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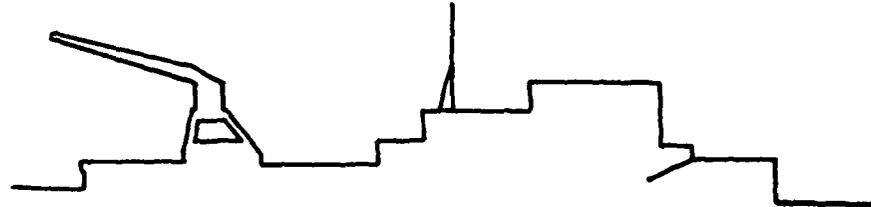
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Project Office
CHESNAVFACENGC

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CHESAPEAKE DIVISION
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WASHINGTON, DC 20374

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Tracor Marine was tasked by Chesapeake Division Naval Engineering Command to perform a dive survey in areas off AUTEC Sites 1 and 2 at Andros Island, Bahamas. The survey was requested by Naval Underwater Systems Command (NUSC), Newport to evaluate the existing bottom conditions at specific Site 1 (Con't)

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and Site 2 locations previously marked by reference buoys. The topographic information was required in order to determine a location for the proposed ocean hauldown facility. Ideally, such a location would be in depths of approximately 40 feet with flat terrain and free of large obstructions.

Information required by NUSC at Site 1 and Site 2 during the dive survey included bottom types, depths, possible platform locations, locations of obstruction, and possible cable routes through the reef line to shore.

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Final Report
AUTEC Ocean Hauldown Dive Survey
Site 1 & Site 2

Submitted to:
NAVAL FACILITIES ENGINEERING
COMMAND

By
TRACOR MARINE, INC.

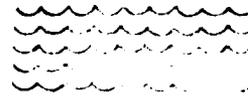
31 August 1983

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Building 200
Washington Navy Yard
Washington, D.C. 20374

Contract Number
N00600-81-D-5270

TRACOR MARINE, INC.
Job Number 723511

31 August 1983

Approved

Edward Clausner
Vice President



DIVE SURVEY FOR OCEAN HAULDOWN

Site 1 & Site 2

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1.0 OVERVIEW

Tracor Marine was tasked by Chesapeake Division Naval Engineering Command to perform a dive survey in areas off AUTECH Sites 1 and 2 at Andros Island, Bahamas. The survey was requested by Naval Underwater Systems Command (NUSC), Newport to evaluate the existing bottom conditions at specific Site 1 and Site 2 locations previously marked by reference buoys. The topographic information was required in order to determine a location for the proposed ocean hauldown facility. Ideally, such a location would be in depths of approximately 40 feet with flat terrain and free of large obstructions.

Information required by NUSC at Site 1 and Site 2 during the dive survey included bottom types, depths, possible platform locations, locations of obstruction, and possible cable routes through the reef line to shore.



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2.0 SURVEY DATE SITE 1

2.1 Scope

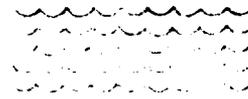
The Site 1 dive survey was conducted at an area outside the shallow reef approximately 0.5 miles north of the Site 1 seabuoy. The area was marked with a surface reference buoy at Latitude $24^{\circ} 43' 43.2403''$ N, Longitude $77^{\circ} 45' 39.9693''$ W. The location of the reference buoy in 40 feet of water was determined from Trisponder information obtained during an earlier bathymetric survey at Site 1 on 7 August, 1983.

The survey was conducted on August 21 and 22 from Zodiac inflatable boats with motors. Three scuba divers were used to perform this survey. Small marker buoys were placed to indicate areas of interest.

A theodolite positioning team from RCA-West Palm Beach was used at the completion of the survey to determine positions of the small marker buoys for future reference. This team used existing control points at Site 1.

The expected position of the reference buoy was confirmed by the theodolite positioning team on August 22 and its position

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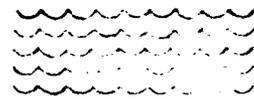


is shown in Figure 2-1. (Reference buoy anchor chain was wrapped around coral head). The survey in the vicinity of the buoy indicated several areas of interest and small marker buoys numbered 3, 7, 2, 1, and 5 were placed to delineate these areas.

Figure 2-2 is a bottom-type chart generated from information gathered during the survey. The bottom directly east or seaward of the reference buoy is characterized by a spur and groove coral formation running east and west for approximately 50 feet. The sand trenches (grooves) have a general depth of 40 feet and the coral spurs have a relief of 4 to 6 feet. The coral spurs diminish seaward to a sand area 75 feet wide which parallels the coral line and sweeps back toward the shoreline. There is no coral in this sand area. The sand is approximately 14" thick over a coral hard ground and the depth is approximately 50 feet. Buoy #7 is located on the east side of this sand area and buoy #3 is located on the western side.

A coral bottom is again present for approximately 20 feet from buoy #7 seaward, with the normal 4 to 6 foot relief. The depth of water in this area is 55 feet.

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Buoys #1 and 2 mark an area of sand of approximately 40 feet in length and at a water depth of 65 feet.

Further seaward, the sand fades into a coral bottom with a slight rise at the 65 foot depth and then falls off to approximately 80 feet with a fairly gentle slope.

Continuing seaward, the slope becomes more pronounced and the bottom drops to 110 feet. Here the slope becomes fairly steep 45° and drops to 145 feet. At this point, the bottom slope is much more pronounced and drops on off to the floor at TOTO (Approximately 80° slope).

Buoy # 5 marks an outcropping which was teeming with fish and may be an outflow of water from an underground source.

