Approved May 7/47

THE ECONOMIC SOUNDNESS AND POSSIBILITIES OF OPERATING A DAIRY FARM WITHIN THE CITY LIMITS OF VANCOUVER.

-by-

Harry Fitzgerald McCleery Logan

A Thesis Submitted in Partial Fulfilment
of the Requirements for the Degree of
MASTER OF SCIENCE IN AGRICULTURE
in the
DEPARTMENT OF ANIMAL HUSBANDRY

The University of British Columbia

April, 1947.

ACKNOWLEDGEMENT

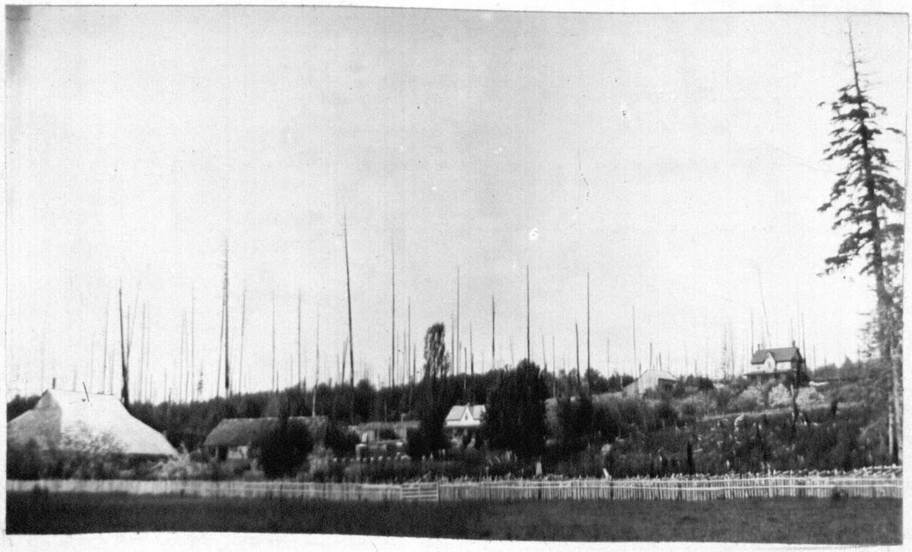
The writer wishes to thank sincerely Professor H.M. King, Head of the Department of Animal Husbandry, for his criticism and help in the preparation of this study. Credit is also due to Dr. S.N. Wood, and Dr. A.J. Wood of the Department of Animal Husbandry.

The writer also wishes to express appreciation to the Agricultural Economics Division at The University of British Columbia for their willing co-operation in supplying helpful information.

TABLE OF CONTENTS

URBANIZATION

1900



1947

Abstract on p.64

INTRODUCTION

Today, large and growing cities with adjacent restricted farming areas are experiencing a rapid urbanization of these farm lands. This situation presents a problem directly concerned with the supply of fresh dairy products in many cases, and has been selected for study as applied to Vancouver and vicinity.

Probably the most practical way to approach a study of this problem is to take as an example a specific farm in such a locality. The farm to be dealt with is an 80-acre block of land which, since its pre-emption in 1862, has become enclosed within the city limits of Vancouver. Present restrictions on new subdivisions prevent the opening up of this property for building lots, and, as a result, the farm must be converted to some line of production which will return the operator sufficient income to cover the heavy taxes and still leave a fair margin of profit.

The farm chosen as an example illustrates the effect of urbanization of agricultural lands as it is occurring throughout the Lower Fraser Valley. The situation is not so serious in the more rural areas; however, high land values, high taxes and the resulting high production costsare creating a problem not unlike the one being studied. As the Greater Vancouver and Fraser Valley areas increase in population and expand industrially, lands now used as dairy farms will be in demand for industrial use as well as for residential areas. This competition for land utilization will further increase land values. Already farmers are feeling the need of increased efficiency in operation in order to obtain desirable returns on their investment. It may even be necessary to make changes in operational methods -- changes similar to those occurring in other areas which have in the past experienced conditions that are developing in the Fraser Valley today. One such area is the Los Angeles milkshed.

The data in this thesis are collected under two main sections:

A. A Study of Milk Production in the Fraser Valley, Including a Comparison with that of Los Angeles and an Investigation of a New Method of Dairy Farm Operation.

B. Application of the Information and Conclusions Obtained Thus Far to a Selected Fraser Valley Farm now Coming Within the City Limits of Vancouver. (Including an Outline of a Possible Dairy Unit on the Selected Farm.)

From this information the writer hopes to draw some conclusions as to the possibility of utilizing the selected farm for milk production.

A. A STUDY OF MILK PRODUCTION IN THE FRASER VALLEY INCLUDING A COMPARISON WITH THAT OF LOS ANGELES AND AN INVESTIGATION OF A NEW METHOD OF DAIRY FARM OPERATION.

I. Study of Fraser Valley Conditions and Trends in Dairy Production.

(a) Present trends affecting Vancouver milk production area.

A dairyman in the Vancouver area is confronted with two main problems today. First, the extremely rapid expansion of the city of Vancouver is bringing about a considerable urbanization of agricultural lands. High land values and subsequent high taxation within the city are encouraging many city workers to seek homes in areas adjacent to the city where overhead costs are lower. Emergency housing units, established during the war to house industrial workers, have also contributed in no small manner to this urbanization. Secondly, the urbanization trend already referred to, is forcing the farmers close into the city to adopt a degree of specialization hitherto unnecessary.

Competition for lands, previously used only for agricultural purposes, is raising fixed production costs to a point where diversified farming is no longer economically sound. For example, the local dairymen can no longer maintain complementary enterprises to add to the farm income. In other words, the day of specialization is approaching.

(b) Relationship between supply and demand.

At present the farmers producing milk in the Fraser Valley are in the desirable position of having a ready market for all the milk they can produce. This condition exists even though greater production has been encouraged by the prevailing high prices which have developed during the war years. Since 1939 both population and consumer income have shown a marked increase; these two factors have been the main influences affecting the increased demand for farm produce in general.

Now that the war is over, it is expected that prices will gradually decline as a result of increased milk production, unemployment, and a reduction of the consumers' incomes. This is a fact that must be carefully considered by the farmer as he is the first to feel the effect of a depression period. The government price controls employed should aid considerably in avoiding the disastrous price drops that occurred following the war of 1914-18. Inflation has been checked and held down to some extent.

Another factor which deserves attention is the problem of absorbing wartime increases in milk production brought about by increased population (war industries), high wages, and military requirements. These increases, which may tend to lower prices on a normal market, might be absorbed by the following means:(1)

1. Population increases.
2. Exporting cattle.
3. Culling of dairy cows.
4. Expanding markets for manufactured dairy products.
5. Outlets for market milk and cream.

These points would also serve as a means of warding off the effect of a post-war depression in the dairy industry.

In considering just how the Fraser Valley area might absorb the wartime surplus of milk and at the same time avoid price declines, each of the above points may be studied separately.

1. Population increases.

Within the last few years, there has been a very rapid increase in population throughout the whole of the Fraser Valley. The most important factor, however, is the growth of the Greater Vancouver area. Since 1939 the population has increased approximately from 300,000 to 400,000. As this area is the chief market for fluid milk produced in the Fraser Valley, the population increase of approximately 100,000 plays an important role in relieving any surplus that might occur on the fluid milk market.

The Greater Vancouver area includes the following:

Vancouver
New Westminster
North Vancouver
District of North Vancouver
Municipality of West Vancouver
Burnaby

2. Exporting cattle.

Both grade and purebred cattle are exported to foreign countries. The principal markets appear to be the U.S.A., and the Orient; other countries such as Mexico take the occasional shipment. There is a possibility of a new market's arising in the British Isles where breeders are looking for reserves to build up herds which suffered set-backs during the war. British agents have recently travelled across Canada inspecting the dairy herds. The demand for dairy cattle is increasing since transport restrictions have been removed, and there should be a ready market for any surplus that might occur.

3. Culling of dairy cows.

This is a practice which is entirely up to the individual farmer. Culling cannot be forced, but can only be encouraged by breed organizations or government propaganda. Farmers are not particularly efficient in culling and tend to ignore the practice more than they should. This fact applies to breeders of purebreds as well as to those who raise grade cattle. The average farmer feels that as long as an animal is producing milk which contributes to the total volume, he cannot afford to cull out that animal or other similar ones. With the pressure of greater efficiency requirements in production, however, there will probably be an increase in the amount of culling practised.

4. Expanding markets for manufactured dairy products.

There is a good demand for manufactured dairy products on the local markets. British Columbia is an importer of dairy products; the excess of imports over exports during the period 1926 to 1940 was $2,841,368.00 annually. Creamery butter imports amount to 62% and cheese to 52% of total consumption.[7] Evaporated milk is the only manufactured dairy product in which we are self-sufficient. The dairy products produced are as follows:

Primary

Butter
Cheese
Evaporated milk
Condensed milk

Secondary

Cottage cheese
Farm cheese
Condensed buttermilk
Whole milk powder
Skim milk powder
Buttermilk
Casein
Ice cream and ice cream mix

The only milk product exported from the Fraser Valley is evaporated milk. At present this commodity is deficient in quantity and there is no danger of a surplus. As for future markets, the European countries, and the pre-war Oriental markets will aid in relieving any surplus that might exist.

5. Outlets for market milk and cream.

This, again, is a point which is not important at present but may have a bearing on the future. Today there is an ample market for milk and cream. As for milk, advertising and health programs encouraging its use are the only present-day methods of increasing consumption. There are apparently enough distributors to handle the milk; the problem here is the method and organization of distribution.

It would appear that the problem in the Fraser Valley is not going to be one of demand, but rather one of supply. So far, any wartime increases in the milk production have been handled successfully. More than a year has passed since the war ended, and there is still a good market for milk, in spite of the fact that fluid milk prices have been increased. It is quite probable that population increases have been the main influence in maintaining this demand.

Even though wartime surpluses are successfully absorbed, another problem still exists. If consumer incomes are lowered the public will demand cheaper milk, and thus create a situation which will necessitate the lowering of either production or distribution costs, or both.

(c) Available land resources for immediate future.

