

**Gulf Intracoastal Waterway in Texas
Laguna Madre**

ANALYSIS OF ICT-DESCRIPTIONS OF UPLAND PLACEMENT SITES

October 2001

Prepared for:

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EXECUTIVE SUMMARY

Gahagan & Bryant Associates, Inc. (GBA) analyzed technical data and projections developed by the Laguna Madre Interagency Coordination Team (ICT) for a 50-year program of proposed "upland" placement of dredged material from the Laguna Madre portion of the Gulf Intracoastal Waterway. The ICT's proposal, with related assumptions and projections, is set forth in the ICT document at Appendix A. GBA relied on the ICT's information to the extent possible, and made best practice engineering assumptions to the extent required to fill in gaps or resolve inconsistencies. The ICT is considering 18 placement sites along the 113 mile Laguna Madre shoreline in the study area. The ICT is considering two alternative methods of placement, "confined" and "thin layer." Confined placement uses dikes to contain a slurry of dredged material as it is pumped into the placement area. See Figures 2-1 and 2-2. Excess water, with a certain amount of suspended solids, is allowed to flow out of the confined site and back to the bay waters of the Laguna. Confined sites require maintenance for the entire 50-year program and beyond, and will require access roads for such maintenance. Thin layer placement sites are intended by the ICT to result in an accumulated layer of dredged material no greater than one foot in height over the course of the 50-year program. Slurry is allowed to spread relatively uncontrolled over the placement area, and excess water with suspended solids not trapped in the placement area flows uncontrolled back to the bay waters of the Laguna. In both the confined and the thin layer methods, pipelines are used to pump the slurry from the dredging site to the placement site. One hundred-fifty foot wide access channels for the pipelines would be cut through the bay waters and seagrass to shore, and then both laterally and inland across the shoreline to the placement point. See Figure 2-4.

Under either method, approximately 89 million cubic yards of dredged material will be placed onshore during the 50-year program. Approximately 315 acres of nearshore bay bottom, including some with sea grasses, will be dredged to create pipeline corridors to shore, and 64 acres of onshore coastal area will be converted to pipeline corridors. Since the presence of pipelines causes environmental impacts in undeveloped areas such as the Laguna Madre, the ICT uses a measure of pipeline-mile-days ("p-m-d") in accounting for such impacts. P-m-d is a measure of the total number of days that the required length of pipeline will be deployed in the bay and onshore. Based on detailed analyses of each proposed placement site and on projected dredging requirements, GBA concludes that the 50-year project will entail 94,000 p-m-d, which is more than twice the 38,941 p-m-d that the ICT stated without explanation.

If the confined placement method is selected, the 29 to 33 feet diked placement sites (approximately three-stories high) will affect 18 percent (20 miles) of the Laguna Madre shoreline. The placement sites will cover approximately 4,287 acres of shore lands. Additionally, a minimum of 41 acres of shore will be converted to access roads for site construction and maintenance.

If the thin layer placement method is selected, approximately 73,000 acres of shoreline would be covered. The shoreline corridor affected will be approximately 89 miles long by 1.3 miles wide, i.e. 79 percent of the entire length of the Laguna Madre coastline in the study area. These estimates of the extent of thin layer burial were calculated based on the ICT's assumption that no more than one vertical foot of waste would be accumulated. The ICT memorandum makes an inconsistent statement that the area covered by thin layer sites would be roughly the same as the area covered by the confined sites, although confined sites would contain much deeper accumulations of dredged

materials. Thus, the ICT memorandum severely underestimates the areal extent required for thin layer sites.

This report does not include a quantitative analysis of the return flow of suspended sediments to the bay waters from the placement sites. Return flow is being addressed by another independent dredging engineer, Dr. Donald Hayes, who has special expertise in that area.

Costs for dredging and placement using the confined placement method will be approximately \$3 to \$41 per cubic yard of dredged material, varying among the 18 proposed sites. Based on the amount of dredging that will be required, the 50-year dredging program would cost approximately \$518 million, including startup construction and annual operating and maintenance. This averages to approximately \$10.4 million per year for dredging and confined disposal. Costs are not included for acquiring the land for the disposal sites, pipeline corridors, and access roads, for post-50-year program maintenance of the diked disposal sites, and for environmental impacts.

Costs for dredging and placement using the thin layer placement method will be approximately \$1.10 to \$4.62 per cubic yard, varying along the Laguna Madre shoreline. The 50-year dredging program would cost approximately \$189 million, which averages to approximately \$3.8 million per year for dredging and thin layer placement. Costs are not included for acquiring the land for the placement sites and pipeline corridors, and for environmental impacts.

Confined Upland Sites: Summary of Physical Effects

Number of Sites	18
External Area	4,287 acres
Length of Shoreline Affected	104,000 feet or 20 miles
In-Bay Pipeline and Access Channel from GIWW to Site	315 acres
Access Corridor from Shoreline to Site	64 acres
Access Road to Site	41 acres
Volume of Material Placed Over 50 Years	89 million cy
Average Interval Between Material Placements	1.1, 2.3 or 10 Years
Duration of Placement Operations per Site	2 to 35 days
Average Daily Flow at Site During Placement, in million gallons per day	9 (7 sites) and 29 (11sites)
Pipeline-mile-days (p-m-d)	93,831

Thin Layer Sites: Summary of Physical Effects,

Number of ICT Sites	14
Sites Area, acres	73,000
Length of Shoreline Affected, miles	89
In-Bay Pipeline and Access Channel from GIWW to Site, acres	315 +
Access Corridor from Shoreline to Site	64 +
Access Road to Site, acres	<i>not estimated</i>
Volume of Material Placed/50 Years, Mcy	88
Average Interval Between Material Placements, years (5)	1.1, 2.3
Duration of Placement Operations per Site, days	2 to 35
Average Daily Flow at Site During Placement, Million Gallons per Day	9 (5 sites) and 29 (9 sites)
Pipeline-mile-days (p-m-d)	94,000 +

+ indicates value expected to be greater than that for Confined Upland sites.
Actual value not estimated.

1.0 INTRODUCTION

1.1 DESCRIPTION OF STUDY AREA

This report presents an analysis of Confined Upland and Thin Layer dredged material placement sites described in a memorandum prepared by the Interagency Coordination Team (ICT) for the Gulf Intracoastal Waterway, Laguna Madre portion, in Texas. The north limit of the study area is at the John F. Kennedy Causeway, statute mile 552.5 (St M 552.5), near Flour Bluff, at the southerly edge of Corpus Christi Bay. The south limit is at Port Isabel (St M 665.5), near the Brownsville Ship Channel. The total length of the reach under study is 113 statute miles.

The ICT analysis available for this evaluation is presented in a memorandum of thirty pages with a fax date of December 5, 2000 (ICT 2000). The map on page 2 of the ICT memorandum indicates that the GIWW was divided into six reaches with eighteen identified placement site locations. The ICT Reaches are indicated in Table 1-1. Statute miles are referenced to the NOAA charts for the study area.

Table 1-1, GIWW – Laguna Madre, ICT Study Reaches

REACH	FROM MILE	TO MILE	LENGTH, MILES	COMMENT
---	549.5	---	---	Intersection with Corpus Christi Channel
---	552.5	---	---	John F. Kennedy Causeway
1	552.5	571.5	19	
2	571.5	587.5	16	
3	587.5	611.5	24	Land Cut
4	611.5	636.5	25	
5	636.5	647.5	11	
6	647.5	665.5	18	Reach length noted as 16 miles in ICT memorandum
---	665.5	---	---	Port Isabel
---	688.5	--	---	Intersection with Brownsville Channel
			113	Total

Notes: Adapted by GBA from ICT memorandum (ICT 2000).

Mileage is statute miles (St M) as given on NOAA charts 11302, 11303, 11306 and 11308. Note that Corps of Engineers mile points differ about 2 miles from those used on the NOAA charts.

GBA estimated the locations of the ICT-identified sites using the map on page 2 of the ICT memorandum, Figure 1-1. The estimated locations by statute mile for the sites and other related information contained in the ICT memo are presented in Table 1-2 and indicated on the schematic diagram of Figure 1-2.

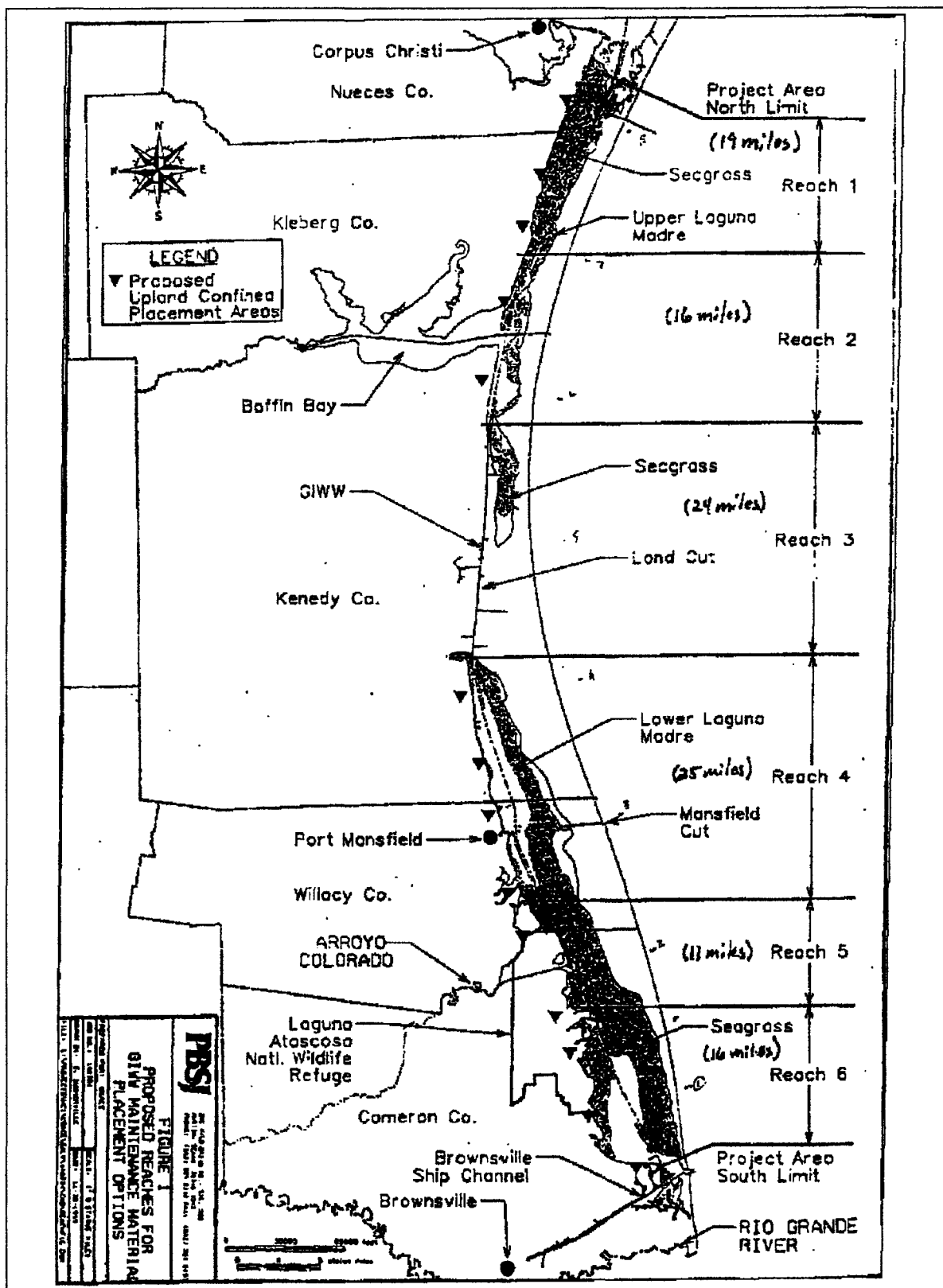


Figure 1-1, ICT Location Map (ICT 2000)

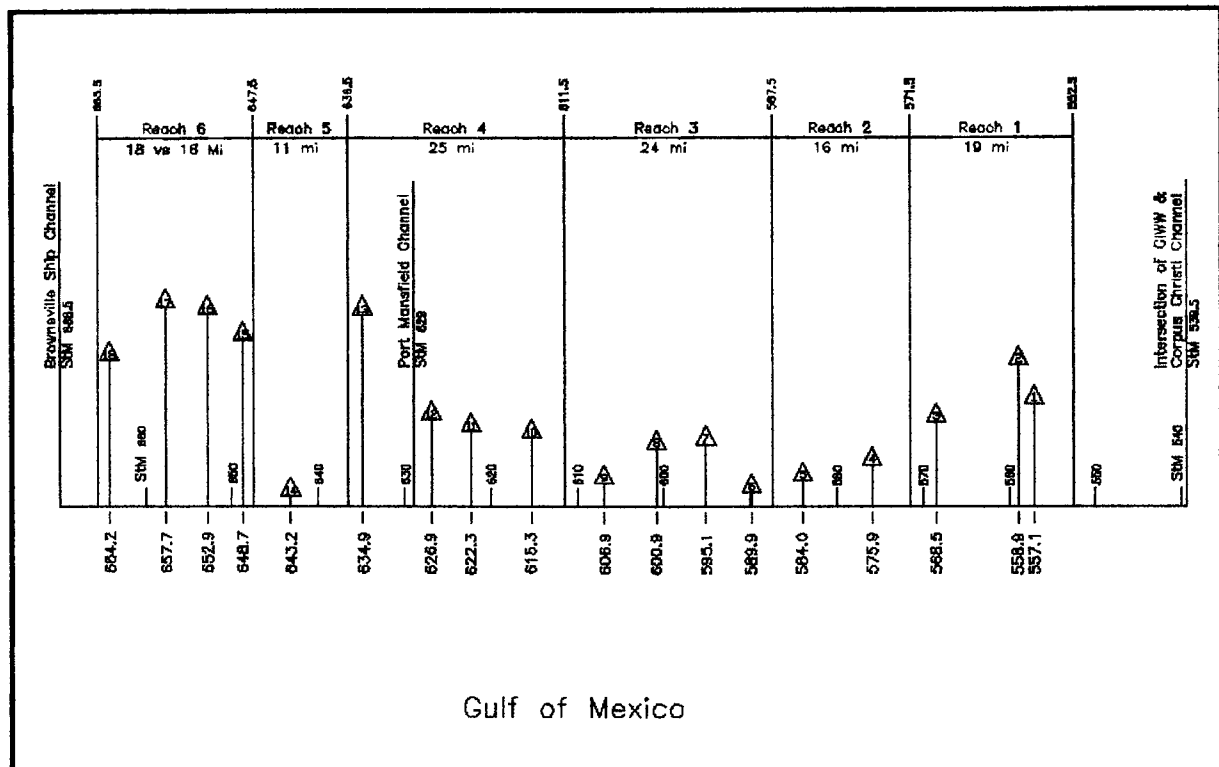


Figure1-2, Schematic Diagram of Study Area, no scale

Table 1-2, Estimated Locations & Selected Characteristics Of ICT-Identified Sites

REACH	SEGMENT (1)	STATUTE MILE, ST M (2)	DISTANCE BETWEEN SITES, ST M	THIN LAYER AREA, AC (3)	CONFINED UPLAND INITIAL AREA, AC (4)	CONFINED UPLAND FINAL DIKE HEIGHT, FT (4)
		552.5	John F. Kennedy Causeway			
1	1	556.0	---	84	68	32
1	2	558.5	2.5	205	126	32
1	3	569.0	10.5	501	322	32
2	4	576.2	7.2	532	338	32
2	5	584.0	7.8	1,119	643	32
3	6	(5)	---	(6)	99	29
3	7	(5)	---	(6)	411	29
3	8	(5)	---	(6)	174	29
3	9	(5)	---	(6)	92	29
4	10	615.5	---	346	338	33
4	11	622.3	6.8	282	283	33
4	12	626.9	4.6	331	321	33
4	13	635.0	8.1	174	180	33
5	14	643.0	8.0	103	99	33
5	15	648.7	5.7	69	77	33
6	16	652.9	4.2	252	254	31
6	17	658.3	5.4	474	429	31
6	18	664.2	5.9	19	33	31
		665.5	Port Isabel			
Totals		113			4,287	

Source: adapted by GBA from ICT 2000

Reach 1 = John F Kennedy Causeway to St M 571.5

Reach 2 = St m 571.5 to St M 587.5, vicinity of Baffin Bay

Reach 3 = St M 587.5 to St M 611.5, "Land Cut"

Reach 4 = St M 611.5 to 636.5, vicinity of Port Mansfield Cut

Reach 5 = St M 636.5 to 647.5, vicinity of Arroyo Colorado

Reach 6 = St M 647.5 to 665.5, vicinity of Port Isabel

(1) Segments correspond to ICT- identified site locations

(2) Estimated by GBA using statute miles on NOAA charts

(3) ICT Memorandum page 15

(4) ICT Memorandum page 13

(5) Site not located by ICT

(6) Noted as not feasible in ICT memorandum

2.0 ANALYSIS OF ICT-SITES & MAINTENANCE DREDGING CHARACTERISTICS

The ICT Memorandum identifies two types of upland placement sites; a) Confined Upland Placement and b) Thin Layer Placement.

Maintenance dredging volumes and existing site characteristics are based on available information. No surveys or field investigations were undertaken. USGS 1:24,000 topographic maps and available U. S. Soil Conservation Service soil survey reports were used to determine characteristics at the eighteen ICT-identified CDF sites.

2.1 CONFINED UPLAND PLACEMENT SITES

A Confined Upland Placement site has a perimeter of confining dikes to contain the dredged material slurry that is pumped into the site by a hydraulic dredge. During retention within the dikes the solid particles contained in the pipeline slurry gradually settle under the influence of gravity. The discharge from the site of water containing some particulate matter is controlled by means of a spillway. Water levels within the site are controlled by placing or removing wooden weir boards that are fitted in the spillway.

The principal characteristics of a Confined Upland site analyzed in this report are; (a) Volumes and types of Dredged Materials to be Placed, (b) Foundation Conditions, (c) Confining Dikes, (d) Placement Operations, (e) Site Access, (f) Site Maintenance (g) Spillways and (h) Crust Management Operations. A schematic diagram of the Confined Upland site as analyzed in this report is presented in Figure 2-1. The typical perimeter arrangement and dike cross section as used in this analysis is presented in Figure 2-2. Characteristics of the eighteen ICT identified sites are summarized in Table 2-1.

Table 2-1, Range of Confined Upland Site Sizes, ICT Values

REACH	NUMBER OF SITES	RANGE OF SITE SIZE, ACRES		TOTAL SITE AREA IN REACH, ACRES	DIKE HEIGHT, FT
		min.	max.		
Northern (1)	5	68	643	1,497	32
Land Cut (2)	4	92	411	776	29
Southern (3)	9	33	429	2,014	31 – 33
Totals	18	---	---	4,287	---

Notes:

(1) Northern Reach, Corpus Christi to the Land Cut, includes ICT Reaches 1 and 2, Sites 1 – 5

(2) Land Cut Reach includes ICT Reach 3, Sites 6 – 9

(3) Southern Reach, Land Cut to Port Isabel, includes ICT Reaches 4 – 6, Sites 10 – 18

The ICT memorandum estimates a total "External Area" for the eighteen sites of 4,287 acres. Individual ICT sites have external areas varying from 33 acres, Site 18 to 643 acres, Site 5. Dike heights at the sites vary from 29 ft to 33 ft. The GBA estimates for selected characteristics of the 18 ICT Confined Upland site are contained in Table B-1 (Appendix B).

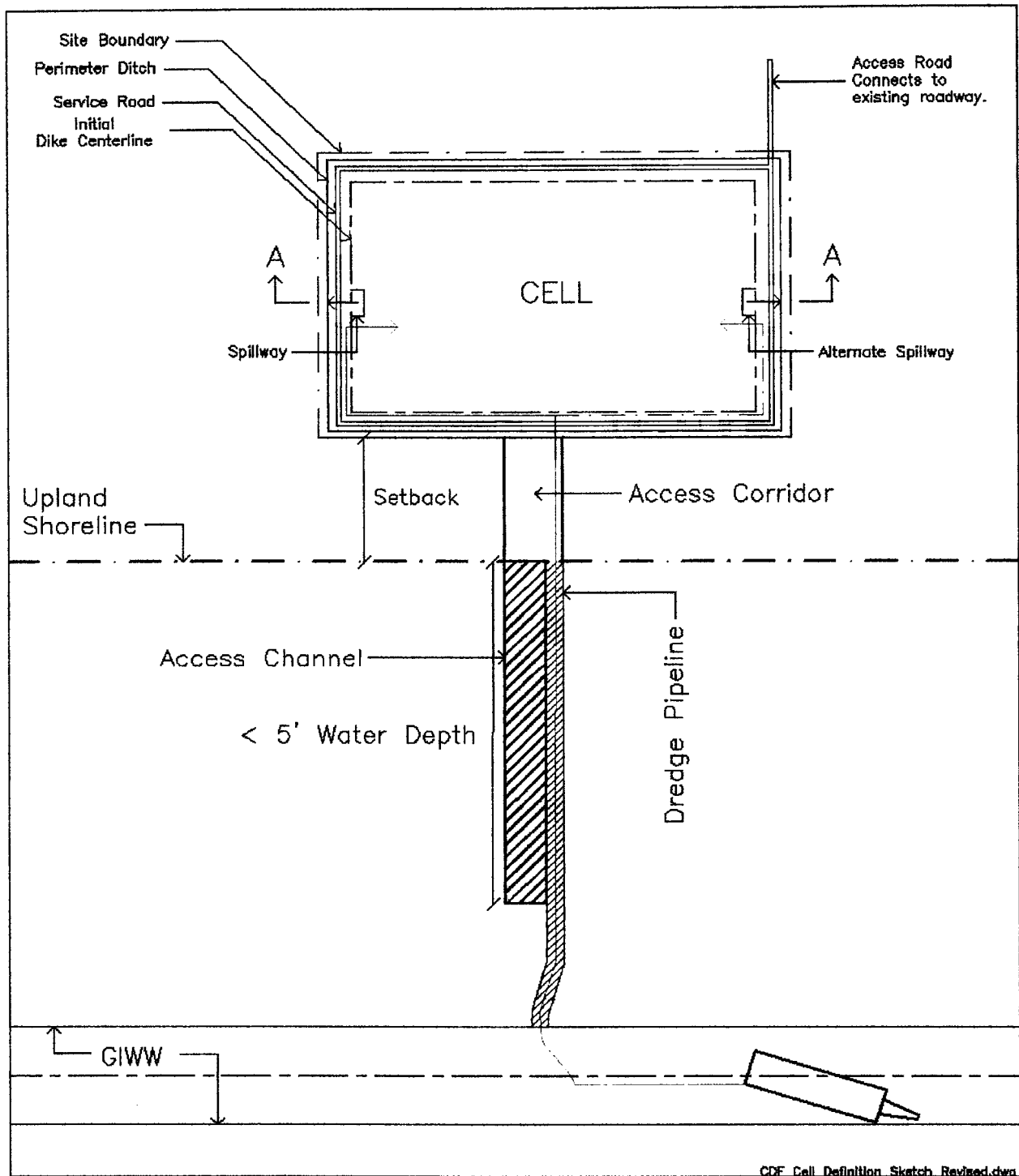


Figure 2-1, Confined Upland Site, Schematic Diagram (no scale)

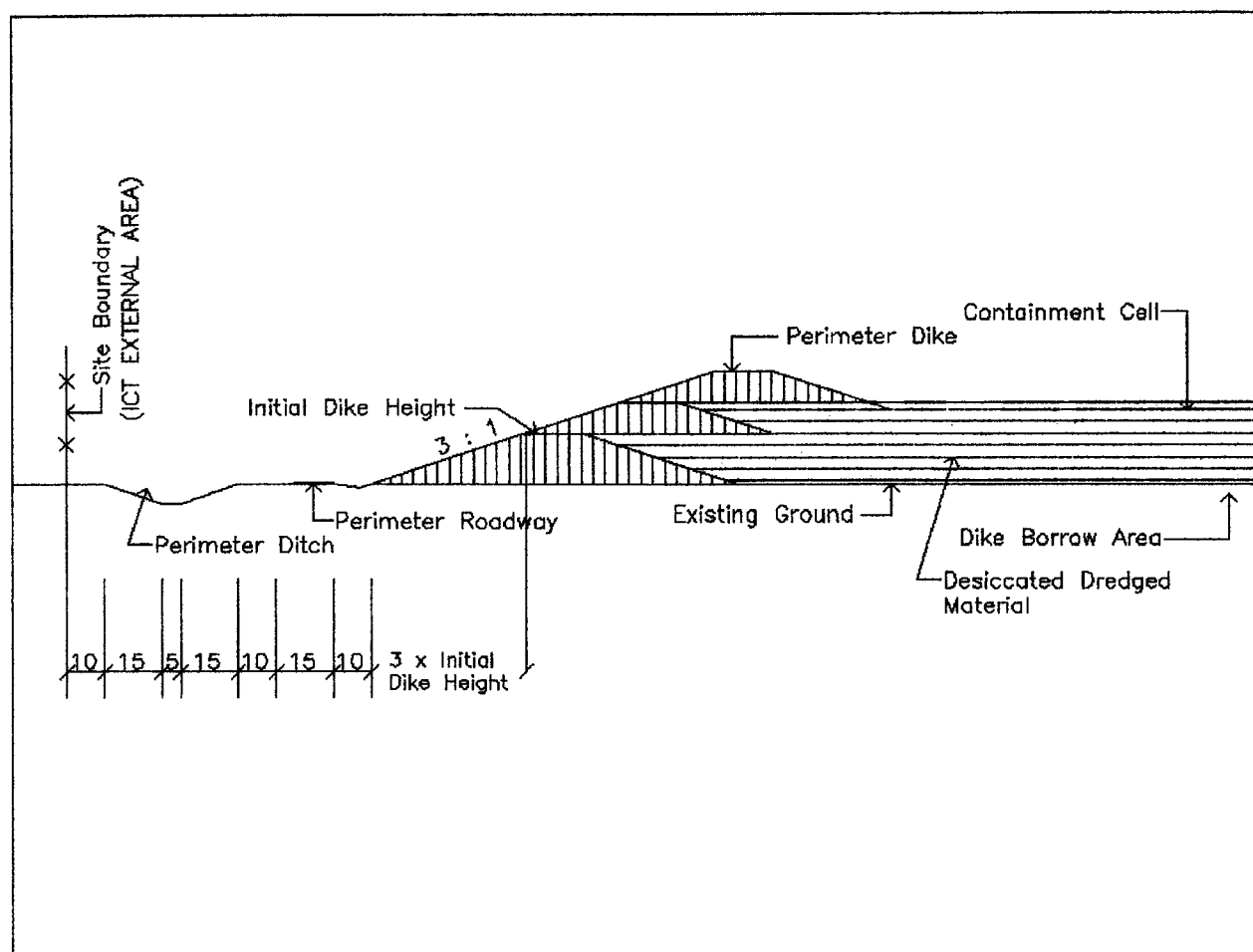


Figure 2-2, Confined Upland Site, Typical Perimeter Arrangement & Dike Cross Section, (no scale)

The Site Boundary (estimated to be the limit of the ICT External Area) is shown on the left edge of the above sketch. The series of dimensions to the right of the site boundary give dimensions in feet for the various segments of the site Perimeter Ditch, Perimeter Roadway and the Initial Dike used in estimating site characteristics. The initial dike and the one or more raisings of the perimeter dike are indicated by the vertical lines. The Initial Dike is constructed with material excavated from the Borrow Area within the containment dike. The subsequent dike raisings are made using the dried (desiccated) dredged material.

Ideally the dredged material lift thickness for each placement at a Confined Upland site should be limited to a maximum of 3 ft. This will allow removal of entrained water through drying and desiccation of the dredged material between dredging and placement intervals. The removal of this excess water results in increased site capacity. The dried material can be used to periodically raise the perimeter dikes to further increase site capacity. The drying and reuse of dredged material is referred to as crust management.

The shrinkage potential is estimated using material percentages for sand and fine-grained materials in Table 2-3 and a shrinkage coefficient of 1.0 for sand and 0.6 for fine-grained materials. This coefficient is applied to the cut yardage placed. Fine-grained dredged materials also “bulk” when initially placed at confined upland sites. The bulking is estimated by using a weighted “bulking” value of sand of 1.0 and 1.4 for fine-grained materials applied to the cut yardage placed.

2.2 THIN LAYER PLACEMENT SITES

In the GBA analysis of Thin Layer sites several assumptions are made; a) characteristics of a Thin Layer Placement site are less elaborate than the Confined Upland site, Spillways and crust management operations are not required. b) With a Thin Layer site the dredged material slurry is allowed to flow overland in a relatively thin sheet. Training dikes may be used at the upper end and along the sides of the site in order to confine materials to the desired area. c) As the overland flow passes over the site a combination of solid materials removal by vegetation and gravity takes place and the slurry water returns to the waterway. The ICT report states that some areas may benefit from this practice (ICT 2000, page 15).

It appears that a Thin Layer site should have a relatively uniform slope from the “back limit” (line of discharge points for the dredge pipeline slurry) to the receiving water. A Thin Layer site as defined in this analysis has some equivalence to the earlier practice of discharging to an unconfined placement area until such time as the thickness and/or the areal extent of the fill warrant construction of partial or full containment dikes (USACE 1990, par 2.02).

The ICT states that the thickness of material placed at a Thin Layer site will vary from 0.5 ft to 1 ft with an average thickness of 0.75 ft. Thin Layer sites are judged not feasible by the ICT for the 24-mile long Land Cut reach. The Corpus Christi to Land Cut and the Land Cut to Port Isabel reaches with a length of 89 miles remain as candidates for this method. ICT values for Thin Layer Sites and a comparison to Confined Upland sites is contained in Table B-2 (Appendix B).

