

CAPE CANAVERAL AIR FORCE STATION,  
LAUNCH COMPLEX 39,  
HYPERGOL MAINTENANCE AND CHECKOUT AREA  
(HMCA COMPLEX)  
(John F. Kennedy Space Center)  
Cape Canaveral  
Brevard County  
Florida

HAER FL-8-11-T

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record  
National Park Service  
Department of the Interior  
100 Alabama St., SW  
Atlanta, GA 30303

HISTORIC AMERICAN ENGINEERING RECORD  
CAPE CANVERAL AIR FORCE STATION, LAUNCH COMPLEX 39  
HYPERGOL MAINTENANCE AND CHECKOUT AREA  
(HMCA Complex)

HAER No. FL-8-11-T

Location: John F. Kennedy Space Center, Industrial Area,  
Brevard County, Florida.

USGS Orsino, Florida, Quadrangle, Universal  
Transverse Mercator Coordinates: E 535124 N  
3154204 Zone 17, NAD 1983.

Date of Construction: 1964

Present Owner: National Aeronautics and Space Administration (NASA)

Present Use: Not in use

Significance: The Hypergol Maintenance and Checkout Area complex (HMCA Complex) is eligible for listing as a historic district on the National Register of Historic Places in the context of the U.S. Space Shuttle Program (SSP) (1969-2011) under Criterion A for its significant associations in the area of Space Exploration. Since it has achieved exceptional national significance in the last 50 years, Criteria Consideration G applies. The HMCA Complex was built in 1964 and originally called the Fluid Test Complex. It contains three historic facilities: Hypergol Module Processing North (HMP North, M7-0961), Hypergol Module Processing South (HMP South, M7-1212), and the Hypergol Support Building (M7-1061). The HMCA Complex performed hazardous materials testing for the SSP, including the refurbishment of the Space Shuttle's Forward Reaction Control System (FRCS) and Orbital Maneuvering System (OMS) pods, hypergolic test loading, and hazardous systems tests and checkout.

Report Prepared by: New South Associates, Stone Mountain, Georgia

Date: March 11, 2013

Part I. HISTORICAL INFORMATION

List of Acronyms

CIF	Central Instrumentation Facility
EST	Environmental Systems Test Building
HAER	Historic American Engineering Record
He	Helium
HMCA	Hypergol Maintenance and Checkout Area
HMP	Hypergol Module Processing (HMF- Hypergolic Maintenance Facility)
KSC	Kennedy Space Center
LC 39	Launch Complex 39
LCC	Launch Control Center
LH <sub>2</sub>	Liquid Hydrogen
LO <sub>2</sub>	Liquid Oxygen
MMH	Monomethyl Hydrazine
NASA	National Aeronautics and Space Administration
GN <sub>2</sub>	Gaseous Nitrogen
N <sub>2</sub> O <sub>4</sub>	Nitrogen Tetroxide
O&C	Operations & Checkout
OMS	Orbital Maneuvering System
PRF	Parachute Refurbishment Facility
FRCS	Forward Reaction Control System
SCAPE	Self Contained Atmospheric Protective Ensemble
SRB	Solid Rocket Booster
SSP	Space Shuttle Program
TVC	Thrust Vector Control
VAB	Vehicle Assembly Building

A. Development of the KSC Industrial Area and the HMCA Complex

NASA was created in 1958 in response to the Soviet launch of the *Sputnik* satellite a year earlier. NASA's first series of missions were to send man into space, followed by manned orbits around the Earth, mastery of rendezvous and

docking procedures, and finally, landing man on the moon and returning him safely to Earth. These goals defined the three main programs of the late 1950s and 1960s: Mercury (1959-1963), Gemini (1962-1966), and Apollo (1968-1972). This effort culminated in the first moon landing, which occurred on July 20, 1969. Moon landings continued until 1972 when the Apollo program ended.<sup>1</sup>

The success of NASA's early manned spaceflight programs depended on the construction of unprecedented launch facilities at the agency's "moonport" at the John F. Kennedy Space Center (KSC). Located on Merritt Island in Brevard County, Florida, the construction of KSC by the U.S. Army Corps of Engineers began in 1962 and was mostly complete by 1965. It included Launch Complex 39 (LC 39) on the northern portion of the island with the giant Vehicle Assembly Building (VAB), Launch Control Center (LCC), launch pads, and other support buildings and infrastructure.

On the southern end of KSC, located a safe distance from the explosive and toxic hazards of LC 39, is the KSC Industrial Area. Located near the former town of Orsino, the Industrial Area was established so that functions not requiring immediate location at a launch complex could be grouped for ease of administration and efficiency in the construction of roads and utilities. It contained administrative, engineering, and operational facilities, including the Headquarters Building, Central Instrumentation Facility (CIF), Operations & Checkout (O&C) Building, and the Parachute Refurbishment Facility (PRF). The Corps of Engineers also built support buildings in the Industrial Area, including administrative office buildings,

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<sup>1</sup> Joan Deming and Patricia Slovinac, NASA-Wide Survey and Evaluation of Historic Facilities in the Context of the U.S. Space Shuttle Program: Roll-Up Report, (Sarasota, FL: Archaeological Consultants, Inc., 2008), 2.1.

a cafeteria, a medical services dispensary, automotive maintenance and fueling buildings, physical plant maintenance buildings, a security building, a fire station, and storage warehouses.

Construction of the KSC Industrial Area also included the Fluid Test Complex, now known as the HMCA Complex. Designed in 1963 by the Tampa Bay Engineering Company of St. Petersburg, Florida, the complex was completed in 1964. The complex first served Gemini and Apollo spacecraft, which contained ordnance, hypergolic fuels, and cryogenic systems that posed explosive and toxic hazards. Early master plans produced by Pan American World Airlines, Inc., determined that checkout of these systems was not possible in the O&C Building, so it was built a safe distance away in the southeast corner of the KSC Industrial Area.<sup>2</sup>

Hypergolic propellants are fuels and oxidizers that ignite on contact with each other and need no other ignition source. These fuels are easy to ignite and do not require extreme temperature controls for storage, making them ideal for manned and unmanned spacecraft use. The hypergolic fuel used by NASA is monomethyl hydrazine (MMH) and the oxidizer is nitrogen tetroxide (N<sub>2</sub>O<sub>4</sub>). Both fluids are highly toxic and are handled under the most stringent safety conditions, including the use of Self Contained Atmospheric Protective Ensemble (SCAPE) suits by technicians who handled them.<sup>3</sup>

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<sup>2</sup> Pan American World Airways, Inc., "Analytical Report, John F. Kennedy Space Center, NASA, Kennedy Space Center, Florida - Master Plan." (KSC Master Planning Office, 1965), 3.

<sup>3</sup> National Aeronautics and Space Administration [NASA], *NASA Facts Online: Propellants - Hypergolic*, <http://www-pao.ksc.nasa.gov/nasafact/count2.htm#hypergol>, 2002. Accessed August 6, 2012.

HMP North was originally called the Environmental Systems Test Building (EST). It contained test equipment for spacecraft environmental control, or life support, systems. The facility had two 40' square by 60' high test cells on opposite sides of a central building that contained control rooms on the second floor and equipment storage rooms on the first floor. Each test cell had an overhead crane with a hook height of 45'. There were also pre-installation acceptance laboratories for the validation of spacecraft components on the first floor.<sup>4</sup>

The HMP South building was first called the Hypergolic Test Building. It contained equipment for checkout of the hypergolic systems of manned spacecraft. Like HMP North, it had two high-bay test cells with 45' cranes on opposite sides of a two-story central building. The central building contained control rooms, an equipment room, locker rooms, and a machine room. The buildings were designed with special features to ensure the safe handling of hazardous fuels and oxidizers. The control room was designed to protect operators from possible explosion and fumes during testing of spacecraft hypergolic systems. The test cells were designed with large-capacity exhaust systems to remove dangerous fumes, and a floor system that could collect and dilute hypergolic spills.<sup>5</sup>

The Hypergol Support Building was originally called the Fluid Test Support Building. It supported all the non-hazardous test operations of the Fluid Test Complex, including laboratory space, offices, and shop space for processing spacecraft components. Components were processed, cleaned, calibrated, and stored in the building.<sup>6</sup>

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<sup>4</sup> Pan American, "Analytical Report," 33.

<sup>5</sup> Pan American, "Analytical Report," 34.

<sup>6</sup> Ibid.

The building also housed a SCAPE suit storage room, employee locker room, and break rooms.

At the southern end of the Fluid Test Complex were two Cryogenic Test Buildings, later renamed the Solid Rocket Booster (SRB) Thrust Vector Control (TVC) Buildings, which were demolished circa 1996. The buildings each had a single test cell with attached laboratory and dressing room.

#### B. HMCA and the Space Shuttle

The Fluid Test Complex continued to serve the Apollo program until 1972. By that time NASA was developing the Space Shuttle Program (SSP), designed to serve orbiting space stations and related missions. The SSP was announced in a speech by President Richard Nixon in 1972, who outlined its future on the idea that a series of reusable space flight vehicles would provide "routine access to space".<sup>7</sup> Following this announcement, new SSP contracts were awarded, new space vehicles were designed, old Apollo-era facilities like the Fluid Test Area were modified, and new facilities were built. After a decade of preparation, the first shuttle flight occurred in 1981. After almost three decades of operations, the SSP was retired in 2011.

To support the SSP, the Fluid Test Complex facilities were modified in 1976 by Pan American Technical Services, Inc., of Cocoa Beach, Florida. Changes were made to the interiors of the buildings, especially in the high bay work areas, to refurbish and checkout the Space Shuttle's OMS pods, hypergolic (liquid propellant) systems, and other hazardous systems tests.

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<sup>7</sup> Deming and Slovinac, *NASA-Wide Survey and Evaluation*, 2.1.

The EST Building was renamed HMP North (M7-961) and modified to refurbish and checkout the hypergolic fuel modules of the Space Shuttle's FRCS and OMS pods. The FRCS and OMS systems worked in tandem to provide thrust for pitch, yaw, and roll rotational maneuvers while in orbit, as well as small velocity changes.<sup>8</sup> The FRCS/OMS pods were located on either side of the tail fin, or vertical stabilizer.

