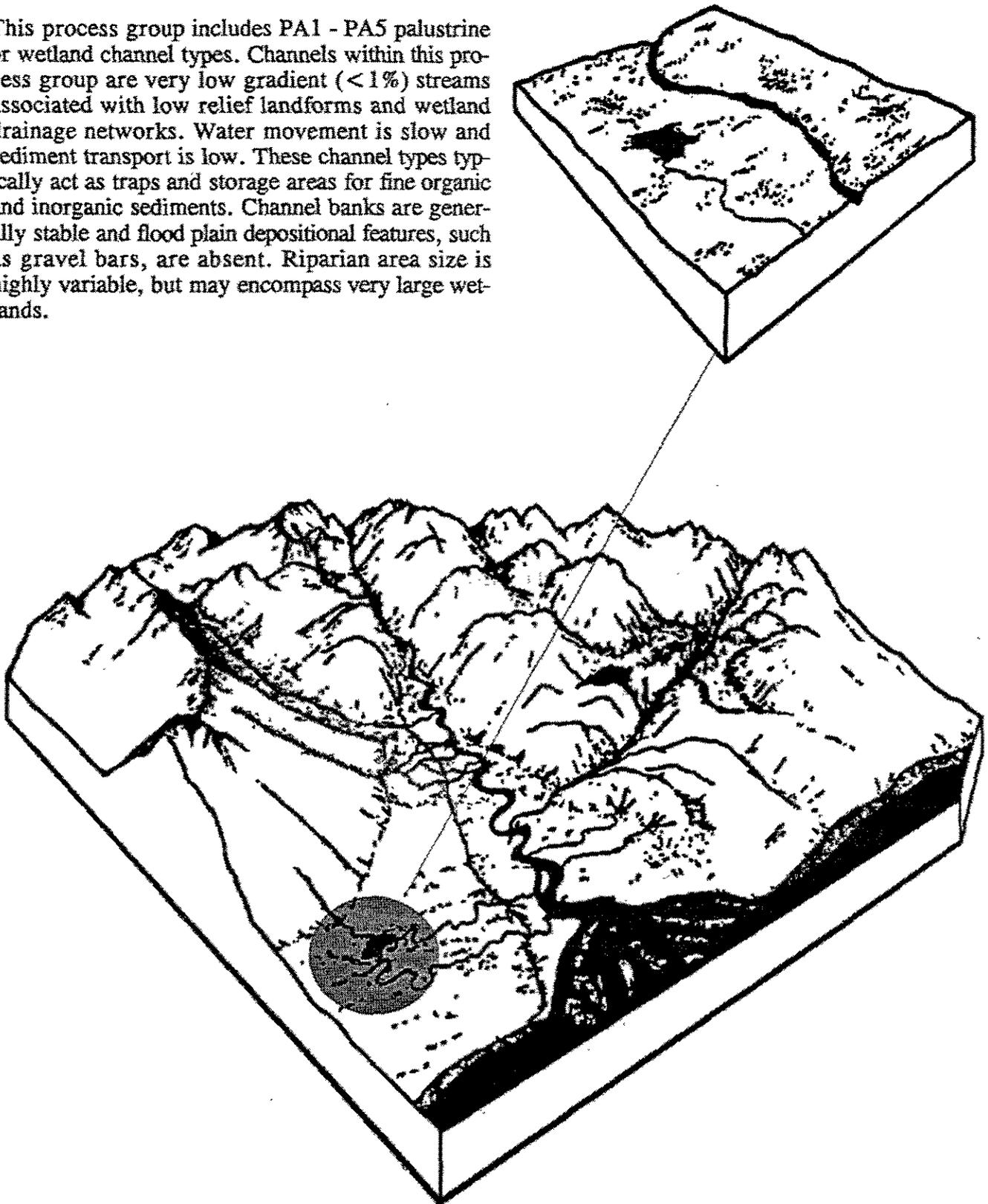


PALUSTRINE PROCESS GROUP

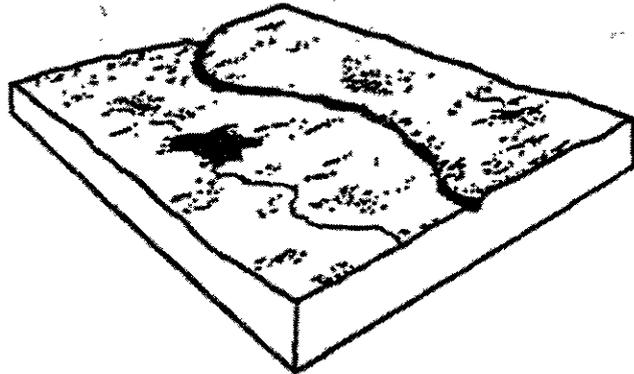
This process group includes PA1 - PA5 palustrine or wetland channel types. Channels within this process group are very low gradient (<1%) streams associated with low relief landforms and wetland drainage networks. Water movement is slow and sediment transport is low. These channel types typically act as traps and storage areas for fine organic and inorganic sediments. Channel banks are generally stable and flood plain depositional features, such as gravel bars, are absent. Riparian area size is highly variable, but may encompass very large wetlands.



