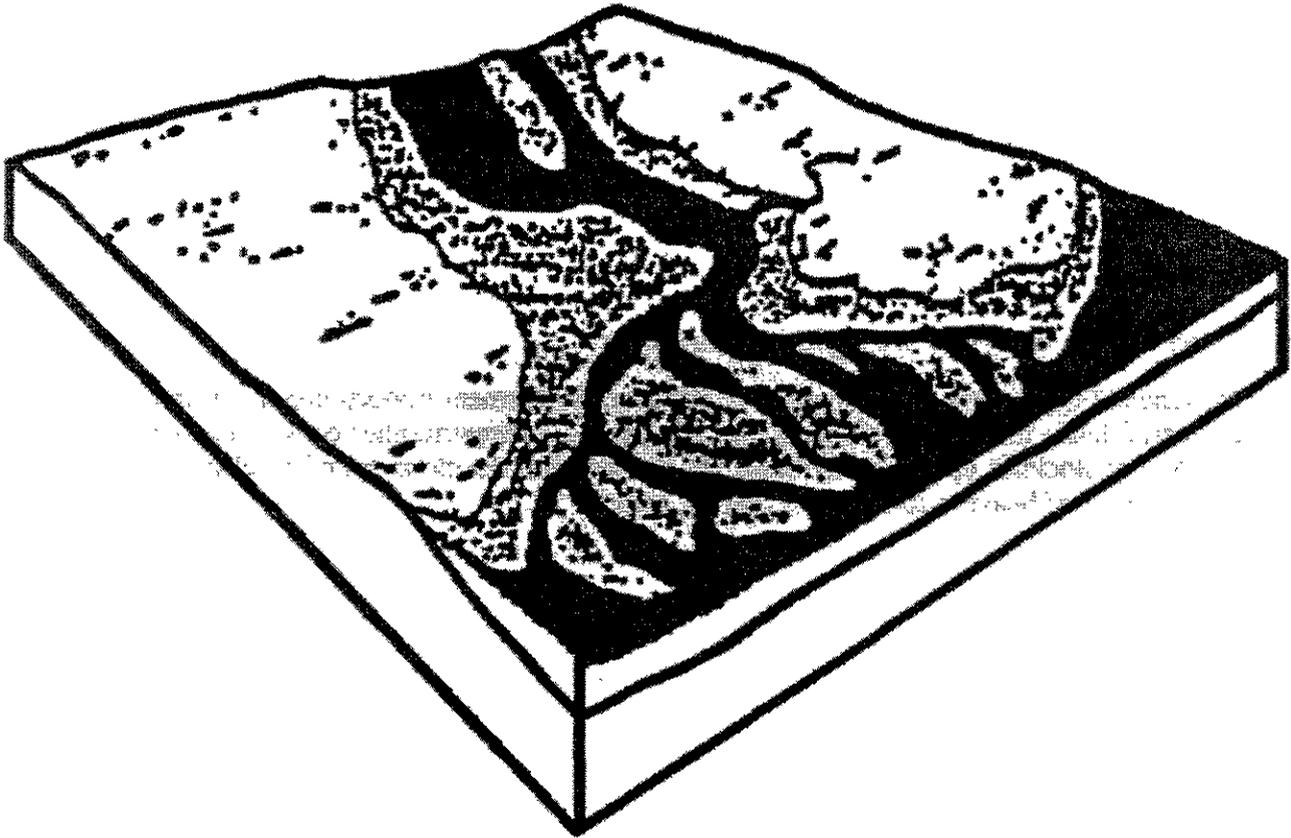
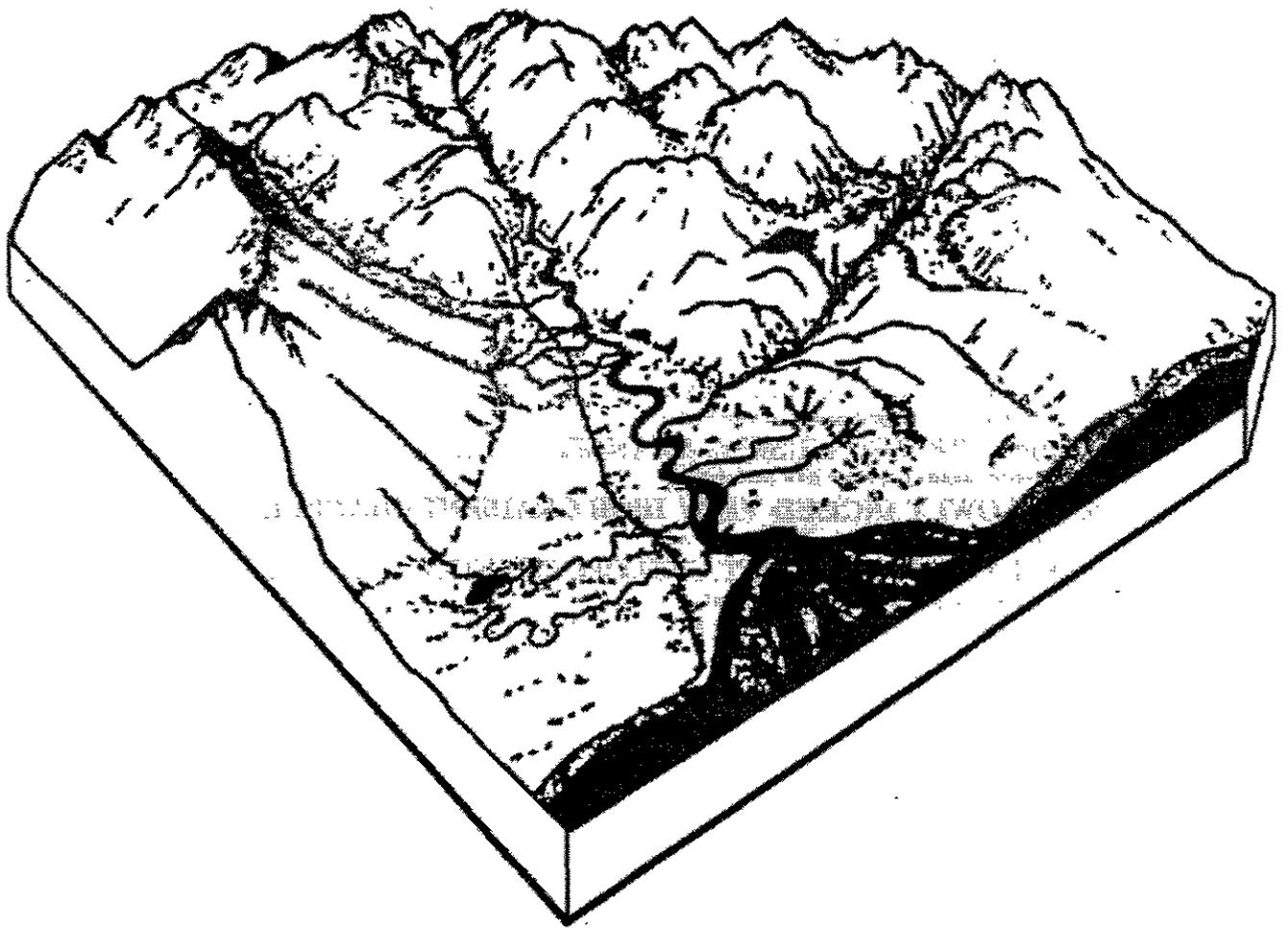


