Barrier Island Restoration, Isle Dernieres Raccoon Island Breakwaters (PTE-15 phase 7)

Candidate Project for the Fourth Priority List of the

Coastal Wetlands Planning, Protection and Restoration Act

Candidate Project Information Sheet for Wetland Value Assessment

Proposed by:

USDA Soil Conservation Service
and the
State of Louisiana

August 8, 1994

{Revised in accordance with the CWPPRA WVA Working Group meeting of 8/3/94}

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Coastal Wetlands Planning, Protection and Restoration Act
Barrier Island Restoration, Isle Dernieres
Raccoon Island Breakwaters (PTE-15 phase 7)
Project Fact Sheet

Location and Size

Located on the southern coast of Terrebonne Parish, Raccoon Island is the western most island in the Isle Dernieres chain. This project calls for the installation of ten (10) previously permitted offshore segmented breakwaters along the Gulf side of Raccoon Island. Two distinct areas will benefit from this restoration project--the island marshes and the inland marshes. The first area is a 60 acre section of the eastern end of Raccoon Island and the second area is a 500 ac. inland saline marsh area. The island area was determined by digitizing March 1994 aerial photography. The mainland marsh impacted area was determined using information from the 1993 CWPPRA WVA evaluation. The 1993 WVA called for protection of the entire island and stated that approximately 2000 acres of mainland marsh would be influenced by this island. This acreage figure has been reduced by 75% mainly because this project will only protect the eastern half of the island and partially due to the island's geographic proximity to the rest of the barrier chain and great distance from the mainland marsh. At it's closest point to the mainland, Raccoon Island is greater than five miles offshore. Thus situated, Raccoon Island probably plays a substantially smaller role than the other islands in the Isle Dernieres chain in protecting mainland marshes. List and Hansen (1992) evaluated the value of barrier islands for protecting the mainland shoreline from locally-generated wave attack using a shallow water wave prediction model and concluded that, in general, barriers fronting wide shallow bays have little potential to protect mainland shoreline from wave attack. These wide shallow bay systems are characteristic of those found landward the Isles Dernieres and the Timbalier Islands,

Justification:

The Isles Dernieres provide protection for the back-barrier and possibly to some extent, mainland marshes through dissipation of storm surges, and as some experts believe, reduced salt water intrusion and tidal inundation.

Two distinct destructive processes can occur after barrier island formation in an abandoned delta (McBride et al 1992): 1) landward rollover, and 2) in-place breakup. Isle Dernieres falls into the type 2 category of in-place breakup which typically involves the landward movement of the gulfside shoreline and stability or seaward movement of the bayside shoreline. In Louisiana, this type of barrier island evolution is characterized by insufficient sediment supply or an island that is too wide to be overwashed; Raccoon Island falls under the first category.

It is widely accepted that the Isles Dernieres barrier arc is representative of a sediment starved system. Penland and Suter, 1992, found that there is a net export of sediment

from the barrier shoreline because fair-weather wave processes cannot return all the sediment transported offshore during storms. On Isle Dernieres, the depositional volume ($18x10^6m^3$) is about 1/3 of the erosional volume ($-55x10^6m^3$) (List et al 1992). This is substantiated by the rapid rate of disappearance of the island chain.

These data bring the following question: Is sufficient sediment available from wave and littoral drift transport to replenish the islands using segmented breakwaters? The Traverse report (1988) estimated the average littoral drift transport to fluctuate between -2,800 and +50,400 cubic yards/month at Raccoon Island. The average rate of littoral drift is 13,000 cubic yards/month and the annual total is 160,000 cubic yards (Traverse Group, 1988). It is important to note that this rate does not take into account the volume of sediment transported by wave action. This information provides a basis for the assumption that sediment can be trapped by segmented breakwaters. It is conservatively estimated that segmented breakwaters will trap between 10 and 20% of the available sediment (Long, pers. comm.). If only 10% of the sediment carried by littoral drift is retained as a result of the breakwaters, this amounts to 320,000 cubic yards of sediment over 20 years.

To put this in perspective, assume that the protected portion of the islands averages 2 ft MSL in elevation, is 4,500 ft. in length and averages 200 ft in width. This equates to roughly 66,700 cubic yards in volume. This is only 40% of the sediment transported by littoral drift each year. Thus, assuming that segmented breakwaters trap 10% of the sediment carried by littoral drift, the total volume of the subaerial sediment on the island could be matched approximately every four years.

