ATTACHMENT R

KAYENTA MESA IMPOUND.

United States Department of the Interior

MINING ENFORCEMENT AND SAFETY ADMINISTRATION
COAL MINE HEALTH AND SAFETY
DISTRICT 9
POST OFFICE BOX 15037
DENVER, COLORADO 80215

March 25, 1977

In Reply Refer To:
EMS:D9-6029

Mr. Roger Dewey
Area Engineer
Peabody Coal Company
P.O. Box 23
Farmington, New Mexico 87401

Re: Kayenta Mine
I.D. No. 02-01195
Kayenta Mine Reservoir
I.D. No. 1211-AZ-9-0001

Dear Mr. Dewey:

The information submitted on August 25, 1976, for the subject site as required by Section 77.216-2(a), 30 CFR 77, has been reviewed and approved by this office.

Since a site visit was not made by our technical specialist, it is assumed that the information submitted is correct and accurate. Should a subsequent inspection of the site reveal a deficiency, additional information may then be required.

Sincerely yours,

John W. Barton
District Manager

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

GEOTECHNICAL INVESTIGATION REPORT

Dam No. 1 - Kayenta Mine

Navajo County, Arizona

SHB Job No. E76-29A

SERGENT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS
PHOENIX • ALBUQUERQUE • EL PASO • TUCSON

SERGENT, HAUSKINS & BECKWITH CONSULTING SOIL AND FOUNDATION ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

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August 16, 1976

Peabody Coal Company
P. O. Box 23
117 East Ute Street
Farmington, New Mexico 87401

SHB Job No. E76-29A

Attention: Roger Dewey, P.E.

Re: Dam No. 1
Kayenta Mine
Navajo County, Arizona

Gentlemen,

Our Geotechnical Investigation Report on the referenced project is herewith submitted. Included in this report are the results of subsurface exploration and laboratory analysis, along with a discussion of our engineering analysis and our conclusions and recommendations.

Should any questions arise concerning this report, we would be pleased to discuss them with you.

Respectfully submitted,
Sergent, Hauskins & Beckwith Engineers

By Robert W. Crossley
Robert W. Crossley, E.I.T.

Reviewed by George H. Beckwith
George H. Beckwith, P.E.

Registered Professional Engineer Certificate No. 1633 GEORGE HENRY BECKWITH Date Signed 8-16-76 ARIZONA, U.S.A.

Copies: Addressee (4)
Peabody Coal Company
St. Louis, Missouri
Attn: Francis X. Kaiser, Jr., P.E. (1)

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SHB Job No. E76-29A

1. INTRODUCTION

This report is submitted pursuant to a geotechnical investigation made by this firm of Kayenta Pond, a fresh water retention reservoir, MESA I.D. No. 1211-AZ-9-0001, located at the Peabody Coal Company Kayenta Mine on Black Mesa in Navajo County, Arizona. The general location of the site is shown on Figure 1*.

An objective of this investigation was to evaluate the physical properties of embankment materials and of the soil and rock beneath the embankment in order to analyze the safety of the dam. A second objective was to provide recommendations for any remedial measures which might be necessary to bring the impoundment in full compliance with current "Design Guidelines for Coal Refuse Piles and Water, Sediment or Slurry Impoundments and Impounding Structures" published by the United States Department of the Interior, Mining Enforcement and Safety Administration.

The scope of our investigation was limited to analysis of geotechnical factors affecting dam stability. It is understood that Peabody Coal Company is performing the necessary hydrological analysis.

*Figures and illustrations are presented in Appendix C.

2. PROJECT DESCRIPTION

Details of the project were provided to us by Roger Dewey, P.E., and Reynaldo Armijo, staff engineer, of Peabody Coal Company.

The water retention pond was constructed in 1972 to provide storage of fresh water to be used at Kayenta Mine for dust control, washing, and to be mixed with coal for transport in the coal-slurry pipeline to the Mohave Generating Station in Nevada. The pond, which is fed as needed from two wells through an 8-inch standpipe, has a bottom elevation of 6603 and a maximum crest elevation of about 6618 at its lowest point near the southwest corner of the embankment. Discharge into the pond is through a standpipe near the center. At the time of our investigation, the inside freeboard was about 5 feet.

The surface area of the pond is about 125,000 square feet (2.9 acres) with inside slopes ranging from 3:1 to 4.3:1 (horizontal to vertical). It is estimated that if it was filled to its crest elevation, the pond could contain at most 1,000,000 cubic feet (22.0 acre-feet).

It is understood that the embankment is lined throughout the inside slopes and bottom with a polyvinyl chloride plastic membrane. The commercial product used was water vinyl liner (PVC). Thickness is 0.015 inch on the bottom and 0.020 inch on the slopes. It was furnished by Water Saver Company, Inc. of Denver, Colorado. About 6 inches of soil cover is present over the liner.

The pond is protected on all sides by a chain link fence. There is a light growth of grass on the crest and side slopes.

3. INVESTIGATION

3.1 Subsurface Exploration

The subsurface exploration program, which was planned and executed by this firm in order to provide the necessary geotechnical information, consisted of a total of three exploratory borings. Borings numbered 7, 8 and 9 were drilled using 6 5/8" O.D., 3¼" I.D., hollow stem auger through the dam embankment into the rock which provides the foundation for the embankment. In borings 7 and 8, the drilling was continued until the auger or sampler refused on hard sedimentary rock. Boring 9 was discontinued in weathered sandstone after penetration of 10 feet. Standard penetration testing or open-end drive sampling was performed at intervals of 5 feet or less in these borings.

Results of the field investigation are presented in Appendix A which includes a site plan showing boring locations, logs of the test borings and a brief description of drilling and sampling equipment and procedures. The subsurface exploration was supervised by Robert W. Crossley, staff engineer of this firm, who located the borings, continuously examined and logged the drill cuttings and drive samples, and prepared the boring logs.

3.2 Laboratory Analysis

Grain-size analysis, Atterberg Limits, moisture-density and direct shear tests were performed on selected samples to aid in soil classification and evaluation of engineering properties. Results of these tests are presented in Appendix B along with a brief description of the testing procedures.

3.3 Site Inspection

The site was visited on April 14, 1976, by principal engineer, George H. Beckwith and Robert Crossley of this firm, along with Messrs. Roger Dewey, Francis Kaiser and Reynaldo Armijo of Peabody Coal Company. The purpose of this visit was to observe the present condition of the pond and to perform a brief reconnaissance of the adjacent topography and geology.

3.4 Survey of Borings

Topographic and planimetric survey data of the pond area were furnished to us by Peabody Coal Company of Kayenta, Arizona on plates dated April 3, 1976 and April 21, 1976, respectively.

4. GEOLOGY, EMBANKMENT & SEISMICITY

4.1 Aerial & Site Geology

Black Mesa, in the area of investigation, is composed of

rocks of Jurassic and Cretaceous ages. The surface slopes gently to the southwest. The uppermost formation of Black Mesa is the Wepo Formation, which has been eroded into parallel ridges and narrow valleys. O'Sullivan et al (21)* describe the Wepo as alternating siltstone, mudstone, coal, and sandstone beds, and as 304 to 743 feet in thickness.

4.2 Geologic History & Structure

According to O'Sullivan et al (21), the Wepo Formation was deposited primarily in a continental environment in which siltstones, mudstones, coal and sandstone were laid down. Locally, some marine sandstones are interbedded in the formation.

Following deposition of the Wepo Formation and younger formations of Cretaceous age, the Navajo Country was affected by a structural period during late Cretaceous and early Tertiary time - the Laramide Orogeny. This resulted in an assortment of folds; such as basin downwarps, uplifts, monoclines, anticlines and synclines (1). One of the downwarps is the Black Mesa Basin. Black Mesa is a dissected highland in the structural center of this basin. In late Tertiary and Quaternary time, the Navajo Country was upwarped and locally faulted.

*Numbers in parentheses correspond to references listed at end of report.

Maps prepared by Cooley et al (1) show that the Wepo Formation of the northern part of Black Mesa has been warped by gentle monoclines and synclines and has not been broken by faults. The nearest faults are shown as 30 to 50 miles north-northwest from the area of investigation, and these trend from eastward to northeastward. Two east trending faults, about 4 to 5 miles long, are about 30 miles from the site. Several northeast trending faults as long as 12 miles occur about 40 miles from the site.

4.3 Embankment Soils

4.3.1 Description of Soils

The embankment was found to be comprised predominantly of clayey sand and clayey silt with lesser amounts of clean sand and gravel mixtures. There is, in the upper few feet of boring 7, a considerable amount of organic carbonaceous material present. Penetration test data indicates the embankment materials are generally moderately firm to firm or medium dense to dense. However, scattered looser zones were present.

Moisture contents were very low throughout, with the exception of the near surface soils in boring 7. Higher moisture contents in this zone apparently are the result of recent snowmelt. Careful inspection of the toe of the embankment revealed no evidence that there has been direct seepage from the pond through the embankment or foundation.

4.3.2 Piping Potential

Sherard et al (2) have published a rough empirical relationship of observed piping and soil types. Using this criteria, the embankment materials probably would fall into categories 4 to 5. The soil and rock foundation materials would have extremely high resistance to internal erosion. In this system, soils are ranked according to their resistance to piping; 1 being most resistant and 8 being least resistant.

4.4 Seismology

4.4.1 Seismic History of the Area

Research was made of the seismic history of the general area of the site. Principal source of information was "Earthquake History of the United States" by Coffman and Von Hake (3). It presents a table listing earthquakes in the Western Mountain Region with intensities equal to or greater than V on the Modified Mercalli Intensity Scale of 1931. This table was used in compiling Table 1 of this report, which lists historical earthquakes within the general area of the site.

Other references that were used include the "Preliminary Safety Analysis Report" (4) prepared by FUGRO, Inc. for Arizona Public Service Company Palo Verde Nuclear Generating Station west of Phoenix and Sturgul and Irwin's report on "Earthquake History of Arizona and New Mexico" (5).

The earthquakes listed in Table 1 are plotted on Figure 2. The figure covers an area of about 420 x 500 miles in Arizona, New Mexico, Utah and Colorado. As the data shows, the region of the site is one of very low seismicity.

Figure 2 shows that within a 100 mile radius of the site, only five earthquakes of intensity V or greater have been recorded during historic time. Of these, the closest epicenter to the site was an intensity VI earthquake reported about 40 miles to the southwest in 1910, while the intensity VI Ganado earthquake of January 16, 1950, was placed about 75 miles southeast of Black Mesa. The largest tremor ever reported in northern Arizona was intensity VII, occurring on January 15, 1906 near the north rim of the Grand Canyon.

4.4.2 Significant Geologic Structure

As discussed in Section 4.2, no faulting is mapped in the immediate area of the site. Minor faulting 40 to 50 miles north of the site is not considered capable of creating an earthquake of sufficient intensity to significantly affect the embankment.

Shown on Figure 2 are locations of significant faults in the general region of the site which are known to have been active during the Quaternary period (past one million years). These include the San Francisco Mountain fault west of Flagstaff and the Verde fault

which has been mapped for 70 miles or more. These faults are located more than 100 miles southwest of the site. Also shown on Figure 2 are the north-south trending Sevier, Hurricane, Toroweap and Grand Wash fault zones in northwestern Arizona and southern Utah. These zones of normal faulting are close enough to the site to be of significance from a seismic risk standpoint. Their significance is discussed by Smith and Sbar (20).

4.4.3 Previous Seismic Zoning & Estimated Effect of Hypothetical Earthquakes

The northern portion of Arizona is located in Zone 2 on the Seismic Risk Map found in the current Uniform Building Code. This means that the general area has experienced in the past, and thus may experience in the future, moderate damage corresponding to intensity VII of the Modified Mercalli Scale. Richter (6) classified the general area as intensity VIII occasional in a study published in 1959. Based upon more detailed analysis, Algermissen (7) classified the general area of the site as intensity VII occasional. This type of zoning is very general in nature and must be controlled by the areas of higher risk within the zone. In a study by the U. S. Geological Survey, based on both statistical analysis of seismic history and evaluation of geology, Algermissen and Perkins (8) have estimated a 50 year return peak ground acceleration of less than 0.01g and a 90 percent probable peak ground acceleration of about

0.03g for the site. Recent studies by Bell Telephone Laboratories (9) estimated 100 year return peak ground acceleration of 0.03g for the site.

In a current study by the Applied Technology Council (15) directed toward development of seismic design methods for buildings, an EPA of less than 0.05g was estimated for the site. A report of on-going U. S. Geological Survey Studies (16), just published, estimated an EPA of less than 0.04g. For the latter two studies, the EPA's of 0.05g and 0.04g were the lowest contours reported. They state that for EPA's lower than these values, wind normally controls the lateral force requirements and, thus, lower contours are not significant in seismic risk evaluation. The EPA's in these two studies (15, 16) are both defined as values with a 90 percent probability of not being exceeded in 50 years.

Estimates of EPA reported by the U. S. Geological Survey in 1976 (16), in the general area of the site, are substantially lower than corresponding values reported in 1972 (8).

Based upon data summarized by Howell and Schultz (10), Bolt (11), Schnabel and Seed (12), Barosh (13) and Hays et al (14), it is possible to roughly estimate the effect of hypothetical earthquakes at the site. Maximum credible earthquakes for a given fault can be estimated, using this data, on the basis of length. The effects

at sites away from the fault can then be assessed utilizing various attenuation curves.

The foregoing analysis is based on these techniques. Should an earthquake of magnitude 6 occur in the San Francisco Peaks area, about 120 miles southwest of the site, it would create an intensity of about 3.7 (MM) and a peak ground acceleration of about 0.02g. Bracketed duration (time during which acceleration is about 0.02g) would be 1 second at most. According to Schnabel and Seed (12), predominant period would be about 0.8 seconds considering the subsurface profile at this site.

Maximum credible earthquakes on the Sevier fault system, and other major fault zones in southwestern Utah, would produce peak ground accelerations of less than 0.02g with a predominant period of perhaps 1.0 second. These zones are 130 miles or more away from the site.

In summary, all data shows the site is in an area of very low seismicity and, thus, a very low level of seismic risk is involved.

5. STABILITY ANALYSIS

5.1 Assumed Soil Parameters

Shear strength parameters were estimated from the results of the direct shear tests performed under submerged conditions. The direct shear tests on submerged, remolded

soils are believed to yield strength parameters which are lower than might be expected for the actual compacted embankment at present low moisture contents. Most of the embankment is below optimum water content as a result of the effectiveness of the plastic liner. Because of the low rate of strain and the soil type involved, the direct shear tests are believed to yield essentially effective stress parameters.

The effective shear strength and other parameters used in stability analyses are as follows:

$\emptyset' = 25^{o}$
C' = 100 lbs./sq.ft.
Density - Wet = 110 lbs./cu.ft.
Submerged = 58 lbs./cu.ft.

5.2 Seismic Design Considerations

As stated in Section 4.4.1, this site is in an area of very low seismicity. Based on assessment of this data, a seismic coefficient of 0.05g was selected for use in analysis.

5.3 Methods of Analysis

Using the geometry shown in Figure 3, slope stability analyses were made by various stability number methods and verified by manual calculation utilizing the traditional method of slices. The slope was assumed to be

fully drained, i.e., no seepage forces present. This assumption is believed to represent present and probable future conditions. Steady-state seepage would develop only if the plastic liner were severely ruptured and then would be present only in very localized areas. The possibility of this condition is believed to be extremely remote.

Stability number methods published by Hoek and Bray (17) and Morgenstern and Bishop (18) were found to give minimum factors of safety.

5.4 Summary of Results

Based upon the analysis methods and assumed shear strength parameters described in Sections 5.1 and 5.3 above, the following factors of safety were computed.

Height	Slope	Factor of Safety
28'	1.7:1	1.23 (1.12)*

*Number in parentheses is the estimated factor of safety with 0.05g seismic coefficient.

The slope and embankment heights were taken from survey data furnished by Peabody Coal Company. A documentation of these figures is presented in Appendix C.

6. CONCLUSIONS & RECOMMENDATIONS

It is concluded that the dam embankment is safe for present

conditions and foreseeable future operating conditions. It is our conclusion that very high factors of safety against slope failure exist for these conditions and thus no alterations of the embankment are necessary for safety reasons.

The absence of elevated moisture within the embankment and the absence of seepage at the toe clearly indicates that the lining is functioning well and no significant leakage is occurring. University of Arizona researchers believe that membrane lining of the type used for the project can be expected to perform for 25 years or more without deterioration, assuming proper soil cover. This is consistent with results of a study by the Bureau of Reclamation (19) which indicate a 10 mil PVC plastic lining buried for 10 years gave excellent performance. Bacteriological deterioration was slight, and strength and tensile properties were only slightly affected. PVC lining was also shown to be the most tear resistant of all plastic liners. The entire pond is enclosed by a chain link fence so there is little likelihood of livestock or wild animals damaging the membrane. Thus, it is concluded that the embankment is likely to perform as a dry slope for 25 years or more.

It is recommended that the condition of the soil cover be periodically inspected and, should the PVC lining become exposed due to erosion, the cover be replaced.

Even if the lining should develop major leaks, it is our conclusion a sufficiently high factor of safety against

slope failure would exist. It is further concluded, considering the seepage gradients which would exist in the event of leakage, that the embankment would not be susceptible to piping or internal erosion.

Because of the low estimated EPA, it is concluded that the embankment would not have the potential for liquefaction, even if portions of it became saturated.

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TEST DRILLING EQUIPMENT & PROCEDURES

Drilling Equipment Truck mounted CME-55 drill rigs powered with 4 or 6 cylinder Ford industrial engines are used in advancing test borings. The 4 cylinder and 6 cylinder engines are capable of delivering about 4,350 and 6,500 foot/pounds torque to the drill spindle, respectively. The spindle is advanced with twin hydraulic rams capable of exerting 12,000 pounds downward force. Drilling through soil or softer rock is performed with 6½" O.D., 3¼" I.D. hollow stem auger or 4½" continuous flight auger. Carbide insert teeth are normally used on the auger bits so they can often penetrate rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NW rods using water or air as a drilling fluid.

Sampling Procedures Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 procedure. Two inch O.D., 1-3/8" I.D. samplers are used in many cases to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" O.D. samplers lined with 2.42" I.D. brass rings. Driving energy is generally recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the samplers in 6 inch increments. However, in stratified soils, driving resistance sometimes is recorded in 2 or 3 inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and realistic penetration values obtained for consideration in design. These values are expressed in blows per foot on the logs. "Undisturbed" sampling of softer soils is sometimes performed with thin walled Shelby tubes (ASTM D1587). Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113). The tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings.

Boring Records Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487) with appropriate group symbols being shown on the logs.

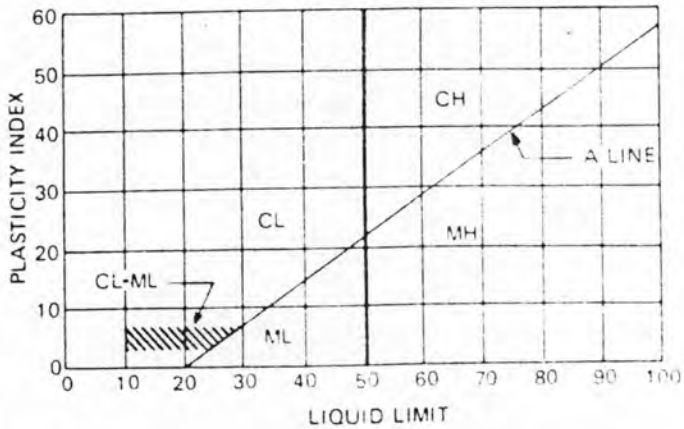
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified by the Unified Soil Classification system on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" Corp of Engineers, US Army Technical Memorandum No. 3-357 (Revised April 1960) or ASTM Designation: D2487-66T.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 seive)			SW	Well graded sands, gravelly sands.
					SP	Poorly graded sands, gravelly sands.
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (LIMITS PLOT BELOW "A" LINE & HATCHED ZONE ON PLASTICITY CHART)	SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50)			ML	Inorganic silts, clayey silts with slight plasticity.
		SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	CLAYS (LIMITS PLOT ABOVE "A" LINE & HATCHED ZONE ON PLASTICITY CHART)	CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50)			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

NOTE: Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with limits plotting in the hatched zone on the plasticity chart to have double symbol.

PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to ¾ in.
Fine gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY, CONSISTENCY OR FIRMNESS OF SOILS

The terminology used on the boring logs to describe the relative density, consistency or firmness of soils relative to the standard penetration resistance is presented below. The standard penetration resistance (N) in blows per foot is obtained by the ASTM D1586-67 procedure using 2" O.D. - 1 3/8" I.D. samplers.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands & sand-gravel mixtures.

N	Relative Density
0-4	Very loose
5-10	Loose
11-30	Medium dense
31-50	Dense
50+	Very dense

2. Relative Consistency. Terms for description of clays which are saturated or near saturation.

N	Relative Consistency	Remarks
0-2	Very soft	Easily penetrated several inches with fist.
3-4	Soft	Easily penetrated several inches with thumb.
5-8	Medium stiff	Can be penetrated several inches with thumb with moderate effort.
9-15	Stiff	Readily indented with thumb, but penetrated only with great effort.
16-30	Very stiff	Readily indented with thumbnail.
30+	Hard	Indented only with difficulty by thumbnail.

3. Relative Firmness. Terms for description of partially saturated and/or cemented soils which commonly occur in the Southwest including clays, cemented granular materials, silts and silty and clayey granular soils.

N	Relative Firmness
0-4	Very soft
5-8	Soft
9-15	Moderately firm
16-30	Firm
31-50	Very firm
50+	Hard

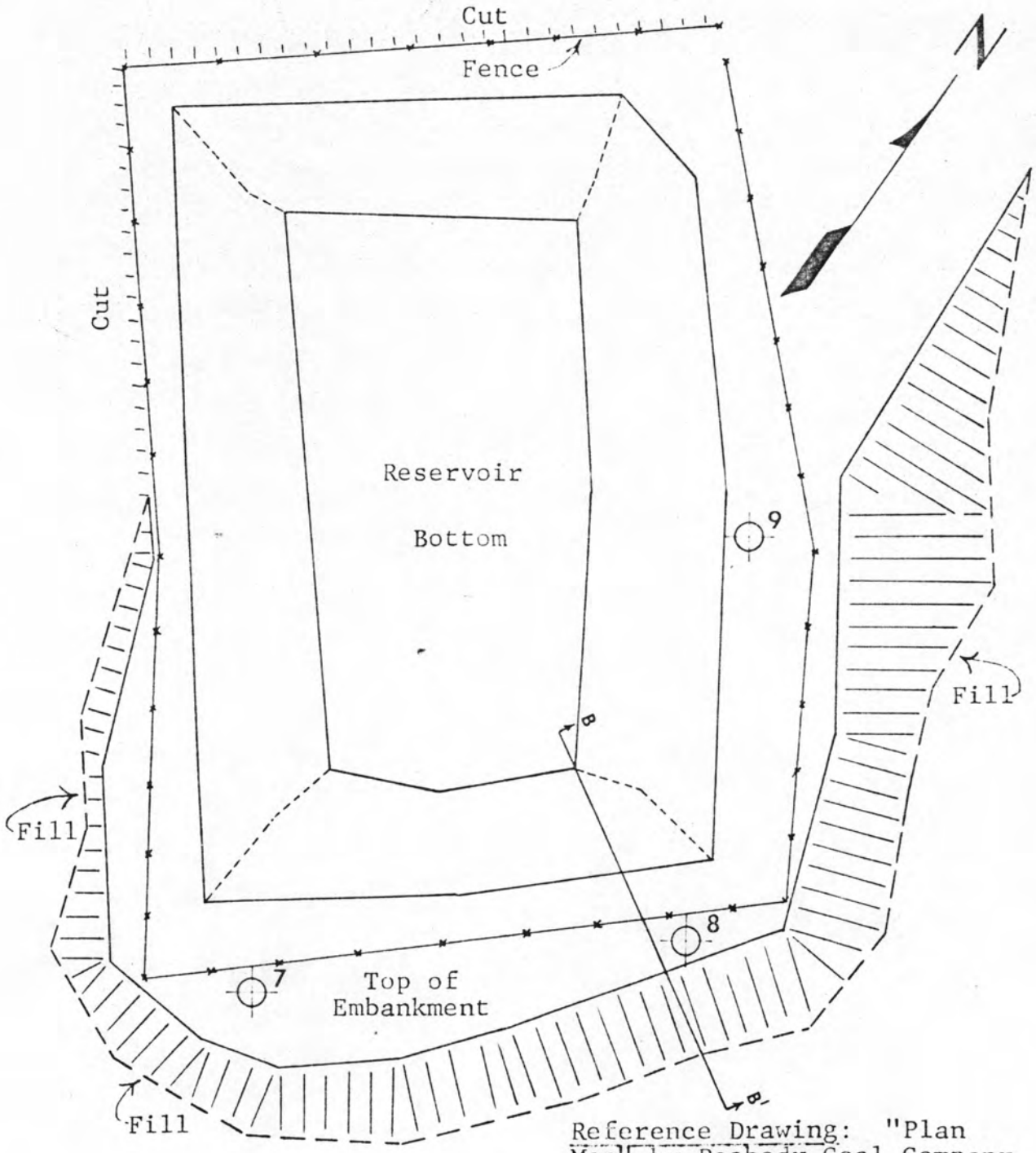
TERMINOLOGY FOR THE DESCRIPTION OF ROCK

General Property	Descriptive Term	Visual or Physical Properties
WEATHERING	VERY WEATHERED	Abundant fractures coated with oxides, carbonates, sulphates, mud, etc., thorough discoloration, rock disintegration, mineral decomposition
	MODERATELY WEATHERED	Some fracture coating, moderate or localized discoloration, little to no effect on cementation, slight mineral decomposition
	SLIGHTLY WEATHERED	A few stained fractures, slight discoloration, little to no effect on cementation, no mineral decomposition
	FRESH	Unaffected by weathering agents, no appreciable change with depth
FRACTURING	INTENSELY FRACTURED	less than 1" spacing
	VERY FRACTURED	1" to 6" spacing
	MODERATELY FRACTURED	6" to 12" spacing
	SLIGHTLY FRACTURED	12" to 36" spacing
	SOLID	36" spacing or greater
STRATIFICATION	THINLY LAMINATED	less than 1/10"
	LAMINATED	1/10" to 1/2"
	VERY THINLY BEDDED	1/2" to 2"
	THINLY BEDDED	2" to 2 feet
	THICKLY BEDDED	more than 2 feet
HARDNESS	SOFT	Can be dug by hand and crushed by fingers
	MODERATELY HARD	Friable, can be gouged deeply with knife and will crumble readily under light hammer blows
	HARD	Knife scratch leaves dust trace, will withstand a few hammer blows before breaking
	VERY HARD	Scratched with knife with difficulty, difficult to break with hammer blows

SITE PLAN

SHOWING LOCATIONS OF TEST BORINGS

FRESH WATER DAM



Reference Drawing: "Plan Map" by Peabody Coal Company, Farmington, New Mexico, dated April 21, 1976

80 40 0 80 160

FEET

Dam No. 1
Kayenta Mine
Navajo County, Arizona
SHB Job No. E76-29A

SERGENT, HAUSKINS & BECKWITH

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PROJECT Dam No. 1 Rayched Hike

JOB NO. E76-29A DATE 4-13-76

LOG OF TEST BORING NO. 7

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 6617.4'

DATUM Peabody Survey 4-21-76

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Percent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	1-5-4-5 (9)			SP-SM	loose	Embankment FILL SILTY SAND, small amount of gravel, fine grained, nonplastic, gray
				S	15-12-7 (19)			SC,CL & ML	very stiff	Embankment FILL thin lifts of CLAYEY SAND, CLAYEY SILT & CLAY, some gravel, coarse fragments are angular to subangular, high plasticity to non-plastic, 3'-6' - fill contains considerable carbonaceous material, color ranges from yellow to gray to black
5				S	8-8-6 (14)					
				S	12-15-12 (27)			SP		
10				S	3-3-2 (5)				loose to medium dense	Embankment FILL mostly clean SAND, some gravel, few lifts of clayey sand, fine grained, nonplastic, yellow
				S	9-10-18 (28)			SC		Native Material
15				S	50/2"				firm	CLAYEY SAND & GRAVEL, few cobbles, well graded, subangular to subrounded, very low plasticity, yellow to brown
				S	36-40-50/2" (190)					SILTSTONE, moderately weathered, thinly to very thinly bedded, moderately hard, yellow to white
20										Stopped auger at 17' Sampler refused at 18'2"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A - Auger cuttings. B - Block sample
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.

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PROJECT - Dam No. 1 - Kayenta Mine

JOB NO. E76-29A DATE 4-13-76

LOG OF TEST BORING NO. 0

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 6618.5'

DATUM Peabody Survey 4-21-76

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Percent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	4-7-10-11 (21)			SP-SM	medium dense	Embankment FILL SILTY SAND, considerable gravel, fine grained, very low plasticity to nonplastic, reddish-brown note: trace of carbonaceous material
5				U	41	102	7		very firm	Embankment FILL CLAYEY SAND & GRAVEL, few cobbles, coarse fragments of sandstone & shale are angular to subrounded, low to medium plasticity, reddish-brown to yellow
10				S	50/0" (no recovery)			SC-GC		
15				U	23	97	8			
								GC		Native Material CLAYEY GRAVEL, well graded, angular, low plasticity, reddish-yellow
20				S	50/5"					SANDSTONE, fine grained, slightly weathered, thinly bedded, reddish-white Auger refused at 19'6" Sampler refused at 19'11"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A - Auger cuttings. B - Block sample
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.

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PROJECT - Dam No. 1 - Kayenta Mine

JOB NO. E76-29A DATE 4-13-76

LOG OF TEST BORING NO. 9

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 6619.6'

DATUM Peabody Survey 4-21-76

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Percent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	2-4-5-8 (13)				moderately firm	FILL SILTY SAND & GRAVEL, some clayey silt, few cobbles, fragments of sandstone are angular to subangular, low plasticity to nonplastic, reddish-brown
5				S	7-6-7 (13)			SM & ML-CL		
				A						
10				S	25-50/5"					SANDSTONE, fine grained, moderately to very weathered, thinly bedded, moderately hard, reddish-white
15				S	50/6"					
20				S	8-10-18 (28)					
										Stopped auger at 19' Stopped sampler at 20'6"
25										

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A - Auger cuttings. B - Block sample
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.

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LABORATORY TESTING PROCEDURES

Direct Shear Tests Direct Shear Tests are run using a Clockhouse or Soiltest apparatus of the strain-control type. Shearing forces are applied at a rate deformation of approximately 0.05 inches per minute. The machine is designed to receive one of the one inch high 2.42 inch diameter specimens obtained by tube sampling. Generally, each sample is sheared under a normal load equivalent to the effective overburden pressure at the point of sampling. In some instances, samples are sheared at several normal loads to obtain the cohesion and angle of internal friction. When necessary, samples are saturated and/or consolidated before shearing in order to approximate the anticipated controlling field loading conditions.

..BUL...ON TE.. RES...S

Job No. E76-29A

Date

Client:

Project Dam No. 1 - Kayenta Mine

Navajo County, Arizona

Material

Source

HOLE NO	LOCATION	DEPTH	UNIFIED CLASS	LL	PI	SIEVE ANALYSIS – ACCUM % PASSING												LAB NO
						200	100	40	16	10	4	¼	⅜	¾	1	1½	2	
7	See Site Plan	2'-3½'	CL	29	11	58	72	81	82	82	84	86	87	87	87	100		29-150
7	See Site Plan	4½'-6'	CL-ML	24	5	51	70	78	81	82	85	86	88	91	91	100		29-151
9	See Site Plan	0-2'	ML		NP	50	80	94	95	95	96	97	99	100				29-160
9	See Site Plan	6'-9'	SM	22	3	43	76	94	95	96	98	99	99	100				29-162

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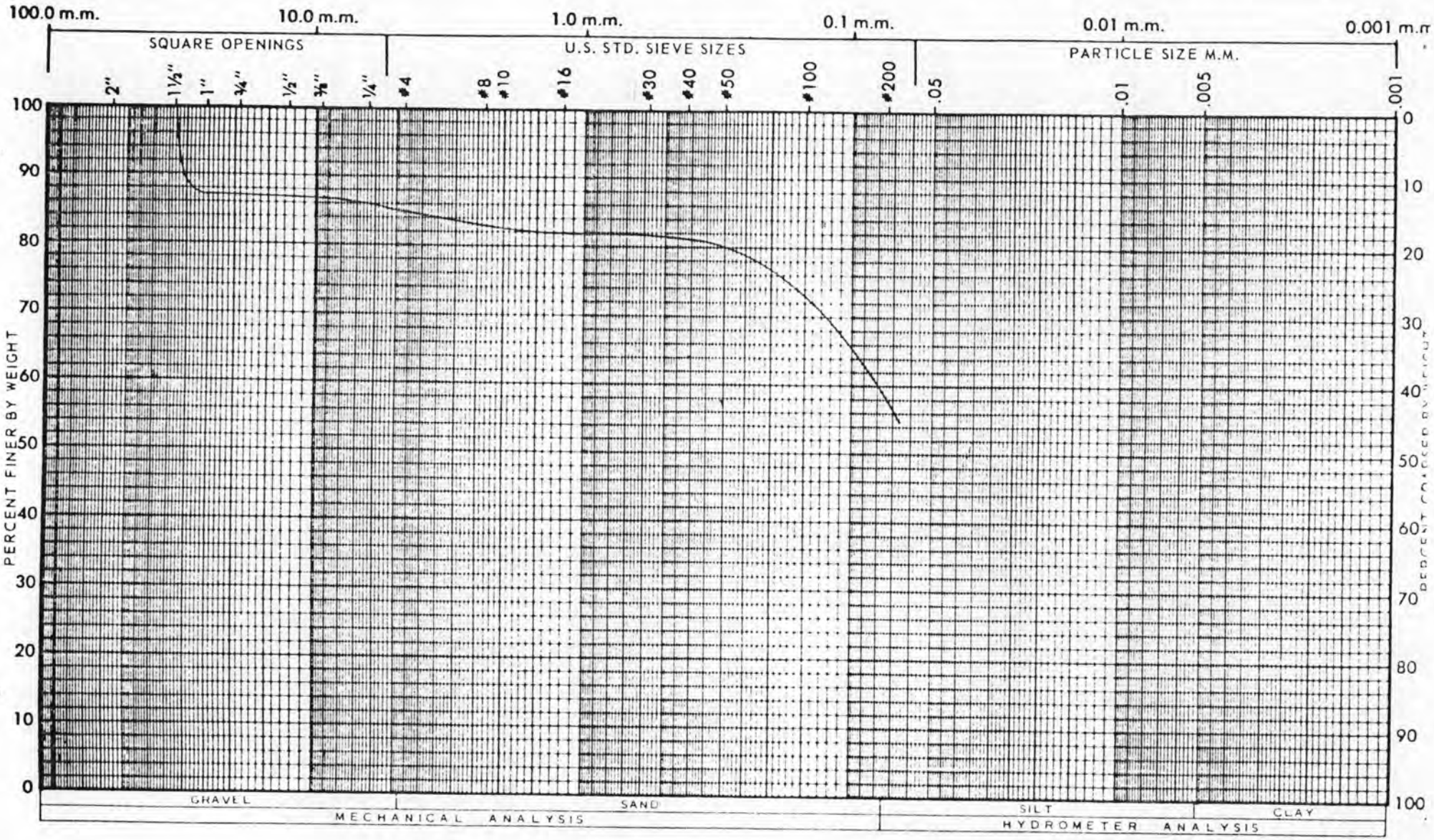
NO

PARTICLE SIZE DISTRIBUTION CURVE

PROJECT Dam No. 1 - Kayenta Mine **LOCATION** Navajo County, Arizona



CURVE	SAMPLE	LIQUID LIMIT	PLASTICITY INDEX	ACTIVITY	UNIFIED SOIL CLASSIFICATION	LAB NO.
A	Boring #7 @ 2'-3½'	29	11		CL	6-29-150

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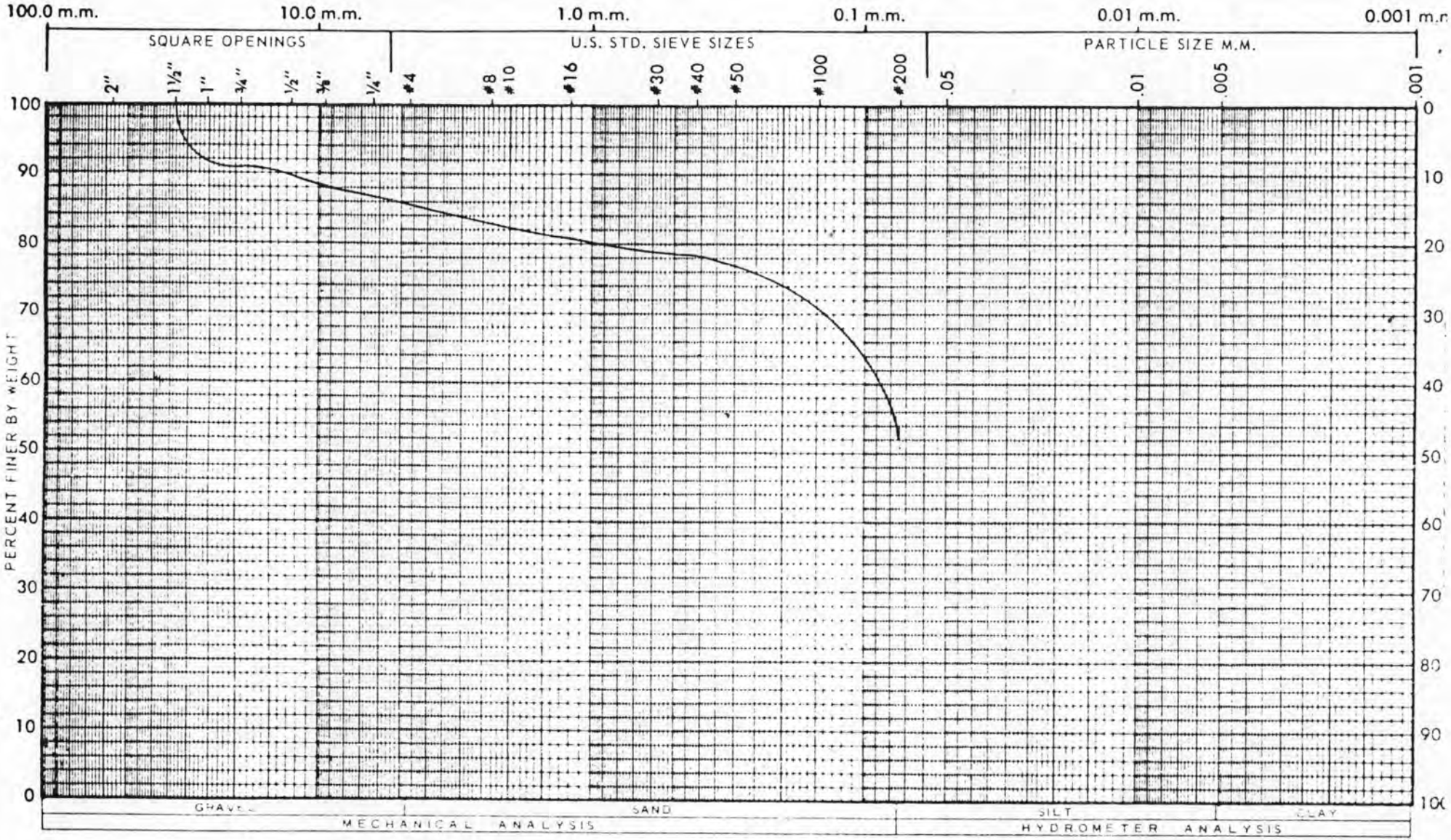
PARTICLE SIZE DISTRIBUTION CURVE

PROJECT Dam No. 1 - Kayenta Mine LOCATION Navajo County, Arizona



CURVE	SAMPLE	LIQUID LIMIT	PLASTICITY INDEX	ACTIVITY	UNIFIED SOIL CLASSIFICATION	LAB NO.
B	Boring #7 @ 4½'-6'	24	5		CL-ML	6-29-151

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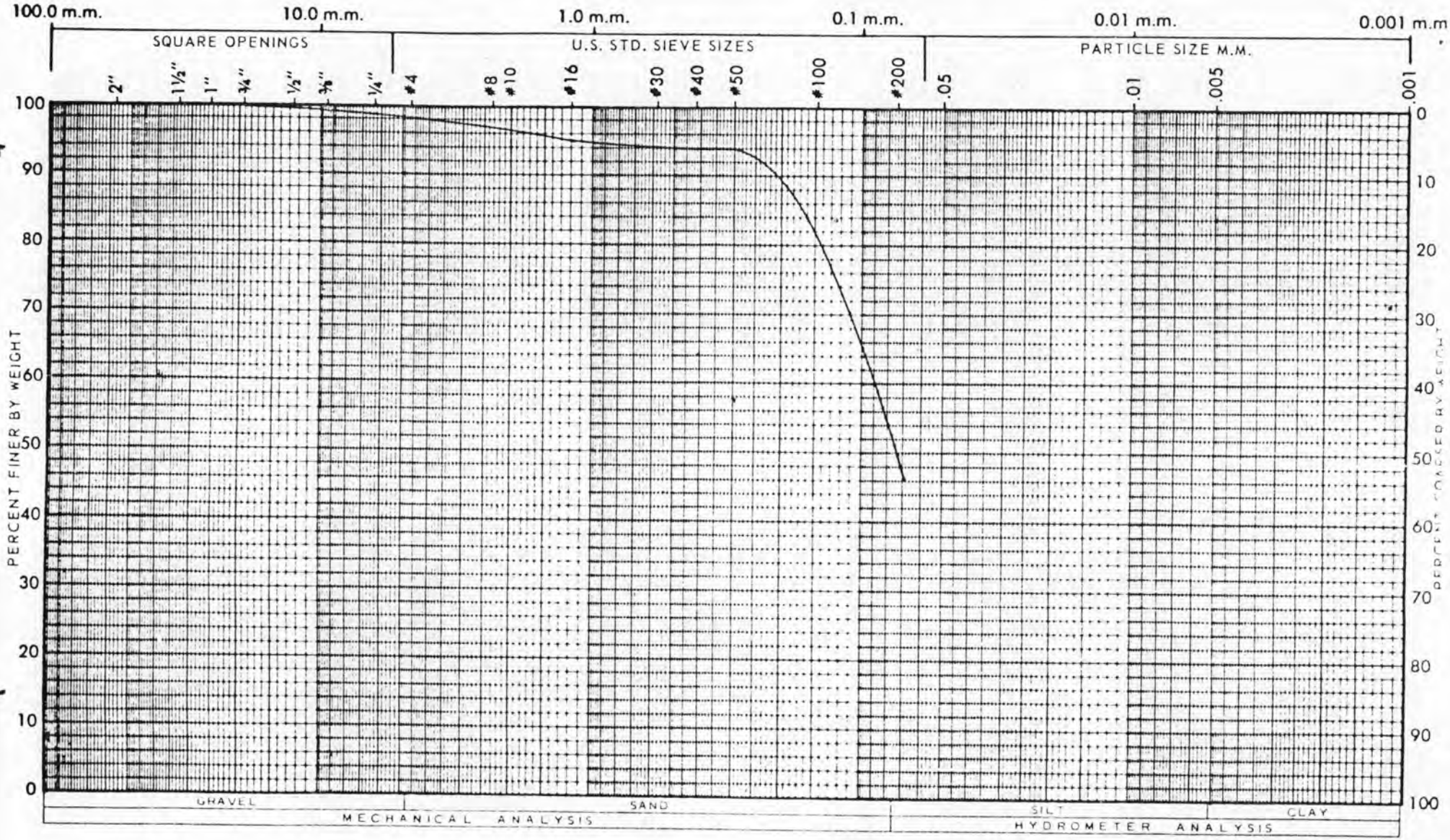
NO.

PARTICLE SIZE DISTRIBUTION CURVE

PROJECT Dam No. 1 - Kayenta Mine LOCATION Navajo County, Arizona



CURVE	SAMPLE	LIQUID LIMIT	PLASTICITY INDEX	ACTIVITY	UNIFIED SOIL CLASSIFICATION	LAB NO.
C	Boring #9 @ 0-2'		NP		ML	6-29-160

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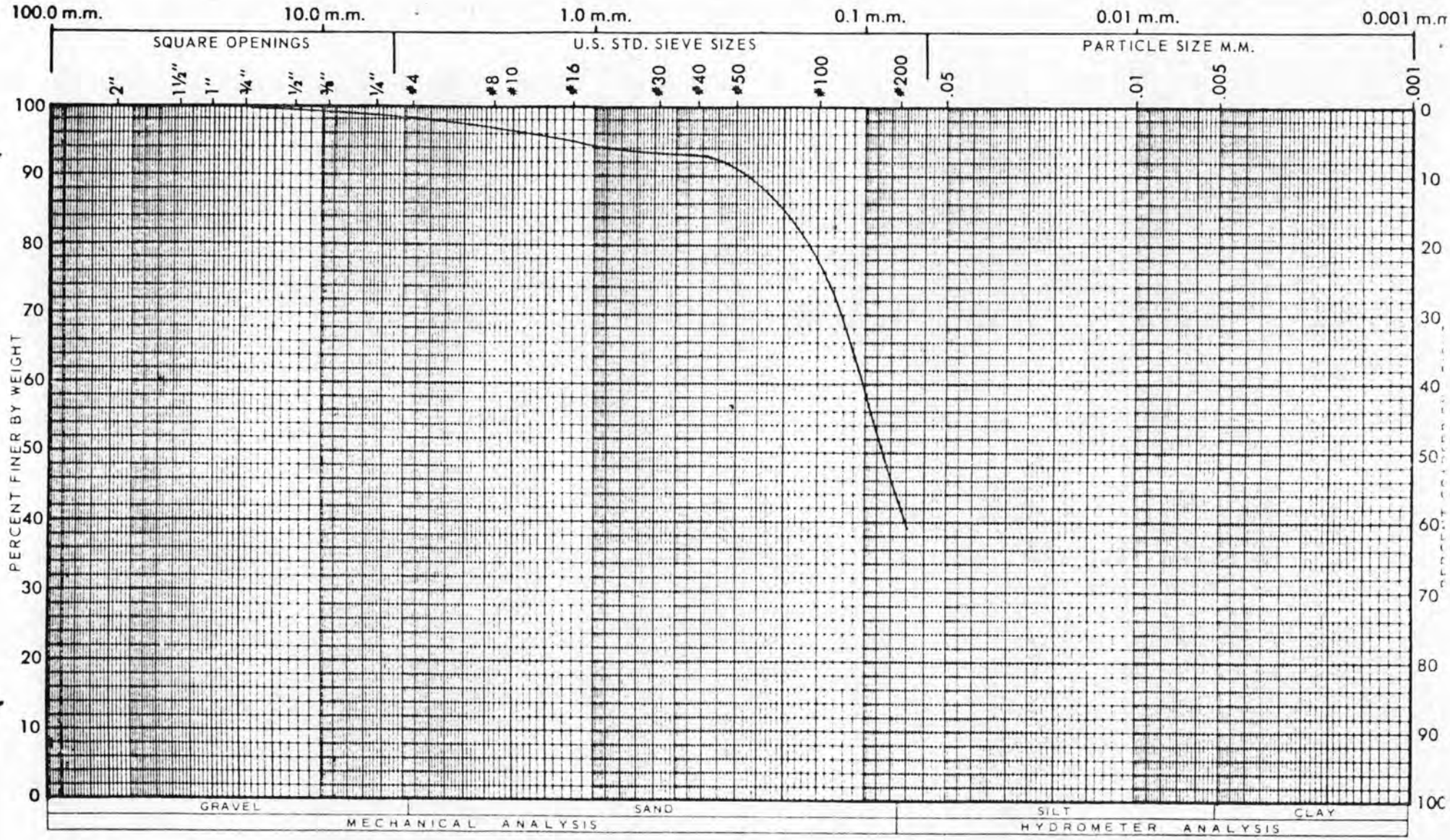
NO

PARTICLE SIZE DISTRIBUTION CURVE

PROJECT Dam No. 1 - Kayenta Mine **LOCATION** Navajo County, Arizona



CURVE	SAMPLE	LIQUID LIMIT	PLASTICITY INDEX	ACTIVITY	UNIFIED SOIL CLASSIFICATION	LAB NO.
D	Boring #9 @ 6'-9'	22	3		SM	6-29-162

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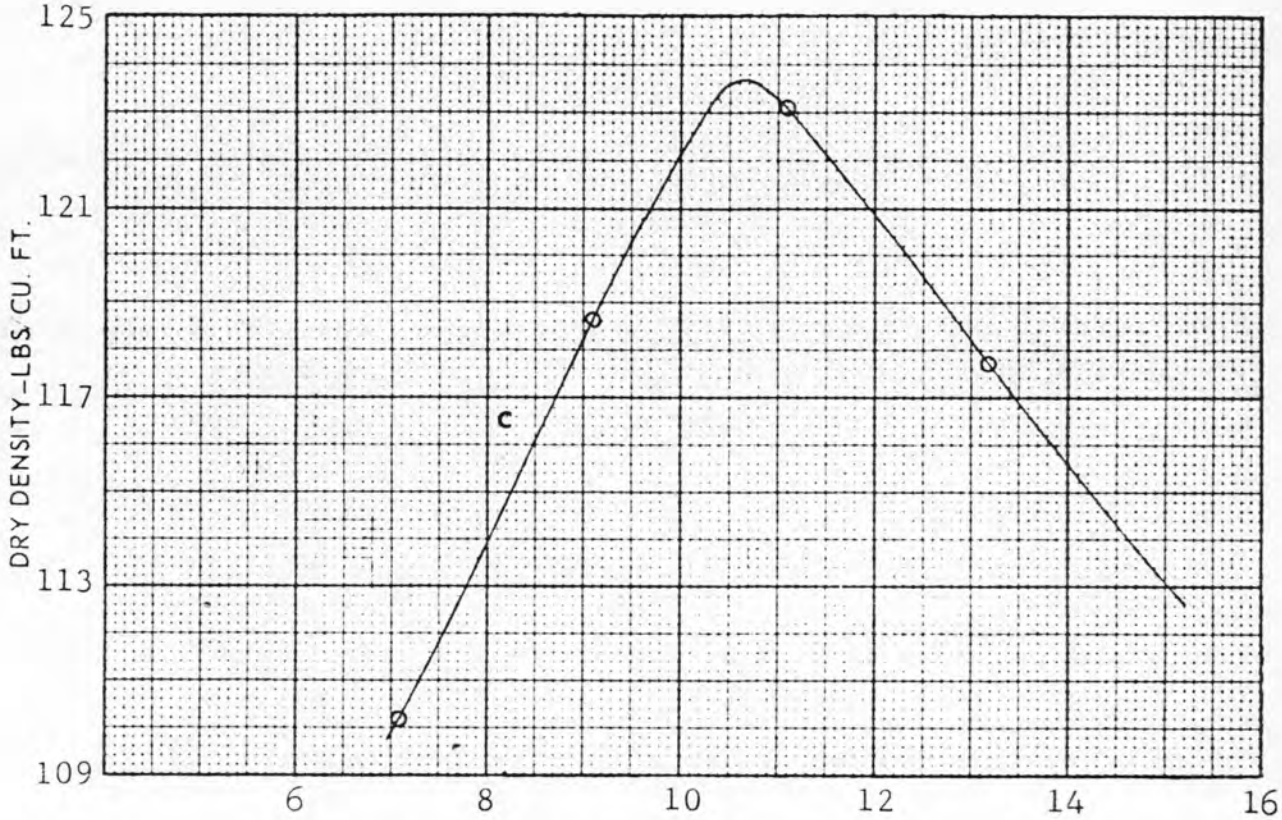
SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT Dam No. 1 Kayenta Mine JOB NO. E76-29A



CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS. CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
C	Boring No. 9 @ 6'-9'	10.6	123.6	ASTM D-698	A	29-162

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHO T99-61 and ASTM D 698-66T (Standard Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.58"	3	56	5.5 LBS.	12"	12,317

AASHO T180-61 and ASTM 1557-66T (Modified Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

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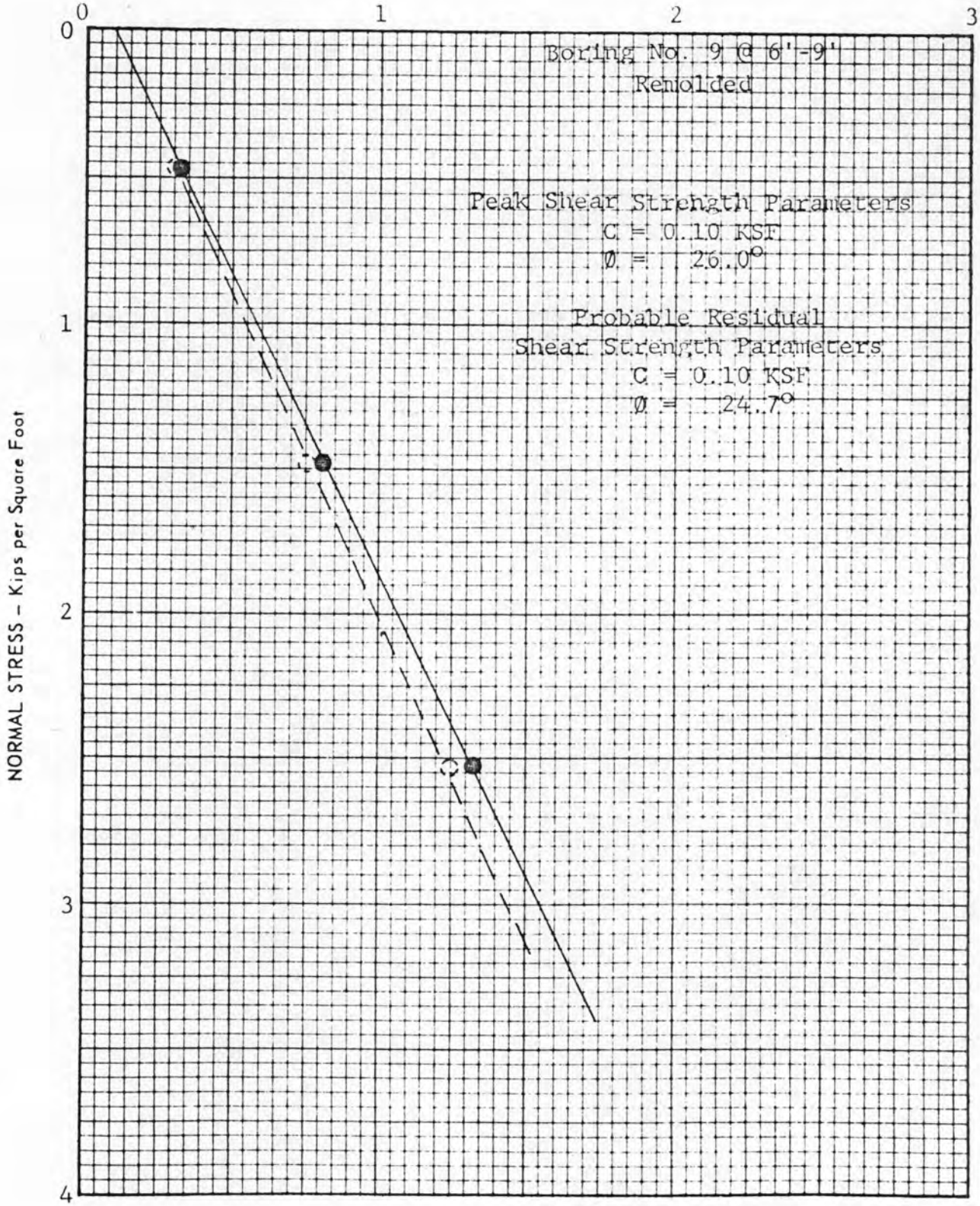
PROJECT Dam No. 1 - Kayenta Mine JOB NO. E76-29A

Lab No. 29-162



SOIL MOISTURE CONDITION

O – INSITU

● – SUBMERGED

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REPORT OF LABORATORY TESTS

DATE _____

PROJECT Dam No. 1 - Kayenta Mine JOB NO. E76-29A
LOCATION Navajo County, Arizona LAB NO. 29-162
SAMPLE Boring No. 9 @ 6'-9' (Remolded)

DIRECT SHEAR TESTS

In Situ - Point No. 1 (= ± 0.47 KSF)

Initial Moisture Content	8.7 %
Dry Density (PCF)	103.6
Submerged	
Final Moisture Content	19.5 %
Maximum Vertical Strain @ T max.	(-) 0.001 inches
Shearing Stress, T max.	0.32 KSF

In Situ - Point No. 2 (= ± 1.47 KSF)

Initial Moisture Content	8.8 %
Dry Density (PCF)	103.5
Submerged	
Final Moisture Content	19.0 %
Maximum Vertical Strain @ T max.	(-) 0.022 inches
Shearing Stress, T max.	0.81 KSF

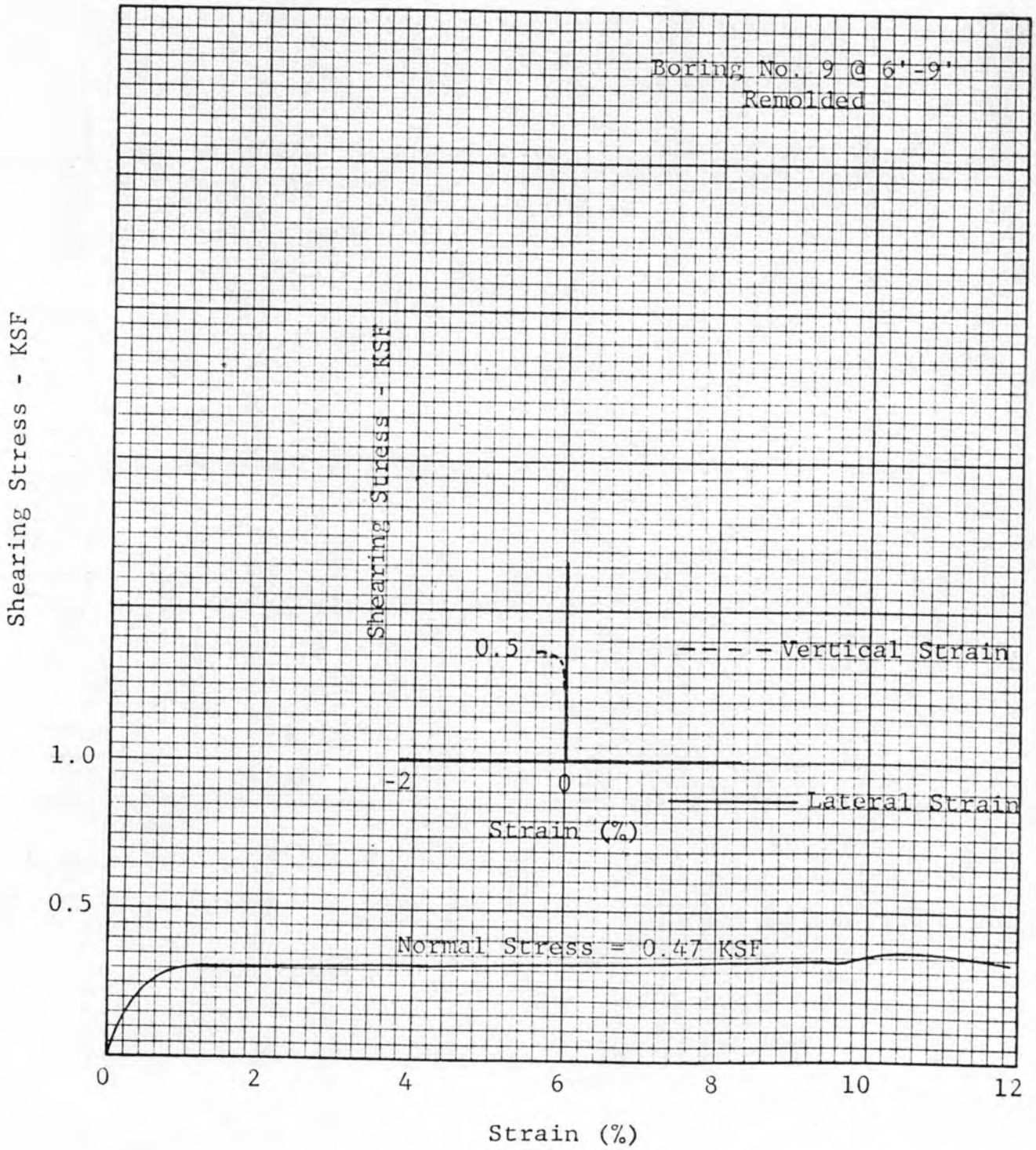
In Situ - Point No. 3 (= ± 2.53 KSF)

Initial Moisture Content	8.6 %
Dry Density (PCF)	103.7
Submerged	
Final Moisture Content	19.5 %
Maximum Vertical Strain @ T max.	(-) 0.035 inches
Shearing Stress, T max.	1.32 KSF

PROJECT Dam No. 1 - Kayenta Mine JOB NO. E76-29A

STRESS-STRAIN CURVES

FROM DIRECT SHEAR TESTS



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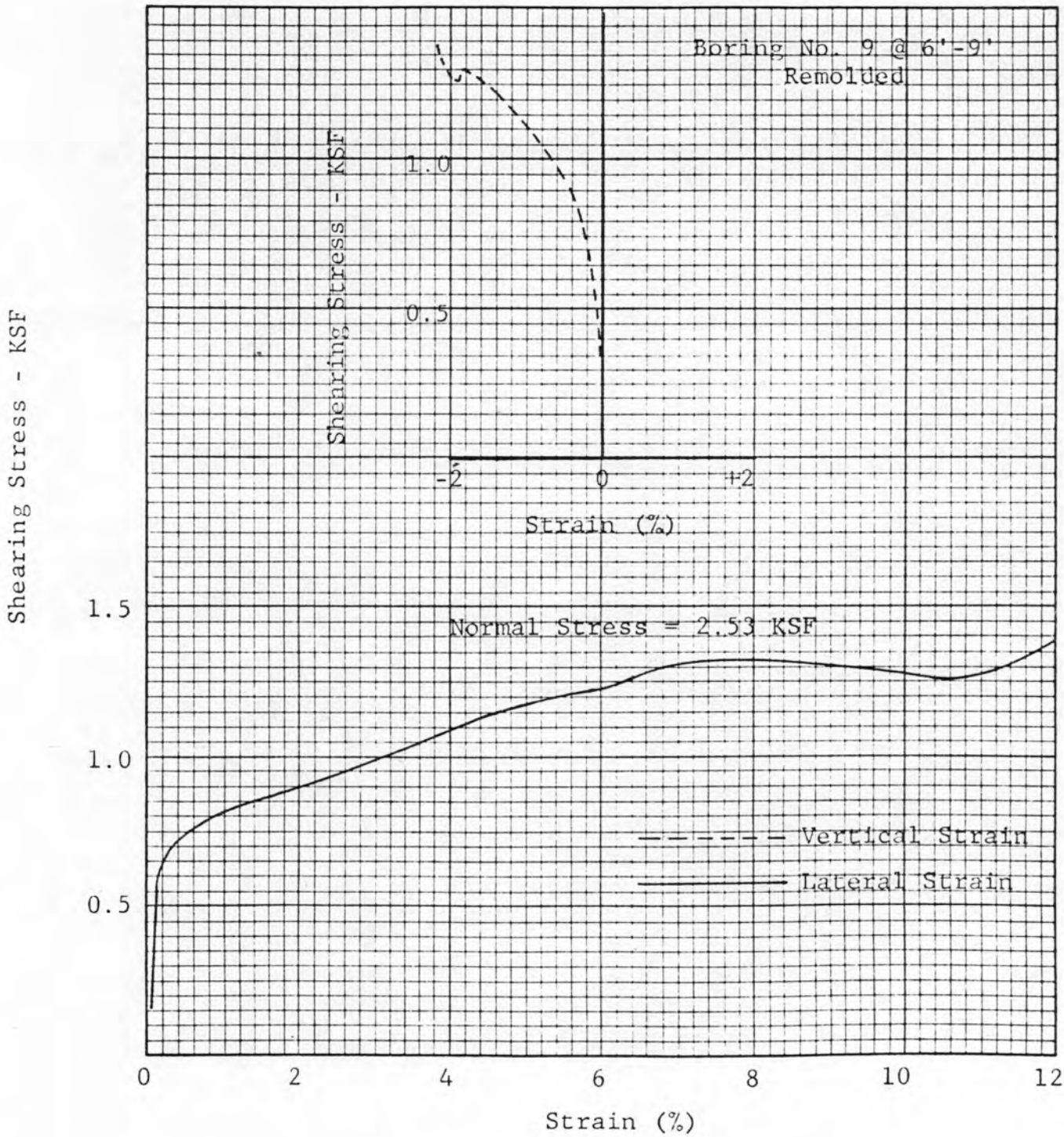
PROJECT Dam No. 1 - Kayenta Mine JOB NO. E76-29A

STRESS-STRAIN CURVES

FROM DIRECT SHEAR TESTS



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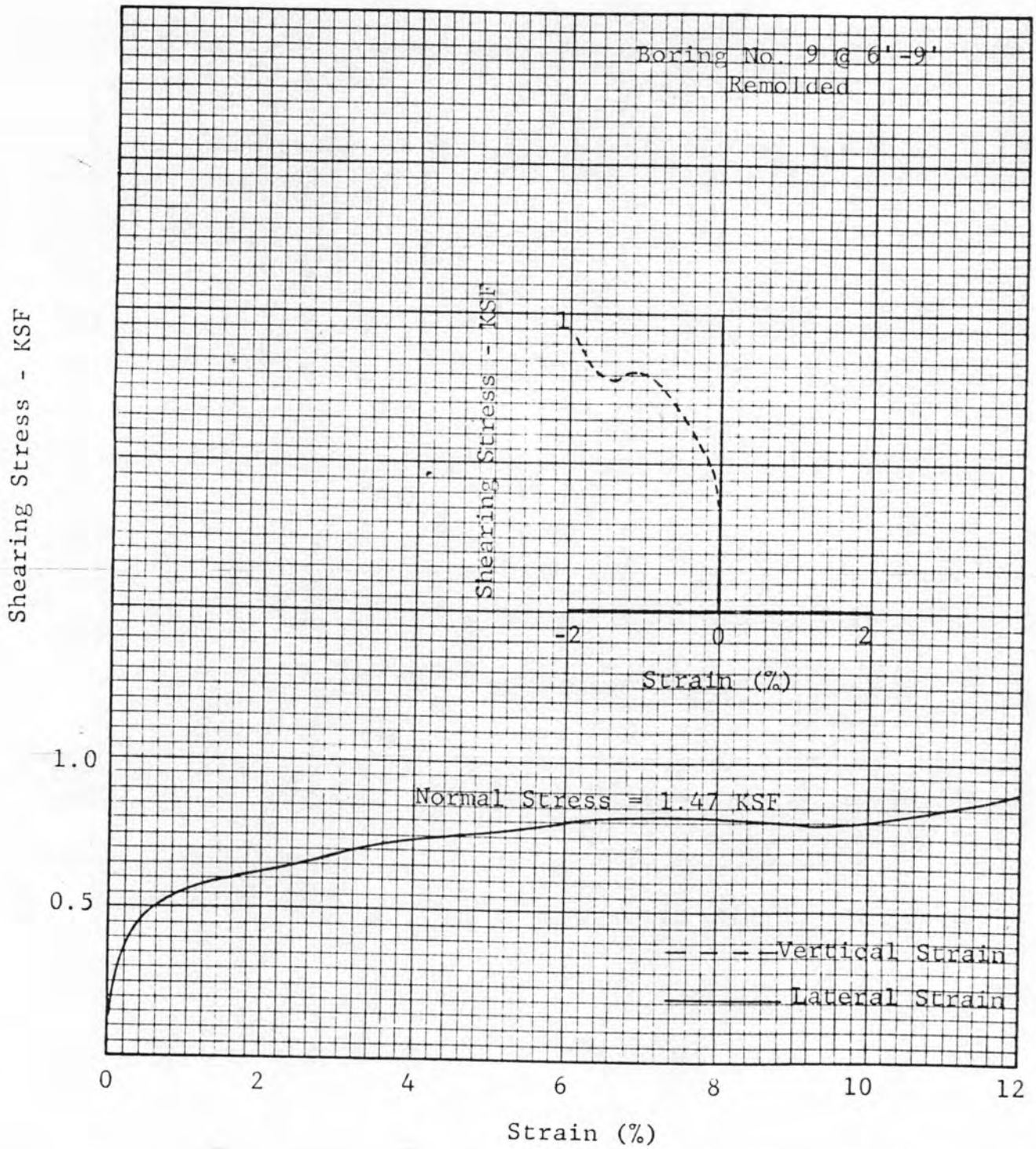
PROJECT Dam No. 1 - Kayenta Mine JOB NO. E76-29A

STRESS-STRAIN CURVES

FROM DIRECT SHEAR TESTS



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PROJECT Dam No 1 Kayenta Mine JOB NO. E76-29A

LOCATION Black Mesa

SUBJECT Slope Stability Analysis - Hoek & Bray Charts * SHEET NO. 1

COMPUTED BY KC DATE 8/12/76 CHECKED BY DATE

Given: Slope is 1.7 : 1 height = 28' $\angle$ = 30.5°

Shear Strength Parameters

γ_{wet} = 110 pcf
ϕ' = 25°
c' = 100 psf

The case to be analyzed is a dry slope, therefore use Hoek's Chart No 1

Calculate the stability number to enter the chart.

$$SN = \frac{c}{\gamma H \tan\phi}$$

$$SN = \frac{100}{(110)(28)\tan 25°}$$

$$SN = 0.07$$

Go to the chart, get $\frac{\tan\phi}{F.S.}$, calculate F.S.

$\tan\phi / F = .38$

$$\therefore F = \frac{\tan 25°}{.38} = 1.23$$

* Ref: Rock Slope Engineering by Hoek & Bray JW, The Gresham Press, London, U.K. 1974 pp 214-22

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PROJECT Dam No 1 Kayenta Mine JOB NO. E76-29A

LOCATION Black Mesa

SUBJECT Slope Stability analysis - Bishops & Morgenstern* SHEET NO. 2

COMPUTED BY KC DATE 8/12/76 CHECKED BY DATE

$F.S. = m - n r_u$

where m, n are stability coefficients dependent on slope geometry, c' and ϕ', and r_u = pore pressure ratio = $u/\gamma h$. For the case of no seepage $r_u = 0$ provided there are no zones of residual p.w.p. from construction

Parameters

Slope	=	1.7:1 (30.5°)
height	=	28'
γ_{wet}	=	110
ϕ'	=	25°
c'	=	100

$$SN = \frac{c'}{\gamma H} = \frac{(100)}{(110)(28)} = .032$$

From Tables in Appendix A

For SN = 0 $\phi = 25°$

slope	m
2:1	.933
3:1	1.349

For SN = .025 $\phi = 25°$

slope	m
2:1	1.356
3:1	1.875

For SN = .05

slope	m
2:1	1.624
3:1	2.193

* Bishop, A.W. and Morgenstern, N. "Stability Coefficients for Earth Slopes" Geotechnique Volume 10, Number 4, pp 129-150.

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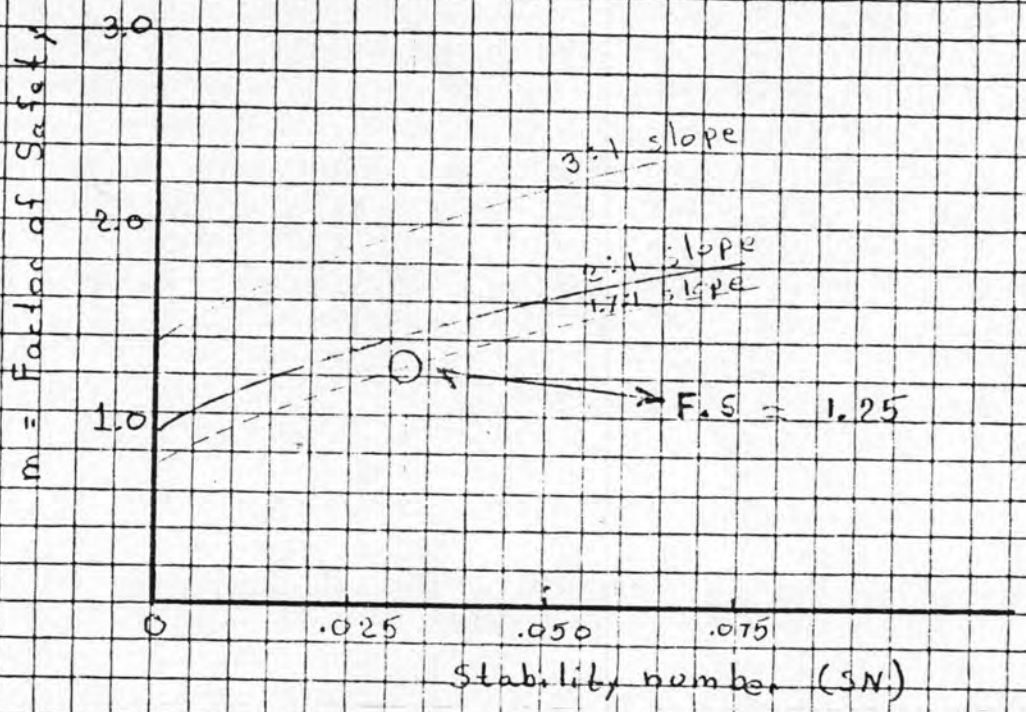
PROJECT Dam No. 1 Kayenta Mine JOB NO. E76-29A

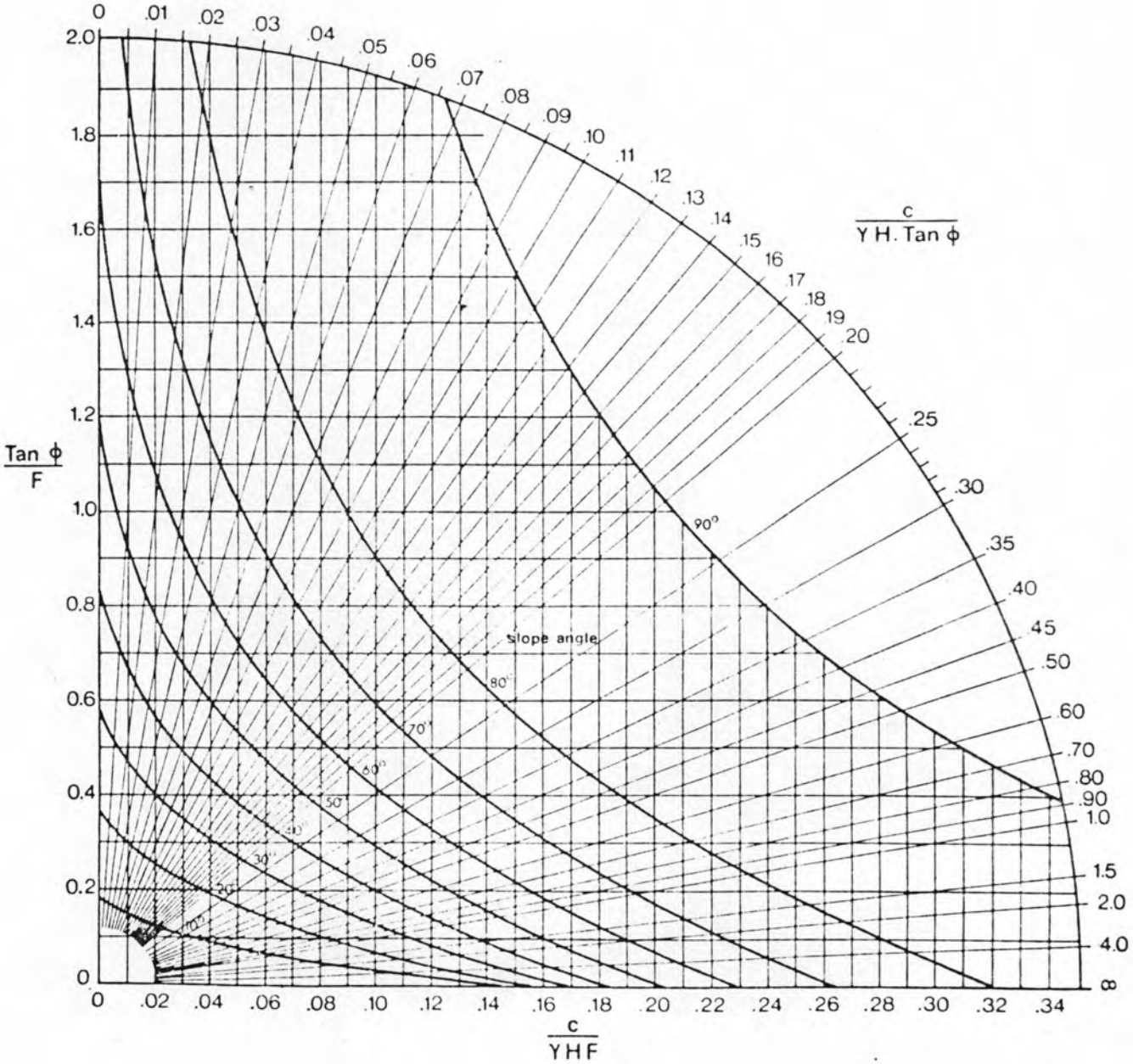
LOCATION Black Mesa

SUBJECT Slope Stability Analysis - Bishop & Morgenstern SHEET NO. 3

COMPUTED BY BC DATE 8/12/76 CHECKED BY DATE



CIRCULAR FAILURE CHART NUMBER 1



Radius = 70.0'

$\widehat{C}$ = 439.82'

$\angle^{c-1}$ = 53.13°

$\angle^{0-5}$ = 43.26°

$\angle^{0-4}$ = 34.87°

$\angle^{0-3}$ = 25.39°

$\angle^{0-2}$ = 16.57°

$\angle^{0-1}$ = 8.24°

$\angle^{1}$ = 8.24°

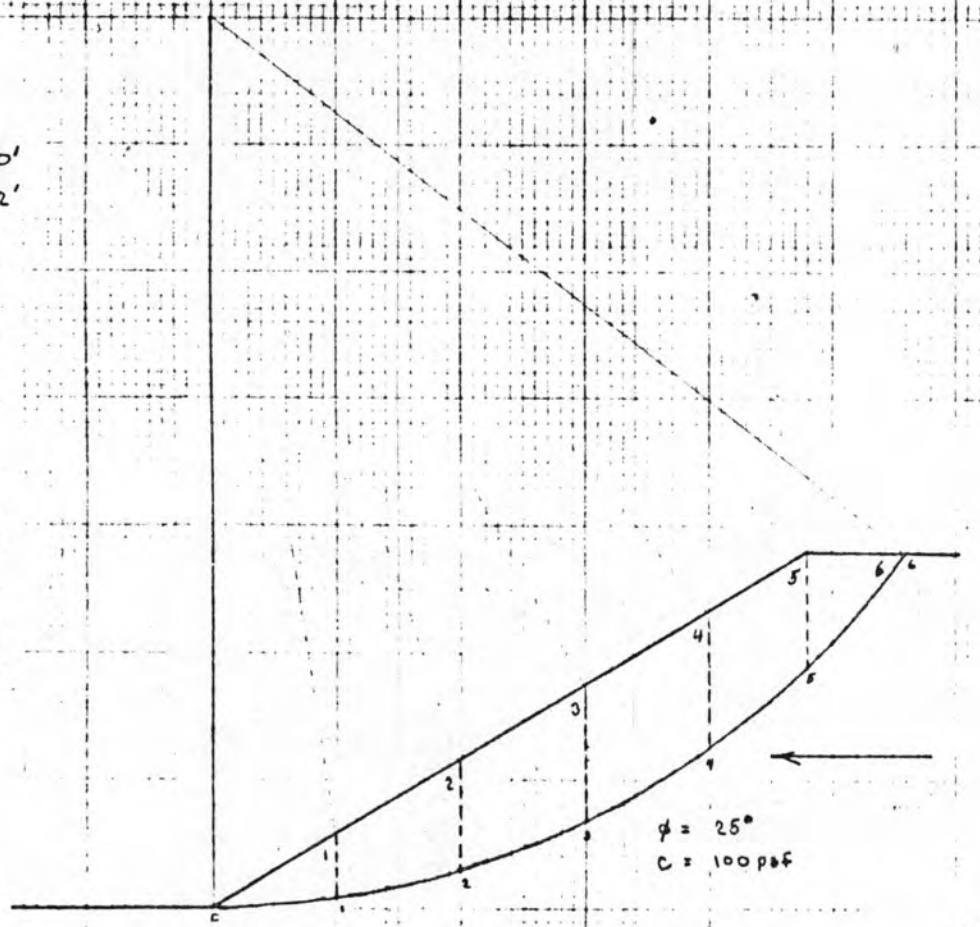
$\angle^{2}$ = 8.33°

$\angle^{3}$ = 8.82°

$\angle^{4}$ = 9.48°

$\angle^{5}$ = 8.39°

$\angle^{6}$ = 9.87°



Scale 1" = 10'

	Area cu ft	Area ft²	a_n ft	W_n	ln	cln	α	cos α	tan φ
1	27	27	6.6	2970	10.56	1056	5.25	.995	.4663
2	72	72	16	7920	10.18	1018	12.8	.974	↓
3	96	96	25	10560	10.77	1077	20.4	.937	↓
4	107	107	35	11770	11.58	1158	29.7	.868	↓
5	76	76	44	8360	10.25	1025	41.4	.749	↓
6	37	37	50	4070	12.06	1206	48.2	.666	↓

$$F.S = \frac{\Sigma R.M}{\Sigma O.M} = \frac{R(2cln + \Sigma W_n \cos\alpha \tan\phi)}{\Sigma W_n a_n}$$

i	$cln + W_n \cos\alpha \tan\phi$	$W_n a_n$
1	2384 ft-lb	19,600 ft²-lb
2	4615	126,720
3	5691	264,000
4	5922	411,950
5	3945	367,840
6	2470	203,500
	25027 ft-lb	1,393,610 ft²-lb

$$F.S = \frac{(70')(25,027)}{1,393,610} = 1.26$$

If we add an earthquake force of 0.05g times the mass at the approximate C.G. of the section (Moment Arm ≈ 58 ft)

$$F.S = \frac{(70)(25,027)}{(1,393,610) + (58)(46,650)(.05)} = 1.15$$

On the basis of this calculation, we can say that the effect of a 0.05g horizontal force is to reduce the S.F. to 0.91 times it static value

Dam No 1

Kayenta Mine

E76-2

SERGENT, HAUSKINS & BECKWITH

C-

Dam No. 1
Kayenta Mine
Navajo County, Arizona
SHB Job No. E76-29A

TABLE 1

Earthquakes intensity V and above within the general region of Black Mesa through 1970. (From "Earthquake History of the United States", Dept. of Commerce Publication 41-1).