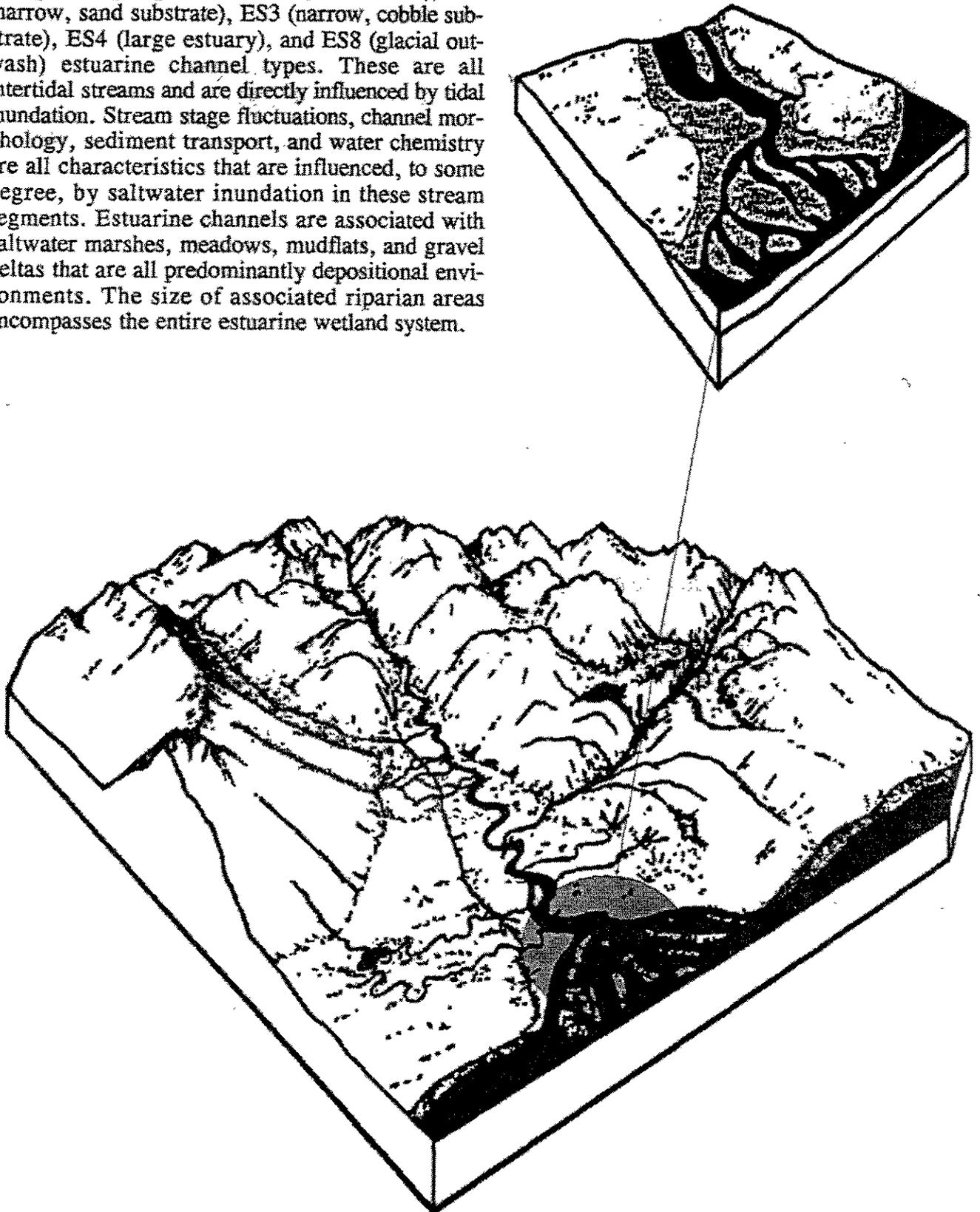
Estuarine Process Group





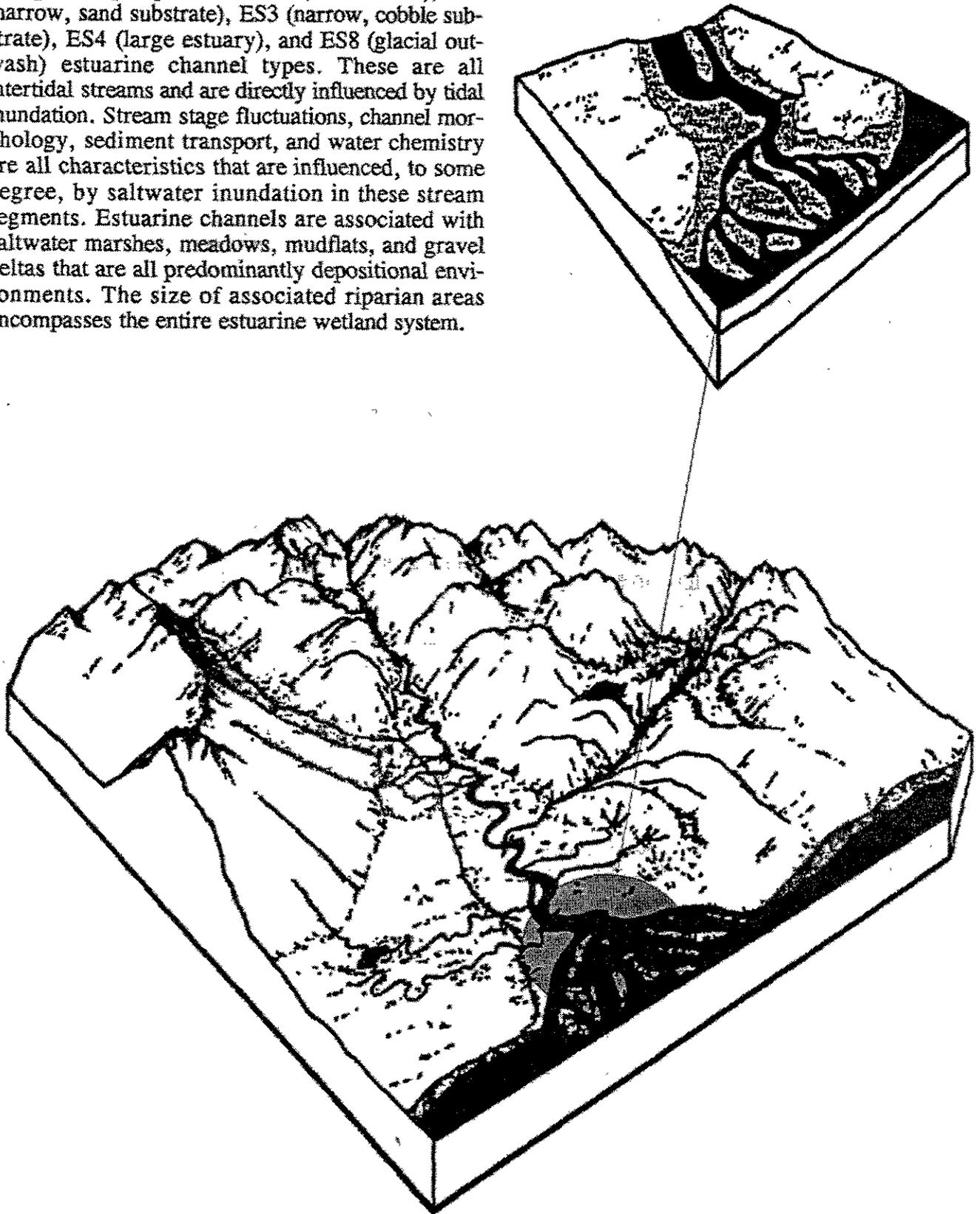
ESTUARINE PROCESS GROUP

This process group includes ES1 (silt substrate), ES2 (narrow, sand substrate), ES3 (narrow, cobble substrate), ES4 (large estuary), and ES8 (glacial outwash) estuarine channel types. These are all intertidal streams and are directly influenced by tidal inundation. Stream stage fluctuations, channel morphology, sediment transport, and water chemistry are all characteristics that are influenced, to some degree, by saltwater inundation in these stream segments. Estuarine channels are associated with saltwater marshes, meadows, mudflats, and gravel deltas that are all predominantly depositional environments. The size of associated riparian areas encompasses the entire estuarine wetland system.



ESTUARINE PROCESS GROUP

This process group includes ES1 (silt substrate), ES2 (narrow, sand substrate), ES3 (narrow, cobble substrate), ES4 (large estuary), and ES8 (glacial outwash) estuarine channel types. These are all intertidal streams and are directly influenced by tidal inundation. Stream stage fluctuations, channel morphology, sediment transport, and water chemistry are all characteristics that are influenced, to some degree, by saltwater inundation in these stream segments. Estuarine channels are associated with saltwater marshes, meadows, mudflats, and gravel deltas that are all predominantly depositional environments. The size of associated riparian areas encompasses the entire estuarine wetland system.