The Fraser Valley is very peculiarly situated, in fact, there is no other area with quite the same topographical features. The section of the valley which forms the milkshed for the Greater Vancouver area, namely the Lower Fraser Valley, is about 75 miles long, beginning in the East at Agassiz and continuing westward to Vancouver, which borders on the Staits of Georgia. The total area covered is approximately 545,000 acres. The mountain ranges on the East and North sides of the valley, the ocean at the West end, and the American borderline (49th parallel) on the South side, form a closed area in which expansion is necessarily limited by natural boundaries.

It can be seen how the Greater Vancouver area is dependent on a relatively small milkshed for its supply. It is true that only a small percentage of the arable land in the Fraser Valley is now under cultivation.(7) The remainder, however, which consists mainly of the upland regions, is heavily timbered, and as a result, very expensive to clear. The low-lying lands which could be cultivated with little or no clearing have all been taken up. The following table(7) gives some idea of just what land resources do exist. This is a broad classification.

Arable areas	317,926 acres	58.4%
Lands with adverse topography, excessive subdrainage, etc.	175,881 acres	32.1%
Undifferentiated peat	50,890 acres	9.5%
	544,697 acres	100.0%

Of the total area approximately only 317,926 acres or 58.4% is arable.

Another factor becoming increasingly important is the way in which the urban population of Greater Vancouver is spreading out into the farming areas. Some of the best agricultural land is being subdivided and sold as building lots. This is especially evident on Sea Island and Lulu Island which have some of the richest farm lands in the world. Such a situation is fine for the real estate agents but will soon prove to be a serious problem if the population in Vancouver and throughout the whole Fraser Valley increases to the extent that present indications forecast. There is an ample supply of non-agricultural building land close to the city without crowding into the farming communities. It may possibly be necessary to restrict this present tendency to migrate to the country. Restrictions could be imposed to force the utilization of lands other than agricultural for building purposes. If some people, however, desire small holdings, these could be allowed if certain minimum acreage requirements were necessary before purchases of land could be made. This would force the individual buyers to make some use of the land they own in order to have some return on their investment.

Summing up the situation, probably the surest way of maintaining farms is to make sure the farmers get sufficient returns to make it worth while their staying on the farms rather than selling out.

This discussion of land resources has been included in this study mainly as a point of interest pertaining to the subject. The writer does not intend to enter the economic study of these problems. The depletion of farm land is, however, becoming a serious menace to the supply of fresh dairy products for the Greater Vancouver market.

II. Comparison of Fraser Valley and Los Angeles Milkshed With Reference to Fraser Valley Application.

Probably the area most comparable to the Fraser Valley is the Los Angeles milkshed. The Los Angeles area has experienced conditions quite similar to those developing in the Fraser Valley today.

Dairying in Southern California[22] is devoted entirely to the production of market milk, although when production exceeds the effective demand, the surplus is utilized for manufacturing other dairy products. This area is characterized by high land values and high water costs.

A very important part of dairying is that done around the Los Angeles metropolitan area, which is referred to as "dry-lot" dairying. This term is applied to the practice of keeping cows in corrals and feeding them almost entirely on purchased feeds produced outside of the immediate vicinity. The operators thus need to own or rent only an acre or two of land for buildings and corrals or feed lots. The buildings usually consist of a milking barn, milk house, and perhaps a shelter shed in the feeding or holding corral. Many of these small places are rented, since it is easy for the dairyman to move his cows and dairy equipment. Frequently there are small fields nearby that can be rented or pastured for short periods. Some of the fields are used for green-feed production which thus makes possible an improvement in the feeds used by including some succulence. Where dairies are located in truck or field-crop areas, they can also purchase and use such crop residues as cull lettuce, beet tops, and some temporary pasturage of fields after or between crops.

Dry-lot farming differs from the ordinary type of farming in other lines besides feed sources. One of the most important differences is in the purchase of replacement cows rather than the raising of them. Since calves are not raised in the herds little attention is paid to the quality of the bull. Bulls are sometimes only kept during the parts of the year when needed to breed those cows that are being kept over for another lactation period.

Production per cow is high in this kind of dairying. In 1938 the average production per cow for 7,943 cows on test by the Los Angeles County Cow-Testing Association was 425.6lbs. of milk fat. This high production is attained through the heavy feeding of concentrates in addition to the usual amount of good alfalfa hay. The hay used in the area is largely trucked in from Imperial Valley, Antelope Valley, and San

Joaquin Valley, where land values and water costs are more favourable to its production than in the area around Los Angeles.

About five tons of hay, one and one-half tons of concentrates, a half-ton of green feed (9.4% of total ration) and a very small amount of pasture (1.5% of total ration) is the average yearly feed per cow. In some herds concentrate feeding is said to go above two tons per cow for the year. Since feed, particularly alfalfa hay, costs more in this area than in areas where it is produced, the cost per pound of milk fat is bound to be higher.

The question frequently arises regarding the relative economy of producing milk for the Los Angeles metropolitan area in the feed-growing areas and hauling the milk a considerable distance, as compared with hauling the feed to the vicinity of Los Angeles and producing the milk there under dry-lot feeding conditions. The answer to this question will indicate the future of dairying under the high cost conditions in the vicinity of Los Angeles. More is involved than a simple comparison of the cost of transporting the feed or transporting the milk. Irrigated pasture which is the cheapest kind of feed in the outer areas cannot be transported. Some of the concentrates, however, are as cheap at Los Angeles as in the interior valleys, although the average cost of all is higher. Wage rates, hence labour costs, are a little higher in this area than in the more distant competing areas. Miscellaneous costs also are higher in the Los Angeles area. These generally higher costs tend to raise the cost per pound butter fat from $0.159 to $0.237 above that of the outlying areas. This higher cost per pound butter fat, combined with the fact that the cost to haul milk is about the same as to haul hay would seem to indicate no advantage in the dry-lot type of dairying. However, in spite of this, dry-lot dairying has been increasing in recent years, even when butter fat prices were low.

The main similarity between the Los Angeles area and the Fraser Valley is the high land values and the high taxes which exist in both areas. The Los Angeles area suffers also from high water costs. These conditions were undoubtedly the main reasons for the development of dry-lot farming as it is carried on today. The Fraser Valley is at present experiencing conditions similar to those occuring in the Los Angeles area before dry-lot farming came into being. High land values and high taxes are greatly increasing production costs of Fraser Valley dairy farmers. This is even more true in the case of the farm under question where taxes and land values are the highest. It may be that a change in operative methods, not entirely different to that occuring in the Los Angeles area, will be the solution to the problem. That is, dairy farmers may find it necessary to adopt the practice of "dry-lot" farming or at least some modification of it.

Climatic differences between Southern California and the Fraser Valley would have to be carefully considered before one attempted "dry-lot" dairying. The climate in Southern California is more suited for such a system than that in the Fraser Valley where winter temperatures are more severe. Milder winters allow the utilization of year-round pastures where available, and make-shift shelters or corrals. Also a greater number of forage crops can be harvested per year. In the Fraser Valley one would have to figure on a shorter pasture season and more expensive shelters. Our hay production season being shorter, good hay is much more expensive than that grown in California where conditions are more favourable, expecially for alfalfa. Alfalfa hay in 1940 was $15.00 per ton in the Los Angeles area; in the Fraser Valley the price would be $15.00-$20.00 more per ton. Even the mixed hay produced in the Fraser Valley would be approximately $10.00 more per ton than the corresponding alfalfa prices in California. These higher roughage costs could possibly be offset by using more silage and succulent crops than are used in California. This could be done as the high water costs of the Southern area are not a limiting factor here. Also the increased use of by-products such as pea vines, brewers' grain, and waste products of the fruit industry might be used to reduce roughage costs.

The average production per cow in the Fraser Valley during 1940 was 359 lbs.[7] of milk fat, while in the Los Angeles area during the period 1932-1938 the average production was 405 lbs. of milk fat. This difference may be partly due to the heavy feeding of concentrates and the availability of alfalfa hay in California.

During the last few years larger farms close to the Vancouver area have shown a trend towards reducing farm acreages and increasing the purchases of feeds from outside sources. That is, the principle of "dry-lot" farming is being introduced to some extent. Although these farms generally utilize farm pastures, roughages and grains as a part of the rations fed, considerable feed is bought. A few operators own auxiliary farms farther from the city where land values and taxes are more favourable for crop production.

"Dry-lot" farming in the Fraser Valley would differ somewhat from that practised in California. Such a farm in this northern area would be a more stable unit than those that are found around Los Angeles. Climatic conditions in the Fraser Valley necessitate the provision of a more elaborate and permanent housing system, rather than a temporary corral or shelter accompanying a milking barn. Larger areas would be operated by the individual farmers in the Fraser Valley as compared with the Los Angeles area where "dry-lot" feeding units are set up on one or two acre lots. As the Fraser

Valley is a natural pasture area, supplied with cheap water, it would be sound practice to provide pasture, and in some cases crops for silage. A well-managed pasture is considered the cheapest source of feed.[18] Another factor encouraging the usage of pasture is the high freight charge on feeds shipped from the Okanagan and Prairie Provinces. If pasture is provided, cash outlay for purchased feeds can be substantially reduced.

III. Investigation of a Trend and New Method of Dairy Farm Operation and Milk Production -- Loafing Shed-Milking Parlour System.

Review of Literature.

Every dairy farmer is interested in an inexpensive, convenient, accessible barn which is adequately arranged for the health and comfort of the animals and for the production of high quality milk. For many years the conventional stanchion type barn has been the accepted housing system. Another type of barn that has gained popularity in many dairy areas, particularly in parts of the United States of America, is the "pen barn," also known as the "loafing barn," in which the cows run loose in a large barn, shed, or pen. The cows are milked in a small, adjoining room.

This system enjoyed considerable popularity a number of years ago in the Fraser Valley, but due to the increased incidence of contagious abortion it rapidly fell into disuse. With the advent of calfhood vaccination, however, the prevalence of Bang's disease has been reduced. Hence the advantages of this system again become apparent.

There are two main modifications of the system. One in which a "milking parlour" is used in conjunction with the pen barn, the other in which a "milking barn" is used along with the pen barn. In the latter, management differs somewhat in feeding and milking practices. The milking barn is generally large enough to house the whole herd at one time for milking, and in some instances roughage as well as grain is fed there. In the milking parlour, on the other hand, only grain is fed and the cattle are milked in small unit groups according to the size of the parlour, which may range from two to sixteen stanchions. Each type, however, has the fundamental similarity of separating milking from housing. The advantages of the loafing shed are:

1. Greater economy of construction.
2. Improved sanitation.
3. Cleaner milk production.
4. Less labour required in handling older animals of the herd.
5. More animal comfort.
6. Fewer injuries to animals.
7. Conservation and simplified handling of manure.
8. Greater flexibility, permitting considerable increase in size of herd without changes in barn construction and additions in equipment.
9. "Pen barn" easily adapted to other types of livestock.
10. Facilitation of feeding in many cases.

