

# **LAGUNA MADRE GIWW DREDGED MATERIAL MANAGEMENT PLAN**

**Prepared by  
The Corps of Engineers and the Interagency Coordination Team  
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The Dredged Material Management Plan (DMMP) for the Laguna Madre section of the GIWW was prepared with the guidance and close coordination of the Interagency Coordination Team (ICT). The ICT was assembled in February 1995 to help the Corps of Engineers (USACE) prepare a Supplement to the 1975 Environmental Impact Statement (SEIS) on maintaining the GIWW along the Texas coast.

The ICT considered several alternative methods for dredging and placement of shoaled material in the GIWW to identify the least environmentally damaging alternative that was within the engineering capabilities of the USACE and was economically feasible. The ICT reached consensus on the DMMP.

The Placement Areas (PAs) will be managed primarily for reducing impacts to nearby seagrass habitat, but some sites will be managed for bird use, vegetation control, or public recreation use. All discussions on management of the PAs in Reach 1 and some of the PAs in Reach 2 include the recommendations of Dr. Allan Chaney and Mr. Gene Blacklock based on the latest bird use information and management strategies (appended to the EIS) needed to enhance the sites for birds. Special concerns on management practices on the PAs located inside the Padre Island National Seashore (PINS) have been addressed as well. The PINS management plan is appended to the EIS.

In some cases, the ICT recommended the designated boundaries of a PA be shifted to include all of an island or provide pipeline access to nearby deep, unvegetated water to best facilitate dredged material management in a PA. All islands inside the PAs were created during GIWW construction and nourished with shoaled material during subsequent maintenance dredging operations. Clearance for moving the boundaries will be obtained through the National Environmental Policy Act (NEPA) process by describing the need for and impacts of the action in the SEIS. The ICT also recommended that new PAs be designated or existing PAs should be combined to meet special management requirements or to handle excess dredged material if it is determined an existing PA cannot accommodate all the material normally designated for the site and meet the goals of the management plan. If any of the new PAs are located outside of the existing disposal easements, the USACE will use the submerged sites pursuant to the Navigation Servitude Authority.

Another concern of the ICT is the issue of coastal cabins located inside the PAs in the upper Laguna Madre. Many of these cabins could be damaged if the entire PA is used for disposal. The Texas General Land Office (GLO) has issued permits for these

cabins to be built on the PAs and reviews these permits when they come up for renewal every five years. The ICT recommended that the GLO send a letter to the affected cabin owners notifying them of the potential damage to their cabins in a future dredging cycle. At their discretion, GLO and the School Land Board (SLB) will require cabins to be relocated or removed, as necessary, prior to placement of dredged material.

The management plans in the DMMP will be reviewed prior to each dredging event to ensure the best management practice for each PA in every reach is incorporated to the extent practicable. It is assumed that all pumping of dredged material will be done by the best management practices, including the use of a dispersing or energy-dissipating device such that the material is spread out in a thin layer to decrease the chance of burying seagrass too deep to recover and does not create a scour hole when it exits the discharge pipe.

One of the management plan restrictions the ICT recommended to the USACE was that a dredging window should be observed throughout the Laguna Madre for routine GIWW maintenance to minimize impacts to seagrass. Within this window, open-bay, unconfined dredging would be restricted to the period from November through February, inclusive. Open-bay, unconfined placement outside the dredging window would require coordination with the ICT. As discussed in the SEIS, studies have shown that this is the period when seagrass is dormant and will not be impacted by turbidity as much as at other times of the year. Hydrodynamic and Sediment Transport and Seagrass modeling also indicated that the extent of the impact from high turbidity levels that reduces light penetration to the seagrass below the level needed to survive and grow is usually confined to an area within  $\frac{3}{4}$  to 1 mile of the open-water discharge point. These high turbidity conditions attributable to unconfined disposal generally occurred over a period of less than 3 months after disposal is completed. Another impact of dredged material disposal is seagrass burial when the mud flows away from the point of discharge. Seagrass studies by Dr. Ken Dunton at UTMSI have shown that if seagrass is buried under no more than 3 inches of sediment, it can fully recover in about 3-5 years, depending on the depth of burial. However, in the case of shoalgrass, the dominant seagrass in most of the Laguna Madre, studies also have shown that new shoalgrass quickly invades the buried site through seed dispersal to create new seagrass meadows before the original plants have a chance to regenerate. Therefore, if dredging and disposal operations are conducted during the dormant phase of seagrass growth, the plants are not affected as much as in other seasons, unless they are buried. Even with burial close to the PA, shoalgrass can quickly recover through colonization by new plants or growth of the original plants if burial is less than 3 inches.

The PA descriptions are taken from 1995 aerial photos (Digital Ortho Quarter Quads) and the north-south limits of each PA are provided in parenthesis following the PA heading. These station numbers are in feet and can be used to calculate the total length of a PA along the GIWW (e.g., PA 176 is 35,700 – 30,150 = 5,550 feet long). Additional information on each PA is included in Table 1. This information includes: average percent sand in the maintenance material that goes into the PA, the number of times the PA was used during the period of record (May 1949 – March 1995), the

average number of years between dredging events (frequency of use), size of the designated PA (acres), the average per cycle amount of maintenance material (cy), and the average annual amount of maintenance material (cy) that has historically accumulated in a PA reach of the GIWW.

**Reach 1** – This Reach contains PAs 175 through 191. PAs 182, 183, 185, 187, 188, 190, 191, 192, 194, and the northern half of 195 are inside the Padre Island National Seashore (PINS) boundary.

The ICT considered all of the alternative dredging and placement options described in Section 5.0 of the SEIS for these PAs. Following the criteria designed to identify fatal flaws in a disposal option, the ICT eliminated Ocean Placement as a viable option due to the long haul distances, lack of appropriate equipment, and excessive pumping distances for pipeline disposal. One other option, piping the material across Padre Island was eliminated in most of Reach 1 because the PINS would not permit it since this action would represent an impairment of natural resources in the Park. Likewise, Upland Confined and Upland Thin Layer Placement were eliminated from further consideration due to the permanent impacts to seagrass and wetland habitats that would occur in pumping the material to an upland site. The required pumping distances also would require booster pumps (see Section 5.0 of the SEIS), which would reduce efficiency. The only remaining options (fully confined, semi-confined, and unconfined open-bay placement) were analyzed for each PA in Reach 1 before determining the best option, given the unique combination of habitat, dredging frequency and volume, and environmental management plans proposed for each PA.

In addition to managing the PAs for seagrass, bird use, and recreational opportunities proposed by others (when compatible with the DMMP), the ICT reviewed the management plan prepared by the PINS for PAs located inside the PINS boundaries to determine if it was compatible with the DMMP. The disposal practices described in the PINS plans were incorporated into the DMMP to the extent practicable. Some of the limitations on disposal described in the PINS plan could not be incorporated due to type of material and dredging frequency or volume, but the ICT determined that each PA management plan would be reviewed prior to dredging and placement to determine the best plan for that dredging cycle in coordination with the PINS personnel.

**PA 175** – This PA is located behind the businesses near Marker 37 on the east side of the GIWW just south of the Kenedy Causeway and has never been used. The ICT decided the best option is to continue with the current practice of not using this PA, but it will remain as an authorized PA.

**PA 176** – (30+150 – 35+700) This partially-leveed PA is located on the east side of the GIWW. The PA consists of one long island with a narrow shallow strip of water between it and a condo development on Padre Island. It was used once (1962) between 1949 and 1995, with a per-cycle discharge of 128,041 cubic yards (cy). The

maintenance material consists of about 50% sand. The USACE started construction to fully confine the site in 1992, but work stopped before a 3,400-foot section in the back levee could be finished due to Section 7 consultation with the USFWS on piping plover impacts. The ICT decided the best management option is to complete the levee and use the site as an upland confined placement option. The uncompleted section will be staked according to a previous agreement with the USFWS during the consultation in 1992 and completed as part of the next dredging cycle. The USFWS will be consulted before levee construction begins to ensure there are no adverse impacts to the piping plover.

**PA 177** – (38+300 – 39+700) This PA is located on the east side of the GIWW. The PA is a small, unleveed island separated from the condo development on Padre Island by a narrow small-boat channel. It was used once (1962) between 1949 and 1995, with a per-cycle discharge of 74,691 cy. The ICT decided the best management option is to make complete levees on the east (back) north, and south sides, with a partial levee and baffles on the west side to retain as much material on the island as possible. This would partially contain the dredged material (consisting of about 72% sand) and prevent the material from flowing north, east, or south onto seagrass beds.