SILT SUBSTRATE ESTUARINE CHANNEL OR SLOUGH

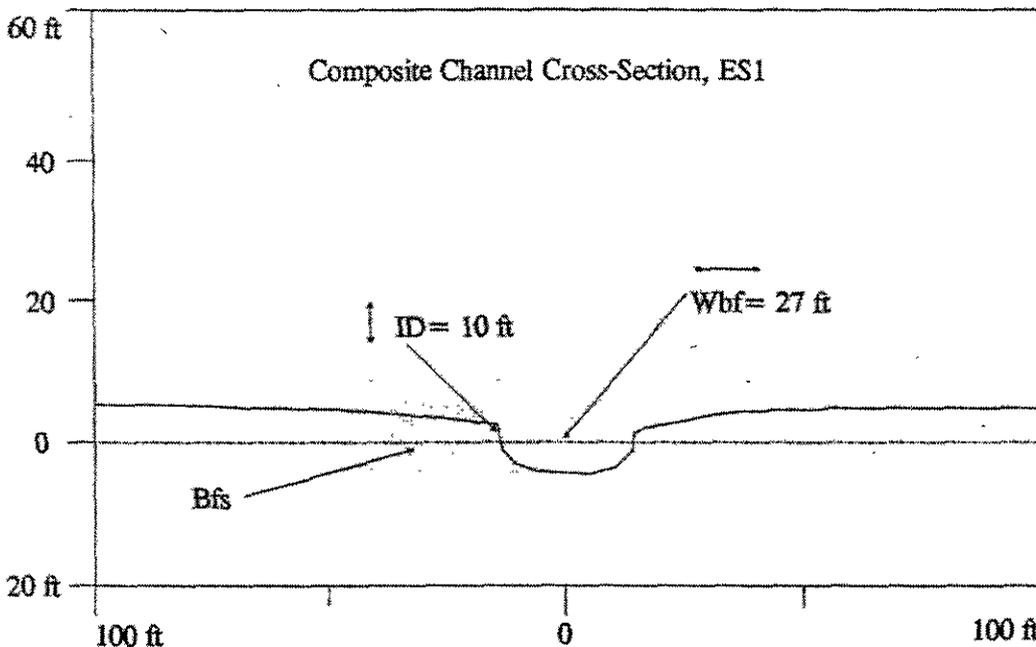
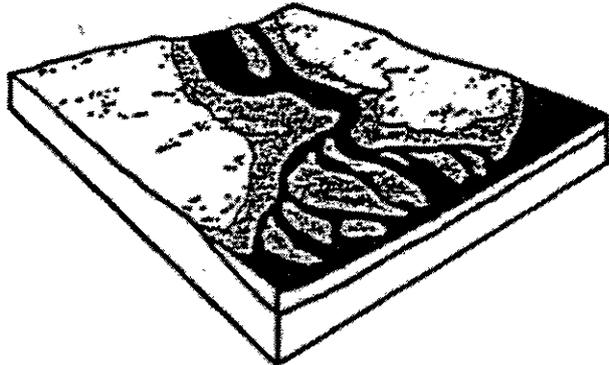
Channel Mapping Symbol: ES1 (Formerly E4)

PHYSICAL CHARACTERISTICS

Geographic Setting: The ES1 is normally associated with salt chucks, shallow embayments along coastal forelands, and large glacial river deltas.

Similar Channel Types: ES2

Channel Structure



- Stream Gradient:0-0.5%, mean = 0.5%
- Incision Depth:0-4 m (13 ft), mean = 3 m (10 ft)
- Bankfull Width:.....< 20 m (66 ft), mean = 8 m (27 ft)
- Dominant Substrate:Silt/clay to sand
- Stream Bank Composition:Silt and sand
- Sideslope Length:Not significant, flat landforms associated
- Sideslope Angle:Not significant
- Channel Pattern:.....Single, sinuous
- Drainage Basin Area:.....Variable

INCHANNEL PHOTO: ES1



Riparian Vegetation: The riparian plant community is dominated by nonforested plant communities, and the Sitka spruce-cottonwood plant associations are of some significance. Nonforest vegetation consists of estuarine forbs and grasses.

Plant Association Series	% Cover
Nonforest	76%
Sitka Spruce-Cottonwood	13%
Sitka Spruce	11%

Channel Type Phases: N/A

MANAGEMENT CONSIDERATIONS

Hydrologic Function: ES1 streams are depositional channels. Stream energy is very low due to nearly flat gradients. Glide flow is the dominant velocity type. Water flow and depth is strongly influenced by the tidal stage. Substrate consists mainly of sand and silt. Suspended, glacial silt load is high in those channels associated with glacial outwash systems. Bank sloughing may be extensive along meander bends.

Aquatic Habitat Capability

Large Woody Debris	N/A
Available Spawning Area (ASA)	N/A
Available Rearing Area (ARA)	Avg = 67% for 13 sites

ESTUARINE PROCESS GROUP

Indicator Species Ratings

<u>MIS</u>	<u>ASA</u>	<u>ARA</u>
Coho.....	NEG	HIGH
Pink.....	NEG	NEG
Chum.....	NEG	LOW
Sockeye.....	NEG	LOW
Chinook.....	NEG	NEG
Dolly Varden.....	NEG	NEG
Steelhead.....	NEG	NEG

These channels are always accessible to anadromous species. Very little, if any, spawning occurs in these slough channels as 98% of the substrate is very fine gravel, sand, silt, clay, and muck. ARA is high, with 45% of the active water in pools having a mean depth of 0.52 meters (1.7 feet). Despite the high rearing potential, these channels are generally under-utilized. High densities of coho juveniles utilize rearing habitat during summer months. Sockeye salmon may use the slough (still water) for rearing where tidal influences are minimal. Chum salmon may temporarily remain here before migrating seaward.

Riparian Management Considerations

Concern for Management of:

Large Woody Debris	LOW
Sediment Retention	HIGH
Stream Bank Sensitivity	MOD
Sideslope Sensitivity	N/A
Flood Plain Protection.....	LOW
Culvert Fish Passage.....	HIGH

ES1 channels are associated with extensive mudflat embayments and sediment retention is very high. Control of road drainage (BMP 14.9), erosion control, revegetation, and maintenance (BMPs 13.11-13.13) should be emphasized.

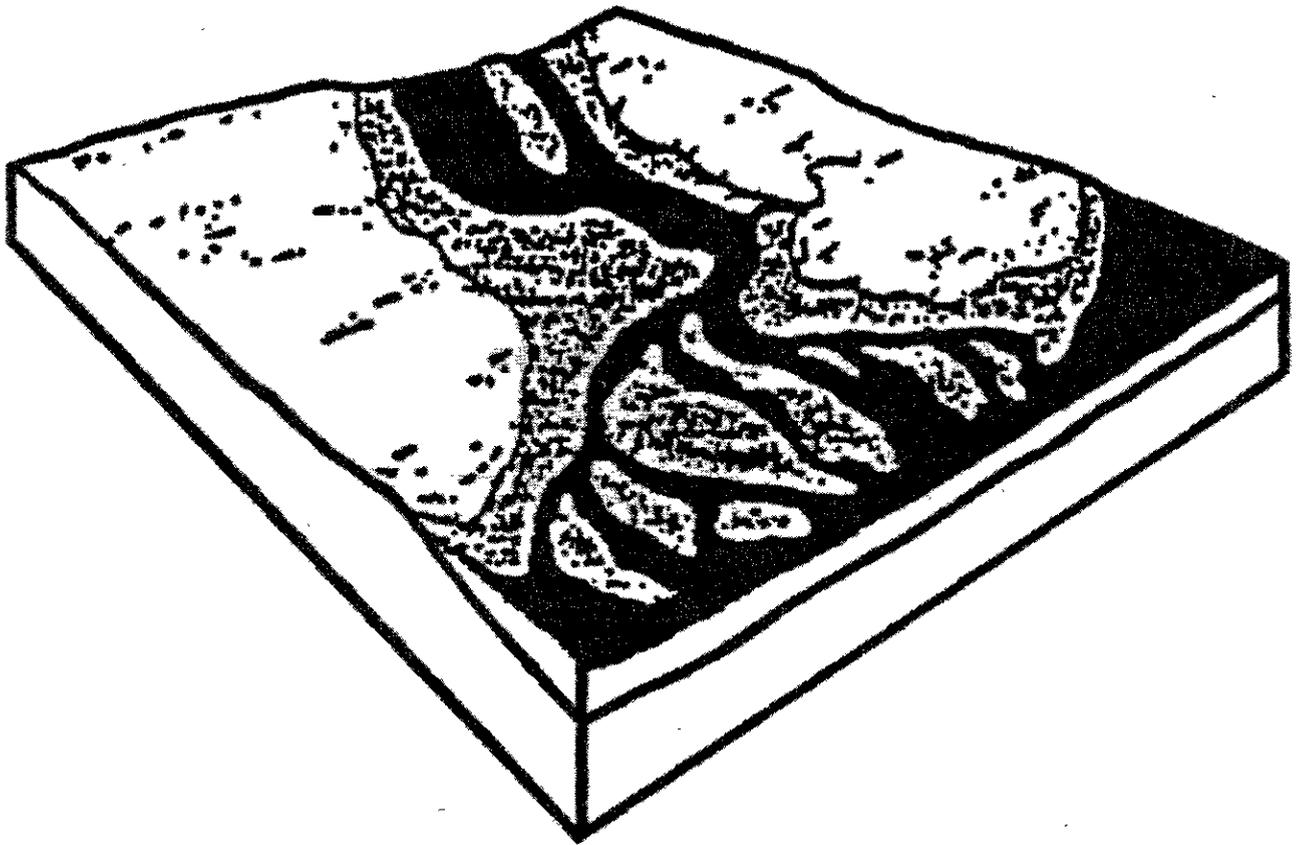
Stream bank erosion risk is moderate. Although stream banks are composed of relatively cohesive silt and clay size sediments, they are subject to undermining by strong tidal ebb and flood currents. Channel protection (BMP 13.16) and bridge and culvert design (BMP 14.17) are important measures to consider to reduce stream bank erosion. Culvert installations on upland segments of ES1 channels should be designed to provide unrestricted upstream migration for juvenile salmonids (BMPs 14.14, 14.17).