NARROW PLACID FLOW CHANNEL
 Channel Mapping Symbol: PA1 (Formerly L1)

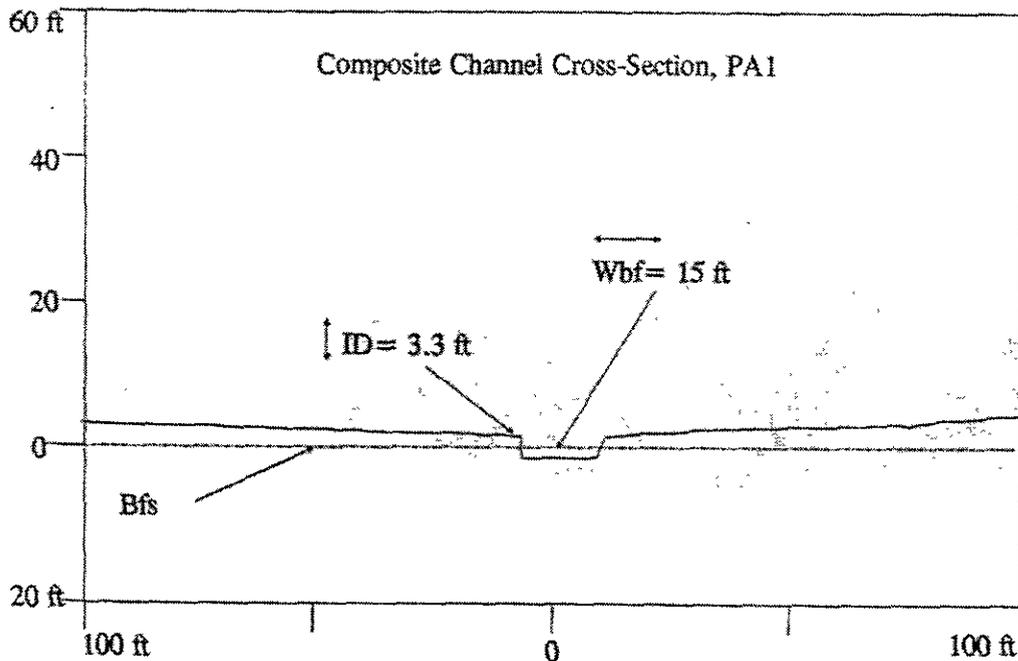
PHYSICAL CHARACTERISTICS

Geographic Setting: PA1 streams often occur in association with muskeg bogs on low relief landforms. Channel pattern may be highly sinuous. These streams are commonly associated with ponds and small lakes.



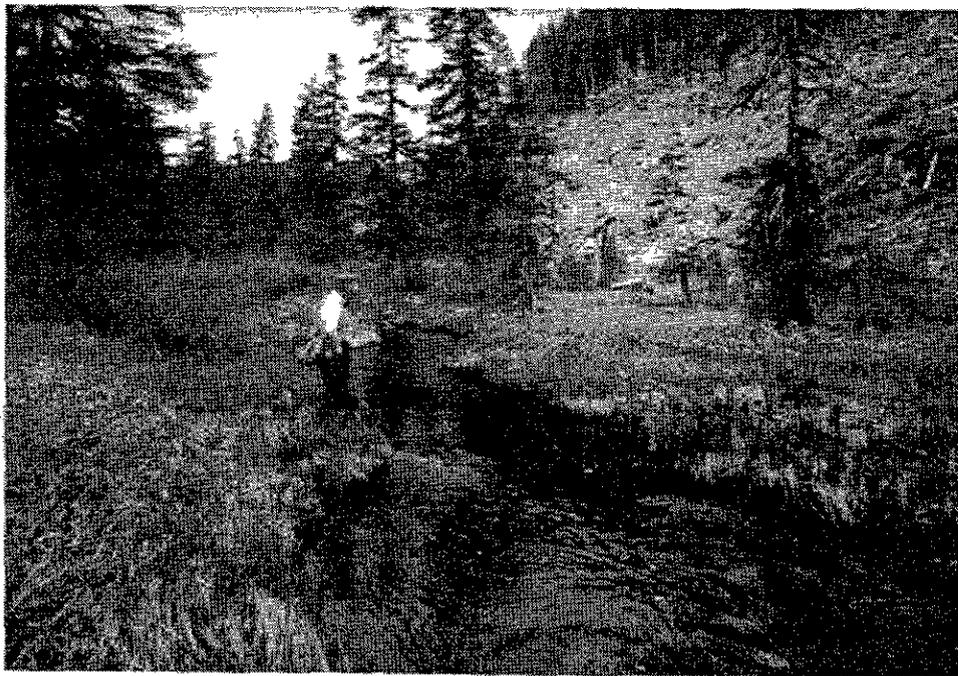
Similar Channel Types: PA3, MC1.4

Channel Structure



- Stream Gradient: <2%, mean = 1.0%
- Incision Depth: < or = 2 m (6.5 ft), mean = 1 m (3.3 ft)
- Bankfull Width: < 10 m (33 ft), mean = 4.6 m (15 ft)
- Dominant Substrate: Organic silt to very fine gravel
- Stream Bank Composition: Alluvium and/or organic mat
- Sideslope Length: Not significant, palustrine area associated with this channel
- Sideslope Angle: Not significant, very flat landforms associated
- Channel Pattern: Single, sinuous
- Drainage Area: < 5.2 km² (< 2 mi²)

