	Imports	Steel construction fixtures, small items such as door locks	Construction
		Valve products	Metals, parts	Imports	Portable sprayers, sprinklers	Agriculture
		Electric parts	Non-ferrous metals	Imports	Nozzles	Construction
Machinery repair	Insulation materials (molded) (including iron-works)	(F)	Sockets, receptacles, etc.	Construction		

Fig. 4-3 Raw Material and Product Flow for Agricultural Processing Projects



4-13 Necessity of Market Surveys and Market Development

At the survey and planning stage of the individual projects, the most important and difficult theme to be investigated is the market. Prerequisite conditions for maintaining sound management of a manufacturing company are stable sales of the quantity of the products which can be met at a suitable price. Among the required market conditions in the final market, factors such as price, quality and finishing, function or usefulness and design serve as product evaluation standards for the consumer. Normally, in places where there is competition with similar products on the market, these market conditions are evaluated individually and in general while comparing with various other products.

In ordinary feasibility studies, the two decisive factors are prediction of the market scale and the supply/demand balance and the fixing of a competitive market price. However, if possible, it is desirable to perform a more detailed market analysis (consumer intentions, price elasticity effects, etc.). Dynamic marketing development policies should be established on the basis of the results of these static market condition surveys. The main points to be investigated are as follows:

- a. Optimization of distribution (decrease in distribution costs, marketing organization, inventory planning, etc.)
- b. Demand development methods (design development, introduction of new products, etc.)
- c. Comparative evaluations of market competitiveness

In the case of the projects to be undertaken in the Nyeri District where, with the exception of projects limited to the regional market, the main markets are in other areas outside the region, especially in the capital district, the establishment of the distribution system up to the final market presents a very important problem. This type of problem is extremely difficult to solve by the efforts of companies alone, especially when the company scale is small, and cooperation of the K.I.E. will be indispensable.

Advice concerning distribution and marketing has been obtained from advisors stationed at the existing estates and from market experts from the K.I.E. in Nairobi, but it will be necessary to propose more positive marketing methods. Since the Kenyan distribution system has not yet reached a high level, the distribution costs for ordinary goods are comparatively high with respect to commercial capital and therefore, the marketing of small and medium companies becomes dependent on the market oriented location. When this problem is considered for regional cities, effective methods include cooperative marketing (industrial cooperatives) formed by several companies. In the case of companies controlled by the K.I.E., the development of cooperative markets (ex. supermarkets) and cooperative publicity (trade fairs) with K.I.E. assistance are able to be planned.

4-14 Outline of Projects to be Introduced on the Industrial Estate

The standard specifications of some of the prototype factory buildings and the types of industry to be introduced in the predesign area will be outlined for reference. The specifications given here are based on standard reference data, and when these projects are actually started on the industrial estate, it will be necessary to thoroughly investigate such matters as market scale,

the possibility of procuring raw materials and selection of the technology to be used, and then draft an actual plan differing from the specifications given here.

A. Making charcoal (ogalite) using sawdust as raw material

There is an integration of lumbering and other industries utilizing the forestry resources and the possibility of future development is also considered good. The project described here involves the reutilization of sawdust arising from these industries. Wood vinegar can also be obtained as a by-product. In this project, the sawdust is mechanically solidified to form a solid fuel.

Standard plant specifications based on actual cases in Japan are as follows.

(1) Manufacturing process (Fig. 4-4)

(2) Factory specifications

Monthly production: Rod-shaped ogalite 225 tons (1.5 kg/rod x 150,000 rods)

Product specifications: Rod-shaped product, 3.5 cm in length x 7 cm in diameter, with a 1 cm diameter hole in the center

Raw materials: Sawdust arising from the lumbering of 5,000 m³ of logs monthly (20% conifers, 80% medium-hard broad-leaved trees). The raw material weight is estimated as 250 tons (dry water content: 5-8%)

Equipment and equipment investment outline: Table 4-14

Production cost structure: Table 4-15 shows an estimate of the production costs in the Nyeri District based on the above technical specifications in Japan. Accordingly, the production cost per ton of product is estimated as 3,605 yen.

For reference, the market price in Japan is 300 yen per 15 kg, i.e. 20,000 yen/ton.

(3) Product application

This product has a calorific value of 3,800 cal. and in Japan it is used mainly as

Table 4-14 Amount of Investment in the Manufacturing Facilities of Ogalite (Sawdust Charcoal)

Classification	Size, specifications, or No. of units	Amount (¥)	Remarks
Plant site	2,000 m ²	200,000	Estimated
Building for the plant and warehouse	1,000 m ²	5,000,000	Built of steel with slated roof
Machinery		19,000,000	Based on 1975 prices
Forming machines	3		
Dryer	1		
Saw dust burner	1		
Screen conveyers	7		
Electric motors 16	175 KW		
Duct	1		
Others	Complete		
Cost of installation of machines	Complete	2,000,000	
Total		26,200,000	

fuel for baths and cooking. It can be lit with a single match and no special combustion implements are required.

(4) Problems

In Kenya which has no fuel resources, there is a market for domestic fuel but the problem is collection of the sawdust which serves as the raw material. In Japan, 250 tons a month of sawdust is put to practical use by means of incidental equipment in a lumbering plant with a monthly capacity of 5,000 m³ but if the raw materials have to be collected from several plants, the practicality of the project comes into question.

Table 4-15 Cost Estimation on the Manufacture of Ogalite (Sawdust Charcoal)

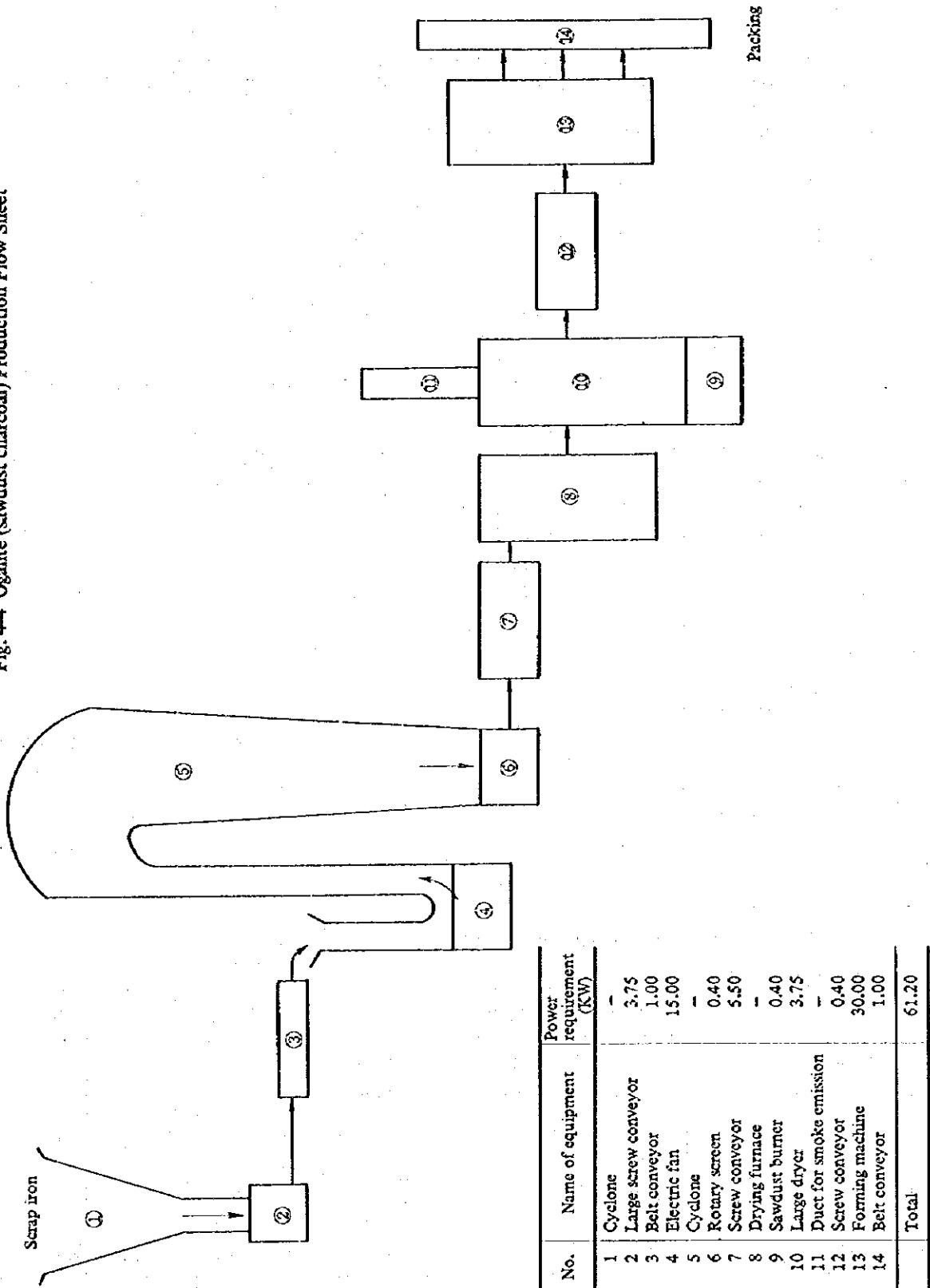
Number of days of operation: 300 days/year

Item	Quantity	Unit price (¥)	Amount (¥)	Remarks
Cost of sawdust raw material	3,000 ton	1,000	3,000,000	Only cost of transportation considered
Heavy oil	1,200 L	63	75,600	
Electricity	200,000 KWh	13	2,600,000	Wrapping papers and others
Administrative expense and miscellaneous			1,200,000	
Labor cost	6 persons	180,000	1,080,000	Including packaging work
Clerical expense	one person	240,000	240,000	
Depreciation			1,539,000	Depreciation over 15 years with 10% scrap value
Total			9,734,600	

Table 4-16 Summary of Cost of Construction and Required Personnel

No.	Name of facility	Equipment FOB cost (¥)	Material local cost (¥)	Labor local cost (¥)	Total cost (¥)	No. of required personnel	Remarks
		X10 ³	X10 ³	X10 ³	X10 ³		
1	Forging facility	7,296	111	342	7,749	10	
2	Welding facility	3,584	208	35	3,827	10	
3	Machining facility	7,138	1,133	510	8,781	4	
4	Electricity, water, gas	1,044	1,079	322	2,445	1	
5	Sub-total	19,062	2,531	1,209	22,802	25	
6	Ocean freight	4,627			4,627		FOB x 0.25/1.03
7	C&F cost	23,689					
8	Marine insurance	474			474		C&F x 0.02(2%)
9	CIF unloading handling	24,163					
10	DI Land transportation	925			925		FOB x 0.05/1.03
11	Cost delivered to site	25,088					
12	Cost at site	25,088	2,531	1,209	28,828	25	
13	Indirect cost	2,859	380	181	3,420		No.5 x 0.15(15%)
14	Erected cost	27,947	2,911	1,390	32,248	25	

Fig. 4-4 Ogalite (sawdust charcoal) Production Flow Sheet



(4) Forging facility

No.	Name of equipment	Quantity	Specifications	Equipment FOB cost	Materials cost at site	Labor cost at site	Remarks
1	Forge heating furnace	2	Floor space 0.6m x 0.6m	3,433	—	320	
2	Lifting arm & hoist	1	2 T	824	111	32	
3	Anvil	3		155	—	—	
4	Tools and jigs	Complete		2,060	—	—	
5	Measuring instruments			824	—	—	
	Total direct cost	10 persons		7,296	111	342	Total 7,749

(5) Welding facility

* Facility primarily for bending, welding, and cutting of pipes and wheels for the rear-cars (bicycle cast)

No.	Name of equipment	Quantity	Specifications	Equipment FOB cost	Materials cost at site	Labor cost at site	Remarks
1	A.C. arc welder	1	25 KVA/300 A	72	—	—	
2	A.C. arc welder	2	13 KVA/180 A	124	—	—	
3	Gas welder	3	Class A	71	—	—	
4	Gas welder	3	Class B	83	—	—	
5	Gas cutting machine	3		93	—	—	
6	Surface plate	1	2 x 2 x 0.3m	2,018	137	15	
7	Two-head grinder	1		52	7	2	
8	Upright drilling machine	1	25mm ϕ	474	64	18	
	Sub-total			2,987	208	35	Total 3,230
9	Tools	Complete		16% 478	—	—	
10	Measuring instruments	Complete		4% 119	—	—	
	Total direct cost	10 persons		3,584	208	35	Total 3,827

(6) Machining facility

* Machining facility for machining round workpieces, such as axles, bearing portions, round handles, etc.

No.	Name of equipment	Quantity	Specifications	Equipment FOB cost	Materials cost at site	Labor cost at site	Remarks
1	Engine lathe	1	4 feet	3,605			
2	Wood lathe	1	6 feet	2,060			
	Sub-total			100% 5,665	20% 1,133	9% 510	Total 7,308
3	Tools	Complete		20% 1,133	—	—	
4	Measuring instruments	Complete		6% 340	—	—	
	Total direct cost	4 persons		7,138	1,133	510	Total 8,781

(7) Utilities

No.	Name of equipment	Quantity	Specifications	Equipment FOB cost	Materials cost at site	Labor at site	Remarks
1	Receiving and transforming facility	Complete	50 KVA	1,044	160	104	
2	Electric distribution	Complete	50 KVA	—	619	128	
3	Water, gas distribution	Complete			300	90	
	Total direct cost	1 person		1,044	1,079	322	Total 2,445

(8) Required floor space

1	Forging facility	7m	8m	56m ²	
2	Welding facility	8	13	104	
3	Machining facility	7	8	56	
4	Office, receiving and transforming facility	8	3	24	
	Total			240	16m x 15m = 240m ²

B. Manufacture and repair of agricultural implements, bicycle trailers and wheelbarrows in ironworks

The projects included in the general range of ironworks cover diverse fields. The selected projects include ironworks, irrigation equipment, agricultural machinery, construction fixtures, valves and machinery repair. Among these, projects such as casting and forging equipment, machining and boiler making considered to be suitable for the predesign area are left to the technical data in the appendix. Here, the contents of a small scale plant for the manufacture and repair agricultural implements and manually operated transport equipment, are outlined.

(1) Main products

1. Manufacture and repair of agricultural implements
2. Manufacture of bicycle trailers
3. Manufacture of wheelbarrows

(2) Main equipment required

1. Forging equipment
2. Welding equipment
3. Machine processing equipment

(3) Construction costs and required personnel (Table 4-16)

C. Urea resin processing

(Tableware, buttons, electrical parts, etc.)

A project to manufacture urea resin molding materials upstream from the urea resin processing plant was originally a candidate for these projects but it was considered to be unsuitable by the manufacturers for the following reasons:

- (1) The minimum economic scale of a urea resin molding material plant is 50t per month per line (150t if there are three lines). However, this requires an equipment investment of about 300,000,000 yen, which is about 100,000,000 yen above the intended equipment investment for each of these projects.
- (2) There is no definite supply system for urea and formalin, the main raw materials for urea resin molding materials.
- (3) It is improbable that the total resin consumption of the urea resin processing plant would reach 30 -- 40 tons/month; the molding material plant would not have a high operating rate and costs would be high.

In Southeast Asian countries such as Thailand, molding materials are imported from Japan. The market has been expanding and it is planned to advance into the manufacture of molding materials if the market reaches a paying level in the future. This method will also be desirable for Kenya.

Therefore, the processing of urea resins can be described as follows:

- (1) Product fields considered suitable with respect to the Kenyan technical level
Such products as buttons and tableware which are produced by compression of the molding materials only are considered to be suitable for the Kenyan technical level which can handle plastic processing and it should be easy to understand demand trends in case of applications closely related to clothing (buttons) and eating (tableware). However, it is difficult to recommend electrical parts because of the competition with metal parts manufacture and assembly and the necessity of high level mold processing techniques involving metal part inserts.
- (2) Materials
Compounds for molding: There are various grades according to hardening speed, elongation, applications, etc. and colored compounds are also supplied. Japanese products are supplied in 20 kg paper bags.
(Reference export price: 190 yen/kg ex Yokohama warehouse)
- (3) Equipment used (equipment which can be accommodated in a 15 x 30 m structure)
 - a. Compression molding equipment (oil hydraulic press: semi-automatic or fully automatic type)

50-ton oil hydraulic molder (for tableware)	10
37-ton oil hydraulic molder (for buttons)	5
 - b. Metal molds
In accordance with type and quantity of molded products
(at over 2 million yen each)
 - c. Finishing equipment

Trimming equipment	} 17
Buffer equipment	

 (Both can be supplied from Japan)
- (4) Processing process
The process can generally be divided into molding and finishing.
The molding process consists of:
 - (1) Weighing the molding material
 - (2) Insertion of the material in the cavity of the mold (after preheating of the mold)

- (3) Pressurization (First, low pressure pressurization at about 100 kg/cm² is applied. After 5–60 seconds, the gas created when the molding material is in a fluid condition is removed and high pressure pressurization at 200 kg/cm² is applied. The mold temperature is 125–150°C.)
- (4) Hardening (Chemical reaction occurs due to heating and pressurization in (3) and hardening takes place.) The hardening time is set to achieve an optimum degree of hardening in accordance with the molding temperature and the thickness of the molded product.
- (5) Removal of the molded product and cleaning of the mold

Finishing process

- (1) Removal of the trim around the molded product using grinders, etc.
- (2) Polishing using buffers

(5) Required personnel

	No. of molding machines	Resin consumption (l/machine/month)	Molders	Finishers	(Managers, technicians)	Total (excluding packers)
Tableware	10	1.0	10	2	3	15
Buttons	5	0.3	5	15	2	22/37

(6) Equipment costs (ex Yokohama warehouse in export packing)

	(1,000 yen)	Fully automatic	Fully automatic
a. 50t oil hydraulic press (semi-automatic)	10 x 1,710	(2,070)	17,100 (20,700)
b. 37t oil hydraulic press (semi-automatic)	5 x 1,350	(1,710)	6,750 (8,550)
c. Molds (varies according to design, no. of removals, etc.)	30 x 2,000 = 60,000	(1,000 yen)	
	(assumed as two per molding machine)		
d. Trimmers	17 x 230 = 3,900	yen (1,000 yen)	
e. Buffers			

D. Rubber sundries processing

(Belts, packing, regenerated tires)

1. Compound rubber

(1) Materials and process

Compound rubber is used for all of the above products and they are all produced via molding processes.

Crude rubber supplied by the rubber manufacturers is kneaded and pressed through rolls to give it plasticity. Then, as in the following compounding example, the components are mixed to obtain the compound rubber.

These components naturally must be purchased.

Compounding example:

Crude rubber	100 parts	Vulcanizing accelerator	DM0.9
Sulfur	3.5	Age-resistor	1.0
Vulcanizing accelerator	D0.5	Zinc oxide	15.0

Magnesium carbonate	5.0	Stearic acid	1.0
Calcium carbonate	11.0	Pine	6.0
Orange (pigment)	0.1		

- (2) Equipment used
 Mixing roller (roll diameter: 16 in., roll width: 42 in.) 1
 Open roll type with low turn ratio

- (3) Required personnel
 A batch type process for which one operator is sufficient.

2. Belts (flat rubber belts for drive transmission)

- (1) Materials
 a. Cloth for belt base . . . cotton fabric for rubber belts (as per JIS L3104)
 b. Compound rubber (refer to 1.)

- (2) Process
 The cloth which has been dried in a cell drier is frictioned on both sides and topped on one side of the rubber mixed beforehand via a calender. It is then cut to the desired width and length with a knife, vulcanized with a belt press and finished.