The area required for a given site is a direct function of the volume of material placed and the thickness of the placement. For a Confined Upland site using a placement depth of 3 ft, 1,000,000 cy would require 207 acres. For a Thin Layer site using a placement depth of 0.75 ft, 1,000,000 cy would require 827 acres. Under these conditions, Thin Layer sites require four times the area of Confined Upland sites.

The analysis of the ICT use of Thin Layer sites raises two issues; a) one application of a thin layer at a given site, and b) multiple applications of a thin layer at a given site.

a. One Application at a Thin Layer Site

One application of dredged material at an initial thickness averaging 0.75 ft, using a new site for each placement, would require about 73,000 acres for the 50-year volume of 88 million cy. This acreage would require a strip of land about 1.3 miles in width along the 89 miles of waterway where the ICT states the method is applicable. The ICT states that about 4,500 acres is required for the Thin Layer method at 14 sites, as contrasted to about 4,300 acres for the 18 confined sites. This ICT value suggests that multiple applications of a thin lift at a given site may be intended.

b. Multiple Applications at a Thin Layer Site

Multiple applications of thin lifts at each site would ultimately reach a thickness equivalent to those estimated for the Confined Upland sites. Such "Thin Lift" sites would require dikes, spillways and ancillary improvements comparable to those at Confined Upland sites.

2.3 COMPARISON OF CONFINED UPLAND AND THIN LAYER PLACEMENT SITES

The major differences between Confined Upland and Thin Layer sites are essentially in the use of dikes and spillways and in the thickness of the placement lift. The difference in placement lift between the two types of sites can be significant. The placement volume difference for a given placement area between the two types, measured in cut cy, is indicated in Figure 2-3. As noted above, in this analysis we assume that only one application of the thin layer is made at a given location. If by thin layer the ICT means a thin layer for each of a number of repetitive applications at a given site, a Thin Layer site still requires several times more area than a Confined Upland site for the same volume of dredged material.

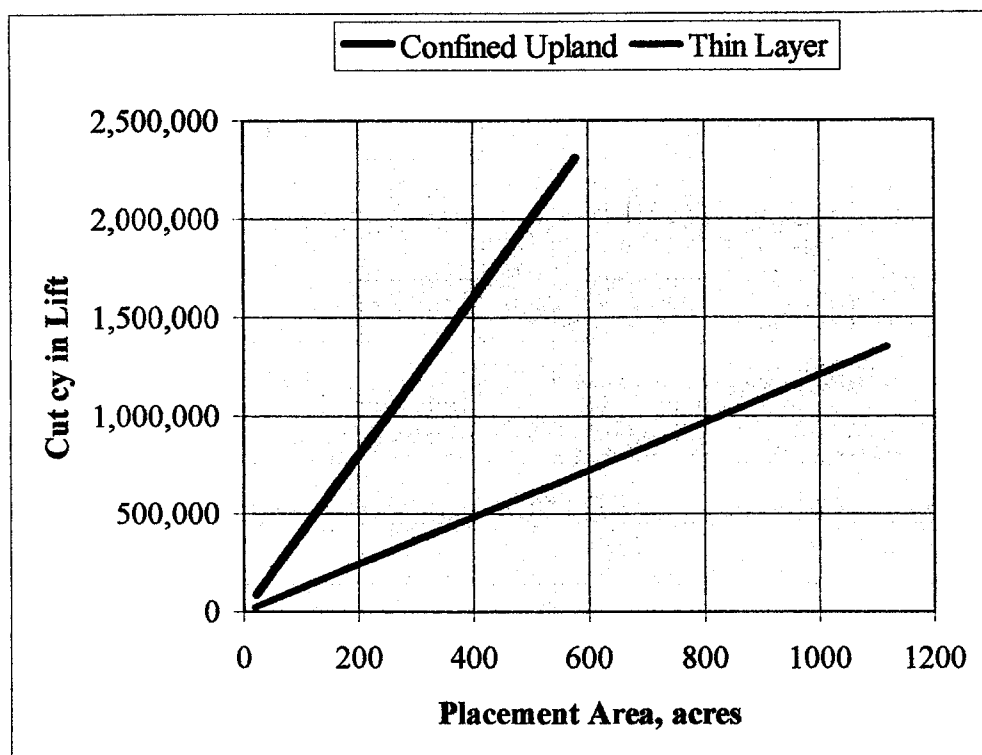


Figure 2-3, Comparison of Confined Upland and Thin Layer Placement For Typical Lifts of Dredged Materials

This chart shows the cut, or "in-channel," volume of dredged material that can be placed in a Confined Upland Site with a typical lift of 3 ft and for a Thin Layer Site with a typical lift of 0.75 ft. The volume of material in a Confined Upland site is adjusted for the bulking of fine-grained material placed hydraulically by a factor of 1.4. There is no volume adjustment for a Thin Layer site. For example, for a 200 acre Thin Layer site, one lift will accommodate approximately 250,000 cy. A 200-acre Confined Upland site will accommodate approximately 800,000 cut cy in one bulked, un-desiccated, lift of 3 ft. This chart is based on a dredged material consisting of 31% sand and 69% fines as explained in the text.

As shown in the above chart Thin Layer sites require several times the area of a Confined Upland site for comparable volumes of material.

2.4 MAINTENANCE DREDGING REQUIREMENTS

2.4.1 Past Shoaling Record

The ICT analysis presumably uses the past shoaling record for the GIWW in the Laguna Madre. GBA used this past record in the analysis of the ICT memorandum as outlined in Section 2.4.3.

2.4.2 Future Dredging Requirements

Two recent papers discuss sediment supply and the factors controlling navigation channel shoaling in the Laguna Madre (Morton 2000 and Morton 2001). These papers have not been reviewed as part

of this report but the relationships between channel shoaling sources and upland placement of dredged materials should be examined in any further evaluation of upland placement sites.

2.4.3 Past Shoaling Volumes, Material Type And Schedules

Maintenance dredging volumes and schedules have been developed as outlined in Table 2-3.

Table 2-3a, Past Shoaling Rates

REACH	FREQUENCY, YEARS	SHOALING, CY/YEAR
GIWW - Corpus Christi Bay to Mud Flats	2.3	795,000
GIWW Mud Flats	10.3	Nil
GIWW - Mud Flats to Port Isabel	1.1	1,051,000
Total		1,846,000

Source "216 Report" (USACE 1997, Table 9, page 46)

Table 2-3b, Analysis Of Shoaling Rates

REACH	PROJECT VOLUME, CY (1)	GIWW BEGIN ST MILE	GIWW END ST MILE	REACH LENGTH, ST M	PROJECT CY PER ST M
GIWW - Corpus Christi Bay to Mud Flats	1,828,500	549.6	597.3	47.7	38,333
GIWW Mud Flats	Nil	597.3	608.5	11.2	nil
GIWW - Mud Flats to Port Isabel	1,156,100	608.5	666.5	58.0	19,929
Totals				117 (2)	

Source: Adapted from "216 Report" (USACE 1997, Table 9, page 46)

(1) Product of Frequency x Shoaling

(2) There are differences among "216," "1975 FEIS" and "ICT" values for reach lengths. These differences do not affect the analyses contained in this report.

In this analysis the placement volumes for each placement event for each site are based on the values shown in Table B-1, Line 31, i.e. (average dredging per year per St M) times (reach length serviced by site) times (average dredging interval). Dredging may not take place uniformly along a reach during a given dredging cycle, thus every site may not be used in each dredging cycle. A detailed analysis of dredging requirements by reach and by site is beyond the scope of this analysis.

2.4.4 Dredged Material Types

The 1990 Corps of Engineers environmental assessment describes material types as; "The material to be excavated consists of deposits with particle size ranging from sands to clays. The material generally averages around 31% sand, 29% silt and 40% clay" (USACE 1990, Appendix B, page 5). An average range of 31% sand and 69% fine-grained material is used in the analyses made in this report.

The salinity and grain sizes of the maintenance dredging materials and implications for the dredged material behavior during and after placement are not discussed in the ICT memorandum.

2.5 MAINTENANCE DREDGING OPERATIONS

Maintenance dredging operations were estimated for the ICT-identified sites for the dredging volumes and schedules developed above. A schematic diagram indicating the pipeline arrangement used in analyzing the maintenance dredging operation is shown in Figure 2-4. This analysis is summarized in Table B-3 (Appendix B).

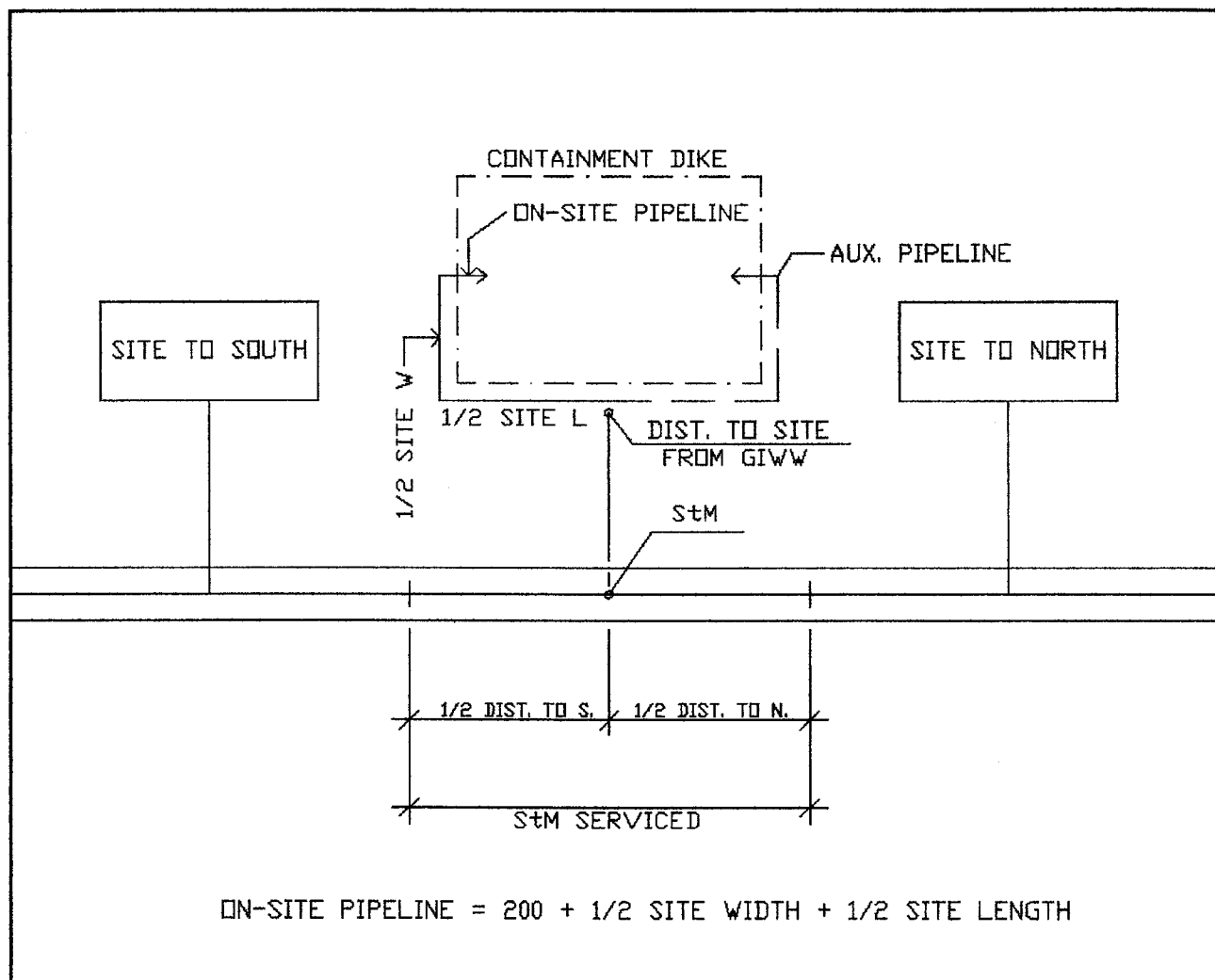


Figure 2-4, Schematic Diagram of Pipeline Arrangement, no scale

This diagram illustrates the manner in which the average pipeline distance is computed for each site. The average pipeline distance is used to compute the duration and the cost of dredging for each site. It is assumed that each site will receive dredged material from the GIWW reach equal to one-half the distances to the adjoining sites (for the sites at the north and south ends of the study reach an appropriate adjustment is made). This distance is identified as the "St M Serviced." The maximum of the two distances along the GIWW is selected and the pipeline distance from the GIWW to the shoreline and the pipeline distance on the site itself are added to the maximum of the two distances to get the total average pipeline distance for each site.

As indicated above, an alternate spillway is provided to allow for an equitable distribution of dredged materials within the containment dikes.

2.6 NUMBER OF PLACEMENT SITES REQUIRED

The ICT memorandum states that sites are located in order to keep the pipeline distance from the dredge to the placement site a maximum of seven miles. A maximum pumping distance of seven miles would result in a site interval approaching 14 miles. As can be seen in Table 1-2, there is some variation from this ideal distance between sites. The GBA-estimated interval between sites varies from 8.5 miles to 4.5 miles with an average interval of 6.3 miles. The distance from the GIWW to the point of discharge in the site must be counted as part of the pipeline distance. This consideration is taken into account in the calculations presented in Section 2.5.

Another comparison can be made between the estimated site capacity and the volume of dredged material placed over the 50-year study period. These values are indicated in Table 2-1. The total estimated capacity of the eighteen ICT-identified sites is 241 million cy. The estimated 50-year maintenance dredging volume is 89 million cy as developed in Section 2-4. This difference indicates a surplus capacity. There are also differences in the dredging and capacity volumes among the sites. These values are also shown in Table B-1. Site capacities utilized vary from a maximum of 311% for Site 18 to 1% for Site 4. The dredging and site volumes described above indicate that the identified sites are not distributed in an optimal manner under the assumptions made in this analysis.

3.0 SITE AND MAINTENANCE DREDGING COSTS

3.1 CONFINED UPLAND SITE COSTS

Site first-costs and operation and maintenance costs are developed for the site characteristics identified in Section 2. Maintenance dredging costs are updated from the GBA 1997 report on dredging and placement costs in the Laguna Madre (GBA 1997). These updated costs are indicated in Tables B-7 and B-8 (Appendix B).

In preparing cost estimates we have used the site characteristics summarized in Table B-1 and have assumed that the average annual shoaling takes place uniformly over the length of the waterway as noted in Table 2-3. Uniform shoaling is not likely but is judged appropriate for the purpose of this report. The ICT memorandum does not state the dredging volumes evaluated. The range of site and dredging costs are given in Table 3-1 following.

Site construction costs are primarily a function of site size; smaller sites are cheaper to build than large sites. Site capacity cost is a function of site construction and operation costs and dredging cost as well as the volume of material placed. High capacity cost may be an indication of poor utilization of site capacity. This condition is indicated for the Land Cut where, under the analysis procedures used in this report, site capacity is too large for the volume of material placed. Details of these cost estimates are contained in Tables B-4 through B-9.

3.2 THIN LAYER SITE AND DREDGING COSTS

3.2.1 One Application at a Thin Layer Site

One application of material at a Thin Layer site would require only the necessary rights of way. These costs have not been estimated. As in the case of Confined Upland sites, planning and administration costs have not been estimated. Dredging costs for one application at thin layer sites would tend to be higher than those for Confined Upland sites because of longer pipeline lengths required to reach the farthest extent of the site and additional pipeline handling required. An increase of 10 percent over Confined Upland site estimated dredging cost is used.

3.2.2 Multiple Applications at a Thin Layer Site

Under multiple applications of a thin layer the Thin Layer sites would ultimately reach a thickness equivalent to those estimated for the Confined Upland sites. Sites cost are therefore comparable to those for Confined Upland sites.

Thin Layer site and dredging costs are summarized in Table 3-2.

Table 3-1, Confined Upland Site Costs, Ranges and Totals
\$ per cy and \$million as noted

REACH	OVERBOARD DISPOSAL \$/CY AND \$MILLION (4)		INITIAL CONSTRUCTION, \$MILLION (5)			DREDGING, \$/CY AND \$MILLION (6)			SITE OPERATIONS AND MAINTENANCE, \$MILLION (7)			TOTAL PLACEMENT, \$/CY AND \$MILLION (8)		
	avg. (9)	total (10)	min.	max.	total (10)	min.	max.	total (10)	min.	max.	total (10)	min.	max.	total (10)
Northern (1)	\$1.00	37	1.1	5.2	16	\$1.00	\$4.20	77	8	23	72	\$3	\$6	165
Land Cut (2)	\$1.00	Nil	1.4	4.7	10	\$1.40	\$3.50	3	3	7	18	\$17	\$41	31
Southern (3)	\$1.00	52	0.8	4.2	23	\$1.10	\$3.20	90	11	34	208	\$4	\$9	321
Totals for 50 Years	---	\$89	---	---	\$49	---	---	\$170	---	---	\$298	---	---	\$517

Notes: Values are rounded

min. - minimum value in reach

max. - maximum value in reach

total - total for all sites in reach and total for three reaches, \$million

(1) Northern Reach - Corpus Christi to Land Cut, includes ICT Reaches 1 and 2, Sites 1 - 5

(2) Land Cut Reach includes ICT Reach 3, Sites 6 - 9

(3) Southern Reach - Land Cut to Port Isabel, includes ICT Reaches 4 - 6, Sites 10 - 18

(4) The current practice of in-Bay disposal, unit cost shown is approximate

(5) Estimated contract cost for site construction, does not include planning and administration costs

(6) Estimated dredging contract cost, does not include planning and administration costs

(7) Site operations and maintenance costs, does not include planning and administration costs

(8) Estimated cost based on all site construction, operation and maintenance and dredging costs divided by cut volume placed

(9) Approximate unit cost for conventional overboard disposal

(10) Total cost for reach and total for three reaches, \$million

**Table 3-2, Summary of Thin Layer Site Dredging Costs (1)
\$ per cy and \$million as noted**

PLACEMENT METHOD	RANGE OF DREDGING COST, \$/CY & \$MILLION(2)		
	MIN.	MAX.	TOTAL
One Application, @ 110% of Confined Upland sites unit cost (3)	\$1.10	\$4.60	\$190
Multiple Applications, @ 100% of Confined Upland sites unit cost (4)	\$1.00	\$4.20	\$170

(1) Site acquisition and maintenance and planning and administrative costs are not included.

(2) Determined by applying percentages under Placement Method to dredging unit costs identified in Table 3-1.

(3) See par. 3.2.1

(4) See par. 3.2.2

4.0 PHYSICAL EFFECTS OF SITES AND MAINTENANCE DREDGING OPERATIONS

GBA estimated selected physical effects of the ICT-identified sites at the request of a consultant to CWT. These estimated physical effects are presented below.

4.1 CONFINED UPLAND SITES

Values for selected physical effects of the ICT-identified Confined Upland sites estimated by GBA are listed in Table B-10 (Appendix B). These values are estimated from the characteristics listed in Table B-1 and Plates 1 through 18 (Appendix C). A summary of ICT values and GBA estimates for the physical effects of Confined Upland sites is contained in Table B-11.

**Table 4-1, Summary of Physical Effects, Confined Upland Sites
ICT Values and GBA Estimates**

CHARACTERISTIC	ICT VALUE	GBA ESTIMATE
Number of ICT Sites	18	---
ICT Site External Area, acres (1)	4,287	---
Length of Shoreline Affected	---	104,000 feet or 20 miles
In-Bay Pipeline and Access Channel from GIWW to Site	445 (2)	315 (3)
Access Corridor from Shoreline to Site, acres	---	64
Access Road to Site, acres (4)	---	41
ICT Site Capacity, Mcy	---	241
Volume of Material Placed Over 50 Years, Mcy	---	89
Average Interval Between Material Placements, years (5)	---	1.1, 2.3 or 10
Duration of Placement Operations per Site, days	---	2 to 35
Approximate Time to Dewater Site After Placement, days	---	15 to 60 (varies w/ site)
Average Daily Flow at Site During Placement, Million Gallons per Day	---	9 (7 sites) and 29 (11 sites)
Pipeline-mile-days (pmd)	45,952	93,831 (6)

Notes: — indicates no value given

(1) ICT- identified sites vary in size from 33 to 643 acres.

(2) ICT Conveyance Action includes; Seagrass, Open Bay Bottom, Emergent Bay Habitat and Terrestrial Receptors.

(3) GBA estimate does not include pipeline within the GIWW channel.

(4) Not all sites have access to the mainland.

(5) Sites from Corpus Christi to the Land Cut have an interval of 2.3 years, Land Cut sites 10 years and Land Cut to Port Isabel sites 1.1 years. (USACE 1997).

(6) GBA estimate results from using each placement site during each maintenance episode. A more optimal number of sites might result in a lower value for pmd.

4.2 THIN LAYER SITES

The physical effects of Thin Layer sites are uncertain due to the factors discussed in Section 2.3. A summary of physical effects showing ICT and GBA values is given in Table 4-2.

**Table 4-2, Summary of Physical Effects, Thin Layer Sites
ICT Values and GBA Estimates**

CHARACTERISTIC	SINGLE APPLICATION		MULTIPLE APPLICATIONS	
	ICT VALUE	GBA ESTIMATE	ICT VALUE	GBA ESTIMATE
Number of ICT Sites	---	---	14	---
ICT Site External Area, acres (1)	---	73,000	4,449	---
Length of Shoreline Affected, miles	---	89	---	20
In-Bay Pipeline and Access Channel from GIWW to Site, acres	---	315 +	445 (2)	315 (3)
Access Corridor from Shoreline to Site	---	64 +	---	64
Access Road to Site, acres (4)	---	---	---	41
ICT Site Capacity, Mcy	---	88	---	88
Volume of Material Placed/50 Years, Mcy	---	88	---	88
Average Interval Between Material Placements, years (5)	---	1.1, 2.3	---	1.1, 2.3
Duration of Placement Operations per Site, days	---	2 to 35	---	2 to 35
Approximate Time to Dewater Site After Placement, days	---	---	---	---
Average Daily Flow at Site During Placement, Million Gallons per Day	---	9 (5 sites) and 29 (9 sites)	---	9 (5 sites) and 29 (9 sites)
Pipeline-mile-days (pmd)	---	94,000 +	45,952	93,831 (6)

+ indicates value expected to be greater than that for Confined Upland sites. Actual value not estimated.

- (1) ICT- identified sites vary in size from 19 to 1,119 acres.
- (2) ICT Conveyance Action includes; Seagrass, Open Bay Bottom, Emergent Bay Habitat and Terrestrial Receptors.
- (3) GBA estimate does not include pipeline within the GIWW channel.
- (4) Not all sites have access to the mainland
- (5) Sites from Corpus Christi to the Land Cut have an interval of 2.3 years, and Land Cut to Port Isabel sites 1.1 years. (USACE 1997).
- (6) GBA estimate results from using each placement site during each maintenance episode. A more optimal number of sites might result in a lower value for pmd.

4.3 MAINTENANCE DREDGING OPERATIONS

Selected physical effects of dredging operations at the ICT-identified confined upland sites are indicated in Table B-12. The estimated physical effects of access channels and pipelines routes from the GIWW to the shoreline of the upland sites are shown in Table B-10. Physical effects for multiple applications at a Thin Layer site are comparable to those for Confined Upland sites. Physical effects for a single application at Thin Layer sites are indicated in Table 4-2 but a detailed analysis has not been made.

5.0 REFERENCES

GBA 1997 – *“Alternative Dredging and Placement Cost Estimates, Laguna Madre, Port Isabel to Mud Flats, Vicinity of Mile 660, GIWW Stations 45+000 to 65+000,”* Prepared for Espy, Huston & Associates and U S Army Corps of Engineers, Galveston District, Prepared by Gahagan & Bryant Associates, Inc., Houston, Texas, August 1, 1997.

GBA 2001 – *“Costs of Gulf Placement of Laguna Madre Dredge Spoils,”* Prepared for Cadwalader, Wickersham & Taft, Prepared by Gahagan & Bryant Associates, Inc., Baltimore, Maryland, April 17, 2001.

ICT 2000 – Faxed Memorandum, [Description of ICT Site Evaluations], December 5, 2000,

Morton 2000 – Morton. R. A., Ward. G. H. and White. W. A., *“Rates of Sediment Supply and Sea-level Rise in a Large Coastal Lagoon.”* Marine Geol., Amsterdam. 167 261-284.

Morton 2001 – Morton. R. A., Nava. R. C. and Arhelger. M. *“Factors Controlling Navigation-Channel Shoaling in Laguna Madre, Texas,”* American Society of Civil Engineers, Journal of Waterway, Port, Coastal, and Ocean Engineering/March/April 2001.

USACE 1975 – U. S. Army, Corps of Engineers, Galveston District, *“Final Environmental Impact Statement, Maintenance Dredging, Gulf Intracoastal Waterway, Texas Section, Main Channel and Tributary Channels,”* October 1975, Volume 1

USACE 1975a – U. S. Army, Corps of Engineers, Galveston District, *“Final Environmental Impact Statement, Maintenance Dredging, Gulf Intracoastal Waterway, Texas Section, Main Channel and Tributary Channels,”* October 1975, Volume 3, Supplements, pages 125 – 129; 223 - 227 and drawings, Port Isabel to Mud Flats, Sheets 1, 2, 3 and 4 of 4; Corpus Christi Bay to Mud Flats, Sheets 1, 2, 3 and 4 of 4.

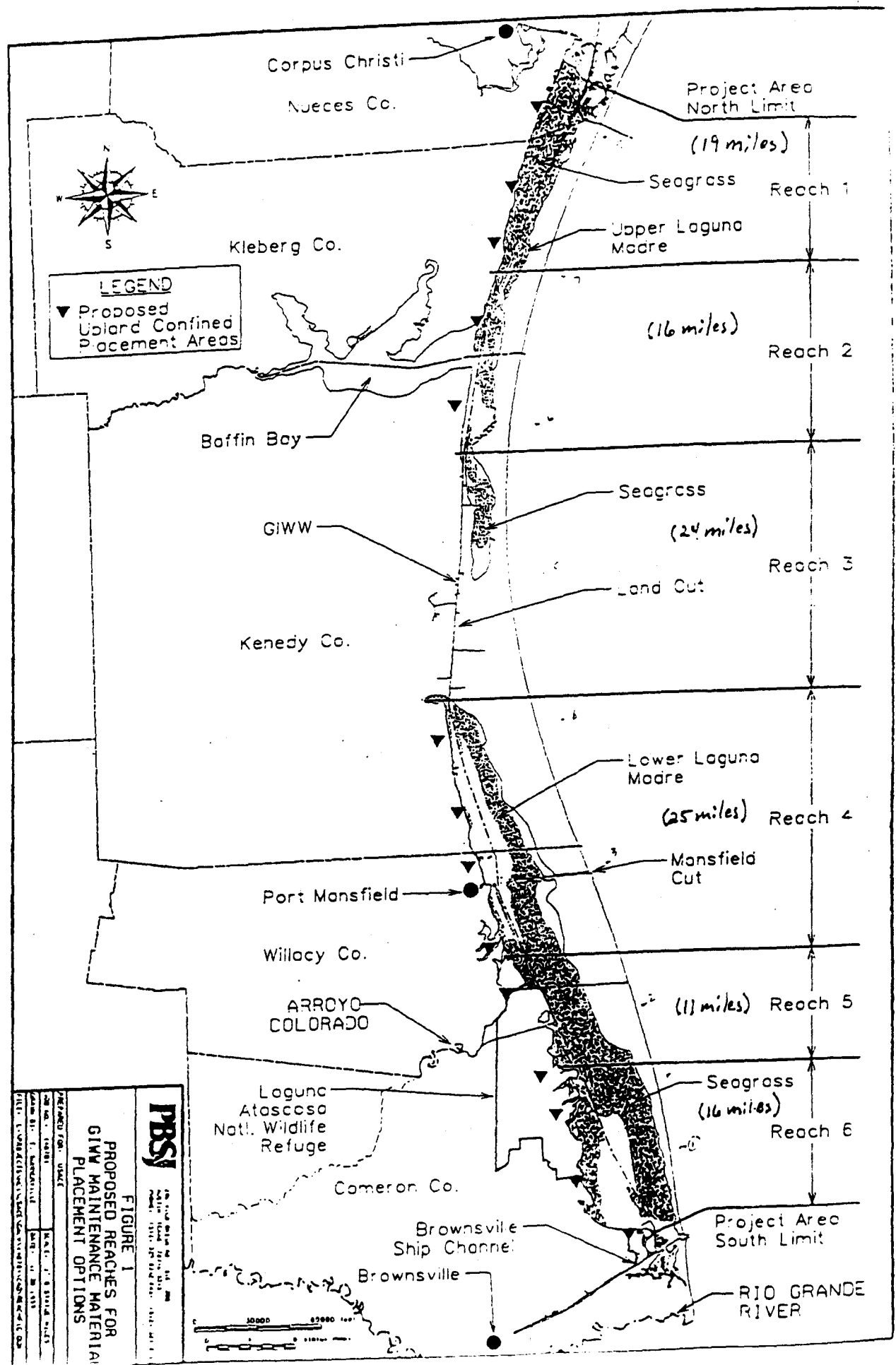
USACE 1990 – U. S. Army, Corps of Engineers, Galveston District, *“Environmental Assessment, Gulf Intracoastal Waterway, Texas, Main Channel to Mud Flats, Alternate Disposal Areas Within Vicinity of Baffin Bay,”* 1990.

USACE 1994 - U. S. Army, Corps of Engineers, Galveston District, *“Gulf Intracoastal Waterway, Corpus Christi Bay to Port Isabel, Texas, (Section 216) Reconnaissance Report,”* July 1994.

USACE 1997 – U. S. Army, Corps of Engineers, Galveston District, *“Gulf Intracoastal Waterway, Corpus Christi Bay to Port Isabel, Texas, (Section 216) Reconnaissance Report,”* January 1997.