The disadvantages are:

1. More bedding required.
2. "Boss" cows may be troublesome.
3. Cows should be dehorned.

4. More space required per cow.
5. More of a chore to milking.
6. Herd doesn't show off to the same advantage as when in stanchions.
7. Greater difficulty in handling calves and young stock.

The Loafing Barn

Size: Although there is some variation in floor space per cow in established loafing barns, it is generally agreed that a minimum of 75 square feet, exclusive of manger space, is adequate if the pen is well bedded. In the case of large high producing cows, 100 square feet per cow is more advisable.[11] It should be remembered that increasing the floor area is not, however, a substitute for proper care and management. A dry and well-protected barnyard is also very desirable in connection with a pen barn as this increases the amount of resting space.

Bedding requirements: The amount of bedding required varies according to management practices. It is generally considered that a minimum of one and one-half tons of straw per cow per year should be provided. Since it is available in most areas, straw is the common bedding material used. Although sawdust and shavings do not possess the same absorptive power as straw, they may substitute as bedding where roughage is less readily available. Furthermore, it has been concluded that sawdust and shavings are not detrimental when added to the land.[20]

Chopped straw should be used for bedding if possible. Chopping increases the absorption and facilitates handling the manure. Uncut straw used as bedding, makes for difficult removal of manure.

There is much unfounded criticism of the loafing barn system where it is said that the cattle cannot be kept clean. Practice has shown that, if sufficient bedding is supplied, animals housed under this system can be kept clean with less work than animals housed in a stanchion barn.

Type of Floor:

The amount of bedding, and the floor area per cow, are more important in keeping the cows clean than is the type of floor. A concrete floor is not necessary, but a concrete apron around the water tank and barn doors is desirable. Dirt floors, which are used extensively, prove to be economical and quite satisfactory. Many operators prefer this type of floor because it gives a soft footing and facilitates the absorption of liquids. It should be noted that, when a dirt floor is used the barn must be situated on a well-drained area. A thick layer of bedding material should be applied after each cleaning in order to provide an absorptive mat. The use of loafing pens eliminates the evils of stanchion barns by allowing the animals to move about freely and by keeping them off cold concrete floors.

Injuries:

The danger of injuries is largely obviated through the practice of dehorning. Animals may be further prevented from "butting" each other by pinching three or four hog rings through the skin of the head between the horn buttons.

Labour:

Operators in general agree that the labour requirements are considerably reduced using the pen type barn. The chore of cleaning out the stables becomes a monthly task rather than a daily one. The time and labour of feeding roughages is also reduced. The moving of the cows from the loafing barn into the loafing parlour is somewhat inconvenient and may require additional labour.

Feeding arrangement:

In most cases all roughage is fed in the loafing barn, by the use of hay racks and mangers. The important consideration is to arrange these racks and mangers so they can be most conveniently filled through hay chutes directly over them, or from the front in the case of silage.

The type of manger will depend on whether the hay is chopped, baled, or loose. Where silage is only moderately fed, central feed racks are more desirable. Self feeder racks are easily kept full from the loft. Wall type mangers tend to block out windows and require more chutes. They do, however, provide a large open floor space. When hay and silage are fed at regular intervals, rack and manger space should be provided at the rate of two and one-half feet per animal. If self feeding is used the rack space per cow can be considerably less, providing the racks are kept full at all times.

Management of young stock:

Experience with pen barns indicates that it is particularly desirable to raise herd replacements on the farm, and to let the heifers run with the milking herd. In this way the heifers become accustomed to the milking arrangement. This means that some space must be provided for calves and young stock. It is sometimes difficult to arrange permanent calf pens without interfering with the most convenient method of removing manure. By careful planning, however, it is usually possible to provide necessary pens by installing temporary gates at one end or corner of the barn. For large herds a separate barn for dry cows, calves and young stock is desirable.

Milking parlours:

The milking parlour is the most important unit of the pen barn system. Essentially they are small, well-lighted rooms, providing accommodation at milking time for a unit string of cows. The size of the milking room depends on the number of milking stalls and other facilities required. The number of stalls is determined by the size of the herd, the number of milkers and the milking procedure. There are various types of construction according to individual preferences and governmental regulations. They all, however, operate on the same principle - the provision of a clean, sanitary room, equipped for the production of high quality milk. The milking parlour should be arranged for the efficient handling of cows at milking time. If it is under the same roof as the loafing barn, it should be sealed off by a tight partition and tight fitting doors. As it is general practice to feed grain during milking, the grain supply should be easily accessible.

There are two general types of milking parlours, the conventional type, with level floors, gutters, and standard stanchion arrangement, and the walk-through type. The latter is generally operated in conjunction with elevated stalls or depressed alleyways which facilitate milking. Much bending and stooping is eliminated with this system as the cows' udders are at shoulder level. In the walk-through type, the stanchions are so built that one end or side swings back when milking is finished, and the cow can be released without backing out. Within these two general types there are many modifications which vary according to the individual operator's desires. Some more elaborate milking parlours have the milking machines separated from the cows by a wall. The machines are attached through an opening in the wall, and pipes carry the milk to the milk room for cooling. This type of arrangement is used with some of the larger herds where labour and capital are not limiting factors. In many cases, holding alleys and foot baths for the cattle are included in the layout.

When grain is fed in the milking parlour, it is necessary to hold the cows there for approximately eight minutes, in order to allow time to consume a normal ration of eight to ten pounds.

Personal Investigation:

In order to obtain a more comprehensive idea of how the loafing barn and milking parlour system is fitting into practice, a one-day trip was taken to Whatcom and Skagit Counties in Washington. In this area loafing barns and milking parlours are becoming increasingly popular. The objective was to visit as many farms as possible to obtain a general idea of the method of operation. The system was found to be well established in Skagit County and rapidly gaining popularity in Whatcom County. The writer realizes that the data collected are insufficient in scope to be considered entirely representative. Some of the observations, however, are worth mentioning and comparing to the Fraser Valley area.

The striking difference between the two areas is the way in which the cattle are housed, fed and milked. In the Fraser Valley the common custom is to build a large barn to house the whole herd. If an attempt is made to meet "Grade A" requirements in such a building, the expense is high.

In the area visited, it was obvious that the emphasis had been placed not on building a large Grade A barn, but instead on building a small milking parlour in conjunction with a low cost loafing shed. This system is far less expensive but provides a very desirable housing unit for milking. Very little attention is paid to keeping the animals warm and free from draughts. Loafing sheds vary in construction, some having open doors and windows, others being completely open on one side or end.

Grain was fed in the milking parlours on the farms visited. Silage and roughage were commonly fed in the loafing shed, although, in some cases, outside feeding racks were used. These outside feeding racks were used to reduce trampling, and so cut down the amount of bedding required.

The operators visited were all satisfied with the system. They agreed that it resulted in the production of a better quality milk and pointed out that labour costs were reduced. Because of free calfhood vaccination, Bang's disease, which was at one time the limiting factor in the loafing barn set-up, appeared to be largely controlled.

Three of the farms visited best illustrated the principle of using a loafing barn in combination with a milking parlour, each with a different arrangement. All three farms were well organized and appeared to be operating efficiently. They were as follows:

The G. Bossenbruck Farm
(Located in the Bellingham area of Whatcom County)

This farm is a very compact unit, consisting of a milking room, a twelve cow loafing shed and outside feeding racks. The feeding racks are of special interest. They are built on concrete, and are filled from overhead walks running from the hayloft above the main barn, and a small storage shed. The milking room and loafing shed are built in an old barn. Due to the absence of the operator, further data on management could not be obtained.

Outside feed area on Bossenbruck farm.

The feed racks and overhead walks on Bossenbruck farm.

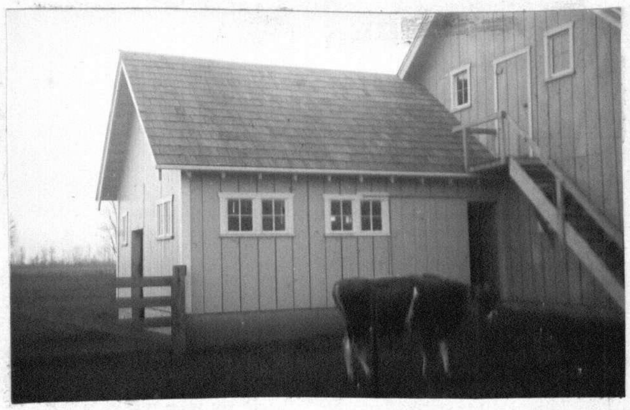
The B. Krangnes Farm
(Located in the Mount Vernon area of Skagit County)

This is an 18 cow set-up utilizing a milking barn (in place of a milking parlour) and a newly built loafing shed. This latter is of particular interest.

The loafing barn is equipped with inside feeding racks, water trough and salt lick. The salt lick and water trough are accessible from both inside and outside the barn. A calf pen for four calves has been partitioned off in one corner and a bull pen built on one end. The building has a well-drained dirt floor covered with shavings. This provides dry and clean accommodation. The milking barn is large enough to handle all the milking cows at one time. The animals spend six to seven hours a day in the milking barn, during which time they are fed grain and roughage. They spend the rest of the day in the loafing barn, and obtain further feed from the hay racks there. The alleyway between the two barns is of concrete, as shown below.

PICTURES OF KRANGNES FARM

Milking barn and loafing barn (in foreground)



Bull pen on end of loafing shed

Loafing shed

KRANGNES FARM (cont'd.)

Interior of loafing barn - note water trough.