- (3) Equipment used
 a. Calender (roll diameter: 12 in., roll width: 24 in., 3-roll type) 1
 b. Cloth drying equipment (cell dryer) 1
 c. Belt press (width: 300 mm, length 2 m) 1

- (4) Required personnel
 Since all processes are of the batch type, a total of three persons, for with the foreman, is sufficient if they help each other.

3. Packing (molded vulcanized product)

- (1) Materials
 a. Compound rubber (refer to 1.)
 b. Inserts (metals, textiles, plastics, etc. or combinations of these)

- (2) Process
 The compound rubber is pressed out in a sheet form by a calender. This is then bottom processed to the approximate shape, dimensions and weight of the product, placed in the mold and galvanized.

- (3) Equipment used
 a. Calender: same as 2-(3)-a 1
 b. Vulcanizers: The mold material (carbon steel, stainless steel, bronze, etc.), type and number differ in accordance with the size, number, etc. of the product to be galvanized.
 c. Heating press: Same as b., size differs according to product size but in this case, 400 x 400 mm is estimated 1

- (4) Required personnel
 Since the process is the same as that for the belts up to calender, the number of personnel can be 1 – 2 for molding, including bottom processing, and heating press operation.

4. Regenerated tires

(1) Materials

- a. Old tires
- b. Compound rubber (refer to 1.)
- c. Rubber solvent

(2) Process

- a. The remaining part of the tread rubber is cut off of the old tires to be regenerated, and preparations are made for buffing.
- b. The compound rubber is pressed out by the calender with a twin-peak shape (camel-back)
- c. Rubber paste is made by placing rubber base and gasoline in a mixer.
- d. The prepared old tires are placed in the tread gluing machine, the rubber paste is applied by a sprayer and the camel-back is glued on.
- e. After the gluing is completed, the tire is placed in a aluminum alloy mold, placed in a regeneration vulcanizer and tread molding and vulcanization are performed. The steam and electrical heat required for the galvanizing is 153°C.

(3) Equipment used

- a. Tread rubber removal equipment

Peeling machine: This machine rapidly cuts off the residual tread rubber and prepares the under-surface for buffing.

Buffer: Performs direct polishing of the tread friction surface.

	1 each	2 in total
b. Calender: same as 2-(3)-a	1	
c. Rubber paste mixer	1	
d. Tread gluing machine	1	
e. Tire regeneration vulcanizer	1	

(4) Required personnel

One person each is required for tread rubber removal, tread gluing and regeneration vulcanization. The gluing operator can also operate the rubber paste mixer. The personnel for processes 1, 2, 3 and 4 can be compiled as follows:

Compound rubber mixing	1
Belt manufacturing	4
Molded galvanized products	2
Regenerated tires	3
Technicians	1
Foreman	<u>1</u>
Total	12

5. Main equipment price estimates (ex. factory, no packing)

a. Mixing roll (16"D x 42"L)	8,000,000 yen
b. Calender roll (12"D x 24"L)	10,000,000 yen
c. Belt press (300 mm W x 2,000 mmL)	16,000,000 yen
d. Packing heating press (400 mmW x 400 mmL)	1,300,000 yen

- e. Tread gluing machine 2,500,000 yen
- f. Tire regeneration vulcanizer 5,000,000 yen
- g. Others (cell drier, vulcanizer mold, peeling machine, buffing machine, gum paste mixer, etc.)

E. Processing small leather products (bags)

(1) Raw materials

- a. Tanned and dyed leather
- b. Fixtures (guffer finished, plated) Outside order
- c. Internal material (cloth, pigskin, core materials—non-woven materials, foam)
- d. Adhesive

(2) Process outline

- a. Using cutting equipment (oil-hydraulic press), the design shape is stamped out of the leather. (Since the leather shape, faults, etc. are not uniform, only one sheet is stamped each time.)
- b. The leather thickness is adjusted by slicing with a band M/C.
- c. Only the parts for overlapping and sewing margins are partially sliced using a deckle edge cutting machine.
- d. The outer bag and innerlining are each sewn together (using flat and arm sewing machines).
- e. The inner lining is attached to the outer bag and the fixtures are added to complete the bag.

(3) Equipment and personnel

In accordance with the factory size (15 x 30 m), it is assumed that there will be 40 – 50 employees, a monthly production of 2,000 to 3,000 bags and 4 – 5 types of products. (However, this is assuming that tanned and dyed leather can be obtained and completed fixtures can be purchased or ordered from outside).

(In Japan)

	Required area	Purchase price	No. required	Personnel required
Cutter (oil hydraulic press)	0.7 x 1.5 m	700,000 – 1,200,000 yen	4	4
Band M/C	0.7 x 1	1,500,000 yen	1	1
Deckle Edge Cutting M/C	0.5 x 1	180,000 yen	3	3
Flat sewing machine	0.5 x 1	130,000 yen	5	5
Arm sewing machine	0.5 x 1	180,000 yen	5	5
Total		6,390,000 – 8,390,000 yen		

Work benches will be needed for 22–32 persons performing hand work.

(4) Problem points at the time of commercialization in Kenya

- (1) Tanning and the degree of finishing to permit use in bags
- (2) Dying and the degree of finishing to permit use in bags
- (3) Fixture supply system
- (4) Lining material supply system

F. Manufacture of readymade clothing

(work clothes, children's trousers, skirts)

(1) Optimum production scale with respect to building area

In a sewing factory, the process which requires the most steps and takes up the most area is the sewing process using sewing machines. It accounts for about 80% of the area of the direct manufacturing depart.

Although these figures exceed the area of the planned prototype structure, the most efficient solution at about the size planned would be two sewing lines covering 15 x 50 M.

The sewing capacity varies according to the type and size of the product, the level of skill of the sewers, etc. but if production is 300 garments/line/day, annual production will be 180,000 garments for 300 working days a year. However, because of the actual area limitation of 450 m², only one line has been planned. Therefore, the capacity will be 90,000 garments annually.

(2) Materials

- a. With such garments as work clothes and children's clothing, cotton denim fabric (mixed with some nylon) is suitable.
- b. Sewing machine thread
- c. Buttons, linings, padding and other accessories

(3) Estimated prices of equipment used (Purchasing price in Japan)

a. Spreading and cutting benches (provided at the site) (1.8 m x 20 m)	1(2)*	
b. Cutters	2 (3)	250,000 yen each
c. Sewing machines	20 (40)	350,000 yen each
d. Lockstitch machines	4 (8)	
e. Special sewing machines (for buttons, button holes, belt rungs, etc.)	3 (6)	1,800,000 yen
f. 6-pound irons	3 (6)	50,000 yen
Total		14,450,000 yen

*Figures in parentheses show values for 2 lines

Note: The spreading and cutting benches are mainly table parts and they can be made by hand if thick plywood is available. Therefore, they should be prepared at the site.

(4) Process

- a. Design and preparation of paper patterns
- b. Spreading of the material:
The rolls of cloth are spread out in layers on the spreading benches. The spreading length is decided to match the design. There are also spreading machines but manual spreading must also be considered with respect to production scale and the creation of employment.
In Japan, to color matching process (check for minute color differences and confirmation of same color tone in each set) is performed after cutting but there do not appear to be such severe requirements in Kenya.
- c. Tracing of pattern cutting lines
- d. Cutting: Cutting by a straight blade cutter (cutting blade moves up/down and back/forth at high speeds.)

- e. Machine sewing: The cut pieces are sewn, part by part and gradually assembled. Finally, they are completely assembled and the buttons are sewn on.
- f. Press finishing: The sewn products are pressed with irons to remove wrinkles.
- g. Product checking: Checks are made of the sewing including the sleeves, collars and pockets; damages, dimensions, etc.
- h. Packing

(5) Required personnel

Spreading and cutting	2 (3)*
Machine sewing	27 (54)
Pressing	3 (6)
Checking and packaging	3 (6)
Managers	2 (3)
Technicians and designers	2 (3)
Total	39 (75)

*Figures in parentheses indicate case of 2 lines.

Note: The reasons for the large number of machine sewers (27) on each line are that it is assumed that the sewers will be unskilled, the process will be subdivided and the work will be simpler. (In Japan, 20 – 25 workers are used in one line in local areas where unskilled workers are used.)

Chapter 5

Draft Plan for the Industrial Estate

A master plan for the industrial estate which forms the core of the fundamental concept of industrial development in the Nyeri District is hereby presented on a tentative basis to contribute to the realization of this project.

The planning rationale of the industrial estate development aiming at well aligned industrial structure and regional development in general, namely "what kind of industrial estate should be made", especially in the Nyeri District, has been expanded with respect to the following four points.

The first point involves the progressive formation of various socioeconomic activities in the Nyeri District. The types of industry to be introduced to form the industrial estate have been investigated which lead to specifying the contents of the plan mainly by selection of the types of industry concerned.

In general when development is aimed at economic expansion in an area of a given size, the first prerequisite is the formation of an independent economic zone. Therefore, the requirement is to form an industrial site by the active introduction of various types of industry in accordance with the following aims:

- Effective utilization of natural resources in the region concerned.
- Self-sufficiency with respect to goods from other regions and imports.
- Fostering and strengthening of the existing industrial base.

Therefore, the industrial estate must be such that the industries selected should have sufficient possibilities to achieve their production goals, which requires improved land, factory buildings, and an adequate supply of utilities including electric power, and transport.

The second point is concerned with the spacial formation of the Nyeri District. An important point to be considered in regional development is the selection of the industrial site location on the basis of coordination between the provision of an effective regional infrastructure and urban planning such as the practical layout of urban housing and the industrial site which will be a new source of employment (compact land utilization is desirable to allow for a sufficient reserve for future population increases and urban expansion).

The third point involves the problem of planning scale. The scale at the initial stage of industrial estate planning is generally decided by studying the following conditions:

- Demand level of companies to be located on the site (external condition)
- Manageable scale of the estate as a whole (internal condition)

In the case of medium and small-scale companies, the location requirements have a strong correlation with the economic scale of the region concerned. Even though it is desirable to concentrate several companies at one site to obtain an integrated profit, there is a certain level as to how many due to the limitation of cost effective management of the estate as a whole.

In the case of the Nyeri industrial site, it is considered appropriate for the first stage of development to propose a site development plan requiring 5-10 ha for 20-25 companies in consideration of the Nyeri District characteristics coupled with the surveys and the experiences of the K.I.E. in Nakuru Mombasa and Kisumu. Therefore, when formulating the plan, investigations should be first made concerning the land which can be procured and the companies to be established based on the abovementioned scale and basic planning goals, and then, the final step should be working out of the detailed plan.

The fourth point concerns the facilities to be included in the plan. The economic benefits of industrial sites are generally based on the following points:

1. Economy of scale according to estate development
2. External economy induction factor resulting from the concentration of companies in large scale.
3. Furnishing of various types of services as a result of the concentration of many companies on the site.

These benefits will occur only when single entity activities are allowed. Therefore, the establishment of the estate involves not only the concentration of several companies but also must be based on a plan which has as its goal the formation of a single organizational unit with the possibility of providing unified management and control to tackle such matters as the supply of facilities and services, management and technical training, information exchange, and the stable supply of utilities such as water and electrical power which cannot be solved economically by an individual enterprise located in the estate. Therefore, the site must include not only factories but also include such facilities as an administration building, technical service center (T.S.C.) meeting room, restaurant and environmental control facilities such as waste water treatment equipment coupled with the qualified managerial personnel. The administration building will play a central function such as promotion and management of the entire estate, technical and management services, data services concerning distribution and other fields, and the control of utilities.

The technical service center will undertake the supply of machinery and equipment required by companies in the estate, the repair of production facilities in individual factories, the provision of equipment required for parts manufacture and technical training. Another important part of the industrial estate is the provision of leisure and recreational facilities such as restaurants, meeting rooms, sports facilities and green areas. It is necessary to formulate a draft plan based on a reconfirmation of the concept of services and systems which bring together the aims of individual companies in the estate and the estate as a whole.

5-1 Selection of Land Suitable for Development

In general, the selection of land suitable for the development of an industrial estate is carried out by investigating the following points:

- (1) The land must be such that there seems to be no major obstacle to site preparation, especially with respect to civil engineering.
- (2) The land chosen must be not only in harmony with current conditions and future land utilization policies in the region concerned but it must also have as critical as

- possible an effect on future building programs in the region.
- (3) The land must be able to be supplied with the utilities and have the infrastructure required for it to function as an industrial estate without excessive investment.

In this survey, an attempt was made to select land within the planning range of 5-10 ha in the Nyeri District which is best suited to development on the basis of an evaluation of the development conditions for the land concerned.

Investigations were performed concerning estimation of land services (water supply, electricity) in accordance with the development scale of the industrial estate in Nyeri; topographical conditions of the land, possibilities of expansion, accessibility for commuting employees, traffic conditions for freight transport, etc., according to current conditions; neighboring land utilization, the effects of distribution of the facilities, current urban planning, in relation with future urban development trends, wide ranging urban correlation conditions, drainage condition from the site, etc. The most suitable land for development of an industrial site in Nyeri was selected on the basis of an evaluation of the development suitability of potential areas currently in operation.

5-1-1 Conditions for Industrial Estate

The conditions for the industrial estate with respect to optimum land selection were set as follows:

- (1) Industrial estate development scale
It is assumed that the scale will be about the same as that of the existing industrial estates in Kisumu and Nakuru (5-10 ha). This will be the first stage development and additional land for future industrial development requirements shall be secured. First stage development scale 20-25 projects (Shed-type).

- (2) Investigations of number of employees, water supplies and electrical power requirements in the estate.

The following figures are for the first stage of development (standard factory type for 20-25 projects).

a. Number of employees

— 1st investigation

Using examples of small Japanese companies as a reference, the factory floor area per employee was calculated for the assumed types of industries for the Nyeri industrial estate and similar industries and then the number of employees required for the estate was estimated as a prime unit.

● Average factory floor area per employee

Average floor area per employee for each type of industry is 10.2 m².

● Estimated scale of standard factories for the estate

Using the Nakuru industrial estate as a reference, the scales of the standard factory were estimated as follows for three cases: the case where there are many large-scale standard factories, the case where there are many small-scale standard factories and the case where both types of factory are about even.

- A. Many large standard factories
 - 1,500 sq. ft. 20%
 - 2,250 sq. ft. 20%
 - 3,000 sq. ft. 30%
 - 3,750 sq. ft. 30%
- B. Many small standard factories
 - 1,500 sq. ft. 30%
 - 2,250 sq. ft. 30%
 - 3,000 sq. ft. 20%
 - 3,750 sq. ft. 20%
- C. Equal distribution of both large and small standard factories
 - 1,500 sq. ft. 25%
 - 2,250 sq. ft. 25%
 - 3,000 sq. ft. 25%
 - 3,750 sq. ft. 25%

- Estimation of the number of employees
The number of employees have been estimated for each of the cases above according to the average floor area per employee for standard factories as follows:

Standard factory scale case A	
20 standard factories	505 employees
25 standard factories	632 employees
Standard factory scale case B	
20 standard factories	451 employees
25 standard factories	564 employees
Standard factory scale case C	
20 standard factories	478 employees
25 standard factories	598 employees

- 2nd investigation
This investigation was performed according to the number of employees per standard factory in existing industrial sites.

- Number of employees per standard factory in existing industrial estate: approximately 17 persons
- Number of standard factories present: 20-25 factories
- Number of employees
 - 20 standard factories: approximately 340
 - 25 standard factories: approximately 425

From the results of the above investigations, the number of persons employed in the estate can be estimated as 400-600 persons.

b. Civil engineering and industrial water requirements

- Drinking water requirements
The amount of water required per person of the population was calculated from water utilization data in the Nyeri District, and water requirements in accordance with the planned population for the Nyeri industrial estate were estimated.

	Annually	Daily
1974	763,255 m ³	2,091 m ³
1975	837,813 m ³	2,295 m ³
1976	904,446 m ³	2,477 m ³

- Nyeri (Urban) population (1,000 persons)

	1973	1978	1980	1990*	2000*
Nyeri	27.9	36.3	40.3	73.0	122.9
Urban	14.4	22.8	27.4	73.0	122.9
Rural	13.5	13.5	12.9		

(Including Kiganjo)

Estimated Nyeri urban population in 1976: 20,000

- Water consumption per person in 1976

$$2,500 \div 20,000 = 125 \text{ } \ell/\text{person}$$

- Rate of consumption in the estate

$$50\% \text{ of daily consumption: } 62.5 \text{ } \ell/\text{person}$$

- Estimated water supply requirements

$$62.5 \times 400 = 25,000 \text{ } \ell$$

$$62.5 \times 600 = 37,500 \text{ } \ell$$

- Industrial water requirements

According to Japanese industrial statistics, the amount of fresh water used per unit factory construction area (100 m²) of the industries proposed for the Nyeri industrial estate was calculated. A classification was made between industries using large amounts of water and those using little and then the maximum and minimum values of industrial water requirements for the Nyeri industrial estate in accordance with a combination of the standard factory types were estimated.

- Industrial water utilization of the proposed industries

Industries using a large amount of water

Amount of industrial water used per unit factory area:

	(m ³ /100 m ²)
Carpet manufacturing	2.97
Towel manufacturing	5.76
Urea resin processing	4.12
Rubber sundries manufacturing	7.21
Leather secondary processing	6.74
Agricultural implement manufacturing	5.36
Plastic sundries manufacturing	5.97
Sporting goods manufacturing	2.67
Glass sundries manufacturing	3.87
Average	4.97

Industries using a small amount of water

Amount of industrial water used per unit factory area:

	(m ³ /100 m ²)
Readymade clothing manufacturing	1.05
Leather products manufacturing	0.83
Ironworks	0.80

Construction fixtures manufacturing	2.37
Valve products manufacturing	2.66
Electrical parts manufacturing	2.01
Bamboo processing and wood products manufacturing	0.75
Machinery repair shops	2.14
Average	1.58

- **Estimated standard factory scale**

The standard factory scales were estimated on the assumption of the number of employees estimated above and the same conditions as in Nakuru.

A type	1,500 sq. ft. (139.35 m ²)
B type	2,250 sq. ft. (209.03 m ²)
C type	3,000 sq. ft. (278.7 m ²)
D type	3,750 sq. ft. (348.38 m ²)

- **Combination of standard factories and types of industries**

The maximum value was assumed to be for the case of an industry using a large amount of water in a large standard factory and the minimum value the case of an industry using a small amount of water in a small standard factory. The industrial water requirements in both cases were investigated. A combination of the type of industry and standard factory is given below.

Maximum value cases

Industries using large amounts of water	D type factory (50%)
Industries using small amounts of water	A type factory (50%)

Minimum value cases

Industries using large amounts of water	A type factory (50%)
Industries using small amounts of water	D type factory (50%)

- **Industrial water requirements**

Maximum values

Case of 25 factories	244 m ³
Case of 20 factories	195 m ³

Minimum values

Case of 25 factories	156 m ³
Case of 20 factories	124 m ³

From the above investigations, it can be assumed that the industrial water requirements on the Nyeri industrial estate will range from 250 m³ to 100 m³.

c. **Estimated electrical power requirements**

The Nyeri industrial estate electrical power requirements were estimated using the electric power capacity for the standard factories in the Nakuru industrial estate for reference.

- **Power capacity in the standard factories in the Nakuru estate**

Power capacity for D type plant about 14 kW

- **Estimated power requirements**

The A type factory power was estimated as follows on the basis of permissible power capacity of the D type factory of approximately 14 kW.