**PA 178** – (41+300 – 46+500) This PA is located on the east side of the GIWW. The PA consists of three small islands separated by deeper channels on the north end and one long island with three high mounds at the south end. There is another mound on the south end just outside the PA boundary. Each mound is covered with brush and two of the mounds have trees at the top. There is one cabin on the island at the south end just outside of the boundary of the PA. The PA was used twice between 1949 and 1995, with an average per-cycle discharge of 100,408 cy. There are no data on sand content. The ICT decided to protect the seagrasses to the east with a training levee. The circulation channels will be left open (through the use of training levees or other means) to allow for water circulation, limit predator access, and provide access for marine organisms and the public. The northern islands in the chain would be avoided unless needed in the future, but the PA would be expanded to the south to include all of the southernmost island near marker buoys 63 and 65. The second island from the north is an important bird nesting island and will be avoided during disposal operations. Flow onto the emergent islands would be directed to the west, using natural contours as much as possible. The cabin at the south end will be within the new boundary and may be affected by this management plan.

**PA 179** – (49+500 – 51+400) This short PA is located on the east side of the GIWW. It was used twice between 1949 and 1995, with an average per-cycle discharge of 30,940 cy. The PA now includes parts of two islands. There are two mounds on each of the islands with brush and cabins. The ICT decided the best management option is to expand the PA to the north and south to include all of the islands and pump the maintenance material (consisting of an average of about 68% sand) on top of the mounds to increase the size of these islands for bird use, while avoiding runoff onto the seagrasses to the extent possible. A training levee will be placed on the south end of the PA to prevent maintenance material from filling a small boat channel. Six of the

nine cabins inside the present and proposed boundaries may be affected by this management plan.

**PA 180** – (52+850 – 58+300) This PA is located on the east side of the GIWW. The PA consists of three islands. The northern and southern islands are the largest with three mounds each and the middle island has only one mound. Each of the mounds is covered by brush. Channels separate the islands and provide circulation to the area on the east side. The PA was used five times between 1949 and 1995, with an average per-cycle discharge of 122,564 cy. The ICT decided the best management option is to pump the maintenance material (no data on sand content) to the east side of the mounds with a diffuser at the end of the pipe to prevent scouring and direct the flow to the east to increase the size of these islands for bird use. This technique will help reduce runoff onto the seagrasses. Care will be taken to keep circulation channels open (with some maintenance required periodically) to allow for water circulation, limit predator access, and provide access for marine organisms and the public. Eleven cabins may be affected by this management plan.

**PA 180A** – The USFWS noted that since there is no bird management plan for PA 180, the ICT could incorporate the bird plan to nourish and rebuild two man-made islands on the west side of the GIWW opposite from PA 180. These islands are severely eroded and bird use has declined. The ICT adopted this plan and want to establish a new PA (PA 180A) at this location and use some of the maintenance material to rebuild the islands on an “as needed” basis. Because there will be new impacts to seagrass beds around the area, the USACE agreed to this plan only if the rest of the ICT concurs and there is no mitigation required for loss of seagrass. There is one cabin on one of the islands that may be affected by this management plan.

**PA 181** – (59+950 – 64+200) This PA is located on the east side of the GIWW. The PA consists of four islands separated by circulation channels. Each of the five mounds is covered with brush. It was used six times between 1949 and 1995, with an average per-cycle discharge of 73,253 cy. There is no bird management plan for this PA. The ICT decided the best management option is to pump the maintenance material (consisting of an average of about 36% sand) on top or just east of the mounds to direct the flow to the east side to increase the size of these islands for bird use. This technique will help reduce runoff onto the seagrasses. Care will be taken to keep circulation channels open to allow for water circulation, limit predator access, and provide access for marine organisms and the public. Eight permitted cabins and one cabin used by TAMU for research may be affected by this management plan.

**PA 182** – (65+800 – 68+400) This short PA is located on the east side of the GIWW and is within the boundary of the PINS. The PA consists of one large island with four mounds. There are no cabins in this PA. There is a deep channel extending from the GIWW to the middle of the PA, almost bisecting the island. This PA was used three times between 1949 and 1995, with an average per-cycle discharge of 61,126 cy. The ICT decided the best management option is to avoid the Fina Mitigation Area (island removal and seagrass planting) located at the northern edge of the PA. There are some

large trees on the northern 1/3 of the site that the ICT may want to avoid during future disposal operations. This determination will be made prior to each dredging cycle. If it is determined the trees should be avoided, the maintenance material (consisting of an average of about 4% sand) could be pumped on top or to the east side of the mounds at the southern 2/3 of the PA to direct the flow to the east side to increase the size of these islands for bird use. A diffuser will be used on the end of the dredge pipe to minimize energy and prevent scouring on the mounds. This should help maximize sediment retention on the island and minimize runoff into the surrounding water and seagrasses. The ICT determined it was necessary for proper management to extend the southern PA boundary to include all of the island for disposal use.

**PA 182S** – As part of the PINS management plan, the PINS proposed adding a new disposal site to the DMMP. The new site would enclose a small island located between PAs 182 and 183 that was probably created during construction of the GIWW. It has been invaded by exotic, undesirable vegetation that PINS would like to control with periodic placement of maintenance material. There is a pond on the island that PINS would like to protect during disposal operations. The ICT determined the new site could be added to the DMMP to help PINS manage vegetation on the island. The new PA will be used for disposal during a dredging cycle for this reach of the GIWW when the need is determined by PINS and the ICT. Establishing this site as a new PA will incur new, additional impacts to the marine resources that will need to be addressed in the SEIS.

**PA 183** – (71+600 – 77+500) This PA is located on the east side of the GIWW and is within the boundary of the PINS. It consists of three islands in the middle and parts of two other islands, one at each end of the PA. The mounds are covered with brush and the island at the north end has a fringe of trees around the perimeter of the mound. PINS is doing a vegetation study at this site. There are no cabins on the islands. It was used three times between 1949 and 1995, with an average per-cycle discharge of 115,008 cy. The ICT decided the best management option is to pump some of the maintenance material (consisting of about 80% sand) over the top and to the east side of the mounds at the south end of the PA to manipulate vegetative cover and enlarge the islands to the east for bird use. It may also be desirable to pump some material to the east side of the other islands, but the timing and need for this will be determined during coordination with the ICT and PINS. Material that cannot be utilized in PA183 will be pumped to PA184. The amount of material to be used at this site will be determined during preparation of disposal plans for each dredging cycle and in coordination with the ICT and PINS.

**PA 184** – (79+000 – 83+000) This PA is located on the west side of the GIWW. The PA is located outside the PINS boundary and consists of three islands, the largest located at the north end of the PA. The islands consist of a mosaic of patches of vegetation and bare ground. It was used four times between 1949 and 1995, with an average per-cycle discharge of 84,640 cy. The ICT decided the best management option is to pump the maintenance material (consisting of an average of about 7% sand) over the crest to the west side of the islands to avoid coastal cabins, if possible, and

avoid runoff onto seagrasses adjacent to the islands. However, since this PA will receive maintenance material from its designated reach of the GIWW, plus the overflow from the reach designated for PA183 if determined necessary by the ICT and PINS, avoidance of the coastal cabins may not be possible. Sixteen cabins inside the PA and 9 cabins outside the PA may be affected by this management plan. There is no bird management plan recommended for this PA. Emmord's Hole, located west of the PA, will be used only if the ICT determines there is a compelling need for it.

**PA 185** – (84+500 – 88+500) This PA is located on the east side of the GIWW and is within the boundary of the PINS. The PA consists of four islands with the lower two almost, if not completely, coalesced into one large island. The central mound on each island is covered with brush. There are no cabins in this PA. It was used six times between 1949 and 1995, with an average per-cycle discharge of 104,431 cy. The ICT decided the best management option is to place some (if not all) of the maintenance material from the reach designated for this site on the east side of the lower two islands to build up the beach. The maintenance material consists of an average of about 58% sand. Care must be taken to avoid filling in the wide channel between the northern island and South Bird Island northeast of the PA, as well as the small boat channel connecting Bird Island Basin to the GIWW. If a levee is used to keep maintenance material out of the small boat channel, it will be flattened if it does not erode on its own after use. Material that cannot be utilized in PA185 will be pumped to PAs 184, 186, or Emmord's Hole. A determination of which disposal site or sites will be used will be made during coordination with the ICT prior to each dredging cycle. The ICT also determined it was necessary to extend the southern boundary of the PA to include all of the southernmost island to increase the size of the disposal area. The USACE will consult with the PINS and ICT about placement location and quantities for each dredging operation.

**PA 186** – (90+000 – 94+500) This PA is located on the west side of the GIWW. The PA consists of one large island on the north end with six cabins and a series of very small islands at the south end. There is a narrow submerged ridge connecting the islands with seagrass located primarily on the east side. This PA was used 10 times between 1949 and 1995, with an average per-cycle discharge of 126,495 cy. The ICT decided the best management option is to extend the PA boundary about 1,000 feet to the west to include deep water in Emmord's Hole and pump the maintenance material (consisting of an average of about 34% sand) to the deeper water west of the PA to avoid seagrass. This also would avoid the cabins on the island in the northern portion of the PA.