INCHANNEL PHOTO: PA1



Riparian Vegetation: The riparian plant communities in the PA1 channel type are dominated by nonforested sedge, sphagnum, and sweet gale bog plant communities. The western hemlock series, mountain hemlock/blueberry series, and shore pine series share dominance in the PA1v phase, with nonforested plant communities being of some significance.

Plant Association Series	% Cover	
	PA1	PA1v
Nonforest	72%	16%
Shore Pine	9%	24%
Western Hemlock	7%	22%
Sitka Spruce	6%	12%
M.Hemlock/Blueberry	---	23%

Channel Type Phases:

- PA1v - SCRUB FOREST PHASE: Riparian vegetation interspersed with patches of muskeg or shrub (Sitka alder and shore pine) plant communities.

MANAGEMENT CONSIDERATIONS

Hydrologic Function: PA1 channels are sediment storage channels. Stream energy is low, therefore, organic silt, sand, and very fine gravel size sediments are retained in PA1 reaches. Streamflow in these channels is somewhat influenced by runoff from extensive muskeg bogs.

Aquatic Habitat Capability

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

PALUSTRINE PROCESS GROUP

Indicator Species Ratings

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

These channels are moderately accessible to anadromous fish. ASA is low because of the extremely fine substrate (7% fine gravel, 24% sand, and 69% silt and organic muck). Coho salmon and Dolly Varden char will spawn in patches of gravel and sand. Sockeye salmon will spawn in sand and muck where upwelling groundwater provides adequate an supply of dissolved oxygen to the redds. Coho salmon and Dolly Varden char frequently, and sockeye occasionally, rear in these channels. Large amounts of deep (mean depth = 0.7 meters [2.3 feet]), pooled water (51% of active water), in conjunction with cover from overhanging stream bank vegetation, provide high ARA. These channels probably provide little overwintering habitat unless flowing from a lake source or a spring fed tributary.

Riparian Management Considerations

Concern for Management of:

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

Sediment retention is very high in these palustrine channels. However, lack of spawning habitat generally makes these channels less sensitive to sedimentation impacts than flood plain channels.

Stream banks are composed of dense organic root mats that are resistant to erosion. However, bank degradation can occur from heavy foot traffic (BMP 16.7).

Fish access is often a concern in PA1 channel segments. Culverts laid at stream grade should not be barriers to juvenile fish passage (BMP 14.17).

Management prescriptions should emphasize wetland protection and control of potential erosion sources (BMPs 13.15, 13.11-13.13).

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 Potential..... MODERATE

Enhancement Opportunities Beaver Introduction

Some resident sport fish opportunities exist in many PA1 segments. Species of interest include Dolly Varden and cutthroat trout. Streams adjacent to lakes and large beaver ponds may have very good angling.

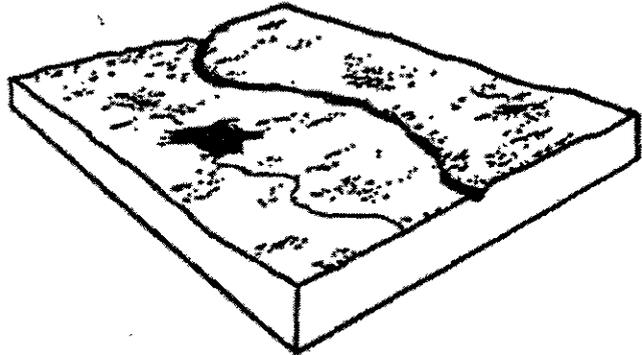
Beaver colonization could expand rearing habitat capability in these channels.

MODERATE WIDTH PLACID FLOW CHANNEL

Channel Mapping Symbol: PA2 (Formerly L2)