Likewise, the Hypergolic Test Building was renamed HMP South (M7-1212) and modified to test and checkout the Space Shuttle's FRCS, a panel located on the shuttle's nose.<sup>9</sup> The Fluid Test Support Building was renamed the Hypergol Support Building (M7-1061) and continued to house non-hazardous activities, with an office space addition on the north end of the building.

The HMCA Complex continued to service the Space Shuttle's hypergolic systems until the end of the program in July 2011, when the crew of *Atlantis* landed at KSC and completed its final mission.

## C. Physical History

### 1. Dates of Construction

1964

### 2. Architect/Engineer

Tampa Bay Engineering Company, St. Petersburg, Florida.

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<sup>8</sup> NASA, "Reaction Control System," NSTS Shuttle Reference Manual, 1988, <http://science.ksc.nasa.gov/shuttle/technology/sts-newsref/sts-rcs.html>.

<sup>9</sup> Deming and Slovinac, *NASA-Wide Survey and Evaluation*, 8-1; *NASA Space Transportation System: Facilities and Operations, Kennedy Space Center, FL*, on file at the Kennedy Space Center Archives Department.

### 3. Builder/Contractor/Supplier

Unknown

### 4. Original Plan and Construction

The three HMCA facilities documented here were built in 1964 in the southeast corner of the KSC Industrial Area. A 1964 master plan map shows the complex's existing buildings in black, with proposed new buildings shown in white with black outlines (see map on page 14). A 1964 aerial photograph shows the complex's original arrangement (see photograph on page 16). The facilities were arranged in the following order from north to south on the west side of Avenue G: the Environmental Control Systems Building (HMP North), then the Fluid Test Support Building (Hypergol Support Building), Hypergolic Test Building (HMP South), and the Cryogenic Test Buildings (SRB TVC Test Buildings - demolished circa 1996).

The buildings have reinforced concrete frame structural systems, concrete block walls, and steel high bay doors. Each was served by exterior ventilation equipment. The complex included a number of scrubber pads for the volatile chemicals used in the spacecraft checkout process, including pads for liquid oxygen (LO<sub>2</sub>), helium (He), gaseous nitrogen (GN<sub>2</sub>), monomethyl hydrazine (MMH), nitrogen tetroxide (N<sub>2</sub>O<sub>4</sub>), and liquid hydrogen (LH<sub>2</sub>).

The proposed new buildings in the 1964 master plan included an additional Environmental Test Building, a Hypergolic Test Building, and Cryogenic Test Building (most recently called the SRB TVC Test Building), all located to the west of their existing counterparts (see map on page 14). A 1965 aerial photograph shows that

two of those proposed facilities, the Hypergolic Test Building and Cryogenic Test Building, were built by that time, in addition to a network of supply pipes from the various storage pads (see photograph on page 17).

## 5. Alterations and Additions

The HMCA Complex retained its original plan and construction until circa 1996, when three buildings were demolished and associated chemical storage pads and transmission lines were removed. Demolished buildings included the two SRB TVC Test Buildings and the western Hypergolic Test Building. Two 1996 aerial photographs illustrate the condition and arrangement of the complex just before these alterations (see photos on page 18 and 19).

## Part II. Structural/Design/Equipment Information

### A. General Statement

#### 1. Character

The three buildings of the HMCA Complex were used to process and checkout hypergolic fuels and other hazardous systems of the Gemini and Apollo spacecraft, and the Space Shuttle. The buildings known today as HMP North and HMP South each have pairs of high bay work cells on either side of a central building that contain offices, control rooms, and other support areas. The Hypergol Support Building housed non-hazardous testing laboratories, offices, and other support areas. The building's main function was computer remote control of the FRCS and OMS pods. Engineers in the building's control room could function all of the FRCS and OMS pods' valves and solenoids, and had the capability of full flight simulation of the forward and aft

assemblies while sitting at the control consoles. The facility also served as the staging area for technicians to get suited into Self Contained Atmospheric Protective Ensemble (SCAPE) gear to work around the FRCS and OMS pods while exposed to hazardous materials. The HMCA facilities performed unique functions that were not completed anywhere else at KSC and played a key role in the success of manned spaceflight programs.

## 2. Condition of Fabric

The condition of the HMCA Complex's fabric is good. The buildings were regularly maintained throughout their lifespans. They do exhibit minor signs of deterioration such as peeling paint, rust, and roof leaks.

## B. Descriptions of Interior and Exterior

The individual contributing facilities of the HMCA are described in the next sections of the HAER documents.

## C. Site Layout

As described above, the HMCA facilities are located in the southeast corner of the KSC Industrial Area arranged from north to south on the west side of Avenue G between 5<sup>th</sup> Street on the north and 8<sup>th</sup> Street on the south. The boundaries of the HMCA Complex NRHP Historic District are illustrated on the 1964 Master Plan map shown on page 14.

The facilities are surrounded by safety buffer areas of wooded land, to protect from potential toxic and explosive hazards. The nearest buildings to the HMCA are the Parachute Refurbishment Facility (M7-657) and Multi-Payload Processing Facility (M7-1104), which are both approximately

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2,000 feet away. Similarly, the three facilities in the  
HMCA area are spaced over 500-feet apart from one another.

### Part III. Operations and Process

The operations and processes that occurred at each of the HMCA facilities are described in the next sections of the HAER documentations.

### Part IV. Sources of Information

#### A. Engineering Drawings and Plans

Tampa Bay Engineering Co.

1963 "NASA Merritt Island Launch Area, Merritt Island, FLA., Fluid Test Complex." Construction Drawings.

"NASA Merritt Island Launch Area, Merritt Island, FLA., Fluid Test Complex - Environmental Control Systems Bldg." Construction Drawings.

"NASA Merritt Island Launch Area, Merritt Island, FLA., Fluid Test Complex - Fluid Test Support." Construction Drawings.

"NASA Merritt Island Launch Area, Merritt Island, FLA., Fluid Test Complex - Hypergolic Test #1." Construction Drawings.

#### B. Early Views

Kennedy Space Center. Photograph negative number LOC-63-7252, dated 1963. On file at Kennedy Space Center Archives.

Kennedy Space Center. Photograph negative number 100-KSC-64C-2626, dated 1964. On file at Kennedy Space Center Archives.

Kennedy Space Center. Photograph negative number 100-KSC-65C-8832, dated 1965. On file at Kennedy Space Center Archives.

Kennedy Space Center. Photograph negative number KSC-396C-0940-10, dated 1996. On file at Kennedy Space Center Archives.

Kennedy Space Center. Photograph negative number KSC-396C0947-36, dated 1996. On file at Kennedy Space Center Archives.

#### C. Primary Sources

Pan American World Airways, Inc.

1965 "Analytical Report, John F. Kennedy Space Center, NASA, Kennedy Space Center, Florida - Master Plan." On file in the KSC Master Planning Office.

#### D. Secondary Sources

Deming, Joan, and Patricia Slovinac

2008 *NASA-Wide Survey and Evaluation of Historic Facilities in the Context of the U.S. Space Shuttle Program: Roll-Up Report*. Submitted to the National Aeronautics and Space Administration, Environmental Management Branch. Sarasota, Florida: Archaeological Consultants, Inc. February 2008, revised July 2008.

National Aeronautics and Space Administration [NASA]

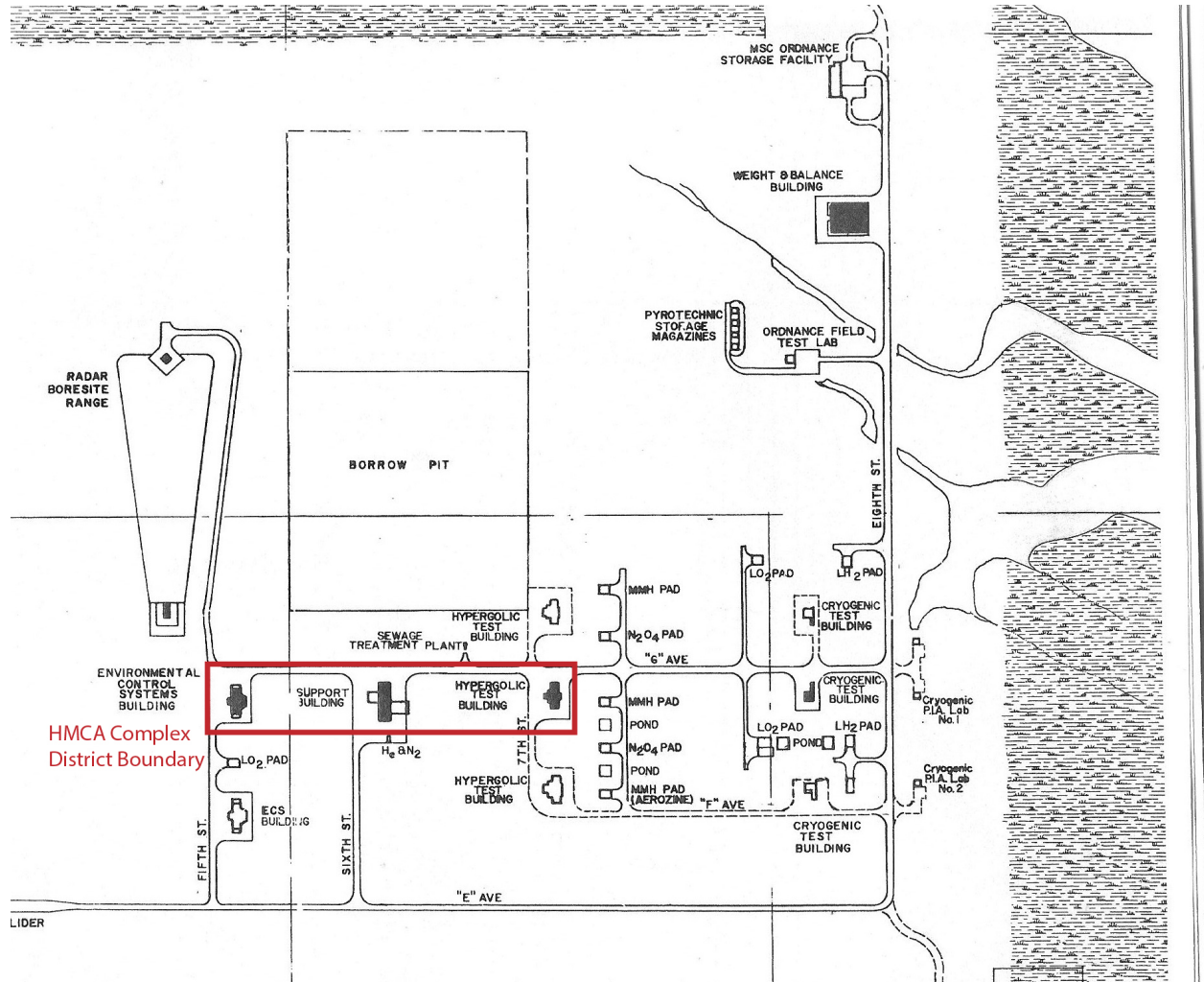
1964 "Master Plan." On file in the KSC Master Planning Office.