**PA 187** – (95+700 – 101+300) This PA is located on the east side of the GIWW and is within the boundary of the PINS. The PA consists of a ridge of dredged material in the northern 2/3 of the PA with small islands at each end. Several small areas of the ridge between the islands are slightly emergent. The PA is surrounded by deep water and has seagrass growing along the shallow ridge. It was used 13 times between 1949 and 1995, with an average per-cycle discharge of 183,893 cy. The ICT decided the best management option is to pump some of the maintenance material (consisting of an

average of about 24% sand) on top of the emergent mounds on the south side of the north island and the north side of the south island to increase their size and enhance them for bird nesting. Dredged material will not be placed on the ridge along the middle of the PA to avoid the seagrasses and prevent the islands from coalescing. There is a Texas Parks and Wildlife Department artificial reef in PA 187 at its southeast boundary. This reef has been in place since 1962 and may no longer be present. The ICT decided to put excess material in Emmord's Hole only if there is no other option available.

**PA 188** – (104+500 – 110+700) This PA is located on the east side of the GIWW and is within the boundary of the PINS. The lower 2/3 of the PA has a narrow submerged ridge of sediments in the center and a small narrow island at the north end of the ridge. The PA is surrounded by deep water with seagrass along the ridge. The island has a mosaic of brush and ponds. It was used 14 times between 1949 and 1995, with an average per-cycle discharge of 196,804 cy. The ICT decided the best management option is to pump maintenance material (consisting of an average of about 27% sand) on top of the emergent mounds on the island in the north portion of the ridge to increase the size of the island for bird use. PINS would like to see the island enlarged to about 1,200 feet in diameter. Emmord's Hole would be used as an alternate site for excess material from this PA only if there is no other option available.

**PA 189** – (111+800 – 116+500) This PA is located on the west side of the GIWW. The PA consists of a ridge of sediments with two islands, one located at the north end of the PA and a smaller island near the middle of the PA. However, the small island may have eroded away at this time. This PA is close to the mainland and is surrounded by deeper water with some areas of unvegetated bottom. Seagrass can be seen in the aerial photo along the shallow ridge, primarily on the western side of the PA. It was used 14 times between 1949 and 1995, with an average per-cycle discharge of 157,432 cy. The ICT decided the best management option is to follow the bird management plan and try to reestablish the southern island with dredged material for bird use. Because the material may not stack, the USACE will look into using a retaining system (sheetpile, geotubes, levees, etc.) to help retain material at the site. Also, because the PA receives a large amount of dredged material, especially if excess material from PA 190 is placed here, the ICT determined it may be necessary to extend the western boundary of PA 189 about 1,000 feet west at the north end and taper this new boundary back to the southwest corner of the PA, forming a triangular extension into deeper water to the west. The new area will allow the USACE to place the dredge pipe over the ridge and pump excess material to the west in deeper, unvegetated water. A diffuser will be used on the end of the pipe to prevent scour. There are two cabins on stilts in the water, one near each island, that may be impacted.

**PA 190** – (117+800 – 120+700) This PA is located on the east side of the GIWW and is within the boundary of the PINS. The PA consists of a thin submerged ridge down the center of the PA with a small island at each end. Parts of the middle section of the ridge are emergent at high tide. It was used 11 times between 1949 and 1995, with an average per-cycle discharge of 114,168 cy. The ICT decided the best management option is to pump the maintenance material (consisting of an average of

about 21% sand) on top of the islands at each end of the ridge to increase their size to about 1,200 feet in diameter for bird use. The PINS management plan calls for disposal on a 4-5 year or greater interval to allow seagrass to recover. The ICT decided that the 4-5 year interval between disposal operations would be accommodated in the DMMP to the extent practicable. Because past records show that dredging needs are sometimes more frequent, especially if storms pass through, the ICT will review the disposal needs for each dredging cycle to determine where and how much material to place at this site or alternate sites after taking into consideration the engineering needs as presented by the USACE. PA 189 could be an alternate site for some of the excess material. The USACE will coordinate with PINS and the ICT on vegetation manipulation once the islands are large enough to support vegetation. The unvegetated deeper water of Emmord's Hole does not extend this far south on the west side of the GIWW, so there is no potential open water disposal area available in this reach.

**PA 191** – (123+300 – 126+100) This PA is located on the east side of the GIWW and is within the boundary of the PINS. There is a large island (known as Pelican Island) at the north end with two shallow mounds of sediment immediately south of it and a small submerged mound at the south end of the PA. It was used eight times between 1949 and 1995, with an average per-cycle discharge of 95,129 cy. The ICT decided the best management option is to pump the maintenance material (consisting of about 5% sand) to the southeast side of Pelican Island in an existing small embayment to expand the southern end of the island. The intent is to expand the nesting area on the only nesting site for white pelicans in the Laguna Madre. When the island is at optimum size, future material can be pumped to PA 190 or PA 192. A training levee will be placed on the southwest and south sides of Pelican Island to retain the material in the embayment and let excess material flow out on the southeast side to form a sloping beach.

**Reach 2** - This reach contains PAs 192 to 202. PAs 192, 194, and half of PA 195 are also located inside the boundaries of PINS.

The ICT considered all of the alternative dredging and placement options described in Section 5.0 of the SEIS for the PAs in Reach 2. Following the criteria designed to identify fatal flaws in a disposal option, the ICT again eliminated Ocean Placement as a viable option due to the long haul distances, lack of appropriate equipment, and excessive pumping distances for pipeline disposal. One other option, piping the material across Padre Island was eliminated for Reach 2 because the PINS would not permit it since this action would represent an impairment of natural resources in the Park. Likewise, Upland Confined and Upland Thin Layer Placement were eliminated from further consideration due to the permanent impacts to seagrass, serpulid reefs, and wetland habitats that would occur in pumping the material to an upland site. The required pumping distances also would require booster pumps (see Section 5.0 of the SEIS), which would reduce efficiency. The only remaining options (fully confined, semi-confined, and unconfined open-bay placement) were analyzed for each PA in Reach 2 before determining the best option, given the unique combination of

habitat, dredging frequency and volume, and environmental management plans proposed for each PA.

Because PAs 192, 194, and half of PA 195 are located inside the PINS boundary, the ICT reviewed the management plan prepared by the PINS for these PAs to determine if they were compatible with the DMMP. The disposal practices described in the PINS plans were incorporated into the DMMP to the extent practicable. Some of the limitations on disposal described in the PINS plan could not be incorporated due to type of material and dredging frequency or volume, but the ICT determined that each PA management plan would be reviewed prior to dredging and placement to determine the best plan for that dredging cycle in coordination with the PINS personnel.

**PA 192** – (128+700 – 132+500) This PA is located on the east side of the GIWW and is within the boundary of the PINS. The PA consists of a narrow, submerged ridge of sediments in the center with several small islands at each end of the PA. The PA appears to be surrounded by deep water (probably nonvegetated) and has patches of seagrass along the shallow edge of the ridge. It was used nine times between 1949 and 1995, with an average per-cycle discharge of 80,009 cy. PINS has no management plan for this site. The ICT decided the best management option is to pump the maintenance material (consisting of an average of about 33% sand) on top of the emergent thin mounds and the shallow areas, with frequent moving of the discharge pipe to stay on top of the string to increase the size of these islands for bird use, while minimizing impacts to seagrass.

**PA 193** – (133+800 – 137+800) This PA is located on the west side of the GIWW. The PA consists of a string of small islands, with the largest located at the north end. There are two cabins on the north side of the largest island just outside of the PA boundary. There are eight floating cabins or houseboats outside the western boundary of the PA. There is deep water immediately to the east and west of the PA. It was used nine times between 1949 and 1995, with an average per-cycle discharge of 87,218 cy. The ICT decided the best management option is to pump most of the maintenance material (no data on sand content) to the southeast side of the north island, gradually increasing the size of the island to the south, with the flow directed to the south. The north, west, and south boundaries of the PA will be moved out to include all of the islands for disposal use.

**PA 194** – (137+900 – 142+300) This PA is located on the east side of the GIWW and is within the boundary of the PINS. The lower half of the PA is shallow with one vegetated island holding a small freshwater pond. There is a small area of seagrass growing in the shallow water on the north and south ends of the island. Most of the upper half of the PA is unvegetated bottom in deep water. It was used 12 times between 1949 and 1995, with an average per-cycle discharge of 92,550 cy. The ICT decided the best management option is to pump the maintenance material (consisting of an average of about 55% sand) on top of the island to increase the size of the island for bird use and use training levees to help retain the material and prevent additional

shoaling of the surrounding shallow areas. The training levees would also help minimize impacts to surrounding seagrass. The small pond could be recreated after disposal if it has filled in with sediments.