These are classified as Value Class I streams. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber Reform Act, 1991). Control of inchannel operations is an important riparian management concern (BMP 14.14).

Riparian Management Opportunities:

Sport Fish Potential	LOW
Enhancement Opportunities	N/A

Estuarine Process Group

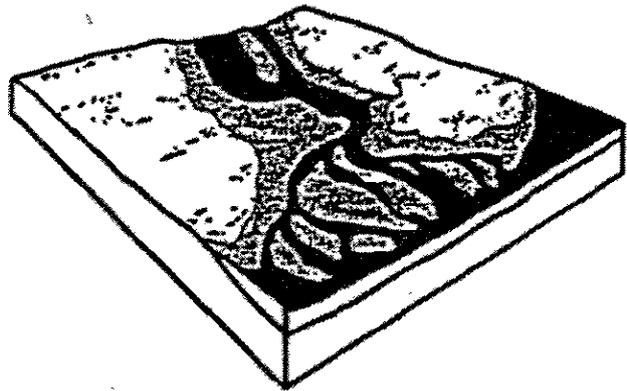


NARROW SMALL SUBSTRATE ESTUARINE CHANNEL

Channel Mapping Symbol: ES2 (Formerly E3)

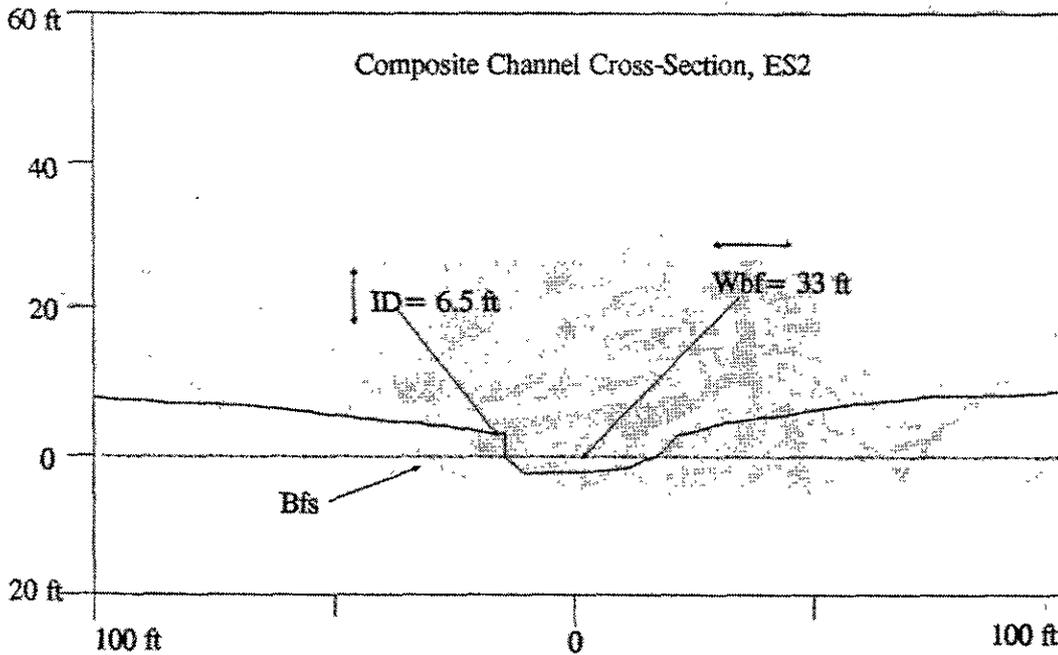
PHYSICAL CHARACTERISTICS

Geographic Setting: ES2 streams occur exclusively within estuary landforms, usually draining a small to moderate size watershed. These channels are most commonly found in drainages along outer coastal beaches.



Similar Channel Types: ES3

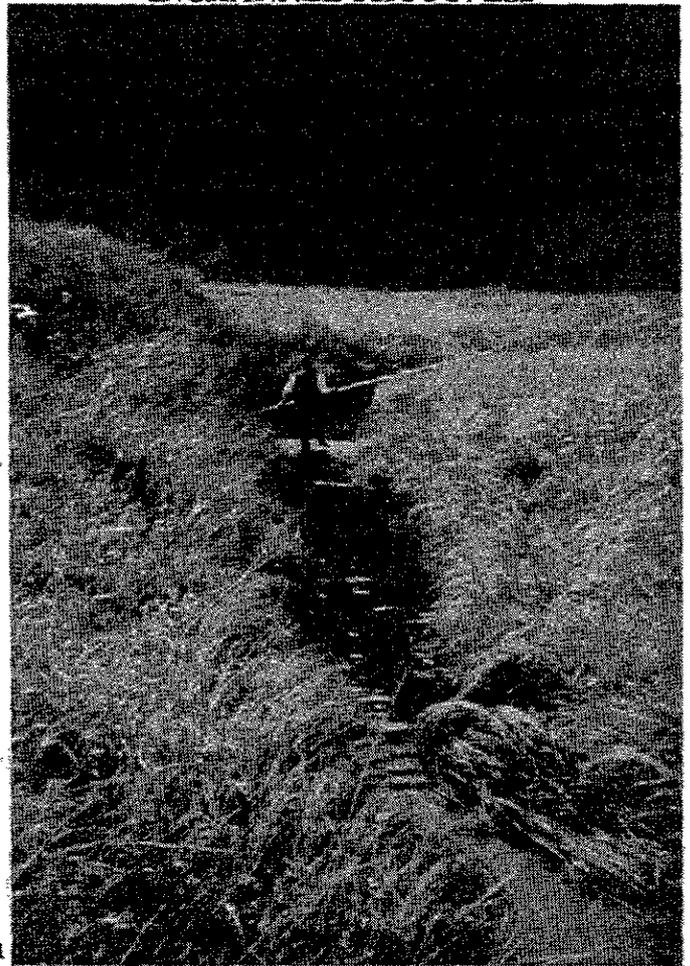
Channel Structure



- Stream Gradient: < or = 1%, mean = 1%
- Incision Depth: < 3 m, mean = 2 m (6.5 ft)
- Bankfull Width: < 10 m (33 ft)
- Dominant Substrate: Sand to gravel
- Stream Bank Composition: Alluvium (sand)
- Sideslope Length: Not significant, flat landform associated
- Sideslope Angle: Not significant
- Channel Pattern: Single, sinuous
- Drainage Basin Area: < 25.9 km² (< 10 mi²)

Riparian Vegetation: The riparian plant community is dominated by nonforested plant communities. The western hemlock/blueberry plant associations are also significant. Nonforested plant communities consist of estuarine forbs and grasses.

INCHANNEL PHOTO: ES2



Plant Association Series	% Cover
Nonforest	48%
Western Hemlock	15%
Western Hemlock-Red Cedar	13%
Sitka Spruce.....	12%

Channel Type Phases: N/A

MANAGEMENT CONSIDERATIONS

Hydrologic Function: ES2 streams are predominantly depositional channels. Stream energy is very low for these channels. Substrate material consists mainly of gravels and sand. Bank erosion is influenced more by ocean erosion processes than by stream discharge events.