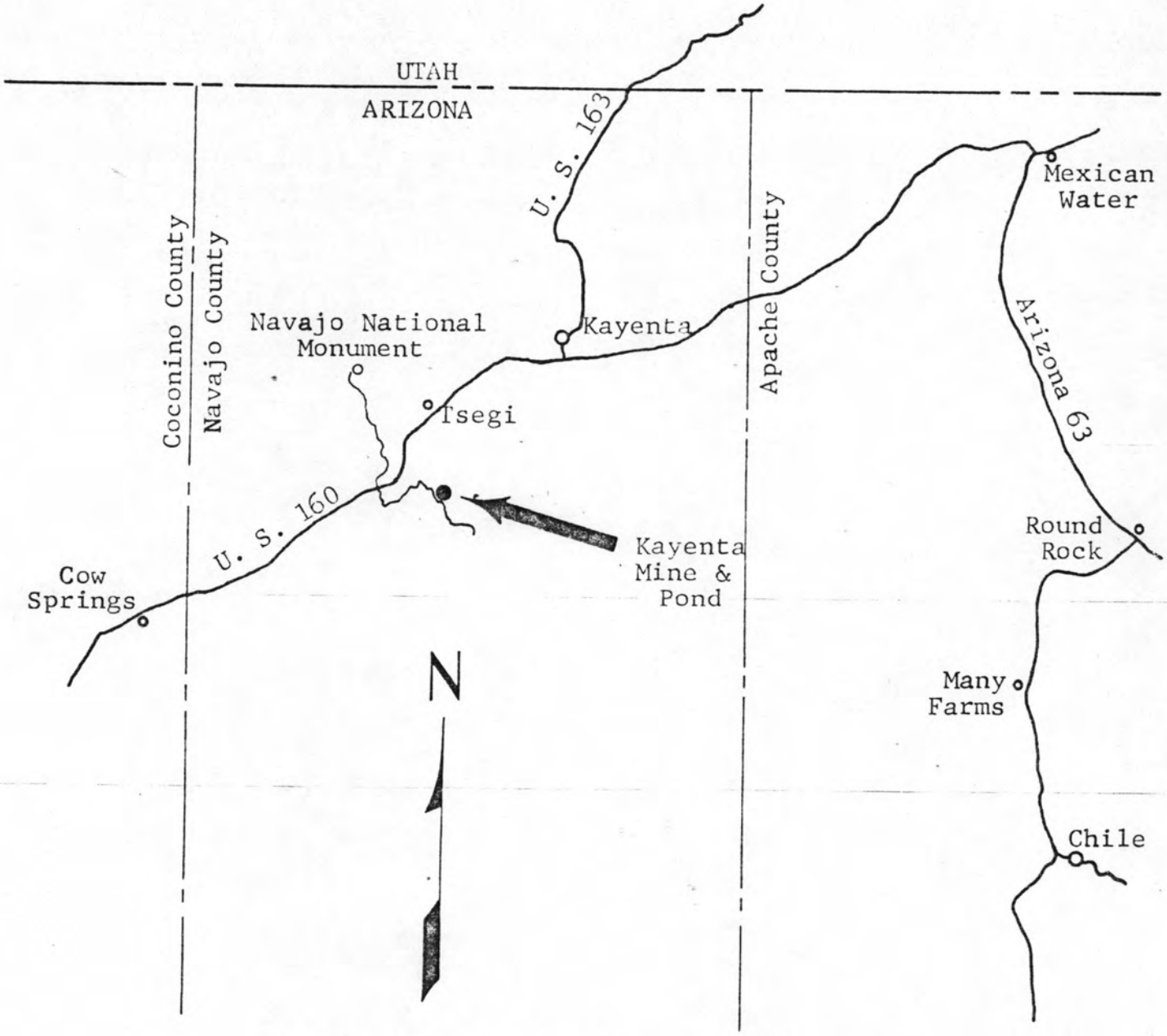
		Latitude	Longitude	Intensity
1873	July 30	38.3	112.7	VI
1887	Dec. 5	37.1	112.5	VI
1901	Nov. 13	38.7	112.1	VIII
1902	Nov. 17	37.4	113.5	VII
1910	Jan. 10-12	38.7	112.1	VI
1913	Nov. 11	38.2	107.7	V
1914	Dec. 20	37.6	113.8	V
1920	Nov. 25	37.1	113.5	V
1921	Sept. 29	38.8	112.2	VIII
1921	Sept. 29	38.8	112.2	VII
1921	Oct. 1	38.8	112.2	VIII
1928	Apr. 20	37.8	107.0	V
1933	Jan. 20	38.0	113.0	VI
1936	May 9	37.5	113.0	V-VI
1937	Feb. 17	38.0	112.5	V
1942	Aug. 30	37.7	113.0	VI
1944	Sept. 8	39.0	107.5	VI
1949	Nov. 1	37.2	113.3	VI
1953	Oct. 21	37.5	112.3	V
1955	Aug. 2	38.0	107.0	VI
1959	Feb. 27	38.0	112.5	VI
1959	July 21	37.0	112.5	VI
1960	Oct. 11	38.3	107.6	VI
1962	Feb. 15	36.9	112.4	V
1966	Jan. 22	37.0	107.0	VII
1967	Oct. 4	38.5	112.1	VII

Dam No. 1
Kayenta Mine
Navajo County, Arizona
SHB Job No. E76-29A

Arizona		Latitude	Longitude	Intensity
1906	Jan. 25	35.2	111.7	VII
1910	Sept. 23	36.0	111.1	VI
1912	Aug. 18	36.5	111.5	VI-VII
1931	July 28	35.0	112.0	V
1935	Jan. 10	36.1	112.2	VI
1950	Jan. 16	35.5	109.5	VI
1959	Feb. 11	35.2	111.7	V
1959	July 21	37.0	112.5	VI
1959	Oct. 13	35.5	111.5	V
1962	Feb. 15	36.9	112.4	V

VICINITY MAP

FIGURE 1



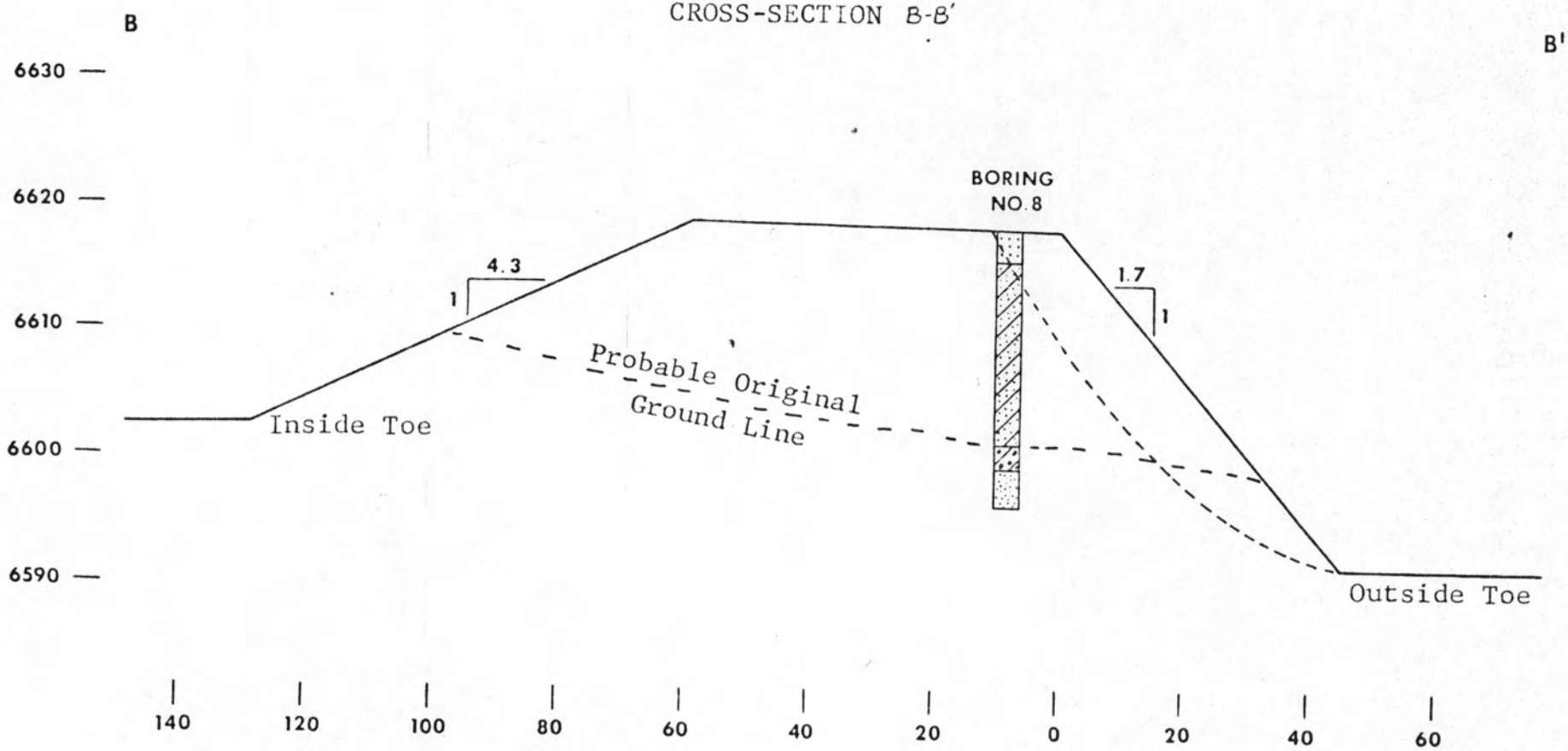
Dam No. 1
Kayenta Mine
Navajo County, Arizona
SHB Job No. E76-29A

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
PHOENIX • FLAGSTAFF • ALBUQUERQUE • EL PASO

FIGURE 3

CROSS-SECTION OF SOUTH SIDE

CROSS-SECTION B-B'



Reference Drawing: "Cross-sections of Three Sided Dam" by Peabody Coal Company, Farmington, New Mexico, dated April 3, 1976

Dam No. 1
Kayenta Mine
Navajo County, Arizona
SHB Job No. E76-29A

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
PHOENIX • FLAGSTAFF • ALBUQUERQUE • EL PASO

EDDY COAL COMPANY

MSP DATA INPUT FORM

TITLE _____ PAGE 1

LINE USE INDICATOR						
1	X	DAMS 2	04/03/76	KAYENTA DAM NO 1 MESA 1 0 NO 1211-AZ-9-0001		CARD IDENT
2		AREA CRCT				
3	X	BTM WIDTH	FEET	1		
		BTM WIDTH				
4		DW DATA				
5		CLASS				
6		COMMENT				
7						
8		OUTLETS				
9	X	ES CREST	ELEV	6417		
		ES CREST				
		ES CREST				

S2 DATA INPUT FORM

TITLE _____ 300.01

PAGE 2

LEFT JUSTIFY ALL FIELDS

LINE USE INDICATOR							
10 ☒	ES DATA	12	80	.020	521	.020	1.90
		PROFILE NUMBER	DISTANCE PT 2	DEPTH PT 2	DISTANCE PT 3	DEPTH PT 3	
11 ☒	ES PROFILE	12	20	4.4	40	8.7	
			DISTANCE PT 4	DEPTH PT 4	DISTANCE PT 5	DEPTH PT 5	
12 ☒	ES PROFILE		60	13.0	80	17.3	
			DISTANCE PT 6	DEPTH PT 6	DISTANCE PT 7	DEPTH PT 7	
13 ☐	ES PROFILE						
		SPILLWAY TYPE NUMBER	STAGE INCREMENT	ANY ALPHANUMERIC LABEL			
14 ☐	ES RATING						
		Q_1	Q_2	Q_3	Q_4	Q_5	Q_6
15 ☐	ES RATING						
		Q_7	Q_8	Q_9	Q_{10}	Q_{11}	Q_{12}
16 ☐	ES RATING						
17 ☒	KIRPICK						
		NO. OF POINTS					
18 ☐	NPOINTS						
		TOP WIDTH	P 100A - IN	P 100A - IN	P 100A - IN	P 100A - IN	
19 ☐	PDIRECT						

Form 946 Page 2

HS2 DATA INPUT FORM

B TITLE _____

LEFT JUSTIFY ALL FIELDS

	LINE USE INDICATOR							
20	X	POOL DATA	ELEV	PERMANENT POOL GG17.9	CREST PRINCIPAL SPILLWAY FG17.9	FLOOD POOL SEDIMENT		
21		PS COEFFS		"C" WEIR FIRST STAGE	"C" ORIFICE FIRST STAGE	"C" WEIR - HIGH STAGE	FILLET INCHES	
22		PS DATA		NUMBER OF CONDUITS	LENGTH - FEET	DIAMETER OR WIDTH	BLANK OR HEIGHT	MANNING'S "n"	HYDRAULIC GRADIENT AT OUTLET
23		PS INLET		HIGH STAGE CREST UNITS	ENTRANCE LOSS K_1	WEIR LENGTH - FT	CREST OF HIGH STAGE	ORIFICE HEIGHT - FT	ORIFICE LENGTH - FT
24		PS FULL							
25	X	PS RATING							
26	X	P100 PMP	CLIMATIC INDEX 4.4.8	P 100 2.9	PMP 1.3	RATIO P_{24}/P_{6} 1.21	RATIO P_{12} DA/P_{24} 1.49		
27		QDIRECT		Q 10A-IN	Q 100A-IN	Q ESH-IN	Q FBH-IN		
28		Q.1A+I		[illegible] - INCHES	INFILTRATION IN/HR				
29		Q.SCS							

MS2 DATA INPUT FORM

JOB TITLE _____ PAGE 4

LEFT JUSTIFY ALL FIELDS

LINE USE INDICATOR		1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80
30	☐	STEPS TP	NO. OF STEPS						
31	☐	STORM	NO. OF POINTS OR INFLOW NO.	INFLOW HYD. TIME INCREMENT	STORM DURATION	STORM CN	STORM TC	STORM BASEFLOW	
32	☐	TC-15.3							
33	☐	TEMPLATE	TOP WIDTH	Z - UPSTREAM	Z - DOWNSTREAM	WAVE BERM WIDTH	STABILITY BERM WIDTH	DH MAXIMUM	
34	☒	WS DATA	(1) 1 (2) A	RUNOFF CURVE NUMBER 49	DRAINAGE AREA IN SQ. MI. .014	TC OR W/S LENGTH 1140	BLANK OR W/S Δ ELEV. 80.7	QUICK RETURN FLOW-CFS	
35	☐	WSP. ACCUR.		DELTA Φ	DELTA V				

(1) AREAL CORRECTION TYPE NUMBER
(2) DESIGN CLASS

PEABODY COAL COMPANY
DAMS2 DATA INPUT
MULTIPLE PASS FORM

JOB TITLE

LEFT JUSTIFY ALL FIELDS

	DATA FIELD 1	DATA FIELD 2	DATA FIELD 3	DATA FIELD 4	DATA FIELD 5		
COMMENT	ASSUMING	POOL TO BE	5 FT.	HIGHER THAN	EXISTING	PRESENTLY	
*	RUNNING	6 HOUR	STORMS	FIRST			
GO, STORM	4.0		2.9				
GO, STORM	4.0		1.3				
GO, RAINS			1.	10.	2.		
COMMENT	RUN NO.	1					
END JOB							

LINE USE INDICATOR CHECK ONLY IF LAST PAGE OF INPUT ☒

DATE

PEABODY COAL COMPANY
STRUCTURE DATA
DAMS2 INPUT TABLE

JOB TITLE _____

LEFT JUSTIFY ALL FIELDS

LINE USE INDICATOR ☒

STRUCTURE	STRUCTURE NAME		ANY ALPHANUMERIC LABEL					CARD IDENT.
1–10	11–15	16–20	21–30	31–40	41–50	51–60	61–70	71–80

	ELEVATION, FEET	SURFACE AREA, AC.	DISCHARGE, CFS.	STORAGE VOL. AC.-FT.		CARD IDENT.
	6600	0.00	0			
	6605	1.13	0			
	6610	1.53	0			
	6615	1.94	0			
	6617.9	2.40	0			
END TABLE						

CODE ONLY IF LAST PAGE OF TABLE ☒

DAMS2 XEC 6/23/76
REV 06/18/73

KAYENTA DAM NO.1 MESA I.D. NO. 1211-AZ-9-0001

TOP OF DAM ELEV AT SOUTHEAST CORNER IS ELEV 6619

RUN GEN. STORM(6HR DURATION)

********** BASIC DATA **********

ARID-SEMIARID CLIMATE AREA

DESIGN CLASS A

STORM DISTRIBUTION.....GEN. 6 HOUR STORM DISTRIBUTION

P-100	PMP	P10A/P6HR	P10DA/P10A	CN	DA-SM	TC/L	-/H
2.90	13.00	1.210	1.490	63.00	0.01	680.00	80.70
CONDUITS	COND L	D/W	-/H	PS N	KI	WEIR L	TW EL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PERM POOL	CREST PS	FP SED	BASEFLOW	2ND STG	ORF H	ORF L	START
6617.90	6617.90	0.0	0.0	0.0	0.0	0.0	6617.90
ES1	ES2	ES3	ES4	ES5	Z ES	EXIT N	EXIT S
6617.90	0.0	0.0	0.0	0.0	521.00	0.020	0.019
ES TYPE	ES L	ES N	BW1	BW2	BW3	BW4	BW5
42	80	0.020	1.00	0.0	0.0	0.0	0.0

PROVIDED BY ES FILE

ES CODE	INCREMENT			Q1	Q2	Q3	Q4
42080.020	1.000			3.270	8.921	16.252	24.924
Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
34.745	45.594	57.407	70.087	83.579	97.844	112.837	128.523

********** DETAILED LIST OF BASIC DATA **********

WEIR COEF. FOR ORIFICES..... 3.10	RATIO OF IA TO S(CH.10,NEH4).. 0.20	MIN ES BW WHEN MAX V/C GIVEN.. 20.0
WEIR COEF. FOR DROP INLET..... 3.10	TIME INCS TO PEAK OF UNIT HYD. 5.	DELTA BW WHEN MAX V/C GIVEN... 64.0
DISCHARGE COEF. FOR ORIFICES.. 0.60	NO. POINTS FOR DESIGN HYD..... 101	PRECISION OF BW SOLUTION..... 1.0
FILLET SIZE FOR BOX CONDUITS.. 6.00	ES-WSP CALC. DEPTH PRECISION. 0.005	PRECISION OF V/C SOLUTION..... 0.03
GRAVITATIONAL CONSTANT..... 32.16	ES-WSP PERMISSIBLE VEL.CHANGE. 0.05	

	TOP WIDTH	UPSTREAM Z	DOWNSTREAM Z	WAVE BERM	STAB. BERM	DH MAX
EMBANKMENT TEMPLATE	0.0	2.5	2.5	10.0	0.0	0.0
	K1 PSH	K1 ESH	K1 FBH	K2 PSH	K2 ESH	K2 FBH
RAINFALL EQUATION CONSTANTS CLASS A	0.82	1.00	1.00	0.0	0.0	0.12

DIMENSIONLESS UNIT HYDROGRAPH PEAK FACTOR = 484.0

0.0	0.030	0.100	0.190	0.310	0.470	0.660	0.820	0.930	0.990
1.000	0.990	0.930	0.860	0.780	0.680	0.560	0.460	0.390	0.330
0.280	0.240	0.207	0.177	0.147	0.127	0.107	0.090	0.077	0.065
0.055	0.047	0.040	0.034	0.029	0.025	0.021	0.018	0.015	0.013
0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001
0.0									

SCS DESIGN STORM RAINFALL DISTRIBUTION. (CHAPTER 21, NEH4 AND SCS EM-27)

0.0	0.013	0.027	0.042	0.059	0.078	0.099	0.122	0.147	0.180
0.230	0.380	0.530	0.625	0.670	0.705	0.736	0.764	0.790	0.814
0.836	0.856	0.875	0.893	0.910	0.927	0.942	0.957	0.972	0.986
1.000									

POINT ONE-HR. STORM ID NAME IS USBRG

0.0	0.170	0.400	0.880	1.000

GEN. 6 HOUR STORM DISTRIBUTION ID NAME IS GRBSU

0.0	0.120	0.260	0.420	0.710	0.890	1.000

```
DAMS2 XEC  6/23/76
      REV 06/18/73

      ************************** 80-80 LIST OF INPUT DATA **************************

      DAMS2     04/03/76  KAYENTA   DAM NO.1  MESA I.C. NC. 1211-AZ-9-0001        3500
      STRUCTURE                                                                   3500
                          6600      0.00      0                                   3500
                          6605      1.13      0                                   3500
                          6610      1.53      0                                   3500
                          6615      1.94      0                                   3500
                          6617.9    2.40      0                                   3500
                          6619      2.82      0                                   3500
      ENCTABLE                                                                    3500
      RAINTABLE USBRG     1.0       POINT ONE-HR. STORM                           3500
                          0.0       0.17      0.40      0.88      1.0             3500
      ENCTABLE                                                                    3500
      RAINTABLE GRBSU     6.0       GEN. 6 HOUR STORM DISTRIBUTION                3500
                          0         0.12      0.26      0.42      0.71            3500
                          0.89      1.00                                          3500
      ENCTABLE                                                                    3500
      BTMWIDTH  FEET      1                                                       3500
      DDTESTS                                                                     3500
      ESCREST   ELEV      6617.9                                                  3500
      ESDATA    42        80        .020      521       .020      1.90            3500
      ESPROFILE 42        20        4.4       40        8.7                       3500
      ESPROFILE           60        13.0      80        17.3                      3500
      KIRPICH                                                                     3500
      POCLDATA  ELEV      6617.9    6617.9                                        3500
      PSRATING                                                                    3500
      P100,PMP  .448      2.9       13        1.21      1.49                      3500
      WSDATA    1A        63        .014      680.0     80.7                      3500
      COMMENT   TOP OF DAM ELEV AT SOUTHEAST CORNER IS ELEV 6619                  3500
      COMMENT   RUN GEN. STORM(6HR DURATION)                                      3500
      STORM     30.0                6.0                                           3500
      GO,STORM  LPC       GRBSU     2.9  100yr                        6617.9     3500
      STORM     35.0                6.0                                           3500
      GO,STORM  LPC       GRBSU     13.0 PMP                          6617.9     3500
      COMMENT   ROUTE ONE-HR PT STORM                                             3500
      STORM     30.0                1.0                                           3500
      GO,STORM  LPC       USBRG     2.7  100yr                        6617.9     3500
      STORM     35.0                1.0                                           3500
      GO,STORM  LPC       USBRG     9.5  PMP                          6617.9     3500
      GO,TDD              6619      6617.9    0                                   3500
      COMMENT   WATERSHED IS PREDOMINANTLY RANGE IN FAIR CONDITION                3500
      COMMENT   RUN NO. 11  ROUTE BOTH DURATION STORMS                            3500
      ENDJOB                                                                      3500

      ******************************************************************************
```

PERM POOL	6617.90 FT	24.4 ACFT	2.40 AC	
CREST PS	6617.90 FT	24.4 ACFT	2.40 AC	
SED ACCUM	6617.90 FT	24.4 ACFT	2.40 AC	
ES CREST	6617.90 FT	24.4 ACFT	2.40 AC	
PS STORAGE	0.0 ACFT			
STARTING E	6617.90 FT	24.4 ACFT	2.40 AC	0.0 CFS

STORM HYD D= 6.00 HR P= 2.90 IN Q= 0.39 IN
TC= 0.04 HR CN= 63.00 V= 0.3 ACFT
PEAK 1.6 CFS AT 4.02 HRS

****

RATING TABLE NUMBER 2

	E FEET	Q CFS	V AC FT	A ACRE
1	6617.90	0.0	24.44	2.40
2	6617.90	0.0	24.44	2.40
3	6617.90	0.0	24.44	2.40
4	6617.90	0.0	24.44	2.40
5	6617.90	0.0	24.44	2.40
6	6617.90	0.0	24.44	2.40
7	6617.90	0.0	24.44	2.40
8	6617.90	0.0	24.44	2.40
9	6617.90	0.0	24.44	2.40
10	6617.90	0.0	24.44	2.40
11	6617.90	0.0	24.44	2.40
12	6617.90	0.0	24.44	2.40
13	6617.90	0.0	24.44	2.40
14	6617.95	9.48	24.57	2.42
15	6618.01	29.88	24.70	2.44
16	6618.11	86.18	24.94	2.48
17	6618.23	185.29	25.25	2.53
18	6618.45	438.54	25.82	2.61
19	6618.72	857.75	26.55	2.71
20	6619.00	1549.03	27.31	2.82

TYPE	BW	EMAX	VMAX	AMAX	HP	V-ES	Q-PS	Q-ES	Q-TOT	D/C	V/C	S/C	S/C.25	D-ES
STORM HYD	1.0	6617.91	24.5	2.4	0.01	0.0	0.	1.	1.	0.05	1.24	0.016	0.022	3.8

PLOT 1 IN = 10. CFS EXIT SLOPE = 0.019

T	I	O	E	V	A	0. I	10. I	20. I	30. I	40. I	50. I	60. I	70. I	EXIT VEL
0.0	0	0	6617.9	24.4	2.4	.								0.0
0.21	0	0	6617.9	24.4	2.4	.								0.0
0.42	0	0	6617.9	24.4	2.4	.								0.0
0.64	0	0	6617.9	24.4	2.4	.								0.0
0.85	0	0	6617.9	24.4	2.4	.								0.0
1.06	0	0	6617.9	24.4	2.4	.								0.0
1.27	0	0	6617.9	24.4	2.4	.								0.0
1.48	0	0	6617.9	24.4	2.4	.								0.0

2.12	0	0 6617.9	24.4	2.4	.		
2.33	0	0 6617.9	24.4	2.4	.		0.0
2.54	0	0 6617.9	24.4	2.4	.		0.0
2.75	0	0 6617.9	24.4	2.4	.		0.0
2.97	0	0 6617.9	24.4	2.4	.		0.0
3.18	0	0 6617.9	24.4	2.4	.		0.51
3.39	1	1 6617.9	24.4	2.4	.E		0.87
3.60	1	1 6617.9	24.5	2.4	.E		1.00
3.81	2	1 6617.9	24.5	2.4	.EI		1.14
4.02	2	1 6617.9	24.5	2.4	.XX		1.29
4.24	1	1 6617.9	24.5	2.4	.E		1.30
4.45	1	1 6617.9	24.5	2.4	.E		1.32
4.66	1	1 6617.9	24.5	2.4	.E		1.27
4.87	2	1 6617.9	24.5	2.4	.EI		1.33
5.08	1	1 6617.9	24.5	2.4	.E		1.30
5.29	1	1 6617.9	24.5	2.4	.E		1.27
5.51	1	1 6617.9	24.5	2.4	.E		1.25
5.72	1	1 6617.9	24.5	2.4	.E		1.20
5.93	1	1 6617.9	24.5	2.4	.E		1.23
6.14	0	1 6617.9	24.4	2.4	.E		1.26
T	I	O E	V	A	I	I	1.11
					0. 10. 20. 30. 40. 50. 60. 70.		VEL EXIT

********** BASIC DATA **********

ARID-SEMIARID CLIMATE AREA

DESIGN CLASS A

STORM DISTRIBUTION.....GEN. 6 HOUR STORM DISTRIBUTION

P-100	PMP	P1DA/P6HR	P10DA/P1DA	CN	DA-SM	TC/L	-/H
2.90	13.00	1.210	1.490	63.00	0.01	80.00	80.70
CONDUITS	COND L	D/W	-/H	PS N	KI	EIR L	TW EL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PERM POOL	CREST PS	FP SEC	BASEFLOW	2ND STG	ORF H	ORF L	START
6617.90	6617.90	0.0	0.0	0.0	0.0	0.0	6617.90
ES1	ES2	ES3	ES4	ES5	Z ES	EXIT N	EXIT S
6617.90	0.0	0.0	0.0	0.0	521.00	0.020	0.019
ES TYPE	ES L	ES N	BW1	BW2	BW3	BW4	BW5
42	80	0.020	1.00	0.0	0.0	0.0	0.0

PROVIDED BY ES FILE

ES CODE	INCREMENT			Q1	Q2	Q3	Q4
42080.020	1.000			3.270	8.921	6.252	24.924
Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
34.745	45.594	57.407	70.087	83.579	97.844	2.837	128.523

********** DETAILED LIST OF BASIC DATA **********

WEIR COEF. FOR ORIFICES..... 3.10
WEIR COEF. FOR DROP INLET..... 3.10
DISCHARGE COEF. FOR ORIFICES.. 0.60
FILLET SIZE FOR BOX CONDUITS.. 6.00
GRAVITATIONAL CONSTANT..... 32.16

RATIO OF IA TO S(CH.10,NEH4).. 0.20
TIME INCS TO PEAK OF UNIT HYD. 5.
NO. POINTS FOR DESIGN HYD..... 101
ES-WSP CALC. DEPTH PRECISION. 0.005
ES-WSP PERMISSIBLE VEL.CHANGE. 0.05

MIN ES BW V
DELTA BW WH
PRECISION O
PRECISION O

MAX V/C GIVEN.. 20.0
AX V/C GIVEN... 64.0
SOLUTION..... 1.0
C SOLUTION..... 0.03

	TOP WIDTH	UPSTREAM Z	DOWNSTREAM Z	WAVE BERM	S	BERM	DH MAX
EMBANKMENT TEMPLATE	0.0	2.5	2.5	10.0		.0	0.0
RAINFALL EQUATION CONSTANTS	K1 PSH	K1 ESH	K1 FBH	K2 PSH		ESH	K2 FBH
CLASS A	0.82	1.00	1.00	0.0		.0	0.12

DIMENSIONLESS UNIT HYDROGRAPH PEAK FACTOR = 484.0

0.0	0.030	0.100	0.190	0.310	0.470	0.660	0.820	0.930	0.990
1.000	0.990	0.930	0.860	0.780	0.680	0.560	0.460	0.390	0.330
0.280	0.240	0.207	0.177	0.147	0.127	0.107	0.090	0.077	0.065
0.055	0.047	0.040	0.034	0.029	0.025	0.021	0.018	0.015	0.013
0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001
0.0									

SCS DESIGN STORM RAINFALL DISTRIBUTION. (CHAPTER 21, NEH4 AND SCS EM-27)

0.0	0.013	0.027	0.042	0.059	0.078	0.099	0.122	0.147	0.180
0.230	0.380	0.530	0.625	0.670	0.705	0.736	0.764	0.790	0.814
0.836	0.856	0.875	0.893	0.910	0.927	0.942	0.957	0.972	0.986
1.000									

POINT ONE-HR. STORM ID NAME IS USBRG

0.0	0.170	0.400	0.880	1.000

GEN. 6 HOUR STORM DISTRIBUTION ID NAME IS GRBSU

0.0	0.120	0.260	0.420	0.710	0.890	1.000

PERM POOL	6617.90 FT	24.4 ACFT	2.40 AC	
CREST PS	6617.90 FT	24.4 ACFT	2.40 AC	
SED ACCUM	6617.90 FT	24.4 ACFT	2.40 AC	
ES CREST	6617.90 FT	24.4 ACFT	2.40 AC	
PS STORAGE	0.0 ACFT			
STARTING E	6617.90 FT	24.4 ACFT	2.40 AC	0.0 CFS

STORM HYD D= 6.00 HR P= 13.00 IN Q= 7.90 IN
TC= 0.04 HR CN= 63.00 V= 5.9 ACFT
PEAK 27.5 CFS AT 3.97 HRS

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RATING TABLE NUMBER 2

	E FEET	Q CFS	V AC FT	A ACRE
1	6617.90	0.0	24.44	2.40
2	6617.90	0.0	24.44	2.40
3	6617.90	0.0	24.44	2.40
4	6617.90	0.0	24.44	2.40
5	6617.90	0.0	24.44	2.40
6	6617.90	0.0	24.44	2.40
7	6617.90	0.0	24.44	2.40
8	6617.90	0.0	24.44	2.40
9	6617.90	0.0	24.44	2.40
10	6617.90	0.0	24.44	2.40
11	6617.90	0.0	24.44	2.40
12	6617.90	0.0	24.44	2.40
13	6617.90	0.0	24.44	2.40
14	6617.95	9.48	24.57	2.42
15	6618.01	29.88	24.70	2.44
16	6618.11	86.18	24.94	2.48
17	6618.23	185.29	25.25	2.53
18	6618.45	438.54	25.82	2.61
19	6618.72	857.75	26.55	2.71
20	6619.00	1549.03	27.31	2.82

TYPE	BW	EMAX	VMAX	AMAX	HP	V-ES	Q-PS	Q-ES	Q-TOT	D/C	V/C	S/C	S/C.25	D-ES
STORM HYD	1.0	6618.00	24.7	2.4	0.10	0.2	0.	27.	27.	0.15	2.23	0.011	0.015	6.0

PLOT 1 IN = 10. CFS EXIT SLOPE = 0.019

T	I	O	E	V	A	0. I	10. I	20. I	30. I	40. I	50. I	60. I	70. I	EXIT VEL
0.0	0	0	6617.9	24.4	2.4	.								0.0
0.18	0	0	6617.9	24.4	2.4	.								0.0
0.36	0	0	6617.9	24.4	2.4	.								0.0
0.54	0	0	6617.9	24.4	2.4	.								0.0
0.72	0	0	6617.9	24.4	2.4	.								0.0
0.90	1	0	6617.9	24.4	2.4	.I								0.95
1.08	2	1	6617.9	24.5	2.4	.EI								1.29
1.26	4	2	6617.9	24.5	2.4	. E I								1.51

```
1.81     7     6 6617.9    24.5    2.4 .     EI                                                          1.8
1.99     7     7 6617.9    24.5    2.4 .      E                                                          1.91
2.17     9     8 6617.9    24.5    2.4 .       EI                                                        1.99
2.35    10     9 6617.9    24.6    2.4 .        EI                                                       2.05
2.53    11    10 6618.0    24.6    2.4 .         EI                                                      2.12
2.71    11    11 6618.0    24.6    2.4 .          E                                                      2.15
2.89    12    12 6618.0    24.6    2.4 .           E                                                     2.18
3.07    22    17 6618.0    24.6    2.4 .                E    I                                           2.38
3.25    24    24 6618.0    24.7    2.4 .                     E                                           2.57
3.43    25    25 6618.0    24.7    2.4 .                      E                                          2.59
3.61    26    26 6618.0    24.7    2.4 .                       E                                         2.58
3.79    27    26 6618.0    24.7    2.4 .                       EI                                        2.64
3.97    28    27 6618.0    24.7    2.4 .                        XX                                       2.64
4.15    17    22 6618.0    24.7    2.4 .                I    E                                           2.51
4.34    18    17 6618.0    24.6    2.4 .                EI                                               2.37
4.52    18    18 6618.0    24.6    2.4 .                 E                                               2.37
4.70    18    18 6618.0    24.6    2.4 .                 E                                               2.39
4.88    18    18 6618.0    24.6    2.4 .                 E                                               2.37
5.06    12    15 6618.0    24.6    2.4 .           I  E                                                  2.28
5.24    11    11 6618.0    24.6    2.4 .          E                                                      2.14
5.42    11    11 6618.0    24.6    2.4 .          E                                                      2.15
5.60    11    11 6618.0    24.6    2.4 .          E                                                      2.16
5.78    11    11 6618.0    24.6    2.4 .          E                                                      2.12
5.96    11    11 6618.0    24.6    2.4 .          E                                                      2.13
6.14     0     7 6617.9    24.5    2.4 .     E                                                           1.87
  T      I     O       E       V       A  I         I         I         I         I         I         I         I   VEL
                                          0.       10.       20.       30.       40.       50.       60.       70. EXIT
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DAMS2 XEQ 6/23/76
REV 06/18/73

KAYENTA DAM NO.1 MESA I.D. NO. 1211-AZ-9-0001

ROUTE ONE-HR PT STORM

********** BASIC DATA **********

ARID-SEMIARID CLIMATE AREA

DESIGN CLASS A

STORM DISTRIBUTION.....POINT ONE-HR. STORM

P-100	PMP	P1DA/P6HR	P10DA/P1DA	CN	DA-SM	TC/L	-/H
2.90	13.00	1.210	1.490	63.00	0.01	680.00	80.70
CONDUITS	COND L	D/W	-/H	PS N	KI	WEIR L	TW EL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PERM POOL	CREST PS	FP SED	BASEFLOW	2ND STG	ORF H	ORF L	START
6617.90	6617.90	0.0	0.0	0.0	0.0	0.0	6617.90
ES1	ES2	ES3	ES4	ES5	Z ES	EXIT N	EXIT S
6617.90	0.0	0.0	0.0	0.0	521.00	0.020	0.019
ES TYPE	ES L	ES N	BW1	BW2	BW3	BW4	BW5
42	80	0.020	1.00	0.0	0.0	0.0	0.0

PROVIDED BY ES FILE

ES CODE	INCREMENT			Q1	Q2	Q3	Q4
42080.020	1.000			3.270	8.921	16.252	24.924
Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
34.745	45.594	57.407	70.087	83.579	97.844	112.837	128.523

********** DETAILED LIST OF BASIC DATA **********

WEIR COEF. FOR ORIFICES.....	3.10	RATIO OF IA TO S(CH.10,NEH4)..	0.20	MIN ES BW WHEN MAX V/C GIVEN..	20.0
WEIR COEF. FOR DROP INLET.....	3.10	TIME INCS TO PEAK OF UNIT HYD.	5.	DELTA BW WHEN MAX V/C GIVEN...	64.0
DISCHARGE COEF. FOR ORIFICES..	0.60	NO. POINTS FOR DESIGN HYD.....	101	PRECISION OF BW SOLUTION.....	1.0
FILLET SIZE FOR BOX CONDUITS..	6.00	ES-WSP CALC. DEPTH PRECISION.	0.005	PRECISION OF V/C SOLUTION.....	0.03
GRAVITATIONAL CONSTANT.....	32.16	ES-WSP PERMISSIBLE VEL.CHANGE.	0.05		

	TOP WIDTH	UPSTREAM Z	DOWNSTREAM Z	WAVE BERM	STAB. BERM	DH MAX
EMBANKMENT TEMPLATE	0.0	2.5	2.5	10.0	0.0	0.0
RAINFALL EQUATION CONSTANTS	K1 PSH	K1 ESH	K1 FBH	K2 PSH	K2 ESH	K2 FBH
CLASS A	0.82	1.00	1.00	0.0	0.0	0.12

DIMENSICNLESS UNIT HYDROGRAPH

PEAK FACTOR = 484.0

0.0	0.030	0.100	0.190	0.310	0.470	0.660	0.820	0.930	0.990
1.000	0.990	0.930	0.860	0.780	0.680	0.560	0.460	0.390	0.330
0.280	0.240	0.207	0.177	0.147	0.127	0.107	0.090	0.077	0.065
0.055	0.047	0.040	0.034	0.029	0.025	0.021	0.018	0.015	0.013
0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001
0.0									

SCS DESIGN STORM RAINFALL DISTRIBUTION. (CHAPTER 21, NEH4 AND SCS EM-27)

0.0	0.013	0.027	0.042	0.059	0.078	0.099	0.122	0.147	0.180
0.230	0.380	0.530	0.625	0.670	0.705	0.736	0.764	0.790	0.814
0.836	0.856	0.875	0.893	0.910	0.927	0.942	0.957	0.972	0.986
1.000									

POINT ONE-HR. STORM

ID NAME IS USBRG

0.0	0.170	0.400	0.880	1.000

GEN. 6 HOUR STORM DISTRIBUTICN

ID NAME IS GRBSU

0.0	0.120	0.260	0.420	0.710	0.890	1.000

DAMS2 XEC 6/23/76
REV 06/18/73

KAYENTA DAM NO.1 MESA I.D. NO. 1211-AZ-9-0001

PASS 3
PAGE 2

PERM POOL	6617.90 FT	24.4 ACFT	2.40 AC
CREST PS	6617.90 FT	24.4 ACFT	2.40 AC
SED ACCUM	6617.90 FT	24.4 ACFT	2.40 AC
ES CREST	6617.90 FT	24.4 ACFT	2.40 AC
PS STORAGE	0.0 ACFT		
STARTING E	6617.90 FT	24.4 ACFT	2.40 AC

STORM HYD D= 1.00 HR P= 2.70 IN Q= 0.31 IN 0.0 CFS
TC= 0.04 HR CN= 63.00 V= 0.2 ACFT
PEAK 12.6 CFS AT 0.75 HRS

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RATING TABLE NUMBER 2

	E FEET	Q CFS	V AC FT	A ACRE
1	6617.90	0.0	24.44	2.40
2	6617.90	0.0	24.44	2.40
3	6617.90	0.0	24.44	2.40
4	6617.90	0.0	24.44	2.40
5	6617.90	0.0	24.44	2.40
6	6617.90	0.0	24.44	2.40
7	6617.90	0.0	24.44	2.40
8	6617.90	0.0	24.44	2.40
9	6617.90	0.0	24.44	2.40
10	6617.90	0.0	24.44	2.40
11	6617.90	0.0	24.44	2.40
12	6617.90	0.0	24.44	2.40
13	6617.90	0.0	24.44	2.40
14	6617.95	9.48	24.57	2.42
15	6618.01	29.88	24.70	2.44
16	6618.11	86.18	24.94	2.48
17	6618.23	185.29	25.25	2.53
18	6618.45	438.54	25.82	2.61
19	6618.72	857.75	26.55	2.71
20	6619.00	1549.03	27.31	2.82

TYPE	BW	EMAX	VMAX	AMAX	HP	V-ES	Q-PS	Q-ES	Q-TOT	D/C	V/C	S/C	S/C.25	D-ES
STORM HYD	1.0	6617.93	24.5	2.4	0.04	0.1	0.	6.	6.	0.08	1.66	0.013	0.018	1.2

PLOT

1 IN = 10. CFS

T	I	O	E	V	A
0.0	0	0	6617.9	24.4	2.4
0.04	0	0	6617.9	24.4	2.4
0.08	0	0	6617.9	24.4	2.4
0.12	0	0	6617.9	24.4	2.4
0.16	0	0	6617.9	24.4	2.4
0.20	0	0	6617.9	24.4	2.4
0.24	0	0	6617.9	24.4	2.4
0.28	0	0	6617.9	24.4	2.4

0. I 10. I 20. I 30. I 40. I 50. I 60. I 70. I

EXIT SLOPE = 0.019

EXIT VEL
0.0
0.0
0.0
0.0

```
0.39    0    0 6617.9    24.4    2.4 .                                                                    0.0
0.43    0    0 6617.9    24.4    2.4 .                                                                    0.0
0.47    0    0 6617.9    24.4    2.4 .                                                                    0.0
0.51    0    0 6617.9    24.4    2.4 .                                                                    0.0
0.55    1    0 6617.9    24.4    2.4 .I                                                                   0.0
0.59    3    0 6617.9    24.4    2.4 .  I                                                                 0.71
0.63    6    1 6617.9    24.5    2.4 .E    I                                                              0.99
0.67    8    2 6617.9    24.5    2.4 . E     I                                                            1.27
0.71   10    4 6617.9    24.5    2.4 .   E     I                                                          1.48
0.75   13    5 6617.9    24.5    2.4 .    E       X                                                       1.66
0.79    7    6 6617.9    24.5    2.4 .     XI                                                             1.83
0.83    4    6 6617.9    24.5    2.4 .   I E                                                              1.85
0.87    4    6 6617.9    24.5    2.4 .   I E                                                              1.85
0.91    4    5 6617.9    24.5    2.4 .   IE                                                               1.84
0.95    4    5 6617.9    24.5    2.4 .   IE                                                               1.79
0.98    4    5 6617.9    24.5    2.4 .   IE                                                               1.78
1.02    3    5 6617.9    24.5    2.4 .  I E                                                               1.75
1.06    0    4 6617.9    24.5    2.4 .   E                                                                1.73
1.10    0    3 6617.9    24.5    2.4 .  E                                                                 1.66
1.14    0    3 6617.9    24.5    2.4 .  E                                                                 1.58
  T     I    O       E       V     A  I         I         I         I         I         I         I         I  1.50
                                      0.       10.       20.       30.       40.       50.       60.       70. VEL
                                                                                                             EXIT
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********** BASIC DATA **********

ARID-SEMIARID CLIMATE AREA

DESIGN CLASS A

STORM DISTRIBUTION.....POINT ONE-HR. STORM

P-100	PMP	P1DA/P6HR	P10DA/P1DA	CN	DA-SM	TC/L	-/H
2.90	13.00	1.210	1.490	63.00	0.01	680.00	80.70
CONDUITS	COND L	D/W	-/H	PS N	KI	WEIR L	TW EL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PERM POOL	CREST PS	FP SED	BASEFLOW	2ND STG	ORF H	ORF L	START
6617.90	6617.90	0.0	0.0	0.0	0.0	0.0	6617.90
ES1	ES2	ES3	ES4	ES5	Z ES	EXIT N	EXIT S
6617.90	0.0	0.0	0.0	0.0	521.00	0.020	0.019
ES TYPE	ES L	ES N	BW1	BW2	BW3	BW4	BW5
42	80	0.020	1.00	0.0	0.0	0.0	0.0

PROVIDED BY ES FILE

ES CODE	INCREMENT			Q1	Q2	Q3	Q4
42080.020	1.000			3.270	8.921	16.252	24.924
Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
34.745	45.594	57.407	70.087	83.579	97.844	112.837	128.523

********** DETAILED LIST OF BASIC DATA **********

WEIR COEF. FOR ORIFICES..... 3.10	RATIO OF IA TO S(CH.10,NEH4).. 0.20	MIN ES BW WHEN MAX V/C GIVEN.. 20.0
WEIR COEF. FOR DROP INLET..... 3.10	TIME INCS TO PEAK OF UNIT HYD. 5.	DELTA BW WHEN MAX V/C GIVEN... 64.0
DISCHARGE COEF. FOR ORIFICES.. 0.60	NO. POINTS FOR DESIGN HYD..... 101	PRECISION OF BW SOLUTION..... 1.0
FILLET SIZE FOR BOX CONDUITS.. 6.00	ES-WSP CALC. DEPTH PRECISION. 0.005	PRECISION OF V/C SOLUTION..... 0.03
GRAVITATIONAL CONSTANT..... 32.16	ES-WSP PERMISSIBLE VEL.CHANGE. 0.05	

EMBANKMENT TEMPLATE	TOP WIDTH	UPSTREAM Z	DOWNSTREAM Z	WAVE BERM	STAB. BERM	DH MAX
	0.0	2.5	2.5	10.0	0.0	0.0
RAINFALL EQUATION CONSTANTS	K1 PSH	K1 FSH	K1 FBH	K2 PSH	K2 ESH	K2 FBH
CLASS A	0.82	1.00	1.00	0.0	0.0	0.12

DIMENSIONLESS UNIT HYDROGRAPH

PEAK FACTOR = 484.0

0.0	0.030	0.100	0.190	0.310	0.470	0.660	0.820	0.930	0.990
1.000	0.990	0.930	0.860	0.780	0.680	0.560	0.460	0.390	0.330
0.280	0.240	0.207	0.177	0.147	0.127	0.107	0.090	0.077	0.065
0.055	0.047	0.040	0.034	0.029	0.025	0.021	0.018	0.015	0.013
0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001
0.0									

SCS DESIGN STORM RAINFALL DISTRIBUTION. (CHAPTER 21, NEH4 AND SCS EM-27)

0.0	0.013	0.027	0.042	0.059	0.078	0.099	0.122	0.147	0.180
0.230	0.380	0.530	0.625	0.670	0.705	0.736	0.764	0.790	0.814
0.836	0.856	0.875	0.893	0.910	0.927	0.942	0.957	0.972	0.986
1.000									

POINT ONE-HR. STORM

0.0	0.170	0.400	0.880	1.000

ID NAME IS USBRG

GEN. 6 HOUR STORM DISTRIBUTION

0.0	0.120	0.260	0.420	0.710	0.890	1.000

ID NAME IS GRBSU

PERM POOL	6617.90 FT	24.4 ACFT	2.40 AC	
CREST PS	6617.90 FT	24.4 ACFT	2.40 AC	
SED ACCUM	6617.90 FT	24.4 ACFT	2.40 AC	
ES CREST	6617.90 FT	24.4 ACFT	2.40 AC	
PS STORAGE	0.0 ACFT			
STARTING E	6617.90 FT	24.4 ACFT	2.40 AC	0.0 CFS

STORM HYD D= 1.00 HR P= 9.50 IN Q= 4.88 IN
TC= 0.04 HR CN= 63.00 V= 3.6 ACFT
PEAK 125.6 CFS AT 0.74 HRS

****

RATING TABLE NUMBER 2

	E FEET	Q CFS	V AC FT	A ACRE
1	6617.90	0.0	24.44	2.40
2	6617.90	0.0	24.44	2.40
3	6617.90	0.0	24.44	2.40
4	6617.90	0.0	24.44	2.40
5	6617.90	0.0	24.44	2.40
6	6617.90	0.0	24.44	2.40
7	6617.90	0.0	24.44	2.40
8	6617.90	0.0	24.44	2.40
9	6617.90	0.0	24.44	2.40
10	6617.90	0.0	24.44	2.40
11	6617.90	0.0	24.44	2.40
12	6617.90	0.0	24.44	2.40
13	6617.90	0.0	24.44	2.40
14	6617.95	9.48	24.57	2.42
15	6618.01	29.88	24.70	2.44
16	6618.11	86.18	24.94	2.48
17	6618.23	185.29	25.25	2.53
18	6618.45	438.54	25.82	2.61
19	6618.72	857.75	26.55	2.71
20	6619.00	1549.03	27.31	2.82

TYPE	BW	EMAX	VMAX	AMAX	HP	V-ES	Q-PS	Q-ES	Q-TOT	D/C	V/C	S/C	S/C.25	D-ES
STORM HYD	1.0	6618.14	25.0	2.5	0.25	0.6	0.	120.	120.	0.28	3.00	0.009	0.012	1.2

PLOT 1 IN = 20. CFS EXIT SLOPE = 0.019

T	I	O	E	V	A	0. I	20. I	40. I	60. I	80. I	100. I	120. I	140. I	EXIT VEL
0.0	0	0	6617.9	24.4	2.4	.								0.0
0.03	0	0	6617.9	24.4	2.4	.								0.0
0.07	0	0	6617.9	24.4	2.4	.								0.0
0.10	0	0	6617.9	24.4	2.4	.								0.0
0.13	0	0	6617.9	24.4	2.4	.								0.0
0.17	0	0	6617.9	24.4	2.4	.								0.0
0.20	0	0	6617.9	24.4	2.4	.								0.61
0.24	3	0	6617.9	24.4	2.4	.I								0.93

0.34	19	5	6617.9	24.5	2.4	1.79
0.37	24	8	6617.9	24.6	2.4	1.97
0.40	28	13	6618.0	24.6	2.4	2.21
0.44	32	19	6618.0	24.6	2.4	2.44
0.47	35	24	6618.0	24.7	2.4	2.55
0.50	39	29	6618.0	24.7	2.4	2.68
0.54	71	41	6618.0	24.8	2.4	2.92
0.57	93	61	6618.1	24.8	2.5	3.19
0.60	104	79	6618.1	24.9	2.5	3.41
0.64	111	95	6618.1	25.0	2.5	3.54
0.67	116	106	6618.1	25.0	2.5	3.67
0.71	121	114	6618.1	25.0	2.5	3.71
0.74	126	120	6618.1	25.0	2.5	3.77
0.77	102	116	6618.1	25.0	2.5	3.72
0.81	45	89	6618.1	25.0	2.5	3.49
0.84	35	64	6618.1	24.9	2.5	3.25
0.87	33	49	6618.0	24.8	2.5	3.02
0.91	33	41	6618.0	24.8	2.4	2.93
0.94	33	37	6618.0	24.7	2.4	2.84
0.97	34	35	6618.0	24.7	2.4	2.82
1.01	33	34	6618.0	24.7	2.4	2.79
1.04	10	29	6618.0	24.7	2.4	2.67
1.07	2	21	6618.0	24.6	2.4	2.46
1.11	0	14	6618.0	24.6	2.4	2.24
1.14	0	9	6617.9	24.6	2.4	2.04
T	I	O	E	V	A	VFL

********** BASIC DATA **********

ARID-SEMIARID CLIMATE AREA

DESIGN CLASS A

STORM DISTRIBUTION.....POINT ONE-HR. STORM

P-100	PMP	P1DA/P6HR	P10DA/P1DA	CN	DA-SM	TC/L	-/H
2.90	13.00	1.210	1.490	63.00	0.01	680.00	80.70
CONDUITS	COND L	D/W	-/H	PS N	KI	WEIR L	TW EL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PERM POOL	CREST PS	FP SED	BASEFLOW	2ND STG	ORF H	ORF L	START
6617.90	6617.90	0.0	0.0	0.0	0.0	0.0	6617.90
ES1	ES2	ES3	ES4	ES5	Z ES	EXIT N	EXIT S
6617.90	0.0	0.0	0.0	0.0	521.00	0.020	0.019
ES TYPE	ES L	ES N	BW1	BW2	BW3	BW4	BW5
42	80	0.020	1.00	0.0	0.0	0.0	0.0

PROVIDED BY ES FILE

ES CODE	INCREMENT			Q1	Q2	Q3	Q4
42080.020	1.000			3.270	8.921	16.252	24.924
Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
34.745	45.594	57.407	70.087	83.579	97.844	112.837	128.523

********** DETAILED LIST OF BASIC DATA **********

WEIR COEF. FOR ORIFICES..... 3.10
WEIR COEF. FOR DROP INLET..... 3.10
DISCHARGE COEF. FOR ORIFICES.. 0.60
FILLET SIZE FOR BOX CONDUITS.. 6.00
GRAVITATIONAL CONSTANT..... 32.16

RATIO OF IA TO S(CH.10,NEH4).. 0.20
TIME INCS TO PEAK OF UNIT HYD. 5.
NO. POINTS FOR DESIGN HYD..... 101
ES-WSP CALC. DEPTH PRECISION. 0.005
ES-WSP PERMISSIBLE VEL.CHANGE. 0.05

MIN ES BW WHEN MAX V/C GIVEN.. 20.0
DELTA BW WHEN MAX V/C GIVEN... 64.0
PRECISION OF BW SOLUTION..... 1.0
PRECISION OF V/C SOLUTION..... 0.03

	TOP WIDTH	UPSTREAM Z	DOWNSTREAM Z	WAVE BERM	STAB. BERM	DH MAX
EMBANKMENT TEMPLATE	0.0	2.5	2.5	10.0	0.0	0.0
	K1 PSH	K1 ESH	K1 FBH	K2 PSH	K2 ESH	K2 FBH
RAINFALL EQUATION CONSTANTS CLASS A	0.82	1.00	1.00	0.0	0.0	0.12

DIMENSIONLESS UNIT HYDROGRAPH

PEAK FACTOR = 484.0

0.0	0.030	0.100	0.190	0.310	0.470	0.660	0.820	0.930	0.990
1.000	0.950	0.930	0.860	0.780	0.680	0.560	0.460	0.390	0.330
0.280	0.240	0.207	0.177	0.147	0.127	0.107	0.090	0.077	0.065
0.055	0.047	0.040	0.034	0.029	0.025	0.021	0.018	0.015	0.013
0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001
0.0									

SCS DESIGN STORM RAINFALL DISTRIBUTION. (CHAPTER 21, NEH4 AND SCS EM-27)

0.0	0.013	0.027	0.042	0.059	0.078	0.099	0.122	0.147	0.180
0.230	0.380	0.530	0.625	0.670	0.705	0.736	0.764	0.790	0.814
0.836	0.856	0.875	0.893	0.910	0.927	0.942	0.957	0.972	0.986
1.000									

POINT ONE-HR. STORM

0.0	0.170	0.400	0.880	1.000

ID NAME IS USBRG

GEN. 6 HOUR STORM DISTRIBUTION

0.0	0.120	0.260	0.420	0.710	0.890	1.000

ID NAME IS GRBSU

DDT TEST 6600.00 FT 0.0 ACFT 0.0 CFS
CONTROL IS 0.0 DETENTION STORAGE

*****DRAWDOWN TEST ELEVATION CANNOT BE REACHED.
DDT TEST USED 6617.90 FT 24.4 ACFT 0.0 CFS

DRAWDOWN TIME = 0.02 DAYS (LIMIT = 0.0 DAYS)

****

RATING TABLE NUMBER 1

	E FEET	Q CFS	V AC FT	A ACRE
1	6600.00	0.0	0.0	0.0
2	6605.00	0.0	2.82	1.13
3	6610.00	0.0	9.47	1.53
4	6615.00	0.0	18.15	1.94
5	6617.90	0.0	24.44	2.40
6	6619.00	0.0	27.31	2.82

KAYENTA DAM NO.1 MESA I.D. NO. 1211-AZ-9-0001

WATERSHED IS PREDOMINANTLY RANGE IN FAIR CONDITION

RUN NO. 11 ROUTE BOTH DURATION STORMS

DAMS2.....JOB NO. 1 COMPLETE

KAYENTA DAM NO.1 MESA I.D. NO. 1211-AZ-9-0001

1 STRUCTURE(S) ANALYZED

4 HYDROGRAPHS ROUTED

0 TRIAL ROUTINGS

****

```
CAMS2.....RUN CCMPLETE

                                        H A S P   S Y S T E M   L O G

$ 11.15.49 JOB  39 -- TV300    -- BEGINNING EXEC - PART 2 - CLASS B
 *11.21.38 JOB  39 TV300     JOB TIME LIMIT EXPIRED - GIVING 2 MORE MINS
 *11.27.35 JOB  39 TV300     JOB TIME LIMIT EXPIRED - GIVING 2 MORE MINS
$ 11.31.00 JOB  39 -- TV300    -- END EXEC        847 LINES      0 CARDS.


HASP-II JOB STATISTICS --     48 CARDS READ --      857 LINES PRINTED --      0 CARDS PUNCHED --  15.17 MINUTES EXECUTION TIME
```

file copy

```
TV300    **HASP-II.......END JOB  39.....11.49.01 AM 23 JUN 76....TV300    .......PRODTN B 483 11 00000..............    ..END JOB  39
TV300    **HASP-II.......END JOB  39.....11.49.01 AM 23 JUN 76....TV300    .......PRODTN B 483 11 00000..............    ..END JOB  39
TV300    **HASP-II.......END JOB  39.....11.49.01 AM 23 JUN 76....TV300    .......PRODTN B 483 11 00000..............    ..END JOB  39
```

DAMS2.....RUN COMPLETE

DATE 6-24-76

PEABODY ENGINEERING OFFICE SOUTHWESTERN AREA (Farmington, N.M.)

Attached herewith are your hydrologic analyses for the following impoundment:

NAME Kayenta Mine (Fresh Water) Reservoir, Navaho County, Arizona

MESA I. D. # 1211-AZ-9-0001

As you may recall, the "DAMS 2" Computer Program, Version 2, February 1971, U. S. Dept. of Agriculture, Soil Conservation Service, was used to perform these flood routing analyses. The User's Guide, Technical Release 48, describes the program operation, input data requirements, options and output, and is available from the Soil Conservation Service.

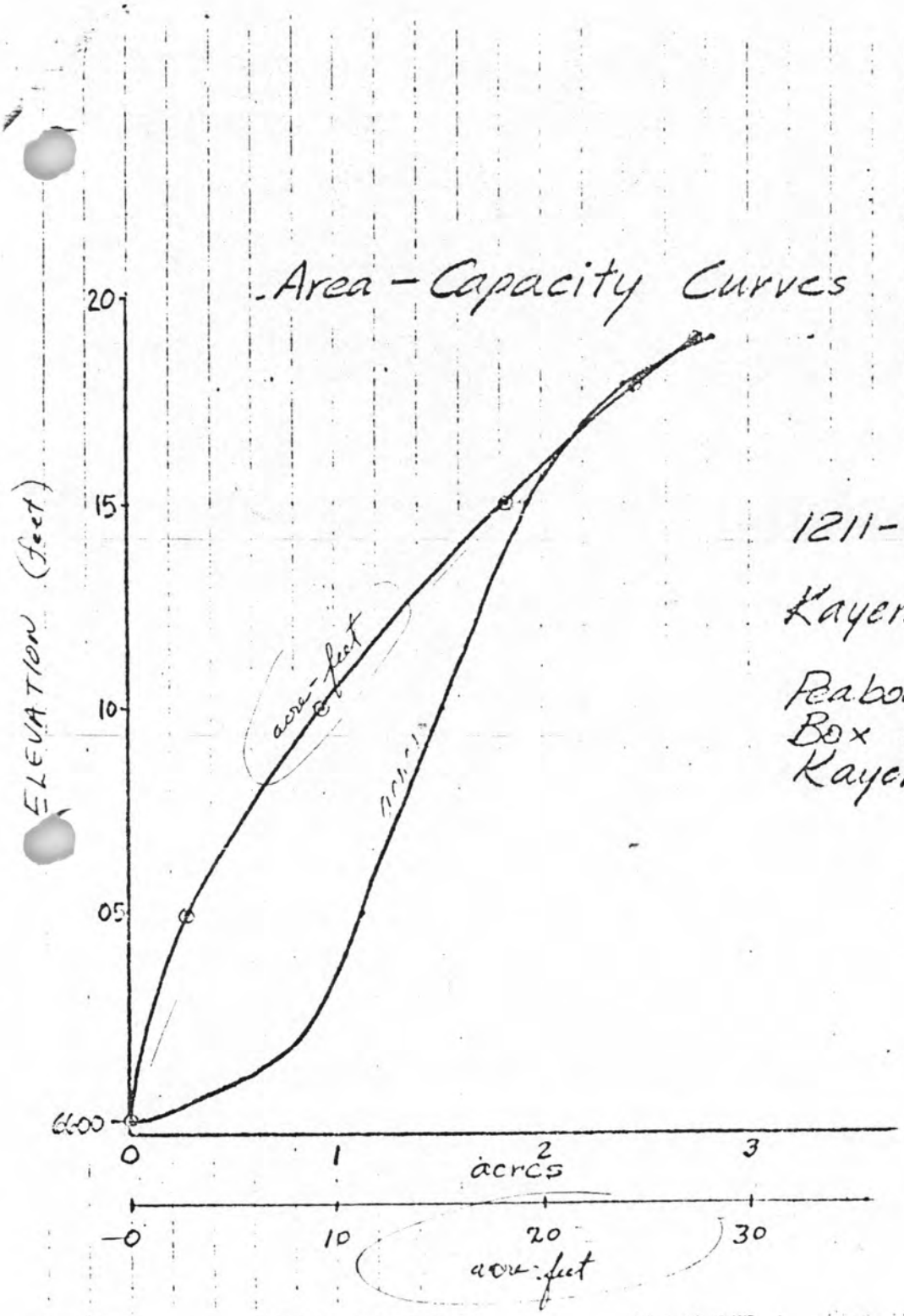
The impoundments, associated hydraulic facilities and watershed were analyzed for the following appropriate, required storms. The impoundment and associated facilities meet or exceed pertinent MESA standards.

Storm	Rainfall/Duration	Freeboard*	Drawdown Time
OPP-General	2.9"/6 hr.	1.1'	Less than 10 days
PMP-General	13.0"/6 hr.	1.0'	Less than 10 days
OPP-Thunderstorm	2.7"/1 hr.	1.1'	Less than 10 days
PMTS	9.5"/1 hr.	0.9'	Less than 10 days

* Difference between maximum reservoir water surface elevation and elevation of lowest point on the crest of the dam. The analyses were made using an ultra-conservative assumption that the pool was at elevation 6617.9 immediately before the storm occurred.

D. M. Schlueter
F. X. Kaiser
Peabody - St. Louis

Note - According to table 6.6, page 6.62, MESA "Engineering and Design Manual - Coal Refuse Disposal Facilities," a structure, such as the above, which is located in a rural/desert area where failure might cause only slight damage, such as to an isolated ranch building, forest or desert lands, or minor roads (LOW hazard potential), in view of the appropriate SMALL impoundment size category, the OPP is the indicated applicable design storm.



1211-AZ-9-0001

Kayenta Mine Reservoir

Peabody Coal Company
Box 606
Kayenta, Arizona 86033

8/25/76

added on — volume as well as area is req'd. to be plotted
FVK 8-31-76

1211 - AZ - 9 - 0001
EXHIBIT E : AREA-CAPACITY CURVE

CERTIFICATION

TO WHOM IT MAY CONCERN:

RE: Kayenta Mine (Fresh Water) Reservoir
MESA I. D. #1211-AZ-9-0001
Navajo County, Arizona

Based on recently completed slope stability investigations, hydrologic analyses, historical information, and apparent present conditions, the subject facility should perform satisfactorily, as a whole, under current maximum design conditions.

Registered Professional Engineer
CERTIFICATE NO.
9157
LAWRENCE M.
BRENNAN
DATE SIGNED 8-31-76
Arizona U. S. A.

Lawrence M. Brennan
Lawrence M. Brennan
Professional Engineer #9157

Aug 31, 1976
(Date)

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
Mailing Address:
P.O. Box 25367, DFC
Denver, Colorado 80225
Street Address:
730 Simms
Lakewood, Colorado
Coal Mine Safety & Health
District 9

MAR 1979
RECEIVED
Peabody Coal Co.
Permits &
C ance

March 28, 1979

S. Dennis Dawson
Supervisor, Permits & Compliance
Peabody Coal Company
Arizona Division
2224 E. Cedar Avenue, Suite A
Flagstaff, Arizona 86001

RE: Kayenta Fresh Water Pond
I.D. # 1211-AZ-9-0001
Kayenta Mine
I.D. No. 02-01195

Dear Mr. Dawson:

The plan to place a 12 inch CMP pipe in your pond has been received and placed on file in this office. This is acceptable for overflow control.

Thank you for your attention to this matter.

Sincerely yours,

Harold E. Dolan

Harold E. Dolan
Supervisory Mining Engineer

BLACK MESA MINE RESERVOIR (J-7 DAM)

30CFR 77.216-2 PLAN

SERGENT, HAUSKINS & BECKWITH CONSULTING SOIL AND FOUNDATION ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

B. DWAINE SERGENT, P.E.
DALE V. HEDENKOP, P.E.
JOHN J. MORAN, P.E.
JOHN B. HAUSKINS, P.E.
ROBERT D. BOOTH, P.E.
DONALD G. METZGER, GEOL.
GEORGE H. BECKWITH, P.E.
BENNY E. McMILLAN, P.E.
BUD WOODWARD

August 27, 1976

Peabody Coal Company
P. O. Box 23
117 East Ute Street
Farmington, New Mexico 87401

SHB Job No. E76-29B

Attention: Roger Dewey, P.E.

Re: Dam No. 3
Black Mesa Mine
Navajo County, Arizona

Gentlemen,

Our Geotechnical Investigation Report on the referenced project is herewith submitted. Included in this report are the results of subsurface exploration and laboratory analysis, along with a discussion of our engineering analysis and our conclusions and recommendations.

Should any questions arise concerning this report, we would be pleased to discuss them with you.

Respectfully submitted,
Sergent, Hauskins & Beckwith Engineers

By Robert W. Crossley
Robert W. Crossley, P.E.

Reviewed by George H. Beckwith
George H. Beckwith, P.E.

Registered Professional Engineer
Certificate No. 3133
GEORGE HENRY BECKWITH
Date Signed 8-27-76
ARIZONA, U.S.A.

Copies: Addressee (4)
Peabody Coal Company
St. Louis, Missouri
Attn: Francis X. Kaiser, Jr., P.E. (1)

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SHB Job No. E76-29B

1. INTRODUCTION

This report is submitted pursuant to a geotechnical investigation made by this firm of J-7 Dam, MESA I.D. No. 1211-AZ-9-0003, a major haul road embankment crossing a sizeable natural drainage channel at the Peabody Coal Company Black Mesa Mine in Navajo County, Arizona. The general location of the site is shown on Figure 1*.

An objective of this investigation was to evaluate the physical properties of embankment materials and of the soil and rock beneath the embankment in order to analyze the safety of the dam. A second objective was to provide recommendations for any remedial measures which might be necessary to bring the impoundment in full compliance with current "Design Guidelines for Coal Refuse Piles and Water, Sediment or Slurry Impoundments and Impounding Structures" published by the United States Department of the Interior, Mining Enforcement and Safety Administration.

The scope of our investigation was limited to analysis of geotechnical factors affecting dam stability. It is understood that Peabody Coal Company is performing the necessary hydrological analysis.

*Figures and illustrations are presented in Appendix C.

2. PROJECT DESCRIPTION

Details of the project were provided to us by Roger Dewey, P.E., and Reynaldo Armijo, staff engineer, of Peabody Coal Company.

The J-7 embankment was constructed in 1973 as part of the network of haul roads connecting the various coal excavations with the crusher plant. At that time, a subsurface investigation for the embankment was performed by the engineering division of Peabody Coal Company.

It is understood that prior to construction, all loose earth, scoria and carbonaceous shale (smut) was removed from the abutments and near centerline of the dam and replaced with compacted clay fill. A 60 foot wide keyway was constructed along the centerline axis of the dam to provide a seepage cutoff.

The crest of the dam is at elevation 6382, 77 feet above the original elevation of the stream channel (elevation 6305) at the centerline. In addition, berms 3 to 6 feet high have been built adjacent to the roadway across the crest of the dam to provide traffic protection. A typical cross section and axis profile of the dam are presented as Figures 3 and 4 of this report.

Runoff from the watershed (an area of approximately 20 square miles) is impounded on the east side of the dam. Egress is provided by a spillway channel crossing the haul road 500 feet past the south abutment of the dam. Bottom elevation of the spillway is 6372.

At the time of our investigation, in early spring 1976, the water level in the reservoir was 6355 feet. As previously stated, a detailed hydrological analysis of the J-7 Pond will be performed by Peabody Coal Company. In this report, the stability analyses are given for the reservoir level as stated above and for the case of the reservoir, filled to bottom elevation of the spillway. These assumptions are arbitrary in nature and should in no way be taken to suggest a judgment on our part as to the likelihood of occurrence of such conditions. Projections of future reservoir levels are not within the scope of this report.

3. INVESTIGATION

3.1 Subsurface Exploration

The subsurface exploration program, which was planned and executed by this firm in order to provide the necessary geotechnical information, consisted of a total of six exploratory borings. The borings were advanced using 6 5/8" O.D., 3¼" I.D., hollow stem auger through the dam embankment into the rock which provides the foundation for the embankment. In all borings, the drilling was continued until it was certain that intact rock had been encountered. Standard penetration testing or open-end drive sampling was performed at intervals of 5 feet or less in these borings.

The results of the field investigation are presented in Appendix A which includes a site plan showing boring

locations, logs of the test borings and a brief description of drilling and sampling equipment and procedures.

The subsurface exploration was supervised by Robert W. Crossley, staff engineer of this firm, who located the borings, continuously examined and logged drill cuttings and drive samples, and prepared the boring logs.

3.2 Laboratory Analysis

Moisture content determinations were made on selected tube samples recovered, while dry densities were determined for the 2.42 inch diameter open-end drive samples. The results of these tests are shown on the boring logs.

Grain-size analysis and Atterberg Limits tests were performed on selected samples to aid in soil classification. In addition, moisture-density, direct shear, unconfined compression, consolidation and remolded permeability tests were performed on the selected samples in order to evaluate engineering properties of the materials. Results of these tests are presented in Appendix B along with a brief description of the testing procedures.

3.3 Site Inspection

The site was visited on April 14, 1976, by principal engineer, George H. Beckwith and Robert Crossley of this firm, along with Messrs. Roger Dewey, Francis Kaiser and Reynaldo Armijo of Peabody Coal Company. The purpose of this visit was to observe the present condition of the

pond and to perform a brief reconnaissance of the adjacent topography and geology.

3.4 Survey of Borings

Topographic data of the J-7 Dam was furnished to us by Peabody Coal Company of Kayenta, Arizona on a plate dated April 13, 1976.

4. GEOLOGY, EMBANKMENT & SEISMICITY

4.1 Aerial & Site Geology

Black Mesa, in the area of investigation, is composed of rocks of Jurassic and Cretaceous ages. The surface slopes gently to the southwest. The uppermost formation of Black Mesa is the Wepo Formation, which has been eroded into parallel ridges and narrow valleys. O'Sullivan et al (1)* describe the Wepo as alternating siltstone, mudstone, coal, and sandstone beds, and as 304 to 743 feet in thickness.

4.2 Geologic History & Structure

According to O'Sullivan et al (1), the Wepo Formation was deposited primarily in a continental environment in which siltstones, mudstones, coal and sandstones were laid down. Locally, some marine sandstones are interbedded in the formation.

*Numbers in parentheses correspond to references listed at end of report.

Following deposition of the Wepo Formation and younger formations of Cretaceous age, the Navajo Country was affected by a structural period during late Cretaceous and early Tertiary time - the Laramide Orogeny. This resulted in an assortment of folds; such as basin downwarps, uplifts, monoclines, anticlines and synclines (2). One of the downwarps is the Black Mesa Basin. Black Mesa is a dissected highland in the structural center of this basin. In late Tertiary and Quaternary time, the Navajo Country was upwarped and locally faulted.

Maps prepared by Cooley et al (2) show that the Wepo Formation of the northern part of Black Mesa has been warped by gentle monoclines and synclines and has not been broken by faults. The nearest faults are shown as 30 to 50 miles north-northwest from the area of investigation, and these trend from eastward to northeastward. Two east trending faults, about 4 to 5 miles long, are about 30 miles from the site. Several northeast trending faults as long as 12 miles occur about 40 miles from the site.

4.3 Embankment Soils & Foundation

4.3.1 Description of Soils & Rock

The embankment was found to be comprised predominantly of clay, clayey sand and clayey gravel with a few thin lifts of cohesionless silty sand and gravel mixtures. There is a considerable amount of carbonaceous material mixed with the clay and gravel, particularly below the elevation of 6340. Penetration test data indicates the

embankment materials are generally firm to very firm. However, a few zones of loose material were present.

Beneath the embankment, a few feet of native soil was encountered in borings 1, 2 and 3 near the center of the dam. These consisted of sandy clays and clayey sands in borings 2 and 3. In boring 1, 6½ feet of channel alluvium was encountered. It appears that all borings are outside or at the edge of the cutoff trench.

Weathered shales and sandstones of the Wepo Formation were encountered in all borings. In boring 5, an inch of scoria over soft shale was found.

4.3.2 Moisture & Seepage

Within the embankment, moisture contents were generally slightly below the plastic limit, although lifts dominated by cohesionless material often appeared to be very dry. A groundwater table was encountered in borings 1, 2 and 5 at elevations 6312, 6312 and 6317, respectively. In all cases, this phreatic surface occurred in channel alluvium or other native material. There was no indication of saturation within the embankment fill.

Seepage through the channel alluvium beneath the embankment and cutoff trench is taking place at a very nominal rate. At the time of our investigation, a trickle of water was seen exiting a few feet downstream from the toe of embankment at approximate elevation 6295. There is no indication of erosion or distress of the toe due to this seepage.

4.3.3 Piping Potential

Sherard et al (3) have published a rough empirical relationship of observed piping and soil types. In this system, soils are ranked according to their resistance to piping; 1 being most resistant and 8 being least resistant. Using this criteria, the embankment and soil foundation materials probably would fall into categories 2 to 4. The rock foundation materials would have extremely high resistance to internal erosion.

4.4 Seismology

4.4.1 Seismic History of the Area

Research was made of the seismic history of the general area of the site. Principal source of information was "Earthquake History of the United States" by Coffman and Von Hake (4). It presents a table listing earthquakes in the Western Mountain Region with intensities equal to or greater and V on the Modified Mercalli Intensity Scale of 1931. This table was used in compiling Table 1 of this report, which lists historical earthquakes within the general area of the site.

Other references that were used include the "Preliminary Safety Analysis Report" (5) prepared by FUGRO, Inc. for Arizona Public Service Company Palo Verde Nuclear Generating Station west of Phoenix and Sturgul and Irwin's report on "Earthquake History of Arizona and New Mexico" (6).

The earthquakes listed in Table 1 are plotted on Figure 2. The figure covers an area of about 420 by 500 miles in Arizona, New Mexico, Utah and Colorado. As the data shows, the region of the site is one of very low seismicity.

Figure 2 shows that within a 100 mile radius of the site, only five earthquakes of intensity V or greater have been recorded during historic time. Of these, the closest epicenter to the site was an intensity VI earthquake reported about 40 miles to the southwest in 1910, while the intensity VI Ganado earthquake of January 16, 1950, was placed about 75 miles southeast of Black Mesa. The largest tremor ever reported in northern Arizona was intensity VII, occurring on January 15, 1906 near the north rim of the Grand Canyon.

4.4.2 Significant Geologic Structure

As discussed in Section 4.2, no faulting is mapped in the immediate area of the site. Minor faulting 30 to 50 miles north of the site is not considered capable of creating an earthquake of sufficient intensity to significantly affect the embankment.

Shown on Figure 2 are locations of significant faults in the general region of the site which are known to have been active during the Quaternary period (past one million years). These include the San Francisco Mountain fault west of Flagstaff and the Verde fault which has been mapped for 70 miles or more. These faults are located more than 100 miles southwest of

the site. Also shown on Figure 2 are the north-south trending Sevier, Hurricane, Toroweap and Grand Wash fault zones in northwestern Arizona and southern Utah. These zones of normal faulting are close enough to the site to be of significance from a seismic risk standpoint. Their significance is discussed by Smith and Sbar (7).

4.4.3 Previous Seismic Zoning & Estimated Effect of Hypothetical Earthquakes

The northern portion of Arizona is location in Zone 2 on the Seismic Risk Map found in the current Uniform Building Code. This means that the general area has experienced in the past, and thus may experience in the future, moderate damage corresponding to intensity VII of the Modified Mercalli Scale. Richter (8) classified the general area as intensity VIII occasional in a study published in 1959. Based upon more detailed analysis, Algermissen (9) classified the general area of the site as intensity VII occasional. This type of zoning is very general in nature and must be controlled by the areas of higher risk within the zone. In a study by the U. S. Geological Survey, based on both statistical analysis of seismic history and evaluation of geology, Algermissen and Perkins (10) have estimated a 50 year return peak ground acceleration of less than 0.01g and a 90 percent probable peak ground acceleration of about 0.03g for the site. Recent studies by Bell Telephone Laboratories (11) estimated 100 year return peak ground acceleration of 0.03g for the site.

In a current study by the Applied Technology Council (12) directed toward development of seismic design methods for buildings, an EPA of less than 0.05g was estimated for the site. A report of on-going U. S. Geological Survey Studies (13), just published, estimated an EPA of less than 0.04g. For the latter two studies, the EPA's of 0.05g and 0.04g were the lowest contours reported. They state that for EPA's lower than these values, wind normally controls the lateral force requirements for buildings and, thus, lower contours are not significant for building design purposes. The EPA's in these two studies (12, 13) are both defined as values with a 90 percent probability of not being exceeded in 50 years.

Estimates of EPA reported by the U. S. Geological Survey in 1976 (13), in the general area of the site, are substantially lower than corresponding values reported in 1972 (10).

Based upon data summarized by Howell and Schultz (14), Bolt (15), Schnabel and Seed (16), Barosh (17) and Hays et al (18), it is possible to roughly estimate the effect of hypothetical earthquakes at the site. Maximum credible earthquakes for a given fault can be estimated, using this data, on the basis of length. The effects at sites away from the fault can then be assessed utilizing various attenuation curves.

The foregoing analysis is based on these techniques. Should an earthquake of magnitude 6 occur in the San

Francisco Peaks area, about 120 miles southwest of the site, it would create an intensity of about 3.7 (MM) and a peak ground acceleration of about 0.02g. Bracketed duration (time during which acceleration is about 0.02g) would be 1 second at most. According to Schnabel and Seed (16), predominant period would be about 0.8 seconds considering the subsurface profile at this site.

Maximum credible earthquakes on the Sevier fault system, and other major fault zones in southwestern Utah, would produce peak ground accelerations of less than 0.02g with a predominant period of perhaps 1.0 second. These zones are 130 miles or more away from the site.

In summary, all data shows the site is in an area of very low seismicity and, thus, a very low level of seismic risk is involved.

5. STABILITY ANALYSIS

5.1 Assumed Soil Parameters

Shear strength parameters were estimated from the results of the direct shear tests performed under submerged conditions on both undisturbed and remolded samples of typical materials from the embankment. The direct shear tests on submerged soils are believed to yield strength parameters which compare favorably with the actual parameters for the embankment materials at their present moisture contents. Because of the low rate of strain and soil type involved, the direct shear tests are believed to yield essentially effective stress parameters.

The effective shear strength and other parameters used in stability analyses are as follows:

Upper Embankment (Above Elevation 6340)

$\emptyset' = 25^{o}$
C' = 400 psf
Density - In Situ = 110 pcf
Saturated = 130 pcf

Lower Embankment (Below Elevation 6340)

$\emptyset' = 20^{o}$
C' = 350 psf
Density - In Situ = 115 pcf
Saturated = 135 pcf

Foundation Materials

$\emptyset' = 30^{o}$
C' = 1,000 psf
Density - In Situ &
Saturated = 140 pcf

5.2 Seismic Design Considerations

As stated in Section 4.4.1, this site is in an area of very low seismicity. Based on assessment of this data, a seismic coefficient of 0.05g was selected for use in analysis.

5.3 Methods of Analysis

Using the geometry shown in Figure 4, slope stability analyses were made using SSTAB1, a general computer program for

slope stability analyses, available from the University of Texas (19), and developed by Stephen G. Wright. The program utilizes a limit equilibrium procedure of slices, to calculate a factor of safety, which satisfies all conditions of static equilibrium. In this procedure, the resultant side forces acting on each slice are assumed parallel, as first introduced by E. Spencer. The solution for factor of safety is obtained by iteration and required successive approximations for the factor of safety and side force inclination in order to satisfy the equilibrium boundary conditions.

In addition, a stability number method published by Hoek and Bray (20) was employed to analyze segments of the upstream and downstream slopes. For further verification and to analyze effects of a seismic force, one critical circle was examined by manual calculation utilizing the traditional method of slices.

5.4 Summary of Results

Based upon the analysis methods and assumed shear strength parameters described in Sections 5.1 and 5.3 above, the following factors of safety were computed.

Upstream Slope - Dry

Height	Slope	Factor of Safety
32 feet	3.1:1	2.91

Upstream Slope - Sudden Drawdown*

Height	Slope	Factor of Safety
32 feet	3.1:1	Approximately 2.60 (See trials 2 & 3)

Downstream Slope -
Dry Slope, Static Conditions

Height	Slope	Factor of Safety
80 feet	3 segments as shown (Figure 5)	Approximately 2.30 (See trial 5)

Downstream Slope - Dry
Seismic Force = 0.05g

Height	Slope	Factor of Safety
80 feet	3 segments as shown (Figure 5)	1.98

*In this analysis, using SSTAB1, it was assumed the water level in the reservoir was at spillway elevation (6372) for a sufficient period of time for material in the face of the embankment to become saturated. A sudden drawdown to elevation 6348 was analyzed because on any upstream slope, this is the worst set of static conditions which can possibly be injected into a slope stability problem. The high safety factor shown is evidence of the inherent stability of the present embankment.

The slope and embankment heights were taken from survey data furnished by Peabody Coal Company. A documentation of these figures is presented in Appendix C.

6. CONCLUSIONS & RECOMMENDATIONS

It is concluded the dam embankment is safe for present conditions and foreseeable future operating conditions.

It is our conclusion that very high factors of safety against slope failure exist for these conditions and, thus, no alterations of the embankment are necessary for safety reasons.

Even in the event that maximum pool evaluation is reached, complete saturation of the embankment would take many years to accomplish due to its high clay content. Therefore, the development of a high phreatic surface within the dam, or seepage on the downstream face, is considered highly unlikely.

The danger of piping in the embankment foundation is considered minimal. This is due to low exit velocities which are associated with such a shallow seepage gradient, as well as the considerable amount of clay in the soil and weathered rock which are found beneath the dam.

Because of the low estimated EPA, as well as the internal cohesion of the embankment materials, it is concluded the embankment would not have the potential for liquefaction, even if portions of it became saturated.

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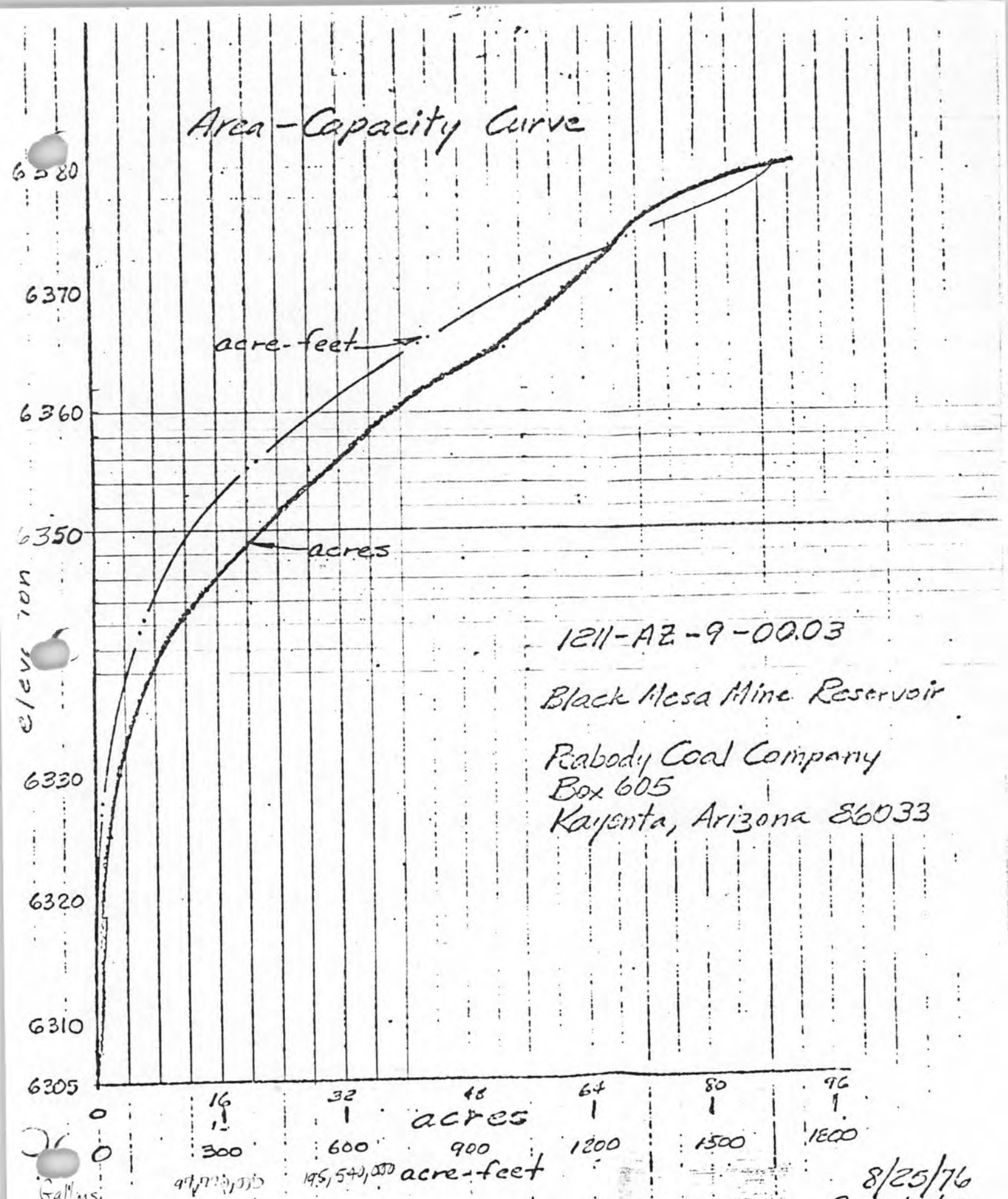
REFERENCES

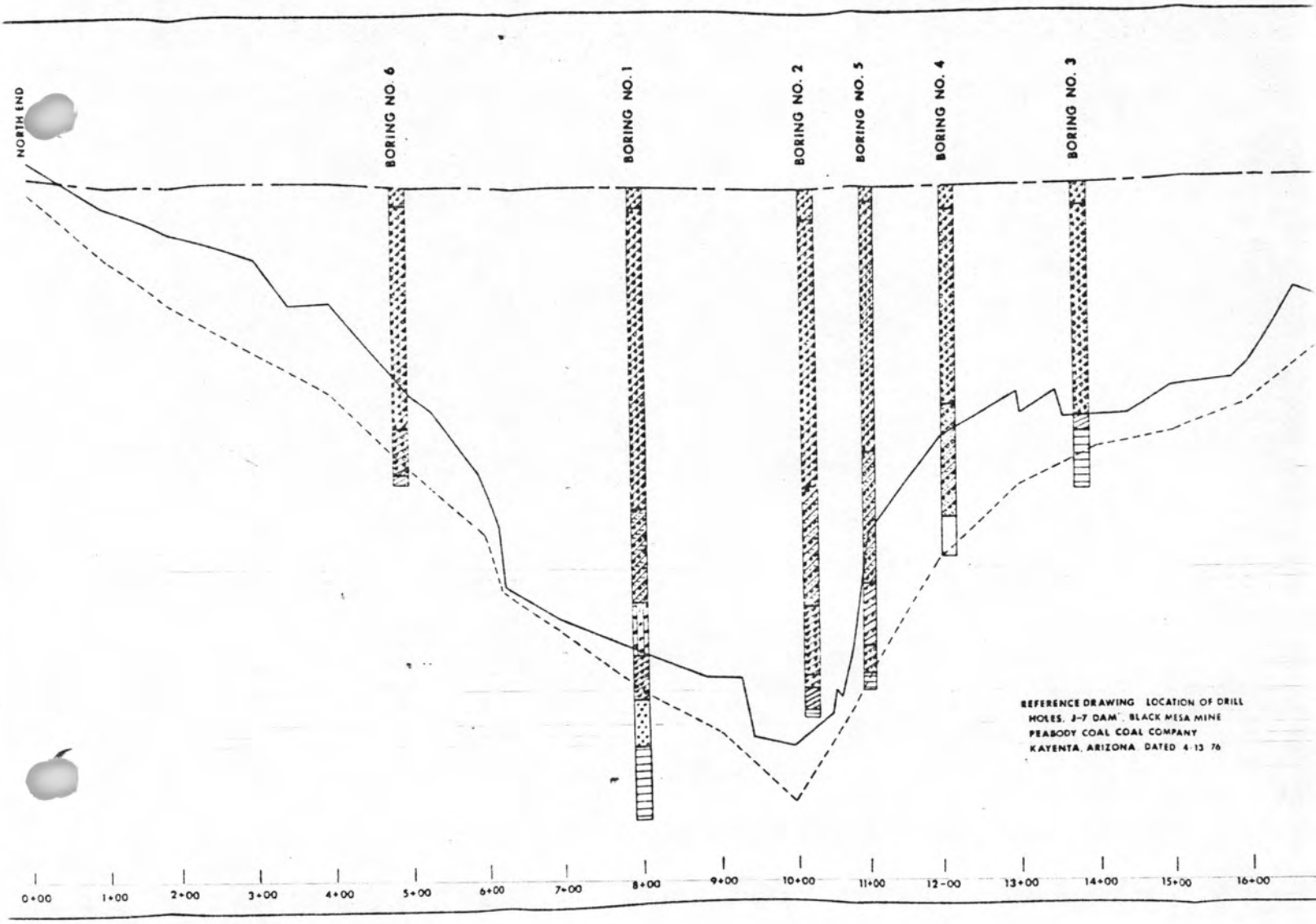
20. Hoek, E. and Bray, J. W., "Rock Slope Engineering", The Gresham Press, London, U. K., 1974.

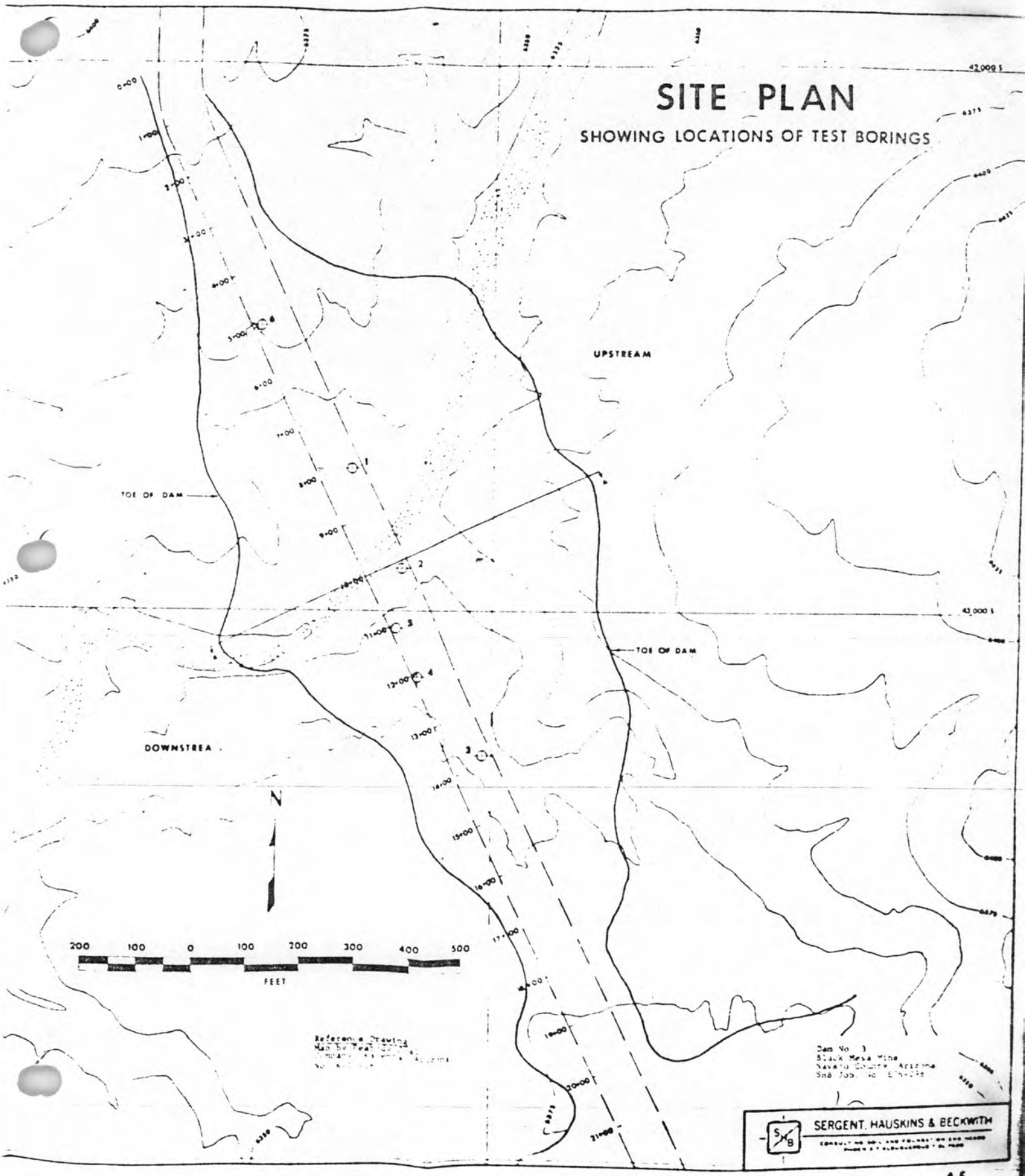


8/25/76
Rev. 9/14/77

1211 - AZ - 9 - 0003

EXHIBIT E : AREA - CAPACITY CURVE


NORTH END
BORING NO. 6
BORING NO. 1
BORING NO. 2
BORING NO. 5
BORING NO. 4
BORING NO. 3
REFERENCE DRAWING LOCATION OF DRILL HOLES, J-7 DAM, BLACK MESA MINE PEABODY COAL COAL COMPANY KAYENTA, ARIZONA DATED 4-13-76
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12-00
13+00
14+00
15+00
16+00


SITE PLAN
SHOWING LOCATIONS OF TEST BORINGS
UPSTREAM
DOWNSTREA
TOE OF DAM
TOE OF DAM
N
200 100 0 100 200 300 400 500
FEET
SERGENT, HAUSKINS & BECKWITH

Date 6-22-76

Peabody Engineering Office KAYENTA ARIZONA

Attached herewith are your hydrologic analyses for the following impoundment.

Name BLACK MESA J-7 DAM

MESA I.D.# 1211-AZ-9-0003

As you may recall, the "DAMS 2" Computer Program, Version 2, February 1971, U. S. Dept. of Agriculture, Soil Conservation Service, was used to perform these flood routing analyses. The User's Guide, Technical Release 48, describes the program operation, input data requirements, options and output, and is available from the Soil Conservation Service.

The impoundments, associated hydraulic facilities and watershed were analyzed for the following appropriate, required storms. The impoundment and associated facilities meet or exceed pertinent MESA standards.

Storm	Rainfall / Duration	Freeboard*	Drawdown Time
GENERAL 100YR	2.9" / 6 HRS	6.4'	LESS THAN 10 days
GENERAL PMP	13.0" / 6 HRS	0.9'	LESS THAN 10 days
THUNDERSTORM 100YR	2.7" / 1 HRS	6.4'	LESS THAN 10 days
THUNDERSTORM PMTS	9.5" / 1 HRS	0.9'	LESS THAN 10 days

* Difference between maximum reservoir water surface elevation and elevation of lowest point on the crest of the dam.

D. M. Schlueter
F. X. Kaiser
Peabody - St. Louis

The indicated hydrologic analysis and performance of this impoundment is in accordance with current, prudent engineering practices for the passage of runoff from the designed storm which exceeds the storage capacity of the impoundment.