Feed racks in loafing barn

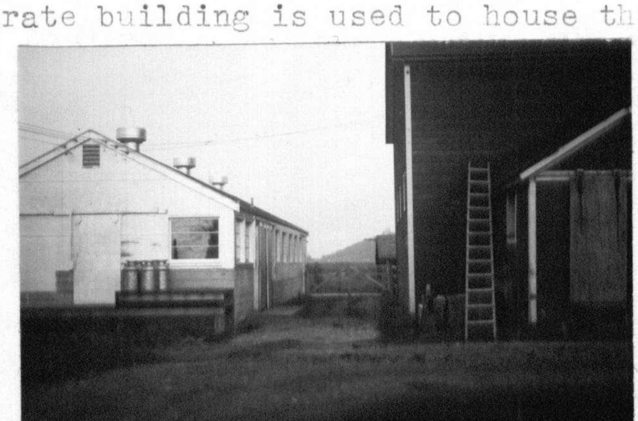
Entrance to loafing shed - note water troughs.

The F. Fredericks Farm
(Located in the Mount Vernon area of Skagit County)

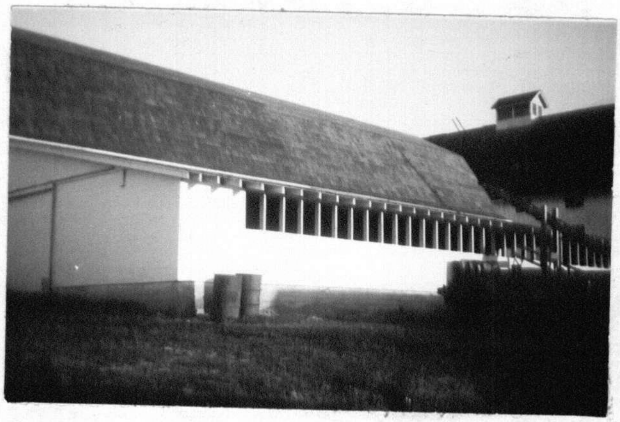
This farm utilizes an old barn for a loafing shed. The milking parlour is a new building of plywood construction.

This 10 cow, single storey milking parlour is the distinguishing feature of the farm. Bright aluminum paint and fluorescent lighting give it an appearance that would please any visitor or inspector. Only grain is fed in this milking parlour. Next to the milking room is a grain storage room, and adjoining this is the dairy. The complete building is 55 ft. x 20 ft., the milking parlour being 39 ft. x 20 ft.

In the loafing barn there are two ten-stanchion rows, equipped with water bowls, facing a central feeding alley. The space behind each row of stanchions serves as a loafing area. The hay is dropped from the loft to the feeding alley. The cows are stanchioned only during the feeding period. Oat straw is used as bedding, and the droppings picked up twice daily. A separate building is used to house the calves.



The plywood milking parlour next to the loafing barn on the Fredericks farm. The dairy is in the foreground, the milking room in the background.



Exterior and interior views of the loafing shed on the G. Dynes farm. This shed is built against the side of the milking barn. No milking parlour is used on this farm.

Conclusions:

In summarizing this study of loafing barns and milking parlours, it appears that the system adequately meets the requirements of cheap housing, milking, and sanitation, as well as reducing labour requirements. Furthermore, when it comes to the question of sanitation and consumer appeal, there seems to be no argument against separating the job of milking from that of housing.

In view of the successful operation of the system in the North Western States and considering the similarity between that area and the Fraser Valley, there is no apparent reason why this system should not be suitable to the latter area.

The chief problem confonting older dairy farms in the use of loafing barns and milking parlours is that the dairy plant is already built and operating on a satisfactory basis. To change over under such conditions seems unnecessary and of questionable economy. As a long-time adjustment in housing and milking procedure, however, this system should not be overlooked.

IV. Summary of Information as Obtained From the Preceding Studies.

It is evident from the preceding studies that the Greater Vancouver area is entirely dependent upon the Fraser Valley for its supply of fresh dairy produce, and that the Fraser Valley is an area of limited agricultural development, characterized by high costs of production. On comparison of the Fraser Valley with the Los Angeles milk shed, where the "dry-lot" system of dairying is practised extensively, several striking similarities are evidenced which suggest a possible future change of operative methods in the Fraser Valley. These changes will likely follow the general trend now in operation throughout the Los Angeles area. Further investigation of operative methods seems to show no apparent reason why the loafing shed-milking parlour system could not be used extensively in the Fraser Valley area.

B. APPLICATION OF THE INFORMATION AND CONCLUSIONS OBTAINED THUS FAR TO A SELECTED FRASER VALLEY FARM NOW COMING WITHIN THE CITY LIMITS OF VANCOUVER.

I. Description of the Farm Selected for Study (Appendix A).

The farm selected for this study is an 80 acre tract of land situated on the banks of the North Arm of the Fraser River, within the city limits of Vancouver. On the city planning map it is labelled as "Parcel B of District Lot 315." Macdonald Street borders the west side, Marine Drive Golf Course the east side, and a row of residential homes form the boundary line on the north side.

(a) Present condition of the farm.

The farm is at present in a run-down condition. The buildings (with the exception of a new barn), the fences and drains should be replaced or repaired. Machinery on the farm is in fair condition and is adequate for satisfactory operation; however, several replacements and additions could and should be made. Soil fertility has been maintained fairly well (Appendix A), but there is an immediate need of lime applications. The livestock owned by the farm operator are few in number, only five head of cattle and a team of work horses being maintained at present.

The present farm business is divided between two main enterprises: crop production, and boarding light horses. The poor condition of the buildings and the difficulty in obtaining building materials for replacements combined to prevent the operation of the farm as a milk production unit in recent years.

(b) Required changes on the farm.

To operate successfully a dairy enterprise on this farm some changes, requiring capital outlay, would be necessary. These changes would involve the provision of new buildings, fences and drains, the correction of soil acidity through liming, and the re-stocking of the farm.

These improvements are shown in the following section outlining a possible dairy unit.

II. Outline of a Possible Dairy Unit.

(a) Proposed unit and approximate capital investment required (Appendix B). (Items listed below include some equipment, etc. already on the farm.)

Land (assessed value)	$13,690.00
Livestock (60 milk cows)	10,500.00
Buildings	12,050.00
Farm machinery	3,280.00
Dairy equipment	5,325.00
Pasture establishment	1,000.00
TOTAL INVESTMENT	$45,845.50

(b) Yearly feed requirements and costs (Appendix C).

Grains..................................	$ 2,773.68
Roughage (alfalfa)......................	1,650.00
Silage (pea vines)......................	396.00
Mineral supplement......................	60.00
Bedding	1,800.00
Pasture maintenance (Appendix B).......	600.00
TOTAL FEED COSTS	$ 7,279.68

(c) Estimate of yearly receipts, fixed costs, and operating costs (Appendix D).

Receipts from milk sales of 425 qts. per day @ $ .16 per qt.	$24,820.00

Fixed Costs

5% Interest charges on $40,520.00 investment, (exclusive of dairy equip.)	$ 2,026.00
5% Depreciation charges on $15,330.00 (farm machinery and buildings, exclusive of dairy equipment)	756.50
TOTAL	$ 2,782.50

Operating Costs

Gas, oil and repairs for tractor	$ 50.00
Taxes	800.00
Feed requirements (plus bedding)	7,279.68
Labour (2 hired men)	2,400.00
FORWARD	$10,529.68

FORWARD...$10,529.68

<u>Operating Costs (contd.)</u>

Processing and distributing	8,160.00
Replacements (cattle)	500.00
General expense	500.00
TOTAL	$19,689.68

(d) Estimate of yearly returns.

Cash receipts from milk sales	$24,820.00
Fixed costs	2,782.50
Operating costs	19,689.68
Gross profit (including operator's labour income)	$ 2,347.82

CONCLUSIONS

The proposed dairy unit fails to show a very satisfactory return on the investment. The study, however, does indicate a fair labour income to the operator, and offers a definite challenge to anyone whose interests lie in dairy farming.

Several factors enter the calculations which perhaps make the above conclusion too conservative. Among these factors are the following:

(a) All estimated costs are shown at a high level.
(b) The production estimates are at best, moderate.
(c) Additional income possibilities (e.g. through custom work) have not been mentioned.

Costs could be reduced by improved management practices, including:

(a) Purchasing feeds from primary producers.
(b) Increasing the carrying capacity of pasture.
(c) Increasing production per cow through careful breeding and selection.
(d) Utilization of surplus produce in the most profitable manner.

The supply of fresh dairy produce is now, and definitely will continue to be, an important problem in the Vancouver area. A dairy unit such as the one studied would not therefore be a purely selfish business enterprise, but might serve as an example to be followed in the alleviation of an important food problem.

Operation of this type of dairy unit might well encourage also the use of a system of agricultural zoning, under which only land unfit for specialized farming would be made available for residential or commercial building.

APPENDICES

Appendix A: Topography, soil types, and climatic condition of selected farm.

Appendix B: Details of proposed dairy unit.

1. Livestock.
2. Buildings.
3. Machinery and equipment.
4. Pasture layout.

Appendix C: Details of yearly feed requirements and costs.

1. Purchased feeds.
2. Feed and bedding requirements.
3. Total cost of feed and bedding.

Appendix D: Details of yearly receipts, fixed costs, and operating costs.

Appendix A. TOPOGRAPHY, SOIL TYPES, AND CLIMATIC CONDITIONS OF SELECTED FARM.

1. Topography and Soil Types

The cultivated acreage of the farm ($72\frac{1}{2}$ acres) is all level bottomland with an elevation of approximately 10 feet above sea level. The uncultivated area, which includes the farmstead ($2\frac{1}{2}$ acres) and 5 acres of bushland, is situated on a slope of about 25 degrees. Such a set-up is ideal as it provides a well-drained location for the buildings.

The basic soil type is loam, varying slightly to include peaty and silty loams. The soil map on page (44) shows the distribution of soil types.

The analysis and classification of soil samples, taken in October, 1946, indicate a definite need for liming (illustrated on page(45). An application of 3 tons per acre of ground limestone would do much to improve the acid condition of the soil. Although ground limestone is slower reacting than hydrated lime, it would be used because of its greater lasting effect and lower cost. As far as legume crops are concerned, the application of lime is a necessity before profitable crops can be grown. Potassium is the only mineral indicating a deficiency which requires immediate attention. It is not advisable, however, to make heavy applications of potash fertilizers on loam soils.[8] Light applications could be made on ground used for legumes or barley, and if any improvement was noted further applications could be made. The cereal crops are not usually affected by a potash deficiency.