In the 1993 Isles Dernieres Restoration (PTE-15) Wetland Value Assessment Information Sheet, all of the islands were projected to be lost by year 15 of the project, and Raccoon Island by the year 2000. According to the 1993 Wetland Value Assessment Information Sheet, Raccoon Island should disappear by the year 2000, based on coastal erosion rates between 1978 and 1988 (Jones, 1993).

Two factors have not been included in this erosion rate: 1) 40% of the Isle Dernieres land mass was lost during Hurricane Andrew in 1992 and 40% of the remaining land mass was lost in the following winter storms (Jones, 1993) and 2) 1.62 million cubic yards of sand from Caillou Bay was used to restore part of Raccoon Island (Dept. of Army Permit).

The 1993 Wetland Value Assessment Worksheet indicates that 187 ac (20%) of the saline marsh will remain on Raccoon Island at TY 20. This would indicate that a portion of Raccoon Island was assumed to be remaining at TY 20. Without substantial restoration, this is a highly unlikely scenario. For the mainland marshes, 1,099 ac (55%) of saline marsh will be present at TY 20.

In R. Jones proposal, *Barrier Island Restoration, Isle Dernieres Raccoon Island Breakwaters*, Jones indicates that Raccoon Island will be lost by the year 2000 based on erosion rates between 1978 and 1988. He points out that this rate does not include the

damage caused by Hurricane Andrew (Jones, 1994). Currently the eastern half of Raccoon island covers an area of approximately 60 acres. If, as anticipated, the island will be submerged by the year 2000, this equates to a loss rate of 10 ac/yr. Note that this loss rate may be too optimistic in light of historical loss rates.

Project Objectives:

The objectives of the comprehensive Isle Dernieres Restoration project are to create and restore beaches and back island marshes, close breaches, and construct protection structures in an effort to protect the mainland coastal wetlands of Terrebonne Parish, Louisiana. The objectives of the Raccoon Island phase are to protect the newly refurbished beaches and wetlands of Raccoon Island and protect back barrier and mainland marshes with segmented breakwaters.

Project Features:

1. Construct ten (10) offshore segmented breakwaters using large limestone rock. These breakwaters are to be placed in water at a depth of 4-6 ft with a designed freeboard of 4 ft for a total height of 10 ft. The conceptual crown dimensions for the breakwaters are 175 ft long and 10 ft wide with 3:1 side slopes. Breakwaters will be placed on 450 foot centers with 275 ft. wide gaps between them.

ANTICIPATED BENEFITS

Type(s) and acres of coastal wetlands enhanced, and the design and nature of the enhancement

This project is not designed for marsh enhancement per se but marsh protection. Segmented breakwaters will protect and restore the island and back-barrier marsh by baffling wave energy and increasing sediment deposition and retention along this beach during normal tidal conditions. This will increase the volume of sediment on the island and improve conditions for dune building and marsh nourishment with sediment during overwash events. Breakwaters will also offer greater protection to the island during severe weather events when erosion is greatest.

Type(s) and acres of coastal wetlands protected

The 1994 Wetland Value Assessment Worksheet projected that this project would protect 23 ac of island marsh and 14 ac of mainland marsh

Type(s) and acres of coastal wetlands restored

No increase in marsh acreage is anticipated.

Duration (life expectancy) of coastal wetland benefits

The project has an expected life of at least twenty years.

Benefits to coastal wetland dependent fish and wildlife populations

This island provides nesting habitat for thousands of shorebirds and wading birds including Brown pelicans, Black skimmers, American oystercatchers, terns, gulls, Roseate spoonbills, Great Blue herons and other species. The island also baffles wave energy and improves conditions for commercial and recreational fishing vessels.

Other significant benefits

Nothing remarkable.

ANTICIPATED ADVERSE EFFECTS

Types and acres of coastal wetlands and other habitats adversely affected by the project

No adverse impacts are anticipated.

Conflicts with other projects and programs

No conflicts with other programs are anticipated at this time.