Certified by _____

Registered Professional Engineer # _____

Date _____

EXHIBIT F

```
DAMS2 XFC  6/15/76
      REV 06/18/73

      ************************** 80-80 LIST OF INPUT DATA **************************

      DAMS2     04/03/76  BLACK MESA   J-7 DAM  MESA I.D. 1211-AZ-9-0003          3400
      STRUCTURE                                                                   3400
                          6305      0         0                                   3400
                          6310      .12       0                                   3400
                          6315      .80       0                                   3400
                          6320      1.29      0                                   3400
                          6325      2.11      0                                   3400
                          6330      3.48      0                                   3400
                          6335      5.62      0                                   3400
                          6340      9.33      0                                   3400
                          6345      14.66     0                                   3400
                          6350      22.10     0                                   3400
                          6355      30.83     0                                   3400
                          6360      39.71     0                                   3400
                          6365      49.94     0                                   3400
                          6370      61.79     0                                   3400
                          6373.6    67.91     0                                   3400
                          6380      92.45     0                                   3400
      ENDTABLE                                                                    3400
      RAINTABLE USBRG     1.0       POINT ONE HOUR STORM                          3400
                          0.0       0.17      0.40      0.88      1.0             3400
      ENDTABLE                                                                    3400
      RAINTABLE GRBSU     6.0       GEN. 6 HOUR STORM DISTRIBUTION                3400
                          0         0.12      0.26      0.42      0.71            3400
                          0.89      1.00                                          3400
      ENDTABLE                                                                    3400
      BTMWIDTH  FEET      282                                                     3400
      DDTESTS                                                                     3400
      ESCREST   ELEV      6373.6                                                  3400
      ESDATA    41        585       0.025     25        0.025     3.33            3400
      ESPROFILE 41        85        0.5       180       1.2                       3400
      ESPROFILE           282       3.9       377       4.2                       3400
      ESPROFILE           500       7.0       585       25.7                      3400
      KIRPICH                                                                     3400
      POOLDATA  ELEV      6373.6    6373.6                                        3400
      PSRATING                                                                    3400
      P100,PMP  .448      2.9       13        1.21      1.49                      3400
      WSDATA    1A        44        14.41     32000     726.4                     3400
      COMMENT   NOW ROUTE  GEN 6-HR STORM                                          3400
      STORM     30.0                6.0                                           3400
      GC,STORM  LPC       GRBSU     2.9                         6373.6            3400
      STORM     35.0                6.0                                           3400
      GC,STORM  LPC       GRBSU     13.0                        6373.6            3400
      COMMENT   ROUTE ONE-HR PT STORM                                             3400
      STORM     30.0                1.0                                           3400
      GC,STORM  LPC       USBRG     2.7                         6373.6            3400
      STORM     35.0                1.0                                           3400
      GO,STORM  LPC       USBRG     9.5                         6373.6            3400
      GO,TOD              6380      6373.6    0                                   3400
```

```
DAMS2 XEQ  6/15/76
      REV 06/18/73

      ************************** 80-80 LIST OF INPUT DATA **************************

      COMMENT   TOP OF DAM ELEV  6380                                          3400
      COMMENT   RUN BOTH DURATION STORMS (RUN 10)                              3400
      ENDJOB                                                                   3400

      ******************************************************************************
```

```
DAMS2 XEQ  6/15/76
     REV 06/18/73                BLACK MESA   J-7 DAM  MESA I.D. 1211-AZ-S-0003

          NOW ROUTE  GEN 6-HR STORM
```

********** BASIC DATA **********

ARID-SEMIARID CLIMATE AREA DESIGN CLASS A

STORM DISTRIBUTION.....GEN. 6 HOUR STORM DISTRIBUTION

P-100	PMP	P10A/P6HR	P10DA/P10A	CN	DA-SM	TC/L	-/H
2.90	13.00	1.210	1.490	44.00	14.41	32000.00	726.40

CONDUITS	COND L	D/W	-/H	PS N	KI	WEIR L	TW EL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PERM POOL	CREST PS	FP SED	BASEFLOW	2ND STG	ORF H	ORF L	START
6373.60	6373.60	0.0	0.0	0.0	0.0	0.0	6373.60

ES1	ES2	ES3	ES4	ES5	Z ES	EXIT N	EXIT S
6373.60	0.0	0.0	0.0	0.0	25.00	0.025	0.033

ES TYPE	ES L	ES N	BW1	BW2	BW3	BW4	BW5
41	585	0.025	282.00	0.0	0.0	0.0	0.0

PROVIDED BY ES FILE

ES CODE	INCREMENT			Q1	Q2	Q3	Q4
41585.025	1.000			2.441	7.276	13.779	21.666
Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
30.734	40.888	51.996	64.012	76.859	90.519	104.943	120.074

********** DETAILED LIST OF BASIC DATA **********

WEIR COEF. FOR ORIFICES..... 3.10 RATIO OF IA TO S(CH.10,NEH4).. 0.20 MIN ES BW WHEN MAX V/C GIVEN.. 20.0

WEIR COEF. FOR DROP INLET..... 3.10 TIME INCS TO PEAK OF UNIT HYD. 5. DELTA BW WHEN MAX V/C GIVEN... 64.0

DISCHARGE COEF. FOR ORIFICES.. 0.60 NO. POINTS FOR DESIGN HYD..... 101 PRECISION OF BW SOLUTION..... 1.0

FILLET SIZE FOR BOX CONDUITS.. 6.00 ES-WSP CALC. DEPTH PRECISION. 0.005 PRECISION OF V/C SOLUTION..... 0.03

GRAVITATIONAL CONSTANT.....32.16 ES-WSP PERMISSIBLE VEL.CHANGE. 0.05

	TOP WIDTH	UPSTREAM Z	DOWNSTREAM Z	WAVE BERM	STAB. BERM	DH MAX
EMBANKMENT TEMPLATE	0.0	2.5	2.5	10.0	0.0	0.0

RAINFALL EQUATION CONSTANTS	K1 PSH	K1 ESH	K1 EPH	K2 PSH	K2 ESH	K2 EPH
CLASS A	0.82	1.00	1.00	0.0	0.0	0.12

DIMENSIONLESS UNIT HYDROGRAPH

PEAK FACTOR = 484.0

0.0	0.030	0.100	0.190	0.310	0.470	0.660	0.820	0.930	0.990
1.000	0.990	0.930	0.860	0.780	0.680	0.560	0.460	0.390	0.330
0.280	0.240	0.207	0.177	0.147	0.127	0.107	0.090	0.077	0.065
0.055	0.047	0.040	0.034	0.029	0.025	0.021	0.018	0.015	0.013
0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001
0.0									

SCS DESIGN STORM RAINFALL DISTRIBUTION. (CHAPTER 21, NEH4 AND SCS EM-27)

0.0	0.013	0.027	0.042	0.059	0.078	0.099	0.122	0.147	0.180
0.230	0.380	0.530	0.625	0.670	0.705	0.736	0.764	0.790	0.814
0.836	0.856	0.875	0.893	0.910	0.927	0.942	0.957	0.972	0.986
1.000									

POINT ONE HOUR STORM

ID NAME IS USPRG

0.0	0.170	0.400	0.880	1.000

GEN. 6 HOUR STORM DISTRIBUTION

ID NAME IS GRBSU

0.0	0.120	0.260	0.420	0.710	0.890	1.000

PERM POOL	6373.60 FT	1287.7 ACFT	67.91 AC
CREST PS	6373.60 FT	1287.7 ACFT	67.91 AC
SED ACCUM	6373.60 FT	1287.7 ACFT	67.91 AC
ES CREST	6373.60 FT	1287.7 ACFT	67.91 AC
PS STORAGE	0.0 ACFT		
STARTING E	6373.60 FT	1287.7 ACFT	67.91 AC 0.0 CFS

STORM HYD D= 6.00 HR P= 2.90 IN Q= 0.01 IN
TC= 1.64 HR CN= 44.00 V= 7.3 ACFT
PEAK 54.8 CFS AT 6.59 HRS

****

RATING TABLE NUMBER 2

	E FEET	Q CFS	V AC FT	A ACRE
1	6373.60	0.0	1287.73	67.91
2	6373.60	0.0	1287.73	67.91
3	6373.60	0.0	1287.73	67.91
4	6373.60	0.0	1287.73	67.91
5	6373.60	0.0	1287.73	67.91
6	6373.60	0.0	1287.73	67.91
7	6373.60	0.0	1287.73	67.91
8	6373.60	0.0	1287.73	67.91
9	6373.60	0.0	1287.73	67.91
10	6373.60	0.0	1287.73	67.91
11	6373.60	0.0	1287.73	67.91
12	6373.60	0.0	1287.73	67.91
13	6373.60	0.0	1287.73	67.91
14	6373.91	222.95	1309.41	69.12
15	6374.23	454.76	1331.75	70.35
16	6374.81	1044.22	1373.05	72.57
17	6375.52	2135.64	1425.05	75.26
18	6376.80	5074.19	1524.61	80.17
19	6378.40	10300.64	1657.92	86.31
20	6380.00	17325.74	1801.07	92.45

TYPE	BW	EMAX	VMAX	AMAX	HP	V-ES	Q-PS	Q-ES	Q-TOT	D/C	V/C	S/C	S/C.25	Q-ES
STORM HYD	282.0	6373.54	1290.8	68.1	0.04	2.1	0.	32.	32.	0.07	1.54	0.022	0.030	8.9

PLOT 1 IN = 10. CFS EXIT SLOPE = 0.035

T	I	Q	E	V	A	0. I	10. I	20. I	30. I	40. I	50. I	60. I	70. I	EXIT VEL
0.0	0	0	6373.6	1287.7	67.9	.								0.0
0.39	0	0	6373.6	1287.7	67.9	.								0.0
0.78	0	0	6373.6	1287.7	67.9	.								0.0
1.16	0	0	6373.6	1287.7	67.9	.								0.0
1.55	0	0	6373.6	1287.7	67.9	.								0.0
1.94	0	0	6373.6	1287.7	67.9	.								0.0
2.33	0	0	6373.6	1287.7	67.9									

```
 2.71   0   0 6373.6  1287.7  67.9 .                                                                  0.0
 3.10   0   0 6373.6  1287.7  67.9 .                                                                  0.0
 3.49   0   0 6373.6  1287.7  67.9 .                                                                  0.0
 3.88   0   0 6373.6  1287.7  67.9 .                                                                  0.0
 4.26   0   0 6373.6  1287.7  67.9 .                                                                  0.0
 4.65   0   0 6373.6  1287.7  67.9 .                                                                  0.0

IHC210I PROGRAM INTERRUPT(P) OLD PSW IS    FF35000F62030146
 5.04   0   0 6373.6  1287.7  67.9 .
 5.43   3   0 6373.6  1287.7  67.9 . I                                                                0.02
 5.81  15   3 6373.6  1288.0  67.9 . E         I                                                      0.41
 6.20  39  10 6373.6  1288.7  68.0 .       F                   I                                       0.72*
 6.59  55  20 6373.6  1289.7  68.0 .                 E                                                 1.09
 6.98  48  29 6373.6  1290.6  68.1 .                           E                   X                   1.45
 7.36  31  32 6373.6  1290.8  68.1 .                              IX          I                        1.70
 7.75  17  30 6373.6  1290.6  68.1 .                     I        E                                    1.75
 8.14   9  25 6373.6  1290.1  68.0 .         I                E                                         1.71
 8.53   5  20 6373.6  1289.7  68.0 .     I             F                                               1.56
 8.91   3  15 6373.6  1289.2  68.0 .  I            E                                                   1.46
 9.30   2  12 6373.6  1288.9  68.0 . I         E                                                       1.31
 9.69   1   9 6373.6  1288.6  68.0 .I       F                                                          1.20
10.08   1   7 6373.6  1288.4  67.9 .I     E                                                            1.05
10.46   0   5 6373.6  1288.2  67.9 .    E                                                              0.95
10.85   0   3 6373.6  1288.1  67.9 .  E                                                               0.85
11.24   0   3 6373.6  1287.7  67.9 .  E                                                               0.76*
                                                                                                       0.68
   T   I   D     E       V     A  I         I         I         I         I         I         I         I   VEL
                                  0.        10.       20.       30.       40.       50.       60.       70. EXIT
```

********** BASIC DATA **********

ARID-SEMIARID CLIMATE AREA DESIGN CLASS A

STORM DISTRIBUTION.....GEN. 6 HOUR STORM DISTRIBUTION

P-100	PMP	P10DA/P6HR	P100DA/P10DA	CN	DA-SM	TC/L	-/H
2.90	13.00	1.210	1.490	44.00	14.41	32000.00	726.40

CONDUITS	COND L	D/W	-/H	PS N	KI	WEIR L	TW EL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PERM POOL	CREST PS	FP SED	BASEFLOW	2ND STG	ORF H	ORF L	START
6373.60	6373.60	0.0	0.0	0.0	0.0	0.0	6373.60

ES1	ES2	ES3	ES4	ES5	Z ES	EXIT N	EXIT S
6373.60	0.0	0.0	0.0	0.0	25.00	0.025	0.033

ES TYPE	ES L	ES N	BW1	BW2	BW3	BW4	BW5
41	585	0.025	282.00	0.0	0.0	0.0	0.0

PROVIDED BY ES FILE

ES CODE	INCREMENT			Q1	Q2	Q3	Q4
41585.025	1.000			2.441	7.276	13.779	21.666

Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
30.734	40.888	51.996	64.012	76.858	90.519	104.943	120.074

********** DETAILED LIST OF BASIC DATA **********

WEIR COEF. FOR ORIFICES..... 3.10 RATIO OF IA TO S(CH.10,NEH4).. 0.20 MIN ES BW WHEN MAX V/C GIVEN.. 20.0

WEIR COEF. FOR DROP INLET..... 3.10 TIME INCS TO PEAK OF UNIT HYD. 5. DELTA BW WHEN MAX V/C GIVEN... 64.0

DISCHARGE COEF. FOR ORIFICES.. 0.60 NO. POINTS FOR DESIGN HYD..... 101 PRECISION OF BW SOLUTION..... 1.0

FILLET SIZE FOR BOX CONDUITS.. 6.00 ES-WSP CALC. DEPTH PRECISION. 0.005 PRECISION OF V/C SOLUTION..... 0.03

GRAVITATIONAL CONSTANT..... 32.16 ES-WSP PERMISSIBLE VEL.CHANGE. 0.05

	TOP WIDTH	UPSTREAM Z	DOWNSTREAM Z	WAVE BERM	STAB. BERM	DH MAX
EMBANKMENT TEMPLATE	0.0	2.5	2.5	10.0	0.0	0.0

RAINFALL EQUATION CONSTANTS	K1 PSH	K1 ESH	K1 FRH	K2 PSH	K2 ESH	K2 FRH
CLASS A	0.82	1.00	1.00	0.0	0.0	0.12

DIMENSIONLESS UNIT HYDROGRAPH PEAK FACTOR = 484.0

0.0	0.030	0.100	0.190	0.310	0.470	0.660	0.820	0.930	0.990
1.000	0.990	0.930	0.860	0.780	0.690	0.560	0.460	0.390	0.330
0.280	0.240	0.207	0.177	0.147	0.127	0.107	0.090	0.077	0.065
0.055	0.047	0.040	0.034	0.029	0.025	0.021	0.018	0.015	0.013
0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001
0.0									

SCS DESIGN STORM RAINFALL DISTRIBUTION. (CHAPTER 21, HEM AND SCS EM-27)

0.0	0.013	0.027	0.042	0.059	0.078	0.099	0.122	0.147	0.180
0.230	0.380	0.530	0.625	0.670	0.705	0.736	0.764	0.790	0.814
0.836	0.856	0.875	0.893	0.910	0.927	0.942	0.957	0.972	0.986
1.000									

POINT ONE HOUR STORM ID NAME IS USBRG

0.0	0.170	0.400	0.880	1.000

GEN. 6 HOUR STORM DISTRIBUTION ID NAME IS GRBSU

0.0	0.120	0.260	0.420	0.710	0.890	1.000

PERM POOL	6373.60 FT	1287.7 ACFT	67.91 AC	
CREST PS	6373.60 FT	1287.7 ACFT	67.91 AC	
SED ACCUM	6373.60 FT	1287.7 ACFT	67.91 AC	
ES CREST	6373.60 FT	1287.7 ACFT	67.91 AC	
PS STORAGE	0.0 ACFT			
STARTING E	6373.60 FT	1287.7 ACFT	67.91 AC	0.0 CFS

STORM HYD D= 6.00 HR P= 15.00 IN Q= 4.71 IN
TC= 1.64 HR CN= 44.00 V= 3586.7 ACFT
PEAK 13513.3 CFS AT 4.96 HRS

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RATING TABLE NUMBER 2

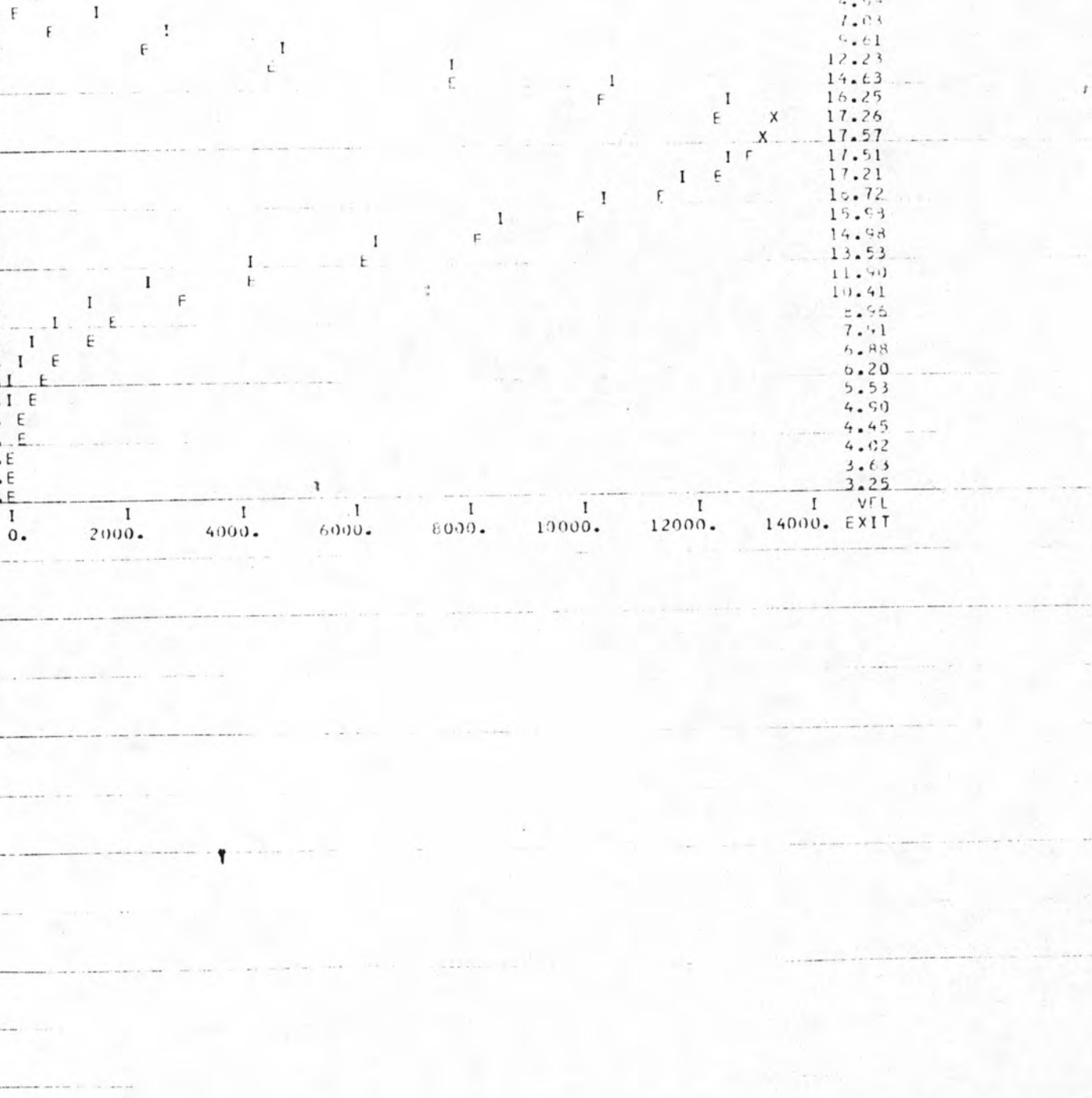
	E FEET	Q CFS	V AC FT	A ACRE
1	6373.60	0.0	1287.73	67.91
2	6373.60	0.0	1287.73	67.91
3	6373.60	0.0	1287.73	67.91
4	6373.60	0.0	1287.73	67.91
5	6373.60	0.0	1287.73	67.91
6	6373.60	0.0	1287.73	67.91
7	6373.60	0.0	1287.73	67.91
8	6373.60	0.0	1287.73	67.91
9	6373.60	0.0	1287.73	67.91
10	6373.60	0.0	1287.73	67.91
11	6373.60	0.0	1287.73	67.91
12	6373.60	0.0	1287.73	67.91
13	6373.60	0.0	1287.73	67.91
14	6373.91	222.95	1309.41	69.12
15	6374.23	454.76	1331.75	70.35
16	6374.81	1044.22	1373.06	72.57
17	6375.52	2135.64	1425.03	75.26
18	6376.80	5074.19	1524.61	80.17
19	6378.40	10300.64	1657.92	86.31
20	6380.00	17325.74	1801.07	92.45

TYPE	BW	EMAX	VMAX	AMAX	HP	V-ES	Q-PS	Q-ES	Q-TOT	D/C	V/C	S/C	S/C.25	D-ES
STORM HYD	282.0	6379.10	1719.5	85.0	5.50	431.3	0.	13325.	13325.	3.44	10.52	0.006	0.008	9.3

PLOT 1 IN = 2000. CFS EXIT SLOPE = 0.033

T	I	O	E	V	A	0 I	2000. I	4000. I	6000. I	8000. I	10000. I	12000. I	14000. I	EXIT VEL
0.0	0	0	6373.6	1287.7	67.9	.								0.0
0.33	0	0	6373.6	1287.7	67.9	.								0.0
0.66	0	0	6373.6	1287.7	67.9	.								0.0
0.99	0	0	6373.6	1287.7	67.9	.								0.0

T	I	D	E	V	A	
1.26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
1.65	[illegible]	0	6373.6	1287.7	67.9	
1.98	5	8	6373.6	1288.5	67.9	
2.31	285	47	6373.7	1292.3	68.2	
2.64	848	175	6373.8	1304.8	68.9	
2.97	1740	453	6374.2	1331.6	70.3	
3.31	3044	1099	6374.8	1375.7	72.7	
3.64	5098	2507	6375.7	1437.6	75.9	
3.97	7913	4805	6376.7	1515.5	79.7	
4.30	10770	7912	6377.7	1597.0	83.6	
4.63	12780	10652	6378.5	1665.1	86.6	
4.96	13513	12654	6378.9	1705.9	88.4	
5.29	13466	13325	6379.1	1719.5	89.0	
5.62	12856	13193	6379.1	1716.9	88.9	
5.95	11918	12546	6378.9	1703.7	88.3	
6.28	10687	11548	6378.7	1683.3	87.4	
6.61	8873	10151	6378.4	1654.1	86.1	
6.94	6557	8452	6377.8	1610.8	84.2	
7.27	4318	6350	6377.2	1557.1	81.7	
7.60	2608	4466	6376.5	1504.0	79.2	
7.93	1593	3107	6375.9	1457.9	76.9	
8.26	979	2077	6375.5	1422.3	75.1	
8.59	591	1501	6375.1	1394.8	73.7	
8.92	352	1043	6374.8	1372.9	72.6	
9.25	207	794	6374.6	1355.5	71.6	
9.59	122	588	6374.4	1341.1	70.8	
9.92	67	434	6374.2	1329.7	70.2	
10.25	35	339	6374.1	1320.6	69.7	
10.58	17	261	6374.0	1313.1	69.3	
10.91	6	199	6373.9	1307.1	69.0	
11.24	0	151	6373.8	1302.4	68.7	



DAMS2 XEQ 6/15/76
REV 06/18/73 BLACK MESA J-7 DAM MESA I.D. 1211-AZ-9-0003

ROUTE ONE-HR PT STORM

BASIC DATA

ARID-SEMIARID CLIMATE AREA

DESIGN CLASS A

STORM DISTRIBUTION.....POINT ONE HOUR STORM

P-100	PMP	P10DA/P6HR	P10DA/P1DA	CN	DA-SM	TC/L	-/H
2.90	13.00	1.210	1.490	44.00	14.41	32000.00	726.40

CONDUITS	COND L	D/W	-/H	PS N	KI	WEIR L	TW EI
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PERM POOL	CREST PS	FP SED	BASEFLOW	2ND STG	ORF H	ORF L	START
6373.60	6373.60	0.0	0.0	0.0	0.0	0.0	6373.60

ES1	ES2	ES3	ES4	ES5	Z ES	EXIT N	EXIT S
6373.60	0.0	0.0	0.0	0.0	25.00	0.025	0.033

ES TYPE	ES L	ES N	BW1	BW2	BW3	BW4	BW5
41	585	0.025	282.00	0.0	0.0	0.0	0.0

PROVIDED BY ES FILE

ES CODE	INCREMENT			Q1	Q2	Q3	Q4
41585.025	1.000			2.441	7.276	13.779	21.666

Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
30.734	40.888	51.996	64.012	76.858	90.519	104.943	120.074

DETAILED LIST OF BASIC DATA

WEIR COEF. FOR ORIFICES.....	3.10	RATIO OF TA TO TC(CH.10,DEH4).. 0.20	MIN ES BW WHEN MAX V/C GIVEN.. 20.0
WEIR COEF. FOR DROP INLET.....	3.10	TIME INCS TO PEAK OF UNIT HYD. 5.	DELTA BW WHEN MAX V/C GIVEN... 64.0
DISCHARGE COEF. FOR ORIFICES..	0.60	NO. POINTS FOR DESIGN HYD..... 101	PRECISION OF BW SOLUTION..... 1.0
FILLET SIZE FOR BOX CONDUITS..	6.00	ES-WSP CALC. DEPTH PRECISION. 0.005	PRECISION OF V/C SOLUTION..... 0.03
GRAVITATIONAL CONSTANT.....	32.16	ES-WSP PERMISSIBLE VEL.CHANGE. 0.05	

	TOP WIDTH	UPSTREAM Z	DOWNSTREAM Z	WAVE BERM	STAB. BERM	DH MAX
EMBANKMENT TEMPLATE	0.0	2.5	2.5	10.0	0.0	0.0

	K1 PSH	K1 ESH	K1 EFH	K2 PSH	K2 ESH	K2 EFH
RAINFALL EQUATION CONSTANTS CLASS A	0.82	1.00	1.00	0.0	0.0	0.12

DIMENSIONLESS UNIT HYDROGRAPH

PEAK FACTOR = 484.0

0.0	0.030	0.100	0.190	0.310	0.470	0.660	0.820	0.930	0.990
1.000	0.990	0.930	0.860	0.780	0.680	0.560	0.460	0.390	0.330
0.280	0.240	0.207	0.177	0.147	0.127	0.107	0.090	0.077	0.065
0.055	0.047	0.040	0.034	0.029	0.025	0.021	0.018	0.015	0.013
0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001
0.0									

SCS DESIGN STORM RAINFALL DISTRIBUTION. (CHAPTER 21, NEH4 AND SCS EM-27)

0.0	0.013	0.027	0.042	0.059	0.078	0.098	0.122	0.147	0.180
0.230	0.380	0.530	0.625	0.670	0.705	0.736	0.764	0.790	0.814
0.836	0.856	0.875	0.893	0.910	0.927	0.942	0.957	0.972	0.986
1.000									

POINT ONE HOUR STORM

ID NAME IS USEPG

0.0	0.170	0.400	0.880	1.000

GEN. 6 HOUR STORM DISTRIBUTION

ID NAME IS GRESU

0.0	0.120	0.260	0.420	0.710	0.890	1.000

PERM POOL	6373.60 FT	1287.7 ACFT	67.91 AC
CREST PS	6373.60 FT	1287.7 ACFT	67.91 AC
SED ACCUM	6373.60 FT	1287.7 ACFT	67.91 AC
ES CREST	6373.60 FT	1287.7 ACFT	67.91 AC
PS STORAGE	0.0 ACFT		
STARTING E	6373.60 FT	1287.7 ACFT	67.91 AC 0.0 CFS

STORM HYD D= 1.00 HR P= 2.70 IN Q= 0.00 IN
TC= 1.64 HR CN= 44.00 V= 1.4 ACFT
PEAK 11.6 CFS AT 1.94 HRS

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RATING TABLE NUMBER 2

	E FEET	Q CFS	V AC FT	A ACRE
1	6373.60	0.0	1287.73	67.91
2	6373.60	0.0	1287.73	67.91
3	6373.60	0.0	1287.73	67.91
4	6373.60	0.0	1287.73	67.91
5	6373.60	0.0	1287.73	67.91
6	6373.60	0.0	1287.73	67.91
7	6373.60	0.0	1287.73	67.91
8	6373.60	0.0	1287.73	67.91
9	6373.60	0.0	1287.73	67.91
10	6373.60	0.0	1287.73	67.91
11	6373.60	0.0	1287.73	67.91
12	6373.60	0.0	1287.73	67.91
13	6373.60	0.0	1287.73	67.91
14	6373.91	222.95	1309.41	69.12
15	6374.23	454.76	1331.75	70.35
16	6374.81	1044.22	1373.06	72.57
17	6375.52	2135.64	1425.03	75.26
18	6376.80	5074.19	1524.61	80.17
19	6378.40	10300.64	1657.92	86.31
20	6380.00	17325.74	1801.07	92.45

TYPE	BW	EMAX	VMAX	AMAX	HP	V-FS	Q-PS	Q-FS	Q-TOT	Q/C	V/C	S/C	S/C.25	Q-FS
STORM HYD	282.0	6373.61	1288.4	67.9	0.01	0.6	0.	5.	[illegible]	0.02	0.91	0.031	0.042	8.0

PLOT 1 IN = 10. CFS EXIT SLOPE = 0.033

T	I	O	E	V	A	0. I	10. I	20. I	30. I	40. I	50. I	60. I	70. I	EXIT VEL
0.0	0	0	6373.6	1287.7	67.9	.								0.0
0.22	0	0	6373.6	1287.7	67.9	.								0.0
[illegible]	0	0	[illegible]	1287.7	67.9									0.0

IPC210I ERO[illegible] I[illegible]RPT(P) [illegible] PSW IS [illegible]

T	I	O	F	V	A	I 0.	I 10.	I 20.	I 30.	I 40.	I 50.	I 60.	I 70.	VFL EXIT
0.86		0	6373.6	1287.7	67.9	.								[illegible]
1.08	2	0	6373.6	1287.7	67.9	. I								[illegible]
1.29	5	1	6373.6	1287.7	67.9	.F	I							[illegible]
1.51	9	2	6373.6	1287.7	67.9	. F		I						[illegible]
1.72	11	3	6373.6	1288.1	67.9	. F			I					0.72*
1.94	12	5	6373.6	1288.2	67.9	.	F			X				0.83
2.15	10	6	6373.6	1288.3	67.9	.		F	I					0.90
2.37	8	6	6373.6	1288.3	67.9	.		F I						0.96
2.58	6	6	6373.6	1288.4	67.9	.		X						0.93
2.80	4	6	6373.6	1288.3	67.9	.	I	F						0.93
3.01	3	6	6373.6	1288.3	67.9	.	I	E						0.90
3.23	2	5	6373.6	1288.2	67.9	. I		F						0.89
3.44	2	5	6373.6	1288.2	67.9	. I		F						0.82
3.66	1	4	6373.6	1288.1	67.9	.I		E						0.80*
3.87	1	4	6373.6	1288.1	67.9	.I		E						0.73*
4.09	1	3	6373.6	1288.0	67.9	.I	F							0.72*
4.30	0	3	6373.6	1287.7	67.9	.	E							0.67
4.52	0	2	6373.6	1287.7	67.9	.	F							0.67
4.73	0	2	6373.6	1287.7	67.9	.	E							0.63
4.95	0	2	6373.6	1287.7	67.9	.	E							0.58
5.16	0	1	6373.6	1287.7	67.9	.E								0.55
5.38	0	1	6373.6	1287.7	67.9	.E								0.52
5.59	0	1	6373.6	1287.7	67.9	.E								0.50
5.81	0	1	6373.6	1287.7	67.9	.E								0.49
6.02	0	1	6373.6	1287.7	67.9	.E								0.49
6.24	0	1	6373.6	1287.7	67.9	.E								0.41

********** BASIC DATA **********

ARID-SEMIARID CLIMATE AREA DESIGN CLASS A

STORM DISTRIBUTION.....POINT ONE HOUR STORM

P-100	PMP	P10DA/P6HR	P100A/P10DA	CN	DA-SM	T/L	-/H
2.90	13.00	1.210	1.490	44.00	14.41	32000.00	726.40
CONDUITS	COND L	D/W	-/H	PS N	KI	WEIR L	TW EL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PERM POOL	CREST PS	EP SED	BASEFLOW	2ND STG	ORF H	ORF L	START
6373.60	6373.60	0.0	0.0	0.0	0.0	0.0	6373.60
ES1	ES2	ES3	ES4	ES5	Z ES	EXIT N	EXIT S
6373.60	0.0	0.0	0.0	0.0	25.00	0.025	0.033
ES TYPE	ES L	ES N	BW1	BW2	BW3	BW4	BW5
41	585	0.025	282.00	0.0	0.0	0.0	0.0

PROVIDED BY ES FILE

ES CODE	INCREMENT			Q1	Q2	Q3	Q4
41585.025	1.000			2.441	7.276	13.779	21.666
Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
30.734	40.888	51.996	64.012	76.858	90.519	104.943	120.074

********** DETAILED LIST OF BASIC DATA **********

WEIR COEF. FOR ORIFICES..... 3.10 RATIO OF IA TO S(CH.10,NEH4).. 0.20 MIN ES BW WHEN MAX V/C GIVEN.. 20.0

WEIR COEF. FOR DROP INLET..... 3.10 TIME INCS TO PEAK OF UNIT HYD. 5. DELTA BW WHEN MAX V/C GIVEN... 64.0

DISCHARGE COEF. FOR ORIFICES.. 0.60 NO. POINTS FOR DESIGN HYD..... 101 PRECISION OF BW SOLUTION..... 1.0

FILLET SIZE FOR BOX CONDUITS.. 6.00 ES-WSP CALC. DEPTH PRECISION. 0.005 PRECISION OF V/C SOLUTION..... 0.03

GRAVITATIONAL CONSTANT..... 32.16 ES-WSP PERMISSIBLE VEL.CHANGE. 0.05

	TOP WIDTH	UPSTREAM Z	DOWNSTREAM Z	WAVE BERM	STAB. BERM	DH MAX
EMBANKMENT TEMPLATE	0.0	2.5	2.5	10.0	0.0	0.0

RAINFALL EQUATION CONSTANTS	K1 PSH	K1 ESH	K1 FRH	K2 PSH	K2 ESH	K2 FRH
CLASS A	0.82	1.00	1.00	0.0	0.0	0.12

DIMENSIONLESS UNIT HYDROGRAPH PEAK FACTOR = 484.0

0.0	0.030	0.100	0.190	0.310	0.470	0.660	0.820	0.930	0.990
1.000	0.990	0.930	0.860	0.780	0.680	0.560	0.460	0.390	0.330
0.280	0.240	0.207	0.177	0.147	0.127	0.107	0.090	0.077	0.065
0.055	0.047	0.040	0.034	0.029	0.025	0.021	0.018	0.015	0.013
0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001
0.0									

SCS DESIGN STORM RAINFALL DISTRIBUTION. (CHAPTER 21, NEH4 AND SCS EM-27)

0.0	0.013	0.027	0.042	0.059	0.078	0.099	0.122	0.147	0.180
0.230	0.380	0.530	0.625	0.670	0.705	0.736	0.764	0.790	0.814
0.836	0.856	0.875	0.893	0.910	0.927	0.942	0.957	0.972	0.986
1.000									

POINT ONE HOUR STORM ID NAME IS USBRG

0.0	0.170	0.400	0.880	1.000

GEN. 6 HOUR STORM DISTRIBUTION ID NAME IS GRBSU

0.0	0.120	0.260	0.420	0.710	0.890	1.000

PREM POOL	6373.60 FT	1287.7 ACFT	67.91 AC
CREST PS	6373.60 FT	1287.7 ACFT	67.91 AC
SED ACCUM	6373.60 FT	1287.7 ACFT	67.91 AC
ES CREST	6373.60 FT	1287.7 ACFT	67.91 AC
PS STORAGE	0.0 ACFT		
STARTING E	6373.60 FT	1287.7 ACFT	67.91 AC 0.0 CFS

STORM HYD D= 1.00 HR P= 9.50 IN Q= 2.46 IN
TC= 1.64 HR CN= 44.00 V= 1869.3 ACFT
PEAK 15068.3 CFS AT 1.05 HRS

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RATING TABLE NUMBER 2

	E FEET	Q CFS	V AC FT	A ACRE
1	6373.60	0.0	1287.73	67.91
2	6373.60	0.0	1287.73	67.91
3	6373.60	0.0	1287.73	67.91
4	6373.60	0.0	1287.73	67.91
5	6373.60	0.0	1287.73	67.91
6	6373.60	0.0	1287.73	67.91
7	6373.60	0.0	1287.73	67.91
8	6373.60	0.0	1287.73	67.91
9	6373.60	0.0	1287.73	67.91
10	6373.60	0.0	1287.73	67.91
11	6373.60	0.0	1287.73	67.91
12	6373.60	0.0	1287.73	67.91
13	6373.60	0.0	1287.73	67.91
14	6373.91	222.95	1309.41	69.12
15	6374.23	454.76	1331.75	70.35
16	6374.81	1044.22	1373.06	72.57
17	6375.52	2135.64	1425.03	75.26
18	6376.80	5074.19	1524.61	80.17
19	6378.40	10200.64	1657.92	86.31
20	6380.00	17325.74	1801.07	92.45

TYPE	BW	EMAX	VMAX	AMAX	HP	V-FS	Q-PS	Q-FS	Q-TOT	D/C	V/C	S/C	S/C.25	D-ES
STORM HYD	282.0	6379.11	1720.2	89.0	5.51	432.5	0.	13358.	13358.	3.45	10.53	0.006	0.008	6.4

PLOT 1 IN = 5000. CFS EXIT SLOPE = 0.033

T	I	O	E	V	A	0.	5000.	10000.	15000.	20000.	25000.	30000.	35000.	EXIT VEL
0.0	0	0	6373.6	1287.7	67.9	.								0.0
0.18	0	0	6373.6	1287.7	67.9	.								0.0
0.37	24	2	6373.6	1287.7	67.9	.								0.63
0.55	266	22	6373.6	1289.9	68.0	.I								1.52
0.73	1467	145	6373.8	1301.8	68.7	. I								3.18
0.92	3818	526	6374.3	1336.8	70.6	.E	I							5.28
1.10	7508	1727	6375.3	1405.6	74.3	. E		I						8.35
1.28	11475	4431	6376.5	1502.8	79.1	.	E		I					11.86
1.47	14190	8118	6377.7	1602.2	83.8	.		E		I				14.76
1.65	15068	11248	6378.6	1677.2	87.2	.			E		X			16.57
1.83	14373	13131	6379.1	1715.6	88.8	.				E I				17.60

T	I	O	E	V	A	I	I	I	I	I	I	I	I	VEL
0.92	[illegible]	526	6374.3	1336.8	70.6	.								[illegible]
1.10	79[illegible]	1727	6375.3	1405.6	74.3	.								[illegible]
1.28	114[illegible]	4431	6376.5	1502.8	79.1	.								[illegible]
1.47	1419[illegible]	8118	6377.7	1602.2	83.8	.								[illegible]
1.65	15068	11248	6378.6	1677.2	87.2	.								11.86
1.83	14373	13131	6379.1	1715.6	88.8	.								14.76
2.02	12726	13358	6379.1	1720.2	89.0	.								16.57
2.20	10299	12357	6378.9	1699.8	88.1	.								17.43
2.39	7778	10557	6378.5	1663.2	86.5	.								17.58
2.57	5816	8794	6377.9	1619.5	84.6	.								17.12
2.75	4412	7108	6377.4	1576.5	82.6	.								16.20
2.94	3393	5639	6377.0	1539.0	80.8	.								15.19
3.12	2578	4555	6376.6	1507.0	79.3	.								14.08
3.30	1981	3723	6376.2	1478.8	77.9	.								12.95
3.49	1493	2997	6375.9	1454.2	76.7	.								11.99
3.67	1133	2381	6375.6	1433.3	75.7	.								11.13
3.85	863	1940	6375.4	1415.7	74.8	.								10.27
4.04	656	1616	6375.2	1400.3	74.0	.								9.43
4.22	502	1331	6375.0	1386.7	73.3	.								8.73
4.40	385	1087	6374.8	1375.1	72.7	.								8.14
4.59	295	929	6374.7	1365.0	72.1	.								7.56
4.77	224	798	6374.6	1355.8	71.6	.								6.99
4.95	168	681	6374.5	1347.6	71.2	.								6.59
5.14	131	577	6374.4	1340.3	70.8	.								6.21
5.32	101	487	6374.3	1334.0	70.5	.								5.84
5.50	76	421	6374.2	1328.5	70.2	.								5.48
5.69	50	368	6374.1	1323.4	69.9	.								5.13
5.87	25	320	6374.0	1318.8	69.6	.								4.84
6.05	7	276	6374.0	1314.5	69.4	.								4.61
6.24	0	236	6373.9	1310.7	69.2	.								4.36
														4.10
														3.87
						0.	5000.	10000.	15000.	20000.	25000.	30000.	35000.	EXIT

********** BASIC DATA **********

ARID-SEMIARID CLIMATE AREA DESIGN CLASS A

STORM DISTRIBUTION.....POINT ONE HOUR STORM

P-100	PMP	P10DA/P6HR	P10DA/P1DA	CN	DA-SM	TC/L	-/H
2.90	13.00	1.210	1.490	44.00	14.41	32000.00	726.40

CONDUITS	COND L	D/W	-/H	PS N	KI	WEIR L	TW EL
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PERM POOL	CREST PS	FP SFD	BASEFLOW	2ND STG	ORF H	ORF L	START
6373.60	6373.60	0.0	0.0	0.0	0.0	0.0	6373.60

ES1	ES2	ES3	ES4	ES5	Z ES	EXIT N	EXIT S
6373.60	0.0	0.0	0.0	0.0	25.00	0.025	0.033

ES TYPE	ES L	ES N	BW1	BW2	BW3	BW4	BW5
41	585	0.025	282.00	0.0	0.0	0.0	0.0

PROVIDED BY ES FILE

ES CODE	INCREMENT			Q1	Q2	Q3	Q4
41585.025	1.000			2.441	7.276	13.779	21.666

Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
30.734	40.888	51.996	64.012	76.858	90.519	104.943	120.074

********** DETAILED LIST OF BASIC DATA **********

WEIR COEF. FOR ORIFICES..... 3.10 RATIO OF IA TO S(CH.10,NEH4).. 0.20 MIN ES BW WHEN MAX V/C GIVEN.. 20.0

WEIR COEF. FOR DROP INLET..... 3.10 TIME INCS TO PEAK OF UNIT HYD. 5. DELTA BW WHEN MAX V/C GIVEN... 64.0

DISCHARGE COEF. FOR ORIFICES.. 0.60 NO. POINTS FOR DESIGN HYD..... 101 PRECISION OF BW SOLUTION..... 1.0

FILLET SIZE FOR BOX CONDUITS.. 6.00 ES-WSP CALC. DEPTH PRECISION. 0.005 PRECISION OF V/C SOLUTION..... 0.03

GRAVITATIONAL CONSTANT..... 32.16 ES-WSP PERMISSIBLE VEL.CHANGE. 0.05

	TOP WIDTH	UPSTREAM Z	DOWNSTREAM Z	WAVE BERM	STAB. BERM	DH MAX
EMBANKMENT TEMPLATE	0.0	2.5	2.5	10.0	0.0	0.0

RAINFALL EQUATION CONSTANTS	K1 PSH	K1 ESH	K1 EPH	K2 PSH	K2 ESH	K2 EPH
CLASS A	0.82	1.00	1.00	0.0	0.0	0.12

DIMENSIONLESS UNIT HYDROGRAPH

PEAK FACTOR = 484.0

0.0	0.030	0.100	0.190	0.310	0.470	0.660	0.820	0.930	0.990
1.000	0.990	0.930	0.860	0.780	0.680	0.560	0.460	0.390	0.330
0.280	0.240	0.207	0.177	0.147	0.127	0.107	0.090	0.077	0.065
0.055	0.047	0.040	0.034	0.029	0.025	0.021	0.018	0.015	0.013
0.011	0.009	0.008	0.007	0.006	0.005	0.004	0.003	0.002	0.001
0.0									

SCS DESIGN STORM RAINFALL DISTRIBUTION. (CHAPTER 21, NEH4 AND SCS EM-27)

0.0	0.013	0.027	0.042	0.059	0.078	0.099	0.122	0.147	0.180
0.230	0.380	0.530	0.625	0.670	0.705	0.736	0.764	0.790	0.814
0.836	0.856	0.875	0.893	0.910	0.927	0.942	0.957	0.972	0.986
1.000									

POINT ONE HOUR STORM

ID NAME IS USBRG

0.0	0.170	0.400	0.880	1.000

GEN. 6 HOUR STORM DISTRIBUTION

ID NAME IS GRBSU

0.0	0.120	0.260	0.420	0.710	0.890	1.000

DDT TEST 6305.00 FT 0.0 ACFT 0.0 CFS
CONTROL IS 0.0 DETENTION STORAGE

*****DRAWDOWN TEST ELEVATION CANNOT BE REACHED.
DDT TEST USED 6373.60 FT 1287.7 ACFT 0.0 CFS

DRAWDOWN TIME = 0.02 DAYS (LIMIT = 0.0 DAYS)

****

RATING TABLE NUMBER 1

	E FEET	Q CFS	V AC FT	A ACRE
1	6305.00	0.0	0.0	0.0
2	6310.00	0.0	0.30	0.12
3	6315.00	0.0	2.60	0.80
4	6320.00	0.0	7.82	1.29
5	6325.00	0.0	16.32	2.11
6	6330.00	0.0	30.30	3.48
7	6335.00	0.0	53.05	5.62
8	6340.00	0.0	90.42	9.33
9	6345.00	0.0	150.40	14.66
10	6350.00	0.0	242.30	22.10
11	6355.00	0.0	374.62	30.83
12	6360.00	0.0	550.97	39.71
13	6365.00	0.0	775.10	49.94
14	6370.00	0.0	1054.42	61.79
15	6373.60	0.0	1287.73	67.91
16	6380.00	0.0	1801.07	92.45

DAMS2 XFQ 6/15/76
REV 06/18/73

BLACK MESA J-7 DAM MESA I.D. 1211-AZ-9-0003

TOP OF DAM ELEV 6380

RUN BOTH DURATION STORMS (RUN 10)

DAMS2.....JOB NO. 1 COMPLETE

BLACK MESA J-7 DAM MESA I.D. 1211-AZ-9-0003

1 STRUCTURE(S) ANALYZED

4 HYDROGRAPHS ROUTED

0 TRIAL ROUTINGS

****

ATTACHMENT S

TYPICAL SEDIMENTATION POND'S SEDIMOT II

AND SEDCAD+ INPUTS

JAN 3 1 1989

BATCH INPUT

The SEDIMOT II Model was developed to run as a batch job on the IBM/370/165 and the HP3000 systems. Also, an interactive version is available on the HP3000 system. The interactive program can be used to produce a data file that is directly compatible with either the IBM or HP batch system. It is expected that the user may use the interactive version to produce the initial data file for a particular problem and then simply modify a few lines in the file to evaluate alternative designs or management schemes. Alternatively, the user may utilize the coding sheet and work sheets to directly produce an input data file that may be used on either the HP or the IBM system.

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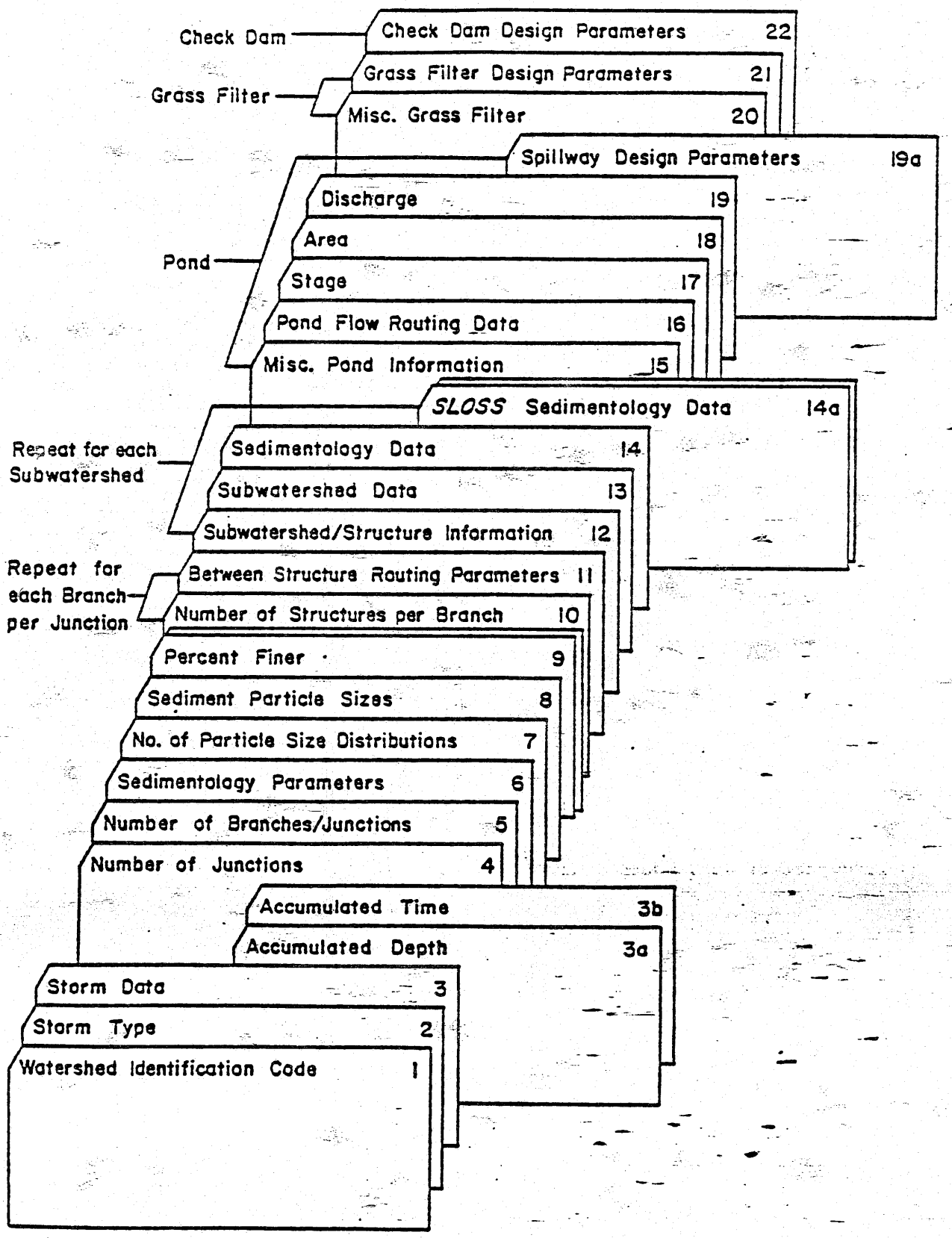

Code Card Sequence for Batch Input

FEB 25 1988

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CARD CODE 1	WATERSHED IDENTIFICATION CODE	
1 5	10 15	56 60
	. . . . .	. . . . .

Any alpha-numeric character (i.e. A - Z or 1 - 9) is acceptable

CARD CODE 2	STORM TYPE	FORMAT I8
ITYPE	NRPIV	
1 8	16	

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
ITYPE:	Storm Type	1	3	2
	1 - SCS's Type I	2 - SCS's Type II	3 - Input Storm	
NRPIV:	No. of Depth, Time Values	2	50	None

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CARD CODE 3 STORM DATA

FORMAT F8.2

P	SDUR	DELTSW	P30INT
1–8	9–16	17–24	25–32
F8.2	F8.2	F8.2	F8.2

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
P:	Rainfall Depth (inch)	0	15.	None
SDUR:	Storm Duration (hr)	1.	24.	None
DELTSW:	Storm Time Increment	0.1	1.	0.1
P30INT:	Max. 30 Min. Intensity	0.	500.	None

CARD CODE 3a ACCUMULATED DEPTH,

FORMAT F8.2

RTAB1(1)	RTAB1(2)	RTAB1(3)		RTAB1(NRPIV)
1–8	9–16	17–24		73–80
F8.2	F8.2	F8.2	.....	F8.2

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
RTAB1(I):	Accum. Depth of Rainfall	0.	P	None

Use Card 3a only if ITYPE = 3 on Card 2. Otherwise, skip Cards 3a and 3b completely.

CARD CODE 3b ACCUMULATED TIME

FORMAT F8.2

RTAB2(1)	RTAB2(2)	RTAB2(3)		RTAB2(NRPIV)
1–8	9–16	17–24		73–80
F8.2	F8.2	F8.2	.....	F8.2

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
RTAB2(I):	Accum. Time of Rainfall	0.	SDUR	None

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CARD CODE 4	NUMBER OF JUNCTIONS	FORMAT I8

NOJ	IHYDR
1 8	16

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
NOJ:	Number of Junctions	1	5(15)*	1
IHYDR:	Hydrology only or both Hydrology and Sediment-ology Option	1	2	1

*IBM 370 version

CARD CODE 5	NUMBER OF BRANCHES/JUNCTIONS	FORMAT I8

NOB(I)	NOB(2)	NOB(3)		NOB(NOJ)
1 8	16	24		33 40
			. . . . .	

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
NOB(I):	Number of Branches per Junction	1	3	1

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The following group of cards (Card Codes 6 - 9) are used in the sedimentology section. If you are using the "Hydrology Only" option (IHYDR = 1) skip Card Code 6 - 9.

CARD CODE 6 SEDIMENTOLOGY PARAMETERS FORMAT F8.2

SG	APLUSI	SBSG
1 - 8	16	24
.	.	.

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
SG:	Specific Gravity	1.	3.	2.5
APLUS1:	Coeff. for Distributing Sediment Load	1.	2.	1.5
SBSG:	Submerged Bulk Specific Gravity Used in Imhoff Cone Calculations	1.	1.75	1.25

CARD CODE 7 NUMBER OF PARTICLE SIZE DISTRIBUTIONS FORMAT I8

NPSD	NDVPC
1 - 8	16

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
NPSD:	No. of Particle Size Distributions	1	10	1
NDVPC:	No. of Data Values per Particle Distribution	2	15	2

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CARD CODE 8	SEDIMENT PARTICLE SIZES			FORMAT F8.4
PS(1)	PS(2)	PS(3)		PS(NDVPC)
1 8	16	24		73 80
.	.	.	. . . . .	. . . . . .

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
PS(I):	Particle Size Value	.0001	250.	None

The Largest Sized Particles are Entered First
Particle Sizes are in Units of Millimeters
A Single Particle Size Data Set is used for all Percent Finer Distributions

CARD CODE 9	PERCENT FINER			FORMAT F8.2
PF(1,1)	PF(1,2)	PF(1,3)		PF(1,NDVPC)
1 8	16	24		73 80
.	.	.	. . . . .	. . . . . .
⋮	⋮	⋮		⋮
PF(NPSD,1)	PF(NPSD,2)	PF(NPSD,3)		PF(NPSD,NDVPC)
1 8	16	24		73 80
.	.	.	. . . . .	. . . . . .

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
PF(I, J):	Percent Finer Values	0.	100.	None

Percent Finer Values are Entered for Each Particle Size Distribution. If There are More Than Ten Values per Distribution Two Cards Will Be Used For Each Distribution. Card Code 9 Will Be Repeated For Each of the Particle Size Distribution.

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CARD CODE 10	NUMBER OF STRUCTURES PER BRANCH	FORMAT I8

NOS(I,1)	NOS(I,2)	NOS(I,NOB(I))
1 – 8	16	24

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
NOS(I, J):	Number of Structures per Branch (I) for each Junction (J)	1	4	1

CARD CODE 11	BETWEEN STRUCTURE ROUTING PARAMETERS	FORMAT F8.2

TIME(I,1)	RK(I,1)	RX(I,1)		TIME(I,NOS)
1 – 8	16	24		73 – 80
.	.	.	. . . . .	.

RK(I,NOS)	RX(I,NOS)
1 – 8	16
.	.

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
TIME(I,J,K):	Travel Time Between Structures (hr)	0.	5.	.06
RK(I,J,K):	Muskingum's K Between Structures (hr)	0.	5.	.06
RX(I,J,K):	Muskingum's X Between Structures (hr)	0.	5.	None

Card Code 11 is repeated for each of the Branches per Junction listed on Card Code 5. Time, RK, and RX are repeated on Card 11 for each Structure on a Given Branch.

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CARD CODE 12	SUBWATERSHED/STRUCTURE INFORMATION	FORMAT I8

NSWS	CNTROL	IPRINT	ISUBSP	IPRIN2
1 8	16	24	32	40

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
NSWS:	Number of Subwatersheds per Structure	0	14(29)*	1
CNTROL:	Type of Sediment Control Structure	1	4	1
	1 - Null, 2 - Pond, 3 - Grass Filter, 4 - Check Dam			
IPRINT:	Print Control Variable for Total Drainage Area	1	3	1
	1 - summary table, 2 - hydrograph, sediment graph, and particle size distribution arrays, 3 - no output			
ISUBSP:	Print Control Variable for the Drainage Area Between Previous Structure or Junction. Options are Identical to those of IPRINT.	1	3	1
IPRIN2:	Print Option for Subwatershed Inputs	1	2	2
	1 - Input Tables, 2 - No Tables			

*IBM 370 version

Repeat Code Cards 12, 13, and 14 for each Branch of Each Junction.

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CARD CODE 13	SUBWATERSHED DATA			FORMAT F8.3
PARAH(I,1)	PARAH(I,2)	PARAH(I,3)		PARAH(I,9)
1 8	16	24		65 72
.	.	.	.....	..... .

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
PARAH(I,1):	Subwatershed Area (acres)	0.	5000.	None
PARAH(I,2):	Curve Number	0.01	100.	None
PARAH(I,3):	Time of Concentration (hr)	0.	3.	None
PARAH(I,4):	Travel Time (to Structure)	0.	5.	.06
PARAH(I,5):	Muskingum's K (to Structure)	0.	5.	.06
PARAH(I,6):	Muskingum's X (to Structure)	0.	5.	None
PARAH(I,7):	Hydrology Print Option	1.	2.	1.
← PARAH(I,8):	Hydraulic Surface Condition	1.	3.	None
PARAH(I,9):	Number of Flow Segments if PARAH(I,9) = 0, MUSLE will be used. If PARAH(I,9) = 1-6, SLOSS will be used.	0.	6.	None

1=DISTURBED
2=[illegible]
3=[illegible]

Repeat Code Cards 13 and 14 or 14a for each subwatershed.

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CARD CODE 14	SEDIMENTOLOGY DATA			FORMAT F8.3
PARAS(I,J,1)	PARAS(I,J,2)	PARAS(I,J,3)	PARAS(I,J,4)	PARAS(I,J,5)
1 8	16	24	32	40
.	.	.	.	.

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
PARAS(I,J,1):	Soil Erodibility Factor	0.	.8	None
PARAS(I,J,2):	Length of Slope (ft)	0.	800.	None
PARAS(I,J,3):	Average Slope (%)	0.	100.	None
PARAS(I,J,4):	Control Practice Factor	0.	1.7	None
PARAS(I,J,5):	Particle Size Distribution Selection	1	NPSD	None

CARD CODE 14a	*SLOSS* SEDIMENTOLOGY DATA			FORMAT F8.3
PARAS(I,J,1)	PARAS(I,J,2)	PARAS(I,J,3)		PARAS(I,J,8)
1 8	16	24		57 64
.	.	.	. . . . .	. . . . .

PARAS(I,1) → PARAS(I,5) are Same as Code Card 14.

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
PARAS(I,J,6):	Sediment Surface Condition	1.	3.	None
PARAS(I,J,7):	Segment Area	0.	PARAH(I,1)	None
PARAS(I,J,8):	Steepness Factor	1.	50.	50.

Repeat Code Card 14a for Each Flow Segment

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CARD CODE 15 MISCELLANEOUS POND INFORMATION FORMAT F8.2

DELPLG	FIX	DEAD
1 – 8	16	24
.	.	.

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
DELPLG:	Time Increment of the Routed Hydrograph in Hours	DELPLG	5.0	DELTAT
FIX:	Nonideal Settling Correction Factor.	0.1	2.0	1.0
DEAD:	Percent of Permanent Pool That is Dead Space	0.	100.	40.

Cards 15 through 19a are used for Sediment Basin Inputs

CARD CODE 16 POND FLOW ROUTING DATA FORMAT I8

FLOW	FRACTN	NSP	NRHP	ISDO	IPRINT	NCSTR
1 – 8	16	24	32	40	48	56

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
FLOW:	Outflow Withdrawal Option: 1 – uniform 2 – bed 3 – surface	1	4	1
FRACTN:	Inflow Vertical Concentration 0 – completely mixed 1 – density current	0	1	0
NSP:	Number of Stage Point (max=24)	2	24	None
NRHP:	No. of Routed Hydrograph Points	2	500	500
ISDO:	Stage-Discharge Option 1 – input 2 – SEDIMOT II calculates values → PIPES & CULVERTS	1	2	1
IPRINT:	Print Control Options 1 – summary tables 2 – hydrograph, sediment graph and particle size distr., 3 – no output	1	3	1
NCSTR:	Continuous Stirred Type Reactors or DEPOSITS 0 – DEPOSITS 1 – 10 CSTRS	0	10	0

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CARD CODE 17	STAGE			FORMAT F8.2
STAGE(1)	STAGE(2)	STAGE(3)		STAGE(NSP)
1 8	16	24		73 80
.	.	.	. . . . .	. . . . . .

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
STAGE(I):	Pond Stage Values (ft)	0	100.	None

First Stage Value Should be Zero

CARD CODE 18	AREA			FORMAT F8.3
AREA(1)	AREA(2)	AREA(3)		AREA(NSP)
1 8	16	24		73 80
.	.	.	. . . . .	. . . . . .

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
AREA(I):	Pond Area Values (ac)	0.	9999.	None

List the Area Values Corresponding to Each Stage Value

CARD CODE 19	DISCHARGE			FORMAT F8.2
DISCH(1)	DISCH(2)	DISCH(3)		DISCH(NSP)
1 8	16	24		73 80
.	.	.	. . . . .	. . . . . .

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
DISCH(J):	Pond Discharge Values (cfs)	0.	1500.	None

At Least Two Stage Points Must Have Zero Discharge
The Last Zero Discharge Stage Corresponds to the Stage of the Principal Spillway

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CARD CODE 19a	SPILLWAY DESIGN PARAMETERS						FORMAT F8.3
BDIA	RDIA	ELOSS	BLOSS	FRLEN	WCOE	OCOE	MN
1 8	16	24	32	40	48	56	64
.	.	.	.	.	.	.	.

HDROP	EPS
65 72	80
.	.

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
BDIA:	Barrel Diameter (inches)	3.	60.	None
RDIA:	Riser Diameter (inches)	3.	60.	None
ELOSS:	Pipe Flow Entrance Loss Coef.	0.	3.	1.
BLOSS:	Pipe Flow Bend Loss Coef.	0.	2.	.5
FRLEN:	Pipe Length (ft)	2.	500.	None
WCOE:	Weir Flow Coefficient	1.	10.	3.1
OCOE:	Orifice Flow Coefficient	.1	2.	0.6
MN:	Manning's n of Pipe	.01	.06	.025
HDROP:	Head Drop Between Inlet and Outlet (ft)	.01	100.	None
EPS:	Stage of Principal Spillway (ft)	.01	100.	None

FEB 25 1988

CARD CODE 20 MISCELLANEOUS GRASS FILTER FORMAT F8.2

SEG	RPRINT	BSG	DINIT
1 – 8	16	24	32

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
SEG:	Number of Segments (max=3)	1.	3.	1.
RPRINT:	Print Code: 1-summary, 2-hydrograph, etc., 3-no output	1.	3.	1.
BSG:	Bulk Specific Gravity of Deposited Sediment	0.5	3.	1.25
DINIT:	Initial Depth of Sediment in Zone D	0.	0.8	0.

CARD CODE 21 GRASS FILTER DESIGN PARAMETERS FORMAT F8.4

MN(I)	GHGHT(I)	LEN(I)	SPAC(I)	SSC(I)	WIDTH(I)	INFILL(I)	MEI(I)
1 – 8	16	24	32	40	48	56	64

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
MN(I)	Grass Filter Manning's Roughness Coefficient	.003	.017	None
GHGHT(I):	Grass Height	0.1	9.0	None
LEN(I):	Grass Filter Length	1.0	500.	None
SPAC(I):	Average Grass Spacing	0.1	3.0	None
SSC(I):	Grass Filter Slope	.01	20.	None
WIDTH(I):	Grass Filter Width	1.0	500.	None
INFILL(I):	Grass Filter Infiltration Rate	0.0	4.0	None
MEI(I):	Grass Stiffness Factor	.002	250.	None

FEB 25 1988

CARD CODE 22	CHECK DAM DESIGN PARAMETERS				FORMAT F8.3
SLOPE	POR	MN	Z	H	VPRINT
1 8	16	24	32	40	48
.	.	.	.	.	.

Variable Name	Variable Description	Lower Limit	Upper Limit	Default Value
SLOPE	Channel Bed Slope	.0001	50.	None
POR	Checkdam Porosity (%)	0.01	1.0	None
MN	Manning's Coefficient	.01	.15	None
Z:	Channel Sideslope	.5	10.	None
H:	Checkdam Height (ft)	.01	20.	None
VPRINT:	Checkdam Print Option: 1-summary table, 2-hydrograph, etc., 3-no output	1.	3.	1.

FEB 25 1988

Typical SEDCAD+ Input

Impoundments

Line Code	Parameter	Typical Input
	Time of day of file creation	System Input
	Date of file creation	System Input
	Name of person creating file	As Applicable
	Watershed identification code	As Applicable
2	Storm Type ; "0"	2;0
3	P1; P2; SDUR1; SDUR2; Time Increment; "1"	3; 2.1; 1.9; 0; 24; 6; 0; 0.1; 0
	P1=Precip. depth in inches of initial storm	
	P2=Precip. depth of em. spillway storm (arbitrary if no em. spillway)	
	SDUR1=Storm duration of intial storm	
	SDUR2=Storm duration of em. spillway storm	
4	Number of Junctions; Hydrology option	1;2
	Hydrology option - 1 = Hydrology only 2 = Hyd. & Sedimentology	
5	Number of branches on J1; on J2; on J3 ...	1
6	Specific gravity; "1.5"; Submerged bulk spec. grav.	2.5; 1.5; 1.25
7	No. of particle size dist; No. of data values per dist. If running hydrology only, use "1"; "2" (dummy values)	1; 15
8	Particle size 1; PS 2; PS3 ...	As applicable; As applicable; ... etc.
9	Percent finer 1 for dist. 1; PF 2 for dist. 1, ... If running hydrology only, use "100"; "0" (dummy values) [Repeat 9 for up to 4 distributions]	As measured; As measured; ... etc.

Revised 01/27/89

JAN 31 1989

Typical SEDCAD+ Input

- Impoundments

Line Code	Parameter	Typical Input
10	No. of structures on J1, B1 [; No. on J1, B2 (; No. on J1, B3)]	1
11	Travel time, Musk. K; Musk. X [Repeat 10 & 11 for all structures]	0; 0; 0
12	No. of SWS for structure; structure type; "1"; "1"; hydrograph print opt hydrograph print option - "1"=No, "2"=Yes	1; 2; 2; 1; 1
13	SWS area; curve number; t. conc; travel time; MK; MX; "1"; hydrologic response type (1,2,3); RUSLE or MUSLE or SLOSS For hydrology only, travel time = 0 For only 1 SWS, MK & MX = 0 If using RUSLE, use "-1" If using MUSLE, use "0" If using SLOSS, use number of segments	As measured; As determined; As calculated; 0; 0; 0; 1; 2; 0
14	K factor; length; slope; CP factor; Part. dist. #;"0"; "0"; "0" [; surf. cond; seg area; "50"] [For Hydrology ONLY, enter "0"; ""0"; "0"; "0" "0"] [Brackets indicate SLOSS input parameters - Repeat 14 for each SLOSS segment] [Repeat 13 & 14 for each No. of SWS for the structure] Enter Structure Data [NULL structure return to line code 12]:	As determined; As measured; As calculated; As determined; 1

Revised 01/27/89

JAN 31 1989

Typical SEDCAD+ Input

Impoundments

Line Code	Parameter	Typical Input
	POND:	
15	Time increment; "1"; dead space; volume; elev; ems volume - 0 = no volume calculated by digitizer 1 = volume to follow - calculated by digitizer elev - 0 = no elevation data entered (only stage data) 1 = elevation data to follow ems - 0 = no emergency spillway at this structure 1 = emergency spillway and parameters will follow	0.1; 1; 20; 0; 1; 1
16	"1"; "0"; # stage points; "500"; discharge opt; hydrograph print opt; CSTRS hydrograph print option - "1"=No, "2"=Yes Discharge opt - 1 = input own discharge 2 = Drop inlet 3 = trickle tube 4 = perforated riser CSTRS - number of continuous stirred type reactors: "0" if running hydrology only! (will not run unless this is 0) "0" if running DEPOSITS (hydrology & sedimentology) "2" if running CSTRs (hydrology & sedimentology)	1; 0; As measured; 500; 1; 1; 2; 0
17	Elev 1, elev. 2, ... up to number of stage points [This line is skipped if elev in line code 15 is 0]	As applicable, As applicable, ... etc.
18	Stage 1, stage 2, ... up to number of stage points	As applicable; As applicable, ... etc.
19	Area 1, area 2, ... up to number of stage points	As applicable, As applicable, ... etc.

Revised 01/27/89

JAN 3 1 1989

Typical SEDCAD+ Input

Impoundments

Line Code	Parameter	Typical Input
20	Length of emergency spillway; Stage of em. spillway. If stage is to be set at calculated peak stage, then "0" [This line is skipped if ems in line code 15 is 0]	As applicable, As applicable
21	"1"; outslope; sideslope ratio; bottom width; safety factor [This line is skipped if ems in line code 15 is 0]	1; As applicable; 3; As applicable; 1.2
22	discharge 1, disch. 2, ... up to no. of stage points [Only for discharge option #1]	0; 0 ... etc.
23	barrel dia.; riser dia; "1"; "0.5"; pipe length; "3.1"; "0.6"; Manning's n of pipe; Head drop; Stage of Princ. spillway [Only for discharge option #2 - Drop Inlet]	As applicable when Drop Inlet is used
	Repeat line code 23 [Only for discharge option #4 - Perf. Riser]	
24	Initial stage of orifices; number of orifices per stage [Only for discharge option #4 - Perf. Riser]	Used with Drop Inlet Spillways Only
25	orifice dia. at stage 1; stage 2, ... to number of stages [Only for discharge option #4 - Perf. Riser]	Used with Drop Inlet Spillways Only
26	barrel dia.; pipe slope; pipe length; Manning's n; Stage of Princ. spillway [Only for discharge option #3 - Trickle Tube]	Used with Trickle Tube Only
27	"Reserved variables - do not change" [This line is skipped if volume in line code 15 is 0]	Not Applicable
28	"Reserved variables - do not change" [This line is skipped if volume in line code 15 is 0]	Not Applicable
	[Return to line code 12 for next structure]	

Revised 01/27/89

JAN 3 1 1989

Typical SEDCAD+ Input

Impoundments

Line Code	Parameter	Typical Input
	GRASS FILTER:	
29	No. of filter segs; hydrograph print opt; bulk specific gravity; initial depth of sediment hydrograph print option - "1"=No, "2"=Yes	Generally Not Applicable to Impoundment Design
30	Manning's n; grass height; filter length; grass spacing; filter slope; filter width; infiltration rate; stiffness factor [Repeat line code 30 for each filter segment] [Return to line code 12 for next structure]	Generally Not Applicable to Impoundment Design
	CHECK DAM:	
31	bed slope; porosity; Manning's n; sideslope; dam height; hydrograph print opt hydrograph print option - "1"=No, "2"=Yes [Return to line code 12 for next structure]	Generally Not Applicable to Impoundment Design
	NONERODIBLE DIVERSION:	
32	shape; bed slope; sideslopes; Manning's n; bottom width; top width [top width only applicable to parabolic channels] [Return to line code 12 for next structure]	Generally Not Applicable to Impoundment Design
	ERODIBLE DIVERSION:	
33	shape; bed slope; sideslopes; Manning's n; bottom width; top width; method method - "1" = limiting velocity, "2" = tractive force	Generally Not Applicable to Impoundment Design
34	permissible velocity/tractive force [Return to line code 12 for next structure]	Generally Not Applicable to Impoundment Design

Revised 01/27/89

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Typical SEDCAD+ Input

Impoundments

Line Code	Parameter	Typical Input
	VEGETATED DIVERSION:	
35	shape; bed slope; sideslopes; bottom width; velocity Retardance Class 1 (capacity) Retardance Class 2 (stability) [Return to line code 12 for next structure]	Generally Not Applicable to Impoundment Design
	RIPRAP DIVERSION:	
36	shape; bed slope; sideslopes; bottom width; safety factor [Return to line code 12 for next structure]	Generally Not Applicable to Impoundment Design
	CULVERT:	
37	max. headwater; pipe slope; length; Manning's n [Return to line code 12 for next structure]	Generally Not Applicable to Impoundment Design

Revised 01/27/89

JAN 3 1 1989

ATTACHMENT T

WATER PERSISTENCE CALCULATIONS

JAN 5 1989

PERMANENT IMPOUNDMENT

J2-A

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J2-A

A_D: 2661.3 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

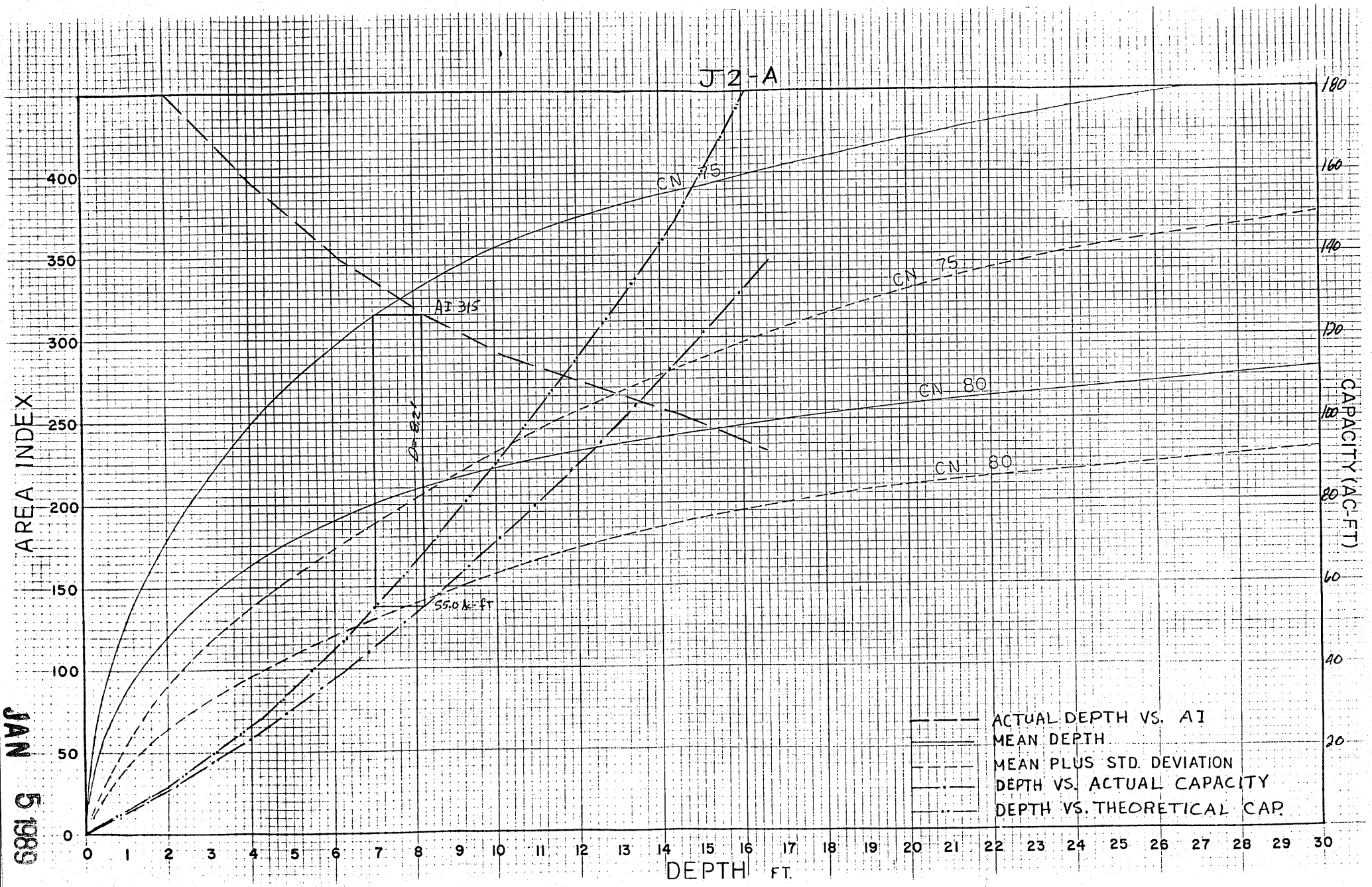
Notes: MSHA Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6332	5.23	2656.07	0	508	0
2	6334	5.99	2655.31	12.0	443	11.3
4	6336	6.84	2654.46	27.4	388	24.1
6	6338	7.68	2653.62	46.1	346	38.6
8	6340	8.49	2652.81	67.9	313	54.8
10	6342	9.22	2652.08	92.2	288	72.5
12	6344	9.85	2651.45	118.2	269	91.6
14	6346	10.44	2650.86	146.2	254	111.9
16.3	6348.3	11.54	2649.76	188.1	230	137.4

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

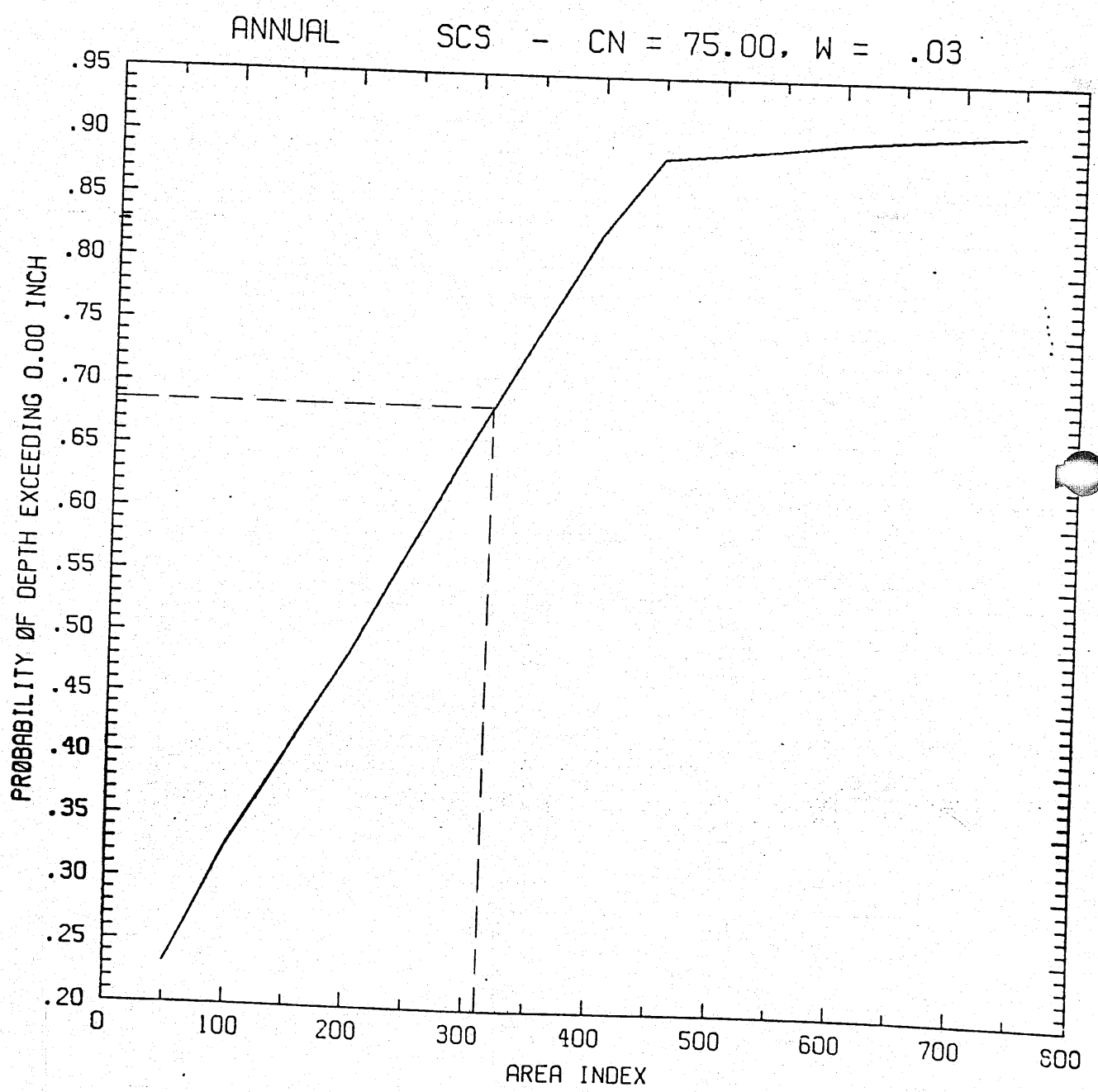
Plate 1:	Annual Mean Depth (AMD)	8.2 ft.	--
	Minimum Depth (MIN)	--	3.0 ft.
	Actual Capacity	55.0 ac-ft.	17.9 ac-ft.
	AI	315	415
Plate 2 or 3:	Probability	69%	78%

JAN 5 1989


J 2 - A
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 315
55.0 ac-ft
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

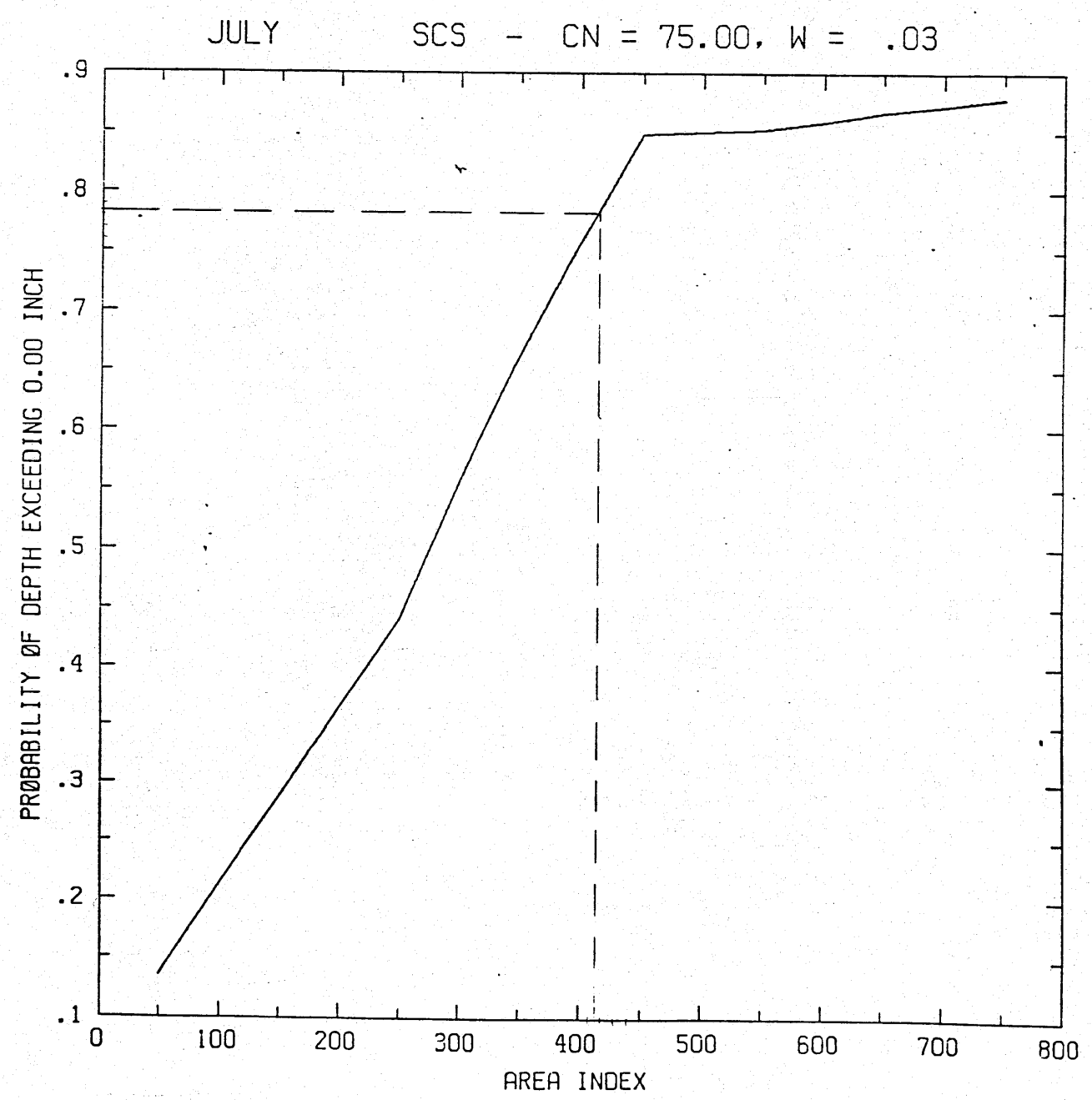
JAN 5 1989

J2-A



Annual Mean Depth
Plate 2

J2-A



Minimum Depth
Plate 3

JAN 5 1989

5 1989

PERMANENT IMPOUNDMENT

J3-D

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J3-D

A_D: 318.0 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

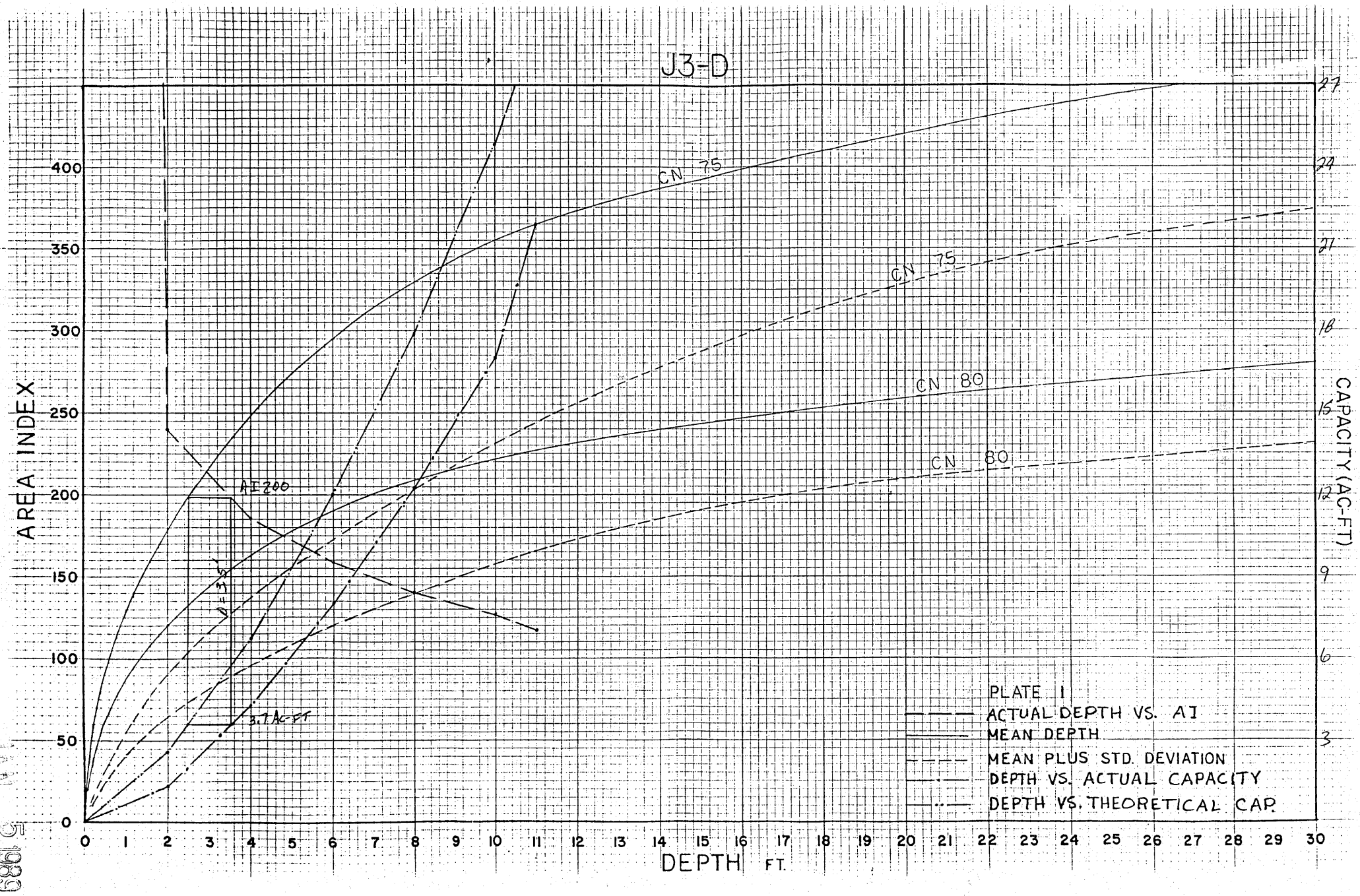
Notes: Existing Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6458	0.075	317.925	0	4261	0
2	6460	1.314	316.686	2.6	241	1.3
4	6462	1.699	316.301	6.8	186	4.3
6	6464	1.997	316.003	12.0	158	8.0
8	6466	2.244	315.755	17.9	141	12.3
10	6468	2.491	315.509	24.9	127	17.0
11	6469	2.703	315.297	29.7	117	22.2

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

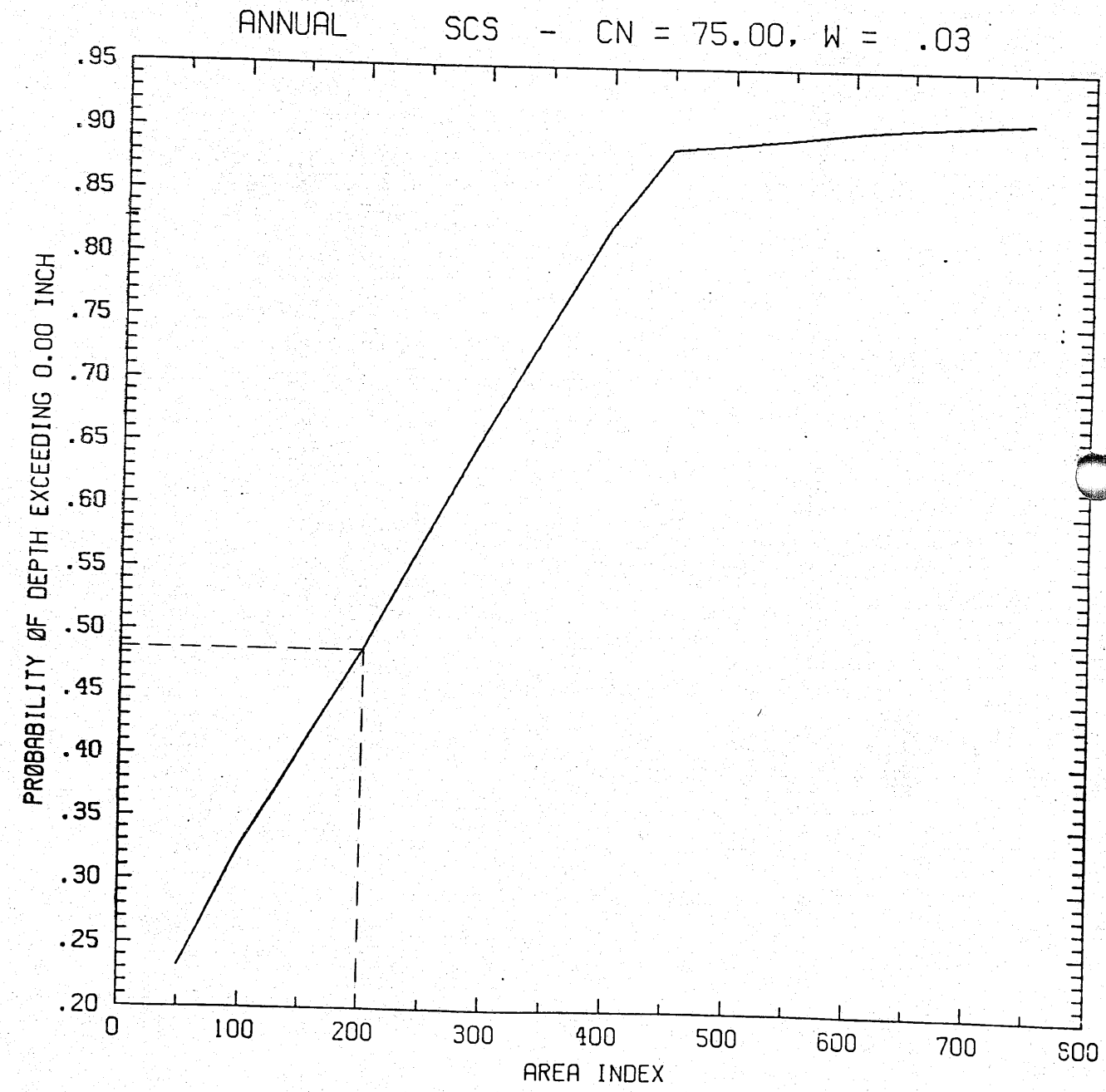
Plate 1:	Annual Mean Depth (AMD)	3.5 ft.	--
	Minimum Depth (MIN)	--	3.0 ft.
	Actual Capacity	3.7 ac-ft.	2.8 ac-ft.
	AI	200	214
Plate 2 or 3:	Probability	49%	39%

JAN 5 1989


J3-D
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 200
3.7 AC-FT
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

5 1989

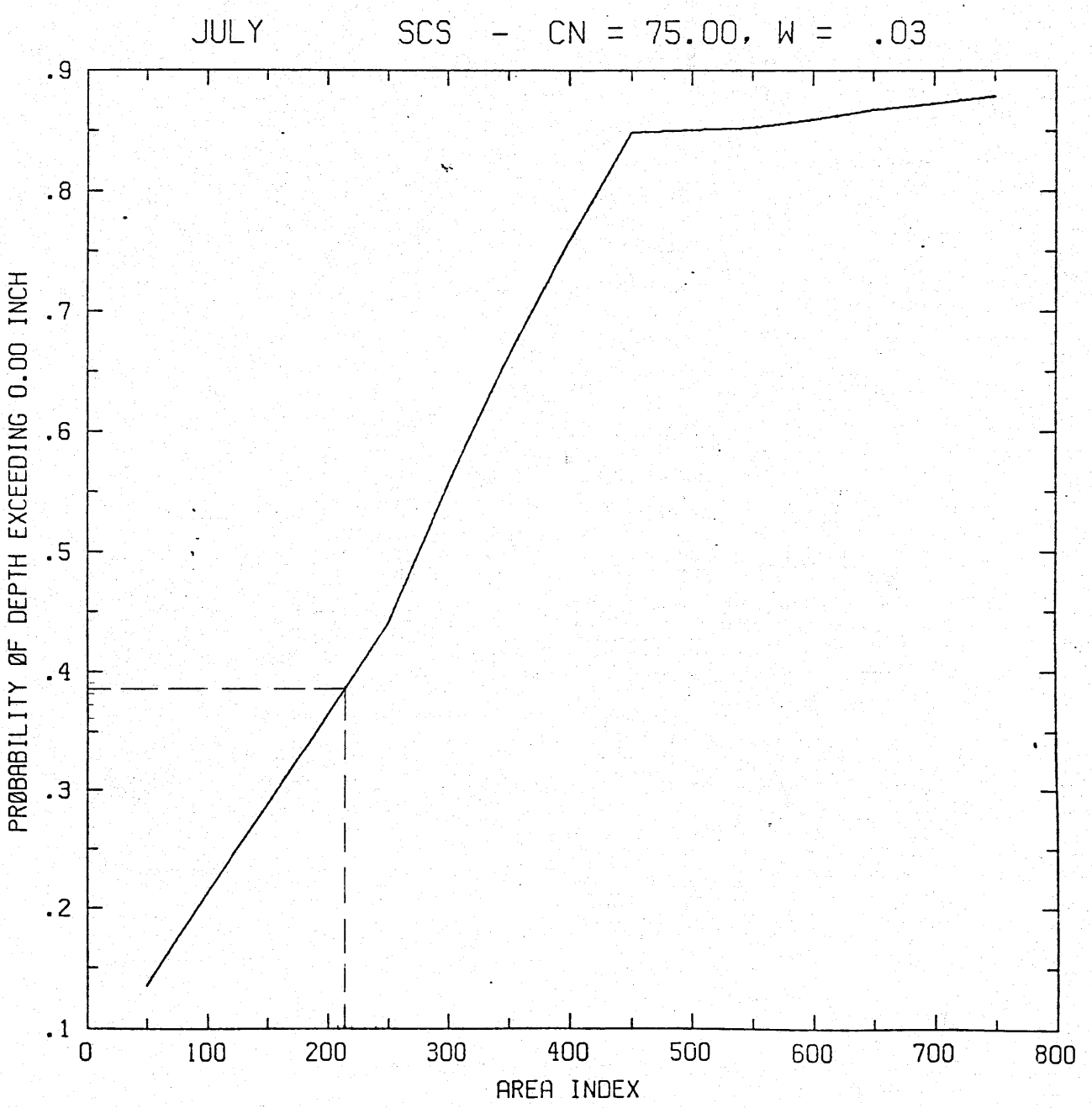
J3-D



Annual Mean Depth
Plate 2

MAY 5 1980

J3-D



Minimum Depth
Plate 3

JAN 5 1989

PERMANENT IMPOUNDMENT

J3-E

WATER PERSISTENCE WORKSHEET

5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J3-E

A_D: 251.3 Acres

Depth: From Bottom Elevation

A_D: Total Drainage Area

A_P: Surface Area of Pond

A_B: Watershed Area = $A_D - A_P$

Theoretical Capacity: A_P x Depth

AI: Area Index = A_B/A_P

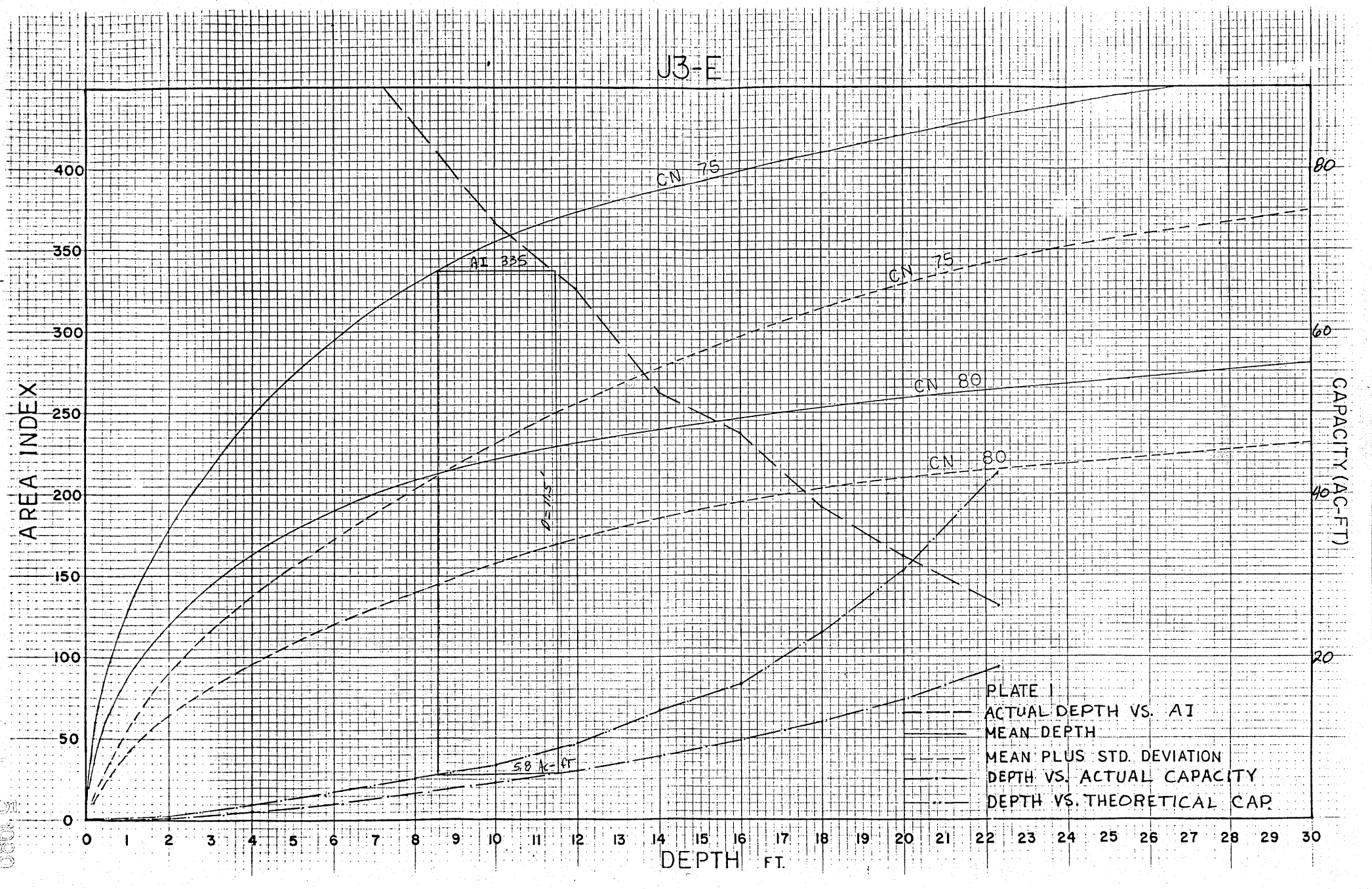
Notes: Existing Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6508	0.001	251.299	0	251,299	0
2	6510	0.381	251.919	0.8	659	0.4
6	6514	0.512	250.788	3.1	490	2.2
10	6518	0.682	250.618	6.8	368	4.6
12	6520	0.770	250.530	9.2	325	6.0
14	6522	0.950	250.350	13.3	263	7.7
16	6524	1.054	250.246	16.9	237	9.7
18	6526	1.297	249.003	23.3	193	12.1
20	6528	1.530	249.770	30.6	163	14.9
22.3	6530.3	1.908	249.392	42.5	131	18.9

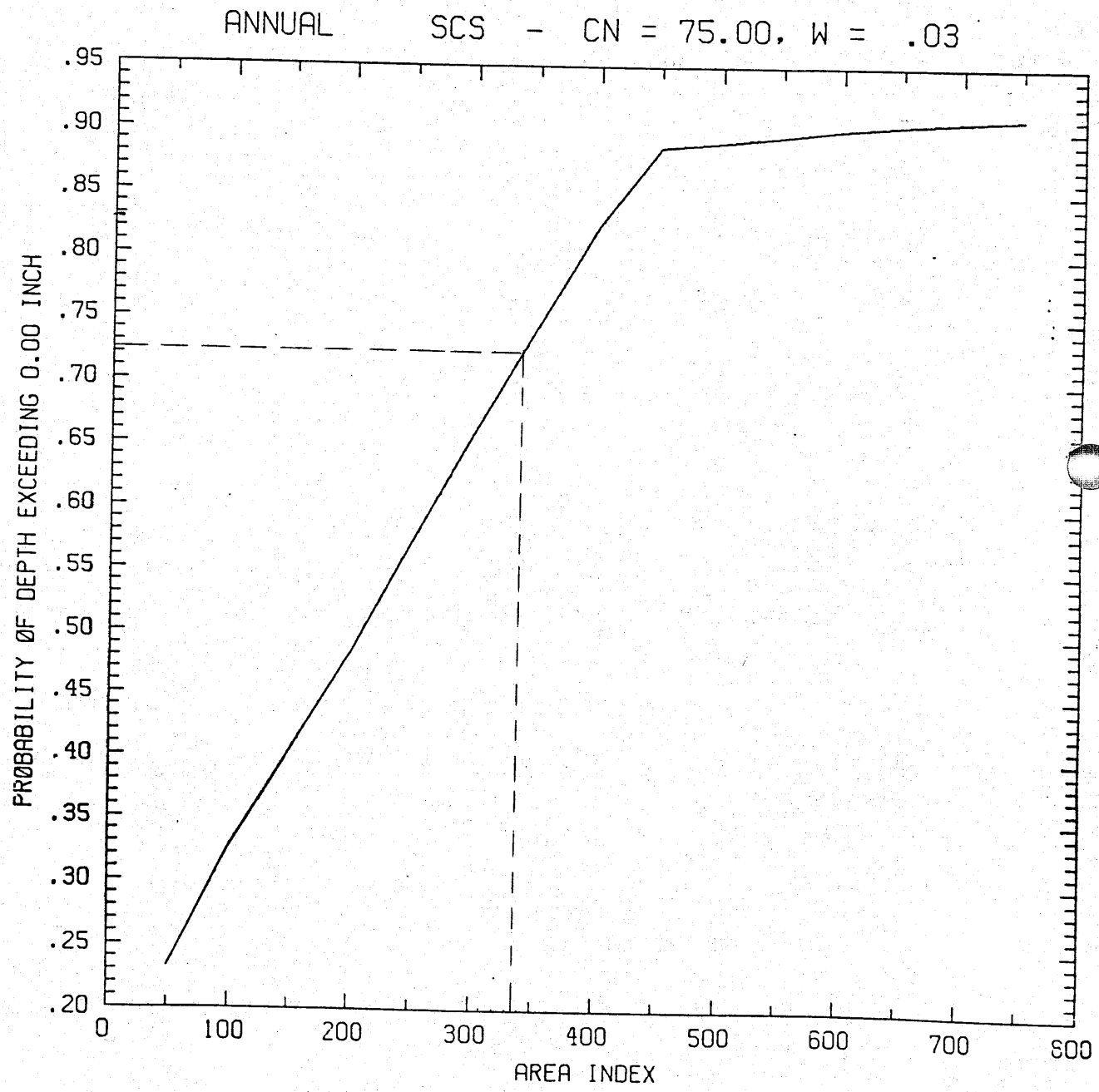
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	11.5 ft.	--
	Minimum Depth (MIN)	--	6.0 ft.
	Actual Capacity	5.8 ac-ft.	2.2 ac-ft.
	AI	335	490
Plate 2 or 3:	Probability	72%	85%

JAN 5 1989


J3-E
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 335
58 Ac-ft
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