Buoys #10 and 11 were placed in a shallow reef cut to define a possible cable route to shore which is shown as a dashed line on Figure 2-1. They are located in approximately 10 feet of water with coral and sand bottom. The relief is approximately 2-3 feet and clear of obstructions to shore.

Figure 2-3 gives lat/long of all buoys placed at site one plus buoy depth and bottom description.

1 x x 2
3 x x 7
△ REFERENCE
x 5 BUOY

W 77° 46' 30"

N 24° 43' 30"
W 77° 45' 30"

SEA BUC
NO. 2

N 24° 43' 00"

ANDROS
ISLAND

SITE 1 MARKER BUOY LOCATION - 22 AUGUST 9-3

FIG. 1-2

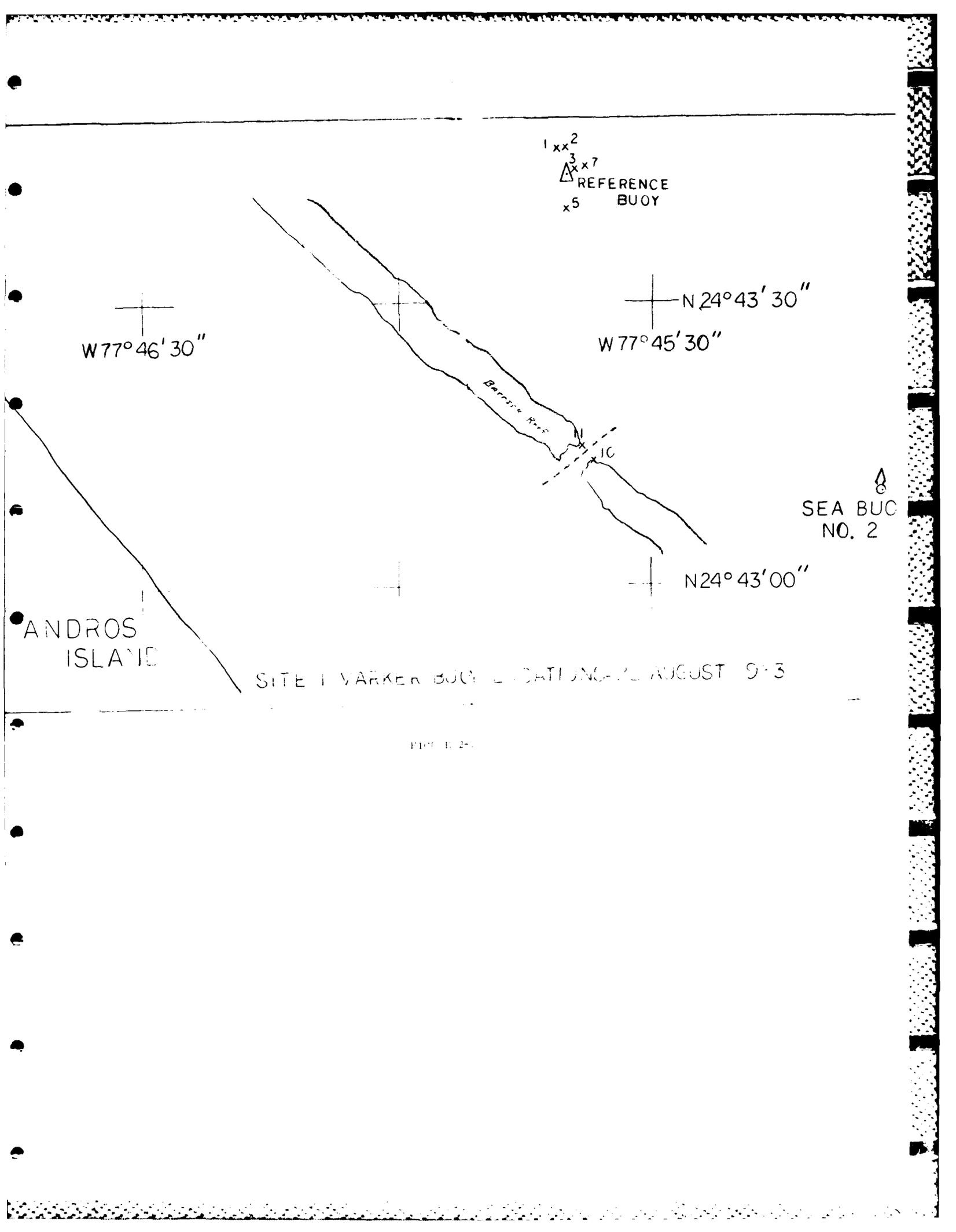
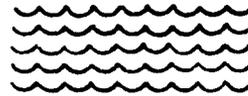


Figure 2-3 LATITUDE AND LONGITUDE OF SITE 1 BUOYS

SITE # 1

BUOY	DEPTH	DESCRIPTION	LAT.	LONG.	REMARKS
3	50'	50' North-Western Edge of Sand	24° 43' 43.2933"	77° 45' 38.8736	Good Area of Sand
7	55'	East Side of Sand Split	24° 43' 43.8615"	77° 45' 37.5888"	Good Area of Sand
Ref.	40'	Positioned After Previous Survey	24° 43' 43.2403"	77° 45' 39.9693"	Good Area of Sand
2	35'	Sand Patch North East Corner	24° 43' 45.7675"	77° 45' 40.0988"	Buoys Placed on Coral Adj. to Sand
1	25'	Sand Patch South East Corner	24° 43' 45.6554"	77° 45' 40.8005"	Buoys Placed on Coral Adj. to Sand
5	50'	Center of Outcropping	24° 43' 39.4386"	77° 45' 39.9763	Possible Underground Water Source
11	10'	North End of Reef Cut	24° 43' 14.1491"	77° 45' 38.0937"	Cable Route to Shore
10	10'	South End at Reef Cut	24° 43' 13.0235"	77° 45' 36.5662"	Cable Route to Shore

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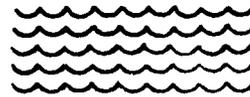
3.0 SURVEY DATE SITE 2

3.1 Scope

The Site 2 survey was conducted in an area approximately $\frac{1}{2}$ mile south of the Site 2 sea buoy. The general area was marked with a surface reference buoy at Latitude $24^{\circ} 29' 24.2049$ N, Longitude $77^{\circ} 41' 53.0062$ W as shown in Figure 3-1. The location of the reference buoy was determined from Trisponder information obtained during a bathymetric survey of the Site 2 area on 8 August, 1983.