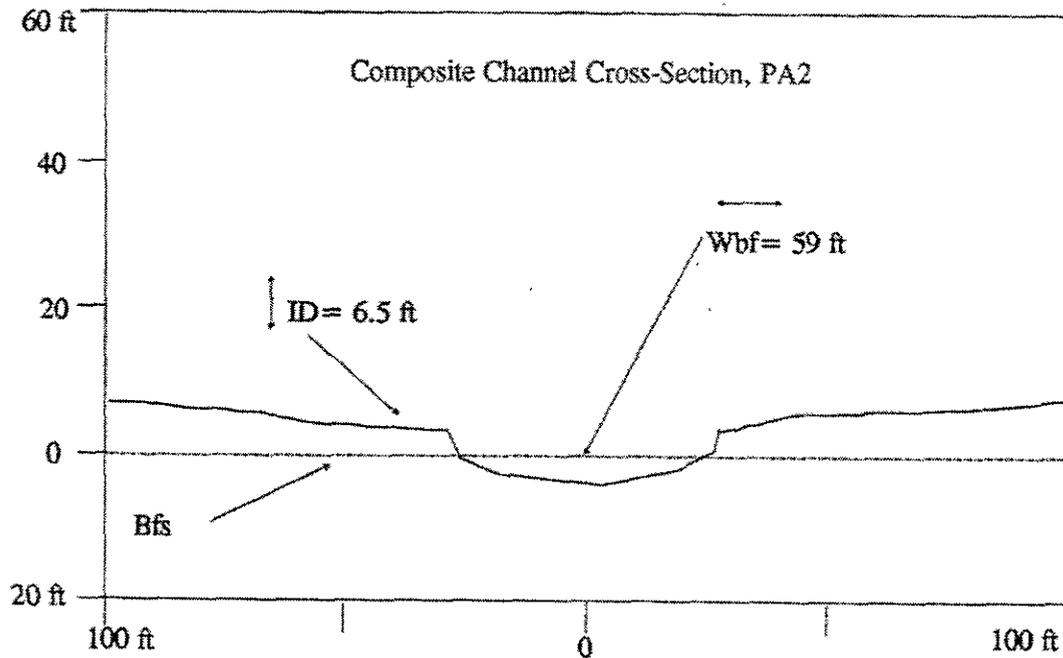
PHYSICAL CHARACTERISTICS

Geographic Setting: PA2 channels are associated with extensive wetlands on low relief landforms. The PA2 channel is often a lake inlet or outlet stream. Drainage basin size is moderate to large.



Similar Channel Types: LC1.7, PA1, PA5

Channel Structure



- Channel Gradient:.....0-1%, mean = 0.0%
- Incision Depth: < or = 2 m (6.5 ft)
- Bankfull Width:..... > 10 m (33 ft), mean = 16.5 m (59 ft)
- Dominant Substrate:Organic silt, sand, and fine gravel
- Stream Bank Composition:Alluvium
- Sideslope Length:Not significant, associated with low relief landforms
- Sideslope Angle:Not significant
- Channel Pattern:.....Single, deep, wide glides
- Drainage Basin Area:.....N/A (associated with low relief landforms)

PALUSTRINE PROCESS GROUP

Riparian Vegetation: The riparian plant communities are dominated by nonforested sedge and sphagnum bog communities and the shore pine/crowberry plant association.

Plant Association Series	% Cover
Nonforest	40%
Shore Pine	24%
Sitka Spruce	20%
Western Hemlock-Red Cedar	13%

Channel Type Phases: N/A

MANAGEMENT CONSIDERATIONS

Hydrologic Function: PA2 channels are sediment storage sinks consisting of glide flow extensions from valley bottom lakes, or wide, low velocity glides associated with wetlands. Palustrine areas are normally associated with PA2 channels, therefore, the substrate contains a large percentage of organic silt. Due to flat gradients, stream energy is very low. Little stream bank erosion occurs during high flow events due to the flow attenuation capacity of the associated lakes or wetlands.

Aquatic Habitat Capability

Large Woody Debris	2700 ft ³ /1000 linear ft
Available Spawning Area (ASA)	Insufficient data
Available Rearing Area (ARA)	Insufficient data

Indicator Species Ratings

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

These channels are frequently accessible to anadromous species. Available spawning area (ASA) is low due to placid water flow and predominantly gravel, sand, and silt/muck substrate. Coho and Dolly Varden will spawn in scattered pockets of gravel and sand. In addition, sockeye will spawn on a sand and muck bottom, however, most spawning takes place in areas of upwelling groundwater, which tends to offset the substrate deficiencies. Much of the PA2 channel consists of deep pools (mean pool depth = 0.9 meters [3.0 feet]). The addition of large woody debris cover yields a system that is virtually all rearing area. Coho, sockeye, and Dolly Varden frequently take advantage of this prime habitat. These channels provide extensive overwintering habitat due to temperature moderation from lake water sources and shallow groundwater aquifers.

Riparian Management Considerations

Concern for Management of:

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

Large woody debris sources are highly variable in PA2 channels. Most large woody debris recruitment occurs from beaver activity or large wood that floats in from upstream reaches or lake shores. Retention time of large woody debris in these channels is high. Accumulations of large woody debris provide added cover and protection for rearing fish.

Sediment retention is very high in these channels. Due to naturally high concentrations of fines in PA2 channels, it is difficult to assess cumulative effects of sediment from upstream activities.

Stream banks are composed of organic soils held together by dense root mats that are resistant to erosion by the low velocity stream flows. Disturbances to stream bank vegetation (heavy foot traffic) may break down channel banks making them susceptible to sloughing (BMP 16.7).

