SOIL SURVEY OF ISLAND COUNTY, WASHINGTON.

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LOCATION AND BOUNDARIES OF THE AREA.

Island County comprises a group of islands lying in about the center of Puget Sound, between 122° 21′ and 122° 46′ west longitude and between 47° 54′ and 48° 25′ north latitude. It is bounded on the north by Skagit County, on the east by Skagit and Snohomish counties, on the south by Snohomish and Kitsap counties, and on the west by Jefferson County and the strait of San Juan de Fuca. The land area of the county is about 148,992 acres, or 233 square miles.

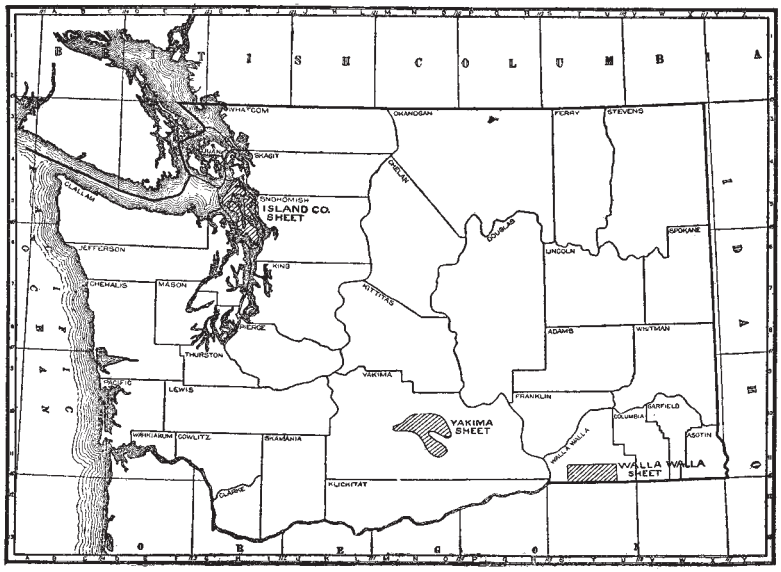

FIG. 44.—Sketch map showing location of the Island County area, Washington.

Whidbey Island is the largest and most important island of the county and of Puget Sound, with a length, north and south, of 35 miles, and varying in width from 1 to 11 miles. Camano Island lies just to the east of Whidbey, and embraces an area about one-fifth as large as the latter. Besides these two main islands, the county includes the very small islands of Deception, Smiths, and Ures, which it was not practicable to show on the map.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The original inhabitants of Island County were a mild-mannered race of Indians that made an easy living fishing and digging clams and growing potatoes and camas bulbs. They have never offered any serious obstacle to the settlement of the islands.

In 1850 Colonel Ebey took up the first donation claim on Whidbey Island, and in the same year other claims were taken up at Oak Harbor. In 1857 Captain Coupe laid out the town of Coupeville, the county seat. Coveland was settled in 1853 and Utsaladdy in 1856. These first settlers took up the choice untimbered black "prairie" lands on the islands, while the extensive uplands were gradually taken up for the sake of the fine timber, and lumbering has been, and is still, the only industry of importance on these upland soils. Fir, cedar, spruce, and hemlock have been removed from considerable tracts of land, yielding from 25,000 to 35,000 feet of lumber per acre. About nine-tenths of the county is still uncleared, and while the choicest timber has been cut on most of the lands, there are still considerable bodies of good fir and cedar. Many tracts have been cut over two or three times, and large sawmills have been operated at Utsaladdy, Coupeville, and other points. There is at present no land in the county subject to homesteading.

In the eighties the railroads opened up the Northwest Territory, and the development of Alaska and of the oriental trade has further stimulated the agriculture of the section in establishing ready markets for the farm produce. Immigrants from Holland and Scandinavia have more recently built up a promising dairy business, and a creamery has been in operation at Crescent Harbor since 1898. The establishment of Fort Casey on Whidbey Island in 1897 served to strengthen the local market for produce.

A serious obstacle to extending the area of cultivated land to the timbered upland soils is the great difficulty in clearing such heavily timbered land. The cost of clearing is estimated at from $85 to $150 an acre on these uplands, an almost prohibitive cost, except for select crops for special markets. The open and more fertile "prairie" areas have largely remained the limited seat of farming operations.

The fisheries are an important economic resource of this county, and several large fish traps along the northern shores of Whidbey Island yield a considerable income from the catches of sockeye salmon and other fish.

Island County was organized January 6, 1853. The population in 1900 was 1,870, and was estimated in 1903 to be 2,618. Coupeville, the county seat, has a population of about 600.

CLIMATE.

The following tables, compiled from the records of the Weather Bureau station at Coupeville, serve to indicate the climatic conditions in this area:

Normal monthly and annual temperature and precipitation.