Aquatic Habitat Capability

Large Woody Debris < 500 ft³/1000 linear ft
 Available Spawning Area (ASA).. Insufficient data
 Available Rearing Area (ARA).... Insufficient data

Indicator Species Ratings

MIS	ASA	ARA
Coho.....	HIGH	HIGH
Pink.....	HIGH	HIGH
Chum.....	HIGH	LOW
Sockeye	NEG	NEG
Chinook.....	NEG	NEG
Dolly Varden	MOD	MOD
Steelhead.....	NEG	NEG

These channels are always accessible to anadromous species. ASA is high and seems to be limited primarily by fine sediment content. Pink and chum salmon frequently, and Dolly Varden char occasionally, spawn in ES2 channels. Coho salmon and Dolly Varden char will move into ES2 channels from upstream areas during summer and will rear until fall. Pink and chum salmon fry may also temporarily inhabit the ES2 channel before migrating seaward. Overwintering habitat is minimal (mean pool depth of 0.02 meters [0.6 feet]).

Riparian Management Considerations

Concern for Management of:

- Large Woody DebrisLOW
- Sediment RetentionHIGH
- Stream Bank SensitivityHIGH
- Sideslope SensitivityN/A
- Flood Plain Protection NeedMOD
- Culvert Fish Passage.....MOD

The ES2 channel type is associated with low relief coastal landforms, therefore, sediment retention is rated high.

Stream banks are composed of sand and fine gravel, and are, therefore, highly sensitive to erosion. Beach erosion processes often have a dominant influence on these outer coastal estuarine streams. Stream channel protection (BMP 13.16), construction in riparian areas (BMP 14.13), and bridge/culvert design (BMP 14.17) should be emphasized.

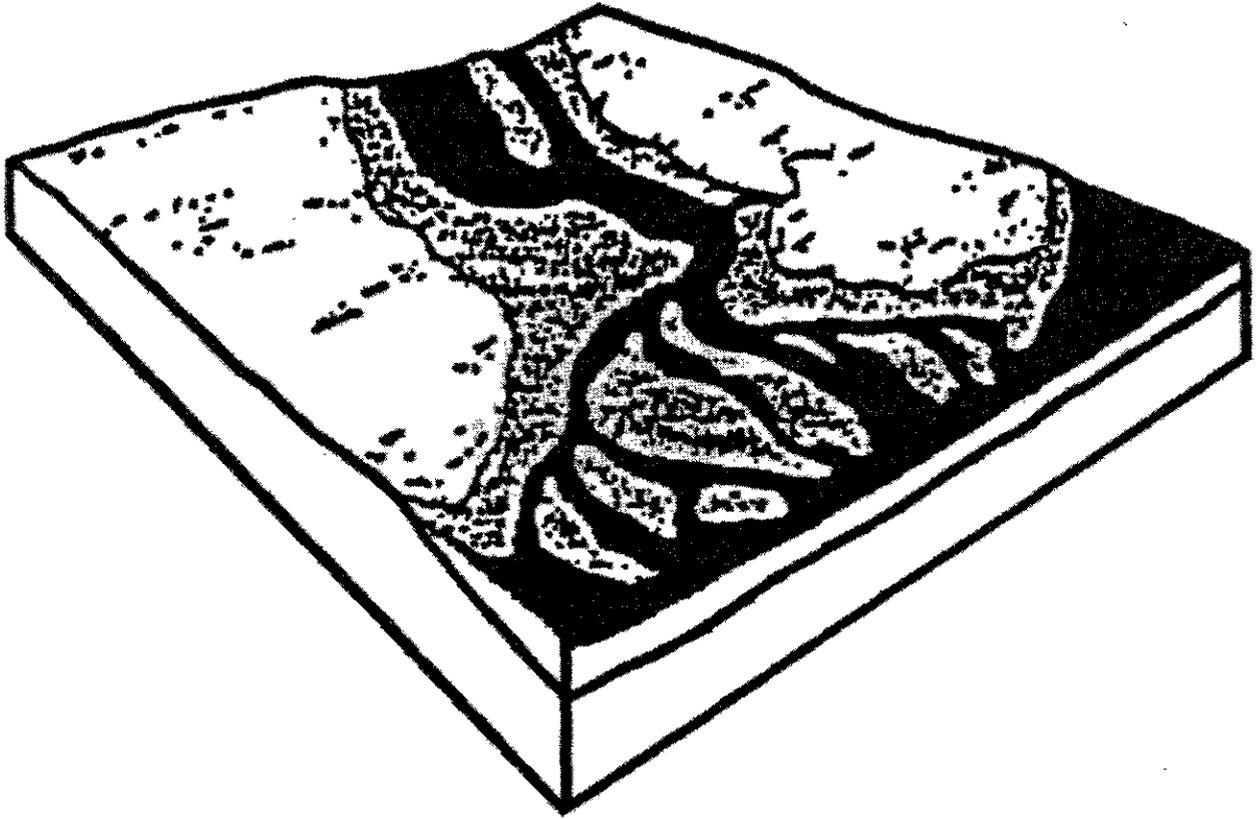
Culvert installations in the upland segments of ES2 channels should be designed to provide unrestricted passage for juvenile salmonids (BMP 14.17).

These are classified as Value Class I streams. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber Reform Act, 1991). Control of inchannel operations is an important riparian management concern for these streams (BMP 14.14).

Riparian Management Opportunities:

- Sport Fish PotentialLOW
- Enhancement OpportunitiesN/A

Estuarine Process Group

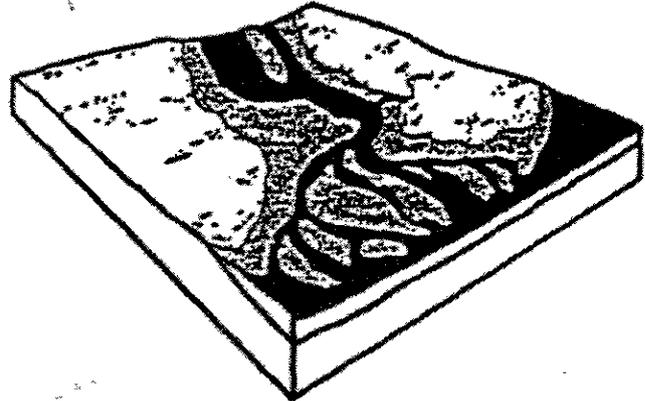


NARROW LARGE SUBSTRATE ESTUARINE CHANNEL

Channel Mapping Symbol: ES3 (Formerly E2)

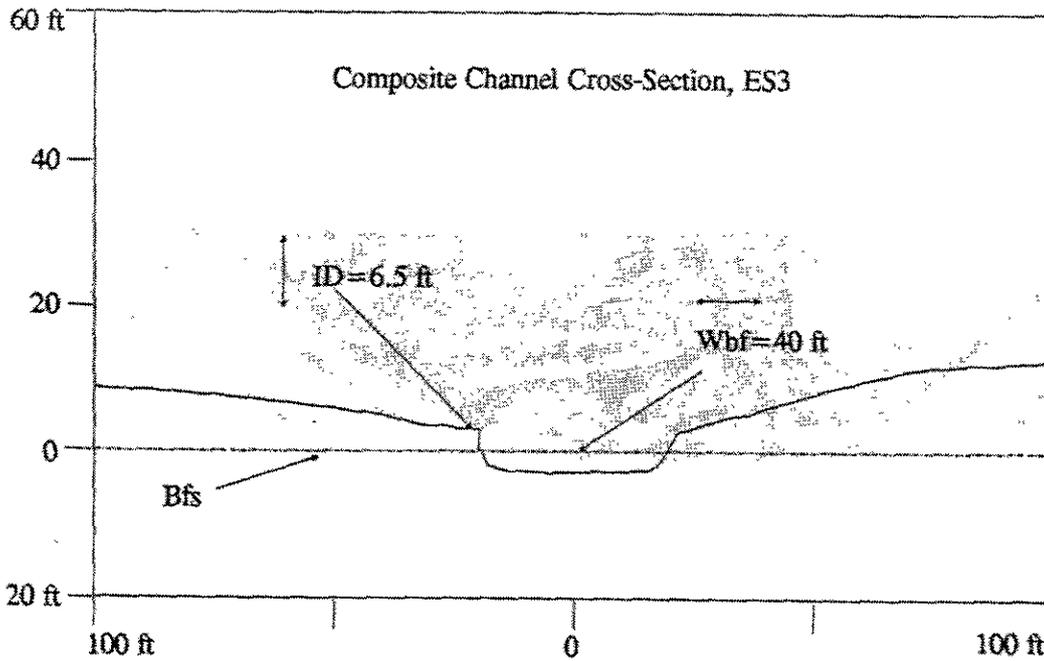
PHYSICAL CHARACTERISTICS

Geographic Setting: ES3 streams occur in small estuaries, usually less than 100 acres in size. These streams are most commonly associated with small, high relief drainage basins that empty into inland straits and inlets.