The survey was conducted from 23 to 25 August, 1983, using Zodiac inflatable boats with motors. Four scuba divers were used to perform this survey with a Nikonos underwater camera for photo documentation. During the survey, buoys were dropped to mark obstructions and identify the area. Buoys were also anchored to mark the locations of the proposed cable route from the hauldown area through a small cut in the barrier reef to the beach at Site 2. (See Figure 3-2).

At the completion of the survey, a theodolite positioning team from RCA-West Palm Beach, positioned all marker buoys to

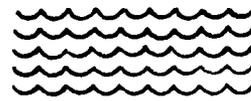


determine their latitude and longitude. Three theodolites were used on a 3 mile base line, Figure 3-1.

3.2 Results

The first dive made at Site 2 was made at the reference buoy. This inspection dive was to survey the general area and to pinpoint what regions might be suitable for the ocean haul-down platform or barge. The 9 August 1983 deep water bathymetric survey had determined a depth of 38 feet at the reference buoy. Diver measurements at the location concluded that the actual depth was 53 feet and determined that the 38 feet reading resulted from the extreme coral relief at this location. The coral heads were tightly spaced, pinnacle shaped buttresses rising as much as 20 feet off the bottom. Diver observations indicate that this bottom type characterized a large area (100 yard radius of the reference buoy) between depths of 40 to 60 feet. The unusual coral growth covered 90 percent of the bottom with the heads separated by narrow meandering sand channels. For at least 150 yards south of the reference buoy, similar rocky heads were observed. However,

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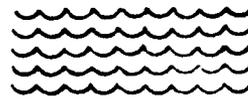


50 yards to the north and north east, sand terraces were found. These sand terraces occurred between water depths of 65 and 90 ft. and were most common at 70 ft. Boundaries of the largest and most suitable sand terrace was marked with buoys as shown in Figure 3-2.

The general profile (Figure 3-3) of the surveyed area from west to east consists of a hard coral rock plateau with small heads from the barrier reef to 100 yards west of the reference buoy. The depth of the plateau before the drop off to the deep reef is 25 feet. The deep reef begins after the drop at 45 to 50 feet and continues gradually to 70 feet where the sand terraces begin. The terraces extend from 70 to 90 ft. to the rock ridge or sill. The ridge has a slight rise of coral rock before the start of the 45° slope which extends to 140 feet. At the 140 foot level, the escarpment begins with a very sharp drop off 80° .

Coral types and biotope data may be obtained from the Technical Notes TN 7113-80, NEAR SHORE ECOLOGICAL MONITORING AT AUTECH SITES, U.S. Naval Oceanographic Office, NSTL Station, Bay St. Louis, MS 39522. In general, our survey confirmed the findings of the NSTL Reports.

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Upon completion of the deep water survey, a tentative cable route was surveyed. A small cut in the barrier reef was found and is noted on the Site 2 marked buoy locations shown in Figure 3-2. This is the shortest possible route from the reference buoy area to Site 2. The reef cut was located during an aerial survey using the Autec Helicopter and subsequently confirmed by diver observation.

Figure 3-4 gives latitude and longitude of all buoys placed at Site 2 including reference buoy. This chart presents water depth and a description of the bottom at each buoy location.

ANDROS ISLAND

W77°43'00"

SITE 2

x 21

x 22

x 23

x 24

x 25

x 26

x 27

x 28

x 29

x 30

x 31

x 32

x 33

x 34

N24° 29' 30"