APPENDIX A

Description of ICT Site Evaluations, Faxed Memorandum, Dated December 5, 2000



At an early meeting, the ICT developed 22 evaluation criteria or receptors. At subsequent meetings, those 22 evaluation criteria were synthesized into six Resource Categories, as shown below.

Resource Category	Original Evaluation Receptors
Seagrass	• Aquatic Flora (Submerged Aquatic Vegetation)
Open Bay Bottom (excluding seagrass)	• Benthos • Beneficial Uses
Emergent Bay Habitat	• Benthos • Beneficial Uses • Tidal Flats • Waterfowl / Wading Birds • Wetlands
Terrestrial Habitat	• Beneficial Uses (sediment quality, location, recreational fisheries) • Terrestrial Flora - Wetlands/Uplands • Terrestrial Fauna
Water Column Effects	• Nekton • Plankton • Water Quality – Turbidity / Toxicity • Circulation
Human Use Effects	• Air Quality / Noise • Navigation Hazards • Historical Resources • Commercial / Recreational Fisheries
Cost	• Dredging / Placement Costs • Reduce Frequency of Maintenance • Time – ability to meet GIWW maintenance schedule
	• Endangered and Threatened Species - the impacts on E & T Species should be considered for all relevant criteria. For example, the impact to endangered sea turtle species is reflected in the scoring of the impact to their habitat, in this case, primarily seagrass beds.

PLACEMENT ALTERNATIVES

1. Open Ocean/Offshore Placement
 - a. Hopper Dredges
 - b. Pipeline Dredges and Scows
 - c. Pipeline Dredges and Pipelines
2. Upland Placement
 - a. Confined Upland Placement
 - b. Thin Sheet Placement
3. Beneficial Uses
 - a. Beach Nourishment
 - b. Washover Nourishment
4. Aquatic Placement
 - a. Open Bay Unconfined
 - b. Open Bay Confined
 - c. Open Bay Semi-Confined.

SCREENING CRITERIA

- X Meet Engineering Feasibility – For example, a hopper dredge that was too tall to fit under the JFK Causeway could not be used for ocean placement of material from Reaches 1 through 4.
- X Meet Federal Requirements – For example, pipelines across the Padre Island National Seashore are not allowed by the National Park Service and, therefore, an alternative that required pipelines across the Padre Island National Seashore would not meet the Federal Requirements Screening Criterion.
- X Meet State Requirements – For example, if an alternative allowed the release of a discharge that violated TNRCC Water Quality Standards or if an alternative was not in compliance with the Texas GLO's Coastal Management Plan, that alternative would not meet the State Requirements Screening Criterion.

Table 5-1

			Placement Options									
			Upland		Open Ocean / Offshore			Beneficial Uses		Aquatic		
			Confined Upland	Thin Layer	Lopper Dredges	Butterhead Suction Dredge and Scows	Butterhead Suction Dredge and pipelines	Beach Nourishment	Washover Nourishment	Open Bay / Unconfined, existing PAs only	Confined	Semi confined
REACH # 1			+									
Screening Criteria	Engineering Feasibility		Y	Y	N	N	Y	N	N	Y	Y	Y
	Meet Federal Requirements		Y	Y	Y	Y	N*	N*	N*	Y	Y	Y
	Meet State Requirements		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
REACH # 2			+									
Screening Criteria	Engineering Feasibility		Y	Y	N	N	N	N	Y	Y	Y	Y
	Meet Federal Requirements		Y	Y	Y	Y	N	N	N	Y	Y	Y
	Meet State Requirements		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
REACH # 3			+									
Screening Criteria	Engineering Feasibility		Y	Y	N	N	N	Y	Y*	Y	Y	Y
	Meet Federal Requirements		Y	Y	Y	Y	N	N	N	Y	Y	Y
	Meet State Requirements		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
REACH # 4			+									
Screening Criteria	Engineering Feasibility		Y	Y	N	N	N	N	N	Y	Y	Y
	Meet Federal Requirements		Y	Y	Y	Y	N*	N*	N*	Y	Y	Y
	Meet State Requirements		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
REACH # 5			+									
Screening Criteria	Engineering Feasibility		Y	Y	N	N	Y	N	N	Y	Y	Y
	Meet Federal Requirements		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Meet State Requirements		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
REACH # 6			+									
Screening Criteria	Engineering Feasibility		Y	Y	N	N	Y	N	N	Y	Y	Y
	Meet Federal Requirements		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Meet State Requirements		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

N* Part of Reach encompasses the National Seashore, which no pipelines can cross.

Y* Not enough washover areas to handle all material

+ Present Practice for this Reach.

Ranking System

- + 3 potentially overriding benefits, thus, critical to decision making;
- + 2 significant positive improvement considering magnitude of net change and the value of the resource;
- + 1 environmentally preferable to impacts on resource than current practice;
- 0 same or equivalent impact on resource as current practice;
- 1 environmentally less preferable impacts on resources than current practice;
- 2 significant negative impact considering magnitude of net change and the value of the resource;
- 3 potentially unacceptable impacts to resources.

Scoring Criteria

In the process of deriving the scores of the various Placement Alternatives, the ICT determined that, for consistency, criteria would have to be established relative to the size of the area of impact that would be assigned to each of the scores.

Areal Impacts

(burying seagrasses, open bay bottom, emergent bay habitat, and terrestrial habitat)

< 1 acre (relative to current practices) = "0"

1 to 100 acres (relative to present practice) = "1"

100 to 1,000 acres (relative to present practice) = "2"

>1,000 acres (relative to present practice) = "3"

In all cases, the score was a "+", if the impact was positive, and "-", if the impact was negative. Other examples of areal impacts are:

(1) the area of a receptor that would be impacted by laying and removing pipelines for upland placement

(2) dredging channels to contain booster pumps required for long pumping distances

Scoring for destruction of piping plover habitat, where piping plovers have actually been found in past investigations:

"0" if no sites of habitat are destroyed

"1" if 1 to 10 sites are destroyed

"2" if 11 to 100 sites are destroyed

"3" if more than 100 sites are destroyed

Water Column Effects

For water column impacts for constituents for which there are Texas Surface Water Quality Standards (WQS), two zones were used:

the Zone of Initial Dilution (ZID), and
the Mixing Zone (MZ).

The ZID and MZ are presented in the Texas Surface Water Quality Standards (§§307.1-307.10, TNRCC 1995a) and the Implementation of the Texas Natural Resources Conservation Commission Standards via Permitting (TNRCC 1995b). These are defined as the volume of water within a 50-foot and 200-foot radius of the discharge point, respectively.

If the acute marine Texas Water Quality Standards (WQSS) were not exceeded at the end of the discharge pipe, a score of "0" was assigned.

If the acute marine WQSS were exceeded at the end of the discharge pipe, but were not exceeded inside the ZID, a score of "-1" was assigned.

If the acute marine WQSS were exceeded inside the ZID, a score of "-2" was assigned.

If the chronic marine WQSS were exceeded in the MZ, a score of "-3" was assigned.

However, an examination of the data indicated only a few stations from the 1980s for which slight exceedance of WQSS would have occurred at the end of the discharge pipe only. The instances were few and all recent data indicated no exceedances, so no scoring was based on chemical analyses of the elutriates.

Water Column Effects

Turbidity

If TSS for "with placement" compared to "without placement" increased by more than 25 mg/L for at least three months, a score of "-1" was assigned;

If >50 mg/L for at least three months, a score of "-2" was assigned

If >100 mg/L for at least three months, a score of "-3" was assigned.

This determination was based on information provided in the results of the Seagrass Modeling (Burd 2000). Additionally, an examination was made of plots provided in Teeter (2000) which compared the isopleths for 20% irradiance reaching the seagrasses, with and without open-bay dredged material placement. The differences in areas were estimated and summed by reach, in acres. These acre values were assigned a score the same as the acres of impact described previously.

Bioassay Data and Toxicity Criteria

If the toxicity criterion was not violated at the discharge pipe, a score of "0" was assigned.

If the toxicity criterion was exceeded only inside the ZID, a score of "-1" was assigned.

If it was exceeded outside the ZID but not outside the MZ, a "-2" was assigned.

If it was exceeded outside the MZ, a "-3" was assigned.

An examination of the data indicated no violation of the toxicity criterion and no scoring occurred with this method.

Human Use Effects

Dredging duration in days for dredging and levee construction was listed under the "Dredging" activity, since together they equal the total impact to human use for the GIWW, and scored as follows:

- "0" = less than 100 days
- "1" = 100 – 500 days
- "2" = 500 – 1,000 day
- "3" = >1,000 days

Pipeline lengths and duration are presented as the number of pipeline-mile-days per 50 years. Land use impacts are presented as acres, scored like all other acreages. The ICT determined for pipeline-mile-days (pmd) that:

- "0" = 0 – 100 pmd
- "1" = 101 – 2,500 pmd
- "2" = 2,501 – 10,000 pmd
- "3" = >10,000 pmd

There are coastal cabins, permitted by the TGLO, in some reaches. The creation of open bay confined and open bay semi-confined PAs has the potential to destroy some of these cabins, with impacts to the human uses of those facilities. Scoring for destruction of coastal cabins is:

- "0" = none are destroyed
- "1" = 1 to 10 are destroyed
- "2" = 11 to 100 are destroyed
- "3" = more than 100 are destroyed.

As with other receptors, if more than one method was applied to Human Use Effects, an average was used such that the maximum score by reach, per activity, did not exceed "3".

Activities

The process of maintenance dredging was broken into four activities in order to logically examine impacts.

1. Dredging Activity - impacts that occur during and because of the dredging, per se, and are independent of the transport and/or placement of the dredged material. These include the turbidity at the dredging site and impacts to benthos that might be in the maintenance material.
2. Conveyance Activity - impacts that occur during and because of the transport of the dredged material from the dredge to the placement area. These include impacts to human health and fisheries economics from pipelines across the Laguna Madre, impacts to seagrass and benthos from laying pipelines across the Laguna, impacts to seagrass and benthos from dredging canals to place booster pumps, congestion in the GIWW and ship channels from large numbers of dredges or scows for ocean placement, etc.
3. Placement Activity - impacts associated solely with the placement of dredged material. These include impacts to terrestrial flora and fauna from the creation of upland placement areas, impacts to seagrass and benthos from creation of open bay confined or semi-confined placement areas, turbidity from open bay unconfined placement, etc.
4. Post-placement Activity - impacts associated with the fact that some placement options have long-term implications for various ecosystems or are outside the "footprint" of the placement site. For example, open-bay non-confined and semi-confined placement would allow dredged material to flow outside of the PA. Upland confined and open-bay confined would reduce the frequency of dredging as well as reducing the turbidity from resuspension of placed material.

Cutterhead Pipeline Dredges

Reach	Seagrass (ac)	Bay Bottom	Emergent Habitat	Terrestrial Habitat	Dredging and Construction Days
1	61	75	0	59	2,538
5	82	0	72	15	1,132
6	124	10	7	24	2,353

Confined Upland

All reaches are broken into segments to prevent the distance from the dredge to the UCPA from exceeding seven miles. The table below presents a summary of the calculated results.

Reach Segment	1 <u>1 2 3</u>			2 <u>4 5</u>	
External Area Initial (acres)	68	126	322	338	643
Levee Heights Long-Term (feet)	32	32	32	32	32

Reach Segment	3 <u>6 7 8 9</u>				4 <u>10 11 12 13</u>			
External Area Initial (acres)	99	411	174	92	338	283	321	180
Levee Heights Long-Term (feet)	29	29	29	29	33	33	33	33

Reach Segment	5 <u>14 15</u>		6 <u>16 17 18</u>		
External Area Initial (acres)	99	77	254	429	33
Levee Heights Long-Term (feet)	33	33	31	31	31

Confined Upland

The following table presents the acres of various receptors from the pipelines that would need to be placed across the Laguna and upland areas to the PAs. Since precise routes were not available, precise determinations of seagrass to open bay bottom ratios were not possible.

Reach	Seagrass	Bay Bottom	Emergent Habitat	Terrestrial Habitat*
1	23	28	40	12
2	8	18	10	1
3	0	0	0	0
4	40	59	16	9
5	29	10	30	0
6	38	42	4	28

* While not quantifiable, there would be losses of Terrestrial Habitat from road construction associated with PA construction.

Human Use Impacts

The following table presents the dredging/construction days and pipeline-mile-days, per 50 years, for conveyance of dredged material by reach and the acres of land use involved in placement.

Category	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Days	926	1,538	528	2,043	566	1,416
pmd	6,483	10,767	528	14,298	3,961	9,915
Land use	516	980	776	1,123	176	716

There are 31 coastal cabins on existing PAs in Reach 3, none of which would be affected by confined upland placement in Reach 3.

Thin Layer

The placement is designed so that a sediment layer roughly 6-12 inches thick is produced. Since the dredged material would be pumped just as it would for the Upland Confined Placement Alternative, the same segments were used for Thin Layer. This option is not feasible for Reach 3 because there is insufficient upland area that would benefit from this type of treatment in this reach. The impacts from the pipeline corridors are the same as those for upland confined, but the PA size is not.

Reach	Segment	PA (ac)	Seagrass (ac)	Bay Bottom (ac)	Emergent Bay (ac)	Terrestrial Habitat* (ac)
1	1	84				
1	2	205	23	28	40	12
1	3	501				
2	4	532				
2	5	1,119	8	18	10	1
3	6	Not Feasible				
3	7	Not Feasible				
3	8	Not Feasible				
3	9	Not Feasible				
4	10	346				
4	11	282				
4	12	331	40	59	16	9
4	13	174				
5	14	103				
5	15	69	29	10	30	0
6	16	252				
6	17	474	38	42	4	28
6	18	19				

* While not quantifiable, there would be losses of Terrestrial Habitat from road construction associated with PA construction.

Human Use Impacts from Thin Layer

The following table presents the dredging/construction days and pipeline-mile-days, per 50 years, for conveyance of dredged material by reach and the acres of land use involved in placement.

Category	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Days	926	1,538	N/A	2,043	566	1,416
pmd	6,483	10,767	N/A	14,298	3,961	9,915
Land use	790	1,651	N/A	1,133	172	745

No coastal cabins would be affected by this placement option in Reach 3 since there is sufficient upland area available so that existing coastal cabins could be avoided by the construction of new levees, and most PAs are already leveed.

Open Bay Unconfined

Open bay unconfined placement would be the continuation of the present practice in all reaches, except for Reach 3 in the Land Cut. Material is pumped via pipeline into the existing open water placement areas and allowed to flow by gravity and currents onto the Laguna bottom. Mounding occurs next to the discharge pipe and the dredged material feathers out from there. Potential impacts would include burial of benthic organisms and seagrasses and increased turbidity. Seagrasses can endure burial of roughly three inches. The following table presents the acreage between the isolines for 20% irradiance reaching the seagrasses by month for the first three months after dredging and unconfined open bay placement. The three-month average was used for scoring.

Month	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
April	0	227	N/A	362	17	314
May	0	14	N/A	19	0	114
June	0	9	N/A	11	14	101
Average	0	80	0*	131	10	176

* based on high sand content

The average TSS was not higher than 25 mg/L for any three months after dredged material placement at any Reach, according to the modeling conducted for the ICT by the USACE WES (Teeter, 2000). Average TSS values above 100 mg/L only occurred in the 119 hours during placement activities. A TSS average above 50 mg/L occurred in Reaches 2 and 4 during the month of simulated placement activities (April 1995) but not after April.

Open bay unconfined placement has not historically impacted either coastal cabins or piping plover habitat (Drake et al., 2000).

Human Use Impacts

Category	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Days	423	808	1,227	969	132	588
pmd	423	808	17,182	969	132	588

Open Bay Confined

This scenario presumes that all material will be placed in leveed areas, as with upland disposal, but the leveed areas would be along the GIWW. This is present practice only for Reach 3. Fifteen feet was considered to be the practical upper levee-height limit for confined PAs in the open bay. The segments used for UCPAs are not used here since the limitations on pumping distance does not apply. This scenario would remove the maintenance material from the system, so that the future maintenance frequencies were reduced by 14%.

Reach 1

PA	Total Area	Emergent Area	Area Required for Confined Placement	Additional Area Required
175	29.1	28.4	0 (never used)	0
176*	133.8	113.4	7.5	0
177	35.8	27.0	5.0	0
178	125.3	78.6	12.3	0
179	40.1	23.9	6.6	0
180	125.6	76.1	21.7	0
181	96.6	58.9	23.2	0
182	58.5	36.5	12.2	0
183	152.1	59.3	21.1	0
184	98.7	43.9	11.3	0
185	105.4	33.6	21.1	0
186	117.4	2.4	57.1	54.8
187	137.8	0.0	110.2	110.2
188	165.8	0.0	140.7	140.7
189	124.7	0.0	113.3	113.3
190	69.9	0.0	82.6	82.6
191	57.3	0.0	131.4	131.4
Total	1,673.9	582.0	777.3	633.0

* PA 176 is confined.

Open Bay Confined

Reach 2

PA	Total Area	Emergent Area	Area Required for Confined Placement	Additional Area Required
192	90.6	0.0	59.7	59.7
193	90.6	38.0	60.8	22.8
194	121.5	24.6	91.2	66.7
195	103.0	0.3	93.7	93.3
196	103.0	41.2	63.4	22.1
197	304.4	80.4	377.6	297.2
198	146.2	0.0	166.6	166.6
199	124.9	0.0	167.1	167.1
200	196.2	5.1	180.8	175.7
201	173.7	0.0	194.9	194.9
202	195.6	121.1	275.1	136.0
Total	1,649.6	310.7	1,712.7	1,402.1

Reach 3

PA	Total Area	Emergent Area	Area Required for Confined Placement	Additional Area Required
203	324.5	311.3	28.7	28.7
204	167.7	167.7	89.6	89.6
206	380.4	380.4	152.9	152.9
207	322.2	322.2	221.2	221.2
208	769.0	767.0	478.5	478.5
209	193.4	193.4	56.2	56.2
210	242.8	240.7	101.4	101.4
Total	2,593.4	2,576.1	1,184.8	1,184.8

Open Bay Confined

Reach 4

PA	Total Area	Emergent Area	Area Required for Confined Placement	Additional Area Required
211	140.8	45.4	146.4	101.0
212	192.1	0.0	205.2	205.2
213	191.7	0.0	147.3	147.3
214	191.4	0.0	152.7	152.7
215	194.1	0.0	177.4	177.4
216	194.7	0.0	93.3	93.3
217	193.3	0.0	121.8	121.8
218	194.3	0.0	208.2	208.2
219	119.8	0.0	94.5	94.5
220	216.1	2.0	208.6	206.5
221	387.2	63.3	61.4	0
222*	259.4	52.6	243.6	191.0
Total	2,475.1	163.4	1,860.4	1,698.9

* Parts of PA 222 are completely leveed

Open Bay Confined

Reach 5

PA	Total Area	Emergent Area	Area Required for Confined Placement	Additional Area Required
223	158.8	137.4	37.7	0
224	175.4	172.3	17.5	0
225*	84.3	77.6	5.7	0
226*	257.6	247.6	16.6	0
227	65.4	43.0	104.9	61.8
228	294.4	115.1	37.2	0
Total	1,035.9	793.3	219.4	61.8

* PA 225 is semi-confined and PA 226 is leveed.

Reach 6

PA	Total Area	Emergent Area	Area Required for Confined Placement	Additional Area Required
229	129.2	50.4	6.0	0
230	82.5	46.5	3.1	0
231	127.8	67.0	5.1	0
232	127.4	52.5	54.9	2.4
233	210.0	14.7	635.1	620.4
234	121.6	0.0	395.7	395.7
235	121.6	0.0	5.9	5.9
236	129.1	0.0	2.1	2.1
239	49.38	0.0	23.6	23.6
Total	1,098.5	231.0	1,131.6	1,050.2

Open-Bay Semi-Confined

This alternative would allow runoff from existing confined PAs or new semi-confined PAs on emergent land near the GIWW, onto the flats or open water behind the PAs. The levee system would partially contain the material and, theoretically, create emergent areas.

Over time, more Laguna bottom would likely be covered than with confined placement. The loss of seagrasses by this option and confined disposal would probably be the most serious consequences of these two options. This scenario should remove some of the maintenance material from the system, so that the future maintenance frequencies were reduced by 7%.

Reach 1

PA	Total Area	Emergent Area	Area Required for Semi-confined Placement	Additional Area Required
175	29.1	28.4	0 (never used)	0
176	133.8	113.4	8.1	0
177	35.8	27.0	5.4	0
178	125.3	78.6	13.3	0
179	40.1	23.9	7.1	0
180	125.6	76.1	23.4	0
181	96.6	58.9	25.1	0
182	58.5	36.5	13.2	0
183	152.1	59.3	22.8	0
184	98.7	43.9	12.2	0
185	105.4	33.6	22.8	0
186	117.4	2.4	61.8	59.4
187	137.8	0.0	119.2	119.2
188	165.8	0.0	152.1	152.1
189	124.7	0.0	122.5	122.5
190	69.9	0.0	89.4	89.4
191	57.3	0.0	142.1	142.1
Total	1,673.9	582.0	840.5	684.7

Open-Bay Semi-Confined

Reach 2

PA	Total Area	Emergent Area	Area Required for Semi-confined Placement	Additional Area Required
192	90.6	0.0	64.5	64.5
193	90.6	38.0	65.8	27.8
194	121.5	24.6	98.7	74.1
195	103.0	0.3	101.3	100.9
196	103.0	41.2	68.5	27.3
197	304.4	80.4	408.3	328.0
198	146.2	0.0	180.2	180.2
199	124.9	0.0	180.7	180.7
200	196.2	5.1	195.5	190.4
201	173.7	0.0	210.7	210.7
202	195.6	121.1	278.0	156.9
Total	1,649.6	310.7	1,852.2	1,541.5

Reach 3

PA	Total Area	Emergent Area	Area Required for Semi-confined Placement	Additional Area Required
203	324.5	311.3	31.0	31.0
204	167.7	167.7	96.9	96.9
206	380.4	380.4	165.4	165.4
207	322.2	322.2	239.2	239.2
208	769.0	767.0	517.5	517.5
209	193.4	193.4	60.8	60.8
210	242.8	240.7	109.7	109.7
Total	2,400.0	2,382.7	1,220.4	1,220.4

Open-Bay Semi-Confined

Reach 4

PA	Total Area	Emergent Area	Area Required for Semi-confined Placement	Additional Area Required
211	140.8	45.4	158.4	112.9
212	192.1	0.0	221.9	221.9
213	191.7	0.0	159.2	159.2
214	191.4	0.0	165.1	165.1
215	194.1	0.0	191.8	191.8
216	194.7	0.0	100.9	100.9
217	193.3	0.0	131.7	131.7
218	194.3	0.0	225.2	225.2
219	119.8	0.0	102.2	102.2
220	216.1	2.0	225.6	223.6
221	387.2	63.3	66.4	3.1
222	259.4	52.6	263.4	210.8
Total	2,475.1	163.4	2,011.8	1,848.4

Reach 5

PA	Total Area	Emergent Area	Area Required for Semi-confined Placement	Additional Area Required
223	158.8	137.4	40.7	0
224	175.4	172.3	18.9	0
225	84.3	77.6	6.1	0
226	257.6	247.6	17.9	0
227	65.4	43.0	113.4	70.3
228	294.4	115.1	40.2	0
Total	1,035.9	793.3	237.2	70.3

Open-Bay Semi-Confined

Reach 6

PA	Total Area	Emergent Area	Area Required for Semi-confined Placement	Additional Area Required
229	129.2	50.4	6.5	0
230	82.5	46.5	3.4	0
231	127.8	67.0	5.5	0
232	127.4	52.5	59.4	6.9
233	210.0	14.7	686.8	672.1
234	121.6	0.0	427.9	427.9
235	121.6	0.0	6.6	6.4
236	129.1	0.0	2.2	2.2
239	49.38	0.0	27.8	27.8
Total	1,098.5	231.0	1,223.7	1,141.1

Table 5-3
Matrix Summary for Reach 1

Receptor	Option	Action								Total Score
		Dredging		Conveyance		Placement		Post-placement		
		Impact	Score	Impact	Score	Impact	Score	Impact	Score	
Seagrass	OBUn	0 ac	0.0	0 ac	0.0	711 ac	0.0	178 Long term ac		
	OBC	0 ac	0.0	0 ac	0.0	570 ac	2.0	0 20% isopleth ac	0.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	617 ac	1.0	570 Permanent ac	-1.0	1.0
	UpC	0 ac	0.0	23 ac	-1.0	0 ac	2.0	0 20% isopleth ac	-1.0	0.0
	UpTL	0 ac	0.0	23 ac	-1.0	0 ac	2.0	617 Permanent ac	1.0	2.0
	OcnP	0	0.0	61 ac	-1.0	0 ac	2.0	0 20% isopleth ac	1.0	2.0
Open Bay Bottom	OBUn	0 ac	0.0	0 ac	0.0	79 ac	0.0	0 * ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	63 ac	1.0	63 Permanent ac	-1.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	68 ac	1.0	68 Permanent ac	-1.0	0.0
	UpC	0 ac	0.0	28 ac	-1.0	0 ac	1.0	28 Long term ac	-1.0	-1.0
	UpTL	0 ac	0.0	28 ac	-1.0	0 ac	1.0	28 Long term ac	-1.0	-1.0
	OcnP	0 ac	0.0	75 ac	-1.0	0 ac	1.0	75 Long term ac	-1.0	-1.0
* Benthos recover rapidly except very near PA										
Emergent Bay Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac, 0 PP**	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac, 0 PP	0.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	(+1)Temp creation, 0 PP(0)	0.5	0.5
	UpC	0 ac	0.0	40 ac	-1.0	0 ac	0.0	(-1) 40 Long term ac, 0 PP(0)	-0.5	-1.5
	UpTL	0 ac	0.0	40 ac	-1.0	0 ac	0.0	(-1) 40 Long term ac, 0 PP(0)	-0.5	-1.5
	OcnP	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac, 0 PP	0.0	0.0
** Piping Plover Sites										
Terrestrial Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation	1.0	1.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation	1.0	1.0
	UpC	0 ac	0.0	12 ac	-1.0	516 ac	-2.0	516 Permanent ac	-2.0	-5.0
	UpTL	0 ac	0.0	12 ac	-1.0	790 ac	-2.0	790 Improvement ac	2.0	-1.0
	OcnP	0 ac	0.0	59 ac	-1.0	0 ac	0.0	0 ac	0.0	-1.0
Water Column Effect	OBUn	0 ac	0.0	No booster channel	0.0	Turbidity, no volume loss	0.0	No long-term turbidity	0.0	0.0
	OBC	0 ac	0.0	No booster channel	0.0	(+1)No turbidity, volume (-1)	0.0	Reduce turbidity	0.0	0.0
	OBSC	0 ac	0.0	No booster channel	0.0	(0)Turbidity, volume loss(-1)	-0.5	No long-term turbidity	0.0	-0.5
	UpC	0 ac	0.0	Booster channels	-1.0	(+1)No turbidity, no volume(e)	0.5	Reduce turbidity	0.0	-0.5
	UpTL	0 ac	0.0	Booster channels	-1.0	(+1)No turbidity, no volume(e)	0.5	Reduce turbidity	0.0	-0.5
	OcnP	0 ac	0.0	Booster channels	-1.0	(0)Transfer turbidity, no volume loss(0)	0.0	Reduce turbidity	0.0	-1.0
Human Uses	OBUn	423 days	0.0	423 pmd*	0.0	0 ac	0.0	Minimal TSS, 0 CC*, no LTA*	0.0	0.0
	OBC	854 days	-1.0	4,804 pmd	-2.0	633 ac	-2.0	(e),(-1)No TSS, 4 CC, no LTA(e)	-0.3	-5.3
	OBSC	815 days	-1.0	4,615 pmd	-2.0	685 ac	-2.0	(e),(-1)Min. TSS, 4 CC, no LTA(e)	-0.3	-5.3
	UpC	926 days	-2.0	6,483 pmd	-2.0	516 ac	-2.0	(0),(0)No TSS, 0 CC, LTA(-1)	-0.3	-6.3
	UpTL	926 days	-2.0	6,483 pmd	-2.0	790 ac	-2.0	(0),(0)No TSS, 0 CC, no LTA(e)	0.0	-6.0
	OcnP	2,538 days	-3.0	93,823 pmd	-3.0	0 ac	0.0	(0),(0)No TSS, 0 CC, no LTA(e)	0.0	-6.0
* pipeline-mile-days; * Coastal Cabins; * Long-term aesthetic effect										
Overall Scores	OBUn									0.0
	OBC									-3.3
	OBSC									-4.3
	UpC									-12.3
	UpTL									-8.0
	OcnP									-7.0