These channels are associated with important wetland/flood plain complexes that function to moderate runoff, store sediment, and bank nutrients. Protection of wetland functions and values is an important management consideration for these streams (BMPs 12.4-12.6, 13.15).

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 Potential..... MODERATE

Enhancement Opportunities Beaver Introduction, Fry Stocking, Large Wood Placement

Sport fishing opportunities are often good in PA2 channels, with the best fishing generally being associated with lake inlets and outlets. Species of primary interest are Dolly Varden, cutthroat, and sockeye. Small boat access, particularly from lakes, is usually good.

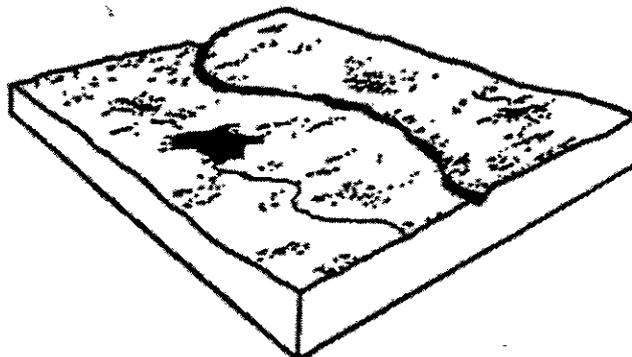
Encouragement of beaver colonization or the addition of large woody debris can significantly enhance rearing habitat associated with PA2 channels.

SHALLOW GROUNDWATER FED SLOUGH

Channel Mapping Symbol: PA3 (Formerly L4)

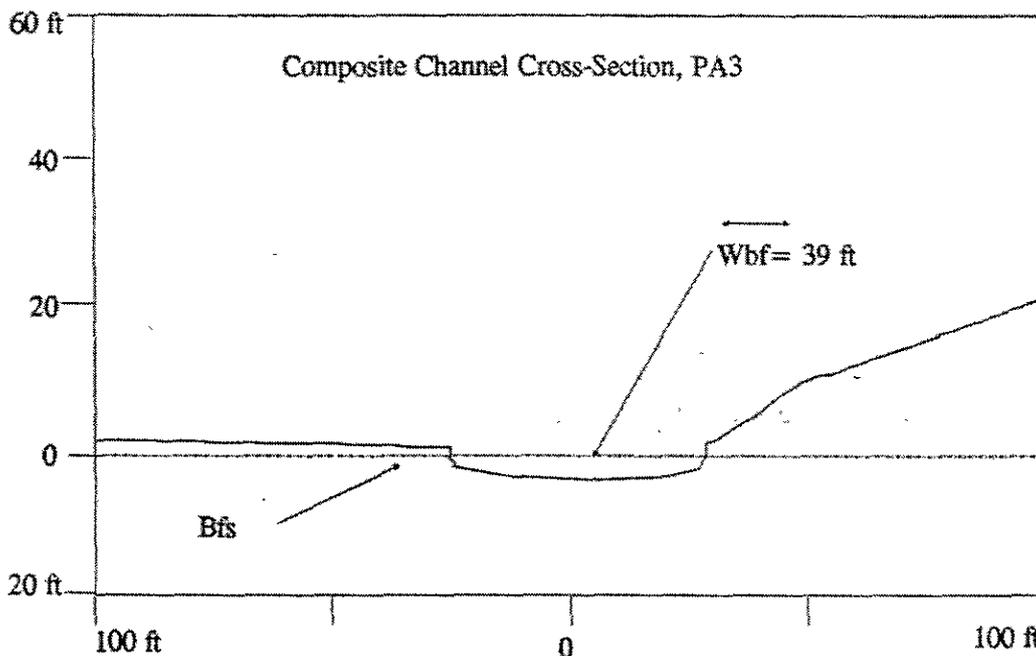
PHYSICAL CHARACTERISTICS

Geographic Setting: PA3 streams are located on low relief glacial outwash flood plains. These channels typically occupy relic glacial braided channels and are recharged by clear groundwater flow.



Similar Channel Types: PA1, PA4

Channel Structure



- Stream Gradient:0.0-1%, mean = 1%
- Incision Depth: < or = 4 m (13 ft), mean = 2.5 m (8 ft)
- Bankfull Width:.....Variable, mean = 12 m (39 ft)
- Dominant Substrate:Silt to fine gravel
- Stream Bank Composition:Alluvium
- Sideslope Length:Not significant
- Sideslope Angle:Not significant*
- Channel Pattern:.....Single to braided
- Drainage Area:Variable

*In glacial outwash areas the PA3 may be proximal to moraine deposits. In these cases a mean sideslope length equals 46 m (150 ft) and mean sideslope angle equals 27 degrees.

INCHANNEL PHOTO: PA3



Riparian Vegetation: The riparian plant communities are dominated by the Sitka spruce series, and the western hemlock series. Nonforested plant communities, which are predominantly willow or bog communities, commonly occur as a fringe along stream banks.