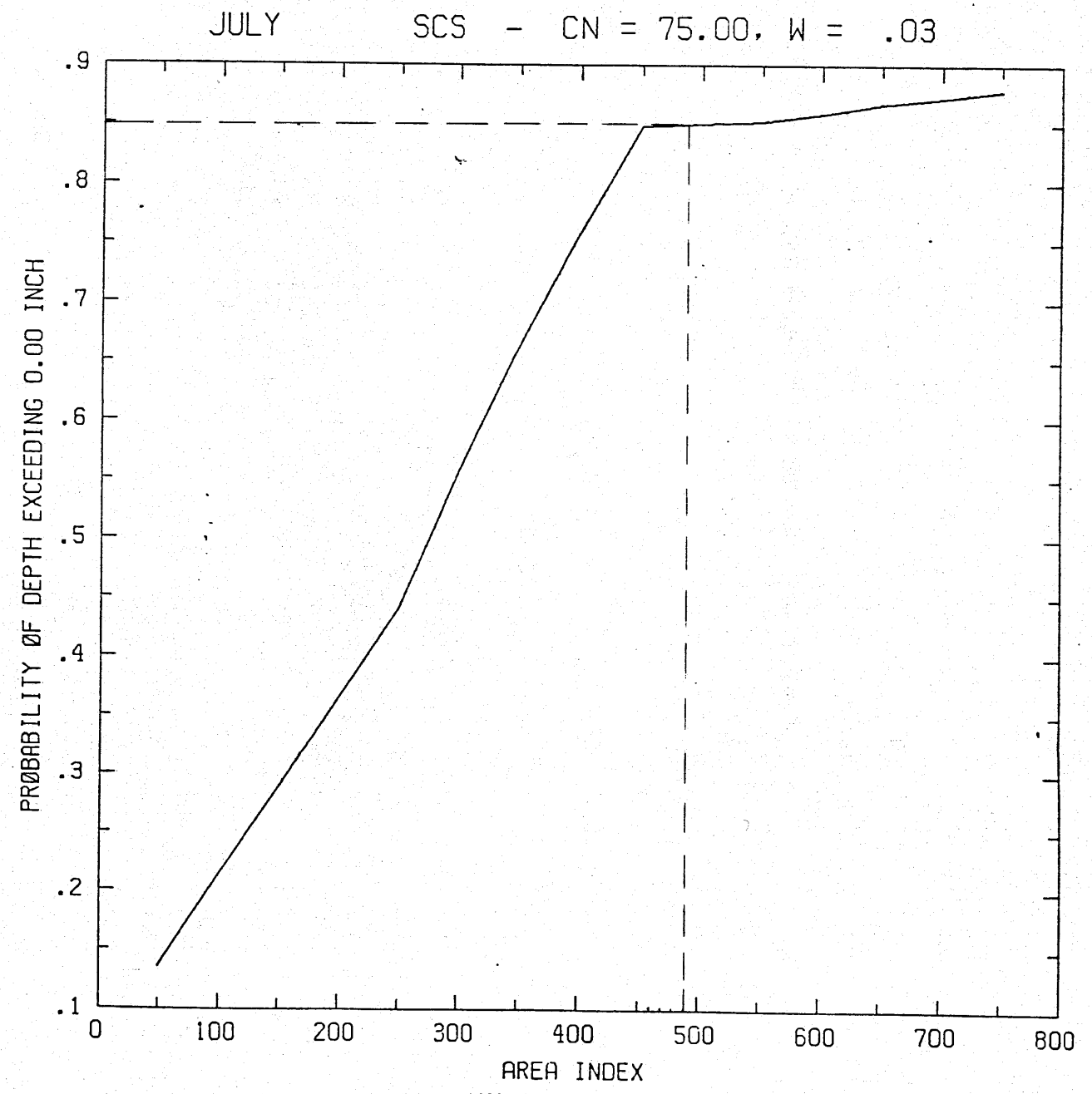
J3-E



Annual Mean Depth
Plate 2

JAN 5 19

J3-E



Minimum Depth
Plate 3

55

PERMANENT IMPOUNDMENT

J3-G

WATER PERSISTENCE WORKSHEET

5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J3-G

A_D: 89.0 Acres

Depth: From Bottom Elevation

A_D: Total Drainage Area

A_P: Surface Area of Pond

A_B: Watershed Area = A_D - A_P

Theoretical Capacity: A_P x Depth

AI: Area Index = A_B/A_P

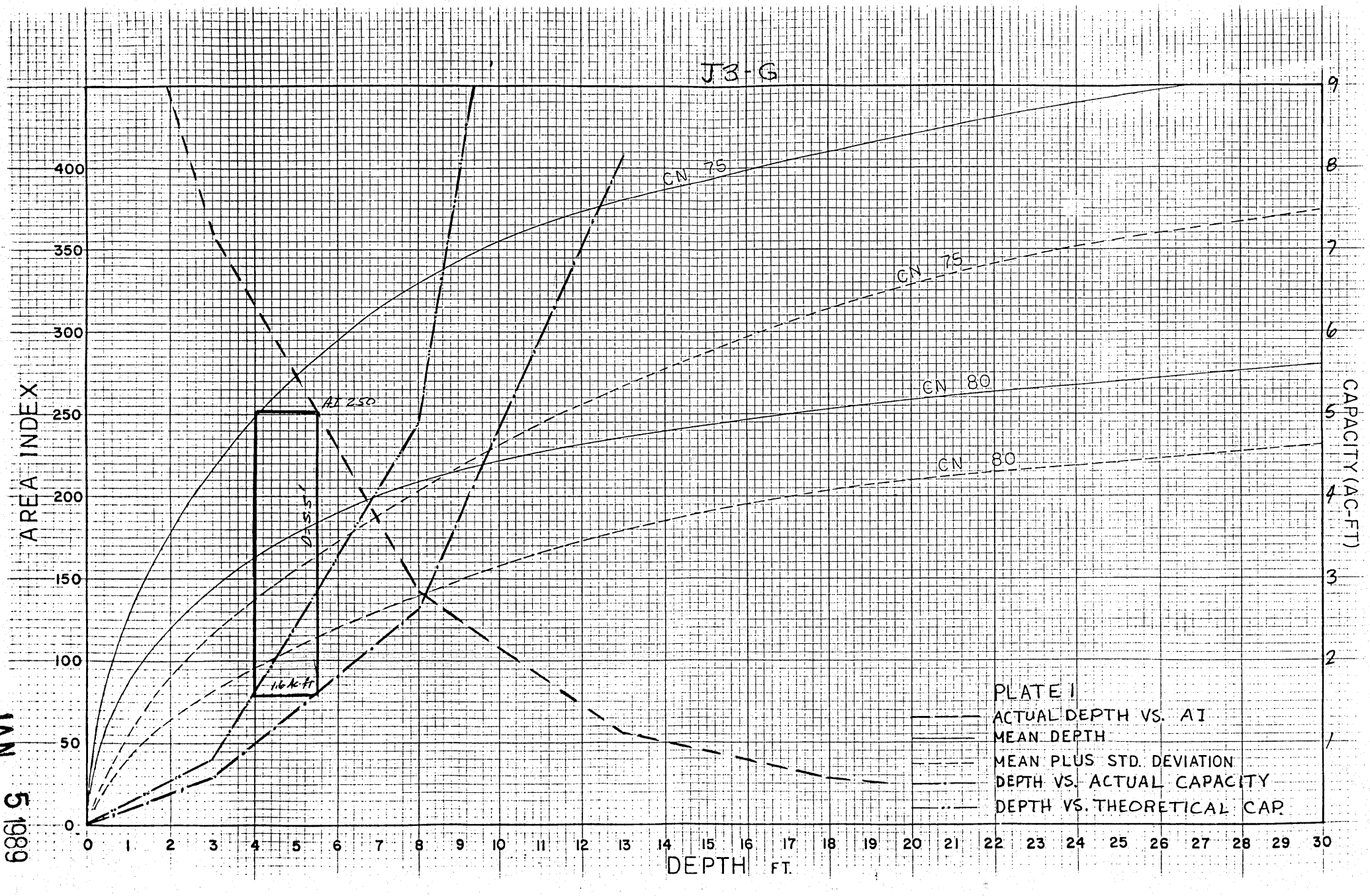
Notes: Existing Internal Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6472	0.050	88.950	0	1779	0
3	6475	0.249	88.751	0.7	356	0.5
8	6480	0.615	88.385	4.9	144	2.7
13	6485	1.573	87.427	20.4	56	8.1
18	6490	3.006	85.994	54.1	29	19.6
23	6495	4.668	84.332	107.4	18	38.8
28	6500	6.614	82.386	185.2	13	67.0
33	6505	8.811	80.189	290.8	9	105.5

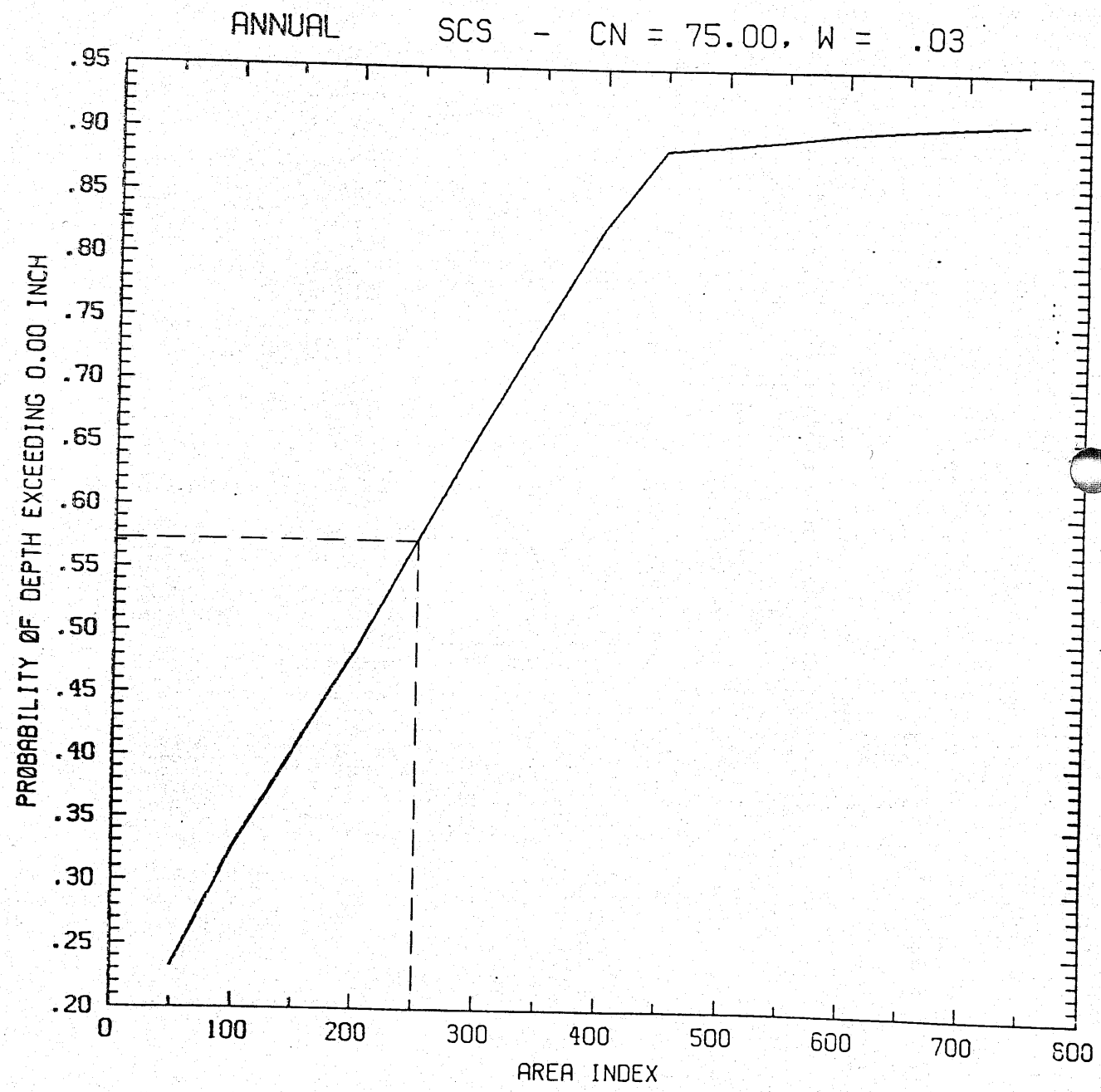
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	5.5 ft.	--
	Minimum Depth (MIN)	--	6.5 ft.
	Actual Capacity	1.6 ac-ft.	2.0 ac-ft.
	AI	250	208
Plate 2 or 3:	Probability	57%	37%

JAN 5 1989


J3-G
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 250
1.6 Ac-ft
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

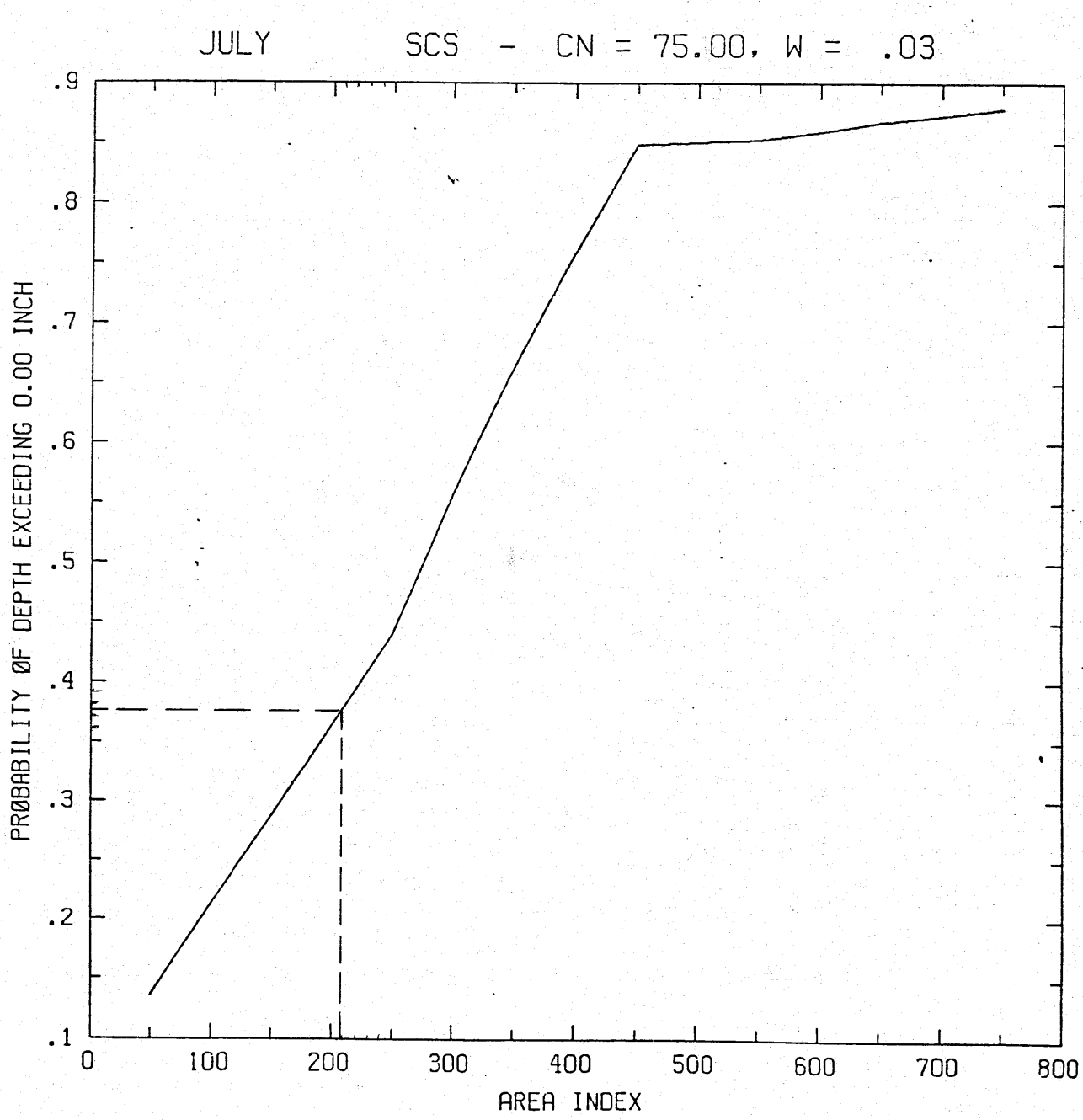
JAN 5 1989



Annual Mean Depth
Plate 2

JAN 5 198

J3-G



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 1989

PERMANENT IMPOUNDMENT

J-7 DAM

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J-7 Dam

A_D: 5385.0 Acres

Depth: From Bottom Elevation

A_D: Total Drainage Area

A_P: Surface Area of Pond

A_B: Watershed Area = $A_D - A_P$

Theoretical Capacity: A_P x Depth

AI: Area Index = A_B/A_P

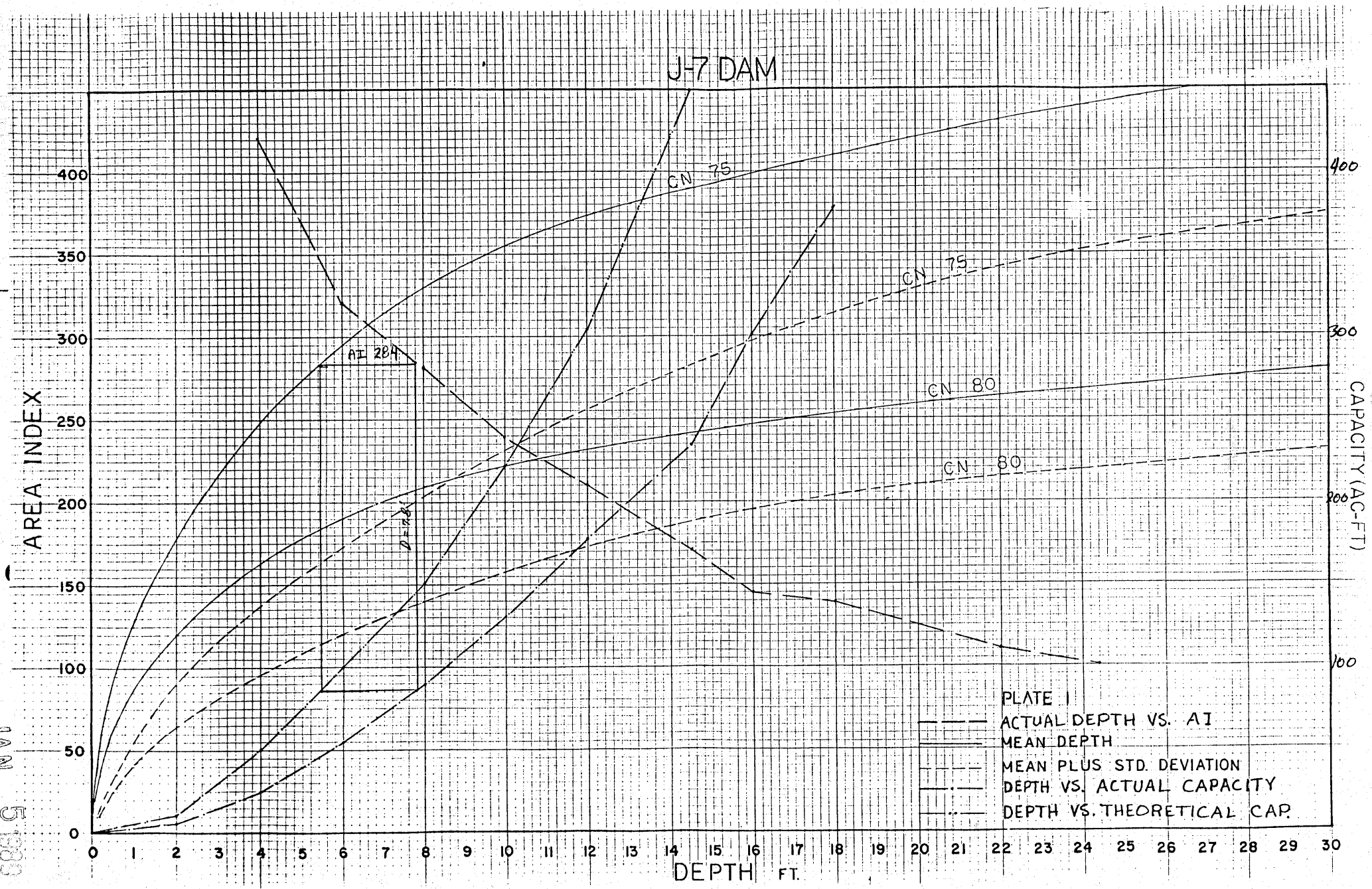
Notes: MSHA Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6344	0.308	5384.692	0	17,483	0
2	6346	5.792	5379.208	11.6	929	6.1
4	6348	12.717	5372.283	50.9	422	24.6
6	6350	16.720	5368.28	100.3	321	54.0
8	6352	18.978	5366.022	151.8	283	89.7
10	6354	22.348	5362.652	223.5	240	131.1
12	6356	25.346	5359.654	304.2	212	178.8
14.5	6358.5	31.034	5353.966	450.0	173	235.1
16	6360	36.582	5348.4	585.3	146	302.8
18	6362	38.393	5346.607	691.1	139	377.7
22	6366	47.287	5337.713	1040.3	113	549.1
24.4	6368.4	52.547	5332.453	1282.1	102	669.0

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

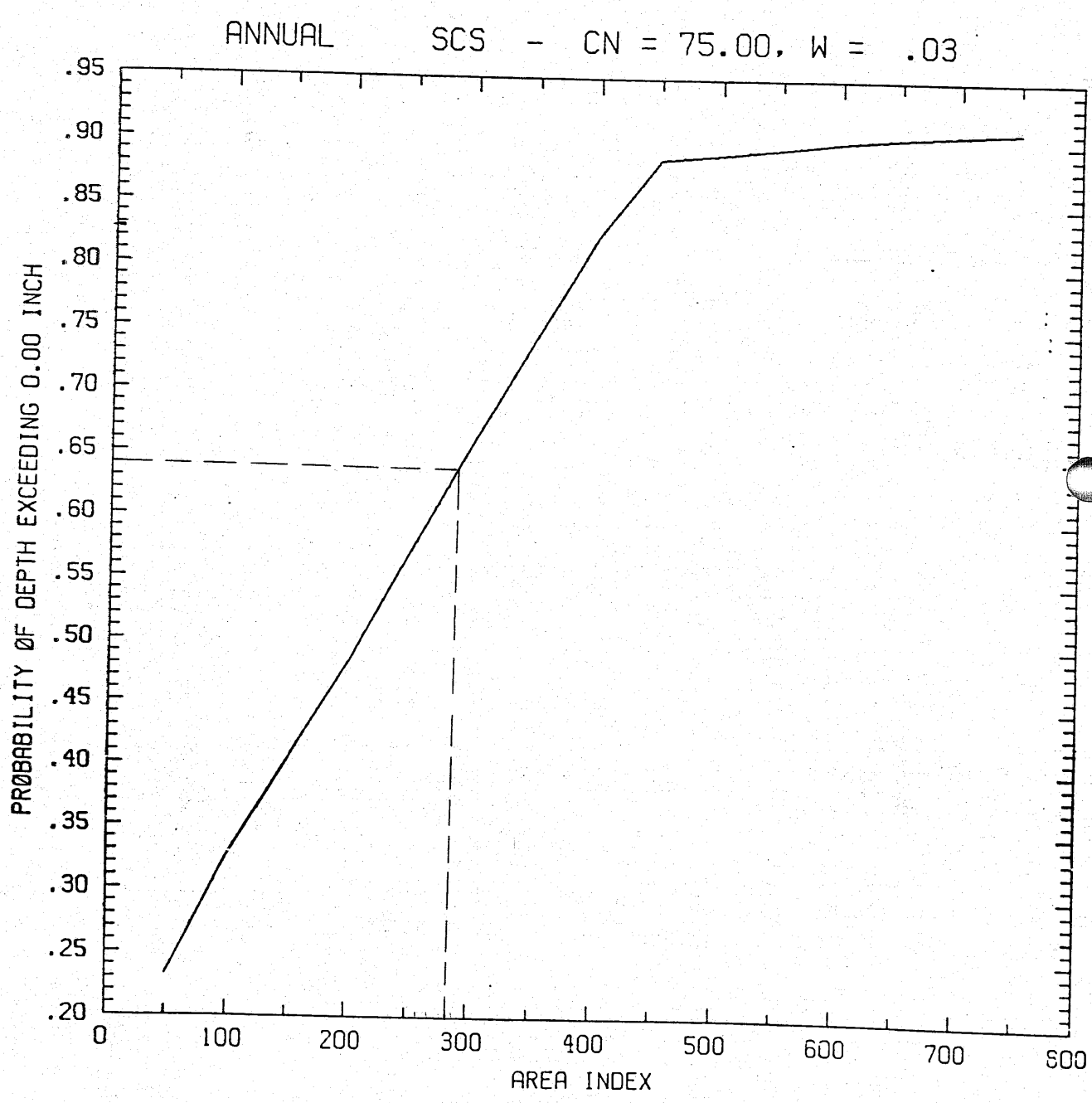
Plate 1:	Annual Mean Depth (AMD)	7.8 ft.	--
	Minimum Depth (MIN)	--	3.0 ft.
	Actual Capacity	86.0 ac-ft.	15.0 ac-ft
	AI	284	581
Plate 2 or 3:	Probability	64%	86%

JAN 5 1989


J-7 DAM
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 284
D = 8
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

JAN 5 1983

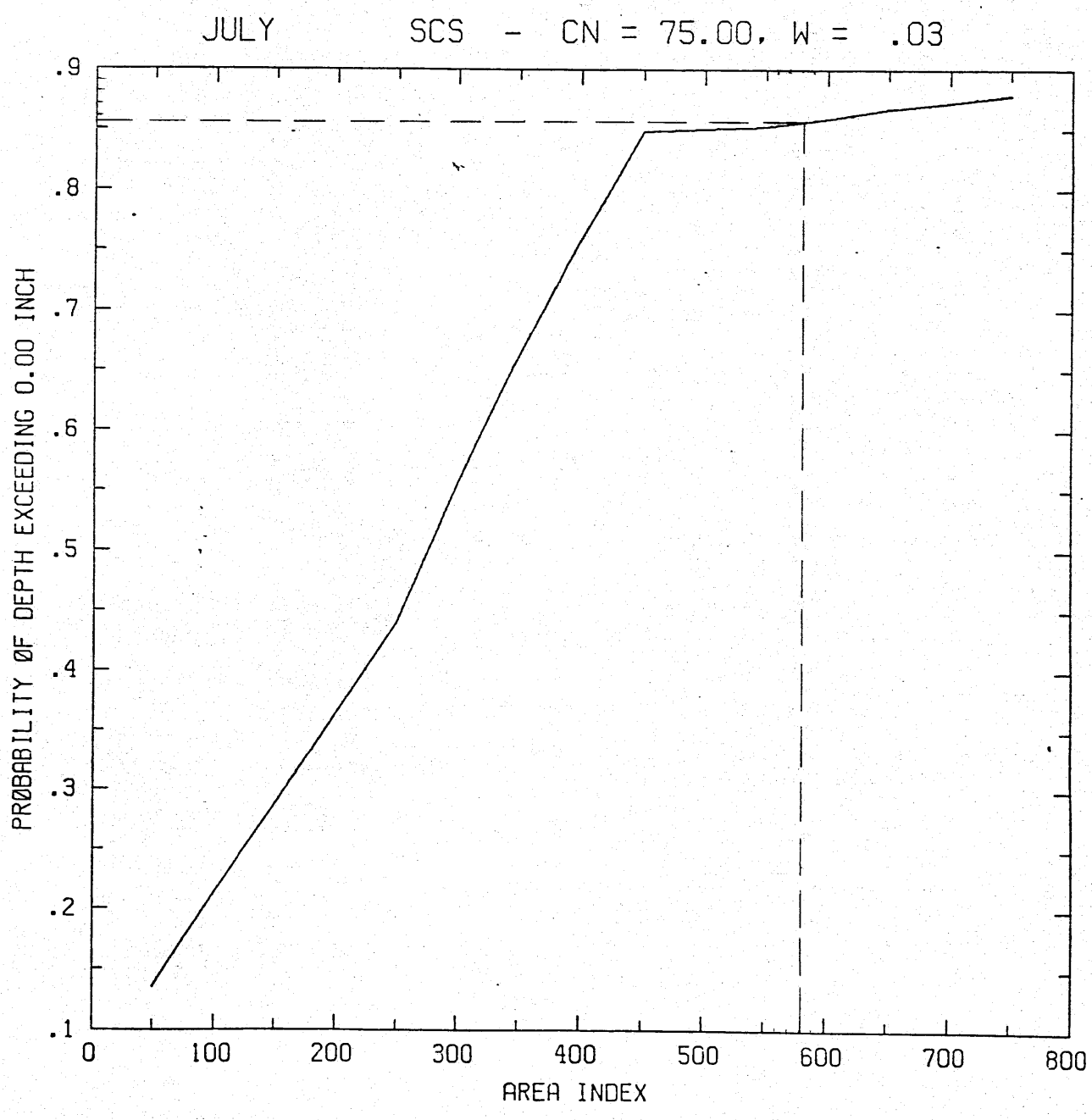
J-7 DAM



Annual Mean Depth
Plate 2

JAN 5 1989

J-7 DAM



Minimum Depth
Plate 3

JAN 5 1980

JAN 5 198

PERMANENT IMPOUNDMENT

J7-JR

WATER PERSISTENCE WORKSHEET

5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J7-JR

A_D: 3832.4 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

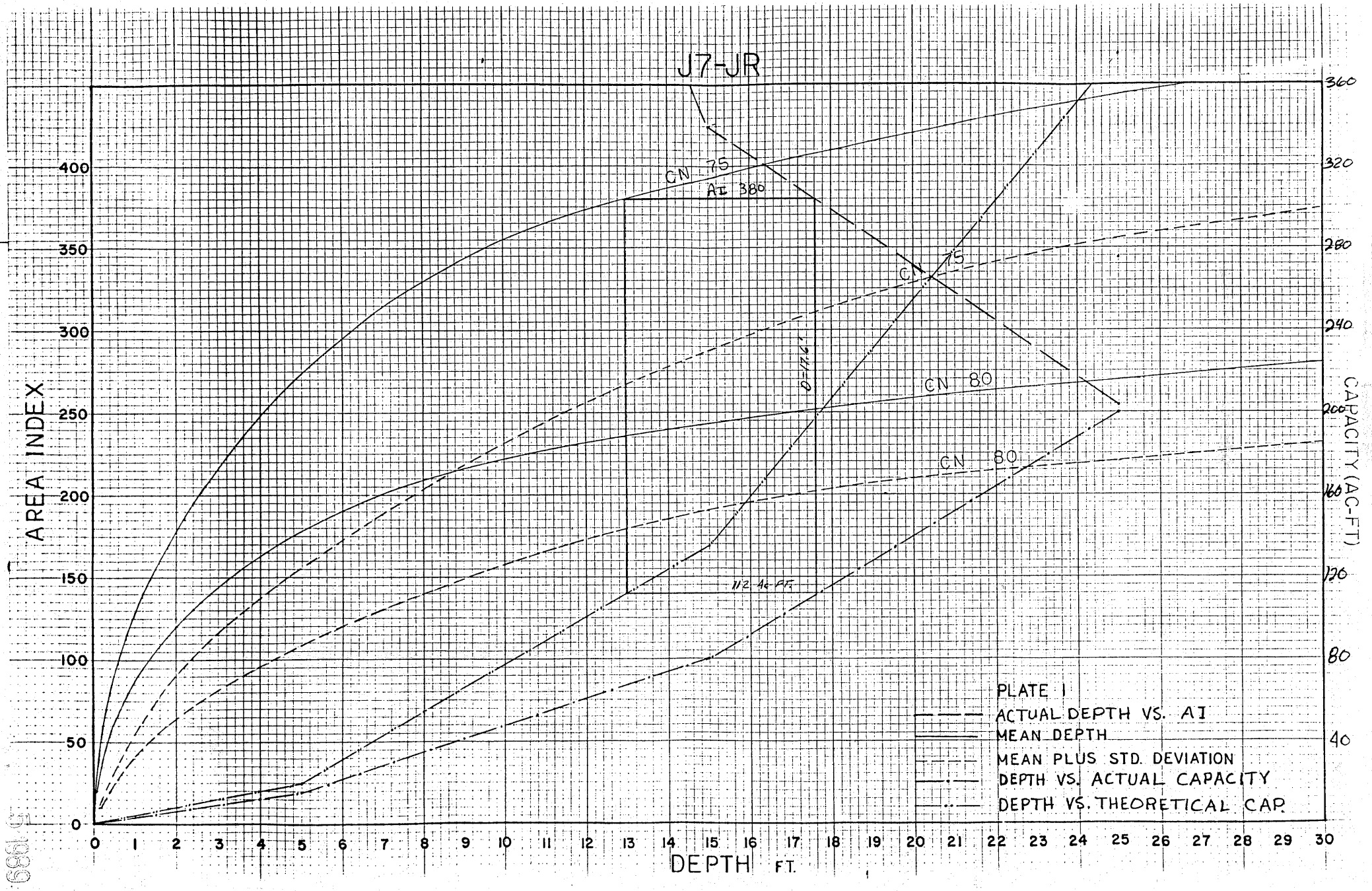
Notes: Proposed MSHA Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6955	2.00	3830.40	0	1915	0
3	6958	3.20	3829.2	9.6	1197	8.2
5	6960	4.0	3828.4	20.0	957	15.0
15	6970	9.0	3832.4	135.0	425	80.0
25	6980	15.0	3817.4	375.0	254	200.0

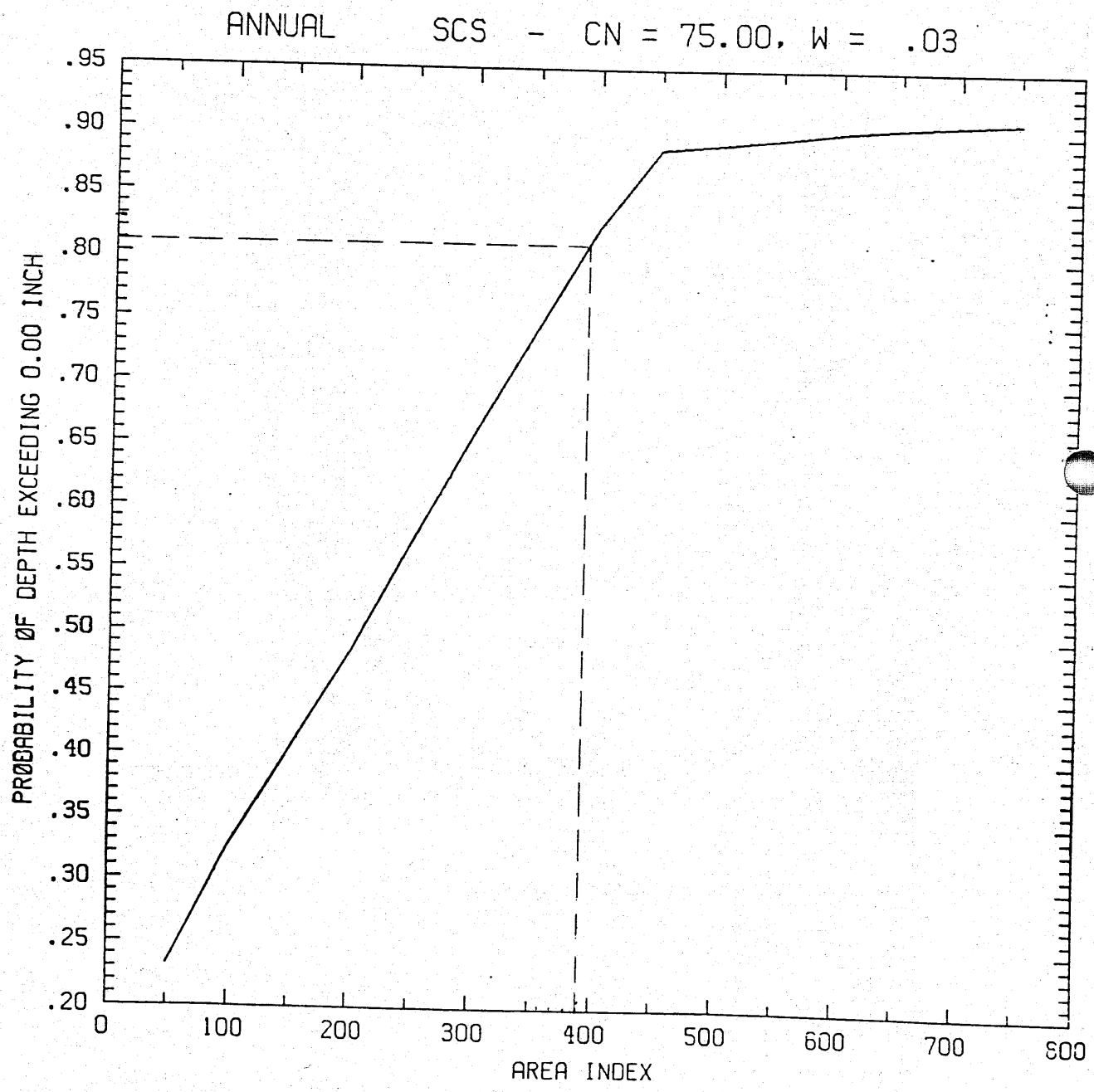
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	17.6 ft.	--
	Minimum Depth (MIN)	--	3.0 ft.
	Actual Capacity	112 ac-ft.	8.2 ac-ft
	AI	380	1197
Plate 2 or 3:	Probability	81%	88+%

JAN 5 198


J7-JR
CN 75
AI 380
CN 75
CN 80
CN 80
D=17.4'
112 Ac-FT.
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

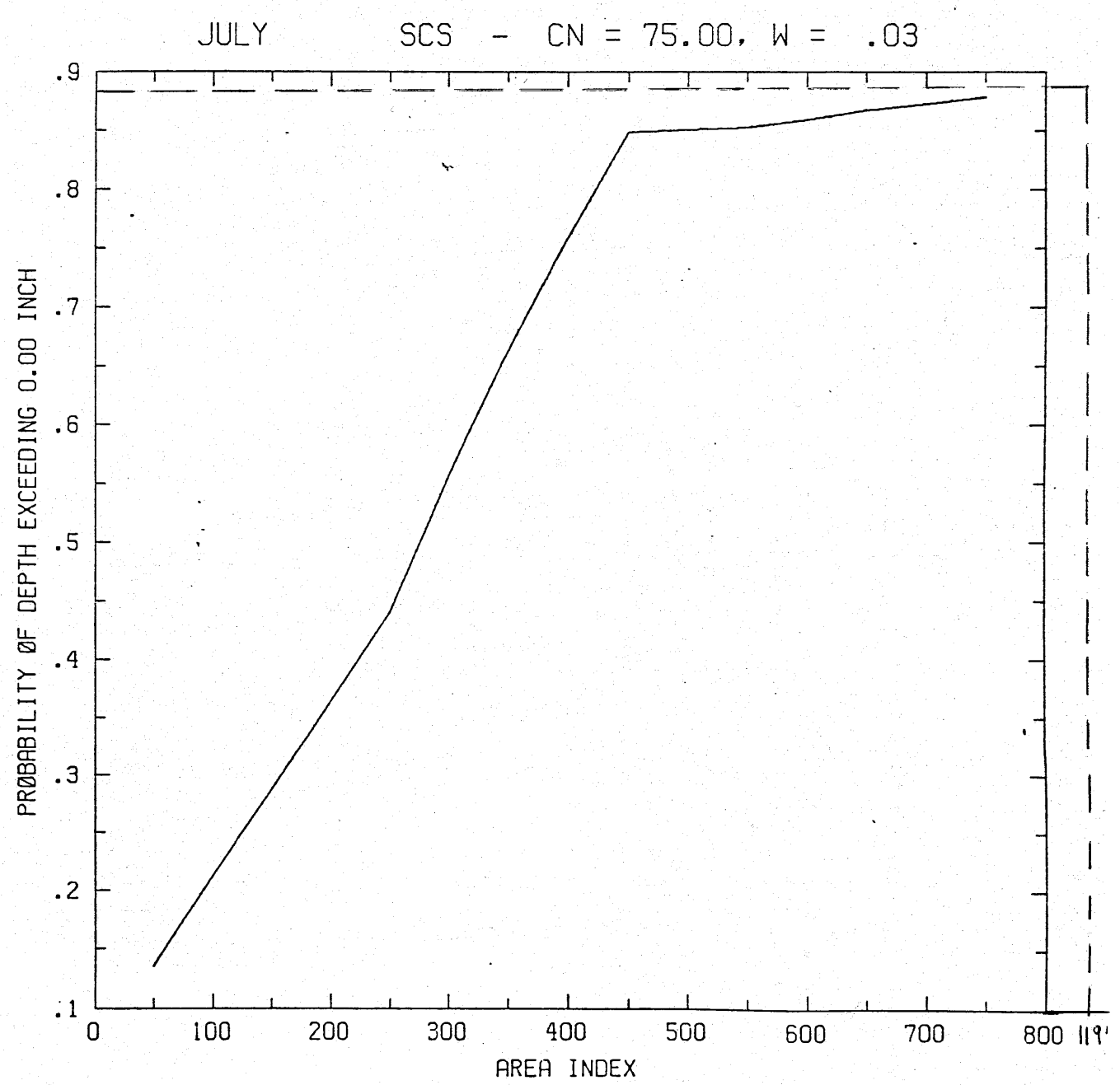
J7-JR



Annual Mean Depth
Plate 2

JAN 5 1989

J7-JR



Minimum Depth
Plate 3

JAN 5 1

PERMANENT IMPOUNDMENT

J7-R

WATER PERSISTENCE WORKSHEET

WATER PERSISTENCE WORKSHEET

Pond ID: J7-R

A_D: 325.9 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

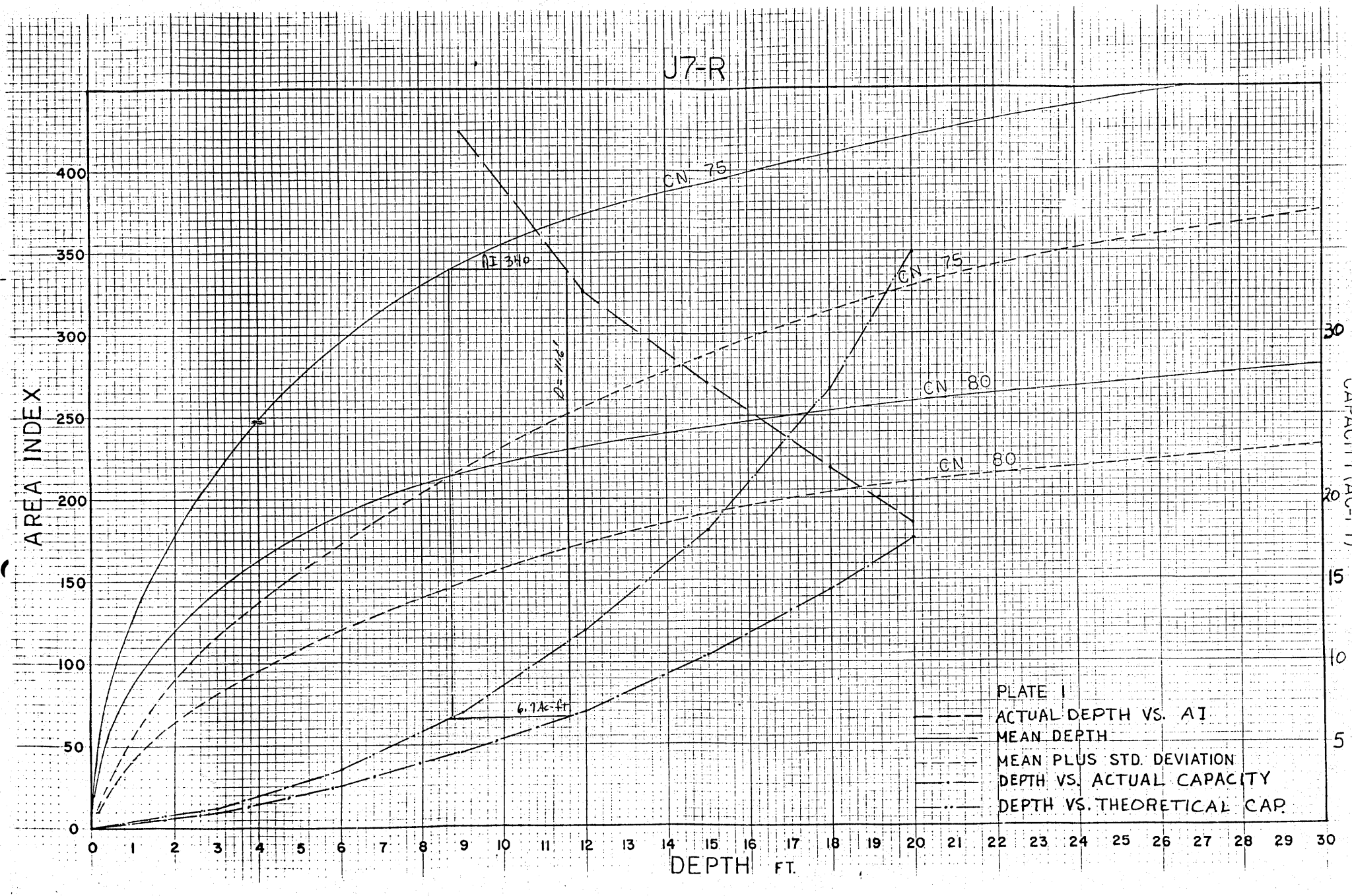
Notes: Proposed Impoundment

Depth (ft)	Elevation (MSL)	A_P (AC)	A_B (AC)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	N/A	0.276	325.624	0	1180	0
0.3		0.422	325.478	1.3	771	1.0
.6		0.597	325.303	3.6	545	2.5
9		0.766	325.134	6.9	426	4.5
12		0.922	324.908	11.9	328	7.1
15		1.205	324.695	18.1	270	10.4
18		1.483	324.417	26.7	219	14.4
20		1.745	324.155	34.9	186	17.6

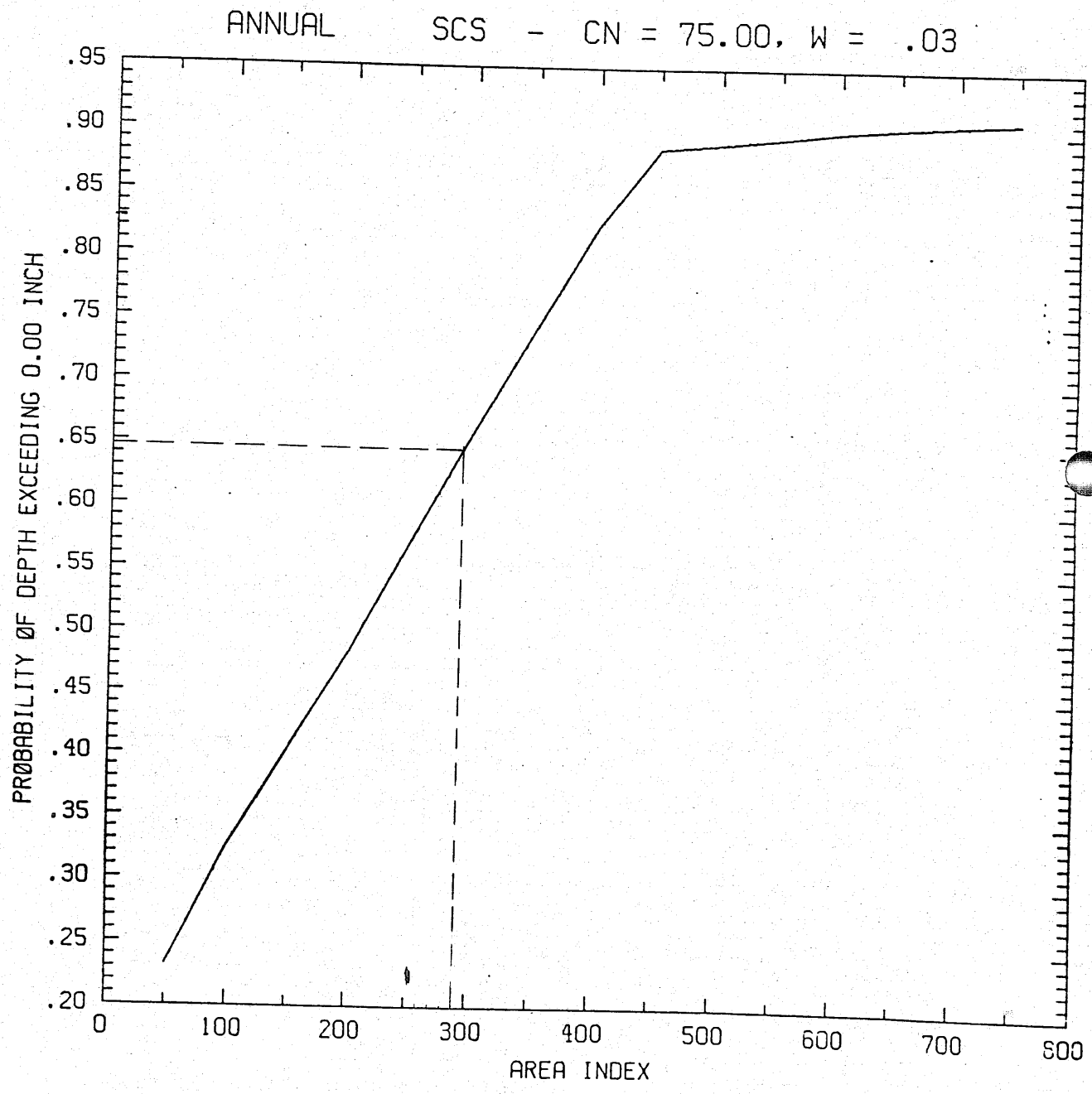
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	11.6 ft	--
	Minimum Depth (MIN)		5.0 Ft
	Actual Capacity	--	2.0 Ac-ft
	AI	340	630
Plate 2 or 3:	Probability	65%	87%

JAN 5 1989


J7-R
AREA INDEX
DEPTH FT.
CAPACITY (AC-FT)
CN 75
CN 75
CN 80
CN 80
AI 340
D = 11.6'
6.7 Ac-ft
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

J7-R

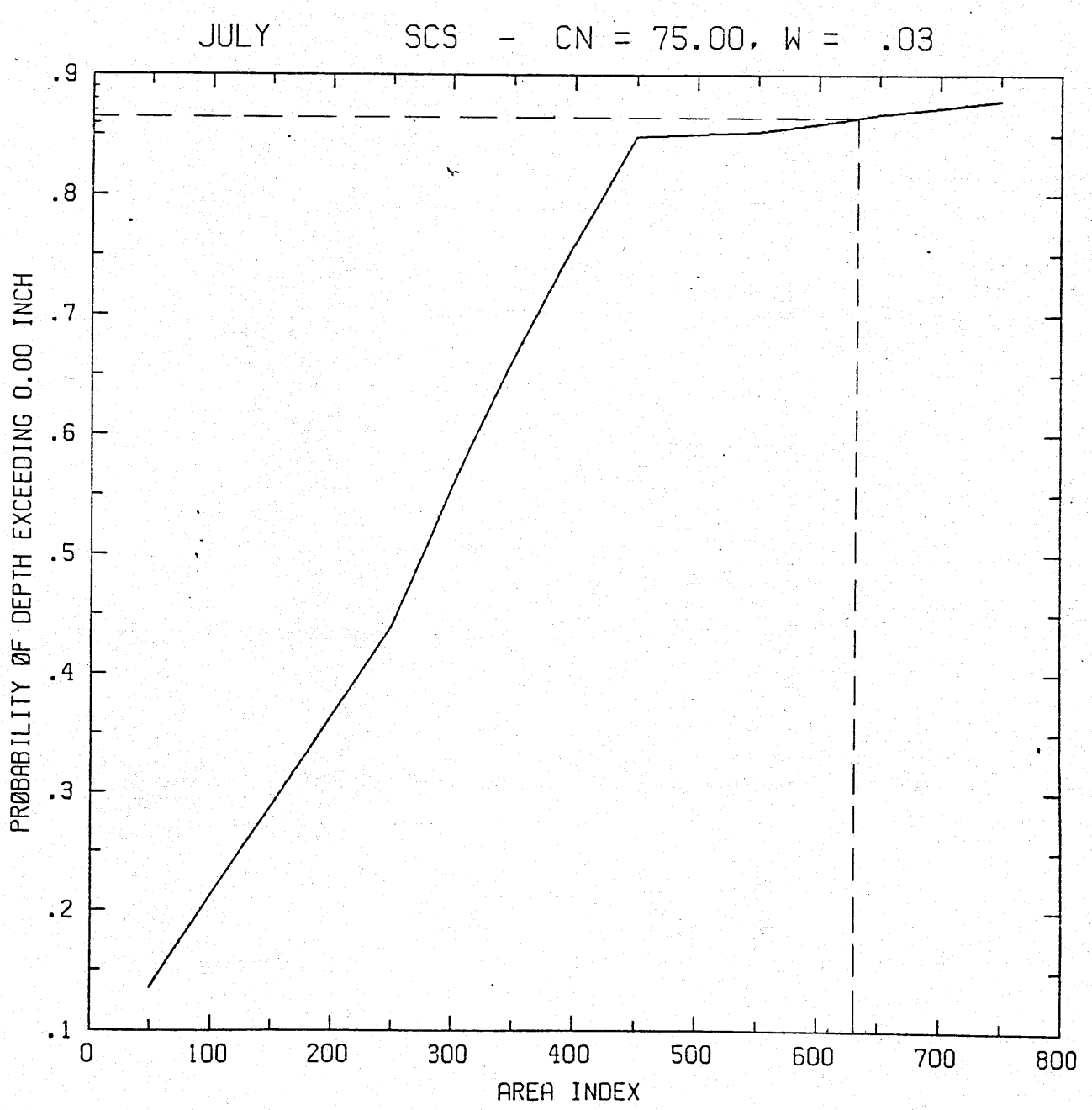


Annual Mean Depth

Plate 2

JAN 5 1999

J7-R



Minimum Depth

Plate 3

JAN 5 1989

JAN 5 1989

PERMANENT IMPOUNDMENT

J16-A

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J16-A

A_D: 2684.0 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

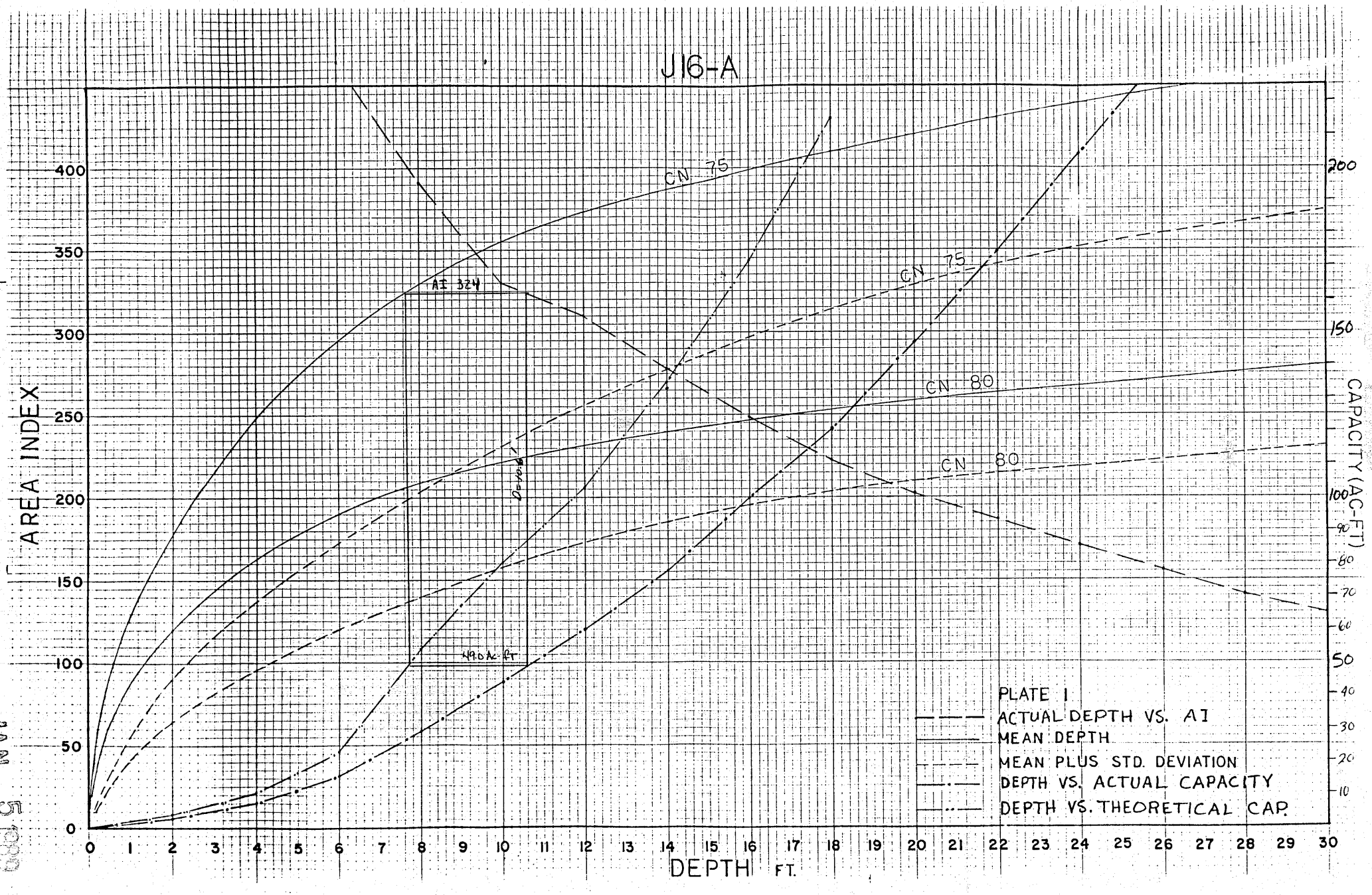
Notes: MSHA Impoundment

Depth (ft)	Elevation (MSL)	A_P (AC)	A_B (AC)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6604	0.922	2683.078	0	2910	0
2	6606	2.110	2681.890	4.2	1271	3.0
4	6608	2.728	2681.272	10.9	983	7.9
6	6610	5.761	2678.239	23.0	465	16.4
8	6612	6.828	2677,172	54.6	392	28.9
10	6614	8.097	2675.903	81.0	331	43.9
12	6616	8.622	2675.378	103.5	310	60.6
14	6618	9.603	2674.397	134.4	279	78.8
16	6620	10.774	2673.226	172.4	248	99.2
18	6622	11.947	2672.053	215.0	224	121.9
20	6624	13.106	2670.894	262.1	204	147.0
22	6626	14.206	2669.794	312.5	188	174.3
24	6628	15.519	2668.481	372.5	172	204.0
26	6630	17.047	2666.953	443.2	156	236.6
28	6632	18.649	2665.351	522.2	142	272.3
30	6634	20.420	2663.580	612.6	130	311.3

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

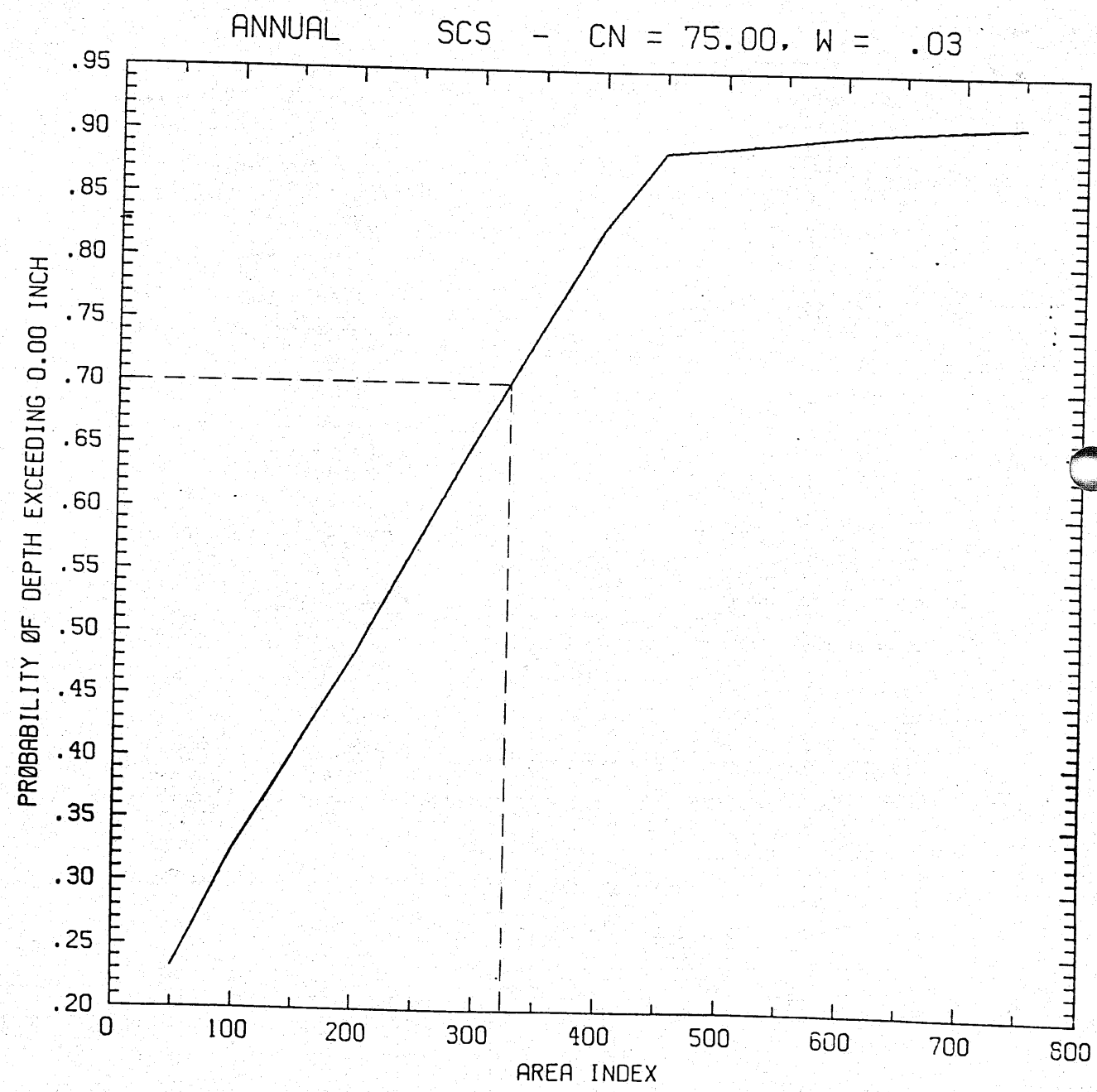
Plate 1:	Annual Mean Depth (AMD)	10.6 ft	--
	Minimum Depth (MIN)	--	3.0 ft
	Actual Capacity	49.0 Ac-ft	5.1 Ac-ft
	AI	324	1108
Plate 2 or 3:	Probability	70%	88+%

JAN 5 1989


J16-A
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 324
49.0 Ac-ft
Depth
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

JAN 5 1980

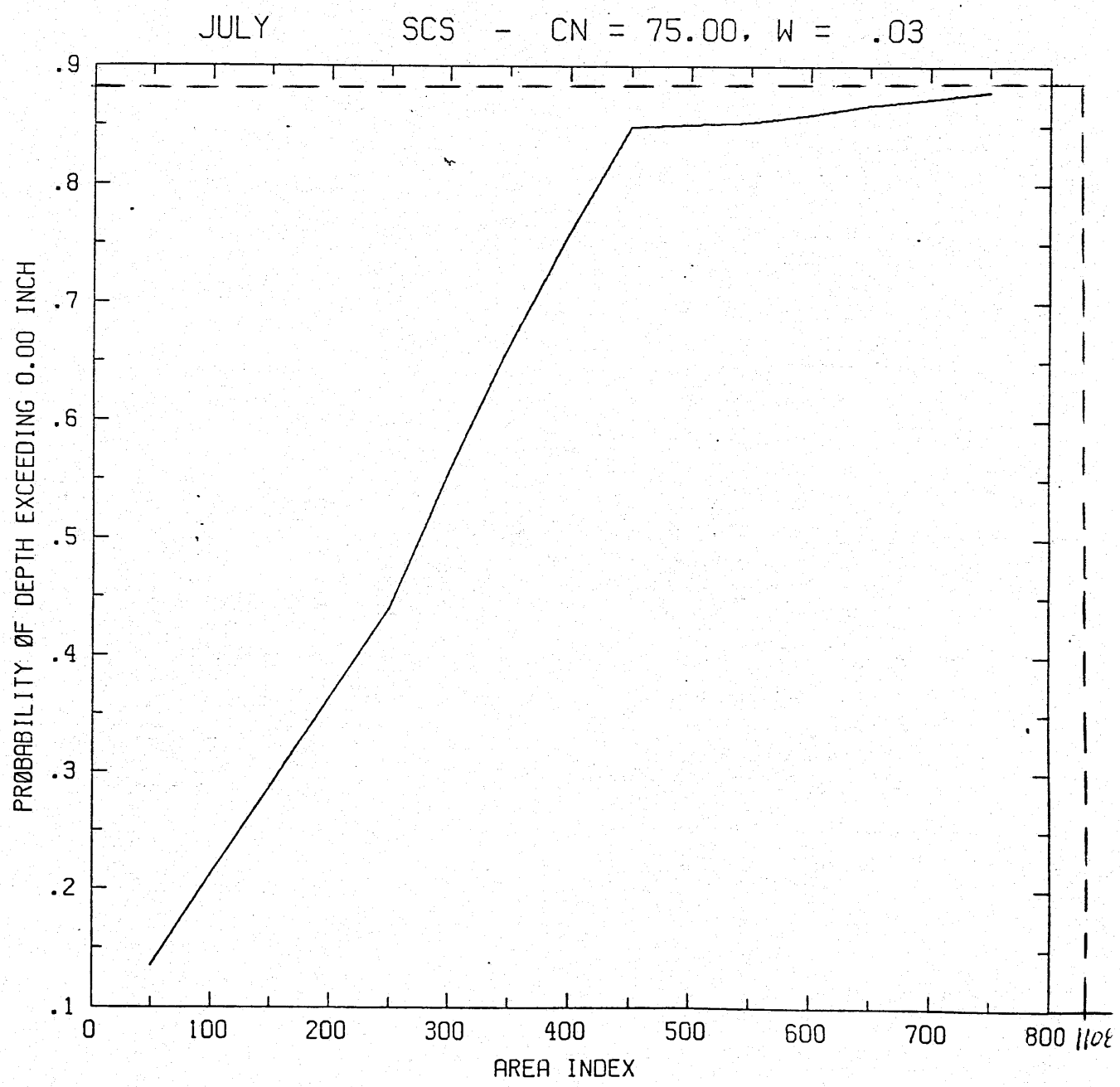
J16-A



Annual Mean Depth
Plate 2

JAN 5 1989

J16-A



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 1985

PERMANENT IMPOUNDMENT

J16-G

WATER PERSISTENCE WORKSHEET

5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J16-G

A_D: 272.0 Acres

Depth: From Bottom Elevation

A_D: Total Drainage Area

A_P: Surface Area of Pond

Notes: Existing Impoundment

A_B: Watershed Area = A_D - A_P

Theoretical Capacity: A_P x Depth

AI: Area Index = A_B/A_P

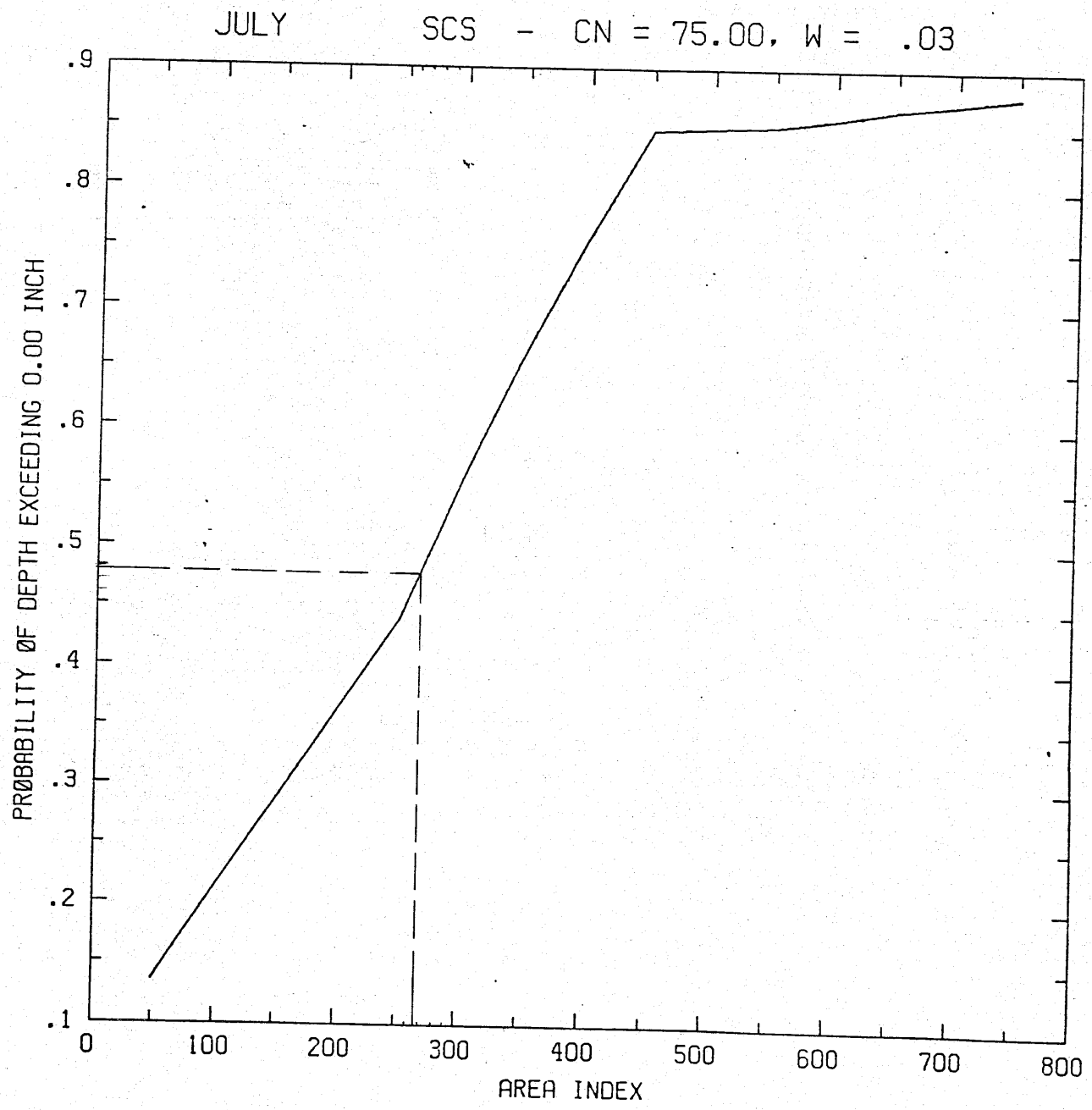
Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6564	0.063	271.937	0	4317	0
2	6566	0.829	271.171	1.7	327	0.9
4	6568	1.312	270.688	5.2	206	3.0
6	6570	1.742	270.259	10.4	155	6.1
8	6572	2.091	269.909	16.7	129	9.9
10	6574	2.400	269.600	24.0	112	14.4
12	6576	2.747	269.253	33.0	98	19.6

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	4.0 ft	--
	Minimum Depth (MIN)	--	3.0 ft
	Actual Capacity	3.0 Ac-ft	2.0 Ac-ft
	AI	205	267
Plate 2 or 3:	Probability	49%	48%

JAN 5 1989

J16-G



Minimum Depth

Plate 3

JAN 5 1989

PERMANENT IMPOUNDMENT

J16-L

WATER PERSISTENCE WORKSHEET

5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J16-L

A_D: 6373.0 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

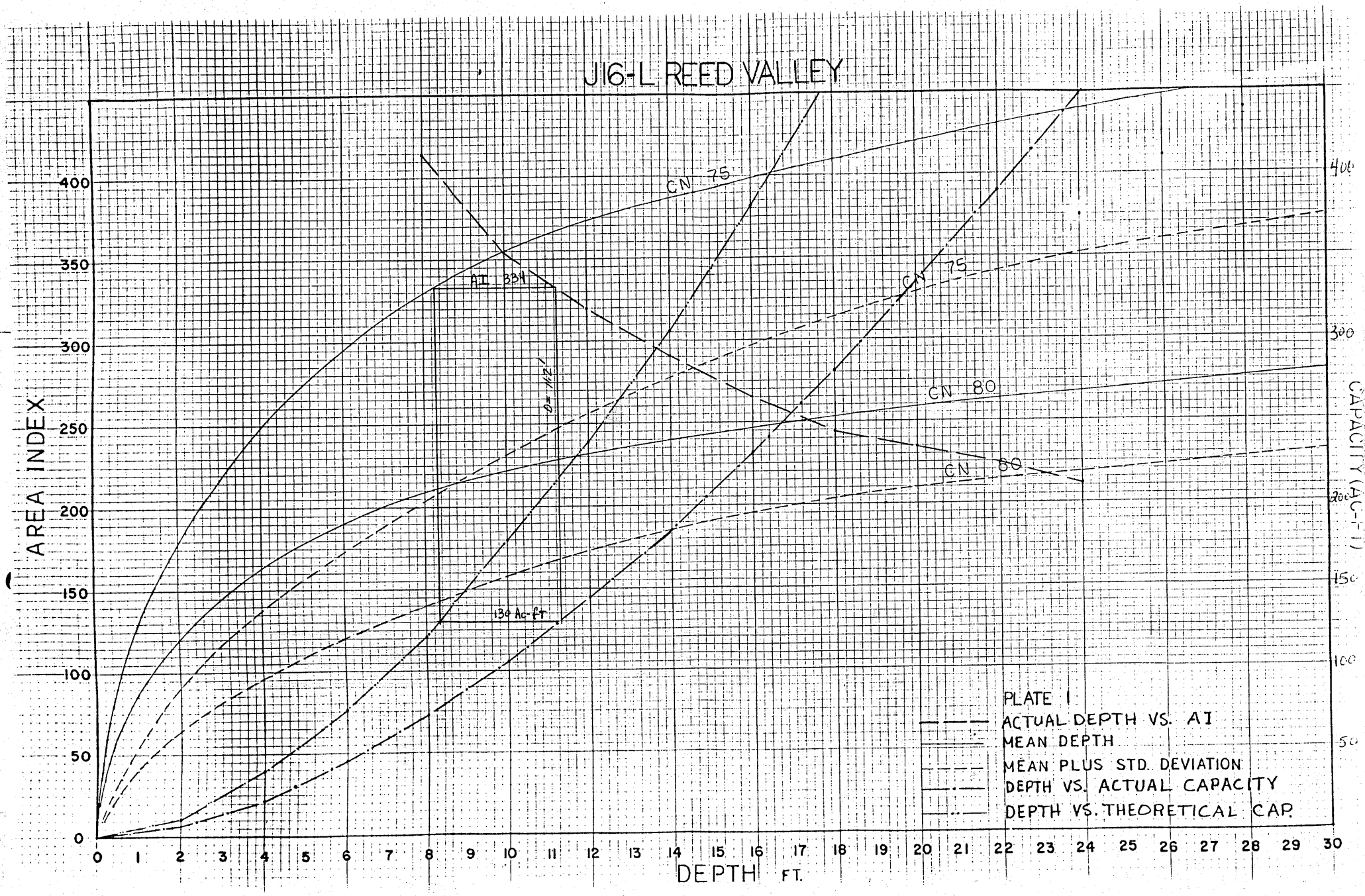
Notes: MSHA Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6546	1.286	6371.7	0	4955	0
2	6548	5.934	6367.066	11.9	1073	7.2
4	6550	9.755	6363.245	39.0	652	22.9
6	6552	12.752	6360.248	76.5	499	45.4
8	6554	15.333	6357.667	122.7	415	73.5
10	6556	17.912	6355.088	179.1	355	106.7
12	6558	19.902	6353.098	238.8	319	144.6
14	6560	21.882	6351.118	306.3	290	186.3
16	6562	23.858	6349.142	381.7	266	232.1
18	6564	25.987	6347.013	467.8	244	281.9
20	6566	26.924	6346.076	538.5	236	334.8
22	6568	28.320	6344.680	623.0	224	390.1
24	6570	29.788	6343.212	714.9	213	448.2
25.2	6571.2	30.815	6342.185	776.5	206	484.6

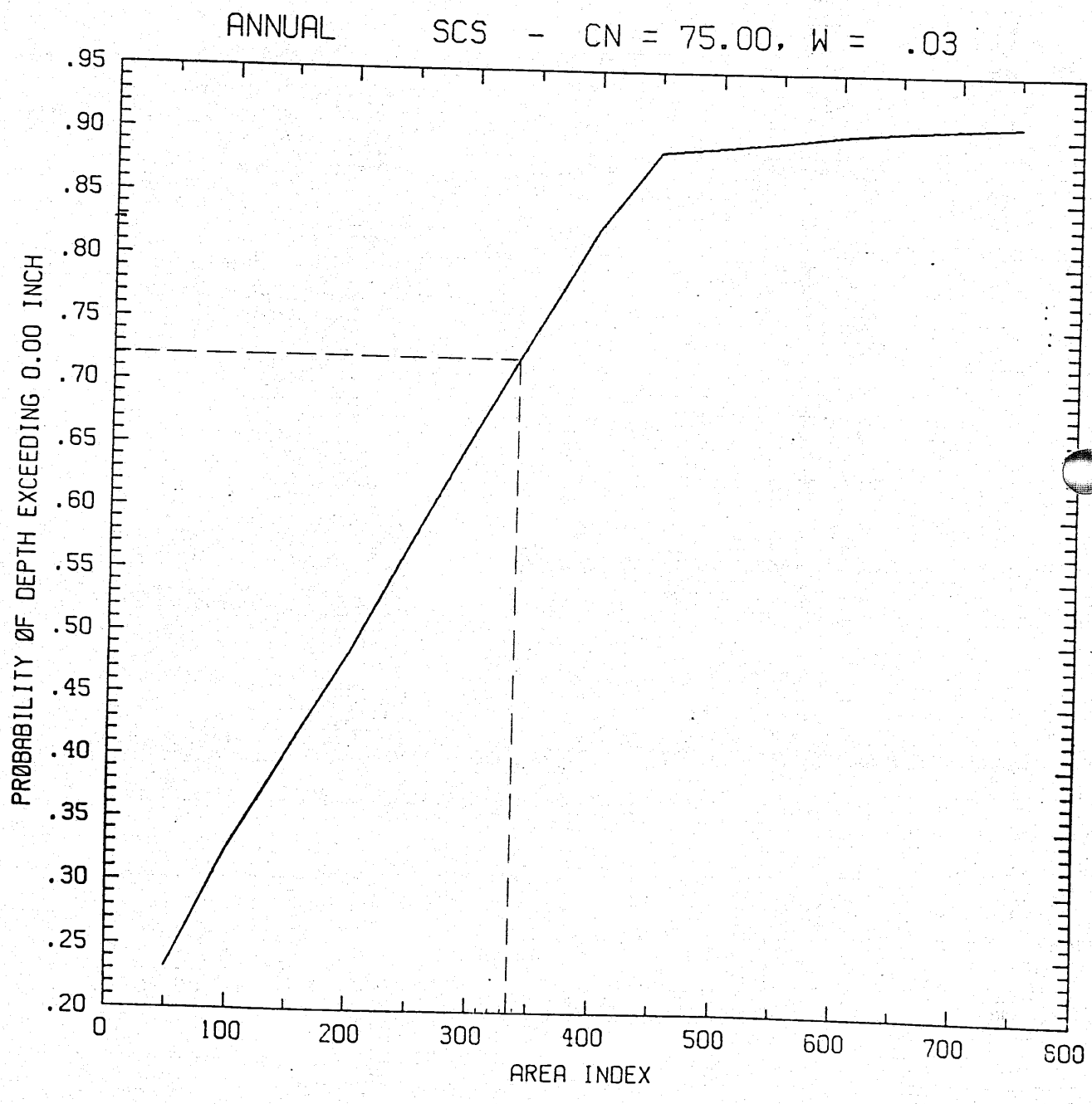
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	11.2 ft	--
	Minimum Depth (MIN)	--	3.0 ft
	Actual Capacity	130 Ac-ft	14.0 Ac-ft
	AI	334	811
Plate 2 or 3:	Probability	72%	88%

JAN 5 1989


J16-L REED VALLEY
AREA INDEX
DEPTH FT.
CAPACITY (AC-FT)
CN 75
CN 75
CN 80
CN 80
AI 334
D = 11.2'
130 Ac-ft
PLATE 1
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

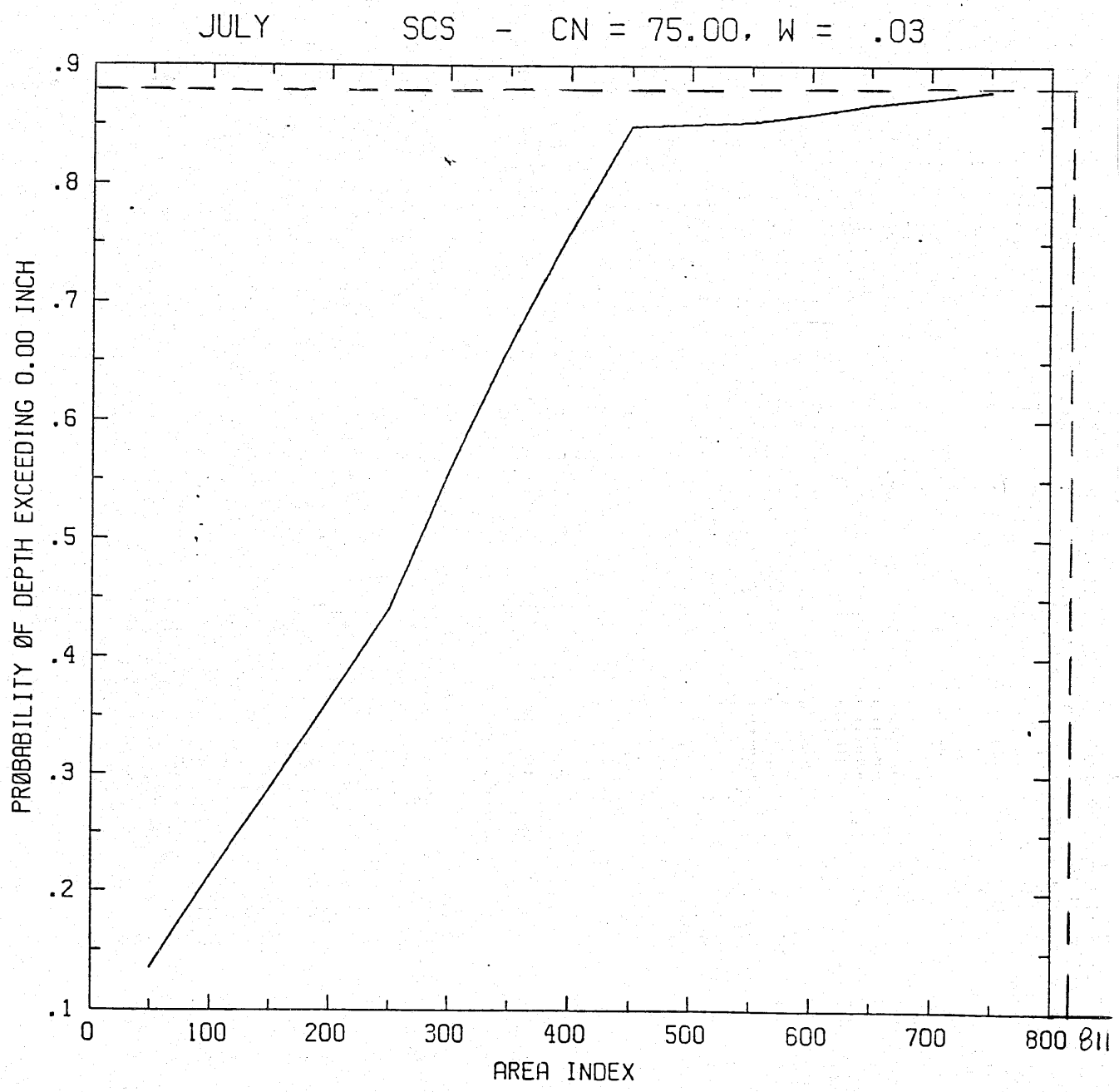
J16-L REED VALLEY



Annual Mean Depth

Plate 2

J16-L REED VALLEY



Minimum Depth

Plate 3

5 1989

JAN 5 198

PERMANENT IMPOUNDMENT

J19-RA

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J19-RA

A_D: 781.3 Acres

Depth: From Bottom Elevation

A_D: Total Drainage Area

A_P: Surface Area of Pond

A_B: Watershed Area = A_D - A_P

Theoretical Capacity: A_P x Depth

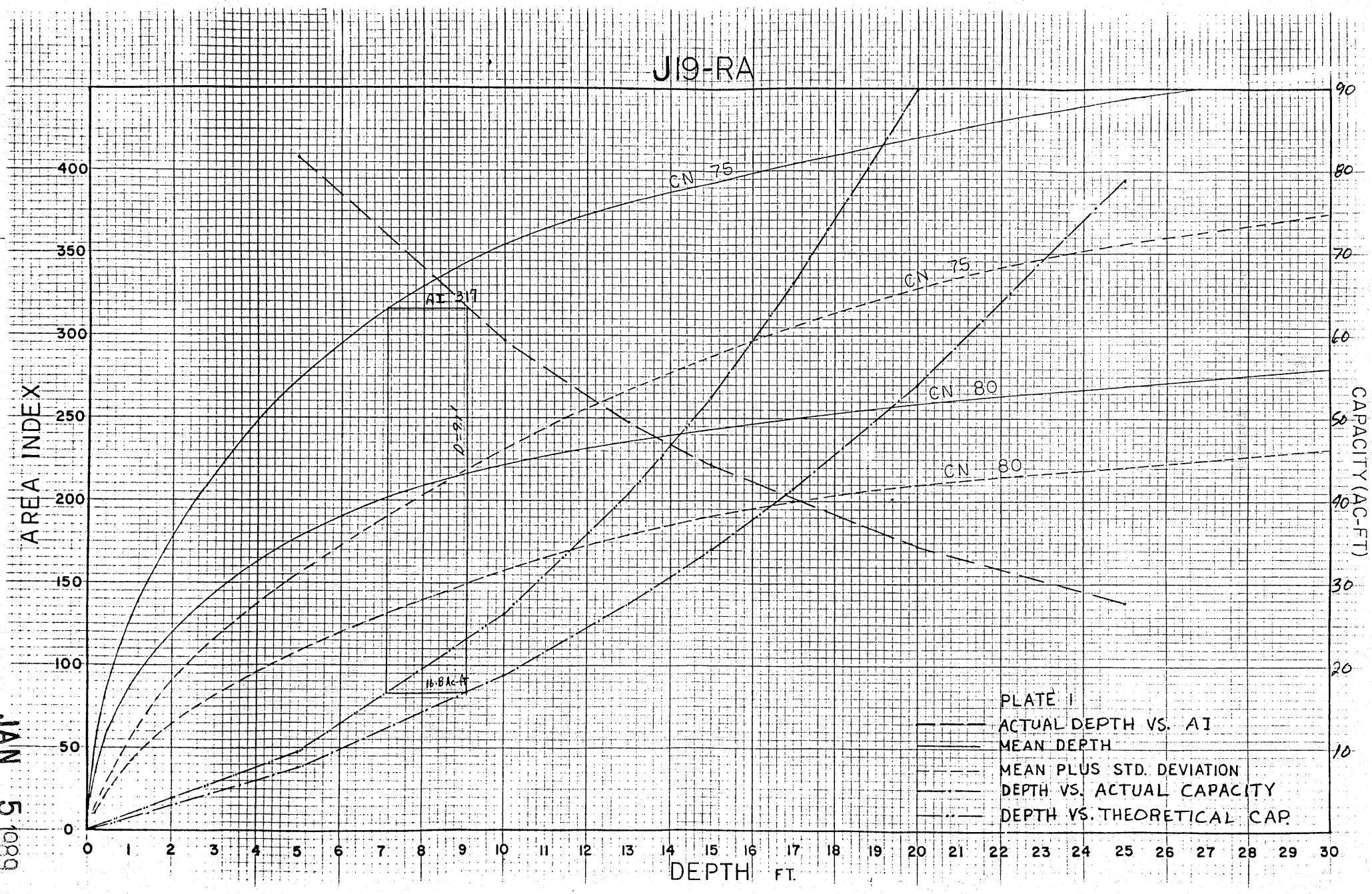
AI: Area Index = A_B/A_P

Notes: Proposed Internal Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	N/A	1.240	780.06	0	629	0
3		1.612	779.688	4.8	484	4.3
5		1.882	779.418	9.4	414	7.8
10		2.640	778.66	26.4	295	19.0
13		3.150	778.15	41.0	247	27.6
15		3.513	777.787	52.7	221	34.2
17		3.894	777.406	66.2	200	41.5
20		4.500	776.80	90.0	173	54.0
25		5.602	775.698	140.0	138	79.0

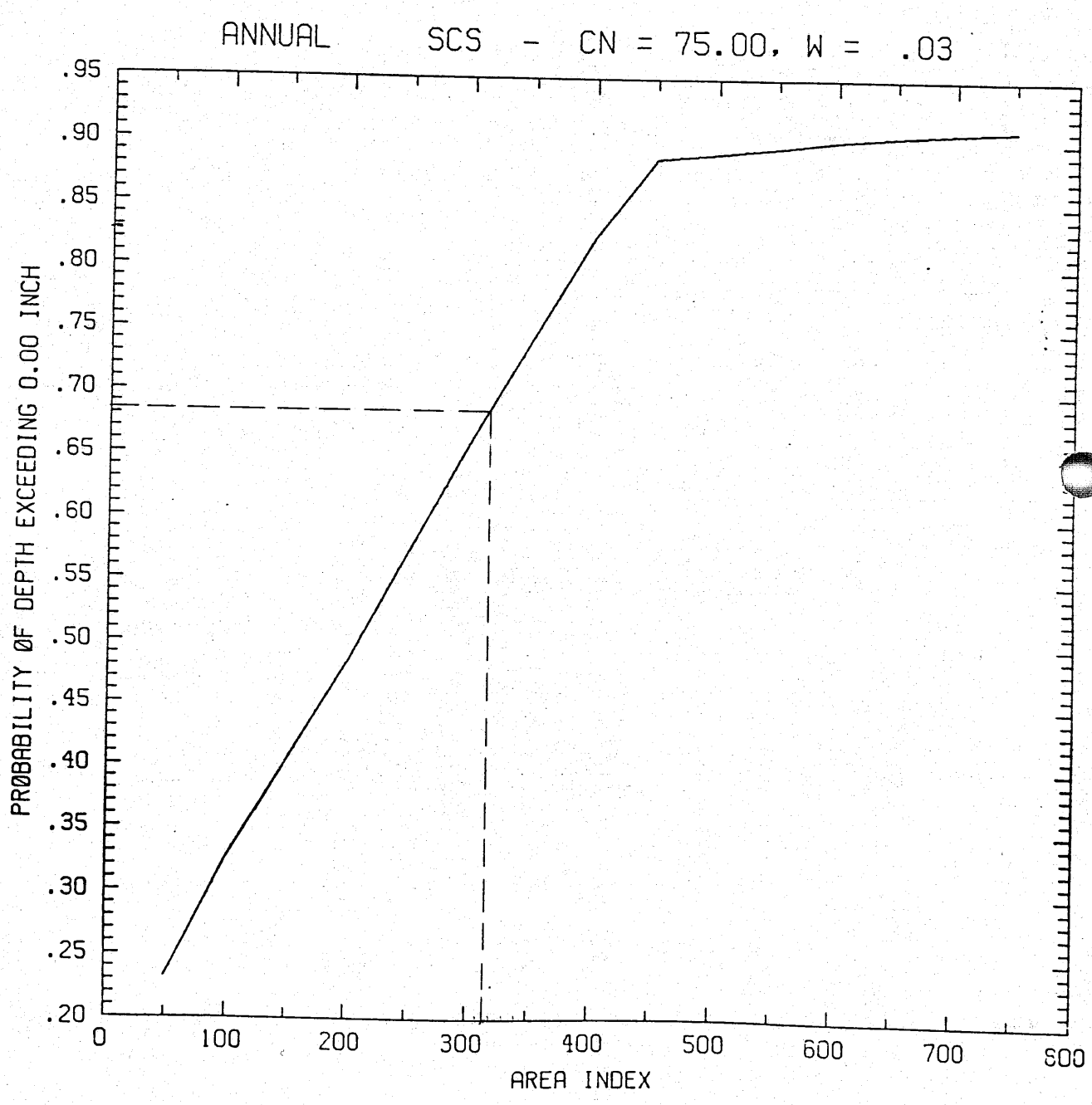
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	9.1 ft	--
	Minimum Depth (MIN)	--	3.0 ft
	Actual Capacity	16.8 Ac-ft	4.6 Ac-ft
	AI	317	484
Plate 2 or 3:	Probability	68%	85%


J19-RA
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 317
16.8 AC-FT
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

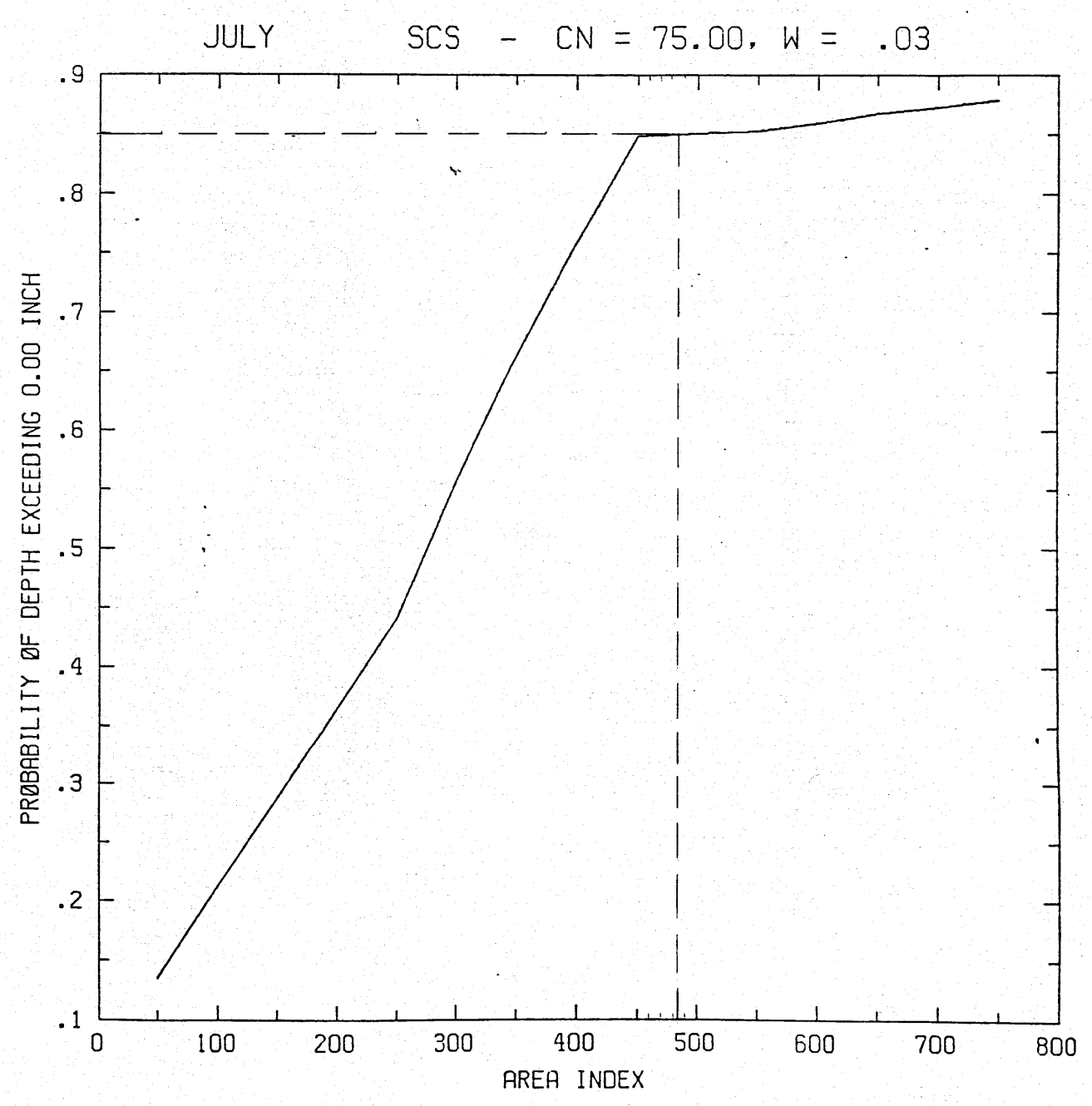
JAN 5 1988

J19-RA



Annual Mean Depth
Plate 2

J19-RA



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 19

PERMANENT IMPOUNDMENT

J19-RB

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J19-RB

A_D: 815.1 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

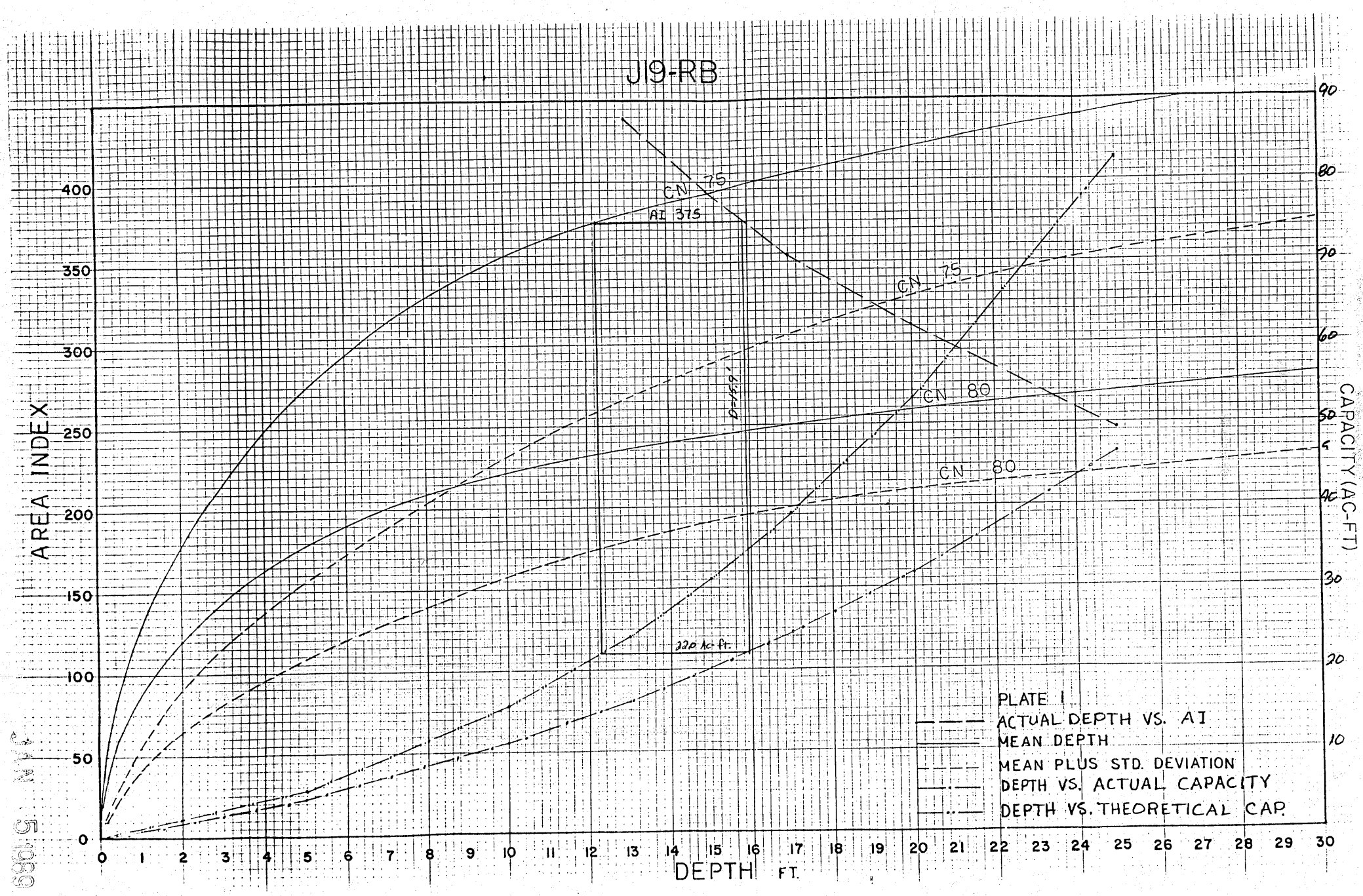
Notes: Proposed Internal Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	N/A	0.723	814.277	0.0	1126	0.0
3		0.941	814.159	2.8	866	2.5
5		1.102	813.898	5.5	739	4.6
10		1.550	813.45	15.5	525	11.1
13		1.851	813.149	24.1	439	16.2
15		2.066	812.934	31.0	393	20.0
17		2.292	812.708	39.0	354	24.4
20		2.652	812.35	53.0	306	31.7
25		3.306	811.69	82.6	246	46.5