Table 5-4
Matrix Summary for Reach 2

Receptor	Option	Action								Total Score	
		Dredging		Conveyance		Placement		Post-placement			
		Impact	Score	Impact	Score	Impact	Score	Impact	Score		
Seagrass	OBUn	0 ac	0.0	0 ac	0.0	802 ac	0.0	201 Long term ac			
	OBC	0 ac	0.0	0 ac	0.0	681 ac	2.0	80 20% isopleth ac	0.0	0.0	
	OBSC	0 ac	0.0	0 ac	0.0	749 ac	1.0	681 Permanent ac (-2)			
	UpC	0 ac	0.0	8 ac	-1.0	0 ac	2.0	0 20% isopleth ac(+1)	-0.5	1.5	
	UpTL	0 ac	0.0	8 ac	-1.0	0 ac	2.0	749 Permanent ac(-2)			
	OcnP							0 20% isopleth ac(+1)	-0.5	0.5	
										1.5	2.5
										1.5	2.5
											N/A
Open Bay Bottom	OBUn	0 ac	0.0	0 ac	0.0	849 ac	0.0	0 ac	0.0	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	721 ac	2.0	721 Permanent ac	-2.0	0.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	793 ac	1.0	793 Permanent ac	-2.0	-1.0	-1.0
	UpC	0 ac	0.0	18 ac	-1.0	0 ac	2.0	18 Long term ac	-1.0	0.0	0.0
	UpTL	0 ac	0.0	18 ac	-1.0	0 ac	2.0	18 Long term ac	-1.0	0.0	0.0
	OcnP										N/A
* Benthos recover rapidly except very near PA											
Emergent Bay Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac, 0 PP**	0.0	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	(0) 0 ac, 2 PP (-1)	-0.5	-0.5	-0.5
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	(+1) Temp creation, 2 PP (-1)	0.0	0.0	0.0
	UpC	0 ac	0.0	10 ac	-1.0	0 ac	0.0	(-1) 10 Long term ac, 0 PP(0)	-0.5	-1.5	-1.5
	UpTL	0 ac	0.0	10 ac	-1.0	0 ac	0.0	(-1) 10 Long term ac, 0 PP(0)	-0.5	-1.5	-1.5
	OcnP										N/A
** Piping Plover Sites											
Terrestrial Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac	0.0	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation	1.0	1.0	1.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation	1.0	1.0	1.0
	UpC	0 ac	0.0	1 ac	-1.0	980 ac	-2.0	980 Permanent ac	-2.0	-5.0	-5.0
	UpTL	0 ac	0.0	1 ac	-1.0	1,651 ac	-3.0	1,651 Improvement ac	3.0	-1.0	-1.0
	OcnP										N/A
Water Column Effect	OBUn	0 ac	0.0	No booster channel	0.0	(0)Turbidity, no volume loss(0)	0.0	No long-term turbidity	0.0	0.0	0.0
	OBC	0 ac	0.0	No booster channel	0.0	(+1)No turbidity, volume(-1)	0.0	Reduce turbidity	0.0	0.0	0.0
	OBSC	0 ac	0.0	No booster channel	0.0	(0)Turbidity, volume loss(-1)	-0.5	No long-term turbidity	0.0	-0.5	-0.5
	UpC	0 ac	0.0	Booster channels	-1.0	(+1)No turbidity, no volume(0)	0.5	Reduce turbidity	0.0	-0.5	-0.5
	UpTL	0 ac	0.0	Booster channels	-1.0	(+1)No turbidity, no volume(0)	0.5	Reduce turbidity	0.0	-0.5	-0.5
	OcnP										N/A
Human Uses	OBUn	808 days	0.0	808 pmd ^a	0.0	0 ac	0.0	Minimal TSS, 0 CC ^b , no LTA ^c	0.0	0.0	0.0
	OBC	1,058 days	-1.0	8,567 pmd	-2.0	1,402 ac	-3.0	(0),(-2)No TSS, 33 CC, no LTA(0)	-0.7	-6.7	-6.7
	OBSC	1,038 days	-1.0	8,412 pmd	-2.0	1,542 ac	-3.0	(0),(-2)Min. TSS, 33 CC, no LTA(0)	-0.7	-6.7	-6.7
	UpC	1,538 days	-2.0	10,767 pmd	-2.0	980 ac	-2.0	(0),(0)No TSS, 0 CC, LTA(-1)	-0.3	-6.3	-6.3
	UpTL	1,538 days	-2.0	10,767 pmd	-2.0	1,651 ac	-3.0	(0),(0)No TSS, 0 CC, no LTA(0)	0.0	-7.0	-7.0
	OcnP										N/A
a pipeline-mile-days; b Coastal Cabins; c Long-term aesthetic effect											
Overall Scores	OBUn										0.0
	OBC										-4.7
	OBSC										-6.7
	UpC										-10.8
	UpTL										-7.5
	OcnP										N/A

Table 5-5
Matrix Summary for Reach 3

Receptor	Option	Action								Total
		Dredging		Conveyance		Placement		Post-placement		
		Impact ^a	Score	Impact	Score	Impact	Score	Impact ^a	Score	
Seagrass	OBUn	0 ac	0.0	0 ac	0.0	630 ac	-2.0	(-2) 156 Long term ac 0 20% isopleth ac(0)	-1.0	-3.0
	OBC	0 ac	0.0	0 ac	0.0	770 ac	-2.0	(-2) 770 Permanent ac 0 20% isopleth ac(0)	-1.0	-3.0
	OBSC	0 ac	0.0	0 ac	0.0	793 ac	-2.0	(-2) 793 Permanent ac 0 20% isopleth ac(0)	-1.0	-3.0
	UpC	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 Long term ac 0 20% isopleth ac	0.0	0.0
	UpTL OcnP									N/A N/A
Open Bay Bottom	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 * ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 Permanent ac	0.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 Permanent ac	0.0	0.0
	UpC	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 Long term ac	0.0	0.0
	UpTL OcnP									N/A N/A
* Benthos recover rapidly except very near PA										
Emergent Bay Habitat	OBUn	0 ac	0.0	0 ac	0.0	340 ac	-2.0	(0) 0 ac, 0 PP** (0)	0.0	-2.0
	OBC	0 ac	0.0	0 ac	0.0	415 ac	-2.0	(0) 0 ac, 0 PP (0)	0.0	-2.0
	OBSC	0 ac	0.0	0 ac	0.0	427 ac	-2.0	(+1) Temp creation, 0 PP(0)	0.5	-1.5
	UpC	0 ac	0.0	0 ac	0.0	0 ac	0.0	(0) 0 Long term ac, 0 PP(a)	0.0	0.0
	UpTL OcnP									N/A N/A
** Piping Plover Sites										
Terrestrial Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	2.0	0 ac	0.0	2.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	2.0	Temp creation	1.0	3.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	2.0	Temp creation	1.0	3.0
	UpC	0 ac	0.0	0 ac	0.0	776 ac	0.0	0 Permanent ac	0.0	0.0
	UpTL OcnP									N/A N/A
Water Column Effect	OBUn	0 ac	0.0	0 booster channel	0.0	(-1) Turbidity, no volume loss(a)	-0.5	No long-term turbidity	0.0	-0.5
	OBC	0 ac	0.0	0 booster channel	0.0	(0) No turbidity, volume loss(-1)	-0.5	Reduce turbidity	0.0	-0.5
	OBSC	0 ac	0.0	0 booster channel	0.0	(-1) Turbidity, volume loss(-1)	-1.0	No long-term turbidity	0.0	-1.0
	UpC	0 ac	0.0	0 booster channel	0.0	(0) No turbidity, no volume loss (a)	0.0	Reduce turbidity	0.0	0.0
	UpTL OcnP									N/A N/A
Human Uses								(0) Minimal TSS, 0 CC ^b , (0)		
	OBUn	1,227 days	-2.0	17,182 pmd ^c	-3.0	243 ac	-2.0	(0) no LTA ^d , no impacts to the Hole (0)	0.0	-7.0
	OBC	1,136 days	-2.0	15,909 pmd	-3.0	1,185 ac	-3.0	(0) No TSS, 0 CC (0), no (-1) LTA (0), impacts to The Hole	-0.3	-8.3
	OBSC	1,045 days	-2.0	14,636 pmd	-3.0	1,220 ac	-3.0	(0) Minimal TSS, 0 CC (0), (0) no LTA, impacts to The Hole(-1)	-0.3	-8.3
	UpC UpTL OcnP	528 days	0.0	528 pmd	0.0	0 ac	0.0	(0) No TSS, 0 CC (0), no (0) LTA, no impacts to The Hole (a)	0.0	0.0 N/A N/A
* pipeline-mile-days; ^b Coastal Cabins; ^c Long-term aesthetic effect										
Overall Scores	OBUn									-10.5
	OBC									-10.8
	OBSC									-10.8
	UpC									0.0
	UpTL OcnP									N/A N/A

Table 5-6
Matrix Summary for Reach 4

		Action								
Receptor	Option	Dredging		Conveyance		Placement		Post-placement		Total
		Impact	Score	Impact	Score	Impact	Score	Impact	Score	
Seagrass	OBUn	0 ac	0.0	0 ac	0.0	429 ac	0.0	107 Long term ac		
	OBC	0 ac	0.0	0 ac	0.0	643 ac	-2.0	131 20% isopleth ac	0.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	699 ac	-2.0	643 Permanent ac		
								0 20% isopleth ac	0.0	-2.0
	UpC	0 ac	0.0	40 ac	-1.0	0 ac	2.0	0 20% isopleth ac	0.0	-2.0
	UpTL	0 ac	0.0	40 ac	-1.0	0 ac	2.0	40 Long term ac	1.5	2.5
	OcnP							0 20% isopleth ac	1.5	2.5
										N/A
Open Bay Bottom	OBUn	0 ac	0.0	0 ac	0.0	704 ac	0.0	0 * ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	1,056 ac	-2.0	1,056 Permanent ac	-3.0	-5.0
	OBSC	0 ac	0.0	0 ac	0.0	1,149 ac	-2.0	1,149 Permanent ac	-3.0	-5.0
	UpC	0 ac	0.0	59 ac	-1.0	0 ac	2.0	59 Long term ac	-1.0	0.0
	UpTL	0 ac	0.0	59 ac	-1.0	0 ac	2.0	59 Long term ac	-1.0	0.0
	OcnP									N/A
* Benthos recover rapidly except very near PA										
Emergent Bay Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac, 0 PP**	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac, 0 PP	0.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation, 0 PP	0.5	0.5
	UpC	0 ac	0.0	16 ac	-1.0	0 ac	0.0	16 Long term ac, 0 PP	-0.5	-1.5
	UpTL	0 ac	0.0	16 ac	-1.0	0 ac	0.0	16 Long term ac, 0 PP	-0.5	-1.5
	OcnP									N/A
** Piping Plover Sites										
Terrestrial Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation	1.0	1.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation	1.0	1.0
	UpC	0 ac	0.0	9 ac	-1.0	1,123 ac	-3.0	1,123 Permanent ac	-3.0	-7.0
	UpTL	0 ac	0.0	9 ac	-1.0	1,133 ac	-3.0	1,133 Improvement ac	3.0	-1.0
	OcnP									N/A
Water Column Effects	OBUn	0 ac	0.0	No booster channels	0.0	Turbidity, no volume loss	0.0	No long-term turbidity	0.0	0.0
	OBC	0 ac	0.0	No booster channels	0.0	No turbidity, volume loss	0.0	Reduce turbidity	0.0	0.0
	OBSC	0 ac	0.0	No booster channels	0.0	Turbidity, volume loss	-0.5	No long-term turbidity	0.0	-0.5
	UpC	0 ac	0.0	Booster channels	-1.0	No turbidity, no volume loss	0.5	Reduce turbidity	0.0	-0.5
	UpTL	0 ac	0.0	Booster channels	-1.0	No turbidity, no volume loss	0.5	Reduce turbidity	0.0	-0.5
	OcnP									N/A
Human Uses	OBUn	969 days	0.0	969 pmd ^a	0.0	0 ac	0.0	Minimal TSS, 0 CC ^b , no LTA ^c	0.0	0.0
	OBC	1,594 days	-2.0	9,563 pmd	-2.0	1,699 ac	-3.0	No TSS, 6 CC, no LTA	-0.3	-7.3
	OBSC	1,500 days	-2.0	9,000 pmd	-2.0	1,848 ac	-3.0	Minimal TSS, 6 CC, no LTA	-0.3	-7.3
	UpC	2,043 days	-3.0	14,298 pmd	-3.0	1,123 ac	-3.0	No TSS, 0 CC, LTA	-0.3	-9.3
	UpTL	2,043 days	-3.0	14,298 pmd	-3.0	1,133 ac	-3.0	No TSS, 0 CC, no LTA	0.0	-9.0
	OcnP									N/A
^a pipeline-mile-days; ^b Coastal Cabins; ^c Long-term aesthetic effect										
Overall Scores	OBUn									0.0
	OBC									-13.3
	OBSC									-13.3
	UpC									-15.8
	UpTL									-9.5
	OcnP									N/A

Table 5-7
Matrix Summary for Reach 5

Receptor	Option	Action								Total
		Dredging		Conveyance		Placement		Post-placement		
		Impact	Score	Impact	Score	Impact	Score	Impact	Score	
Seagrass	OBUn	0 ac	0.0	0 ac	0.0	139 ac	0.0	35 Long term ac, 10 20% isopleth ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	50 ac	1.0	50 Permanent ac 0 20% isopleth ac	0.0	1.0
	OBSC	0 ac	0.0	0 ac	0.0	56 ac	1.0	56 Permanent ac 0 20% isopleth ac	0.0	1.0
	UpC	0 ac	0.0	29 ac	-1.0	0 ac	2.0	29 Long term ac 0 20% isopleth ac	1.0	2.0
	UpTL	0 ac	0.0	29 ac	-1.0	0 ac	2.0	29 Long term ac 0 20% isopleth ac	1.0	2.0
	OcnP	0 ac	0.0	82 ac	-1.0	0 ac	2.0	82 Long term ac 0 20% isopleth ac	0.0	1.0
Open Bay Bottom	OBUn	0 ac	0.0	0 ac	0.0	33 ac	0.0	0 * ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	12 ac	1.0	12 Permanent ac	-1.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	14 ac	1.0	14 Permanent ac	-1.0	0.0
	UpC	0 ac	0.0	10 ac	-1.0	0 ac	1.0	10 Long term ac	-1.0	-1.0
	UpTL	0 ac	0.0	10 ac	-1.0	0 ac	1.0	10 Long term ac	-1.0	-1.0
	OcnP	0 ac	0.0	0 ac	0.0	0 ac	1.0	0 Long term ac	0.0	1.0
* Benthos recover rapidly except very near PA										
Emergent Bay Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac, 0 PP**	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac, 0 PP	0.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation, 0 PP	0.5	0.5
	UpC	0 ac	0.0	30 ac	-1.0	0 ac	0.0	30 Long term ac, 0 PP	-0.5	-1.5
	UpTL	0 ac	0.0	30 ac	-1.0	0 ac	0.0	30 Long term ac, 0 PP	-0.5	-1.5
	OcnP	0 ac	0.0	72 ac	-1.0	0 ac	0.0	72 ac, 0 PP	-0.5	-1.5
** Piping Plover Sites										
Terrestrial Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation	1.0	1.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation	1.0	1.0
	UpC	0 ac	0.0	0 ac	0.0	176 ac	-2.0	176 Permanent ac	-2.0	-4.0
	UpTL	0 ac	0.0	0 ac	0.0	172 ac	-2.0	172 Improvement	2.0	0.0
	OcnP	0 ac	0.0	15 ac	-1.0	0 ac	0.0	15 Long term ac	-1.0	-2.0
Water Column Effect	OBUn	0 ac	0.0	No booster channel	0.0	Turbidity, no volume loss	0.0	No long-term turbidity	0.0	0.0
	OBC	0 ac	0.0	No booster channel	0.0	No turbidity, volume loss	0.0	Reduce turbidity	0.0	0.0
	OBSC	0 ac	0.0	No booster channel	0.0	Turbidity, volume loss	-0.5	No long-term turbidity	0.0	-0.5
	UpC	0 ac	0.0	Booster channels	-1.0	No turbidity, no volume loss	0.5	Reduce turbidity	0.0	-0.5
	UpTL	0 ac	0.0	Booster channels	-1.0	No turbidity, no volume loss	0.5	Reduce turbidity	0.0	-0.5
	OcnP	0 ac	0.0	Booster channels	-1.0	Transfer turbidity, no volume loss	0.0	Reduce turbidity	0.0	-1.0
Human Uses	OBUn	132 days	0.0	132 pmd ^a	0.0	0 ac	0.0	Minimal TSS, 0 CC ^b , no LTA ^c	0.0	0.0
	OBC	316 days	-1.0	1,895 pmd	-1.0	62 ac	-1.0	No TSS, 0 CC, no LTA	0.0	-3.0
	OBSC	289 days	-1.0	1,737 pmd	-1.0	70 ac	-1.0	Minimal TSS, 0 CC, no LT	0.0	-3.0
	UpC	566 days	-1.0	3,961 pmd	-2.0	176 ac	-2.0	No TSS, 0 CC, LTA	-0.3	-5.3
	UpTL	566 days	-1.0	3,961 pmd	-2.0	172 ac	-2.0	No TSS, 0 CC, no LTA	0.0	-5.0
	OcnP	1,132 days	-2.0	27,158 pmd	-3.0	0 ac	0.0	No TSS, 0 CC, no LTA	0.0	-5.0
^a pipeline-mile-days; ^b Coastal Barges; ^c Long-term aesthetic effect										
Overall Scores	OBUn									0.0
	OBC									-1.0
	OBSC									-1.0
	UpC									-10.3
	UpTL									-6.0
OcnP										-7.5

Table 5-8
Matrix Summary for Reach 6

Receptor	Option	Action								Total
		Dredging		Conveyance		Placement		Post-placement		
		Impact	Score	Impact	Score	Impact	Score	Impact	Score	
Seagrass	OBUn	0 ac	0.0	0 ac	0.0	596 ac	0.0	149 Long term ac 176 20% isopleth ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	420 ac	2.0	420 Permanent ac 0 20% isopleth ac	0.0	2.0
	OBSC	0 ac	0.0	0 ac	0.0	456 ac	2.0	456 Permanent ac 0 20% isopleth ac	0.0	2.0
	UpC	0 ac	0.0	38 ac	-1.0	0 ac	2.0	38 Long term ac 0 20% isopleth ac	2.0	3.0
	UpTL	0 ac	0.0	38 ac	-1.0	0 ac	2.0	38 Long term ac 0 20% isopleth ac	2.0	3.0
	OcnP	0 ac	0.0	124 ac	-2.0	0 ac	2.0	124 Long term ac 0 20% isopleth ac	1.5	1.5
Open Bay Bottom	OBUn	0 ac	0.0	0 ac	0.0	895 ac	0.0	0 * ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	630 ac	2.0	630 Permanent ac	-2.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	685 ac	2.0	685 Permanent ac	-2.0	0.0
	UpC	0 ac	0.0	42 ac	-1.0	0 ac	2.0	42 Long term ac	-1.0	0.0
	UpTL	0 ac	0.0	42 ac	-1.0	0 ac	2.0	42 Long term ac	-1.0	0.0
	OcnP	0 ac	0.0	10 ac	-1.0	0 ac	2.0	10 Long term ac	-1.0	0.0
* Benthos recover rapidly except very near PA										
Emergent Bay Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac, 0 PP**	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac, 0 PP	0.0	0.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation, 0 PP	0.5	0.5
	UpC	0 ac	0.0	4 ac	-1.0	0 ac	0.0	4 Long term ac, 0 PP	-0.5	-1.5
	UpTL	0 ac	0.0	4 ac	-1.0	0 ac	0.0	4 Long term ac, 0 PP	-0.5	-1.5
	OcnP	0 ac	0.0	7 ac	-1.0	0 ac	0.0	7 ac, 0 PP	-0.5	-1.5
** Piping Plover Sites										
Terrestrial Habitat	OBUn	0 ac	0.0	0 ac	0.0	0 ac	0.0	0 ac	0.0	0.0
	OBC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation	1.0	1.0
	OBSC	0 ac	0.0	0 ac	0.0	0 ac	0.0	Temp creation	1.0	1.0
	UpC	0 ac	0.0	28 ac	-1.0	716 ac	-2.0	716 Permanent ac	-2.0	-5.0
	UpTL	0 ac	0.0	28 ac	-1.0	745 ac	-2.0	745 Improvement ac	2.0	-1.0
	OcnP	0 ac	0.0	24 ac	-1.0	0 ac	0.0	24 Long term ac	-1.0	-2.0
Water Column Effect	OBUn	0 ac	0.0	No booster channel	0.0	Turbidity, no volume loss	0.0	No long-term turbidity	0.0	0.0
	OBC	0 ac	0.0	No booster channel	0.0	No turbidity, volume loss	0.0	Reduce turbidity	0.0	0.0
	OBSC	0 ac	0.0	No booster channel	0.0	Turbidity, volume loss	-0.5	No long-term turbidity	0.0	-0.5
	UpC	0 ac	0.0	Booster channels	-1.0	No turbidity, no volume loss	0.5	Reduce turbidity	0.0	-0.5
	UpTL	0 ac	0.0	Booster channels	-1.0	No turbidity, no volume loss	0.5	Reduce turbidity	0.0	-0.5
	OcnP	0 ac	0.0	Booster channels	-1.0	Transfer turbidity, no volume loss	0.0	Reduce turbidity	0.0	-1.0
Human Uses	OBUn	588 days	0.0	588 pmd*	0.0	0 ac	0.0	Minimal TSS, 0 CC ^b , no LTA ^c	0.0	0.0
	OBC	971 days	-1.0	6,794 pmd	-2.0	1,050 ac	-3.0	No TSS, 0 CC, no LTA	0.0	-6.0
	OBSC	882 days	-1.0	6,176 pmd	-2.0	1,141 ac	-3.0	Minimal TSS, 0 CC, no LT	0.0	-6.0
	UpC	1,416 days	-2.0	9,915 pmd	-2.0	716 ac	-2.0	No TSS, 0 CC, LTA	-0.3	-6.3
	UpTL	1,416 days	-2.0	9,915 pmd	-2.0	745 ac	-2.0	No TSS, 0 CC, no LTA	0.0	-6.0
	OcnP	2,353 days	-3.0	68,235 pmd	-3.0	0 ac	0.0	No TSS, 0 CC, no LTA	0.0	-6.0
* pipeline-mile-days; ^b Coastal Cabins; ^c Long-term aesthetic effect										
Overall Scores	OBUn									0.0
	OBC									-3.0
	OBSC									-3.0
	UpC									-10.3
	UpTL									-6.0
	OcnP									-9.0

APPENDIX B Detailed Analysis Sheets

Table B-1, Estimate of Site Characteristics, Confined Upland Sites

Table B-2, Comparison of ICT Confined Upland and Thin-Layer Sites

Table B-3, Estimate of DREDGING Characteristics, Confined Upland Sites

Table B-4, Site Construction Quantities, Confined Upland Sites

**Table B-5, First-Cost Estimate, Confined Upland Sites
(These Costs do not Include Right of Way Costs or Engineering & Administration Costs)**

Table B-6a, Site Operations and Maintenance Costs for Each Dredging Event, Upland Confined Sites

Table B-6b, 50-Year Cash Flow, Upland Confined Sites

Table B-7, Mobilization and Demobilization Costs

Table B-8, Dredge Operating and Ownership Costs

Table B-9, Estimate of Dredging Costs

Table B-10, Estimate of Site Characteristics, Confined Upland Sites – PHYSICAL EFFECTS

Table B-11, Comparison of ICT Values and GBA Estimates – Confined Upland Sites

Table B-12, Estimate of DREDGING Characteristics, Confined Upland Sites - PHYSICAL EFFECTS

Table B-1, Estimate of Site Characteristics,
Upland Confined Sites

line		Note		1	2	3	4	5	6	7	8	9	10
1	Site Number (ICT Segment)	1		557.1	558.9	568.5	575.9	584.0	589.9	595.1	600.9	606.8	615.3
2	Site St M	2	552.5	---	1.8	9.6	7.4	8.1	5.9	5.2	5.8	5.9	8.5
3	Distance From Site to North, miles			5.5	5.7	8.5	7.8	7.0	5.6	5.5	5.8	7.2	7.8
4	GIWW Distance serviced	3		Pita Island	Pita Island	South Bird Island NW	Point of Rocks	Yarborough Pass	Yarborough Pass	Potrero Cortado	Potrero Lopeno NW	Portreo Lopeno NW	Portreo Lopeno SW
5	USGS Quadrangle						Point of Rocks		Land Cut	Potrero de las Canelas, Land Cut	Potrero Lopeno, Land Cut	Banderia Pt, Land Cut	Ricon de San Jose
6	Geographic Feature	4		1	Kleberg	Kleberg	Kleberg	Kenedy	Kenedy	Kenedy	Kenedy	Kenedy	Kenedy
7	County			1	1	1	2	2	3	3	3	3	4
8	GIWW ICT Reach	5		2	13	18	11	7	5	15	15	7	10
9	Typical ground elevation, ft			10,700	14,700	8,800	4,300	2,700	1,500	6,500	4,350	2,400	7,250
10	Distance from GIWW to Site, ft			300	750	2,200	1,300	350	300	700	100	600	1,300
11	Return Flow Distance, ft			1,800	100	100	150	100	100	no access	16,500	no access	100
12	Access Road Length, ft			68	126	322	338	643	99	411	174	92	338
13	ICT External Area, acres	6		3,169	4,367	7,168	7,351	10,260	3,878	8,139	5,229	3,729	7,351
14	Inferred Site Length, ft			935	1,257	1,957	2,003	2,730	1,112	2,200	1,450	1,075	2,003
15	Inferred Site Width, ft			5	10	10	10	10	5	10	5	5	10
16	Estimated Initial Dike Height, ft	7		95	110	110	110	110	95	110	95	95	110
17	Width Occupied by Initial Dike Height, ft			51	99	277	292	579	78	360	146	72	292
18	Inferred Cell Area, acres	8		745	1037	1737	1783	2510	922	1980	1260	885	1783
19	Inferred Cell Width, ft			2,979	4,147	6,948	7,131	10,040	3,688	7,919	5,039	3,539	7,131
20	Inferred Cell Length (4 x w), ft			32	32	32	32	32	29	29	29	29	33
21	ICT Dike Height, ft	9		0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
22	Dredged Material percent sand	10		0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
23	Dredged Material percent fines	11		2.46	4.78	13.41	14.12	27.99	3.40	15.67	6.35	3.13	14.59
24	Inferred Site Volume, Mcy	12		0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
25	Coefficient for material shrinkage	13		3.40	6.60	18.52	19.51	38.67	4.70	21.65	8.76	4.32	20.16
26	Site Capacity using ICT dike height, Mcy	14		0.021	0.021	0.021	0.021	0.021	0.001	0.001	0.001	0.001	0.019
27	Average Dredging /Acre/Year, cut Mcy	15		0.115	0.120	0.178	0.163	0.147	0.006	0.006	0.006	0.007	0.148
28	Average Dredging/Year, cut Mcy	16		5.8	6.0	8.9	8.1	7.3	0.3	0.3	0.3	0.4	7.4
29	50-Year dredging Volume, Mcy			2.3	2.3	2.3	2.3	2.3	10.3	10.3	10.3	10.3	1.1
30	Average placement interval, yrs	17		0.265	0.275	0.410	0.374	0.338	0.057	0.057	0.060	0.074	0.163
31	Average Volume/Dredging Project, cut Mcy	18		4.1	2.2	1.2	1.0	0.5	0.6	0.1	0.3	0.8	0.4
32	Average Initial Lift Thickness, ft	19		2.3	1.3	0.7	0.6	0.3	0.3	0.1	0.2	0.5	0.3
33	Average Desiccated lift thickness, ft	20		169%	91%	48%	42%	19%	6%	1%	3%	8%	37%
34	Percentage of Site Capacity Utilized	21											

Notes: See Sheet 3

Table B-1, Estimate of Site Characteristics,
Upland Confined Sites

line		Note											Totals
1	Site Number (ICT Segment)	1	11	12	13	14	15	16	17	18			
2	Site St M	2	622.3	626.8	634.9	643.2	648.7	652.9	657.7	664.2	665.5	113.0	
3	Distance From Site to North, miles		7.0	4.5	8.1	8.3	5.5	4.2	4.8	6.5		6.3	
4	GIWW Distance serviced	3	5.8	6.3	8.2	6.9	4.8	4.5	5.7	4.5		113.0	
5	USGS Quadrangle		South of Portreo Lopeno NW	Port Mansfield	Hawk Island	Green Island	Three Islands	La Coma	La Coma	Port Isabel			
6	Geographic Feature	4			Chubby Island	Existing Disposal Area	Red Head Bluff	Barclay Island	Moranco Blanco	Laguna Heights			
7	County		Kenedy	Willacy	Willacy	Willacy	Cameron	Cameron	Cameron	Cameron			
8	GIWW ICT Reach	5	4	4	4	5	5	6	6	6			
9	Typical ground elevation, ft		7	7	7	5	9	10	7	9			
10	Distance from GIWW to Site, ft		7,850	9,100	19,800	1,100	17,200	19,850	20,500	13,300			
11	Return Flow Distance, ft		1,300	500	1,400	250	500	3,200	3,200	400			
12	Access Road Length, ft		100	1,600	100	---	100	100	100	100		4.0	miles
13	ICT External Area, acres	6	283	321	180	99	77	254	429	33		4,287	acres
14	Inferred Site Length, ft		6,700	7,156	5,323	3,878	3,389	6,331	8,322	2,130			
15	Inferred Site Width, ft		1,840	1,954	1,473	1,112	990	1,748	2,246	675			
16	Estimated Initial Dike Height, ft	7	10	10	5	5	5	10	10	5			
17	Width Occupied by Initial Dike Height, ft		110	110	95	95	95	110	110	95			
18	Inferred Cell Area, acres	8	241	276	151	78	59	214	377	22		3,662	acres
19	Inferred Cell Width, ft		1620	1734	1283	922	800	1528	2026	485			
20	Inferred Cell Length (4 x w), ft		6,480	6,936	5,133	3,688	3,199	6,111	8,102	1,940			
21	ICT Dike Height, ft	9	33	33	33	33	33	31	31	31			
22	Dredged Material percent sand	10	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31			
23	Dredged Material percent fines	11	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69			
24	Inferred Site Volume, Mcy	12	12.05	13.81	7.56	3.90	2.94	10.02	17.62	1.01		175	Mcy
25	Coefficient for material shrinkage	13	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72			
26	Site Capacity using ICT dike height, Mcy	14	16.64	19.07	10.44	5.39	4.06	13.85	24.34	1.40		241	Mcy
27	Average Dredging /Mile/Year, cut Mcy	15	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019			
28	Average Dredging/Year, cut Mcy	16	0.110	0.120	0.157	0.132	0.093	0.086	0.108	0.087		1.8	Mcy
29	50-Year dredging Volume, Mcy		5.5	6.0	7.8	6.6	4.6	4.3	5.4	4.3		89.3	Mcy
30	Average placement interval, yrs	17	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1			
31	Average Volume/Dredging Project, cut Mcy	18	0.121	0.132	0.172	0.145	0.102	0.095	0.119	0.096		3.1	Mcy
32	Average Initial Lift Thickness, ft	19	0.4	0.4	0.9	1.5	1.4	0.3	0.2	3.5			
33	Average Desiccated lift thickness, ft	20	0.2	0.2	0.5	0.8	0.8	0.2	0.1	2.0			
34	Percentage of Site Capacity Utilized	21	33%	32%	75%	122%	114%	31%	22%	311%			