Plant Association Series	% Cover
Sitka Spruce	46%
Nonforest	44%
Western Hemlock	10%

Channel Type Phases: N/A

MANAGEMENT CONSIDERATIONS

Hydrologic Function: PA3 streams tend to store fine sediment due to low stream energy and, normally, low peak flows. During high flow periods the PA3 may be inundated by water heavily laden with silt from adjacent glacial outwash channels. Base stream flow in these channels is maintained by groundwater recharge.

Aquatic Habitat Capability

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

PALUSTRINE PROCESS GROUP

Indicator Species Ratings

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

PA3 channels are only moderately accessible to anadromous species because of seasonally low flows and possible physical isolation. Substrate consists of 20% gravel and 75% fine gravel, sand, and silt/muck. ASA is generally low, but what is available may be used by coho salmon, chinook salmon, and Dolly Varden char. Sockeye salmon will spawn in these channels more frequently, especially where there is active upwelling of groundwater. All of the above species, especially coho and sockeye salmon, find PA3s favorable for rearing.

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.....	HIGH
Culvert Fish Passage.....	N/A

PA3 stream segments are found on flood plains or glacial outwash plains and thus have relatively high sediment retention. Accelerated sediment deposition caused by riparian or upstream disturbances can adversely affect spawning gravel quality in PA3 channel types. Important spawning beds are generally associated with zones of upwelling ground water in PA3 stream segments. Control of sediment sources should be a management emphasis (BMPs 13.11-13.13, 14.14).

Stream banks are generally composed of fine textured, unconsolidated alluvium which is sensitive to physical disturbance (BMPs 13.16, 14.13, 14.17).

Flood plain protection is an important management concern for PA3 channel types. These streams are associated with extensive wetland/flood plain complexes. PA3 channels help to buffer flows from extreme floods, store sediment and nutrients, and provide important fish habitat. Protection of these functions and values should be a principal management goal (BMPs 13.8, 13.15, 12.4, 12.6, 14.13).

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).

Riparian Management Opportunities:

Sport Fish Potential..... LOW

Enhancement Opportunities Spawning Channels

Provided that rearing areas are not at carrying capacity, production can be increased by constructing spawning channels in areas adjacent to PA3 channels. An abundance of alluvial gravels and upwelling groundwater are key features of PA3 channels that generally make them suited to development of spawning channels.

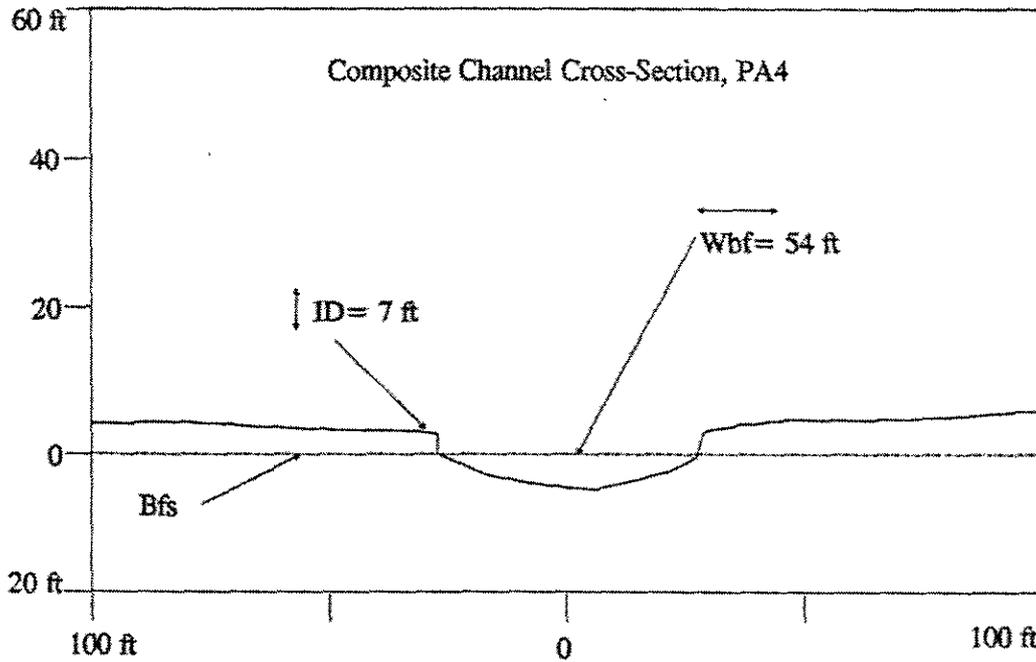
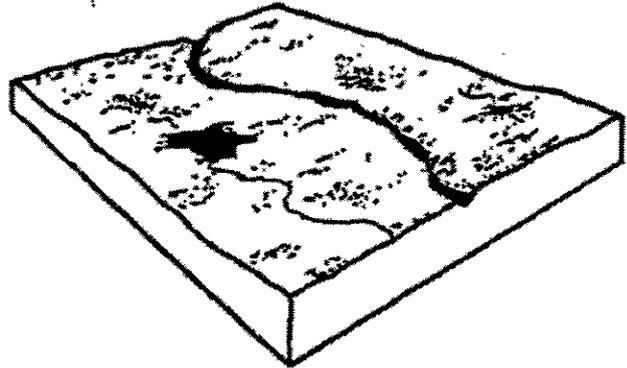
FLOOD PLAIN BACKWATER SLOUGH
Channel Mapping Symbol: PA4 (Formerly L5)

PHYSICAL CHARACTERISTICS

Geographic Setting: Glacial outwash flood plains and river terrace lowlands adjacent to active flood plains are associated with the PA4 channel.