**PA 195** – (145+000 – 149+000) This PA is located on the east side of the GIWW and half of it is within the boundary of the PINS. The site consists of shallow seagrass beds at the north end, tapering off to a thin fringe on the west side at the middle and south end of the PA. The majority of the PA is a very shallow bare sandy area that may be emergent at low tide. A series of four small, vegetated islands is located south and east of the PA along an old oil exploration canal connected to the GIWW. Two cabins are located between the islands and the canal. It was used 10 times between 1949 and 1995, with an average per-cycle discharge of 112,778 cy. The ICT decided the best management plan is to extend the boundary of the PA south to include the four islands, and the sand flat south of the oil company access channel, and east to include the turning basin since the intent is to fill the channel with dredged material. The maintenance material (consisting of an average of about 85% sand) will be pumped on top of the islands and the flow directed to the south to increase the size of the islands for bird use, while minimizing impacts to seagrass. This plan is compatible with the bird management plan which wants to build up the first, third, and fourth islands (from west to east) for bird use. Two cabins may be affected by disposal in this management plan. The ICT must determine the long-term effects of filling in the shallow area east of the PA since it may become piping plover critical habitat as it becomes emergent. This portion of the PA is outside of the PINS boundary and disposal will not affect their property.

**PA 196** – (150+700 to 155+000) This is a short PA composed of one emergent area with three large mounds, which is located on the west side of the GIWW near Point of Rocks (north side of Baffin Bay). The PA was used seven times between 1949 and 1995 with a variable accumulation of 5,000 cy to 126,000 cy each dredging cycle (averaging about 103,000 cy), depending on storm activity. There is no bird use due to the large number of cabins (16) and human disturbance. There is seagrass habitat around the island that the ICT wanted to avoid. The ICT determined it would be less damaging to the resources in the area to confine the material (consisting of about 51% sand) on the island inside PA 196. However, in order to minimize short-term impacts to most of the cabins, the ICT decided it would be best to use confining levees on the north, east, and south sides to hold material on that side and prevent seagrass burial there. Low training levees will be placed on the west side to hold most of the material flowing between the mounds on the island and build up the island. The cabin owners will be notified that they either need to raise their cabins or move them off the island. Over time, as the material builds up on the island, the confining levees will be raised and extended until the entire island is completely confined. In order to maximize the size of the confined PA to provide a 50-year capacity, the north and south boundaries will be extended to enclose all of the emergent land. GLO/SLB will require cabins to be relocated or removed, as necessary, prior to placement of dredged material.

**PA 197** – (156+000 to 169+000) This is a long PA located on the east side of the GIWW across from the mouth of Baffin Bay. It was used 15 times between 1949 and 1995, with an average per-cycle discharge of 318,930 cy. Most of the northern 2/3 of the PA is emergent and has numerous cabins. Even with the human disturbance, there is high black skimmer use in the area (there are seven waterbird colonies identified in this PA). The upper area is shallow and has extensive seagrass beds. The lower 1/3 of the PA is 6-feet deep or more and does not have seagrass. The ICT determined the best management practice for this site is to establish at least three corridors over the northern islands and pump some of the dredged material over the mounds to build up the northern islands for bird use. By using each corridor in alternating cycles, each area would have a 6-year interval between disposal operations for the surrounding seagrass to recover. However, most of the dredged material (consisting of about 25% sand) would need to be placed on the southernmost island during each dredging cycle to build it up for bird use. Much of the excess material will flow east into the deep, unvegetated water. The ICT decided to extend the east boundary about 500 feet to the east from the north end of the southern island to the south end of the island to provide space to place the pipe and to include the potential footprint of the material flowing into the deep water. One cabin on the southern island is occupied and another cabin is considered to be derelict by GLO.

**PA 198** – (172+000 – 177+800) This PA is located on the west side of the GIWW and close to Point Penascal (south side of Baffin Bay). It was used 18 times between 1949 and 1995, with an average per-cycle discharge of 132,755 cy. It is surrounded by deep water with no nearby seagrass habitat. The ICT did not want to pump the dredged material (consisting of an average of about 34% sand) to an upland site on the mainland, because it would permanently impact seagrass growing along the shore. The ICT decided the best management option is to continue with the current practice of unconfined disposal in the PA in deep, unvegetated water.

**PA 199** – (179+000 – 183+700) This PA is located on the east side of the GIWW in shallow water with seagrass habitat along the upper half of the east side. It was used 16 times between 1949 and 1995, with an average per-cycle discharge of 140,854 cy. The ICT decided to extend the PA south to provide enough disposal area to avoid the seagrass habitat in the north and connect it to PA 200. All disposal of dredged material (consisting of an average of about 12% sand) will be in the deep water area. There is a small channel running a short distance from the GIWW to the east between PAs 199 and 200. There are no records or knowledge of who constructed the channel or the reason for its existence. Since it does not appear to function as a circulation channel, the ICT determined there would be less impact to lagoon habitat to fill it in with dredged material when the two PAs are combined than to preserve it and risk impacting the extensive seagrass beds to the north.

**PA 200** – (186+300 – 194+600) This PA has the same characteristics as PA 201. It was used 15 times between 1949 and 1995, with an average per-cycle discharge of 156,537 cy. The ICT decided that the current practice of unconfined disposal of dredged material (consisting of an average of about 27% sand) can be continued since

there is no nearby seagrass habitat or bird use area to be impacted. Birds will not use the islands inside the PA due to disturbance associated with the numerous cabins on the islands.

**PA 201** – (197+200 – 204+700) This PA is located on the east side of the GIWW and was used 14 times between 1949 and 1995 with an average per-cycle discharge of 177,145 cy. The site is located in deep water with a few islands scattered along the length of the site. There is some bird use on the islands at each end, but no seagrass habitat in the deep water on the east side of the site. Dredged sediments are too fine (consisting of an average of about 18% sand) for building any seagrass habitat. The ICT determined the best management use for the site is the present practice of unconfined disposal, but limit the disposal to the middle submerged area of the PA. This will avoid the bird islands at each end of the PA.

**PA 202** – (207+300 – 215+270) This is the southernmost PA in Reach 2 and is located at the entrance to the Land Cut. It is an emergent site located on the east side of the GIWW. The southern half of the disposal site is leveed. This PA was used 16 times between 1949 and 1995 with an average per-cycle discharge of 195,382 cy. There is no bird nesting on the site because of predator disturbance, but there are algal flats and seagrass beds along the east side of the PA. The ICT determined that the levees should be extended south to the channel between PAs 202 and 203 and north along the emergent area as far as needed to confine all the dredged material (consisting of an average of about 7% sand) over the next 50 years. The west boundary (next to the GIWW) will be moved out to enclose all of the west levee that is presently outside of the PA. The expansion of the leveed area to the north may enclose some open water to provide enough capacity for the 50-year life of the DMMP for this section of the GIWW. There is one cabin that may be affected by the northerly expansion of the leveed area.

**Reach 3:** This reach includes PAs 203-210, all located at upland sites in the Land Cut.

The ICT considered all of the alternative dredging and placement options described in Section 5.0 of the SEIS for the PAs in Reach 3. Following the criteria designed to identify fatal flaws in a disposal option, the ICT again eliminated Ocean Placement as a viable option due to the long haul distances, lack of appropriate equipment, excessive pumping distances for pipeline disposal, and the prohibition against crossing the PINS. Open-Bay Disposal was also eliminated because the closest open-bay site is The Hole, which is a shallow, vegetated area that is a popular fishing destination. The ICT did not consider taking any of the material to The Hole because of the impacts to seagrass and productive bay bottom that would accrue. Similarly, the Beach and Washover Nourishment options were eliminated for this reach because of the lack of sufficient sites to hold all of the dredged material and the prohibition against crossing PINS property with a pipeline. Thin Layer Placement was eliminated because of the lack of sufficient sites to hold all of the dredged material and it would not enhance the upland (sand/mud flat) habitat, which is a goal of this option.

The only remaining option (Upland Confined Placement) was analyzed for each PA in Reach 3 before determining the best management plan, given the unique combination of habitat, dredging frequency and volume, and environmental management plans proposed for each PA. In some cases, the ICT determined it was not necessary to completely confine a PA in this reach, as described below.