- 1984 "Space Transportation System: Facilities and Operations, Kennedy Space Center, FL." On file at the Kennedy Space Center Archives Department.
- 1988 "Reaction Control System," NSTS Shuttle Reference Manual,  
<http://science.ksc.nasa.gov/shuttle/technology/sts-newsref/sts-rcs.html>. Accessed March 8, 2012.
- 2002 NASA *Facts Online: Propellants - Hypergolic*,  
<http://www-pao.ksc.nasa.gov/nasafact/count2.htm#hypergol>.  
Accessed August 6, 2012.

Sciarini, E. Daniel, and Susan S. Tzareff

- 2004 "Hypergol Maintenance Facility - North Area (HMP North) (M7-961), Kennedy Space Center, Florida, Solid Waste Management Unit (SWMU) Assessment Report, PRL #118 (Revision 0) [KSC-TA-7110]. J-BOSC Environmental Health and Services, Environmental Compliance and Public Health Section, Kennedy Space Center.

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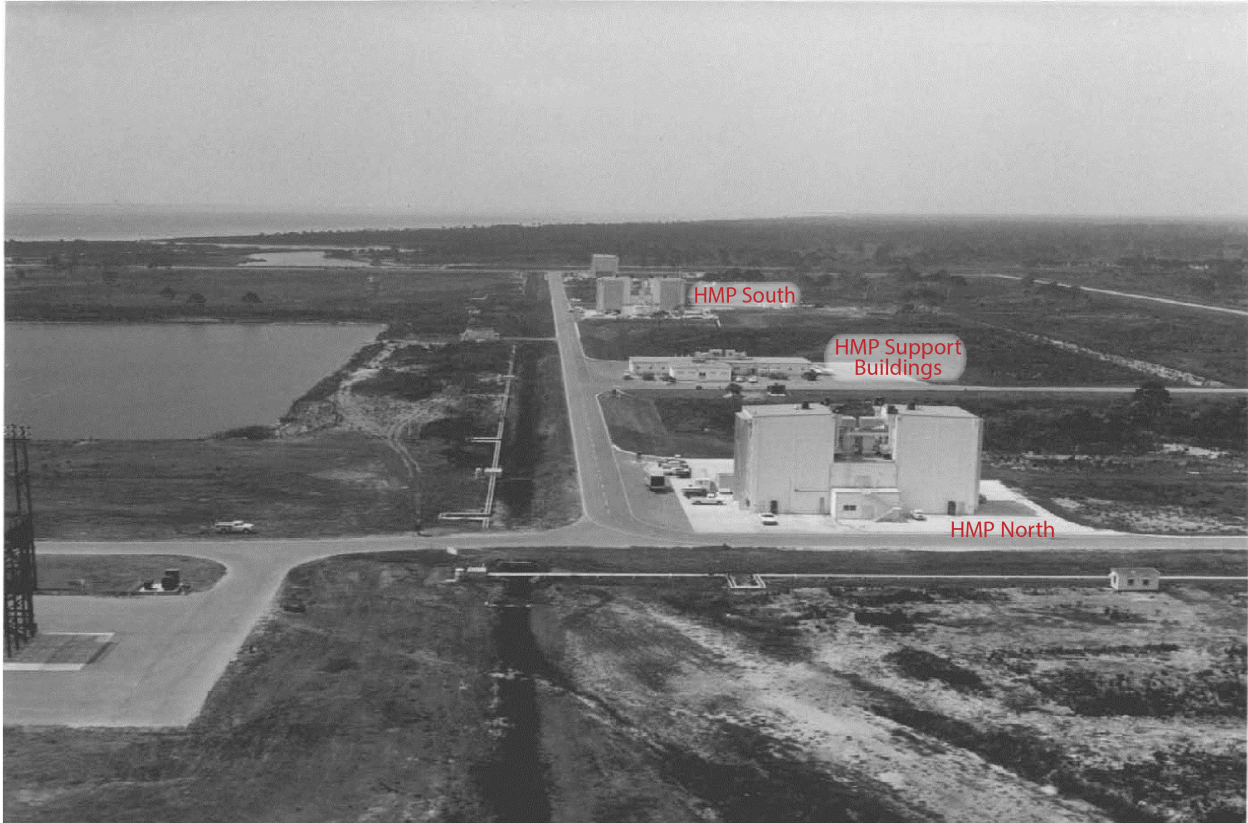
1964 Master Plan with existing facilities in black, proposed facilities in white. (Source: NASA, 1964)

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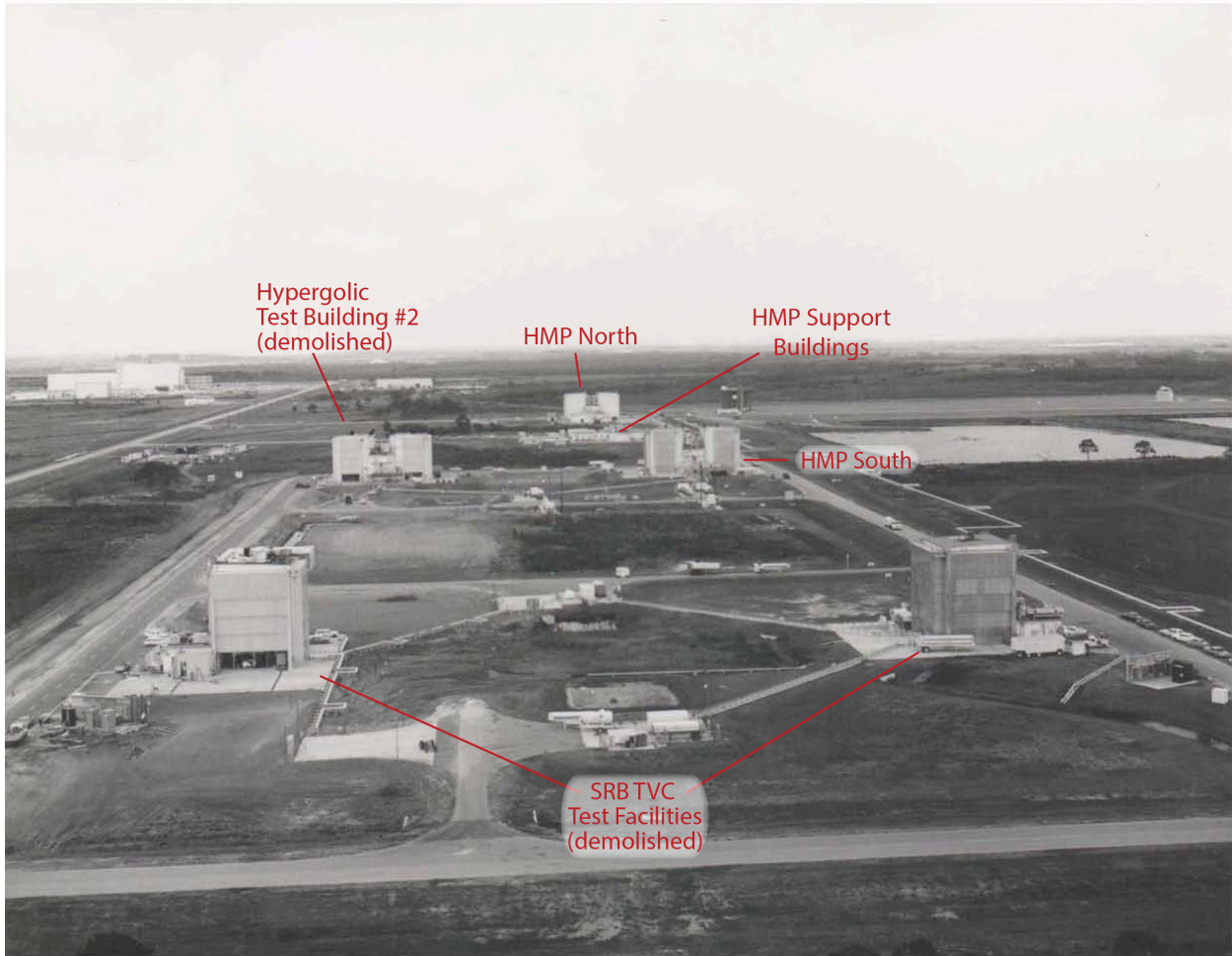
1963 aerial photograph showing the HMCA area under construction, view south. (Courtesy KSC: Image LOC-63-7252)

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This 1964 aerial view to the south shows the original HMCA facilities, including (from front to back) HMP North, Hypergol Support Building, HMP South, and the SRB TVC Test Building. (Courtesy KSC: Image 100-KSC64C-2626)