Similar Channel Types: PA2, PA5

Channel Structure



- Stream Gradient:0.0-1%, mean = 1%
- Incision Depth: < 4 m (13 ft), mean = 3 m (10 ft)
- Bankfull Width:..... < or = 30 m (99 ft)
- Dominant Substrate:Silt to fine gravel
- Stream Bank Composition:Alluvium or organic mat
- Sideslope Length:Not significant
- Sideslope Angle:Not significant
- Channel Pattern:.....Single, low velocity flow
- Drainage Area:Variable

INCHANNEL PHOTO: PA4



Riparian Vegetation: The riparian plant community is dominated by nonforested plant communities, with the Sitka spruce series also being of significance. Nonforested plant communities are dominated by willow, Sitka alder, salmonberry, and devil's club shrub communities.

Plant Association Series	% Cover
Nonforest	80%
Sitka Spruce.....	16%
Sitka Spruce-Cottonwood.....	4%

Channel Type Phases: N/A

MANAGEMENT CONSIDERATIONS

Hydrologic Function: PA4 channels store sediment. Flow velocity is very sluggish and is controlled by backwater from main river channels. Fine silt sediment composes the bed substrate.

Aquatic Habitat Capability

Large Woody Debris	< 500 ft ³ /1000 linear ft
Available Spawning Area (ASA)	N/A
Available Rearing Area (ARA)	Avg = 91% for 11 sites

PALUSTRINE PROCESS GROUP

Indicator Species Ratings

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

PA4 channels are often accessible to anadromous species, but occasionally may be physically isolated from a stream network. Their slough-like characteristics render spawning capability insignificant, although coho, sockeye salmon, and Dolly Varden may have some success in isolated patches of gravel. Coho and sockeye salmon will frequently rear in these channels. Chinook salmon may also rear here temporarily, if accessible from large mainstem channels. Overwintering habitat can be significant if groundwater inflow is present. Pool area is 66 percent of the channel with an average mean depth of .61 meters (2.0 feet).

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 Need	HIGH
Culvert Fish Passage.....	N/A

Sediment retention in PA4 slough channels is high. These channels may also function as longer term sediment sinks when cut off from the main flood plain side channels. Increased sedimentation will likely have minor effects on spawning capability in PA4 channels, due to a lack of usable spawning gravels.

Stream banks are moderately sensitive to disturbance due to a high percentage of fine unconsolidated alluvium (BMP 12.7).

These channels are often associated with extensive flood plain/wetland complexes. PA4 channel types and adjacent riparian areas function as sediment and nutrient sinks, and are important buffers against extreme flood flows. Protection of these values and functions should be a primary management emphasis (BMPs 12.4, 12.6, 13.8, 13.15, 14.13).

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 Potential..... LOW

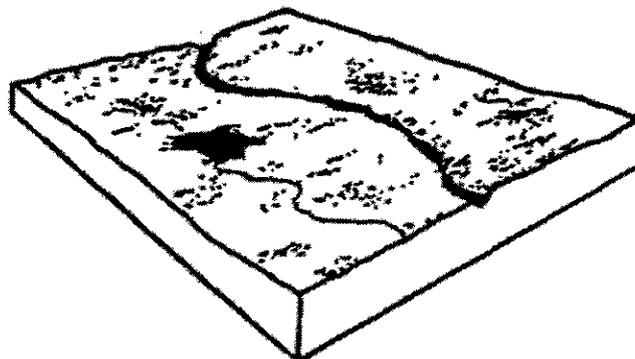
Enhancement Opportunities Spawning Channels

Provided that the rearing habitat is not at its carrying capacity, construction of spawning channels adjacent to PA4 channels may increase fish production. Flood plain gravels and near surface groundwater are key features often associated with PA4 channels, making them potentially suitable for spawning channel projects.