**PA 203** – (218+000 – 232+000) This upland site is located on the east side of the GIWW and is about 2 miles long. It was used six times between 1949 and 1995 with an average per-cycle discharge of 149,376 cy. The last time it was used was for emergency dredging created by Hurricane Brett in 1999. Normally, only about 5,000 cy/yr of sediments accumulate in this area. There is a narrow fringe of seagrass on the east side of the PA in The Hole. The southern end of PA 203 is fully leveed and encompasses about 108 acres. However, the front levee (nearest to the GIWW) may be outside the designated boundary of the PA. The west boundary will be moved out to enclose the levee and documented in the SEIS. Since there is no bird use here, the ICT determined it would be best to move the dredge pipe frequently to deposit only a thin layer of dredged material (consisting of an average of about 27% sand) in the unconfined portion of the PA until reaching the confined area and then place the rest in the leveed section.

**PA 204** – (234+600 – 241+700) This PA is completely leveed. However, the front levee (nearest to the GIWW) may be outside the designated boundary of the PA, so the west boundary will be moved out to enclose the levee and documented in the SEIS. A 1,300-foot unleveed area at the north end is outside the PA boundary and will not be used for disposal. There is no bird use here. The site was used five times between 1949 and 1995 with an average per-cycle discharge of 100,581 cy. The maintenance material consists of about 72% sand. The ICT had no problems with continuing with the present disposal practice here.

**PA 205** – This PA is used only for the circulation channel connecting the GIWW to The Hole. It is seldom used and the ICT determined the present disposal practice could be continued. However, the ICT qualified this by requesting the Galveston District coordinate with GLO prior to dredging to determine if birds are using the site.

**PA 206** – (243+300 – 258+850) The northern third of this PA is fully confined. It has been used five times between 1949 and 1995 and has no bird use. The average per-cycle discharge is 352,592 cy. The southern end has some training levees. However, the front levee (nearest to the GIWW) and north levee (next to the circulation channel) may be outside the designated boundary of the PA. The north and west boundaries will be moved out to enclose the levees and the change documented in the SEIS. The ICT agreed that it is best to continue with the current disposal practice and maintain the training levees, if they still exist, in the southern end.

**PA 207** – (261+450 – 274+875) This is a short PA that is fully confined in the lower 2/3 of the site. It was used five times between 1949 and 1995 and has no bird use. The average per-cycle discharge is 524,366 cy. The ICT decided to continue with

the current disposal practice since there would be little impact, but to move the dredge pipe frequently to keep the dredged material run-off as thin as possible in the unleveed section.

**PA 208** – (277+475 – 318+900) This is a very long PA with short, leveed sections in the middle and southern end of the site. There is no bird use or nearby seagrass habitat. The site has been used nine times between 1949 and 1995 with an average per-cycle discharge of 715,043 cy. The dredged material consists of about 75% sand. The ICT recommended continuing the current disposal practice, but move the pipeline frequently to prevent excessive dredged material run-off at any one location in the unleveed sections. Several small, shallow channels were seen in the aerial photo cutting across the PA from the GIWW. The ICT recommended keeping the channels clear of any dredged material during disposal operations.

**Note:** The dividing line between Corpus Christi to Mud Flats and Port Isabel to Mud Flats standard dredging reaches occurs within the length of this PA, so channel numbers now decrease to the south instead of increasing to the south. The station number for the south limit of this PA is based on Corpus Christi stationing rather than Port Isabel stationing to facilitate calculation of total PA length.

**PA 209** – (319+200 – 310+800) This is a short PA without levees. There is no bird use or nearby seagrass habitat. It has been used six times between 1949 and 1995 with an average per-cycle discharge of 110,338 cy. The ICT recommended using the same management plan for this site as described for PA 208.

**PA 210** – (309+200 – 299+800) This is a short PA with levees at the back and on the sides in the southern third of the site. The GIWW side is open. Again, there is no bird use or nearby seagrass habitat. It has been used 13 times between 1949 and 1995 with an average per-cycle discharge of 81,911 cy. The ICT recommended continuing the present disposal practice in the semi-confined area and moving the dredge pipe frequently in the unleveed section.

**Reach 4:** This reach contains PAs 211 to 222. Because several of the sites are close to the mainland or an entrance channel, are located in deep, unvegetated water, or have special requirements for environmental management, each PA or group of PAs was considered separately when determining the best dredging option for the area. A description of the ICT's reasons for selecting an option is provided for each site.

**PA 211 and 212** – (297+000 – 290+800; 289+200 – 280+800) These PAs are located on the east side of the GIWW. PA 211 has an earthen levee on the east side to prevent sediment flowing out into the seagrass on the backside of the site. PA 212 consists of a series of small islands paralleling the GIWW just south of PA 211. It has some bird use on the south end of the site. Both PAs have been used 15 times between 1949 and 1995 with an average per-cycle discharge of 117,247 cy and 175,985 cy, respectively. The sand content of the dredged material varies from 28% to

30%. The ICT decided that, following the criteria designed earlier to identify fatal flaws in a disposal option, Ocean Placement was not a viable option here. Neither were Upland Confined or Upland Thin Layer Placement, because the only upland sites to the west on the mainland contain sensitive wetlands and fringing seagrass in front. Another option was to pump the material to the north to existing upland disposal sites at the Land Cut. However, it was decided that these sites were needed for disposal of material from Reach 3 and should not be filled with material from Reach 4. Another problem with using the area in Reach 3 is that there are algal flats surrounding these upland disposal sites to the south that are considered to be piping plover habitat.

Elimination of these options left the three open bay disposal options (fully confined, semi-confined, and unconfined) as the only viable options. The ICT decided that confining PA 211 with earthen levees would create a problem for birds nesting at the south end of PA 212 by allowing predators easier access from the Land Cut and possibly ponding freshwater for their use. Another idea was to use bw geotubes to contain most of the material on PA 211 to prevent burying any nearby seagrass beds, while preventing freshwater retention for predators. More geotubes could be added over the 50-year project life to retain sediments as the site fills. However, this would eventually raise the site high enough to allow predators easy access to PA 212.

The ICT agreed on a plan to move the existing earthen levees on PA 211 farther to the east and north to enclose all of the island (which is beyond the present PA boundary), add baffle levees across the site to slow the sediment flow (consisting of an average of about 30% sand) and allow more settling, and add earthen levees on the west side while leaving the south side open, thus creating a horseshoe-shaped disposal site. The north and east boundary of PA 211 will be extended to enclose all of the northern island.

The plan for PA 212 consists of removing the northernmost island and piling this material on the next island to the south. Precautions will be taken when placing maintenance material (consisting of an average of about 30% sand) on the islands to the south to avoid filling in the newly created gap. The purpose of the plan is to create a larger water gap between PAs 211 and 212 and make it harder for predators to reach the bird nesting site on PA 212. Another benefit is that seagrass would also be allowed to recover in the gap between the PAs between dredging cycles. The islands in PA 212 would not be leveed to contain the dredged material, but would be managed for bird nesting by alternately disposing on one island during a dredging cycle and then on another island in the next cycle. This would allow vegetation to recover on islands recently used and create a mosaic of vegetation types in various recovery stages from unvegetated to dense cover for the nesting needs of the different species of birds using them. Seagrasses near the islands in PA 212 would recover between dredging cycles as in the past.

In summary, this plan would provide additional benefits for the seagrasses around PA 211 by protecting them from burial or high turbidity, manage the islands in PA 212 for bird nesting and create greater barriers for predators, and provide no net

change in impacts to seagrass around PA 212. A small increase in seagrass habitat would be provided by widening the gap between PAs 211 and 212.

**PAs 213 – 219** - (279+200 – 270+800, 269+200 – 260+800, 259+200 – 250+800, 249+200 – 240+800, 239+000 – 230+800, 229+200 – 220+800, 219+200 – 214+300) These PAs are located on the east side of the GIWW in deeper water. There are no emergent islands in these PAs and the water is too deep to support seagrass. Ocean Placement was eliminated earlier as a fatal flaw. Also, there would be no other identified biological benefit in using this option. Upland Placement was not a viable option either, since the pumping distance is too great. Other objections to this option include impacts to algal flats to the east and to fringing wetlands and seagrasses on the west (mainland) side.

The ICT determined that the only viable disposal option for these PAs is one of the open bay disposal alternatives. Since there are no bird nesting sites or seagrass beds in the area, the ICT decided it would be best to continue the present practice of using unconfined disposal at these sites. The dredged material in this reach of the GIWW contains an average of about 7-23% sand. The PAs have been used 6-14 times between 1949 and 1995 with an average per-cycle discharge varying from 101,885 cy to 218,230 cy. There would be no significant biological benefits to be gained by trying to create a fully confined or semiconfined PA system in this area.