By combining the standard factory layout, estimates were made for cases of both high and low site power requirements.

- A type standard factory power capacity
50% of that for the D type factory: 7 kW
- High power capacity requirements
Two-thirds of total layout is D type standard factories.
One-third of total layout is A type standard factories.
Case of 25 factories Approx. 291 kW
Case of 20 factories Approx. 233 kW
- Low power requirements
One-third of total layout is D type standard factories.
Two-thirds of total layout is A type standard factories.
Case of 25 factories Approx. 233 kW
Case of 20 factories Approx. 187 kW

From the above investigations, it appears that the Nyeri industrial estate electric power requirements will be in the 200-300 kW range.

5-1-2 **Conditions of Optimum Land Selection**

The optimum land was selected in accordance with the following conditions:

- (1) Scope of optimum land selection
Within the Nyeri Municipality
- (2) Selection method and results

First, the land where development is possible in accordance with topographical and current land utilization conditions was selected. In the case of topography, development was considered possible on land with a slope of 10% or less. In the case of land utilization, development was considered possible on large scale agricultural land, land with buildings or other structures, protected forests (Nyeri, Kiganjo and Nyeri Hill forests), national parks and land with existing communities (mainly to the south of the city of Nyeri). Fig. 5-1 shows the potential sites with a total area of 5 ha or over selected according to the above conditions.

Current conditions of this 18 potential sites were compiled with respect to the following development conditions. The advantages and disadvantages of each of the sites with respect to each development condition were compared and a final overall evaluation was made for each site. The results of the evaluations are shown in Table 5-1.

Development conditions:

- Road traffic conditions
- Electric power supply conditions
- Water supply conditions
- Drainage conditions
- Commuting conditions
- Related facility distribution conditions
- Problems concerning proximate environment
- Nyeri urban planning
- Future Nyeri expansion trends
- Possibility of site expansion

Table S-1

Site Item	1	2	3	4	5	6	7	8	9
Space Available (ha)	66.5	13.6	7.4	55.7	19.0	45.6	11.7	10.3	7.5
Road Traffic	3.5Km of access road to be up-graded	300m of new access road to be built	200m of new access road to be built	4.5Km of access road to be up-graded	1.5Km of access road to be up-graded	1.2Km of access road to be up-graded	facing all weather road (unpaved) 500m to the paved road	facing the paved road	facing all weather road (unpaved) 500m to the paved road
Power Supply	2.5Km to the 11KV O/H line	3.5Km to the 11KV O/H line	4.0Km to the 11KV O/H line	1.2Km to the 11KV O/H line	1.2Km to the 11KV O/H line	300m to the 11KV O/H line	300m to the 11KV O/H line	2.0Km to the 11KV O/H line	2.3Km to the 11KV O/H line
Water Supply	no drinking water available no river water available	no drinking water available no river water available	no drinking water available no river water available	no drinking water available 300m to the Muringato River head: 40m	no drinking water available no river water available	no drinking water available 150m to the Muringato River head: 40m	no drinking water available near to the water purification plant 300m to the Chanya River head: 60m	no drinking water available no river water available	no drinking water available no river water available
Drainage	200m to the tributary of Muringato River	100m to the tributary of Muringato River	100m to the tributary of Muringato River	300m to the Muringato River	300m to the Chanya River	100m to the Muringato River	200m to the Chanya River	750m to the tributary of Muringato River	adjacent to the tributary of Muringato River
Commuting Condition	3.5Km to the existing bus route	300m to the existing bus route	200m to the existing bus route	3.0Km to the existing bus route	bus service is not available	2.5Km to the existing bus route	facing the existing bus route	facing the existing bus route	facing the existing bus route
Environment	no particular facilities involved	no particular facilities involved	no particular facilities involved	no particular facilities involved	adjacent to Nyeri Hill	adjacent to the school	adjacent to the residential area	no particular facilities involved	no particular facilities involved
Related Facilities	none	none	none	none	none	adjacent to labour lines	adjacent to the market	none	none
Urban Plan	undesignated	undesignated	undesignated	undesignated	undesignated	undesignated	undesignated	undesignated	undesignated
Linkage with other cities	links with Mweiga thru highway	links with Mweiga thru highway	links with Mweiga thru highway	does not connect with highway	links with Ihururu thru highway	links with both Ihururu and Kabuyo thru highway	links with Kamakuwa (old) thru highway	links with Mweiga, Naro Moru thru highway	links with Naro Moru thru highway

Evaluation of Potential Sites

10	11	12	13	14	15	16	17	18
25.3	6.2	7.2	6.4	14.0	9.5	74.2	22.3	102.2
facing all weather road (unpaved) 1Km to the paved road	facing the paved road	facing the paved road	facing the paved road	facing the paved road	facing the paved road	facing all weather road (unpaved) 4.5Km to the paved road	facing all weather road (unpaved) 6Km to the paved road	facing all weather road (unpaved) 4.5Km to the paved road
1.9Km to the 11KV O/H line	100m to the 11KV O/H line	easy connection 11KV O/H line	easy connection 11KV O/H line	easy connection 11KV O/H line	200m to the 11KV O/H line	300m to the line (capacity unknown)	easy connection to the line (capacity unknown)	700m to the line (capacity unknown)
no drinking water available no river water available	400m to the Water Tower 250m to the Muringato River head: 40m	facing drinking water supply line 150m to the Chanya River head: 60m	facing drinking water supply line 400m to the Muringato River head: 60m	facing drinking water supply line 250m to the Chanya River head: 40m	facing drinking water supply line	no drinking water available no river water available	no drinking water available no river water available	no drinking water available no river water available
150m to the tributary of Muringato River	adjacent to the tributary of Muringato River	150m to the Chanya River	400m to the Muringato River	250m to the Chanya River	100m to the Chanya River	250m to the Muiga River	700m to the Amboni River	faces both the Amboni River and tributary of Muiga River
facing the existing bus route	facing the existing bus route	250m to the existing bus route	facing the existing bus route	facing the existing bus route	facing the existing bus route	facing the existing bus route	facing the existing bus route	facing the existing bus route
adjacent to the farmland	adjacent to the community	adjacent to the farmland	adjacent to the school	adjacent to the Rison, residential area	adjacent to the residential area	no particular facilities involved	no particular facilities involved	no particular facilities involved
adjacent to Telejmle one	adjacent to Telejmle one	none	none	none	none	adjacent to the Airfield	adjacent to the Airfield	adjacent to the Airfield
undesignated	undesignated	industrial area	industrial area	residential area	educational area	undesignated	undesignated	undesignated
links with Naro Moru thru highway	links with Mweiga, Naro Moru thru highway	links with both Ihururu and Kibuyo thru highway	links with Kiganjo thru highway	links with Kiganjo thru highway	links with Karatina thru highway	links with Naro Moru thru highway	links with Naro Moru thru highway	links with Naro Moru thru highway

5-1-3 Results of Land Selection

According to the selection results, the candidate sites with the highest potentiality for industrial estate development are Nos. 12, 13 and 14, followed by Nos. 10, 11, 15 and 18. The other potential sites are, inferior to those in the vital criteria for evaluation. For example, there are no approach roads or other poor road conditions (1, 2, 3, 4, 5, 6). Because they are far from the Old Municipality, utility conditions such as water supply (1, 2, 3, 4, 5, 6, 8, 9, 10) and electric power supply (1, 2, 3, 4, 8, 9, 10) are poor. Commuting conditions for workers are also inconvenient and there are many problems involved in the development of an industrial estate. The potentiality of these sites is extremely low.

Site Nos. 10, 11, 12, 13, 14, 15 and 18, which showed high values in the overall evaluation above, carry some problem points in the detailed, individual development conditions which are discussed as follows:

Site 10:

As in the case of neighboring sites 8 and 9, conditions for the supply of electrical power and water and drainage are so poor that it may be necessary to improve these infrastructures for the industrial estate development. Considering the future development trends in Nyeri, however it is doubtful that efforts for such infrastructural improvement will bring fair benefits.

Site 11:

Because the site is near to the Old Municipality, the utilization of facilities such as the existing power supply and water supply is easy and the road conditions are also good. There is no problem for commuting workers. However, the scale of the usable land is small and future expansion is difficult because of the topography.

Site 12:

This site is in the Old Municipality and infrastructural facilities such as roads, electrical power and water supply are provided and could be easily utilized. This site has also been designated as an industrial site in the Nyeri urban plan. However, the scale of usable land is small and the land is long and narrow which may restrict the layout of factory structures. There also appears to be no possibility for expansion in the future because there is a steep cliff to the south and the land on the other side of the road is a high productive large-scale coffee plantation.

Site 13:

As in the case of 12, this site is in the Old Municipality and the infrastructure conditions are much better than those in the other sites. The site also borders on the main road connecting the center of Nyeri and Kiganjo and its development potential is very high considering the direction of Nyeri urban expansion. However, the current land scale is very small, only about 6.4 ha (a Coca-Cola bottling plant is now under construction and only about 4.9 ha of the land can actually be used). Future expansion is considered possible to the east along the road facing the site but since this is outside the municipality, it is necessary to investigate the possibility of combining development outside the municipality with the Nyeri urban development program.

The current distribution of neighboring facilities includes an elementary school to the west and a housing development under the Nyeri urban plan, which is currently under

construction on the other side of the road facing the site. Therefore, noise, etc., produced by the factories must be considered.

Site 14:

This site is on the other side of the road facing site 13 and the location conditions are almost the same. However, part of the site is planned as a housing development area in the Nyeri urban plan and this development is already under construction. Conversion of land use in the future appears to be impossible and development of this site as an industrial estate is difficult.

Site 15:

This site is at the south end of the Nyeri Old Municipality and in the same way as sites 12, 13 and 14, infrastructure facilities and commuting conditions are good. However, this site is zoned as an educational area in the Nyeri urban plan and it would be necessary to change this plan to develop the site as an industrial estate.

The current distribution of public facilities and land use conditions around the area involve mainly educational facilities and the land has also been designated for utilization as a housing development. Therefore, this potential site is not suitable for development as an industrial estate.

Site 18:

Site No. 18 has the largest land scale of any of the sites and there is sufficient land not only to cover present scale of development but also to meet future industrial development requirements. The roads are unpaved but considered to be all-weather and approach by automobile is possible. For electric power, it is possible to use power lines to the Nyeri airfield. However, because the site is far away from the Old Municipality, the utilization of the existing water supply system is completely impossible. The utilization of river water from the Ambon River which flows along the east side of the site can be considered but it is extremely difficult because the valley is deep and there are still major problems in industrial development.

Because this site is far away from the Nyeri urban area and it is also far away from Kiganjo, this becomes development of an isolated area and the appropriateness of such development in future Nyeri urban formation is very low. This can be considered as a deviation from the future Nyeri development trends.

Based on the result of these investigations, site No. 13 selected and planned by K.I.E. is suitable for the development of the Nyeri industrial estate. However, this site is suitable with respect to nine development conditions including infrastructure conditions, commuting conditions, urban planning and the future direction of Nyeri urban development, and it is possible to secure development of about medium-scale between which falls in that of the K.I.E. Nakuru and Kisumu industrial estates. However, it is difficult to meet the necessity of industrial development in Nyeri due to the increase of population in Nyeri city and the surrounding districts, and increase in demand for employment opportunities. To comply with the future needs for expansion, it is necessary to secure an area which can absorb such needs on gradual basis. Future direction of expansion of the estate could be to the east but currently, the east side of the site is outside the boundary of Nyeri Municipality. Therefore, it will be necessary to expand the municipal boundary to allow future expansion.

Table 5-2 Result of Evaluation on the Potential Sites

Item	Site																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Space (ha)	66.5	13.6	7.4	55.7	19.0	45.6	11.7	10.3	7.5	25.3	6.2	7.2	6.4	14.0	9.5	74.2	22.3	102.2
Road traffic	2	3	3	0	1	2	5	10	5	5	10	10	10	10	10	5	5	5
Power supply	2	2	2	3	4	5	5	3	2	2	5	10	10	10	5	5	10	4
Water supply	0	0	0	3	0	3	10	0	0	0	6	10	10	10	10	0	0	0
Drainage	5	5	5	4	3	5	4	0	5	2	5	4	1	4	5	3	0	5
Commuting condition	3	3	3	0	3	3	10	10	10	10	10	10	10	10	10	5	5	5
Environment	10	10	10	10	5	5	5	10	10	10	5	10	5	5	5	10	10	10
Related facilities	0	0	0	0	0	5	5	0	0	5	5	0	0	0	0	5	5	5
Urban plan	3	3	3	3	3	3	3	3	3	3	3	10	10	0	0	3	3	3
Direction of urban development	5	5	5	0	3	3	1	5	5	5	5	3	10	10	10	3	3	3
Expansiveness	10	2	0	10	5	10	1	1	0	8	0	0	0	2	0	10	7	10
Overall evaluation	40	33	31	33	27	44	49	42	40	50	54	67	66	61	55	49	48	50

5-2 Basic Plan for the Industrial Estate

Generally, one of the benefits of locating factories in an industrial estate is service that can be offered as a result of concentration of many factories in one area. This benefit can be brought about only when all the factories located are well organized and can act as an economic entity for all activities.

Therefore, the industrial estate is not only an accumulation of several companies but it must also have as its goal the formation of an organization which will make possible overall control and management as well as the supply of facilities and services, management and technical training, information exchange and the stable supply of utilities such as water and electrical power, all of which individual companies can not handle themselves because of costs and other problems. This must be the basis of this plan.

Therefore, the industrial estate must consist not only of factories but also of such structures as an administrative building, technical service center (T.S.C.), meeting rooms, canteen, and environmental facilities such as a waste water purification plant coupled with the qualified administrative offices and maintenance engineers.

The administrative building will have a centralizing function in the estate providing business promotion, technical and management services, information services concerning distribution and other matters, and the control of utility services.

The technical service center (T.S.C.) will have such functions as supplying the machinery and equipment necessary for production by the occupants, technical training and provision of the equipment necessary for parts manufacture and repairs of the production machinery and equipment of individual factories. It is also important to provide the estate with recreational facilities such as a canteen, meeting rooms, exercise facilities and relaxing space such as green areas. Therefore, it is necessary to prepare a plan by reconfirming the importance of services that are offered by the estate to the occupants and the system in a form that the intentions of each occupant are unified into that of the estate as a whole and which will characterize the estate in question.

An attractive physical appearance is also an important element in the industrial estate plan. Therefore, careful consideration must be given to the design of landscaping. This design must be such that the estate has a high level of harmony with its natural surroundings. It must not be forgotten that the problem of design has a major influence on the formation of an awareness among the occupants and also has a very great impact on the success of the industrial estate.

The Nyeri industrial estate plan has been studied in accordance with the following policies on the basis of the above points.

- (1) The initial industrial estate development shall be in a triangular area of about 4.9 ha (excluding the Coca-Cola bottling factory) to the east of the Government Primary School, and site expansion to meet future demand shall be considered to the east of this triangular area (outside the Nyeri Municipality).
- (2) On this initial 4.9 ha, factories of the standard type shall be constructed and both a free design area and standard factories shall be designated on the land for future

expansion.

- (3) The estate as a whole shall be uniform in such a way that there is no functional division between the initial part and future expansion part of the construction.
- (4) The plan shall be such that the utmost is done to obtain the production areas within the planned land.
- (5) Land utilization zoning and site facilities shall be arranged so that there is rational functioning within the estate with respect to efficient management of the estate control and easy access of materials in and out of the factories.
- (6) An attractive estate shall be created befitting the scenic beauty of city of Nyeri.
- (7) Land utilization zoning, factory layout and arrangement of various types of industries will be such that noise, vibrations, smoke, etc., from the factories will have a minimum effect on neighboring schools and residential areas.

5-2-1 Investigations of Factories and Other Facilities to be Introduced in the Estate

(1) *Facilities to be introduced in the estate*

- a. Standard factories
Standard factories for leasing to small companies.
- b. Estate administrative building
Offices for the K.I.E. staff who manage the estate and also for the regional manager who controls operation in the whole Central Province.
- c. Technical service center
A factory for repair of machinery used by the factories of companies in the estate.
- d. Canteen
A restaurant for workers, visitors at the estate and for workers and residents of neighboring areas.
- e. Others
Water supply facilities (water tower, pumps)
Electrical receiving equipment
Waste water treatment plant

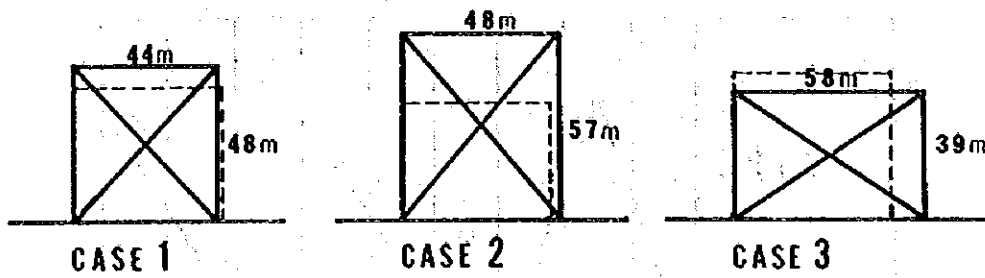
(2) *Investigation of the scale and form of standard factories*

- a. Investigations of standard factory minimum units
Minimum units for various types of industry were investigated on the basis of examples of existing small factories in Japan (1968) and the minimum units for the standard factories were decided so that the companies (types of industry) which wish to center the estate may all select the units that fit their different needs.