End Study Area

Notes: See Sheet 3

Table B-2, Comparison of ICT Confined Upland and Thin Layer Sites

Confined and Thin Layer Site Areas from ICT Memorandum (Appendix A, pages A-13 and A-14)																					
		Northern Reach					Land Cut				Southern Reach										
Site No.	notes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Totals	
Confined	(1)	68	126	322	338	643	99	411	174	92	338	283	321	180	99	77	254	429	33	4,287	
Thin Layer	(1)	84	205	501	532	1,119	---	---	---	---	346	282	331	174	103	69	252	474	19	4,491	
Ratio Thin Layer/Confined		1.2	1.6	1.6	1.6	1.7	---	---	---	---	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.1	0.6	---	
Dredging Interval, yrs	(2)	2.3	2.3	2.3	2.3	2.3	10.3	10.3	10.3	10.3	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1		
Placement Volume, million cy	(2)	0.265	0.275	0.410	0.374	0.338	0.057	0.057	0.060	0.074	0.163	0.121	0.132	0.172	0.145	0.102	0.095	0.119	0.096		
Thin Layer Thickness, ft		2.0	0.8	0.5	0.4	0.2	---	---	---	---	0.3	0.3	0.2	0.6	0.9	0.9	0.2	0.2	3.1	0.760	
																					average

--- ICT judges thin layer not feasible for Land Cut, sites 6 through 9

(1) from ICT memorandum (ICT 2000)

(2) estimated by GBA from Corps of Engineers data (USACE 1997)

**Table B-3, Estimate of DREDGING
 Characteristics, Confined Upland Sites**

line		Note	North	1	2	3	4	5	6	7	8	9
1	Site Number (ICT Segment)		North	1	2	3	4	5	6	7	8	9
2	Site St M		552.5	557.1	558.9	568.5	575.9	584.0	589.9	595.1	600.9	606.8
3	Distance to Northern Site, miles		---	1.8	9.6	7.4	8.1	5.9	5.2	5.8	5.9	
4	GIWW Distance serviced			5.5	5.7	8.5	7.8	7.0	5.6	5.5	5.8	7.2
5	GIWW distance to North Dredging Limit, St M			4.6	0.9	4.8	3.7	4.1	2.9	2.6	2.9	2.9
6	GIWW distance to South Dredging Limit, St M			0.9	4.8	3.7	4.1	2.9	2.6	2.9	2.9	4.3
7	GIWW distance served by site, St M			5.5	5.7	8.5	7.8	7.0	5.6	5.5	5.8	7.2
8	Distance from GIWW to Site, ft			8,500	13,200	8,400	3,600	2,700	1,750	5,700	5,200	2,000
9	Distance to North Limit, ft			24,288	4,752	25,344	19,536	21,384	15,576	13,728	15,312	15,576
10	Distance to South Limit, ft			4,752	25,344	19,536	21,384	15,576	13,728	15,312	15,576	22,440
11	Inferred Site Length, ft			3,169	4,367	7,168	7,351	10,260	3,878	8,139	5,229	3,729
12	Inferred Site Width, ft			935	1,257	1,957	2,003	2,730	1,112	2,200	1,450	1,075
13	On-site Pipeline Length, ft			2,252	3,012	4,763	4,877	6,695	2,695	5,370	3,540	2,602
14	Average Pipeline Length, ft			25,272	31,260	35,603	28,937	27,875	19,097	25,590	24,183	23,610
15	Maximum Pipeline Length, miles			6.6	7.9	7.3	5.7	5.8	3.8	5.0	4.6	5.1
16	Number of Booster pumps required			2	2	2	1	1	1	1	1	1
17	Average Dredge Production, cy/day			8,180	7,851	24,663	25,850	26,040	8,520	26,447	26,698	8,272
18	Average Dredging /Mile/Year, cut Mcy			0.021	0.021	0.021	0.021	0.021	0.001	0.001	0.001	0.001
19	Average Dredging/Year, cut Mcy			0.115	0.120	0.178	0.163	0.147	0.006	0.006	0.006	0.007
20	50-Year dredging Volume, Mcy			5.8	6.0	8.9	8.1	7.3	0.3	0.3	0.3	0.4
21	Average placement interval, yrs			2.3	2.3	2.3	2.3	2.3	10.0	10.0	10.0	10.0
22	Average Volume/Dredging Project, cut Mcy			0.265	0.275	0.410	0.374	0.338	0.056	0.055	0.058	0.072
23	Average Duration of Dredging Project, days			32	35	17	14	13	7	2	2	9
24	Inferred Cell area, ac			51	99	277	292	579	78	360	146	72
25	Average Daily Dredge Flow, mgd			9	9	28	29	29	9	29	29	9
26	Cell Overflow Rate, gal/day/sq ft			4	2	2	2	1	3	2	5	3
27	Reduced production due to small size of site			reduced production	reduced production				reduced production			reduced production
28	Cell Dewatering at End of Placement											
29	Average depth of water over cell, ft			2	2	2	2	2	2	2	2	2
30	Ratio of spillway flow to flow during placement			0.1	0.1	0.3	0.3	0.3	0.1	0.3	0.3	0.1
31	Water volume, million gals			33.2	64.5	180.5	190.3	377.3	50.8	234.6	95.1	46.9
32	Average spillway flow, cfs			2.9	2.9	8.7	8.7	8.7	2.9	8.7	8.7	2.9
33	Time to dewater, days			17.7	34.4	32.1	33.8	67.1	27.1	41.7	16.9	25.0

Dredging Days over 50 Years

705 761 361 314 282 33 10 11 44

**Table B-3, Estimate of DREDGING
Characteristics, Confined Upland Sites**

line		Note	10	11	12	13	14	15	16	17	18	South	Totals
1	Site Number (ICT Segment)												
2	Site St M		615.3	622.3	626.8	634.9	643.2	648.7	652.9	657.7	664.2	665.5	113.0
3	Distance to Northern Site, miles		8.5	7.0	4.5	8.1	8.3	5.5	4.2	4.8	6.5		6.3
4	GIWW Distance serviced		7.8	5.8	6.3	8.2	6.9	4.8	4.5	5.7	4.5		113.0
5	GIWW distance to North Dredging Limit, St M		4.3	3.5	2.3	4.1	4.2	2.8	2.1	2.4	3.3		58.2
6	GIWW distance to South Dredging Limit, St M		3.5	2.3	4.1	4.2	2.8	2.1	2.4	3.3	1.3		54.9
7	GIWW distance served by site, St M		7.8	5.8	6.3	8.2	6.9	4.8	4.5	5.7	4.5		113.0
8	Distance from GIWW to Site, ft		6,000	7,000	8,700	8,600	1,100	17,000	10,100	16,900	11,750		
9	Distance to North Limit, ft		22,440	18,480	11,880	21,384	21,912	14,520	11,088	12,672	17,160		
10	Distance to South Limit, ft		18,480	11,880	21,384	21,912	14,520	11,088	12,672	17,160	6,864		
11	Inferred Site Length, ft		7,351	6,700	7,156	5,323	3,878	3,389	6,331	8,322	2,130		
12	Inferred Site Width, ft		2,003	1,840	1,954	1,473	1,112	990	1,748	2,246	675		
13	On-site Pipeline Length, ft		4,877	4,470	4,755	3,598	2,695	2,390	4,240	5,484	1,603		
14	Average Pipeline Length, ft		31,337	26,650	30,087	33,846	22,011	32,193	26,220	37,300	25,364		
15	Maximum Pipeline Length, miles		6.3	5.7	6.6	6.5	4.9	6.4	5.1	7.5	5.8		
16	Number of Booster pumps required		2	1	2	2	1	2	1	2	1		
17	Average Dredge Production, cy/day		25,423	26,258	25,645	24,976	8,359	7,799	26,335	24,360	8,175		
18	Average Dredging /Mile/Year, cut Mcy		0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019		
19	Average Dredging/Year, cut Mcy		0.148	0.110	0.120	0.157	0.132	0.093	0.086	0.108	0.087		1.79
20	50-Year dredging Volume, Mcy		7.4	5.5	6.0	7.8	6.6	4.6	4.3	5.4	4.3		89.3
21	Average placement interval, yrs		1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1		
22	Average Volume/Dredging Project, cut Mcy		0.163	0.121	0.132	0.172	0.145	0.102	0.095	0.119	0.096		
23	Average Duration of Dredging Project, days		6	5	5	7	17	13	4	5	12		204.6
24	Inferred Cell area, ac		292	241	276	151	78	59	214	377	22		3,664
25	Average Daily Dredge Flow, mgd		29	29	29	28	9	9	29	28	9		
26	Cell Overflow Rate, gal/day/sq ft		2	3	2	4	3	3	3	2	9		
27	Reduced production due to small size of site						reduced production	reduced production			reduced production		
28	Cell Dewatering at End of Placement												
29	Average depth of water over cell, ft		2	2	2	2	2	2	2	2	2		
30	Ratio of spillway flow to flow during placement		0.3	0.3	0.3	0.3	0.1	0.1	0.3	0.3	0.1		
31	Water volume, million gals		190.3	157.1	179.9	98.4	50.8	38.5	139.5	245.7	14.3		
32	Average spillway flow, cfs		8.7	8.7	8.7	8.7	2.9	2.9	8.7	8.7	2.9		
33	Time to dewater, days		33.8	27.9	32.0	17.5	27.1	20.5	24.8	43.7	7.6		
Dredging Days over 50 Years			291	209	235	313	788	594	163	221	531		5,868

Table B-4, Site Construction Quantities

line																					Totals
1	Site Number																				
2	Site St M	539.5	552.5																		
3	Site Interval, mi	3.5	2.5	10.5	7.2	7.8	5.9	5.9	5.9	607.6	615.5	622.3	626.9	635.0	643.0	648.7	652.9	658.3	664.2	665.5	
4	USGS Quadrangle	Pita Island	Pita Island	South Bird Island	Point of Rocks	Yarborough Pass	Yarborough Pass	Portero Cortado	Portero Lopeno NW	Portero Lopeno NW	Portero Lopeno SW	South of Portero Lopeno	Port Mansfield	Hawk Island	Green Island	Three Islands	La Coma	La Coma	Port Isabel		
5	Geographic Feature				Point of Rocks		Land Cut	Potrero de las Canelas, Land Cut	Portero Lopeno, Land Cut	Bandera Pt. Land Cut	Ricon de San Jose			Chubby Island	Existing Disposal Area	Red Head Bluff	Barclay Island	Moranco Blanco	Laguna Heights		
6	County	Nueces	Kleberg	Kleberg	Kleberg	Kenedy	Kenedy	Kenedy	Kenedy	Kenedy	Kenedy	Kenedy	Kenedy??	Willacy	Willacy	Cameron??	Cameron	Cameron	Cameron		
7	Soil Type	Made Land, Sandy Clay	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	Sandy Clay	Sandy Clay	Silty Clay Loam	Silty Clay Loam	Silty Clay	Silty Clay		
8	GIWW ICT Reach	1	1	1	2	2	3	3	3	3	4	4	4	4	5	5	6	6	6		
9	GIWW Distance serviced, miles	4.8	6.5	8.9	7.5	6.8	5.9	5.9	5.9	6.9	7.4	5.7	6.4	8.1	6.9	4.9	4.8	5.7	4.3		
10	Distance from GIWW to Site, ft	10,700	14,700	8,800	4,300	2,700	1,500	6,500	4,350	2,400	7,250	7,850	9,100	19,800	1,100	17,200	19,850	20,500	13,300		
11	Initial Dike Height, ft	5	10	10	10	10	5	10	5	5	10	10	10	5	5	5	10	10	5		
12	Width Occupied by Initial Dike Height, ft	95	110	110	110	110	95	110	95	110	110	110	110	95	95	95	110	110	95		
13	ICT External Area, acres	68	126	322	338	643	99	411	174	92	338	283	321	180	99	77	254	429	33		
14	ICT Dike Height, ft	32	32	32	32	32	29	29	29	29	33	33	33	33	33	33	31	31	31		
15	Inferred Site Length, ft	3,169	4,367	7,168	7,351	10,260	3,878	8,139	5,229	3,729	7,351	6,700	7,156	5,323	3,878	3,389	6,331	8,322	2,130		
16	Inferred Site Width, ft	935	1,257	1,957	2,003	2,730	1,112	2,200	1,450	1,075	2,003	1,840	1,954	1,473	1,112	990	1,748	2,246	675		
17	Cell length	2,979	4,147	6,948	7,131	10,040	3,688	7,919	5,039	3,539	7,131	6,480	6,936	5,133	3,688	3,199	6,111	8,102	1,940		
18	Cell width	745	1,037	1,737	1,783	2,510	922	1,980	1,260	885	1,783	1,620	1,734	1,283	922	800	1,528	2,026	485		
19	Cell area, Ac	51	99	277	292	579	78	360	146	72	292	241	276	151	78	59	214	377	22		
20	Cell perimeter	7,447	10,368	17,369	17,828	25,100	9,220	19,797	12,596	8,847	17,828	16,200	17,340	12,831	9,220	7,997	15,277	20,255	4,849		
21	Site Volume, MCY	2.46	4.78	13.41	14.13	28.00	3.40	15.68	6.35	3.13	14.60	12.05	13.81	7.56	3.90	2.94	10.03	17.63	1.01		
22	Site Capacity 50-yr, Mcy	3.42	6.64	18.62	19.62	38.89	4.72	21.77	8.81	4.35	20.27	16.74	19.18	10.50	5.42	4.08	13.93	24.48	1.40	243	
23	Average Dredging /Mile/Year, cut Mcy	0.021	0.021	0.021	0.021	0.021	0.001	0.001	0.001	0.001	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019		
24	Average Dredging /Year, cut Mcy	0.100	0.136	0.186	0.157	0.144	0.006	0.006	0.006	0.007	0.140	0.109	0.121	0.154	0.131	0.095	0.092	0.108	0.081		
25	Average placement interval, yrs	2.3	2.3	2.3	2.3	2.3	10.0	10.0	10.0	10.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1		
26	Dike top width	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20		
27	Dike side slopes, 1 vert. x horiz., x =	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
28	Dike end area, SF	175	500	500	500	500	175	500	175	175	500	500	500	175	175	175	500	500	175		
29	Dike crest volume, CY	48,269	191,997	321,649	330,152	464,809	59,760	366,614	81,643	57,343	330,152	299,993	321,110	83,166	59,760	51,834	282,906	375,095	31,432	3,757,683	
30	Dike footprint width, ft	50	80	80	80	80	50	80	50	50	80	80	80	50	50	50	80	80	50		
31	Dike stripping & grubbing depth, ft	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
32	Dike S & G volume, CY	13,791	30,720	51,464	52,824	74,369	17,074	58,658	23,327	16,384	52,824	47,999	51,378	23,762	17,074	14,810	45,265	60,015	8,980		
33	Borrow area cut depth	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
34	Borrow area, ac	10	40	66	68	96	12	76	17	12	68	62	66	17	12	11	58	78	6		
35	Borrow area S & G cut depth	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
36	Borrow area S & G volume	16,093	64,012	107,238	110,073	154,968	19,924	122,230	27,220	19,118	110,073	100,018	107,059	27,728	19,924	17,282	94,321	125,057	10,479		
37	S & G Volume, total	29,884	94,732	158,702	162,898	229,338	36,998	180,888	50,546	35,502	162,898	148,017	158,437	51,489	36,998	32,092	139,586	185,073	19,460		
38	Perimeter road, SY	12,412	17,280	28,948	29,714	41,833	15,367	32,995	20,994	14,745	29,714	26,999	28,900	21,386	15,367	13,329	25,462	33,759	8,082		
39	Access Road Length, ft	1,800	100	100	150	100	100	0	16,500	0	100	100	1,600	100	0	100	100	100	100		
40	Access road Home, SY	3,000	167	167	250	167	167	0	27,500	0	167	167	2,667	167	0	167	167	167	167		
41	Perimeter ditch excavation, CY	30,397	41,659	67,589	69,290	96,221	36,963	76,582	49,468	35,582	69,290	63,258	67,481	50,338	36,963	32,434	59,840	78,278	20,776		
42	Access road ditch excavation, CY	6,667	370	370	556	370	370	0	61,111	0	370	370	5,926	370	0	370	370	370	370		
43	Ditch seeding, ac	7.8	8.8	14.7	15.1	21.2	7.8	16.6	24.5	7.4	15.1	13.7	15.9	10.9	7.8	6.8	12.9	17.1	4.2		
44	Dike seeding, ac	8.8	19.8	33.2	34.1	48.0	10.9	37.8	14.9	10.5	34.1	31.0	33.1	15.2	10.9	9.5	29.2	38.7	5.7		
45	Dike Raising Scenarios	4	3	3	3	3	3	3	3	3	3	3	3	4	4	4	3	3	4		
46	Dike Raising Perimeter	7,123	10,104	17,105	17,564	24,836	8,932	19,569	12,308	8,559	17,552	15,924	17,064	12,495	8,884	7,661	15,025	20,003	4,537		
47	Dike Raising Volume per scenario, CY	104,475	148,190	250,874	257,608	364,256	131,004	287,014	180,522	125,535	257,432	233,547	250,271	183,265	130,300	112,366	220,366	293,379	66,549		
48	Total Dike Raising Volume, CY	417,900	444,570	752,621	772,824	1,092,769	393,013	861,042	541,566	376,606	772,296	700,640	750,814	733,059	521,202	449,463	661,097	880,137	266,197		

Table B-5, First-Cost Estimate
(These Costs do Not Include Right of Way Costs or
Engineering and Administration Costs)

Site Number	Unit Price	Units	1	2	3	4	5	6	7	8	9	10
ITEM												
1 Mobilization/demobilization			\$3,379	\$13,440	\$22,515	\$23,111	\$32,537	\$4,183	\$45,663	\$5,715	\$24,014	\$23,111
Excavators/Dozers/Trucks			\$3,379	\$13,440	\$22,515	\$23,111	\$32,537	\$4,183	\$25,663	\$5,715	\$4,014	\$23,111
Mob/demob dredge and pipeline			n/a	n/a	n/a	n/a	n/a	n/a	\$20,000	n/a	\$20,000	n/a
2 Erosion and Sediment control measures			\$155,137	\$175,782	\$284,727	\$292,650	\$405,023	\$156,270	\$320,177	\$464,007	\$148,134	\$291,872
2a stabilized construction entrance	\$7.00	SY	\$778	\$778	\$778	\$778	\$778	\$778	\$0	\$778	\$0	\$778
2b strip and grub existing vegetatio	\$1,000	Ac.	\$8,041	\$9,118	\$14,743	\$15,152	\$20,955	\$8,099	\$16,614	\$23,989	\$7,719	\$15,112
2c excavate perimeter drainage diti	\$3.50	CY	\$129,724	\$147,102	\$237,858	\$244,458	\$338,070	\$130,668	\$268,037	\$387,026	\$124,538	\$243,810
2d seed and mulch drainage ditch	\$2,134	Ac.	\$16,594	\$18,785	\$31,348	\$32,262	\$45,221	\$16,725	\$35,526	\$52,214	\$15,876	\$32,172
3 Construct site access			\$37,953	\$2,109	\$2,109	\$3,163	\$2,109	\$2,109	\$412,269	\$347,904	\$152,222	\$2,109
3a access roadway	\$12.65	SY	\$37,953	\$2,109	\$2,109	\$3,163	\$2,109	\$2,109	\$0	\$347,904	\$0	\$2,109
3b dredge access channel	\$6.85	CY	n/a	n/a	n/a	n/a	n/a	n/a	\$412,269	n/a	\$152,222	n/a
4 Grade and prepare perimeter road			\$157,027	\$218,607	\$366,228	\$375,909	\$529,229	\$194,407	\$417,425	\$265,595	\$186,545	\$375,909
4a strip and grub existing vegetatio	\$0.21	SY	\$2,564	\$3,570	\$5,981	\$6,139	\$8,643	\$3,175	\$6,817	\$4,338	\$3,047	\$6,139
4b haul graded aggregate	\$4.44	SY	\$55,165	\$76,799	\$128,659	\$132,061	\$185,923	\$68,297	\$146,646	\$93,306	\$65,535	\$132,061
4c 8" thick driving surface	\$8.00	SY	\$99,297	\$138,238	\$231,587	\$237,709	\$334,662	\$122,935	\$263,962	\$167,951	\$117,963	\$237,709
5 Build containment dikes			\$307,218	\$1,187,856	\$1,989,989	\$2,042,596	\$2,875,696	\$380,351	\$2,268,180	\$519,626	\$364,968	\$2,042,596
5a strip and grub existing vegetatio	\$1,000	Ac.	\$10,830	\$41,581	\$69,660	\$71,501	\$100,664	\$13,408	\$79,398	\$18,318	\$12,866	\$71,501
5b on site borrow excavation	\$1.00	CY	\$48,269	\$191,997	\$321,649	\$330,152	\$464,809	\$59,760	\$366,614	\$81,643	\$57,343	\$330,152
5c haul dike fill material	\$2.25	CY	\$108,606	\$431,994	\$723,710	\$742,841	\$1,045,819	\$134,460	\$824,881	\$183,696	\$129,022	\$742,841
5d shaping and compacting dikes	\$2.50	CY	\$120,674	\$479,993	\$804,122	\$825,379	\$1,162,021	\$149,400	\$916,534	\$204,107	\$143,358	\$825,379
5e Seeding and mulching dikes	\$2,134	Ac.	\$18,838	\$42,291	\$70,849	\$72,722	\$102,382	\$23,322	\$80,753	\$31,863	\$22,379	\$72,722
6 Spillways, two per site	\$200,000	LS	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000
7 Construct staging/off-loader area	\$12.65	SY	\$28,113	\$28,113	\$28,113	\$28,113	\$28,113	\$28,113	\$28,113	\$28,113	\$28,113	\$28,113
8 Overhead & Profit	10.0%		\$88,883	\$182,591	\$289,368	\$296,554	\$407,271	\$96,543	\$369,183	\$183,096	\$110,400	\$296,371
9 Contingency	15.0%		\$146,656	\$301,275	\$477,457	\$489,314	\$671,997	\$159,297	\$609,151	\$302,109	\$182,159	\$489,012
10 TOTAL			\$1,124,366	\$2,309,773	\$3,660,506	\$3,751,411	\$5,151,973	\$1,221,274	\$4,670,161	\$2,316,165	\$1,396,555	\$3,749,093

\$15,998,030

\$9,604,155

Table B-5, First-Cost Estimate
(These Costs do Not Include Right of Way Costs or
Engineering and Administration Costs)

Site Number	Unit Price	Units	11	12	13	14	15	16	17	18	Totals
ITEM											
1 Mobilization/demobilization			\$21,000	\$22,478	\$5,822	\$4,183	\$3,628	\$19,803	\$26,257	\$2,200	\$303,038
Excavators/Dozers/Trucks			\$21,000	\$22,478	\$5,822	\$4,183	\$3,628	\$19,803	\$26,257	\$2,200	
Mob/demob dredge and pipeline			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2 Erosion and Sediment control measures			\$266,530	\$307,616	\$212,464	\$154,714	\$137,242	\$252,172	\$329,637	\$88,258	\$4,442,417
2a stabilized construction entrance	\$7.00	SY	\$778	\$778	\$778	\$778	\$778	\$778	\$778	\$778	
2b strip and grub existing vegetatio	\$1,000	Ac.	\$13,804	\$15,925	\$11,001	\$8,019	\$7,117	\$13,062	\$17,062	\$4,587	
2c excavate perimeter drainage ditch	\$3.50	CY	\$222,699	\$256,925	\$177,480	\$129,372	\$114,817	\$210,738	\$275,270	\$74,011	
2d seed and mulch drainage ditch	\$2,134	Ac.	\$29,250	\$33,988	\$23,205	\$16,546	\$14,531	\$27,594	\$36,528	\$8,882	
3 Construct site access			\$2,109	\$33,736	\$2,109	\$0	\$2,109	\$2,109	\$2,109	\$2,109	\$1,010,440
3a access roadway	\$12.65	SY	\$2,109	\$33,736	\$2,109	\$0	\$2,109	\$2,109	\$2,109	\$2,109	
3b dredge access channel	\$6.85	CY	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
4 Grade and prepare perimeter road			\$341,571	\$365,615	\$270,550	\$194,407	\$168,624	\$322,115	\$427,081	\$102,251	\$5,279,093
4a strip and grub existing vegetatio	\$0.21	SY	\$5,578	\$5,971	\$4,419	\$3,175	\$2,754	\$5,261	\$6,975	\$1,670	
4b haul graded aggregate	\$4.44	SY	\$119,997	\$128,444	\$95,047	\$68,297	\$59,239	\$113,162	\$150,038	\$35,922	
4c 8" thick driving surface	\$8.00	SY	\$215,995	\$231,199	\$171,084	\$122,935	\$106,631	\$203,692	\$270,068	\$64,659	
5 Build containment dikes			\$1,856,009	\$1,986,658	\$529,321	\$380,351	\$329,907	\$1,750,294	\$2,320,650	\$200,050	\$23,332,316
5a strip and grub existing vegetatio	\$1,000	Ac.	\$64,970	\$69,543	\$18,659	\$13,408	\$11,630	\$61,269	\$81,235	\$7,052	
5b on site borrow excavation	\$1.00	CY	\$299,993	\$321,110	\$83,166	\$59,760	\$51,834	\$282,906	\$375,095	\$31,432	
5c haul dike fill material	\$2.25	CY	\$674,985	\$722,498	\$187,124	\$134,460	\$116,627	\$636,539	\$843,963	\$70,721	
5d shaping and compacting dikes	\$2.50	CY	\$749,983	\$802,776	\$207,915	\$149,400	\$129,586	\$707,265	\$937,737	\$78,579	
5e Seeding and mulching dikes	\$2,134	Ac.	\$66,079	\$70,730	\$32,457	\$23,322	\$20,229	\$62,315	\$82,621	\$12,267	
6 Spillways, two per site	\$200,000	LS	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$3,600,000
7 Construct staging/off-loader area	\$12.65	SY	\$28,113	\$28,113	\$28,113	\$28,113	\$28,113	\$28,113	\$28,113	\$28,113	\$506,042
8 Overhead & Profit	10.0%		\$271,533	\$294,422	\$124,838	\$96,177	\$86,962	\$257,461	\$333,385	\$62,298	\$3,847,335
9 Contingency	15.0%		\$448,030	\$485,796	\$205,983	\$158,692	\$143,488	\$424,810	\$550,085	\$102,792	\$6,348,102
10 TOTAL			\$3,434,895	\$3,724,434	\$1,579,199	\$1,216,638	\$1,100,074	\$3,256,878	\$4,217,317	\$788,072	\$48,668,783
											\$23,066,598
											\$48,668,783

GIWW CDF Cost Evaluation

**Table B-6a, Site Operations and Maintenance Costs
for Each Dredging Event**

Site Number			1	2	3	4	5	6	7	8	9	10
Unit Price Units												
ITEM												
1	Dredged Material Management	\$600 Acre	\$5,224	\$14,096	\$66,277	\$71,673	\$200,004	\$9,914	\$98,139	\$25,279	\$8,759	\$71,673
2	Site Maintenance	\$22 LF	\$163,840	\$228,093	\$382,119	\$392,220	\$552,193	\$202,843	\$435,537	\$277,119	\$194,639	\$392,220
3	Site Monitoring and Reporting	\$100,000 LS	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
4	TOTAL		\$269,065	\$342,189	\$548,396	\$563,894	\$852,197	\$312,757	\$633,676	\$402,398	\$303,398	\$563,894

Table B-6b, 50-Year Cash Flow

Site Number			1	2	3	4	5	6	7	8	9	10
Unit Price Units												
ITEM												
1	Initial Construction Costs		\$1,124,366	\$2,309,773	\$3,660,506	\$3,751,411	\$5,151,973	\$1,221,274	\$4,670,161	\$2,316,165	\$1,396,555	\$3,749,093
2	Hydraulic Dredging Unit Price per Pay CY		\$4.03	\$4.23	\$1.42	\$1.02	\$1.02	\$3.47	\$1.71	\$1.36	\$3.16	\$1.44
	Hydraulic Dredging directly to site		\$20,299,279	\$29,198,400	\$13,321,563	\$8,109,597	\$7,436,349	\$1,024,596	\$503,933	\$400,737	\$1,091,374	\$10,199,232
3	Site Operations and Maintenance Costs		\$5,919,425	\$7,528,158	\$12,064,702	\$12,405,658	\$18,748,327	\$1,563,783	\$3,168,382	\$2,011,992	\$1,516,990	\$25,939,104
4	Dike Raising Costs		\$1,749,507	\$1,856,702	\$3,135,870	\$3,219,763	\$4,548,316	\$1,642,618	\$3,586,083	\$2,259,474	\$1,574,486	\$3,217,570
4a	Mob/Demob	LS	\$14,200	\$10,650	\$10,650	\$10,650	\$10,650	\$10,650	\$10,650	\$10,650	\$10,650	\$10,650
4b	Excavate and place dried crust	\$3.50 CY	\$1,170,120	\$1,244,795	\$2,107,340	\$2,163,909	\$3,039,753	\$1,100,438	\$2,410,918	\$1,516,385	\$1,054,496	\$2,162,430
4c	Excavate and haul borrow material	\$5.75 CY	\$480,585	\$511,255	\$865,514	\$888,748	\$1,256,684	\$451,966	\$990,199	\$622,801	\$433,097	\$888,141
4d	Seeding and mulching dikes	\$2,134 Ac.	\$84,603	\$90,002	\$152,366	\$156,456	\$221,228	\$79,564	\$174,316	\$109,639	\$76,243	\$156,349
5	Spillway Raising Costs, per dike raising	\$50,000 LS	\$200,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000
6	TOTAL		\$29,292,577	\$41,043,033	\$32,332,641	\$27,636,429	\$36,034,965	\$5,602,271	\$12,078,559	\$7,138,368	\$5,729,404	\$43,254,999
7	per CY of site capacity		\$8.56	\$6.19	\$1.74	\$1.41	\$0.93	\$1.19	\$0.55	\$0.81	\$1.32	\$2.13
8	per CY of material placed		\$5.88	\$6.02	\$3.48	\$3.51	\$5.02	\$18.99	\$40.94	\$24.20	\$16.61	\$6.16