N

CUT BARRIER REEF

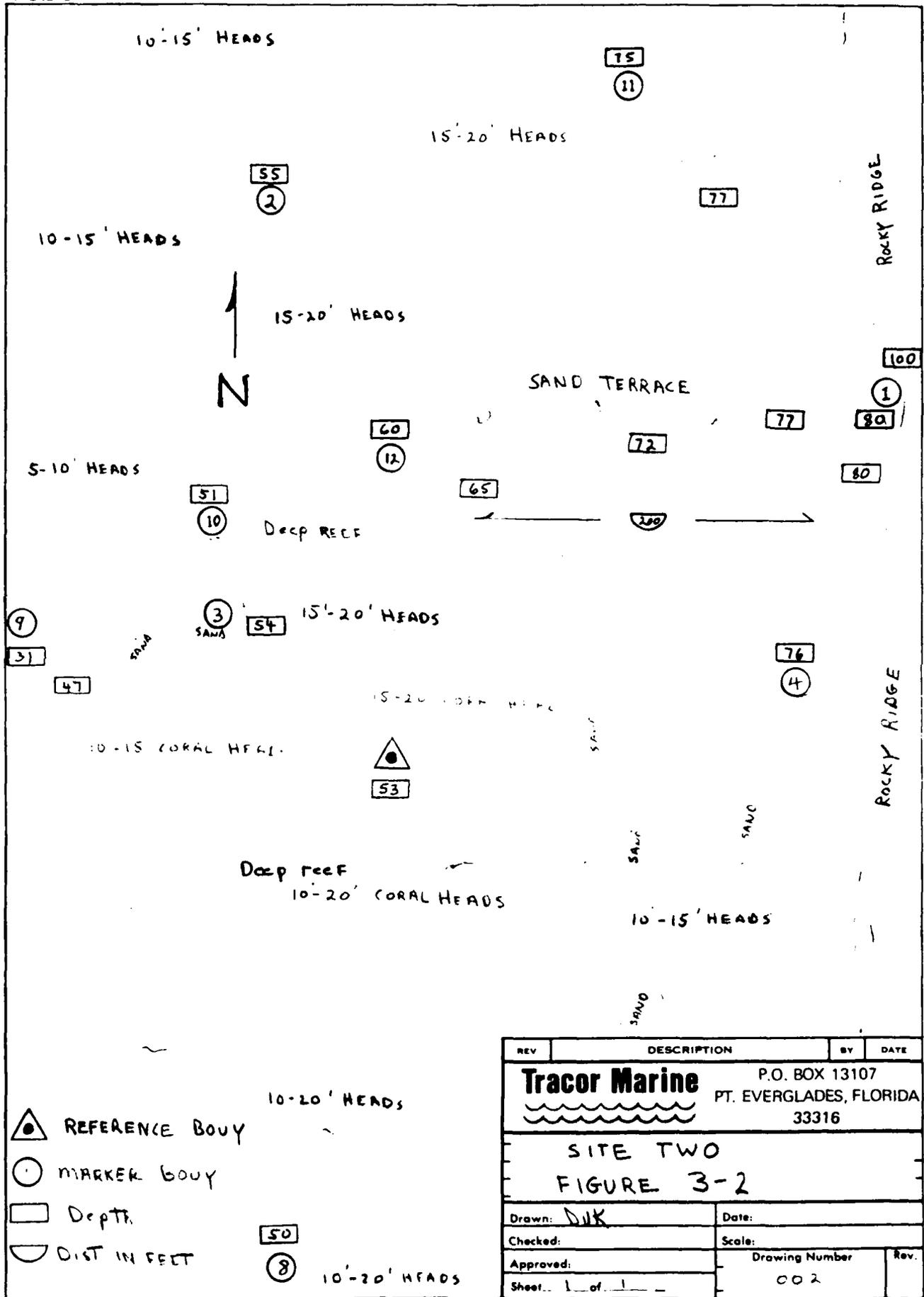
W77°42'00"

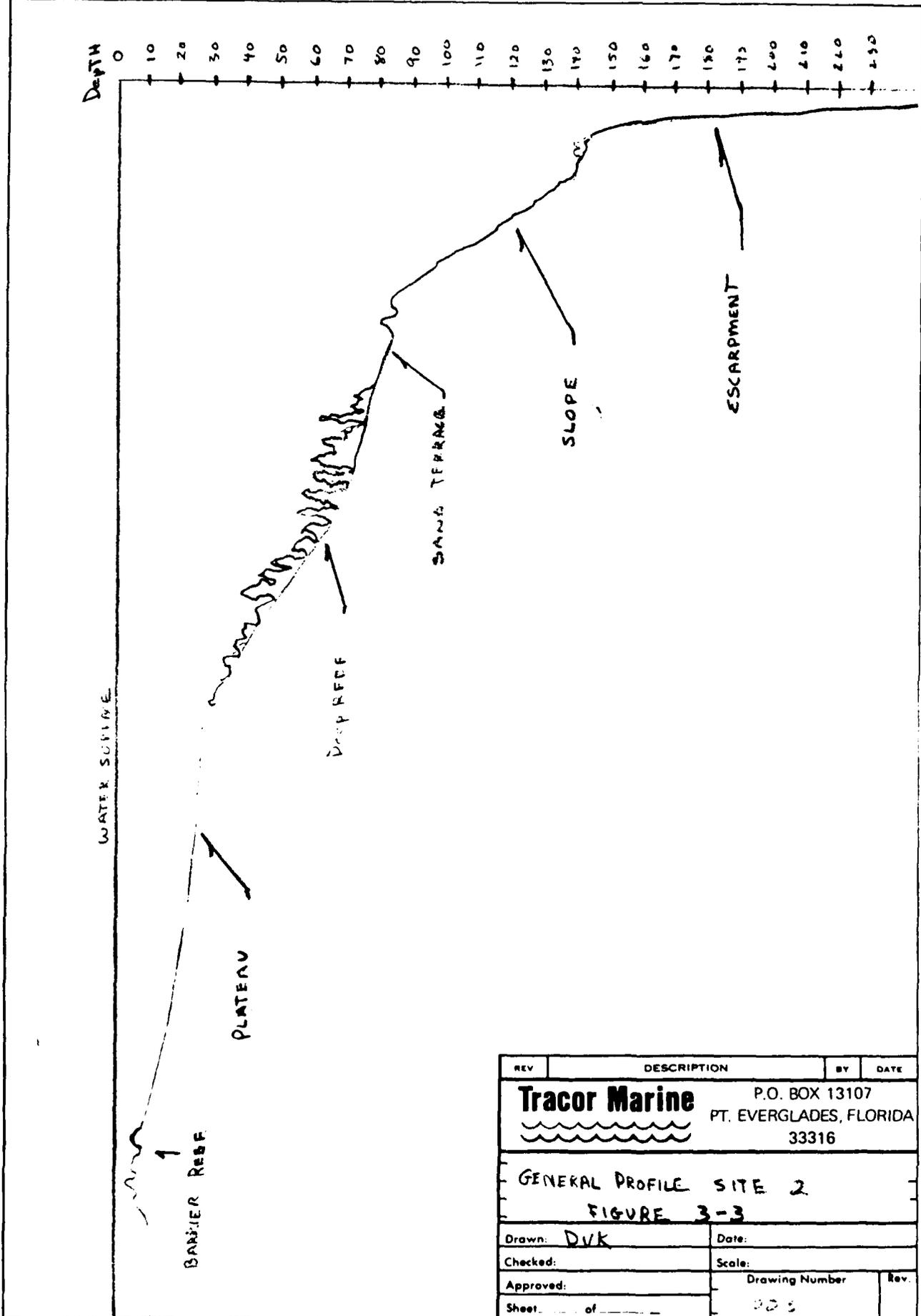
N24° 30' 00"