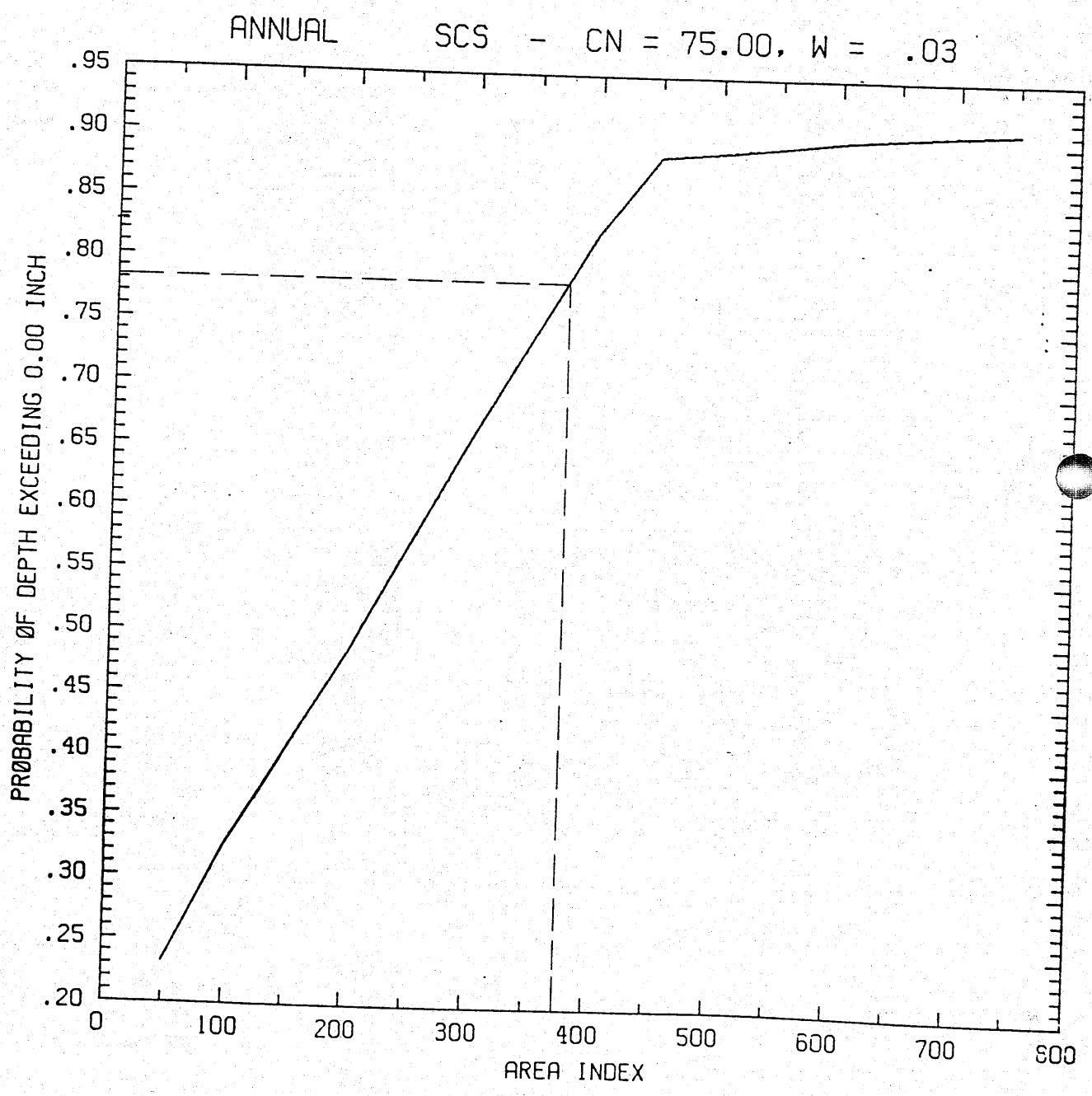
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	15.9 ft	--
	Minimum Depth (MIN)	--	3.0 ft
	Actual Capacity	22.0 Ac-ft	2.5 Ac-ft
	AI	375	866
Plate 2 or 3:	Probability	78%	88+%

JAN 5

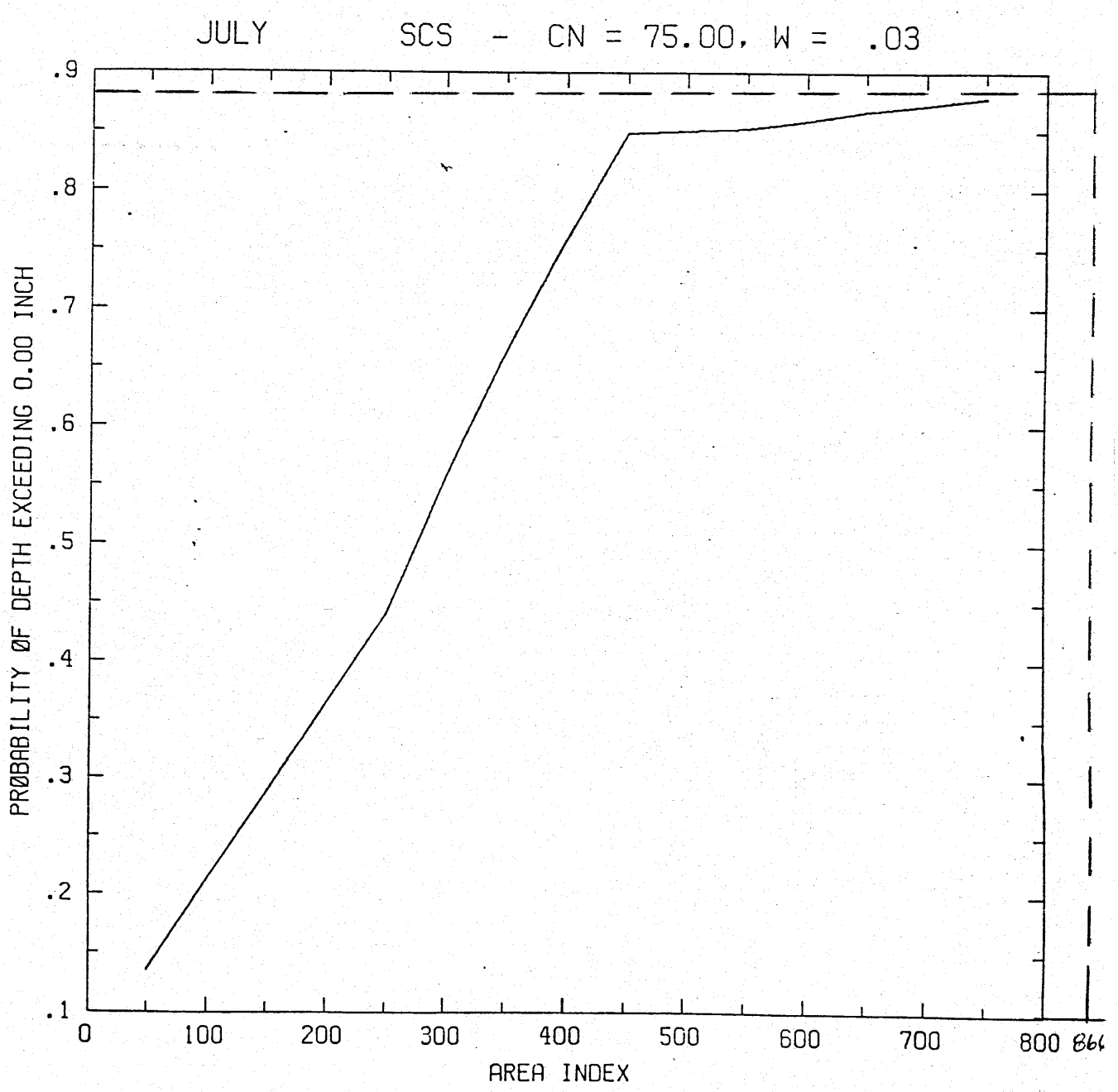

J9-RB
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
AI 375
CN 75
CN 80
CN 80
220 Ac-Ft.
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

J19-RB



Annual Mean Depth
Plate 2

J19-RB



Minimum Depth
Plate 3

5 1989

JAN 5.1989

PERMANENT IMPOUNDMENT

J21-A

WATER PERSISTENCE WORKSHEET

5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J21-A

A_D: 544.0 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

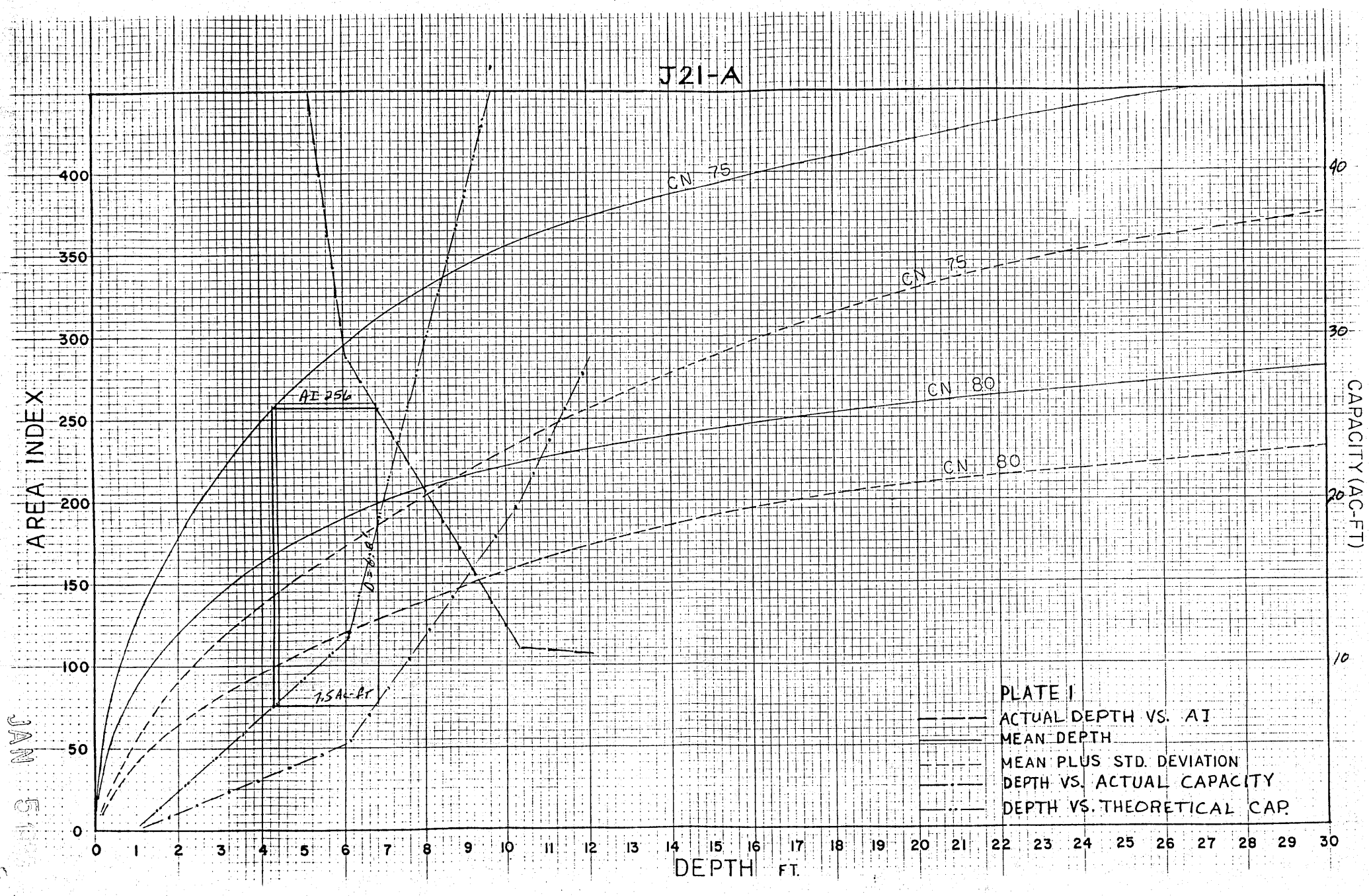
Notes: Proposed Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6924	0.001	543.999	0	543999	0.0
1	6925	0.178	543.822	0.2	3055	0.1
3	6927	0.688	543.312	2.1	790	2.1
6	6930	1.898	542.102	11.4	286	5.3
10.2	6934.2	4.921	539.079	50.2	110	19.6
12	6936.0	5.035	538.965	60.4	107	28.6

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

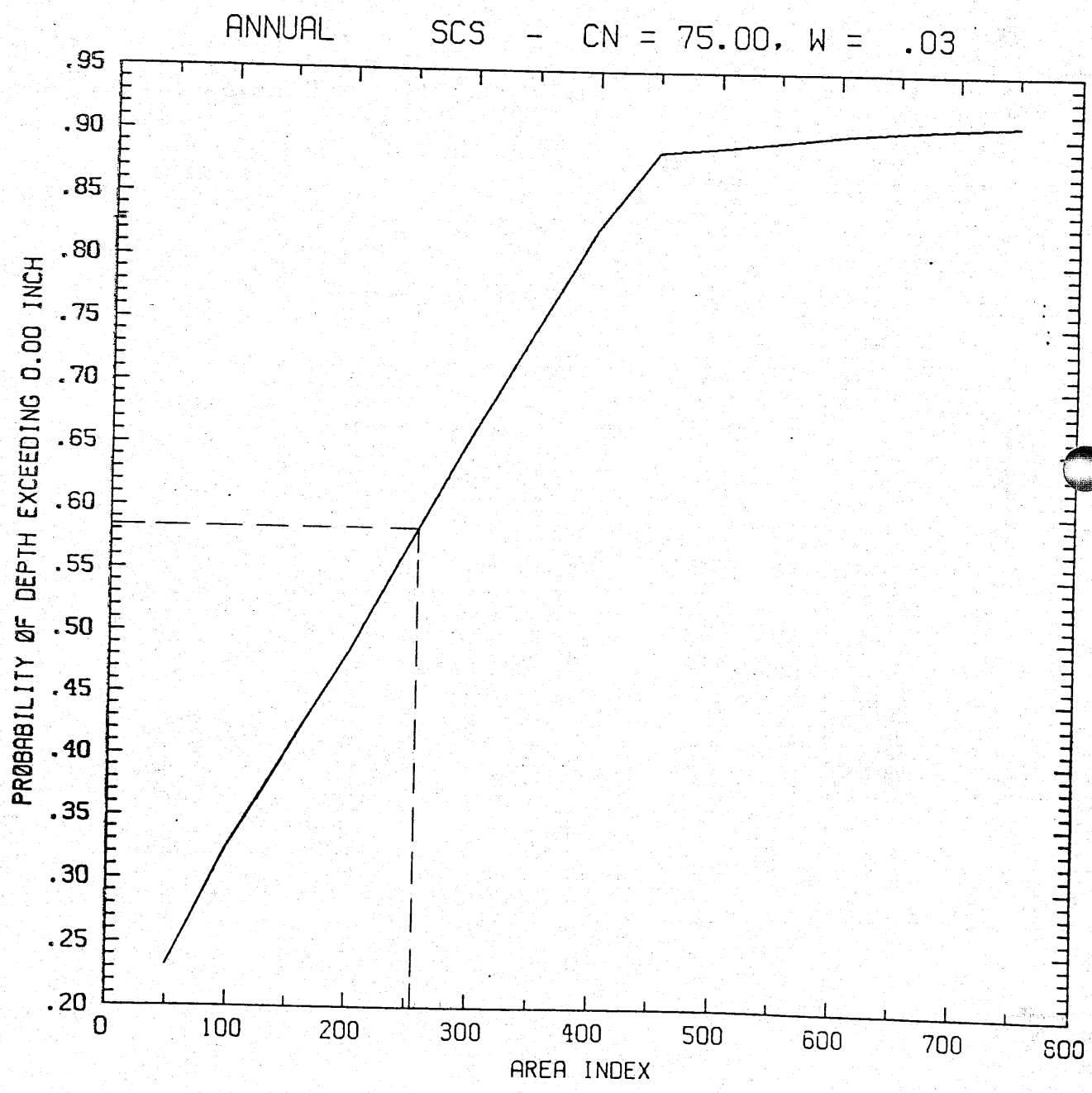
Plate 1:	Annual Mean Depth (AMD)	6.8 ft	--
	Minimum Depth (MIN)	--	3.0 ft
	Actual Capacity	7.5 Ac-ft	2.6 Ac-ft
	AI	256	790
Plate 2 or 3:	Probability	58%	88%

JAN 5 1989


J21-A
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 256
7.5 AC-FT
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

JAM 54

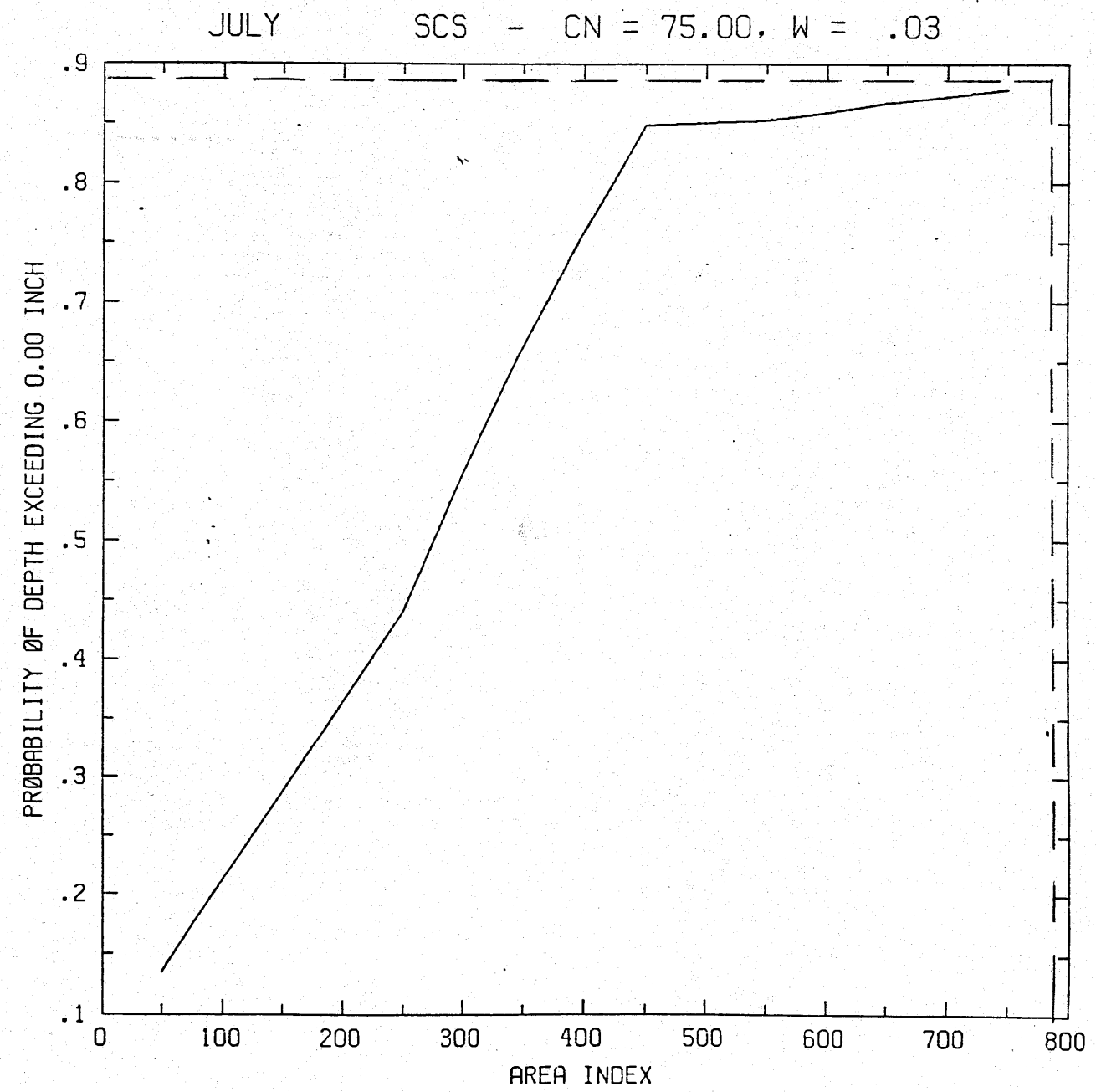
J21-A



Annual Mean Depth
Plate 2

JAN 5 1989

J21-A



Minimum Depth
Plate 3

JAN 5 19

JAN 5 1985

PERMANENT IMPOUNDMENT

J21-C

WATER PERSISTENCE WORKSHEET

5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J21-C

A_D: 780.3 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

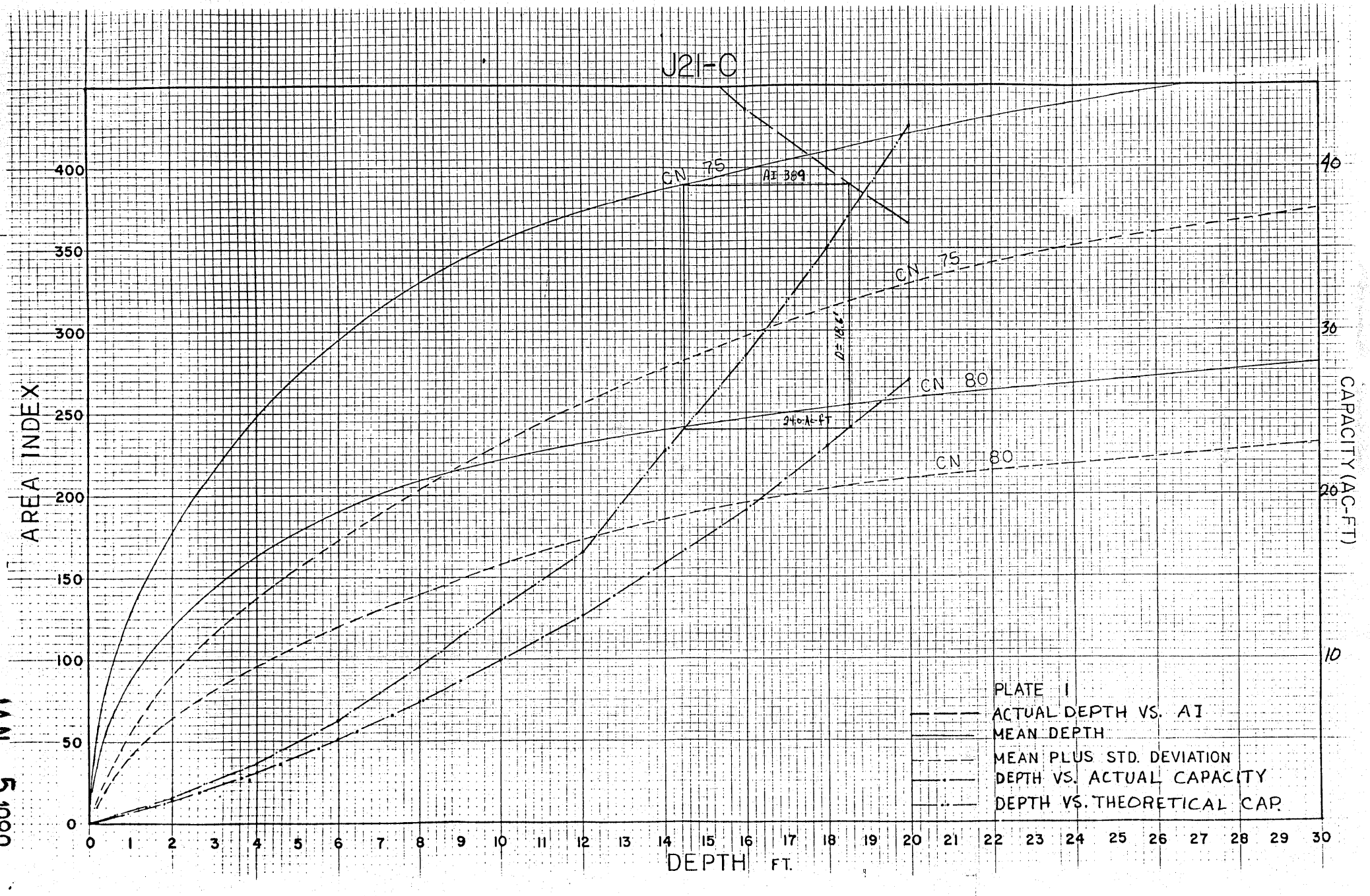
Notes: Proposed Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	N/A	0.689	779.611	0	1132	0
2		0.802	779.5	1.6	972	1.5
4		0.922	779.4	3.7	845	3.2
6		1.049	779.3	6.3	743	5.2
8		1.182	779.1	9.5	659	7.4
10		1.322	778.978	13.2	589	9.9
12		1.469	778.831	17.6	530	12.7
14		1.622	778.7	22.7	480	15.8
16		1.782	778.5	28.5	437	19.2
18		1.948	778.4	35.1	400	22.9
20		2.121	778.2	42.4	367	27.0

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

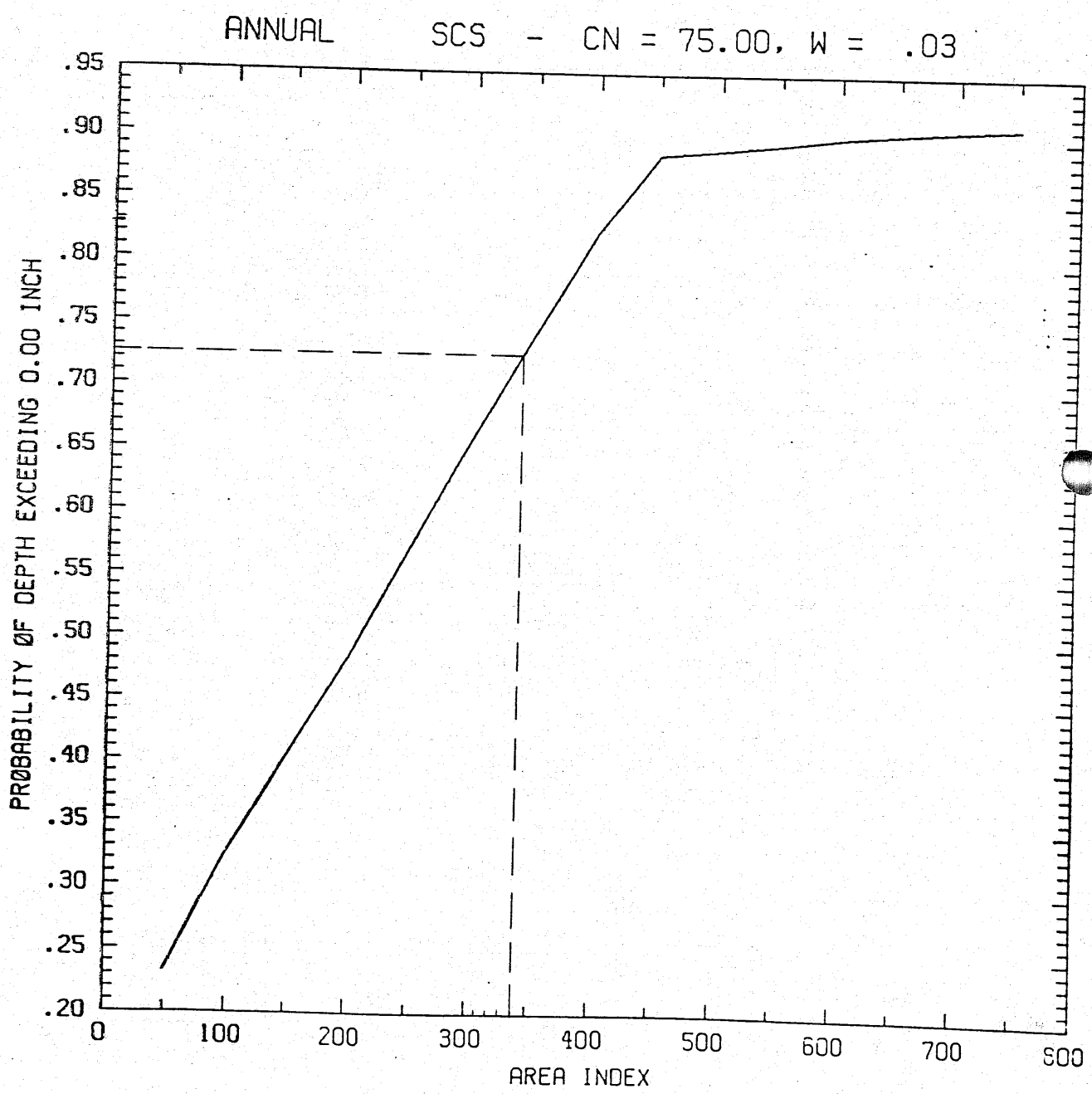
Plate 1:	Annual Mean Depth (AMD)	18.6 ft	--
	Minimum Depth (MIN)	--	3.0 ft
	Actual Capacity	24.0 Ac-ft	2.3 Ac-ft
	AI	389	905
Plate 2 or 3:	Probability	73%	88+%

JAN 5 1


J21-C
CN 75
AI 389
CN 75
D= 19.6'
CN 80
240 AC-FT
CN 80
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

JAN 5 1989

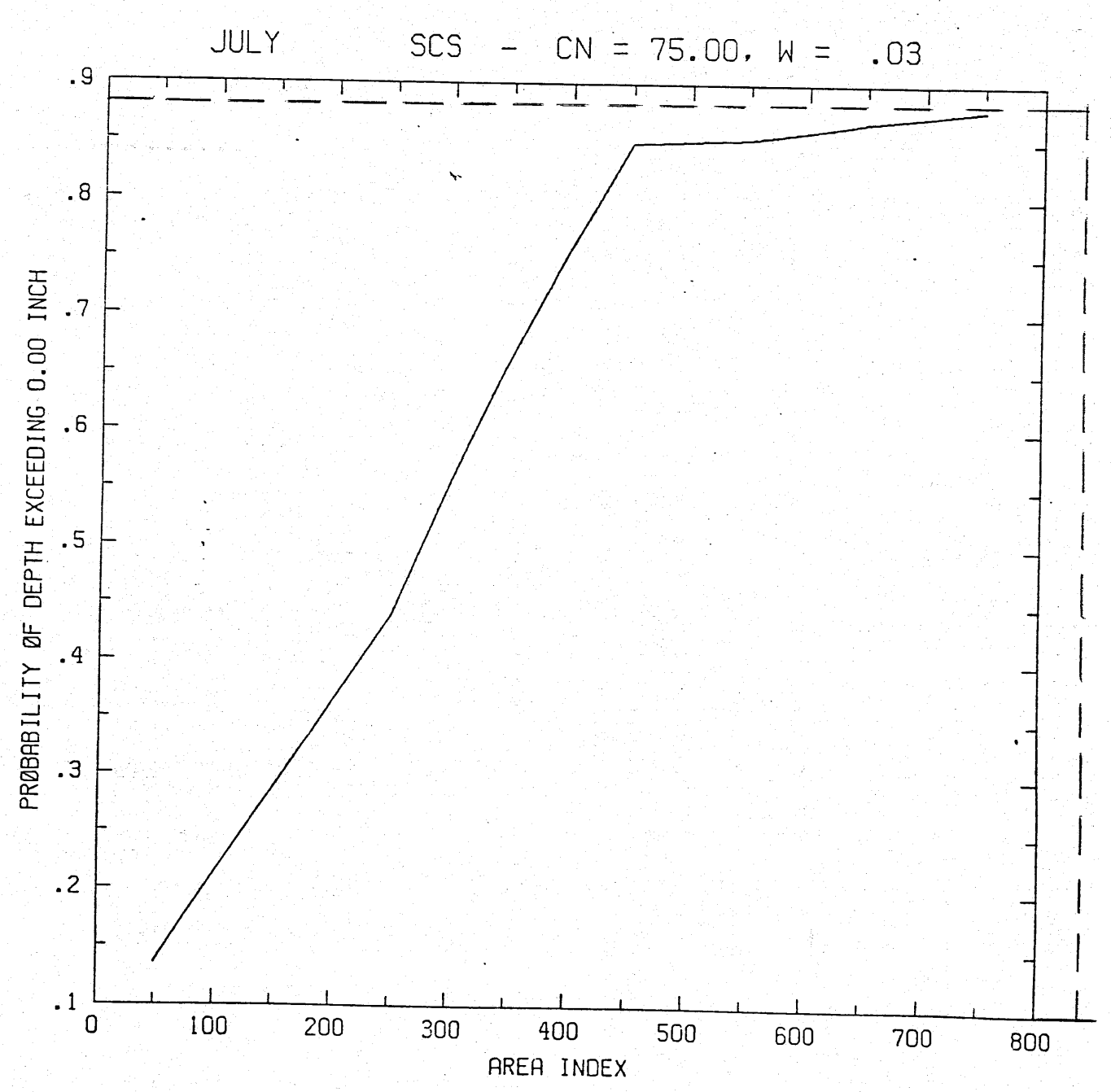
J21-C



Annual Mean Depth
Plate 2

JAN 5

J21-C



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 1989

PERMANENT IMPOUNDMENT

J21-I

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: J21-I

A_D: 780.4 Acres

Depth: From Bottom Elevation

A_D: Total Drainage Area

A_P: Surface Area of Pond

A_B: Watershed Area = A_D - A_P

Theoretical Capacity: A_P x Depth

AI: Area Index = A_B/A_P

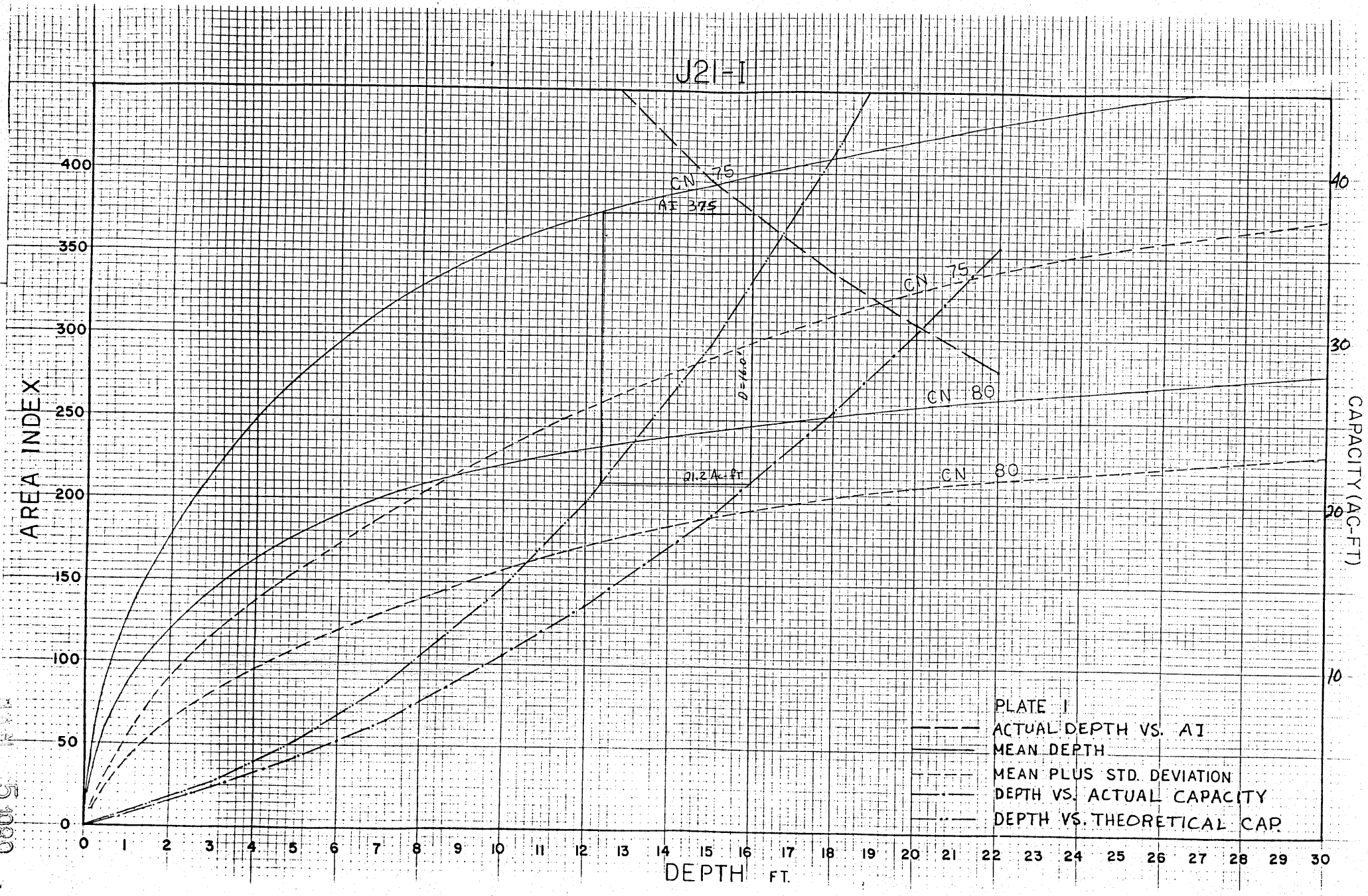
Notes: Proposed Impoundment

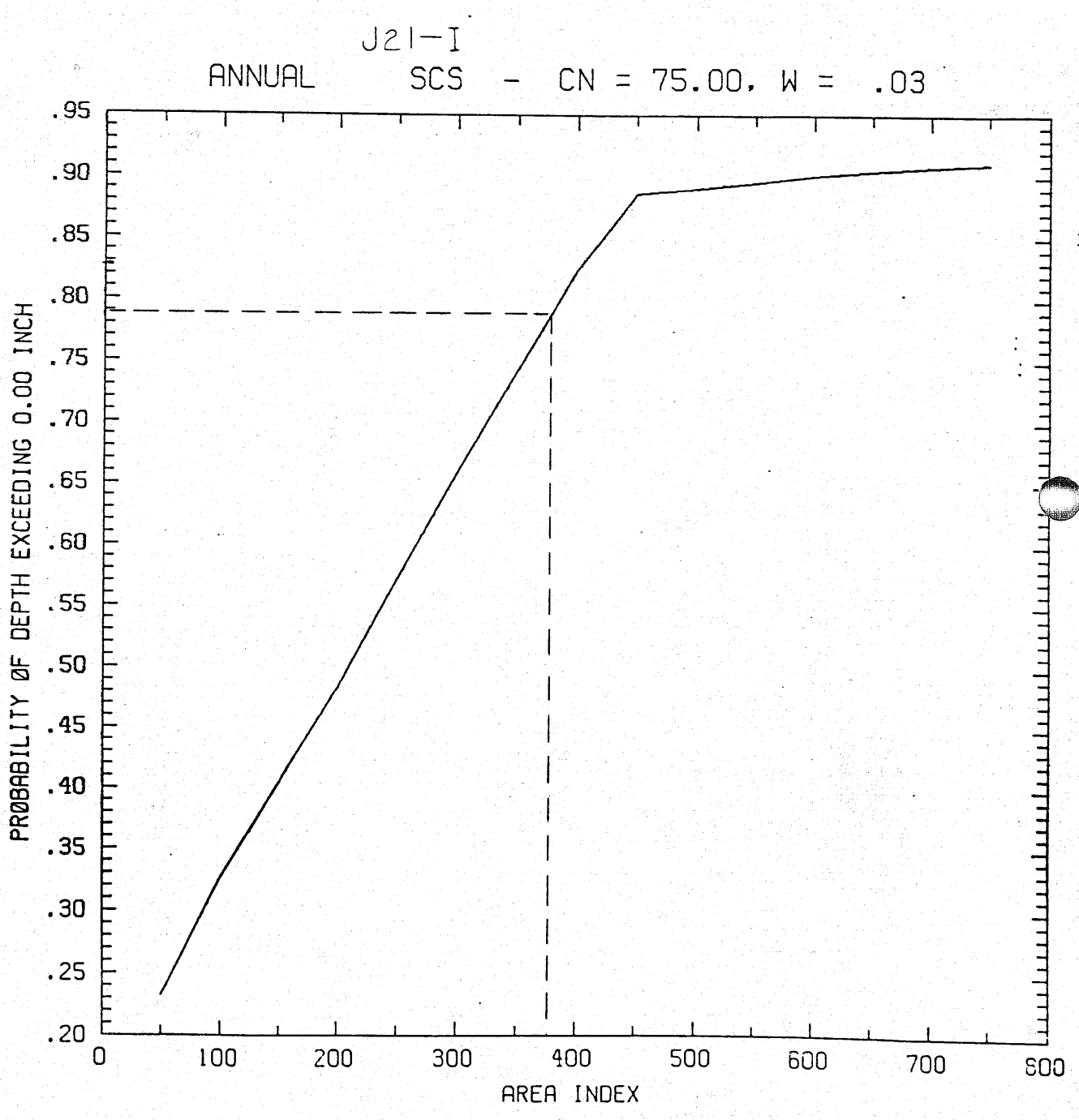
Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	N/A	0.689	779.711	0	1132	0
3		0.894	779.506	2.7	872	2.4
5		1.045	779.355	5.3	746	4.3
7		1.206	779.194	8.4	646	6.6
10		1.469	778.931	14.7	530	10.6
12		1.658	778.742	19.9	470	13.7
15		1.963	778.437	29.4	397	19.1
18		2.292	778.108	41.2	339	25.5
20		2.525	777.875	50.5	308	30.3
22		2.770	777.630	60.9	281	35.6

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	16.0 ft	--
	Minimum Depth (MIN)	--	3.0 ft
	Actual Capacity	21.2 ac-ft	2.4 ac-ft
	AI	375	872
Plate 2 or 3:	Probability	79%	88+%

JAN 5 1989

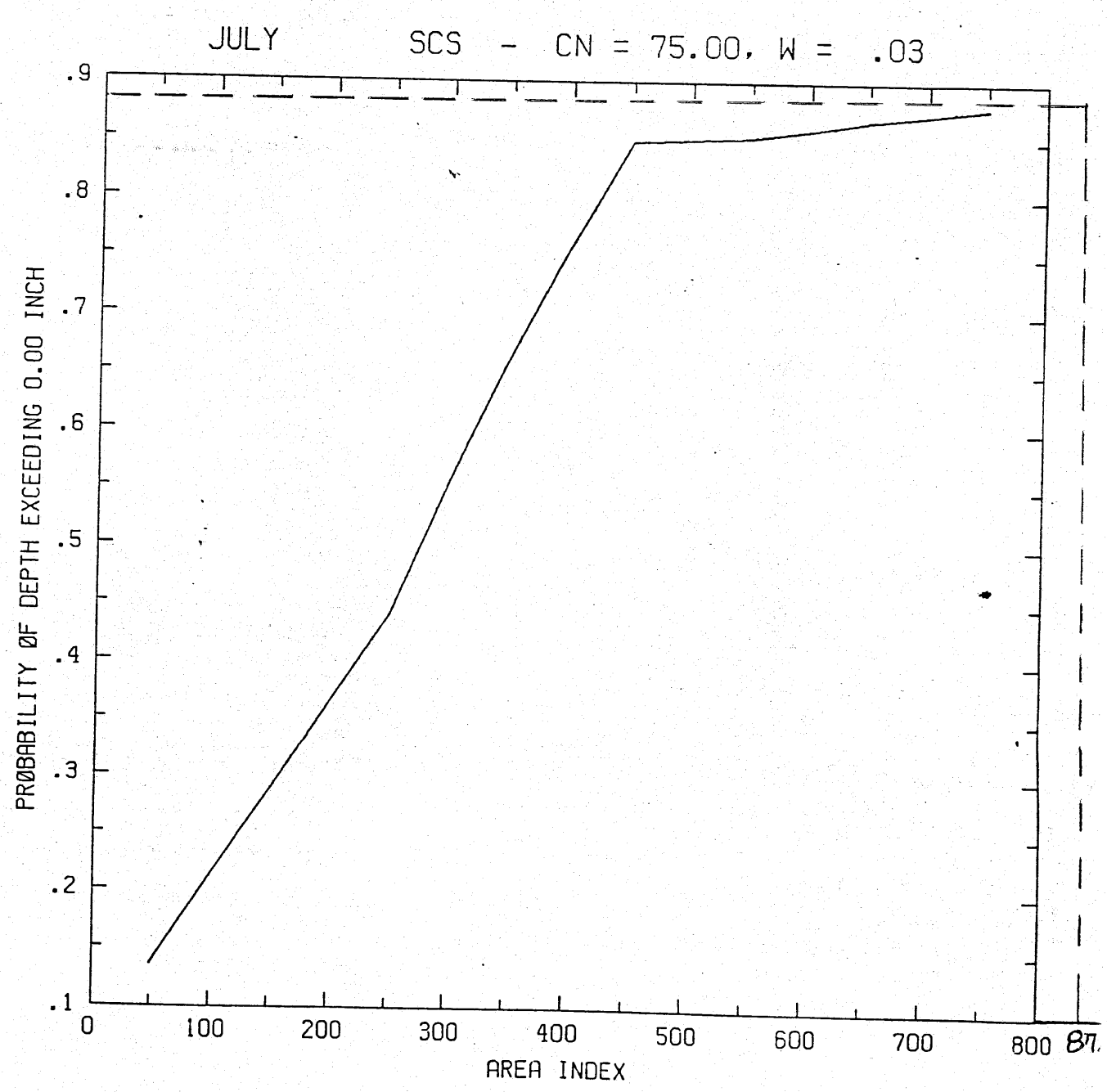

J21-I
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
AI 375
D=16.0'
21.2 AC-FT
CN 75
CN 80
CN 80
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.



Annual Mean Depth
Plate 2

JAN 5 1989

J21-I



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: ____ N2-RA

Ad: 317.0 Acres

Depth: From Bottom Elevation
Ad: Total Drainage Area
Ap: Surface Area of Pond
Notes: Existing Impoundment

Ab: Watershed Area = Ad - Ap
Theoretical Capacity: Ap x Depth
AI: Area Index = Ab / Ap

Depth (ft)	Elevation (ft amsl)	Ap (ac)	Ab (ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6,523.80	0.00	317.00	0.0	-	0.0
2	6,525.80	0.52	316.48	1.0	609	0.5
4	6,527.80	0.80	316.20	3.2	395	1.8
6	6,529.80	0.98	316.02	5.9	322	3.6
8	6,531.80	1.14	315.86	9.1	277	5.7
10	6,533.80	1.28	315.72	12.8	247	8.2
12	6,535.80	1.44	315.56	17.3	219	10.9
14	6,537.80	1.62	315.38	22.7	195	13.9
16	6,539.80	1.84	315.16	29.4	171	17.4
18	6,541.80	2.12	314.88	38.2	149	21.4
20	6,543.80	2.42	314.58	48.4	130	25.9
22	6,545.80	2.80	314.20	61.6	112	31.1
24	6,547.80	3.28	313.72	78.7	96	37.2
26	6,549.80	3.80	313.20	98.8	82	44.3
28	6,551.80	4.36	312.64	122.1	72	52.4
30	6,553.80	5.18	311.82	155.4	60	62.0
32	6,555.80	6.38	310.62	204.2	49	73.5
33.7	6,557.50	7.44	309.56	250.7	42	85.3
34	6,557.80	7.64	309.36	259.8	40	87.5

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	7.2 ft	--
	Minimum Depth (MIN)	--	4.4 ft
	Actual Capacity	4.6 ac-ft	2.0 ac-ft
	AI	290	380
Plate 2 or 3:	Probability	64%	72%

K+E 10 X 10 TO ½ INCH • 7½ X 10 INCHES
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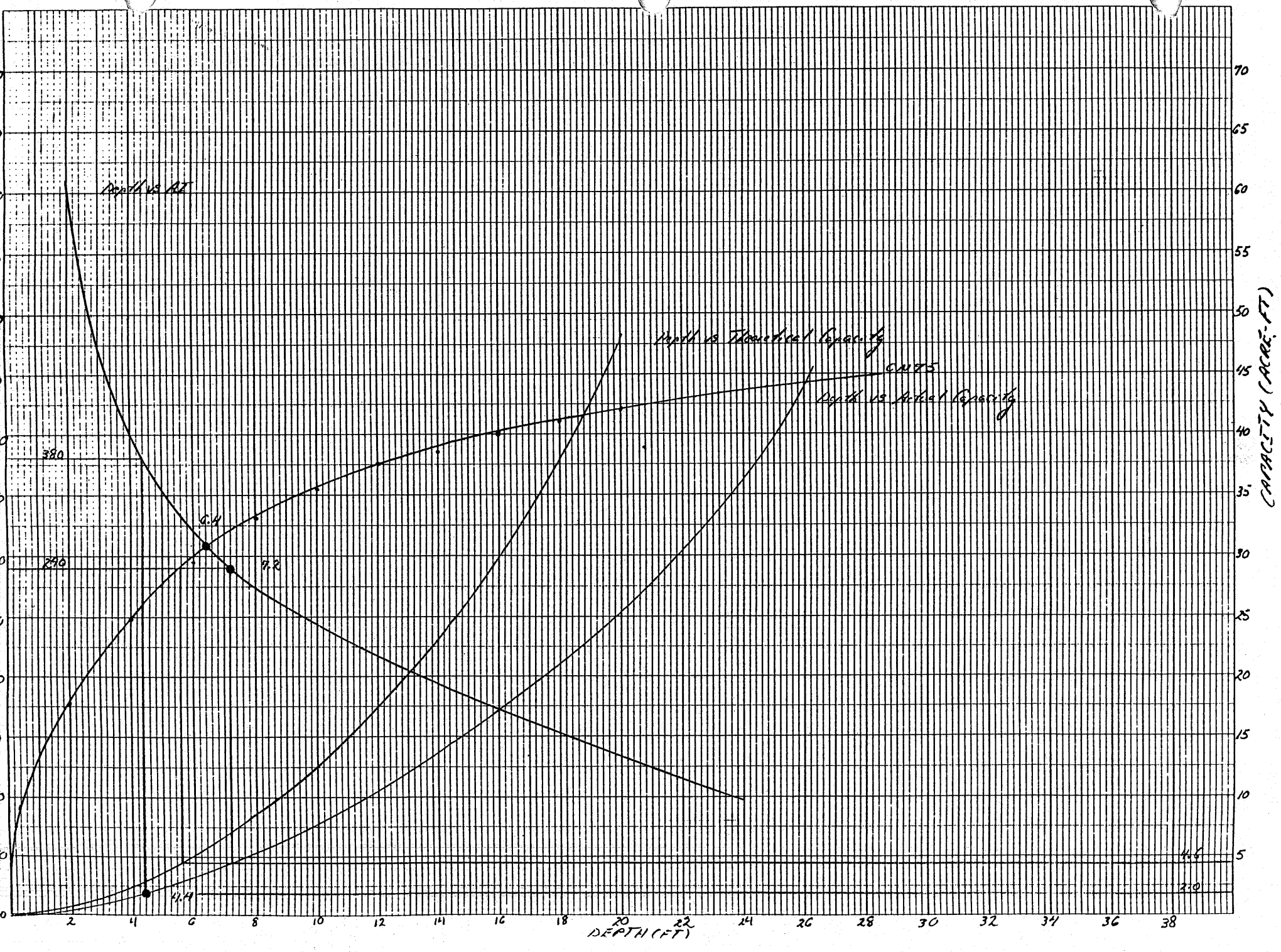
N2-RA



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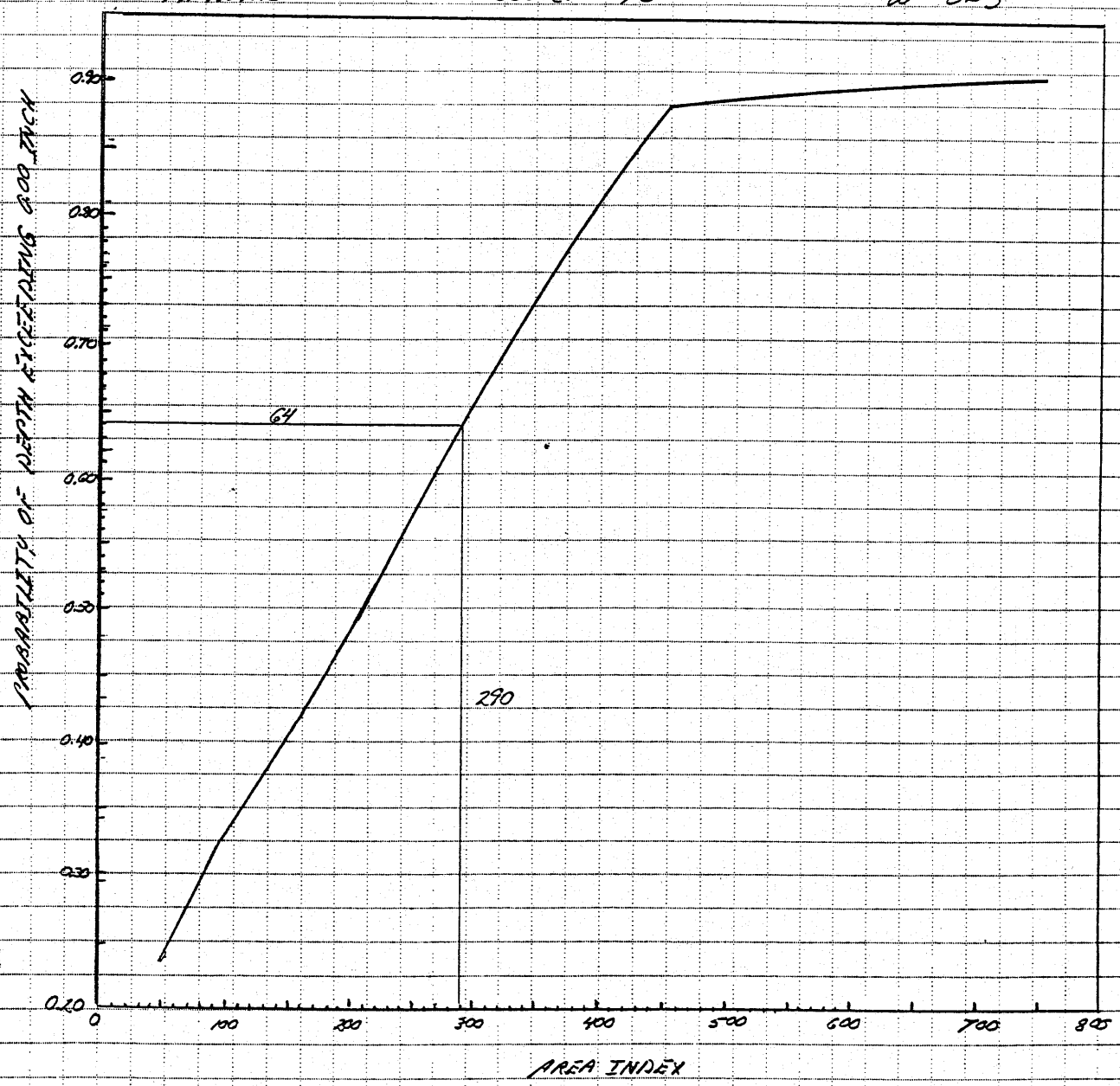
N2-RA

ANNUAL SCS CN - 75 Q = 0.03



ANNUAL MEAN DEPTH
Plate 2

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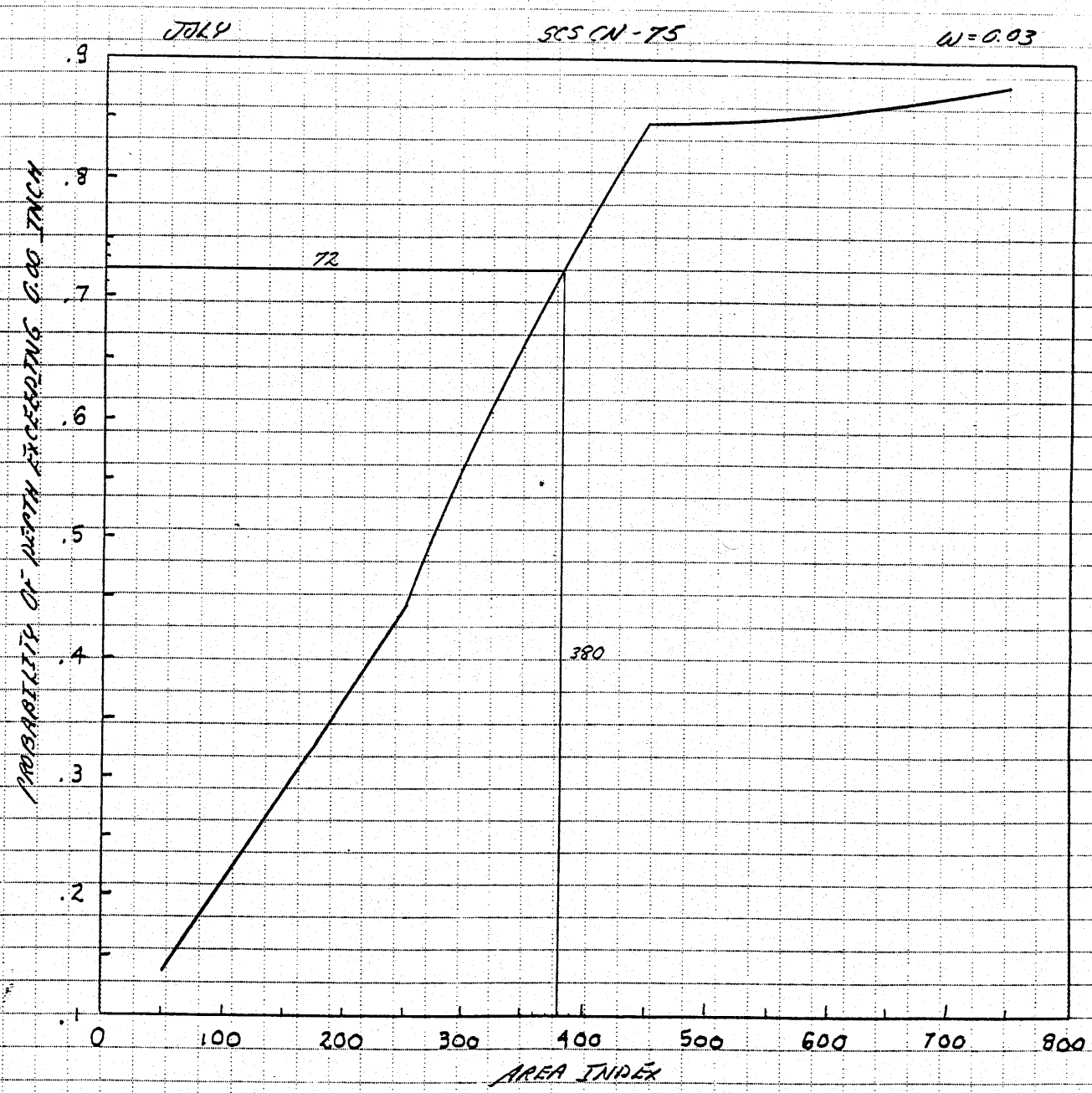
N2-RA



MINIMUM DEPTH
Plate 3

WATER PERSISTENCE WORKSHEET

Pond ID: ____ N2-RB

Depth: From Bottom Elevation
Ad: Total Drainage Area
Ap: Surface Area of Pond
Notes: Existing Impoundment

Ad: 349.8 Acres
Ab: Watershed Area = Ad - Ap
Theoretical Capacity: Ap x Depth
AI: Area Index = Ab / Ap

Depth (ft)	Elevation (ft amsl)	Ap (ac)	Ab (ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6,641.70	0.00	349.80	0.0	-	0.0
2	6,643.70	1.08	348.72	2.2	323	1.1
4	6,645.70	1.78	348.02	7.1	196	3.9
6	6,647.70	2.44	347.36	14.6	142	8.2
8	6,649.70	2.96	346.84	23.7	117	13.6
10	6,651.70	3.34	346.46	33.4	104	19.9
12	6,653.70	3.62	346.18	43.4	96	26.8
14	6,655.70	3.96	345.84	55.4	87	34.4
16	6,657.70	4.32	345.48	69.1	80	42.7
18	6,659.70	4.64	345.16	83.5	74	51.6
20	6,661.70	5.08	344.72	101.6	68	61.4
22	6,663.70	5.52	344.28	121.4	62	72.0
23.9	6,665.60	6.05	343.75	144.6	57	83.0
24	6,665.70	6.10	343.70	146.4	56	83.6

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	3.9 ft	--
	Minimum Depth (MIN)	--	3.0 ft
	Actual Capacity	3.6 ac-ft	2.4 ac-ft
	AI	205	245
Plate 2 or 3:	Probability	49%	44%

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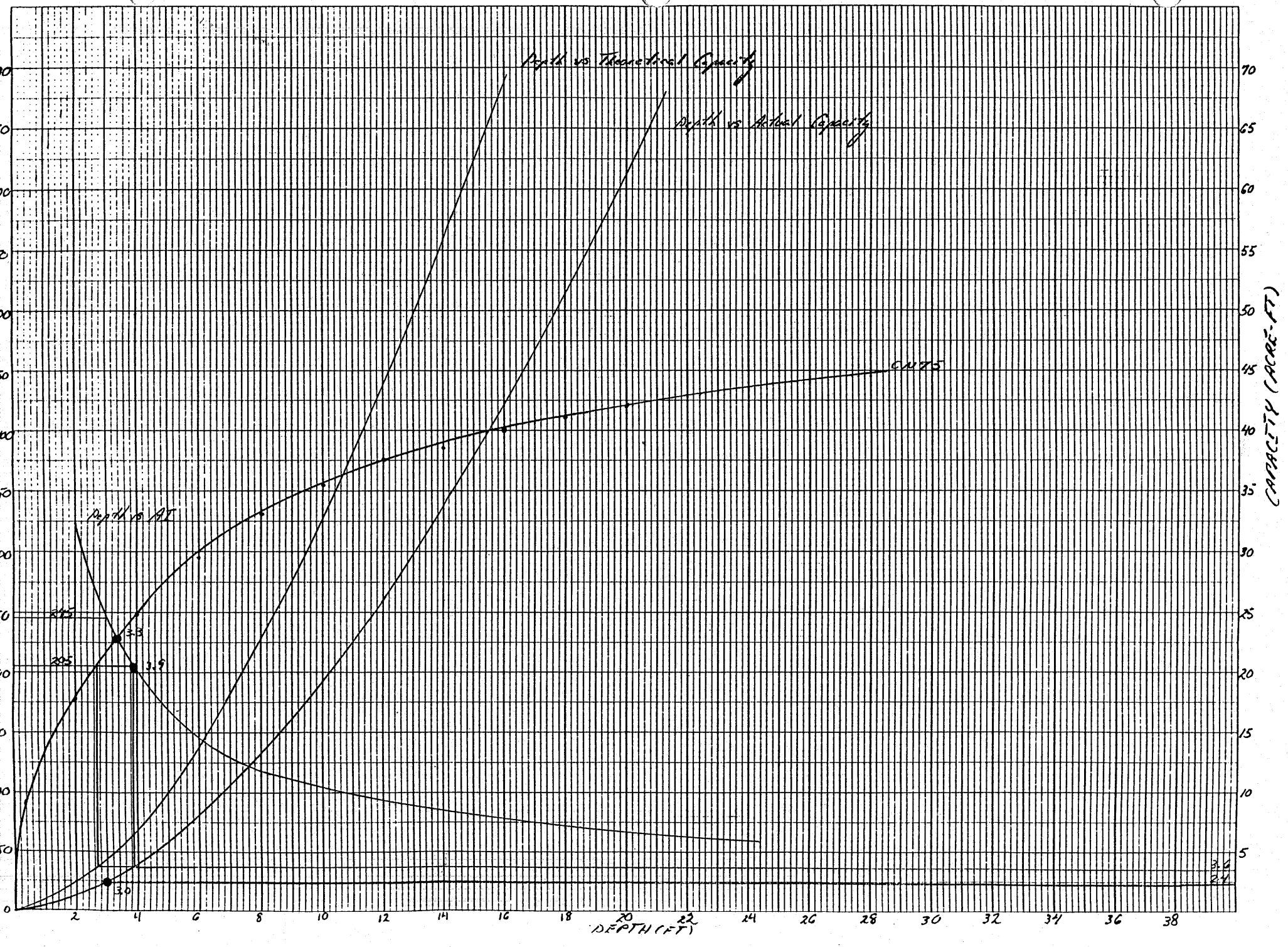
N2-RB



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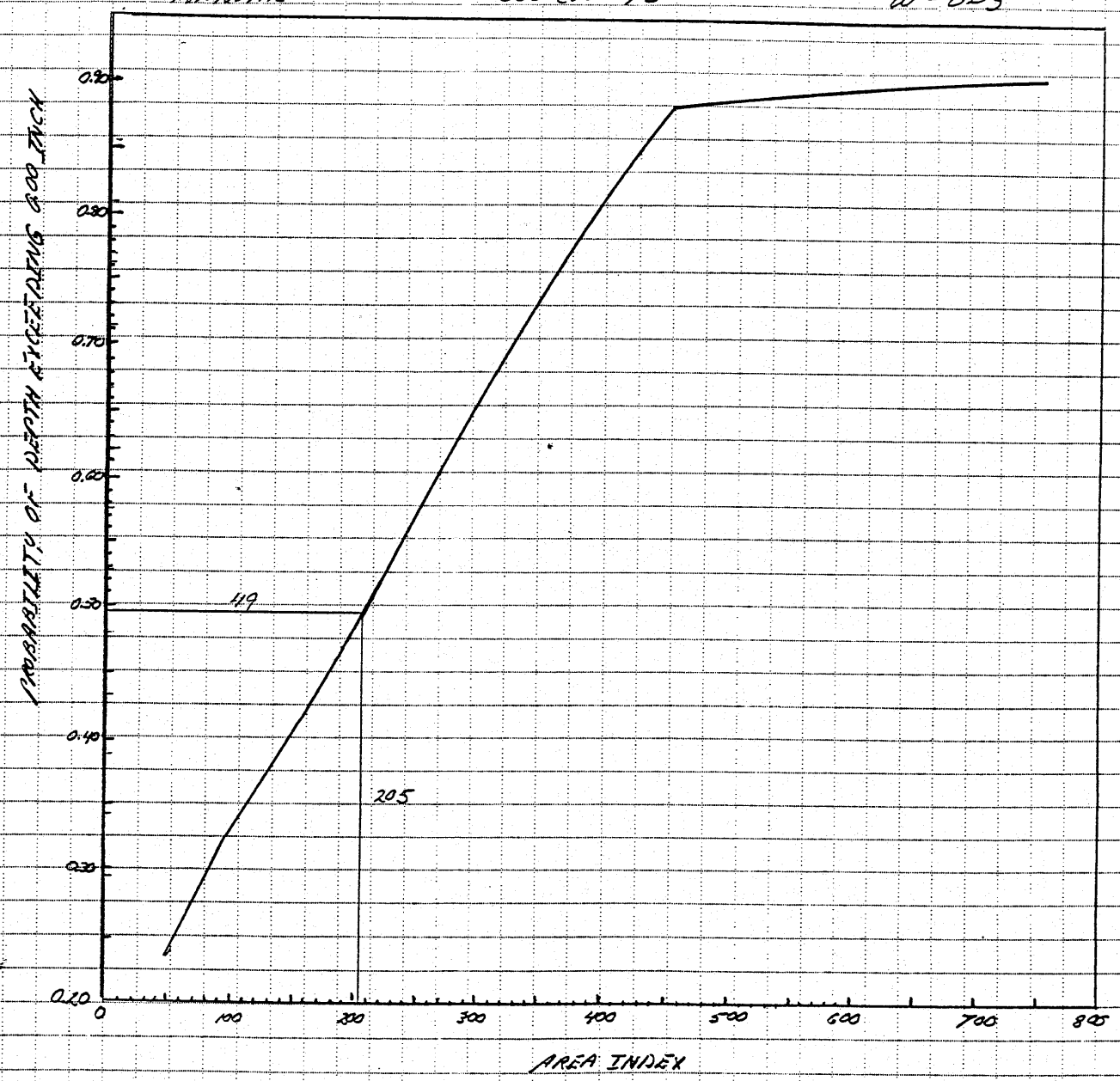
N2-RB

ANNUAL SCS CN-75 W = CD3



ANNUAL MEAN DEPTH
Plate 2

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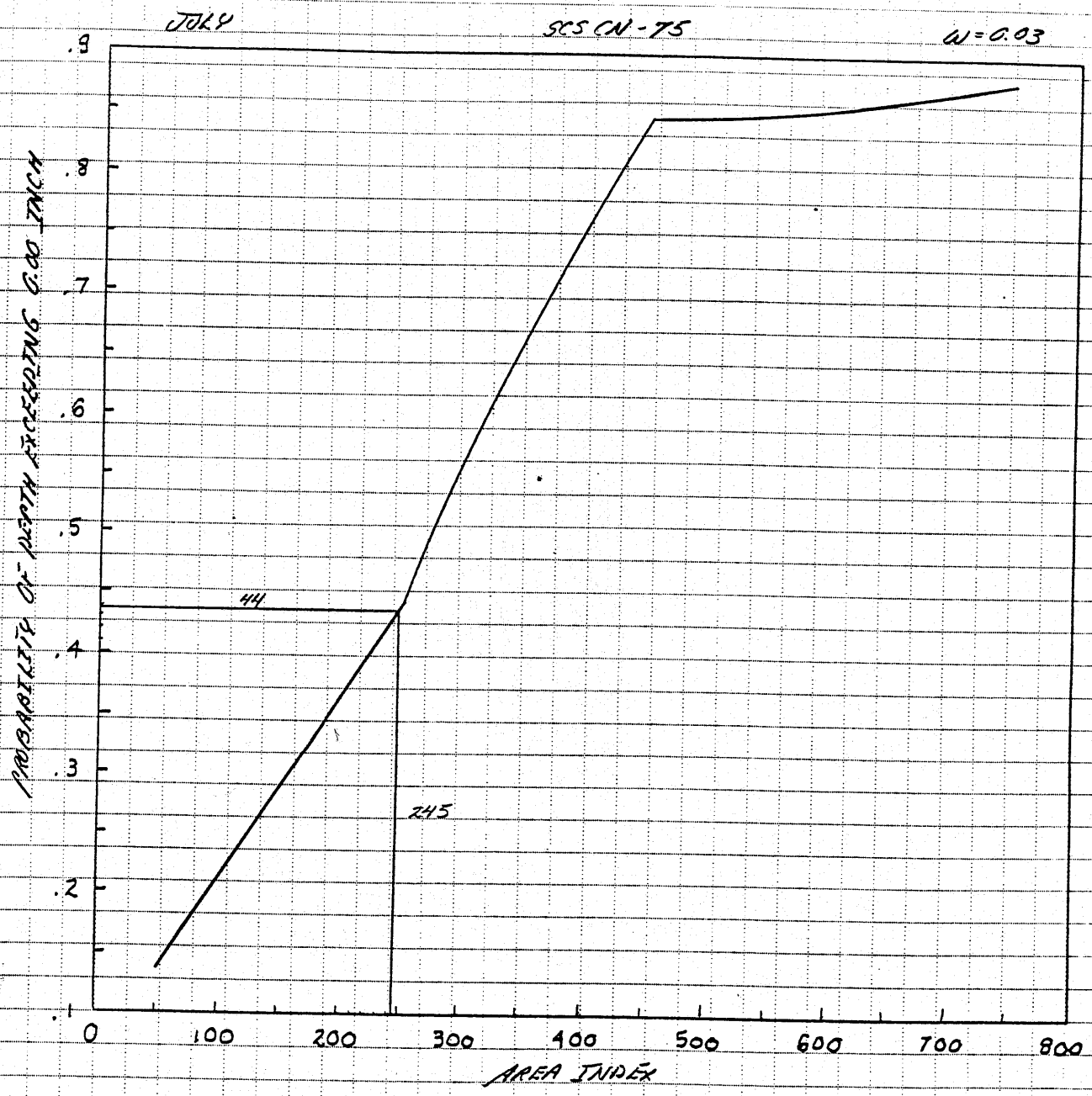
Date:

N2-RB



MINIMUM DEPTH
Plate 3

WATER PERSISTENCE WORKSHEET

Pond ID: ____ N2-RC

Depth: From Bottom Elevation
Ad: Total Drainage Area
Ap: Surface Area of Pond
Notes: Existing Impoundment

Ad: 156.2 Acres
Ab: Watershed Area = Ad - Ap
Theoretical Capacity: Ap x Depth
AI: Area Index = Ab / Ap

Depth (ft)	Elevation (ft amsl)	Ap (ac)	Ab (ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6,796.00	0.00	156.20	0.0	-	0.0
2	6,798.00	0.55	155.65	1.1	283	0.6
4	6,800.00	1.00	155.20	4.0	155	2.1
6	6,802.00	1.64	154.56	9.8	94	4.7
8	6,804.00	2.43	153.77	19.4	63	8.8
10	6,806.00	3.36	152.84	33.6	45	14.6
12	6,808.00	4.20	152.00	50.4	36	22.2
14	6,810.00	5.14	151.06	72.0	29	31.5
16	6,812.00	6.44	149.76	103.0	23	43.1
18	6,814.00	9.42	146.78	169.6	16	58.9
20	6,816.00	14.06	142.14	281.2	10	82.4
22	6,818.00	15.95	140.25	350.9	9	112.4
23	6,819.00	16.98	139.22	390.5	8	128.9
24	6,820.00	18.00	138.20	432.0	8	146.4

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	3.4 ft	--
	Minimum Depth (MIN)	--	3.9 ft
	Actual Capacity	1.5 ac-ft	2.0 ac-ft
	AI	190	160
Plate 2 or 3:	Probability	47%	30%

K+E 10 X 10 TO ½ INCH • 7½ X 10 INCHES
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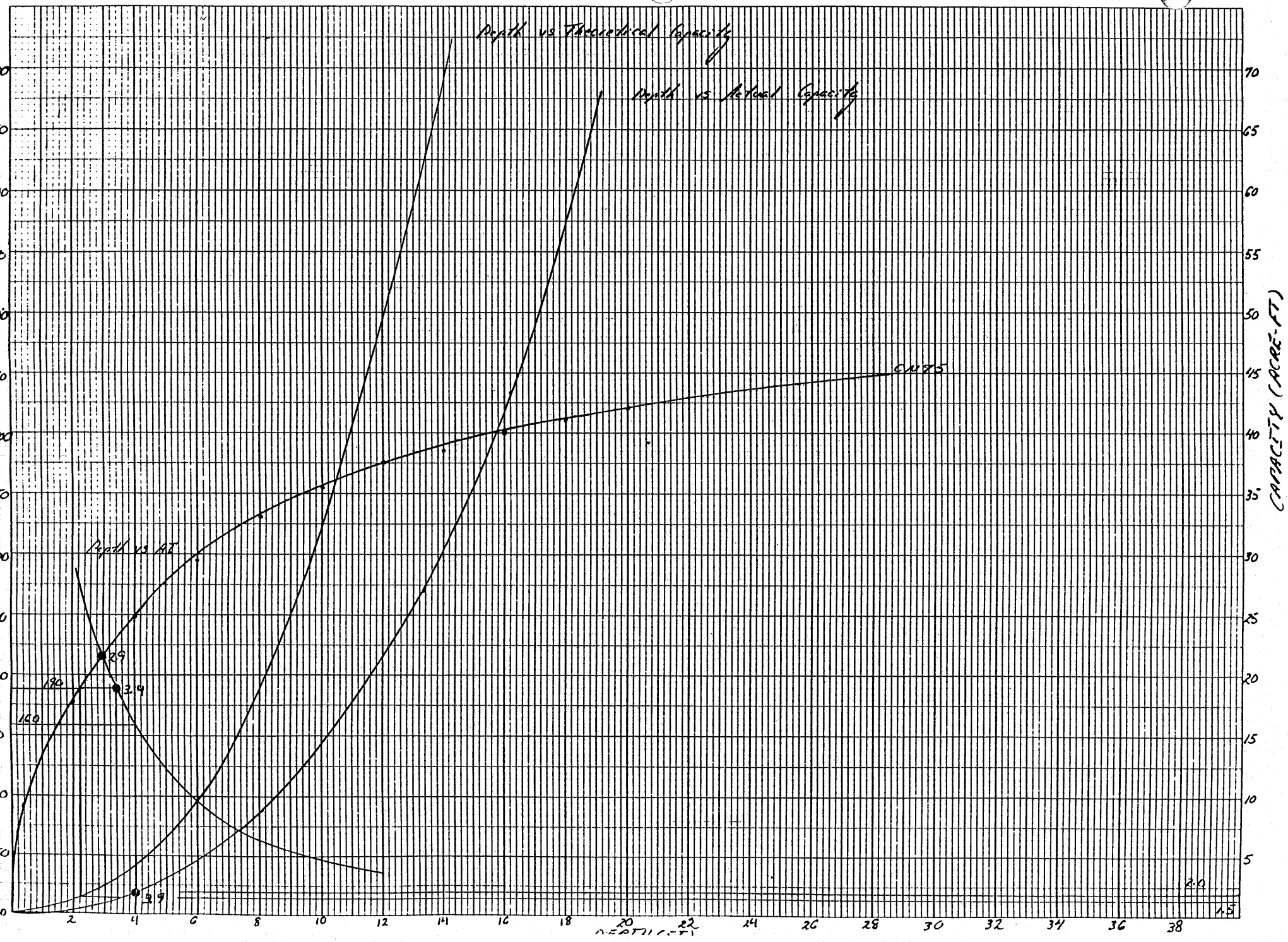
46 1470

N2-RC



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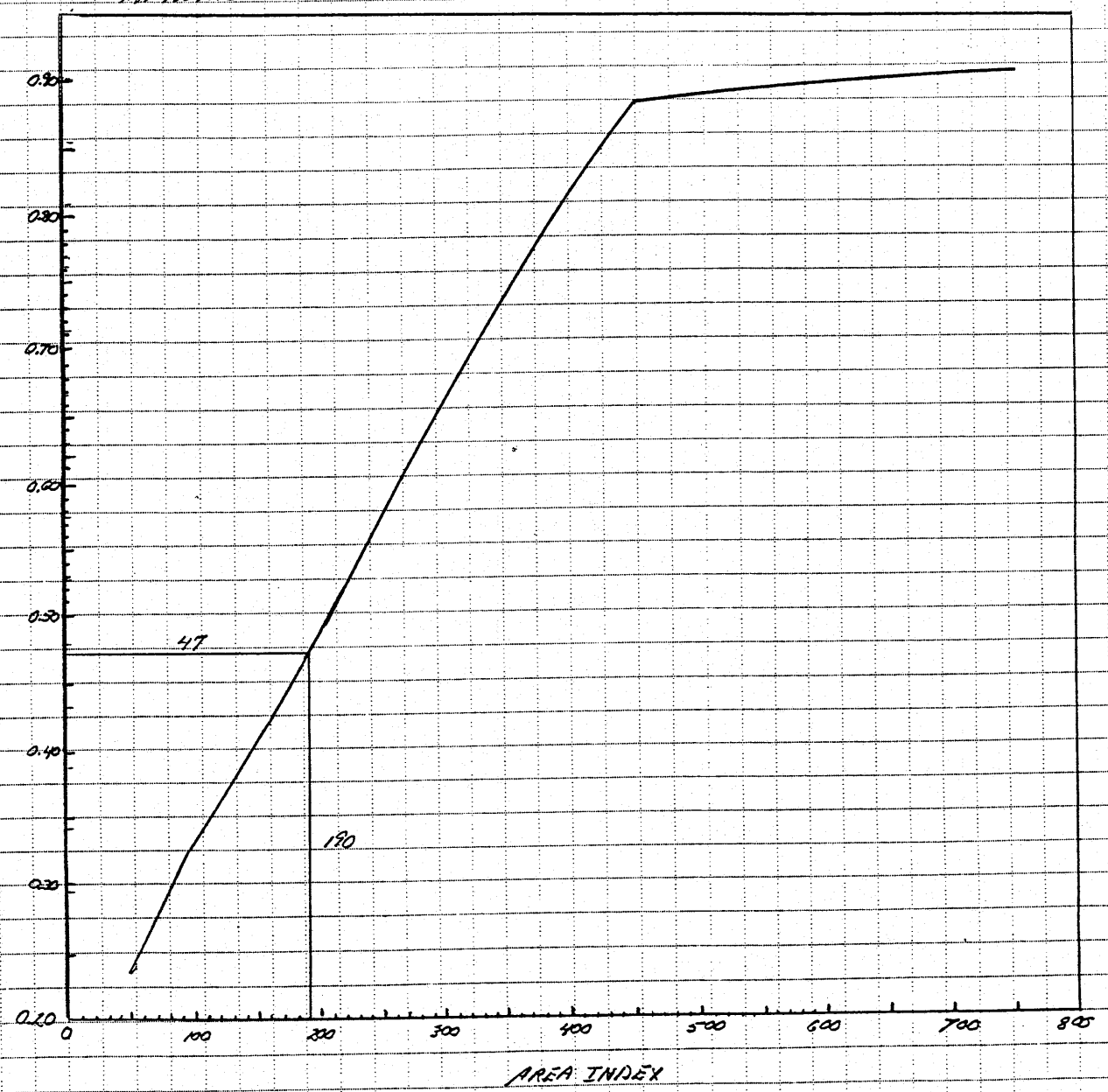
N2-RC

ANNUAL SCS CN-75 W=CD3



ANNUAL MEAN DEPTH
Plate 2

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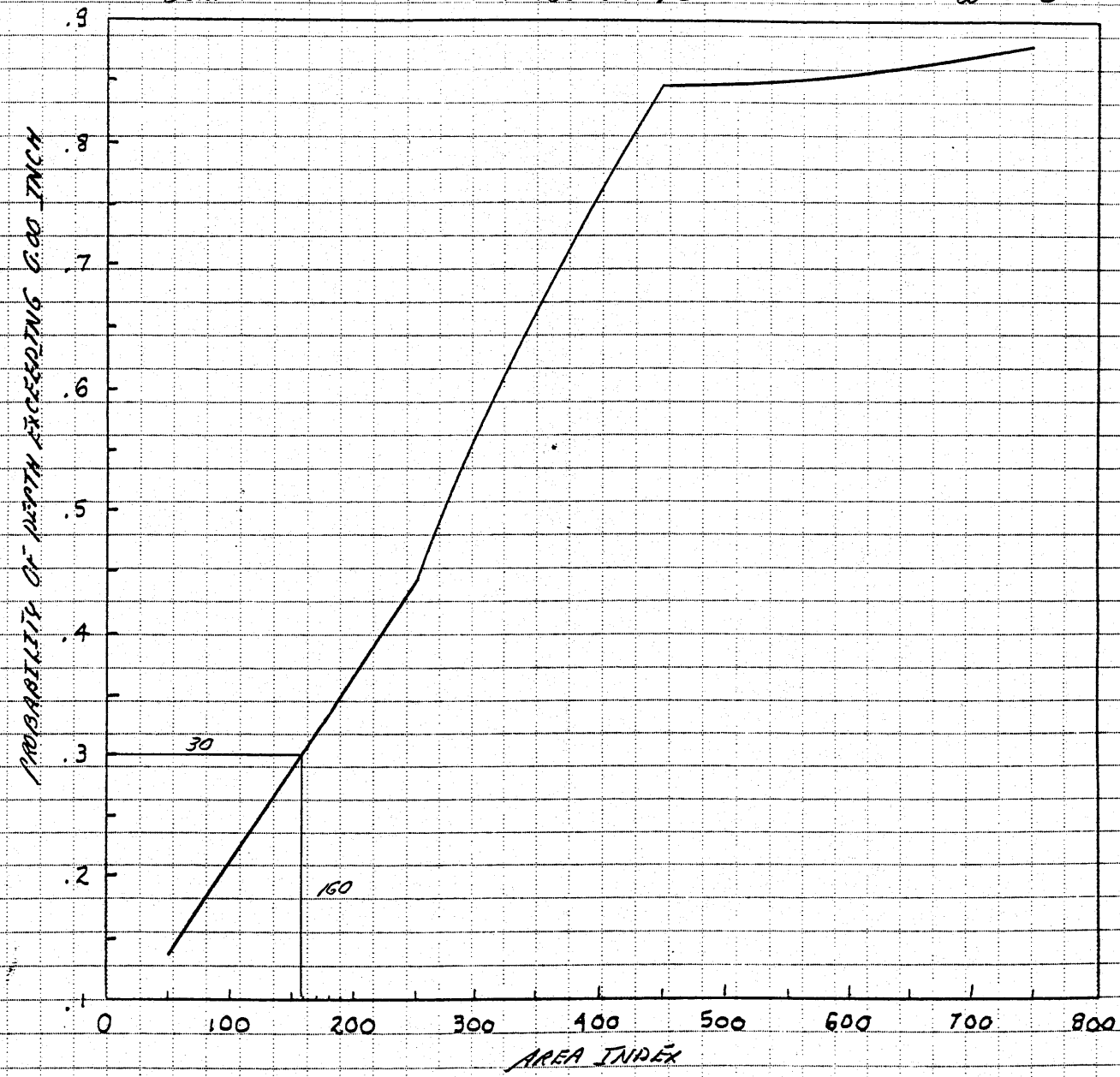
N2-RC

JULY SCS CN-75 W=0.03



MINIMUM DEPTH
Plate 3

PERMANENT IMPOUNDMENT

N5-A

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N5-A

A_D: 547.3 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

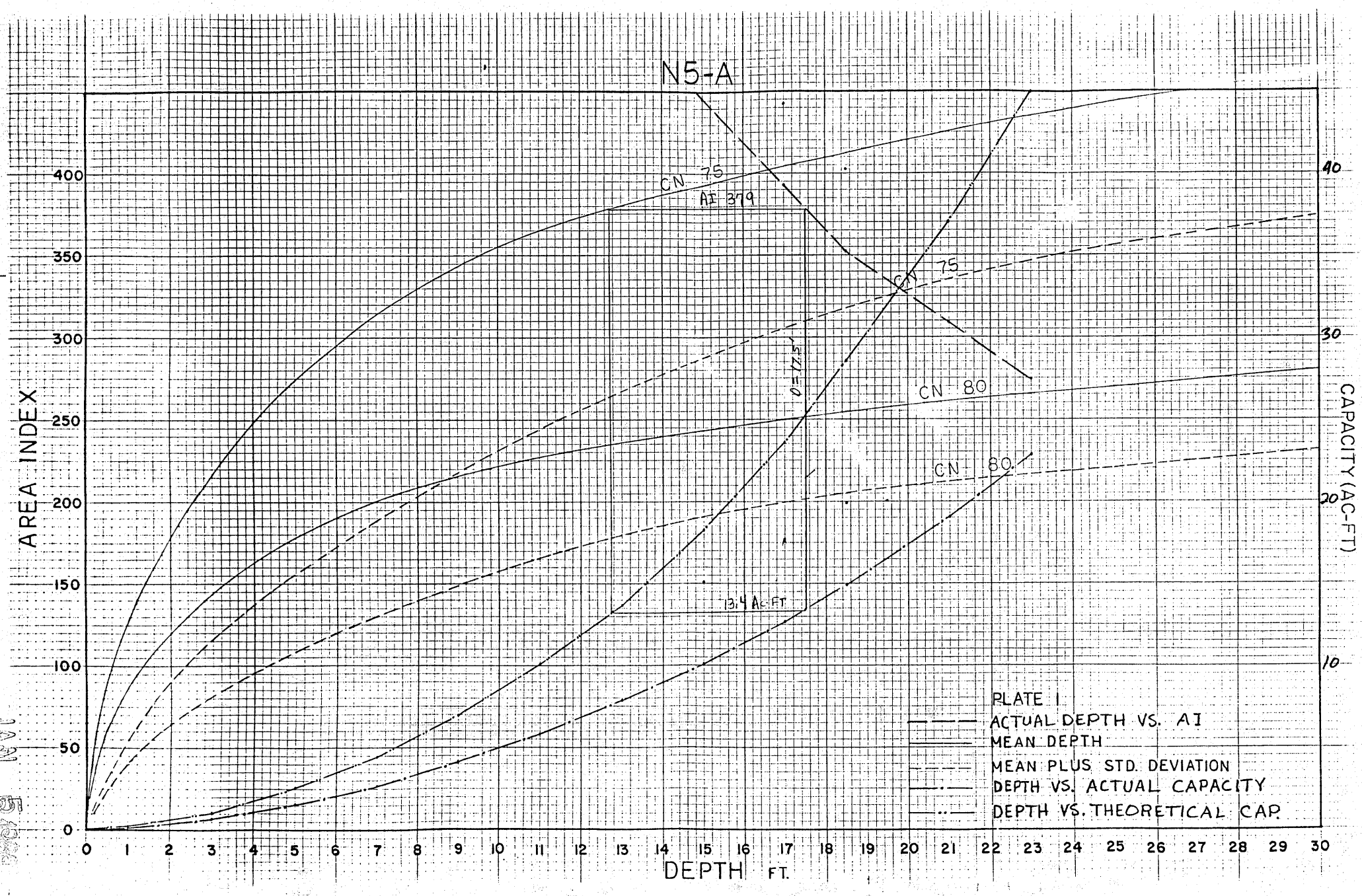
Notes: Existing Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6443	0.023	547.277	0.0	23795	0
1	6444	0.195	547.105	0.2	2805	0.1
3	6446	0.370	546.930	1.1	1478	0.7
5	6448	0.520	546.780	2.6	1052	1.6
7	6450	0.635	546.665	4.4	861	2.7
9	6452	0.777	546.523	7.0	703	4.1
11	6454	0.926	546.374	10.2	590	5.8
13	6456	1.056	546.244	13.7	517	7.8
15	6458	1.222	546.078	18.3	447	10.1
17	6460	1.388	545.912	23.6	393	12.7
18.5	6461.5	1.544	545.756	28.6	354	14.9
21	6464	1.768	545.532	37.1	309	19.0
23	6466	1.990	545.310	45.8	274	22.8

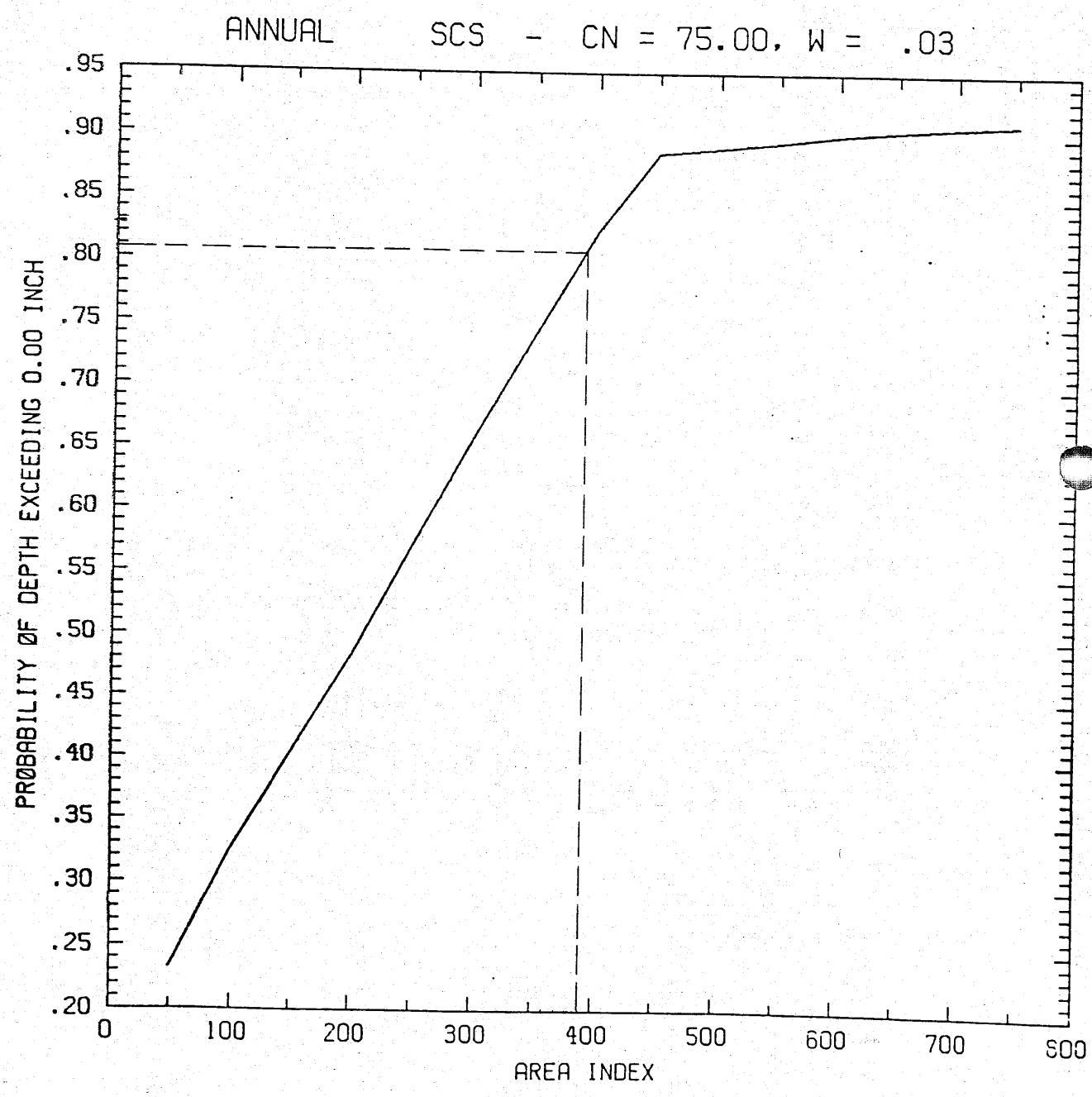
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	17.5 ft	--
	Minimum Depth (MIN)	--	5.8 ft
	Actual Capacity	13.4 ac-ft	2.0 ac-ft
	AI	379	947
Plate 2 or 3:	Probability	81%	88+%