**PA 220** – (212+700 – 207+200) This is an L-shaped disposal site used for disposal of maintenance material from the GIWW and the Channel to Port Mansfield. It is located at the northeast corner of the junction of the GIWW and Channel to Port Mansfield. It has been used 10 times for GIWW disposal between 1949 and 1995 with an average per-cycle discharge of 153,758 cy. There is an emergent island located at the bend of the site, but much of it is outside of the boundary of the PA. This island is used for nesting by birds (including pelicans), but it is eroding severely on the north side.

Because this is the closest site to an opening to the Gulf (Mansfield Pass), the ICT considered Ocean Placement with a pipeline dredge as an option. However, this option was dropped after it was determined that it would be an 8-mile pump (including the reach of the GIWW being dredged) just to reach the beach and even farther to get the material offshore. The silty material (consisting of an average of about 8% sand) is not suitable for beach nourishment. Pumping the material would require as many as two booster pumps (depending on the size of the dredge) and would not be economically viable. Upland Placement was also dropped as an option due to the pumping distances involved. In addition, there were no biological benefits to accrue under either plan.

Another ocean placement alternative was considered by the ICT for PAs 220 and 221 due to their frequent use and proximity to a pass. In this alternative, a bucket dredge and scow would be used to collect shoaled material from the GIWW near Mansfield Channel and taken offshore to a designated ocean disposal site. A cost

analysis of this alternative showed it would be 3.8 times more expensive than the present dredging and disposal method and 3.5 times more expensive than the management plan ultimately accepted by the ICT for this site. Due to the high cost of this alternative, the ICT did not select it as the management plan for this site. However, this alternative could be considered for future dredging cycles by the ICT, provided it could be done economically, equipment was available, and EPA provided the necessary clearance for ocean disposal of the dredged material under Section 102 of the Marine Protection, Research and Sanctuaries Act. EPA clearance for ocean placement will not be pursued until this alternative is identified as a viable option by the ICT.

The ICT also considered the open bay disposal alternatives. It was agreed that the greatest biological benefit of this alternative would be realized by managing the site for bird use. This would be achieved best by placing geotubes on the shallow shelf around the existing island on three sides, leaving the south end open where erosion does not appear to be a problem. Dredged sandy material from the Channel to Port Mansfield would be stockpiled on the north side of the site and used to fill the geotubes later. Silty material in the GIWW from future dredging cycles would be used to fill in the horseshoe-shaped site surrounding the bird island to enhance bird nesting habitat. This would also protect seagrass near the site from burial and high turbidity to the north. The open southern end could be closed with geotubes later, if it is determined there is more erosion occurring there than is currently believed to exist.

This alternative in the management plan, if it is used, would require expanding the boundary of PA 220 beyond what is described in the 1975 EIS to enclose the island. This task could be accomplished in the SEIS being prepared by the ICT. The ICT will make a determination before each dredging cycle which alternative would be used based on ecosystem benefits and habitat needs, equipment limitations, disposal restrictions, and economics.

**PA 221** – (200+000 – 181+300) This PA is located on the west side of the GIWW south of the junction with the Channel to Port Mansfield. It consists of a series of small islands (some have coalesced over the years with disposal) along the GIWW that creates a small bay between the PA and the mainland. The islands protect the shallow water in the bay and allow seagrass to flourish in the area. Because there have been problems in the past with dredged material flowing into the bay, causing circulation problems and the area to shoal more with each dredging cycle, the ICT decided it would be better under the open bay disposal alternative to manage the biological resources (seagrass) by moving PA 221 to the east side of the GIWW. The new site would be known as PA 221A. The water is deeper on the east side and is devoid of seagrass in the immediate area. Moving the PA to the east side would benefit the biological resources on the west side of the GIWW by preventing further circulation and shoaling problems behind PA 221. This segment of the GIWW was dredged 17 times between 1949 and 1995 with an average per-cycle discharge of 177,214 cy. The ICT decided against using geotubes at PA 221A to confine all the material because it is a permanent removal of bay bottom with no ecological benefit. However, a linear arrangement of low geotubes or a levee created with in-situ material (both subsurface) may be needed

between the GIWW and PA 221A to prevent dredged material (consisting of an average of about 6% sand) from flowing back into the GIWW. By designating PA 221A as a submerged, semi-confined, open-bay site, the bay bottom will be available for recolonization by marine organisms between dredging cycles.

An alternative consideration by the ICT would be offshore disposal using a bucket dredge and scows as described for PA 220. The ICT will make a determination before each dredging cycle which alternative would be used based on ecosystem benefits and habitat needs, equipment limitations, disposal restrictions, and economics.

**PA 222** – (178+700 – 165+800) This PA is the southernmost disposal site in Reach 4 and is located on the west side of the GIWW. It consists of one large linear island running the length of the PA. The PA has been used 10 times between 1949 and 1995 with an average per-cycle discharge of 183,776 cy. The northern 6,000 feet of the island was fully leveed in 1996. Birds use a large clump of mesquite trees inside the leveed area for nesting. In order to protect the seagrass in the area south of the leveed section, the ICT determined it would be best to extend the levees to the south and move the west levee farther out (in some areas, a short distance out into the water) to increase the size of the enclosed PA. Because the west levee is presently outside the PA, the west boundary will be moved out to enclose the levee and the islands and described in the SEIS. The larger PA size would allow greater settling time for the dredged sediments (consisting of an average of about 23% sand) and create a cleaner effluent (low turbidity) release back into the bay (seagrass habitat). Since PA 222 is surrounded by seagrass, this action will permanently remove a small area of seagrass on the western side of the PA, but the larger area of seagrass surrounding the PA would be protected from turbidity or future releases of dredged material in the non-leveed section of the PA. This will remove any future temporary impacts to seagrass, prevent the shallow water between the PA and the mainland from additional shoaling, and maintain the area for bird nesting between dredging cycles. The ICT also recommended increasing the size of the gap between the large leveed island and the islands to the south (outside PA 222) by pulling in material at the gap to construct the south levee. This will make it a little more difficult for predators to cross between the islands.

**Reach 5:** This is the shortest reach in the Laguna Madre and contains PAs 223 to 228.

The ICT considered all of the alternative dredging and placement options described in Section 5.0 of the SEIS for these PAs. Following the criteria designed to identify fatal flaws in a disposal option, the ICT eliminated Ocean Placement as a viable option due to the long haul distances between Mansfield Pass and Brazos Santiago Pass, lack of appropriate equipment, and excessive pumping distances for pipeline disposal. One other option, piping the material across Padre Island was eliminated because of the distance involved and the unacceptable impacts to seagrass and extensive sand/mud flats between the GIWW and the barrier island. Likewise, Upland Confined and Upland Thin Layer Placement were eliminated from further consideration

due to the permanent impacts to seagrass and wetland habitats that would occur in pumping the material to an upland site. Another factor affecting upland placement is that the Laguna Atascosa National Wildlife Refuge (LANWR) owns the upland area on the mainland opposite PAs 224-234 and will not accept dredged material in the Refuge. The only remaining options (fully confined, semi-confined, and unconfined open-bay placement) were analyzed for each PA in Reach 5 before determining the best option, given the unique combination of habitat, dredging frequency and volume, and environmental management plans proposed for each PA.

**PA 223** – (164+200 – 154+300) This PA is located on the west side of the GIWW and consists of a long island with a series of mounds separated by barely emergent areas and a small island with two mounds in the southern end. The islands do not have any birds nesting on them. The site was used six times between 1949 and 1995 with an average per-cycle discharge of 92,078 cy. There is seagrass growing around the site, as at PA 222. The ICT determined that it would be best to create a fully confined earthen levee system at this PA to protect the seagrass beds in nearby shallow water. Because the islands are so narrow, the western levee may have to be placed a short distance out into the water to create a PA with useable capacity and greater settling time for a clearer effluent. The west boundary of the PA will be moved out to enclose the west levee and all of the islands and described in the SEIS. This will permanently remove a small area of seagrass, but will benefit the large area behind the PA by preventing future temporary impacts from burial and high turbidity (no data on sand content), as well as gradual shoaling in the area. The gap at the south end would be enlarged by pulling material from the narrow channel onto the island to create the south levee for the PA.

**PAs 224 and 225** – (151+700 – 140+800, 139+200 – 135+600) These PAs are on the same long island located on the west side of the GIWW and are partially leveed. They are open on the west side. These disposal sites aren't used very often (only three times and one time, respectively, and the last use was 1989) and most of the dredged material (consisting of an average of about 15-35% sand) from this section of the GIWW goes into PA 226. The average per-cycle discharge is 58,422 cy and 83,936 cy, respectively. PA 226 is fully leveed and is used to contain material from this segment of the GIWW because it has a low shoaling rate and to prevent excessive shoaling of the small bay between the site and the mainland due to sediment runoff from the PA. The ICT determined it would be best to fully confine the two sites to form one long PA with two cells. Because the east levee of the partially confined sites in both PAs are outside of the PAs, the east boundary will be moved out to enclose the levees and all of the islands. The north boundary of PA 225 and south boundary of PA 224 will be joined, as well. The USACE may still retain the original PA numbers for each site/cell.