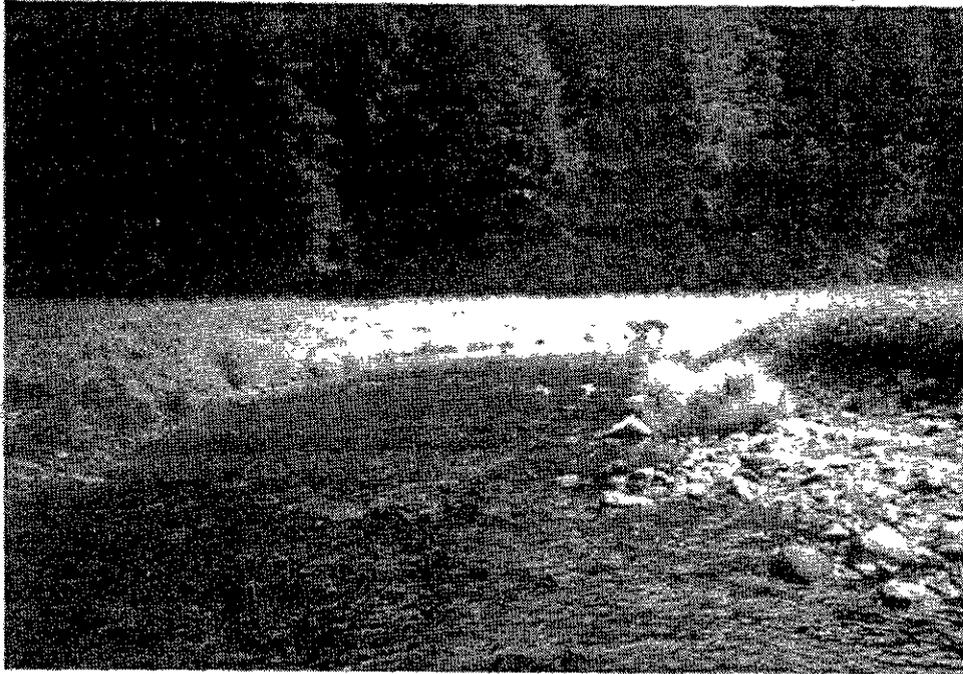
Similar Channel Types: ES2

Channel Structure



- Stream Gradient:0-3%, mean = 1%
- Incision Depth:< 3 m (10 ft), mean = 2 m (6.5 ft)
- Bankfull Width:.....< 10 m (33 ft) at upstream end
- Dominant Substrate:Fine gravel to small boulder
- Stream Bank Composition:Alluvium (occasional bedrock outcrops)
- Sideslope Length:Not significant, flat landform associated
- Sideslope Angle:Not significant
- Channel Pattern:.....Single, linear
- Drainage Basin Area:.....< 25.9 km² (< 10 mi²)

INCHANNEL PHOTO: ES3



Riparian Vegetation: The riparian plant community is dominated by nonforested plant communities, which consist of estuarine forbs and grasses.

Plant Association Series	% Cover
Nonforest	75%
Sitka Spruce	13%
W.Hemlock-Alaska Cedar	8%

Channel Type Phases: N/A

MANAGEMENT CONSIDERATIONS

Hydrologic Function: ES3 streams are predominantly depositional channels. Stream energy is low, although relatively, it is the highest of the estuarine process group. Moderate gradient contained channels often directly precede the ES3 in the watershed network. Moderate loads of coarse and fine gravel may be delivered to the ES3 during large flow events. Channel banks are relatively stable and produce only minor inputs of sediment from erosion processes (bank undercutting and sloughing). Tidal processes also affect deposition and erosion in these channels.

Aquatic Habitat Capability

Large Woody Debris	< 500 ft ³ /1000 linear ft
Available Spawning Area (ASA)	Insufficient data
Available Rearing Area (ARA)	Insufficient data

ESTUARINE PROCESS GROUP

Indicator Species Ratings

MIS	ASA	ARA
Coho.....	MOD	LOW
Pink.....	LOW	LOW
Chum.....	LOW	LOW
Sockeye.....	NEG	NEG
Chinook.....	NEG	NEG
Dolly Varden.....	MOD	MOD
Steelhead.....	NEG	NEG

These channels are frequently accessible to anadromous species. Pink and chum salmon generally spawn in other channel types and occasionally use ES3 segments. Use is increased where larger patches of gravel accumulate near small boulders and bedrock outcrops. Coho may migrate downstream to rear in pools (12% of active water), and pink and chum may temporarily stay in these channels during their seaward migration. Dolly Varden char may spawn and rear in ES3 channels in moderate densities.

Riparian Management Considerations

Concern for Management of:

Large Woody Debris.....	LOW
Sediment Retention.....	MOD
Stream Bank Sensitivity.....	MOD
Sideslope Sensitivity.....	N/A
Flood Plain Protection Need.....	MOD
Culvert Fish Passage.....	HIGH

Sediment retention is rated moderate for ES3 channels. These channels are found on high energy beaches often in association with streams making a rapid transition from high energy mountainslope channel types. Fine sediments are readily flushed from the ES3 channel during flood or storm events.

Stream banks are composed of coarse gravel or cobble size alluvium. Therefore ES3 channels are only moderately susceptible to stream bank erosion.

Flood plain protection need is moderate. Estuarine habitat capability is limited in the ES3 riparian area due to higher energy streamflows and higher beach erosion rates.

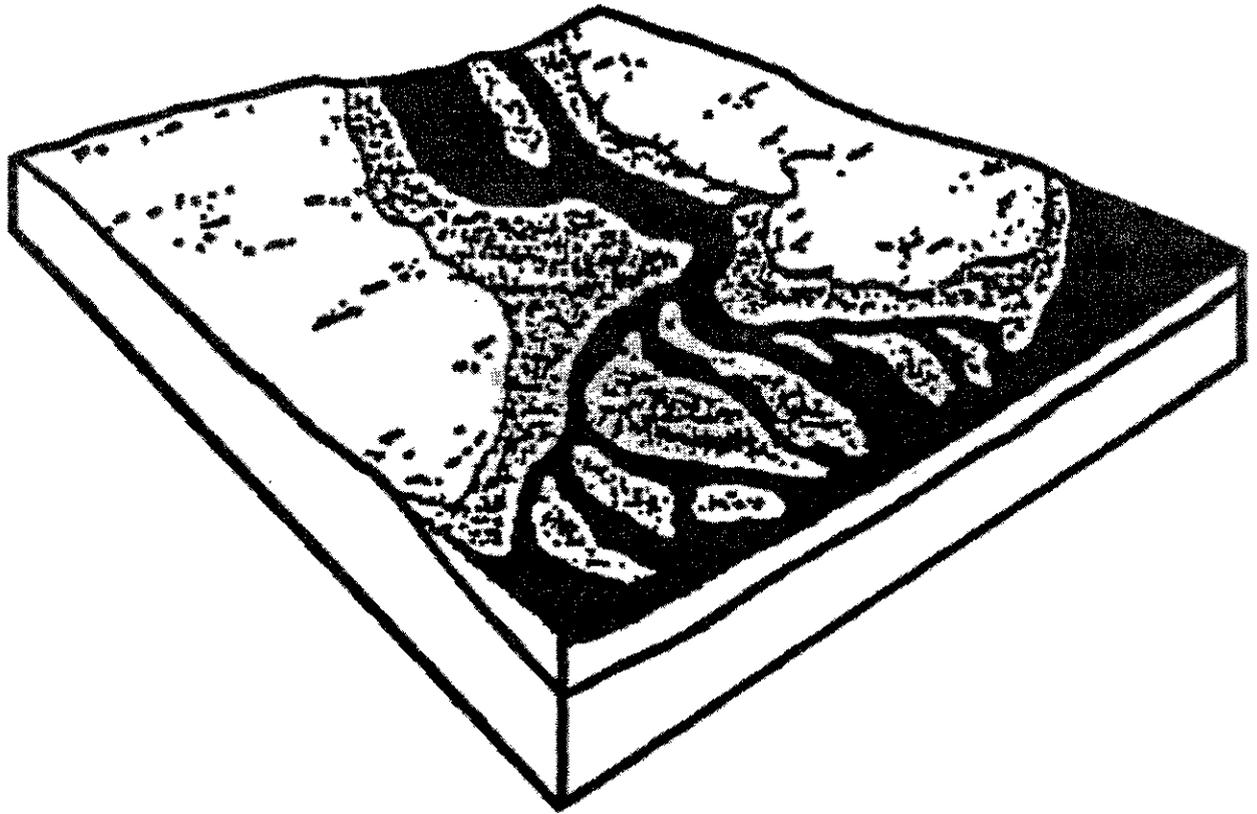
It is important to consider upstream anadromous fish migration in these streams (BMPs 14.4, 14.17).