2. Climatic Conditions[15]

Climatic conditions in the Vancouver area are generally the same as those existing throughout the Fraser Valley, except for the fact that they tend to be less extreme.

Temperatures:

The climate is quite moderate, and the temperatures are comparatively uniform throughout the year, January being the coldest month with an average temperature of $36^{\circ}F$, and July the warmest with an average temperature of $63^{\circ}F$. There is the occasional extreme condition when the temperatures may go down to around $0^{\circ}F$ and as high as $85^{\circ}F$. These extremes, however, are not common.

Early and late frosts are not limiting factors on the average dairy farm. The frost-free period ranges from about April 1 to November 1, totalling approximately 220 days.

Sunshine:

The amount of sunshine received in the winter is considerably less than in summer. At Vancouver, during January, sunshine averages 49 hours for the month, or slightly more than $1\frac{1}{2}$ hours per day. In July, however, the average is 291 hours of sunshine or 9.3 hours per day. The total for the year at this location is 1,847 hours of sunshine.

With the sunshine amounting to 9.3 and 8.6 hours daily in July and August, it is apparent that these two months are comparatively warm and dry. This factor is important in the management of soils with low drought resistance. Early maturing crops are grown on such lands for harvest during the dry period.

Precipitation:

The characteristic feature of the Pacific Coast precipitation is the heavy winter rainfall succeeded by summer dryness. The rainy season begins in October with about 6 inches of rain. In November the average rises to 8 inches, with slightly more than 8 inches in December. In January this is reduced to about 7 inches, followed by 5 inches in February and 5 inches in March. About 2/3 of the annual precipitation occurs during the six colder months.

The farmer is mostly concerned with rainfall between April and September, the crop growing season. In April and May precipitation amounts to between 3 and 4 inches for each month. In June it falls to between 2 and 3 inches, while July and August, the dry months, average less than 2 inches. September is the beginning of the rainy season again with about 4 inches precipitation. Total precipitation varies from 50-70 inches annually.

Only a small amount of the annual precipitation is in the form of snow. At Vancouver (Brockton Point Station) the annual average is 10.7 inches. Snow remains on the ground for only a short time and has little effect on vegetation or climate.

Humidity:

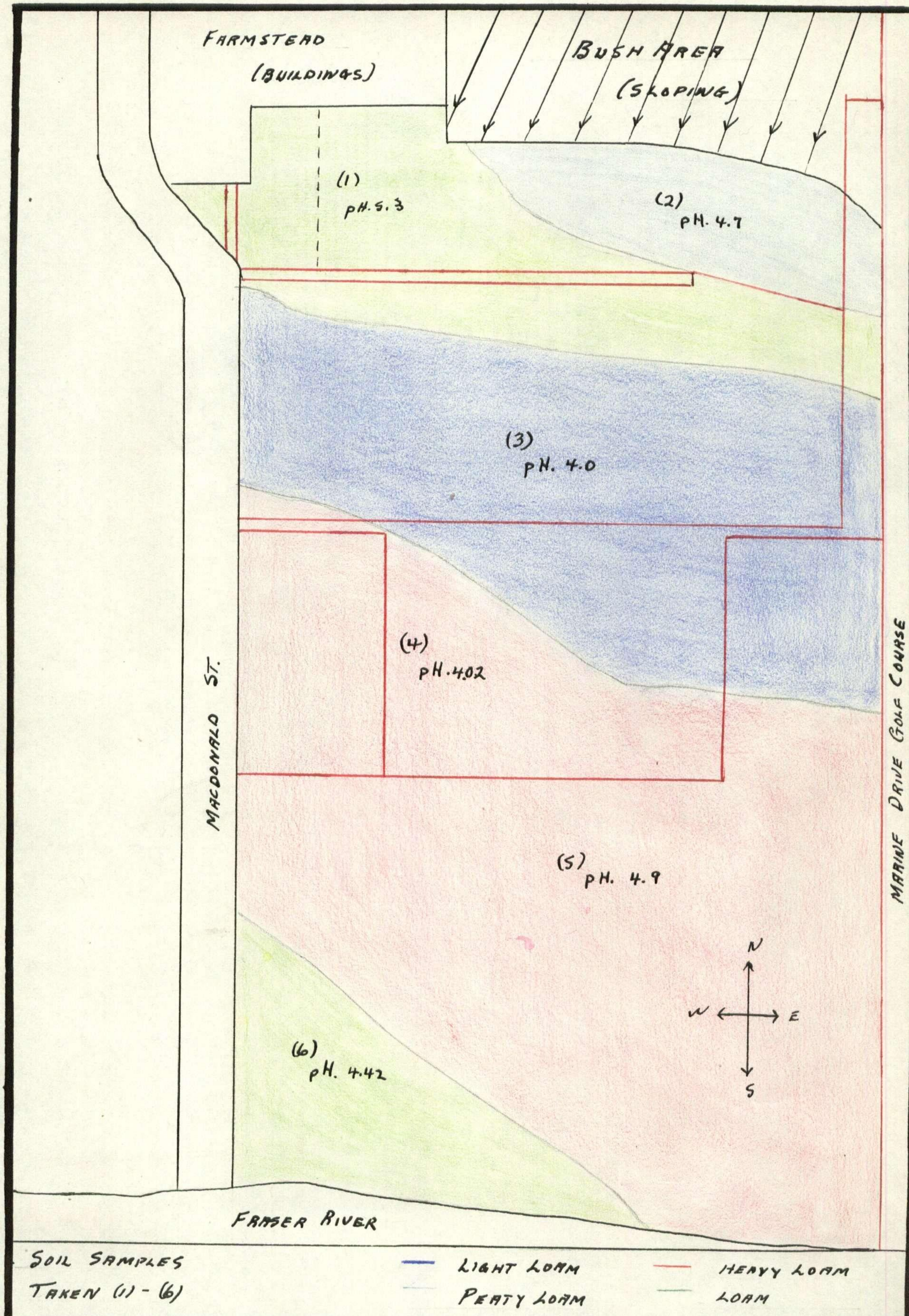
The humidity is relatively high throughout the whole year (slightly higher during the winter). This high humidity causes heavy dews which must be considered during the haying and harvesting season. Fog is also produced by the high humidity. Between September and March there are 20-30 foggy days, some of which tie up transportation facilities.

PICTURES ILLUSTRATING THE TOPOGRAPHY OF THE FARM

Cultivated bottom land

Sloping bush area

SOIL TYPES


FARMSTEAD
(BUILDINGS)
BUSH AREA
(SLOPING)
(1)
pH. 5.3
(2)
pH. 4.7
(3)
pH. 4.0
(4)
pH. 4.02
(5)
pH. 4.9
(6)
pH. 4.42
MACDONALD ST.
MARINE DRIVE GOLF COURSE
N
W
E
S
FRASER RIVER
SOIL SAMPLES
TAKEN (1) - (6)
LIGHT LOAM
PEATY LOAM
HEAVY LOAM
LOAM

SOIL ANALYSIS (1946)

SAMPLE	TEXTURE	COLOUR	pH	NO_3N	P	K	Ca	Mg
No. 1	Loam	Gray	5.3	Very High	High	Very Low	High	High
No. 2	Peaty Loam	Grayish Dark Brown	4.7	Very High	High	Very Low	High	Medium High
No. 3	Light Loam	Gray	4.0	Medium Low	Low	Very Low	Medium	Medium
No. 4	Heavy Loam (Slightly Silty)	Light Gray	4.02	Medium	Low	Very Low	Low	Medium
No. 5	Heavy Loam	Gray	4.9	High	Low	Very Low	Medium	Medium High
No. 6	Loam	Slightly Dark Gray	4.42	Medium	Medium High	Very Low	Low	Medium High

Appendix B. DETAILS OF PROPOSED DAIRY UNIT.

The milk production unit is based on the following three points:

(1) Taking maximum advantage of the location of the farm.
(2) Utilizing the acreage in the most profitable manner.
(3) Meeting the situation of changing conditions and operative methods.

The proposed farm will operate on the "dry-lot" principle in that pasture will be the only home-grown feed; all other feeds will be purchased from outside sources. The loafing shed-milk parlour system will be employed for housing and milking facilities, and it is intended to sell the milk produced on a retail market existing in a limited area surrounding the farm.

1. Livestock

It is assumed that a herd of 60 milking Jersey cows, grades and pure-breds, will be maintained. No young stock are to be raised on the farm; instead, a replacement system will be employed. Replacements will be purchased from a reputable farmer outside the vicinity, who will, in turn, purchase all calves born on the proposed farm.

On the basis of each cow's milking an average of 9 months a year, it is assumed that 45 cows will be milking at all times.

Breeding will be done by means of artificial insemination, thus eliminating the necessity of maintaining bulls.

Approximate investment in cattle will be:

60 milking cows at \$175.00 per head \$10,500.00

Replacements will be made at the rate of 5 animals per year. The estimated cost is \$100.00 per cow (\$175.00 - (value of butchered animal + value of calves)), thus the yearly cost for replacements will be \$500.00.

All animals purchased will be carefully selected for production, and freedom from disease.

2. Buildings

The proposed unit will include a loafing shed and a milking parlour. This system of handling the cows is used on the grounds that it requires a low capital investment and results in no loss in efficiency of operation. The attractive appearance of a clean milking parlour will play an important role in regard to consumer appeal; a farm so situated in the city will have numerous critical visitors.

The buildings will be as follows:

Loafing shed:

The loafing shed will be an L-shaped structure consisting of two wings, one measuring 40' x 70', the other 40' x 50'. This building provides a total of 4,950 sq. ft. of floor space; allowing 4,500 sq. ft. for the cows (75 sq. ft./cow), and 400 sq. ft. for water troughs and boarded-off corners. One side of the loafing shed will be completely open, facing an outside feeding rack. The feeding rack will be 120' in length, providing 2' of feeding space per cow. Silage and hay will be fed in the rack.

Milking parlour:

The milking parlour, measuring 75' x 18' will be a one-storey construction built to accommodate a string of 15 cows at one time. One end of the building will be utilized as feed storage space. Only grain will be fed in the milking parlour.

Dairy:

The dairy will consist of two rooms, a washing room, 20' x 10', and a processing room 20' x 25'. Over-all measurements will be 20' x 35'.

Combined hospital and storage barn:

This barn is a new 34' x 57' building already on the farm. It will be provided with box stalls for freshening or sick cows. The loft above will be used for storing baled hay and straw. Part of the main floor can also be utilized as storage space.