COSTS

Estimated total cost breakdown and sources of the estimates are as follows:

Construction Cost	1,200,000
Feasibility and Planning	30,000
Engineering & Design (includes geotech)	120,000
Supervision & Administration of E & D	18,000
Supervision & Administration of Construction	120,000
Contingencies	300,000
Total First Construction Cost	**$1,788,000**
Operation and Maintenance	0
Monitoring Costs	86,500
Total Estimated Cost	**$1,788,865**

Source(s) of the costs estimate(s)

CRD Engineers

STATUS OF ENVIRONMENTAL COMPLIANCE

NEPA

NEPA compliance has been established.

Section 10/404

A section 10/404 permit has been issued.

Louisiana Coastal Management Program

The project is located within the Louisiana coastal zone and a Coastal Use Permit has been issued.

Louisiana Water Quality Certification

No permit application has been filed.

Endangered Species Act

This project is not believed to adversely affect endangered or threatened species, but the project will be coordinated with the US. Fish and Wildlife Service through the permitting process.

Project Implementation Schedule

Engineering and design start date	September 1994
Engineering and design finish date	November 1994
Construction start date	March 1995
Construction finish date	May 1995

Potential Funding Sources

Federal Funding Source(s)

There is potential for federal funding of this project through the Coastal Wetlands Planning, Protection and Restoration Act (Public Law 101-646).

Non-federal Funding Source(s)

If this project is funded under the CWPPRA, the state will cost share 25%..

Secondary Criteria
Barrier Island Restoration, Isle Dernieres
Raccoon Island Breakwaters (PTE-15 phase 7)

Letter of Intent, State of Louisiana

The project is included in the 1991-92 Louisiana Coastal Wetlands Conservation and Restoration Plan and is approved for implementation by the State pending availability of construction funding.

Letter of Intent, Landowners

Specific terms and conditions have not yet been established under Section 303(e) and landowner contacts for this purpose are not appropriate at this time.

Average Annual Acres - Benefits

The project Wetland Value Assessment (WVA) calculated 14 average annual habitat units (AAHU's)..

Rates of Wetland Loss:

US. Army Corps of Engineers data (Dunbar et al., 1992)

	1932-58 (mi^2/yr)	1958-74 (mi^2/yr)	1974-83 (mi^2/yr)	1983-90 (mi^2/yr)
State wide	1.23	45.6	31.1	25.34

The island is losing approximately 4 acres per year.

Shoreline Erosion Rate:

The island is eroding at a rate of approximately 62.4 ft/yr on the gulf side and 8.8 ft/yr on the bay side.

Freshwater or sediment diversion/introduction features:

None

Relative abundance of project marsh type:

Project: 100% Saline
Basin: Roughly 55% Brackish, 30% Fresh, 15% Saline
State: Brackish is most abundant

Level of public support:

Project has strong support of the local government and citizenry of Terrebonne Parish

Part of major interagency environmental program:

Interagency coordination and documentation will be incorporated through the permit process, as well as during the P.L 101-646 (CWPPRA) funding evaluation.

Direct benefits to threatened or endangered species:

None identified

Speed of implementation:

This project could be completed by May of 1996.

Technologies used are applicable to other coastal wetlands:

This type of restoration technology can and is being used in many areas along the coast that are suffering from the effects of sediment starvation and shoreline erosion.

Coastal Wetlands Planning, Protection and Restoration Act
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Project Information Sheet

Project Area Size: **Total area:** 26,530 acres [18,250 acres marsh, 8,280 acres water]
Area I Raccoon Island: 60 acres [41 acres (**68%**) saline marsh, acres (**8%**) water 14 ac. (**24%**) beach]
Area II Mainland Marsh: 500 acres [300 acres (**60%**) saline marsh, 200 acres (**40%**) water]

Project Description

Location:

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Justification:

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It is widely accepted that the Isles Dernieres barrier arc is representative of a sediment starved system. Penland and Suter, 1992, found that there is a net export of sediment from the barrier shoreline because fair-weather wave processes cannot return all the sediment transported offshore during storms. On Isle Dernieres, the depositional volume ($18x10^6m^3$) is about 1/3 of the erosional volume ($-55x10^6m^3$) (List et al 1992). This is substantiated by the rapid rate of disappearance of the island chain.

