THE SALT MARSHES OF THE COOS BAY ESTUARY

by

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AND

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"There is ooze and slime in the very clime;
and filth and muck are there."

The words of an anonymous poet of
the late 1800s in reference to
Beaver Slouth on the Coquille River.

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Cover photo. Coalbank Slough and the city of Coos Bay

INTRODUCTION

A salt marsh can be defined as the vascular plant community that is found between mean lower high water and the tree or upland vegetation line. In the case of low marshes, inundation can occur with each high tide. With the higher marsh types, the surface of the marsh may be covered by water only a few times during the growing season.

The salt marshes of the Pacific Northwest, occurring as they do only on estuaries, are scarce compared to those on the East Coast, and very little research has been done on their relationship to the workings of the estuary. In addition, the flora of our marshes is different from those in the marshes that have been studied, and so those findings may not be strictly applicable here. Because of the shortage of good flat land and the ease with which marshes are diked and filled, 90% of the salt marshes on Coos Bay have already been utilized for industrial, residential or agricultural use. Before the rest are allowed to go the same way, something should be known about the salt marshes' interactions with the entire estuarine system. Coos Bay is a good place for such a study because of its large size (12,380 acres) and the diversity of habitats found here.

Our project was to be a start in this direction. By mapping and classifying the existing marshes we hoped to establish a base for future studies, and by calculating a preliminary productivity estimate, to establish a tentative idea of the value of the marshes to the system. Ownership and assessed valuation of lands including salt marsh acreage were investigated because of the possibility of land purchases for marsh preservation or restoration.

We would like to thank the Port Commission of Coos Bay and the Oregon Institute of Marine Biology for their generous assistance with this project.

VALUES AND FUNCTIONS OF THE SALT MARSH

Salt marshes are foul smelling, mucky areas seemingly devoid of animal life, or at best insignificant appearing grassy meadows bordering the estuary. What makes these areas significant enough to discuss them more than cursorily? What warrants the funding of a study such as this, on such a small part of the total Coos Bay estuary? The answer lies in the fact that salt marshes' values greatly exceed their appearances. Being important in the productivity of Coos Bay as a whole, in erosion and flood control, serving as a pollution buffer and moderating water temperatures important to the survival of varied juvenile marine species, the salt marsh takes on an air of importance not easily grasped gazing upon it casually.

The Coos Bay estuary functions as one total living organism. Channel waters, mudflats, salt marshes, and incoming freshwater may all be thought of as organs vital to the functioning of the total estuarine system. At the base of this ecosystem, as in all ecosystems, is the radiant energy of the sun. Absorbing this energy and transforming it into plant material, a form of energy much more readily used by a wider variety of consumers, is the photosynthetic unit of green plants, phytoplankton, and algae.

One of the important values of the salt marsh is its tremendous productivity. This high productivity of salt marsh vegetation in comparison with cultivated crops and natural plant communities is due to a variety of factors. Primary among these factors is a constant flow of nutrients from external sources. As freshwater flows into the marsh, topsoil silt from upstream provides valuable nutrients which are trapped by the marsh plants, and utilized by these plants as soil, rich for growth. (Ranwell 1964) Also important in the nutrient trap is the fine composition of the substrate, usually clay material. These materials have a greati krptive capacity which enables them to trap nutrients. (W. E. Odum 1970). Finally, estuarine water circulation also adds to the nutrient trap effect. The ebb and flow of the water, caused by tidal action and streamflow, causes nutrients to be trapped in the estuary, being deposited on the salt marsh during higher tides. This stratified salt wedge estuary is discussed in part in Pritchard (1967). In addition to nutrients from terrestrial systems, there is a constant mixing process at higher tides between the salt marsh and the rest of the estuary. The tide moves nutrients from external sources into the salt marsh. (Aurand 1968),

In addition to the constant flow of nutrients into the salt marsh, several other factors are important to the high productivity of the salt marsh. Salt marshes have a longer growing season than cultivated crops. (Keefe 1972). Salt marsh productivity is further enhanced by the vertical orientation (i.e. Carex, Distichlis) of most salt marsh plant leaves. This maximizes the leaves' surface to sunlight ratio over the entire day and reduces shading, (Jarvis 1964), as well as reduces intense heating of the leaf. (Palmer 1941). Great amounts of soil water are also very important in the high productivity of the salt marsh. This water is used both directly by plants and as a reservoir for nutrients in a dissolved state. (Keefe 1972). Another factor promoting high marsh production is the high concentration of organic matter leading to the formation of colloids (large collections of suspended organic material) which absorb exchangeable ions necessary for plant growth. (Albrecht 1941)

Another important factor increasing the marsh's productivity is the presence of great amounts of algae and blue green algae. These algae are important producers in themselves, accounting for at least 10-20 percent of the total weight in estuarine filter feeders. (W. E. Odum 1969). Detritus consumers even though not depending greatly on this algae seem unable to grow and reproduce on a diet solely of detritus. (Odum 1970).

These several advantages available to plants growing in the salt marsh make it one of the most productive areas on earth; more productive than the forest on one side or the open ocean on the other, and more productive than areas man is currently using for agricultural purposes.

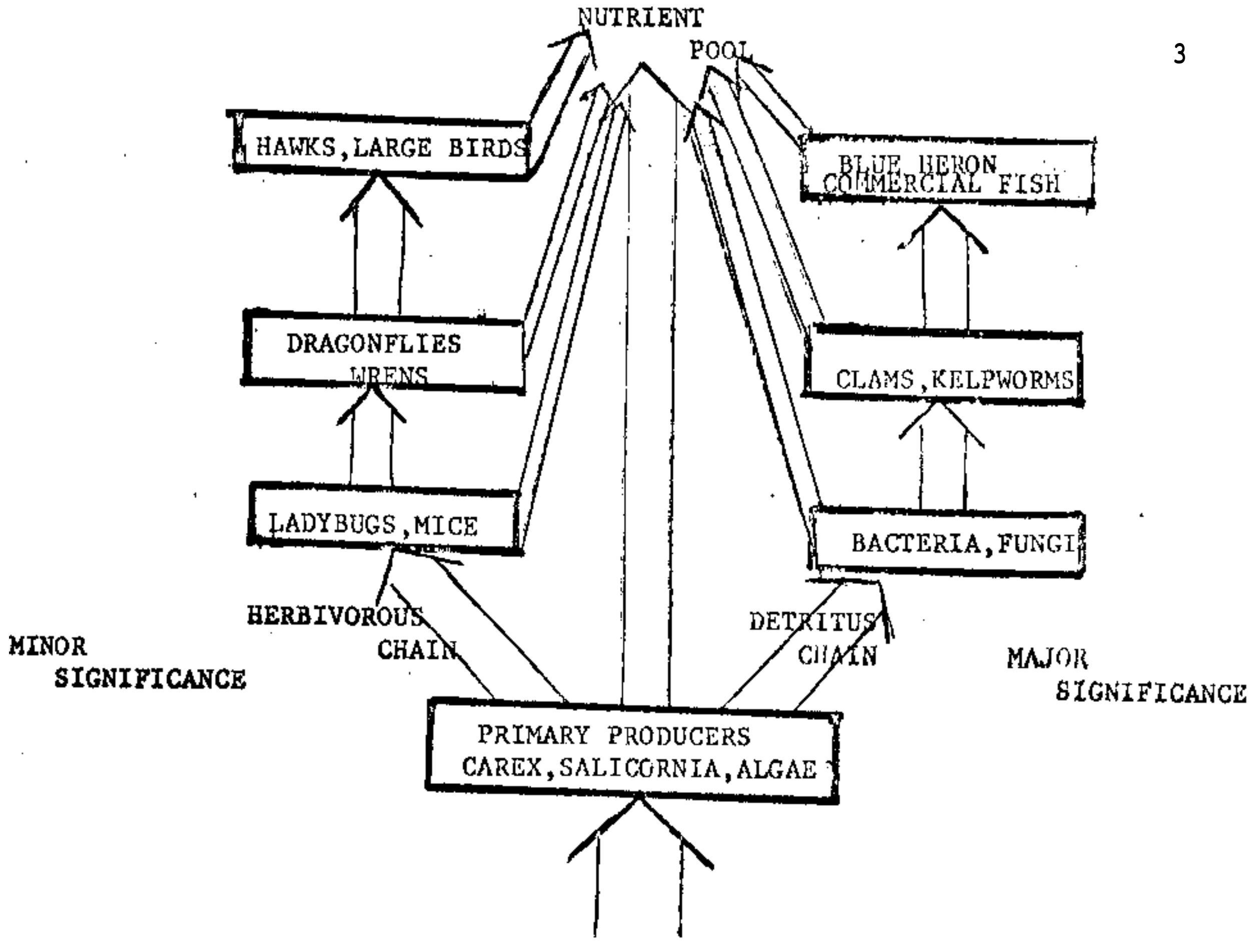
ANNUAL NET PRIMARY PRODUCTION ESTIMATES
OF SELECTED ECOSYSTEMS*

PLANT COMMUNITY	NET PRIMARY PRODUCTIVITY	
	G/ m2 / yr	G/ m2/ day **
wheat (areas of highest yield)	1250	3.43
corn (world average)	412	1.13
hay (areas of highest yield)	940	2.58
forest (pine during years of most rapid growth)	3180	6.0
forest (deciduous, same as pine)	1560	3.0
SPARTINA SALT MARSH (Georgia)	3300	9.0
infertile open ocean	182	.5
shallow inshore waters (Long Island)	1168	3.2

** G/ m^2/ is equivalent to .00256 lbs/ (yd)2

The importance of the immense productivity of salt marshes is in their use in the estuarine food web they are associated with. In general, simple food webs may be theorized for any ecosystem. The energy of the sun is transferred,to plant material which is eaten by herbivores (plant eating animals, i.e., deer, rabbits, insects). These herbivores are in turn eaten by first level carnivores (meat eating animals) who are eaten by higher level carnivores. These carnivores, in addition to animals and plants that have died throughout the chain, are decomposed by bacteria and fungi. The nutrients provided by decomposition are utilized by plants to complete the web. A cyclic flow of nutrients is established, with energy from the sun powering the system. This kind of food web is what is classically taught in biology classes and is in large part of a good representation of most terrestrial and marine ecosystems.

*From (Odum 1971)



DIAGRAMMATIC REPRESENTATION OF FOOD WEBS IN COOS BAY ESTUARY

The salt marsh food web is an exception to this general rule. Salt marsh plants are eaten by herbivores, including fly larvae, deer, ladybugs, and mice, and the food web continues through higher level carnivores, but this food web is of minor significance **in** the salt marsh when compared to the detritus food web. In this food web, a certain part of the system produces excess material which is not eaten by herbivores. By mechanical action and autolysis this dead material that hasn't been utilized by herbivores is broken down by bacteria and fungi. These bacteria and fungi are utilized by filter and bottom feeders who are preyed upon by carnivores. Death and 'decomposition occur, completing the cycle. This is the important food web within the salt marsh. The marsh plants are not being fed upon by herbivores directly, but instead are being shipped into the **estuary** as one of the estuary's primary sources of energy.

Initially it seems as if this process would entail a disastrous energy loss. Instead of feeding on the plant material when it is alive and healthy, the material is utilized only after it has lost a great deal of its cellular constituents. This is not the case. Odum and dela Cruz (1963), have shown in a Georgia marsh that the bacteria clinging to the detritus are removing dissolved nitrogen compounds from the water, increasing the protein content of the detritus. Other investigators (Fenchal 1970) and(Boyd 1970) come to similar conclusions. Fenchal (1969) and Newell (1965) have shown that the harder to digest cellulose of the salt marsh detritus **is** recycled with bacteria in the act of decomposing it being utilized by deposit feeders. In this way salt marsh detritus may be used not only once on its way to decomposition, but several times.

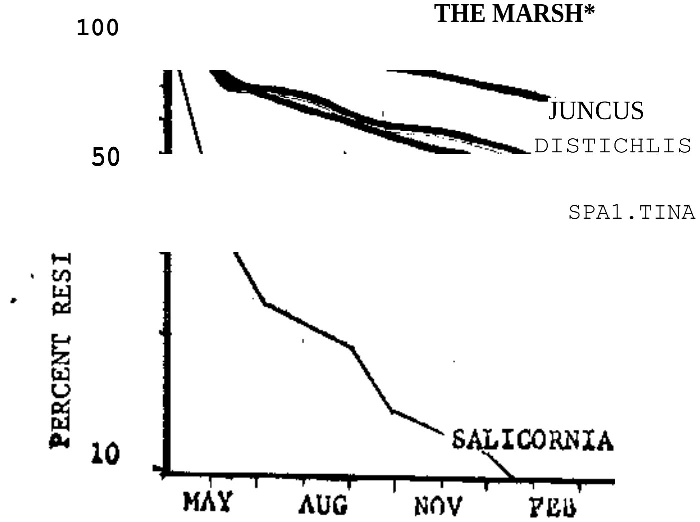
Odum and de la Cruz (1963) state properly the importance of organic detritus to the estuarine system.

> Organic detritus is the chief link between primary and secondary productivity, because only a small portion of the marsh grass is grazed while it is alive, the main energy flow between... levels is by way of the detritus food chain.

Filter feeders; bivalves, oysters, tube worms, kelp worms, and a host of other organisms form the third step in the detritus food web. Their *wide* distribution in Coos Bay and in estuaries in general seems to be due to the abundant detritus present. E. P. Odum (1969) shows that between 6 and 24 percent of filter feeders ash free dry weight is due to detritus alone, disregarding clinging and planktonic forms associated with it. These filter and bottom feeders are consumed at the next energy level by carnivores such as Great Blue Herons, fish such as smelt, perch, shad, flounder, and sole which are preyed upon by top carnivores; greenling, sturgeon, bass, steelhead, and salmon (An Interdisciplinary Study of the Coos Bay Estuary 1971).

Not only the entry of this detritus into the estuary is important, so is its time of entry. As salt marsh plants die, their period of decomposition varies. Some such as Salicornia decompose rapidly while others such as Juncus and Distichlis decompose rather slowly. (Odum and de la Crua 1964) In decomposing over this long period of time, the estuary is provided with a constant source of food material, rather than the boom or bust common to phytoplankton growth. Instead of a dramatic Spring and Fall bloom, as in planktonic communities, the salt marsh detritus provides a fairly steady input into the estuary, allowing for a much more extensive web of consumers to exist in the system. Although more dead marsh grass is present in the winter months, the decomposition rate is more rapid in the summer, offsetting this factor and providing a constant supply of food materials and organic islands for the colonization of bacteria in the estuary and providing food for estuarine organisms. (Odum and Smalley 1959)

DECOMPOSITION IN THE MARSH*



***taken from Odum and de la Cruz(1963)**

The salt marsh provides food and shelter directly to a wide range of birds and mammals in addition to indirectly being a source of productivity to the estuary. In a waterfowl survey taken in five counties: Clatsop, Tillamook, Coos, Lincoln, and Curry, by the Fish and Wildlife Service, an average of 42,000 birds both migratory and resident were found to use these countries' coastal wetlands yearly. Of these five counties, Coos county provided food and cover for 21,000 birds, or nearly half the total. A great portion of this food and shelter was due to the presence of salt marsh in the Coos Bay estuary.

Mammals associated with the salt marsh are also numerous. Beaver, muskrat, otter, raccoon, and deer, as well as field mice and other small mammals make extensive use of the marsh throughout the year. Shellfish including clams, cockles, crab, and commercial oysters also make use of the salt marsh resource.

Subtle as it is, the salt marsh and bacteria and clinging forms associated with its detritus comprise a base of production for the Coos Bay estuary, providing food and habitat for commercial fish, bivalves, crab, birds and mammals, and life on Coos Bay in general.

In addition to working as a magnificent production unit, the salt marsh has other important functions. Foremost of these is its ability to buffer extremes of a wide variety. When sewage and septic tank seepage into the estuary is at its height, the salt marsh absorbs the majority of the raw material from these sources and allows them to enter the estuary at a less drastic rate. While in the salt marsh, the sewage is bacterially decomposed and its nutrients utilized. In a recent study in Florida, a 1500 acre salt marsh was shown to remove all of the nitrogen and one quarter of the phosphorus from the domestic sewage of 62,000 people. (Jahn and Trefethen 1973). The presence of salt marsh area does not mean that sewage may be dumped into the area at an increasing rate. Each salt marsh has a certain carrying capacity for sewage that cannot be exceeded without consequences, however, salt marshes in Coos Bay are providing a necessary sewage buffer between residences and the Bay itself, making the water cleaner and more habitable by estuarine organisms.

The salt marsh also moderates the effects of erosion and siltation in the Coos Bay estuary, acting much in the same way beach grass stabilizes dunes areas, eroding areas near the side of the Bay may be stabilized by the presence of salt marsh. During the storm tides of winter, the salt marsh helps hold together the vulnerable shoreline, preventing erosion and heavy siltation. The damage of logging practices to the total Coos Bay estuary has been mentioned in The Environmental and Economic Impact of Alternative Method of Log Transportation...in the Coos Bay Estuary. (1974). In this report, primary damages were determined to be bark deposits and leachates from floating logs, as well as increased sedimentation due to logging practices that resulted in decreased biological productivity. Although data is not available, it seems probable that these effects could have been moderated effectively had salt marsh area been conserved in Isthmus Slough in the past as a buffer zone necessary for the well-being of the estuary. Salt marshes also moderate the effect of flooding during spring runoff and high winter tides by acting as a sponge between the estuary and the shoreline. Due to the diking of vast areas of salt marsh in the area a greater potential hazard exists for flooding; especially in areas constructed on filled salt marsh. (Jefferson 1973) A salt marsh's compact substrate also acts as a barrier between intruding brackish water and fresh groundwater below the marsh. (Jefferson 1973)

Salt marshes also help in moderating water temperatures within the estuary. Sunlight warms the shallows and salt marshes of the Bay, and provides warmer water important to the juveniles of several species of bivalves, crab, and fish and is also important in the spawning of some other species. These animals would not be able to reproduce were it not for the warmer e$tuarine waters. The marsh plays a role in this warming process by increasing the surface area of the warming sunlight that may come in contact with the waters of the Bay.

The salt marsh functions in a dual role as both a large production unit and a buffer to several types of environmental extremes which are common in Coos Bay. For these reasons its functional importance to the Bay should be clear.

HISTORY

Historically, salt marshes have been a much maligned resource. In contrast to man's use of other resources (i.e. timber, minerals, oil, pastureland), the salt marsh is not valued for what it contains or for its productive capabilities; rather, it is valued solely for its physical position in relation to existing industry and residents and its easy reclaimahility by either diking or filling. Land rich in timber or minerals is usually utilized for the resource itself, with the land being only secondary (at least initially). In the case of salt marshes, the easy availability of the land becomes the prime resource, with the land's value as a productive part of a larger biological system being neglected completely. (The obvious exception---agriculture) This historical picture has been expecially true in the Coos Bay area. With its steep wooded slopes leading down almost to the Bay itself, and with a rapidly expanding industrial and agricultural base, Coos Bay utilized a great deal of salt marsh area for early expansion which has continued to the present time, simply because the land was easily reclaimable and close to existing industry and residents, as well as being flat. With more industry and agriculture utilizing reclaimed marsh, more industry came to the area, leaving us with only 10% of the salt marsh present 100 years ago. (see accompanying table) The 90% that is gone has been utilized for varied purposes; agriculture, industry, residences, and recreation, to name a few. In order to gain a clear picture of our loss, we must go back to the original settlement of Coos Bay.

With a seemingly unlimited supply of forest, a good port, fertile land, and a great abundance of wildlife, it is surprising that the impetus for rapid settlement of Coos Bay was its coal resource. In the 1880s and 90s, 40,000 to 75,000 tons of coal a year were mined. (Beckham 1973) Along with this massive industry came the first destruction of salt marsh area. The soft nature of the surrounding rocks and the quality of the coal led the mines away from the east side of the Bay towards the higher quality coal resources near Coalbank Slough, which is the area that is now known as Coalbank Slough, and several hundred acres of land that now comprise downtown Coos Bay. With the mining in the Coalbank Slough area, the marshes of the slough were soon endangered. Either transformed directly by filling or indirectly by the construction of stilt dwellings which slowed down water circulation, accumulated silt and woodchip debris eventually filled the land, and the salt marshes of Coalbank Slough disappeared. In their place came the heart of what is now downtown Coos Bay. (see accompanying map) Industry and business moved in, utilizing the once biologically productive marsh area. What a century ago was 600 acres of marsh is today 60 acres, and its future is uncertain.

Though coal determined the initial settlements of the Bay, soon lumber came to light as the principal resource of the region. With great exportation of both coal and lumber to California, shipbuilding became an important industry. Through utilization of wood in the area, ships could be constructed of shallow draft in order to negotiate the shallows of the Upper Bay. With logging came the transport of the logs to the mills on the deeper channels of the Bay. Roads were scarce and the fingers of Coos Bay, reaching out in nearly every direction, lent themselves naturally as the transportation arteries of the Bay. Especially utilized in this respect were Catching, Isthmus, and South Sloughs, as well as Willanch and Kentuck Inlets. In the words of Orvil Dodge, a historian of the 1890s:

"Catching Slough, which empties into the bay nearly opposite Marshfield is a stream of considerable importance, as it connects Sumner with the bay and millions of feet of lumber have floated Down the placid stream. The Coos Bay and Roseburg wagon road passing through Sumner has made the slough a highway that has enabled the traveler to reach the bay sooner and easier than to continue staging, especially in the winter time when roads are at their worst."

The direct effects of logging on salt marsh acreage in Coos Bay have been significant in the past. Poorly designed clearcuts, poor road building techniques, large scale slash burning and the burning of slash and use of splash dams in aiding the transportation of logs, all encouraged accelerated erosion conditions resulting in sedimentation within the Bay. (Natural Resources, Ecological Aspects Uses and Guidelines for the Management of Coos Bay, Oregon 1971). In addition to the act of harvesting the logs, log storage and transportation further damaged the salt marsh area. In a recent report written for the Port of Coos Bay, The Environmental and Economic Impact of Alternate Methods of Log Transportation, Storage, and Handling in the Coos Bay Estuary (1974), the effects of log storage and handling on salt marshlands are set out:

MARSHLANDS AND WETLANDS

accumulation of woody debris and bark
increases in the concentration of toxic substances
current and waterflow changes
filling
physical abuse

It goes further to state that these effects on marshes have further effect on resident and migratory birds, resident and anadromous fish, smaller animals critical in food webs and mammals dependent on aquatic systems.

These deleterious effects to the estuarine life on Coos Bay and the salt marshes of the bay have **beee** and **tip** plague the logging industry. Measurements of the total loss to marshland productivity due to logging and related industry are hard to make, due to the lack of suitable measures of salt marsh productivity in altered states (sedimentation, bark debris, etc.).

Indirectly, the growing logging industry forced deepening and dredging of the Bay and its tributaries in order to facilitate larger, deeper, draft vessels. With little concern for esthetics or biological needs, the early dredge spoils were placed directly upon salt marsh area both for expediency and also in order to reclaim tideland for industry and residents. According to An Inventory of Filled Lands in the Coos Bay Area, prepared by the State Land Board, the original use of almost all areas filled in the Coos Bay estuary was disposal sites. Salt marsh acreage was lost as the Pony Slough area was filled in 1939 for the present North Bend Airport, in 1946 for the reclamation of the southern end of Pony Slough for commercial use, and in reclamation of the eastern side of Pony Slough. Coalbank Slough was used as a spoils area starting in 1888 and continuing until 1926. In this way spoils dumping has accounted for the loss of 530 acres of salt marsh in Coalbank Slough and another 200 acres of salt marsh in Pony Slough. An additional several hundred acres was lost much in the same way in smaller salt marsh areas such as those at the East side marsh.

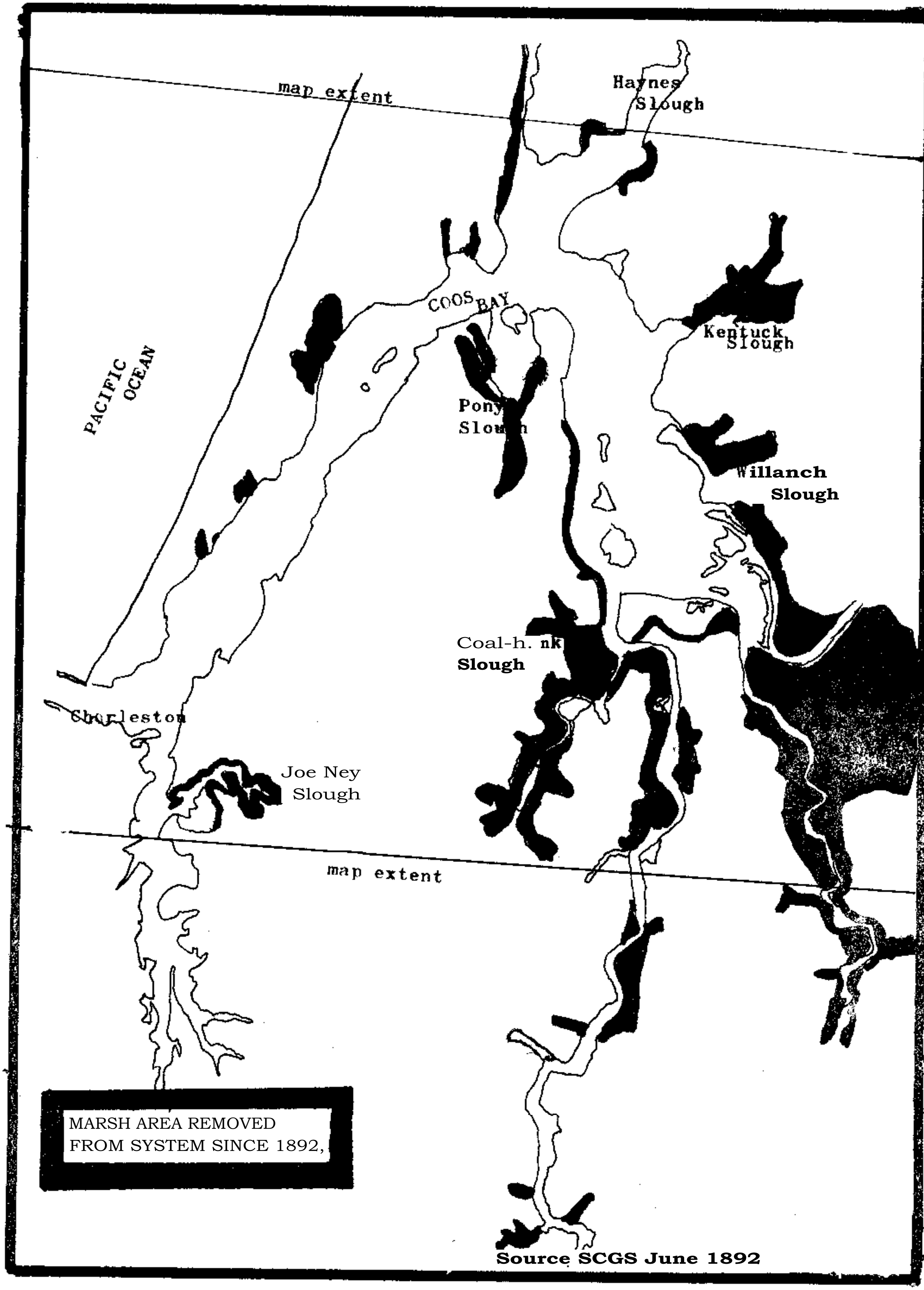
More directly affecting the salt marshes of the lower end of the Bay than the filling for industrial use or logging practices was diking for agricultural use. With the amount of nutrients collected in the salt marsh from tidal inundation and upland sources, marshlands when diked, became phenomenal agricultural lands. With dikes and tidegates, vast areas of agricultural land were created even prior to 1890. In the words of Orvil Dodge, Pioneer History of Coos and Curry County, (1898):

> "On Coos Bay there are many tributaries commonly called sloughs, though they are streams coming in from the hills which are met by the tides as they find the sea's level, and the marshes are formed that in many places have been dyked and placed under cultivation yielding prolific crops of vegetation and hay as well as small grain in favored localities."