These are classified as Value Class I streams. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber Reform Act, 1991). Control of inchannel operations is an important riparian management concern (BMP 14.14).

Riparian Management Opportunities:

Sport Fish Potential.....	LOW
Enhancement Opportunities.....	N/A

Estuarine Process Group



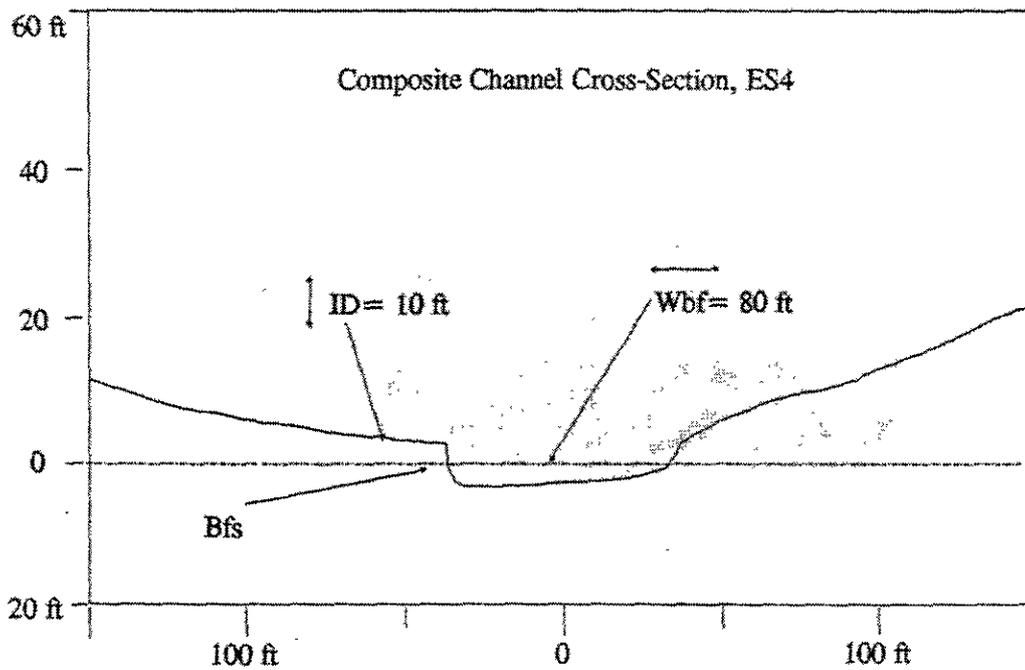
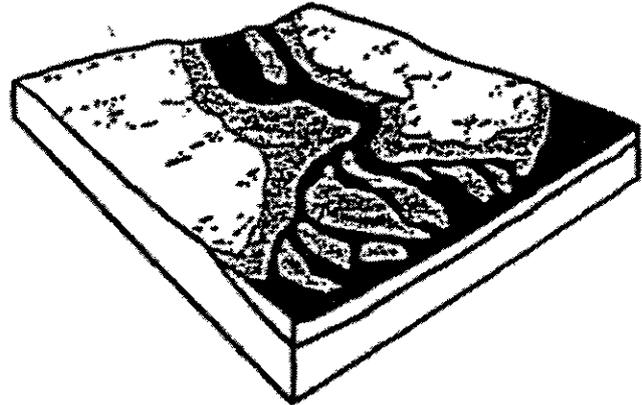
LARGE ESTUARINE CHANNEL
Channel Mapping Symbol: ES4 (Formerly E1)

PHYSICAL CHARACTERISTICS

Geographic Setting: The ES4 channels are associated with estuarine deltas of moderate to large drainage basins of inland bays and inlets.

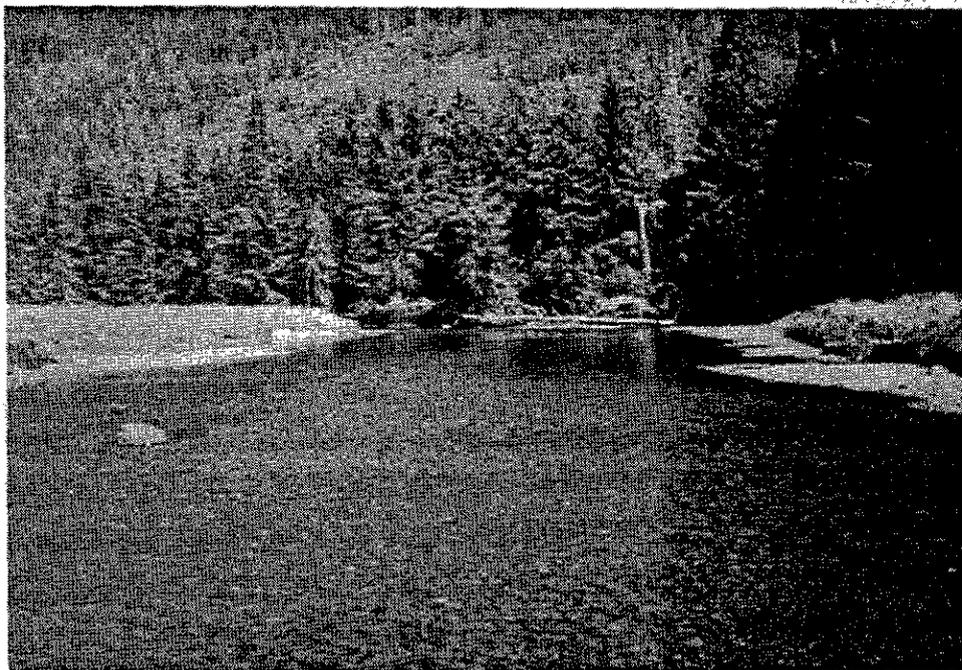
Similar Channel Types: ES3, FP4

Channel Structure



- Stream Gradient: < or = 2%, mean = 1%
- Incision Depth: < 5 m (16.5 ft)
- Bankfull Width: > 10 m (33 ft), mean at upstream end = 23 m (75.9 ft)
- Dominant Substrate: Gravel to cobble
- Stream Bank Composition: Alluvium
- Sideslope Length: Not significant, flat estuarine landform associated
- Sideslope Angle: Not significant
- Channel Pattern: Single to multiple channel, normally single at the apex of the fan with channel branching at the terminus.
- Drainage Basin Area: 25.9-78 km² (10-30 mi²)

INCHANNEL PHOTO: ES4



Riparian Vegetation: The ES4 nonforest riparian plant communities are dominated by grass and sedge communities. The Sitka spruce series and the western hemlock series are also significant beach fringe communities.

Plant Association Series	% Cover		
	ES4	ES4i	ES4d
Nonforest	59%	---	---
Sitka Spruce.....	23%	---	---
Western Hemlock.....	14%	---	---

Channel Type Phases:

- ES4i - LARGE SUBSTRATE PHASE have larger material, cobble/small boulder size range. Available spawning habitat is somewhat less than is typical for this channel type.
- ES4d - SAND DUNE PHASE are incised beach or sand dune channels found in coastal foreland areas. They are differentiated by the amount of glacial influence.

MANAGEMENT CONSIDERATIONS

Hydrologic Function: The ES4 streams are depositional channels subject to tidal influences. Stream energy is low due to wide, low gradient channels. Gravel and sand bars tend to be stable bed features, except during extreme flow events. Large woody debris can significantly influence channel structure. Debris accumulations are important in forming pool habitat in ES4 channels.

Aquatic Habitat Capability

Large Woody Debris1200 ft³/1000 linear ft
 Available Spawning Area (ASA).....Avg = 22% for 11 sites
 Available Rearing Area (ARA).....Avg = 7% for 10 sites

ESTUARINE PROCESS GROUP

Indicator Species Ratings

MIS	ASA	ARA
Coho.....	HIGH	LOW
Pink.....	HIGH	HIGH
Chum.....	HIGH	HIGH
Sockeye.....	NEG	NEG
Chinook.....	NEG	NEG
Dolly Varden.....	MOD	MOD
Steelhead.....	NEG	NEG

These channels are always accessible to anadromous species. Generally, high quality substrate provides high available spawning area (ASA 22%). Spawning pink and chum salmon will frequent ES4 channels in high densities. Although pool development is minimal (3% of water surface area), rearing coho salmon will move downstream from the mainstem in the summer to rear here (ARA 7%). Pink and chum salmon fry may temporarily remain in the ES4 system prior to moving seaward.