These data bring the following question: Is sufficient sediment available from wave and littoral drift transport to replenish the islands using segmented breakwaters? The Traverse report (1988) estimated the average littoral drift transport to fluctuate between -2,800 and +50,400 cubic yards/month at Raccoon Island. The average rate of littoral drift is 13,000 cubic yards/month and the annual total is 160,000 cubic yards (Traverse Group, 1988). It is important to note that this rate does not take into account the volume of sediment transported by wave action. This information provides a basis for the assumption that sediment can be trapped by segmented breakwaters. It is conservatively estimated that segmented breakwaters will trap between 10 and 20% of the available sediment (Long, pers. comm.). If only 10% of the sediment carried by littoral drift is retained as a result of the breakwaters, this amounts to 320,000 cubic yards of sediment over 20 years.

To put this in perspective, assume that the protected portion of the islands averages 2 ft MSL in elevation, is 4,500 ft. in length and averages 200 ft in width. This equates to roughly 66,700 cubic yards in volume. This is only 40% of the sediment transported by littoral drift each year. Thus, assuming that segmented breakwaters trap 10% of the

sediment carried by littoral drift, the total volume of the subaerial sediment on the island could be matched approximately every four years.

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The 1993 Wetland Value Assessment Worksheet indicates that 187 ac (20%) of the saline marsh will remain on Raccoon Island at TY 20. This would indicate that a portion of Raccoon Island was assumed to be remaining at TY 20. Without substantial restoration, this is a highly unlikely scenario. For the mainland marshes, 1,099 ac (55%) of saline marsh will be present at TY 20.

In R. Jones proposal, *Barrier Island Restoration, Isle Dernieres Raccoon Island Breakwaters*, Jones indicates that Raccoon Island will be lost by the year 2000 based on erosion rates between 1978 and 1988. He points out that this rate does not include the damage caused by Hurricane Andrew (Jones, 1994). Currently the eastern half of Raccoon island covers an area of approximately 60 acres. If, as anticipated, the island will be submerged by the year 2000, this equates to a loss rate of 10 ac/yr. Note that this loss rate may be too optimistic in light of historical loss rates.

In addition, and perhaps most importantly, this island provided nesting habitat for thousands of shorebirds and wading birds including Brown pelicans, Black skimmers, American oystercatchers, terns, gulls, Roseate spoonbills, Great Blue herons and other species. The island also baffles wave energy and improves conditions for commercial and recreational fishing vessels.

Anticipated Benefits:

Segmented breakwaters will protect and restore the island and back-barrier marsh by baffling wave energy and increasing sediment deposition and retention along this beach during normal tidal conditions. This will increase the volume of sediment on the island and improve conditions for dune building and marsh nourishment with sediment during overwash events. Breakwaters will also offer greater protection to the island during severe weather events when erosion is greatest.

The 1993 Wetland Value Assessment Worksheet projected that this project would protect 140 ac of island marsh and 32 ac of mainland marsh. R. Jones proposal

projects that this project enhances and protects 72 ac of back-barrier marsh and 3,505 ac of mainland marsh. (Jones determined that the restoration project on Raccoon Island accounted for 3.1% of the proposed restoration area for the Isle Dernieres and the Timbalier Islands, and, then extrapolated from the barrier island model to estimate mainland acres protected.)

Present Conditions:

1. Acres of vegetated marsh and listing of most common plant species present. USFWS GIS and digitized aerial photographic data for 1988 and 1990:
   Area I Island Marsh: 41 acres (**87%**)
   Area II Mainland Marsh: 300 acres (**60%**)

Marsh species common to the area observed during field investigation:

60%	*Spartina alterniflora*	Smooth marsh cordgrass or Oystergrass
25%	*Spartina patens*	Wiregrass or Marsh hay
Tr.	*Avicennia germinans*	Black mangrove
Tr.	*Batis maritimus*	Saltwort
Tr.	*Salicornia* sp.	Glasswort
Tr.	*Borrichia frutescens*	Sea oxeye
Tr.	*Iva frutescens*	Marshelder
Tr.	*Panicum armarum*	Seaside armarum

2. Acres of open water: [USFWS GIS data for 1988]

   Area I Island Water: 6 acres (**13%**)
   Area II Mainland Water: 200 acres (**40%**)

3. Percent of open water area listed in Item #2 dominated by aquatic plants ($\geq$ 50% canopy cover).

   Area I Island Water: (**0%**)
   Area II Mainland Water: (5%) *Ruppia maritima* (Widgeongrass)

4. Historical information on marsh loss trends (provide references, if available, or methods used to derive information given).