JAN 5 1989

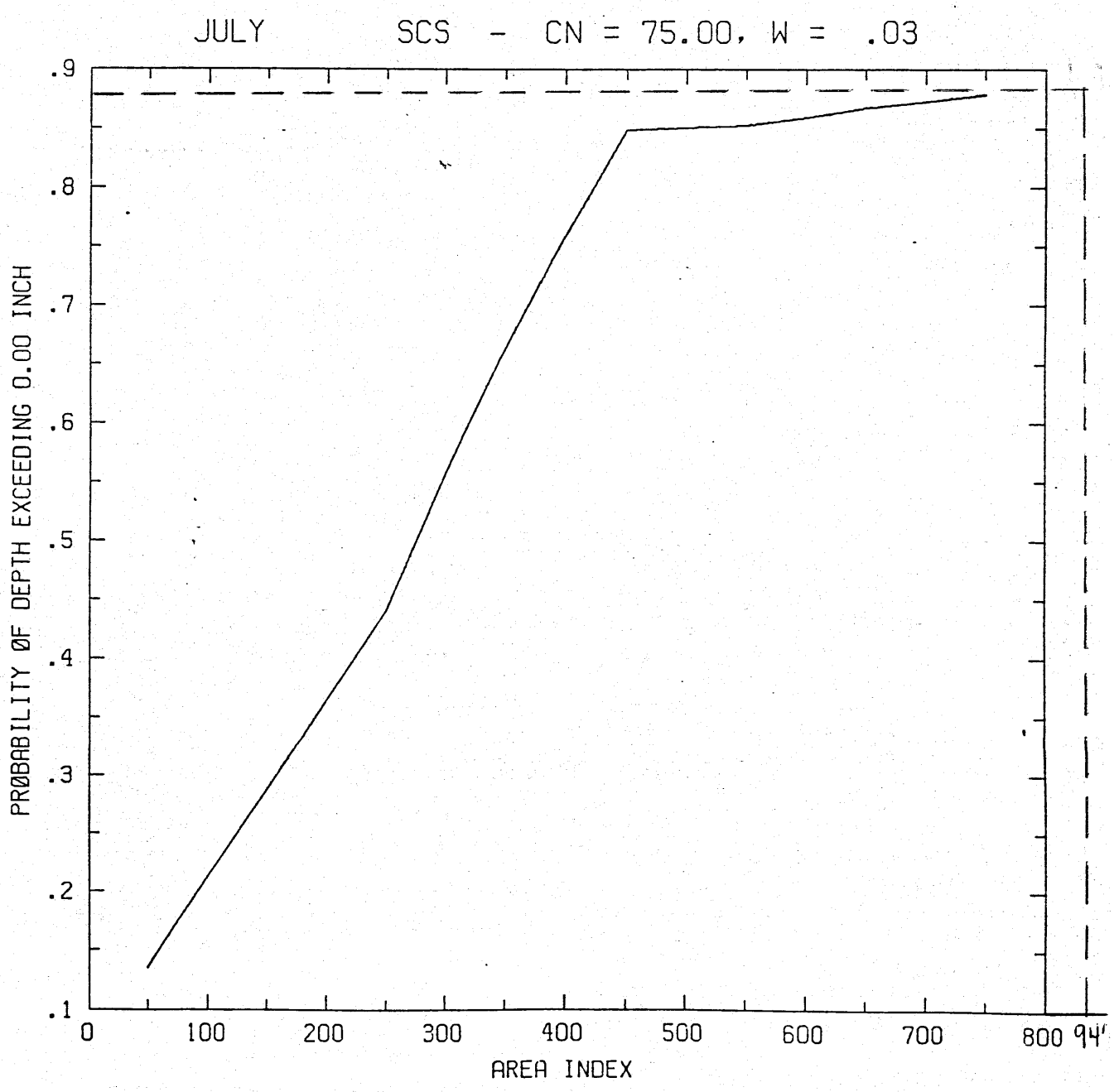

N5-A
CN 75
AI 379
CN 75
CN 80
CN 80
D = 17.5'
13.4 AC-FT
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
0
50
100
150
200
250
300
350
400
10
20
30
40
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

N5-A



Annual Mean Depth
Plate 2

N5-A



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: ____ N6-L

Ad: 402.6 Acres
Ab: Watershed Area = Ad - Ap
Theoretical Capacity: Ap x Depth
AI: Area Index = Ab / Ap

Depth: From Bottom Elevation
Ad: Total Drainage Area
Ap: Surface Area of Pond
Notes: Existing Impoundment

Depth (ft)	Elevation (ft amsl)	Ap (ac)	Ab (ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6,490.00	0.10	402.60	0.0	-	0.0
2	6,492.00	0.40	402.20	0.8	1006	0.5
4	6,494.00	0.51	402.09	2.0	788	1.4
6	6,496.00	0.61	401.99	3.7	659	2.5
8	6,498.00	0.71	401.89	5.7	566	3.9
10	6,500.00	0.82	401.78	8.2	490	5.4
12	6,502.00	0.93	401.67	11.2	432	7.1
14	6,504.00	1.05	401.55	14.7	382	9.1
16	6,506.00	1.17	401.43	18.7	343	11.3
18	6,508.00	1.30	401.30	23.4	309	13.8
20	6,510.00	1.44	401.16	28.8	279	16.5
22	6,512.00	1.58	401.02	34.8	254	19.6
22.5	6,512.50	1.62	400.98	36.5	248	20.4
24	6,514.00	1.74	400.86	41.8	230	22.9

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	15 ft	--
	Minimum Depth (MIN)	--	5.5 ft
	Actual Capacity	10 ac-ft	2.0 ac-ft
	AI	370	700
Plate 2 or 3:	Probability	76%	87%

K+E 10 X 10 TO ½ INCH • 7½ X 10 INCHES
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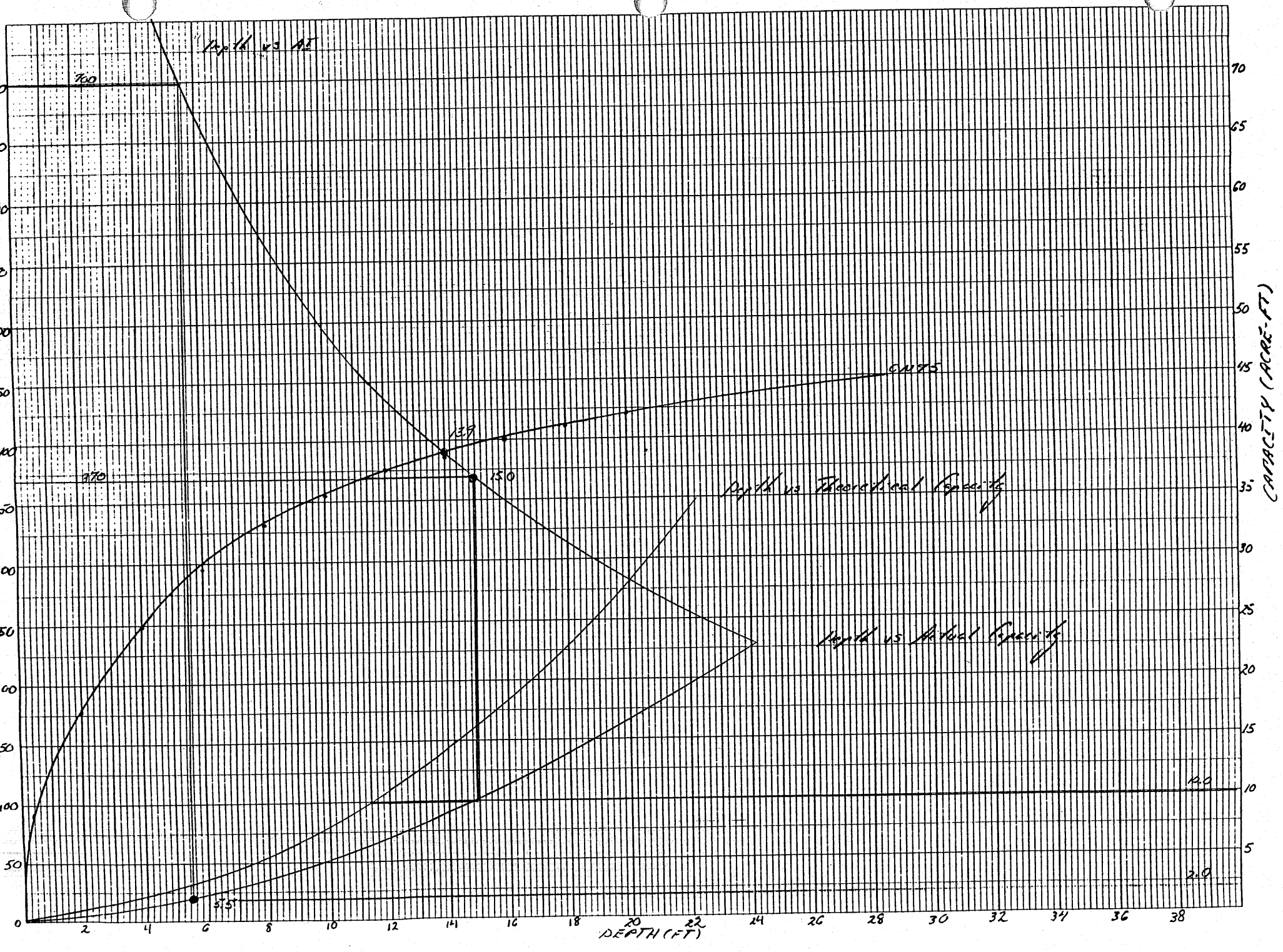
N6-L

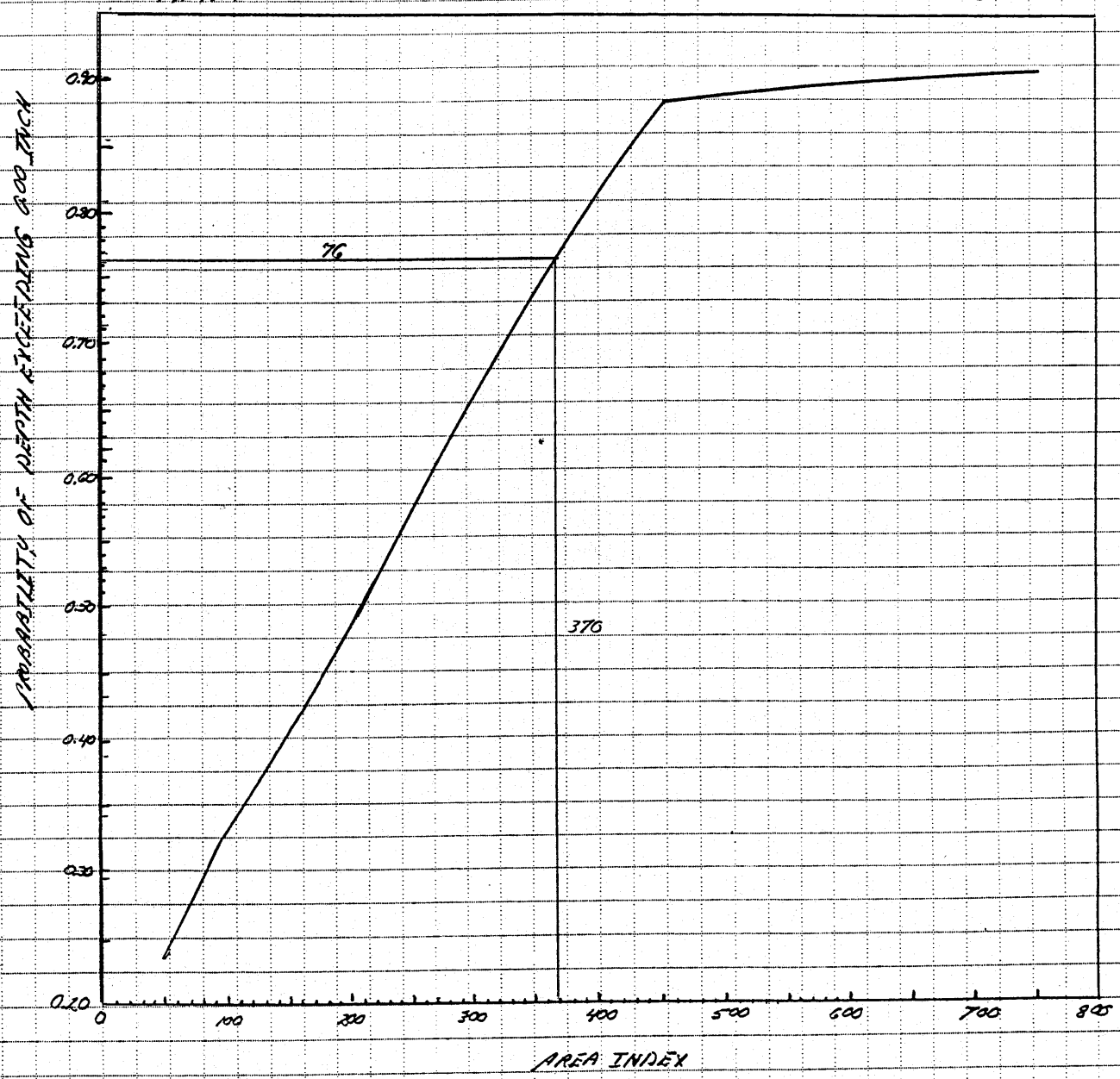


TerraMatrix
Engineering & Environmental Services
P.O. Box 774018, 1475 Pine Grove Road
Steamboat Springs, Colorado 80477
Phone 970.879.6260 Fax 970.879.9048

Project Name: _____
Project Number: _____ Sheet: ____ Of ____
Prepared By: _____ Date: _____
Checked By: _____ Date: _____

NG-L

ANNUAL SCS CN - 75 W = 0.03

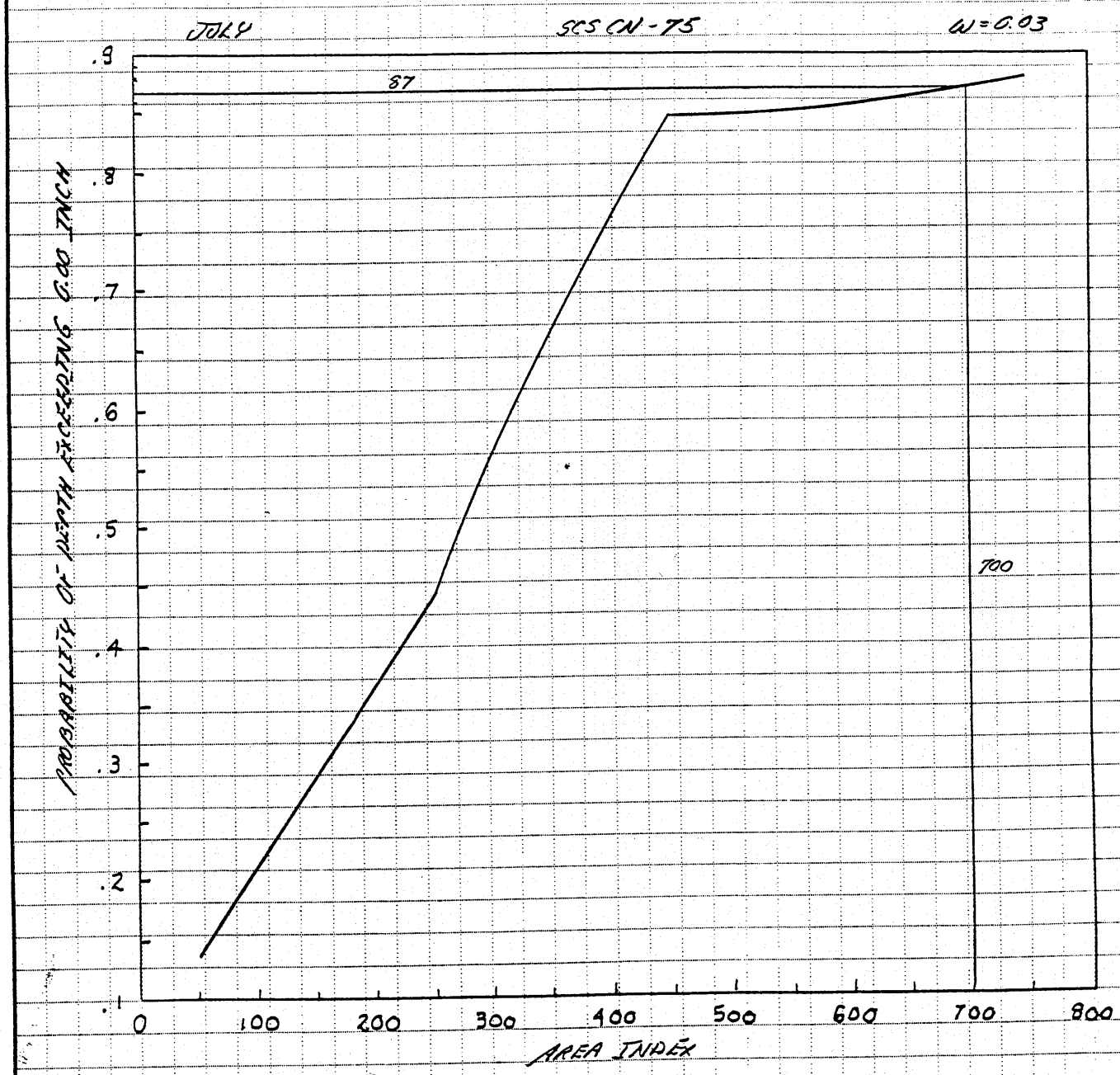


ANNUAL MEAN DEPTH
Note 2

TerraMatrix
Engineering & Environmental Services
P.O. Box 774018, 1475 Pine Grove Road
Steamboat Springs, Colorado 80477
Phone 970.879.6260 Fax 970.879.9048

Project Name: _____
Project Number: _____ Sheet: ____ Of ____
Prepared By: _____ Date: _____
Checked By: _____ Date: _____

NG-L



MINIMUM DEPTH
Plate 3

PERMANENT IMPOUNDMENT

N7-D

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N7-D

A_D: 778.6 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

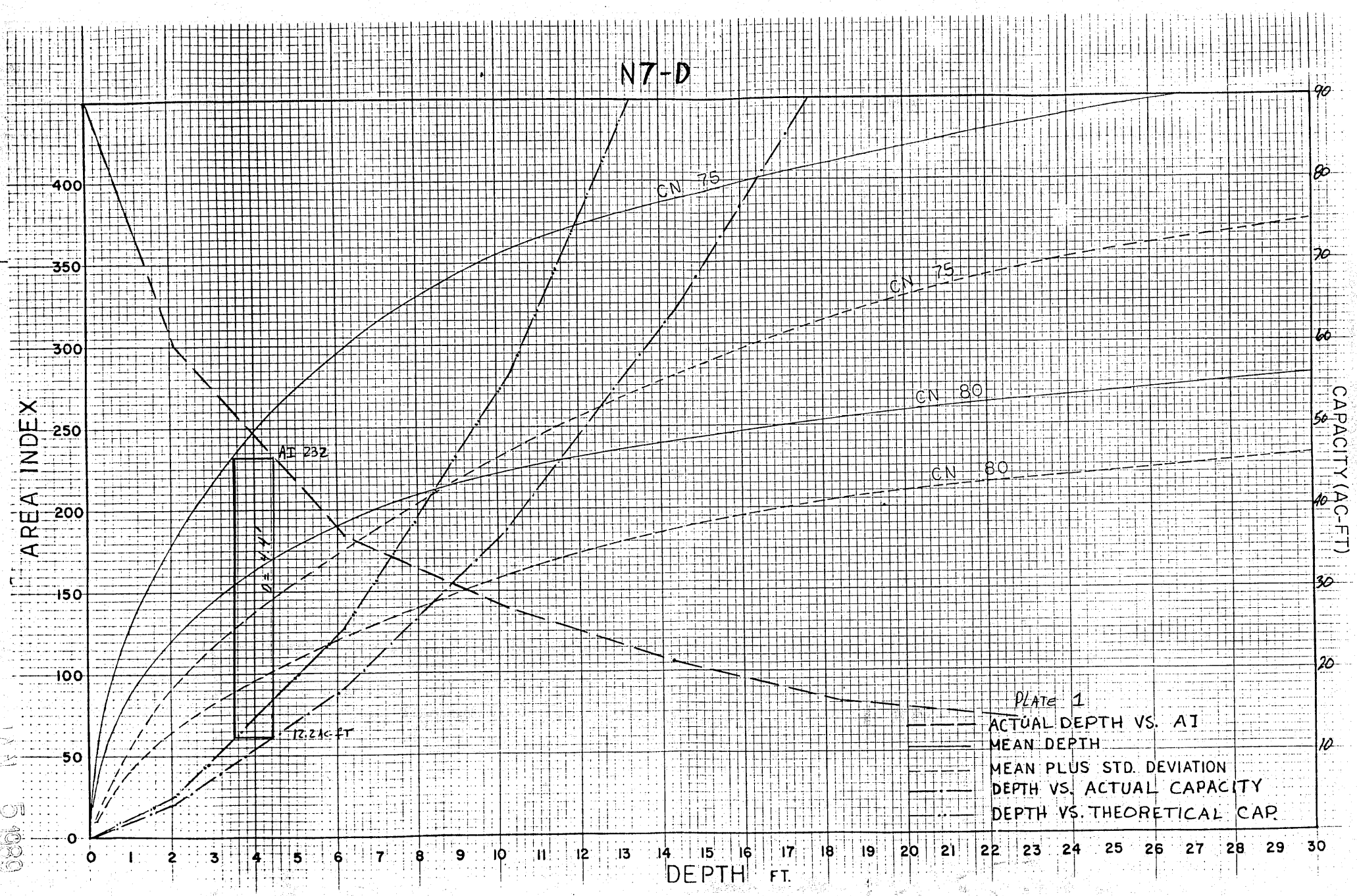
AI: Area Index = A_B/A_P

Notes: Existing Impoundment

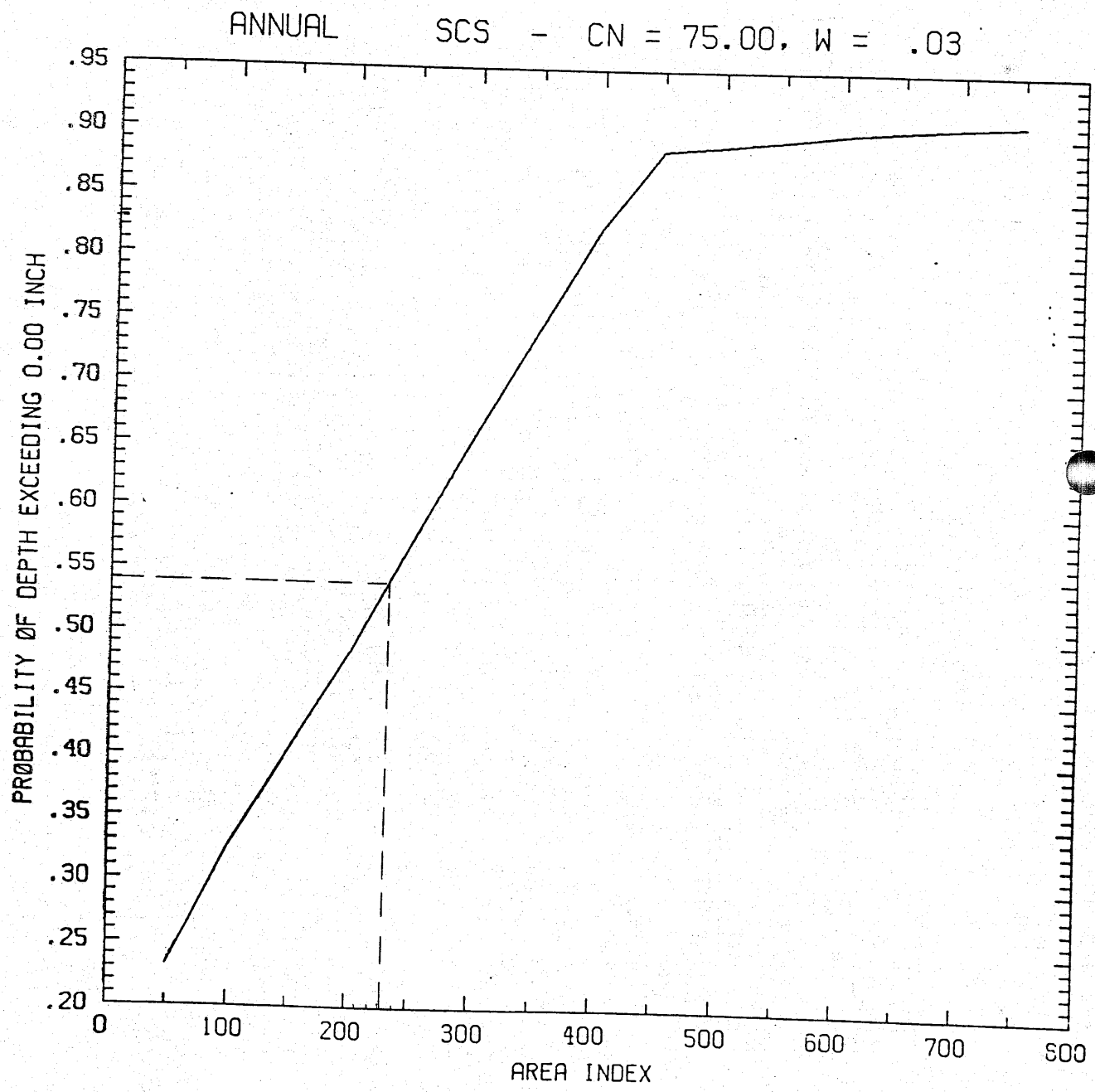
Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6556	1.751	776.849	0	444	0.0
2	6558	2.616	775.984	5.2	230	4.4
6	6562	4.223	774.377	25.3	183	18.0
10	6566	5.575	773.025	55.8	139	37.6
14	6570	7.221	771.379	101.1	107	63.2
18	6574	8.895	769.705	160.1	87	95.5
22	6578	10.495	768.105	230.9	73	134.2
26	6582	12.175	766.425	316.6	63	179.6
30	6586	13.815	764.785	414.5	53	231.6

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	4.4 ft.	--
	Minimum Depth (MIN)	--	3.0 ft.
	Actual Capacity	12.2 ac-ft.	7.8 ac-ft.
	AI	232	268
Plate 2 or 3:	Probability	54%	48%


N7-D
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 232
12.21 AC-FT
PLATE 1
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

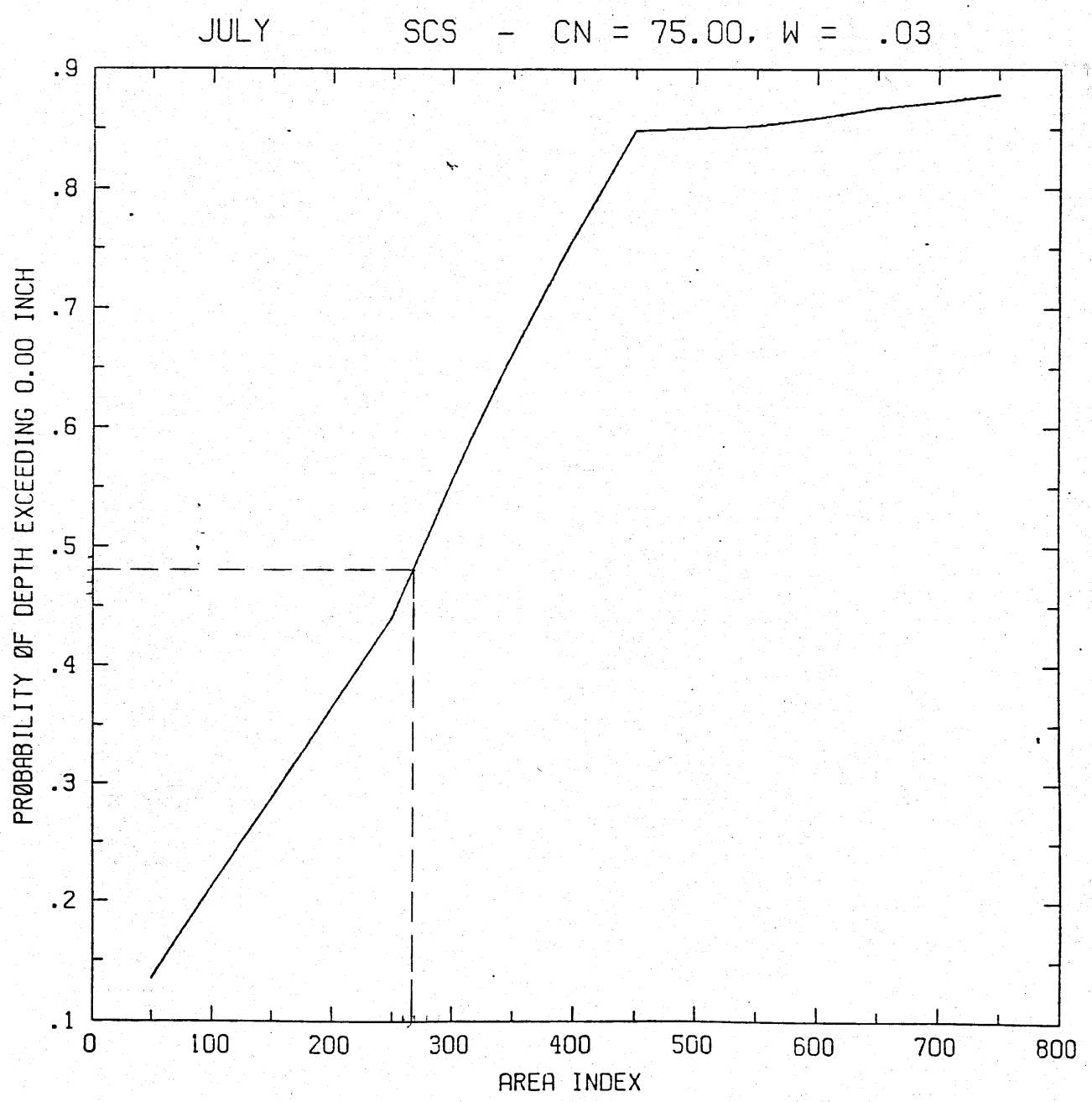
N7-D



Annual Mean Depth
Plate 2

JAN 5 1989

N7-D



Minimum Depth
Plate 3

PERMANENT IMPOUNDMENT

N7-E

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N7-E

A_D: 238.7 Acres

Depth: From Bottom Elevation

A_D: Total Drainage Area

A_P: Surface Area of Pond

A_B: Watershed Area = $A_D - A_P$

Theoretical Capacity: A_P x Depth

AI: Area Index = A_B/A_P

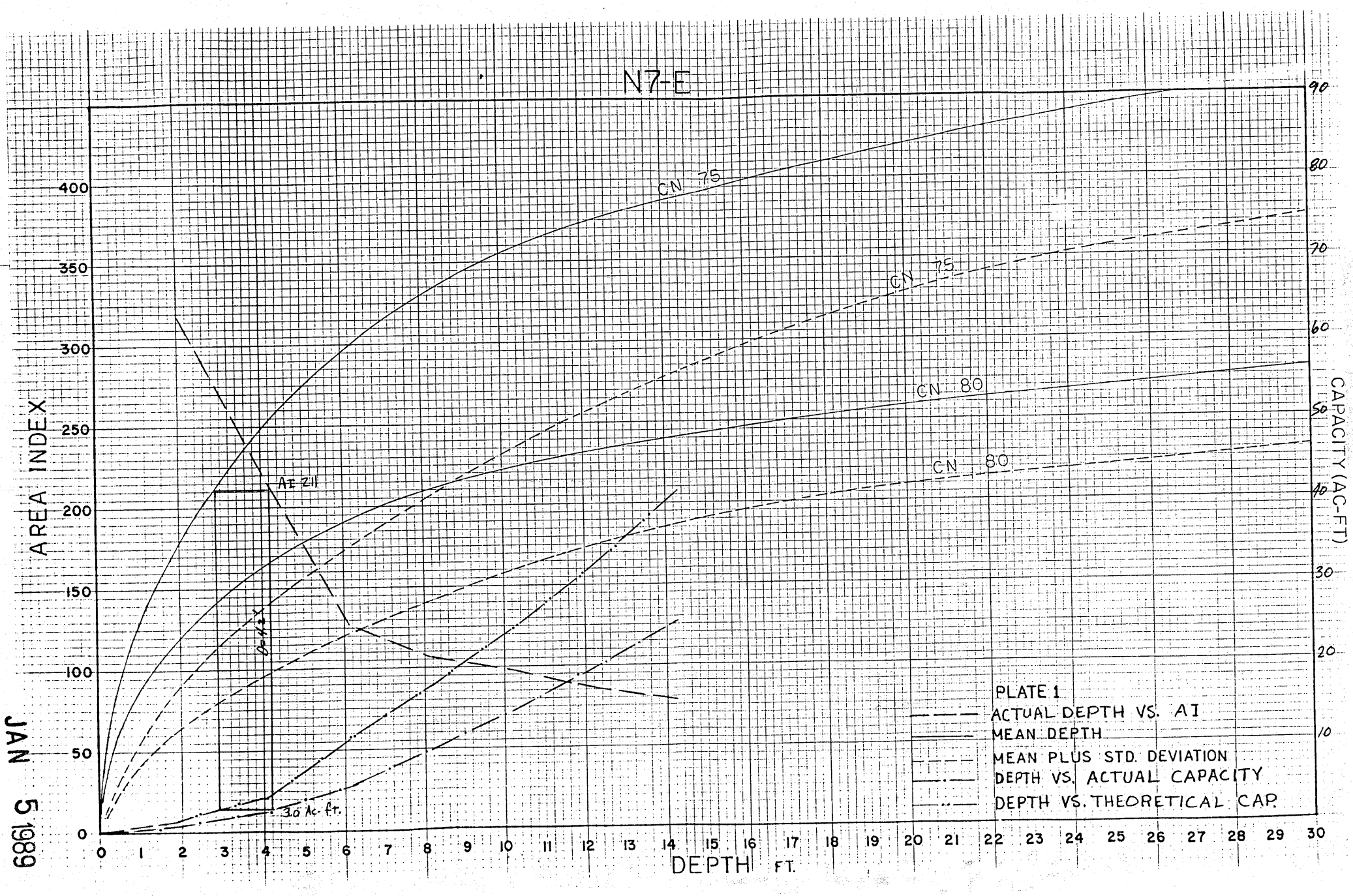
Notes: Existing Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6551	0.25	238.45	0	954	0
2	6553	0.76	237.94	1.5	313	1.0
4	6555	1.10	237.60	4.4	216	2.9
6	6557	1.89	236.81	11.3	126	5.9
8	6559	2.23	236.47	17.8	106	10.0
10	6561	2.47	236.23	24.7	96	14.7
11.5	6562.5	2.66	236.04	30.6	89	18.5
12	6563	2.72	235.98	32.6	88	19.9
14	6567	2.96	235.74	41.4	80	25.6

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

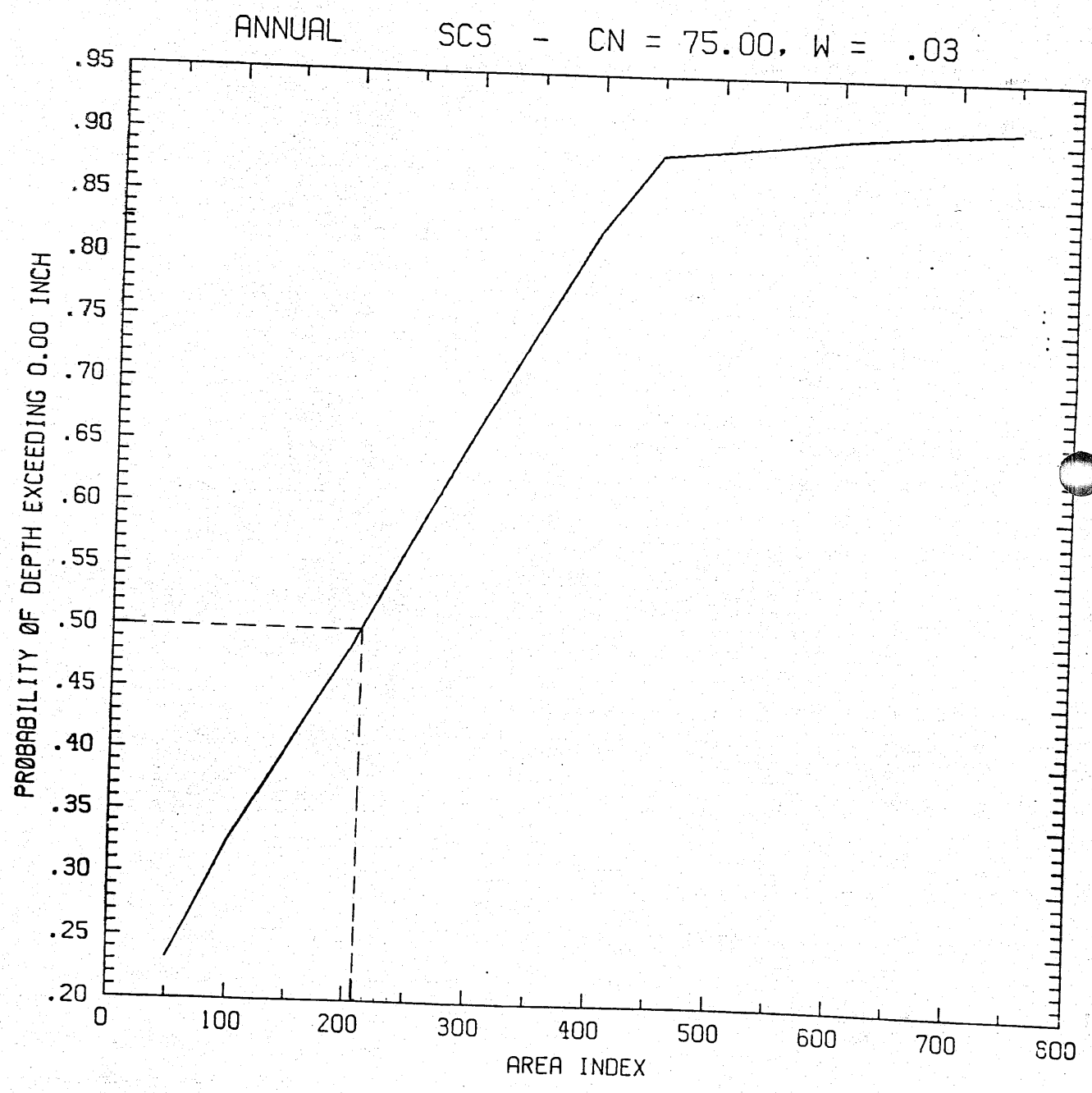
Plate 1:	Annual Mean Depth (AMD)	4.2 ft	--
	Minimum Depth (MIN)	--	3.2 ft
	Actual Capacity	3.0 ac-ft	2.0 ac-ft
	AI	211	246
Plate 2 or 3:	Probability	50%	44%

JAN 5


N7-E
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI = 211
30 Ac. ft.
PLATE 1
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

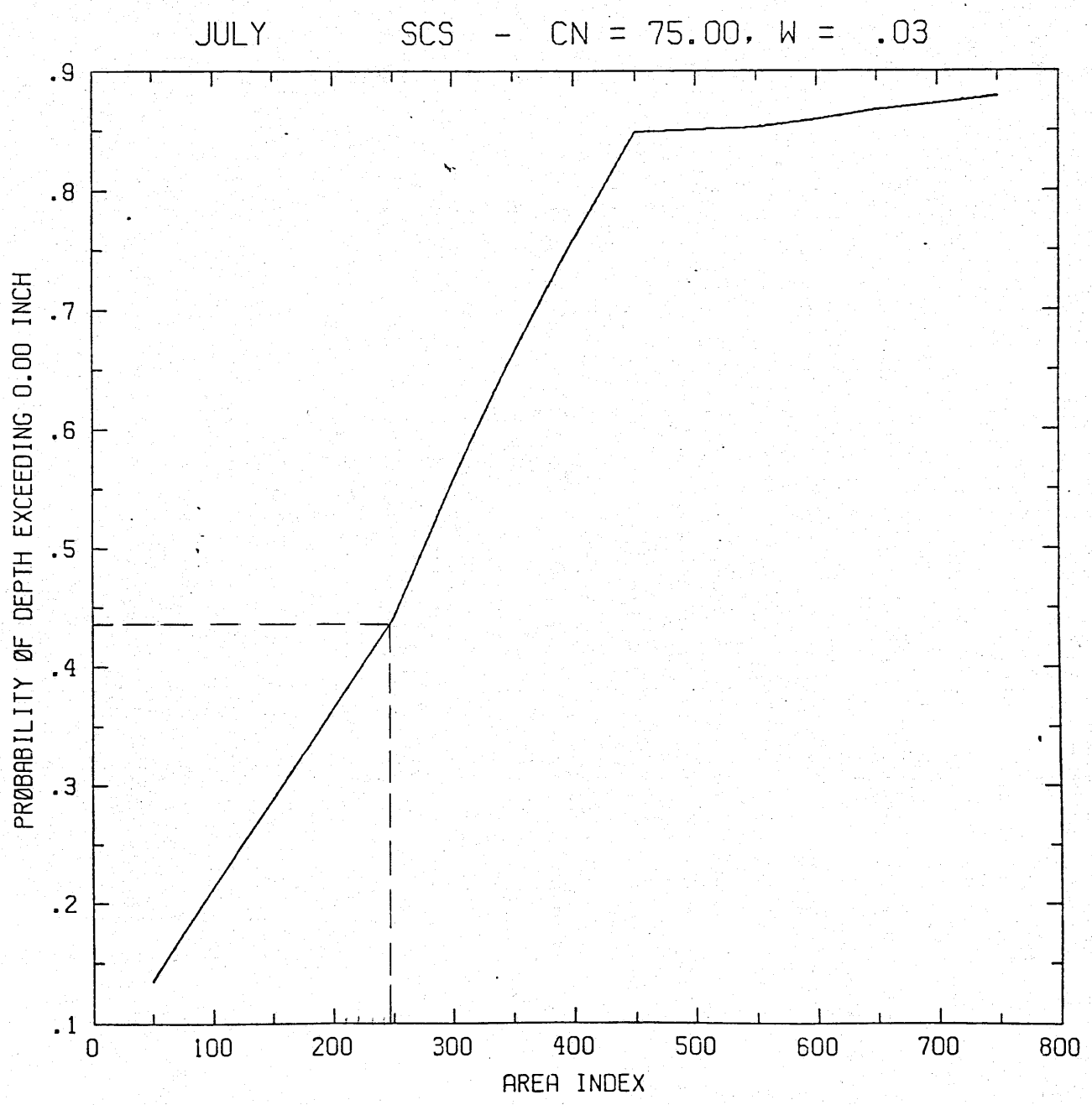
JAN 5 1989

N7-E



Annual Mean Depth
Plate 2

N7-E



Minimum Depth
Plate 3

JAN 5 1989

5 1989

PERMANENT IMPOUNDMENT

N10-A1

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N10-A1

A_D: 701.8 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

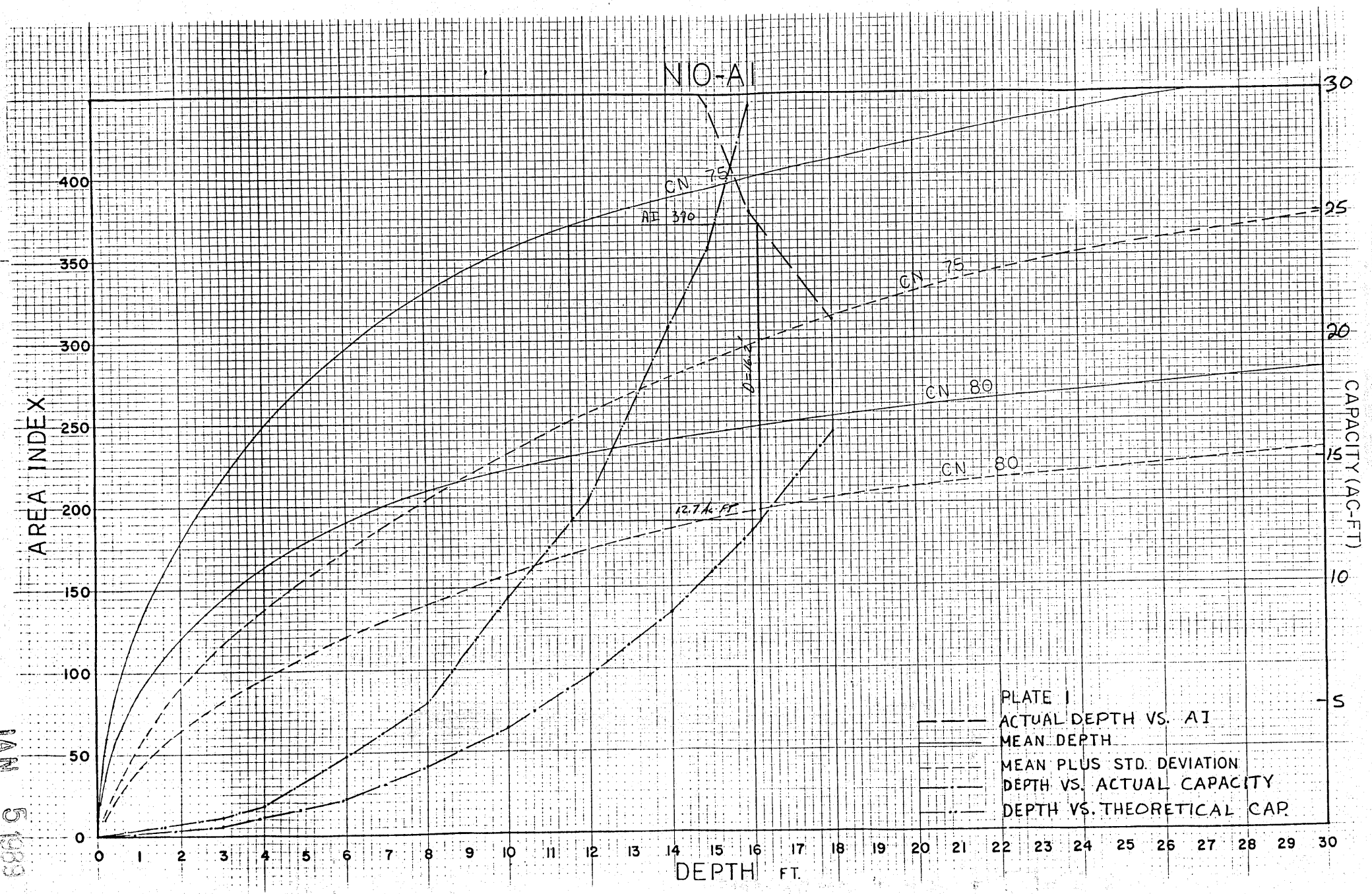
Notes: Existing Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6612	0.001	701.799	0	701,800	0.0
3	6615	0.252	701.548	0.8	2781	0.4
4	6616	0.308	701.492	1.2	2280	0.7
6	6618	0.512	701.288	3.1	1369	1.5
8	6620	0.668	701.132	5.3	1050	2.7
10	6622	0.962	700.838	9.6	728	4.3
12	6624	1.128	700.672	13.5	621	6.4
14	6626	1.462	700.338	20.5	479	9.0
15	6627	1.578	700.222	23.7	444	10.5
16	6628	1.843	699.957	29.5	380	12.2
18	6630	2.247	699.553	40.5	311	16.3

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

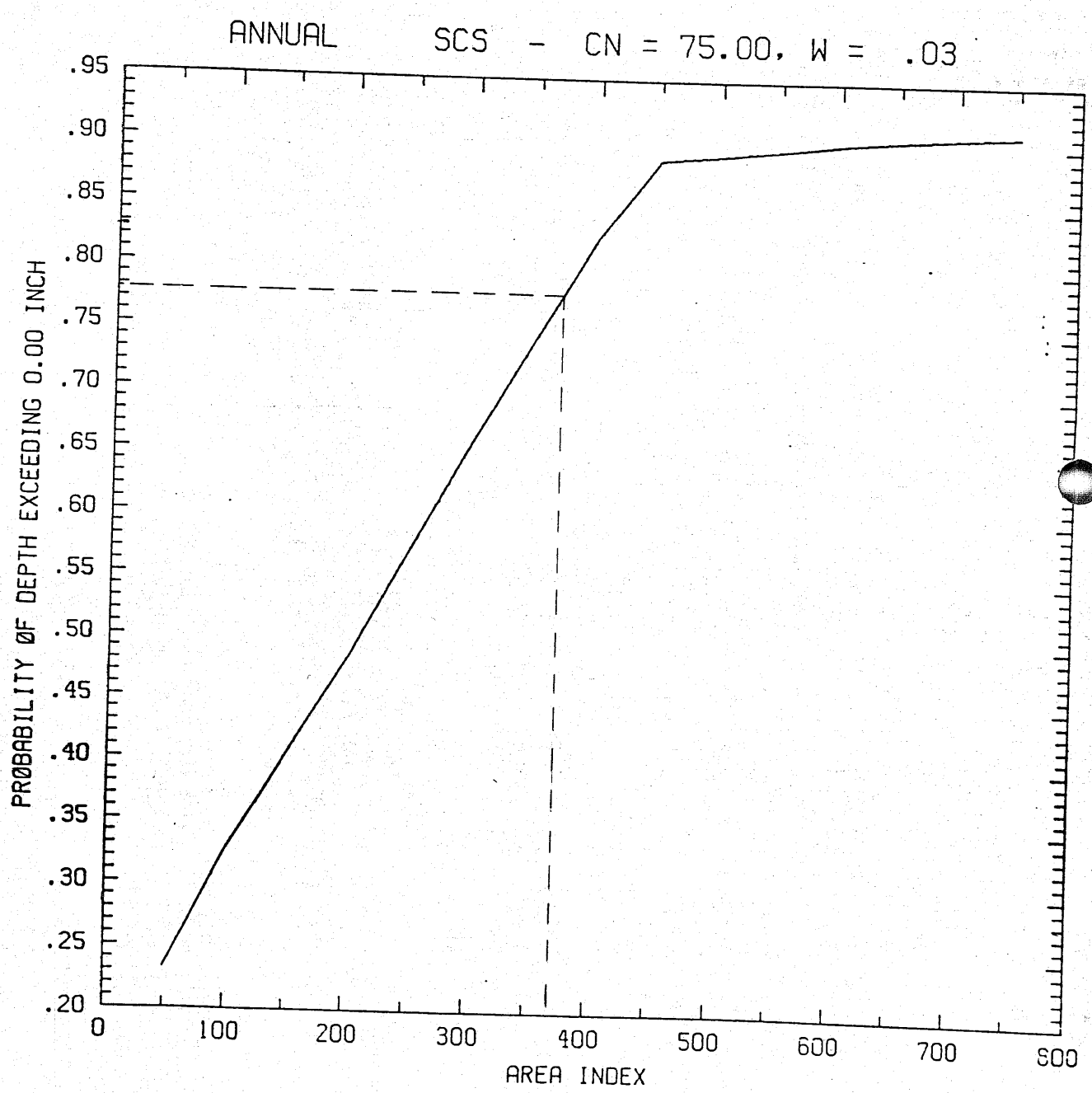
Plate 1:	Annual Mean Depth (AMD)	16.2 ft.	--
	Minimum Depth (MIN)	--	6.8 ft.
	Actual Capacity	12.7 ac-ft.	2.0 ac-ft.
	AI	370	1221
Plate 2 or 3:	Probability	78%	88+%

JAN 5 198


NIO-AI
AREA INDEX
DEPTH FT.
CAPACITY (AC-FT)
CN 75
CN 75
CN 80
CN 80
AI 390
D=16.2
12.7 Ac. FT
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

JAN 5 1983

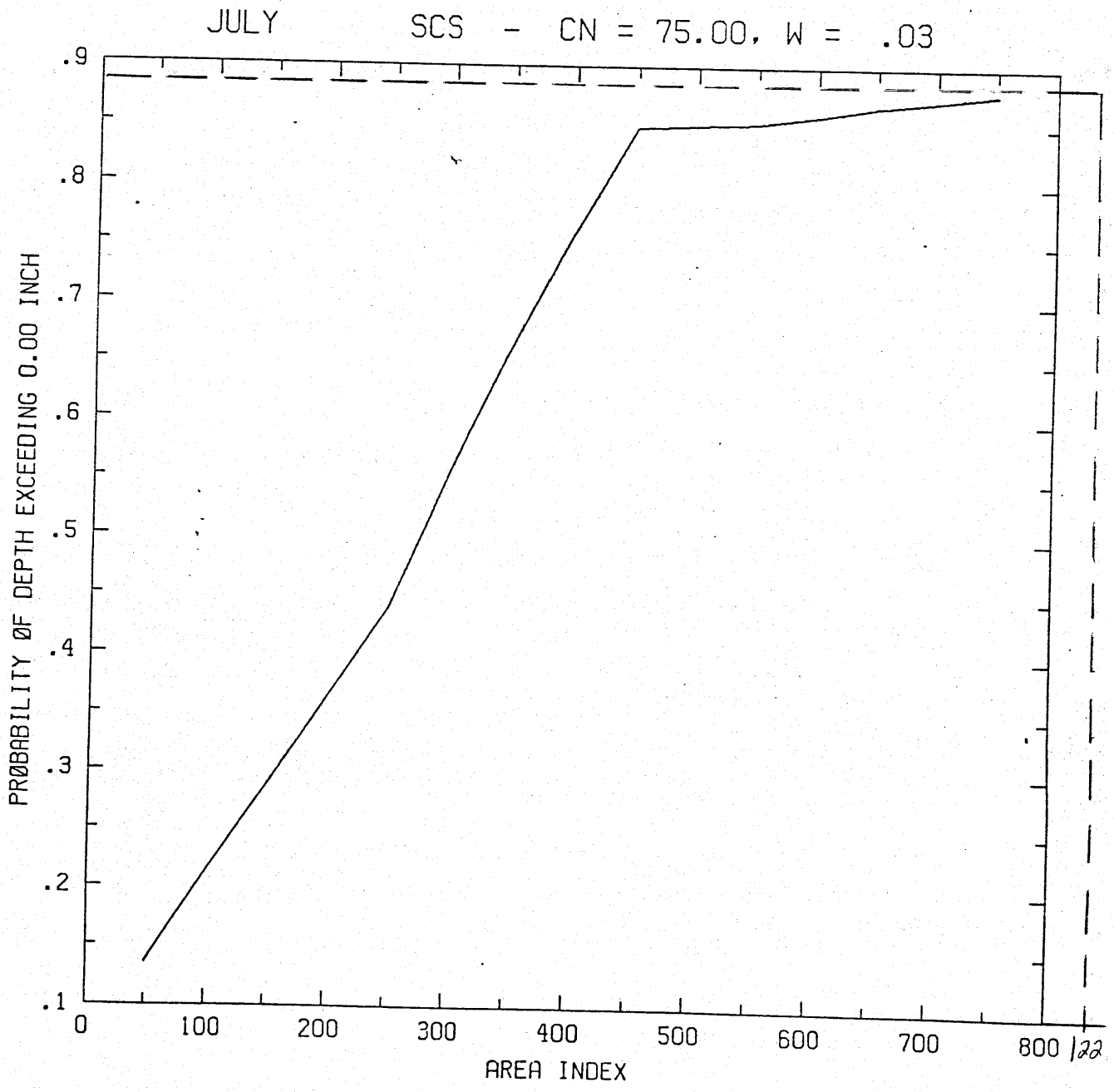
N10-A1



Annual Mean Depth
Plate 2

JAN 5 1989

NIO-AI



Minimum Depth
Plate 3

JAN 5 1989

PERMANENT IMPOUNDMENT

N10-D

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N10-D

A_D: 286.8 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

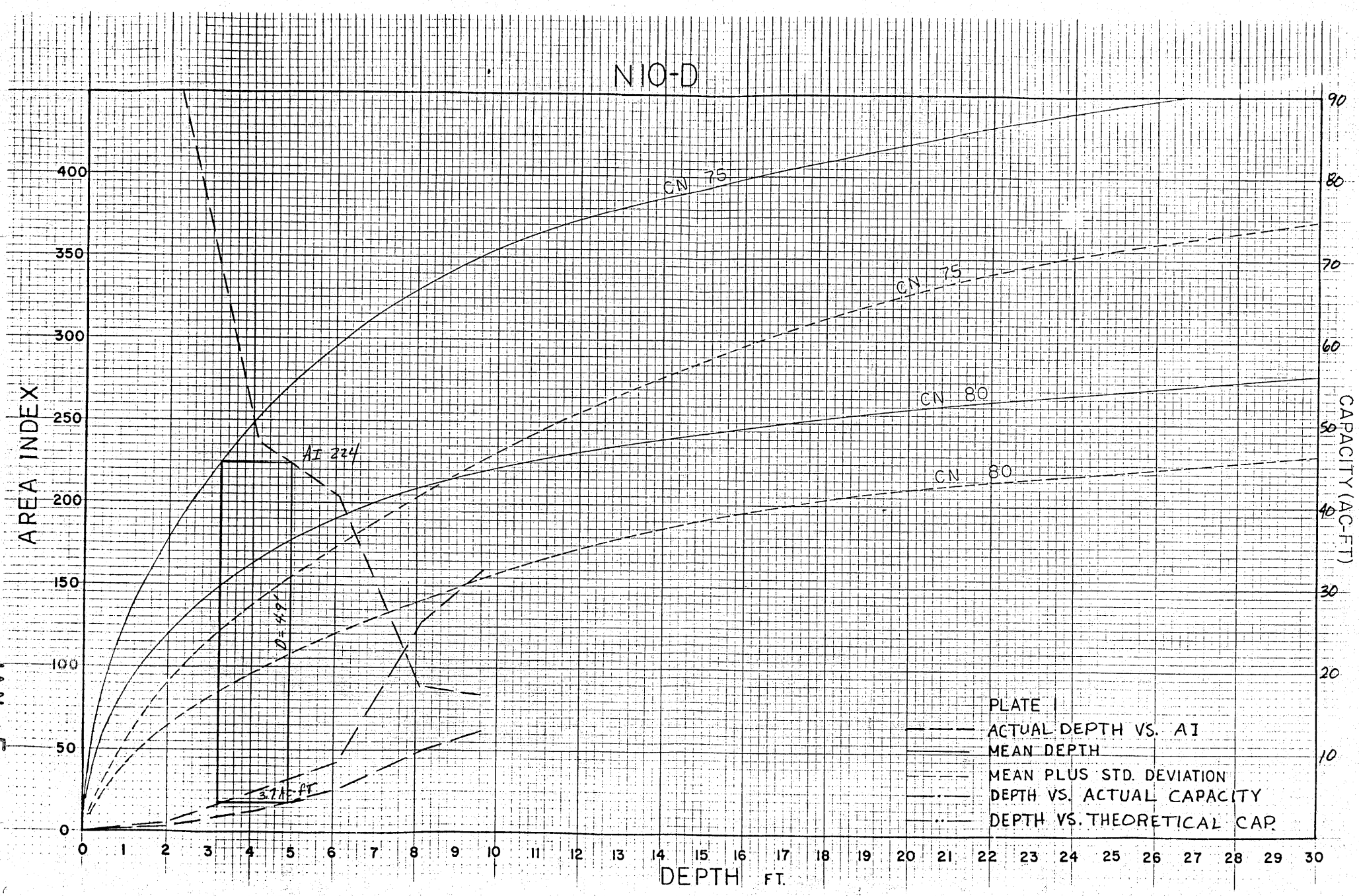
Notes: Existing Impoundment

Depth (ft)	Elevation (MSL)	A_P (AC)	A_B (AC)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6572	0.100	286.70	0	2867	0.0
2	6574	0.620	286.18	1.2	462	0.7
4	6576	1.220	285.6	4.9	234	2.6
6	6578	1.420	285.4	8.5	201	5.2
8	6580	3.180	283.6	25.4	89	9.8
9.5	6581.5	3.353	283.4	31.9	85	12.3

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

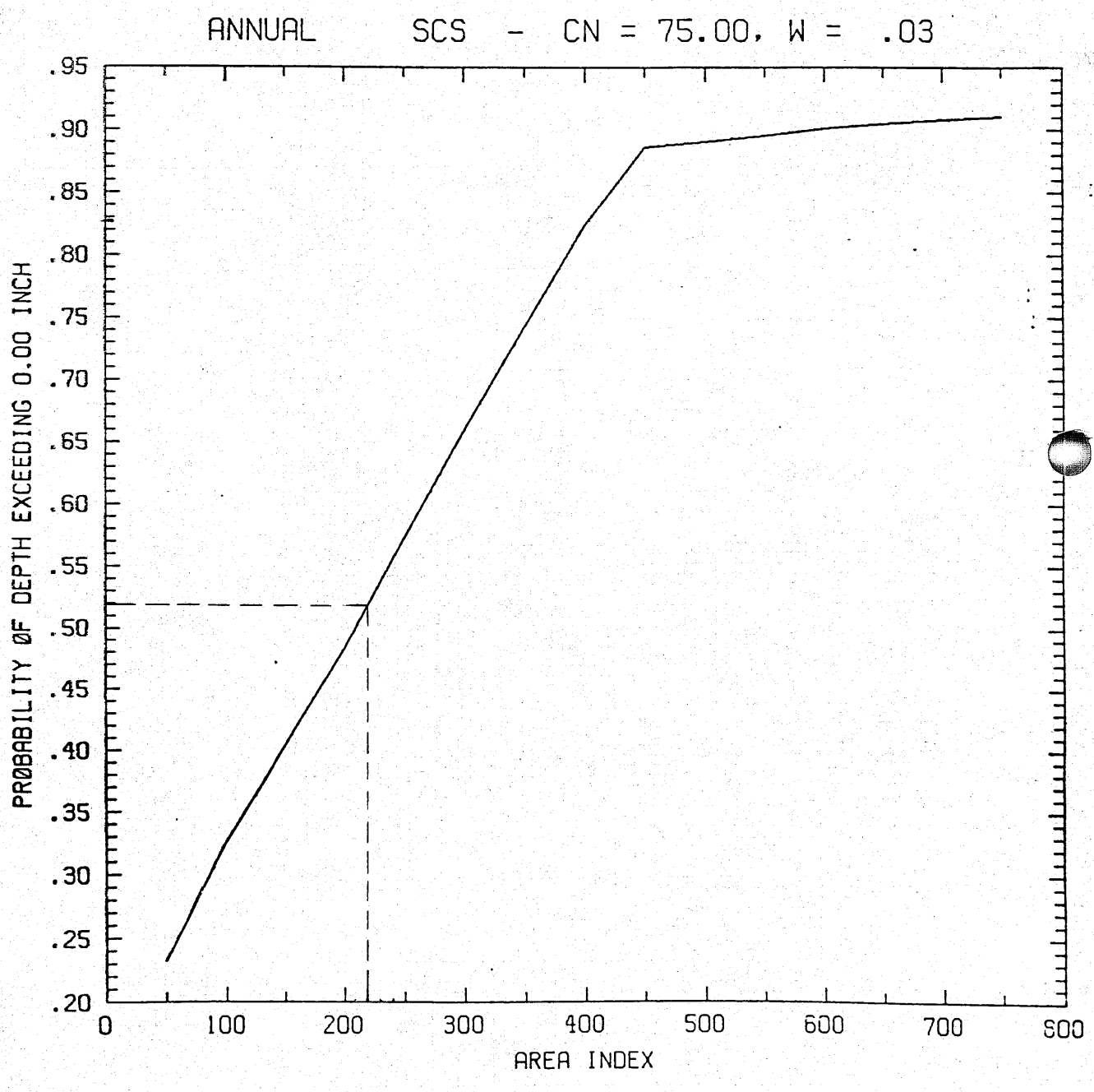
Plate 1:	Annual Mean Depth (AMD)	4.9 ft.	--
	Minimum Depth (MIN)	--	3.4 ft.
	Actual Capacity	3.7 ac-ft.	2.0 ac-ft.
	AI	224	300
Plate 2 or 3:	Probability	52%	56%

JAN 5 1989


N10-D
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 224
D = 4.4 FT
3.7 AC-FT
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

JAN 5 1980

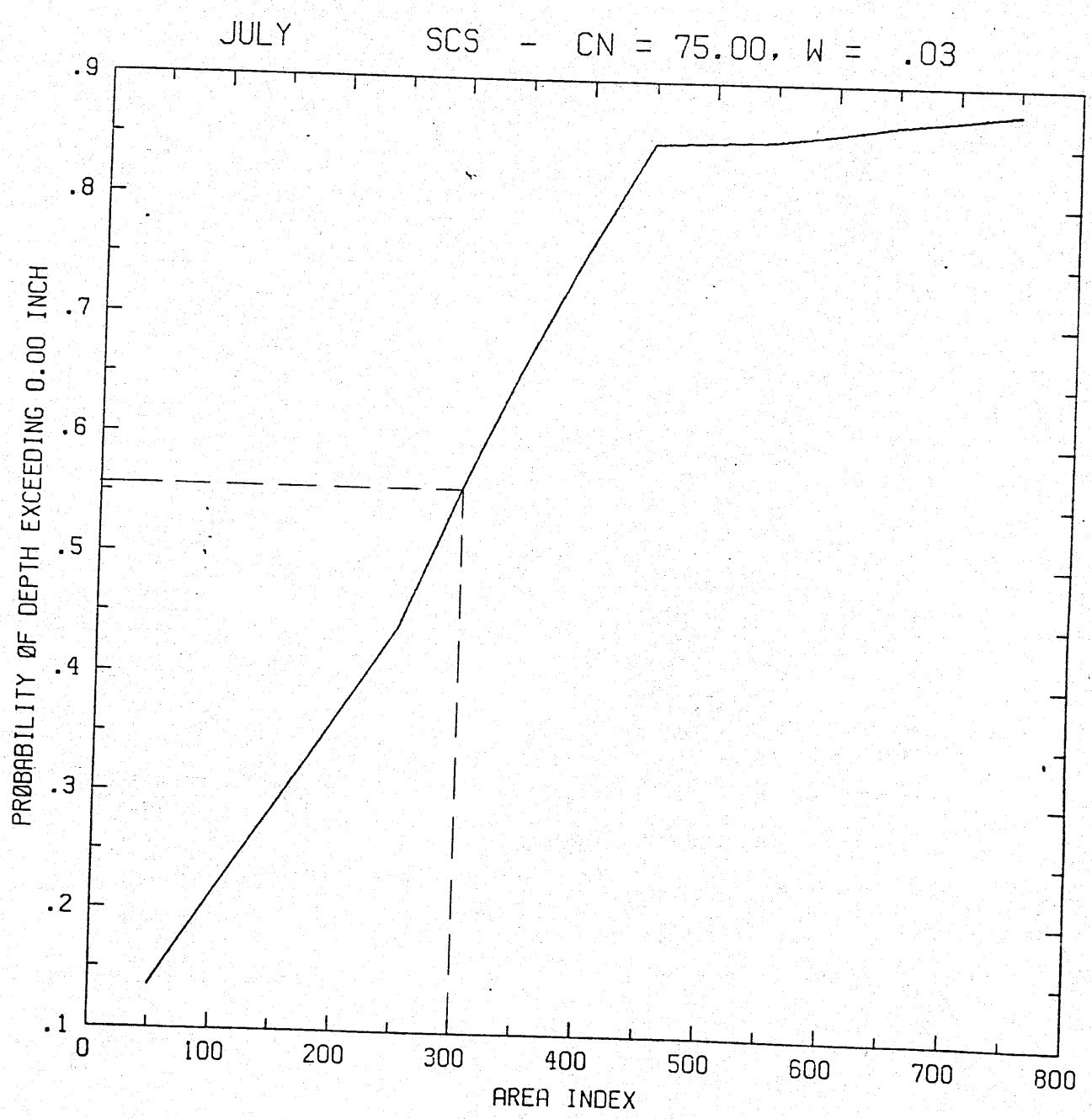
NIØ-D



Annual Mean Depth
Plate 2

JAN 5 1989

NIO-D



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 1989

PERMANENT IMPOUNDMENT

N10-G

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N10-G

A_D: 467.0 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

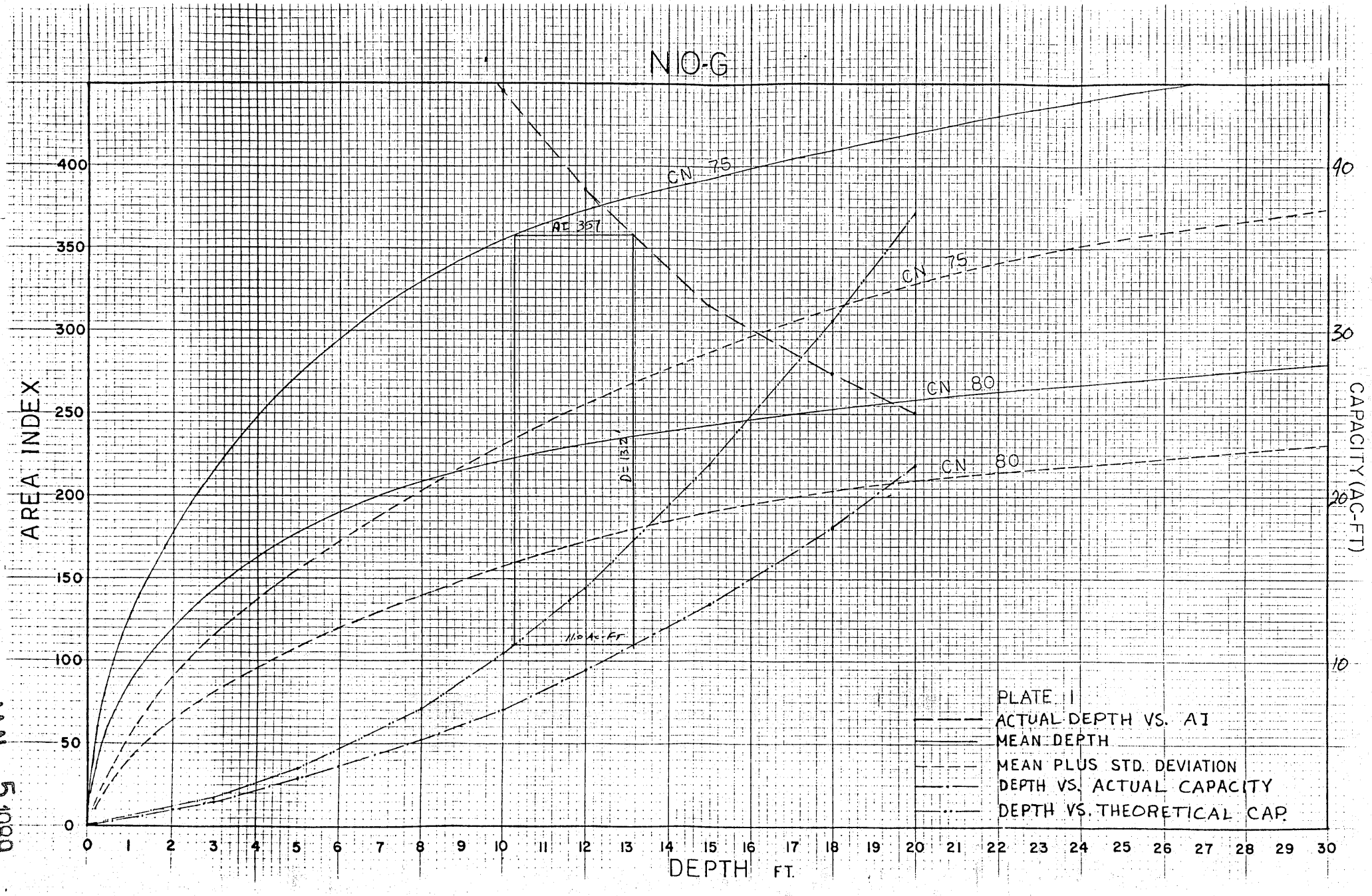
Notes: Proposed Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	N/A	0.402	466.598	0	1161	0
3		0.566	466.434	1.7	824	1.5
5		0.689	466.311	3.4	677	2.8
8		0.894	466.106	7.2	521	5.2
10		1.045	465.955	10.5	446	7.1
12		1.206	465.794	14.5	386	9.4
15		1.469	465.531	22.0	317	13.4
18		1.698	465.302	30.6	274	18.2
20		1.860	465.140	37.2	250	21.8

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

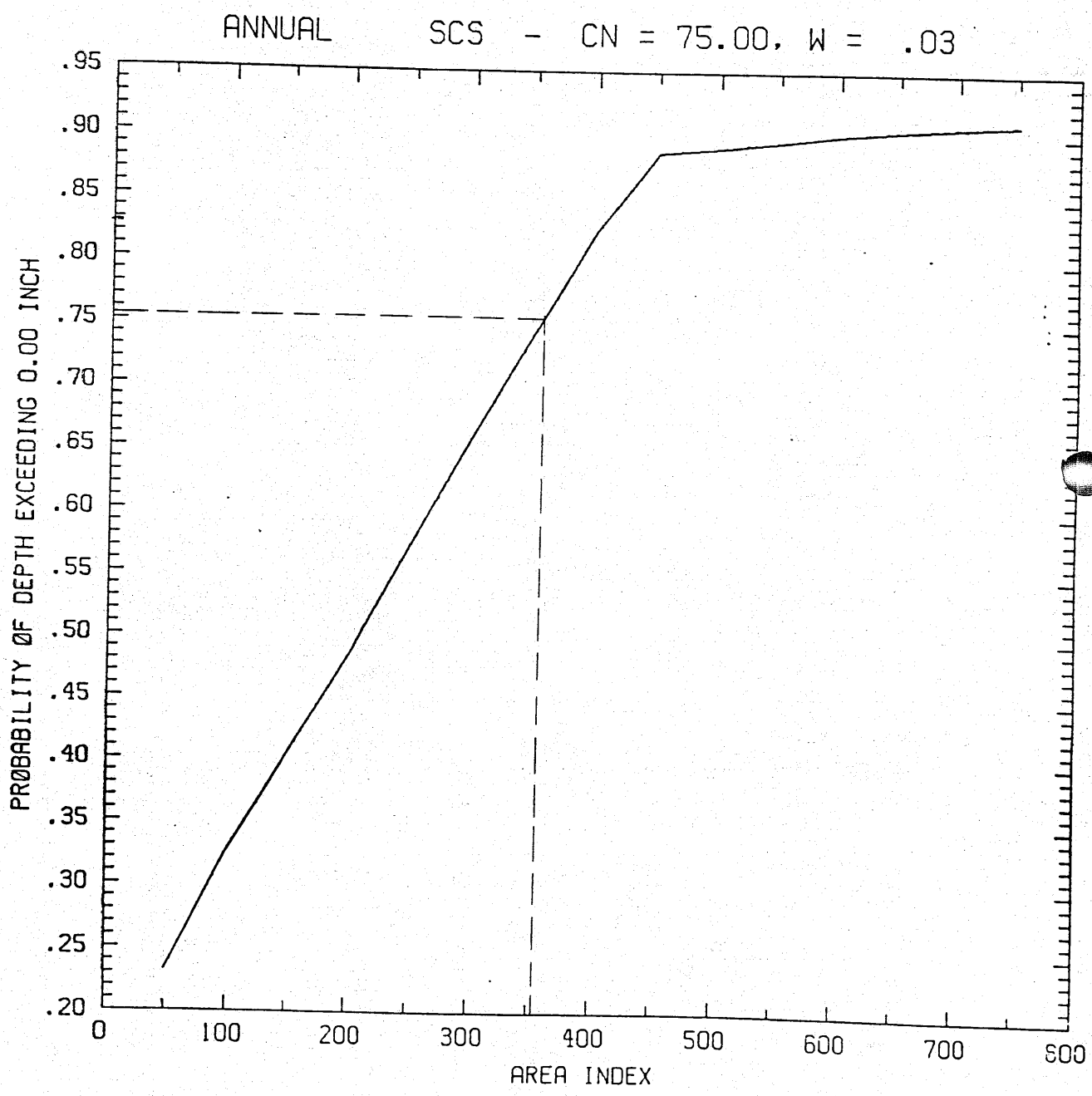
Plate 1:	Annual Mean Depth (AMD)	13.2 ft.	--
	Minimum Depth (MIN)	--	3.8 ft.
	Actual Capacity	11.0 ac-ft.	2.0 ac-ft.
	AI	357	765
Plate 2 or 3:	Probability	75%	88%

5 1989


N10-G
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 357
D = 13.2'
11.0 Ac-Ft
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

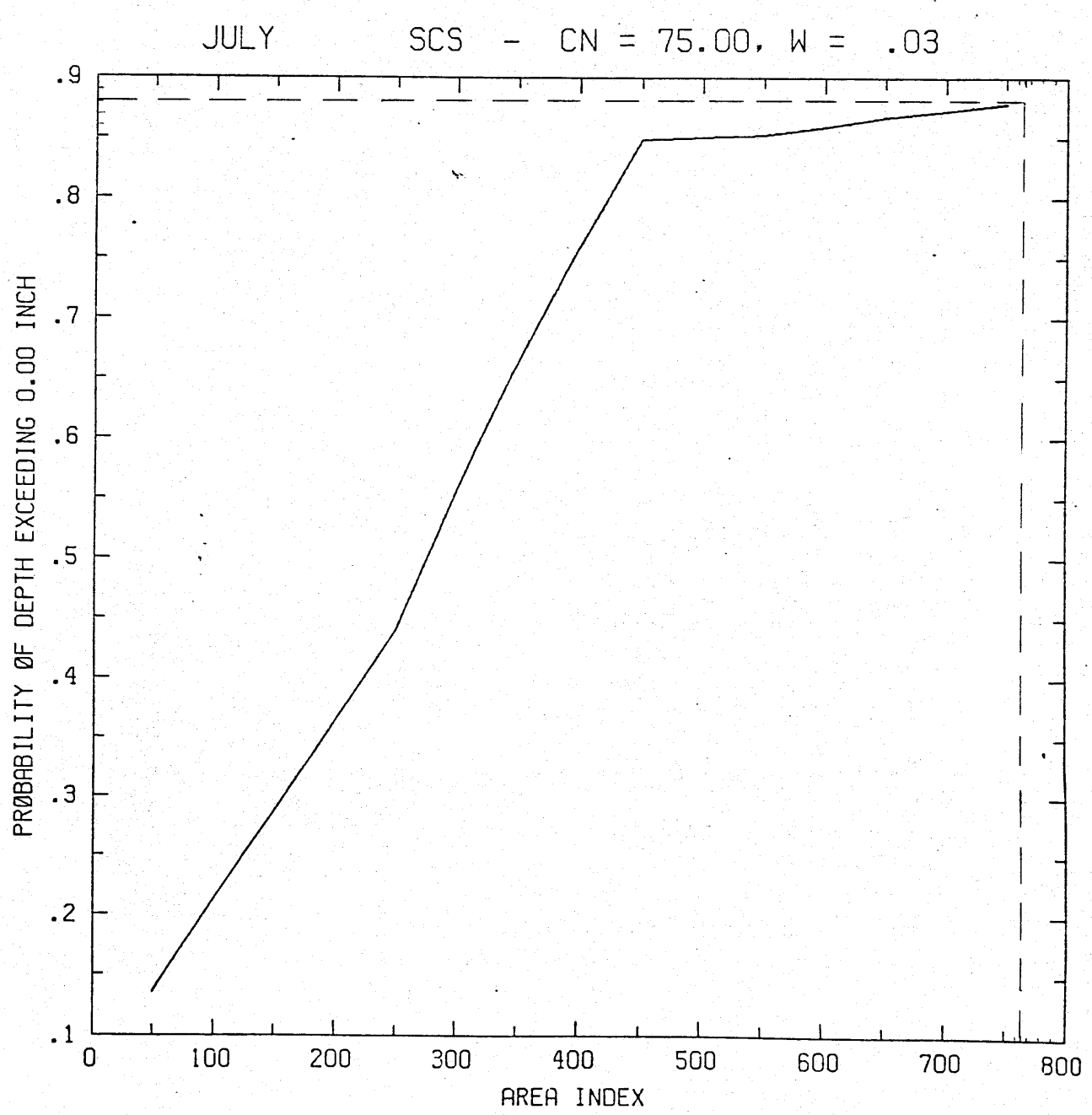
JAN 5 1989

NIO-G



Annual Mean Depth
Plate 2

NIO-G



Minimum Depth
Plate 3

JAN 5 1989

5 1989

PERMANENT IMPOUNDMENT

N11-A

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N11-A

A_D: 495.4 Acres

Depth: From Bottom Elevation

A_D: Total Drainage Area

A_P: Surface Area of Pond

Notes: Proposed Impoundment

A_B: Watershed Area = $A_D - A_P$

Theoretical Capacity: A_P x Depth

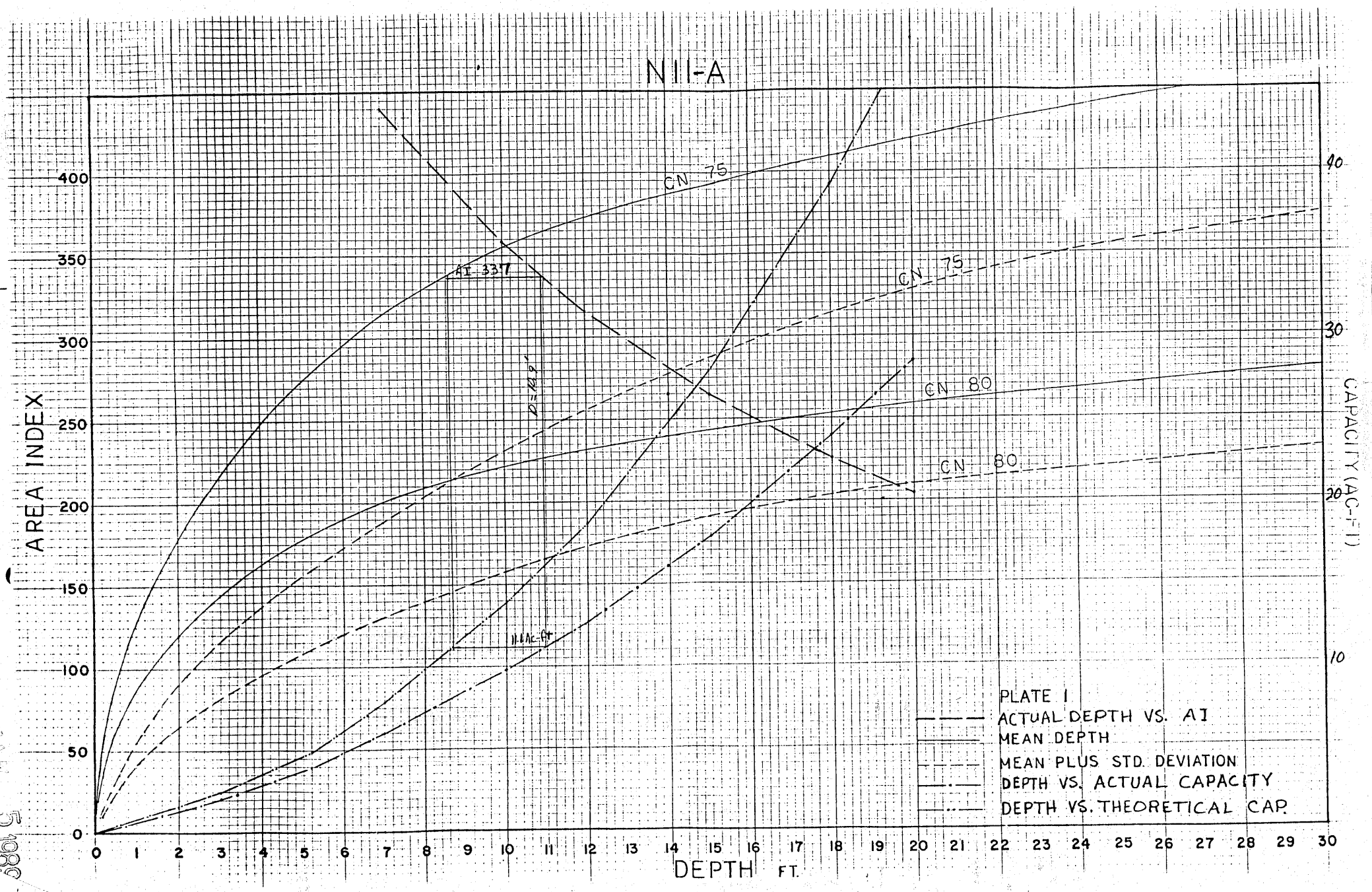
AI: Area Index = A_B/A_P

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	N/A	0.620	494.78	0	798	0
3		0.818	494.582	2.5	605	2.2
5		0.964	494.436	4.8	513	3.9
7		1.121	494.279	7.8	441	6.0
10		1.377	494.023	13.8	359	9.8
12		1.562	493.838	18.7	316	12.7
15		1.860	493.540	27.9	265	17.8
18		2.182	493.218	39.3	226	23.9
20		2.411	492.989	48.2	204	28.5

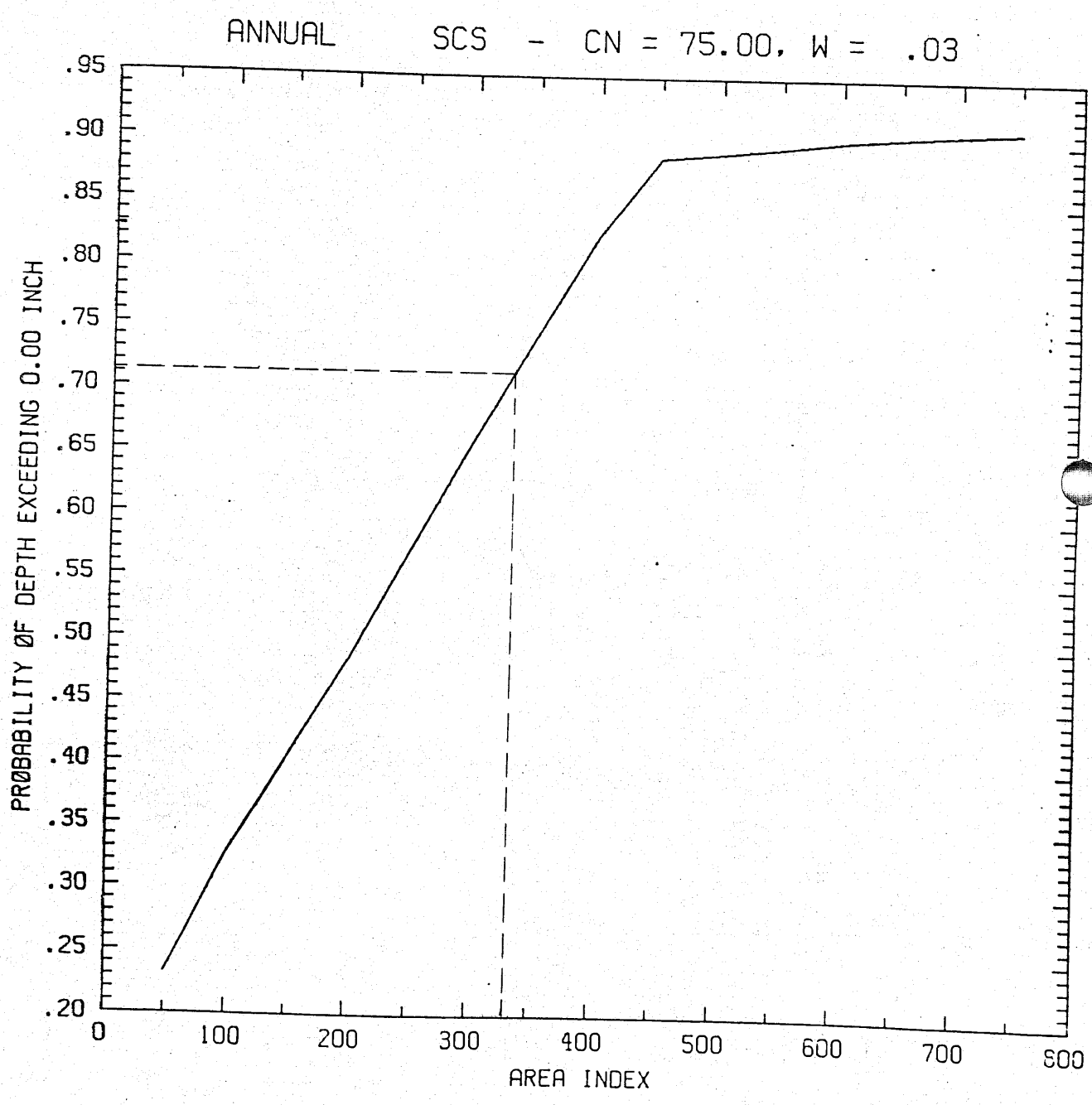
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	10.9 ft.	--
	Minimum Depth (MIN)	--	3.0 ft.
	Actual Capacity	11.1 ac-ft.	2.2 ac-ft.
	AI	337	605
Plate 2 or 3:	Probability	71%	86%

MAM 55 19

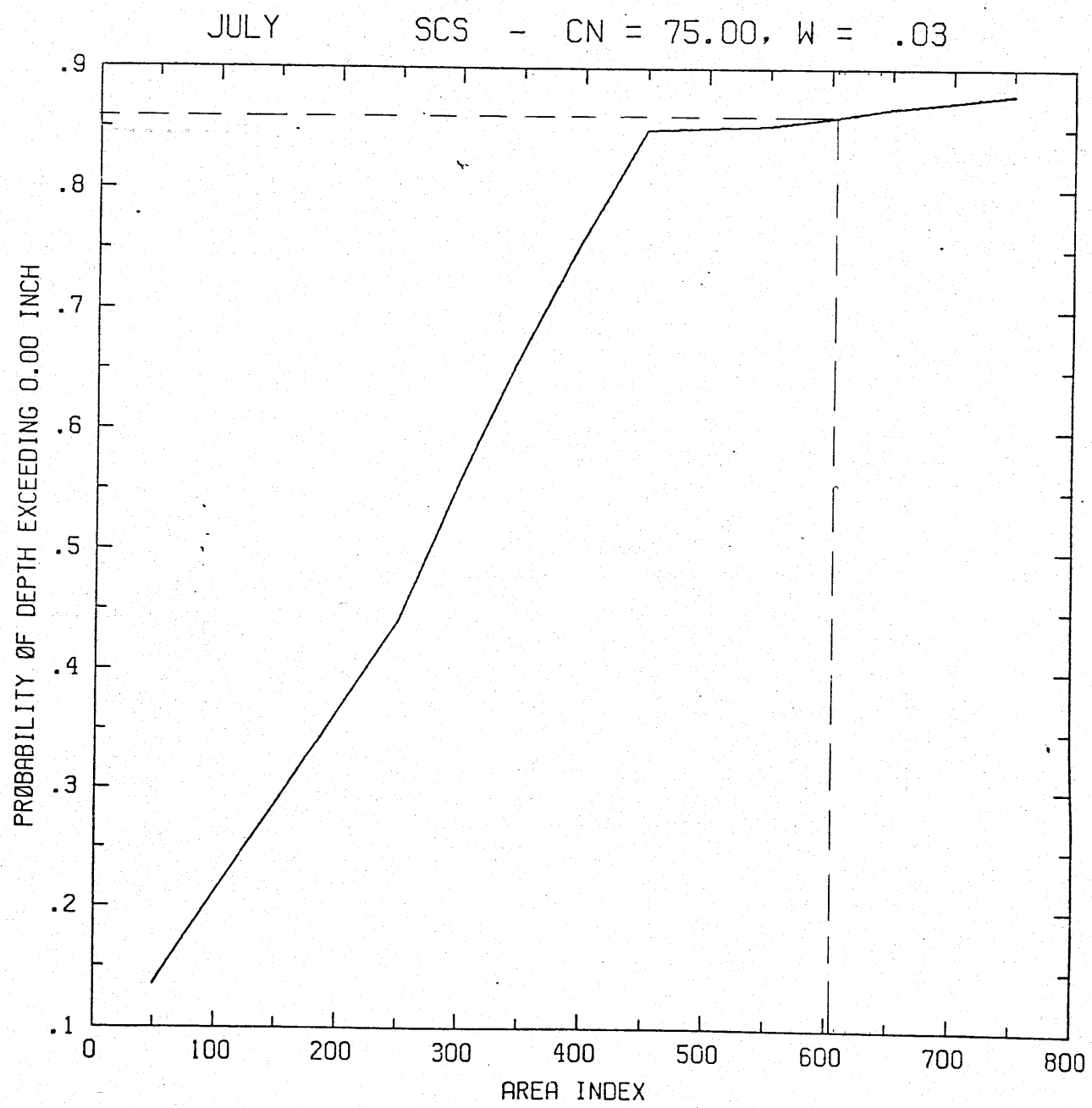

NII-A
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 337
11.1 AC-FT
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

N II-A



Annual Mean Depth
Plate 2

NII-A



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 1989

PERMANENT IMPOUNDMENT

N11-G

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N11-G

A_D: 881.2 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = $A_D - A_P$

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

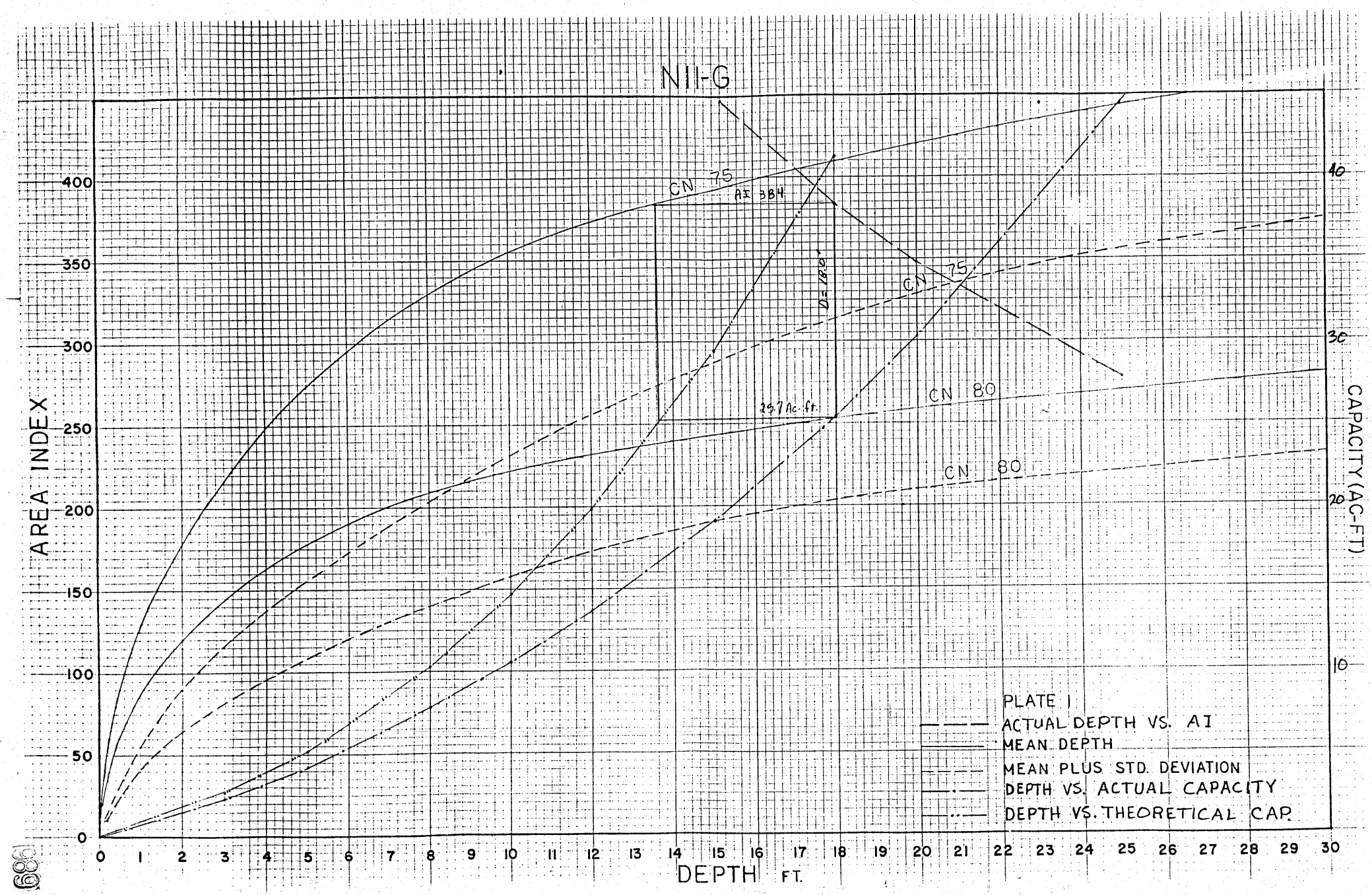
Notes: Proposed Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	N/A	0.689	880.511	0.0	1278	0.0
3	N/A	0.894	880.306	2.7	985	2.4
5	N/A	1.045	880.155	5.2	842	4.3
8	N/A	1.291	879.909	10.3	682	7.8
10	N/A	1.469	879.731	14.7	599	10.6
12	N/A	1.658	879.542	19.9	530	13.7
15	N/A	1.963	879.237	29.4	448	19.1
18	N/A	2.292	878.908	41.3	384	25.5
20	N/A	2.525	878.675	50.5	348	30.3
25	N/A	3.157	878.043	78.9	278	44.5