Month.	Coupeville.		Month.	Coupeville.	
	Temperature.	Precipitation.		Temperature.	Precipitation.
	°F.	*Inches.*		°F.	*Inches.*
January	39.5	2.53	August	61.3	1.08
February	41.9	2.43	September	55.9	1.42
March	42.8	1.93	October	51.3	1.49
April	48.1	1.95	November	42.9	2.81
May	53.0	1.81	December	41.6	3.03
June	57.3	1.26	Year	49.7	22.49
July	60.7	.75			

Dates of first and last killing frosts.

Year.	Coupeville.		Year.	Coupeville.	
	Last in spring.	First in fall.		Last in spring.	First in fall.
1897	Mar. 30	Nov. 20	1901	Apr. 3	Dec. 11
1898	Apr. 18	Nov. 13	1902	Mar. 29	Dec. 6
1899	May 14	Dec. 3	1903	Apr. 11	Oct. 30
1900	Apr. 9	Nov. 18	Average	Apr. 12	Nov. 23

Sheltered from the cold continental winds by the towering, snow-clad Cascade Range to the east, and tempered by its salt-water environment, Island County enjoys an equable marine climate. The winters are mild and the summers cool, the temperature rarely reaching as low as zero or as high as 90° F. But few damaging frosts are known to occur during the growing season.

There is a fairly distinct dry and wet season, the dry season extending from about the 1st of July to the 1st of October, when the rainfall is very scanty, and the wet season lasting from December to March. The snowfall is infrequent and of inconsiderable depth. There is, however, a rather large proportion of days of foggy and overcast weather. Precipitate thunderstorms are unknown. There is quite a marked difference in the rainfall within a distance of a very few miles in the county. Although no records are kept within the county except at Coupeville, an estimate by the observer at that station, based on the difference in the records of Coupeville and of Everett, Snohomish County, makes a difference of nearly 10 inches between the rainfall at Coupeville and at the southern end of the county. This is explained by the geographical position of the county with reference to the Olympic Mountains on the west. The moisture-

laden winds approach generally from the southwest and condense on this range, with a consequent excessive rainfall on the windward or coast side. The central portion of the county, around Coupeville, lies to the leeward of these mountains, and the winds are already deprived of a great part of their moisture before reaching this section. The southern part of the county is not so much sheltered from these winds by the mountains and receives in consequence a higher precipitation.

PHYSIOGRAPHY AND GEOLOGY.

The islands of this county consist for the most part of rolling uplands, varying in elevation from 50 to 150 feet, and rising to an occasional height of 300 feet. Several small areas of open black prairie land are found among the uplands. These constitute the choice farm lands of the area, and represent the beds of former lakes or lagoons. There are about a dozen small fresh-water lakes in the county.

These islands are made up of glacial deposits, and represent the moraines of the glaciers which descended into the Puget Sound basin from the Olympic and the Cascade mountains. These glacial deposits consist of sands, gravel, and clays, showing local stratifications, and mixed with glacial stones and bowlders up to a foot or more in diameter. There are very few bowlders of large size. In topography the glaciated uplands are comparatively uniform and regular, rising to a fairly defined crest or ridge that extends the length of Whidbey Island. Only one or two instances of typical kame and kettle topography was observed. Bowlder clay is generally to be found at a depth of a few feet below the surface, with thin erratic seams rich in lime. These glacial sediments are from 500 to 1,000 feet deep, and overlie the native Eocene rocks of sandstone and shale. The tip of Whidbey Island, at Deception Pass, is the sole instance where the rock outcrops, and here there has been the violent uplift of a small peak of highly metamorphosed sandstone.

The black, level prairie lands in the uplands indicate that they were the floors of former glacial lakes or the beds of brackish lagoons that at one time had outlets into the waters of Puget Sound, but are now at adequate elevations to afford highly productive farm lands. In the beds of these former lakes and lagoons the glacial materials were reworked and redeposited and mixed with a very marked accumulation of peat and other organic matter. Ebeys Prairie and Smiths Prairie are the best instances of such black prairie lands. In certain small depressions in the uplands and among the marshes on the shore organic matter has accumulated to such depth as to form small bogs of peaty soils. These peat areas represent an earlier stage of the same process of humus formation that produced the fer-

tile black prairie soils, but the excess of organic matter unfits these soils for the growth of the staple farm crops, while at the same time adapting them to certain special garden crops.

The waters of the sound around the islands are deep and afford commodious and picturesque channels for steamboats. An exception to this, however, occurs in the shallow waters at the northeast end of Camano Island, where this island is separated from the mainland only by a shallow slough, and where the sediments from the rivers of the mainland have filled up the waters of the sound. One result of these river sediments is the formation of a distinct soil—the highly productive Puget clay—on the northeastern shore of Camano Island.

There are no streams of any size on the islands, and since wells are unsatisfactory on account of the poor seepage through the impervious bowlder clay, dependence is generally placed upon cisterns. The southern portion of Whidbey Island is, however, fairly well watered with springs.

SOILS.