   Area 1 Island Area Loss USGS (1992) data

1890's to 1988 (acres/yr.)	**1978 to 1988 acres/yr.)**
3.1	2.8

   Area II: Mainland Marsh COE land loss data

   1983 to 1990 - **0.43%/yr**

5. Brief summary of significant historical hydrologic changes.

   Marsh loss on Raccoon Island is caused primarily by bayside and gulfside shore erosion, sediment starvation and overwash of the island during storm events. Historically, the island has been disappearing at a rate of approximately 19 ac/yr over the past 100 years. Island loss has continued over 17 ac/yr over the last 10-15 years. In September, 1992 Hurricane Andrew eroded roughly 40% of the island.

6. Shoreline erosion rate (provide source if available).

   According to the Louisiana Barrier Island Erosion Study Atlas of Shoreline Changes In Louisiana From 1853 to 1989, (USGS, 1992) the short term (10-15 years) erosion rate of Raccoon Island is 2.7 m/yr (8.8 ft/yr) on the bayside and 19.2 m/yr (62.4 ft/yr) on the gulfside.

7. Percent of open water area $\leq$ 1.5 feet in depth (relative to marsh surface)

   Area I Island Water: **(60%)**
   Area II Mainland Water: **(40%)**

8. Available historical salinity data, including period of record, sampling location(s) in relation to project area.

   Average annual salinity is approximately 22 ppt. for the island and 18 ppt. for the mainland marsh.

9. Location, type and operation schedule (if applicable) of existing permitted and unpermitted structures.

   Nothing remarkable.

10. If there is an existing management plan for the area, is it permitted? Provide copy of permitted operational schedule scheme and permit number.

    No permitted or unpermitted management plan exists at the present.

11. Location of structures, culverts, breaks in spoil banks, etc. that serve as hydrologic connections and are not identified above or are not easily seen by examination of aerial photography.

    Nothing remarkable.

12. Estimated subsidence rate (provide reference if available).

    Subsidence is approximately 1.03 cm/yr (0.41 in/yr) near the shoreline in Terrebonne Parish. (Penland et al; Relative Sea Level Rise and Delta Plain Development in the Terrebonne Parish Region, Coastal Geology Technical Report No. 4; Louisiana Geological Survey; 1988; p106.

WVA Variables

The benefits listed below should reflect the net benefits attributable to the project for the 20 year analysis period.

Emergent Marsh (V1)

Area 1 Future Without Project Scenario

a-1. Acres of emergent marsh predicted to be gained/lost without project.

Assumptions:

At the current rate of island disappearance, the entire island will be lost by TY 9 or the year 2004 which ever comes first. This equates to a loss rate of 4.5 acres per year.

Area 1 - Saline Marsh -

TY 0: **41** ac. of emergent marsh occupying **87%** of the 47 ac. project area.
TY 1: **5** ac. lost leaving **36** ac or **77%** of the project area covered with marsh.
TY 9: **41** ac. lost leaving **0** ac or **0%** of the project area covered with marsh.
TY 20: Only a subtidal shoal remains.

1. Island marsh loss at TY 9:
   4.5 ac/yr marsh loss x 9 yrs. = - 41 ac.

Area 1 FWOP Total: = - 41 ac.

Area 1 Future With Project Scenario

a-2. Acres of emergent marsh predicted to be gained/lost with the project.

Assumptions:

The overall island loss rate is expected to slow to 1.5 ac/yr. Erosion will be significantly reduced on the gulfside but will continue unabated on the bayside.

Area 1 - Island marsh

TY 0: **41** ac. of emergent marsh occupying **87%** of the 47 ac. project area.
TY 1: **1** ac. lost leaving **40** ac or **85%** of the project area covered with marsh.
TY 9: **14** ac. lost leaving **27** ac or **58%** of the project area covered with marsh.
TY 20: **30** ac. lost leaving **11** ac or **23%** of the project area covered with marsh.

1. Island marsh loss at TY 20:
   1.5 ac/yr marsh loss x 20 yrs. = - 30 ac.

Area 1 FWP Total: = - 30 ac.