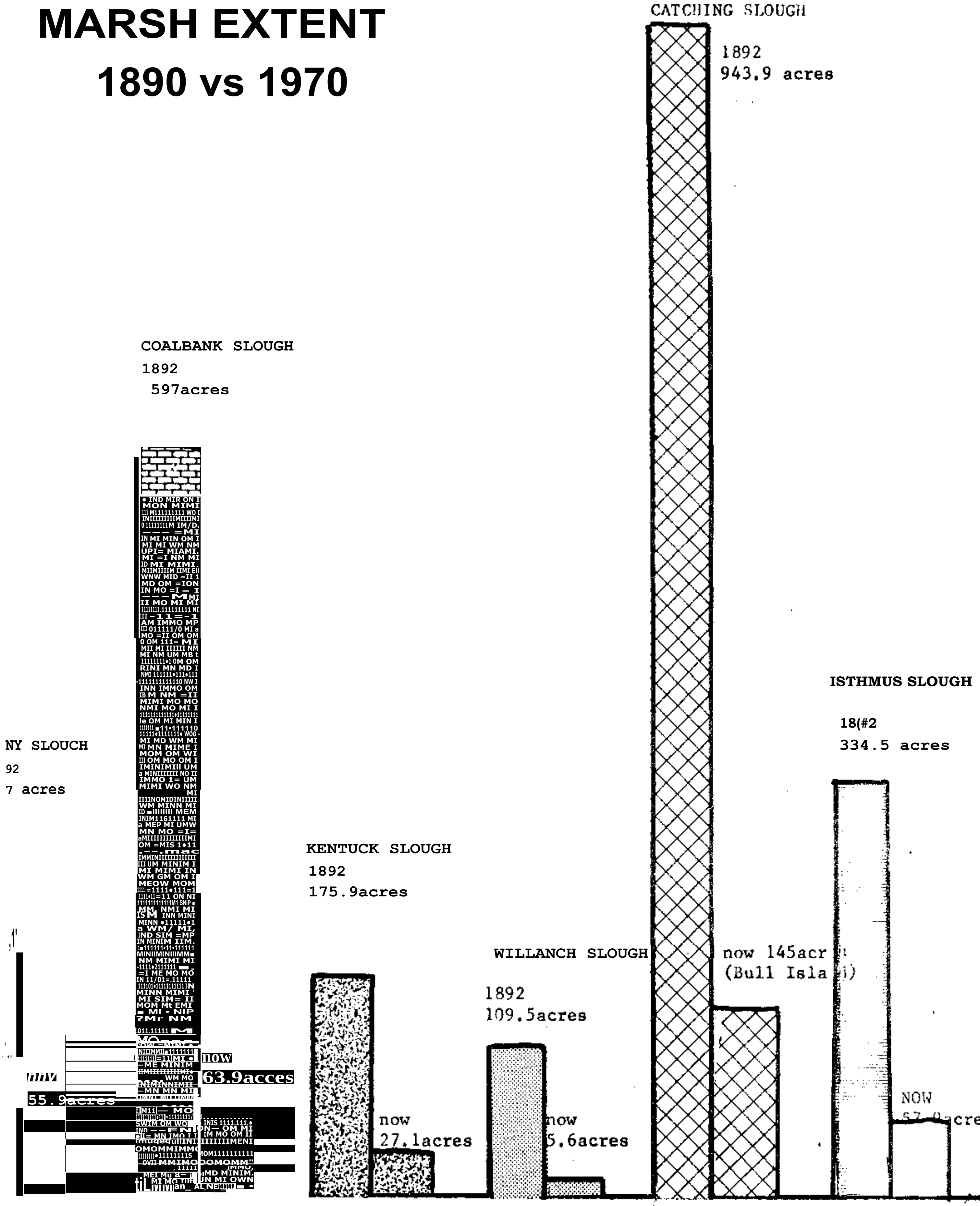
Bearing the greatest burden of agricultural pressures is the southern end of Catching Slough. Once 1600 acres, Catching Slough proper is now less than 50 acres, located on the very sides of the channel. Due to agricultural needs of a growing region, once productive salt marsh is now productive farmland. South Slough's dairy and farm lands have recently fallen into disrepair. This, 14P4APAQe_MAg4_as-pasture, is_ratlArAin g to_ its original state as sslt_marsh.

Miscellaneous uses have also taken their toll of the salt marsh areas. The construction of the railroad through North Slough, although generally near the sand dunes on the western edge of the slough, has cut circulation off to some salt marsh area. The 175 acres of marsh, once Kentuck Slough, are now diked and filled and in use as a golf course. Until recently, chip and refuse filling have removed salt marsh area from the estuary at Shinglehouse Slough. Many of the salt marshes in Coos Bay are strewn with old car bodies and similar scrap metal by unconcerned residents.

Logging, coal mining, agriculture, and miscellaneous uses have accounted for the diking and filling of thousands of acres of salt marsh in the Coos Bay estuary. In nearly every arm of the Bay, 90% of the salt marshes once nresent, have fallen to one of these uses. For the 10% remaining as salt marsh near the Bay's edges, the future is uncertain. Industrial and residential pressure, as well as the demand of lumber companies for log storage lands, has increased the need for protection of remaining salt marsh areas.


map extent
Haynes Slough
PACIFIC OCEAN
COOS BAY
Kentuck Slough
Pony Slough
Willanch Slough
Coal-h. nk Slough
Charleston
Joe Ney Slough
map extent
MARSH AREA REMOVED FROM SYSTEM SINCE 1892,
Source SCGS June 1892

MARSH EXTENT
1890 vs 1970



A COMPARISON OF SALT MARSH EXTENT-1892 and 1972

SALT MARSH PLANTS OF COOS BAY

The seed plants (nhanerogams) that are found in intertidal areas such as salt marshes present a picture of adaptation to environment that is quite different from that of intertidal animals. While most intertidal animals are so adapted as to require the special conditions of salinity and submergence found here, the plants, for the most part, have merely "learned" to tolerate them. By being able to grow in a harsh environment, the salt marsh plants have a competitive edge over other plants; they do not "need" these harsh conditions, however (Eltringham, 1971). Many of these plants are present in the salt marsh not because they grow better than in other environments, but because they can compete nowhere else (Chapman, 1960).

In order to survive in saline conditions, the halophytes (salt-loving plants) have evolved several types of structural and physiological compensating mechanisms. One of the most important of these is the development of succulence (the presence of thick water-filled tissue) which is related to the maintenance of high internal osmotic pressure to cope with the large concentrations of electrolytes (especially chloride ion) in the soil water. Other developments include salt-secreting glands (in such plants as Glaux) to maintain correct salt balance, and a glabrous (smooth) surface (as in Salicornia) (Chapman, 1960).

Since the presence of specific plants as well as communities indicates something about the marsh type in an area, a list of the salt marsh plants commonly found in the Coos Bay estuary follows.

1) Sedge (Carex lyngbyei Hornem.) is probably the most important plant in the system due to its wide occurrence and the ease with which it is broken down to form detritus (Carol Jefferson, pers. comm.) By forming tiny pieces of organic matter that serve as substrates for bacterial growth and food for filter feeders such as crabs and shellfish, the sedge is cycled through the system over and over again. Sedge usually grows at medium height in the marsh, in dense stands. It can be recognized by the W-shaped cross-section of its grasslike leaves and the triangular cross-section of its base. It grows to a height of 4-5 feet, although it often blows or bends down lower. (Fig. I)

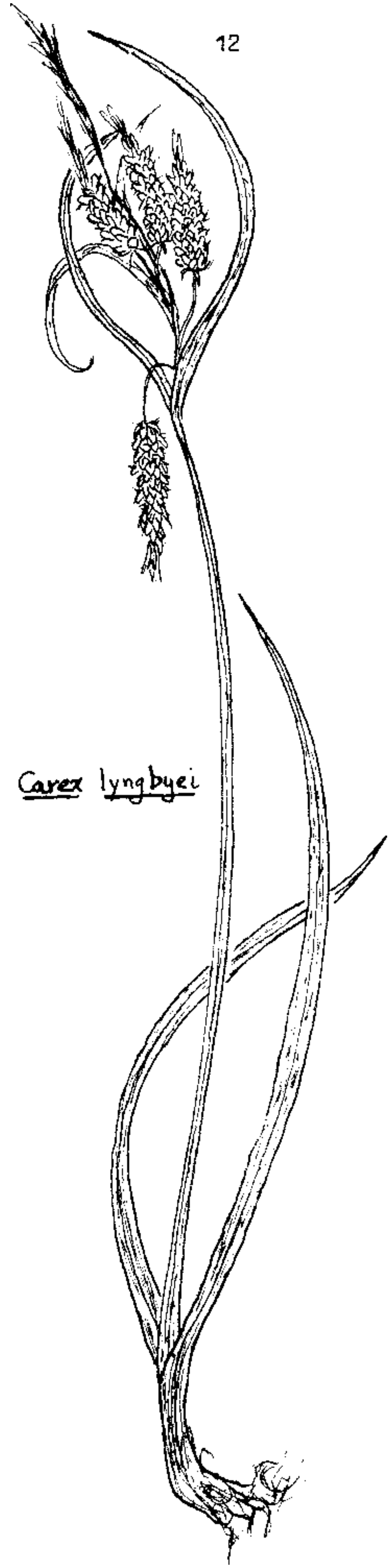


FIG. 1

2) Slough Sedge (Carex obnupta Bailey) has longer seed-bearing parts than C. lyngbyei and is much less common; it is sometimes found in the upper ends of sloughs where there is more fresh water.

3) Three-Square Rush (Scirpus americanus Pers.) A colonizer of sandy substrate (Jefferson, pers. comm.), three-square rush is often found along the water-edge in low sand marshes, although it also grows in mud. It is usually 1-2 feet high, and can be recognized by its triangular cross-section and succulent, fleshy stalk.

4) Salt Marsh Bulrush (Scirpus maritimus L.) is a pioneer plant on mud, and can be seen in the mud flats between the north end of Bull Island and the shore, where new marsh is appearing. It resembles S. americanus but its flowering parts are in a terminal-appearing head rather than a lateral-appearing spike or spikes.

5) American Great Bulrush (Scirpus validus Vahl.) is found where there is a relatively large amount of freshwater influence; North and Davis Sloughs contain large stands. Growing to a height of 6 feet or more, it has a round stem and a dark-green color that can be recognized even from aerial photographs.

6) Salt Rush (Juncus lescurii Boland) is a good example of a salt-tolerant plant that also competes successfully outside the salt marsh. Growing in dense stands in immature marshes and above low sand marshes, salt rush is also found forming tight clumps in diked marshes and upper pastures. It grows to 2-3 feet, and has a sharp point and a hard, dark green stem with lateral flowering parts. (Fig. 2)

7) Little Spike Rush (Eleocharis parvula R. & S. Link.) This small (to 2 inches) plant is found in low sand marsh, but is rather inconspicuous. It has the flowering parts in a terminal spike.

8) Pacific Silver Weed (Potentil.la pacifica How.) This plant is in the same family as the strawberry and grows in a low ground-cover form on the higher ground of many immature and mature marshes. It is also seen around the higher edges of low sandy marshes. The flowers are white and pale yellow. (Fig. 6)

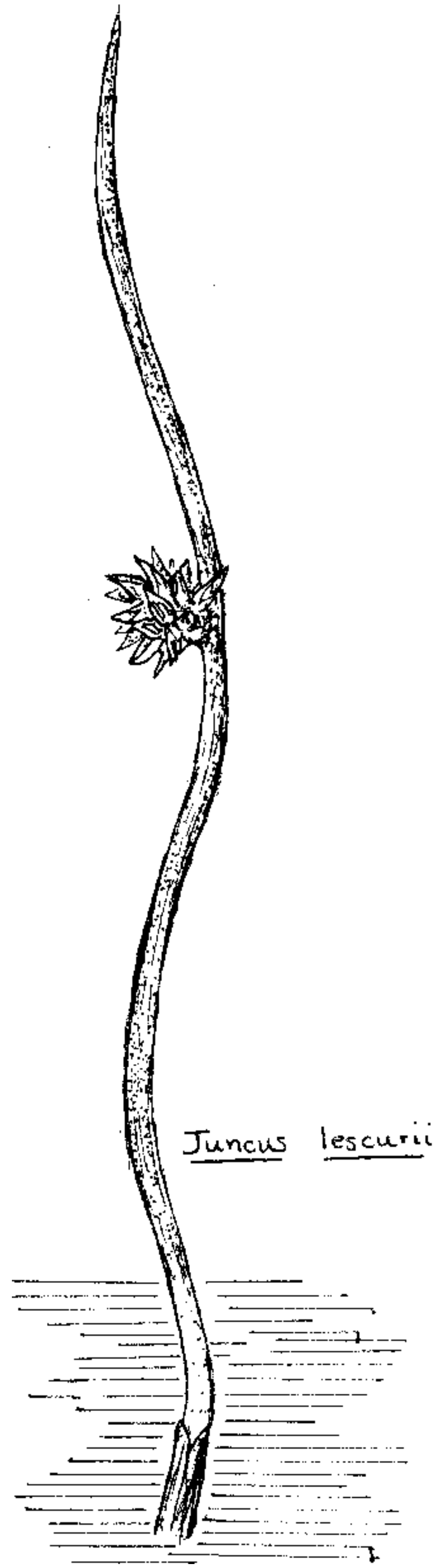


FIG. 2

9) Tufted Hair Grass (Deschampsia caespitosa L.) is often found associated with Carex or Distichlis. It grows to a height of 5-6 feet, and does not droop, so that it forms an upper story on many sedge marshes. The spreading branches which bear the florets and the golden-brown shining color gives the impression of much growth, although a closer look reveals that the plants are actually comparatively sparse. Deschampsia occurs In clumps in the upper parts of low sand marshes also. (Fig. 3)

10) Salt Grass (Distichlis snicata (L.) Greene) Very common in low sand marshes, Distichlis often forms a dense low mat (to about 8 inches) or is mixed with Salicornia or Jaumea. It has close, alternate branching and a terminal spikelet which flowers in late July. (ng. 8)

11) Creeping Bent Grass (Agrostis alba L.) usually grows along the ground, sending up thin, delicate leaves after some distance (3-5 feet). Not extremely common, it is seen in high marshes and above low sand marshes.

12) Meadow Barley (Hordeum brachyantherum L.) occurs infrequently with Carex or Deschampsia, or above low sand marshes. It resembles "foxtails"; the cylindrical spikelets have regular rows of stiff, hair-like projections. J. jubatum foxtail barley is also present in the estuary,

13) Sea Milkwort (Glaux maritima L.) is found in low sand marshes. It stands about 6 inches high, a straight succulent plant with opposite leaves and small white flowers in the leaf axils (between leaf and stem).

14) Pickleweed (Salicornia virginica L.) is one of the most widespread of all salt marsh plants; it is found on sandy and silty substrates, from the lowest elevations to immature high marshes. It is most abundant in low sand marsh, where it often is the major plant species present (as just south of the Charleston Bridge in South Slough). In sedge and immature high marshes, it is found in patches and along drainage channels; its roots require aeration and good drainage (Jefferson, pers. comm.). For this reason one can sometime find underground, hidden channels by looking for growth of Salicornia. The plant's color gives the impression of green glass (hence name "glasswort"); the stems are woody and decumbent while the leaves (which look similar to stems in shape) thrust upward. It is a tough, succulent plant that requires salt water for growth. (Fig. 7)

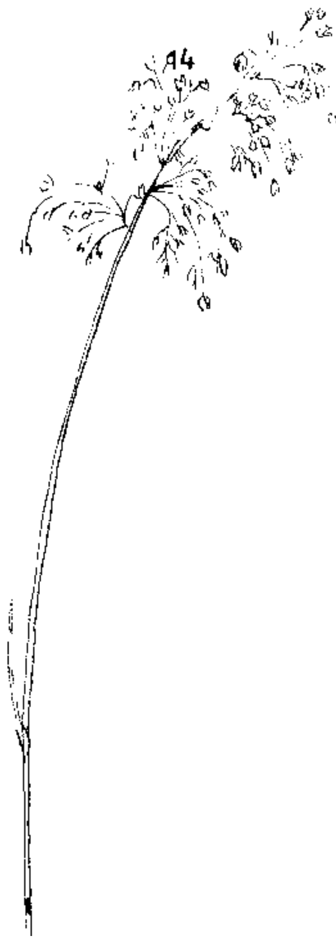


FIG. 3

15) Dodder (Cuscuta salina Engelm. var. major Yunck.) This is a very slender, tubelike, leafless plant that grows as a parasite on Salicornia. Its bright orange color makes it quite obvious as it twines around the other plants. It has small pale yellow flowers that bloom in late July.

16) Jaumea (Jaumea carnosa (Less.) Gray.) is another succulent commonly found in low sand marshes, often with Salicornia and Distichlis. It has a bright yellow flower which blooms in late July or August, has fleshy elongate leaves, and grows in stands which reach about 8 inches in height. (Fig. 8)

17) Salt Marsh Sand Spurry (Spergularia marina (L.) Griselb.) is found in low sand marshes, usually in drainage channels or low spots. It is a small (to 8 inches). fleshy, narrowly cylindrical plant with much branching.

18) Seaside Plantain (Plantago maritima esp. juncoides Lam.) occurs in many situations, but mainly in low sand marsh and immature high marsh. It is a small upright plant with basal leaves and flowering spikes borne on central stalks.

19) Seaside Arrowgrass (Triglochin maritima L.) is a major constituent of low sand marsh; it is also seen in silt, immature, and sedge marsh in some quantities. Arrowgrass grows from underground rhizomes that spread out to form circular colonies in previously barren flats; in higher marshes it is found in small clumps. In annearance it resembles plantain but is larger, up to 3 feet in height. The leaves are fleshy and triangular in cross-section and the central stalk is covered with small flowers for much of its length. (Fig. 4)

20) Paintbrush Orthocarpus (Orthocarpus castillejoides Bent) is found in low sand marshes growing with Distichlis or Jaumea; it is usually higher up the marsh than the Salicornia beds. It is a small (to 8 inches) plant with hairy toothed leaves and several purple and yellow flowers. It is believed to parasitize other plants' root systems, and has very little root of its own.

21) Salt Marsh Bird's Beak (Cordylanthus maritimus Nutt.) This plant, which resembles Orthocarpus in shape, is rare in Oregon; in fact, it was known to inhabit only a small area in the low sand marsh of North Slough (Jefferson, pers. comm.). We noted its presence in two locations in South Slough, which may indicate expansion of its range here. It is hairy, greenish to strongly purple in color, and has several flowers in a tight head. It does not branch as does Orthocarpus but has a single erect stem.

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FIG. 4

22) Saltbush (*Atriplex patula* L.) is a plant of high marshes. It is never found in dense stands but is scattered through immature high and high sedge, and above low sand marshes. It grows to a height of 2-3 feet and has a soft stem and thin, spade-shaped leaves.

23) Gum Plant (*Grindelia integrefolia* D. C.) is a woody-stemmed plant of high marshes, named for its gummy flowers, which are 2-3 inches across with bright yellow petals--in appearance like a sunflower. It grows to 2-3 feet.

24) Lileopsis (*Lilaeopsis occidentalis* C. & R.) is found in low silty marshes and muddy channels in other marsh types. It grows to about 6 inches in height and appears to be a jointed, flattened tube-stem of light-green color.

25) Marsh Clover (*Trifolium wormskjoldii* Lehm.) is found on the margins of immature high marshes or on high ground in the interiors. It has pointed leaves and large flowers typical of the clover genus.

26) Brass Buttons (*Cotula coronopifolia* L.) is originally from South Africa but has been introduced here by lumber-carrying ships (Jefferson, pers. comm.). It is able to survive in substrates that have been impregnated with various chemicals leached from logs during storage. For this reason it has colonized many areas around the Bay. In South Slough there are two drained ponds that are being colonized almost solely by *Cotula* at present. In appearance the plant is about 6 inches high, with lobed leaves and bright yellow button-like flowers.

27) Dock (*Rumex occidentalis* Wats.) is a high marsh plant that is also found in many terrestrial habitats. It is a stout plant that grows to about 3 feet in height, and has reddish wrinkled leaves. (Fig. 5) R. *maritimus* is also common in the salt marshes.

FIG. 5

MARSH TYPES OF COOS BAY

Marsh types in the Coos Bay estuary include the following: 1) Low sand; ?? Low silt; 3) Sedge: 4) Immature high; 5) Mature high; 6) Bulrush-sedge UinMerflarshes of various description. These marsh "types" have been devised by Carol Jefferson at Oregon State University for the estuaries along the entire Oregon coast, and there exist some difficulties in fitting specific areas in Coos Bay to a general scheme such as this. The following discussion of marsh types in this system is an attempt to correlate the formal marsh "type" (as set forth in *Coastal Wetlands* of *Oregon* published by the Oregon Coastal Conservation & Development Commission) with the appearance and plant community structure of specific marshes in Coos Bay.

1) LOW SAND MARSH

The height of the surface of the marsh is generally less than 1-2 feet from the surrounding flats, and there is no abrupt drop-off at the edges of the marsh. The substrate is fairly sandy, although areas within the marsh may be of silt or mud. Plants commonly found in low sandy marshes include (from lowest elevation near water's edge to upper edge) *Salicornia virginica, Triglochin maritima,* and *Distichlis spicata. Scirpus americanus* is sometimes found low on this type of marsh, as it is a colonizing species which grows on bare sand before most other plants. *Spergularia marina, Jaumea carnosa, Eleocharis parvula, Plantago maritima, Orthocarpus castillejoides* and *Claux maritima* are often found in this marsh type also. Blue-green algae mats are generally not found in low sand marshes.

Because low sand marshes are often formed along shorelines as fringing marshes, they usually grade into higher marsh types. Thus, on the landward side of low sandy marshes, *Carex lyngbyei* and *Deschampsia caespitosa* are often seen. These areas have, for the purposes of our study, been lumped with the others as low sandy marsh.

2) LOW SILT MARSH

The substrate in this type of marsh is soft TjaA or silt; in other respects the physical structure resembles that of the,low sand marsh. Generally there are few or no channels for tidal drainage, and much of the bare surface of the marsh is covered by mats of blue-green algae, which "fix" nitrogen from the atmosphere for use by other organisms in the mud substrate. The primary colonizing plants in silty or mud substrate are *Triglochin maritirh* and *Scirpus robustus.* These plants often colonize areas separately, however; they also are found in more mature marsh situations. *Triglochin* tends to grow in circular, slightly elevated "tufts" when in new, very low-lying positions, and may form dense stands in higher situations, growing with *Carex* or other plants.

Low silt marshes often have *Jaumea, Spergularia, Juncus lescurii* and _Cotula coronopifolia_ growing together or separately.

3) SEDGE MARSH

This marsh type is the one most similar in general appearance to the well-known tidal marshes of the southeastern coast of the United States, although the plants comprising the two types are not closely related. The tall, uniform growth of _Carex lynghyei_ that constitutes a sedge marsh is an impressive sight, and this marsh type is an extremely important and abundant one in the Coos Bay estuary system.

Sedge marshes are variable in height; low marshes are likely to have almost pure stands of Carex and diffuse tidal drainage, while higher marshes can have ditches or channels up to four feet high, and many other plants present. These include _Triglochin, Deschampsia caespitosa_ (whose tall, tufted brownish flowering parts give the impression of a significant upper-story growth), and _Hordeum nodosum._

4) IMMATURE HIGH MARSH

The distinguishing characteristic of the next two types of marsh--immature and mature high marsh--is the height above the adjoining flats, with its consequent sudden drop-off at the boundary. The two types of marsh are very similar and in fact are considered as parts of a continuum, so they are not easy to distinguish.

Immature high marsh is usually flat, and raised 2 to 3 feet above the adjacent mudflats. It is drained by deep channels with mud bottoms, and can have a variety of associated plant species. In Coos Bay, the immature marshes consist mainly of _Carex, Deschampsia, Hordeum, Juncus lescurii, Potentilla pacifica, Distichlis, Atriplex natula,_ and _Agrostis alba_, or combinations of these.

5) MATURE HIGH MARSH

The difference between immature and mature high marsh is most readily apnarent in the presence or absence of typicallyjiterrestrial plants in among the more salt-tolerant plants of the marsh. To the plant communities of the immature high marsh may he added such plants as _Rumex occidentalis, Grindelia stricta,_ and _Trifolium wormskjoldii, Vicia gigantea,_ and _Lathyrus japonicus_ as they begin to colonize the high marsh.

In addition, the mature high marsh is slightly higher than immature marsh, and may have deep, underground drainage channels as well as ditches.

However, in Coos Bay today there is little mature high marsh, as almost all of the marsh of this type has been diked off for use as nasture for dairy cattle.

6) BULRUSH-SEDGE MARSH

This type of marsh is nearly always found on the banks of a river or slough where there is considerable freshwater)influence. (An exception is the area at the north edge of Kentuck Inlet.) A relatively narrow fringe (up to 50 yards maximum) of mixed Scirpus validus and Carex lyngbyei is easy to recognize by the extreme height and olive coloring of the bulrush. Generally, the bulrush predominates as more freshwater influence occurs, upstream; near the open bay, sedge is more widespread. These marshes are usually relatively low and gently sloping, with no abrupt drop-off. The substrate is usually fairyy silty.

7) INTERTIDAL GRAVEL MARSH

Intertidal gravel marsh does not occur in Coos Bay. This marsh is described by Carol Jefferson in Coastal Wetlands of Oregon.

8) DIKED MARSH

By cutting off the supply of salt water from a marsh (either by means of a tide gate or only diking), the character of the plant communities is altered, with terrestrial plants soon moving in to colonize. This creates an extremely variable category; the plant community changes are affected by use of the land, time since diking, and the type of original marsh on the site. Most diked marshes in Coos Bay are in use as pasture land, but some have been broken open to salt water influence once more or are otherwise unused. There is little difficulty in recognizing a diked marsh, for the dike is usually overgrown with hushes or trees in contrast to the land behind it.

A "young" diked marsh will retain many of its salt marsh plants while terrestrial plants begin to colonize the area. Some plants, such as Juncus lescurii can remain indefinitely in diked marsh, but most will eventually be replaced by freshwater plants--grasses, shrubs, buttercups, and other herbs, and eventually alders and other trees--as the salt is leached from the soil by rainfall without replenishment by tidal action

Most of the diked marshes around Coos Bay were probably high or immature high marsh originally, since these are the easiest to utilize and they most resemble other types of meadow and pasture lands.

MAPPING AND TOTAL ACREAGES

The following procedure was used in the construction of salt marsh ownership and classification maps and the computation of their acreages.

1. aerial survey (early June).

2. obtaining of aerial photos and tideland maps from Division of State Lands.

3. modification of tidelands maps (erasure of tidelands).

4. field identification of salt marshes throughout the estuary.

5. transfer of salt marshes from aerial photographs to map utilizing photoreduction machinary at the University of Oregon Geology Department. Some conditions necessitated freehand transfer.

6. aerial photography to update State Land's photographs and obtain photographs of those areas not located on State Land's maps.

7. further transfer of photographs.

8. calculation of salt marsh acreage using polar planimeter (South western Oregon Community College).

9. For ownership maps, transfer of County Assessor's information onto State Lands maps (freehand transfer).

Due to the error involved in transferring and recognizing salt marsh areas on aerial photographs and the calculations of acreage using the polar planimeter, the acreages given may be considered rough estimates only. From tests of accuracy it is our belief that the acreages and extent of salt marshes are only within 10% error.

Bearing these inaccuracies in mind, the following are the total marsh acreages for the Coos Bay estuary.

LOW SILTY MARSH 71.6 ACRES

LOW SANDY MARSH 289.1 ACRES

IMMATURE HIGH MARSH 1000.5 ACRES

MATURE HIGH MARSH 87.4 ACRES

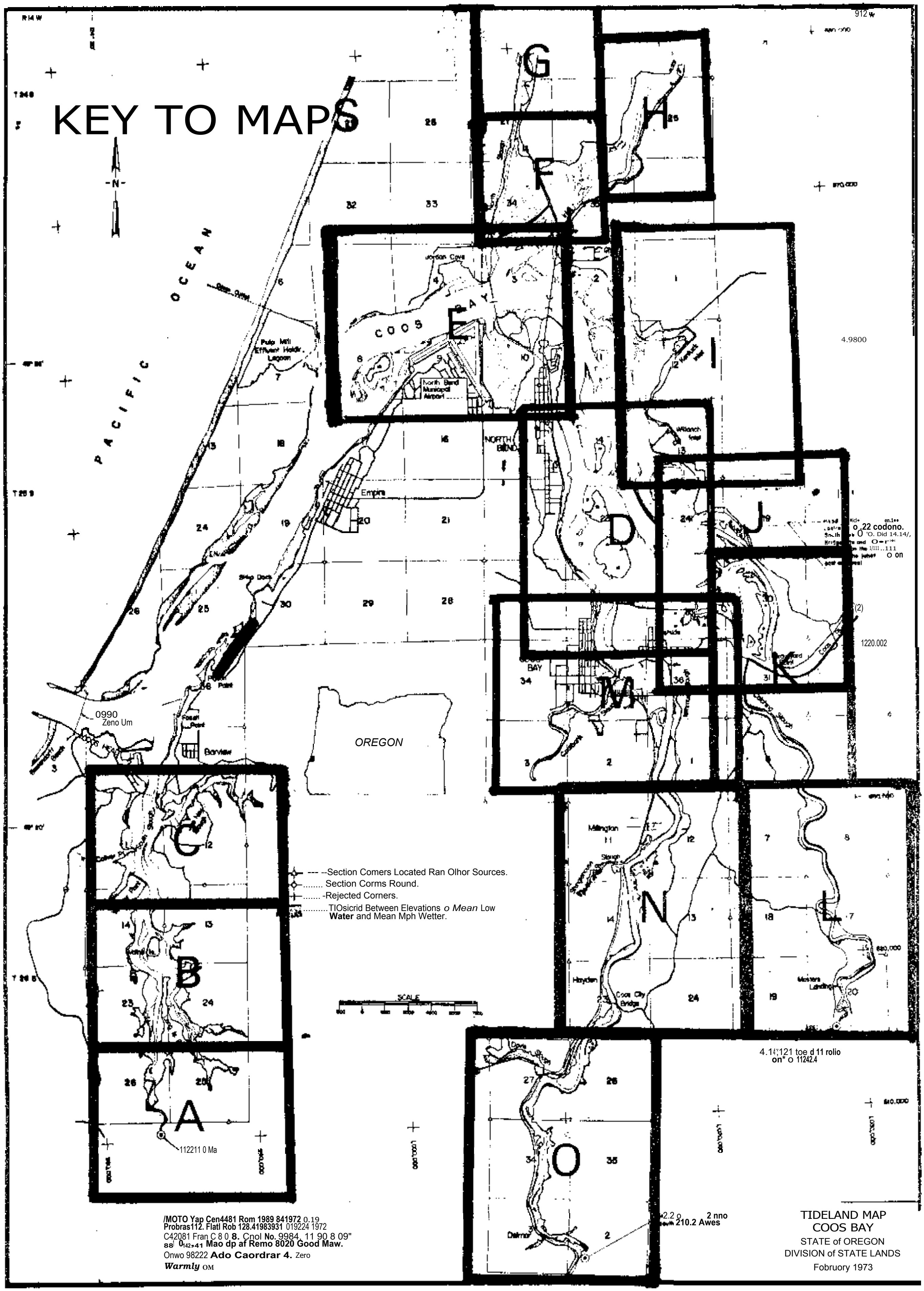
SEDGE MARSH 353.5 ACRES

BULLRUSH-SEDGE MARSH 149.8 ACRES

SURGE PLAIN MARSH 285 ACRES (See South Slough description)

DIKED MARSH 3942.9 ACRES

TOTAL UNDIKED MARSH, COOS **BAY** ESTUARY 1951.90 ACRES


KEY TO MAPS
PACIFIC OCEAN
COOS BAY
North Bend Municipal Airport
Jordan Cove
Pulp Mill Effluent Holdg. Lagoon
NORTH BEND
Empire
OREGON
Barview
Millington
Hayden
Coos City Bridge
Delmar
--Section Corners Located From Other Sources.
Section Corners Found.
-Rejected Corners.
Division Between Elevations of Mean Low Water and Mean High Water.
SCALE
TIDELAND MAP
COOS BAY
STATE of OREGON
DIVISION of STATE LANDS
February 1973

SALT MARSHES OF COOS BAY

Sections A, B, C South Slough

South Slough's marshes are many, small, and varied. There are no extremely large expanses of marsh, but many fringing areas combine to form a significant total acreage. The largest marshes are found at the heads of various inlets along the slough, where streams enter and flood plains are formed. No marshes are found in the tide flats out in the Slough proper, although in a couple of spots this situation may be approaching. These exceptions are low sand marshes, one just south of the Charleston bridge, and another directly south of Valino Island. The first is almost totally Salicornia, while the second marsh consists of Jaumea, Distichlis, and Salicornia.