Riparian Management Considerations

Concern for Management of:

Large Woody Debris	MOD
Sediment Retention	HIGH
Stream Bank Sensitivity.....	HIGH
Sideslope Sensitivity	N/A
Flood Plain Protection Need	HIGH
Culvert Fish Passage.....	N/A

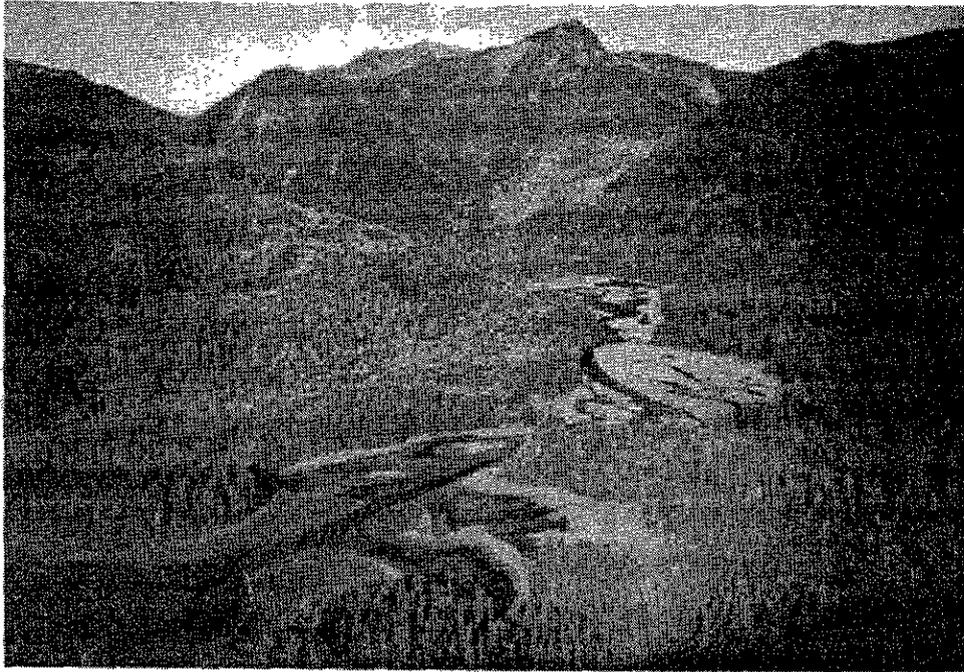
Sediment deposition is a dominant process in estuarine deltas, therefore, sediment retention in ES4 channels is high. These channels are very sensitive to intrusion of fine sediments into spawning beds. The effect of cumulative sediment impacts from upstream watershed disturbance is a major management concern. Erosion control (BMPs 13.11-13.13), control of road drainage (BMP 14.9), and road maintenance (BMPs 14.20, 14.21) are mitigation measures that should be emphasized in areas near these streams.

Stream bank sensitivity is high due to high amounts of fine unconsolidated alluvium in ES4 stream banks. Bank erosion can be a significant source of fine sediment in these channels. Channel protection (BMP 13.16) and bridge design and implementation (BMP 14.17) should be emphasized.

Protection of estuarine wetland and flood plain habitat (BMPs 12.6, 13.15, 14.13) is an important management consideration for ES4 channels and associated riparian areas. These intertidal wetlands provide extremely important habitat for waterfowl, furbearers, and a wide variety of aquatic species.

These are classified as Value Class I streams. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber Reform Act, 1991). Control of inchannel operations is an important riparian management concern for these streams (BMP 14.14).

LANDSCAPE PHOTO: ES4

**Riparian Management Opportunities:**

Sport Fish Potential HIGH

Enhancement Opportunities Large Wood Placement

ES4 channel segments have excellent sport fishing opportunities. Foot access is good from the beach and also from small boats at high tide. Primary species of interest are Dolly Varden char, coho, and pink salmon.

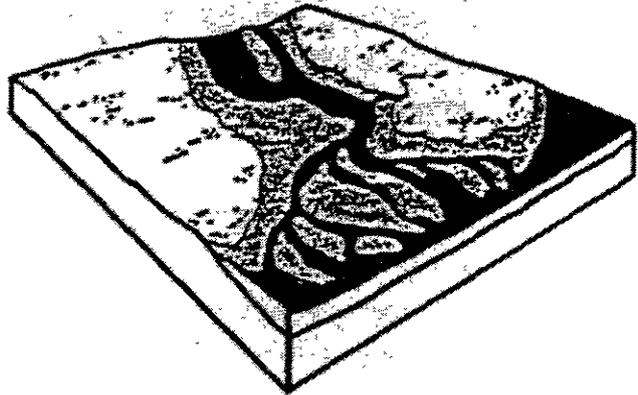
Large woody debris fish enhancement projects may be options in ES4 channels. These structures can be used to improve cover and available pool habitat for adult spawners and rearing juvenile fish. Structures must be designed and anchored to withstand extreme tides.

BROAD BRAIDED GLACIAL OUTWASH ESTUARINE CHANNEL

Channel Mapping Symbol: ES8 (Formerly E5)

PHYSICAL CHARACTERISTICS

Geographic Setting: ES8 streams are associated with large glacial river deltas. These watersheds typically have greater than 15 percent of their drainage area covered by active glaciers and snowfields.



Similar Channel Types: GO3

Channel Structure

- Stream Gradient:0.5-1.5%
- Incision Depth:<2 m (6.5 ft)
- Bankfull Width:.....Variable, normally very wide, braided delta
- Dominant Substrate:Sand to coarse gravel
- Stream Bank Composition:Glacial alluvium
- Sideslope Length:Not significant, broad flat landform
- Sideslope Angle:Not significant
- Channel Pattern:.....Highly braided
- Drainage Basin Area:.....>51.8 km² (20 mi²)

Riparian Vegetation: The riparian areas immediately adjacent to these channels generally are un-vegetated sand and gravel outwash and extensive tidal mudflats. Salt tolerant grasses and sedges dominate the more stable terraces away from the active deposition zone.

Channel Type Phases: N/A

LANDSCAPE PHOTO: ES8



MANAGEMENT CONSIDERATIONS

Hydrologic Function: ES8 channels are depositional streams. GO3 channels immediately precede the ES8, and, consequently, characteristics such as braided channels and excessive sediment loads are very similar. ES8 substrate material ranges from small cobble to glacial silt, and suspended silt loads are high. Tidal influences may affect stream flow and river stage a great distance upstream from saltwater.

Aquatic Habitat Capability

Large Woody DebrisN/A
 Available Spawning Area (ASA).....N/A
 Available Rearing Area (ARA).....N/A

Indicator Species Ratings

<u>MIS</u>	<u>ASA</u>	<u>ARA</u>
Coho.....	NEG	NEG
Pink.....	NEG	NEG
Chum.....	NEG	NEG
Sockeye	NEG	MOD
Chinook.....	NEG	NEG
Dolly Varden	NEG	NEG
Steelhead.....	NEG	NEG

ES8 channels are always accessible to anadromous species. Out migrants and returning adults of all anadromous species may make frequent use of these channels for staging prior to in or out migration. Sockeye use channel margins and slough habitat for summer rearing.

Spawning habitat is negligible.

Riparian Management Considerations

Concern for Management of:

Large Woody Debris LOW
 Sediment Retention HIGH
 Stream Bank Sensitivity HIGH
 Sideslope Sensitivity N/A
 Flood Plain Protection..... HIGH
 Culvert Fish Passage HIGH

These channels are located at the terminus of large glacial rivers, therefore, sediment deposition is extremely high.

Stream bank sensitivity is rated high due to fine textured bank materials and highly variable flood flows. Channel protection (BMP 13.16) and bridge/culvert design (BMP 14.17) are important considerations. Lateral channel migration is extremely active in most ES8 channel types.

Riparian areas adjacent to ES8 segments often have extensive tidal marshes. Protection of these wetland values is an important management concern.

These are classified as Value Class I streams. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber Reform Act, 1991). Control of inchannel operations is an important riparian management concern for these streams (BMP 14.14).

ESTUARINE PROCESS GROUP

Riparian Management Opportunities:

Sport Fish Potential LOW

Enhancement Opportunities N/A

Estuarine Process Group