Ten soil types were encountered in the survey of this county. The following table shows the area of each of these soils, and the proportion which each type forms of the total area surveyed. The distribution of these different soils is shown on the colored map accompanying this report.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Miami stony sand	71,744	48.1	Galveston coarse sand	1,536	1.1
Miami gravelly sand	33,600	22.5	Clyde loam	1,216	.8
Miami stony sandy loam	25,792	17.3	Puget clay	768	.6
Clyde gravelly sandy loam	5,952	3.9	Rock outcrop	256	.2
Peat	4,096	2.8	Total	148,992	
Miami clay loam	2,240	1.5			
Clyde sandy loam	1,792	1.2			

CLYDE LOAM.

The Clyde loam consists of about 10 inches of a black loam to clay loam, very rich in organic matter, overlying a subsoil of drab or mottled drab and yellow clay loam or silty clay reaching to a depth of 36 inches.

This type is found in small isolated areas on Ebeys Prairie and at or near the head of Crockett Lake, Duguala Bay, and Crescent Harbor on Whidbey Island, and at the head of Triangle Cove on Camano Island, besides in one or two other still smaller areas. It occupies the low depressions near the head of coves and inlets, occurring in narrow strips along the courses of the local drainage that empties into

these coves. The type generally lies at a sufficient elevation above tide water to insure fair drainage, but in no case exceeds an elevation of 40 feet. On account of the rather limited rainfall of this area the low position of this soil is quite to its agricultural advantage, and it stands in notably less need of artificial drainage than would be the case in areas of greater rainfall. At its lowest elevations, however, it is decidedly improved by drainage.

The Clyde loam occupies the beds of former brackish sloughs that emptied into marshes at the head of coves, the waters of which have now so far receded as to leave these beds well above the tide. In these channels the glacial materials were reworked and redeposited and mixed with a marked accumulation of peat mosses and other semiswamp vegetation. The heavy texture of the soil indicates that its location was the lowest plane of such redeposition, where the finer sediments were laid down in comparatively deep water; that is, in the middle of these sloughs or lagoons.

The organic matter mixed with this type in its process of formation has been thoroughly decomposed and incorporated with the soil, incident to its emergence and exposure to the air, and has made it naturally very rich.

This soil is one of the very best in the area for general farm crops, receiving no artificial fertilization and producing large yields year after year. Its heavy texture, combined with its low position, insures a large supply of moisture and makes the type practically exempt from drought. This soil is the best in the area for wheat, yielding from 50 to 80 bushels per acre, while a yield of 117 bushels is on record as the average yield of 10 acres during a good season. The wheat is, however, of a soft-grained variety—the Red Australian—and is not so well adapted to milling as the harder wheats. The yield of potatoes runs from 250 to 500 bushels per acre, and hay yields from 3 to 4 tons. Oats likewise will yield from 40 to 75 bushels, but this type is not so well adapted to oats as is the Puget clay, though, on the other hand, it is much better adapted to wheat than is that type.

A small acreage of this soil is planted to beets, carrots, onions, and sugar beets for stock, and the yield of these root crops runs from 10 to 20 tons, showing the soil well adapted to such crops.

This type is all under cultivation, and has been for years. Its value is reckoned at from $80 to $250 an acre.

The table following shows the average results of mechanical analyses of the soil and subsoil of the Clyde loam.

Mechanical analyses of Clyde loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
13161, 13163	Soil	1.6	5.2	4.8	18.5	13.9	29.5	25.9
13162, 13164	Subsoil	.9	6.6	5.4	15.8	11.2	27.1	32.5

CLYDE GRAVELLY SANDY LOAM.

The surface soil of the Clyde gravelly sandy loam consists of from 8 to 15 inches of coarse to medium black sandy loam, very rich in organic matter, and containing a varying percentage of fine gravel. The subsoil, to a depth of 36 inches, consists of a mixture of medium to coarse sand, with a high percentage of gravel, and in certain cases shows evidence of stratification. A small proportion of moderate sized glacial stones is found at times scattered on the surface.

The main areas of the Clyde gravelly sandy loam are located in Ebeys and Smiths prairies, and near the heads of Oak Harbor, Crescent Harbor, Crockett Lake, and Livingston Bay, besides in other scattered localities in the uplands. Its topography varies from nearly level to gently rolling, and it lies at a somewhat higher elevation than the Clyde loam, frequently adjoining the outer margins of that type.

The drainage is amply sufficient, and on account of its coarse gravelly subsoil this type is by nature well underdrained, and is rather liable to drought.

The Clyde gravelly sandy loam has been formed by the accumulation of organic matter in the beds of former inland glacial lakes or swamps, or along the inland margins of sloughs or former glacial channels emptying into the heads of the bays and coves. The glacial materials have been reworked and redeposited by water, but in shallower waters and at a higher elevation than the finer sediments of the Clyde loam. In some cases it now occupies areas of what once were probably the beach lines of brackish inlets or lagoons, while in other cases there seems to have occurred merely an accumulation of swamp growth over low-lying beds of coarse glacial débris, with a minimum of local water action. The organic matter has become well decomposed and thoroughly incorporated into the surface soil as a result of the long exposure to atmospheric conditions.