**PA 226** – (135+600 – 130+500) This PA is located at the northwest corner of the intersection of the GIWW and Arroyo Colorado and is already fully confined by earthen levees. Because of its location, it is used to contain maintenance material dredged from both the Arroyo Colorado and the GIWW. The site has been used 13 times between 1949 and 1995 for GIWW maintenance with an average per-cycle discharge of 84,497

cy. This site presently receives material from the GIWW segments normally designated for PAs 224, 225, and 227, as well. The USACE has determined that this PA has the capacity to hold all this material, unless a severe storm strikes the area and causes excessive shoaling. At this time, it may become necessary to divert dredged material to the other PAs to avoid depleting capacity at this site. This plan will be reviewed by the ICT prior to an emergency dredging caused by a storm. The ICT decided that the PA should be used and managed as currently done by the USACE. There are no biological benefits to be gained by modifying the present management plan.

**PA 227** – (130+500 – 126+500) This PA is an unconfined site located on the east side of the GIWW opposite from the intersection with the Arroyo Colorado. This site has been used five times for disposal but not since the 1960s because birds use it for nesting. Dredged material designated for this PA is currently pumped to PA 226. Although there are no plans to use this PA now, the USACE reserves the right to use the site on an emergency basis. As part of the management plan, the USACE may also use the site if the island appears to be in danger of disappearing through erosion. The dredged sediments in this reach consist of about 23% sand and has a per-cycle discharge of 91,128 cy. The area around PA 227 is very shallow and contains seagrass. The ICT decided to leave the disposal site as it is since there are no plans to use it at this time.

**PA 228** – (123+250 – 105+000) This is the last disposal site in Reach 5 and consists of a very long chain of islands, extending for about 18,000 feet along the west side of the GIWW. The dredged sediments in this reach consist of an average of about 16% sand. It was used five times between 1949 and 1995 with an average per-cycle discharge of 122,115 cy. The PA is located in a very shallow area and is not experiencing much erosion. Due to the narrow gaps between the islands, there is reduced circulation between the islands and the mainland. The ICT determined that the best management plan for this disposal site would be to create a fully confined earthen levee system on 6,000 feet of the longest chain of islands at the north end and place the west levee a short distance into the water to achieve a width of at least 700 feet. This will provide a confined PA sufficiently large to allow greater settling and a clearer effluent compared to unconfined disposal. Another 5,000 feet of the island chain on the south end will also be fully leveed to provide sufficient capacity for the life of the DMMP. The west boundary of the PA will be moved out to fully enclose the islands to provide more capacity for the enclosed PA. The ICT determined the trade-off of a permanent loss of a small area of seagrass habitat to protect the much larger area of surrounding seagrass habitat from many short-term temporary impacts and prevent shoaling in the area was the best management solution for the area. The USACE will determine the proper size of the PAs to be fully leveed and the best location for the levees.

**Reach 6** – This reach includes PAs 229 on the north end through 240 on the south end. Disposal options were examined for each PA separately, because several of the sites are close to the mainland or an entrance channel, are located in deep unvegetated water, or have special requirements for environmental management. Upland disposal

on the mainland was not an option for PAs 224 through 234 because the LANWR owns the uplands.

**PA 229** – (105+000 – 97+000) This PA is located on the east side of the GIWW and consists of an unleveed series of mounds. The site was used three times between 1949 and 1995, but does not receive much dredged material each cycle (an average of about 27,740 cy). The ICT considered the option to pump the material to the Gulf, but it was eliminated because a direct pump is a minimum of 7.5 miles. This would require two booster pumps and impact seagrass, tidal flats, sand dunes, and other sensitive habitats to lay the pipeline. The pumping distance to the mainland is shorter at about 4 miles, but it will impact seagrass, sand/algae flats, and the LANWR. Offshore disposal using hopper dredges or scows was also eliminated as an option because of the fatal flaw analysis done earlier by the ICT (Section 5.0 of the SEIS).

Other considerations for the site include some bird use of the site and nearby seagrass beds. The ICT decided to use the PA as in the past, but move the discharge pipe to the two or three spots available on nonvegetated mounds and let the material run out to the east. Further, the dredging and disposal operations should take place in the winter and late-spring period when seagrass is dormant and birds are not nesting. This will bury some seagrass, but the seagrass will recover between cycles (15.5 years), especially if most of the dredged material (consisting of an average of about 7% sand) is spread out over the nonvegetated mounds.

**PA 230** – (96+465 – 91+300) This PA consists of four large mounds interspersed along a chain of small islands on the west side of the GIWW. The large mounds support dense vegetation that is used by colonial waterbirds for nesting. This site has been used only once since the GIWW was constructed, that occurring in 1974. The ICT considered options for offshore and upland disposal and dismissed them for the same reasons listed for PA 229, including increased pumping distance to the beach over that listed for PA 229. The ICT decided to use the site, if needed in the future, with seasonal restrictions for bird nesting and seagrass growth. The dredged material (no data on sand content) will be discharged over the mounds (43,260 cy during the only dredging event), but the site will be surveyed for suitable discharge points to avoid seagrass and bird use areas, as much as possible, before each use.

**PA 231** – (88+700 – 80+800) This PA has the same characteristics as PA 230, but is a longer chain of small islands. This PA was also used one time only, that occurring in 1974. The ICT eliminated offshore and upland options for the same reasons listed above. The ICT determined the best management plan at this time is to use the PA with the same restrictions as PA 230. There are no data on sand content of dredged material in this segment. The volume discharged during the site's only use was 69,982 cy.

**PA 232** – (79+200 – 71+300) This PA consists of a chain of small islands on the west side of the GIWW. Shoaling is more of a problem at this site than to the north, requiring maintenance dredging 12 times between 1949 and 1995 with an average per-

cycle discharge of 57,126 cy. There is some bird use of the islands and extensive seagrass beds surround the site. The ICT investigated moving the PA to the other side of the GIWW to avoid impacting surrounding seagrass beds. However, surveys of the area found it to be shallow and covered with an extensive bed of seagrass. Rather than create new impacts to an unaffected area of seagrass, the ICT determined that it would be the best management practice to continue placing dredged material (consisting of an average of 17% sand) at the current site, but to spread it along the PA in as thin a layer as possible to limit the depth of seagrass burial. Previous studies have shown that seagrass can recover if burial is no deeper than about 3 inches. The USACE will use a diffuser at the end of the pipe to facilitate thin layer placement. In order to help retain more material on the islands, the south and west boundaries will be expanded to enclose all of the islands. This plan will be reviewed before each dredging event to see if changes in the management plan are needed. This site will be managed primarily for seagrass habitat.

**PA 233** – (68+700 – 55+800) This PA is located on the west side of the GIWW at the northern end of a continuously turbid area known as Cheryl's Shoal. The area has no emergent islands (except one at the extreme north end) due to the erosive currents across the site that tend to carry dredged material back into the GIWW or west and south toward Brazos Santiago Pass. Due to this strong current action, the area is subject to frequent shoaling requiring dredging 24 times between 1949 and 1995 with an average per-cycle discharge of 392,773 cy. A shallow ridge at the disposal site is flanked by deeper water to the west and south and has no seagrass growing near it due to water depth and turbid conditions. The ICT determined that the best management plan under the open bay disposal alternative is to move the disposal site about 2 miles farther to the southwest to deeper water (greater than 4.5 feet deep) to avoid seagrass and minimize the effects of the turbidity plume. The hydrodynamic and sediment transport models indicated the dredged material (consisting of an average of about 8% sand) would stay longer in the deeper water and sediment transport back into the GIWW would be reduced by about 13%. GLO studies have found fine sediments in the deeper areas, so the dredged material should be compatible for the benthos living in this habitat. The new PA will be designated as PA 233A.

The ICT also considered an ocean disposal plan as described under PA 220 that was more economical than ocean disposal with a hopper dredge or pipeline dredge. Under this alternative, a bucket dredge and scow would be used to take shoaled material from the reach of the GIWW designated for PAs 233 and 234 to an EPA designated offshore site to be determined later. A cost analysis of this alternative showed it would be 3.4 times more expensive than the present dredging and disposal method or the management plan ultimately accepted by the ICT for this site. Due to the high cost of this alternative, the ICT did not select it as the management plan for this site. However, the ICT will make a determination before each dredging cycle which alternative (open bay or ocean disposal) would be used based on ecosystem benefits and habitat needs, equipment limitations, disposal restrictions, and economics. EPA clearance for ocean placement will not be pursued until this alternative is identified as a viable option.