Fringing marsh in South Slough is of two main types--low sand and immature high marsh. The nature of a fringe is such that the distance from the water-side to the terrestrial habitat is very short, and the changes in plant community composition with land height are correspondingly rapid. This has made classification rather arbitrary in some cases, due to the very small scale involved in mapping these marshes. In the case of a thin strip of low sand marsh backed by higher immature marsh, the area was labeled immature; if the low sandy area was wider, the entire fringe was so categorized, In any case, these small fringing marsh areas often have individual differences and do not fit readily in any one category.

Fringing marsh is found in South Slough at scattered points all along the edges, but mainly in inlets and coves, One such, on the south side of Younker Point, bears a great resemblance to the low sand marsh at the base of North Slough; in fact, here is found a plant (Cordylanthus maritimus) previously known in Oregon only in that particular North Slough marsh. The vegetation here consists of a carpet of Salicornia and Distichlis, with Cordylanthus, Cuscuta, and Jaumea interspersed. As the ground level gradually rises, Orthocarpus, Plantago, Juncus cernuus and scattered Triglochin are found. Finally, as the marsh meets the hill behind it, Deschampsia, Potentilla, Juncus lescurii Rumex, Atriplex, Hordeum, and Agrostis appear. Salt pans throughout the middle height contain a filamentous green algae and mats of Cladophora are common on the marsh's surface.

Directly across the Slough from Younker Point is a long fringe of low silty/immature high marsh. The difference in substrate of the outer edge is reflected in the plants growing here: Scirpus americanus and Eleocharis in the low, muddy areas, Salicornia, Spergularia and large clumps of Triglochin on the raised, more sandy ridges. Behind and above all this is a sharply-defined platform with mixed Carex. Deschampsia, Juncus lescurii, and upland plants grading in.

The several diked areas in South Slough which have been breached, or which have tidegates which no longer exclude salt water, serve as examples of marshes being returned to a near natural state. These usually show either a sedge or immature high edge, while the interior is still mud flat or even under water. However, these are probably not quite normal situations, owing to the usually small openings in the dikes; these areas do not receive as much salt water during a high tide as would undiked marshes of the same height. Evidence for this is the presence of cattails (which are mainly a-freshwater plant) with the sedge in the large diked area halfway down the east arm of the Slough. Two large flat areas in the west arm of the Slough which were ponds until at least 1970 are now nearly covered by Cotula, a plant which thrives in places where log storage and leaching have left chemicals in the soil.

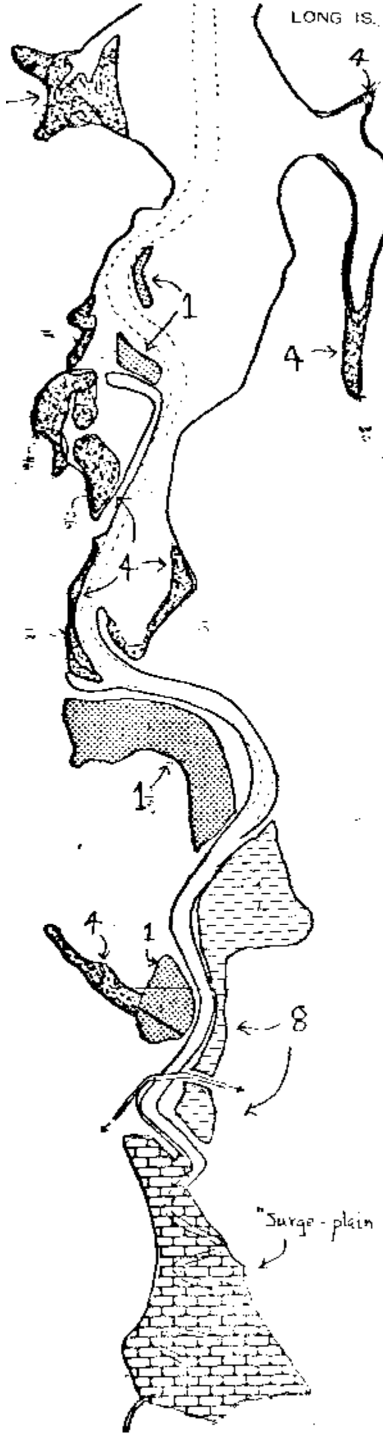
The areas along the extreme southern end of the west arm of South Slough are an example of "surge-plain" marshes, which are perhaps not strictly in the same category as the other marshes we have discussed. Surge-plain marshes are the result of tidal damming of streams so that during high water (or rarely normal water level) they overflow their banks, forming marsh habitat. In mapping these areas, we have tried to limit ourselves to areas with only salt-tolerant plants, and have therefore slighted the upper ends of these marshes. It should be remembered, however, that these areas also are contributors to the lower estuary in times of flood waters or very high tides.

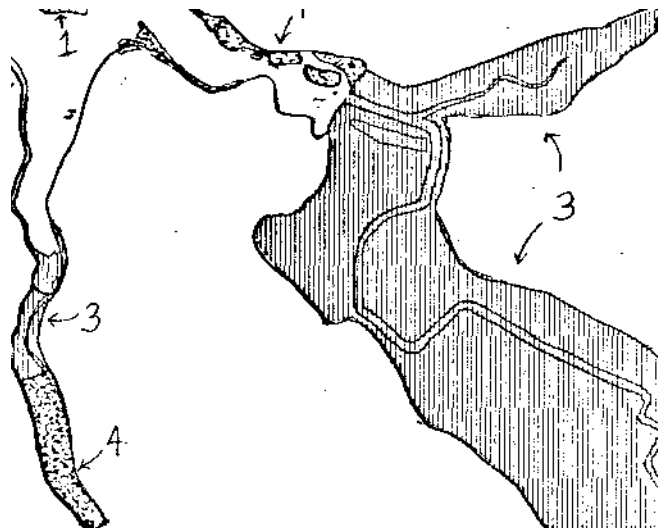
The marshes here resemble high marsh in vegetation but not in height above the surrounding areas. They extend from the stream bank to the edge of the hills, and are drained only be a few large streams, not by channels. We have labeled them immature high marsh as a compromise, though they contain plants usually associated with high marsh, such as Rumex, Trifolium and Vicea.

Joe Ney Slough exhibits much the same pattern as lower South Slough. It is fringed with sedge, low sand, and immature high marsh, and has a large diked-and-tidegated area at its extreme tip. This areas has large stands of cattails, which indicate freshwater influence, as well as Juncus lescurii, Carex obnupta, Potentilla, and other salt marsh plants.

A dense, pure stand of extremely large (4 feet) Scirpus americanus is found on a silty substrate fringing a short section of the north bank of Joe Ney Slough. This is the only place in the South Slough system where this situation occurs.

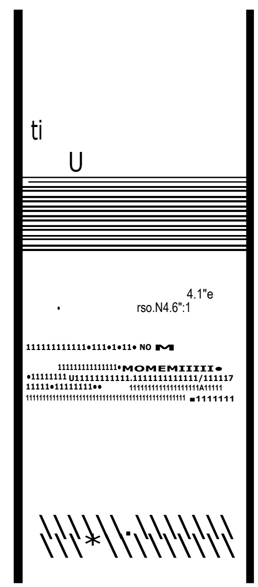
	A	B	C
LOW SAND MARSH ACRES	„88	35	49
SEDGE MARSH ACRES	O	41	262
IMMATURE HIGH MARSH ACRES	6.5	72	85
DIKED MARSH ACRES	225 '	15	30
LOW SILT MARSH ACRES	..1	-	
"SURGE-PLAIN" MARSH ACRES	-	-	





KEY TO SALT MARSH TYPES

1 low sand
2 low silt
3 sedge
4 immature high
5 mature high
6 bulrush & sedge
8 diked



COOS BAY
SOUTH SLOUGH

A

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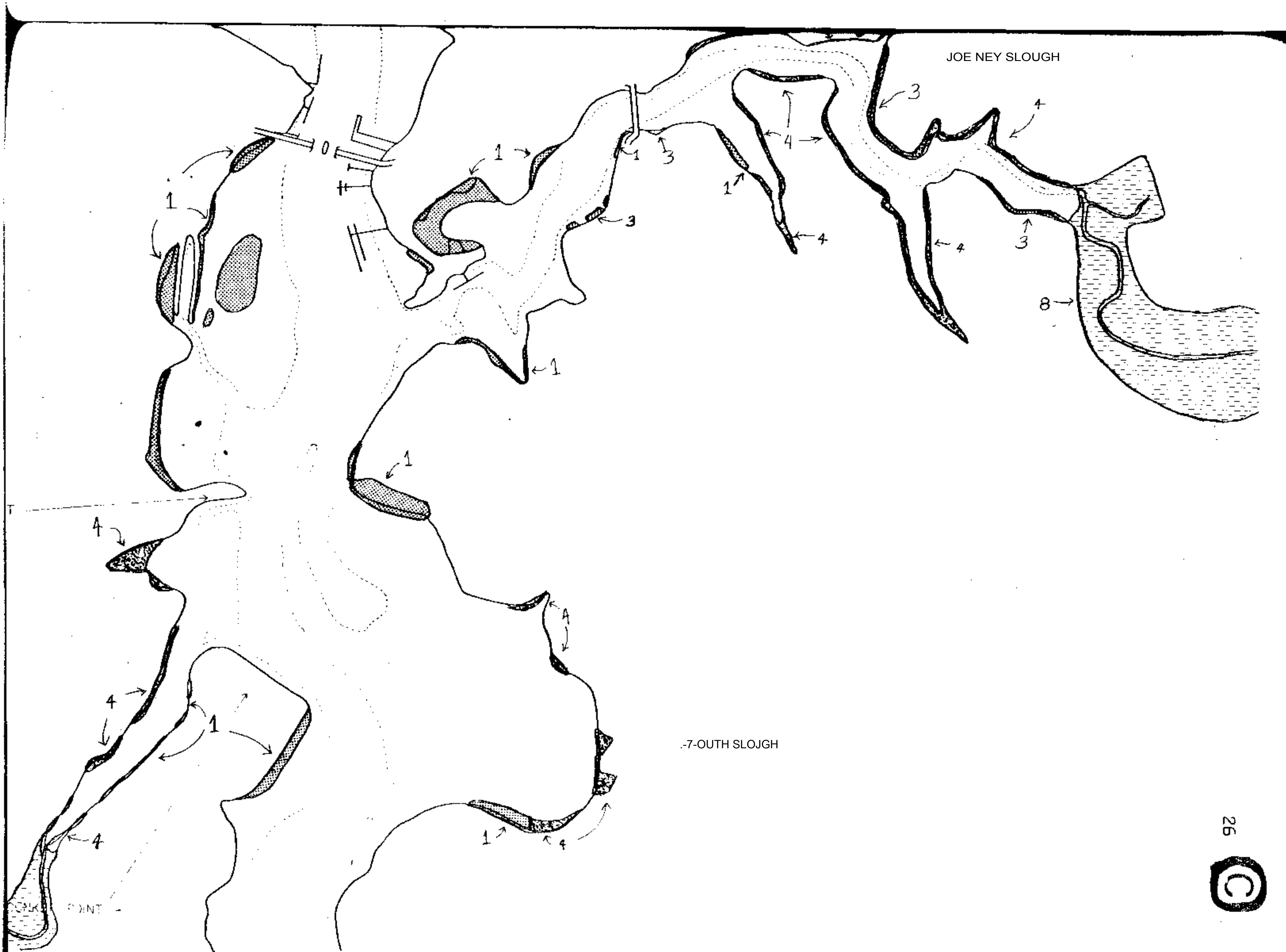

JOE NEY SLOUGH
.-7-OUTH SLOJGH

SECTION D THE SPOIL ISLANDS

The three spoil islands east of the city of North Bend, have small amounts of low sandy marsh growing on their edges. The southernmost island contains 146' es of low sand marsh characterized by Salicornia as well as a great deal of Distichlis, with varying amounts of Plantago maritima -- seaside plantain. The two other islands contain lesser amounts C67 acres and -30 acres respectively) of low sandy marsh. The interiors of these''Zpoil islands have been filled to a level too high to support salt marsh communities. Plans are being made to seed these spoil islands in the near future to provide waterfowl cover.

In the vicinity of Eastside, at the location of further spoils is a segment of diked marsh removed from the bay itself by placement of dredge spoils. Towards the Bay is a large section of mature high marsh. Islands near this mature high marsh contain immature high marsh.

MATURE HIGH MARSH 44.8 ACRES

IMMATURE HIGH MARSH 35.7 ACRES

LOW SANDY MARSH 46.3 ACRES

DIKED MARSH 114.0 ACRES

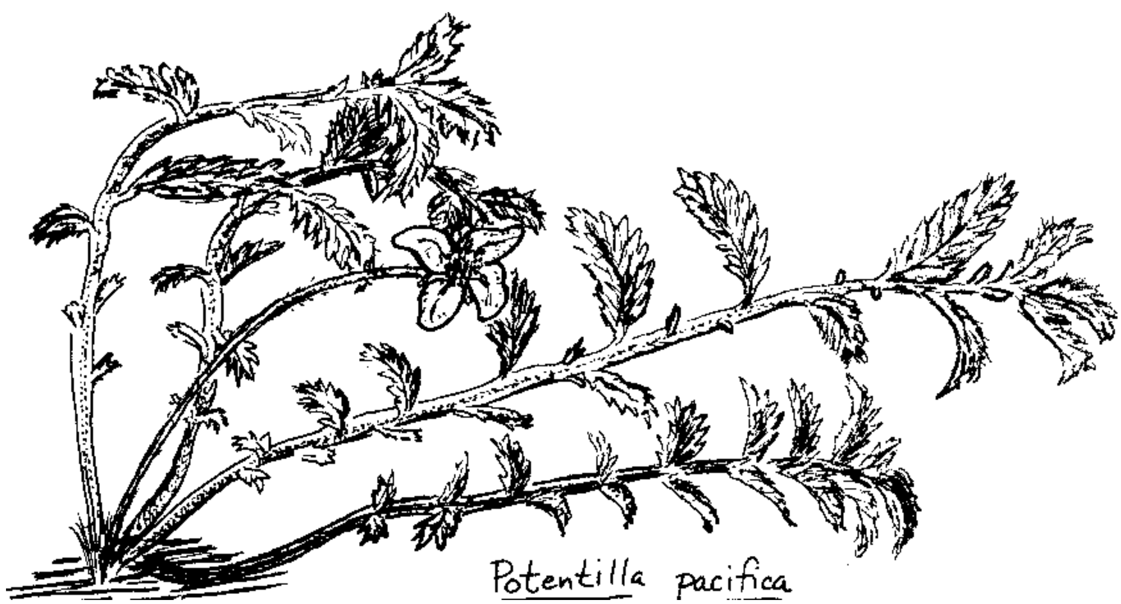
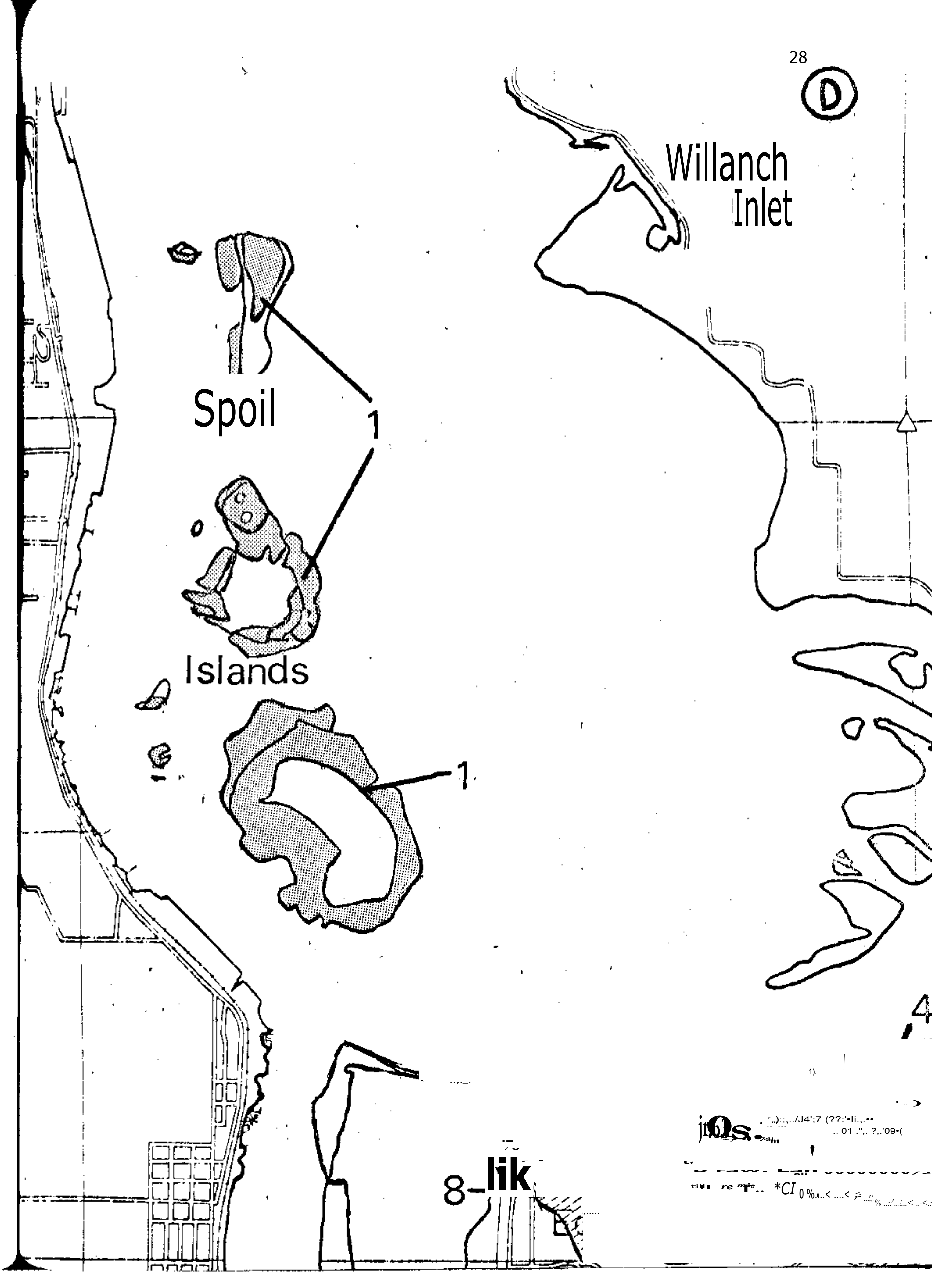


FIG. 6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islands have been filled to a level too high to support salt marsh communities. Plans are being made to seed these spoil islands in the near future to provide waterfowl cover.

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IMMATURE HIGH MARSH 35.7 ACRES

LOW SANDY MARSH 46.3 ACRES

DIKED MARSH 114.0 ACRES

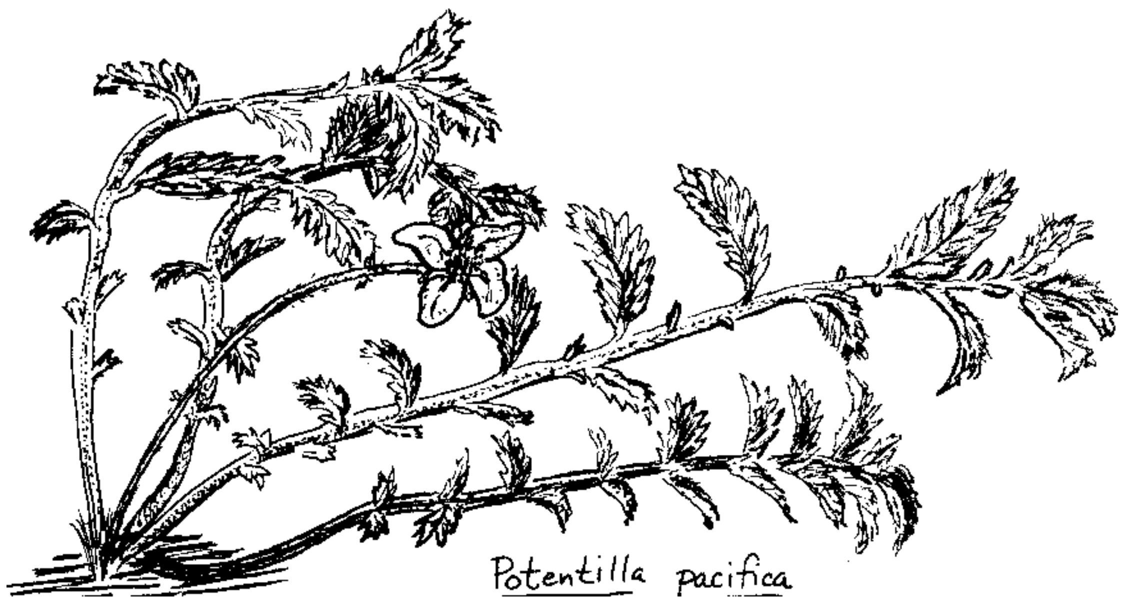


FIG. 6

SECTION F-G NORTH SLOUGH

The marshes in North Slough are some of the finest in the Coos Bay system, in terms of both extent and condition. The slough is hounded on the east by Highway 101 and on the west by a raised set of railroad tracks. Neither of these appears to have seriously affected the marshes, although the railroad bed has cut off two small areas from salt water influence; these now contain cattails and other freshwater plants.

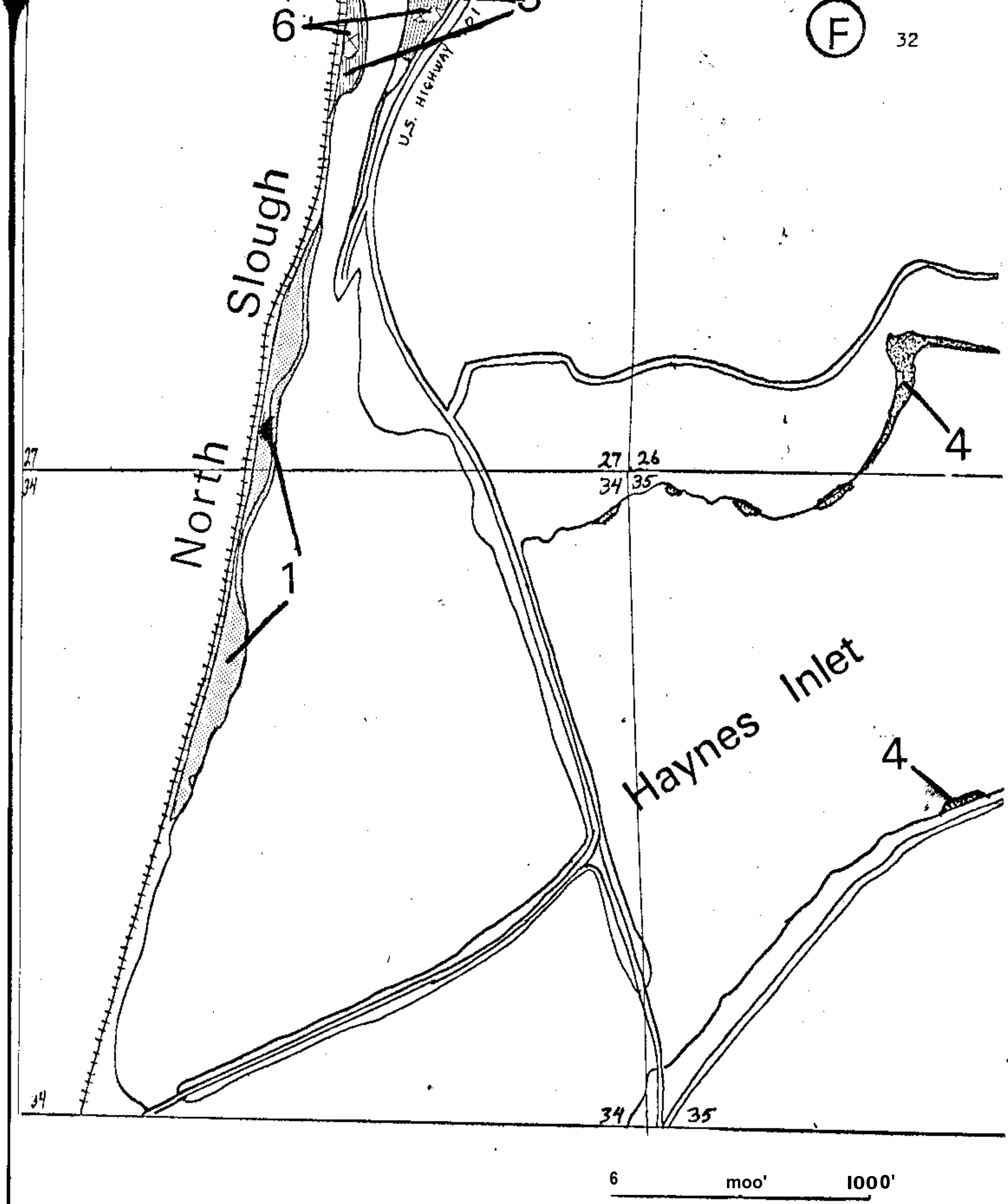
The base of the slough, north of Jordon Cove, is bordered by low sand marsh on the west side. This marsh contains a wide variety of plants characteristic of this category, as well as some others in isolated silty areas. The major plant species present are Scirpus americanus, Eleochris parvula, Juncus lesieurii, Orthocarpus, Jaumea, Glaux, Salicornia Distichlis, Triglochin, Spergularia marina, Plantago, Lolium, Fucus, and Ruppia maritima. In the higher spots was seen Atrinlex, Grindelia, Hordeum and Trifolium wormskoldjii. The upper part of the marsh has an immature high marsh plant community, but it is only a thin fringe below the railroad bed. Cordylanthas maritima, a small plant in the same family as Orthocarpus, is found in one area along this marsh, and has been known no where else in Oregon (Carol Jefferson personal communication).

As the slough narrows to the north, the character of the marsh changes to bullrush-sedge on the west, and sedge marsh on the east side of the channel. About halfway up the length of the channel, an old dike system is present on both sides, but since tidal access is unimpeded at the lower end, there is no exclusion effect. The west side of the slough contains large stands of bullrush (Scirpus validus) along the landward edge, with sedge nearer the water. The east side of the channel is almost wholly Carex 1., with Deschampsia, Hordeum, Salicornia, and Triglochin present in relatively small amounts.

Both sides of the channel have several areas of driftwood-choked marsh near the upper end of the slough. These packs of stranded logs allow very little plant growth and are not included in the marsh extent calculations and maps.

The land surface slowly rises until before the crossing of the slough under highway 101, upland plants are found adjacent to the channel. The agricultural lands on the east side of the highway have tidegates and dikes, but presumably are high enough not to be affected appreciably by salt water. it is possible that these were once flood plain marshes, however.