The main crop grown on this type is potatoes, and while the yield is not so large as on the heavier Clyde loam, the crop matures earlier and gets the benefit of the early market. The yield of potatoes varies from 150 to 300 bushels per acre, according to the season. The soil is not so well adapted to wheat, oats, or grass as the Clyde loam, because of its leachy subsoil and liability to drought. The yields are

from 25 to 40 bushels of soft-grained wheat or oats, and from 1 to 2 tons of hay. Onions, carrots, and sugar beets yield from 5 to 10 tons, but are not planted to any great extent. The soil affords good locations for poultry ranches on account of the ready underdrainage, and in general early garden crops and berries succeed well. The greatest success, however, has been found to be the early potato crop. This type is in pretty general cultivation, the lands being valued at from $40 to $125 an acre.

The following table shows the average results of mechanical analyses of soil and subsoil of this type:

Mechanical analyses of Clyde gravelly sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
13184, 13186	Soil	10.8	31.8	12.7	11.9	4.8	9.6	18.1
13185, 13187	Subsoil	6.6	28.1	27.4	27.7	4.0	2.1	3.9

CLYDE SANDY LOAM.

The surface soil of the Clyde sandy loam consists of about 12 inches of medium black sandy loam, rich in organic matter, and containing some coarse sand and fine gravel. The subsoil, to a depth of 36 inches, consists of a drab or mottled drab and yellow clay loam to clay, containing at times a small proportion of fine gravel. Occasional small glacial stones and cobbles are found scattered through parts of the type.

This type is an intermediate soil between the Clyde loam and the Clyde gravelly sandy loam, possessing the clay subsoil of the former type with the sandy loam surface soil of the latter.

Limited areas of this soil are found on Ebeys Prairie and near Oak Harbor, Crescent Harbor, and the head of Duguala Bay. The topography is level to gently rolling, the areas occupying either the immediate upper margins of the Clyde loam or the lower depressions within the Clyde gravelly sandy loam. Its drainage is in general adequate, and the fairly low position of the soil is an advantage in this climate.

The type has been formed by the accumulation of organic matter in the beds of former swamps or water channels, the glacial materials having been reworked and redeposited in essentially the same manner as in the formation of the Clyde loam.

This soil ranks next to the Clyde loam in its production of wheat and oats, and is practically just as productive as that type for potatoes. The yields of the root crops are high, but the acreage very limited. On account of its heavy subsoil this type is better enabled to withstand drought, and is fitted for the successful growing of wheat,

potatoes, and timothy and clover. This type is all under cultivation, and is valued at $75 to $150 an acre.

The following table shows the average results of mechanical analyses of the fine earth of the soil and the subsoil of this type:

Mechanical analyses of Clyde sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
13167, 13169	Soil	11.3	23.5	11.0	14.8	7.9	12.5	18.4
13168, 13170	Subsoil	1.4	8.6	8.8	12.3	6.4	23.3	38.6

MIAMI CLAY LOAM.

The surface soil of the Miami clay loam consists of 8 to 10 inches of gray to drab heavy loam, containing at times a very small percentage of coarse sand and fine gravel. The subsoil, to a depth of 36 inches or more, consists of a drab silty clay to clay. Some glacial stones are here and there scattered through the type.

Small areas of this soil are found just east of Coupeville, north of Fort Casey, east of Crescent Harbor, at Camano, and east of Livingston Bay and Triangle Cove. The topography comprises characteristic benches near the base of uplands where they lower into local depressions, or at the break between the low-lying prairie lands and the upland hillsides.

The natural drainage is in general good, but underdrainage would be of benefit in rendering more level tracts mellower and more tractable, since the soil clods after rains and is liable to bake when dry.

The Miami clay loam owes its origin to finer glacial deposits, or to the removal by erosion of coarser material from the underlying bowlder clay. It has a low content of organic matter, and this deficiency accentuates its tendency to clod and bake.

This soil is decidedly the best of the upland soils in the county for general farming purposes. It has, however, been little used so far, except for pasture or a limited quantity of hay. It would probably prove a rather difficult task to prepare a mellow seed bed on this soil at one cultivation, and the seed bed should be deepened gradually from year to year. If in addition some attention is given to subsoiling and underdrainage, and crops like buckwheat and clover planted at the start to mellow the soil and add organic matter, this soil would be able in a short time to produce good yields of wheat, hay, potatoes, and root crops. It should likewise prove a safe soil for growing apples, pears, and cherries, since the heavy texture would induce a consistent and not too rapid growth, and favor a stocky and substantial shape of tree.

These lands can be purchased at from $20 to $40 an acre, and offer one of the best opportunities for development in the area, though they are quite limited in extent. Their heavy texture and consequent capacity for storing up the scanty rainfall would prove in the long run one of their best advantages.