SEA BUOY NO. 2

02 11
10 12 x 01
03 Δ REFERENCE BUOY
04
05

SITE 2 MARKER BUOY LOCATIONS - 15 AUGUST 1957

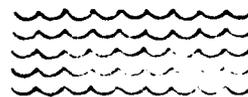




REV	DESCRIPTION	BY	DATE
Tracor Marine 		P.O. BOX 13107 PT. EVERGLADES, FLORIDA 33316	
GENERAL PROFILE SITE 2 FIGURE 3-3			
Drawn: DVK		Date:	
Checked:		Scale:	
Approved:		Drawing Number	Rev.
Sheet: _____ of _____		005	

SITE # 1

BUOY	DEPTH	DESCRIPTION	LAT.	LONG.	REMARKS
Ref.	53'	Reference Buoy	24° 29' 24.2049	77° 41' 53.0062	Coral Head Area 15'-20' Heads
08	50'	Southern Edge of Survey	24° 29' 21.4852	77° 41' 53.9332	Coral Head Area 15'20' Heads
04	76'	Southern Edge of Sand Terrace	24° 29' 25.1053	77° 41' 51.4300	Sand 12" Deep
01	80'	Eastern Edge of Sand Terrace	24° 29' 26.9216	77° 41' 51.0754	Start of Rocky Ridge Drop Off
11	75'	North Edge of Sand Terrace	24° 29' 28.0099	77° 41' 52.3022	Edge Coral Head 10'-15' Heads
02	55'	North West Edge of Survey	24° 29' 27.6589	77° 41' 54.7335	Coral 10'-15' Heads
12	60'	Western Edge of Sand Terrace	24° 29' 26.5619	77° 41' 53.3505	Edge of Coral Head 10'-15' Heads
03	54'	Center Sand Patch	24° 29' 25.5343	77° 41' 54.7574	Patch 20' x 30' Edge 10'-20' Heads
10	51'	Deep Reef	24° 29' 26.0192	77° 41' 54.8186	10' - 20' Heads
09	31'	Slope From Plateau	24° 29' 25.5063	77° 41' 56.1718	20° Slope Small Heads
31	12'	South West Corner B. Reef Cut	24° 29' 28.1890	77° 42' 10.5769	1'-2' Small Coral Heads
30	9'	Flats Coral Patch	24° 29' 30.9904	77° 42' 15.3889	1'-2' Small Coral Heads
29	11'	Grass Flats	24° 29' 32.6166	77° 42' 19.1649	Grass, Sand
28	11'	Grass Flats	24° 29' 34.6985	77° 42' 23.7950	Grass, Sand
27	10'	Flats	24° 29' 36.0448	77° 42' 27.8235	Grass, Sand
26	11'	Flats	24° 29' 37.5203	77° 42' 31.9558	Grass, Sand
25	12'	Flats	24° 29' 39.4516	77° 42' 36.0293	Grass, Sand
24	12'	Flats	24° 29' 40.8326	77° 42' 39.9934	Grass, Sand
23	10'	Flats	24° 29' 42.6959	77° 42' 44.6336	Grass, Sand
22	10'	Flats	24° 29' 44.2053	77° 42' 48.8276	Grass, Sand
21	8'	Flats	24° 29' 46.8991	77° 42' 54.8739	Grass, Sand
34	15'	Plateau	24° 29' 26.5460	77° 42' 00.1883	Small Coral 2'-3' Heads
33	14'	Plateau	24° 29' 27.4447	77° 42' 05.0156	Small Coral 2'-3' Heads
17	8'	North East Corner B. Reef Cut	24° 29' 29.1001	77° 42' 07.0954	North Edge of Coral Patch
14	8'	South East Corner B. Reef Cut	24° 29' 28.0467	77° 42' 07.4819	South Edge of Coral Patch
06	10'	North West Corner B. Reef Cut	24° 29' 28.7091	77° 42' 10.2995	North Edge of Coral Patch



4.0 CONCLUSION

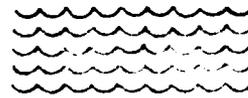
Site 1

The bottom conditions around the reference buoy at Site 1 were very typical. The deep reef was made up of scattered heads with a maximum relief of 4-6 ft. Sand trenches (grooves) running east and west between the coral spurs diminished seaward where the sand terraces begin. The first photograph in the photograph section (page 1) shows the sand grooves. They are also shown on page 4. The sand terraces shown in photographs on page 1 and page 3 were large and extended from approximately 40 ft. to 65 ft. where the rocky ridge begins. Coral spurs (rises between grooves) are shown in numerous photographs pages, 1, 2, 3, 4. Page 6 gives a good view on the rocky ridge where the slope to 140 ft. level begins. No major obstructions were found during the dive survey at Site 1.