	SECTION	F
HIGH IMMATURE MARSH ACRES	7.0	
DIKED MARSH ACRES	-	87.8
SEDGE MARSH ACRES	8.5	130.
BULLRUSH SEDGE MARSH ACRES	2.0	16.0
LOW SAND MARSH ACRES	23.0	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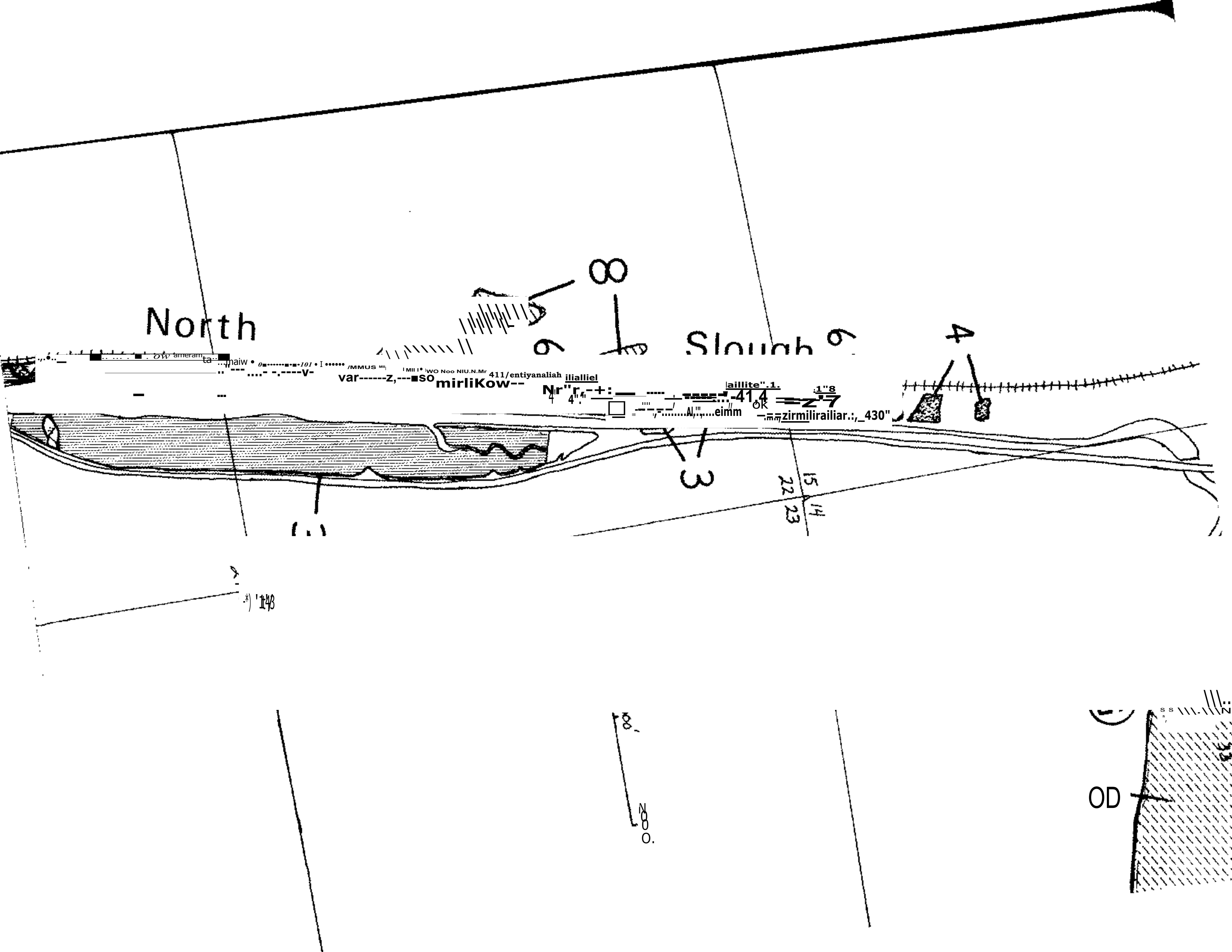
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SECTION H HAYNE'S INLET

Hayne's Inlet is another area extensively used by man. On its southern edge several hundred acres have been diked and used for agricultural purposes. Approximately 150 acres remain as salt marsh. Largest of these areas is a sixty acre section -f 4 m-sture high marsh on the eastern edge of the Inlet near its northern tip. Plants here include Tri&lochin Carex, and Deschampsia on the interior and Salicornia and Juncus on the higher spots and edges. Further north another 40 acres is present of which 35 acres is immature high marsh, the remainder being sedge. On the western side of the Inlet a 16 acre low silty marsh with Deschampsia Distichlis, Trifolium, Cotula, Carex, and Pacific Silverweek present. Two other smaller areas of marsh are located on the southern part of the Inlet as it indents the upland areas and is fed by streams.

DIKED MARSH ACRES 1000?

IMMATURE HIGH MARSH ACRES 54.4

SEDGE MARSH ACRES 6.

LOW SILTY MARSH ACRES 3.

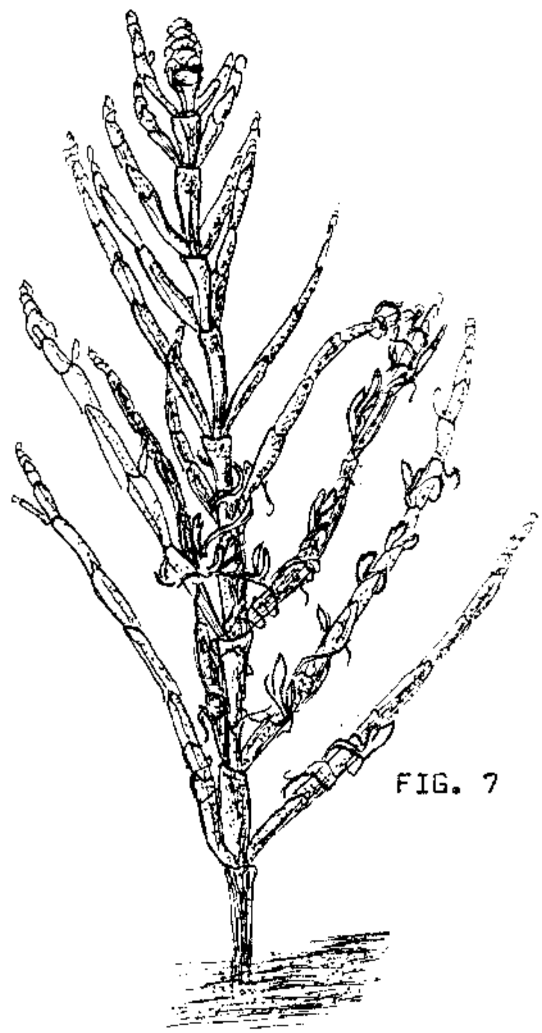

FIG. 7

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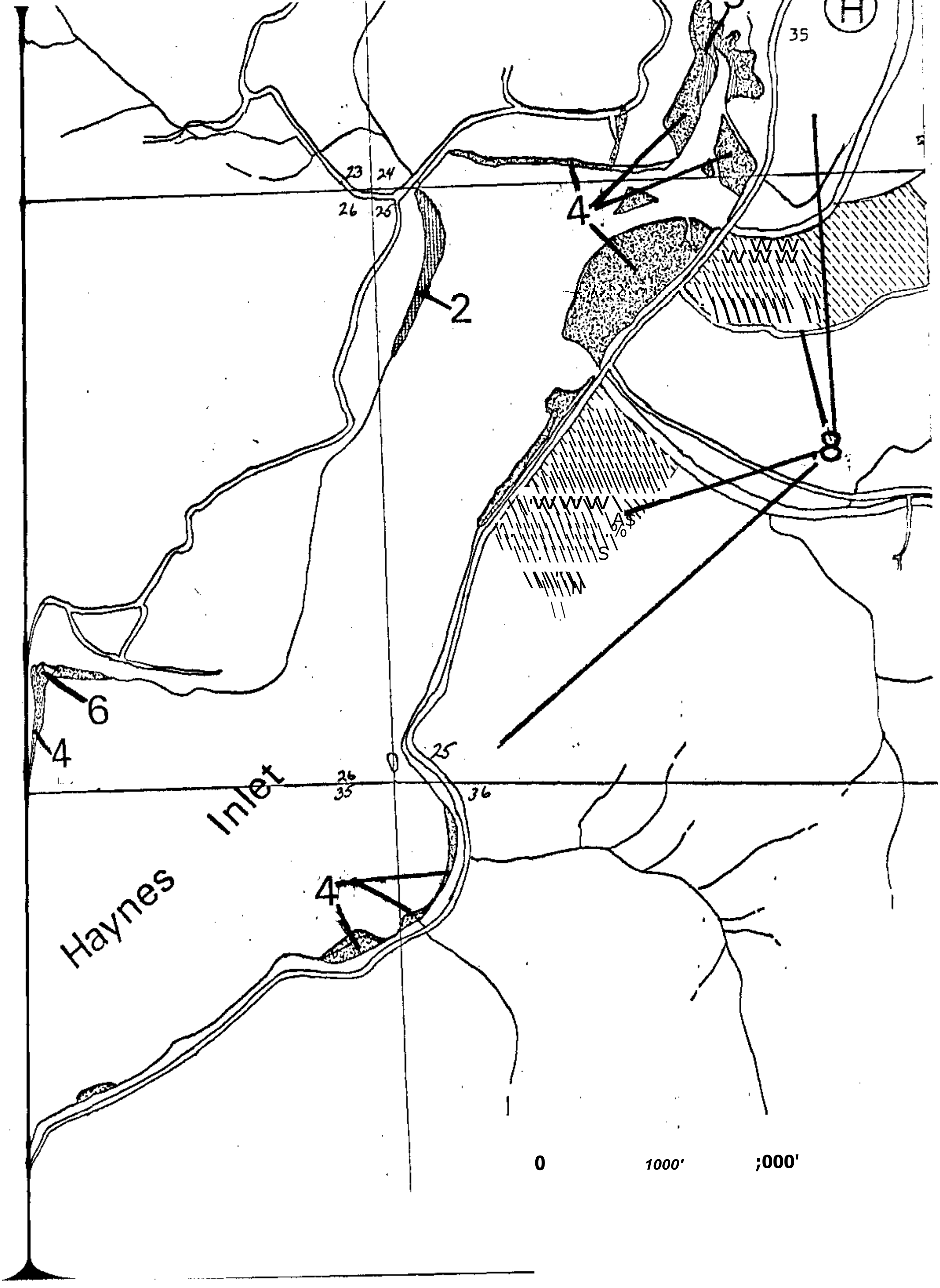

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SECTION I WILLANCH AND KENTUCK INLETS

Once important salt marsh systems within the Bay, Willanch and Kentuck Inlets (formerly Willanch and Kentuck sloughs) have lost much of their salt marsh area through diking. Kentuck Inlet has been the object of a rapid marsh formation in the past. Once shallow water extended approximately one quarter mile further back into the slough being changed into marshland, before its recent diking. Johannessen (1961) believes that this expansion of marsh, nearly twofold between 1939 and 1961 was brought about by extensive diking and changing of current patterns. Now a golf course covers most of the 175 acres of salt marsh in the Kentuck system. Of that Hart remaining salt marsh, approximately half is in the middle and south sections of the bay as high immature marsh. Dominant plants include sedge *Deschampsia, Triglochin,* Dock and *Juncus* 1. Bordering the north side of the bay is a fringe of bullrush sedge marsh with silty substrate and diffuse drainage. *Scirpus* and *Triglochin* are also present. A section of low sandy marsh borders its eastern edge. A smaller section of marsh totalling about 10 acres is currently an immature high marsh due to the disrepair of a tidegate near the mouth of the slough.

Willanch slough is even more extensively diked. 110 acres in 1892, it now totals a mere 6 acres divided into immature high marsh on its outer edges and low silty marsh towards the southern edge near the dikes. The 100 acres of diked marsh is currently used for agricultural purposes. A small sedge marsh occurs on the bay side of the road.

DIKED MARSH ACRES 441.6

BULLRUSH SEDGE ACRES 4.6

IMMATURE HIGH ACRES 25.8

LOW SILTY ACRES 3.8

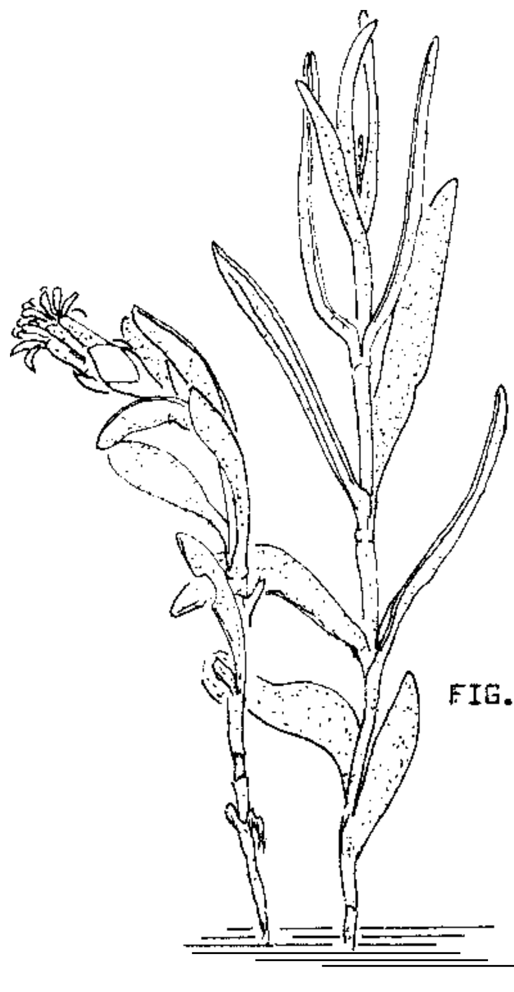
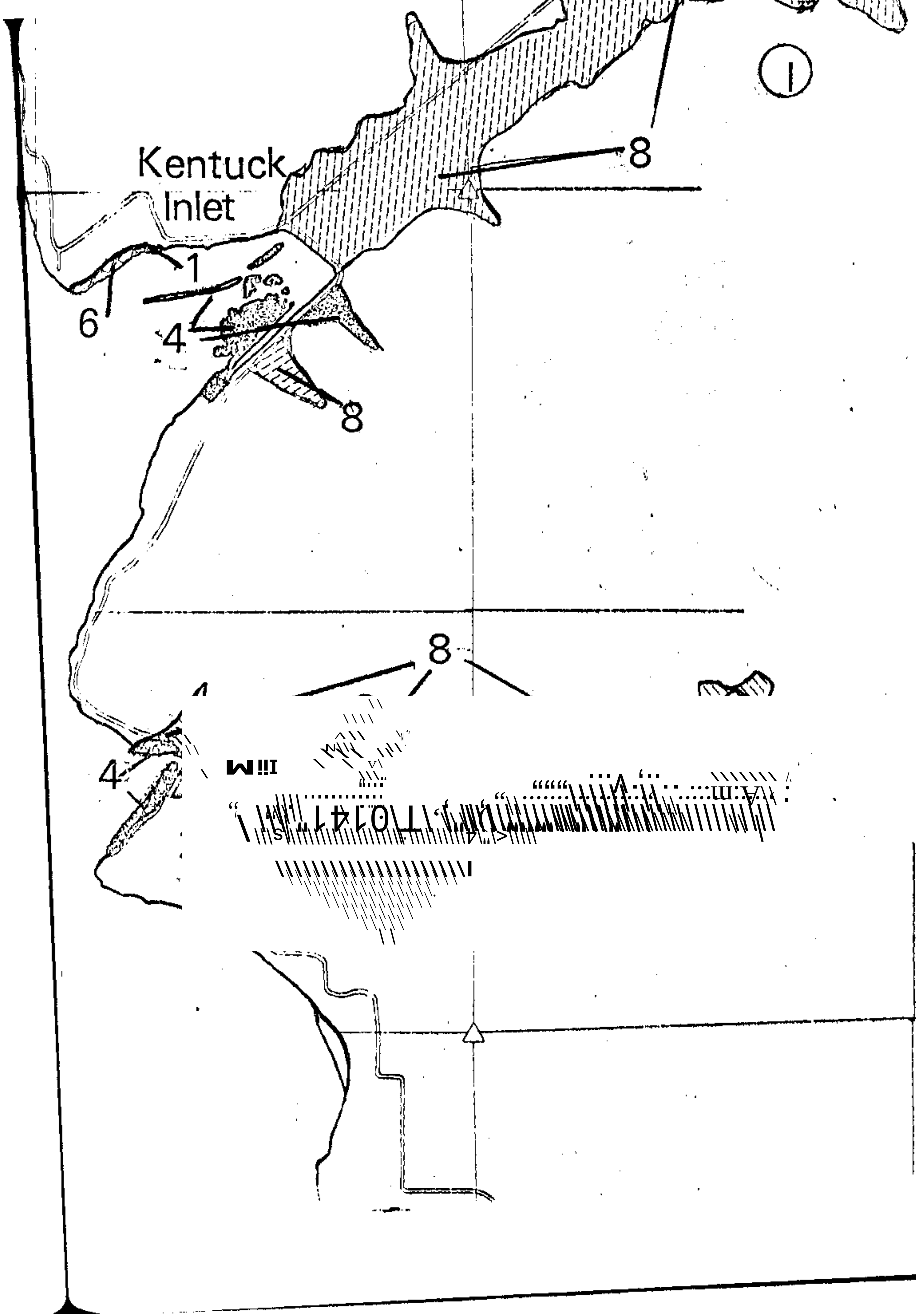


FIG.8

Tau. rn ea. CATAOSCt



Kentuck
Inlet
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4
I

SECTION J BULL ISLAND

At the point where the Coos River and Catching Slough empty into Coos Bay lies Bull Island, a beautiful example of immature high marsh. Virtually untouched by man because of its inaccessibility, the only **evidence** of **dis-**turbance on the entire island are log piles on its **eastern** edge. Bull Island is mostly tideland, with a few trees and bushes on higher ground in the southeast corner. The rest of the island is covered by marsh of varying description, drained by a network of deep channels.

The vegetation cover is continuous but patches of distinct vegetation types occur, varying with small differences in elevation. On the higher areas **is** found Juncus lescurii, Rumex, Hordeum and Potentilla. These are mostly in the interior and near the south end. Near the edges, which consist of an abrupt drop of 4-5 feet on the west side and a gradual slope on the east **is** Carex, Deschampsia, Triglochin and Salicornia along the drainage channels. Smaller amounts of Jaumea, Distichlis and Cotula are also present here. Along the east side runs a fringing strip of sedge marsh about 100 feet wide, for most of the length of the islands.

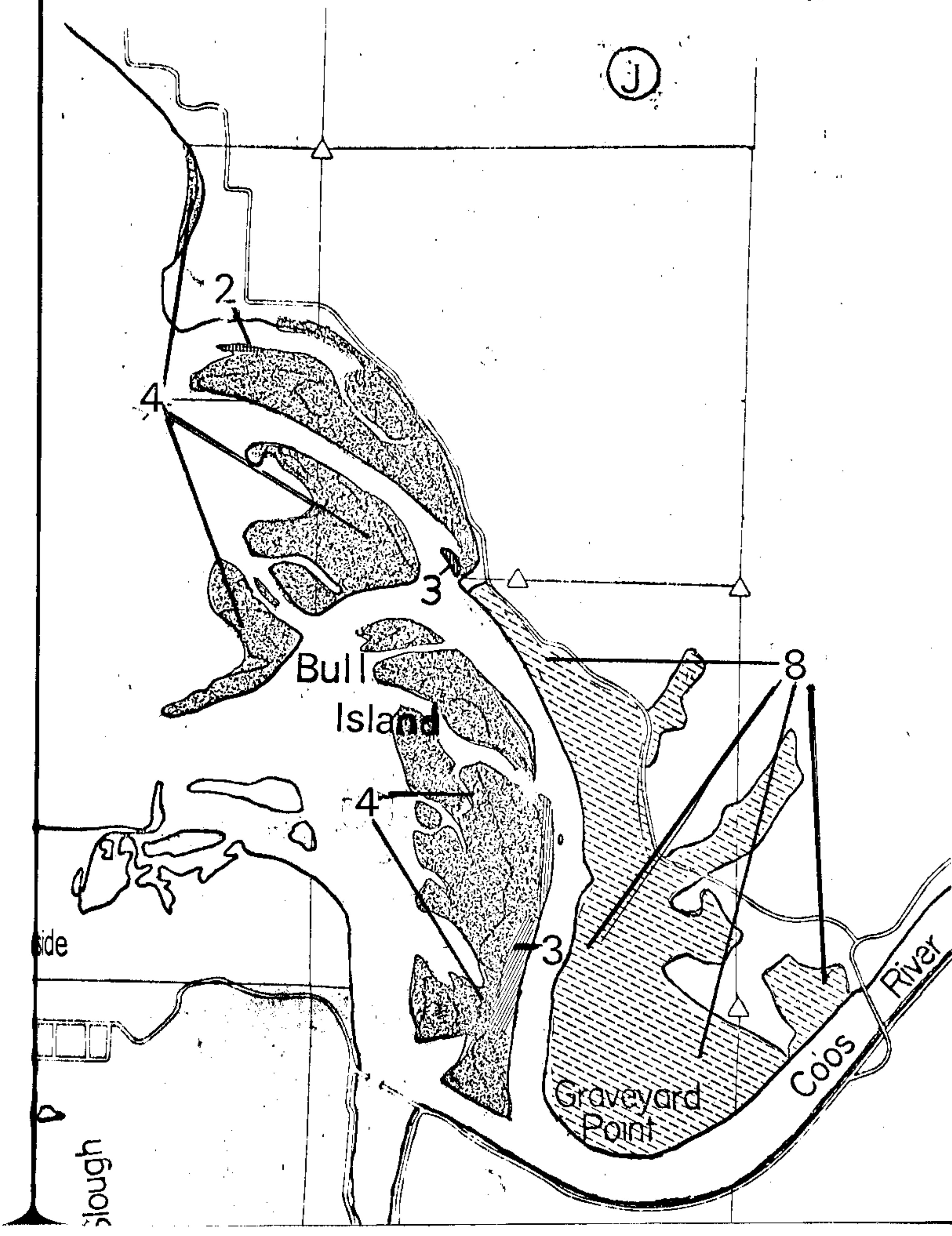
Across the east channel of the Bay from Bull Island is another large expanse (127 acres) of immature high marsh, with the same type of plant community structure. The bank is steep and 4-5 feet high and tidal drainage channels are common. To the south an extensive area of marsh has been diked and has been in **use** as agricultural land since at least 1892, according to the United States Coast and Geodetic Survey.

According to our best estimates from map USCGS-1892, the **area** of Bull Island has increased by from one quarter to one third since that time. Along the northern edge of Bull Island is found a growing area of colonization by Scirpus robustus. The mud substrate here is supporting a significant amount (1-2 acres) of vegetation that was not visible **in** 1970 aerial photographs, but is visible in photos taken in 1974. This is one of the few examples of expansion of marsh we have been able to verify conclusively.

DIKED MARSH ACRES 313.1

IMMATURE HIGH MARSH ACRES 354.9

SEDGE MARSH ACRES 17.5


J
2
4
3
Bull Island
4
3
8
Graveyard Point
Coos River
ide
Slough

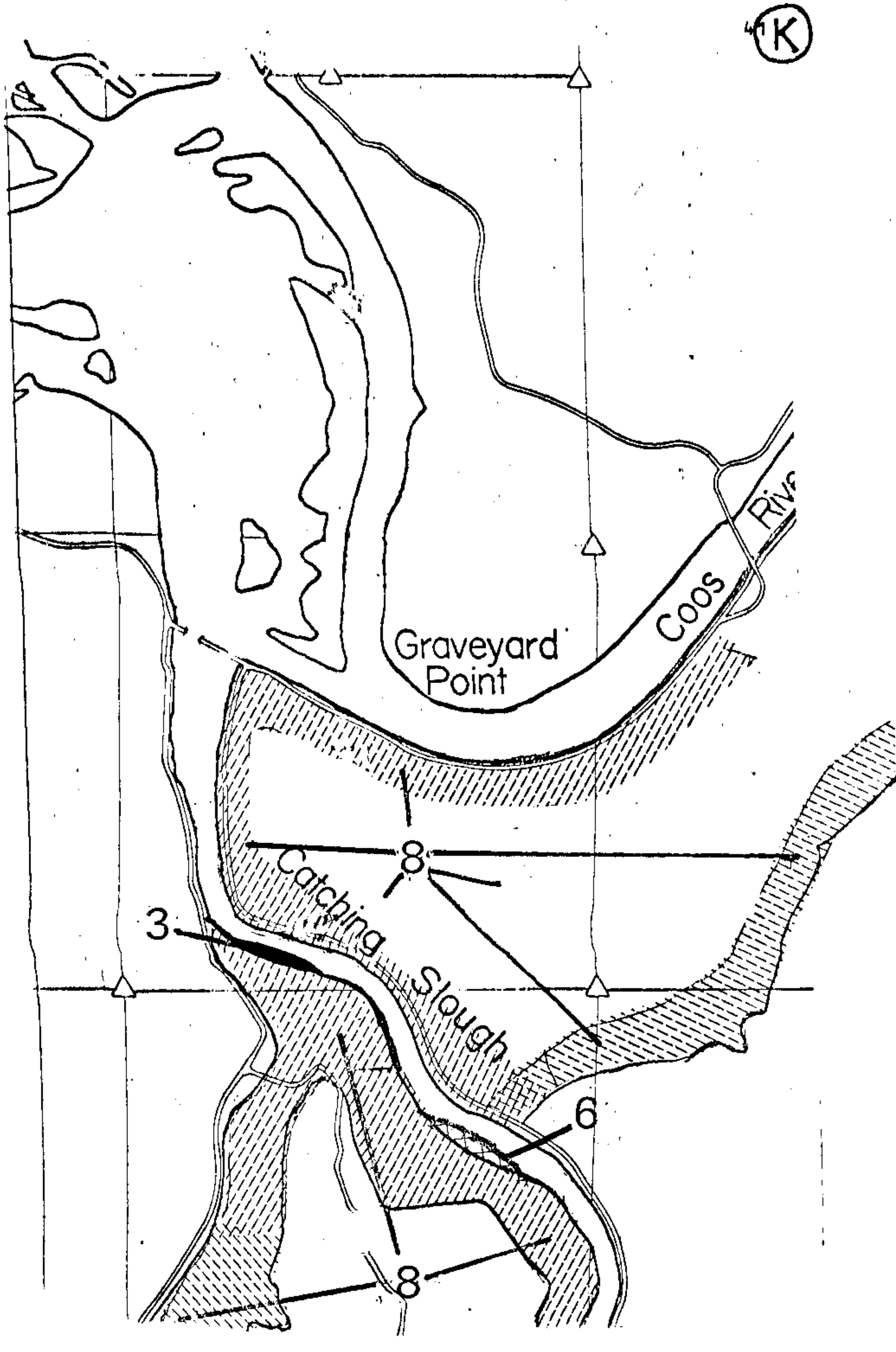
SECTION K-L CATCHING SLOUGH

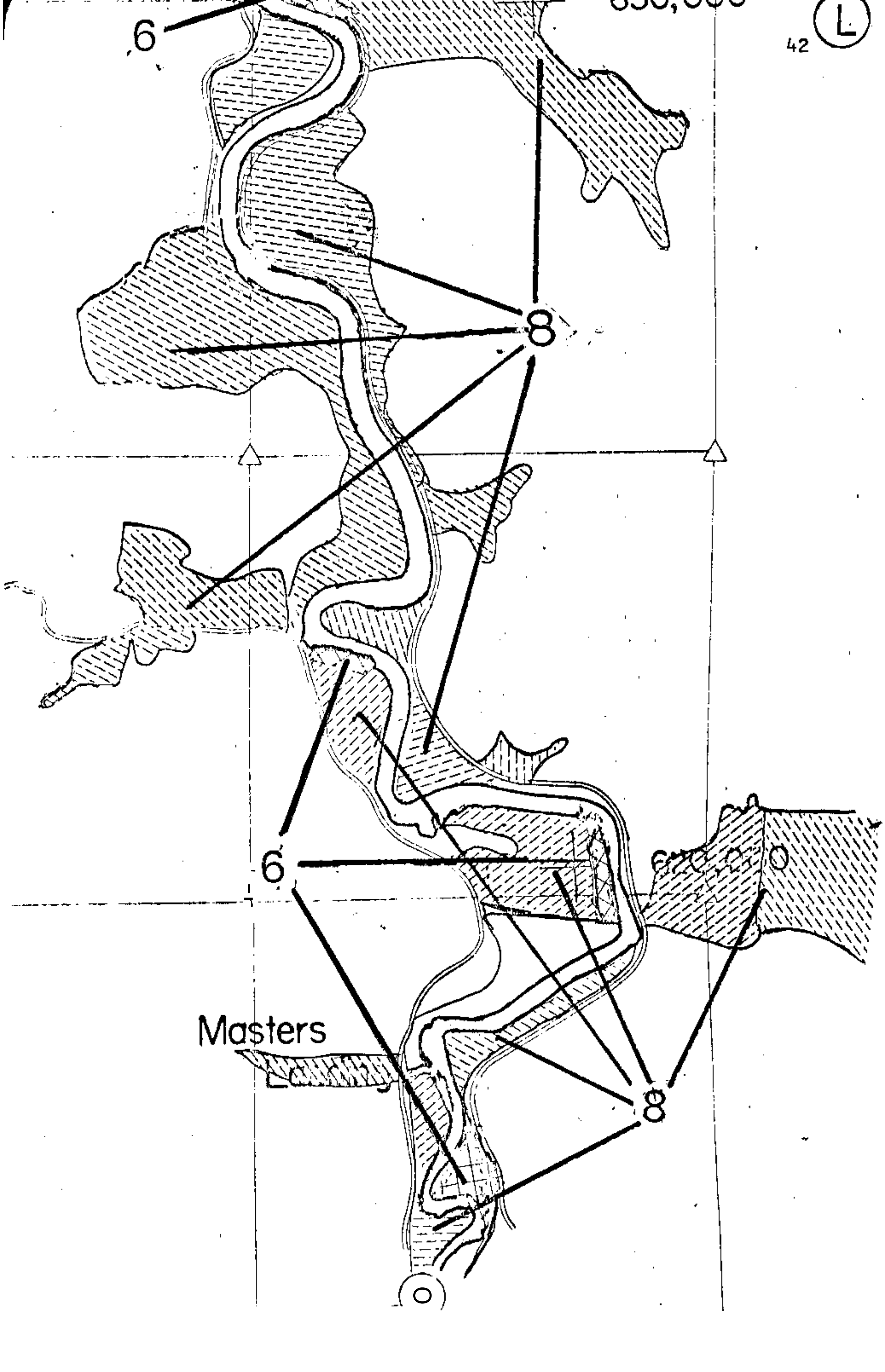
Catching Slough is a salt marsh system extensively altered by agriculture. From just South of Bull Island to where freshwater influences dominate, diked marsh in agricultural use prodominates. Just south of Graveyard Point a massive 1092 acres of diked marsh is present on which residences as well as farms are built. Adjacent to this area on the west hank of the channel is another 510 acre marsh that has been diked. On this West bank there are very thin patches (5 yards wide at their widest extent) of bulrush and sedge, but these diked areas are largely unexploited by salt marsh vegetation due to the steepness of the dikes present.

As one travels further south (map L), more diked marshes are present. At the north end of the map a fairly large (10 yards wide) fringe marsh of bulrush is present. Diked marshes totalling 1075 acres border both sides of the channel, again demonstrating the intense agricultural use of the salt marshes in this slough. Fringe marshes of sedge and bulrush again are present, especially on the West bank, as it is free from the highway's steep rock foundation, as it follows the slough.