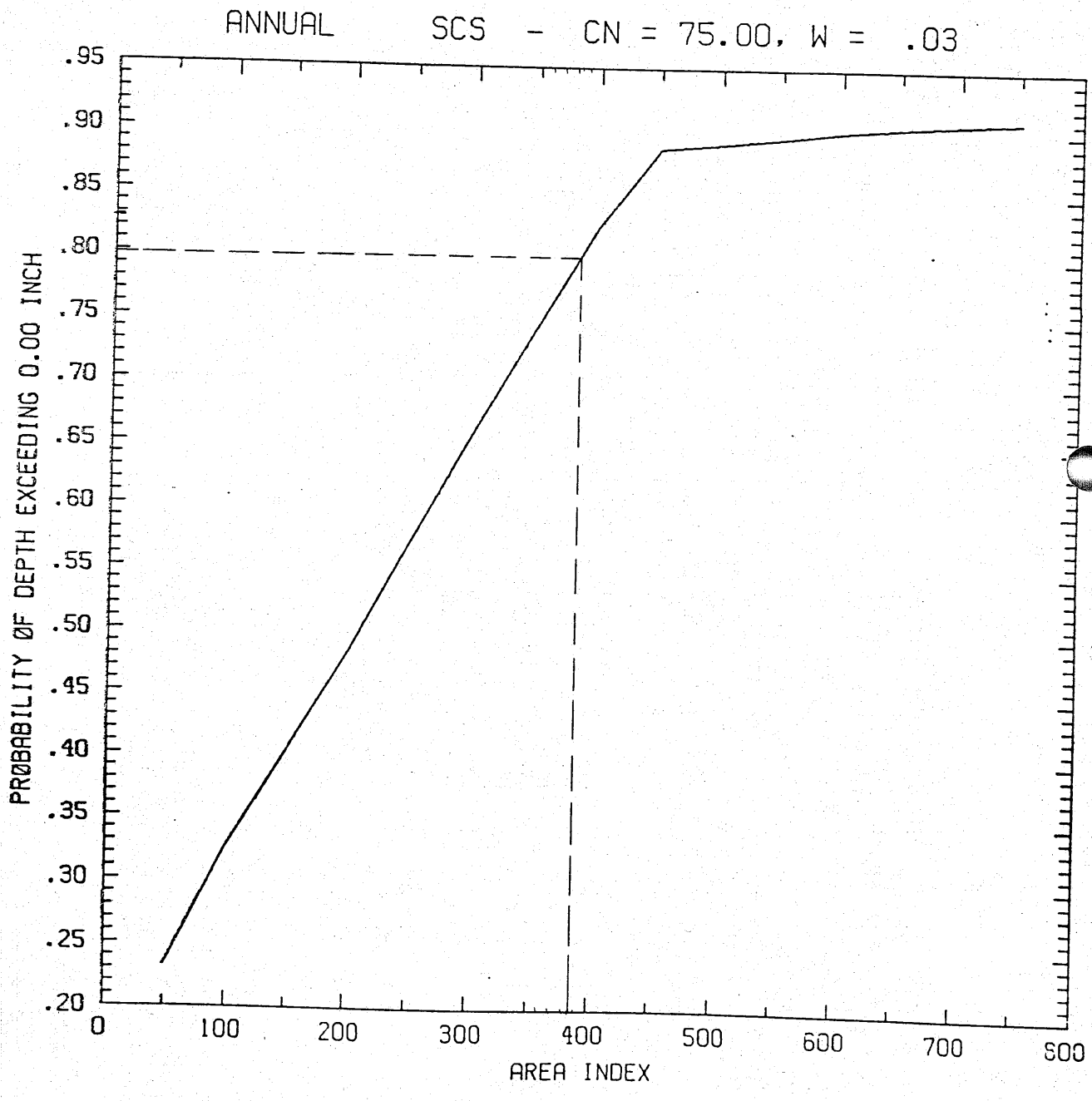
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	18.0 ft.	--
	Minimum Depth (MIN)	--	3.0 ft.
	Actual Capacity	25.7 ac-ft.	2.4 ac-ft.
	AI	384	985
Plate 2 or 3:	Probability	80%	88+%

JAN 5 1988


N11-G
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 384
D= 18.0'
29.7 Ac-ft.
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

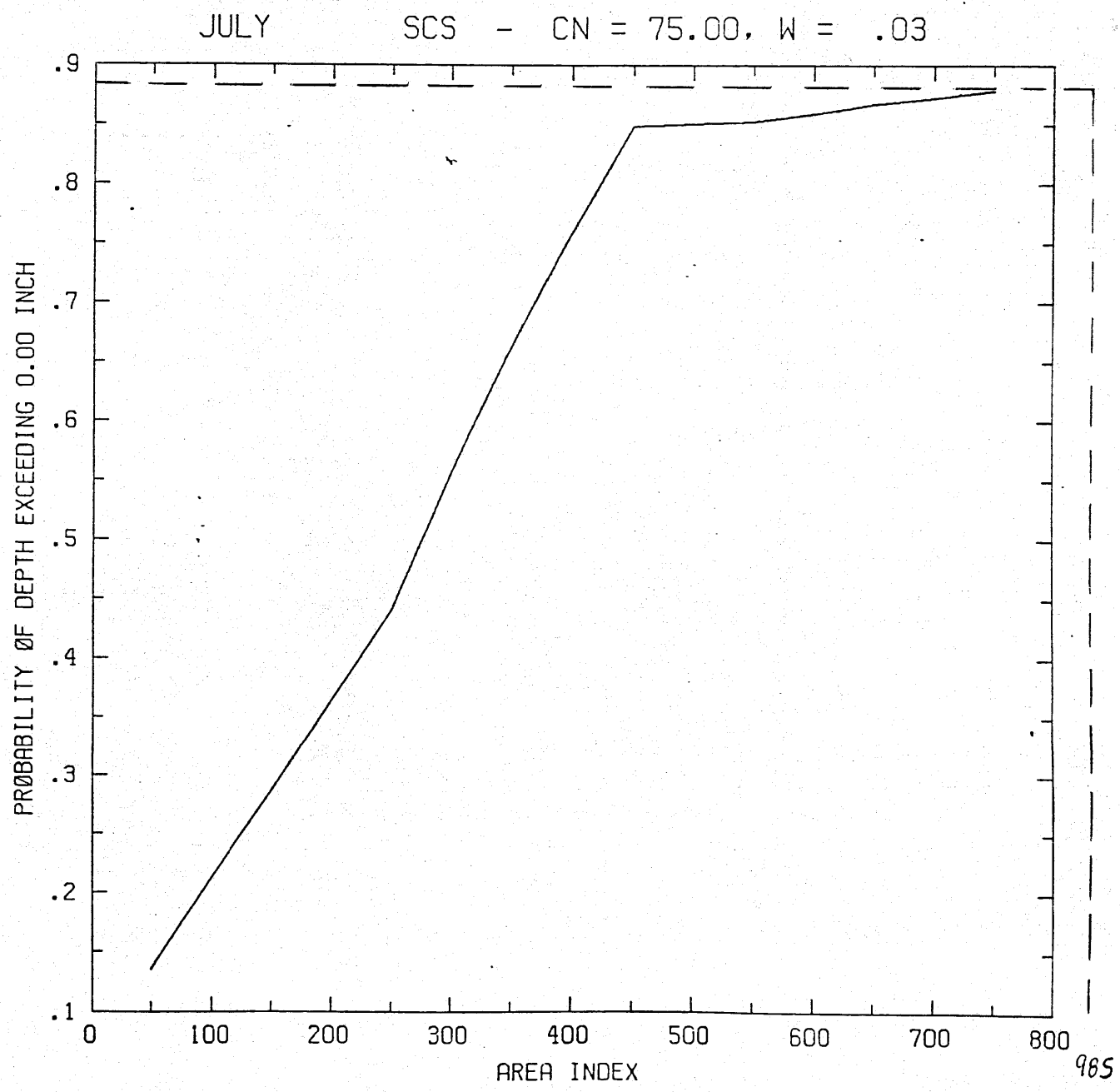
NII-G



Annual Mean Depth
Plate 2

JAN 5 1989

NII-G



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 1989

PERMANENT IMPOUNDMENT

N12-C

WATER PERSISTENCE WORKSHEET

JAN 5

WATER PERSISTENCE WORKSHEET

Pond ID: N12-C

A_D: 850.1 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

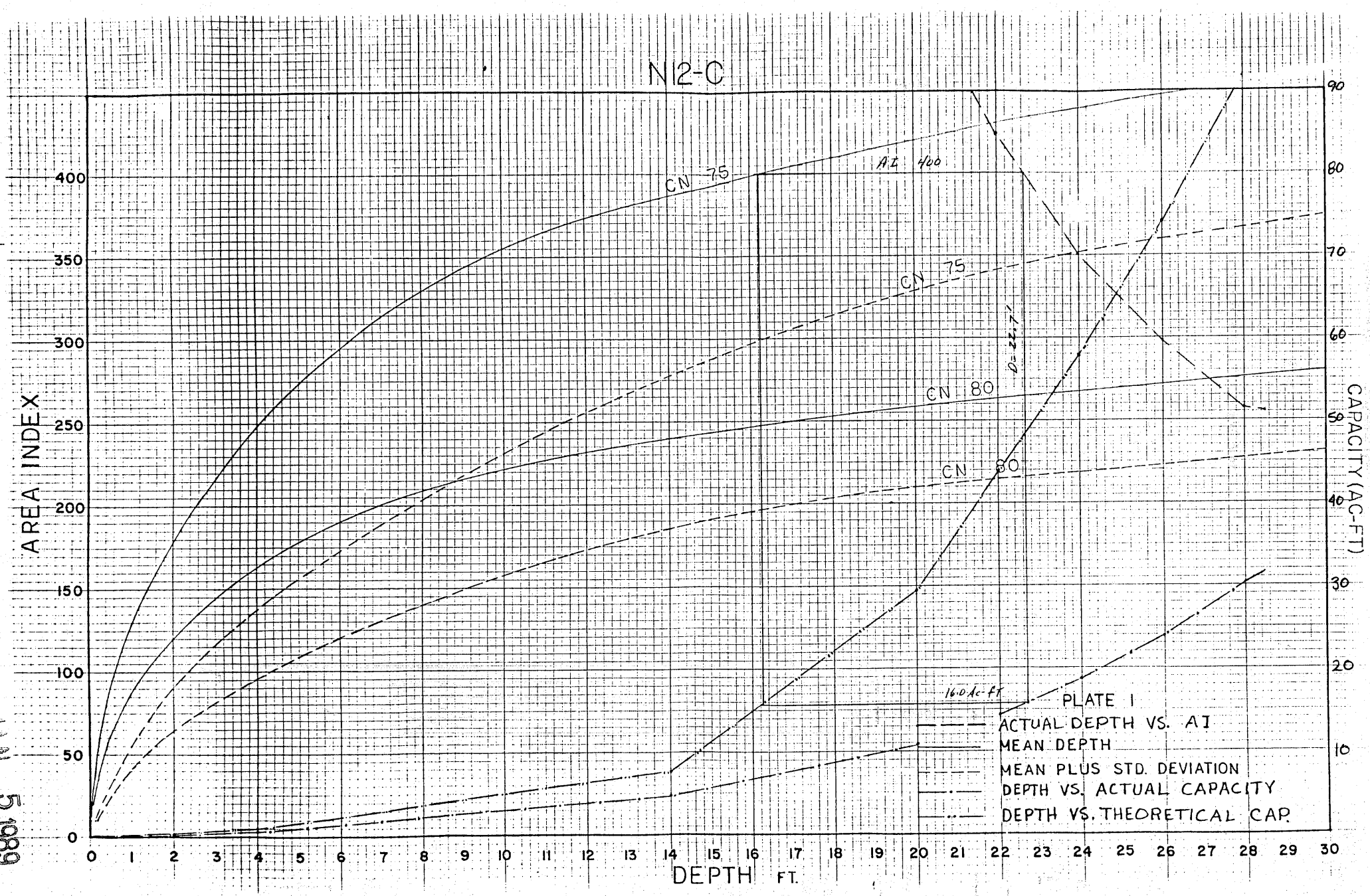
Notes: Existing Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6556	0.103	849.997	0.0	8228	0.0
2	6658	0.186	849.914	0.4	4557	0.3
4	6560	0.253	849.848	1.0	3365	0.7
8	6564	0.370	849.730	3.0	2297	2.0
14	6570	0.545	849.555	7.6	1558	4.7
20	6576	1.467	848.633	29.3	578	10.8
22	6578	1.996	848.104	43.9	423	14.2
24	6580	2.410	847.690	57.9	352	18.6
26	6582	2.847	847.253	74.0	298	23.9
28	6584	3.283	846.817	91.9	258	30.0
28.5	6584.5	3.312	846.788	94.4	256	31.7

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

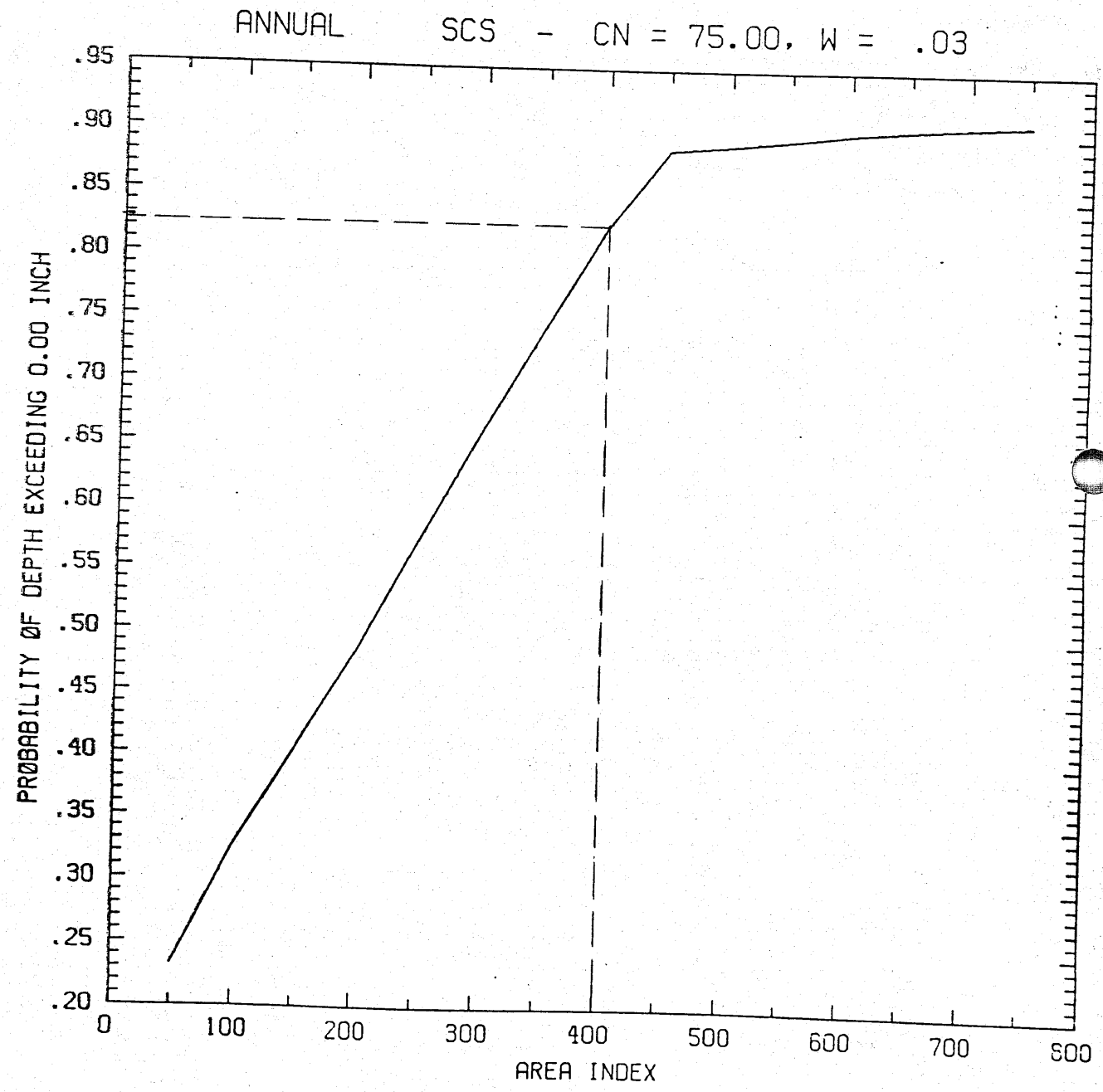
Plate 1:	Annual Mean Depth (AMD)	22.7 ft.	---
	Minimum Depth (MIN)	---	8.0 ft.
	Actual Capacity	16.0 ac-ft.	2.0 ac-ft.
	AI	400	2297
Plate 2 or 3:	Probability	83%	88+%

JAN 5 1989


N12-C
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
A.I. 400
16.0 Ac-ft
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

JAN 5 1989

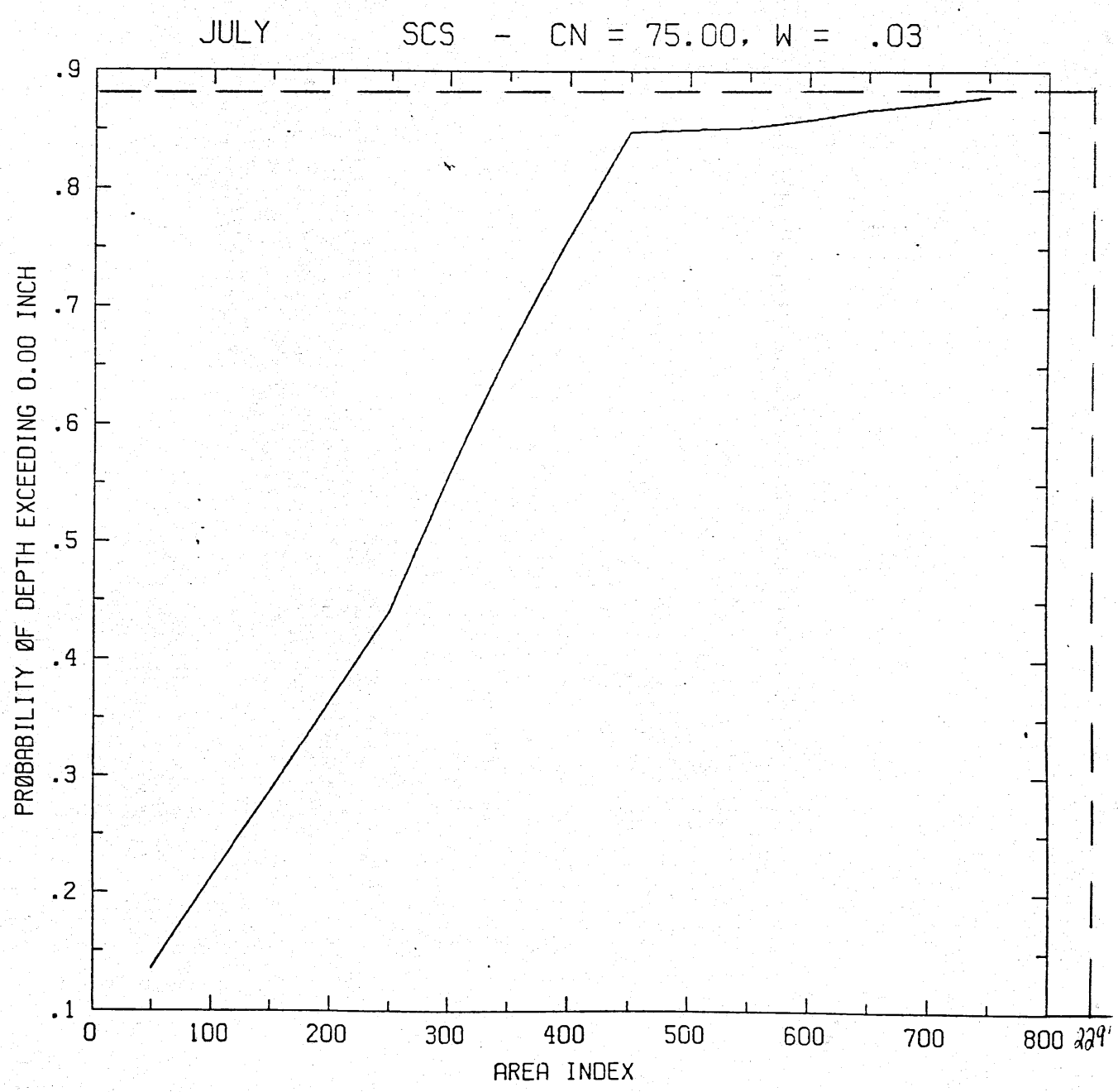
N12-C



Annual Mean Depth
Plate 2

JAN 5 1989

N12-C



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 1989

PERMANENT IMPOUNDMENT

N14-D

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N14-D

A_D: 1836.0 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

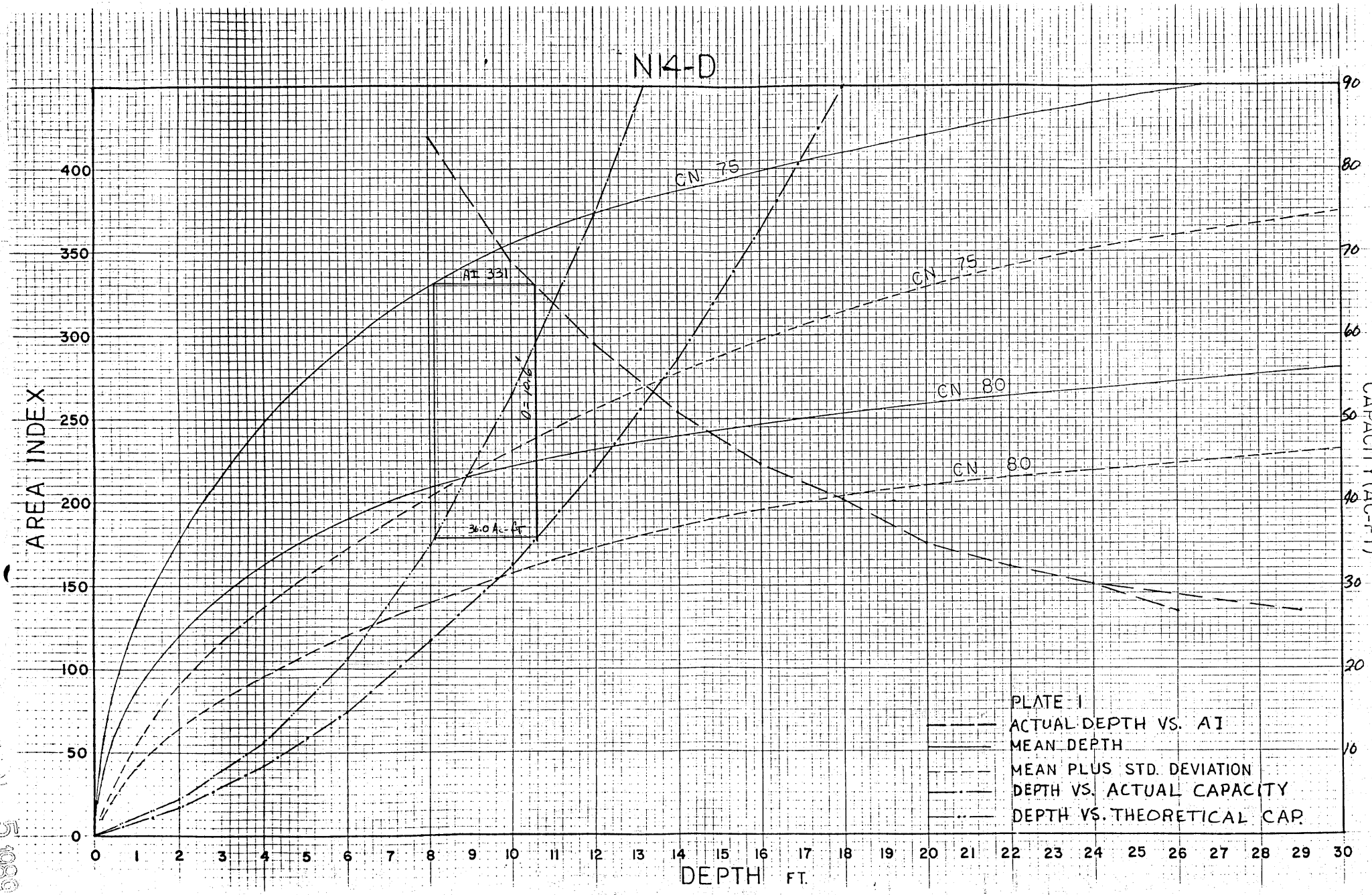
Notes: MSHA Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6606	1.307	1834.693	0	1404	0
2	6608	2.144	1833.856	4.3	855	3.5
4	6610	2.831	1833.169	11.3	648	8.4
6	6612	3.557	1832.443	21.3	515	14.8
8	6614	4.365	1831.635	34.9	420	22.7
10	6616	5.299	1830.701	53.0	346	32.4
12	6618	6.202	1829.798	74.4	295	43.9
14	6620	7.175	1828.825	100.5	255	57.3
16	6622	8.168	1827.833	130.7	224	72.6
18	6624	9.036	1826.964	162.6	202	89.8
20	6626	10.391	1825.609	207.8	176	109.3
22	6628	11.211	1824.789	246.6	163	130.8
24	6630	12.034	1823.966	288.8	152	154.0
29	6635	13.598	1822.402	394.3	134	218.1
34	6640	16.045	1819.955	545.5	113	292.2

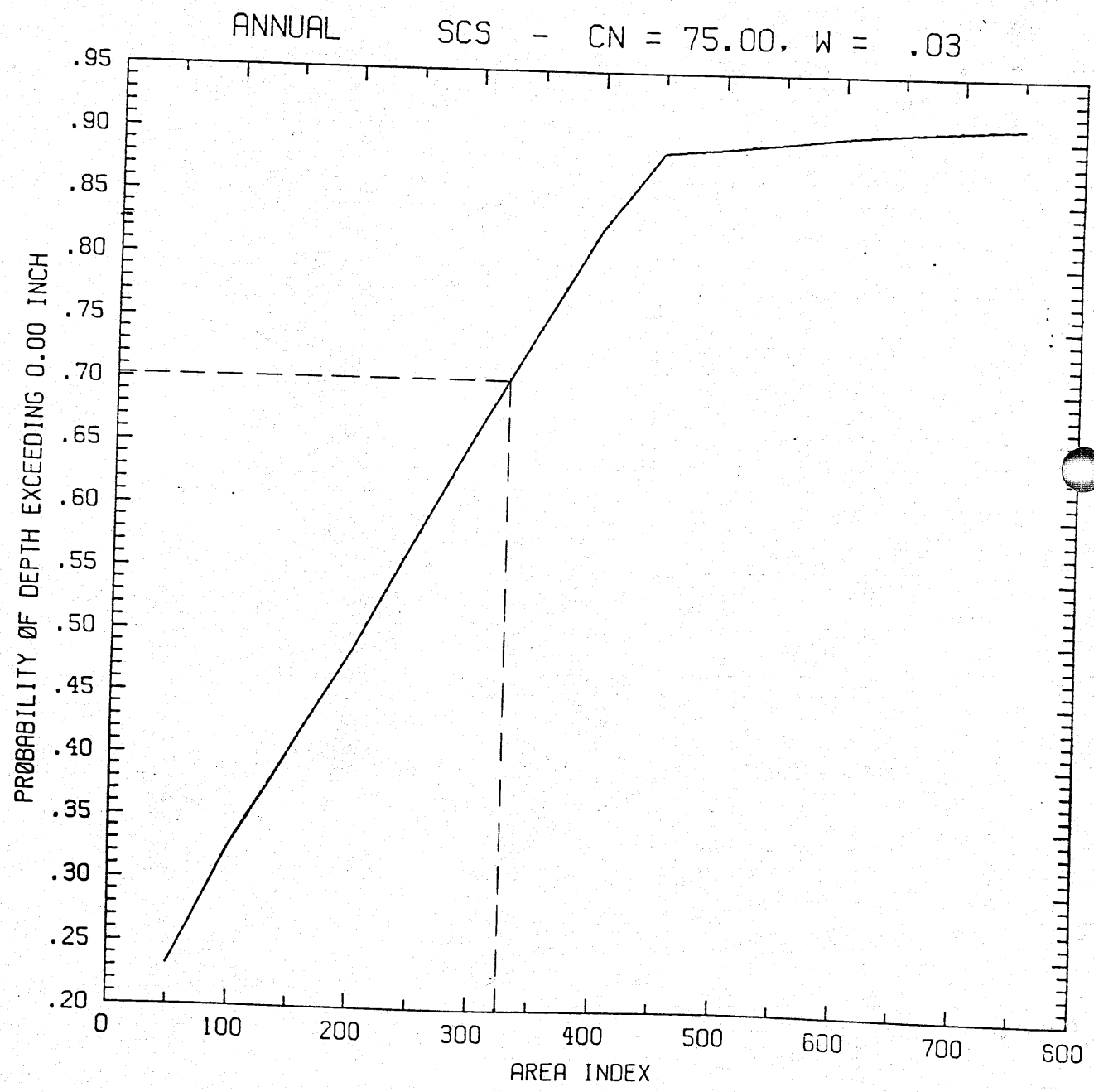
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	10.6 ft.	--
	Minimum Depth (MIN)	--	3.0 ft.
	Actual Capacity	36.0 ac-ft.	6.0 ac-ft.
	AI	331	737
Plate 2 or 3:	Probability	70%	88%

JAN 5


N14-D
AREA INDEX
DEPTH FT.
CAPACITY (AC-FT)
CN 75
CN 75
CN 80
CN 80
AI 331
36.0 Ac-ft
PLATE 1
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

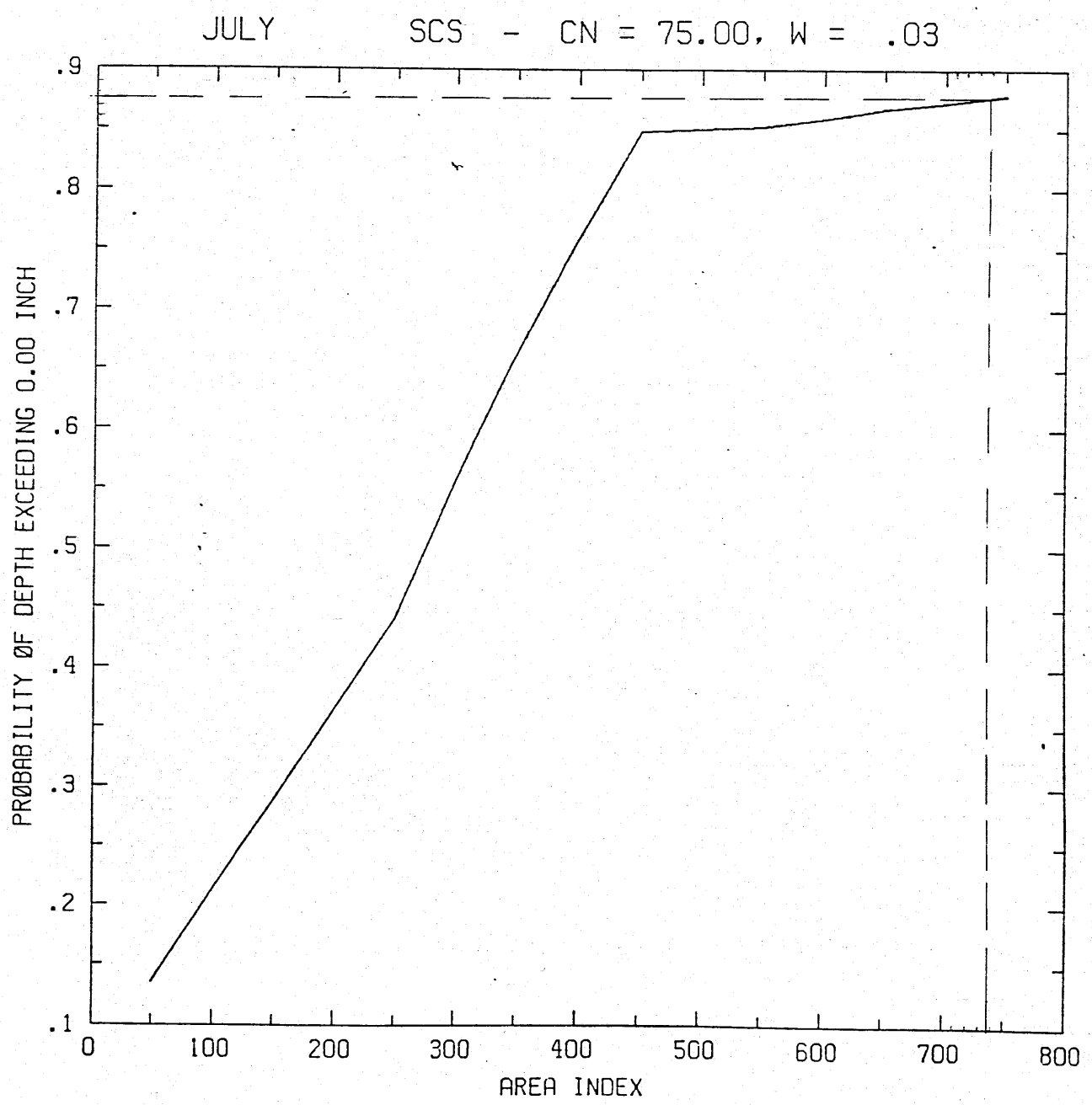
N14-D



Annual Mean Depth
Plate 2

JAN 5 1989

N14-D



Minimum Depth
Plate 3

JAN 5 1983

JAN 5 1988

PERMANENT IMPOUNDMENT

N14-F

WATER PERSISTENCE WORKSHEET

5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N14-F

A_D: 376.0 Acres

Depth: From Bottom Elevation

A_D: Total Drainage Area

A_P: Surface Area of Pond

A_B: Watershed Area = $A_D - A_P$

Theoretical Capacity: A_P x Depth

AI: Area Index = A_B/A_P

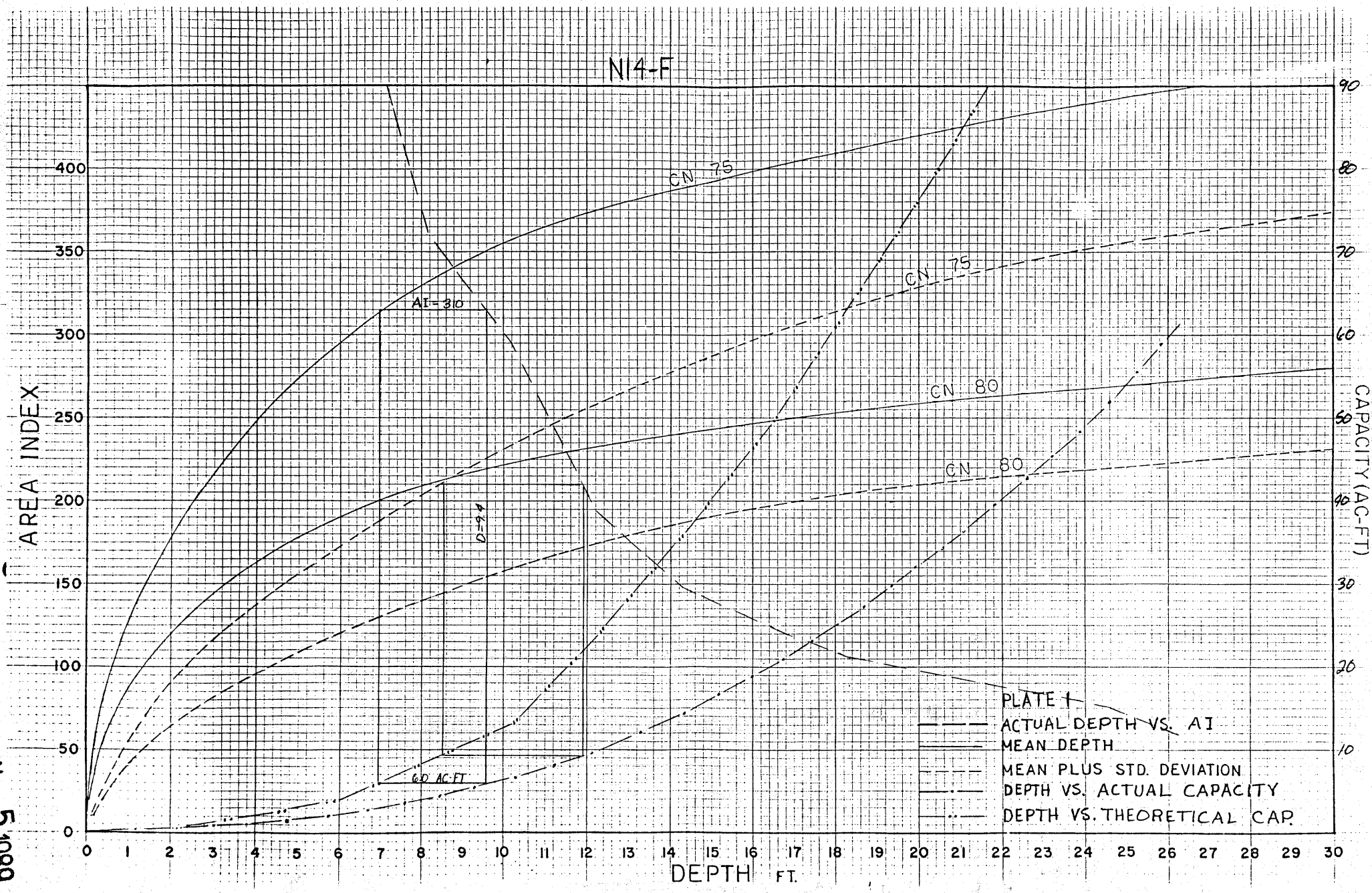
Notes: MSHA Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6634	0.136	375.9	0	2764	0
2	6636	0.264	375.7	0.5	1423	0.4
4	6638	0.490	375.5	2.0	766	1.2
6	6640	0.699	375.3	4.2	537	2.3
8	6642	1.054	374.9	8.4	356	4.1
10	6644	1.292	374.7	12.9	290	6.4
12	6646	1.951	374.0	23.4	192	9.7
14	6648	2.527	373.5	35.4	148	14.2
16	6650	3.000	373.0	48.0	124	19.7
18	6652	3.519	372.5	63.3	106	26.2
20	6654	3.950	372.1	79.0	94	33.7
22	6656	4.367	371.6	96.1	85	42.0
24	6658	4.876	371.1	117.0	76	51.2
25.7	6659.7	6.299	369.7	161.9	59	60.7

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

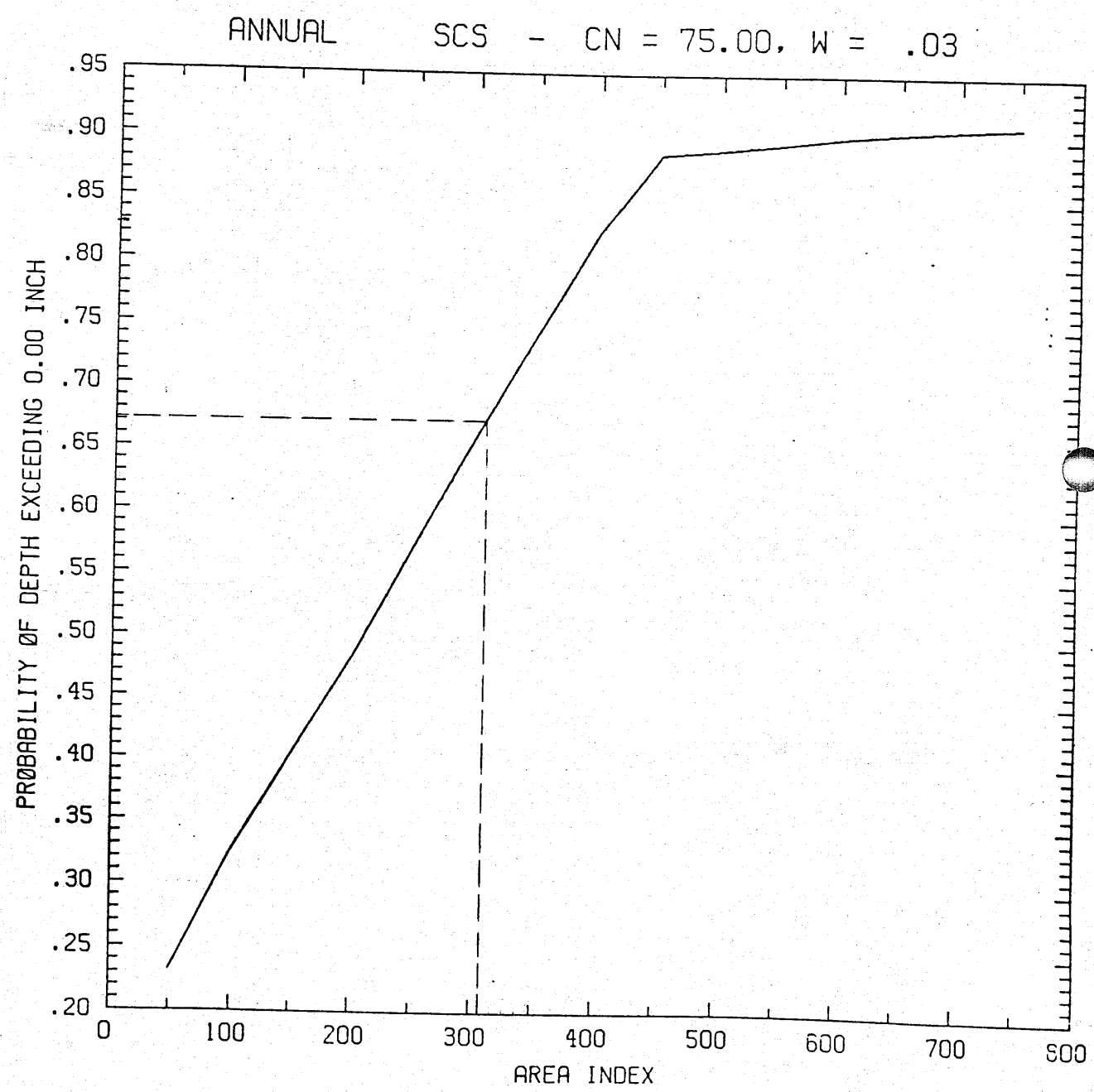
Plate 1:	Annual Mean Depth (AMD)	9.4 ft	--
	Minimum Depth (MIN)	--	6.0 ft
	Actual Capacity	6.0 ac-ft	2.3 ac-ft
	AI	310	537
Plate 2 or 3:	Probability	67%	85%

JAN 5 1989


N14-F
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI = 310
D = 9.4
60 AC-FT
PLATE 1
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

JAN 5 1989

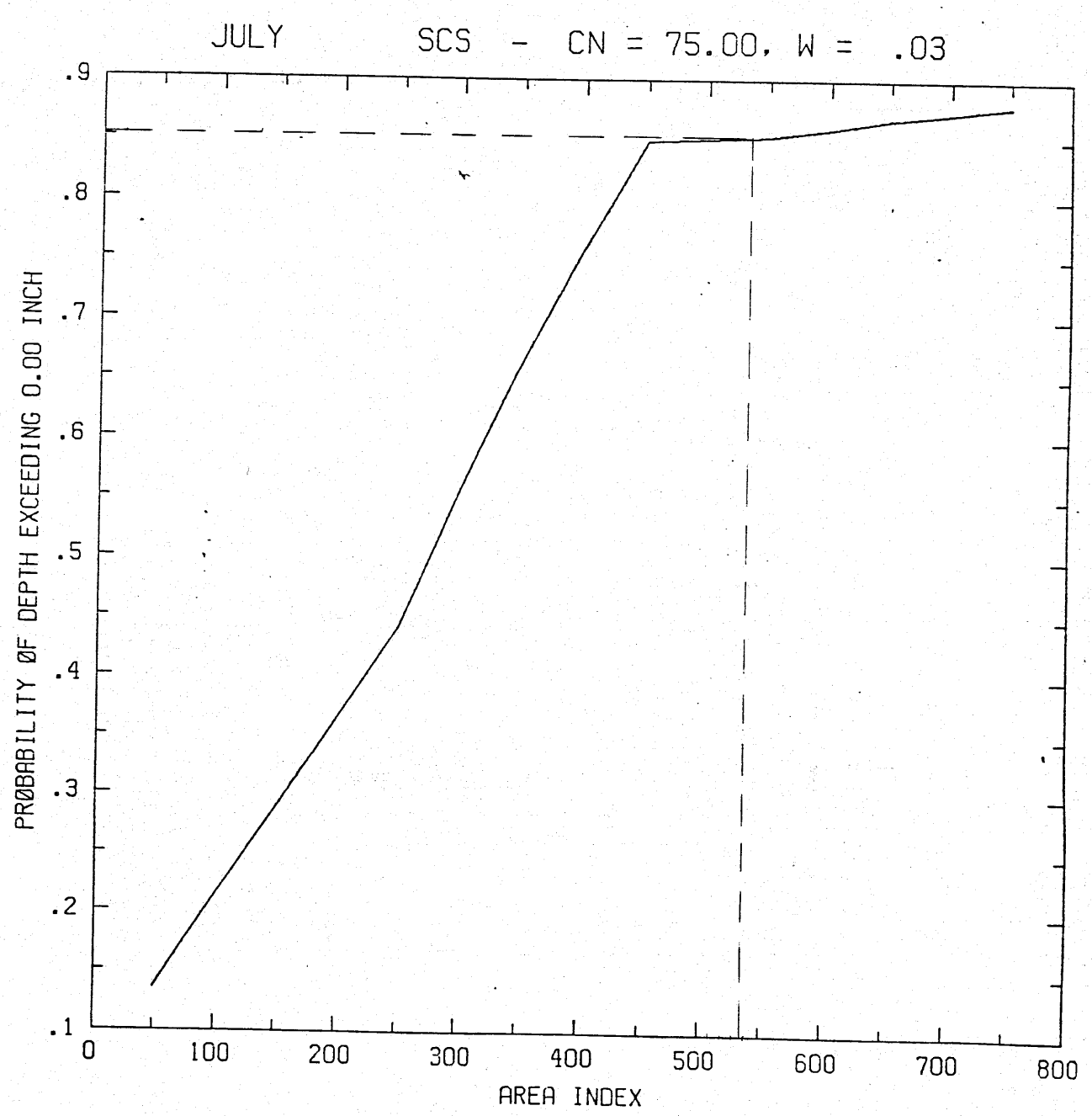
N14-F



Annual Mean Depth
Plate 2

JAN 5 1989

N14-F



Minimum Depth
Plate 3

JAN 5 1989

JAN 5 1989

PERMANENT IMPOUNDMENT

N14-G

WATER PERSISTENCE WORKSHEET

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N14-G

A_D: 1479.0 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

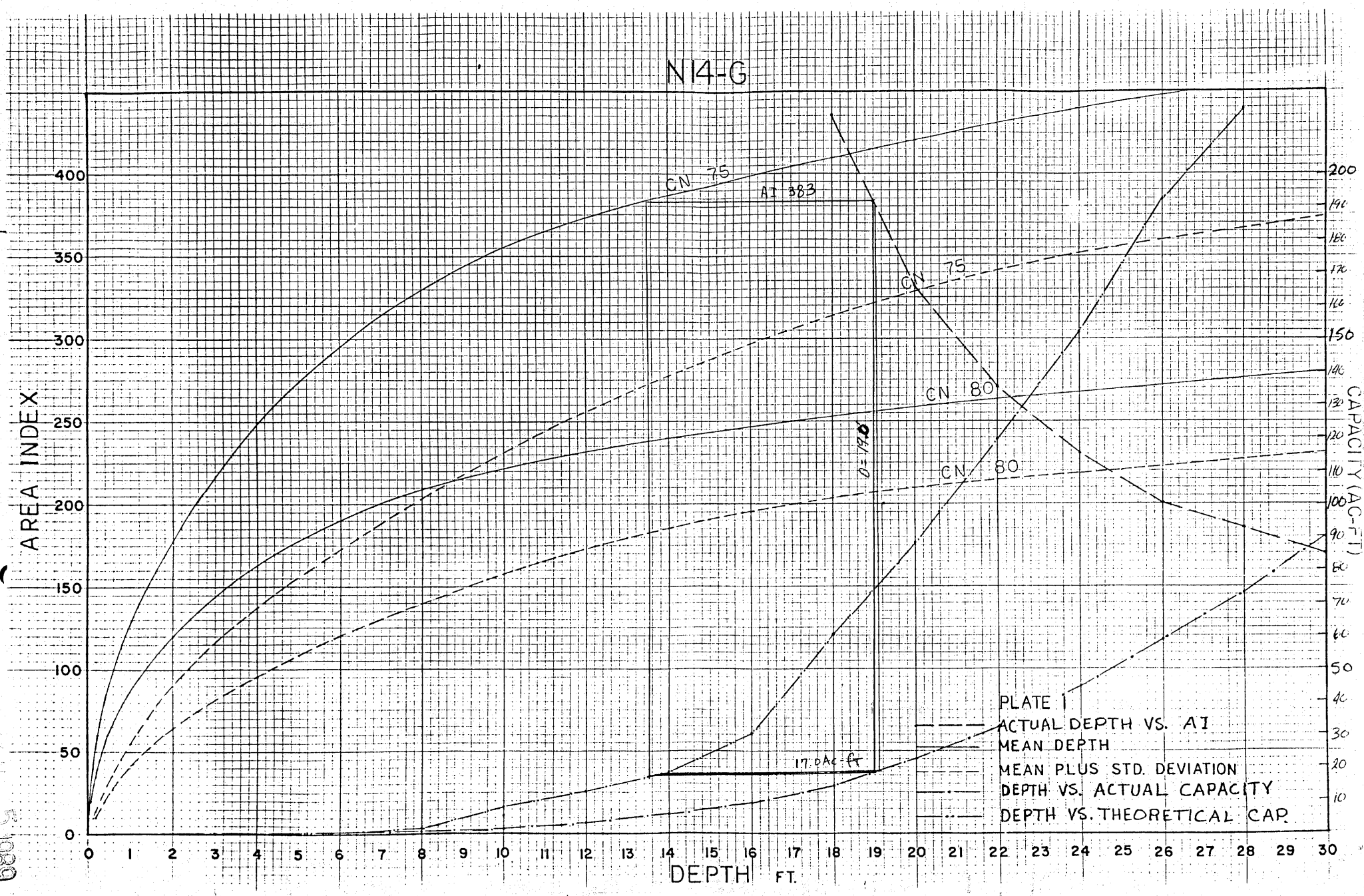
Notes: MSHA Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6622	0.007	1478.993	0	211285	0.0
2	6624	0.039	1478.961	0.1	37922	0.0
4	6626	0.115	1478.885	0.5	12860	0.2
6	6628	0.188	1478.812	1.1	7866	0.5
8	6630	0.273	1478.727	2.2	5417	1.0
10	6632	0.801	1478.199	8.0	1845	2.0
12	6634	1.068	1477.932	12.8	1384	3.9
14	6636	1.306	1477.694	18.3	1132	6.3
16	6638	1.974	1477.026	31.6	748	9.6
18	6640	3.388	1475.612	61.0	436	14.9
20	6642	4.426	1474.574	88.5	333	22.7
22	6644	5.445	1473.555	119.8	271	32.6
24	6646	6.357	1472.643	152.6	232	44.4
26	6648	7.385	1741.615	192.0	199	58.3
28	6650	7.879	1471.121	220.6	187	73.4
30	6652	8.639	1470.461	259.2	170	89.9

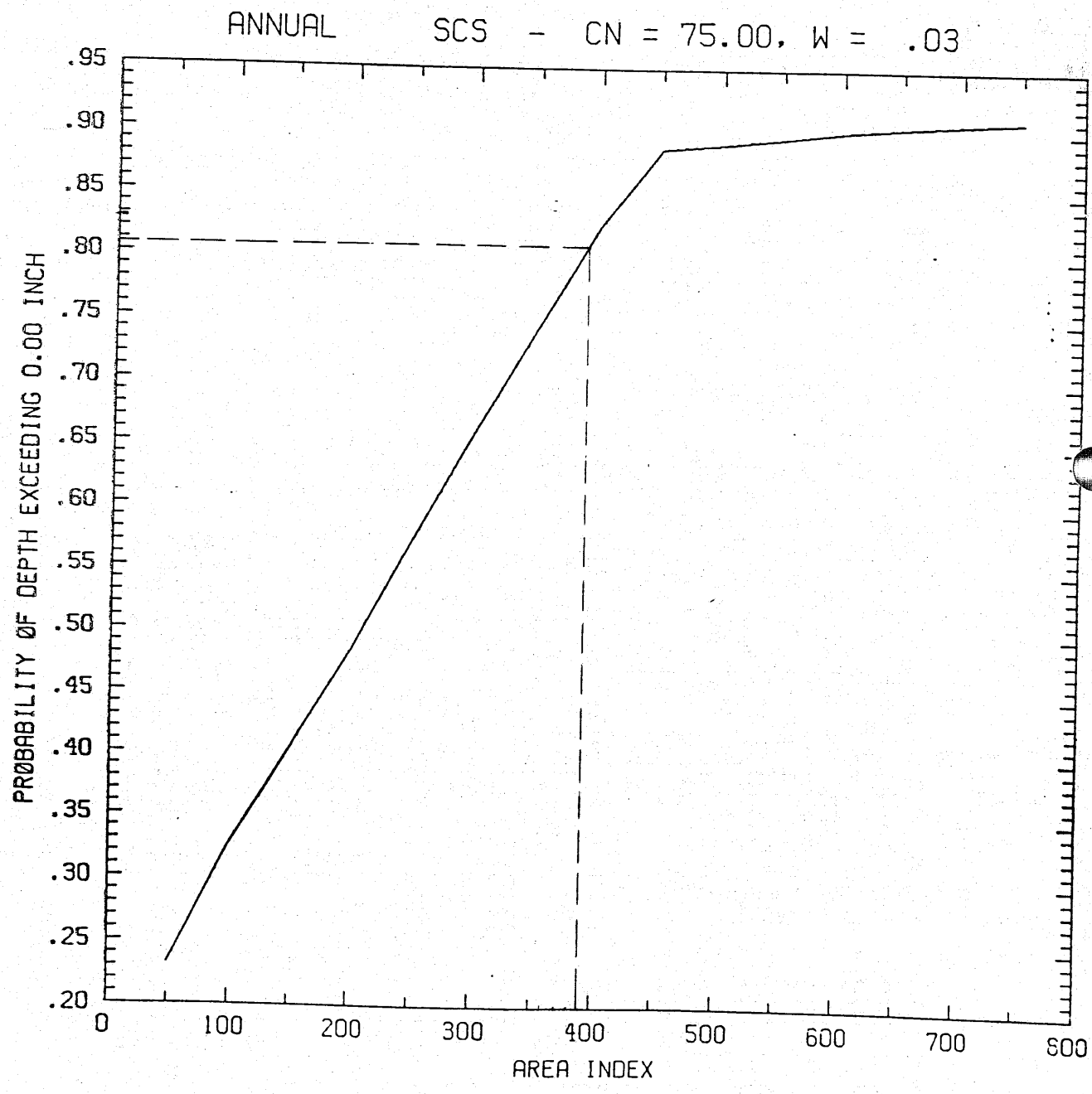
Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	19.0 ft.	--
	Minimum Depth (MIN)	--	10.0 ft.
	Actual Capacity	12.0 ac-ft.	2.0 ac-ft.
	AI	383	1845
Plate 2 or 3:	Probability	81%	88+%

JAN 5 1989


N14-G
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 383
D=19.0
17.0 AC-FT
PLATE 1
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

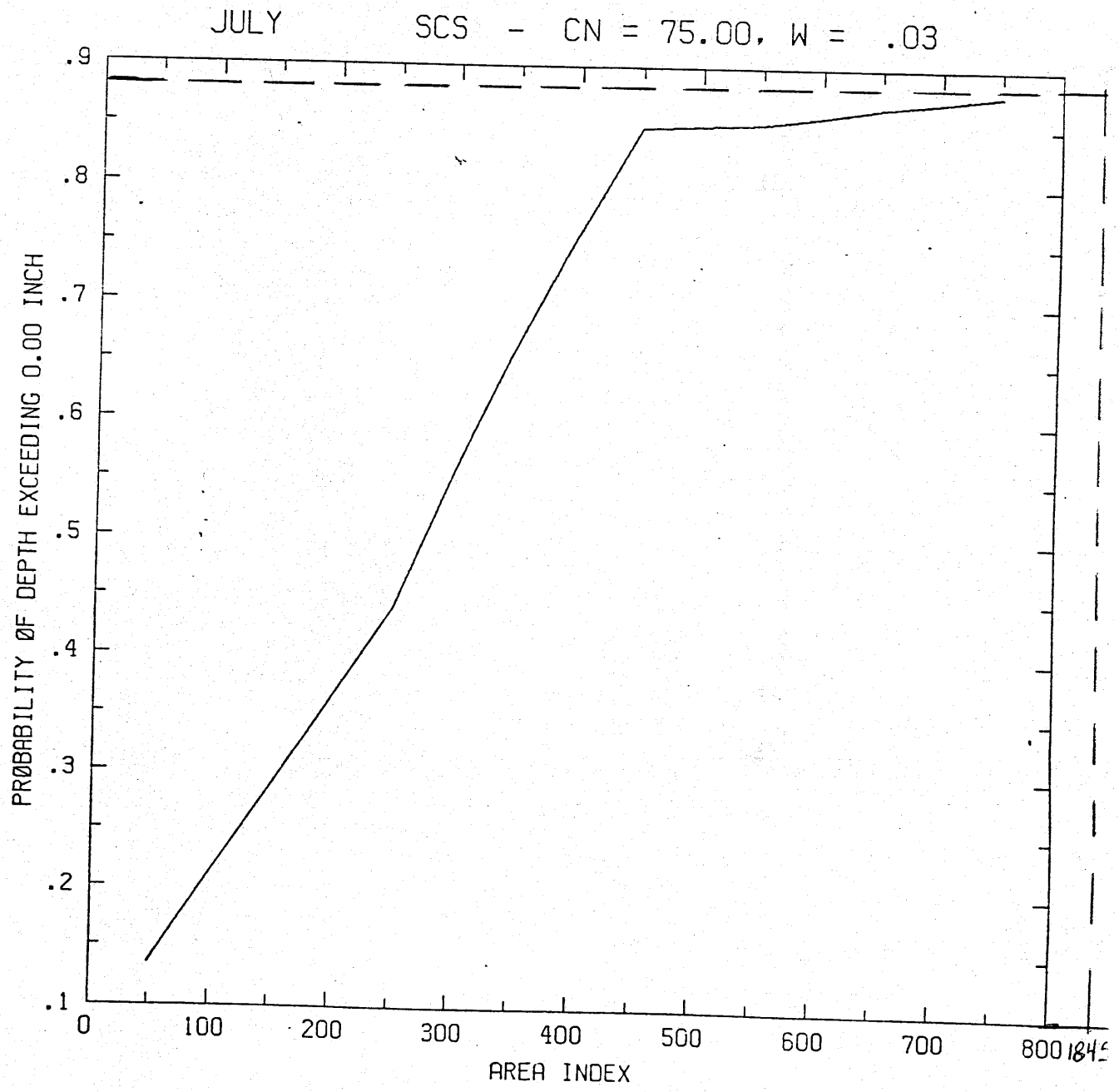
N14-G



Annual Mean Depth
Plate 2

JAN 5 1989

N14-G



Minimum Depth
Plate 3

JAN 5 1982

JAN 5 1999

PERMANENT IMPOUNDMENT

N14-H

WATER PERSISTENCE WORKSHEET

5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: N14-H

A_D: 1615.0 Acres

Depth: From Bottom Elevation

A_D: Total Drainage Area

A_P: Surface Area of Pond

A_B: Watershed Area = $A_D - A_P$

Theoretical Capacity: A_P x Depth

AI: Area Index = A_B/A_P

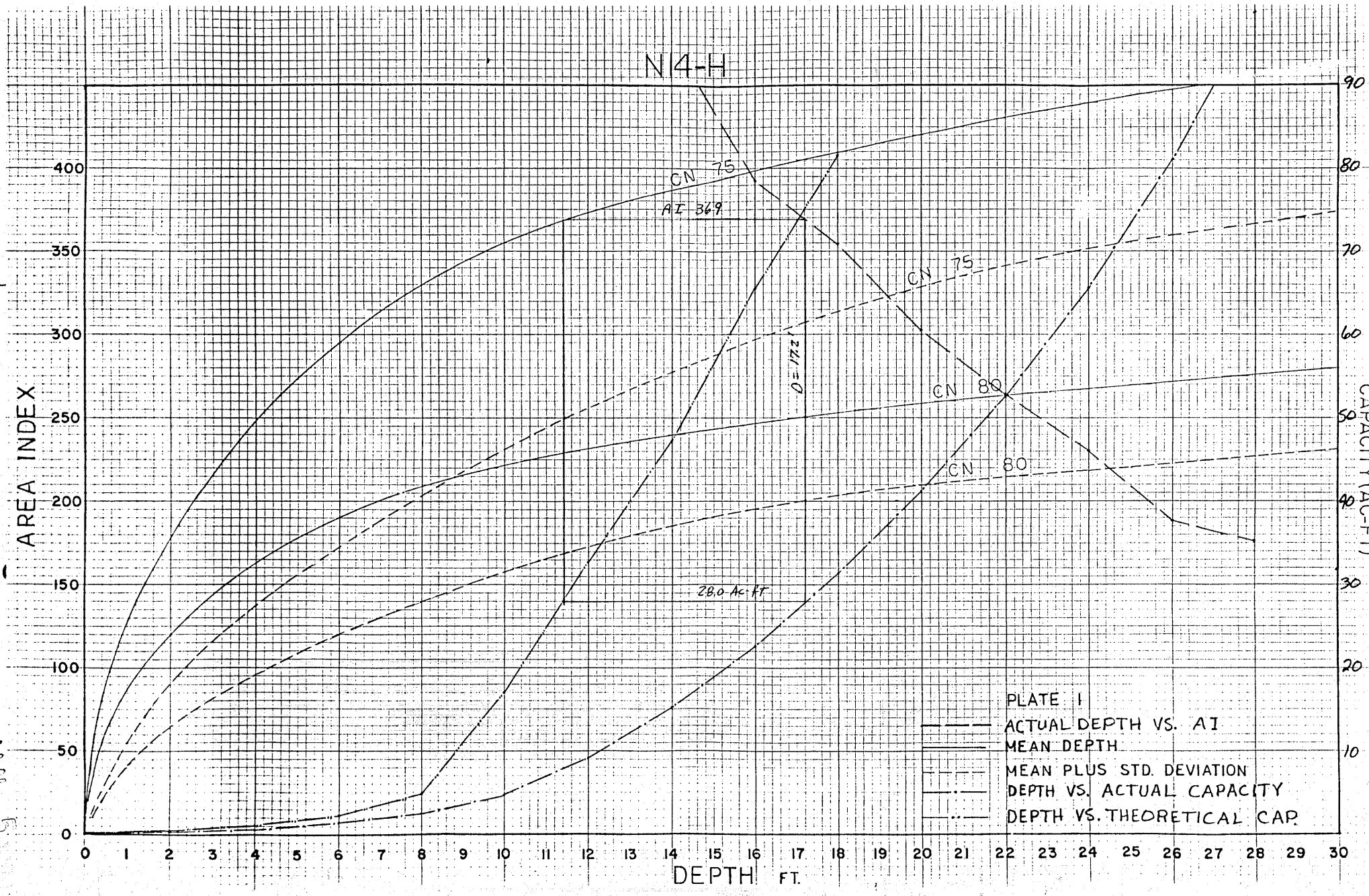
Notes: MSHA Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6680	0.101	1614.90	0	15989	0
2	6682	0.178	1614.82	0.4	9072	0.3
4	6684	0.270	1614.73	1.1	5981	0.7
6	6686	0.389	1614.6	2.3	4151	1.4
8	6688	0.597	1614.4	4.8	2704	2.4
10	6690	1.703	1613.297	17.0	947	4.7
12	6692	2.731	1612.269	32.8	590	9.1
14	6694	3.379	1611.621	47.3	477	15.2
16	6696	4.093	1610.907	65.5	394	22.7
18	6698	4.539	1610.5	81.7	355	31.3
20	6700	5.302	1609.698	106.0	304	41.2
22	6702	6.082	1608.918	133.8	265	52.6
24	6704	6.949	1608.051	166.8	231	65.6
26	6706	8.531	1606.469	221.8	188	81.1
28	6708	9.070	1605.93	254.0	177	98.7
30	6710	10.080	1604.92	302.4	159	117.8

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

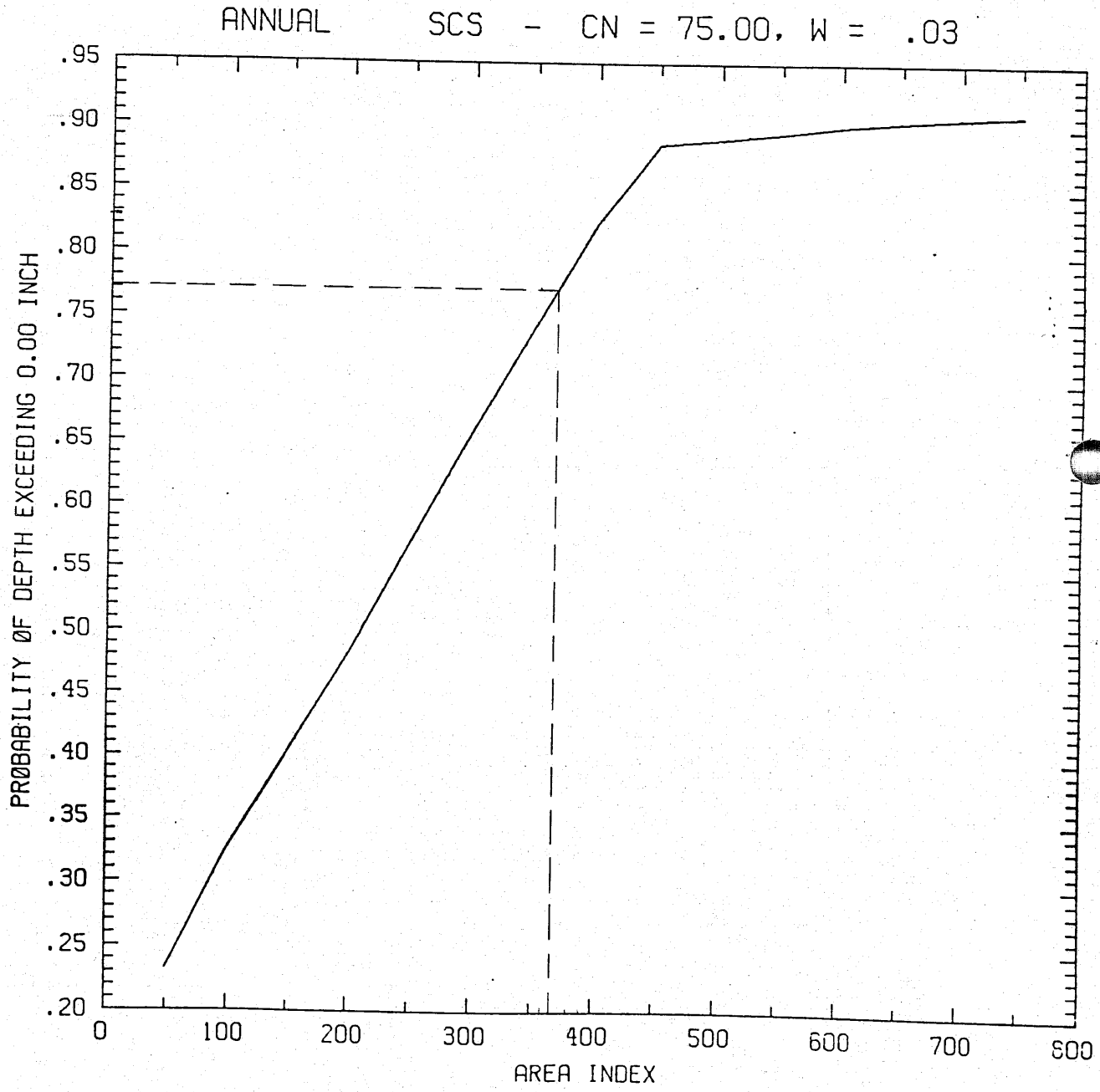
Plate 1:	Annual Mean Depth (AMD)	17.2 ft.	--
	Minimum Depth (MIN)	--	8.0 ft.
	Actual Capacity	28 ac-ft.	2.4 ac-ft.
	AI	369	2704
Plate 2 or 3:	Probability	77%	88+%

JAN 5 1989


N14-H
AREA INDEX
CAPACITY (AC-FT)
DEPTH FT.
CN 75
CN 75
CN 80
CN 80
AI 369
28.0 Ac-FT
0=17.2
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

JAN 5

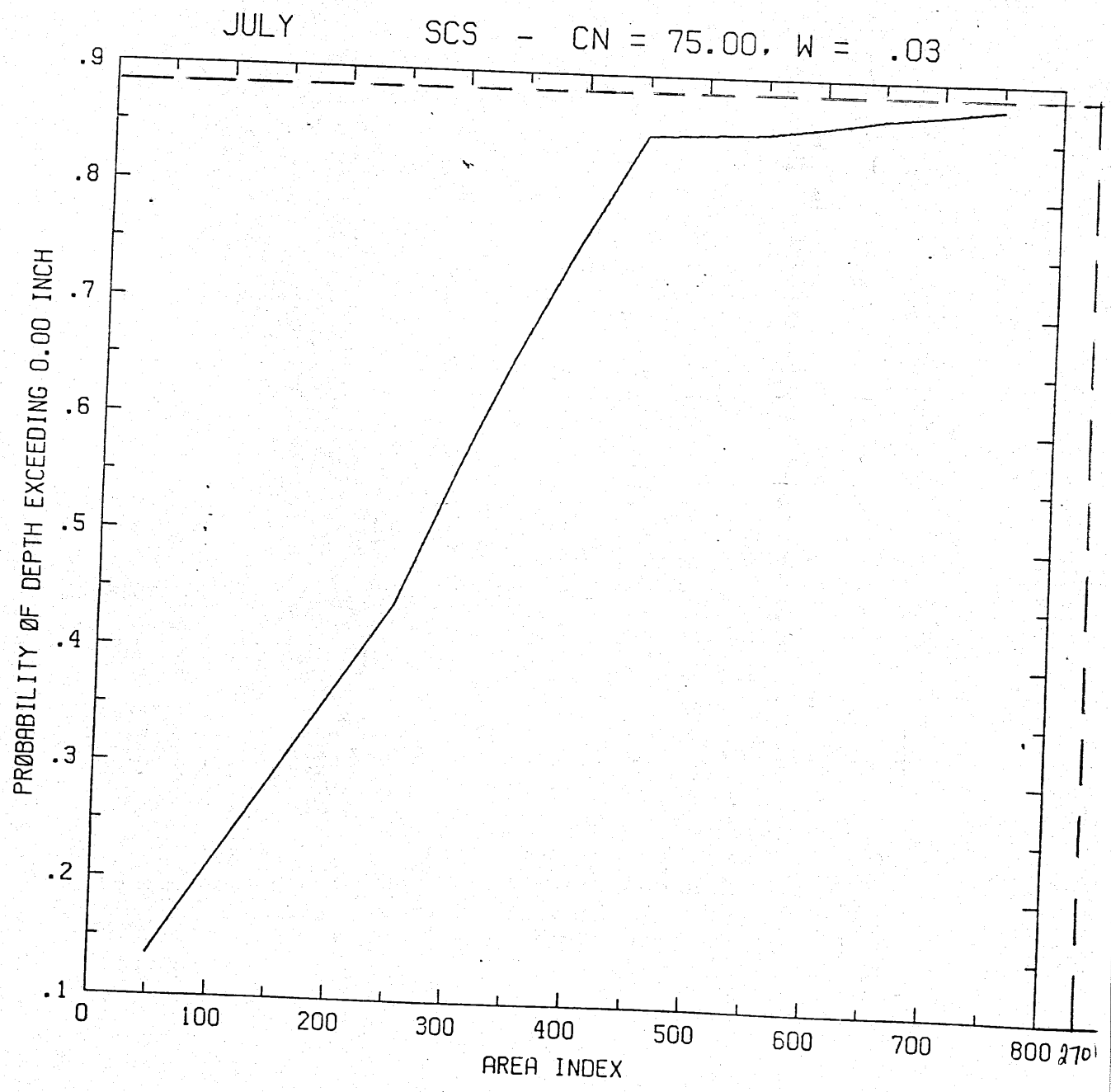
N14–H



Annual Mean Depth
Plate 2

JAN 5

N14-H



Minimum Depth
Plate 3

JAN 5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: ____ TPF-E

Depth: From Bottom Elevation
Ad: Total Drainage Area
Ap: Surface Area of Pond
Notes: Existing Impoundment

Ad: 258.0 Acres
Ab: Watershed Area = Ad - Ap
Theoretical Capacity: Ap x Depth
AI: Area Index = Ab / Ap

Depth (ft)	Elevation (ft amsl)	Ap (ac)	Ab (ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6,526.70	0.00	258.00	0.0	-	0.0
2	6,528.70	0.32	257.68	0.6	805	0.3
4	6,530.70	0.48	257.52	1.9	537	1.1
6	6,532.70	0.72	257.28	4.3	357	2.3
8	6,534.70	0.90	257.10	7.2	286	3.9
10	6,536.70	1.04	256.96	10.4	247	5.9
12	6,538.70	1.20	256.80	14.4	214	8.1
14	6,540.70	1.43	256.57	20.0	179	10.8
16	6,542.70	1.74	256.26	27.8	147	13.9
18	6,544.70	2.14	255.86	38.5	120	17.8
18.8	6,545.50	2.37	255.63	44.6	108	19.6
20	6,546.70	2.58	255.42	51.6	99	22.6

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

Plate 1:	Annual Mean Depth (AMD)	8.0 ft	--
	Minimum Depth (MIN)	--	5.4 ft
	Actual Capacity	3.9 ac-ft	2.0 ac-ft
	AI	286	415
Plate 2 or 3:	Probability	64%	79%

K+E 10 X 10 TO ½ INCH • 7½ X 10 INCHES
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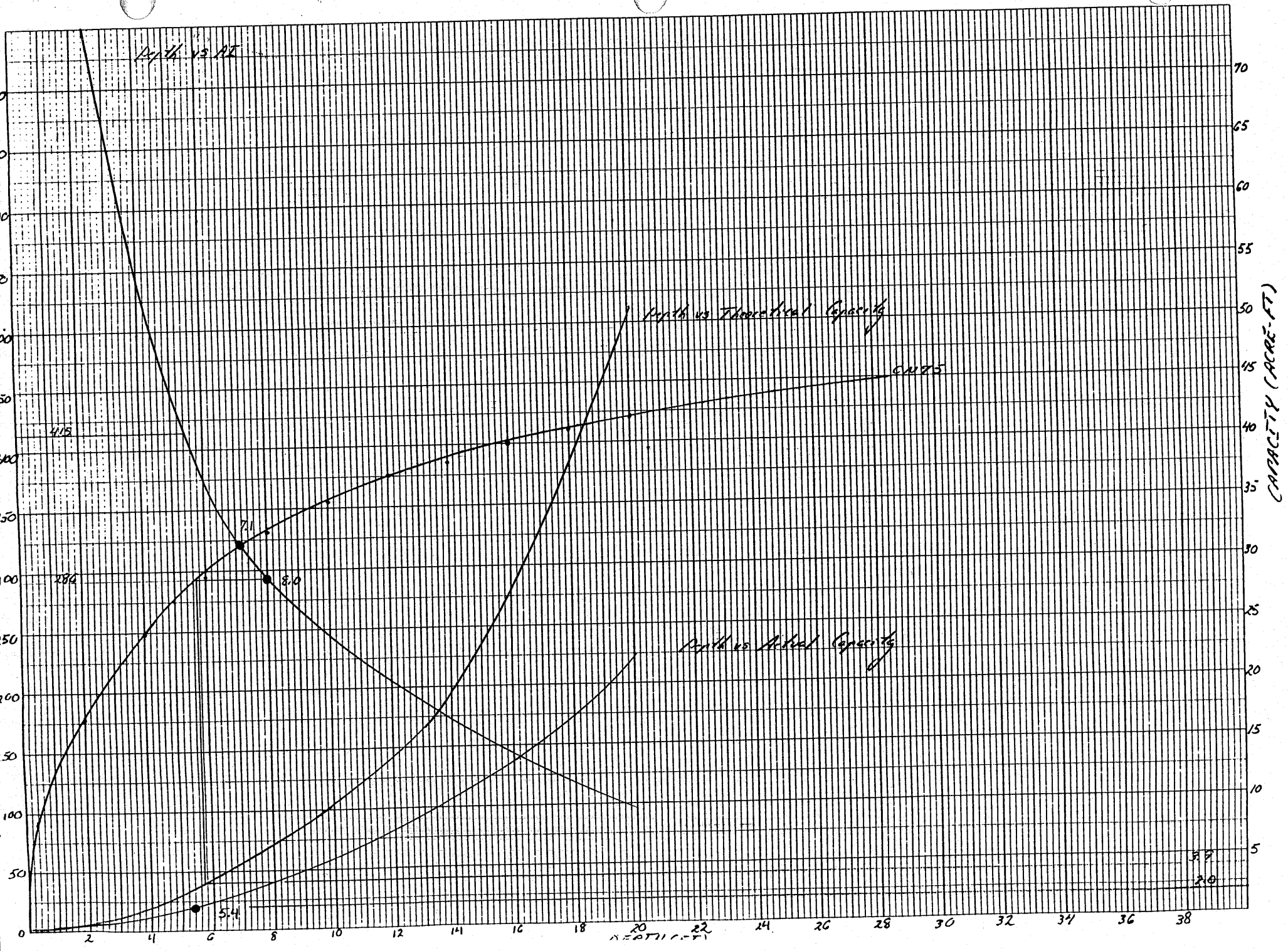
TPF-E

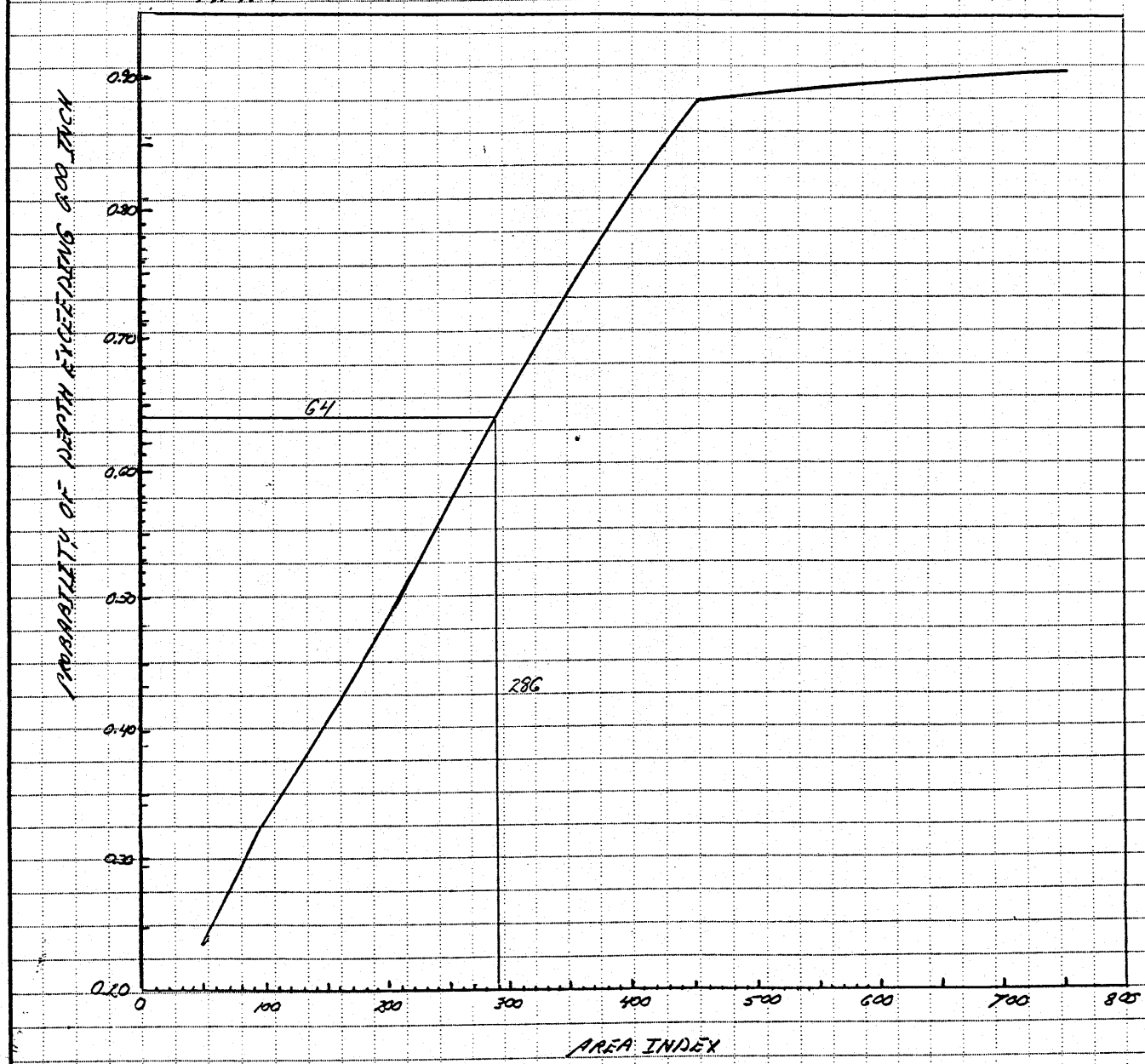


TerraMatrix
Engineering & Environmental Services
P.O. Box 774018, 1475 Pine Grove Road
Steamboat Springs, Colorado 80477
Phone 970.879.6260 Fax 970.879.9048

Project Name: _____
Project Number: _____ Sheet: ____ Of ____
Prepared By: _____ Date: _____
Checked By: _____ Date: _____

TTF-E

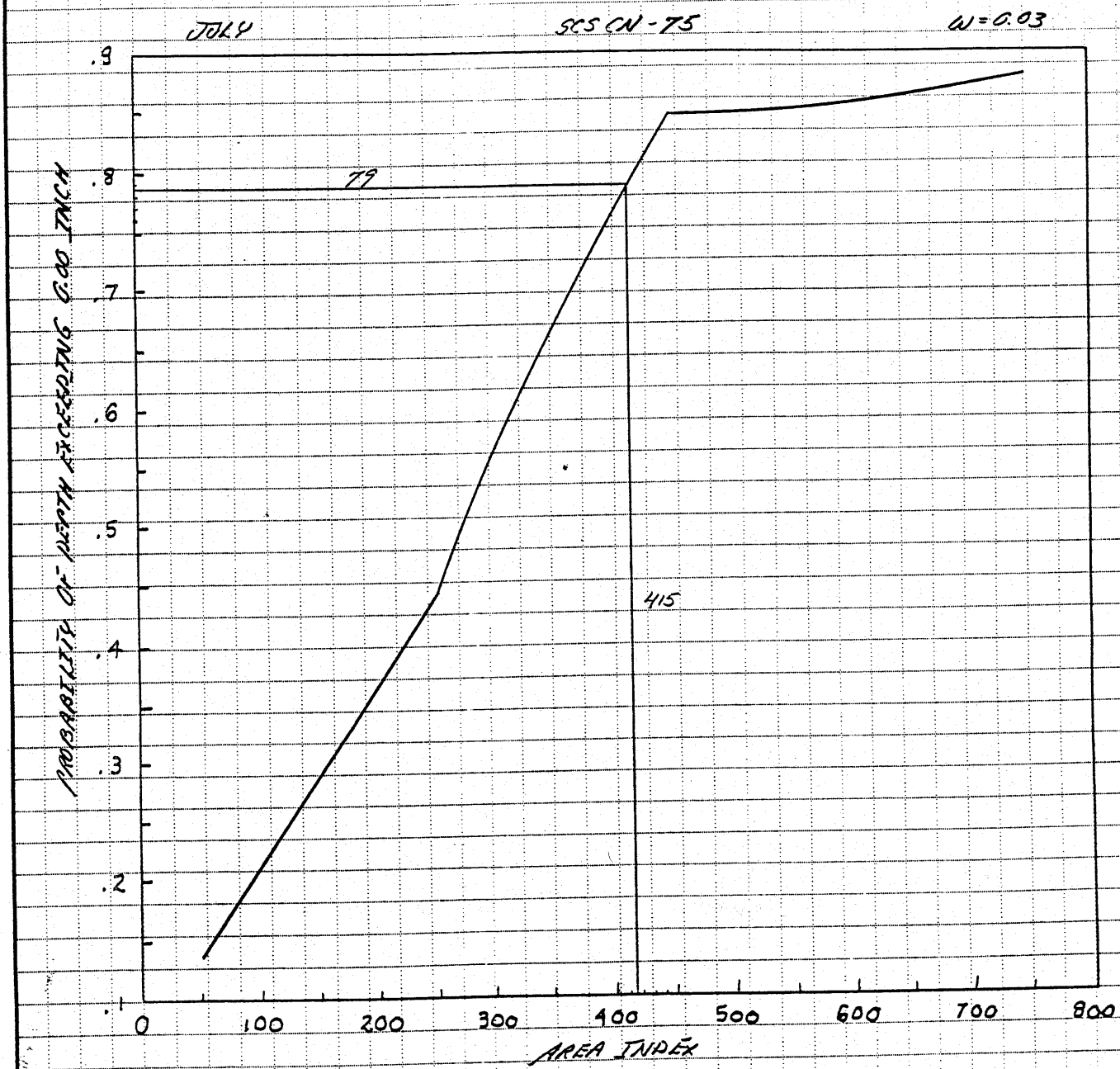
ANNUAL SCS CN - 75 W = GD3



ANNUAL MEAN DEPTH
Plate 2

TerraMatrix
Engineering & Environmental Services
P.O. Box 774018, 1475 Pine Grove Road
Steamboat Springs, Colorado 80477
Phone 970.879.6260 Fax 970.879.9048

Project Name: _____
Project Number: _____ Sheet: ____ Of ____
Prepared By: _____ Date: _____
Checked By: _____ Date: _____



MINIMUM DEPTH
Plate 3

PERMANENT IMPOUNDMENT

TPF-D

WATER PERSISTENCE WORKSHEET

5 1989

WATER PERSISTENCE WORKSHEET

Pond ID: TPF-D

A_D: 330.6 Acres

Depth: From Bottom Elevation

A_B: Watershed Area = A_D - A_P

A_D: Total Drainage Area

Theoretical Capacity: A_P x Depth

A_P: Surface Area of Pond

AI: Area Index = A_B/A_P

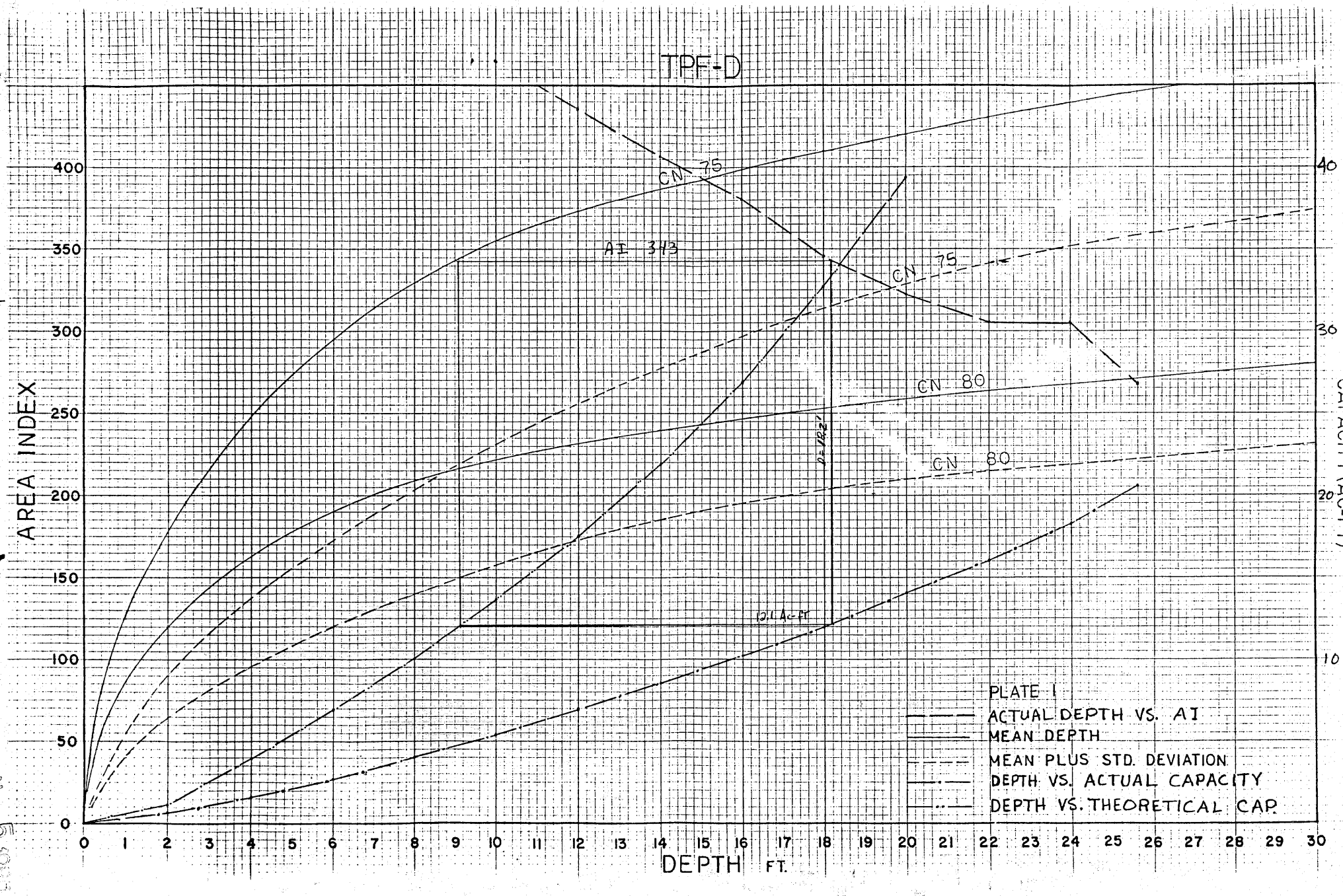
Notes: Existing Impoundment

Depth (ft)	Elevation (MSL)	A_P (Ac)	A_B (Ac)	Theoretical Capacity (ac-ft)	AI	Actual Capacity (ac-ft)
0	6694	0.157	330.443	0	2105	0
2	6696	0.420	330.180	1.2	786	0.6
4	6698	0.545	330.055	3.9	606	1.6
6	6700	0.610	329.990	6.9	541	2.7
8	6702	0.660	329.940	10.1	500	4.0
10	6704	0.709	329.891	13.7	465	5.4
12	6706	0.757	329.843	17.6	436	6.9
14	6708	0.809	329.791	21.9	408	8.5
16	6710	0.864	329.736	26.8	382	10.2
18	6712	0.952	329.648	32.7	346	12.0
20	6714	1.019	329.581	39.4	323	14.0
22	6716	1.078	329.522	46.1	306	16.1
24	6718	1.079	329.521	51.8	305	18.3
25.6	6719.6	1.230	329.370	59.1	268	20.6

Results Assume CN = 75 and minimum depth (greater of) 3.0 feet or depth at 2.0 ac-ft.

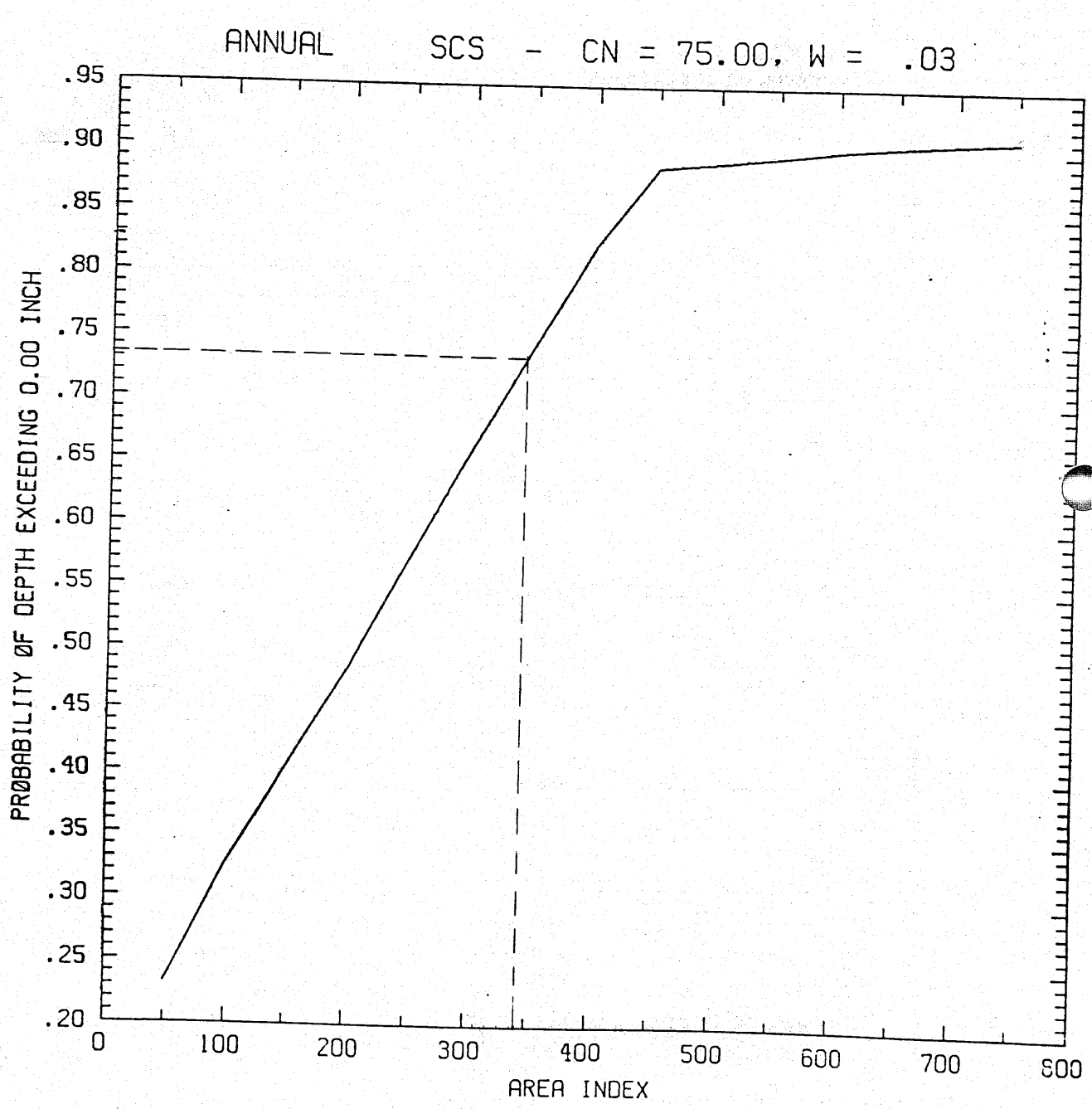
Plate 1:	Annual Mean Depth (AMD)	18.2 ft	--
	Minimum Depth (MIN)	--	4.8 ft
	Actual Capacity	12.1 ac-ft	2.0 ac-ft
	AI	343	578
Plate 2 or 3:	Probability	73%	86%

JAN 5 1989


TPF-D
AREA INDEX
DEPTH FT.
CAPACITY (AC-FT)
CN 75
CN 75
CN 80
CN 80
AI 343
D=18.2'
10.1 AC-FT
PLATE I
ACTUAL DEPTH VS. AI
MEAN DEPTH
MEAN PLUS STD. DEVIATION
DEPTH VS. ACTUAL CAPACITY
DEPTH VS. THEORETICAL CAP.