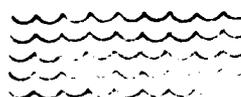
Site 2

Bottom conditions around the reference buoy at Site 2 were not typical. The reference buoy anchor clump, shown in photograph one, page 7, is wedged in coral heads approximately 10 ft. off the bottom. The deep reef consisted of very large pinnacle shape buttresses extending from the plateau drop off 45' to

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approximately 70 ft. of water. These large heads are shown in photographs on pages 7, 8, 9 and 10. The sand terraces, pages 11 and 12 were in deep water 70 ft. to 90 ft and only one large terrace was found. The rocky ridge, page 13, was similar to the ridge at Site 1, however, the coral heads were larger. From the reference buoy directly in line with the Site 2 dock, a small reef cut was found and marked with buoys. Pages 15 and 16 show the bottom condition i.. this area.



5.0 PERSONNEL

Site 1

- o Dennis V. Kembro - Project Manager/Dive Master
- o Len Gordon - Project Engineer/Diver
- o Richard Counter - Diver

Site 2

- o Dennis V. Kembro - Project Manager/Dive Master
- o Len Gordon - Project Engineer/Diver
- o Richard Counter - Diver
- o Rob Munier - Diver (Program Manager)

6.0 GENERAL LOG

Sunday, August 21st

- 1300 - Arrived West Palm Beach
- 1500 - Arrived AUTECH
- 1530 - Arrived Buoy
- 1600 - Assembled equipment and filled tanks
- 1700 - Chow
- 1800 - Secured for day

Monday, August 22nd

- 0600 - Load dive gear and filling tanks.
- 0830 - Commenced dive survey Site 1
Diving at buoy and marking obstructions.
- 1500 - Began position fixes on buoys.
- 1745 - Arrived at dock. Survey complete
- 1830 - Secure for day.

Tuesday, August 23rd

- 0530 - Chow
- 0700 - Departed Site 1 for Site 2

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Tuesday, August 23rd (cont'd)

- 0500 - Off load equipment.
- 0630 - Arrived at Site 2 in boat.
- 0700 - Diving at buoy and marking obstructions.
- 1330 - Chow
- 1400 - Marking obstructions and taking photographs
- 1830 - Secured for day

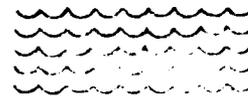
Wednesday, August 24th

- 0530 - Chow
- 0745 - Arrived at Site 2
- 0800 - Loaded dive gear
- 0830 - Continued survey of Site 2.
- 1000 - Started setting buoys to shore
- 1830 - Secured for day

Thursday, August 25th

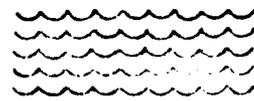
- 0530 - Chow
- 0730 - Departed Site 1 for Site 2
- 0830 - Arrived Site 2
- 1000 - Began position fixes on buoys
- 1330 - Completed positioning.
- 1400 - Chow
- 1730 - Back at Site 1. Secured for day.

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Friday, August 26th

- 0700 - Chow
- 0800 - Unloaded equipment at Site 1
- 0900 - Started packing equipment for shipment
to West Palm Beach.
- 1100 - Chow
- 1400 - Departed AUTECH
- 1500 - Arrived West Palm Beach



7.0 DIVE EQUIPMENT AND MATERIAL

Since the maximum depth was approximately 100 feet, scuba equipment was used for this survey.

Equipment List, Site 1

- 10 scuba tanks
- 2-12' Zodiacs with motors
- Site 1's 16 foot RAR boat with motor
- 30 concrete blocks (anchors)
- 1200' $\frac{1}{4}$ " poly line
- 50 lobster floats
- U/W measuring tape
- Nikonos II 35mm underwater camera, 200ASA, normal lens
- Mako scuba compressor
- Divers personnel gear.

Equipment List, Site 2

- 10 scuba tanks
- 2-12' Zodiacs with motors
- Site 1's 20' Zodiac with motor
- 25 concrete blocks (anchors)
- 800' $\frac{1}{4}$ " poly line
- 30 lobster floats
- U/W measuring tape
- Nikonos II 35 mm underwater camera, 200ASA, normal lens
- Mako scuba compressor
- Divers personnel gear

NEAR BUOY 7 SS
SITE 1

TOP OF LARGE HILL 30'
NE OF REF BUOY
SITE 1

NEAR BUOY 5
SITE 1

SAND TERRACE EAST OF
BUOY 1
SITE 1



Bug 5 30' SITE 1
MURRAY APPROX 6' LONG

NEAR LARGE HILL
SEE FIG 2-2 35' SITE 1

Bug 3 area
SITE 1
35'
SPONGE

NEAR LARGE HILL
30'
SITE 1

4
53

SITE 1 RISE BUOY REF.
NEAR REF BUOY 40'

SITE 1 RISE Looking AT
SAND TERRACE FROM BUOY 3

D 3

RISE POOL 5 30'
SITE 1

EDGE OF SAND TERRACE
NEAR BUOY 3 SITE 1

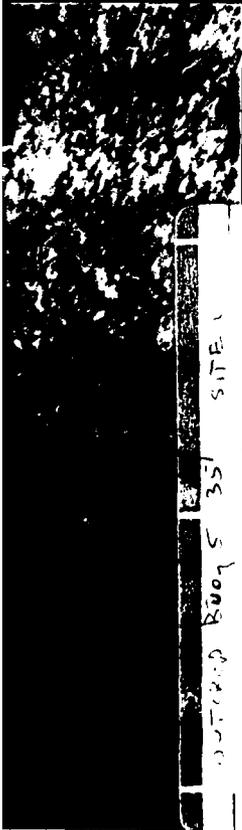
SITE 1 Rocky Ridge 65'
45' Drop off to 140'