Machine shed:

A machine shed 15' x 50' will be built to accommodate the farm implements.

Silos:

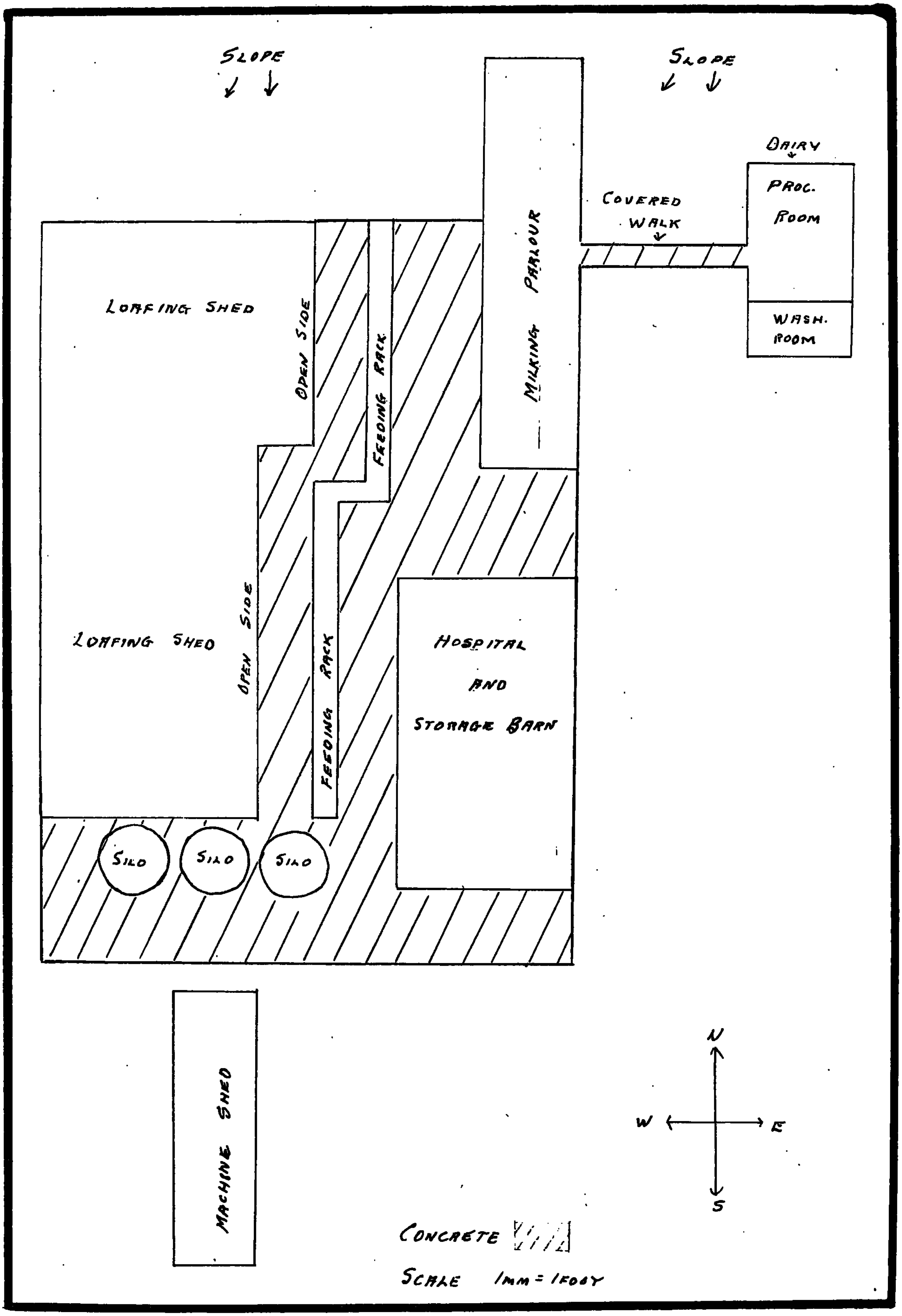
There will have to be three silos constructed, each silo measuring 12' x 22', and having a capacity of approximately 47 tons (total capacity, 141 tons).

Approximate investment in buildings is as follows:

Loafing shed	$3,000.00
Milking parlour	3,000.00
Dairy................	1,500.00
Combined hospital & storage barn	3,500.00
Machine shed	300.00
3 Silos ($250 each)..	750.00
TOTAL	$12,050.00

The building arrangement is shown on page (50).

BUILDING ARRANGEMENT



3. Machinery and equipment

The farm machinery maintained need not be extensive as there will be no cropping other than pasture production. The main outlay of capital will be involved in the purchasing of dairy equipment.

Approximate Investment in Machinery (Some of this machinery is already on the farm, in which case an estimated value is given.)

Small tractor with attachments, including plow, disc, harrows, mower, rake and manure loader	$2,500.00
Rubber tired wagon	230.00
Ensilage cutter	250.00
Forage cutter	25.00
Grain crusher	25.00
Seed drill	150.00
Sundry equipment	100.00
TOTAL	$3,280.00

Approximate Investment in Dairy Equipment Based on Requirements for Handling 125 gals. of Milk per Day.

Pasteurizer	$1,305.00
Cooler	540.00
Bottler	425.00
Sinks	56.50
Bottle washer (electric).....................	15.00
Refrigerator	667.00
Milking machine (3 units)....................	567.00
Small steam boiler	150.00
Miscellaneous equipment (bottles, etc.)......	100.00
Delivery truck (½ ton).......................	1,500.00
TOTAL	$5,325.50

4. Pasture layout

Pasture will be the only crop grown on the farm. Morrison[18] states that good pasture generally supplies the cheapest and most economical feed for cattle. The difference in yield is much more than offset by the greater expenses for labour, seed, and machinery in planting, tilling, and harvesting forage crops. In a well-managed permanent pasture the annual expense is reduced to a minimum. On the high-priced land of this farm, pasture is probably the most profitable feed crop that can be grown.

The total pasture area will consist of 60 acres, allowing one acre per cow. The assumed carrying capacity of one cow per acre[10] is a conservative figure.

The total farm acreage will be divided as follows:

Farmstead	2½ acres
Bush area	5 acres
Uncultivated yards	12½ acres
Pastures	60 acres
	80 acres

Fencing:

The fencing system as it exists on the farm would not be satisfactory in the proposed layout and will have to be changed and replaced. Electric fences will be used extensively as there are no crops to be damaged in case of failure. The existing and proposed fencing systems are shown on pages (54) and (55) respectively.

Drainage:

Efficient drainage on low, level, bottom land such as in this case, is difficult and costly but very necessary. The existing drainage system functions satisfactorily on the lower half of the farm but the upper half nearest the buildings is subject to excess surface water during the winter months. This excess surface water is due to a blockage of underdrains (drains A and B as shown on the drainage map on page (54)). The farm was surveyed in 1946 to determine the drain requirements. The recommendations resulting from the survey are shown on the map, page (55), which illustrates the proposed drain improvements.

Pasture management practices:

These will be as follows:

Rotation - every two weeks.

Irrigation - when necessary pastures will be sub-irrigated by flooding the drains and ditches. This can be controlled by the flood gates.

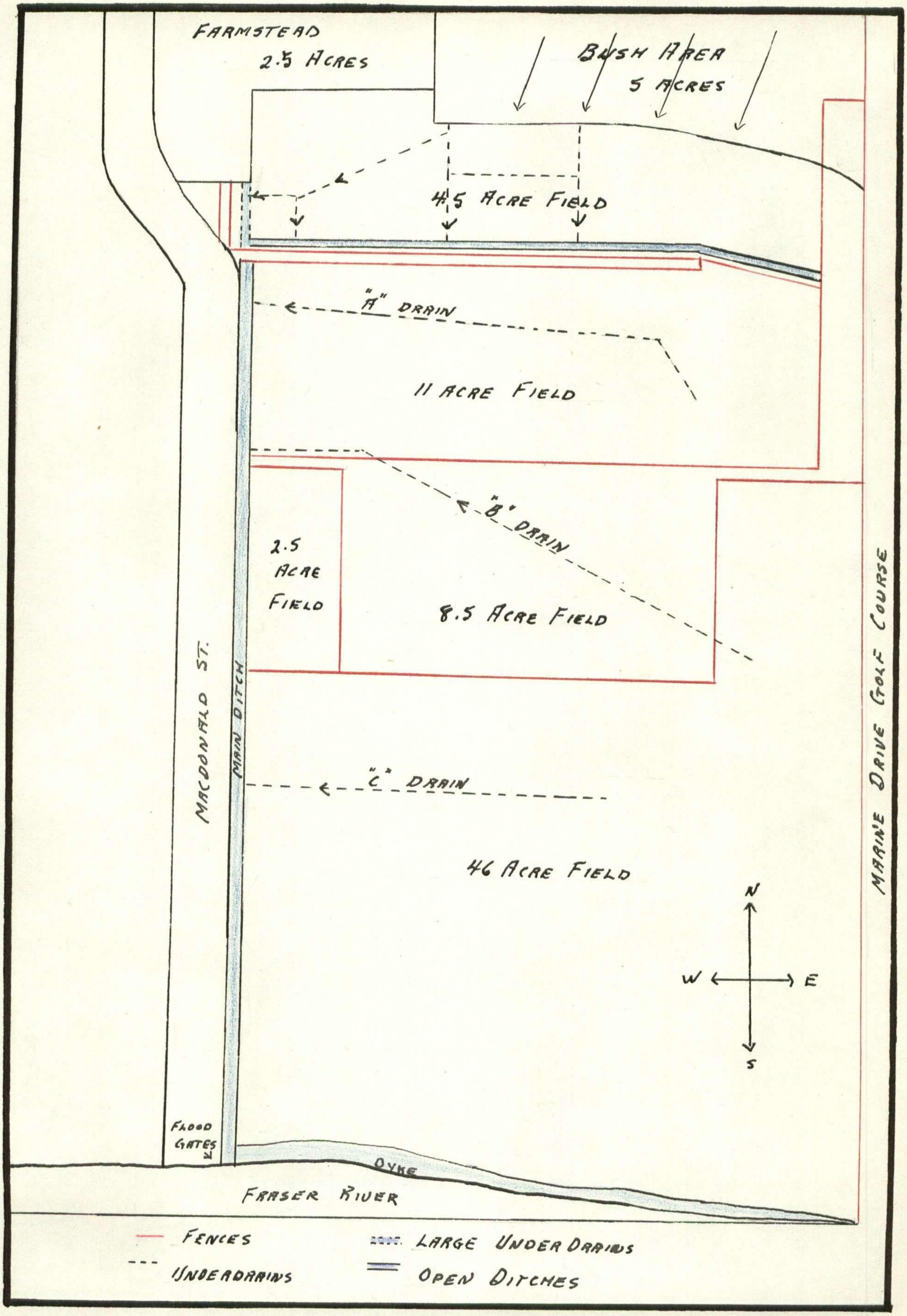
Harrowing)
Clipping) - after each rotation.