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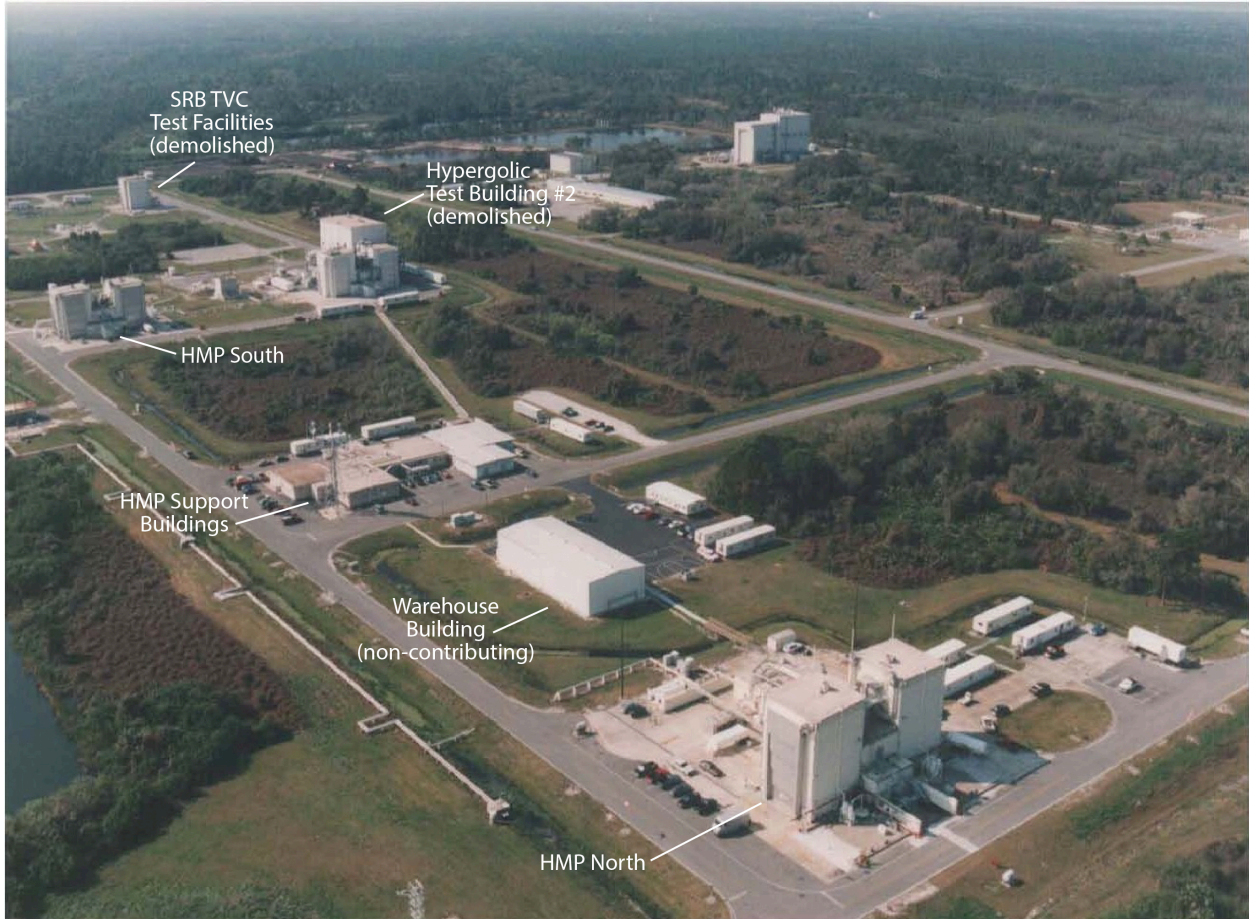


1965 aerial view to the north of the HMCA Complex showing, from front to back, the two SRB TVC Test Facilities (demolished), Hypergolic Test Building 1 (HMP South), Hypergolic Test Building 2 (demolished), Hypergolic Support Building, and Environmental Control Systems Building (HMP North). Note the chemical storage pads and pipelines, which are no longer intact. (Courtesy KSC: Image 100-KSC-65C-8832)

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1996 aerial view to the northeast showing the HMCA complex before demolition of the SRB TVC Test Buildings and Hypergolic Test Building 2. (Courtesy KSC: Image KSC-396C-0940-10)

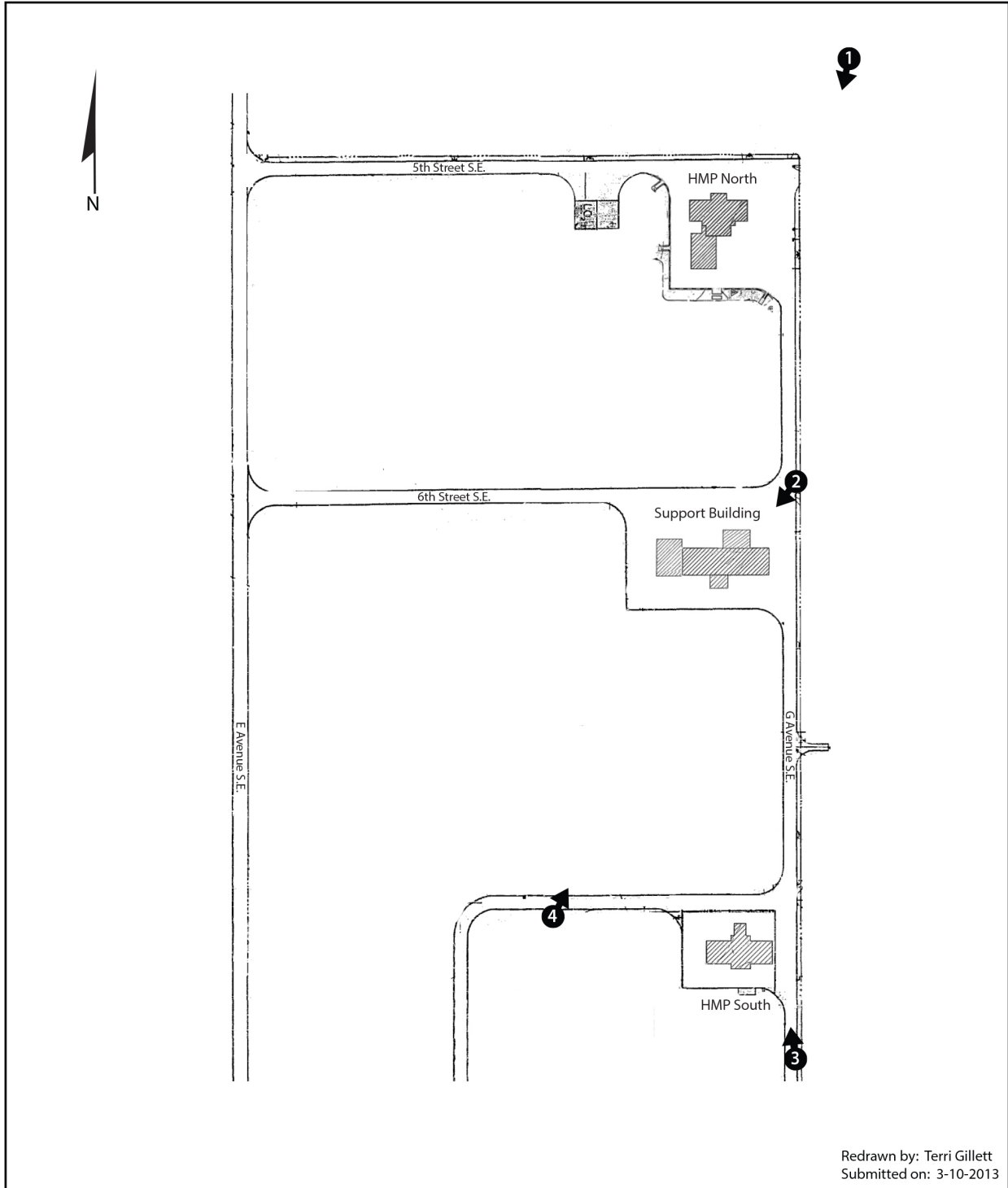


1996 aerial photograph showing the HMCA Complex before demolition of SRB TVC Test Buildings and Hypergolic Test Building 2, view southwest. (Courtesy KSC: Image KSC-396C-0947-36)

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Redrawn by: Terri Gillett  
Submitted on: 3-10-2013

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Cape Canaveral  
Brevard County  
Florida

David Diener, Photographer

April 2012

- FL-8-11-T-1      VIEW OF THE HYPERGOL COMPLEX FROM HMP NORTH AT  
INTERSECTION OF 5<sup>TH</sup> STREET SE AND G AVENUE SE, VIEW  
SOUTH.
- FL-8-11-T-2      VIEW OF THE HYPERGOL COMPLEX FROM HMP SUPPORT BUILDING  
AT INTERSECTION OF 6<sup>TH</sup> STREET SE AND G AVENUE SE, VIEW  
SOUTHWEST.
- FL-8-11-T-3      VIEW OF THE HYPERGOL COMPLEX FROM HMP SOUTH AT  
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SUPPORT BUILDING, VIEW NORTHEAST.
- FL-8-11-T-5      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF  
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ENGINEERING CO.; DRAWING IN POSSESSION OF KENNEDY SPACE  
CENTER) "FLUID TEST COMPLEX, LOCATION PLAN & DRAWING  
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SCANNED ORIGINAL; MARCH 5, 1963 BY TAMPA BAY  
ENGINEERING CO.; DRAWING IN POSSESSION OF KENNEDY SPACE  
CENTER) "FLUID TEST COMPLEX, CIVIL COMPLETE SITE PLAN."
- FL-8-11-T-7      PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF  
SCANNED ORIGINAL; MARCH 5, 1963 BY TAMPA BAY

ENGINEERING CO.; DRAWING IN POSSESSION OF KENNEDY SPACE CENTER) "FLUID TEST COMPLEX, CIVIL ROADS & DRAINAGE PLAN NORTH."