GIWW CDF Cost Evaluation

**Table B-6a, Site Operations and Maintenance Costs
for Each Dredging Event**

Site Number			11	12	13	14	15	16	17	18	TOTALS
Unit Price Units											
ITEM											
1	Dredged Material Management	\$600 Acre	\$53,771	\$65,945	\$26,721	\$9,914	\$6,469	\$45,097	\$105,109	\$1,442	\$885,508
2	Site Maintenance	\$22 LF	\$356,392	\$381,479	\$282,289	\$202,843	\$175,941	\$336,092	\$445,612	\$106,688	\$5,508,159
3	Site Monitoring and Reporting	\$100,000 LS	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$1,800,000
4	TOTAL		\$510,163	\$547,424	\$409,010	\$312,757	\$282,410	\$481,189	\$650,721	\$208,130	\$8,193,667

Table B-6b, 50-Year Cash Flow

Site Number			11	12	13	14	15	16	17	18	TOTALS
Unit Price Units											
ITEM											
1	Initial Construction Costs		\$3,434,895	\$3,724,434	\$1,579,199	\$1,216,638	\$1,100,074	\$3,256,878	\$4,217,317	\$788,072	\$48,668,783
2	Hydraulic Dredging Unit Price per Pay CY		\$1.12	\$1.46	\$1.46	\$2.92	\$1.55	\$1.18	\$1.57	\$3.11	
	Hydraulic Dredging directly to site		\$6,164,031	\$8,980,543	\$11,319,748	\$19,298,708	\$7,433,523	\$5,488,244	\$8,594,763	\$12,767,547	\$171,632,166
3	Site Operations and Maintenance Costs		\$23,467,507	\$25,181,491	\$18,814,469	\$14,386,807	\$12,990,868	\$22,134,690	\$29,933,177	\$9,573,988	\$247,349,519
4	Dike Raising Costs		\$2,920,019	\$3,128,366	\$3,058,191	\$2,178,464	\$1,880,572	\$2,755,819	\$3,665,372	\$1,119,567	\$47,496,759
4a	Mob/Demob	LS	\$10,650	\$10,650	\$14,200	\$14,200	\$14,200	\$10,650	\$10,650	\$14,200	
4b	Excavate and place dried crust	\$3.50 CY	\$1,961,791	\$2,102,280	\$2,052,567	\$1,459,366	\$1,258,497	\$1,851,071	\$2,464,383	\$745,350	
4c	Excavate and haul borrow material	\$5.75 CY	\$805,736	\$863,436	\$843,018	\$599,382	\$516,883	\$760,261	\$1,012,157	\$306,126	
4d	Seeding and mulching dikes	\$2,134 Ac.	\$141,843	\$152,000	\$148,406	\$105,516	\$90,993	\$133,837	\$178,181	\$53,891	
5	Spillway Raising Costs, per dike raising	\$50,000 LS	\$150,000	\$150,000	\$200,000	\$200,000	\$200,000	\$150,000	\$150,000	\$200,000	\$2,950,000
6	TOTAL		\$36,136,452	\$41,164,833	\$34,971,607	\$37,280,617	\$23,605,036	\$33,785,631	\$46,560,629	\$24,449,174	\$518,097,227
7	per CY of site capacity		\$2.16	\$2.15	\$3.33	\$6.88	\$5.79	\$2.43	\$1.90	\$17.42	
8	per CY of material placed		\$6.64	\$6.79	\$4.55	\$5.70	\$4.99	\$7.37	\$8.63	\$6.03	

Table B-7, Mobilization and Demobilization
24-in. or 27-in. Hydraulic Cutterhead Dredge - 4,000 HP

Dredging Cost Estimates Based On GBA August 1, 1997

line	Dredge and Attendant Plant (w/5,000 ft pipeline), ref page 14	quan	unit cost	notes	GBA 1997		2001 Estimate		
					Estimate		quan	unit cost	totals
1	(a) Use 400 miles as location to job site. Dredge tenders will be used as assist boats for towing vessels			4.8 days					
2	(b) Towing days = 400 miles at 3.5 mph			1.2					
3	(c) Lock delays =			1.0					
4	(d) Weather delays =			7.0					
5				3.0					
6	(e) Towing vessels return to base								
7	(f) Towing tugs, number x days @ \$/d	20	\$2,400		\$48,000		20	\$2,701	\$54,024
8	(g) Dredge and attendant plant at 50%, days @ \$/d	7	7,738		54,163		7	\$8,709	60,960
9	(h) One day to setup dredge at full rate	1	15,475		15,475		1	\$17,417	17,417
10	(i) Overhead on items (g) and (h)	15%	---		10,446		15%	---	11,757
11	(j) Profit on items (g), (h) and (i)	10%	---		8,008		10%	---	9,013
12				Mobilization cost	136,091				153,172
13	(k) Use 50% for demobilization			Demobilization cost	68,046				76,586
14				Total	\$204,137				\$229,758
15	Pipeline, ref: page 20								
16	10,000 ft of line per tow, 400 miles at 4 mph	100	150	Mob	15,000		100	\$169	16,883
17	Tug return per 10,000 ft of pipeline	50	150	Mob	7,500		50	\$169	8,441
18	Demobilize 10,000 ft of line per tow as above	100	150	Demob	15,000		100	\$169	16,883
19	Tug arrival per 10,000 ft of pipeline	50	150	Demob	7,500		50	\$169	8,441
20									
21	Booster(s), ref: page 20								
22	Mobilize one booster, roundtrip, use 150 hrs and tug	150	100		15,000		150	\$113	16,883
23	Demobilize one booster at 100% of mob	150	100		15,000		150	\$113	16,883
									\$314,171
					additional 10,000 ft pipeline				\$45,000
					Mob/Demob w/ 25,000 ft pipeline				\$359,171

Table B-8, Dredge Operating and Ownership Costs
24-in. or 27-in. Hydraulic Cutterhead Dredge - 4,000 HP

Dredging Cost Estimates Based On GBA August 1, 1997, Page 27

						1997	2001 Estimate		
						Estimate	quan	unit cost	totals
line	Labor Cost	quan	unit cost	notes	crew	totals			
1	Typical dredge crew and weekly labor cost			24-in.	40	\$25,208			\$28,372
2	Typical dredge crew and weekly labor cost			27-in.	41	28,348			\$31,906
3	Typical dredge crew and weekly labor cost			27-in.	42	25,874			\$29,121
4									
5	Average weekly payroll					\$26,477			\$29,800
6	Average weekly crew count					41			41
7	Payroll, Insurance and taxes @ 45%					11,915			\$13,410
8	Total daily labor cost					5,484			\$6,173
9									
10	Daily Dredge Cost					Daily Cost			Daily Cost
11	(1) labor (crew = 41)					\$5,484			\$5,484
12	(2) Fuel: gal per day @ \$/gal	3,700	\$0.75			\$2,775	3,700	\$0.75	\$2,775
13	(3) oil and grease					\$225			\$253
14	(4)Supplies:					\$833			\$938
15	(5) Dredge depreciation					\$2,000			\$2,251
16	(6) Repairs hr/d x \$/hr	16.5	\$100			\$1,650	16.5	\$113	\$1,857
17	(7) Attendant plant cost:								
18	(a) Tenders: number @ \$/d	3	300			\$900	3	\$338	\$1,013
19	(b) Crane and barge @ \$/d	1	400			\$400	1	\$450	\$450
20	(c) Derrick barge @ \$/d	1	250			\$250	1	\$281	\$281
21	(d) Deck barges @ \$/d	3	100			\$300	3	\$113	\$338
22	(e) Survey boat @ \$/d	1	125			\$125	1	\$141	\$141
23	(f) D-4 dozer @\$/d	1	200			\$200	1	\$225	\$225
24	(g) Pipeline, ft @ \$/d	5,000	0.067			\$333	5,000	\$0.08	\$375
	Total Daily Cost					\$15,476	Total Daily Cost		\$16,381
24-in. or 27-in. Booster Pump, 3,600 to 4,000 HP						Daily Cost	2001 Estimate		
Daily Booster Cost							quan	unit cost	Daily Cost
1	(1) Labor number @ \$/d	6	\$135			\$810	6	\$152	\$912
2	(2) Fuel, gal/d @ \$/gal	2800	0.75			\$2,100	2800	\$0.84	\$2,364
3	(3) Oil and grease					\$210			\$236
4	(4) Supplies,					\$400			\$450
5	(5) Booster depreciation					\$1,400			\$1,576
6	(6) Repairs Hours per day x \$/hr	16.5	50			\$825	16.5	\$56	\$929
7									\$6,466
	Total Daily Cost					\$5,745			
Submerged Pipeline Cost							2001 Estimate		
							quan	unit cost	Daily Cost
1	24-in. or 27-in. line, 500 ft section								
2	500 ft, 0.5-in. wall thickness @ \$/ft	500	\$40			\$20,000	500	\$45	\$22,510
3	Set of balls and bells, number @ \$/set	1	6,000			\$6,000	1	\$6,753	\$6,753
4	Labor & equip, weld 10 pipe joints @ \$/joi	10	300			\$3,000	10	\$338	\$3,377
5	Weld set balls and bells, welds @ \$/weld	2	500			\$1,000	2	\$563	\$1,126
6	Total cost of 500 ft section					\$30,000			\$33,765
7	Estimated life of submerged pipeline is 5 years					\$2.00			
8	Approximate use per year is 50% or six months per year								
9	Total pipeline usage is 5 years at 6 months/year = 30 months								
10	Depreciated pipeline cost per month					\$2 per ft per month	\$2.25	per ft per month	

Table B-9, Estimate of Dredging Costs

line										
1	Site Number (ICT Segment)		1	2	3	4	5	6	7	8
2	Site St M		557.1	558.9	568.5	575.9	584.0	589.9	595.1	600.9
3	Dredge Size, in.		27	27	27	27	27	27	27	27
4	Average Dredge Production, cy/day		26,504	25,436	24,663	25,850	26,040	27,604	26,447	26,698
5			reduced production	reduced production				reduced production		
6	Average Duration of Dredging Project, days		32	35	17	14	13	7	2	2
7	Average Pay Volume, CY		265,346	274,995	410,081	373,897	337,714	55,500	55,000	58,500
8	Cost of Dredge @ daily cost as shown	\$15,475	\$501,976	\$542,053	\$257,312	\$223,828	\$200,698	\$100,808	\$32,182	\$33,909
9	Average Length of Pipeline, ft.		25,272	31,260	35,603	28,937	27,875	19,097	25,590	24,183
10	Pipeline Cost, @ \$ per ft per month as shown	\$2.00	\$54,200	\$72,394	\$39,139	\$27,672	\$23,902	\$8,225	\$3,518	\$3,504
11	Number of Boosters		2	2	2	1	1	1	1	1
12	Days Used First Booster		32	35	17	14	13	7	2	2
13	Days Used Second Booster		8	9	4	0	0	0	0	0
14	Booster @ daily cost as shown	\$5,745	\$465,889	\$503,085	\$238,814	\$83,095	\$74,508	\$37,424	\$11,948	\$12,589
15	Dredging Cost w/o Mob/Demob		\$1,022,065	\$1,117,533	\$535,266	\$334,595	\$299,108	\$146,458	\$47,648	\$50,001
16	Mobilization/Demobilization for North Reach	\$324,137								
17	Mobilization/Demobilization for South Reach	\$324,137								
18	Prorated Mob/Demob Cost		\$46,305	\$46,305	\$46,305	\$46,305	\$46,305	\$46,305	\$46,305	\$29,467
19	Total Dredging Cost		\$1,068,370	\$1,163,838	\$581,571	\$380,901	\$345,413	\$192,763	\$93,954	\$79,468
20	Dredging Cost \$/pay cy		\$4.03	\$4.23	\$1.42	\$1.02	\$1.02	\$3.47	\$1.71	\$1.36

Table B-9, Estimate of Dredging Costs

line										
1	Site Number (ICT Segment)		9	10	11	12	13	14	15	16
2	Site St M		606.8	615.3	622.3	626.8	634.9	643.2	648.7	652.9
3	Dredge Size, in.		27	27	27	27	27	27	27	27
4	Average Dredge Production, cy/day		26,800	25,423	26,258	25,645	24,976	27,085	25,270	26,335
5			reduced production					reduced production		
6	Average Duration of Dredging Project, days		9	6	5	5	7	17	4	4
7	Average Pay Volume, CY		72,000	162,785	120,776	132,328	172,237	144,931	101,872	94,520
8	Cost of Dredge @ daily cost as shown	\$15,475	\$134,703	\$99,088	\$71,179	\$79,850	\$106,719	\$268,295	\$62,385	\$55,543
9	Average Length of Pipeline, ft.		23,610	31,337	26,650	30,087	33,846	22,011	32,193	26,220
10	Pipeline Cost, @ \$ per ft per month as shown	\$2.00	\$13,588	\$13,266	\$8,104	\$10,264	\$15,432	\$25,230	\$8,581	\$6,222
11	Number of Boosters		1	2	1	2	2	1	2	1
12	Days Used First Booster		9	6	5	5	7	17	4	4
13	Days Used Second Booster		0	2	0	1	2	0	1	0
14	Booster @ daily cost as shown	\$5,745	\$50,008	\$91,965	\$26,425	\$74,109	\$99,047	\$99,603	\$57,900	\$20,620
15	Dredging Cost w/o Mob/Demob		\$198,298	\$204,319	\$105,708	\$164,223	\$221,197	\$393,128	\$128,865	\$82,385
16	Mobilization/Demobilization for North Reach	\$324,137								
17	Mobilization/Demobilization for South Reach	\$324,137								
18	Prorated Mob/Demob Cost		\$29,467	\$29,467	\$29,467	\$29,467	\$29,467	\$29,467	\$29,467	\$29,467
19	Total Dredging Cost		\$227,765	\$233,786	\$135,175	\$193,690	\$250,664	\$422,595	\$158,332	\$111,852
20	Dredging Cost \$/pay cy		\$3.16	\$1.44	\$1.12	\$1.46	\$1.46	\$2.92	\$1.55	\$1.18

Table B-9, Estimate of Dredging Costs

line					
1	Site Number (ICT Segment)		17	18	Totals
2	Site St M		657.7	664.2	
3	Dredge Size, in.		27	27	
4	Average Dredge Production, cy/day		24,360	26,487	
5				reduced production	
6	Average Duration of Dredging Project, days		5	12	
7	Average Pay Volume, CY		118,675	95,570	3,046,728
8	Cost of Dredge @ daily cost as shown	\$15,475	\$75,390	\$180,911	
9	Average Length of Pipeline, ft.		37,300	25,364	
10	Pipeline Cost, @ \$ per ft per month as shown	\$2.00	\$12,014	\$19,605	
11	Number of Boosters		2	1	
12	Days Used First Booster		5	12	
13	Days Used Second Booster		1	0	
14	Booster @ daily cost as shown	\$5,745	\$69,970	\$67,162	
15	Dredging Cost w/o Mob/Demob		\$157,374	\$267,677	
16	Mobilization/Demobilization for North Reach	\$324,137			
17	Mobilization/Demobilization for South Reach	\$324,137			
18	Prorated Mob/Demob Cost		\$29,467	\$29,467	
19	Total Dredging Cost		\$186,841	\$297,144	\$6,124,122
20	Dredging Cost \$/pay cy		\$1.57	\$3.11	\$2.01

**Table B-10, Estimate of Site Characteristics,
Upland Confined Sites - PHYSICAL EFFECTS**

line		Note		1	2	3	4	5	6	7
1	Site Number (ICT Segment)									
2	Site St M		552.5	557.1	558.9	568.5	575.9	584.0	589.9	595.1
3	ICT External Area, acres			68	126	322	338	643	99	411
4	Inferred Cell Area, acres			51	99	277	292	579	78	360
5	Length of Shoreline Affected by Site, ft			3,169	4,367	7,168	7,351	10,260	3,878	8,139
6	Bay-Bottom Effects									
7	Pipeline									
8	Length, ft			10,500	12,900	6,500	3,000	2,300	1,250	5,850
9	Width, ft			50	50	50	50	50	50	50
10	Area, acres			12.1	14.8	7.5	3.4	2.6	1.4	6.7
11	Access Channel									
12	Length, ft			10,500	12,900	6,500	3,000	600	1,250	5,850
13	Width, ft			100	100	100	100	100	100	100
14	Depth, ft			5	5	5	5	5	5	5
15	Area, acres			24.1	29.6	14.9	6.9	1.4	2.9	13.4
16	Average water depth, ft			2.0	1.0	2.0	1.0	2.0	0.0	0.0
17	Average cut depth, ft			3.0	4.0	3.0	4.0	3.0	5.0	5.0
18	Total Volume of Material Dredged, cy			116,667	191,111	72,222	44,444	6,667	23,148	108,333
19	"Access Corridor" (road and pipeline)									
20	Length, ft			300	750	2200	1300	350	300	700
21	Width, ft			150	150	150	150	150	150	150
22	Area, acres			1.0	2.6	7.6	4.5	1.2	1.0	2.4
23	Access Road Characteristics									
24	Length, ft			1,800	100	100	150	100	100	no access
25	Width, ft			85	85	85	85	85	85	0
26	Area, acres			3.5	0.2	0.2	0.3	0.2	0.2	0
27	50-Year Effects									
28	Total Volume of Material Placed, million cy			3.40	6.60	18.52	19.51	38.67	4.70	21.65
29	Total Area Covered, acres			108.7	173.2	352.2	353.1	648.4	104.5	433.6
30	Total Length of Shoreline Affected, ft			3,169	4,367	7,168	7,351	10,260	3,878	8,139

**Table B-10, Estimate of Site Characteristics,
 Upland Confined Sites - PHYSICAL EFFECTS**

line		Note								
1	Site Number (ICT Segment)		8	9	10	11	12	13	14	15
2	Site St M		600.9	606.8	615.3	622.3	626.8	634.9	643.2	648.7
3	ICT External Area, acres		174	92	338	283	321	180	99	77
4	Inferred Cell Area, acres		146	72	292	241	276	151	78	59
5	Length of Shoreline Affected by Site, ft		5,229	3,729	7,351	6,700	7,156	5,323	3,878	3,389
6	Bay-Bottom Effects									
7	Pipeline									
8	Length, ft		4,300	1,750	6,000	6,800	8,700	18,650	700	16,200
9	Width, ft		50	50	50	50	50	50	50	50
10	Area, acres		4.9	2.0	6.9	7.8	10.0	21.4	0.8	18.6
11	Access Channel									
12	Length, ft		4,300	1,750	1,650	2,400	3,450	18,650	700	16,200
13	Width, ft		100	100	100	100	100	100	100	100
14	Depth, ft		5	5	5	5	5	5	5	5
15	Area, acres		9.9	4.0	3.8	5.5	7.9	42.8	1.6	37.2
16	Average water depth, ft		0.0	0.0	2.0	4.0	4.0	1.5	0.5	2.5
17	Average cut depth, ft		5.0	5.0	3.0	1.0	1.0	3.5	4.5	2.5
18	Total Volume of Material Dredged, cy		79,630	32,407	18,333	8,889	12,778	241,759	11,667	150,000
19	"Access Corridor" (road and pipeline)									
20	Length, ft		100	600	1300	1300	500	1400	250	500
21	Width, ft		150	150	150	150	150	150	150	150
22	Area, acres		0.3	2.1	4.5	4.5	1.7	4.8	0.9	1.7
23	Access Road Characteristics									
24	Length, ft		16,500	no access	100	100	1,600	100	---	100
25	Width, ft		85	0	85	85	85	85	0	85
26	Area, acres		32.2	0	0.2	0.2	3.1	0.2	0	0.2
27	50-Year Effects									
28	Total Volume of Material Placed, million cy		8.76	4.32	20.16	16.64	19.07	10.44	5.39	4.06
29	Total Area Covered, acres		221.3	100.1	353.3	301.0	343.8	249.2	102.3	134.7
30	Total Length of Shoreline Affected, ft		5,229	3,729	7,351	6,700	7,156	5,323	3,878	3,389

**Table B-10, Estimate of Site Characteristics,
 Upland Confined Sites - PHYSICAL EFFECTS**

line		Note					Totals
1	Site Number (ICT Segment)		16	17	18		
2	Site St M		652.9	657.7	664.2	665.5	113.0
3	ICT External Area, acres		254	429	33		
4	Inferred Cell Area, acres		214	377	22		
5	Length of Shoreline Affected by Site, ft		6,331	8,322	2,130		103,868
6	Bay-Bottom Effects						
7	Pipeline						
8	Length, ft		17,300	17,400	13,000		153,100
9	Width, ft		50	50	50		
10	Area, acres		19.9	20.0	14.9		176
11	Access Channel						
12	Length, ft		17,300	17,400	13,000		137,400
13	Width, ft		100	100	100		
14	Depth, ft		5	5	5		
15	Area, acres		39.7	39.9	29.8		315
16	Average water depth, ft		0.5	2.5	4.0		
17	Average cut depth, ft		4.5	2.5	1.0		
18	Total Volume of Material Dredged, cy		288,333	161,111	48,148		1,615,648
19	"Access Corridor" (road and pipeline)						
20	Length, ft		3200	3200	400		18,650
21	Width, ft		150	150	150		
22	Area, acres		11.0	11.0	1.4		64
23	Access Road Characteristics						
24	Length, ft		100	100	100		21,150
25	Width, ft		85	85	85		
26	Area, acres		0.2	0.2	0.2		41
27	50-Year Effects						
28	Total Volume of Material Placed, million cy		13.85	24.34	1.40		241.5
29	Total Area Covered, acres		324.8	500.1	79.3		4,883.7
30	Total Length of Shoreline Affected, ft		6,331	8,322	2,130		103,868

TABLE B-11 - COMPARISON OF ICT VALUES AND GBA ESTIMATES - CONFINED UPLAND SITES

		ICT Reaches						ICT Total	GBA	
		1	2	3	4	5	6			
1	Number of ICT Sites	3	2	4	4	2	3	18	---	
2	ICT Site External Area (1)	516	980	776	1,123	176	716	4,287	---	acres
3	Length of Shoreline Affected	---	---	---	---	---	---	---	20	miles
4	In-Bay Pipeline and Access Channel from GIWW to Site	(1)	(1)	(1)	(1)	(1)	(1)	(1)	315	acres
5	Access Corridor from Shoreline to Site	(1)	(1)	(1)	(1)	(1)	(1)	(1)	64	acres
6	Sum of Channel & Shoreline to site	103	37	0	124	69	112	445	379	acres
7	Access Road to Site (2)	---	---	---	---	---	---	---	41	acres
8	ICT Site Capacity	---	---	---	---	---	---	---	241	Mcy
9	Volume of Material Placed Over 50 Years	---	---	---	---	---	---	---	89.3	Mcy
10	Average Interval Between Material Placements (3)	---	---	---	---	---	---	---	(2)	
11	Duration of Placement Operations, per 50 years	926	1,538	528	2,043	566	1,416	7,017	5,868	days
12	Average Daily Flow at Site During Placement, million gallons per day	---	---	---	---	---	---	---		

--- indicates this value not estimated

(1) this element not estimated by ICT, included in Sum of Channel & Shoreline to Site

(2) ICT is not explicit. GBA estimates based on Corps statements of dredging intervals of 1.1, 2.3 and 10 years varying with reach

**Table B-12, Estimate of DREDGING Characteristics,
Confined Upland Sites - PHYSICAL EFFECTS**

line		Note	ICT Reach 1			ICT Reach 2	
1	Site Number (ICT Segment)		1	2	3	4	5
2	Site St M		557.1	558.9	568.5	575.9	584.0
3	Characteristics of Placement Episode						
4	Average Interval Between Placements, years		2.3	2.3	2.3	2.3	2.3
5	Volume of Material Placed, cy		265,000	275,000	410,000	374,000	338,000
6	Duration of Placement, days		32	35	17	14	13
7	Average Spillway Flow, cfs		14	14	44	44	45
8	Average Spillway Flow, mgd		9	9	28	29	29
9	Duration of Spillway Flow, days		32	35	17	14	13
10	Site Cell Area Covered, acres		51	99	277	292	579
11	50-Year Effects						
12	Total Volume of Material Placed, million cy		5.761	5.978	8.913	8.130	7.348
13	Total Area Covered, acres		68	126	322	338	643

	ICT Values (ICT 2000, pg. 14)			
14	Dredging/ Construction Days		926	1,538
15	Pipeline-mile-days (pmd)		6,483	10,767
16	Land Use		516	980

	GBA Values			
17	Dredging/ Construction Days		1,828	596
18	Pipeline-mile-days (pmd)		31,900	6,417
19	Land Use		516	981

Pipeline miles based on average length of pipelines

**Table B-12, Estimate of DREDGING Characteristics,
Confined Upland Sites - PHYSICAL EFFECTS**

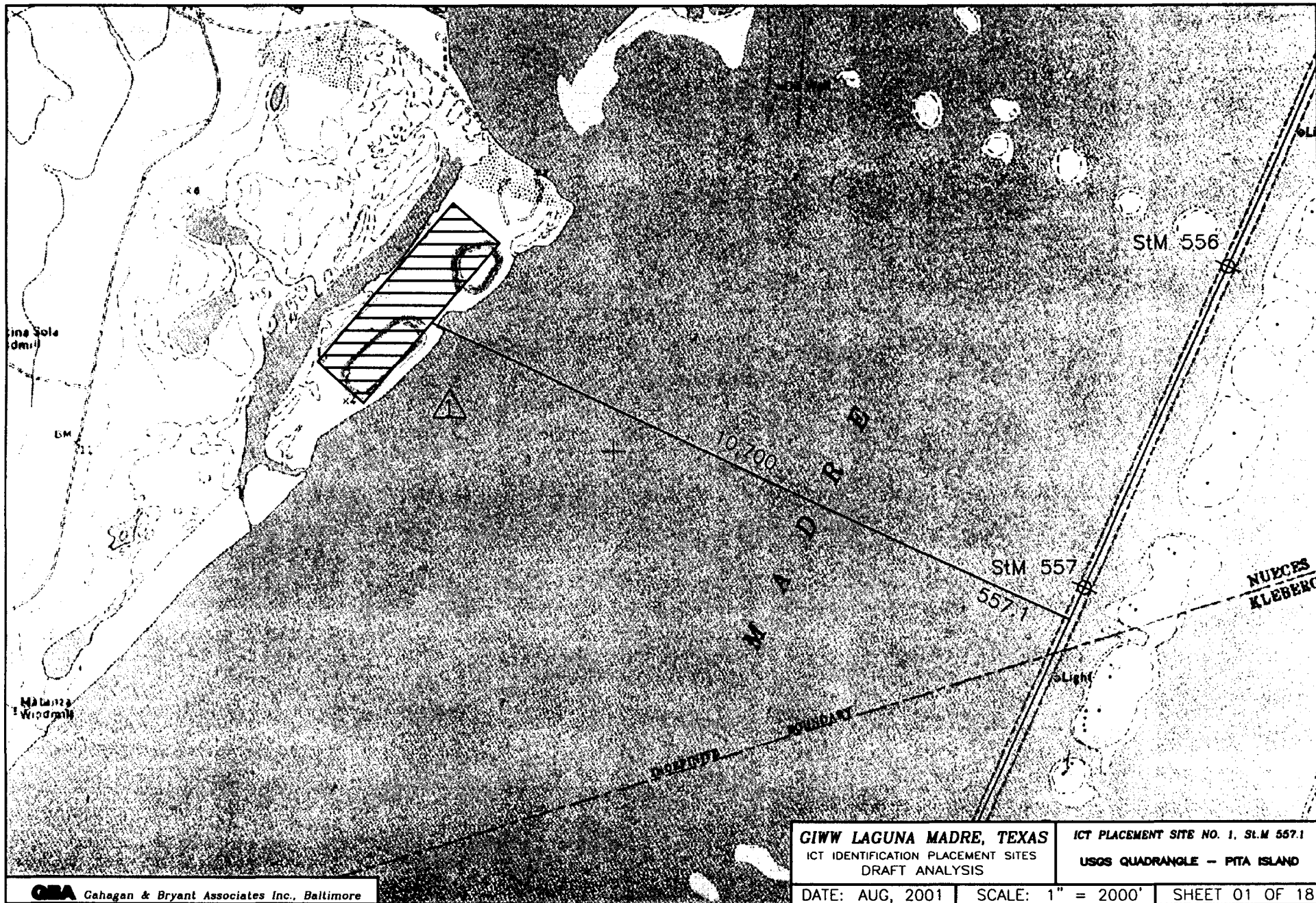
line		Note	ICT Reach 3, Land Cut				ICT Reach 4			
1	Site Number (ICT Segment)		6	7	8	9	10	11	12	13
2	Site St M		589.9	595.1	600.9	606.8	615.3	622.3	626.8	634.9
3	Characteristics of Placement Episode									
4	Average Interval Between Placements, years		10	10	10	10	1.1	1.1	1.1	1.1
5	Volume of Material Placed, cy		56,000	55,000	58,000	72,000	163,000	121,000	132,000	172,000
6	Duration of Placement, days		7	2	2	9	6	5	5	7
7	Average Spillway Flow, cfs		14	45	45	14	44	45	44	44
8	Average Spillway Flow, mgd		9	29	29	9	29	29	29	28
9	Duration of Spillway Flow, days		7	2	2	9	6	5	5	7
10	Site Cell Area Covered, acres		78	360	146	72	292	241	276	151
11	50-Year Effects									
12	Total Volume of Material Placed, million cy		0.280	0.275	0.290	0.360	7.409	5.500	6.000	7.818
13	Total Area Covered, acres		99	411	174	92	338	283	321	180