AREA 1 SUMMARY:

Total acres of marsh lost without the project:	= - 41 ac.
Total acres of marsh lost with the project:	= -30 ac.
Net benefit:	**= 11 ac**

Submerged Aquatic Vegetation (V2)

	FWOP	FWP
Baseline	0%	0%
TY 1	0%	0%
TY 9	0%	0%
TY 20	0%	0%

Marsh Edge (V3)

Baseline	(2) 100%	(2) 100%
TY 1	(2) 75%; (4) 25%	(2) 100%
TY 9	(5) 100%	(2) 60%; (4) 40%
TY 20	(5) 100%	(4) 100%

Shallow Water (V4)

	FWOP	FWP
Baseline	90%	90%
TY 1	85%	90%
TY 9	40%	70%
TY 20	0%	40%

Salinity (V5)

Baseline	22 ppt	22 ppt
TY 1	22 ppt	22 ppt
TY 9	22 ppt	22 ppt
TY 20	22 ppt	22 ppt

Fisheries Access (V6)

Baseline	1	1
TY 1	1	1
TY 9	1	1
TY 20	1	1

Area 2 Future Without Project Scenario

a-1. Acres of emergent marsh predicted to be gained/lost without project.

Assumptions:

The island will disappear by TY 9 and the mainland marsh loss rate will double from 0.43%/yr to 0.86%/yr.

Saline Marsh:

TY 0: **300** ac. of emergent marsh occupying **60%** of the 500 ac. project area.
TY 1: **1** ac. lost leaving **299** ac or **60%** of the project area covered with marsh.
TY 9: **12** ac. lost leaving **288** ac or **58%** of the project area covered with marsh.
TY 20: **40** ac. lost leaving **260** ac or **52%** of the project area covered with marsh.

1. Mainland marsh loss from TY 0 to TY 9:
   (300 ac. x 0.0043) x 9 yr. = - 12 ac.
   [where 0.0043 = 0.43% land loss/yr]

1a. Mainland marsh loss from TY 9 to TY 20:
   (300 ac. x 0.0086) x 11 yr. = - 28 ac.
   [where 0.0086 = 0.86% land loss/yr]

Area 2 FWOP Total: = - 40 ac.

Area 2 Future With Project Scenario

a-2. Acres of emergent marsh predicted to be gained/lost with the project.

Assumptions:

The eastern portion of the island will remain intact and mainland marsh land loss will remain constant at 0.43%/yr.

Area 2 - Saline Marsh -

TY 0: **300** ac. of emergent marsh occupying **60%** of the 500 ac. project area.
TY 1: **1** ac. lost leaving **299** ac or **60%** of the project area covered with marsh.
TY 9: **12** ac. lost leaving **288** ac or **58%** of the project area covered with marsh.
TY 20: **26** ac. lost leaving **274** ac or **55%** of the project area covered with marsh.

1. Mainland marsh loss at TY 20:
   (300 ac. x 0.0043) x 20 yr. = - 26 ac.
   [where 0.0043 = 0.43% land loss/yr.]

Area 2 FWP Total: = - 43 ac.

AREA 2 SUMMARY:

Total acres of marsh lost without the project:	= 40 ac.
Total acres of marsh lost with the project:	= 26 ac.
Net benefit:	**= + 14 ac**

Submerged Aquatic Vegetation (V2)

	FWOP	FWP
Baseline	5%	5%
TY 1	5%	5%
TY 9	5%	5%
TY 20	5%	5%

Marsh Edge (V3)

Baseline	(3) 100%	(3) 100%
TY 1	(3) 100%	(3) 100%
TY 9	(3) 100%	(3) 100%
TY 20	(3) 100%	(3) 100%

Shallow Water (V4)

	FWOP	FWP
Baseline	40%	40%
TY 1	40%	40%
TY 9	40%	40%
TY 20	40%	40%

Salinity (V5)

Baseline	18 ppt	18 ppt
TY 1	18 ppt	18 ppt
TY 9	18 ppt	18 ppt
TY 20	18 ppt	18 ppt

Fisheries Access (V6)

Baseline	1	1
TY 1	1	1
TY 9	1	1
TY 20	1	1

References

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DNR/CRD, 1994. Raccoon Island Field Trip Report.

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