The following table shows the average results of mechanical analyses of typical samples of the fine earth of the soil and the subsoil of the Miami clay loam:

Mechanical analyses of Miami clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
13176, 13178	Soil	1.4	7.3	4.4	7.9	11.9	36.8	30.0
13177, 13179	Subsoil	.4	1.7	1.1	3.3	10.3	50.8	32.1

MIAMI GRAVELLY SAND.

The surface soil of the Miami gravelly sand consists of from 12 to 15 inches of gray medium to fine sand or light sandy loam, containing at times a small percentage of coarse sand and fine gravel. The subsoil to a depth of 36 inches consists of loose yellow medium to fine sand, also containing some coarse sand and fine gravel. Both soil and subsoil carry on an average from 10 to 20 per cent of glacial stones and cobbles, but near the crests of ridges the stone content may rise to as high as 50 per cent, embracing some small glacial bowlders.

The main area of this soil is found covering rather uniformly the southern head of Whidbey Island, and a smaller area occurs in the northeast part of Camano Island. In its topography it is fairly to decidedly hilly, forming the upland glacial ridges. In many places the soil would, if cultivated, be somewhat liable to washing, while on account of the loose sandy subsoil it is leachy and suffers easily from drought.

The Miami gravelly sand is of morainic origin, being formed from the glacial débris of mixed sand and stones. It has been but slightly modified by atmospheric weathering, with only an occasional accumulation of a light sandy loam texture in the top soil, and is quite deficient in organic matter.

The type is almost entirely in forests, from which the choicest fir, cedar, spruce, and hemlock have been cut. Only here and there around the small villages is a small acreage devoted to the home garden or to growing berries, early potatoes, and fruit for local markets. Some good early strawberries are raised and shipped in small quantities. Cherries were observed to flourish on this soil, but the trees seem liable to suffer from bark splitting on account of too rapid growth.

Owing to climatic conditions, peaches do not color and ripen to the best advantage. Red clover was observed to make a remarkably fine growth for such a poor soil. The cool summer days and considerable proportion of overcast forenoons protect the clover from the sun's heat and in a measure compensate for the moderate rainfall and the leachy character of the soil. The occasional seams of lime would also indicate a condition of soil favorable to the growth of clover. This fact of itself must imply a fair agricultural possibility for the less stony areas of this soil, for the clover can be used to build up the soil by supplying it with humus and so increasing its capacity for moisture, while at the same time enriching it with nitrogen.

This type will not prove so well fitted as the heavier soils for general farm crops; but the lower-lying and less stony spots can be utilized in growing garden crops, fruits, and berries for the early market. The light sandy soil naturally forces the maturity of these crops, and such early crops are out of the way before the later droughts.

These lands can be bought for $10 an acre upward, depending largely upon the quantity of timber on them.

The following table shows the average results of mechanical analyses of the fine earth of typical samples of the soil and the subsoil of the Miami gravelly sand:

Mechanical analyses of Miami gravelly sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct*
13194, 13196	Soil	4.9	13.7	17.2	43.2	11.0	5.8	4.0
13195, 13197	Subsoil	3.2	18.5	19.6	38.1	9.2	6.4	4.9

MIAMI STONY SANDY LOAM.

The surface soil of the Miami stony sandy loam consists of about 15 inches of brown sandy loam, with a considerable percentage of fine gravel. The subsoil to a depth of 36 inches or more varies from a light sandy loam to an assortment of loose gray sands, coarse to fine in texture, containing a good proportion of fine and coarse gravel. Both soil and subsoil contain from 20 to 40 per cent of glacial stones, cobbles, and small bowlders. This type represents areas closely related in position to the other upland types—Miami stony sand and Miami gravelly sand—but with a heavier and more loamy top soil than these thinner soils. It is found in the uplands around the head of Penn Cove and over the flatter tops of the more inland hills and ridges in the southern part of Whidbey Island and on Camano Island.

The topography of this type is rolling to hilly, and is most characteristic on the less steep hills and ridges lying within areas of the Miami stony sand.

The Miami stony sandy loam has such ready natural drainage that cultivated areas are somewhat liable to washing. The rainfall, however, is as a rule gentle and protracted, thus reducing the damage from this source. The porous subsoil causes in it a tendency to leach, but at the same time offsets in a measure the danger from washing by absorbing the rainfall more readily.

This soil likewise is of morainic origin, but atmospheric weathering and the accumulation of organic matter has been more pronounced than in the cases of Miami stony sand and Miami gravelly sand, while the humus has been better conserved than on the steeper and more eroded slopes of the latter types.

After the Miami clay loam this type ranks better than the other upland types for farming purposes. Nearly all of it, however, is still in forests of fir and cedar, and only occasional and better lying tracts are devoted to grass and potatoes. Largely owing to favorable climatic conditions, red clover makes a fine growth on lands of this type and should furnish the basis for improvement wherever areas are cleared. The soil is too light for wheat and oats, but well adapted to garden crops intended for the midseason market. It should likewise prove adapted to cherries and to the berry crops. Strawberries would seem better adapted to this type than to the lighter soils, which are more subject to drought. The yields of hay average about 2 tons per acre, and of potatoes from 100 to 200 bushels.