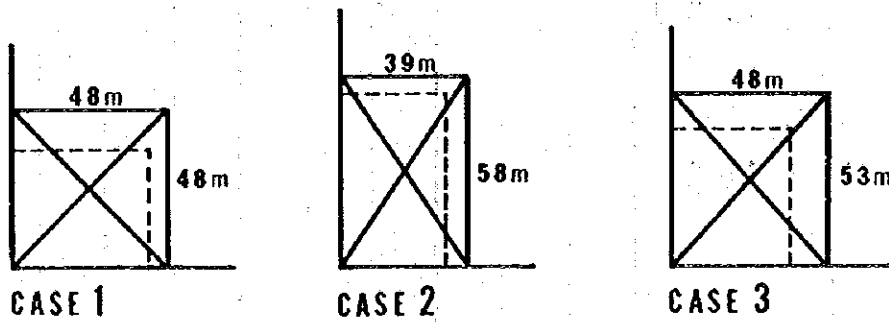
Minimum units for the various types of industries	
Type of industry	Extended floor area
● Bamboo processing and wood products (example: picture frames)	10– 20 m ²
● Rubber sundries (example: rubber packing)	10– 20 m ²
● Leather processing products (example: leather briefcases and handbags)	10– 20 m ²
● Leather secondary processing	x
● Glass sundries (example: glasses, ashtrays)	40– 50 m ²
● Ironworks (example: metal construction fixtures)	90–100 m ²

Unit Lot of Standard Factory

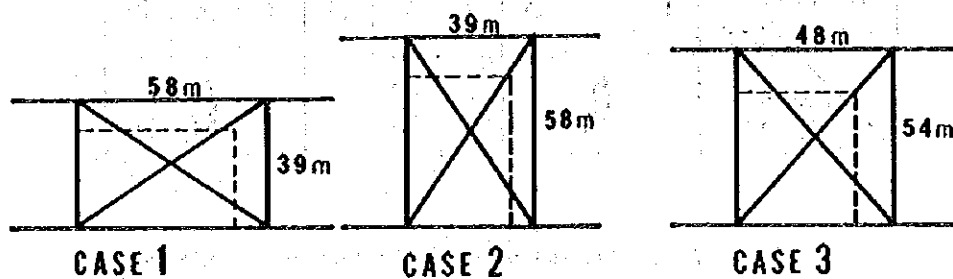
A Lot with one frontage



B Lot with two frontages (corner lot)

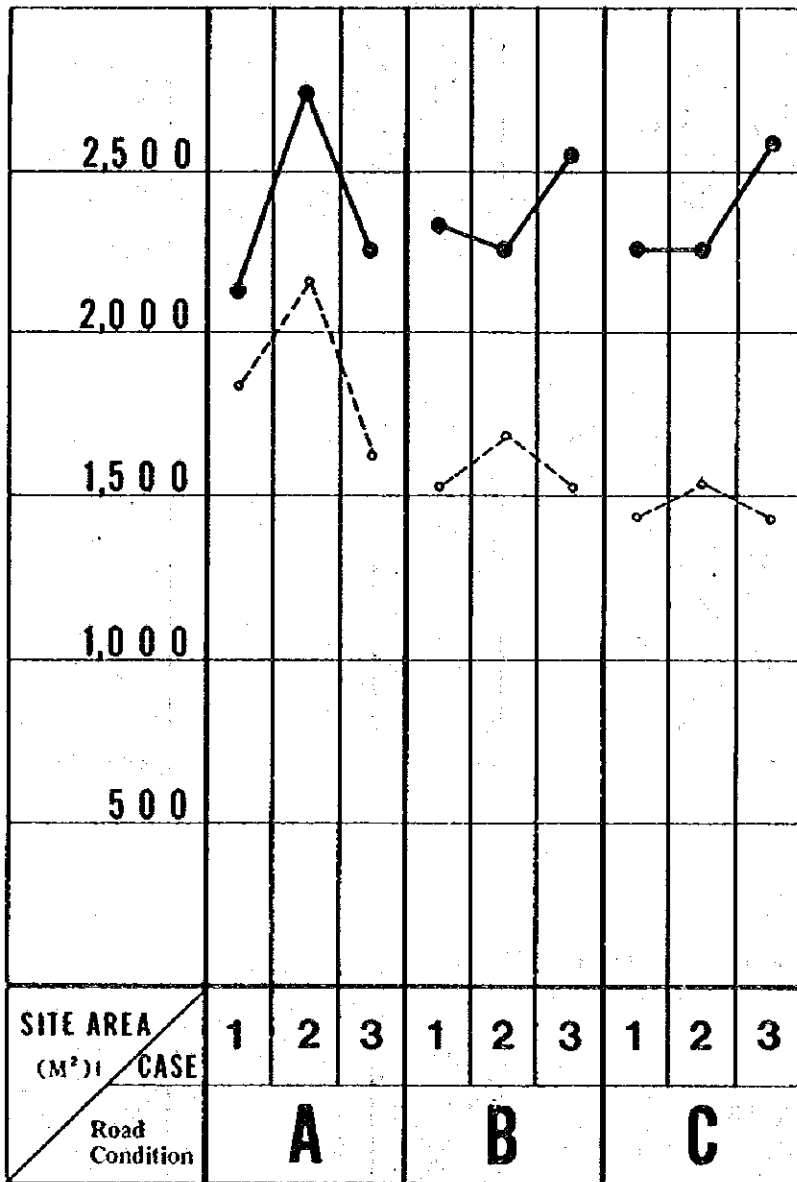


C Lot with two frontages (sandwiched lot)



* Broken line indicates when set back requirement is ignored.

Space Comparison of Minimum Unit Lot of the Standard Factory



●—● Set back requirement of building is considered.

○-○ Set back requirement of building is not considered.

30 m

Standard Factory Structure 450 m²

150 m ²	300 m ²
10 m	20 m

150 m² 300 m²

225 m ²	225 m ²
15 m	15 m

225 m² 225 m²

270 m ²	180 m ²
18 m	12 m

270 m² 180 m²

150 m ²	150 m ²	150 m ²
10 m	10 m	10 m

150 m² 150 m² 150 m²

Comparison with Nakuru Standard Factory Units in this Plan

In this Plan		Nakuru	
A	150 m ²	A	140 m ²
B	180 m ²	B	209 m ²
C	225 m ²	C	279 m ²
D	270 m ²	D	348 m ²
E	300 m ²		
F	450 m ²		

● Agricultural implements	x
● Construction fixtures (example: bolts, nuts)	20– 30 m ²
● Valve products (example: valves)	10– 20 m ²
● Electrical products (example: distribution panels, fuses, devices)	20– 30 m ²
● Plastic processing (example: plastic molding)	20– 30 m ²
● Sporting goods (example: leather bags)	10– 20 m ²
● Machine repairs (example: metal cutting, and welding)	40– 50 m ²
● Carpets	x
● Towels	x
● Readymade clothing	x

According to the above investigations, the largest minimum unit of the industries proposed for the estate is the 90–100 m² unit for the ironworks and it can be assumed standard factories on a smaller scale than this can not be located in the estate. Therefore, it is necessary that the standard factory be about 100 m² or larger so that the ironworks may freely choose a standard plant in the estate. The minimum unit in a minimum plant shall be about 100 m²

b. Investigation of standard building plans

– Standard span

The standard span shall be set at 15 m using the existing K.I.E. (Nakuru and Kisumu) standard buildings as reference.

Nakuru	about 15 m
Kisumu	about 18 m

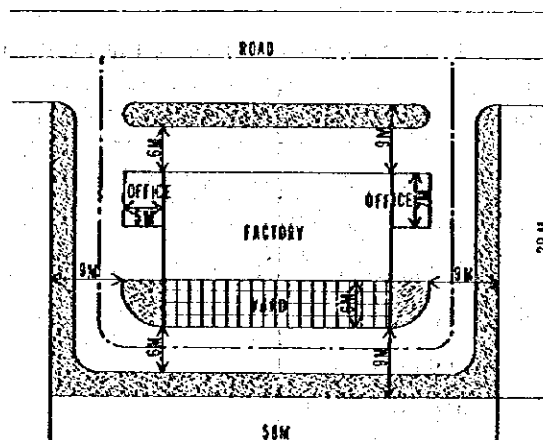
– Standard crossbeam

The crossbeam has been decided as follows to make it possible for one company to locate in one building in order to assure the independence of each occupant.

Standard factory crossbeam = span x 2 = 30 m

c. Investigation of standard factory units

The following standard factory units are planned by using partitions in the standard structure (15 x 30).



d. Standard land units

The minimum standard land units and shapes were investigated in two cases of road traffic conditions. The first in a single access to the road and second is double access to the roads with which the layouts of factory building, office building and parking lot may differ. It has been decided that the walls of the buildings will be set back 30 m from the various boundary lines so that there is an open space between the adjacent land boundaries and the frontage road in the layout of the factory building and office building.

(3) Investigation of scales of other structures

a. Administrative building

The following has been planned on the basis of models on the Nukuru and other estates.

Number of K.I.E. staff: 25

Extended floor area: 297 m²

Flat structure

b. Canteen

The following conditions have been set to reach the scale as follows:

Conditions

- Number of workers: about 500
- The number of persons using the canteen shall be 60%.
- Lunch hour shall be from 13:00 to 14:00.
- Seat occupancy time per person will average 20 minutes.
- The floor area per person shall be 1.4 m² (1.0 m² in the canteen and 0.4 m² in the kitchen).

Calculated scale

$$500 \times 60\% = 300 \text{ people}$$

$$300 \div 3 = 100 \text{ people}$$

$$100 \times 1.4 \text{ m}^2 = 140 \text{ m}^2$$

The canteen scale will be about 140 m²

c. Technical service center

The machinery and equipment which can be introduced are as follows:

- | | |
|------------------------------------|-----------------------------------|
| 1. Engine Lathe | 19. Marking off Table |
| 2. Shaping Machine | 20. Surface Plate |
| 3. Milling Machine (Horizontal) | 21. Hydrostatic Test Pump |
| 4. Milling Machine (Vertical) | 22. A.C. Arc Welder |
| 5. Radial Drilling Machine | 23. Gas Cutting Machine & Welder |
| 6. Upright Drilling Machine | 24. Portable Air Compressor |
| 7. Bench Drilling Machine | 25. Wood Circular Saw |
| 8. Universal Tool Milling Machine | 26. Wood Band Saw |
| 9. Universal Tool & Cutter Grinder | 27. Wood Lathe |
| 10. Tool Room Lathe | 28. Wood Planning Machine |
| 11. Bench Grinder | 29. Twist Drilling Grinder |
| 12. Cylindrical Grinder | 30. Wood Drilling Machine |
| 13. Internal Grinder | 31. Hardening & Tempering Furnace |
| 14. Flat Surface Grinding Machine | 32. Eccentric Press |
| 15. High Speed Cut off Machine | 33. Fly Press |
| 16. Metal Circular Sawing Machine | 34. Punching & Shearing Machine |
| 17. Power Hach Sawing Machine | 35. Bluprinting Machine |
| 18. Overhead Travelling Crane | 36. Drawing Board |

The machinery and equipment which should be provided in the T.C.S. must be decided selectively in accordance with the requirements of the located companies. Therefore, at the present stage, it is risky to specify the equipment to be introduced. This is a problem to be investigated together with the detailed project feasibility studies which are stated in Chapter 4.

However, given several ideas, the first is that the equipment for the wood industry should be selected in accordance with the equipment located in the Nyeri R.I.D.C. workshop controlled by the Karatina I.P.A. The second is that such consideration should be given to reduce financial burden of initial investment of the occupants by leasing universal types of equipment such as motors and converters. In any case, careful investigations are essential since T.S.C. services serve as incentives for companies to locate in the estate from a technical standpoint. In the chart plan, the T.S.C. structure area is given as 420 m².

5-2-2 Facility Layout and Land Utilization Plan

The land units of the factory investigated in the previous sections must be effectively established and a road layout must be made in such a way as the estate as a whole effectively functions. With these factors in mind, comparative investigations were performed for the following three land utilization plans which have different characteristics (Figs. 5-4, 5-5 and 5-6).

(1) Characteristics of the three plans

Plan A

To keep the number of roads low in the entire estate, two trunk roads will be provided and approach to the factories will be directly from these trunk roads. The administrative building, canteen and technical service center are in one block and this block functions as a center of the estate. This center block is located by the entrance gate to serve as a symbol. For easy control of the estate, one entrance shall handle all the traffic in and out of the estate. The waste water treatment plant, power reception equipment and water supply facilities are assembled in the utility block for centralized control. The utility block is assigned to the corners at the northern end of the estate which is not suitable topographically for factory buildings. Liaison roads to areas of future expansion will be extended from the center.

Plan B

One trunk road will pass vertically through the estate. Comparatively large area in the south has sub-roads connected with the trunk road where automobiles will have access to both the front and back of the factories.

As in the plan A, the administrative building, canteen and technical service center will be centralized in one location in about the center of the estate so that they may be utilized equally by all of the workers. The layout of the entrance and the utility block will be the same as in the Plan A.

Plan C

One trunk road will run vertically through the estate on the east side which is connected with sub-roads. The factory lots are so arranged that automobiles have access to both the front and back of the factories (two-roads frontage).

The sub-roads run parallel to the road passing in front of the estate. The center (containing the administrative building, canteen and technical service center as in the A and B plans) together with the entrance which serves as the estate symbol is located on the side of the expansion area to the east in consideration of future expansions. The layout of the entrance and utility block are the same as in Plans A and B.

Comparative Investigations of the Three Plans Land Utilization

Area	A		B		C		Remarks
	(m ²)	%	(m ²)	%	(m ²)	%	
Administration block	6,100	12.5	5,900	12.1	4,900	10.1	Administrative building, canteen, T.S.C.
Utility block	4,500	9.2	4,100	8.4	4,700	9.6	Waste water treatment, electrical reception, water supply and other facilities
Factory area	25,600	52.5	24,900	51.0	19,900	40.8	
Roads	8,100	16.0	8,200	16.8	11,100	22.7	
Unused land	4,500	9.8	5,700	11.7	8,200	16.8	Mainly land to the north and south of the Coca-Cola plant
Total	48,800	100.0	48,800	100.0	48,800	100.0	

In comparisons of the land utilization results for the three plans, the highest values of the land utilization percentages are shown by plan A for both the administration block and the factory land. In the actual layout of standard factories within the industrial land, 10 buildings can be accommodated in the A plan against 9 for B plan and 6.5 for C plan. The triangular areas on both ends of the estate become dead spaces and effective land utilization deteriorates.

In the case of road space, plan A has the smallest value followed by plans B and C. This effects not only the direct construction costs of the roads but also the construction costs for water and electrical supply routes because of the extended road lengths. From this standpoint, the A plan is the most efficient and economical.

In the A plan, the factory sites are divided into three groups, while in both the B and C plans, they are divided into five groups. Five blocks are too many to classify and layout, and assign each factory in accordance with the company's characteristics (company size and type).

From the standpoint of automobile access to the factories, the access directions to the factories can be differentiated in accordance with such factors as the type of automobile (truck, passenger car or pedestrian) and the type of goods (bringing in raw materials and taking out finished products) if the lot has two separate frontages with the roads. Therefore in this regard, the C and B plans are better than the A plan.

From the results of the this investigation, plan A was selected on the grounds that it assures more efficient land utilization and further it is more economical in the development costs.

(2) *Consolidation of facility layout and land conditions in the plan*

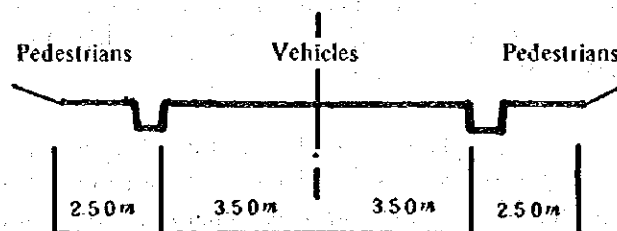
The A plan can be divided into four general zones (refer to the figure). In each zone, the facility layout and land conditions can be consolidated as follows:

Zone	Facilities	Land conditions
A zone	Standard factories 1 shed 520 m ² 4 sheds	<ul style="list-style-type: none"> - Almost all flat land - Access to factories by vehicles and people solely depend on one 12 m road - Standard factory layout selected on basis of land unit investigations described in previous section.
B zone	Administration Flat building Area 360 m ² Canteen Flat building Area 192 m ² T.S.C. Flat building Area 420 m ²	<ul style="list-style-type: none"> - Almost all flat land - For easy management, in the central portion of the estate adjacent to the entrance.
C zone	Standard factories 1 shed 520 m ² 6 sheds	- Land conditions almost same as for A zone
D zone	Utility <ul style="list-style-type: none"> - Waste water treatment - Water tank - Power reception facilities - Garbage treatment facilities, etc. 	<ul style="list-style-type: none"> - This is the lowest level in the estate and the rain and industrial and domestic effluents flow down to the north under the current topographical conditions. Therefore there is natural downflow in the utility zone and the Muringato River is located downward on the north of this zone.

5-2-3 **Road Plans**

(1) *Basic road plan policies*

Approach to all of the factories and other facilities will be by two trunk roads to avoid complicated vehicle and pedestrian routes in the estate as a whole and lower the number of roads in the estate. There is only one entrance to facilitate site control. Traffic routes for future expansion have been established at the present stage. The road widths have been decided as follows to assure pedestrian safety, make traffic smoother and cope with congestion during accidents, etc.



The factories will have parking areas on their premises so that cars will not be parked along the trunk roads. The approaches to each factory will be provided on their sites to avoid direct transport of goods from the trunk roads.

The planning standards are a width of 12 m, a total length of 667 m and a land occupancy rate of 16.6%. The roads will be paved with asphalt (with a gutter on the open side).

Since the road pattern consists of loop and dead-end patterns, there is no unrelated traffic (through-traffic) on the site.

5-2-4 Land Grading Plan

(1) *Basic policies of the land grading plan*

The soil distribution in the planned areas included volcanic rock of the Kenyan mountains from the neolithic and mesolithic periods and the rock is mainly basalt. There is no exposed rock anywhere on the land concerned. The soil is clayey. The flora are mainly small trees and grasses (fields are seen in part) and there are no obstacles with respect to grading. There is also nothing which should be conserved. Since the site scale is very small, only about 4.9 ha, the earthwork for the entire estate can be performed in one operation.

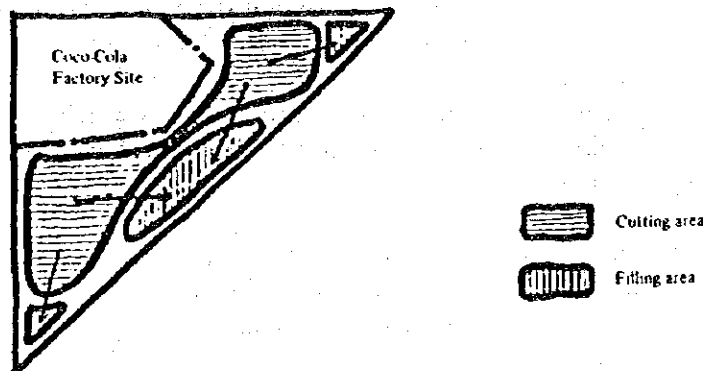
Since the soil of the site is clayey, the earthwork can be accomplished without any accidents due to the shifting of sandy soil. The grading surface has been investigated to keep the amount of civil engineering work to a minimum and balance the cut and fill of the site as a whole. The grading has been planned so that the present topography will be used as much as possible and no retaining walls will be used. A suitable ground level will be formed with respect to drainage of rainwater, etc.

(2) *Soil transport plan*

To maintain a cut and fill balance for the site as a whole, cutting will be performed on the south part of the site and to the north of the Coca-Cola plant and filling will be performed on the slanted land in the east part and the north corner of the estate.

Amount of cutting: 20,217 m²

Amount of filling: 19,393 m²



5-2-5 Plan for Green Areas and Open Spaces

In planning for green areas, it is necessary to give careful consideration to the natural environment surrounding the estate and minimizing the impact of the development on the local ecosystem. The surrounding area of the proposed Nyeri industrial estate is farmland, there is a school to the west and a road to the south. If the housing development now under construction on the other side of this road is taken into consideration, green areas should be arranged effectively around the estate to function as a scenic protection for viewing from the exterior.

A higher level of comfort and health will be assured by providing functions such as shade and air temperature regulation in accordance with a green open space plan to the area where people gather and move.

(1) *Points to consider in the green area and open space plan*

- a. The planned area is rich in natural environment with farming land behind the site.
- b. In the layout of green areas and open spaces, there should be a network of green areas and open spaces matching the various characteristics of the factory zone and the business and service zones.
- c. Greenery should be provided at the demarcation lines of the front road and the factories. The scenic beauty and comfort of the new industrial estate must be assured.

(2) *Green area and open space plan*

- a. In this plan, the green areas and open spaces cover approximately 4,250 m² (8.7% of the total) to form a small scale industrial park.
- b. Green areas will be located both at the entrance and central area of the estate. These areas will play a central role in the estate by serving as an organic bond for the neighboring factories, business and services.
- c. A network of pedestrian pathways and green areas will be especially stressed around the business and service zone to assure a safe from vehicle traffic.
- d. These areas will be open not only to site employees but also to outsiders so that a high degree of utilization will be formed.

(3) *Planting plan*

At first glance, it is easy to imagine that an industrial estate is an unhumanistic place but in this plan, a rich area is proposed with every effort made to conserve and regenerate the natural environment and establish a human environment.