South of Master's Landing on the east side of the channel, a fringe marsh of bulrush and sedge with Pacific Silverweed and Dock at its perimeter may be seen. Being the largest marsh in the system, it is unfortunate that it is less than ten acres in extent. With the extent of diking and agricultural use of this marsh area, it can only be stated that a great deal of modification of the entire southern part of the Coos Bay estuary has occured in terms of organic matter, siltation, wildlife populations etc.

SECTION		K	L
DIKED MARSH	ACRES	690.8	1029.8 ACRES
BULRUSH SEDGE MARSH	ACRES	28.1	13.7 ACRES


K
Graveyard Point
Coos River
Catching Slough
8
3
6
8



42
L
6
8
6
Masters
8
O

SECTION M COALBANK SLOUGH

Coalbank slough **is** divided into two remnants, twenty five and thirty five acres, of a once much larger marsh. Located south of Coos Bay city center, the twenty five acre marsh is bounded on three sides by quickly rising land and spruce and fir vegetation. The marsh itself has been classified a sedge marsh, although Deschampsia, Salicornia, Triglochin, and Pumex are also present in fair quantities. Making a decision between a sedge marsh and a high immature marsh was in this case further complicated by the remains of a coal mine, present some hundred years ago, which provides some land high enough to contain terrestrial vegetation types. This is especially noticeable near the road at the rear of the marsh. Recently this area has been of interest due to the county's diking at the mouth of the slough, cutting off saltwater input, and making organic circulation into the estuary impossible.

The thirty five acre parcel located west and south of Coos Bay downtown is bordered on almost half its perimeter by the channel of the slough which was at one time diked. This diking makes natural circulation impossible, but since the dike has been broken, the marsh is doing quite well. Deep channels flow through the area providing water curculation for the entire marsh. Again this section was classified a sedge marsh, due to the dominance of Carex lyngbei, although several other species do exist including Deschampsia, Salicornia as well as Hordeum, Potentilla, and others.

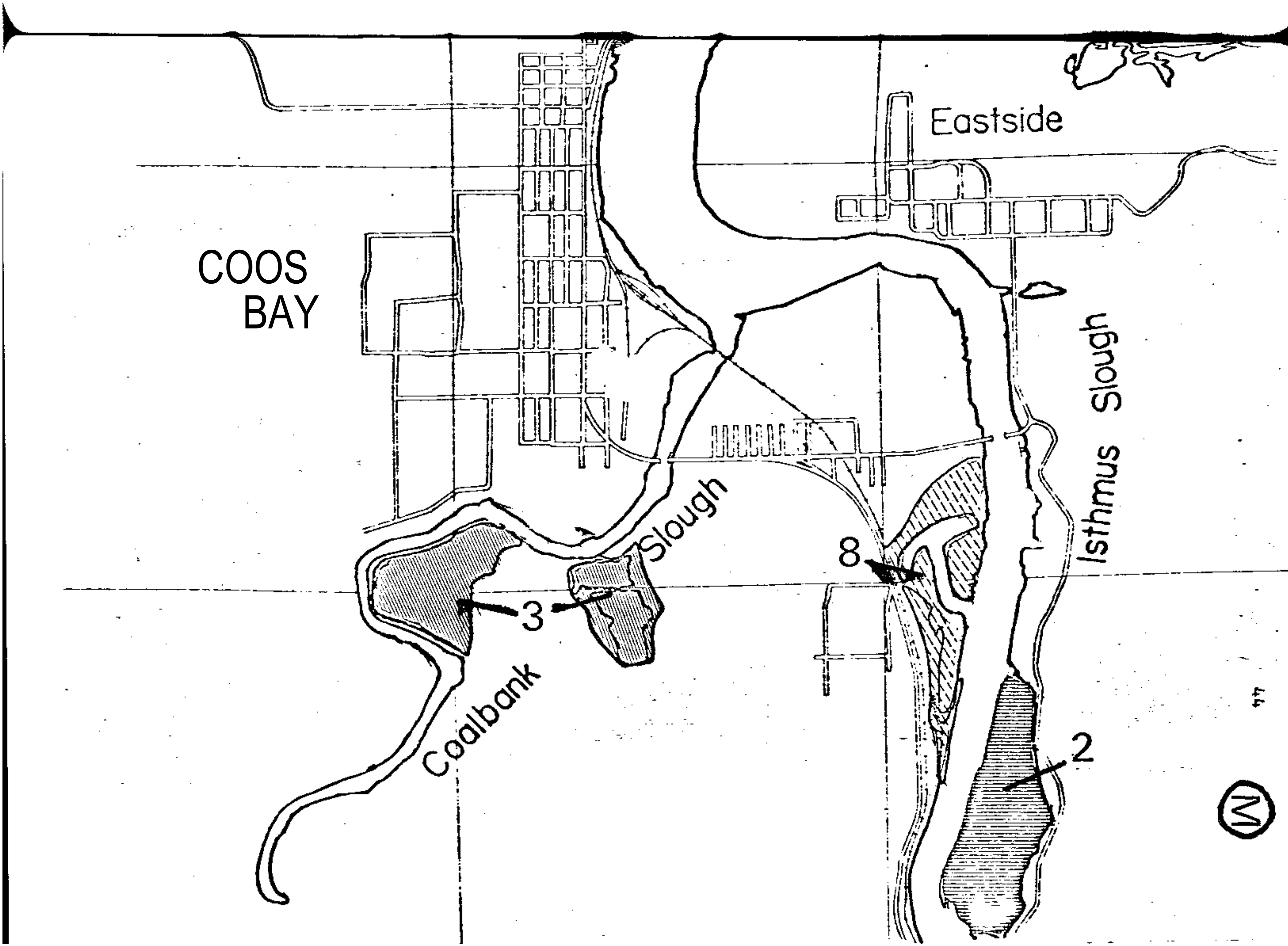
The importance of these marshes cannot be overemphasized, as they are the marshes most intimately connected with the industry of Coos Bay, their beneficial effects being enhanced by their proximity.

South of Eastside on Isthmus slough are two marshes of moderate extent. The diked marsh on the west bank of the slough contains 80 acres of diked marshland and **is** currently being used for log storage and related industry. Further south on Isthmus slough is a low silt marsh of 85 acres that had once been **diked**, and is now returning to a natural state. The ground of this marsh is silty and flat, with few channels interrupting it. Predominant vegetation consists of Triglochin maritima. Again the importance of this marsh is in its proximity to Coos Bay's industrial sector along with its distinction of being the largest low silty marsh in the entire Bay. The marsh itself is not visible from the river as log storage and dikes on the channel side of the marsh obscure its view from passing boats.

DIKED MARSH 41.8 ACRES

SEDGE MARSH 10.1 ACRES

LOW SILTY MARSH 64.6 ACRES


COOS
BAY
Eastside
Isthmus Slough
Coalbank Slough
3
8
2

SECTION N ISTHMUS SLOUGH

The area on Isthmus Slough from Millington south to the Coos City Bridge, contains large expanses of both sedge and immature high marsh, although both have been encroached upon; about half of the original marsh acreage in this section has been diked for use as agricultural land and for log storage.

Shinglehouse Slough is an older sedge marsh, as evidenced by its deep drainage channels and height above the flats. The vegetation consists mainly of Carex lyngbyei, with some Deschampsia and Triglochin scattered throughout the marsh. The total area is about 80 acres.

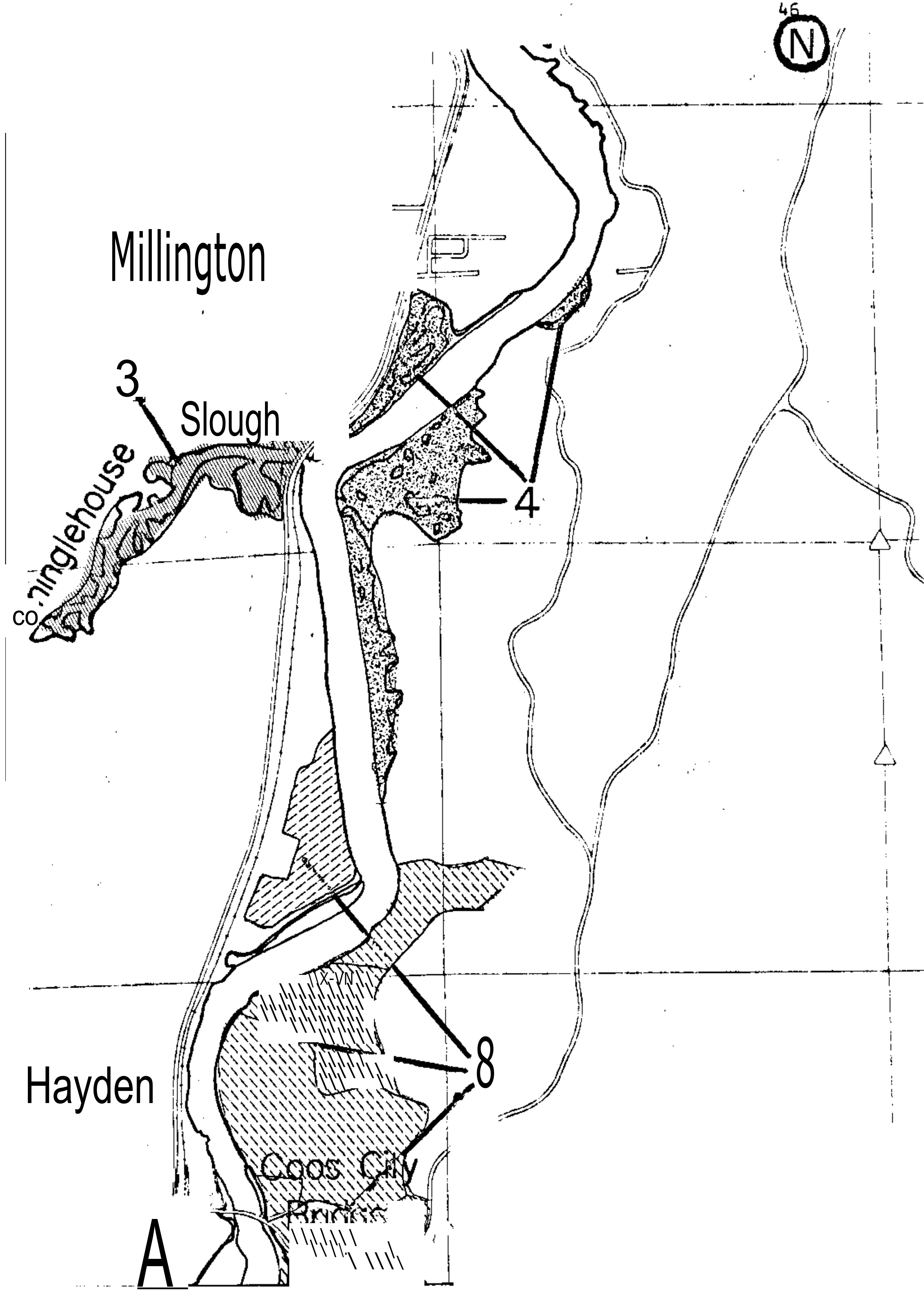
Shinglehouse Slough is bordered by the Coos Bay Sanitary Landfill, and by an old auto graveyard on the north side. Closer to the slough outlet on the same side is a private landfill that has already eliminated a small portion of the marsh. A boat landing and parking lot located on the south side adjacent to Highway 101 has also been built on former marshland.

Across Isthmus channel from Shinglehouse Slough is a large (108 acres) immature high marsh, with deep drainage channels, abrupt drops, and small raised hummocks. The plant community composition is mixed, with Carex, Deschampsia, Triglochin, Agrostis, Salicornia, Glaux, Rumex, and Atriplex all growing together. Farther south on Isthmus Slough is more immature high marsh and large areas of diked marsh which are being heavily used.

PIKED MARSH 206.0 ACRES

IMMATURE HIGH MARSH 76.0 ACRES

SEDGE MARSH 51.7 ACRES


46
N
Millington
3
Slough
Coalinglehouse
4
4
Hayden
8
8
Coos City
A

V

SECTION O ISTHMUS SLOUGH

The south end of Isthmus Slough and most of Davis Slough contain large areas of bulrush-sedge marsh. These are confined to strips along the river, while the immature high marsh in the northern section of the map covers a wider range.

At the end of Davis Slough there are two areas of marsh that have been diked at one time or are now. An immature marsh to the north of the channel is adjoined by a pure sedge marsh on its northern edge; a logging road and tide-gate separate the two. This new situation (age unknown to us) appears not to have affected the sedge marsh yet, however. To the west of the immature high marsh is another road and tidegate, this one stopping tidal flow to a mud- and bramble-covered field. There are some remnants of salt marsh vegetation left, such as Scirpus americanus and Potentilla, so this probably was a marsh at one time. It would be a good case to investigate as to the possibility of reopening the tide gate; the land seems very unproductive as it is now.

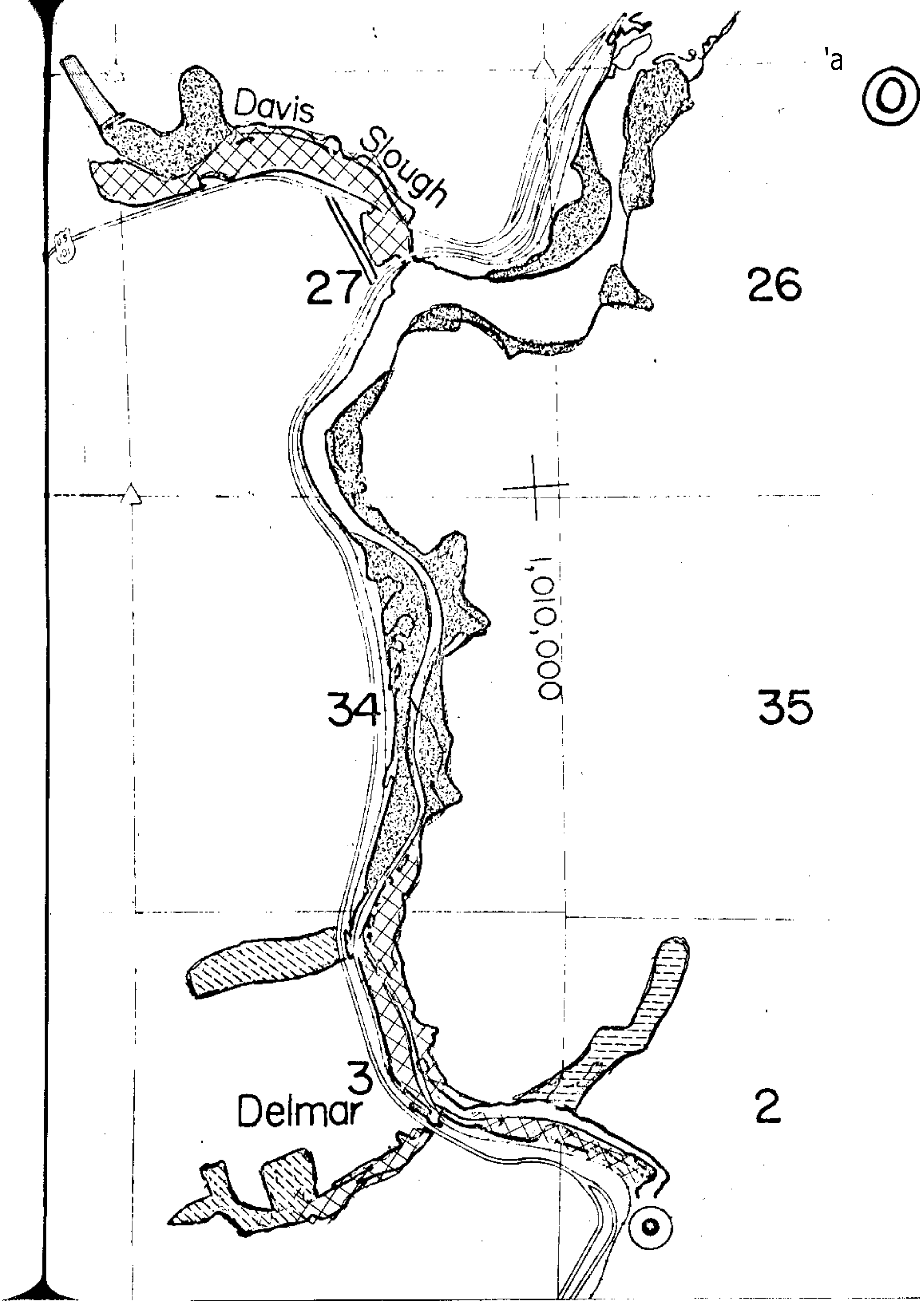
There are several diked areas in the region of Delmar, and as one proceeds south, the bulrush-sedge vegetation gives way to cattails under increasing freshwater influence; the head of the tide is just south of Delmar.

DIKED MARSH 62.4 ACRES

IMMATURE HIGH MARSH 143.0 ACRES

BULRUSH SEDGE MARSH 85.4 ACRES

SEDGE MARSH 1 ACRES



Davis
Slough
27
26
34
35
1,010,000
3
Delmar
2

UNMAPPED -- Empire

Just south of Empire on the east side of the main channel of Coos Bay is a low sand marsh-- the only marsh of any consequence in this outer part of the hay. The marsh extends for about 200 yards along the shore just north of the sewage treatment plant, and covers the landward shore of a low island at the south end. The substrate is sandy and gently sloping, with no drainage channels or dropoffs. The vegetation on the island consists mainly of Salicornia, Cuscuta and Jaumea quickly grading into Scotch Broom, Trifolium, and native dune grass. In the low channel between the island and the shore there is Salicornia, Triglochin and Scirpus americanus; on the shore itself Carex is abundant on the higher edge, with Triglochin and Eleocharis below.

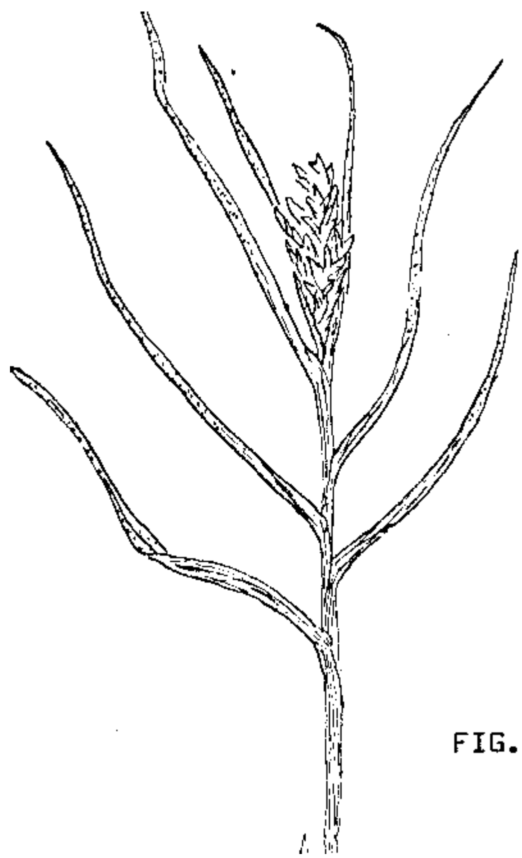


FIG. 9

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SALT MARSH PRIMARY PRODUCTION IN COOS BAY

Primary production refers to the trapping of energy by plants from the primary source of energy, the sun. Light energy is utilized in photosynthesis by plants to assimilate carbon dioxide from the atmosphere into carbohydrates, which then are utilized by herbivores and so travel along the food chain. The energy which went into assembling the small units of carbon, hydrogen, and oxygen into large molecules of "food" is released whenever the molecules are broken down in the process of respiration, whether this takes place in the plant, a herbivorous mammal such as a cow, or by bacteria during decay. Since we are here interested in the energy that is transferred by the salt marsh plants to the rest of the system (the estuary), we would like to ignore the part of the trapped energy used by the plant as it respires; we are speaking of net primary production.

There are several methods for estimating net productivity, including the use of radioisotopes, the monitoring of CO_2/O_2 balance, and the measurement of actual plant mass change over time. The first method involves enclosing the plant in an airtight, transparent chamber and feeding in radioactive carbon dioxide ($^{14}CO^{2}$). After a period of time, the plant is removed and the amount of ^{14}C in thetissues is measured. This gives a direct rate of $^{CO}2$, assimilation; however, there are many technical difficulties involved in its use and equipment is expensive. The second method, that of gaseous exchange, utilizes an infra-red gas analyzer to measure changes in CO_2 and 0_2 concentrations, which are related to photosynthesis and respiration rates. Once again, the equipment needed is very expensive.

The third method, and that which has been most widely used, is the harvest method. Simply stated, it consists of clipping a specified size plot of herbage, drying, and weighing it; the process is repeated on a plot similar to the first after a period of time, and the difference in mass between the two represents the amount of growth during the time period.

Primary production of marshes (considered as grasslands) consists of two factors: root production and aerial production. In a harvest method these are usually estimated separately and added, since they involve different problems. Both factors are complicated by the fact that some of the plant material dies and is removed by decay or other action (tidal, for example) during the period of the study. For roots this effect is usually ignored, since the mortality of roots is very hard to determine. For aerial growth, however, an attempt can be made to correct for mortality losses by estimating its rate and adding this to the production total.

In our attempt to estimate the productivity of Coos Bay marshes, we chose the harvest method, using a modification of that used by Wiegert and Evans (1964). As suggested by Lomnicki (1968), in short term experiments, the amount of live shoot material that dies and is removed by decay is negligibly small. However, this would not necessarily be true of a situation of removal of material by tides; for this reason we chose a study site in *a* recently diked and tidegated marsh (along Coalbank Slough). The **area** had marsh plants still and the appearance of a sedge marsh, but was not subject to flooding by tides any longer. A second area, in normal sedge marsh (also on Coalbank Slough), was tested for comparison.

The areas sampled were in the south end of the diked marsh, and the eastern end of the undiked marsh. Two adjacent plots (each 0.5 m X 0.5 m) were chosen at random by tossing the measuring quadrat into the sedge and cutting wherever it landed. One sample plot was clipped and the green material separated, dried at 100° C for 24 hours (or until constant weight was attained), and weighed to the nearest 0.1 gram. The standing crop of dead shoot material of the adjacent plot was removed (without unduly disturbing the growing plants). This dead material was also dried and weighed. The second plot was allowed a period of time (from 3 weeks to a month) and then was clipped; the "new" dead material was separated, dried and weighed.

The equations for the modified method are as follows (from Lomnicki, et. al. 1968):

b_o = weight of live shoot material from plot 11 1

b_1 = weight of live shoot material from plot 1/ 2

d = dead shoot material produced during interval

Then, Net Primary Production = - 1) 0) + d + change in root biomass.

Production is expressed in grams carbon fixed/meter2

Root production as such was not measured due to difficulties with sampling. Instead a single set of samples was taken and biomass was measured..

The results of this productivity experiment are not listed because they indicated a negative production rate. This was probably a result of the fact that the growing season had already passed its peak, and the plants were no longer actively growing. While recognizing the need for further and more well-timed work in this area, we also wanted to get some idea of the value of the salt marshes to the Coos Bay estuary, and so turned to a different method of data analysis: biomass measurement.

BIOMASS MEASUREMENTS

The term "biomass" refers to the weight of all the animals and plants in a sample area. Its measurement is considerably easier than the estimation of a production rate but does not give as accurate a picture of the biological value of the system, since no definite conception of the time taken to produce the measured amount of material is formed. In our case, we have had to resort to biomass measurements because of the situation described above. Since the marsh plants had already reached their maximum growth apparently, mortality and respiration must have been more than keeping pace with production, causing the negative apparent production figure. For this reason also, the biomass figures are not representative of the maximum standing crop but are low by an undetermined amount. Also, the handling necessary to remove the dead standing crop from the quadrat left standing (in the first Coalbank Slough samples) may have caused enough damage to the plants to have affected their growth.

From brief preliminary surveys of the Coos Bay marshes and from talking to people in the area, we found that, until about February, the marshes were essentially "dead" and had relatively little standing crop. Therefore, the biomass figures can be considered this year's growth, and an idea of production can be tentatively reached. This figure will be high owing to an undetermined amount of last year's dead standing crop (although in most cases this is not large), as well as rootstocks and plant parts that survived the winter. In the case of plants such as Triglochin and Carex, these are a very considerable amount, as the plants spread by means of underground rhizomes, as well as storing food in the roots.

Aerial Biomass

A quadrat 0.5m X 0.25m (encompassing $0.125m^2$) was constructed with an open end to facilitate placing it in dense herbage (Thilenius, 1966). This was used to obtain uniform size samples; randomness within a sampling area *was* obtained by throwing the quadrat out into the area and clipping the plot where it fell. Clipping was done as close to ground level as possible (to within 1 inch) with a pair of garden hedge clippers. Clipped herbage and dead material on the ground was placed in a plastic bag and tied shut. Later (within 12 hours) the samples were either weighed wet and replaced in bags for future drying, or placed directly in the oven for drying at 100° C (24 hours or until constant weight), and subsequent weighing. Samples that could not be dried immediately were stored in a freezer. The results of the aerial biomass measurements are shown in Table 2.

Root Biomass

Soil cores of known area and uniform depth were taken in sampling areas. These were taken with either a sharpened galvanized pipe (4.0 cm inside diameter) or a clam gun (12.3 cm inside diameter) depending on the substrate. The pipe could be turned with a handle at the upper end to facilitate penetrating hard ground and root masses. After the pipe was in the ground to the desired depth, the top was sealed (by closing with a wadded plastic bag) to help keep the soil core inside when the pipe was withdrawn. The soil core was pushed out of the pipe by a close-fitting rod into a plastic bag, to be washed later. The washing was done by hand over a wire screen with 60 meshes/inch, under a stream of water from a garden hose. The washed roots were caught on the screen and dried for 24 hours in an oven at 100° C. They were weighed to the nearest 0.01 gram. The results are shown in Table 3.

The depth to which cores were taken was either 40 or 50cm. In some types of substrates it was impossible to penetrate 50 cm so the lesser depth was used. An experiment was done to determine the difference in root dry weight between 40- and 50-cm cores; the results indicated that, in sedge marsh vegetation, there was no significant difference between the two depths (P less than .05, one-tailed t test; t=.303 with 8 degrees of freedom). The 40-cm average dry weight was 4.60 g (std. dev.=2.02 g) while the 50-cm average dry weight was 5.00 g (std. dev.=2.15 g). This shows that the major portion of the roots at least **is in** the top 40 cm of soil.

Results.

In order to compare biomass figures of the Coos Bay salt marshes to those of other areas, work from the east coast of the United States must be used, as very little has been done on West Coast marshes. Some biomass figures from eastern marshes (which have a different flora than Coos Bay) are given in Table 1 (from Nixon, 1973). The Coos Bay biomass figures, when considered with latitude, length of growing season and climate, are well within the range of established values for salt marshes, at about 800 g/m^2.

TABLE 1. Biomass of *Spartina alterniflora* (aboveground portions only) at the end of the growing season in some salt marsh ecosystems

Marsh location	Biomass (g dry weight/m2)
Georgia	1,290
North Carolina	1,100
Virginia	1,332
Maryland	1,207
Delaware	560
New Jersey	1.600
Long Island, N.Y.	827
Rhode Island	840
Petpsewick Inlet, Nova Scotia	580

The large standard deviations seen in most of the marsh data reflect the variability of vegetation cover present, as well as sampling error. This variability is evident not only in the density of plant cover but in the types of plants in any one area. Many of the marsh plants grow in stands'(e.R. *Carex, Juncus, Distichlis*) or tufts (*Deschampsia, Triglochin*) that differ in dry weight and productivity from each other. When a marsh is sampled for biomass measurement, several quite. distinct stands may be chosen, with resulting variation.

The ratio of wet/dry weight was not consistent, showing a wide range of water content values. This situation occurred within as well as between sampling areas.

The different types of marsh within the Coos Bay system are surprisingly close in terms of biomass present; general appearances are here deceiving. The lower **marshes**, with their woody and stout **vegetation, are** if anything more productive than their grassy, verdant counterparts in the sedge and immature high marshes. This may. not be the case with their value as detritus sources, however; more work needs to be done in this area.

TABLE 2. Aerial biomass in Coos Bay salt marshes.

Date Collected	Sample area	# samples	Wet weight + std. ev. (O2),_—_(9/m)	Dry weight + std. dev. (g/m2) (g/m4)
6/5/74	Coalbank (diked)	8		835 + 206
6/5/74	Coalbank (undiked)	4		855 ± 85
6/20/74	South Slough (Salicornia)	6	3264 + 2218	981 ± 272
6/28/74	Coalbank (diked)	7		660 ± 106
6/28/74	Coalbank (undiked)	3		670 ± 44
7/3/74	North Slough	6		797 ± 268
7/7/74	Pony Slough	12	3188 t 1357	954 ± 182
7/11/74	Shinglehouse	17	3229 ± 724	714 ± 259
7/12/74	Pony Slough	12	1750 ± 1132	909 t 102
7/15/74	South Slough (South)	9		789 ± 288
8/5/74	Coalbank (diked)	9	2538 ± 388	1114 ± 153
8/5/74	Coalbank (undiked)	9	2195 ± 317	834 ± 130

The biomass measurements taken in Coalbank Slough at the beginning and end of the summer serve to illustrate one of the consequences of diking marshland. In early June the two sample areas, one diked and one undiked, were similar in appearance and there was no significant difference (P less than .05, t = .21, 10 df) in biomass between them. When another set of samples was clipped in early August, it was noted that the diked area had much dead and decaying herbage present, while the undiked marsh was composed almost wholly of living plants. The results of a comparison of the sample means from the two marshes now showed a significant difference (P **less** than .05, one-tailed t test: t = 4.19, 16df) in biomass. If we assume the growth rates of the e^g^o marshes to be equal, the larger biomass figure for the diked marsh can be explained by the absence of tidal removal of dead plant material. This implies that the dead material from the undiked marsh had been added to the estuarine food chain as detritus. If other factors are equal, the estuary can be considered to have lost an amount of detritus equivalent to the difference between the two sample area biomass figures--roughly 280 g/m^2, or about 59,000 lbs. (27,000 **kg)**- from the diking of this 25 acre marsh.