BEAVER DAM/POND CHANNEL
Channel Mapping Symbol: PA5 (Formerly L3)

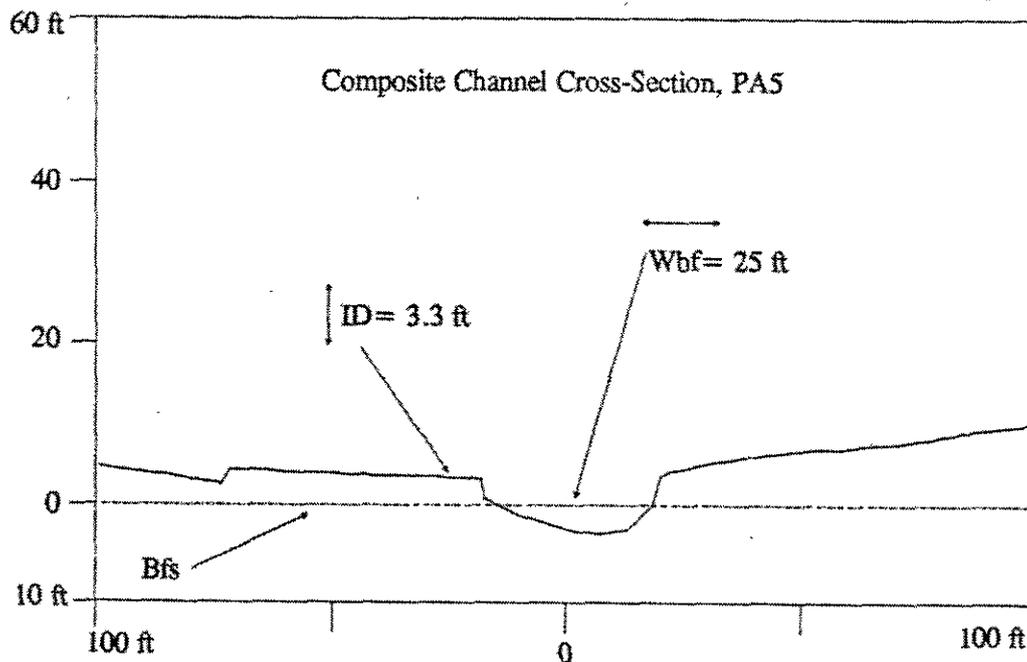
PHYSICAL CHARACTERISTICS

Geographic Setting: PA5 streams are found on valley bottom flood plains and low relief landforms. The PA5 channel type is characterized by a series of beaver impoundments.



Similar Channel Types: PA2, PA4

Channel Structure



- Stream Gradient:0-1%, mean = 1%
- Incision Depth:< or = 2 m (6.5 ft), mean = 1 m (3.3 ft)
- Bankfull Width:.....Variable, normally > 10 m (33 ft)
- Dominant Substrate:Organic silt to sand
- Stream Bank Composition:Organic material
- Sideslope Length:N/A
- Sideslope Angle:N/A
- Channel Pattern:.....Ponded area, glide flow
- Drainage Area:< 25.9 km² (< 10 mi²)

INCHANNEL PHOTO: PA5



Riparian Vegetation: The riparian area is dominated by nonforested plant communities, with the Sitka spruce series and shore pine series also being significant. The nonforested plant communities are dominated by sedge and sphagnum bog communities.

Plant Association Series	% Cover
Nonforest	31%
Sitka Spruce	20%
Shore Pine	17%
Mixed Conifer	13%
Western Hemlock-Red Cedar	8%

Channel Type Phases: N/A

MANAGEMENT CONSIDERATIONS

Hydrologic Function: The PA5 channel is a sediment sink. Silt, sand, and fine gravel sediment particles are effectively trapped by these channel reaches. Typically the PA5 channels occur when valley flood plain channels (FP3, FP4) or palustrine glide channels (PA1) are worked by beavers. Flood peaks tend to be attenuated by these stream reaches. Substantial sediment loads may be delivered to downstream reaches in the wake of a beaver dam burst.

Aquatic Habitat Capability

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

PALUSTRINE PROCESS GROUP

Indicator Species Ratings

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

These channels are moderately accessible to anadromous species. Spawning is limited by the sand, silt and organic muck content of the substrate. Sockeye salmon do spawn near areas of groundwater upwelling. PA5 channels provide good rearing habitat for coho, sockeye salmon, and Dolly Varden char. Good overwintering habitat is provided in the deep (mean depth = 0.55 meters [1.8 feet]) pools (78% of active water).

Riparian Management Considerations

Concern for Management of:

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

The woody debris associated with beaver dam complexes provides extensive areas of cover for juvenile fish. In addition, these beaver dam complexes greatly increase production of invertebrates, upon which the juvenile fish feed.

Sediment retention is very high in PA5 beaver pond channels. These channels can buffer downstream sediment transport. Sedimentation behind beaver ponds gradually reduces available rearing habitat in these channels.

These channels are associated with important wetland/flood plain complexes. The PA5 channel stores sediment and nutrients, and buffers flows from extreme runoff events. Protection of wetlands functions and values is an important management consideration in PA5 channel types (BMPs 12.4-12.6, 13.8, 13.15, 14.13).

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).

Riparian Management Opportunities:

Sport Fish Potential HIGH

Enhancement Opportunities Beaver Introduction, Fry Stocking

PA5 channels provide good sport fishing opportunities especially when these channels are tributary to large flood plain rivers. Primary species of interest include Dolly Varden char and cutthroat trout.

Provided that they are not at carrying capacity, PA5 channels can be stocked with fry to increase production. Beaver populations should be managed to maintain optimum fish rearing capability and sufficient food source for beaver.

Palustrine Process Group