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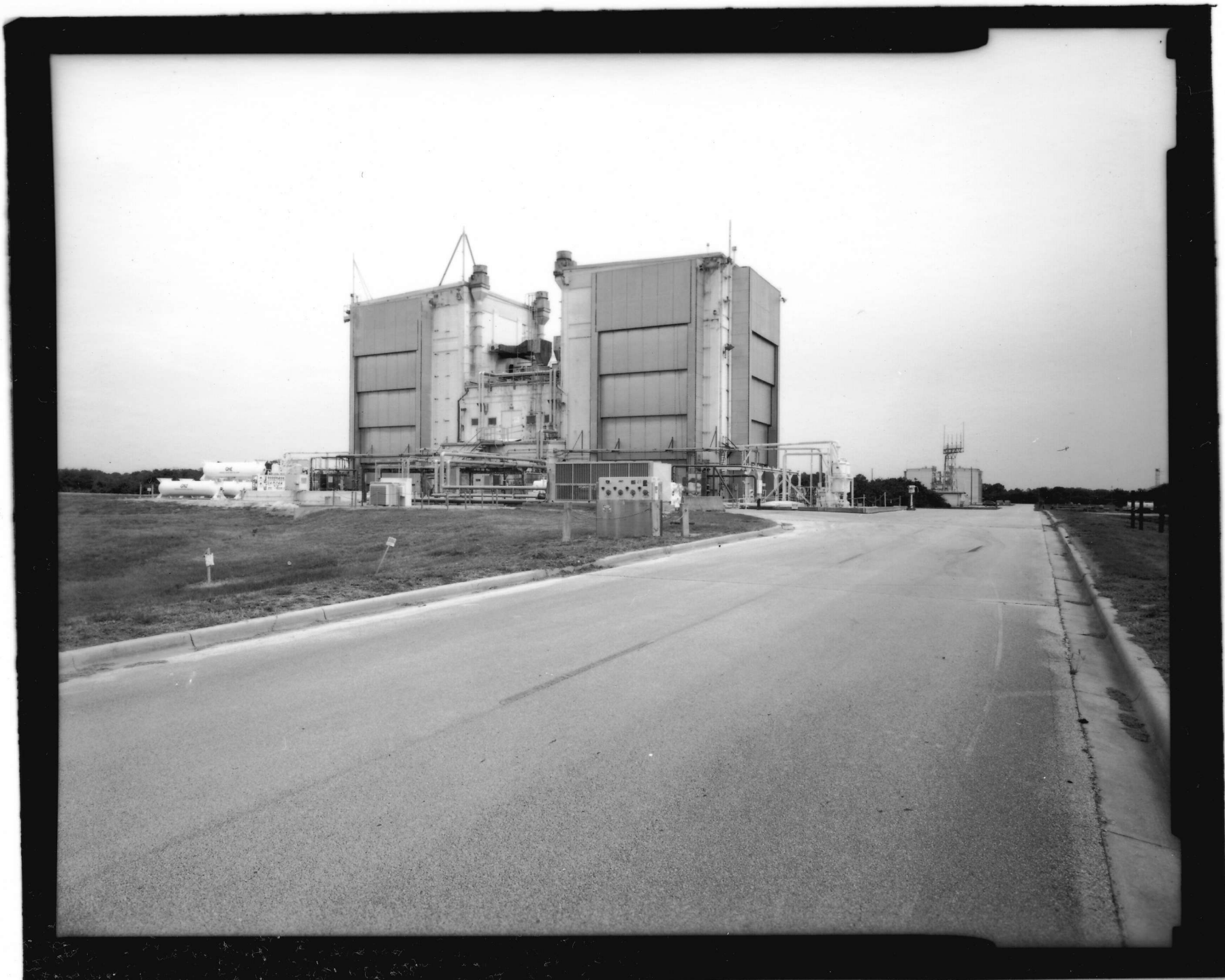
PHOTOCOPY OF ENGINEERING DRAWINGS (8" X 10" PHOTO OF SCANNED ORIGINAL; MARCH 5, 1963 BY TAMPA BAY ENGINEERING CO.; DRAWING IN POSSESSION OF KENNEDY SPACE CENTER) "FLUID TEST COMPLEX, CIVIL ROADS & DRAINAGE PLAN SOUTH."



KODAK 100T MX



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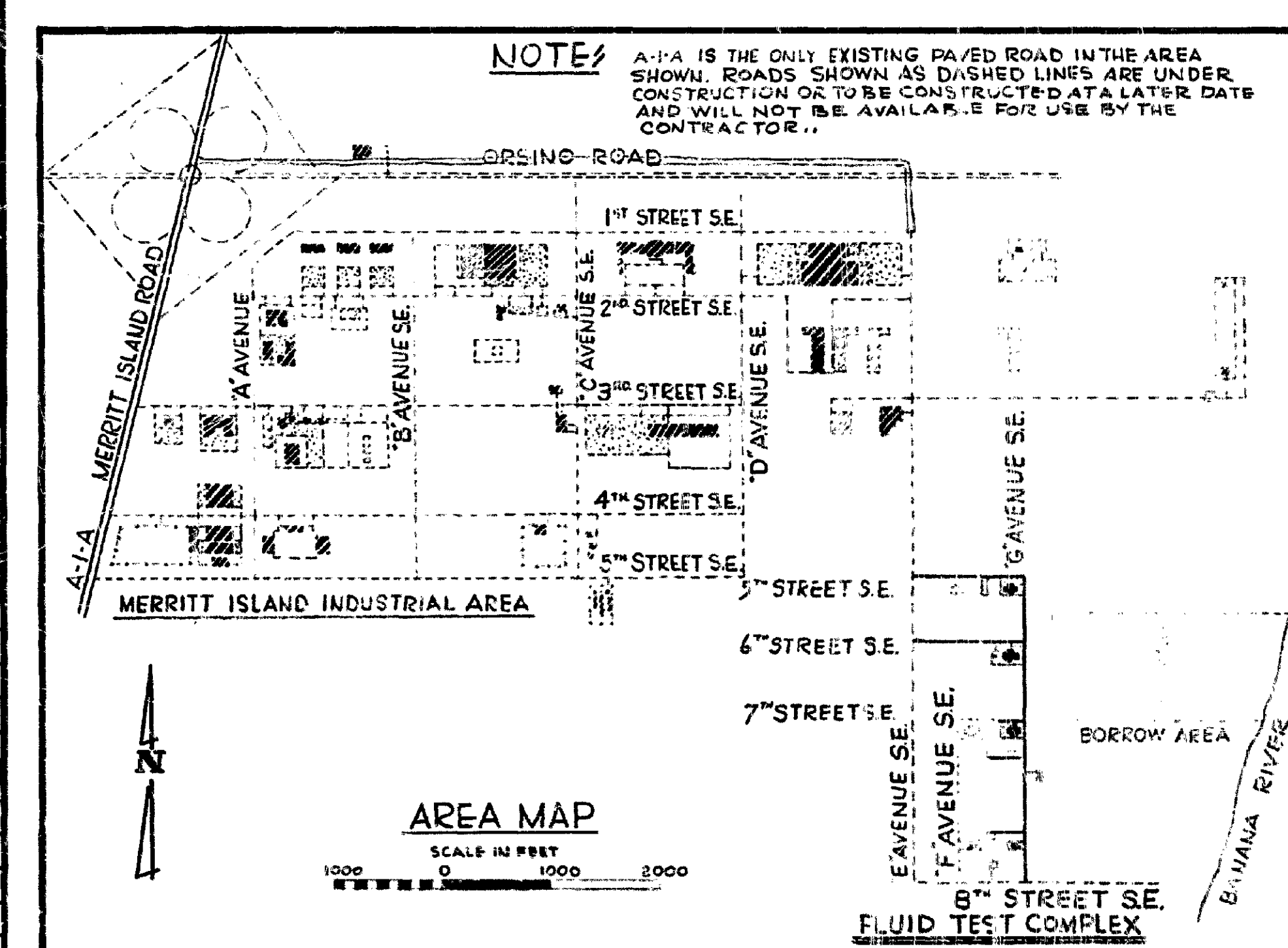
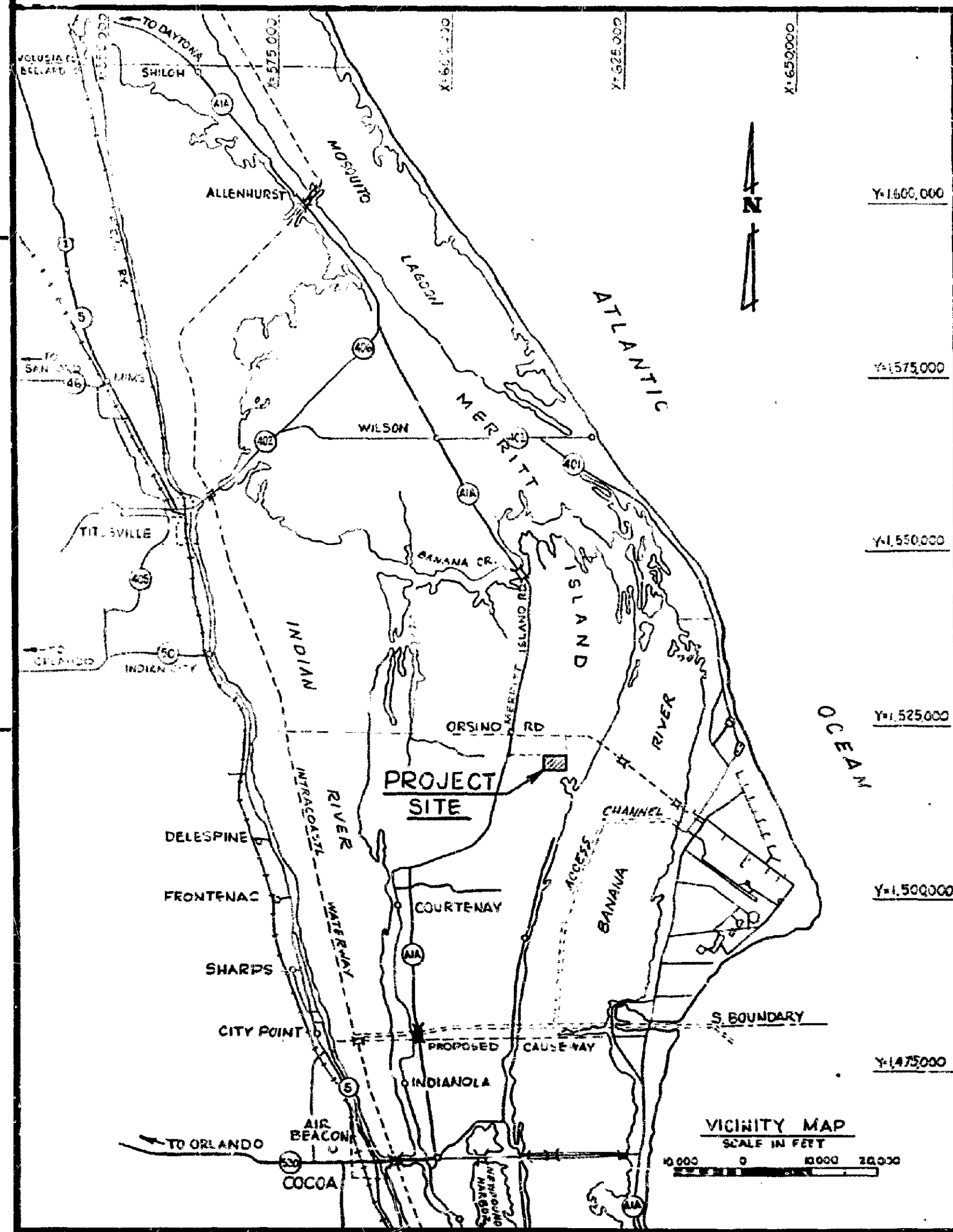
# MERRITT ISLAND INDUSTRIAL AREA MERRITT ISLAND, FLORIDA

## NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

### MSC FLUID TEST COMPLEX

NO.		SYMBOL	ZONE	DESCRIPTION
3	△			REVISED TO CONFORM TO AMMENDMENT NO. 4
6	△			SHEETS ADDED TO ACCOMPANY MOD. TO CONTE. NASA-1970
6	△			MAY CANCELLED SHEETS ADDED TO REV. 4
1	△			SHEETS 1 THROUGH 40 OF D.O. FILE NO. 203-175 ADDED TO ACCOMPANY MOD. TO CONTE. NASA-1970

DWG. NO.	TITLE	DWG. NO.	TITLE	DWG. NO.	TITLE
	SERIES-100-SITE DEVELOPMENT	223	POWER PLAN & SECTIONS	504	ARCHITECTURAL & STRUCTURAL SECTIONS & DETAILS
101	LOCATION PLAN & DRAWING INDEX	224	LIGHTING PLAN & SECTIONS	505	STRUCTURAL FOUNDATION PLAN, SECTIONS & DETAILS
102	COMPLETE SITE PLAN	225	GROUNDING, LIGHTNING PROT., COM. & FIRE ALARM & FANS	506	STRUCTURAL PLAN & DETAILS
102A	DRAINAGE DETAILS	226	CONTROL CIRCUITS	507	STRUCTURAL SECTIONS & DETAILS
103	ROADS & DRAINAGE-NORTH			508	STRUCTURAL ROOF PLAN & DETAILS
104	ROADS & DRAINAGE-SOUTH			509	MAIN DOOR DETAILS
105	ROADS-PLAN & PROFILE			510	MAIN DOOR DETAILS
106	ROADS-PLAN & PROFILE		SERIES-300-SUPPORT BLDG.	511	AIR CONDITIONING, HEATING & PIPING
107	ROADS-PLAN & PROFILE			512	SCHEDULES & DETAILS
108	UTILITY PLAN-NORTH			513	FLOORING DIAGRAMS & DETAILS
108A	SUPPORT BLDG.			514	FLOOR PLAN
109	UTILITY PLAN-SOUTH			515	ONE LINE DIAGRAM, MISC. ELECTRICAL DETAILS
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109B	HYPERGOLIC BLDG. DRAINAGE	302	ARCHITECTURAL ELEVATIONS & DETAILS	517	CONTROL CIRCUITS
109C	HYPERGOLIC BLDG. DRAINAGE				
110	BUILDING DRAINAGE				
111	STANDARD DRAINAGE DETAILS				
112	SANITARY SEWAGE TREATMENT PLANT	303	ARCHITECTURAL SECTIONS & DETAILS		
113	SANITARY SEWAGE LIFT STATION	304	FOUNDATION PLAN & DETAILS		
114	SEWER PLAN & PROFILE	305	STRUCTURAL ROOF PLAN & DETAILS		
115	SANITARY DETAILS	306	AIR CONDITIONING DUCT LAYOUT		
116	HIGH TEMP. WATER - PLAN, PROFILE & DETAILS	307	NITROGEN & HELIUM PIPING		
117	HIGH TEMP. WATER - PLAN & PROFILE	308	PIPING PLAN - SECTIONS & DETAILS		
118	HIGH TEMP. WATER MANHOLE DETAILS	309	FLOW DIAGRAMS & SCHEDULES		
119	HIGH TEMP. WATER DETAILS	310	PLUMBING & DETAILS		
120	FUEL STATIONS, BLAST SHIELD, SLAB & SUMP DETAILS	311	ONE LINE DIAGRAM & MISC. ELECTRICAL DETAILS		
121	LEACHING PONDS & DITCH DETAILS	312	LIGHTING PLAN & DETAILS		
122	ELECTRICAL SERVICES-EXTERIOR	313	POWER, COM., ELECTRONIC GROUND SYSTEMS & FANS		
123	ELECTRICAL ONE LINE SUBSTATION & DUCT PROFILE				
124	ELECTRICAL DUCT BANK PROFILES				
125	STANDARD COM. MANHOLE DETAILS-ELECTRICAL				
126	ELECTRICAL MANHOLE DETAILS				
127	HYPERGOLIC PIPE TRENCH & CONDENSER SUPPORTS				
			SERIES-400-HYPERGOLIC TEST BUILDING		
		401	ARCHITECTURAL FLOOR PLANS 1ST. & 2ND. FLOORS		
		402	ARCHITECTURAL ELEVATIONS		
		403	ARCHITECTURAL SECTIONS & DETAILS		
		404	ARCHITECTURAL SECTIONS & DETAILS		
		405	STRUCTURAL FOUNDATION PLAN & DETAILS		
		406	STRUCTURAL PLAN & SECTIONS FIRST FLOOR		
		407	STRUCTURAL PLAN & SECTIONS SECOND FLOOR & ROOF		
		408	STRUCTURAL SECTIONS & DETAILS		
		409	STRUCTURAL SECTIONS & DETAILS		
		410	STRUCTURAL PLATFORMS & STAIRS		
		411	MAIN DOOR DETAILS		
		412	MAIN DOOR DETAILS		
		413	MAIN DOOR DETAILS		
		414	AIR CONDITIONING FIRST & SECOND FLOOR PLANS		
		415	HEATING, VENT. & AIR CONDITIONING SECTIONS		
		416	AIR CONDITIONING ROOF PLAN & ISOMETRICS		
		417	EQUIPMENT ROOM - PLAN & SECTIONS		
		418	FLOW DIAGRAMS & SCHEDULES		
		419	PLUMBING & DETAILS		
		420	ONE LINE DIAGRAM & MISC. ELECTRICAL DETAILS		
		421	POWER PLAN & SECTIONS		
		422	LIGHTING PLAN & DETAILS		
		423	GROUNDING, LIGHTNING PROT., COM. & FIRE ALARM & FANS		
		424	CONTROL CIRCUITS		
			SERIES-500-CRYOGENIC TEST BUILDING		
201	ARCHITECTURAL FLOOR PLANS & DETAILS	501	ARCHITECTURAL PLAN & DETAILS		
202	ARCHITECTURAL ELEVATIONS & ROOF PLAN	502	ARCHITECTURAL ELEVATIONS		
203	ARCHITECTURAL SECTIONS & DETAILS	503	ARCHITECTURAL SECTIONS & DETAILS		
204	ARCHITECTURAL SECTIONS & DETAILS				
205	ARCHITECTURAL DETAILS				
206	STRUCTURAL FOUNDATION PLAN & DETAILS				
207	STRUCTURAL PLAN & SECTIONS-FIRST FLOOR				
208	STRUCTURAL SECOND FLOOR & ROOF PLAN				
209	STRUCTURAL SECTIONS & DETAILS				
210	STRUCTURAL SECTIONS & DETAILS				
211	STRUCTURAL PLATFORMS & STAIRS				
212	STRUCTURAL PLATFORMS & LADDERS				
213	MAIN DOOR DETAILS				
214	MAIN DOOR DETAILS				
215	MAIN DOOR DETAILS				
216	AIR CONDITIONING DUCT LAYOUT & DETAILS 1ST. FLOOR				
217	HEATING, VENT. & AIR COND. 2ND. FLOOR & ROOF PLAN				
218	HEATING, VENT. & AIR CONDITIONING SECTIONS				
219	FLOW DIAGRAMS & SCHEDULES				
220	EQUIPMENT ROOM - PLAN & SECTIONS				
221	PLUMBING & DETAILS				
222	ONE LINE DIAGRAM & MISC. ELECTRICAL DETAILS				



**RECORD DRAWING NOTE**  
'Shall be,' 'Provide,' 'Install,' 'Remove,' etc. indicates work was accomplished under the contract.

\* THESE DRAWINGS WILL BE FURNISHED BY AMMENDMENT.