Lands composed of the Miami stony sandy loam can be purchased at from $10 to $100 an acre, depending upon the character of timber growth. The partly cleared lands are of course the cheaper ones. Stonier areas of this soil should be kept in forest or utilized for pasturage, white clover being encouraged for this purpose. The better areas will doubtless best pay for the cost of clearing when devoted to truck and berry crops, to which the type is more adapted than to general farming.

The following table gives the average results of mechanical analyses of the fine earth of this type of soil:

Mechanical analyses of Miami stony sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct*	*Per ct.*	*Per ct.*	*Per ct.*
13188, 13190	Soil	7.1	13.4	6.8	13.8	15.1	25.6	18.0
13189, 13191	Subsoil	9.8	19.4	12.0	19.4	11.2	15.9	12.1

MIAMI STONY SAND.

The surface soil of Miami stony sand consists of 0 to 12 inches of gray medium to coarse light sandy loam, containing a considerable proportion of gravel varying from small pebbles to cobbles 3 or 4

inches in diameter. The subsoil, to a depth of 36 inches or more, consists of a mixture of coarse to fine gray sand and various sized gravel. Both soil and subsoil contain from 20 to 40 per cent of moderate sized glacial stones and cobbles, with occasional small bowlders, while rougher areas may contain as high as 60 to 70 per cent of stones.

This soil constitutes the main upland type of Whidbey and Camano islands, covering uniformly the northern part of Whidbey Island, occupying the flanks and steeper hillsides of the uplands of Camano Island, and extending down the steeper sides of the middle and lower part of Whidbey Island. Its topography is rolling to quite hilly, ranging in elevation from the shore-line bluffs to ridges reaching 200 to 300 feet in height.

The hilly topography insures such ready drainage that the fields, if cultivated, would in many cases be somewhat subject to washing. The coarse gravelly subsoil serves also to make the soil very leachy in character and subject to drought.

The Miami stony sand is of morainic origin, representing the coarser sands and gravels of the glacial deposition. Its hilly character has also served to accent its coarse texture, in that the finer materials are more readily removed by erosion. The type has been little modified by atmospheric weathering, and is deficient in organic matter.

The Miami stony sand is still almost entirely in timber, or only partially cut over, the native growth being fir, cedar, and hemlock, with alder bushes and salmon berries in the lower and somewhat moister locations.

In a few less stony areas early potatoes are grown with a very satisfactory yield, securing the very earliest market, and berries and garden crops might be produced. Whatever other areas of this soil are utilized are devoted mostly to pasture. White clover volunteers readily on this soil and furnishes fair pasturage for quite a long season; this indicates the possibility for using this soil, which it would doubtless not pay on the whole to clear for cultivation, as pasture lands for beef cattle and sheep. The mild, equable climate would favor such an industry. A little hay is grown on a few moist areas, the Italian rye grass, redtop, and Alsike clover being preferred for such wet spots. But this soil is on the whole poor and unproductive. The more stony areas should be kept in forest or used for pasturage, while only the less stony areas and moister depressions may find limited use for the crops mentioned.

These lands range in value from $10 up, according to location and the quantity of standing timber.

The following table shows the average results of the mechanical analyses of the fine earth of the Miami stony sand:

Mechanical analyses of Miami stony sand.

Number.	Description.	Fine. gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
13180, 13182	Soil	14.8	21.1	13.6	18.2	8.2	13.2	10.6
13181, 13183	Subsoil	11.1	25.8	16.9	28.1	7.6	5.3	4.9

PUGET CLAY.

The surface soil of the Puget clay consists of about 15 inches of drab clay, containing a high percentage of partially decomposed organic matter, which gives to the soil a loamy, silty feel. The subsoil is a bluish-gray silty clay to clay, with a depth of 36 inches or more, containing a small proportion of more or less decomposed organic matter. The type is entirely free from stones and gravel.

This soil is only found as a narrow strip bordering the shallow waters at the northeast end of Camano Island, and at the head of Livingston Bay. Its topography is very flat and low lying, and the cultivated areas are under dike to keep out the high tides and storm floods.

The natural drainage is consequently poor, and the soil must be ditched and underdrained to give satisfactory yields. The open ditches are fairly permanent in this compact soil, and the dikes are themselves efficiently made out of the heavy peaty and clayey materials of the type. In underdraining "blind drains" or box flumes of cedar slabs are generally employed.

This soil is a marsh type, and owes its origin to beds of fine alluvial sediments brought down from the mainland by the Stilaguamish River and laid down in the shallow waters near its mouth as a delta deposit. The areas of this soil lie just opposite the mouth of the river on the mainland. Upon these finer delta deposits has accumulated the more or less decayed growth of salt grass, etc., which adds organic matter and lightens the soil texture. The soil scours readily under the plow, despite its heavy texture, but is liable to bake and crack badly when it becomes dry.