- a. Since a careful investigation of the plants and trees suitable for the Nyeri Industrial estate is necessary this must be considered at the stage when the plan is executed.

Planting density:

High trees (3 m and over): 0.05 trees/m²

Medium trees (1.5 – 2.0 m): 0.1 trees/m²

Low trees (1 m or less): 0.35 trees/m²

5-2-6 *Plan for Supply and Treatment Facilities*

(1) *Drinking and industrial water*

The drinking industrial water will, in principle, be obtained from the Nyeri water supply system. This presents no problem with respect to the current conditions of the Nyeri water supply system. However, the minimum daily drinking and industrial water requirement for the estate will be about 130 m³ and 100% of this can not be obtained with the current water supply capacity. Supply of more drinking and industrial water by means of the Nyeri water supply system is impossible. Therefore, it will be necessary to consider obtaining water from the nearby Muringato River as the water requirements increase.

(2) *Site drainage*

The site effluents can be drained into the Muringato River but utmost efforts must

be taken to control such waste water so as not to deteriorate the quality of the river water. In consideration of the effects on the downstream environment, both drinking and industrial waste water will have to be treated in the estate. The treatment method will be investigated in the subsequent environment assessment section.

Treatment within the estate as a whole will be performed with respect to B.O.D. Treatment will also be performed in individual factories for materials which as the objects of other environmental standards.

Possible treatment methods:

- a. Drinking waste water and industrial effluent with a high B.O.D. concentration will be combined and released together with other waste water after treatment.
- b. Drinking waste water and industrial effluent with a high B.O.D. concentration will be combined and stored and then purified naturally by means of underground seepage.

The above two methods can be considered and the treatment method will have to be decided in the future at the stage when the industrial layout becomes clear.

(3) *Electrical power supply*

Currently, there is an 11 kV/m high voltage line in the vicinity of the planned industrial estate. If the power capacity (kVA) required by the companies locating in the estate is within the above capacity, it will be possible to lead in from this line by making adjustments with the East African Power and Lighting Co.

If the demands exceed the current surplus power available, a stable supply can be obtained from the Kiganjo Sub-station which is about 8 km away from the planned site.

(4) *Industrial waste*

Waste water release standards

The environmental standards in Nairobi (for release of water into rivers) are as follows:

1. C.O.D.: Not to exceed 10mg/l
2. Total nitrogen exclusive: NO₃ 1 mg/l
NH₃ 1.5 mg/l
3. B.O.D. (5 days at 20°C): Not to exceed 20 mg/l
4. P.H.: In the range 6 to 9
5. Suspended solids: Not to exceed 30 mg/l
6. Total dissolved solids: Not to exceed 1,500 mg/l
7. 4 hours oxygen absorption for permanganate N/80 at 27°C not to exceed 15 mg/l
8. Nitrate as NO₃ Not to exceed 45 mg/l
Greases: The wastes should not contain more than 100 milli grams per litre of greases that dissolve in Ethyl-ether.
9. Oil, Petrol, Kerosene or other combustible materials must be intercepted.
10. Toxicity: The wastes should not include any toxic materials.
11. Temperature: Not to exceed 25°C

	Treated washing water (m ³ /100m ²)	Cooling water (m ³ /100m ²)	B.O.D. (P.P.M.)	Load (g/100m ²)
1. Carpet manufacturing	1.47	0.0078	10	14.70
2. Towel manufacturing	2.06	0.1300	60	120.36
3. Readymade clothing manufacturing	0.02	0.0000	10	0.20
4. Urea resin processing	0.81	1.5000	10	8.10
5. Rubber sundries manufacture	0.48	10.0100	10	4.80
6. Leather secondary processing	5.64	0.3500	3,000	16.92
7. Leather products manufacture	0.03	0.0200	10	0.30
8. Ironworks	0.15	0.2600	10	1.50
9. Agricultural implements manufacturing	0.22	4.8200	10	2.20
10. Construction fixtures manufacturing	0.72	0.8900	10	7.20
11. Valve products manufacturing	0.97	1.0900	10	9.70
12. Electrical parts manufacturing	0.53	0.5800	10	5.30
13. Plastic sundries manufacturing	0.28	6.3000	10	2.80
14. Sporting goods manufacturing	0.84	0.9600	10	8.40
15. Bamboo processing and wooden products manufacturing	0.11	0.0000	10	1.10
16. Glass sundries manufacturing	0.66	0.2800	10	6.60
17. Machinery repair shops	0.59	0.9100	10	5.90

The treatment of waste in the estate will involve dividing between domestic and industrial waste. The domestic waste will be removed by city garbage trucks from each of the companies in the estate and will be taken to the city garbage treatment plant where it will be incinerated. The industrial waste will be treated in facilities in the estate and the residual ash will be dumped in a place specified by the city.

5-2-7 Environmental Considerations (1) Effects of waste water (B.O.D.)

The effects of release of domestic and industrial waste water from the estate into the river can be evaluated as follows on the basis of assumed types of industries are introduced into the estate.

a. Prerequisite conditions

- The environmental standards related to river pollution are shown in the following table. For this impact study, it is a prerequisite that harmful substances such as poisonous materials be removed by treatment in the individual factories and the evaluation will be made with respect to the B.O.D. when the water is released into the river.
- The amount of domestic waste water and the B.O.D. concentration shall be 30 m³/day and 180 ppm.
- The B.O.D. concentrations for the treated water and the amount of industrial waste water (treated washing water and cooling water) will be as follows:

b. Investigation of B.O.D. concentrations

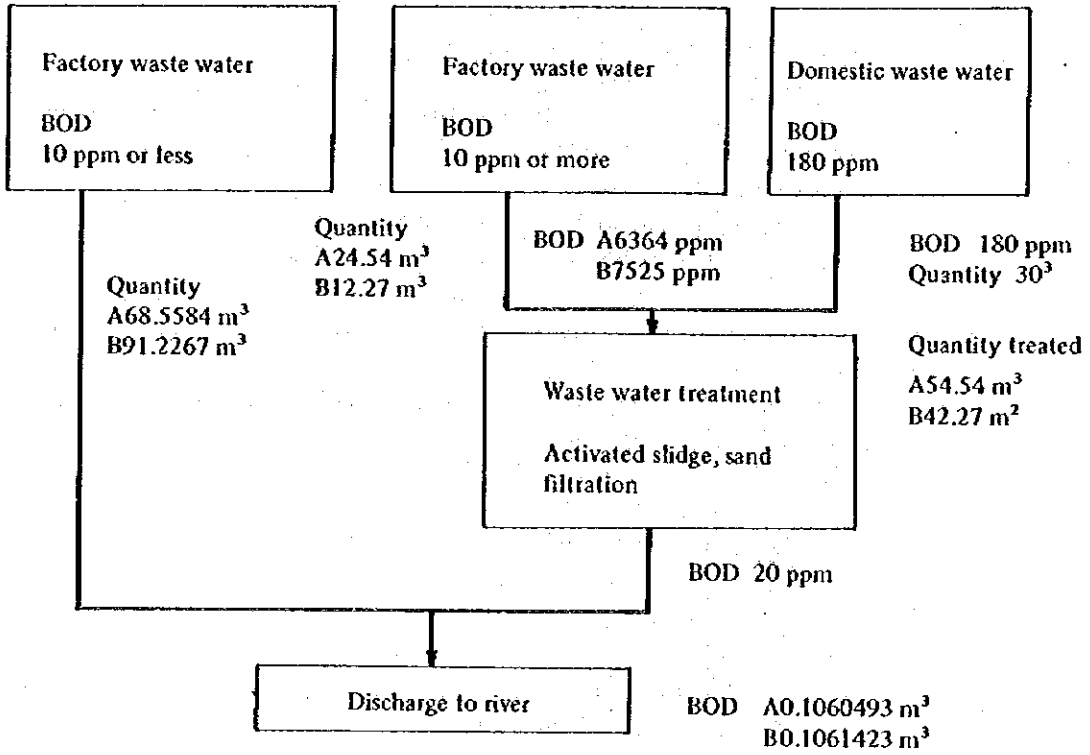
i) When untreated water is released directly into the river

- River for release Muringato River to the north of the estate
- Water quantity and amount (actual site survey results 3 March, 1977)
 1. Water temperature 15°C
 2. Transparency 9 cm
 3. B.O.D. concentration 0.1 ppm (by hearing)
 4. pH 6
 5. Flowrate 1.83 m³/sec.

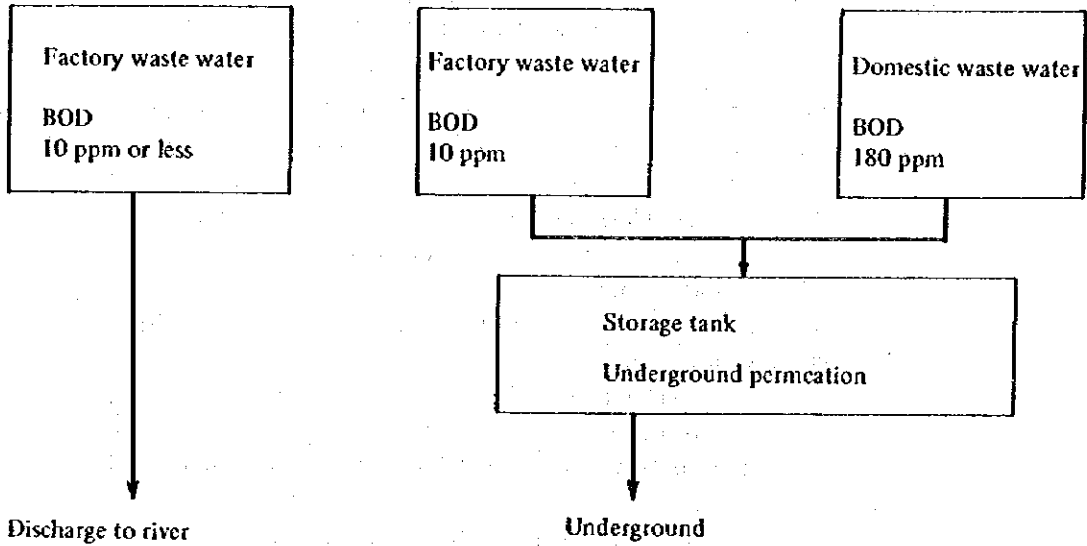
- Amount of factory waste water
 - Case of large amount of waste water
 - Case of use of large sheds by industries with large amounts of waste water (factory: 300 m²)
 - Case of use of small sheds by industries with small amounts of waste water (factory: 150 m²)
 - Treated washing water: $39.51 + 3.615 = 43.125 \text{ m}^3$
 - Cooling water: $15.6 + 34.35 = 49.95 \text{ m}^3$
 - B.O.D. load: $51285.18 + 36.15 = 51321.33 \text{ g}$
 - Case of small amount of waste water
 - Case of use of small sheds by industries with large amounts of waste water (factory: 150 m²)
 - Case of use of large sheds by industries with small amounts of waste water (factory: 300 m²)
 - Treated washing water: $19.755 + 7.23 = 26.985 \text{ m}^3$
 - Cooling water: $7.8117 + 68.7 = 76.5117 \text{ m}^3$
 - B.O.D. load: $25642.59 + 72.3 = 25714.89 \text{ g}$
- Amount of domestic waste water
 - Amount of waste water: 30 m³
 - B.O.D. load: 5,400 g
- Waste water B.O.D. concentration
 - Case of a large amount of waste water ($51285.18 + 36.15$)
 - $\div (43.125 + 49.95 + 30.0) = 416.99232$
 - B.O.D. concentration 416.99232 ppm
 - Case of a small amount of waste water ($5.400 + 25714.89$)
 - $\div (26.985 + 76.1557 + 30.0) = 192.62566$
 - B.O.D. concentration 192.62566 ppm

From the above, it is evident that the B.O.D. of waste water from the estate is much higher than the waste water standard values in the case of no treatment.
- B.O.D. concentration of river water when waste water
 - $(15811.2 + 5400 + 51321.33) \div (158112 + 30 + 93.075)$
 - $= 0.4583846 \text{ ppm}$
 - B.O.D. concentration when there is a small amount of industrial waste water
 - $(15811.2 + 5400 + 25714.89) \div (158112 + 30 + 103.4967)$
 - $= 0.2965398 \text{ ppm}$
- ii) Case of treated domestic and industrial waste water with a high B.O.D. concentration
 - Types of industries with high B.O.D. concentrations
 - Leather secondary processing: 3,000 ppm
 - Towel manufacture: 60 ppm
 - For other types of industry, the value is 10 ppm or less. When the above industrial and domestic waste water is treated by means of the activated sludge method and sand filtration, the B.O.D. concentration can be reduced to 20 ppm.

1



2



- Waste water B.O.D. concentration
 - Case of a lot of waste water
 - Amount of waste water 123.075 m^3
 - B.O.D. load $(600 + 626.1 + 36.15) = 1262.25 \text{ g}$
 - B.O.D. concentration $1262.25 \div 123.075 = 10.255941 \text{ ppm}$
 - Case of little waste water
 - Amount of waste water 133.4967 m^3
 - B.O.D. load $(600 + 313.05 + 72.3) = 985.35 \text{ g}$
 - B.O.D. concentration $985.35 \div 133.4967 = 7.3810813 \text{ ppm}$
- From the above, it is evident that the B.O.D. concentration of the waste water from the estate is much below the waste water standard values.
- B.O.D. concentration of river water after release of waste water
 - River water B.O.D. concentration when there is a large amount of factory waste water
 - $(15811.2 + 1262.25) \div (158112 + 123.075) = 0.1061493 \text{ ppm}$
 - River water B.O.D. concentration when there is a small amount of factory waste water
 - $(15811.2 + 985.25) \div (158112 + 133.4967) = 0.1061423 \text{ ppm}$
- From the above, it is evident that the water quality in the river remains almost unchanged when treated waste water is released into it.

c. Countermeasures

From the above investigations, it appears that the industrial and domestic waste water from the estate can not be released directly into the river without treatment.

In the case of the treatment mentioned above, both the activated sludge and sand filtration methods were used. This is the case where all of the waste water is discharged into the river. There is also the case where industrial waste water with a B.O.D. of 10 ppm or less is discharged directly into the river and industrial waste water with a high B.O.D. concentration is mixed with domestic waste water, stored in a tank and treated by underground seepage. In the latter case, the treatment techniques are simple and there is little direct effects on the river. However, it is not clear to what degree the underground seepage water is purified and what effect there is on the ground water. Therefore, in principle, it is an essential development condition that the industrial and domestic waste water are treated together to reduce the B.O.D. to at least 20 ppm or less and this waste water is piped to the river for discharge with which the current river water quality level is maintained.

(2) *Evaluation of the effects of noise*

The noise generated under working conditions when the proposed industries are located in the estate has been estimated, and its effects and countermeasures are investigated.

a. Main types of industry assumed to generate noise

		Noise level (phons) (1-3m from source)
Wood factories	Nail pounding	90
	Automatic planing	90
	Hole punching	100
Ironworks	Metal hammering	90 - 95
	Farm implements	95
	Grinding	90
	Forging	100
	Press (bending steel)	100
Sewing readymade clothing	Industrial machines	85
Leather sporting goods		

b. Peripheral facility distribution and land utilization

To the west of the estate is a government primary school.

There is farmland to the north and east.

To the south, on the other side of the Wangombe Waihura Road, a housing development is now under construction.

c. Countermeasures

- Factories generating noise will be located as far away as possible from the government primary school and the housing development under construction.
- The existing Coca-Cola plant will be utilized as a sound insulation wall.
- The factory layout should be as shown in Fig. 5-9.

d. Evaluation

- Effects of distance damping

In the case of a point sound source, the sound pressure level is normally decreased only a little as the distance is increased near the wall surface but as the distance from the wall becomes greater, the noise level can be expected to decrease by about 6 dB (in the case of the noise level, about 6 phons at a frequency of 1,000 Hz) every time the distance is doubled.

The following are the permissible noise levels inside schools and houses in Japan:

Detached houses (suburban)	NC 20 - 30 (35 - 45 phons)
Detached houses (urban)	NC 25 - 35 (40 - 50 phons)
School rooms	NC 30 - 40 (45 - 55 phons)

From the above, it appears to be possible to protect the school and housing environment from factory noise sufficiently without considering the sound insulation effects of the Coca-Cola plant, etc.

5-2-8 Related Infrastructure Provision Policies (Outside the Estate)

(1) Roads

Transport for the Nyeri industrial estate will utilize the trunk road adjacent to the estate (connecting Kiganjo and Nyeri). The current width is 6 m and the space for future widening is available. According to traffic surveys, 3,000 - 3,500 vehicles travel over this road daily and it is sufficient to handle the traffic resulting from future industrial estate development. Therefore, widening of this road as the estate develops is not urgent.

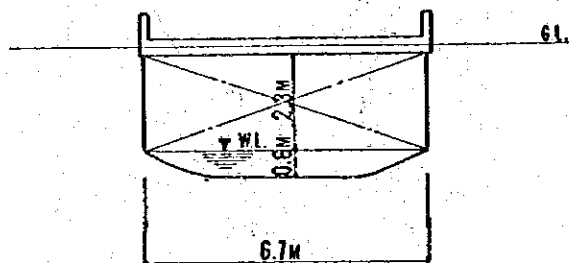
(2) **Water supply**

The water requirements as the industrial estate develops are assumed to be 130 m³ per day, including the industrial water. The main supply line of Nyeri city water is laid in the trunk road facing the estate and there is a slight water supply surplus but this system presents a problem as a stable supply source for such large amounts of water. In consideration of future expansions of the industrial estate, it is better to plan an independent water source for the estate.

According to the results of a river survey, the Moringato River located to the north of the estate provides an excellent water source with respect to both flow rate and water quality and water from this river can be considered as for industrial water supply. The provision of supply pumps, pump head facilities and other equipment is proposed.