**PA 234** – (53+200 – 41+300) This PA is located on the west side of the GIWW at the southern end of the current gyre that flows across the area. Because it has the same problems as PA 233 (dredged 25 times between 1949 and 1995), the ICT determined the best management plan would be to move this site about 1 mile to the west to join with PA 233A. The Hydrodynamic and Sediment Transport Models indicated the dredged material (consisting of an average of about 13% sand with an average per-cycle discharge of 227,513 cy) would stay longer in the deeper water, reducing the GIWW shoaling rate by about 7% at this site. The option of confining the dredged material in PA 233A was considered. However, models showed the large area needed to contain 50 years of dredged material in the deep water would reduce the cross-sectional area for current flow and would cause higher current velocities in the area and increase erosion around the confining levees. This option was eliminated from further consideration by the ICT.

As described in PA 233, an ocean disposal alternative will be considered by the ICT for this PA, along with an open bay disposal, before each dredging cycle based on ecosystem benefits and habitat needs, equipment limitations, disposal restrictions, and economics.

**PA 235** – (38+700 – 30+800) This PA is located on the west side of the GIWW and south of the current gyre. The area is shallower than found around PAs 233 and 234 and has a series of small, low mounds dotting the surface parallel to the GIWW. The mounds are located outside the boundaries of the PA. The site is surrounded by seagrass in the shallow water with deeper water west of the seagrass (between it and the mainland). Birds have been observed roosting on the mounds, particularly at low tide, but they do not nest there. The PA is used infrequently (five times between 1949 and 1995 with an average per-cycle discharge of 43,053 cy) since little shoaling occurs there. The last regularly scheduled use was in 1984, but it was used in 1998 for material that would have gone into PA 234. This was an experimental placement to take the material out of the gyre to prevent it from returning to the GIWW. Some of the material was transported out of PA 235, but it was not determined if this material returned to the GIWW because Hurricane Brett interrupted the experiment in 1999.

The ICT determined that the site should be used only for dredged material (consisting of an average of about 30% sand) from the section of the GIWW it was established for and that no other dredged material be placed in it. This will allow sufficient time for seagrass to recover between cycles (nine years) and reduce the amount of material placed in the site. Disposal will take place during the November 1 to February 28 dredging window when seagrass is normally dormant and the dredge pipe moved frequently to prevent excessive build-up of material in any one location. Sandy material may be used to build up the mounds for more bird use in the future. Since the mounds are outside (west of) the boundary of the PA, the site will have to be expanded in the SEIS to include the mounds for beneficial placement of sandy material, if any is available.

**PA 236** – (29+200 – 22+594) This PA is an L-shaped site located west of the GIWW at the junction with the entrance channel to the small boat harbor at Port Isabel. It has the same characteristics as PA 235, except it has deep water located immediately south of the site. There is no indication in the dredging records that this site has been used since the GIWW was constructed. Although this PA is shared with the entrance channel to the small boat harbor, the entrance channel is seldom dredged at this location since it is naturally deep enough for the boats using the harbor. Most dredging in the entrance channel goes to PA 237, which is not used by the GIWW. The ICT decided to follow the same disposal procedure designated for PA 235, should it become necessary to use this site in the future. There are no data on the sand content from this segment of the GIWW, since it has not required maintenance dredging.

**PA 239** – (20+200 – 18+700) This PA is located in deep water and has been used six times between 1949 and 1995 with an average per-cycle discharge of 86,056 cy. The dredged material consists of an average of about 54% sand, but it is located too far from the beach to be pumped there for beneficial use. The minimum distance is about 3.5 miles without allowing for avoidance, if possible, of seagrass beds or structures in the City of South Padre Island between the GIWW and the beach. The ICT determined that since there is no beneficial use for the material, it is infrequently dredged, and the PA is located in deep water without nearby seagrass beds, the best management plan for the site is continued use of the present disposal practice.

**PA 240** – (16+000 – 13+669) This is a semi-confined site located on the northeast corner of Long Island on the south side of the GIWW opposite from Port Isabel. It has been used five times between 1949 and 1995 with an average per-cycle discharge of 97,482 cy. Dredged material (consisting of an average of about 39% sand) placed in the site can flow out into adjacent shallow flats. The ICT decided to continue the present disposal practice since it is seldom used and has little volume to flow out into shallow water.

TABLE 1

Reach	Segment	PA	Average % Sand	# Uses (1949-1995)	Frequency of Use (1949-1995) (yrs)	Size of Designated PA (ac)	Per Cycle Discharge (CY)	Annual Discharge (CY)				
1	1	175	N/D	0	N/A	29.1	N/A	N/A				
		176	50.10	1	46.4	133.8	128,041	2,760				
		177	72.20	1	46.4	35.8	74,691	1,610				
		178	N/D	2	23.2	125.3	100,408	4,328				
		179	68.20	2	23.2	40.1	30,940	1,334				
		180	N/D	5	9.28	125.6	122,564	13,207				
	2	2	181	36.28	6	7.73	96.6	73,253	9,472			
			182	4.22	3	15.5	58.5	61,126	3,952			
			183	79.90	3	15.5	152.1	115,008	7,436			
			184	7.35	4	11.6	98.7	84,640	7,297			
			185	58.20	6	7.73	105.4	104,431	13,504			
			186	33.73	10	4.64	117.4	126,495	27,262			
		3	3	187	24.02	13	3.57	137.8	183,893	51,522		
				188	27.14	14	3.31	165.8	196,804	59,380		
				189	N/D	14	3.31	124.7	157,432	47,501		
			4	4	190	20.85	11	4.22	69.9	114,168	27,066	
					191	4.90	8	5.80	57.3	95,129	16,402	
				5	4	192	33.40	9	5.16	90.6	80,009	15,519
						193	N/D	9	5.16	90.6	87,218	16,917
3	6	194	55.21	12	3.87	121.5	92,550	23,935				
		195	85.00	10	4.64	103.0	112,778	24,306				
		196	50.56	7	6.63	103.0	102,946	15,531				
		197	25.40	15	3.09	304.4	318,930	103,102				
		198	34.40	18	2.58	146.2	132,755	51,500				
		199	11.87	16	2.90	124.9	140,854	48,570				
		200	27.00	15	3.09	196.2	156,537	50,605				
		201	18.32	14	3.31	173.7	177,145	53,449				
		202	7.58	16	2.90	195.6	195,382	67,373				
		203	27.08	6	7.73	324.5	149,376	19,316				
4	10	204	71.50	5	9.28	167.7	100,581	10,838				
		205	N/D	N/D	N/D	N/D	N/D	N/D				
		206	N/D	5	9.28	380.4	352,592	37,995				
		207	N/D	5	9.28	322.2	524,366	56,505				
		208	75.30	9	5.16	769.0	715,043	138,694				
		209	N/D	6	7.73	193.4	110,338	14,268				
		210	N/D	13	3.57	242.8	81,911	22,949				
		211	30.44	15	3.09	140.8	117,247	37,903				
		212	28.17	15	3.09	192.1	175,985	56,892				
		213	16.06	14	3.31	191.7	101,885	30,741				
5	11	214	17.54	9	5.16	191.4	216,337	41,962				
		215	7.41	11	4.22	194.1	193,123	45,783				
		216	12.17	6	7.73	194.7	149,645	19,351				
		217	22.90	8	5.80	193.3	181,505	31,294				
		218	18.75	12	3.87	194.3	218,230	56,439				
		219	13.14	10	4.64	119.8	112,608	24,269				
	12	12	220	8.05	10	4.64	216.1	153,758	33,138			
			221	8.35	17	2.73	387.2	177,214	64,928			
			222	23.18	10	4.64	259.4	183,776	39,607			
			223	56.00	6	7.73	158.8	92,078	11,907			
6	14	224	35.17	3	15.5	175.4	58,422	3,777				
		225	14.70	1	46.4	84.3	83,936	1,809				
		226	N/D	13	3.57	257.6	84,497	23,674				
		227	22.99	5	9.28	65.4	91,128	9,820				
		228	16.48	5	9.28	294.4	122,115	13,159				
6	16	229	6.71	3	15.5	129.2	27,740	1,794				
		230	N/D	1	46.4	82.5	43,260	932				
		231	N/D	1	46.4	127.8	69,982	1,508				
		232	16.89	12	3.87	127.4	57,126	14,744				
		233	8.01	24	1.93	210.0	392,773	203,158				
		234	12.62	25	1.86	121.6	227,513	122,582				
	17	17	235	30.46	5	9.28	121.6	43,053	4,639			
			236	N/D	N/D	N/D	129.1	N/D	N/D			
			239	53.99	6	7.73	49.4	86,056	11,128			
			240	39.30	5	9.28	N/D	97,482	10,505			