SEE ALSO D.O. FILE NO. 203-175

**AS BUILT**  
APPROVED BY: *[Signature]*  
DATE: 11 August 1969

PREPARED BY: *[Signature]*  
CHECKED BY: *[Signature]*  
APPROVED BY: *[Signature]*

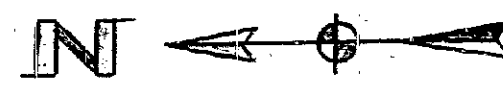
**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**  
LAUNCH OPERATIONS CENTER

**NASA MERRITT ISLAND LAUNCH AREA**  
MERRITT ISLAND, FLA.  
FLUID TEST COMPLEX  
LOCATION PLAN & DRAWING INDEX

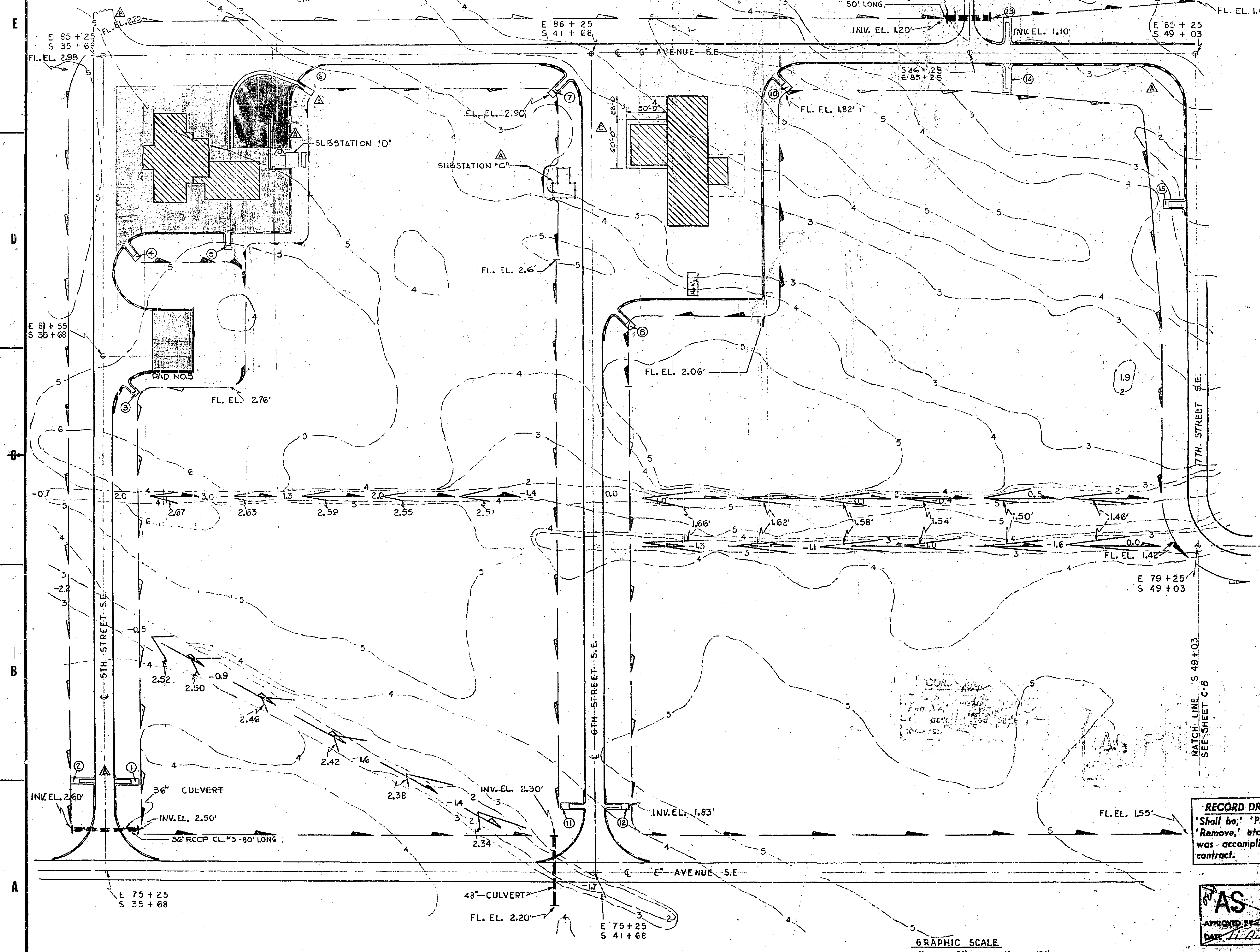
DATE: 2 MARCH 1968  
SCALE: AS SHOWN  
SHEET: 1 OF 10

5 4 3 2 1





REVISIONS			
NO.	SYM.	DESCRIPTION	DATE
4	△	REVISED TO CONFORM TO AMEND. #4	5-20-63
2	△	ADDED NOTE 8 AND F.L. ELEV. TO CONFORM TO MOD. TO CONTRACT (BANK) INTO	9/23/63
1	△	REVISED BITUMINOUS CONCRETE PAVING TO ACCOMPAN. MOD. TO CONTRACT (BANK) INTO	1/6/64
1	△	RELOCATED SUBSTATION 'D' TO ACC. MOD. TO CONT. NASA, 1970	1/19/64
1	△	REVISED TO SHOW ADD. CONC. PAD TO ACC. MOD. TO CONT. NASA, 1970	4/6/64
1	△	UP-DATED FOR FACILITY RECORD DRAWINGS	4-30-68



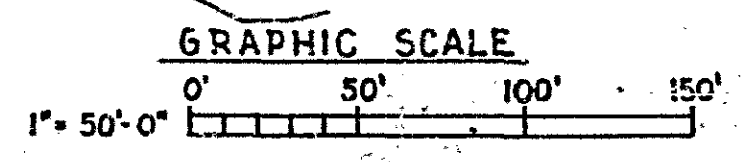
— LEGEND —

	BUILDING
	EXISTING CONTOUR
	GRADED CONTOUR
	DITCH
	REINFORCED CONCRETE PAVED AREA
	BITUMINOUS PAVEMENT
	CULVERT & HEADWALLS
	CURB, GUTTER & FLUME
	1 FT. WIDE SOD STRIP

- NOTE —
- ① DIRT REMOVED FROM DITCHES TO BE USED FOR FILL, AS NEEDED.
  - ② SEE SHEET C-22 FOR PAVEMENT GRADING AND DRAINAGE AT BUILDINGS.
  - ③ SEE SH T-1 FOR BORROW PIT LOCATION.
  - ④ SEE SHEET C-22 FOR GRADING AND DRAINAGE FOR PAD # 5.
  - ⑤ SEE SHEET C-23 FOR SCHEDULE OF NUMBERED FLUMES AND STANDARD DRAINAGE DETAILS.
  - ⑥ EXISTING DITCHES AND PONDS TO BE BACKFILLED SHALL BE CLEARED AND GRUBBED TO LIMITS OF GRADING.
  - ⑦ TO PROVIDE LEVEL AREA FOR ELECTRICAL SWITCH PADS AT LST, HYPERGOLIC AND FTS BUILDINGS WIDEN SHOULDERS AND MODIFY OR LENGTHEN FLUME AS REQUIRED. SIMILAR WIDENING OF SHOULDERS ALSO REQUIRED AT DELUGE PUMP PAD, SUBSTATIONS AND UNDERGROUND TANK LOCATIONS.

**RECORD DRAWING NOTE**  
 'Shall be,' 'Provide,' 'Install,' 'Remove,' etc. indicates work was accomplished under the contract.

**AS BUILT**  
 APPROVED BY: *[Signature]*  
 DATE: *11 August 1968*



NASA-KSC  
 FACILITY RECORD DRAWING  
 DRAWING NO. B14.00.000AP007.00  
 DATE: 12/2/68 APPROVED: *[Signature]*

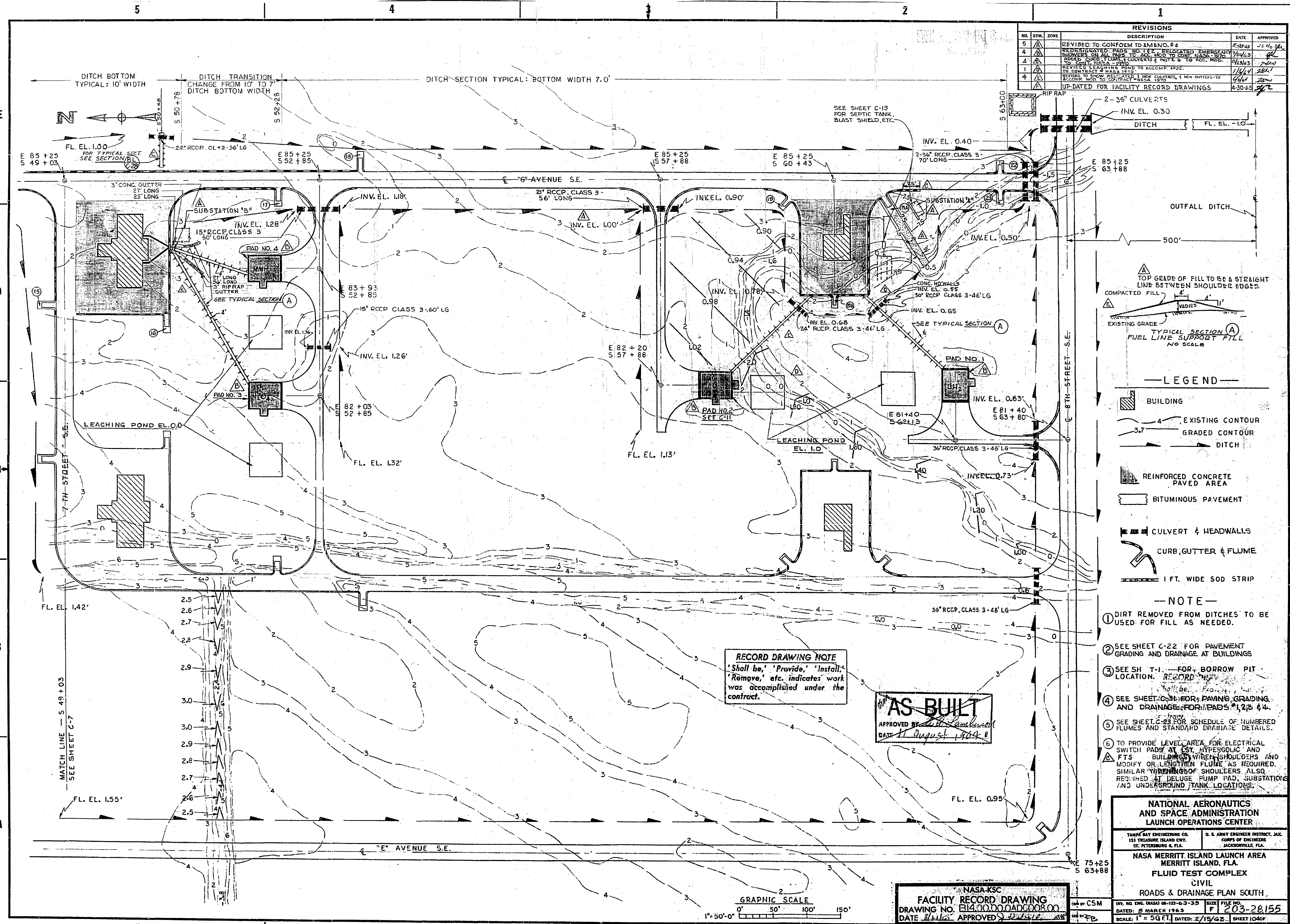
**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
 LAUNCH OPERATIONS CENTER**

TAMPA BAY ENGINEERING CO.  
 151 TREASURE ISLAND CITY  
 ST. PETERSBURG 6, FLA.