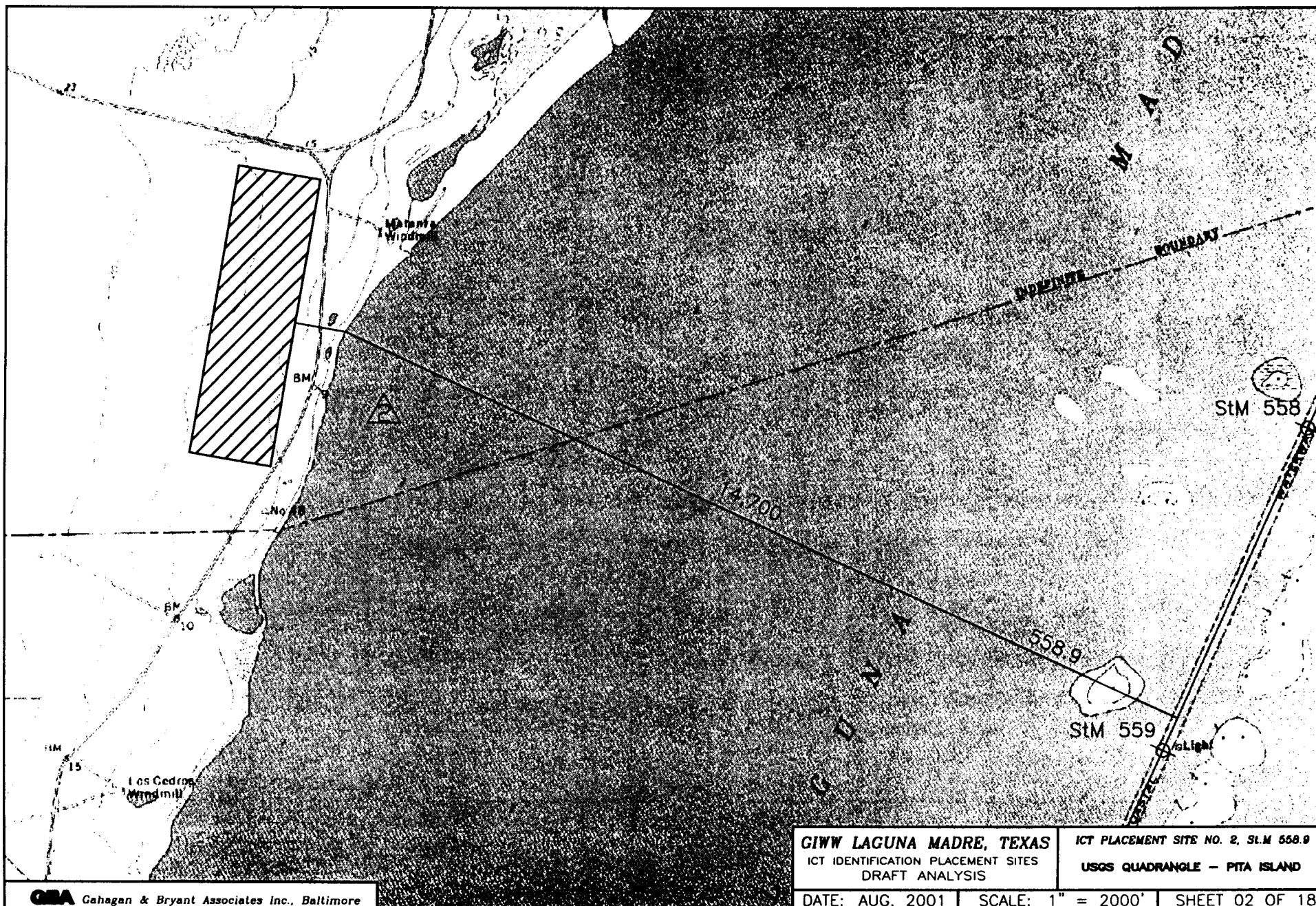
	ICT Values (ICT 2000, pg. 14)			
14	Dredging/ Construction Days		528	2,043
15	Pipeline-mile-days (pmd)		528	14,298
16	Land Use		776	1,123

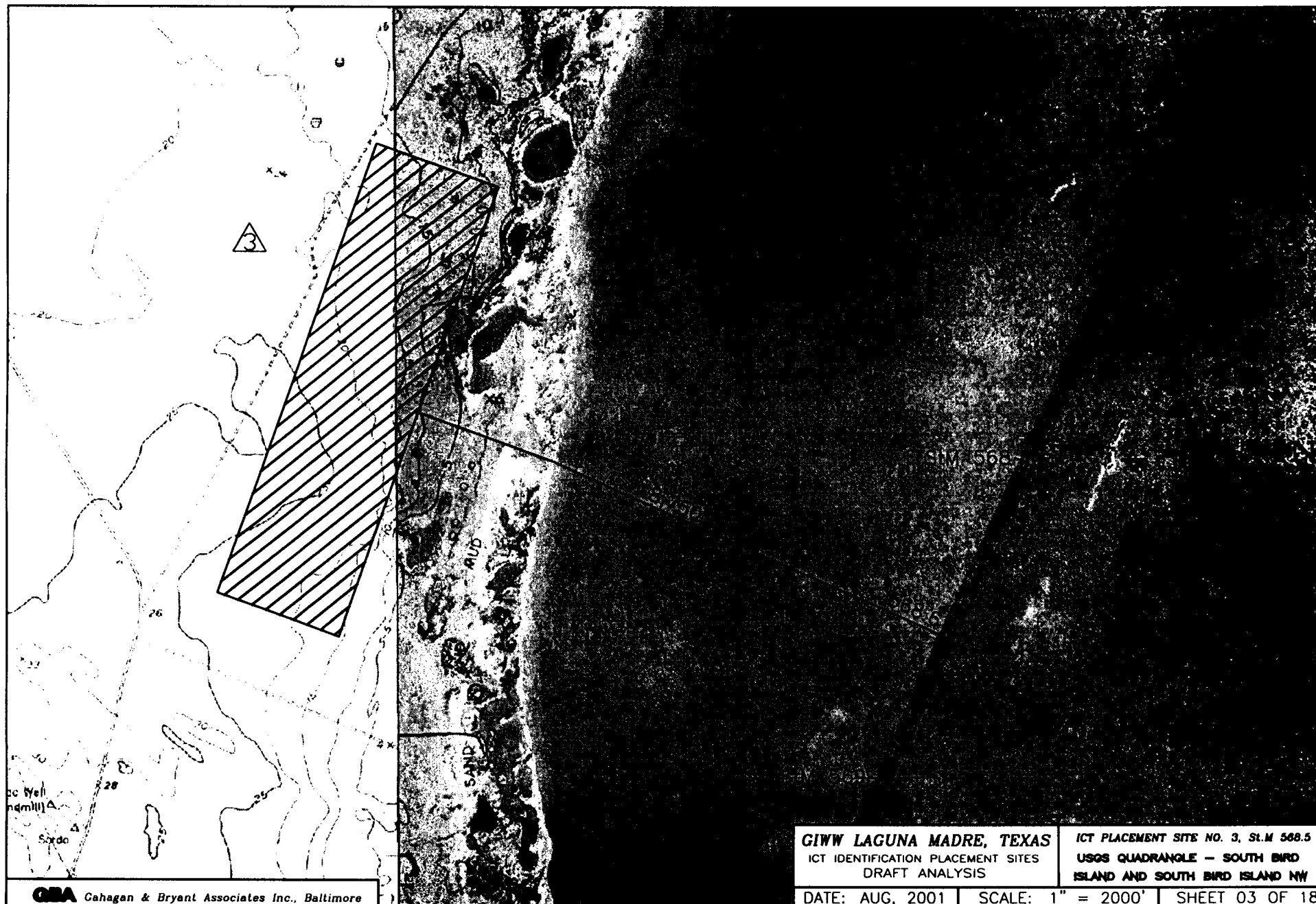
	GBA Values			
17	Dredging/ Construction Days		97	1,048
18	Pipeline-mile-days (pmd)		1,707	24,202
19	Land Use		776	1,122

Pipeline miles based on average length of pipelines

APPENDIX C
Site Location Maps, 18 Sheets





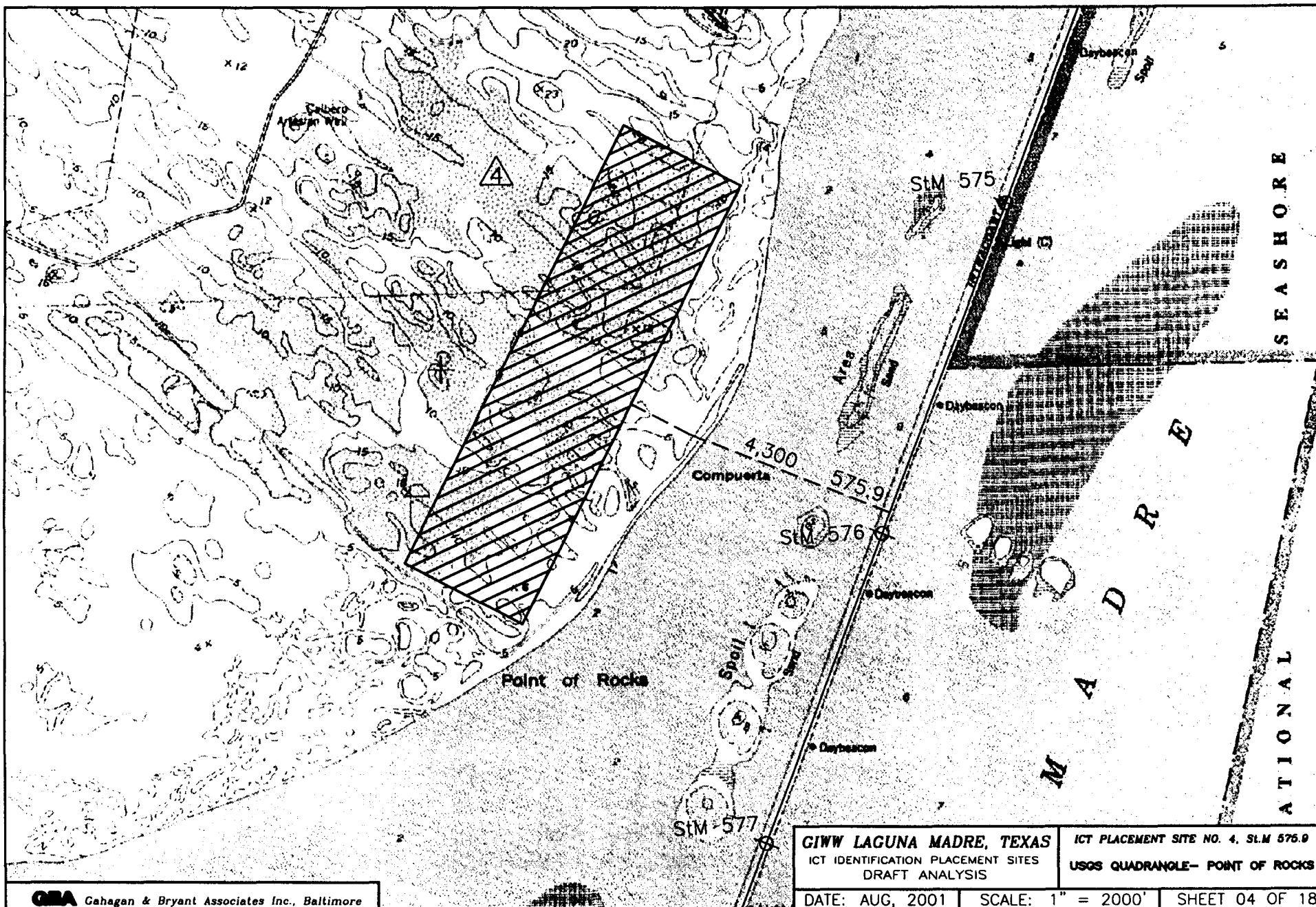


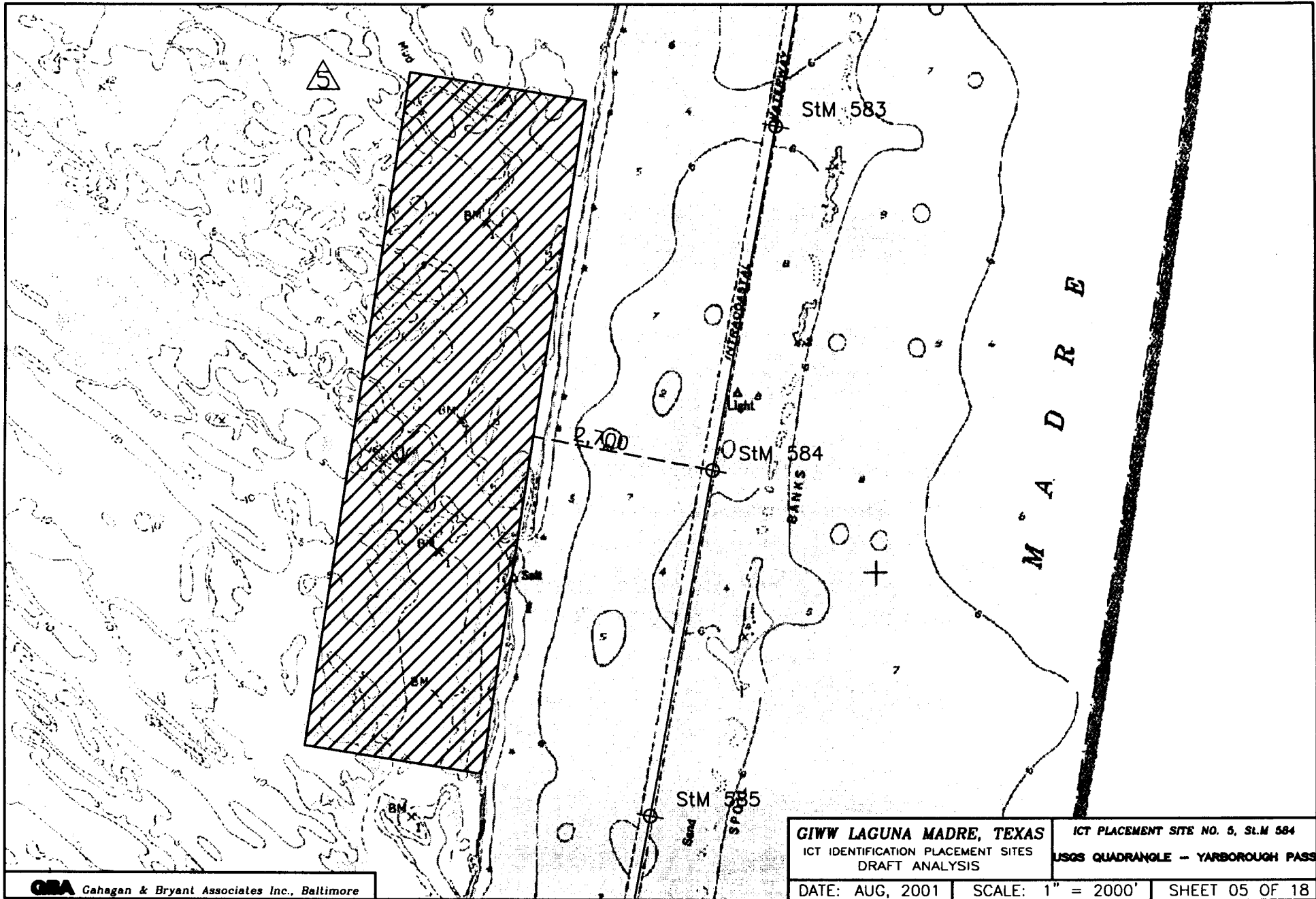
CBA Cahagan & Bryant Associates Inc., Baltimore