Looking at 140' Ledge
Drop off AFTER Ledge SITE 1

ON SAND TERNARY
LOOKING TO BUOY 2

NEAR BUOY 2 ON Rocky Ridge
DIVER AT 70' going down SLOPE 2

7
0



OUTER BuoY 5 35' SITE 1
NURSE SHARK ON BOTTOM 4

AREA BuoY 3 42' SITE 1

AREA NEAR BOOY # 2
Rock Ridge 65 SITE 1

LOOKING EAST BOOY # 1
SAND TERRACE BEHIND CORAL RIDGE
SITE 1

BOOY # 2 LOOKING EAST
SCULPTURE DIVER AT 100' SITE 1

LOOKING UP AT SANDS ON SHOPE
SITE 1

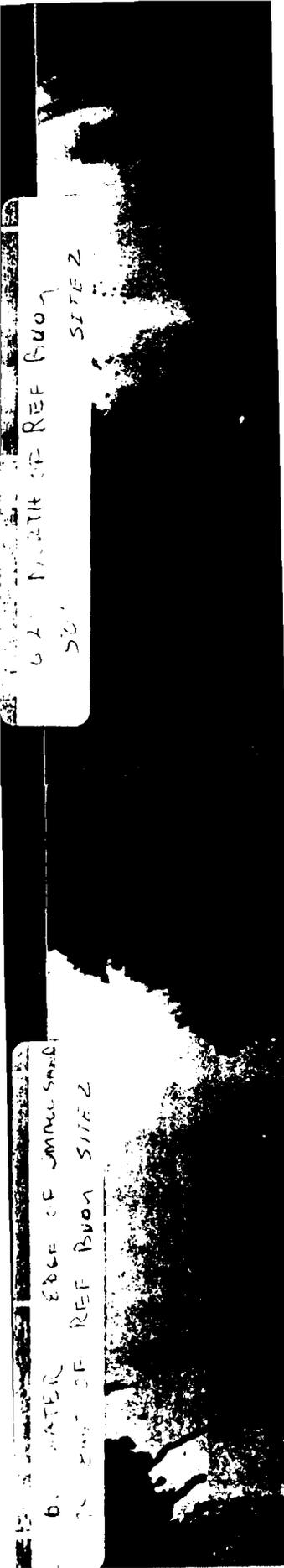


SITE 2 REEF BUOY ANCHOR
Anchor 1' DE BOTTOM 53'

SITE 2 REEF BUOY CHAIN

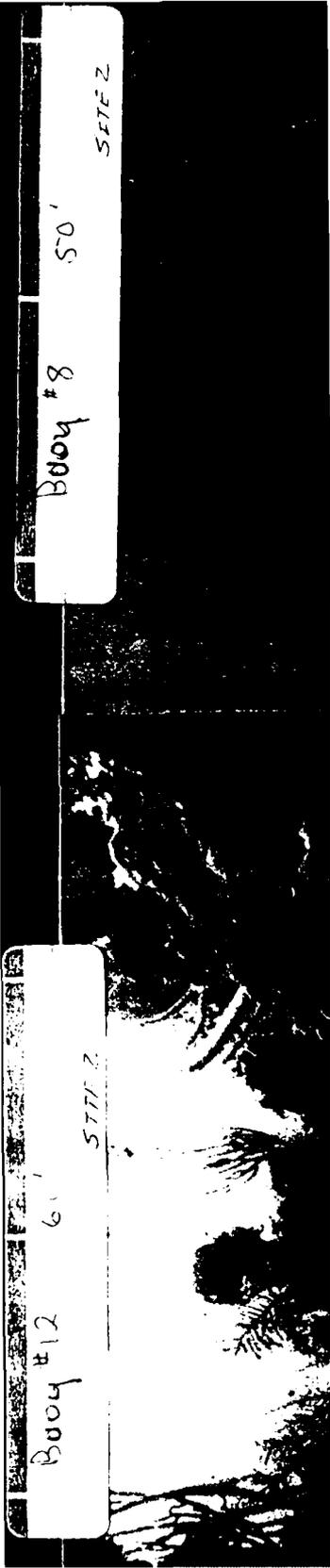
SITE 2 NEAR REEF BUOY
53' DE BOTTOM EAST

SITE 2 Looking South of
REEF BUOY



62' NORTH OF REF BUON
50' SITE 2

6. WATER EDGE OF SAND
50' OF REF BUON SITE 2



Buoy #12 6' STT 2

Buoy #8 5'0' STT 2

12009 B12 LOOKING EAST
TERRACE IN DISTANCE SITE 2

12009 B12
KEY 1007

12009 B12
LOOKING EAST
TERRACE IN DISTANCE SITE 2

12009 B12
KEY 1007

51

Buoy 3 54'
SITE 2

EAST OF BUOY #12 EDGE OF
LARGE SAND TERRACE 65'

EDGE OF SAND TERRACE
Dist. 15'

Buoy 10 51'

F 11

EAST BUOY 12 70' SITE 2
EDGE LARGE SAND TERRACE --

SAND TERRACE LOOKING SITE 2
BUOY # 1 77' --

BUOY # 1 Looking WEST
80' SITE 2

BUOY # 1 77' SITE 2

204

Buoy # 1 SITE 2

SITE 2

Back Ridge Buoy 1 100'
Looking down slope SITE 2

... distance ...

Buoy # 1 SITE 2

EAST OF BUOY # 1 SITE 2
... 100' ...