— Moringato River survey data:
River cross-section:

NO. 1



No. 1 point measurements 3/4/1977

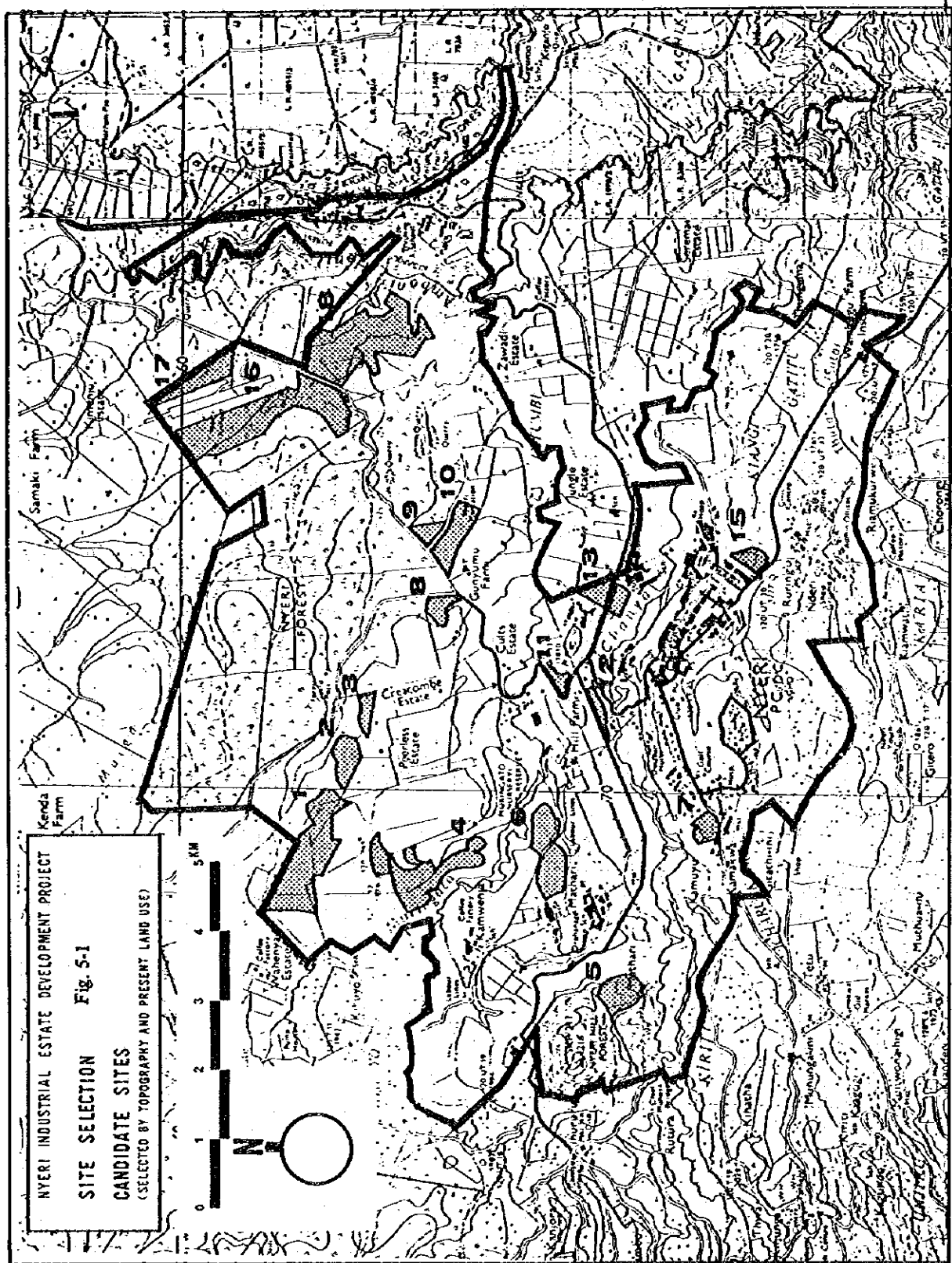
1. Air temperature: 20°C
2. Water temperature: 15°C
3. Transparency: 9 cm
4. pH: 6
5. Water surface slope \approx 3.5%
6. Flow speed: 0.5 m/sec.
7. Water level:
Current water depth is about 600 mm but it should increase by about 700 mm in the rainy season.
8. Flow rate: 13 m³/sec.

(3) **Electric power supply**

There is now an 11 kV overhead line near the estate but on the assumption of increased power requirements in the future in the estate, the laying of independent power supply lines from the Kiganjo Sub-station, about 8 km from the site, is proposed.

(4) **Waste water**

It is desirable that water treated to conform with the water quality specification be discharged directly into the Moringato River and about 600 m of water pipes will be needed for this purpose.



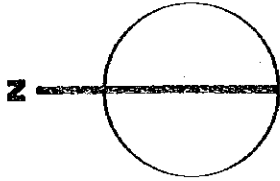
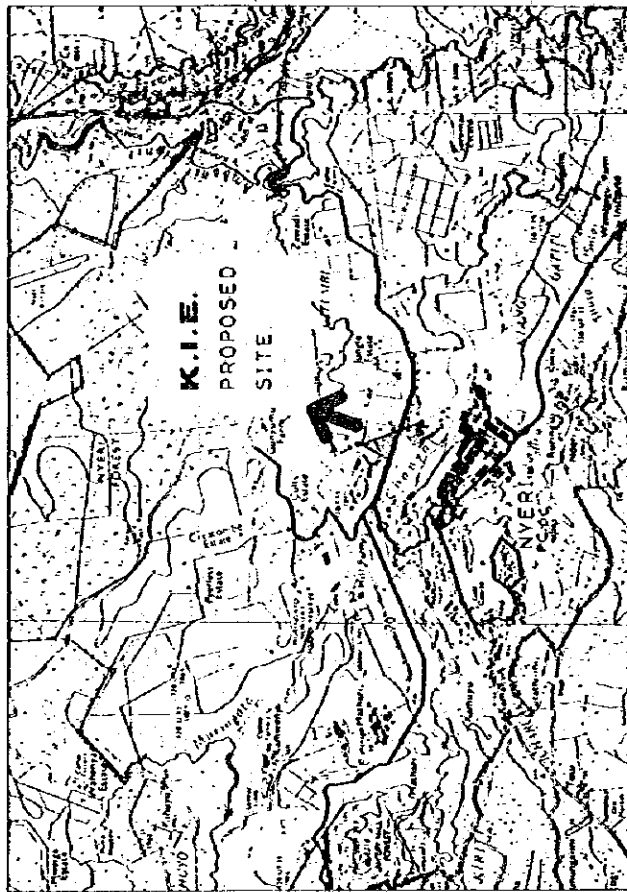


Fig. S-2 K.I.E. Nyeri Location

S. 1 : 50,000



N.I.E.D. PROJECT	10 JUN 77
1	NYERI
LOCATION	L. 50,000
JAPAN INTERNATIONAL COOPERATION SUBJECT	

Fig. 5-3 Unit Lot and Site Utilization Form

A Lot with one frontage

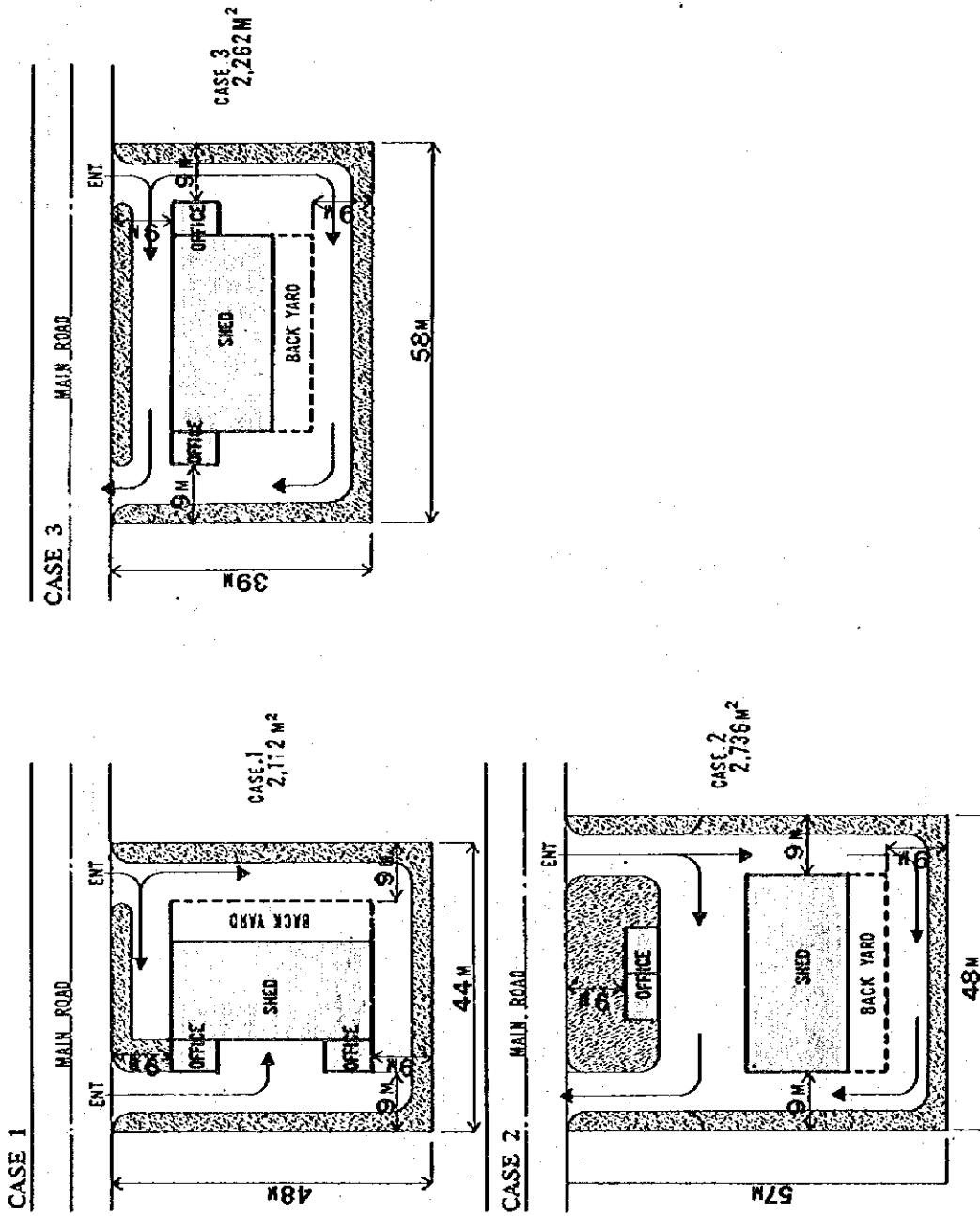


Fig. 5-3 (2)

B Lot with two frontages (corner lot)

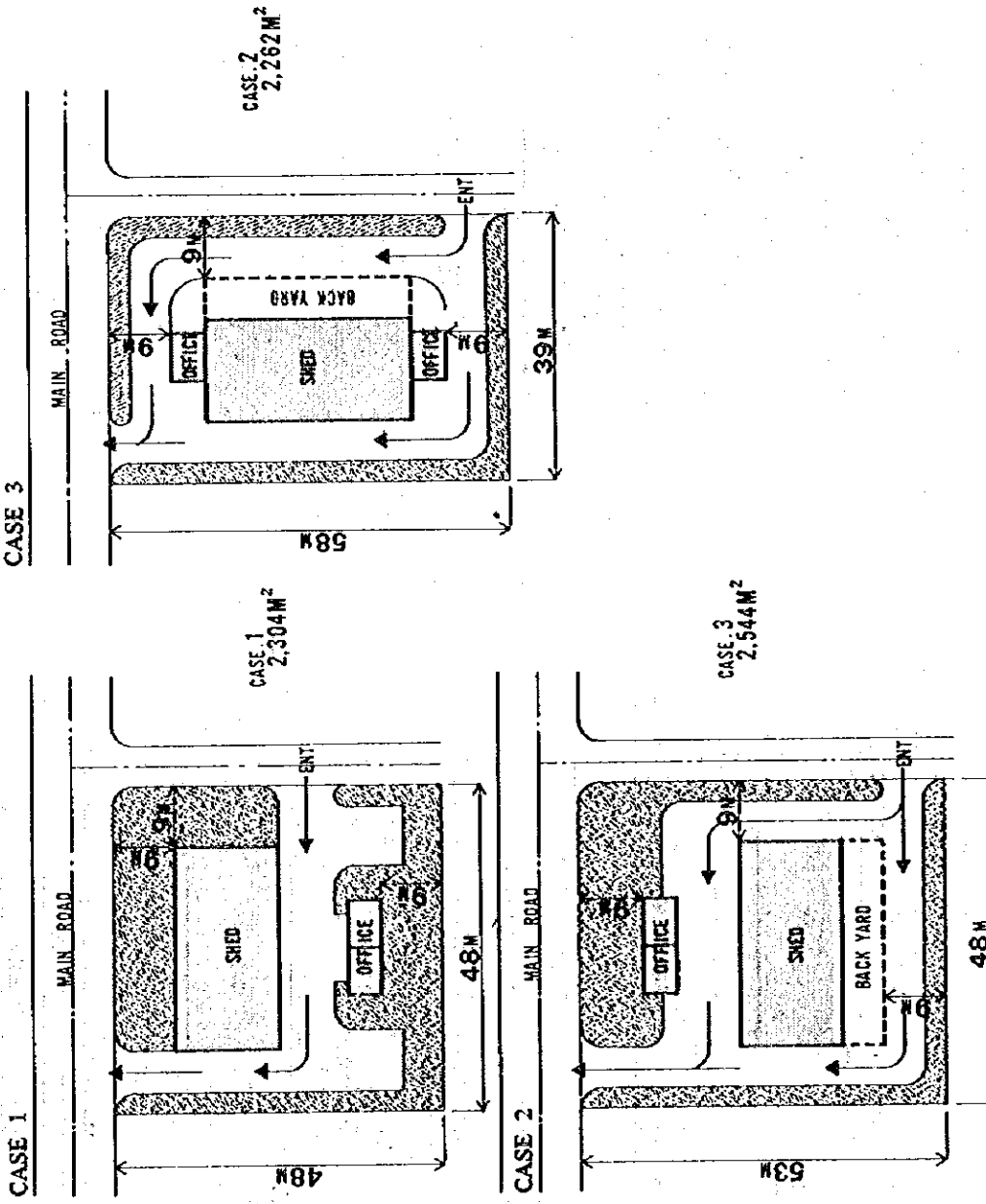
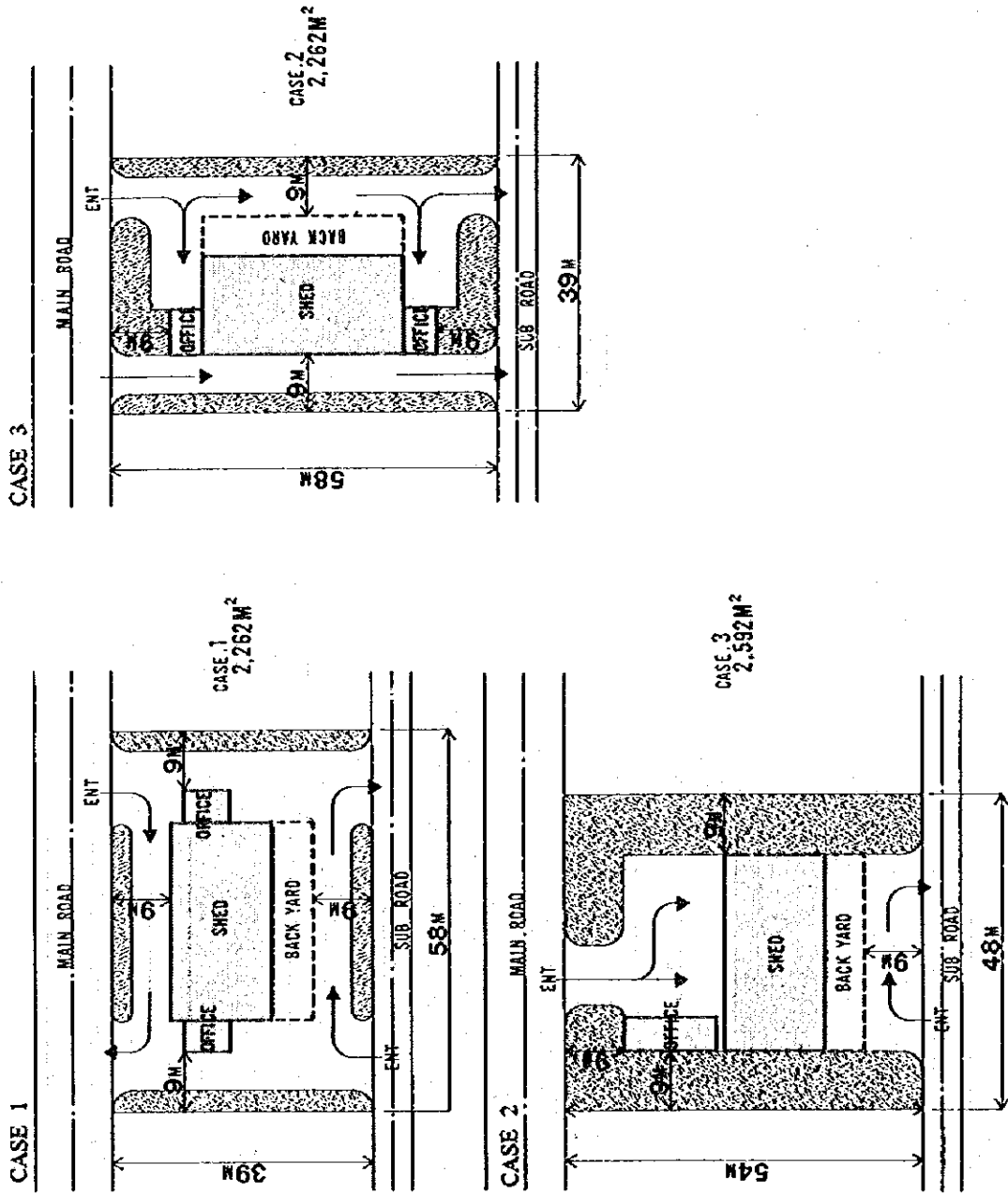
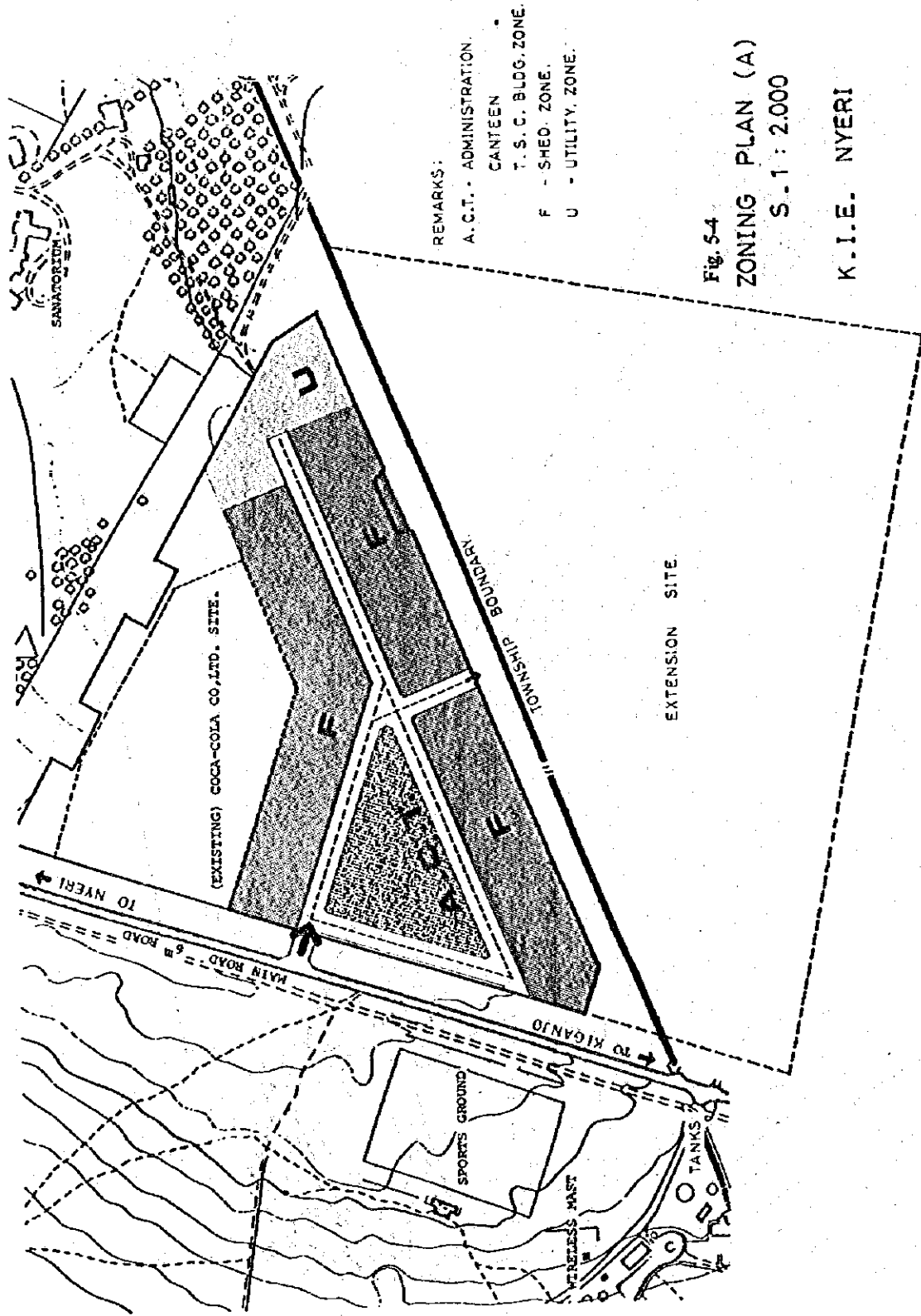
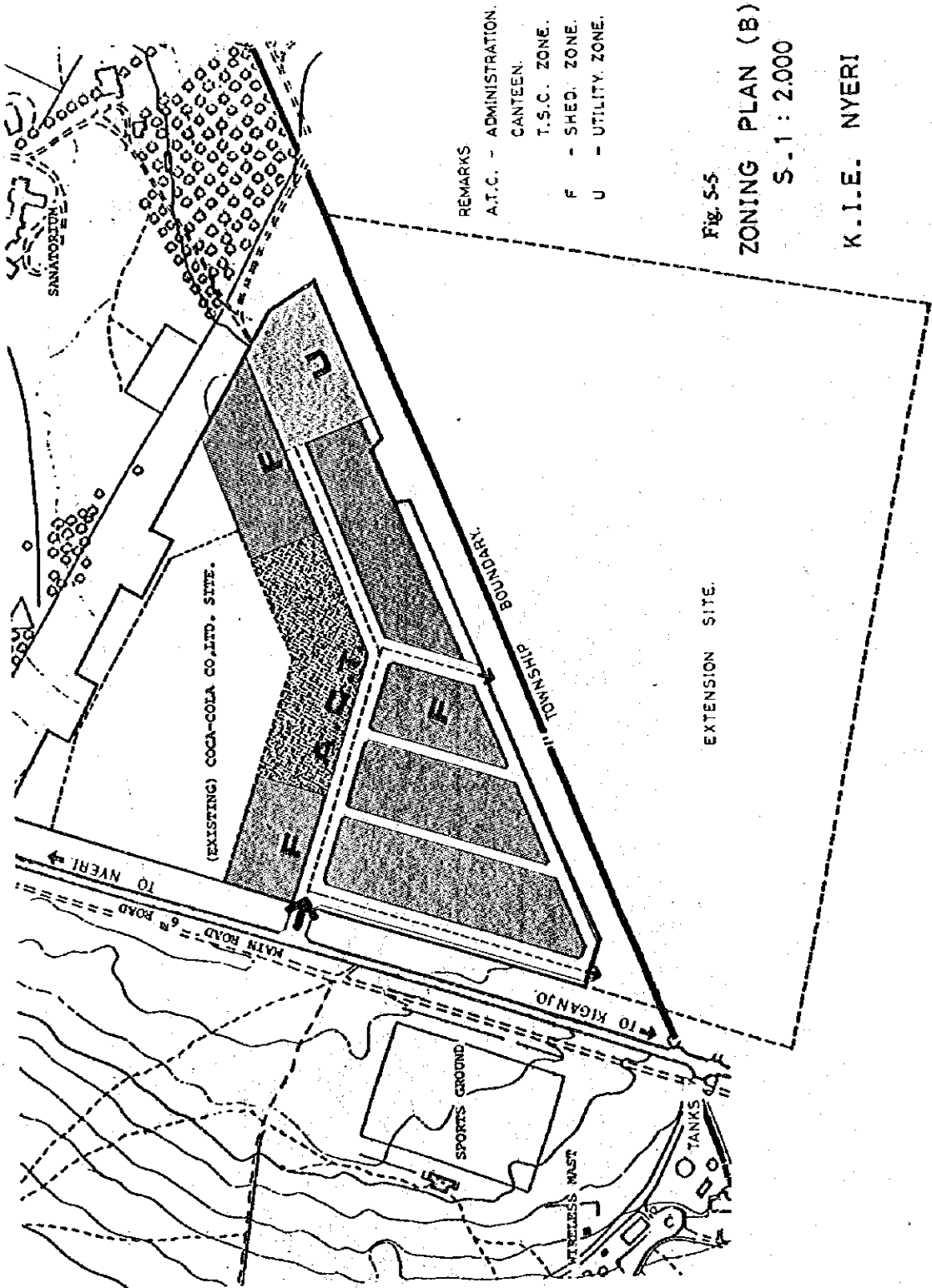