Fertilization - yearly applications of phosphates, farm manure and liquid manure applied when available.

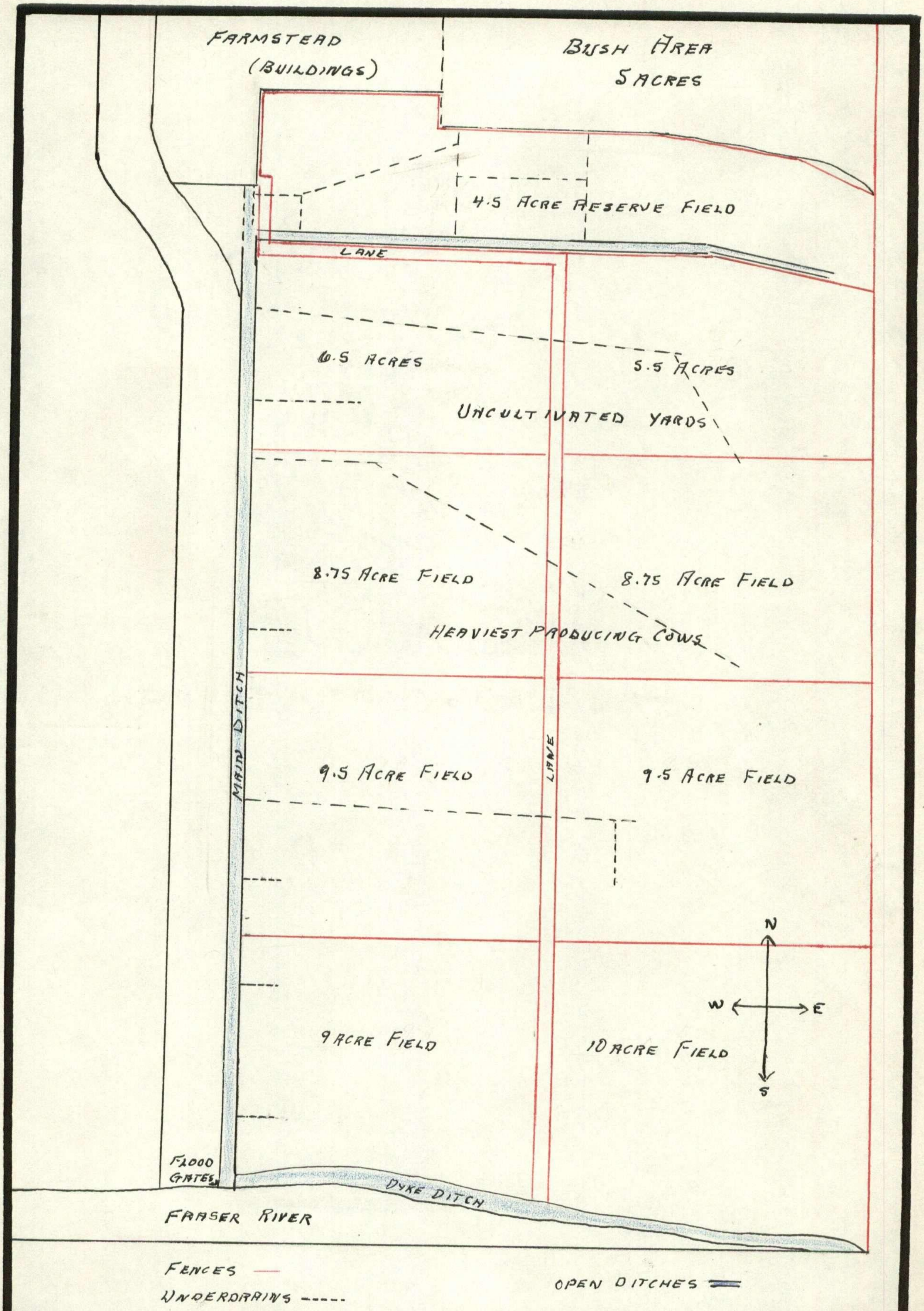
Re-seeding - when necessary.

The cost of maintaining the pastures is estimated at \$10.00 per acre[10] per year. This cost includes fencing, drainage, reseeding, irrigation and cultivation. The estimated cost of establishing the pastures (for seeding, fencing and drainage) is \$1,000.00. Forty acres of the pasture area are already seeded down.

PRESENT FENCING AND DRAINAGE SYSTEMS



PROPOSED FENCING AND DRAINAGE SYSTEMS



Appendix C. DETAILS OF FEED REQUIREMENTS AND COSTS.

1. Purchased Feeds

All feeds other than pasture will have to be purchased from outside sources. These feeds will include alfalfa hay, grain (oats, barley and bran), pea vines for silage, and mineral supplements. Bedding will also have to be purchased.

Alfalfa hay and barley will be bought in the Interior of B.C. and shipped to Vancouver in carload lots. Oats, straw and pea vines will be purchased in the Fraser Valley area. Considerable saving will be made by purchasing these feeds direct from the producer; however, the retail prices (except for alfalfa and straw) are used for the purpose of calculating feed costs. Bran and mineral supplements will be purchased from a local feed dealer.

In the last few years there has been an increase in the use of pea vines for silage. This is a practice that coincides well with the reduction of home-grown feeds. The growing of peas as a cash crop has become an important enterprise in the Delta area of the Fraser Valley. The vines and pods (cannery waste) remaining after the peas have been removed, are relatively high in protein, and if properly preserved, produce a good form of silage. Although the T.D.N.'s of pea vine silage are slightly less than those of corn silage, the protein content is higher, and the palatability seems to compare favourably. There has been little experimental work investigating the comparative feeding value of pea vine;

however, the following data from Morrison[18] gives some idea of its comparative feeding value.

SILAGE	TOTAL DRY MATTER	DIG. PRO-TEIN	T.D.N.	N.R. 1:
	%	%	%	
Clover (Red)	24.4	2.0	13.4	5.7
Corn (Dent, well-matured all analysis)	28.3	1.3	18.7	13.4
Pea Vine from canneries	27.9	2.6	17.8	5.8

With the present tendency to increase field purchases, pea vine silage should play an important role in providing a source of economical silage.

The only limiting factor in the use of pea vine silage is the hauling charge from the cannery to the farm. The initial purchasing price of pea vines is only $ .75 per ton (1946).

The estimated cost of pea vines delivered at the selected farm is $3.00 per ton.

ANALYSIS OF FEEDS USED - Morrison[18]

FEEDS USED	T.DRY M. %	D.P. %	T.D.N. %	N. RATIO
Conc. Mix:				
Pacific Coast Oats	91.2	7.0	72.2	9.3
Common Barley	90.4	9.3	78.7	7.5
Bran	90.6	13.1	70.2	4.4
Roughage:				
Alfalfa	90.4	10.6	50.3	3.7
Silage:				
Pea Vine	27.9	2.6	17.8	5.8
Pasture:				
Grasses, clovers mixed, from closely-grazed fertile pasture	28.7	4.4	20.6	3.7

2. Feed and Bedding Requirements

Total requirements are based on the assumption that a herd of 60 milking cows, averaging 25 lbs. of 4.5% milk daily (7625 milk and 343.13 B.F. per year), will be maintained. There will not be 60 cows milking at all times; however, to provide for a safety margin in feed requirements no allowance is made for reduced rations fed to dry cows.

Yearly feed requirements are calculated for two separate feeding periods, (1) winter feeding period, and (2) summer feeding period.

(1) Winter feeding period:
October 15 to April 15 - approximately 183 days.

Ration: concentrate mix
pea vine silage
alfalfa hay

(2) Summer feeding period:
April 15 to October 15 - approximately 182 days.

Ration: concentrate mix
pasture

A different concentrate mix will be used for each period.

(a) Winter mix:

Oats	1050#	D.P.	8.95%
Barley	500#	T.D.N.	90.9 %
Bran	450#	D.M.	73.4 %
	2000#	N.R.	1:9.1

(b) Summer mix:

Oats	1500#	D.P.	7.6%
Barley	500#	T.D.N.	91.0%
	2000#	D.M.	73.8%
		N.R.	1:10.9

Daily Recommended Requirements of D.P. and T.D.N.
(for 900# cow producing 25# of 4.5% milk daily(18))

	D.P.	T.D.N.
Maintenance	.59	7.23
Production	1.30	8.73
TOTAL	1.89#	15.96#

REQUIREMENTS FOR WINTER FEEDING PERIOD

	DAILY RATION/COW					TOTAL
Feed	Lbs. Fed	D.P. lbs.	T.D.N. lbs.	N.R.	Dry Matter lbs.	REQUIREMENT FOR WINTER PERIOD
Nutr. Requirem'ts.		1.89	15.96	1: 3.7		10# x 183 x 60 = 55T.
Alfalfa	10#	1.06	5.03		9.12	
Diff.		.83	10.93			
Pea Vine Silage	24#	.62	4.27	5.8	6.7	24# x 183 x 60 = 132T.
Diff.		.21	5.66			
Conc. Mix	7#	.63	5.14	9.1	6.4	7# x 183 x 60 = 38½T.
		+ .42	-.52		22.22	

This ration is based on recommended requirements for good cows, rather than minimum requirements,[18] therefore the failure to meet T.D.N. requirements (as above) by .52 lbs. can be disregarded. N.R. of complete ration - 1:5.68

REQUIREMENTS FOR SUMMER FEEDING PERIOD

	DAILY RATION/COW					TOTAL
Feed	Lbs. Fed	D.P. lbs.	T.D.N. lbs.	N.R.	Dry Matter lbs.	REQUIREMENT FOR SUMMER PERIOD
Nutr. Requirem'ts.		1.89	15.96	1:		
Pasture	40#	1.76	8.24	3.7	11.48	
Diff.		.13	7.72			8# x 182 x 60 = 44T.
Conc. Mix	8#	.61	5.9		7.3	
		+ .48	-1.82	10.9	18.78	

In view of the fact that excellent pasture is to be provided, the shortage of T.D.N.'s by 1.82# is not serious. N.R. of whole ration - 1:4.97

A mineral supplement will be added to the concentrate mix at the rate of 20# of supplement (1%) per ton of mix. The total mix requirements are 82.5T., therefore one ton of mineral supplement will be sufficient to cover the year's needs.