P

NE of Buoy # 12
SAND TERRACE 65'
SITE 2

Buoy 3 54'
SITE 2

Pintano Buoy # 9
25'
SITE 2

Buoy 4 South
58'

J-

1500.9 32 working site 2

5776 2

center of small cut

Between 31 + 7

5776 2

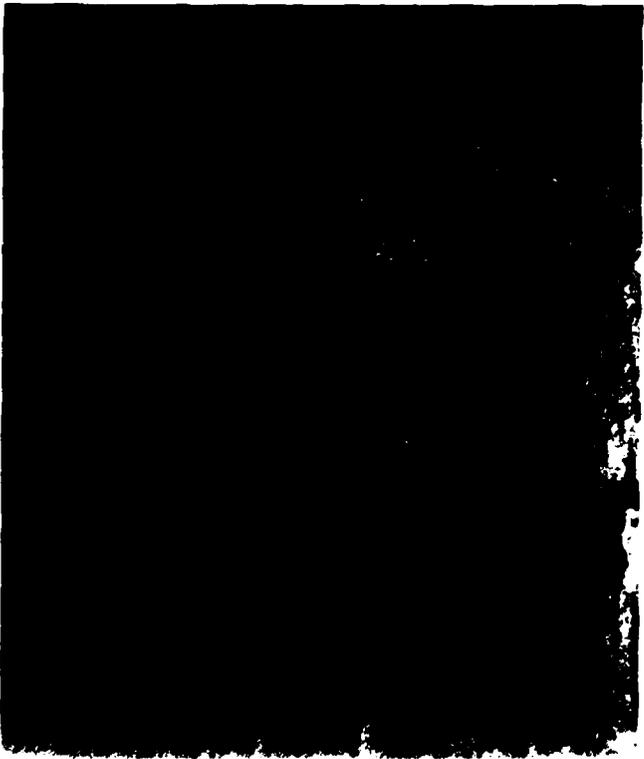
P 15

Buoy 28

5776 2

Buoy 27

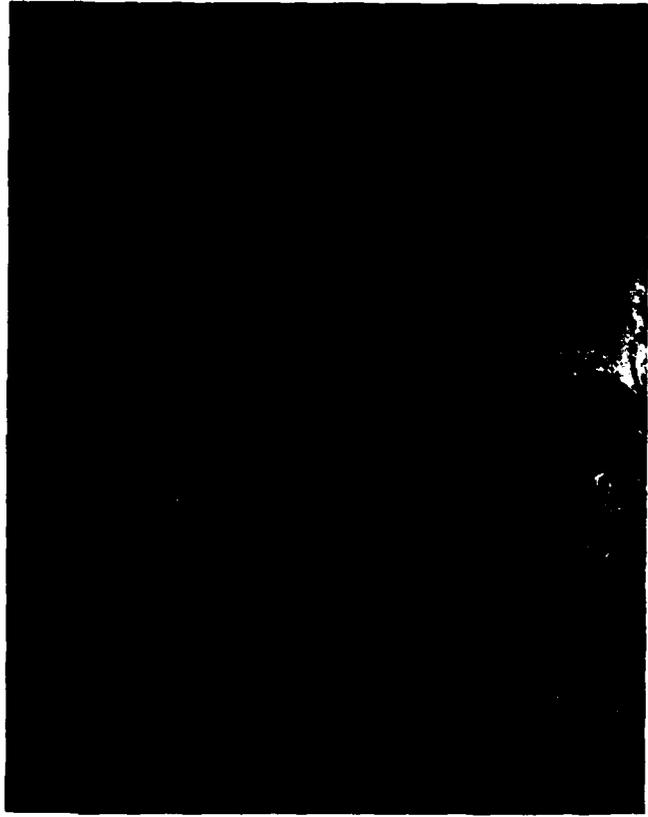
5776 2



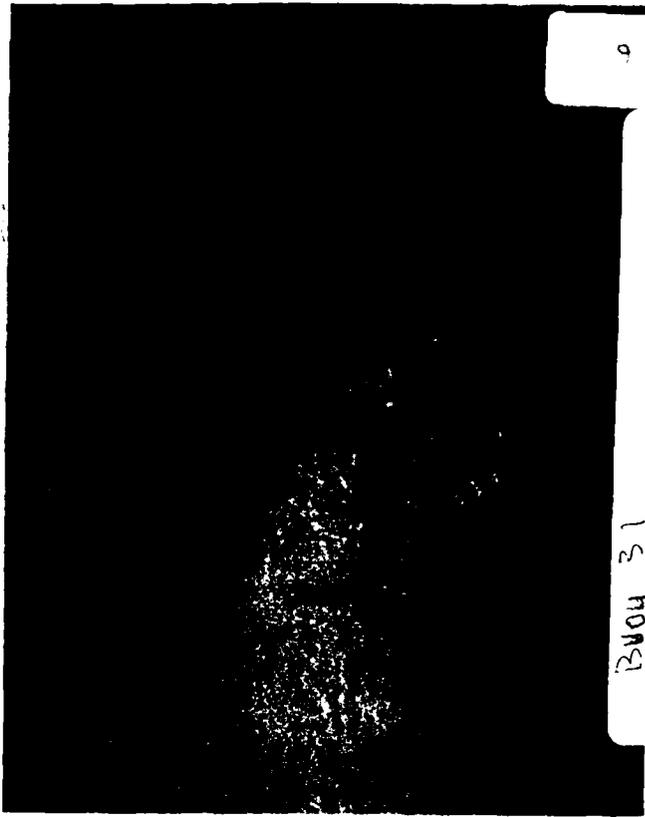
BUOY # 1
LOOKING NORTH



BUOY # 6
SITE 2



LOOKING EAST OF BUOY # 6
SITE 2



BUOY 31
SITE 2

END

DTIC

8-86