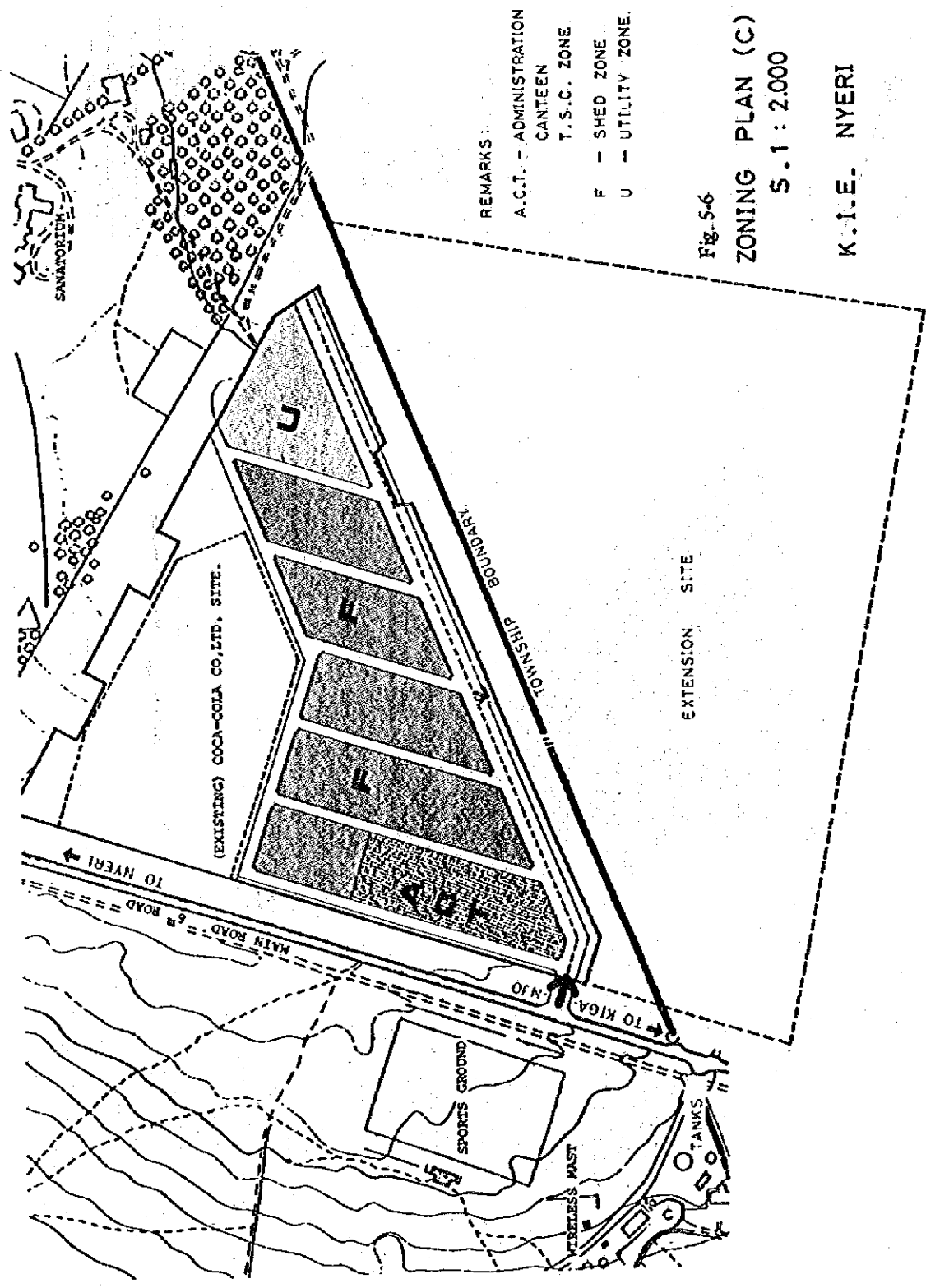
Fig. 5-3 (3)

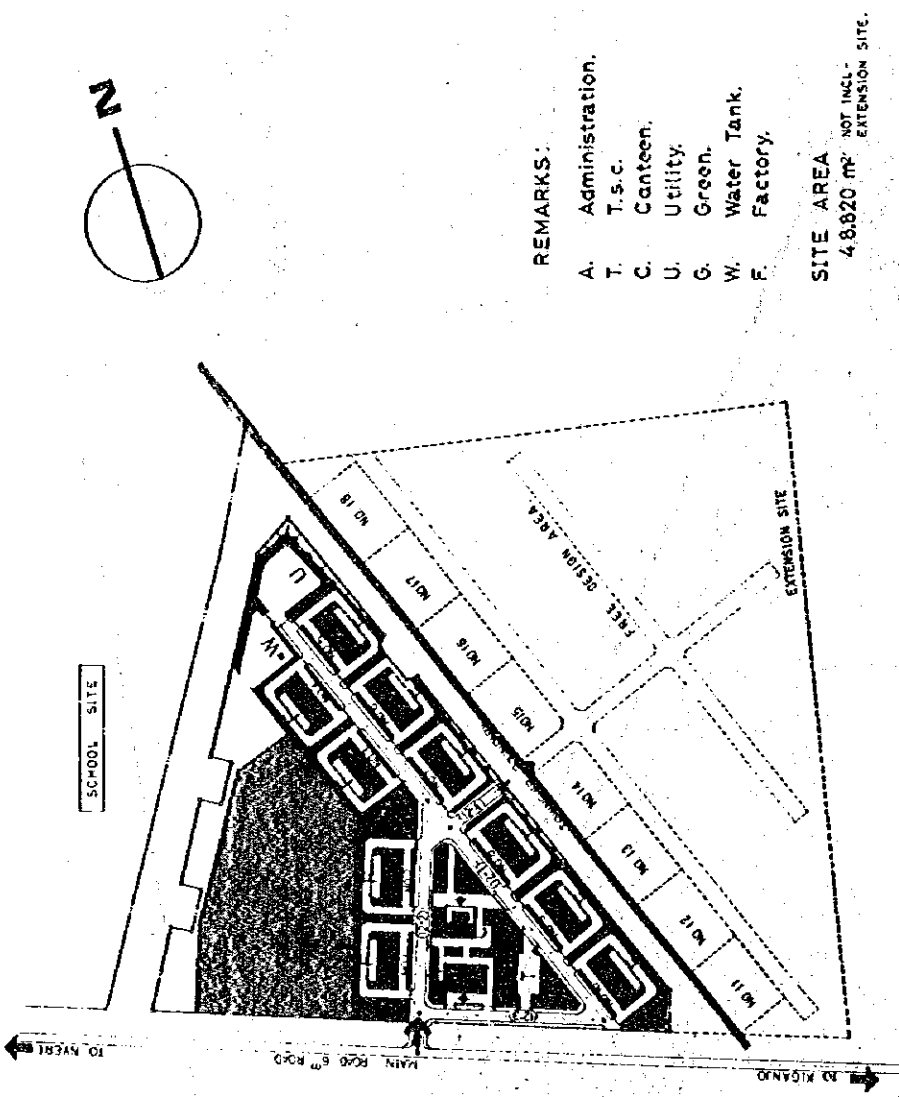
C Lot with two frontages (sandwiched lot)









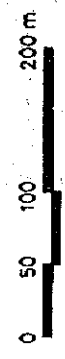


- REMARKS:
- A. Administration.
 - T. T.s.c.
 - C. Canteen.
 - U. Utility.
 - G. Green.
 - W. Water Tank.
 - F. Factory.

SITE AREA 48,820 m² NOT INCL. EXTENSION SITE.

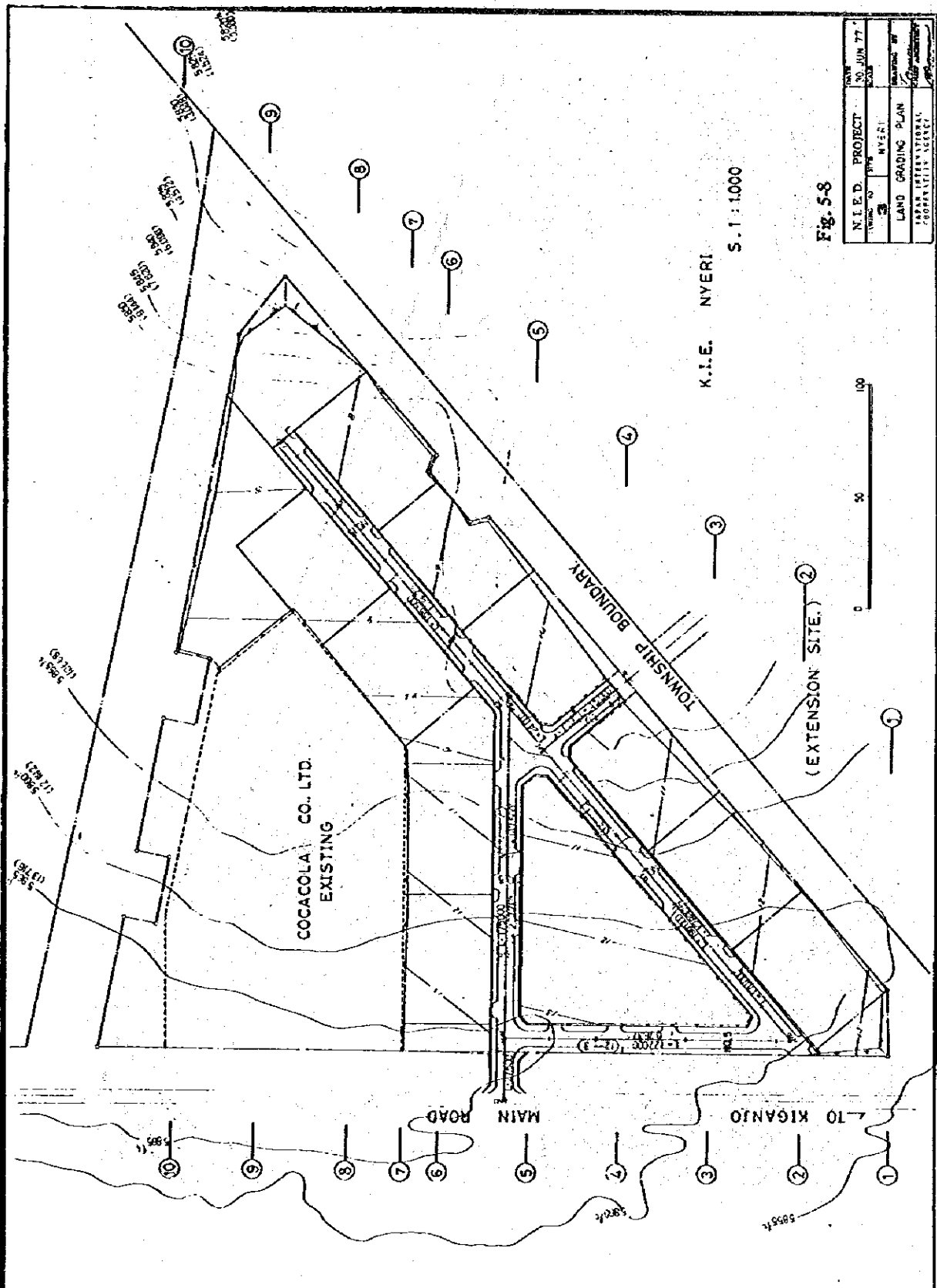
Fig. 5-7

N.I.E.D. PROJECT.	30 JUN 77
BY	NYERI
K.I.E PLOT PLAN.	
KAPPA INTERNATIONAL CORPORATION SUBJECT	



NYERI INDUSTRIAL
ESTATE DEVELOPMENT
PROJECT

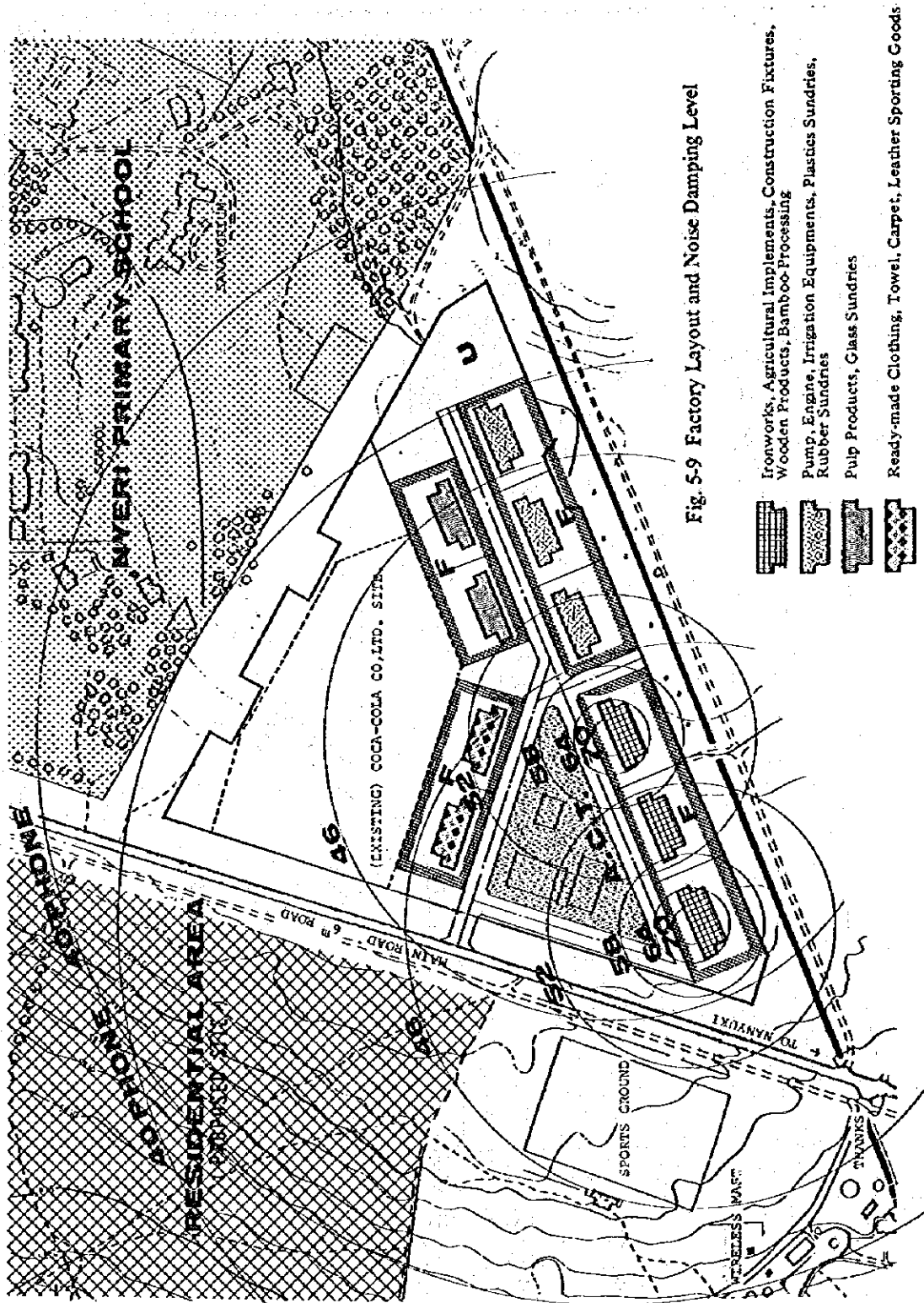
PLOT PLAN
Scale 1 : 2,000



DATE	30 JUN 77
PROJECT	NYERI
SCALE	1:1000
LAND GRADING PLAN	
DESIGNED BY	
CHECKED BY	
APPROVED BY	
AGENCY	LAND GRADING AGENCY