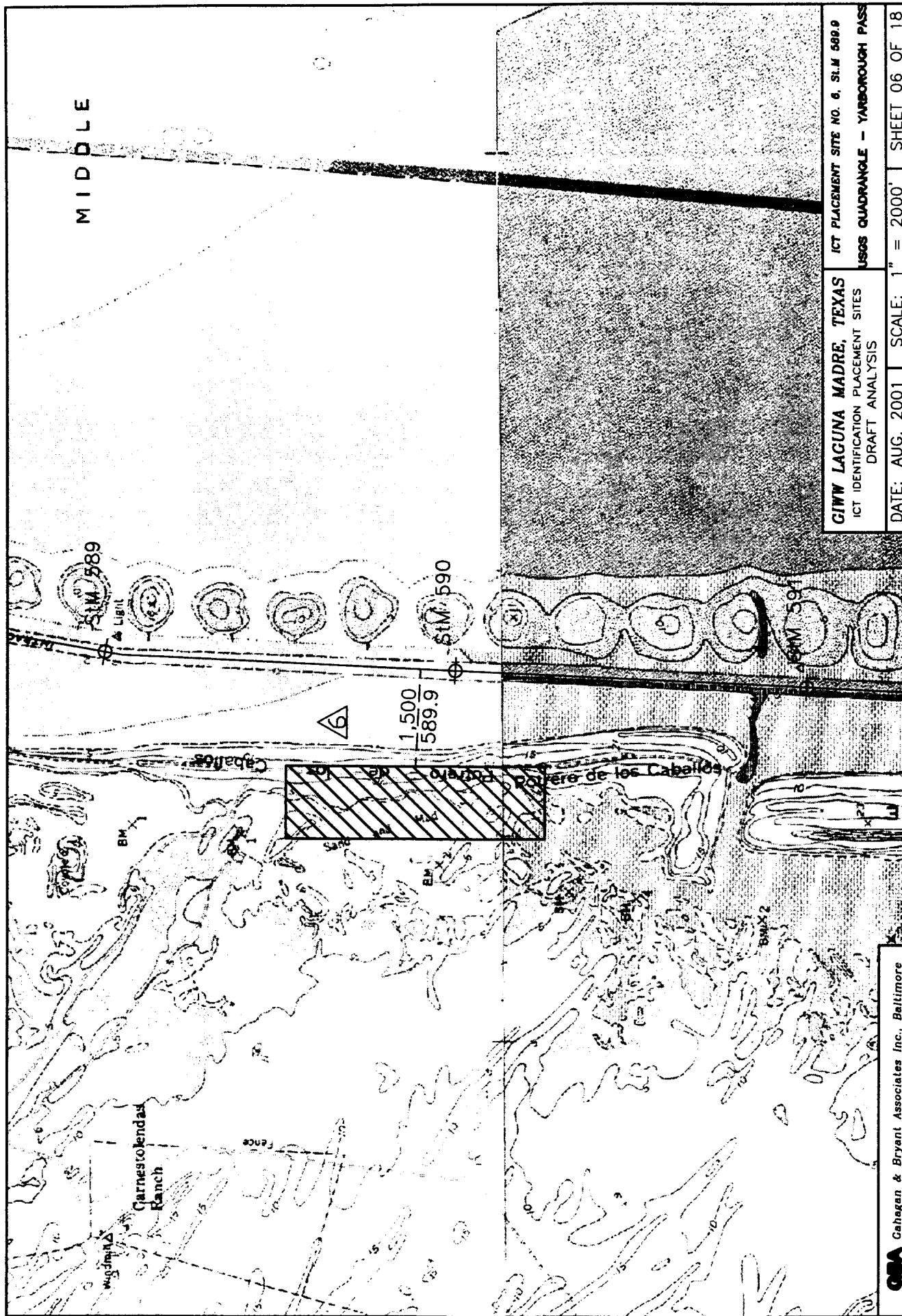
GIWW LAGUNA MADRE, TEXAS
ICT IDENTIFICATION PLACEMENT SITES
DRAFT ANALYSIS

ICT PLACEMENT SITE NO. 3, St.M 568.5
USGS QUADRANGLE - SOUTH BIRD
ISLAND AND SOUTH BIRD ISLAND NW

DATE: AUG, 2001 | SCALE: 1" = 2000' | SHEET 03 OF 18



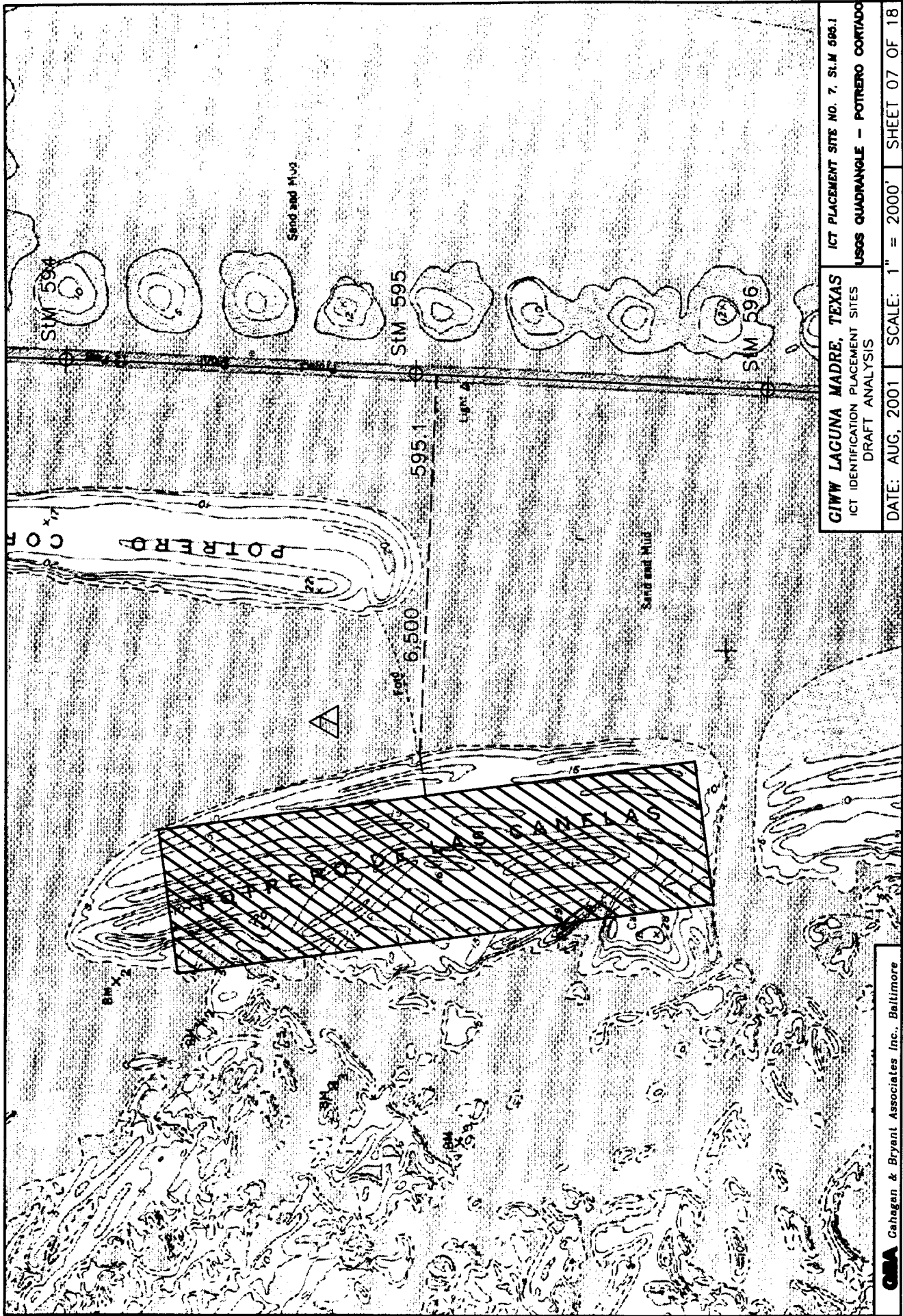




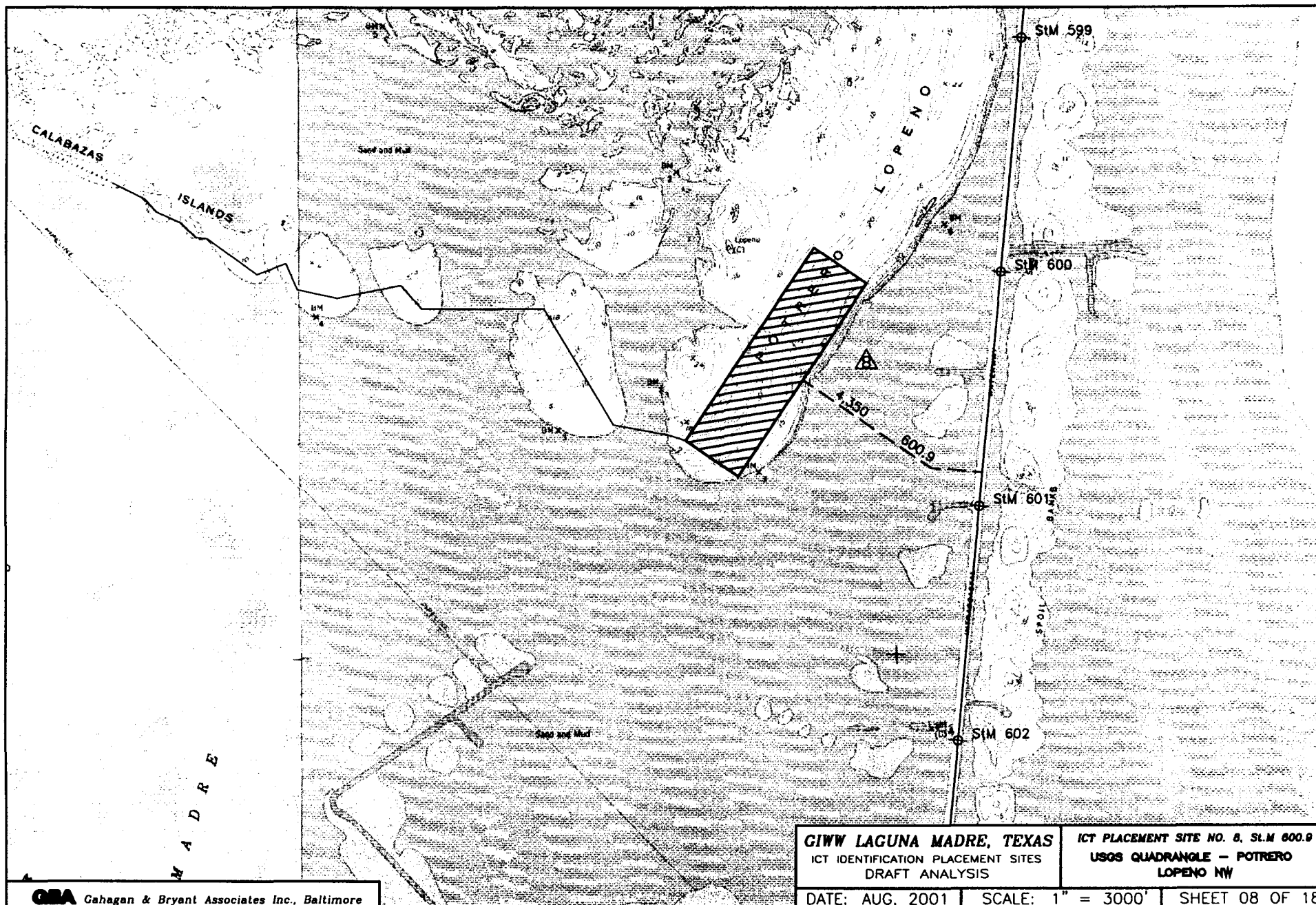
GIWW LAGUNA MADRE, TEXAS
 ICT IDENTIFICATION PLACEMENT SITES
 DRAFT ANALYSIS

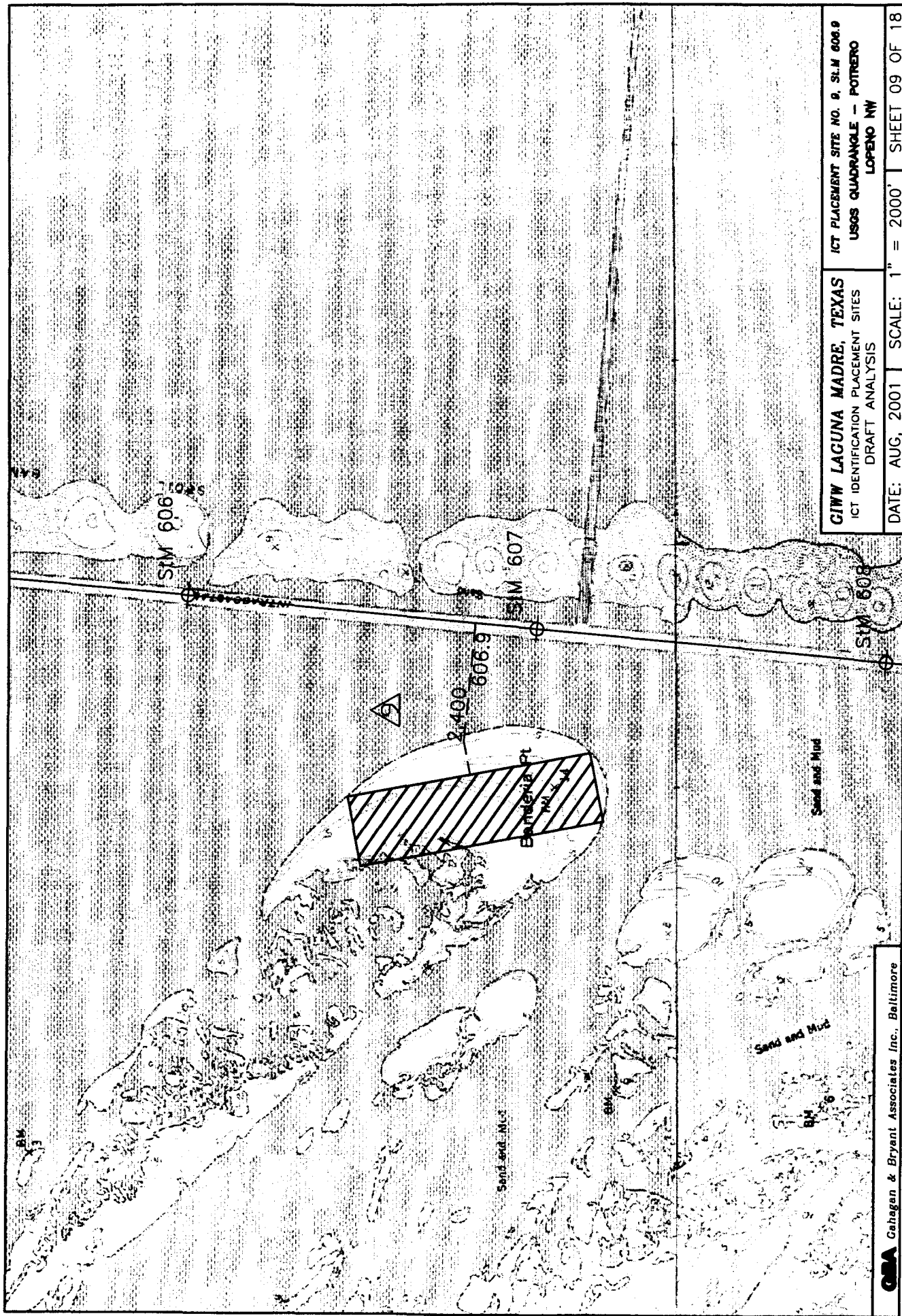
ICT PLACEMENT SITE NO. 6, SLM 589.9
 USGS QUADRANGLE - YARBOROUGH PASS

DATE: AUG, 2001 SCALE: 1" = 2000' SHEET 06 OF 18



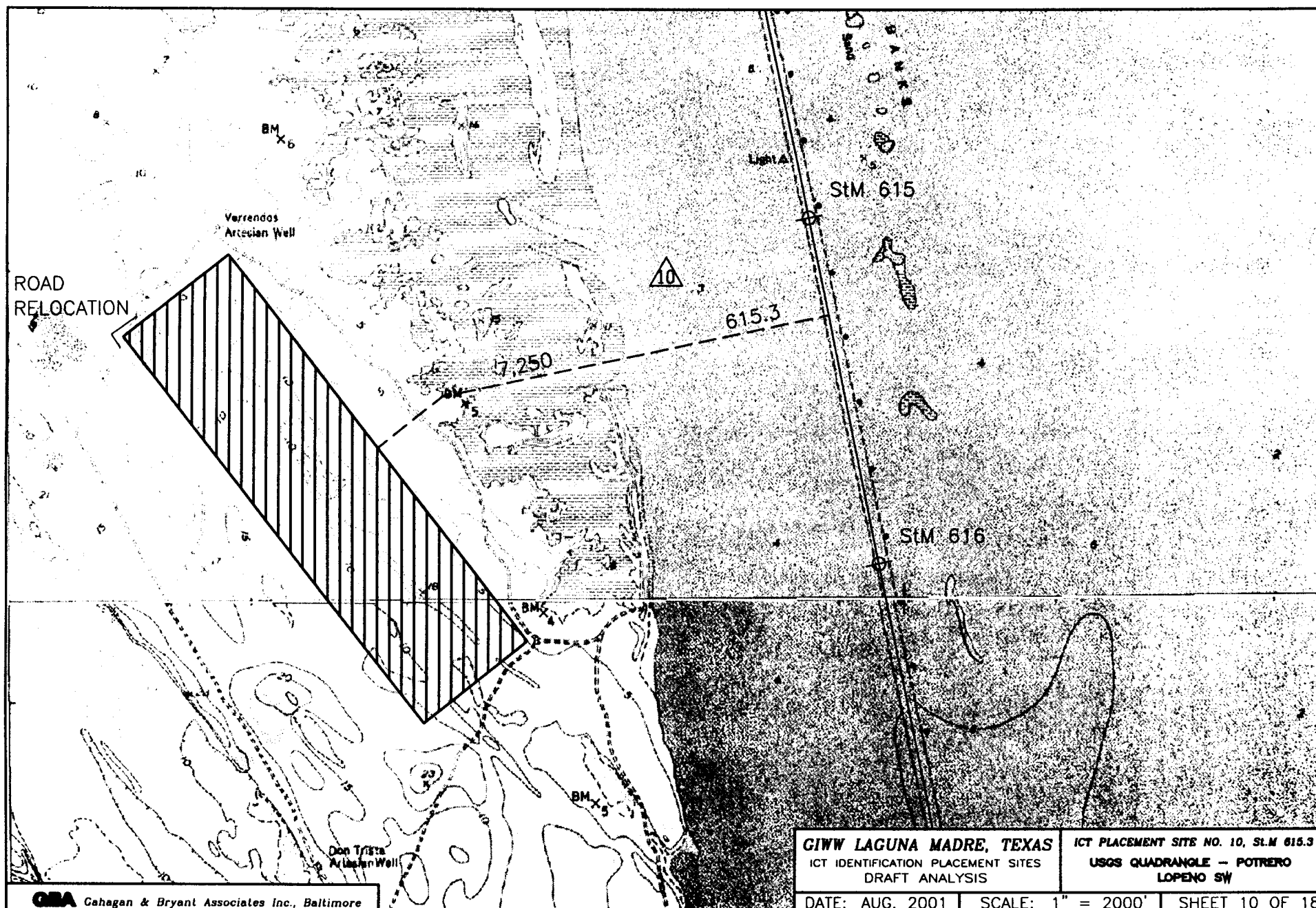
GIWW LAGUNA MADRE, TEXAS
 ICT IDENTIFICATION PLACEMENT SITES
 DRAFT ANALYSIS
 DATE: AUG, 2001
 SCALE: 1" = 2000'
 SHEET 07 OF 18

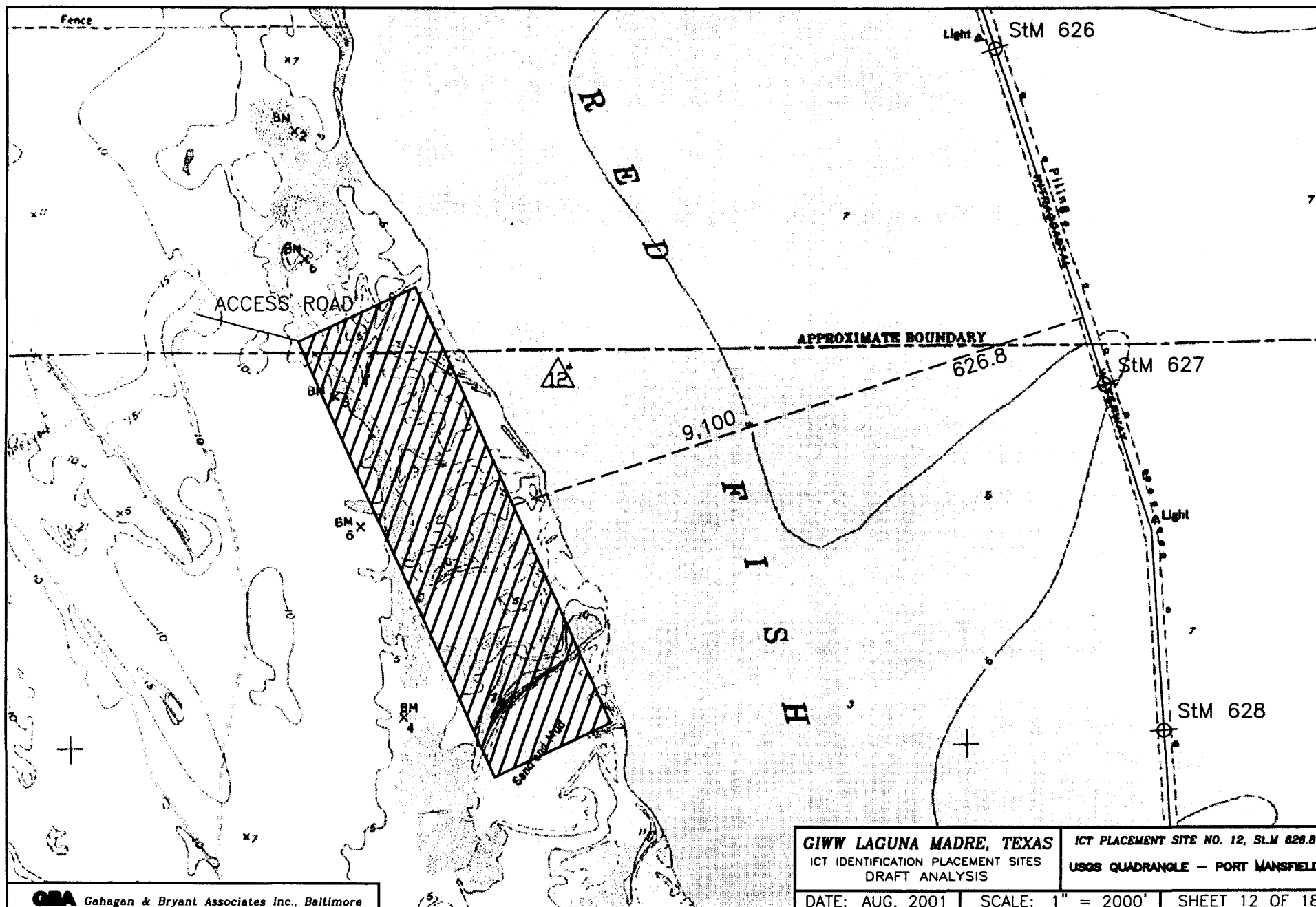




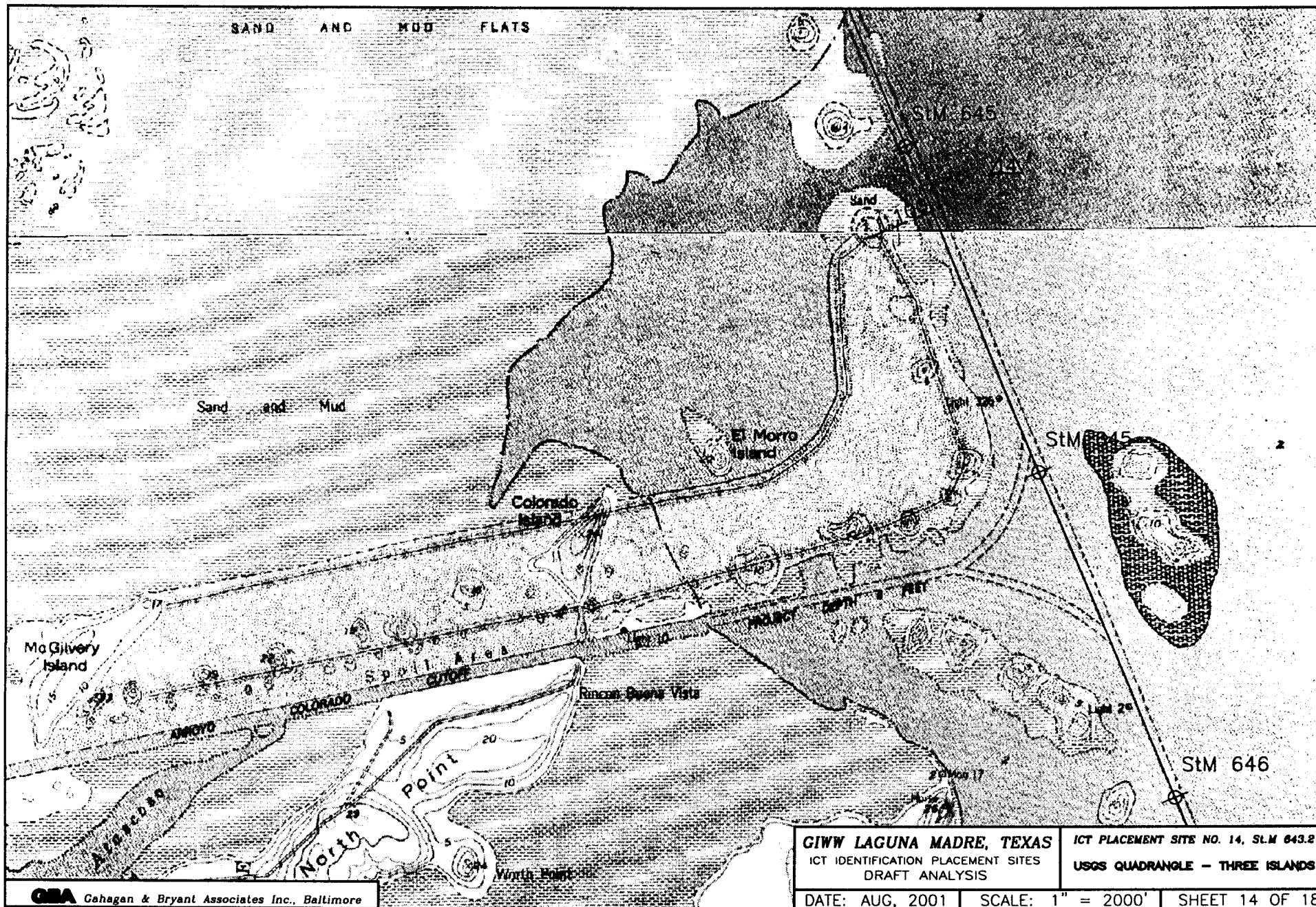
GIWW LAGUNA MADRE, TEXAS ICT IDENTIFICATION PLACEMENT SITES DRAFT ANALYSIS	ICT PLACEMENT SITE NO. 9, SLM 606.9 USGS QUADRANGLE - POTRERO LOPEZO NW
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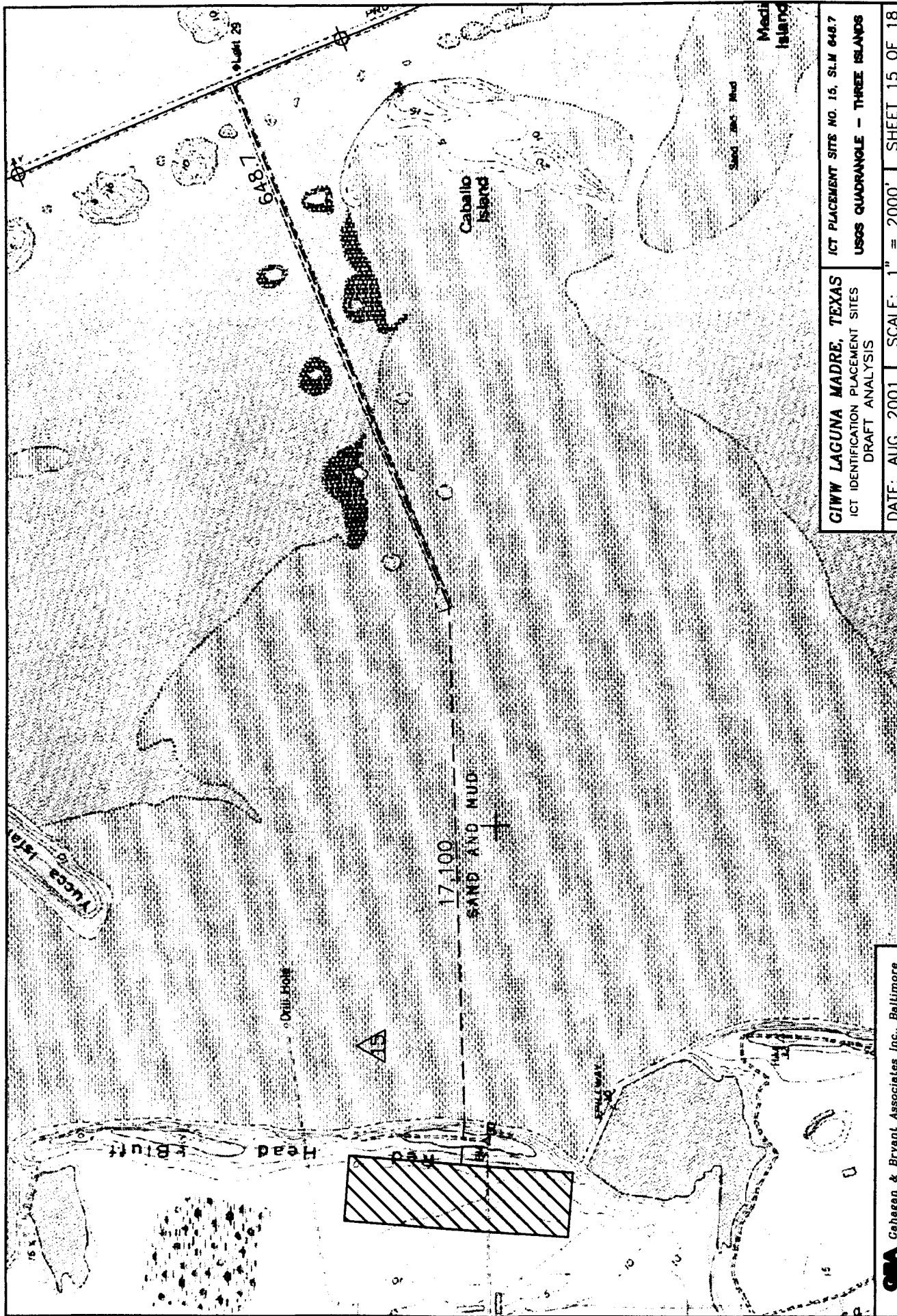
DATE: AUG, 2001 SCALE: 1" = 2000' SHEET 09 OF 18









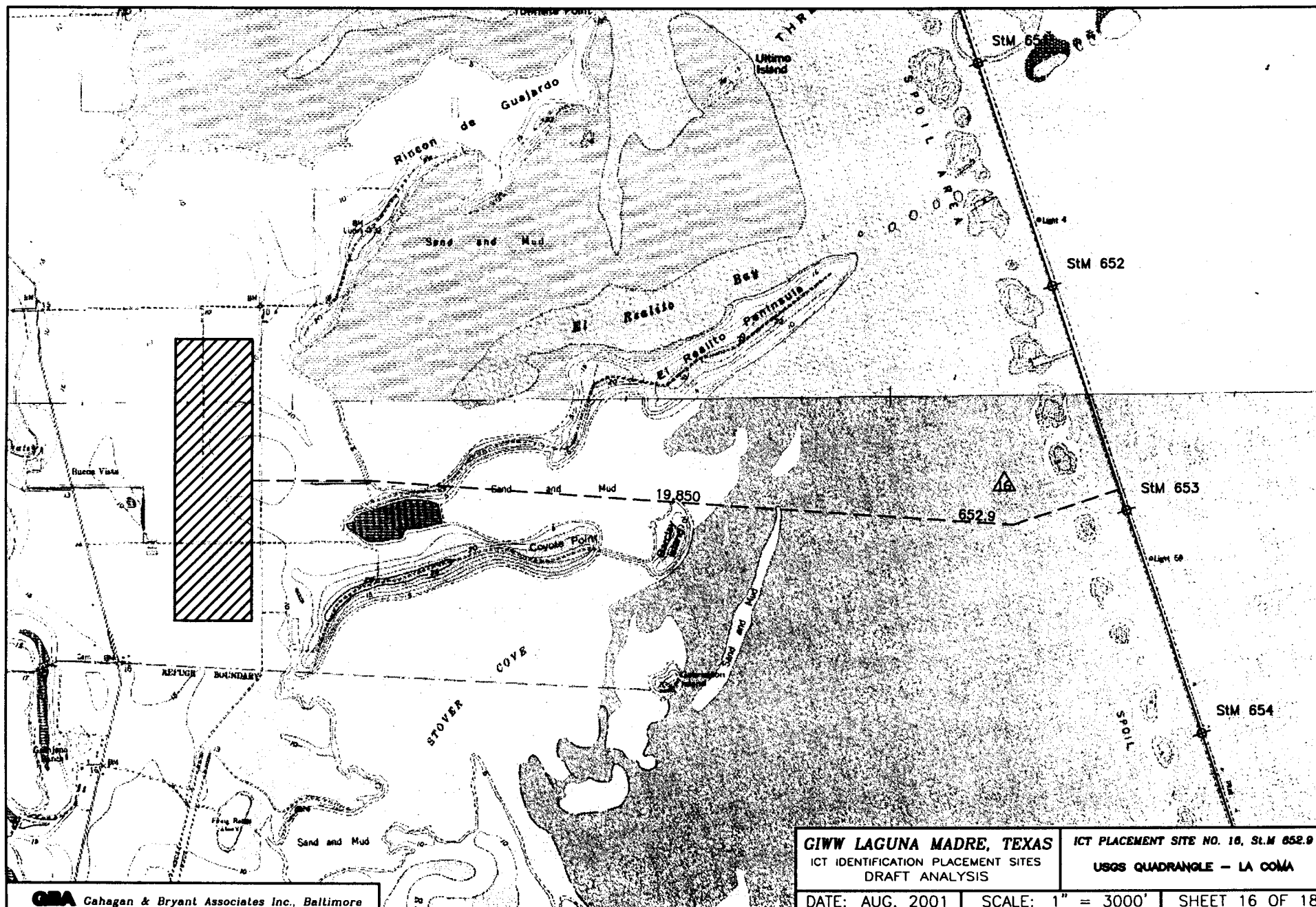


ICT PLACEMENT SITE NO. 15, SLM 648.7
USGS QUADRANGLE - THREE ISLANDS

GIWW LAGUNA MADRE, TEXAS
ICT IDENTIFICATION PLACEMENT SITES
DRAFT ANALYSIS

DATE: AUG, 2001 SCALE: 1" = 2000' SHEET 15 OF 18

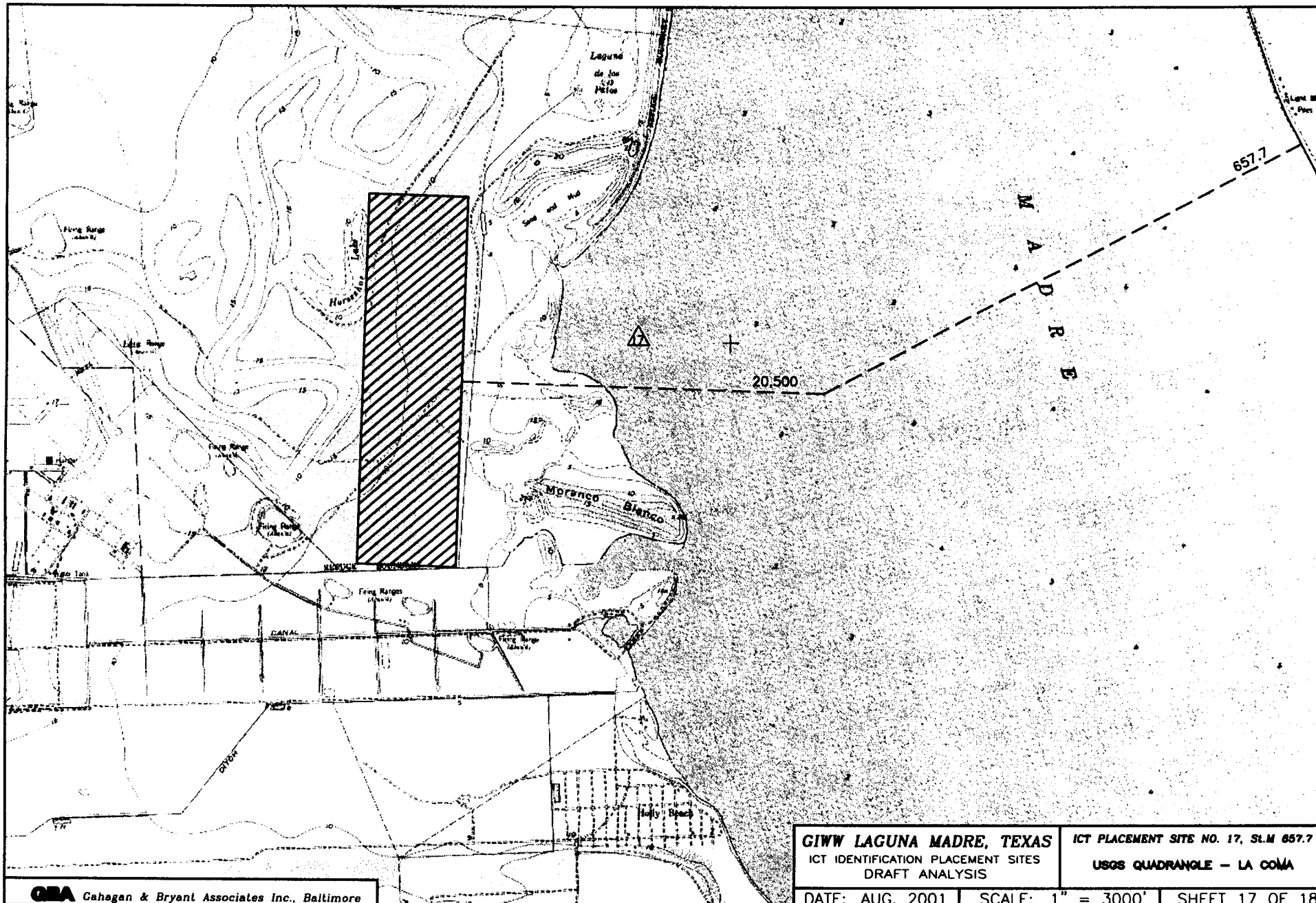
CBA Cahagan & Bryant Associates Inc., Baltimore

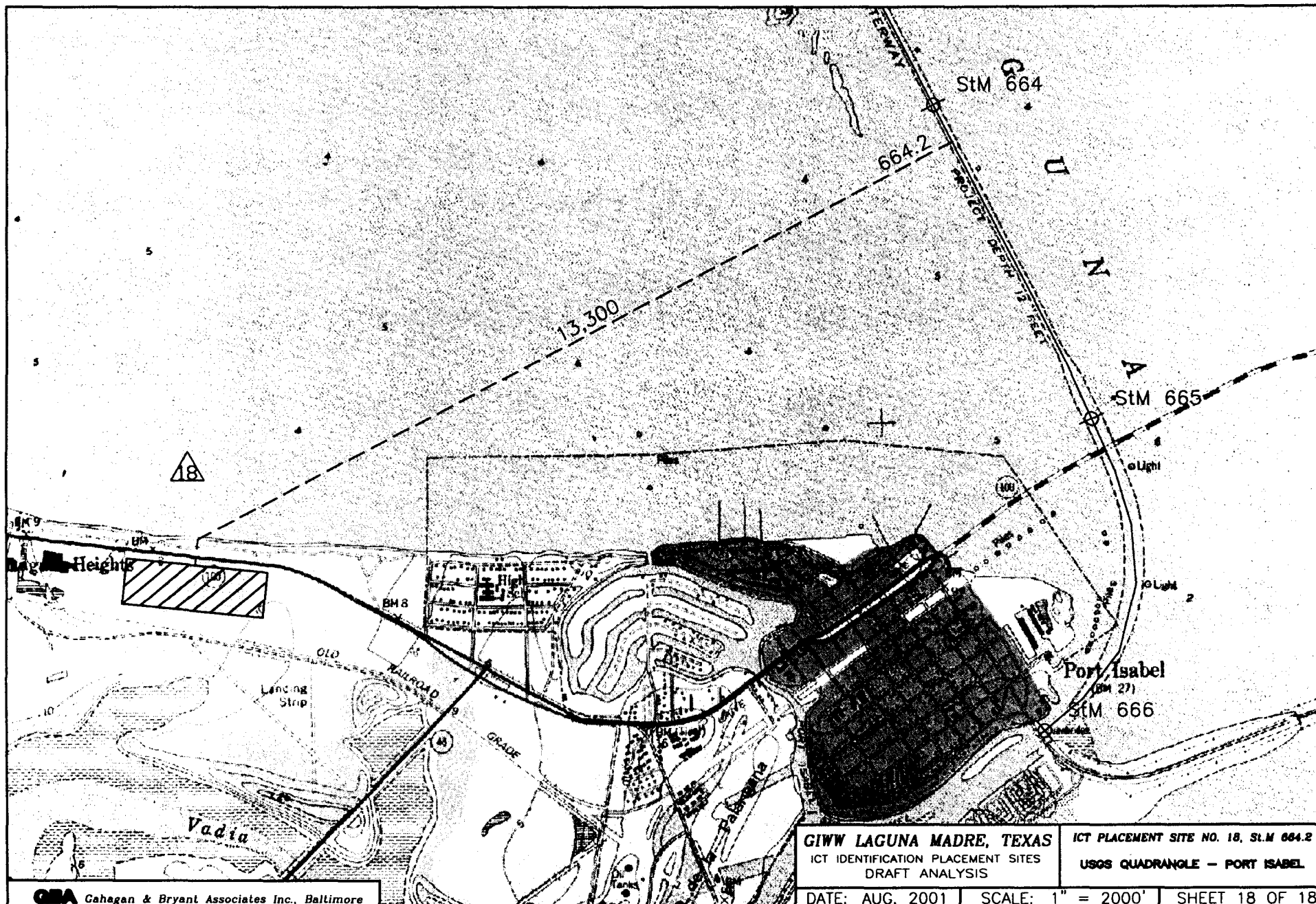


GIWW LAGUNA MADRE, TEXAS
 ICT IDENTIFICATION PLACEMENT SITES
 DRAFT ANALYSIS

ICT PLACEMENT SITE NO. 18, SLM 652.9
 USGS QUADRANGLE - LA COMA

DATE: AUG, 2001 SCALE: 1" = 3000' SHEET 16 OF 18





GIWW LAGUNA MADRE, TEXAS
ICT IDENTIFICATION PLACEMENT SITES
DRAFT ANALYSIS

ICT PLACEMENT SITE NO. 18, St.M 664.2
USGS QUADRANGLE - PORT ISABEL

DATE: AUG, 2001 SCALE: 1" = 2000' SHEET 18 OF 18