No significant difference was found between the means of root biomass samples taken in the undiked and diked sedge marsh in early August (P less than .05, t = 1.65, 18df). The difference between the means of root samples in the diked marsh in June and in August was significant, however, with the root biomass decreasing with **time** (P less than .05, t = 3.78, 16 df). The reason for this situation is unknown, and the need for further work is indicated.

The results of the root biomass study are shown in Table 3. It is obvious that the major portion of the biomass of the marsh is located underground; some marshes showed aerial/root ratios of 1:2 or even more. In addition, this estimate is probably in error on the low side, as some roots certainly penetrate farther than 40 cm below the surface of the ground. However, since the contribution of roots to the functioning of the estuary is difficult to determine (except as purely physical soil-holding properties) these findings are of largely academic interest here.

TABLE 3. **Rodt** biomass in Coos Bay Salt Marshes.

Date Collected	Sample location	# Samples	Dry Weight ± std. dev. (g/m2)
6/5/74	Coalbank (diked)	8	1528 ± 340
6/20/74	South Slough (Salicornia)	6	1212 ± 370
7/3/74	North Slough	3	1934 ± 230
7/7/74	Pony Slough	11	1962 ± 672
7/10/74	Shinglehouse Slough	8	2026 ± 950
7/12/74	Bull Island	11	1654 ± 1142
7/15/74	South Slough (south)	9	1346 ± 220
8/5/74	Coalbank (diked)	10	1198 ± 226
8/5/74	Coalbank (undiked)	10	960 ± 396

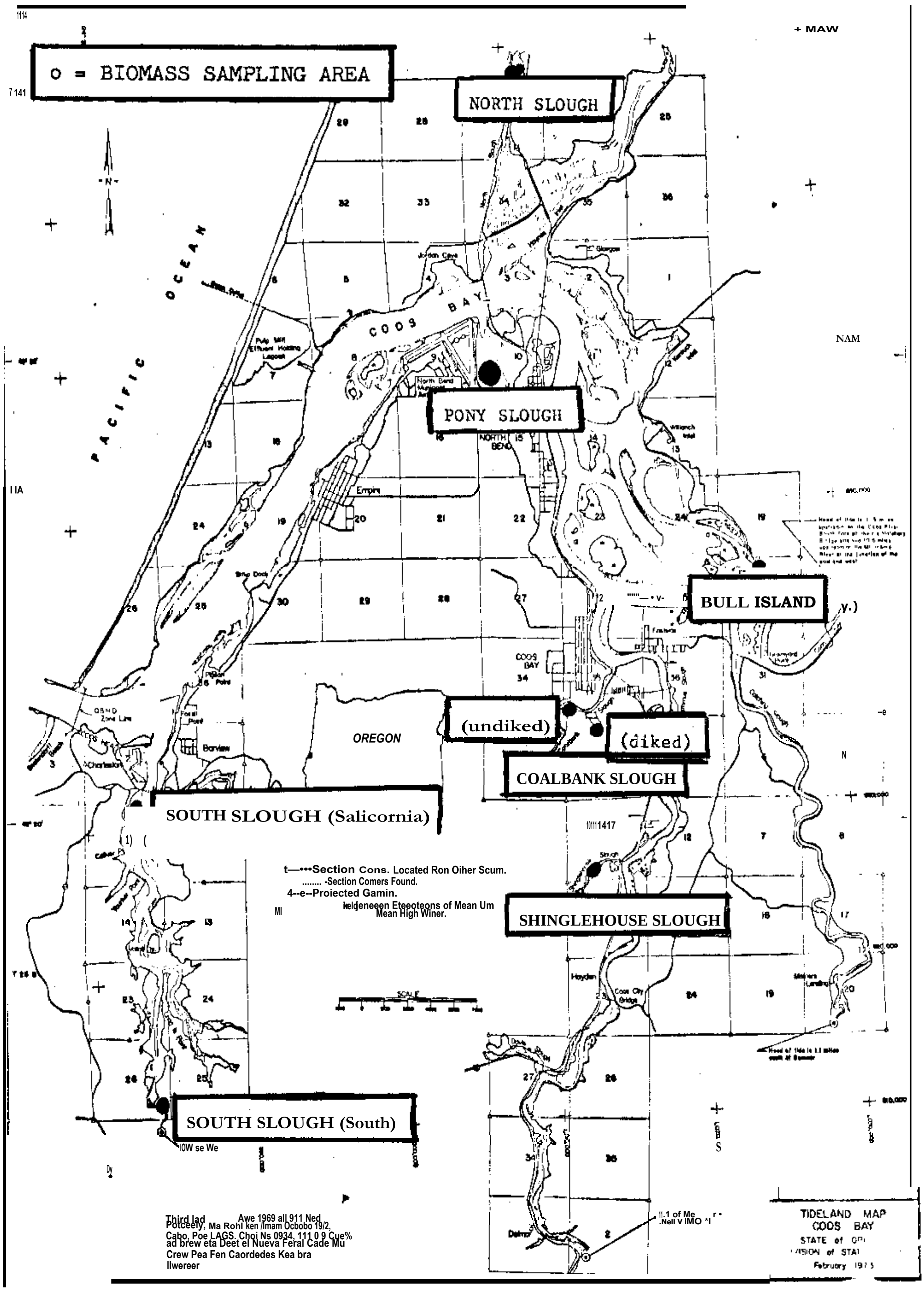
Ash-Free Dry Weights.

Selected subsamples of the dried vegetation samples were oxidized in a muffle furnace at 600° C for 24 hours. By burning all of the organic material away and reweighing the residue, the ash-free or organic weight can be obtained by difference. This is useful in determining the amount of carbon actually assimilated by the plants, since approximately 45% of ash-free dry weight of organic materials is carbon (Keefe, 1972). These results are shown in Table 4.

TABLE 4. Ash-Free Dry Weights of Vegetation Samples

Date Collected	Sample area	Herbage type	Ash-Free Dry Weight (g/m^2)	% of Dry Weight
6/27/74	Coalbank (diked)	Carex (Root)	1277	83.6
7/7/74	Pony Slough	Distichlis (Root)	1439	74.7
7/7/74	Pony Slough	Distichlis (Root)	1450	75.3
8/5/74	Coalbank (diked)	Carex (Root)	1029	85.9
8/5/74	Coalbank (diked)	Carex (Root)	857	71.5
8/5/74	Coalbank (undiked)	Carex (Root)	767	79.9
6/28/74	Coalbank (undiked)	Carex (Aerial)	578	86.5
6/28/74	Coalbank (undiked)	Carex (Aerial)	589	87.9
7/15/74	South Slough (south)	Deschampsia, Carex (Aerial)	629	79.8
8/5/74	Coalbank (diked)	Carex (Aerial)	787	70.7
8/5/74	Coalbank (diked)	Carex (Aerial)	827	74.3
8/5/74	Coalbank (undiked)	Carex (aerial)	527	63.2
8/5/74	Coalbank (undiked)	Carex (Aerial)	556	66.7

We found that the ash-free dry weight is very dependent on the amount of silt deposited on the plants by the falling tide (which is easily visible in sedge and immature high marsh after a high tide). Since this is variable and cannot be easily corrected for, the ash-free dry weights are not a good representation of the percentage of organic material in the plants. The dry weights, which are not affected as much by the small amount of external mud, were therefore used for comparison purposes.


o = BIOMASS SAMPLING AREA
NORTH SLOUGH
PONY SLOUGH
BULL ISLAND
(undiked)
(diked)
COALBANK SLOUGH
SOUTH SLOUGH (Salicornia)
SHINGLEHOUSE SLOUGH
SOUTH SLOUGH (South)
PACIFIC OCEAN
COOS BAY
OREGON
Empire
NORTH BEND
COOS BAY
TIDELAND MAP
COOS BAY

SALT MARSH OWNERSHIP

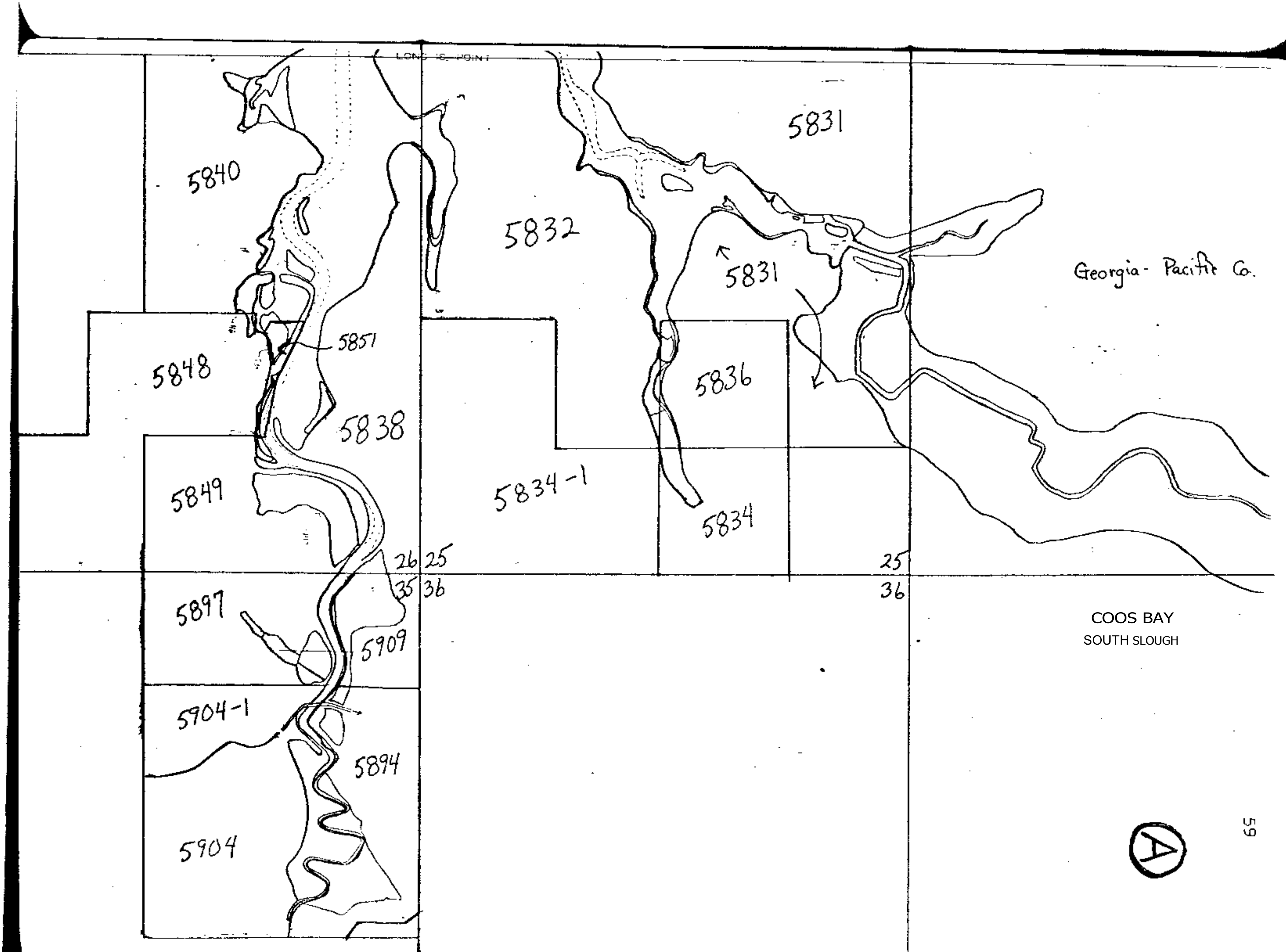
The ownership and land value of the salt marsh areas within Coos Bay play a large part in the wise management of this resource. Through conversations with the Coos County Assessor, Roger Duncan, and information provided in Coastal Wetlands of Oregon, the following facts were obtained. The present marsh acreage in Coos Bay is assessed at a value of from 10-50 dollars an acre, due both to its inability to function as prime pastureland and to agricultural subsidy. This value does not, however, reflect the true market value of the salt marsh involved, but according to the county assessor, the purchase price of the land probably would not exceed 100 dollars an acre. Access to sewage and water systems as well as roads and the potential for future development may raise these values significantly. Since the potential for future diking and filling of marshlands does exist and the price of a bayside lot may often exceed $10,000, it may be assumed that many of the owners of salt marsh in Coos Bay are holding their land for speculative purposes, as an assessed value of $50 an acre is no great tax burden.

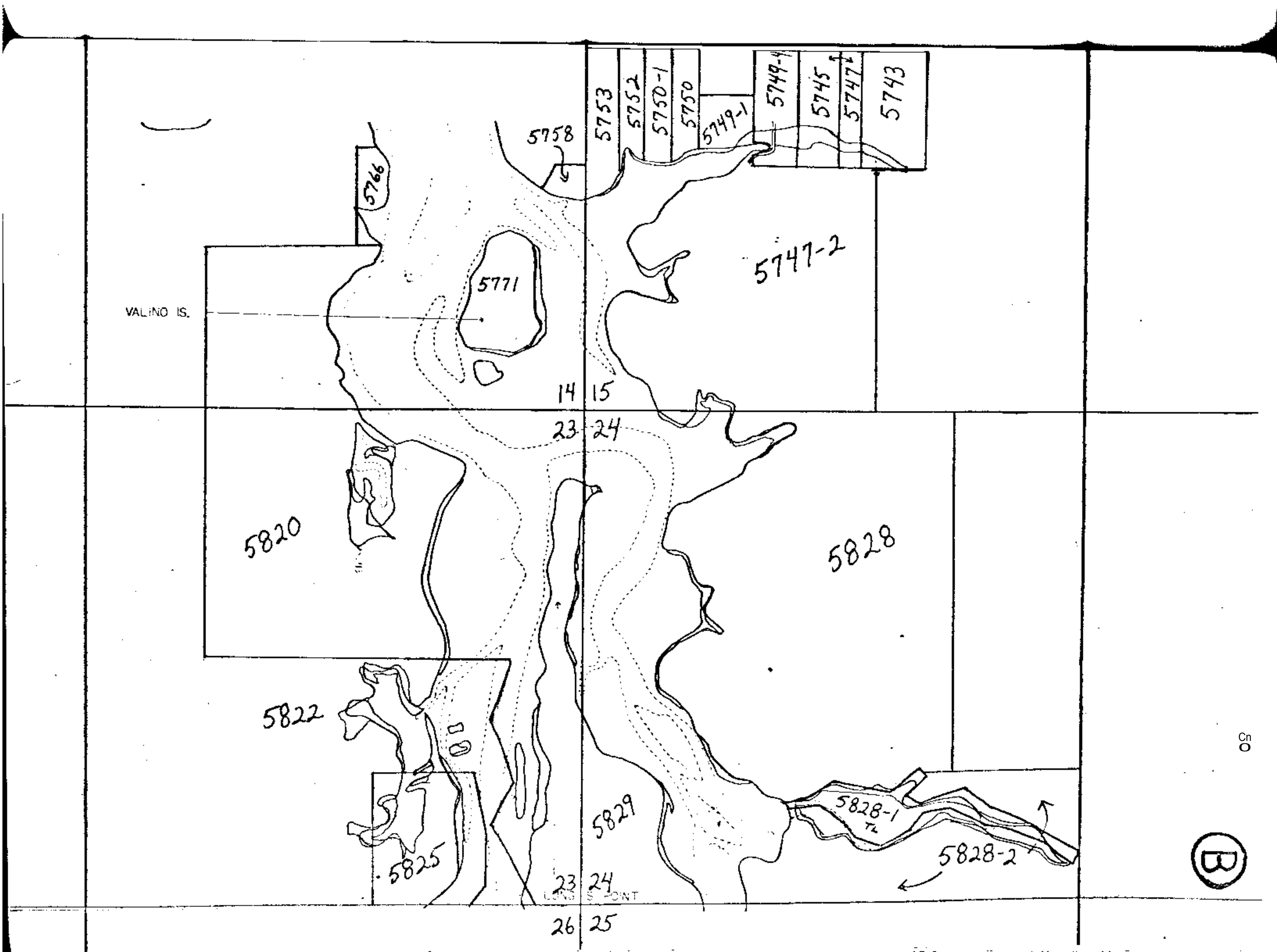
With a lack of market activity and tighter development restrictions regarding septic tanks and water supply, the value of the marshlands has remained stable over the past few years.

In general, salt marsh acreage in Coos Bay is in the hands of private owners. Much of this acreage is as a part of large farms that have been in the hands of these owners for some time. Large exceptions to this generality occur in certain areas, most notably in North Slough, Davis Slough, Bull Island and surrounding, and South Slough. These large tracts of salt marsh land are in the hands of large lumber companies and are presumably being held for their potential as log storage areas. The County and State own surprisingly little salt marsh acreage in Coos Bay.

The object of determining ownership of salt marsh lands in this report was in order to facilitate further research, preservation, and conservation of marshlands. As the potential for the State's purchasing of salt marsh lands below high water as well as the possibility of trades of marshlands for lands presently diked exists, it seemed appropriate at this time to'determine the ownership of the Bay's salt marshes. The inadequacies of our methods are obvious. Without much further labor, the amount of salt marsh versus agricultural or residential land could not be determined from County records. This problem presents difficulties in determining a true assessed value for salt marshlands, as some of the areas mentioned contain 150 acres of pasture and 10 acres of salt marsh while some contain only salt marsh acreage. This makes some assessed values presented seem absurd. It is recognized that the assessed value information presented will be of little use, the value of this section being in its determination of ownership, acreages, and taxlot numbers of salt marsh and adjacent lands. This information alone will save great amounts of time to future researchers.

In some cases the question of who owns a certain salt marsh is unresolved even at the State level. The Division of State Lands claims ownership as well as the person living near the land. The most current information concerning ownership of tidelands is presented in Tidelands Ownership Map of Coos Bay printed by the Division of State Lands, although discrepencies still do exist. Following is the ownership and assessed value of the salt marshes in the Coos Bay area.


5840
5832
5831
5831
Georgia-Pacific Co.
5851
5848
5838
5836
5849
5834-1
5834
26 25
35 36
25
36
5897
5909
COOS BAY
SOUTH SLOUGH
5904-1
5894
5904
A


5753
5752
5750-1
5750
5749-1
5749-4
5745
5747-1
5743
5758
5766
5747-2
5771
VALINO IS.
14
15
23
24
5820
5828
5822
5825
5829
5828-1
5828-2
23
24
26
25
B

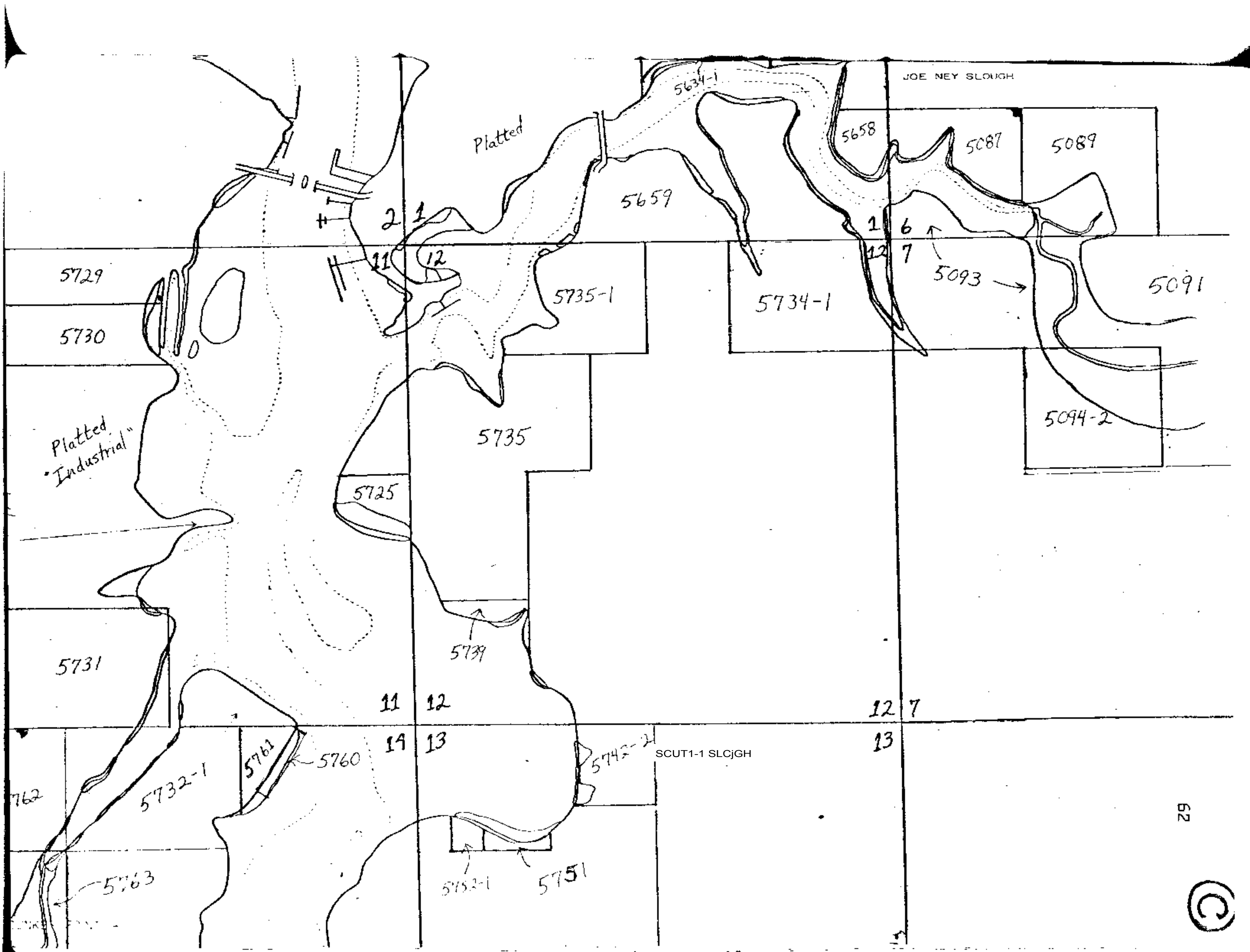
OWNERSHIP: TAX LOT NUMBER, TOTAL ACREAGE, AND ASSESSED VALUE

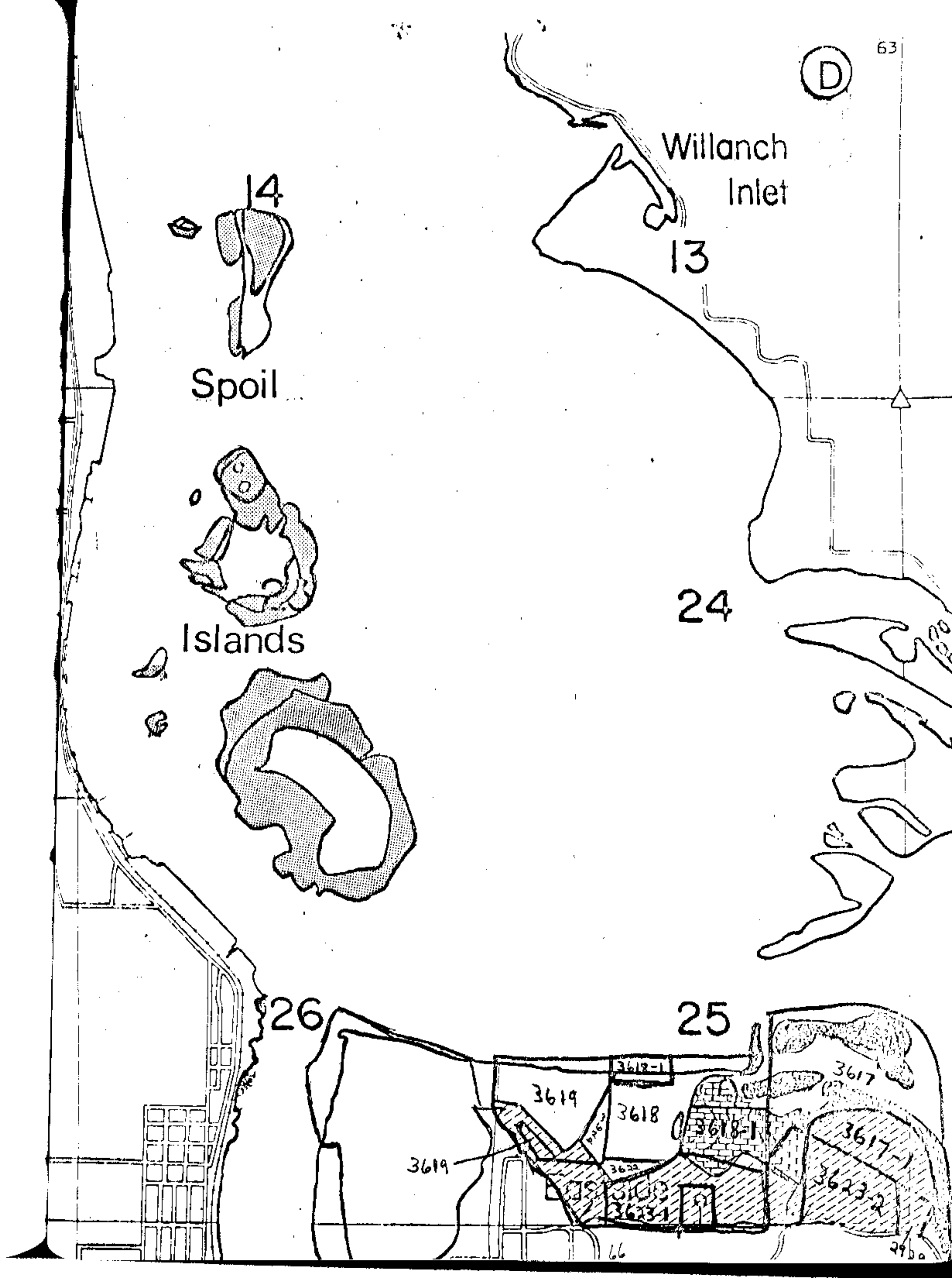
$OUTH SLOUGH (A)

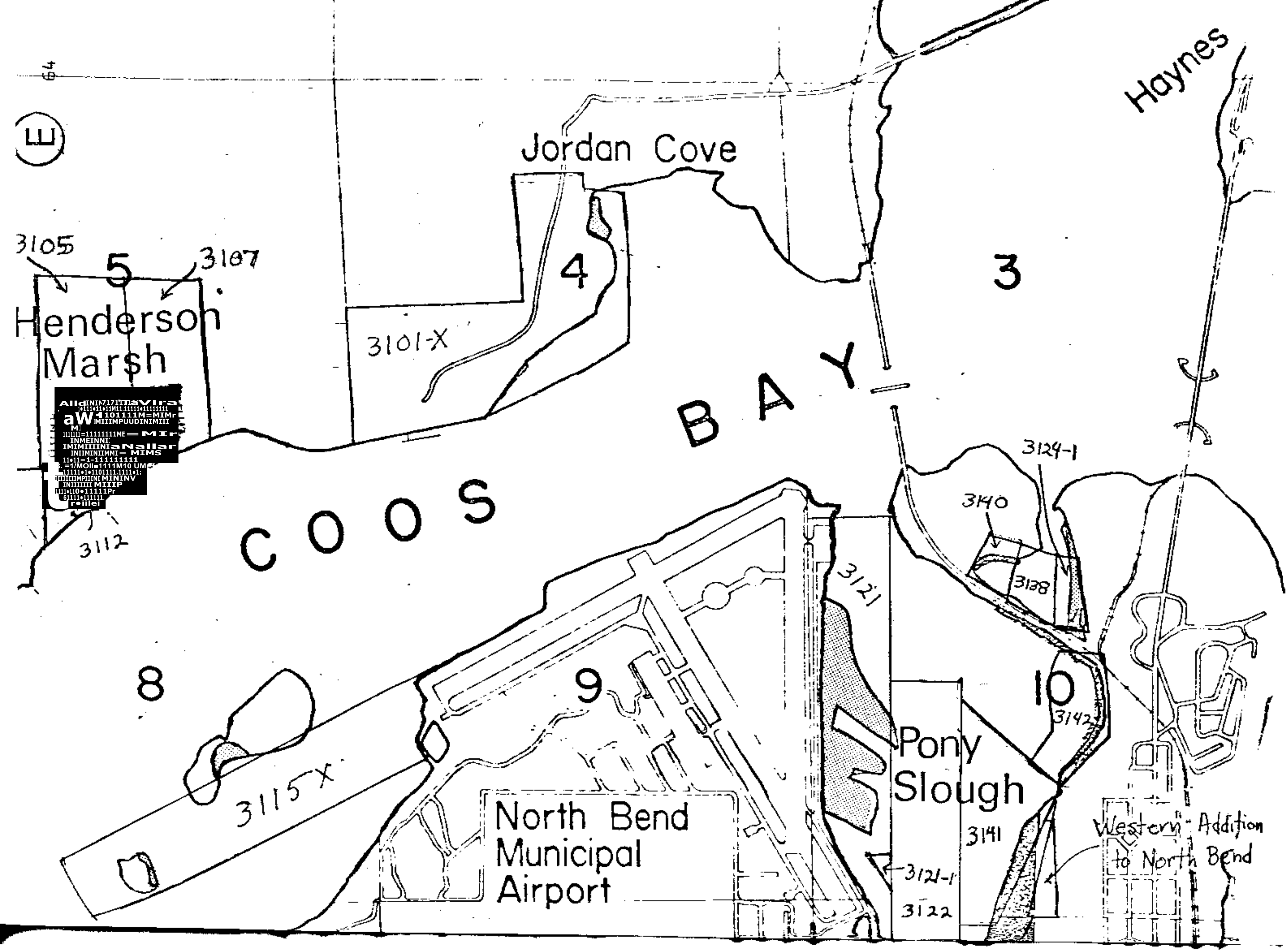
Tax Lot No	Owner	Area (acres)	Assessed Value ($)
5831	Georgia Pacific	9.7	$ 2,480
5832	Moore Oregon Log Co	145.04	5,040
5831 X	Georgia Pacific	9.7	2,430
5834	Moore Oregon Log Co.	40	1,480
5834-1	Moore Oregon Log Co.	98.90	2,770
5836	Coos Head Timber	79.56	2,550
5838	John Anderson	51.26	2,220
5840	Coos Head Timber	56.24	2,590
5848	Georgia Pacific	30.51	1,400
5849	Eleanor Jacobson	60	12,330
5851	Georgia Pacific	8.67	1,730
5894	Marion Tracy	22.6	4,810
5897	Elanor Jacobson	60.55	10,100
5904	Ken Fredrickson	85.89	6,520
5904-1	Coos Head Timber	27.92	1,020
5909	Ken Morris	9.06	2,870