Fig. 5-8

K.N.E. NYERI
S. 1 : 1000



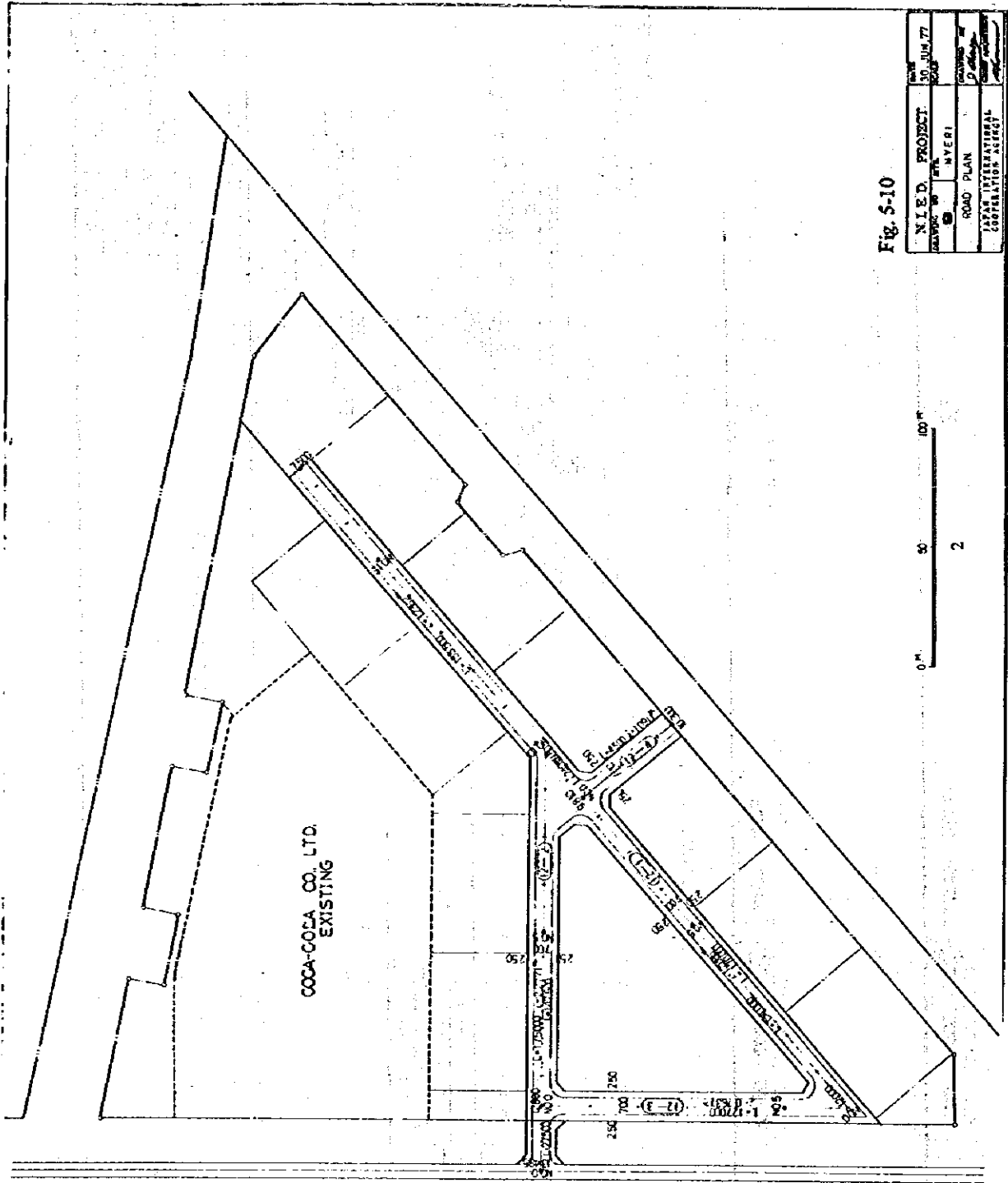
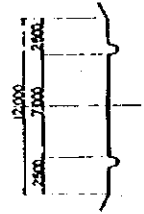


Fig. S-10

DATE	30 JUN 77
PROJECT	NIED PROJECT
NO.	1
BY	NYERI
SCALE	AS SHOWN
TITLE	ROAD PLAN
PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY

12.000' ROAD CROSS SECTION





BACK ELEVATION

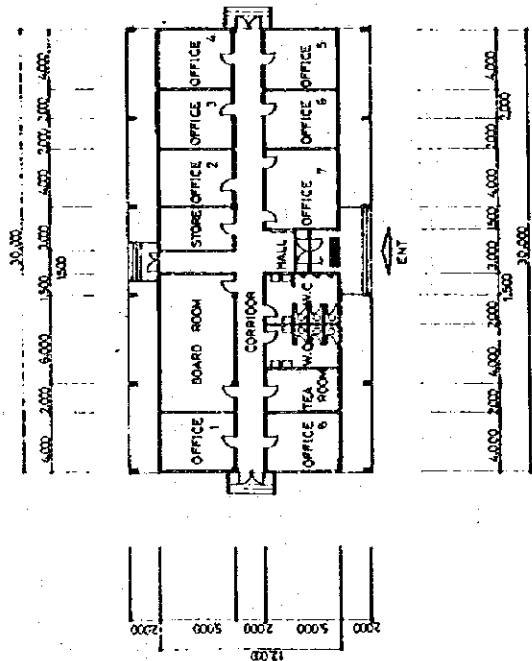


SIDE ELEVATION



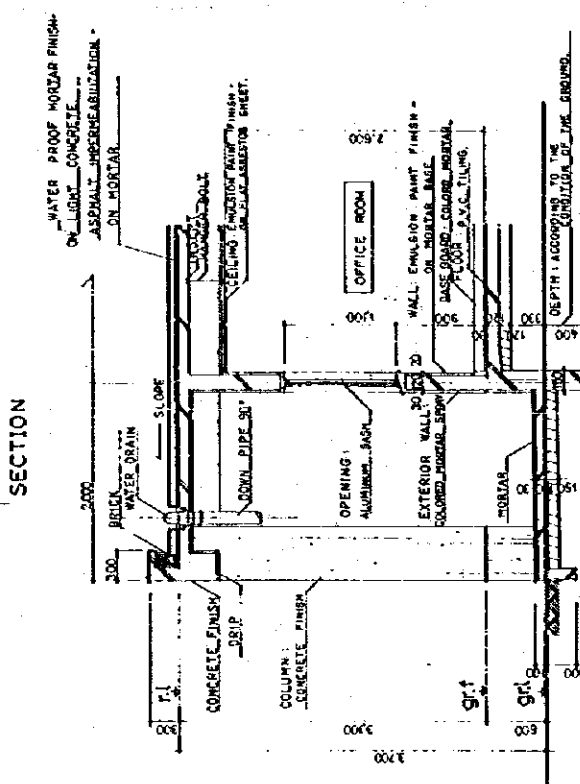
SECTION

FRONT ELEVATION



PLAN

AREA 360 m²



DETAIL DRAWING

FIG. S-11

N.I.E.D. PROJECT:	30 JUN 77
DATE:	1:20
BY:	1:30
CHECKED BY:	
K.I.E. ADMINISTRATION	
JAPAN INTERNATIONAL COOPERATION AGENCY	



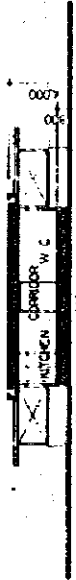
BACK ELEVATION



FRONT ELEVATION



SIDE ELEVATION



SECTION

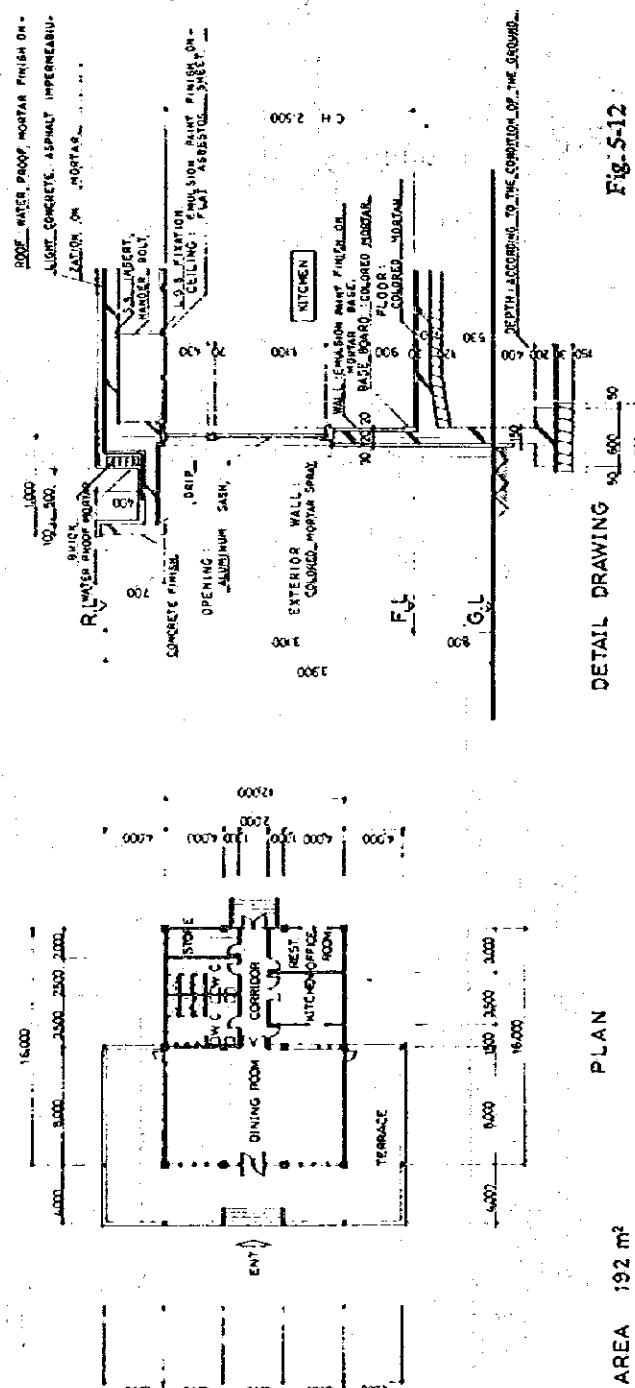
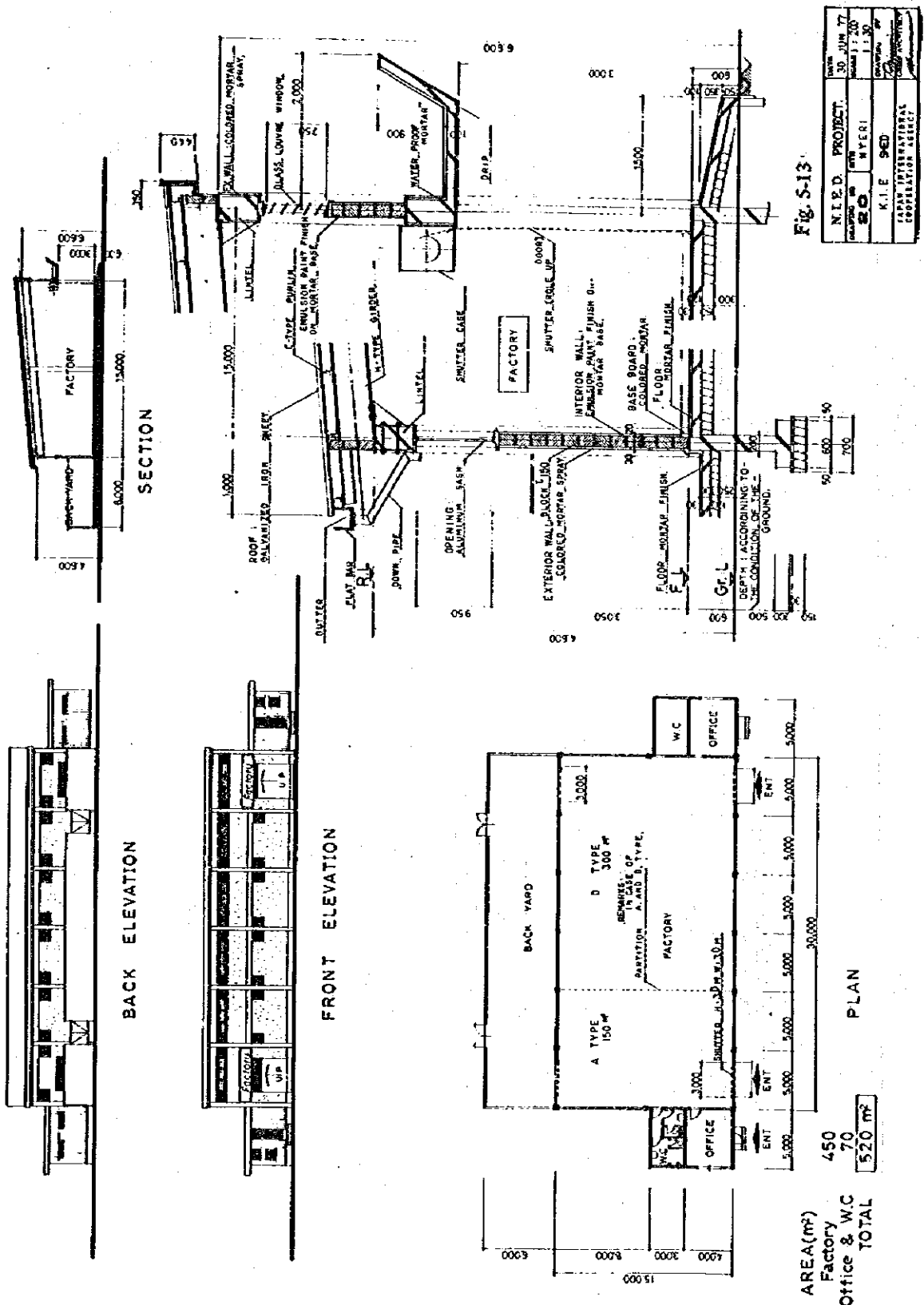


Fig. 5-12

N.I.E.D. PROJECT:	DATE: 30 JUN 77
BY: NVERI	SCALE: 1:20
CHECKED BY: K.I.E. CANTEN	DATE: 1 30
JAPAN INTERNATIONAL COOPERATION CENTER	



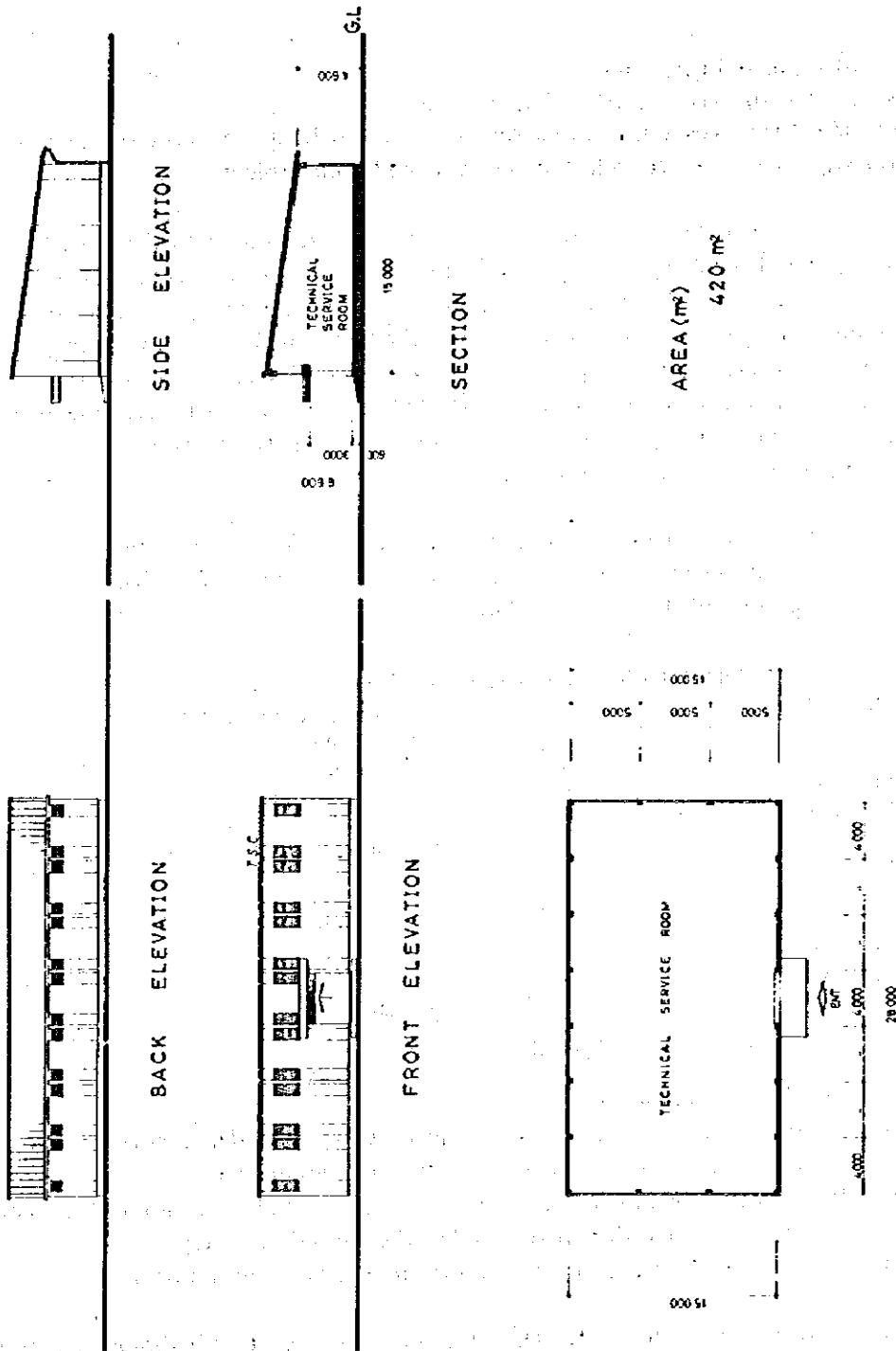


Fig. 5-14

N.I.E.D. PROJECT	DATE
24	30 JUN 77
N.F.E.R.I.	1 JUL 79
K.I.E. TECHNICAL SERVICE CENTER	DESIGNED BY
LIBRARY INFORMATION & COORDINATION AGENCY	SCALE