This type is planted almost exclusively to oats and seems remarkably adapted to that crop. The average yield runs from 80 to 100 bushels per acre, and yields of 150 bushels are on record for good seasons. It appears that such parts of the type as are not too high in their content of organic matter, but in which the silt and clay is prominent and has had a chance to weather by exposure to the air, produce the largest yields. Yields of 3 to 4 tons per acre of timothy

and red clover hay are also made. Potatoes also yield well, but with a tendency to scab.

The type does not succeed well in wheat, and is doubtless too moist for that crop, the grain turning black. Considering the heavy yields of oats secured, there would seem to be no better adaptation possible to the type than the growing of this crop.

The lands composed of the Puget clay are all under cultivation, except the undiked margins close to the water, and are valued at $200 to $300 an acre.

The following table gives the average results of mechanical analyses of typical samples of the Puget clay:

Mechanical analyses of Puget clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
13172, 13174	Soil	0.0	0.7	0.6	1.8	4.0	43.1	49.7
13173, 13175	Subsoil	.1	1.2	.5	1.2	4.3	49.5	42.9

No. 13172, loss on ignition, 12.8 per cent; No. 13174, loss on ignition, 15 per cent.

PEAT.

The Peat consists of 36 inches or more of partially decomposed organic matter, with only a small percentage of earthy material.

The main areas of this soil occur at the heads of Duguala, Admiralty, and Useless bays, and at the heads of other smaller inlets along the shores. Its topography is low and swamplike, representing marshes at the mouths of sloughs emptying into these inlets or the inland bogs at the head of these sloughs where the drainage is not established.

The type is uniformly in need of artificial drainage, and much of it can be rendered a valuable soil if properly drained. While open ditches are of great benefit and hold their shape well on these peaty lands, the best results can only be secured by a system of tile underdrainage.

This soil has been formed by the accumulation of vegetable remains on the inland bogs and the shore-line marshes, and is almost entirely of this organic origin. These shore-line marshes are generally separated from the waters of Puget Sound by a narrow barrier beach or spit of sand and gravel, and within the brackish marshes so formed has occurred the accumulation of rank vegetable growths. These marshes lie, in elevation, from about the upper level of tide action to some 10 feet above, and are instances of more recent swampy conditions than were operative when the Clyde loam was deposited. The small inland bogs occupy undrained depressions at a somewhat higher elevation.

The organic matter in this type is by no means so thoroughly decomposed as in the Clyde loam, owing to lack of drainage and of exposure to the air. The soil is consequently more apt to be acid and in greater need of a neutralizer, such as lime or potash.

The Peat is at present used, if at all, merely for pasture and a little hay; but the soil, when properly drained, is especially adapted to celery, onions, and cranberries, and should be devoted to these crops. There appears to be the chance here to turn these lands to a much larger profit by growing these special crops, with the right attention to the question of drainage.

GALVESTON COARSE SAND.

This type consists of 36 inches or more of medium to coarse sand, with a mixture of fine to coarse gravel, shell fragments, etc. It occurs as a narrow fringe at the foot of the bluffs around the shore lines of the islands, but only the fairly prominent areas, consisting of sand spits and of beach lines along the concave shores of bays and inlets, have been indicated on the map.

The Galveston coarse sand has been formed by the action of waves along the more open beaches. It has no agricultural value and at present no apparent possibility.

The following table gives the results of a mechanical analysis of a single sample of the Galveston coarse sand:

Mechanical analysis of Galveston coarse sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
13171	Soil	2.6	52.9	41.1	2.7	0.0	Trace.	0.4

ROCK OUTCROP.

In the extreme northern end of the survey occurs a small area which has been designated on the map as Rock outcrop. The outcrops of many stones and small bowlders and the generally rough topography render this area of little or no value for agricultural purposes.

AGRICULTURAL METHODS.

The agricultural methods employed in different parts of the area are quite well adapted to the respective soils, and the high cost of labor has encouraged the general use of improved farm machinery.

Potatoes are the chief crop of Island County, and, while the plants are entirely free from potato bugs, there is a tendency to scab. This tendency is doubtless favored by the presence of some salt in the low-lying and marshy areas, and in some parts of the uplands by a notice-

able occurrence of lime in seams and concretions. Burned lands are also very liable to produce scab, on account of the excess potash and lime left in the ashes. The treatment of the tubers with formalin is beginning to be practiced, and is to be recommended. The crop is also somewhat subject to potato blight.

Wheat and oats are planted on the heavier marsh and prairie lands about April 1. These lands are already so rich in humus that no manure or fertilizer dare be used for these crops, on account of the danger from lodging. For this reason, also, it is deemed best not to plant very early in the season. The seed is all drilled.

Timothy and clover are grown for hay, generally in a rotation with oats. A more extended use of Italian rye grass is being recommended, especially for moist lands. This grass affords good winter pasture and allows three cuttings, with a consequent larger yield of hay. Alsike clover is likewise recommended for low, moist soils, where red clover might winter-rot.