SOUTH SLOUGH (B)

Tax Lot No.	Owner	Area (acres)	Assessed Value ($)
5743	Everett Oxford	22.17	$ 13,170
5745	Phillip Cope	27.48	9,190
5747	" "	"	"
5747-1	" "	"	
5742-2	Georgia Pacific	115.10	4,260
5749	W. Justrom	4.70	5,950
5749-4	Walter Meek	6.15	8,680
5750	Ben Ash	19.49	4,570
5750-1	" "	"	"
5752	" "	"	
5753	Lura Schultz	11.0	6,350
5758	Tom Yonker	5.73	16,740
5766	Qualman	20	3,000
5771	J. D. Bergen	23.25	860
5819	Bohemia Inc.	42.14	19,180
5820	Pete Wilson Realty	147.11	4,120
5822	Georgia Pacific	116.46	3,950
5825	Pete Wilson Realty	63.0	12,870
5828	Georgia Pacific	245.77	
5828-1	Georgia Pacific	9.70	2,430
5828-2	Georgia Pacific	73.69	
5829	Bohemia Inc.	37.20	13,020


JOE NEY SLOUGH
5634-1
Platted
5658
5087
5089
5659
2
1
1
6
11
12
12
7
5729
5735-1
5734-1
5093
5091
5730
Platted "Industrial"
5735
5094-2
5725
5739
5731
11
12
12
7
14
13
13
5761
5760
5742-2
SCUT1-1 SLCjGH
5732-1
5763
5751


D
Willanch Inlet
14
13
Spoil Islands
24
26
25
3618-1
3619
3618
3618-1
3617
3619
3622
3617-1
3623-2
3623-1
66



64
E
Jordan Cove
Haynes
3105
5
3107
Henderson
Marsh
4
3
3101-X
BAY
COOS
3112
3124-1
3140
3138
3121
8
9
10
3142
3115 X
Pony
Slough
North Bend
Municipal
Airport
3141
3121-1
3122
Western Addition
to North Bend

SOUTH SLOUGH (C)

Tax Lot No,	Owner	Area (acres)	**Assessed Value** ($)
5087	**Coos Head Lumber**	354.50	$ 13,1201
5089	" " "	"	"
5091	Menasha	677.55	76,500
5094-2	"	"	"
5093	Georgia Pacific	29.71	1,100
5634	*Jay* Tower	23.40	11,990
5658	**William** Arbus	14.90	23,400
5658-1	Marcella Trebaol	25.84	12,900
5659	" "	"	"
5725	Indian Point **Inc.**	46.49	36,800
5729	Melvin Wick	26.28	24,700
*5730	Henry Metcalf	30.86	12,480
5731	George Barton	73.46	4,370
5732-1	**William Hindman**	40.0	13,520
5734	Indian Point Inc.	59.93	24,000
5734-1	Marcella Trebail	50.36	25,200
5735	**Indian Point Inc.**	91.67	84,200
5735-1	Opperman	18.70	28,000
5739	Indian Point Inc.	40.31	34,300
5742-2	**DeLoris Kiester**	18.66	23,150
5751	Jean Grider	8.73	14,860
5752-1	J Woone	3.43	8,890
5760	Joseph Yonker	1	150
5761	Joseph Yonker	5.84	4,200
5762	George Barton	47.60	1,760
5763	**William Hindman**	**49.55**	11,250

***Tidelands deeded to University of Oregon**

(AMIDE (D)

aLot No.	Owner	Area (acres)	**Assessed Value** ($)
X929	Sam Choate	1.21	60
1617	Port of Coos Bay		
1617-1	George Gebhardt	26	**5,200**
1618	Port of Coos Bay		
1618-1	Port of Coos Bay		
61.9	Port of Coos Bay		
23	**Port** of Coos Bay		
1623-1	**City of Eastside**		
U3-2	**Sam Choate**	28.4	4,780

MY SLOUGH (E)

v Lot No.	Owner	Area (acres)	**Assessed Value** ($)
1101 X	Roseburg Lumber	119	802,500
6105	**Menasha Corp**	844.8	**397.690**
11107		"	

KM SLOUGH (E) (CONT.)

Tax Lot No.	Owner	Area (acres)	Assessed VAlue ($)
2115 X	City of North Bend		$
3121	City of North Bend		
3121-1	TCK Corp	2.02	400
3122	Coos County		
3124-1	Al Pierce	42.28	13,740
3138	Eulalie Merrill	11.0	3,300
3140	State of Oregon		
3141	City of North Bend		
3142	City of North Bend		

NORTH SLOUGH (F)

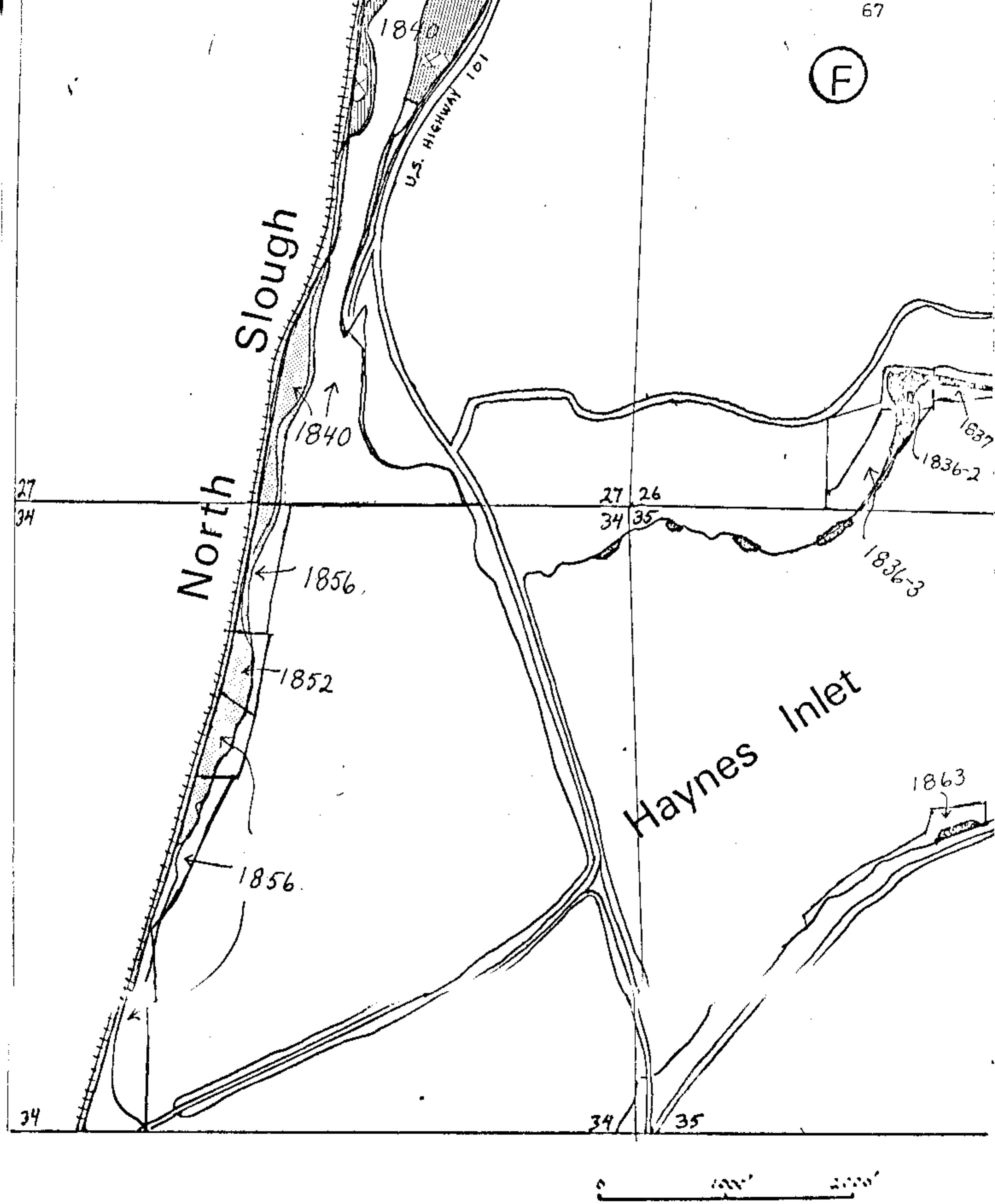
Tax Lot No.	Owner	Area (acres)	Assessed Value ($)
;1836-2	Clarence Jenson	14.64	12,700
11836-3	Boyd Arnot	7.5	9,000
11840	Al Pierce	51.0	5,100
11837	Clarence Jenson	50.33	3,030
1852	USA		
11856	Georgia Pacific	75.64	17,720
1863	State of Oregon		

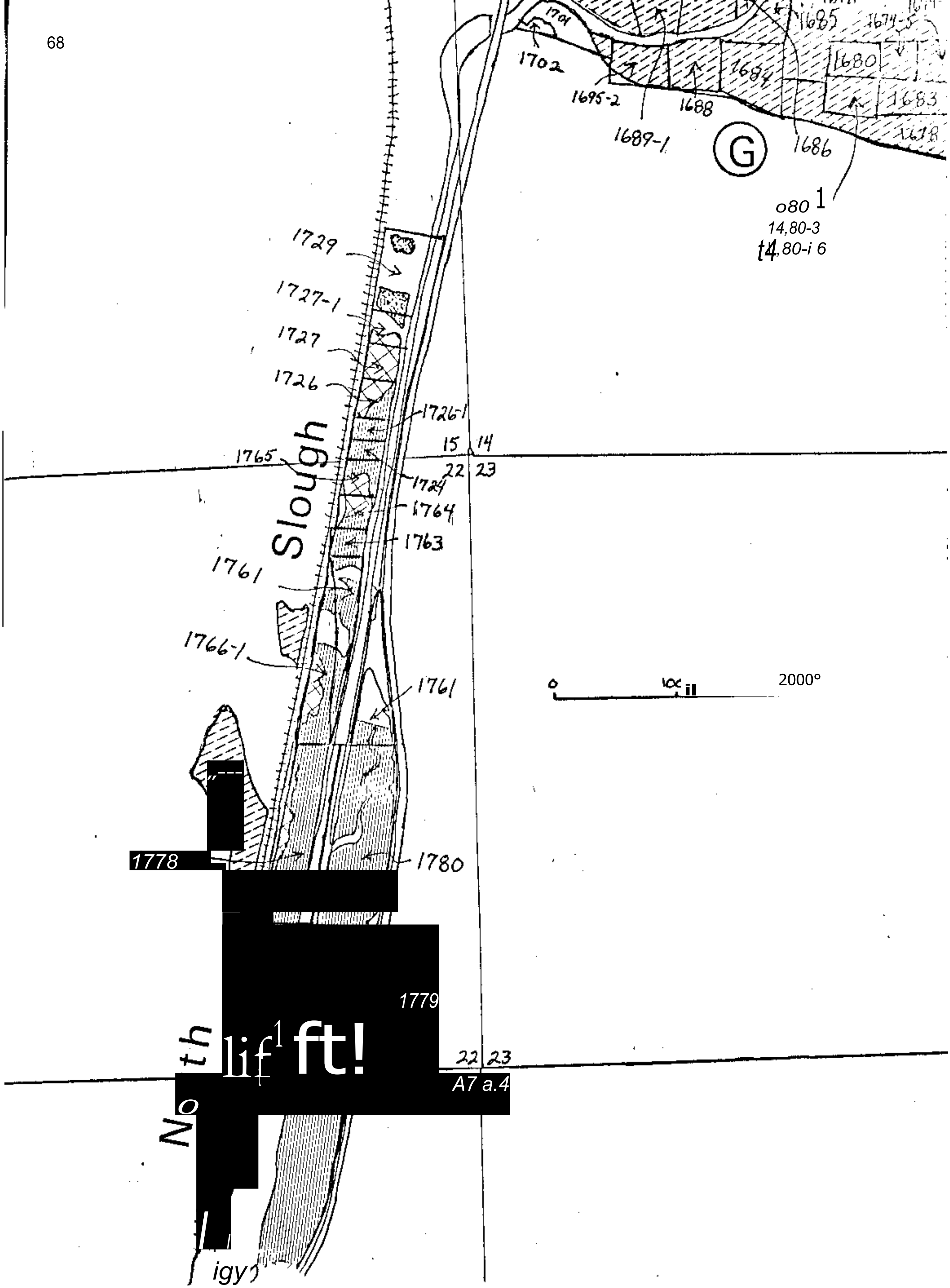
NORTH SLOUGH (G)

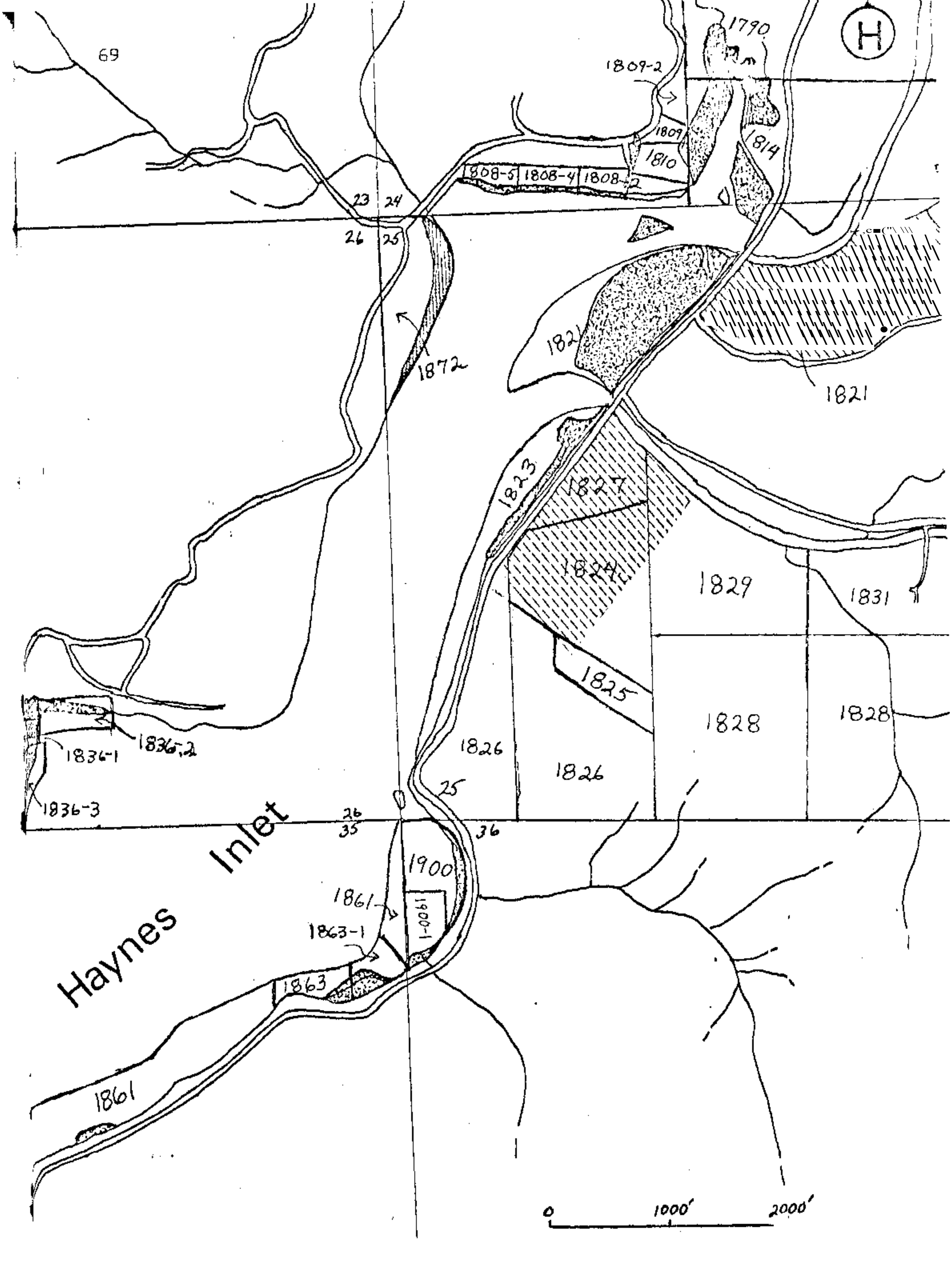
Tax Lot No.	Owner	Area (acres)	Assessed Value ($)
1724	Edward Bolt	8.4	840
1726	Dan Wright	2.65	210
1726-1	Bob Berry	9.21	920
1727	Harold Maurer	5.78	2,240
1721-1	Russell Fox	4.66	2,950
1729	Coos Head Timber	1482	22,250
1763	Reedsport Mortgage	3.11	310
1764	Milt Woodworth	3.39	340
1765	Edward Bolt	13.75	2,890
1766-1	Eleanor Forrest	75.4	12,100
1778	Eleanor Forrest	32.5	9,350
1779	Al Pierce	79.3	4,350
1780	Al Pierce		
1840	Al Pierce	51.0	5,100

HAYNES INLET (H)

Tax Lot No.	Owner	Area (acres)	Assessed Value ($)
1790	Leroy Hanson	58.02	35.720
1808-2	John Hanstruk	4.74	12,100
1808-4	George Rempelos	43.9	20,640
1808-5	Paul Wegfahrt	11.71	10,500


F
1840
U.S. HIGHWAY 101
North Slough
1840
1856
1852
1856
27
34
27 26
34 35
1836-2
1836-3
Haynes Inlet
1863
34
34
35
0
1000'
2000'


1702
1695-2
1688
1689-1
1684
1686
1680
1683
G
1729
1727-1
1727
1726
1726-1
15 14
22 23
1765
1724
1764
1763
Slough
1761
1766-1
1761
2000°
1780
22 23



H
69
1790
1809-2
1809
1810
1814
1808-5
1808-4
1808-2
23
24
26
25
1872
1821
1821
1823
1827
1824
1829
1831
1825
1828
1828
1826
1826
1836-2
1836-1
1836-3
26
35
25
36
Haynes Inlet
1900
1861
1900-1
1863-1
1863
1861
0
1000′
2000′

MYNES INLET (H) (CONT.)

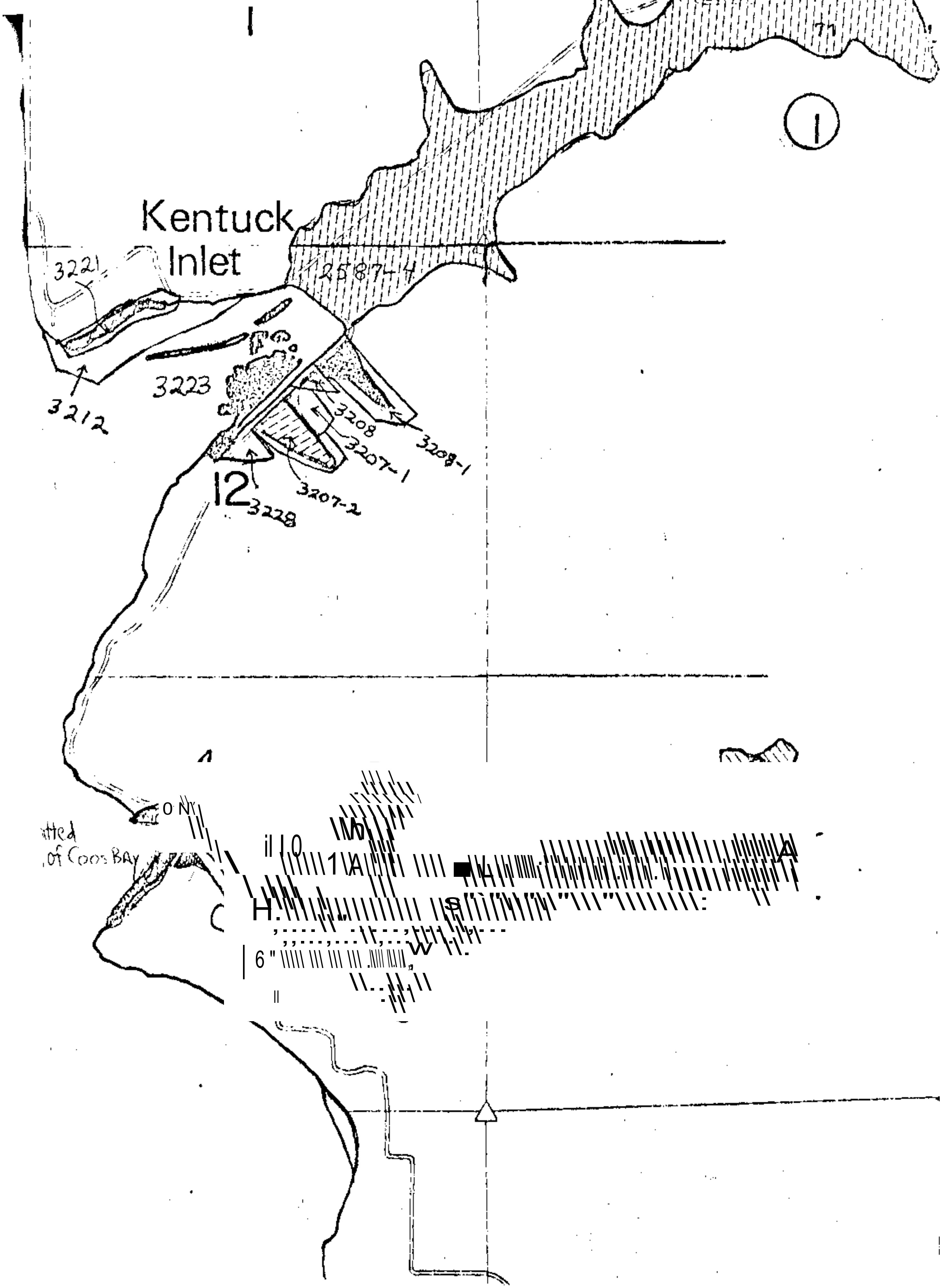
Tax Lot No.	Owner	Area (acres)	Assessed Value ($)
1809	Robert Frank	1.21	$ 700
1809-2	Robert Bernhardt	2.82	3,930
1810	Robert Bernhardt	4.85	570
1814	Coos County		
1821	George Rue	88.96	17,300
1823	Coos County		
1836-1	Al Pierce	3.69	170
1836-2	Central Lincoln P.U.D.	.27	
1836-3	Boyd Arnot	7.5	9,000
1861	Coos County		
1861-1	Wilbur Humbert	4.17	400
263	State of Oregon		
1863-1	Wilbur Humbert	2.99	5,750
1872	Sigurd Sandquist	4.15	8,350
1900	Coos County		
1900-1	Coos County		

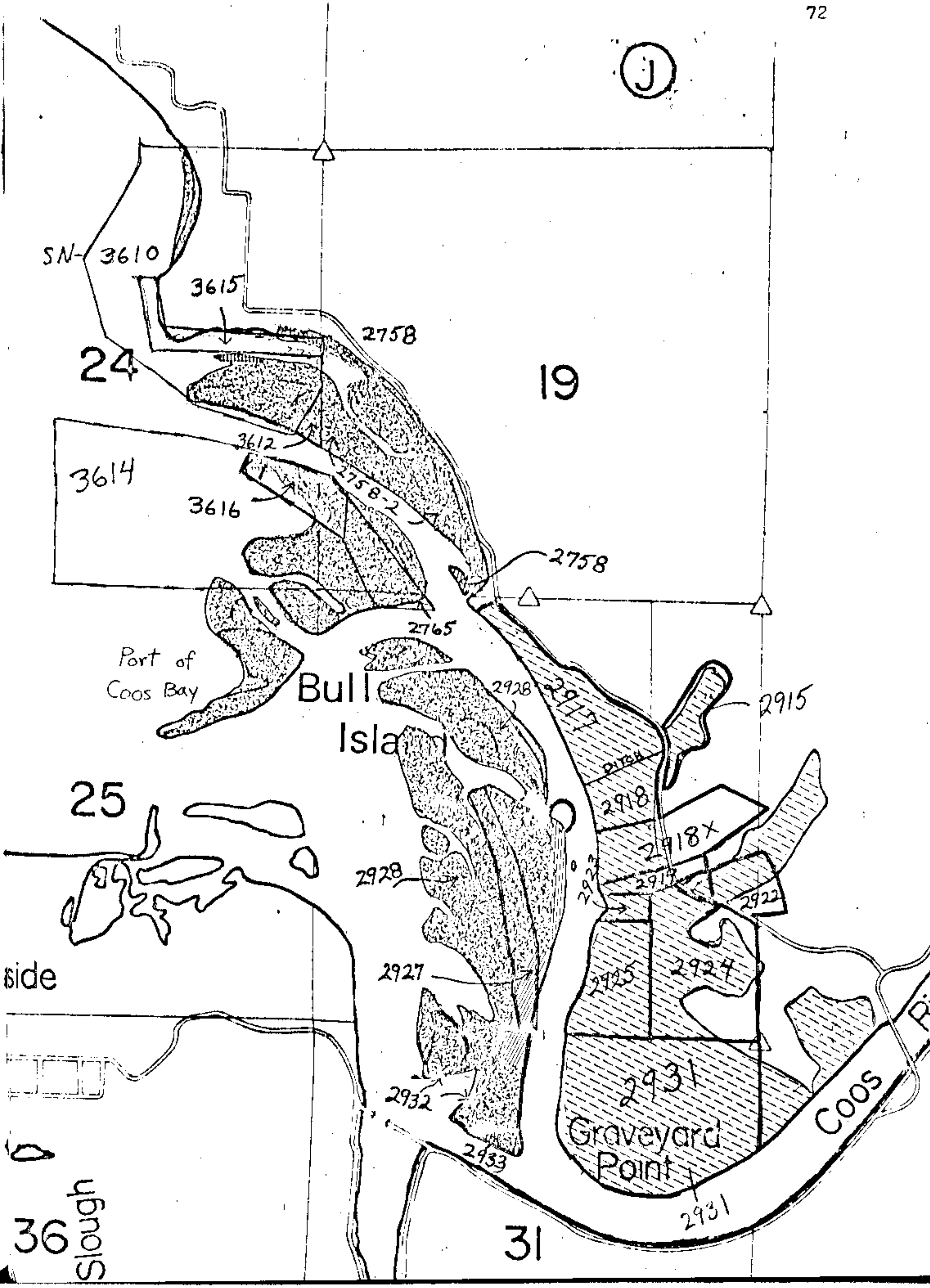
WILLANCH AND KENTUCK INLETS (I)

fax Lot No.	Owner	Area (acres)	Assessed Value ($)
587-4	Wallace Wickett	132.65	166,740
1207-1	Ellsworth Leegard	4.57	10,020
1207-2	Lorell Smith	6.23	3,540
3208	Guy Lortie	1.61	5,670
3208-1	Charles Swift	9.89	10,450
1212	T. De LaRue	29.83	2,300
1221	T. De LaRue	3.66	460
1223	Weyerhaeuser	22.5	1,800
1228	Millard Miller	27.0	16,990
952	Ruhal McCartey	99.89	28,950
3955	Ruhal McCartey	22.9	6,600
981-2	Fred Brunnell	86.85	17,800
982	Myrtle Noah	2.38	3,850
982-1	Brunnell Bros. Const.	5.5	1,380
986	Fred Brunnell	9.73	2,390

3ULL ISLAND (3)

tax Lot No.	Owner	Area (acres)	Assessed Value
3782-2	Weyerhaeuser	31.0	5,970
1765	Menasha	26.19	3,930
917	Herman U. Lilienthal	37.75	4,090
915	Herman U. Lilienthal	36.82	11,660
918	Herman U. Lilienthal	13.89	1,270
919	Joseph Kronsteiner	7.64	10,500
923	Weyerhaeuser	68.08	37,500
924	Weyerhaeuser	68.08	37,500
925	Weyerhaeuser	68.08	37,500
922	Joseph Kronsteiner	3.0	2,100
931	Weyerhaeuser	87.79	33,400
932	Menasha	6.7	250
1933	Georgia Pacific	3,56	140


Kentuck
Inlet
3221
2587-4
3212
3223
3208
3207-1
3208-1
3207-2
12
3228
1
of Coos Bay


J
19
24
SN-3610
3615
2758
3612
3614
3616
2758-2
2758
2765
Port of Coos Bay
Bull Island
2928
2917
2915
DITCH
2918
2918X
2919
2922
2923
2924
2925
2931
Graveyard Point
2928
2927
2932
2933
25
side
36
Slough
31
Coos

BULL ISLAND (J) (CONT.)