Bedding requirements will be heavy. When animals are housed in a loafing shed at least 1½ tons per animal should be provided per year.[11] At the rate of 1½ tons per animal there will be a total requirement of 90 tons.

Mix component requirements are as follows:

Winter Mix: 38.5T.

Oats (52.5% of mix)	20.22T.
Barley (25% of mix)	9.62T.
Bran (22.5% of mix)	8.66T.
	38.5 T.

Summer Mix: 44T.

Oats (75% of mix)	33T.
Barley (25% of mix).....	11T.
	44T.

Total oats	- 53.22T.
Total barley	- 20.62T.
Total bran	- 8.66T.

TOTAL COST OF FEED AND BEDDING

Alfalfa - 55T. @ $30.00	$1,650.00
Pea vines - 132T. @ $3.00	396.00
Oats - 53.22T. @ $35.00	1,862.00
Barley - 20.62T. @ $32.00	659.00
Bran - 8.66T. @ $29.00	251.00
Mineral Suppl.-1T. @ $60.00 ...	60.00
Bedding - 90T. @ $20.00	1,800.00
Pasture maintenance (App. B)...	600.00
TOTAL	$7,279.68

Appendix D. DETAILS ON YEARLY RECEIPTS, FIXED COSTS AND OPERATING COSTS.

Receipts:

The only receipts accounted for in this calculation will be those received from the sale of milk.

The milk produced daily by 45 cows giving 25 lbs. of 4.5% milk will be 112.5 gals. or 450 qts. The estimated average daily sale will be 425 qts. sold at a minimum price of 16¢ per qt.

Daily returns - 425 qts. @ .16	$ 68.00
Yearly returns - $68.00 x 365	$24,820.00

In this calculation of yearly receipts, surplus milk is written off as a dead loss; however, in actual practice it would either be sold wholesale on the fluid market or be converted to some saleable product.

Fixed costs:

The fixed costs consist of a 5% interest charge and a 5% depreciation charge on the farm machinery and buildings. Interest and depreciation charges on dairy equipment are included in the processing and distributing costs.

Total fixed costs:

Interest of 5% on $40,520.00	$2,026.00
Depreciation of 5% on $15,330.00	756.50
	$2,782.50

Operating costs:

Cost of gas, oil, and repairs for the tractor is estimated at $50.00 per year. These expenses cover the cost of filling the silos, and crushing grains for the mix. All machinery expenses involved in pasture maintenance are included in the feed costs (Appendix C).

Taxes are $10.00 per acre, or $800.00 per year on the total farm area.

Feed requirements - $7,279.68 (Appendix C).

Labour costs are based on the salaries of two hired men, each receiving $100.00 per month.

Processing and distributing costs are charged at the rate of 5.26¢ per qt. of milk sold. This cost was determined by an enquiry of the milk processing and distributing costs at Winnipeg, Manitoba.(31)

	¢
Receiving	.07
Delivery	3.15
Processing	1.26
Advertising	.10
Administration	.38
Depreciation	.19
Return on capital	.11
	5.26 ¢ per qt.

Daily cost - 425 x 5.26¢ $22.355
Yearly cost - 365 x $22.355 ....$8160.00

Replacements - $500.00 (Appendix C).

General expense - $500.00. This includes veterinary fees, animal registration, telephone, electricity, water, insurance, etc.

ABSTRACT

An investigation regarding the operation of a selected dairy farm in an area where urbanization presents a problem affecting the supply of fresh dairy produce, is herewith presented. Large and growing cities with adjacent restricted farming areas are experiencing a rapid urbanization of these farm lands; hence, serious depletion of land resources for dairy enterprises is resulting. The problem has been applied to a farm within the city limits of Vancouver. This land is unavailable for use other than agricultural, and, as a result, it is expedient that it be adapted to a profitable farm enterprise. The farm has been outlined as a dairy production unit, operating on the "dry-lot" principle. The results of the study indicate that the unit would provide a fair labour income to the operator, but would offer a definite challenge to anyone whose interests lie in dairy farming.

BIBLIOGRAPHY

*1. Bartlett, R.W. THE MILK INDUSTRY. 1946.

2. B.C. Dept. of Agriculture. SILOS AND SILAGE. Bull. 66, 1941.

3. B.C. Dept. of Agriculture. FARM DRAINAGE. Field Crops Circ. 14, 1945.

4. Bendixen, H.A. & Smith, L.J. APPROVED MILKING PARLORS FOR THE STATE OF WASHINGTON. Bull. 461, 1945. State Coll. of Wash., Agr. Exp. Sta., Pullman, Wash.

5. Black, P.C. SOIL FERTILITY. B.C. Dept. of Agriculture, Field Crops Circ. No. 11, 1942.

6. Bradt, C.G. MILKING PARLORS IN THE NORTHWEST. Hoard's Dairyman, Nov. 25, 1946.

*7. Clement, F.M. & Foreshaw, R.P. A FACTUAL SURVEY OF THE FRASER VALLEY DAIRY INDUSTRY AND THE GREATER VANCOUVER FLUID MILK MARKET. p. 4, 1942.

*8. Dom. Dept. of Agriculture, MANURES, FERTILIZERS AND SOIL AMENDMENTS THEIR NATURE, FUNCTION AND USE. Pub. 585, p. 39, 1940.

9. Forster, G.W., FARM ORGANIZATION AND MANAGEMENT. Prentice-Hall, Inc., New York, 1947.

*10. Gorton, W.W., COST AND EFFICIENCY OF IRRIGATED FARM PASTURES IN EASTERN OREGON. Bull. 391, pp. 5-9, 1941; Agr. Exp. Sta.; Ore. State Coll., Corvallis, Ore.

*11. Jefferson, C.H. & Weaver, E., THE PEN BARN AND MILKING ROOM IN MICHIGAN. Bull. 195, p. 7, 1945; Mich. State Coll. Agr. Exp. Sta., E. Lansing.

12. Jefferson, C.H., THE PEN-TYPE DAIRY STABLE. Hoard's Dairyman, Mar. 28, 1946.

*Specific information cited.

13. Johnston, C.I. & Hopper, W.C., AN ECONOMIC STUDY OF THE CONSUMPTION OF MILK AND CREAM IN VANCOUVER. Dom. Dept. of Agriculture, Pub. 678, 1940.

14. Johnston, F., Porter, A.R., Arnold, F.J., FEEDING DAIRY COWS. Ext. Circ. 253, 1940; Iowa State Coll. of Agriculture & Mechanic Arts, Ames, Iowa.

*15. Kelley, C.C. & Spilsbury, R.H., SOIL SURVEY OF THE LOWER FRASER VALLEY. Dom. Dept. of Agriculture, Pub. 650, pp. 9-15, 1939.

16. Kentucky Agricultural Experiment Station, REPRODUCTIVE EFFICIENCY IN DAIRY CATTLE. Univ. of Kentucky, Lexington, Kentucky; Bull. 402, 1940.

17. McColly, H.F. & Dice, J.R., THE PEN BARN AND SEPARATE MILKING ROOM. Bull. 283, 1935; Agr. Exp. Sta., N. Dakota Agr. Coll., Fargo, N.Dakota.

*18. Morrison, F.B., FEEDS AND FEEDING. 20th Edition, 7th Printing, 1941. The Morrison Pub. Co., Ithaca, New York.

19. Myers, W.I., HOW TO PLAN THE FARM LAYOUT. Ext. Bull. 55, 1922. New York State Coll. of Agriculture, Cornell Univ., Ithaca, N.Y.

*20. Odland, T.E. & Knoblauch, H.C., A COMPARATIVE TEST OF DIFFERENT BEDDING MATERIALS AND CHEMICAL SUPPLEMENTS WITH COW MANURE APPLIED IN A THREE-YEAR ROTATION. Bull. 251, p. 2, 1935, Agr. Exp. Sta. of Rhode Island State Coll., Kingston R.I., U.S.A.

21. Otis, C.E., Morse, R.W., Huber, M.G., MAKING AND FEEDING GRASS AND LEGUME SILAGE IN WESTERN OREGON. Ext. Bull. 669, 1946, Ore. State Coll., Corvallis, Ore.

*22. Shultis, A., DAIRY MANAGEMENT IN CALIFORNIA. Bull. 640, pp. 28-34, 1940. Univ. of Calif., Berkley, Calif.

23. State Coll. of Washington, AN APPROVED WASHINGTON MILK-HOUSE. Ext. Bull. 318, (Revised) 1946. Pullman, Wash.

*Specific information cited.

24. State Coll. of Washington, FARMSTEAD PLANNING-BUILDING ARRANGEMENT. Ext. Bull. 337, 1946. Pullman, Wash.

25. U.S.D.A. Yearbook, SOILS AND MEN. 1938.

26. U.S.D.A., FEEDING THE DAIRY HERD. Ext. Bull.218, 1941.

27. U.S.D.A., IRRIGATED PASTURES FOR FORAGE PRODUCTION AND SOIL CONSERVATION. Farmers' Bull. 1973, 1945.

28. U.S.D.A., THE MAKING AND FEEDING OF SILAGE. Farmers' Bull. 578, 1941.

29. Woodworth, H.C., Harris, C.W., & Rauchenstein, E., EFFICIENCY STUDIES IN DAIRY FARMING. Bull. 275, 1933. Univ. of New Hampshire, Durham, N.H.

30. Wright, K.T. & Baltzer, A.C., PROFITABLE DAIRY MANAGEMENT. Special Bull. 297, 1939. Mich. State Coll. Agr. Exp. Sta., E. Lansing, Mich.

*31. Interview with E.C. Carr, Milk Board, Vancouver, 1947.

*Specific information cited.