The climate is not suited to corn, and sweet corn is of poor quality, there not being sufficient hot weather properly to mature the ear. The growing of field corn, to be cut in the glaze for the silo, is, however, meeting with some success among dairymen.

On the lighter upland soils the small cleared tracts here and there are generally devoted to early potatoes, with some strawberries and raspberries, while the lumbered tracts are utilized for pasture. The small-fruit industry would be quite in place on some of these soils, if there were direct rail transportation to markets. The lands are doubtless too costly to clear for planting to orchards of the larger fruits unless the project is backed by liberal capital. Even after these lands are cleared the cultivation of them must contend with the numerous mounds of upturned earth produced by windfalls, which in many places add materially to the roughness of the upland soils. Only a very intensive system of farming can be profitably practiced under such conditions.

There is no well-recognized system of rotation in vogue in the area. On some of the rich prairie soils it is held to be best to grow the same crop continuously, or merely alternating with potatoes, and rather keep the fertility down than attempt to increase it, to lessen the danger of lodging wheat and oats. Perhaps a rotation of oats, potatoes, and hay is practiced more than any other, and wheat is held to do best after potatoes. On the upland soils clover or spring vetch should be introduced regularly in the cropping, and plowed under to give more body to these thin soils.

AGRICULTURAL CONDITIONS.

The farmers of the county are at present in a prosperous condition, most of them being located on the rich prairie lands to which farming is as yet largely confined in this area. There are practically no mortgages on farming lands, and the majority of the farmers live well and enjoy some luxuries. The general financial condition of the farming class has decidedly improved in the last ten years, with the rapid growth of the cities on the Sound and the demand for farm produce created by the Alaskan trade. The dwellings are on the whole commodious, with large, well-appointed barns, and the farms wire-fenced.

Practically all the farmers in the county own the farms they operate, but a small acreage is rented to Chinamen for growing potatoes, and some farmers rent cleared lands to operate in addition to what they own. When lands are rented, a cash rental of $8 to $14 an acre is asked, the average being about $10. In general only high-grade lands are rented, and the owner secures in addition the contract to furnish teams to work the crop and do the hauling. Very little land is farmed on shares, the owner usually getting one-third of the produce under such arrangements.

The average size of the farms in the county, according to the Twelfth Census, is 121 acres. Many of the prairie farms are larger, but none exceeds 320 acres. The farms on the uplands are much smaller, and as a rule only from 10 to 20 acres have been cleared on these upland soils, the balance of the farm land being still in timber. The prairie lands are altogether under cultivation.

Labor is usually scarce during harvest time, but plentiful at other seasons of the year. This labor consists almost entirely of white laborers, although a few Indians are sometimes used about the farm. The Chinaman generally farms in the capacity of a renter for cash. When hired by the day during the harvest season, the wages are from $1.50 to $2 a day; when hired by the month, from $28 to $35 is paid, with board in addition.

The principal agricultural products are, first, potatoes, then wheat, oats, hay, and dairy produce. The quantity of fruit, berries, and poultry produced is small, but the acreage devoted to these products is on the increase, since most of the uncleared lands can be used for these purposes, and the market is good.

The lumbering and fishing industries have already been mentioned as important interests of the county. A few sheep and beef cattle are raised, but the possibilities of the industries are not yet even entered upon. Fairly good grades of Guernsey and Jersey cows are kept by the dairymen.

There is a rather specific recognition of the adaptation of crops to the soils in the area, as is to be more or less expected where soils of such opposing texture are encountered. For example, the Puget clay is devoted almost exclusively to oats, or to oats with timothy and clover, and it would be difficult to suggest a more remunerative crop for this type of soil. The Clyde loam and Clyde sandy loam are used for wheat, potatoes, and timothy hay, and here again the adaptation could hardly be improved upon. The upland soils, again, where cleared and cultivated, are devoted mostly to garden and berry crops, and the lumbered portions more to pasture, and this is in a line both with business expediency and with the natural adaptation of these soil types. There thus arises a very fair specialization in farm products, for the reason that there are found certain sharply defined open areas of tide land and prairie land that are eminently adapted to oats, and to wheat and hay, and it is hopeless to undertake the formidable and costly task of clearing the lighter and stonier upland soils to compete with these in such staple products.

There is no railroad in Island County, and transportation is by boat and team. No part of the county is more than a few miles from some local wharf, and the small steamboats afford cheap and ready transportation for the farm produce. The county roads around Coupeville and in the central part of Whidbey Island are surfaced with gravel and are exceptionally good, and in general the county roads, even where unimproved, are very fair when the stones are removed. There is, however, need for extension of the road system in the lower and upper parts of Whidbey Island and on Camano Island.

The principal markets for the products of the county are Seattle and Everett. The market at Seattle affords an unlimited demand, with good prices. The lumber and mining companies obtain their supplies at Seattle, and this, coupled with the Alaskan demand and the supplies purchased by the United States Government at that point, maintains a fine market there. The creamery at Oakharbor offers a ready disposal for such dairy products as are not shipped to Seattle and Everett.

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