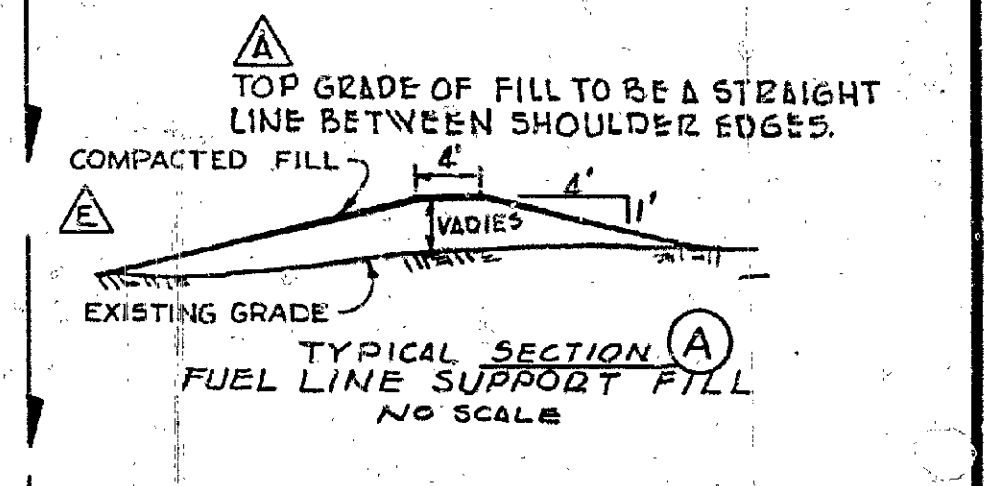
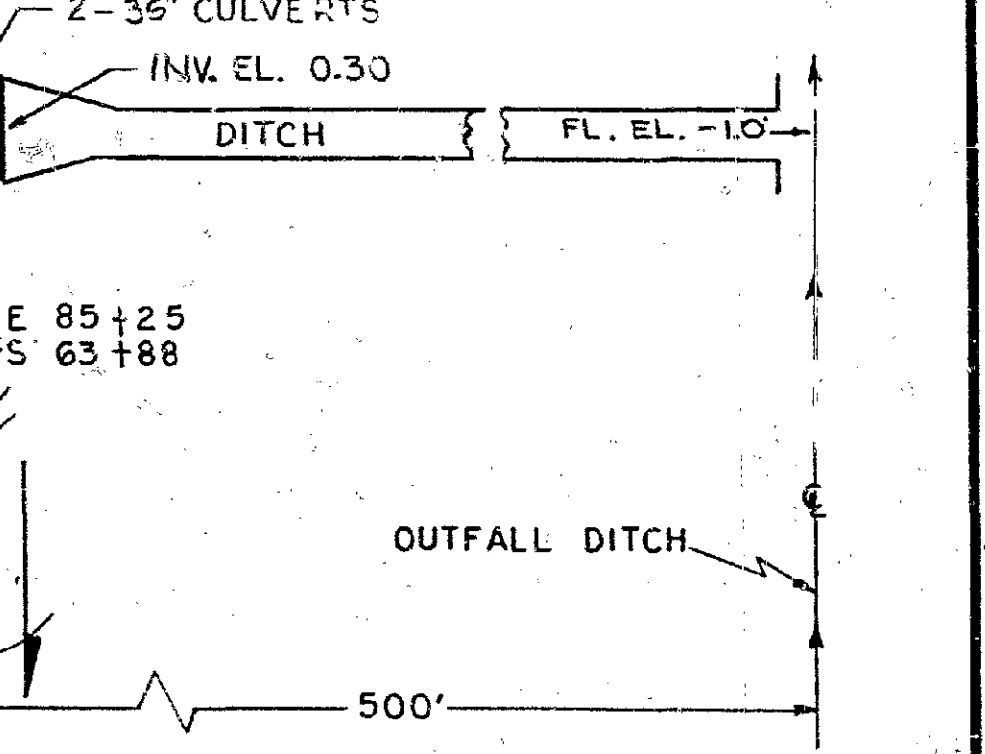
U. S. ARMY ENGINEER DISTRICT, JAX.  
 CORPS OF ENGINEERS  
 JACKSONVILLE, FLA.

**NASA MERRITT ISLAND LAUNCH AREA  
 MERRITT ISLAND, FLA.  
 FLUID TEST COMPLEX  
 CIVIL  
 ROADS & DRAINAGE PLAN NORTH**

INV. NO. ENG. (NASA) 08-123-63-30 SIZE FILE NO.  
 DATED: 5 MARCH 1963 F 1203-28155  
 SCALE: 1" = 50' DATED: 2/15/68 SHEET 105 OF 105



REVISIONS				
NO.	SYM.	DESCRIPTION	DATE	APPROVED
5	△	REVISED TO CONFORM TO AMEND. #4	5-30-63	J. H. [Signature]
4	△	REDESIGNATED PADS #1, #2, RELOCATED EMERGENCY SHOWERS ON ALL PADS IN ACC. W/CD TO CONG. NASA 1970	7/24/63	[Signature]
3	△	ADDED CURB, GUTTER & FLUME TO 7TH ST. ROAD	7/24/63	[Signature]
2	△	REVISED LEACHING POND TO ACCOMP. T.M.G.	11/14/61	[Signature]
1	△	TO CONTRACT # NASA 1970	11/14/61	[Signature]
4	△	REVISED TO SHOW REVISIONS (NEW GUTTERS, (NEW WIRELESS) TO BEZEL) MADE TO CONTRACT # NASA 1970	11/14/61	[Signature]
		UP-DATED FOR FACILITY RECORD DRAWINGS	4-30-68	[Signature]

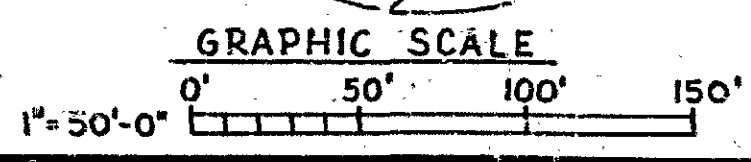


- LEGEND**
- BUILDING
  - EXISTING CONTOUR
  - GRADED CONTOUR
  - DITCH
  - REINFORCED CONCRETE PAVED AREA
  - BITUMINOUS PAVEMENT
  - CULVERT & HEADWALLS
  - CURB, GUTTER & FLUME
  - 1 FT. WIDE SOD STRIP

- NOTE**
- ① DIRT REMOVED FROM DITCHES TO BE USED FOR FILL AS NEEDED.
  - ② SEE SHEET C-22 FOR PAVEMENT GRADING AND DRAINAGE AT BUILDINGS
  - ③ SEE SH T-1 FOR BORROW PIT LOCATION. RECORD
  - ④ SEE SHEET C-21 FOR PAVING, GRADING AND DRAINAGE FOR PADS #1, 2, 3 & 4.
  - ⑤ SEE SHEET C-23 FOR SCHEDULE OF NUMBERED FLUMES AND STANDARD DRAINAGE DETAILS.
  - ⑥ TO PROVIDE LEVEL AREA FOR ELECTRICAL SWITCH PADS AT EST, HYPERGOLIC AND FTS BUILDINGS WIRE SHOULDERS AND MODIFY OR LENGTHEN FLUME AS REQUIRED. SIMILAR WIRE SHOULDERS ALSO REQUIRED AT DELUGE PUMP PAD, SUBSTATION AND UNDERGROUND TANK LOCATIONS.

**RECORD DRAWING NOTE**  
 'Shall be,' 'Provide,' 'Install,' 'Remove,' etc. indicates work was accomplished under the contract.

**AS BUILT**  
 APPROVED BY [Signature]  
 DATE 11 August 1968



NASA-KSC  
**FACILITY RECORD DRAWING**  
 DRAWING NO. B14.00.00.00ADG008.00  
 DATE 2/15/68 APPROVED [Signature]

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LAUNCH OPERATIONS CENTER**

TAMPA BAY ENGINEERING CO. 151 TREASURE ISLAND CRY. ST. PETERSBURG, FLA.  
 U. S. ARMY ENGINEER DISTRICT, JAX. CORPS OF ENGINEERS JACKSONVILLE, FLA.

NASA MERRITT ISLAND LAUNCH AREA MERRITT ISLAND, FLA.  
**FLUID TEST COMPLEX CIVIL**  
 ROADS & DRAINAGE PLAN SOUTH

DESIGNED BY CSM  
 DATED: 5 MARCH 1963  
 SCALE: 1" = 50 FT. DATED: 2/15/68 SHEET 10407