Tax Lot No.	Owner	Area (acres)	Assessed Value
2927	Menasha	20.24	1,520
12928	Raymond Beaudry	96.0	3,650
2758	Weyerhaeuser	98.19	7,390
3615	Luella De La Rhue	7.54	150
3614	Menasha	143.5	2,870
3612	Luella De La Rhue	68.2	1,360
3616	Menasha	21.62	3,240

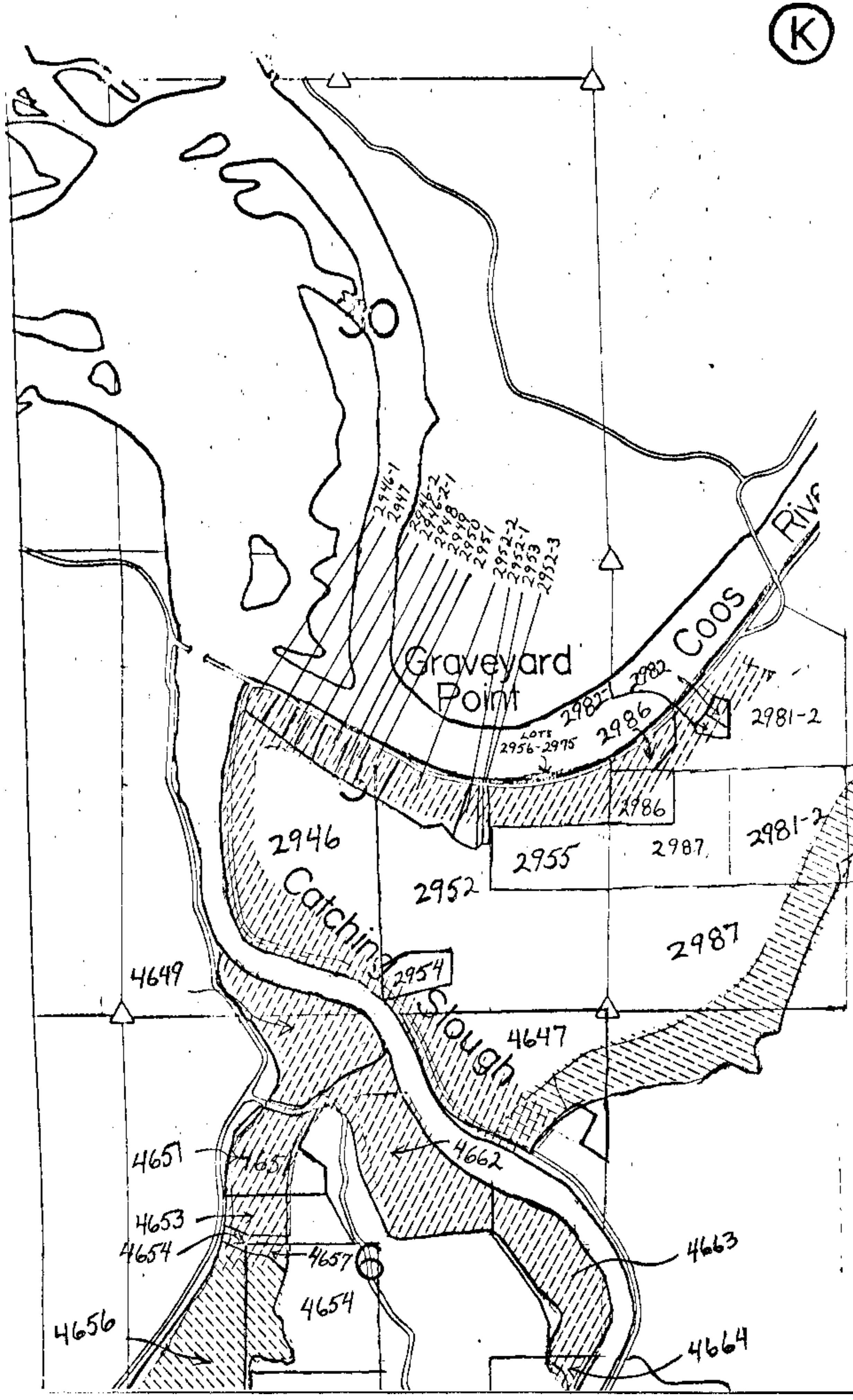
GRAVEYARD POINT (K)

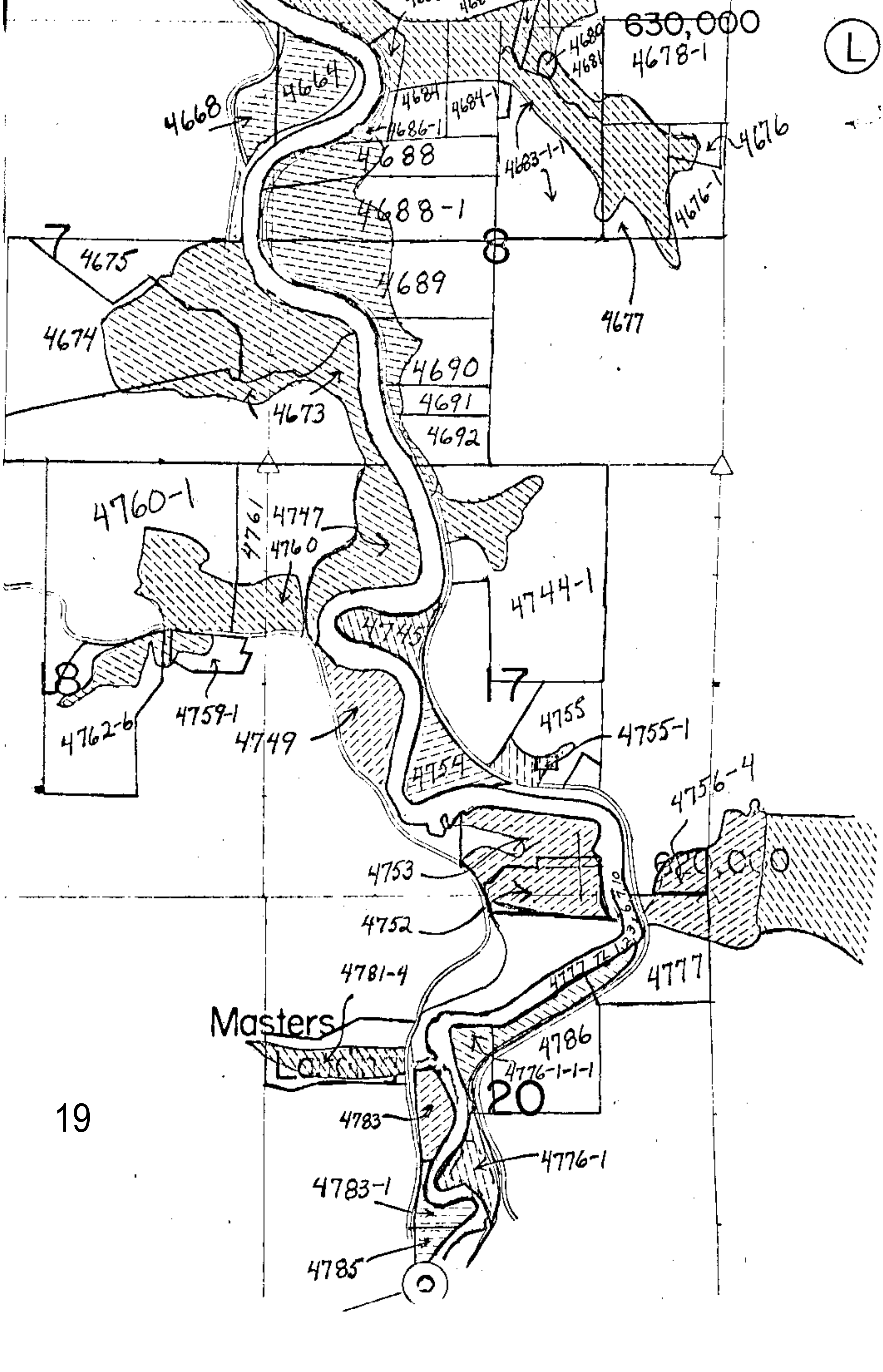
Tax Lot No.	Owner	Area (acres)	Assessed Value
2946	Richard McCarthy	86.9	26,460
2952	Richard Mc Carthy	99.89	28,950
2954	H. A. Crabtree	5.23	6,200
2955	Richard McCarthy	22.9	6,600
2981-2	Fred Brunnell	9.73	2,390
2982	Myrtle Noah	2.38	3,850
2982-1	Brunnell Bros. Const.	5.5	1,380
2986	Fred Brunnell	9.73	2,390
2987	Richard McCarthy	40.0	4.930
2989-3	Georgia Pacific	60.0	13,480
4647	John Gunnell	60.8	12,440
4649	George Messerle	33.19	24,100
4651	H. Meyer	3.45	6,330
4653	Delbert Atkins	19.35	5,350
4654	Clardy Perkins	39.69	18,790
4656	Roy Place	16.5	15,070
4657	Coos County		
4662	Donald Stacey	51.54	10,640
4663	Selmer Swanson	50.78	8,080
4664	Lorraine Jenkens	8.25	620

In addition many small lots on the Northeastern side of the dike

MASTERS LANDING (L)

Tax Lot No.	Owner	Area (acres)	Assessed Value($)
4673	Fred Messerle & Sons	32.54	24,720
4674	Fred Messerle & Sons	32.54	24,720
4675	Fred Messerle & Sons	32.54	24,720
4689	Iril Olson	21.15	5,820
4690	John Noah	7.31	6,620
4691	John Noah	7.31	6,620
4692	John Noah	"	"
4747	Messerle & Sons	26.14	17,140
4744-1	Don Baylor	9.03	16,940
4749	Lottie Irvine	5.0	4,560
4752	William Cole	40.29	29,600
4753	William Cole	"	"
4754	William Cole	9.22	8,910
4755	Niel Carlson	5.51	2,400
4755-1	Niel Carlson	1.00	1,730
4756-4	Dell Brunnell	6.70	1,070
4759-1	Russell McGriff	5.0	4,460
4761	Fred Messerle	11.11	360


K
30
2946-1
2947
2946-2
2946-2-1
2948
2949
2950
2951
2952-2
2952-1
2953
2952-3
Graveyard Point
Coos
Riv
2982
2982
2986
LOTS 2956-2975
2981-2
2986
2946
2955
2987
2981-2
Catching
2952
2987
2954
Slough
4649
4647
4651
4651
4662
4653
4654
4657
6
4663
4654
4656
4664


630,000
L
4678-1
4680
4681
4664
4668
4684
4684-1
4686-1
4688
4683-1-1
4676
4676-1
4688-1
7
4675
8
4689
4677
4674
4690
4691
4673
4692
4760-1
4761
4747
4760
4744-1
4745
18
17
4759-1
4755
4762-6
4749
4755-1
4754
4756-4
4753
4752
4777
4781-4
Masters
Lake
4786
4776-1-1-1
19
20
4783
4776-1
4783-1
4785

MASTERS LANDING (L)

Tax Lot No.	Owner	Area (acres)	Assessed Value ($)
4760	Messerle and Sons	26.14	$ 17,140
4762k6	Russell McGriff	5.0	2,510
4776-1	Eldon Yarbrough	5.0	3,250
4776-1-1-1	Duane Stevens	5.0	4,810
4777	Clifford Brunell	6.7	1,070
4781-4	Frank Ellner	31.10	7,810
4783	John Edmund	5.0	2,190
4783-1	Madge Waggoner	5.0	4,200
4785	Menasha Corp.	104.6	6,690
4960-1	Jimmie Ketchum	20.0	5,720

COALBANK SLOUGH (M)

Tax Lot No.	Owner	Area (acres)	Assessed Value ($)
3933	Rueben Humbert	16.0	9,490
3976-1	Osro Edwards	3.55	1,870
3977	Rueben Humbert	7.90	6,300
3977-1	Fred Stanley	6.5	12,000
4004	Georgia Pacific	40.54	52,500
4007	Coos Head Timber	12.0	27,840
5012	Georgia Pacific	112.55	19,260
5015	W. Kennedy	126.19	34,930
5033	Rueben Humbert	76.20	38,100

Additional acres in Boise subdivision

MILLINGTON (N)

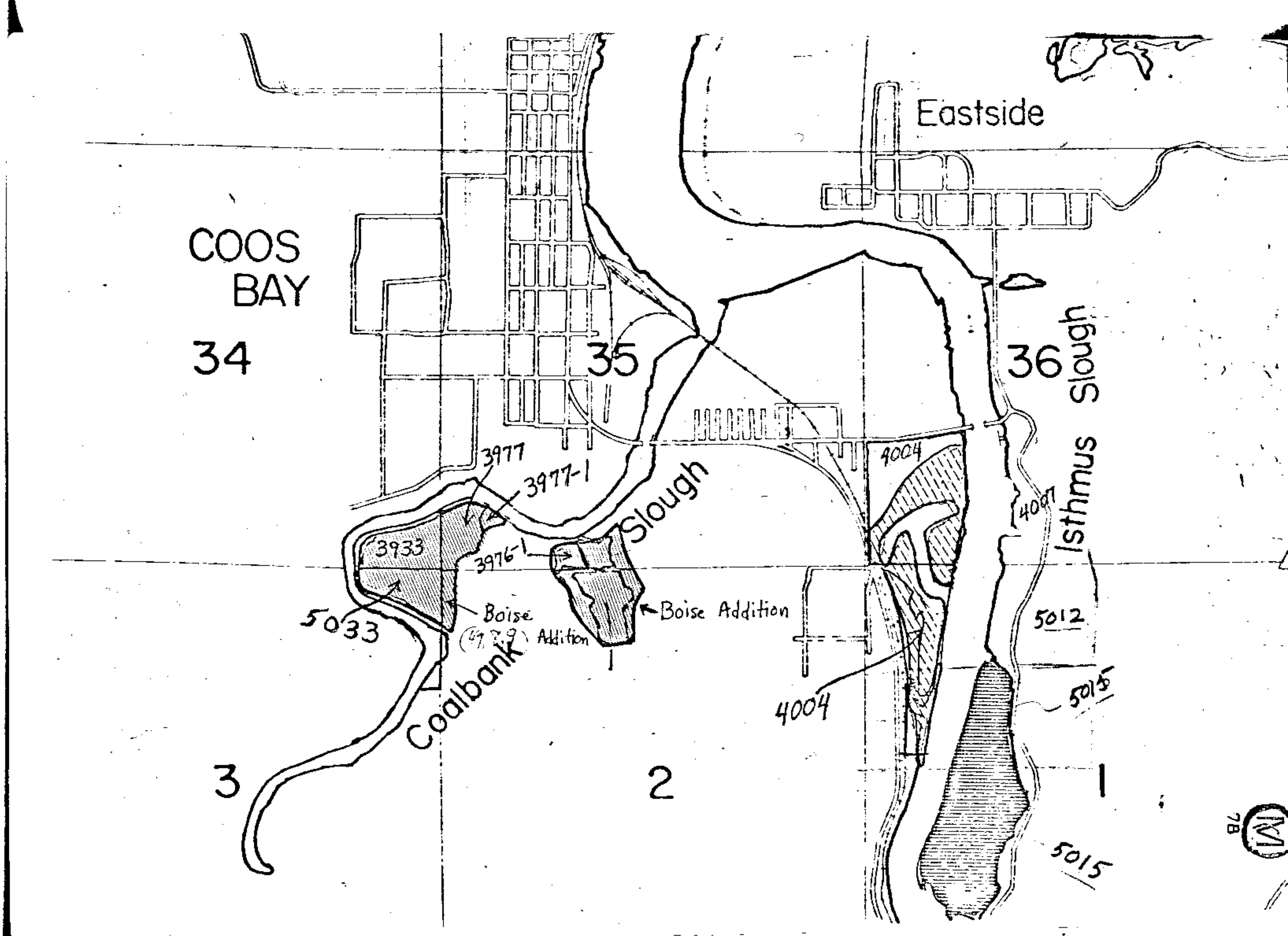
Tax Lot No.	Owner	Area (acres)	Assessed Value ($)
5170	Georgia Pacific	.75	700
5171	Georgia Pacific	64.86	94,600
5220	State Highway Comm.		
5220-2	Robert Mathews	4.0	11,000
5222	Coos Head Timber	18.5	1,850
5229	Gordon Watrous	4.0	5,000
5230	Gordon Watrous	.61	450
5231	Gordon Watrous	7.86	6,650
5259	Jane Lyons	35.5	4,850
5284	Martha Miller	9.7	26,950
5330	Jane Lyons	148	24,180

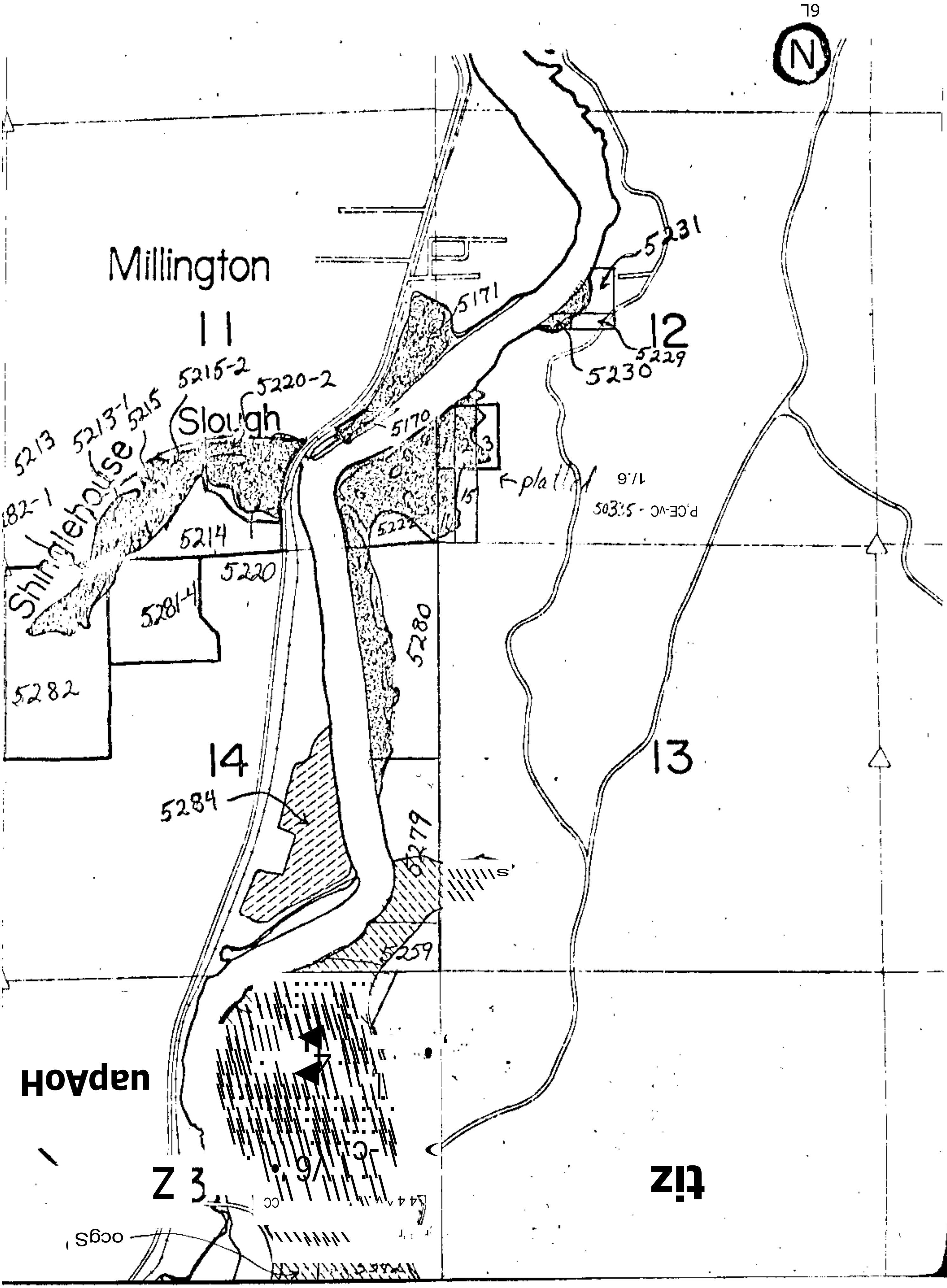
DAVIS (O)

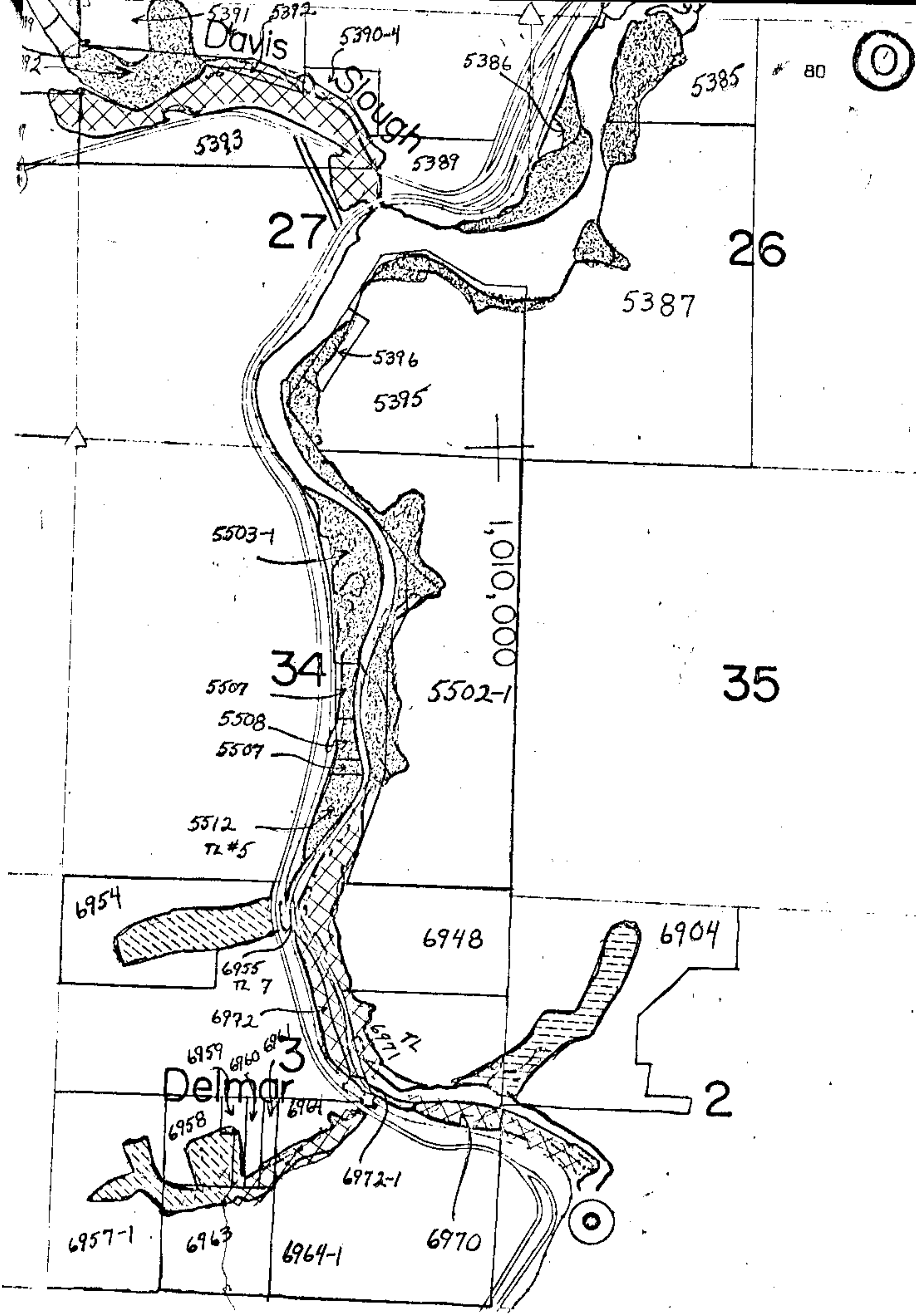
Tax Lot No.	Owner	Area (acres)	Assessed Value ($)
5385	Al Pierce	49.00	7,320
5386	Georgia Pacific	21.43	13,650
5387	Menasha	204.42	13,440
5389	Menasha	36.04	1,660
5390-4	Ken Nissen	8.16	11,400
5391	Menasha	42.10	32,920
5392	Menasha	26	6,170
5393	Menasha	110.99	4,880
5395	Menasha	113.86	7,800

DAVIS (0)

Tax Lot No.	Owner	Area (acres)	Assessed Value ($)
5396	Menasha	6	$ 1,520
5397	Menasha	181.74	37,250
5399	"	"	"
5503-1	George Fujii	25.21	10,890
5502-1	Menasha	190.27	10,520
5507	Billie Worten	47.92	1,400
5508	Richard Cavanaugh	4.26	5,270
5512	Moores Oregon Lumber	4.4	4,690
6904	Michael Siglin	124.22	12,800
6948	Menasha	49.6	2,880
6954	Melvin Spaght	48.61	56,800
6955	Moore Oregon Lumber	8.3	2,390
6957-1	Raymond Dean	68.9	8,140
6958	J. A. Annis	22.5	11,830
6959	John Taylor	7.5	2,740
6960	Howard Kubli	5.0	5,290
6961	John Gilfillan	5.0	1,280
6963	Frank Putnam	40.0	7,520
6964-1	Jean Crider	79.75	14,000
6970	Michael Siglin	2.34	1,350
6971	Coos County		
6972	Georgia Pacific	10.6	2,280
6972-1	L. R. Siglin	.25	250


Eastside
COOS
BAY
34
35
36
Slough
Isthmus Slough
3977
3977-1
3933
3976-1
5033
Boise Addition
Boise Addition
Coalbank
Slough
4004
4004
4097
5012
5015
5015
3
2
1


Millington
11
12
13
14
Slough
Shinglehouse
5171
5231
5229
5230
5215-2
5220-2
5213
5213-1
5215
5170
182-1
5214
5222
5220
5281-4
5280
5282
5284
5279
5259
plat
15
3
2
N


5391
5392
Davis
Slough
5390-4
5386
5385
80
5393
5389
27
26
5387
5396
5395
5503-1
1,010,000
34
35
5507
5508
5507
5502-1
5512
TL #5
6954
6948
6904
6955
TL 7
6972
6971
TL
6959
6960
6961
3
Delmar
2
6958
6964
6972-1
6970
6957-1
6963
6964-1

POTENTIAL SALT MARSH LANDS

It was foreseen at the beginning of this study that further salt marsh areas might be taken from the estuary through diking, dredging, or filling. In order to make this situation more tolerable to the total estuary, areas that have the potential of being undiked in trade for areas filled were discussed. It is our belief that this type of trading, although certainly in many cases completely equitable to the estuary and all involved, must be entered into with a great deal of caution. In trading, location of the marshes to be traded and those to be filled must be such that the estuary is not receiving a disproportionate amount of marshland in any one area. Also to be considered is a marsh's productivity, as this may not be measured by acreage alone. For these reasons we are presenting a list of potential lands that may be utilized as salt marsh area, with the specifics of the trade left to be discussed when the situation arises.

1) Davis Slough. The head of Davis Slough, which is diked and tidegated, and is now covered with a thin layer of mud. It appears to have been covered with water in the recent past. Map 0

2) Davis Slough. The small sedge marsh at the tip of Davis Slough. The surrounding hillsides have just been logged, and a logging road and tidegate now cut it off from the Slough proper. Map 0

3) South Slough. The diked inlet about halfway down the eastern arm of South Slough. It has a tidegate which is not functioning well, but needs to be further opened to allow more salt water to enter. Map B

4) North Slough. The small freshwater marsh on the west side of the railroad tracks in North Slough could be exposed again to salt water influence by placing culverts under the tracks. Map G

5) Bull Island. The diked marsh east of Bull Island, although in use as dairy pasture, could be easily broken open section by section to restore marshland. Map J

6) Catching Slough. The area between one or more of the meanders of Catching Slough just ab ove Master's Landing could be easily opened.

7) Kentuck Inlet. Across the road on the south side is a small area that has a malfunctioning tidegate but not enough salt water flooding to constitute a healthy salt marsh. Map L

8) Joe Ney Slough. The dike and tidegate at the head of the slough could be breached and the large freshwater marshy area behind restored to salt marsh. Map C

9) Isthmus Slough. The low silty marsh could be opened up more to allow better circulation. Map N

CONCLUSION

At this time we have removed 85-90% of the salt marshes originally feeding the estuary and providing estuarine organisms with many of their nutrients. With only one tenth of its primary sources of productivity, the esturary is still functioning, still producing clams and crabs and fish. The ten percent remaining are still working as flood control and pollution buffers and as organic filters.

What does the remaining ten percent of the marsh area mean to the people of Coos Bay? Surely in a century of devastation of these areas, their importance has been noticed, adequate planning measures have been taken. This has not been the case. Recent developments point to a future for the salt marsh as grim as the past has been. Although 60 acres remain of the once gigantic Coalbank Slough, last year Coos County diked off 25 of the remaining 60 acres at the owner's request to provide more land for residences. Plans for other salt marshes point to the same future. A more crowded community depleted of its salt marsh resource awaits. In November 1966, a publication A Comparison of Sites for Industrial Development of the Coos Bai Area appeared. Prime sites were chosen for industrial development in Coos Bay. Criteria for industrial development were based on the following considerations:

1. location near bay-ocean shipment facilities
2. closeness to railroads and highways
3. levelness, stability of foundation
4. power, water and sewage availability
5. sufficient area to encourage grouping of industry

No mention was given to criteria at least equal in importance to the total best use of the Bay.

1. loss of production to the estuary
2. effect of construction on land utilized
3. effect of removal of land from the estuary

Of the fourteen sites chosen for study, all contained portions of salt marsh or productive agricultural land that was once salt marsh. Eight of the sites considered contained salt marsh important to the estuaryl„while_ three sites were primarily agricultural. The final recommendation of the report pointed to North Slough, Pony Slough (east side) and Henderson Marsh as the most likely sites for future development. North Slough, Pony Slough and Henderson Marsh comprise a large part of the remaining 10% of the marshes in the system, an important 10% indeed as they too face destruction at the hands of an expanding community.

The salt marshes of Coos Bay are important in the Bay's overall function and productivity. With the 10% remaining in near natural condition we must be more careful than ever that these marshes do not become the construction sites of the future at the expense of the estuarine system. Suitable planning for the future dictates that these marshes be preserved as necessary components in the ecosystem that is the Coos Bay estuary.

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