JAN 5 1983

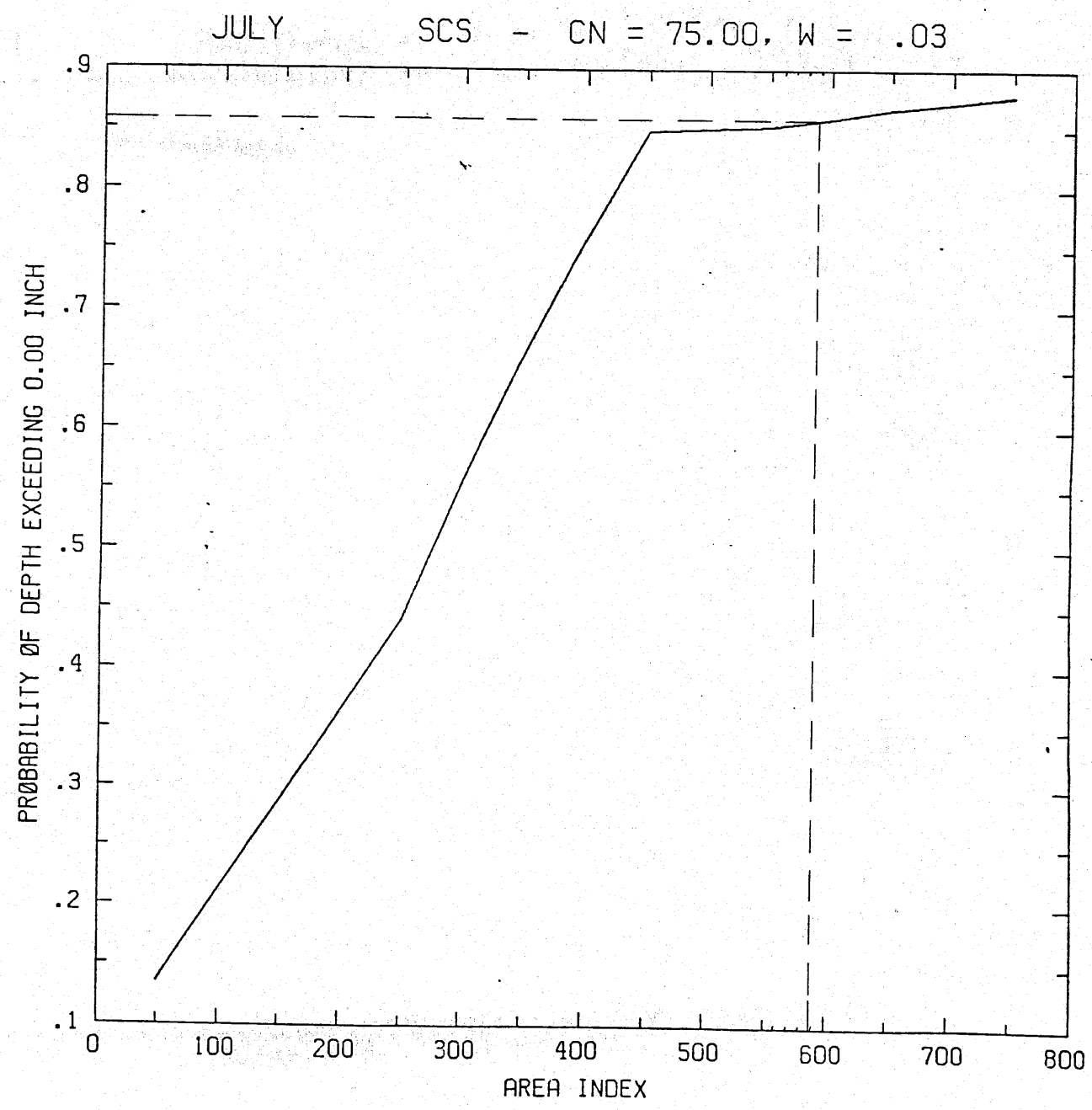
TPF-D



Annual Mean Depth
Plate 2

JAN 5 1989

TPF-D



Minimum Depth
Plate 3

JAN 5 1989

ATTACHMENT U

N-11 Truck Dump/Facilities

Ditch Calculations

(See Drawing 85482A for Location)

SEP 1996
APPROVED

Revised 05/22/96

N10-D #1 (Downdrain)

Ditch Calculations

APPROVED
SEP 1996

Revised 05/22/96

N10-D #1 (Downdrain) Summary

Purpose: To divert approximately 53.3 acres of N-11 coal handling facilities site grading area and undisturbed area runoff into Sedimentation Pond N10-D(see Drawing No. 85482A for location)

10-Year, 6-Hour Precipitation	= 1.60 inches
Area	= 53.34 ac.
CN	= 90
Time of Concentration	= 0.217 hrs
Peak Discharge	= 53.3 cfs
Critical Slope	= 0.79 %
Minimum Design width	= 8 ft.
Minimum Design Depth with Freeboard	= 2.5 ft.

Therefore, two alternative trapezoidal ditch designs are recommended:

A. Earth-lined trapezoidal ditch (subcritical flow)

Average slope	= 0.7 %
n	= 0.022
d_n	= 1.05 ft.
Velocity	= 5.03 fps

B. Riprap-lined trapezoidal ditch (supercritical flow)

Average slope	= 20 %
n	= 0.056
d_n	= 0.69 ft.
Velocity	= 8.3 fps
Riprap D_{max}	= 7.5 in.
Riprap D_{50}	= 6.0 in.

Note:
- Minimum 20 ft. length of riprapped ditch as a transitional channel between the two alternative designs.
- See Chapter 26 for construction specifications.
- The above two alternative ditch designs will be able to handle the design storm at slopes from 0.7% to 20% slopes while still being stable.

APPROVED SEP 1996

Revised 05/22/96

PROJECT N-11 TRUCK DUMP
N10-D#1 (Downdrain)

TIME OF CONCENTRATION:

ELEV. DIFFERENCE =	6834 -	6570 =	264FT.
WATERCOURSE LENGTH =	3950	=	0.748Mi.
Tc= [11.9(W.L.)^3(E.D.)]^0.385		=	0.217Hr.

SCS CURVE NUMBER

COVER TYPE	HYDRO. COND.	SOIL TYPE	CN	AREA (acres)	CN*AREA
Road	--	D	91	31.3	2942.2
P-J	Avg.	D	83	22.1	1834.3
				53.4	4776.5

WEIGHTED CN = 4776.5/ 53.4 = 89.4, Use 90

DRAINAGE BASIN AREA

53.4 ACRES 0.083 Sq. Miles

APPROVED SEP 1996

Revised 05/22/96

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

N10-D #1 (DOWNDRAIN) 10-YR.,6-HR. STORM

by

Name: JGS

Company Name: Peabody Coal Company
File Name: C:\SEDCAD3\K-MINE\N10D1R

Date: 05-17-1996

SEP 1996
APPROVED

Revised 05/22/96

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: Peabody Coal Company
Filename: C:\SEDCAD3\K-MINE\N10D1R User: JGS
Date: 05-17-1996 Time: 13:56:18
N10-D #1 (DOWNDRAIN) 10-YR.,6-HR. STORM
Storm: 1.61 inches, 10 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	53.34	90	F	0.217	0.000	0.000	0.0	3.43	53.30
		Type: Null		Label: N10-D #1 (DOWNDRAIN)						
111	Structure	53.34							3.43	
111	Total IN/OUT	53.34							3.43	53.30

SEP 1996 APPROVED

Revised 05/22/96

TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION

May 20, 1996
N10-D #1 (DOWNDRAIN)
10-YR.,6-HR. STORM
BLACK MESA COMPLEX

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	53.3
Manning's Roughness Coefficient (n-value).....	0.0220
Channel Side Slope - Left Side (horizontal/vertical)....	2.00
Channel Side Slope - Right Side (horizontal/vertical)...	2.00
Channel Bottom Width (feet).....	8.0

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Critical Depth (feet).....	1.02
Critical Slope (feet per foot).....	0.0079
Flow Velocity (feet per second).....	5.22
Froude Number.....	1.000
Velocity Head (feet).....	0.42
Energy Head (feet).....	1.44
Cross-Sectional Area of Flow (square feet).....	10.21
Top Width of Flow (feet).....	12.07

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986
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(713) 895-8322. A manual with equations & flow chart is available.

APPROVED SEP 1996

Revised 05/22/96

SEDCAD+ NONERODIBLE CHANNEL DESIGN

N10-D #1 (DOWNDRAIN)

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	53.30 cfs	
Slope	0.70 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Bottom Width	8.00 ft	
Manning's n	0.022	
Material	OTHER	
Freeboard	1 ft	

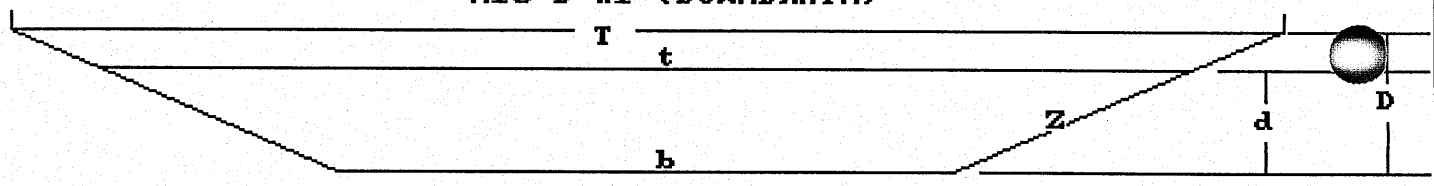
RESULTS:

Depth	1.05 ft
with Freeboard	2.05 ft
Top Width	12.20 ft
with Freeboard	16.20 ft
Velocity	5.03 fps
Cross Sectional Area	10.61 sq ft
Hydraulic Radius	0.84 ft
Froude Number	0.95

APPROVED SEP 1996

Revised 05/22/96

SEDCAD+ CHANNEL DESIGN
N10-D #1 (DOWNDRAIN)



MATERIAL: OTHER

Discharge	=	53.30 cfs	Depth (d)	=	1.05	(D =	w/ Freeboard 2.05
Bottom (b)	=	8.00 ft	Top width (t)	=	12.20	(T =	16.20
Side slopes (Z)	=	2.0:1(L) 2.0:1(R)	Velocity	=	5.03 fps		
Bed Slope	=	0.70 %	Hydraulic Radius	=	0.84 ft		
Manning's n	=	0.022	Froude number	=	0.95		

APPROVED SEP 1996

Revised 05/22/96

SEDCAD+ RIPRAP CHANNEL DESIGN

N10-D #1 (DOWNDRAIN)

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	53.30 cfs	
Slope	20.00 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	8.00 feet	
Freeboard	1 ft	

RESULTS:

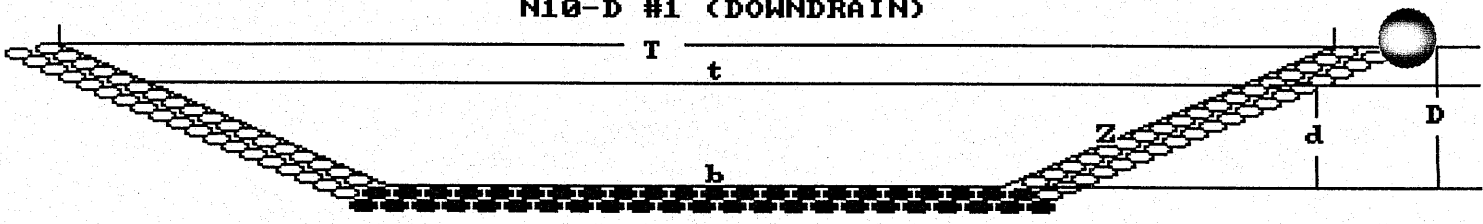
Steep Slope Design - PADER Method

Depth	0.69 ft
with Freeboard	1.69 ft
Top Width	10.75 ft
with Freeboard	14.75 ft
Velocity	8.29 fps
Cross Sectional Area	6.43 sq ft
Hydraulic Radius	0.58 ft
Manning's n	0.056
Froude Number	1.89
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

APPROVED SEP 1996

Revised 05/22/96

SEDCAD+ CHANNEL DESIGN
N10-D #1 (DOWNDRAIN)



Riprap - Steep Slope Design - PADER Method

Discharge	=	53.30 cfs	Depth (d)	=	0.69	w/ Freeboard (D =	1.69
Bottom (b)	=	8.00 ft	Top width (t)	=	10.75	(T =	14.75
Side slopes (Z)	=	2.0:1(L) 2.0:1(R)	Velocity	=	8.29 fps		
Bed Slope	=	20.00 %	Hydraulic Radius	=	0.58 ft		
Manning's n	=	0.056	Froude number	=	1.89		

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

APPROVED
SEP 1996

Revised 05/22/96

N10-D #2 (Downdrain)

SEP 1996
APPROVED

Revised 05/22/96

N10-D #2 (Downdrain) Summary

Purpose: To drain approximately 41.3 acres of N-11 truck dump and road drainage area runoff into Sedimentation Pond N10-D (see Drawing No. 85482A for location).

10-Year, 6-Hour Precipitation	= 1.60	in.
Area	= 41.3	ac.
CN	= 90	
Time of Concentration	= 0.220	hr.
Peak Discharge	= 41.16	cfs
Critical Slope	= 0.81	%
Minimum Design Width	= 7	ft.
Minimum Design Depth w/Freeboard	= 2	ft.

Therefore, two alternative trapezoidal ditch designs are recommended:

A. Earth-lined trapezoidal ditch (subcritical flow)

Average slope	= 0.7	%
Minimum width	= 7	ft.
n	= 0.022	
d_n	= 0.97	ft.
Velocity	= 4.74	fps

B. Riprap lined trapezoidal ditch (supercritical flow)

Average slope	= 30	%
Minimum width	= 7	ft.
n	= 0.060	
d_n	= 0.59	ft.
Velocity	= 8.56	fps
Riprap D_{max}	= 7.5	in.
Riprap D_{50}	= 6.0	in.

APPROVED SEP 1996

Note:
- Minimum 20 ft. length of riprapped ditch as a transitional channel between the two alternative designs.
- See Chapter 26 for construction specifications.
- The above two alternative ditch designs will be able to handle the design storm at slopes from 0.7% to 30% slopes while still being stable.

Revised 05/22/96

PROJECT N-11 TRUCK DUMP
N10-D#2 (Downdrain)

TIME OF CONCENTRATION:

ELEV. DIFFERENCE =	6700 -	6570 =	130F T.
WATERCOURSE LENGTH =	3150	=	0.597Mi.
Tc= [11.9(W.L.)^3(E.D.)]^0.385		=	0.220Hr.

SCS CURVE NUMBER

COVER TYPE	HYDRO. COND.	SOIL TYPE	CN	AREA (acres)	CN*AREA
RECLAIMED	--	C	81	4.4	356.4
ROAD	--	D	91	36.9	3357.9
				41.3	3714.3

WEIGHTED CN = 3714.3/ 41.3 = 89.9, Use 90

DRAINAGE BASIN AREA

41.3 ACRES 0.064 Sq. Miles

APPROVED SEP 1996

Revised 05/22/96

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

N10-D #2 (DOWNDRAIN)

by

Name: JGS

Company Name: Peabody Coal Company
File Name: C:\SEDCAD3\K-MINE\N10D2R

Date: 05-17-1996

SEP 1996
APPROVED

Revised 05/22/96

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: Peabody Coal Company
Filename: C:\SEDCAD3\K-MINE\N10D2R User: JGS
Date: 05-17-1996 Time: 13:56:16
N10-D #2 (DOWNDRAIN)
Storm: 1.61 inches, 10 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	41.30	90	F	0.220	0.000	0.000	0.0	2.65	41.16
		Type: Null			Label: N10-D2 (DOWNDRAIN)					
111	Structure	41.30							2.65	
111	Total IN/OUT	41.30							2.65	41.16

APPROVED
SEP 1996

Revised 05/22/96

TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION

May 20, 1996
N10-D #2 (DOWNDRAIN)
10-YR.,6-HR. STORM
BLACK MESA COMPLEX

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	41.2
Manning's Roughness Coefficient (n-value).....	0.0220
Channel Side Slope - Left Side (horizontal/vertical)....	2.00
Channel Side Slope - Right Side (horizontal/vertical)...	2.00
Channel Bottom Width (feet).....	7.0

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Critical Depth (feet).....	0.93
Critical Slope (feet per foot).....	0.0081
Flow Velocity (feet per second).....	4.98
Froude Number.....	1.000
Velocity Head (feet).....	0.39
Energy Head (feet).....	1.32
Cross-Sectional Area of Flow (square feet).....	8.26
Top Width of Flow (feet).....	10.73

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986
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SEP 1996
APPROVED

Revised 05/22/96

SEDCAD+ NONERODIBLE CHANNEL DESIGN

N10-D #2 (DOWNDRAIN)

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	41.16 cfs	
Slope	0.70 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Bottom Width	7.00 ft	
Manning's n	0.022	
Material	OTHER	
Freeboard	1 ft	

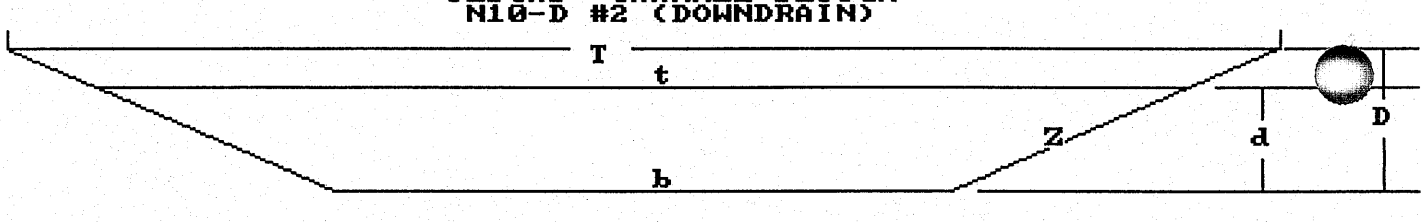
RESULTS:

Depth	0.97 ft
with Freeboard	1.97 ft
Top Width	10.88 ft
with Freeboard	14.88 ft
Velocity	4.74 fps
Cross Sectional Area	8.68 sq ft
Hydraulic Radius	0.77 ft
Froude Number	0.94

APPROVED
SEP 1996

REvised 05/22/96

SEDCAD+ CHANNEL DESIGN
N10-D #2 (DOWNDRAIN)



MATERIAL: OTHER

Discharge	= 41.16 cfs		Depth (d)	= 0.97	(D = 1.97
Bottom (b)	= 7.00 ft		Top width (t)	= 10.88	(T = 14.88
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)		Velocity	= 4.74 fps	
Bed Slope	= 0.70 %		Hydraulic Radius	= 0.77 ft	
Manning's n	= 0.022		Froude number	= 0.94	

w/ Freeboard

APPROVED SEP 1996

Revised 05/22/96

SEDCAD+ RIPRAP CHANNEL DESIGN

N10-D #2 (DOWNDRAIN)

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	41.16 cfs	
Slope	30.00 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	7.00 feet	
Freeboard	1 ft	

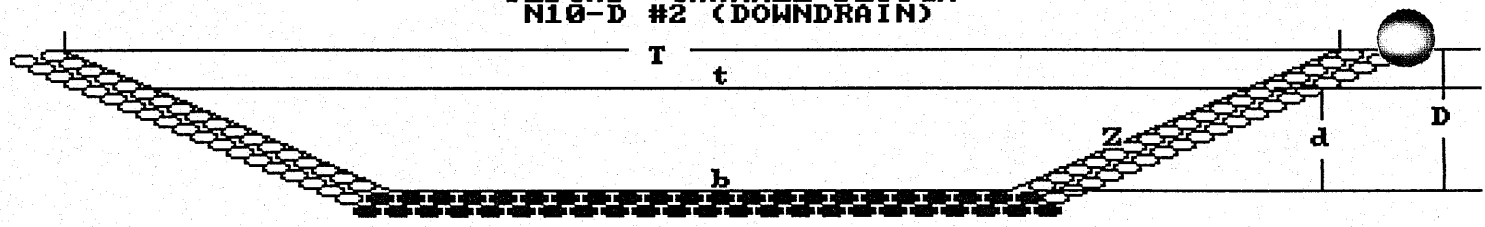
RESULTS:

Steep Slope Design - PADER Method

Depth	0.59 ft
with Freeboard	1.59 ft
Top Width	9.35 ft
with Freeboard	13.35 ft
Velocity	8.56 fps
Cross Sectional Area	4.81 sq ft
Hydraulic Radius	0.50 ft
Manning's n	0.060
Froude Number	2.10
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

SEP 1996 APPROVED

SEDCAD+ CHANNEL DESIGN
N10-D #2 (DOWNDRAIN)



Riprap - Steep Slope Design - PADER Method

Discharge	=	41.16 cfs	Depth (d)	=	0.59	(D =	w/ Freeboard 1.59
Bottom (b)	=	7.00 ft	Top width (t)	=	9.35	(T =	13.35
Side slopes (Z)	=	2.0:1(L) 2.0:1(R)	Velocity	=	8.56 fps		
Bed Slope	=	30.00 %	Hydraulic Radius	=	0.50 ft		
Manning's n	=	0.060	Froude number	=	2.10		

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

APPROVED SEP 1996

N10-D #3 (Downdrain)

Design Calculations

FEB 1999
APPROVED

Revised 05/27/98

N10-D #3 (Downdrain) Summary

Purpose: To drain approximately 15.60 acres of N-11 truck dump and road drainage area runoff and provide a non-erodible downdrain perpendicular to the top of the N-11 truck dump embankment (see Drawing No. 85482A for location). This downdrain drains into the area included in the N10-D #1 channel and then drains into Sedimentation Pond N10-D.

10-Year, 6-Hour Precipitation	=	1.60 inches
Area	=	15.60 ac
CN	=	91
Time of Concentration	=	0.106 hrs
Peak Discharge	=	19.49 cfs
Critical Slope	=	0.91%
Minimum Design Width	=	6 ft.
Minimum Design Depth w/Freeboard	=	2.5 ft.

Therefore, two alternative trapezoidal ditch designs are recommended:

A. Earth-lined trapezoidal ditch (subcritical flow)

Average slope	=	0.8%
Minimum width	=	6 ft.
n	=	0.022
d_n	=	1.26 ft.
Velocity	=	1.82 fps

B. Riprap-lined trapezoidal ditch (supercritical flow)

Average slope	=	33.3%
Minimum width	=	6 ft.
n	=	0.069
d_n	=	0.43 ft.
Velocity	=	6.55 fps
Riprap D_{max}	=	7.5 in.
Riprap D_{50}	=	6.0 in.

FEB 1999 APPROVED

NOTE:
- Minimum 20 ft. length of riprapped ditch as a transitional channel between the two alternative designs.
- See Chapter 26 for construction specifications.
- The above two alternative ditch designs will be able to handle the design storm at slopes ranging from 0.8 to 33.3% and still be stable.

PROJECT N-11 TRUCK DUMP

N-10-D#3 (Downdrain)

TIME OF CONCENTRATION

ELEVATION DIFFERENCE	=	6700-	6612	= 88 FT
WATERCOURSE LENGTH	=	1470		= 0.278 MI
Tc = [11.9(W.L.)^3(E.D.)]^0.385				= 0.106 HR

SCS CURVE NUMBER

COVER TYPE	HYDRO COND.	SOIL TYPE	CN	AREA (Acres)	CN* AREA
ROAD		D	91	15.60	1419.60

WEIGHTED CN = Use 91

DRAINAGE BASIN AREA

15.6 ACRES 0.024 Sq. Miles

APPROVED FEB 1999

Revised 05/27/98

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

N10-D #3 DOWNDRAIN,10-YEAR,6-HOUR STORM

by

Name: JGS

Company Name: PEABODY WESTERN COAL COMPANY
File Name: C:\SEDCAD3\N10D#3D3

Date: 05-23-1998

FEB 1999
APPROV

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: PEABODY WESTERN COAL COMPANY
Filename: C:\SEDCAD3\N10D#3D3 User: JGS
Date: 05-23-1998 Time: 16:45:59
N10-D #3 DOWNDRAIN,10-YEAR,6-HOUR STORM
Storm: 1.60 inches, 10 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	15.60	91	F	0.106	0.000	0.000	0.0	1.07	19.49
		Type: Null			Label: N10-D #3 DOWNDRAIN					
111	Structure	15.60							1.07	
111	Total IN/OUT	15.60							1.07	19.49

APPROVED FEB 1999

TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION

May 26, 1998
N10-D #3 (DOWNDRAIN)
10-YR., 6-HR. STORM
BLACK MESA COMPLEX

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	19.5
Manning's Roughness Coefficient (n-value).....	0.0220
Channel Side Slope - Left Side (horizontal/vertical)....	2.00
Channel Side Slope - Right Side (horizontal/vertical)...	2.00
Channel Bottom Width (feet).....	6.0

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Critical Depth (feet).....	0.64
Critical Slope (feet per foot).....	0.0091
Flow Velocity (feet per second).....	4.19
Froude Number.....	1.000
Velocity Head (feet).....	0.27
Energy Head (feet).....	0.91
Cross-Sectional Area of Flow (square feet).....	4.66
Top Width of Flow (feet).....	8.56

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986 Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092 (713) 895-8322. A manual with equations & flow chart is available.

FEB 1999
APPROVED

SEDCAD+ NONERODIBLE CHANNEL DESIGN

N10-D #3 DOWNDRAIN

INPUT VALUES:

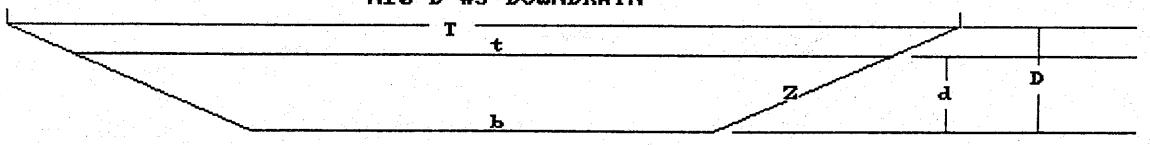
Shape	TRAPEZOIDAL	
Discharge	19.49 cfs	
Slope	0.08 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Bottom Width	6.00 ft	
Manning's n	0.022	
Material	OTHER	
Freeboard	1 ft	

RESULTS:

Depth	1.26 ft
with Freeboard	2.26 ft
Top Width	11.04 ft
with Freeboard	15.04 ft
Velocity	1.82 fps
Cross Sectional Area	10.74 sq ft
Hydraulic Radius	0.92 ft
Froude Number	0.32

APPROVED FEB 1999

SEDCAD+ CHANNEL DESIGN
N10-D #3 DOWNDRAIN



MATERIAL: OTHER

Discharge	= 19.49 cfs		Depth (d)	= 1.26	w/ Freeboard: (D = 2.26) ft
Bottom (b)	= 6.00 ft		Top width (t)	= 11.04	(T = 15.04) ft
Side slopes (Z)	= 2.0:1(L)	2.0:1(R)	Velocity	= 1.82 fps	
Bed Slope	= 0.08 %		Hydraulic Radius	= 0.92 ft	
Manning's n	= 0.022		Froude number	= 0.32	

APPROVED
FEB 1999

SEDCAD+ RIPRAP CHANNEL DESIGN

N10-D #3 DOWNDRAIN

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	19.49 cfs	
Slope	34.00 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	6.00 feet	
Freeboard	1 ft	

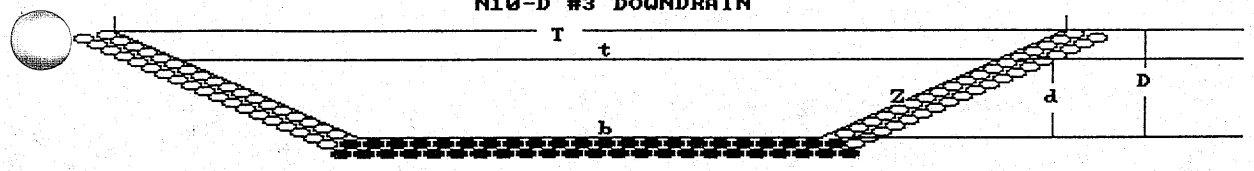
RESULTS:

Steep Slope Design - PADER Method

Depth	0.43 ft
with Freeboard	1.43 ft
Top Width	7.73 ft
with Freeboard	11.73 ft
Velocity	6.55 fps
Cross Sectional Area	2.98 sq ft
Hydraulic Radius	0.37 ft
Manning's n	0.069
Froude Number	1.86
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

APPROVED
FEB 4 1999

SEDCAD+ CHANNEL DESIGN
N10-D #3 DOWNDRAIN



Riprap - Steep Slope Design - PADER Method

Discharge	=	19.49 cfs	Depth (d)	=	0.43	w/ Freeboard: (D =	1.43) ft
Bottom (b)	=	6.00 ft	Top width (t)	=	7.73	(T =	11.73) ft
Side slopes (Z)	=	2.0:1(L) 2.0:1(R)	Velocity	=	6.55 fps		
Bed Slope	=	34.00 %	Hydraulic Radius	=	0.37 ft		
Manning's n	=	0.069	Froude number	=	1.86		

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

FEB 1999
APPROVED

N10-D #1 (Diversion)

Ditch Calculations

APPROVED
SEP 1996

Revised 06/11/92

N1-O #1 (Diversion) Summary

Purpose: To divert approximately 38.0 acres of N-11 truck ready line site grading area and Kayenta Mine haul road runoff into Sedimentation Pond N1-O (see Drawing No. 85482 for location).

10-Year, 6-Hour Precipitation	= 1.60	in.
Area	= 38.0	ac.
CN	= 90	
Time of Concentration	= 0.245	hr.
Peak Discharge	= 36.47	cfs
Critical Slope	= 0.84	%
V-Ditch Design Depth w/Freeboard	= 3.5	ft.

Therefore, two alternative V-ditch designs are recommended:

A. Earth-lined V-ditch (subcritical flow)

Average slope	=	0.67 %	0.75 %
n	=	0.022	0.022
d_n	=	1.91 ft	1.87 ft.
Velocity	=	4.99 fps	5.21 fps

B. Riprap-lined V-ditch (supercritical flow)

Average slope (three sloped drop structures):

Average Slope	=	6.67 %	12.5 %	10.0 %
n	=	0.044	0.045	0.045
d_n	=	1.59 ft.	1.42 ft.	1.48 ft.
Velocity	=	7.03 fps	8.75 fps	8.05 fps
Riprap D_{max}	=	7.5 in.	7.5 in.	7.5 in.
Riprap D_{50}	=	6.0 in.	6.0 in.	6.0 in.

APPROVED SEP 1996

Note: - Minimum 20 ft. length of riprapped ditch as a transitional channel between the two alternative designs.

- See Chapter 26 for construction specifications.

Revised 06/11/92

PROJECT: N-11 TRUCK DUMP
N1-O #1 (DIVERSION)

NAME: GARRY Y.

DATE: 5-27-92

TIME OF CONCENTRATION

ELEV. DIFFERENCE =	6614	-	6540	=	74	Ft.
WATERCOURSE LENGTH =	2870	FT.		=	0.544	Mi.
Tc =	[11.9(W. L.)^3/(E. D.)]^0.385			=	0.245	Hr.

SCS CURVE NUMBER

COVER TYPE	HYDRO. COND.	SOIL TYPE	CN	AREA (Acres)	CN*AREA
RECLAIMED		D	81	2.4	194.4
DISTURBED				0	0
ROAD		D	91	35.6	3239.6
P-J				0	0
S-G				0	0
				38.00	3434

WEIGHTED CN = 3434 / 38 = 90.36842 = 90

DRAINAGE BASIN AREA

38.00 ACRES 0.0594 Sq. Miles

APPROVED SEP 1996

Revised 06/11/92

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

N1-0 #1 (DIVERSION),10-YR.,6-HR. STORM

by

Name: JGS.

Company Name: Peabody Coal Company
File Name: E:\SEDCAD3\K-MINE\N101

Date: 06-11-1992

APPROVED
SEP 1996

Revised 06/11/92

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: Peabody Coal Company
Filename: E:\SEDCAD3\K-MINE\N101 User: JGS.
Date: 06-11-1992 Time: 13:58:23
N1-0 #1 (DIVERSION),10-YR.,6-HR. STORM
Storm: 1.60 inches, 10 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	38.00	90	F	0.245	0.000	0.000	0.0	2.42	36.47
		Type: Null			Label: N1-0 #1 (DIVERSION)					
111	Structure	38.00							2.42	
111	Total IN/OUT	38.00							2.42	36.47

SEP 1996 APPROVED

TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION

June 11, 1992
N1-0 #1 (DIVERSION)

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALU
Flow Rate (cubic feet per second)	36.5
Manning's Roughness Coefficient (n-value)	0.022
Channel Side Slope - Left Side (horizontal/vertical)	2.00
Channel Side Slope - Right Side (horizontal/vertical)	2.00
Channel Bottom Width (feet)	0.0

==========

PROGRAM RESULTS:

DESCRIPTION	VALU
Critical Depth (feet)	[illegible]
Critical Slope (feet per foot)	[illegible]
Flow Velocity (feet per second)	5.43
Froude Number	1.00
Velocity Head (feet)	0.46
Energy Head (feet)	2.29
Cross-Sectional Area of Flow (square feet)	6.71
Top Width of Flow (feet)	7.33

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 198
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 7709
(713) 895-8322. A manual with equations & flow chart is available.

APPROVED
SEP 1996

SEDCAD+ NONERODIBLE CHANNEL DESIGN

N1-0 #1 (DIVERSION)

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	36.47 cfs	
Slope	0.67 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Manning's n	0.022	
Material	OTHER	
Freeboard	1 ft	

RESULTS:

Depth	1.91 ft
with Freeboard	2.91 ft
Top Width	7.64 ft
with Freeboard	11.64 ft
Velocity	4.99 fps
Cross Sectional Area	7.30 sq ft
Hydraulic Radius	0.85 ft
Froude Number	0.90

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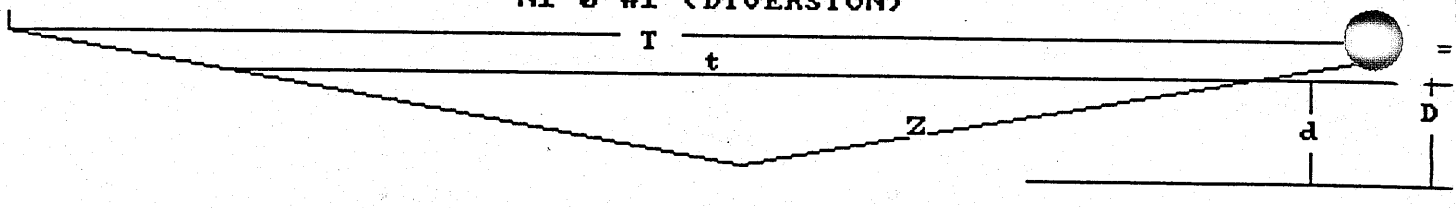
SEP 1996

SEDCAD+ CHANNEL DESIGN
N1-0 #1 (DIVERSION)



MATERIAL: OTHER

Discharge	= 36.47 cfs		Depth (d)	=	1.91 (D = 2.9
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)		Top width (t)	=	7.64 (T = 11.6
Bed Slope	= 0.67 %		Velocity	=	4.99 fps
Manning's n	= 0.022		Hydraulic Radius	=	0.85 ft
			Froude number	=	0.90

w/ Freeboar

APPROVED SEP 1996

Revised 06/11/92

SEDCAD+ NONERODIBLE CHANNEL DESIGN

N1-0 #1 (DIVERSION)

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	36.47 cfs	
Slope	0.75 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Manning's n	0.022	
Material	OTHER	
Freeboard	1 ft	

RESULTS:

Depth	1.87 ft
with Freeboard	2.87 ft
Top Width	7.48 ft
with Freeboard	11.48 ft
Velocity	5.21 fps
Cross Sectional Area	7.00 sq ft
Hydraulic Radius	0.84 ft
Froude Number	0.95

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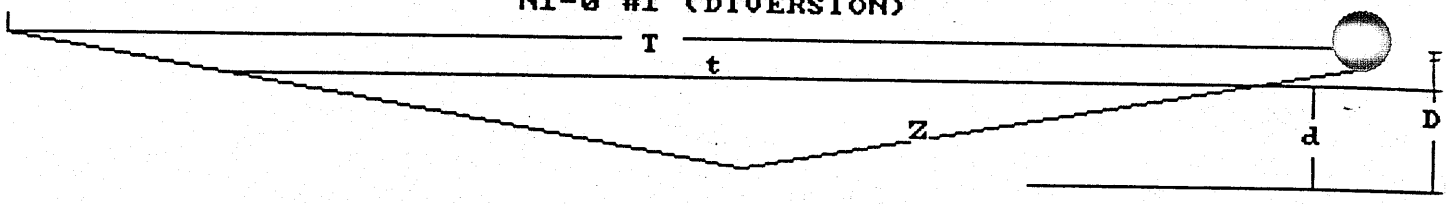
SEP 1996

SEDCAD+ CHANNEL DESIGN
N1-0 #1 (DIVERSION)



MATERIAL: OTHER

Discharge	= 36.47 cfs		Depth (d)	=	1.87	w/ Freeboa (D = 2.
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)		Top width (t)	=	7.48	(T = 11.
Bed Slope	= 0.75 %		Velocity	=	5.21 fps	
Manning's n	= 0.022		Hydraulic Radius	=	0.84 ft	
			Froude number	=	0.95	

APPROVED SEP 1996

Revised 06/11/92

SEDCAD+ RIPRAP CHANNEL DESIGN

N-11 TRUCK DUMP N1-0 #1 DITCH

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	36.47 cfs	
Slope	12.50 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	0.10 feet	
Freeboard	1 ft	

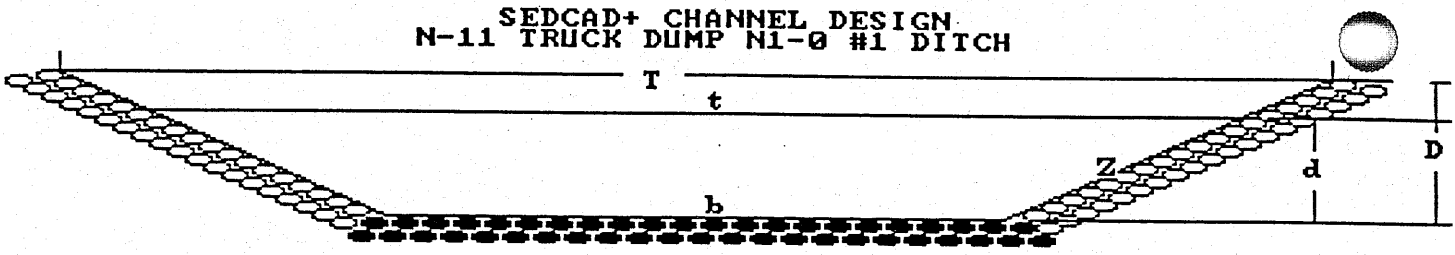
RESULTS:

Steep Slope Design - PADER Method

Depth	1.42 ft
with Freeboard	2.42 ft
Top Width	5.77 ft
with Freeboard	9.77 ft
Velocity	8.75 fps
Cross Sectional Area	4.17 sq ft
Hydraulic Radius	0.65 ft
Manning's n	0.045
Froude Number	1.82
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

APPROVED
SEP 1996

SEDCAD+ CHANNEL DESIGN
N-11 TRUCK DUMP N1-0 #1 DITCH



Riprap - Steep Slope Design - PADER Method

Discharge	=	36.47 cfs	Depth (d)	=	1.42	(D = 2.4
Bottom (b)	=	0.10 ft	Top width (t)	=	5.77	(T = 9.7
Side slopes (Z)	=	2.0:1(L) 2.0:1(R)	Velocity	=	8.75	fps
Bed Slope	=	12.50 %	Hydraulic Radius	=	0.65	ft
Manning's n	=	0.045	Froude number	=	1.82	

w/ Freeboar

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

SEP 1996
APPROVED

Revised 06/11/92

SEDCAD+ RIPRAP CHANNEL DESIGN

N-11 TRUCK DUMP N1-0 #1 DITCH

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	36.47 cfs	
Slope	6.67 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	0.10 feet	
Freeboard	1.0 ft	

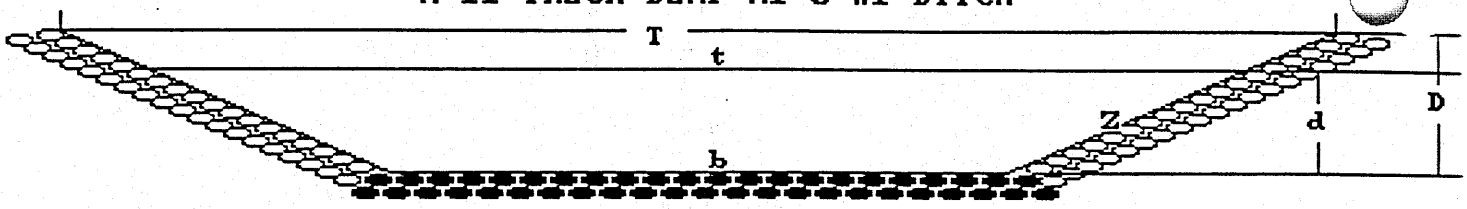
RESULTS:

Steep Slope Design - PADER Method

Depth	1.59 ft
with Freeboard	2.59 ft
Top Width	6.44 ft
with Freeboard	10.44 ft
Velocity	7.03 fps
Cross Sectional Area	5.19 sq ft
Hydraulic Radius	0.72 ft
Manning's n	0.044
Froude Number	1.38
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

APPROVED SEP 1996

SEDCAD+ CHANNEL DESIGN
N-11 TRUCK DUMP N1-0 #1 DITCH



Riprap - Steep Slope Design - PADER Method

Discharge	=	36.47 cfs	Depth (d)	=	1.59	w/ Freeboar (D = 2.5
Bottom (b)	=	0.10 ft	Top width (t)	=	6.44	(T = 10.4
Side slopes (Z)	=	2.0:1(L) 2.0:1(R)	Velocity	=	7.03 fps	
Bed Slope	=	6.67 %	Hydraulic Radius	=	0.72 ft	
Manning's n	=	0.044	Froude number	=	1.38	

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

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SEP 1996

Revised 06/11/92

SEDCAD+ RIPRAP CHANNEL DESIGN

N-11 TRUCK DUMP N1-0 #1 DITCH

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	36.47 cfs	
Slope	10.00 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	0.10 feet	
Freeboard	1.0 ft	

RESULTS:

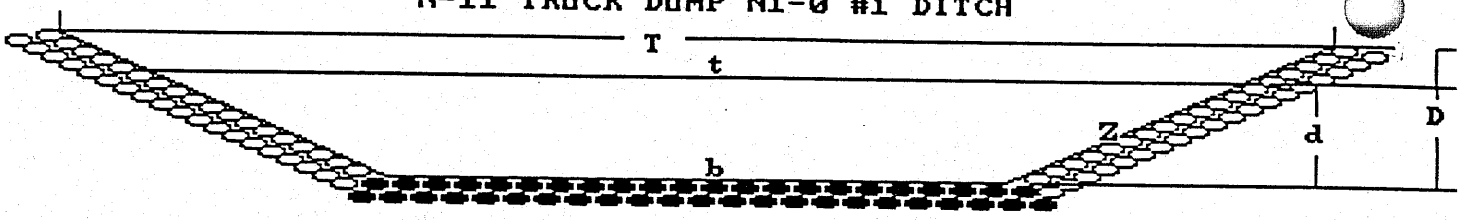
Steep Slope Design - PADER Method

Depth	1.48 ft
with Freeboard	2.48 ft
Top Width	6.02 ft
with Freeboard	10.02 ft
Velocity	8.05 fps
Cross Sectional Area	4.53 sq ft
Hydraulic Radius	0.67 ft
Manning's n	0.045
Froude Number	1.64
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

APPROVED SEP 1996

Revised 06/11/92

SEDCAD+ CHANNEL DESIGN
N-11 TRUCK DUMP N1-0 #1 DITCH



Riprap - Steep Slope Design - PADER Method

Discharge	=	36.47 cfs	Depth (d)	=	1.48	(D = 2.4
Bottom (b)	=	0.10 ft	Top width (t)	=	6.02	(T = 10.0
Side slopes (Z)	=	2.0:1(L) 2.0:1(R)	Velocity	=	8.05	fps
Bed Slope	=	10.00 %	Hydraulic Radius	=	0.67	ft
Manning's n	=	0.045	Froude number	=	1.64	

w/ Freeboar

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

APPROVED
SEP 1996

Revised 06/11/92

CHAPTER 6

ATTACHMENT V

Primary Roads As-Built Certified Report

DEC 2004
APPROVED

Revised January 20, 2004

Primary Roads As-Built Certified Report

Pursuant to 30 CFR, 816.151(a), once construction, or reconstruction is completed and adequate time has occurred to collect the "as-built" data, a Registered Professional Engineer will submit a certified report indicating construction or reconstruction has been performed in accordance with the approved plan. Typically, PWCC's Primary Roads As-Built Certified Report is the submittal of the Drawing No. 85400, "Drainage Area and Facilities Maps". Since July 6,1990 until January 20, 2004, all PWCC primary roads have been constructed or reconstructed as designed and in accordance with the approved plans, including the typical details included in this permit. Continuing in the future, PWCC's Primary Roads As-Built Certified Report is the submittal of the Drawing No. 85400, "Drainage Area and Facilities Maps". In addition, certified "as-built" drawings are kept on file at the mine site and are available for inspection.

Registered Professional Engineer
CERTIFICATE NO. 18782
JAMES GARY SCHLENVOGT
Signed
ARIZONA U.S.A.

Engineer

JAN 20 2004

Date

APPROVED
DEC 2004

ATTACHMENT W

Impoundment Hazard Map

Drawing No. 85408

Resident List

APPROVED
OCT 2002

Revised 01/25/02

IMPOUNDMENTS HAZARD MAP DRAWING NO. 85408
RESIDENT LIST

SITE NO.	NAME	PWCC EASTING	PWCC NORTHING
1.0	ALBERT , ALTA R.	18163.00	-10886.00
1.1	ALBERT , ALTA R.	14561.00	-14862.00
2.0	ALBERT , EARLENE	17322.00	-11246.00
118.0	ALBERT , OLIVER	17909.95	-10989.98
3.0	ANDERSON , WOODY	44900.00	-21378.00
117.0	AUSTIN , BILLY	31857.56	10818.36
4.0	AUSTIN SR. , BILLY	31600.00	8800.00
301.0	B.M. BIBLE CHURCH	21035.18	-16355.32
5.0	BAHE , JOHN	36749.00	-15670.00
6.2	BECENTI , IRENE/KEEVIN	20356.00	-16059.00
6.0	BECENTI , IRENE/KEEVIN	21870.34	-14806.50
6.1	BECENTI , IRENE/KEEVIN	21901.31	-14879.08
7.2	BEGAY , BAH	77936.00	-38947.00
7.1	BEGAY , BAH	77550.00	-40394.00
7.0	BEGAY , BAH	77300.00	-40380.00
8.3	BEGAY , BESSIE	36343.23	-23479.45
8.0	BEGAY , BESSIE	36343.23	-23479.45
8.1	BEGAY , BESSIE	36215.65	-23368.40
8.2	BEGAY , BESSIE	36215.65	-23368.40
8.4	BEGAY , BESSIE	32122.00	-24673.00
9.1	BEGAY , BILTA	73147.00	-52302.00
9.4	BEGAY , BILTA	73100.00	-52300.00
9.2	BEGAY , BILTA	72950.00	-52300.00
9.3	BEGAY , BILTA	55399.00	-52434.00
9.0	BEGAY , BILTA	55431.00	-52299.00
10.1	BEGAY , DANNY	73217.00	-52396.00
10.0	BEGAY , DANNY	73212.00	-53065.00
11.1	BEGAY , EDITH	44832.24	-21484.31
11.0	BEGAY , EDITH	44856.14	-21441.58
133.0	BEGAY , EDWARD	43835.30	-8651.67
14.0	BEGAY , ELSIE	29129.00	-33838.00
12.0	BEGAY , GEORGE/LENA	37837.00	-11453.00
7.1	BEGAY , HARVEY	77960.00	-34868.00
7.0	BEGAY , HARVEY	78023.09	-34779.59
130.0	BEGAY , JOHN D.	77455.60	-39421.11
116.0	BEGAY , KEE Z.	20031.00	-55229.00
127.0	BEGAY , LENORA	69786.00	-44063.00
13.0	BEGAY , LEO	72887.00	-52078.00
15.0	BEGAY , PHILLIP	72826.00	-52120.00
16.0	BEGAY , RAYMOND	78043.00	-38612.00
131.0	BEGAY , RAYTHANIEL	78926.03	-38850.23
17.0	BEGAY , TEDDY	21521.00	-52016.00
17.3	BEGAY , TEDDY	29900.00	-62800.00
17.4	BEGAY , TEDDY	29880.00	-62850.00
17.2	BEGAY , TEDDY	29900.00	-62875.00

APPROVED
OCT 2002

IMPOUNDMENTS HAZARD MAP DRAWING NO. 85408
RESIDENT LIST

SITE NO.	NAME	PWCC EASTING	PWCC NORTHING
17.1	BEGAY , TEDDY	30050.00	-63200.00
18.1	BENALLY , DANIEL/MABEL	29025.00	-33950.00
18.0	BENALLY , DANIEL/MABEL	29068.00	-33962.00
18.3	BENALLY , DANIEL/MABEL	28133.00	-38685.00
18.2	BENALLY , DANIEL/MABEL	29549.00	-34526.00
19.0	BENALLY , LUCILLE B.	32450.00	-53875.00
20.0	BLACKHAT , NELSON	20263.00	-36216.00
119.0	BLACKROCK , STEVEN/HELENA	17895.00	-9941.00
21.0	BOYD , MARY	21568.00	-48444.00
21.1	BOYD , MARY	33931.00	-55862.00
22.0	CHARLEY , ALFERD	77282.82	-31708.42
132.0	CHARLEY , ARDAN	77967.87	-31586.90
126.0	CHARLEY , EDISON	78055.99	-31498.87
23.1	CHARLEY , KATIE	77707.00	-31802.00
23.0	CHARLEY , KATIE	77717.00	-31751.00
23.2	CHARLEY , KATIE	78064.00	-31594.90
24.2	CHIEF , BILL/SALLY	60453.00	-15514.00
24.0	CHIEF , BILL/SALLY	60557.00	-15478.00
24.1	CHIEF , BILL/SALLY	59440.95	-10863.74
25.1	CHIEF , JACK	20779.00	-24344.00
25.0	CHIEF , JACK	20855.00	-24380.00
26.0	CHIEF , LILLY	19123.00	-25441.00
27.0	CHIEF , NEPHI	19506.00	-25176.00
28.0	CHIEF , PAUL	19144.00	-25521.00
29.1	CODY , MYRATA	50902.90	1188.99
29.0	CODY , MYRATA	51015.56	1226.54
30.0	CODY , TOMMY	45822.98	-1217.21
31.0	CODY SR. , JAMES	50224.00	2295.00
32.1	CRANK , ALBERT	20242.00	-15736.00
32.0	CRANK , ALBERT	20585.65	-15874.25
33.4	CRANK , BETTY	20001.00	-16199.00
33.3	CRANK , BETTY	20197.00	-16050.00
33.2	CRANK , BETTY	20399.00	-16006.00
33.1	CRANK , BETTY	20452.00	-15949.00
33.5	CRANK , BETTY	19423.00	-19958.00
34.0	CRANK , ELI	60500.00	-13570.00
34.1	CRANK , ELI	52886.56	-14411.19
35.0	CRANK , HARRISON	53070.00	-14631.00
36.0	CRANK , JOHNSTON	59522.00	-13883.00
37.0	CRANK , LEONARD	21169.00	-15342.00
38.0	CRANK , LILLY	52827.00	-14605.00
39.0	CRANK , MICHAEL/NATASHA	61211.00	-15756.00
40.1	CRANK , ROBERT/LINDA	60749.00	-15959.00
40.0	CRANK , ROBERT/LINDA	60755.00	-15960.00
41.0	CRANK , SIMON	64503.00	-18593.00

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SITE NO.	NAME	PWCC EASTING	PWCC NORTHING
41.2	CRANK , SIMON	60682.00	-16278.00
41.1	CRANK , SIMON	60881.00	-16136.00
42.0	CRANK , THOMAS	60792.00	-15680.00
43.0	CRANK JR. , SIMON/TABBY	61578.00	-15164.00
44.0	CRANK. , BEN	53675.00	-13908.00
120.0	EDSITTY, LAURA	19197.00	-25326.00
45.2	ETSITTY , CALVIN	38102.00	-10416.00
45.1	ETSITTY , CALVIN	38063.97	-11031.72
45.0	ETSITTY , CALVIN	30200.06	-27906.92
46.0	ETSITTY , LAURA	22247.00	-33065.00
47.2	ETSITTY , LESLIE	30148.29	-27958.00
47.0	ETSITTY , LESLIE	30216.38	-27922.25
47.1	ETSITTY , LESLIE	37259.65	-10233.72
48.0	ETSITTY , PHILLIP	37666.00	-11343.00
48.1	ETSITTY , PHILLIP	37704.00	-11297.00
49.0	ETSITTY , STEVEN/IRENE	20657.00	-15658.00
49.1	ETSITTY , STEVEN/IRENE	38364.71	-9702.62
50.0	FARLEY , CORNELIUS/GRACE	20756.00	-15657.00
51.0	FREEMAN , IRENE	9125.00	-24125.00
51.1	FREEMAN , IRENE	11480.00	-17868.00
51.2	FREEMAN , IRENE	12336.00	-21247.00
52.1	GILMORE , MARY	66639.76	-50390.78
52.0	GILMORE , MARY	55000.00	-56000.00
121.0	HARVEY , LEMAN/JEAN	16397.02	14470.62
53.1	HERRERA , ANNIE	18802.00	-10533.00
53.0	HERRERA , ANNIE	21229.00	-15083.00
53.4	HERRERA , ANNIE	18521.00	-10092.00
53.2	HERRERA , ANNIE	18521.00	-10092.00
53.3	HERRERA , ANNIE	18719.10	-10290.10
54.0	HONIE , LEONARD/MARIE	71004.00	-43493.00
54.1	HONIE , LEONARD/MARIE	77408.00	-39264.00
53.0	JAMES , JOE	20789.83	-50758.48
55.0	JIM , MABEL/BENNIE	62235.23	-15923.03
29.0	JOHNSON , BERT	53098.45	-14195.55
56.0	JOHNSON , GRACE	59358.38	-14608.51
57.0	JOHNSON , MILTON/LILY	20638.00	-15918.00
57.1	JOHNSON , MILTON/LILY	52975.47	-14110.78
58.1	JOHNSON , PAUL/THELMA	60187.00	-15464.00
58.0	JOHNSON , PAUL/THELMA	62189.58	-15980.38
58.2	JOHNSON , PAUL/THELMA	59857.89	-11128.89
59.1	JOHNSON , SPENCER	60721.00	-15011.00
59.0	JOHNSON , SPENCER	60762.78	-15145.43
122.0	JOHNSON JR., PAUL	60309.28	-15592.00
60.0	KEE , CHARIE/SARAH	66658.00	-25391.00
61.0	KELLY , SADIE/PRESTON	67362.00	-26023.00

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IMPOUNDMENTS HAZARD MAP DRAWING NO. 85408
RESIDENT LIST

SITE NO.	NAME	PWCC EASTING	PWCC NORTHING
62.0	KESCOLI , EARL/ANCITA	37338.00	-45389.00
63.1	KESCOLI , MAXINE	58003.00	-52045.00
63.3	KESCOLI , MAXINE	55300.00	-52480.00
63.0	KESCOLI , MAXINE	61993.39	-56506.82
63.2	KESCOLI , MAXINE	67607.10	-47009.57
64.0	KESOLI , KEE JOHN/HELEN	56972.00	-52497.00
64.1	KESOLI , KEE JOHN/HELEN	57025.00	-52381.00
65.2	LAKE , ATED	54171.00	-42132.00
65.1	LAKE , ATED	54181.00	-42078.00
65.3	LAKE , ATED	31271.00	-39701.00
65.0	LAKE , ATED	54200.00	-42100.00
65.4	LAKE , ATED	59801.08	-41440.97
65.5	LAKE , ATED	53780.45	-42357.32
66.1	LAKE , CINDY	35555.89	-32546.56
66.0	LAKE , CINDY	35589.44	-32524.44
72.0	LAKE , CLARENCE	36443.00	-46276.00
72.1	LAKE , CLARENCE	36475.00	-46337.00
71.1	LAKE , DWAYNE	36495.00	-46170.00
68.0	LAKE , DZANH	36126.00	-33616.00
69.0	LAKE , JOE	37063.23	-31361.06
69.1	LAKE , JOE	36468.22	-32583.83
70.0	LAKE , MARY	36314.00	-46098.00
67.1	LAKE , MILTON	36710.00	-46380.00
73.0	LAKE , MOLITA	38268.82	-31411.25
74.0	LAKE , SAM	37327.12	-31145.40
75.0	LANE , RONALD/THELMA	58454.16	-15119.59
76.1	LEONARD , EUGENE	20928.00	-49507.00
76.0	LEONARD , EUGENE	20933.00	-49463.00
125.0	LEONARD, FANNIE	13470.56	13313.54
114.0	LEONARD, LILLY	13432.00	13229.66
77.0	LITTLE , AMY	60618.00	-13890.00
78.0	LITTLE , BEN/IDA	32238.00	-54407.00
79.1	LITTLE , JIMMIE/TERESA	57058.00	-52478.00
79.0	LITTLE , JIMMIE/TERESA	60515.00	-13905.00
81.0	LITTLE , ROBERT	20514.00	-15792.00
81.0	LITTLE , SAM/ELLA	32223.00	-54464.00
82.0	LUFKIN , WAYNE/MARTHA	72803.00	-52019.00
83.1	LUNA , BESSIE	16286.00	-7739.00
83.0	LUNA , BESSIE	18448.00	-11590.00
83.2	LUNA, BESSIE	16306.00	-7885.00
84.0	MANSON , ANNA	5375.00	-33000.00
85.0	MANSON , SALLY	5275.00	-32825.00
123.0	MANYMULES, DAUGHTER	36501.00	-46462.00
86.0	NELSON , EDCITTY	21102.00	-15650.00
115.0	OLSON, ROBERT	16189.03	18208.23

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IMPOUNDMENTS HAZARD MAP DRAWING NO. 85408
RESIDENT LIST

SITE NO.	NAME	PWCC EASTING	PWCC NORTHING
88.1	PULINOS , GEORGE/MAE	55144.00	-49446.00
88.0	PULINOS , GEORGE/MAE	61595.99	-52035.15
89.0	RUSSEL , JERRY	55340.00	-52545.00
90.0	RUSSELL , KEE/JULIA	55418.00	-52613.00
91.0	RUSSELL , KEITH/PAULETTA	60066.00	-15310.00
91.1	RUSSELL , KEITH/PAULETTA	60147.00	-14977.00
92.0	SAVAGE , LINDA	36254.00	-33426.00
93.0	SAVAGE , SARAH	35519.22	-32618.11
94.0	SCHMITT , HENRY	39208.00	-51331.00
95.0	SEATON , EVELYN	20814.00	-15319.00
95.1	SEATON , EVELYN	53764.00	-14702.16
124.0	SEGAY, LAVONNE	36411.06	-46581.80
96.0	SHERLOCK , TOM/JULIA	55981.00	-49459.00
97.0	SMITH , AMBROSE	19085.00	-36257.00
98.0	SMITH , BESSIE	19498.00	-36976.00
99.0	SMITH , FRED	17101.00	-32252.00
99.2	SMITH , FRED	17181.00	-32658.00
99.1	SMITH , FRED	17302.00	-32618.00
100.0	SNEDDY , LOCITA	50324.00	2300.00
101.0	TALLMAN , FANAE/STANLEY	20401.00	-16321.00
102.1	TSO , ROY/ALICE	44927.00	-21578.00
102.0	TSO , ROY/ALICE	44745.00	-21570.00
102.2	TSO , ROY/ALICE	45000.00	-21470.00
103.0	TSOSIE , STANLEY/CONNIE	16438.73	6750.67
300.0	UNKNOWN ,	30000.00	-63200.00
300.0	UNKNOWN ,	29960.00	-63210.00
300.0	UNKNOWN ,	29890.00	-63240.00
300.0	UNKNOWN ,	29940.00	-63400.00
104.0	VANDEVER , ELSIE	36542.23	-23295.53
104.1	VANDEVER , ELSIE	36673.03	-23320.83
105.0	VANDEVER , LORRAINE	36876.00	-46180.00
106.0	WILLIAMS , GEORGE/LETA	15757.00	7012.00
107.3	YAZZIE , ALICE	54941.00	-49982.00
107.2	YAZZIE , ALICE	29465.00	10017.00
107.1	YAZZIE , ALICE	28579.00	6491.00
107.0	YAZZIE , ALICE	28650.00	6429.00
107.4	YAZZIE , ALICE	22989.00	4195.00
108.0	YAZZIE , ARLENE	21500.00	-51800.00
109.0	YAZZIE , JAMES	18712.00	-10743.00
109.1	YAZZIE , JAMES	28980.00	7615.00
110.0	YAZZIE , LINDA	22387.00	-32954.00
111.0	YAZZIE , MARILYN	66045.00	-25408.00
111.1	YAZZIE , PRISCILLA	65880.00	-25559.00
112.5	YAZZIE , ROSE	60433.00	-13457.00

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IMPOUNDMENTS HAZARD MAP DRAWING NO. 85408
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SITE NO.	NAME	PWCC EASTING	PWCC NORTHING
112.4	YAZZIE , ROSE	60519.00	-13375.00
112.3	YAZZIE , ROSE	60522.00	-13570.00
112.6	YAZZIE , ROSE	60665.00	-14310.00
112.2	YAZZIE , ROSE	59407.58	-10970.36
128.0	YAZZIE JR. , SILAS	77919.16	-26046.54

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ATTACHMENT X

Typical Water Bar and Road Swale Detail

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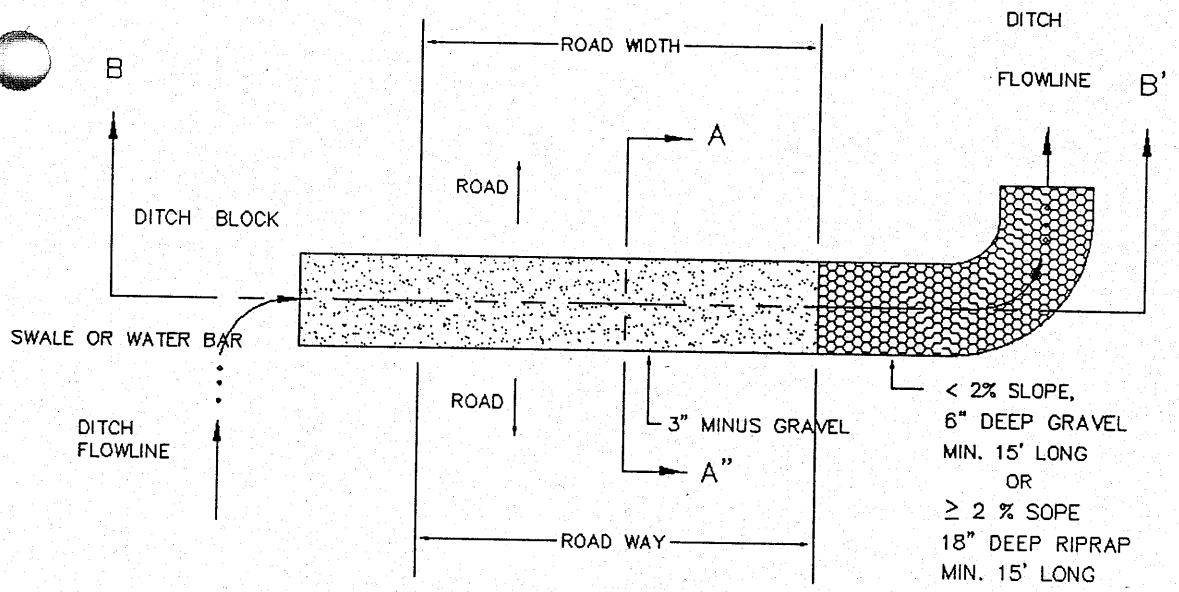
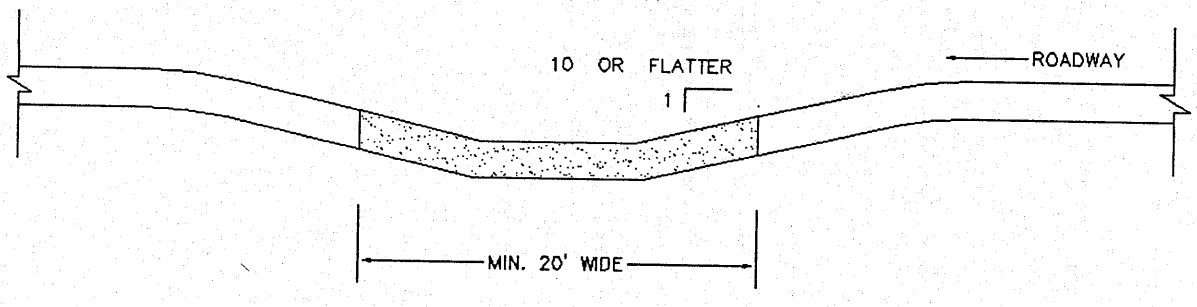
PLAN VIEW

WATER BAR (FOR EPHEMERAL CHANNEL ONLY)



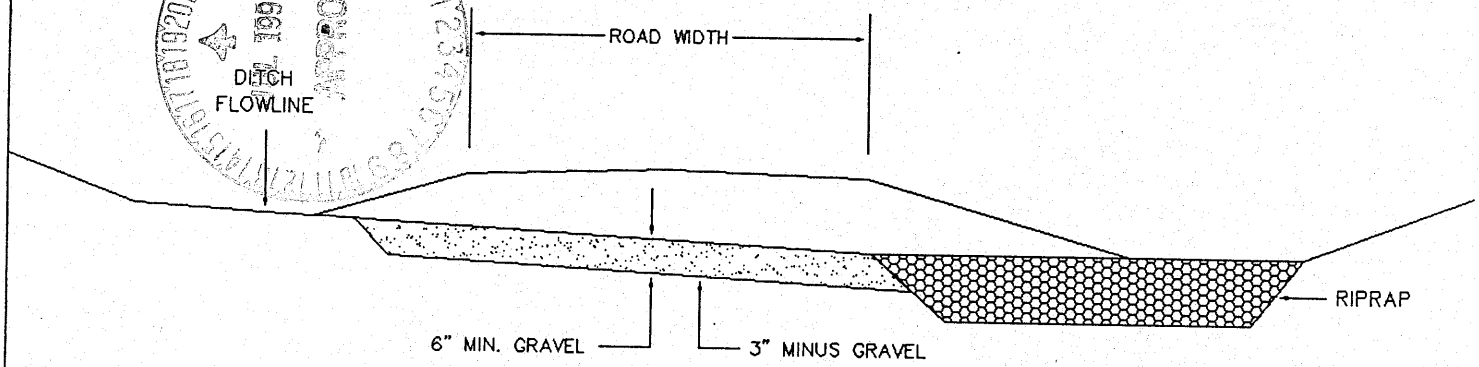
TYPICAL CROSS-SECTION

SECTION A-A'



TYPICAL PROFILE

SECTION B - B'



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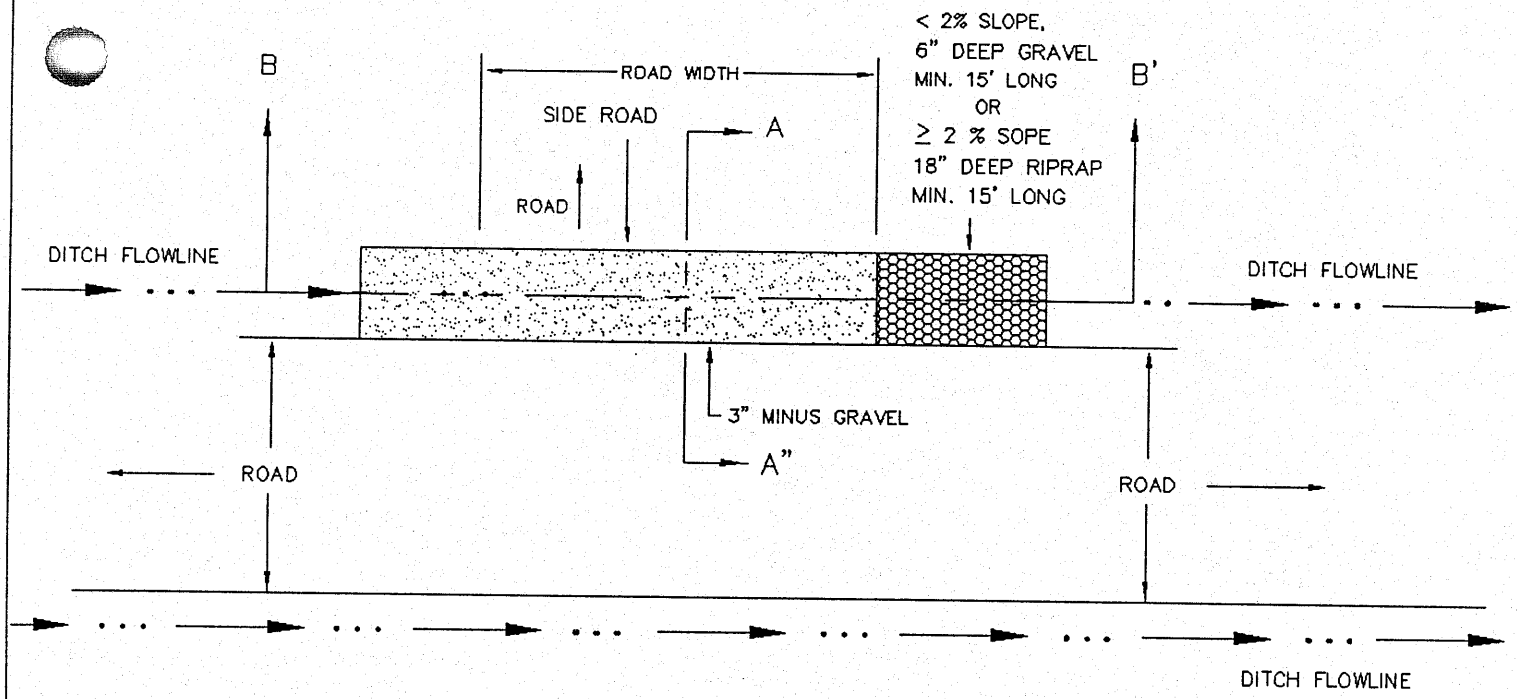
NOT TO SCALE

PEABODY WESTERN COAL COMPANY BLACK MESA COMPLEX PLATE 1 TYPICAL WATER BAR	
DESIGNED BY: JGS	SCALE: NO SCALE
DRAWN BY: PWCC	DRAWING DATE: 6-28-96
CHECKED BY: JGS	PHOTO DATE:
CONTOUR INTERVAL:	DWG FILE: WATER BAR

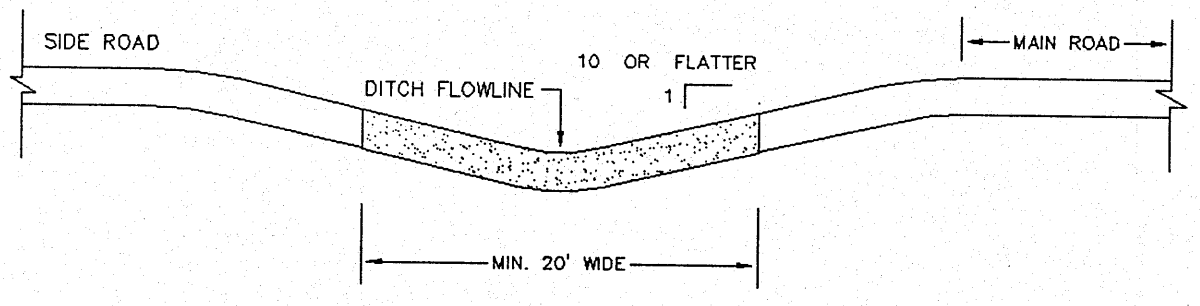
PLAN VIEW

ROAD SWALE (FOR EPHEMERAL CHANNEL ONLY)



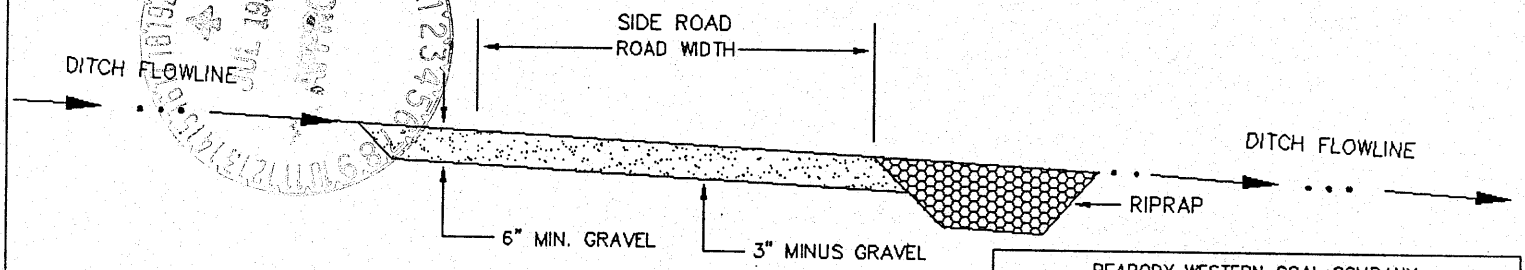
TYPICAL CROSS-SECTION

SECTION A-A'



TYPICAL PROFILE

SECTION B - B'



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NOT TO SCALE

PEABODY WESTERN COAL COMPANY BLACK MESA COMPLEX PLATE 2 TYPICAL ROAD SWALE	
DESIGNED BY: JGS	SCALE: NO SCALE
DRAWN BY: PWCC	DRAWING DATE: 6-28-96
CHECKED BY: JGS	PHOTO DATE:
CONTOUR INTERVAL:	DWG FILE: RDSWALE

ATTACHMENT Y

Temporary Sedimentation Pond N14-T

Permit Information

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Introduction

Sedimentation Structure N14-T will be insized with a small earthen embankment, designed, and to be constructed upon approval by OSMRE in 1996, by Peabody Western Coal Company as a temporary sedimentation structure to control runoff and sediment from a reclaimed stockpile (No. N14-14) located at the Kayenta Mine. The location of Structure N14-T is shown on Plate 1, Site Plan, Drawing No. 85400 (Sheet M-8) and Drawing No. 85405. The pond will be required to control sediment and runoff from the disturbance associated with this reclaimed stockpile.

This permit revision contains information specific to Structure N14-T. Regional site information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody Western Coal Company", December 1985 (PAP), Chapter 6, Attachment D, Volume 2 along with the methods and results of analyses used for slope stability, hydrology, and hydraulics.

Following is a summary of the relevant permit information.

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TABLE A

BLACK MESA/KAYENTA MINES
TEMPORARY SEDIMENT PONDS (1995-2000)
COMPLIANCE SCHEDULE INFORMATION

OBS	Pond	Easting Coordinate	Northing Coordinate	Longitude (D:M:S)	Latitude (D:M:S)	Map Number	Construction Date (YY/MM)	Remedial Work Schedule	Reclamation Date Calendar Year
1	N14-T	54,850	-14,450	110:18:20	36:30:20	M-08	96/08	OK	1998

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TABLE B

BLACK MESA/KAYENTA MINES
TEMPORARY SEDIMENT PONDS (1995-2000)
DESIGN CAPACITY INFORMATION

Obs.	Pond	Embankment Category	Time of Concentration	Curve Number	Drainage Area (Ac)	Design Runoff Capacity (Ac-ft)	Design Storage Capacity (Ac-ft)
1	N14-T	NB	0.097	87	2.10	0.17	0.24

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TABLE C

BLACK MESA/KAYENTA MINES
TEMPORARY SEDIMENT PONDS (1995-2000)
SPILLWAY DESIGN INFORMATION

OBS	Pond	Spillway Elevation	Spillway Type	Spillway Design Flow Rate (cfs)	Spillway Critical Velocity (fps)	Spillway Width (ft)	Spillway Length (ft)
1	N14-T	6603.00	Open Channel	3	2.4	5	10

DESIGN REPORT

Temporary Sedimentation Structure
N-14T
Kayenta Mine
Navajo County, Arizona

PEABODY WESTERN COAL COMPANY

Registered Professional Engineer (Civil)
CERTIFICATE NO.
18782
JAMES GARY SCHENDEL
Date Signed
ARIZONA, U.S.A.

JUL 01 1996

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DESIGN REPORT

Temporary Sedimentation Structure

N-14T

Kayenta Mine

Navajo County, Arizona

PEABODY WESTERN COAL COMPANY

Registered Professional Engineer (Civil)
CERTIFICATE NO.
18782
JAMES GARY SCHLENVOGT
Date Signed.....
ARIZONA, U.S.A.
OCT 01 1996

Revised 10/01/96

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Land Use	1
Embankment	1
Design Analyses	1
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Hydrology	2
Hydraulics	2
Principal Spillway Channel	3
Emergency Spillway Channel	3
Storage Capacity	3

PLATE 1 - Site Plan N14-T
PLATE 2 - Stage-Capacity Chart
PLATE 3 - Cross Section A-A'
PLATE 4 - Emergency Spillway Typical Cross Section

Appendix A - Hydrology, Hydraulic, and Sedimentology Calculations
Appendix B - SEDCAD+ (Input and Output) 10-Year, 24-Hour
Appendix C - SEDCAD+ (Input and Output) 25-Year, 24-Hour

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Introduction

Sedimentation Structure N14-T will be insized with a small earthen embankment, designed, and to be constructed upon approval by OSMRE in 1996, by Peabody Western Coal Company as a temporary sedimentation structure to control runoff and sediment from a reclaimed stockpile (No. N14-14) located at the Kayenta Mine. The location of Structure N14-T is shown on Plate 1, Site Plan, Drawing No. 85400 (Sheet M-8) and Drawing No. 85405. The pond will be required to control sediment and runoff from the disturbance associated with this revegetated stockpile.

This design report contains information specific to Structure N14-T. Regional site information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody Western Coal Company", December 1985 (PAP), Chapter 6, Attachment D, Volume 2 along with the methods and results of analyses used for slope stability, hydrology, and hydraulics.

Inspection

The proposed site of Structure N14-T was inspected by a senior engineer from Peabody Western Coal Company in June, 1996 to ensure that the site is suitable and no adverse conditions exist to prevent the successful construction of the structure. A detailed geotechnical investigation was not performed, rather, the information in Chapter 6, Attachment D will be utilized for embankment design during construction.

Site Description

Land Use. Structure N14-T has a 2.1-acre tributary drainage area. The watershed is classified as a 100 percent reclaimed area.

Embankment. A homogeneous earthen embankment, a minimum of ten feet wide, was assumed for the hydraulic analysis and to develop the stage-capacity chart shown on Plate 2. An upstream slope of 2:1 (horizontal to vertical) and downstream slopes of 3H:1V were used.

Design Analysis

General. Structure N14-T was designed by a senior engineer from Peabody Western Coal Company. The design was performed in accordance with applicable 30 CFR 715 regulations of the United States Department of Interior, Office of Surface Mining (OSM) and included a review of available project files. The most current information contained in the Peabody Western Coal Company files includes topographic maps developed from aerial photography flown in 1985 for Peabody Western Coal Company and was used in the analyses of the structure.

Stability. The slopes of Structure N14-T will be chosen based on the stability analyses performed for existing structures in the General Report. The design assumes "worst case" embankment material (see Attachment D). The embankment fill materials and the type of foundation will be identified in the field during construction and stable slopes will be chosen based on the category classification of the structure.

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Hydrology. The hydrologic analysis was completed using Civil Software Design's computer program SEDCAD+ (see Appendix A, B, and C). Structure N14-T is not in series with any other structure nor does the structure fall under the guidelines of the 30 CFR Section 77.216 for MSHA size structures. Therefore, the spillway was analyzed using the 25-year, 24-hour storm. The storage capacity of Structure N14-T was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course Length, L	0.133 mi
2.	Elevation Difference, H	12 ft
3.	Time of Concentration, T_c	0.097 hr
4.	SCS Curve Number	87
5.	Rainfall Depth, 10-year, 24-hour storm	2.1 in
	25-year, 24-hour storm	2.5 in
6.	Drainage Area	2.1 acres

Hydraulics. The SEDCAD+ program was used to evaluate inflow to the planned sedimentation structure, outflow from the structure, and the resulting water surface elevations. The initial conditions and results of the analysis are summarized in the following table.

N14-T Hydraulics

	Units	10-Yr 24-Hr Storm	25-Yr, 24-Hr Storm
Initial Reservoir Volume Condition		Empty	Full to principal spillway elevation
Inflow			
Peak Flow	cfs	2.2	2.84
Volume	ac-ft	0.17	0.23
Storage			
Peak Stage	ft	6603.0	6603.6
Principal Spillway Elevation	ft	6603.0	6603.0
Emergency Spillway Elevation	ft	6604.0	6604.0
Peak Storage	ac-ft	0.17	0.28
Storage Capacity	ac-ft	0.24	0.49
Available Sediment Storage	ac-ft	.07	-
Sediment Inflow Rate	ac-ft/yr	.0088	-
Sediment Storage Life	years	8	-
Outflow			
Peak Flow	cfs	0	2.11
Embankment Crest			
Elevation	ft	6606.0	6606.0
Peak Stage	ft	6603.0	6603.6
Freeboard	ft	3.0	2.4

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Principal Spillway Channel. The principal spillway for N14-T will be a minimum of one foot lower than the emergency spillway and be a trapezoidal channel with the following dimensions.

Channel depth	1.0 ft.
Channel bottom width	2.0 ft.
Channel length	10 ft.
Side slopes (horizontal to vertical)	0.1:1 or flatter
Average exit slope	0.5 percent
Inlet elevation	6603.0

The outflow channel will not require protection against erosion (see Appendix A). However, the spillway will be lined with a three-inch minus gravel.

Emergency Spillway Channel. The emergency spillway for N14-T will be a trapezoidal channel with the following dimensions.

Channel depth	1.0 ft
Channel bottom width	5 ft
Channel length	10 ft
Side slopes (horizontal to vertical)	3:1 or flatter
Average exit slope	0.5 percent
Inlet elevation	6604.0

The outflow channel will not require protection against erosion. However, the spillway will be lined with a three-inch minus gravel.

Storage Capacity. The impoundment volume-elevation curve is based on the most current topographic maps available in developing Plate 2, Volume-Elevation Curve, N14-T.

The calculations for the sediment load entering Structure N14-T were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.42
3.	Slope Length Factor, LS	2.234
4.	Cover Factor, C	0.240
5.	Erosion Control Factor, P	1.0

The hydrologic analysis gives the storage volume required to contain the 10-year, 24-hour storm, and the remaining storage volume available for storing sediment. The proposed storage capacity of N14-T and the results of the sediment inflow analysis are summarized in the following table.

N14-T Storage

Total Storage Capacity	0.24 acre-ft
10-year, 24-hour Storm Inflow	0.17 acre-ft
Available Sediment Storage Capacity	0.07 acre-ft
Sediment Inflow Rate	.0088 ac-ft/yr
Sediment Storage Life	8 yrs

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The following plates and appendices are attached and complete this design report.

Plate 1 -	Site Plan N14-T
Plate 2 -	Stage-Capacity Chart
Plate 3 -	Cross-Section A-A'
Plate 4-	Emergency Spillway Typical Cross Section
Appendix A -	Hydrology, Hydraulic, and Sedimentology Calculations
Appendix B -	SEDCAD+ (Input and Output) 10-year, 24-hour Storm
Appendix C -	SEDCAD+ (Input and Output) 25-year, 24-hour Storm

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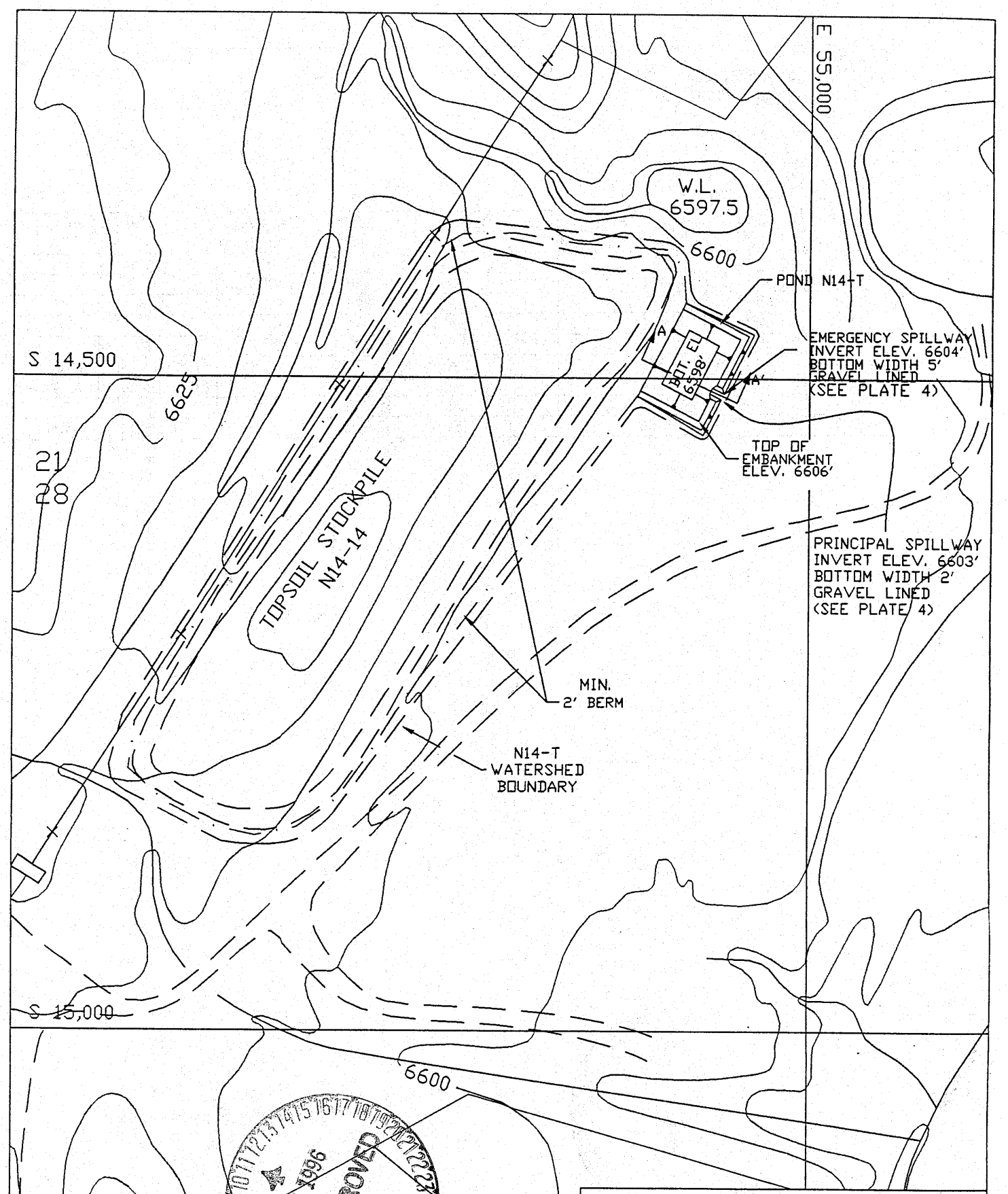

PEABODY WESTERN COAL COMPANY
KAYENTA MINE
PLATE 1 SITE PLAN

DESIGNED BY: TMI	SCALE: 1' = 100'
DRAWN BY: TMI	DRAWING DATE: 9-23-96
CHECKED BY: JGS	PHOTO DATE: 1985
C.I. 5'	DWG FILE: N14TSITE.DWG

APPROVED
OCT 1996

PEABODY WESTERN
KAYENTA AND BLACK MESA MINES
POND N14-T STAGE STORAGE

Project N 808-0100
Calculate *TEL*
Checked by:
Date: 23-Sep-96

Stage (ft)	Area (sqft)	Avg. Area (sqft)	Depth (ft)	Volume (cft)	Cum. Vol. (cft)	Cum. Vol. (ac-ft)	Description
6598	1196					0	Bottom of Pond
6599	1500	1348	1	1348	1348	0.03	
6600	1836	1668	1	1668	3016	0.07	
6601	2204	2020	1	2020	5036	0.12	
6602	2604	2404	1	2404	7440	0.17	
6603	3036	2820	1	2820	10260	0.24	Principal Spillway Invert
6604	3500	3268	1	3268	13528	0.31	Emergency Spillway Invert
6605	3996	3748	1	3748	17276	0.4	
6606	4524	4260	1	4260	21536	0.49	Top of Embankment

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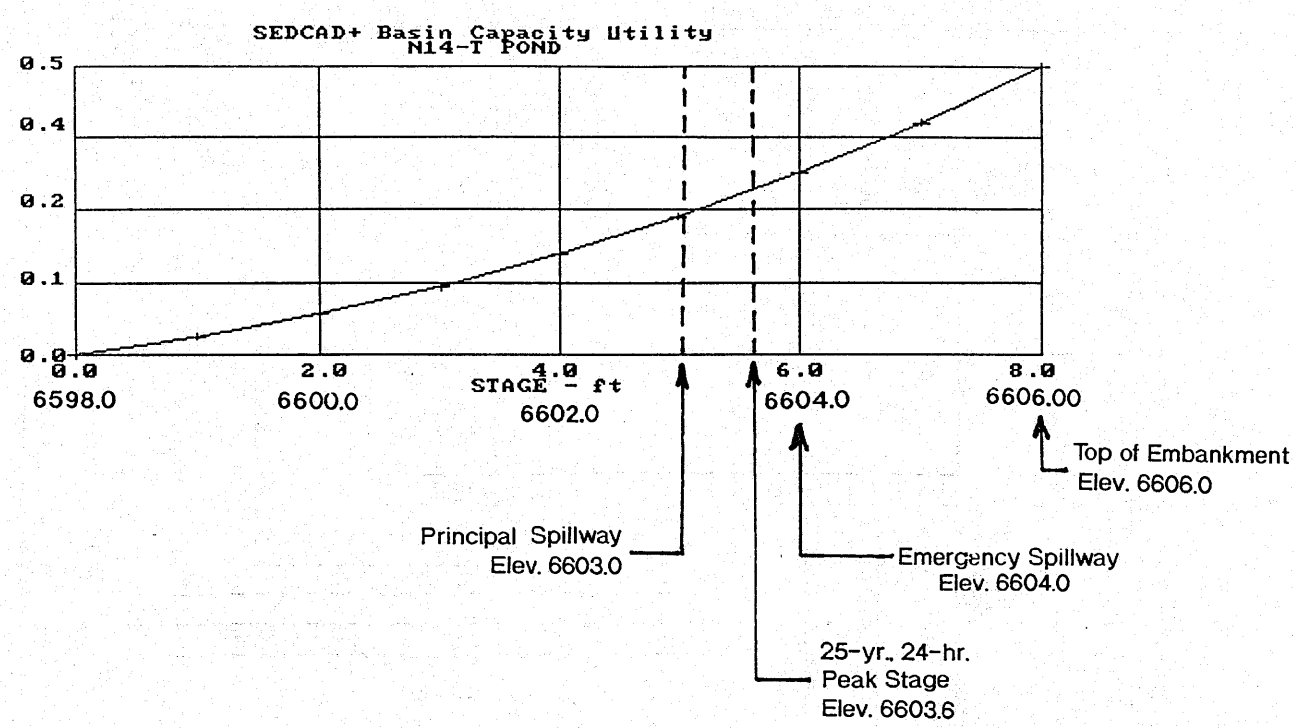
OCT 1996

STAGE-CAPACITY CHART

PLATE 2



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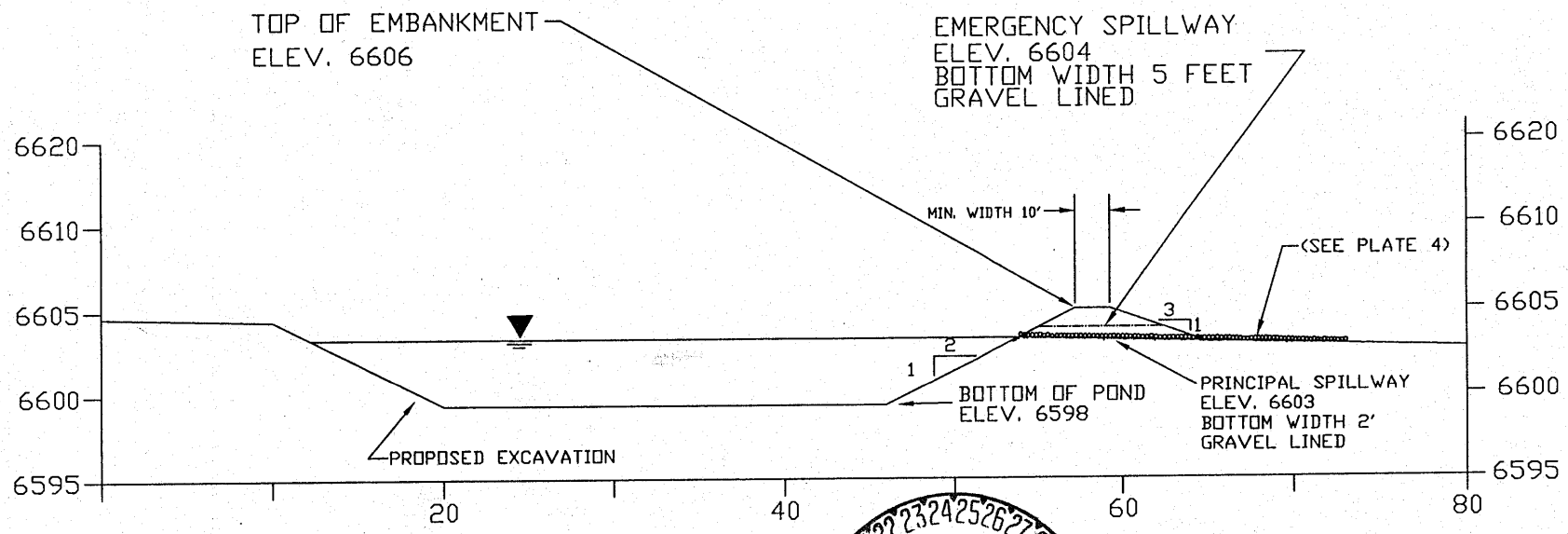
4 JAN 1996

Plate 2



CROSS-SECTION A-A'

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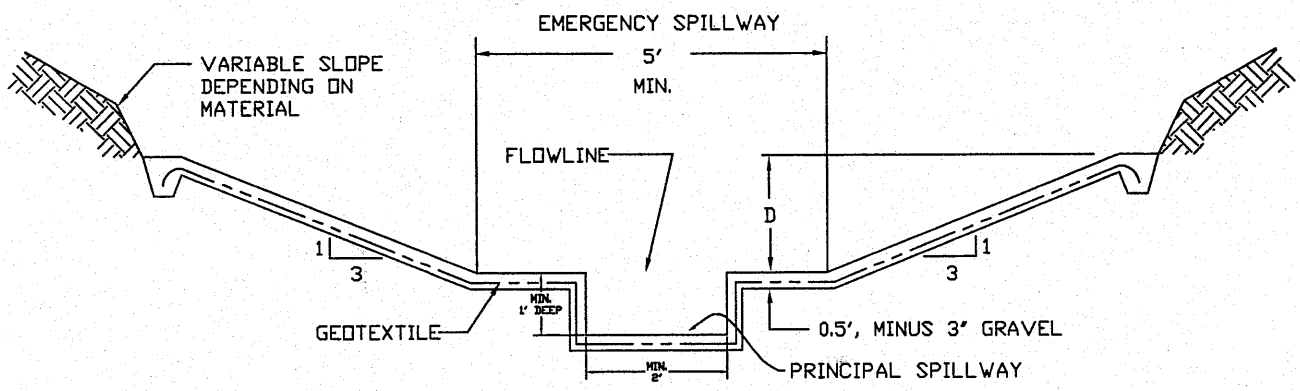
PEABODY WESTERN COAL COMPANY
KAYENTA MINE
PLATE 3 CROSS-SECTION A-A'

DESIGNED BY: TMI	SCALE: 1' = 10'
DRAWN BY: TMI	DRAWING DATE: 9-23-96
CHECKED BY: JGS	PHOTO DATE:
C.I.	DWG FILE: N14TXS.DWG



POND N14-T

EMERGENCY SPILLWAY

OUTFLOW CHANNEL

TYPICAL CROSS-SECTION

EMERGENCY SPILLWAY CHANNEL

D = 1.5'

LENGTH = 10'

FLOWLINE ELEV. = 6604

OUTFLOW CHANNEL

D = 1.5'

PRINCIPAL SPILLWAY CHANNEL

LENGTH = 10'

FLOWLINE ELEV. = 6603

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PEABODY WESTERN COAL COMPANY KAYENTA MINE PLATE 4 EMERGENCY SPILLWAY: TYPICAL CROSS-SECTION	
DESIGNED BY: TMI	SCALE: NOT TO SCALE
DRAWN BY: TMI	DRAWING DATE: 9-23-96
CHECKED BY: JGS	PHOTO DATE:
C.I.	DWG FILE: N14TDIT.DWG

APPENDIX A

HYDROLOGY, HYDRAULIC, AND SEDIMENTOLOGY CALCULATIONS

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N14-T

Time of Concentration

Elevation Difference = DH = 12

Water Course Length = L = $\frac{700}{5280}$ = .133

$$T_c = \frac{[11.9\ (L)^3]^{0.385}}{H} = \frac{[11.9\ (.133)^3]^{0.385}}{12} = .097$$

SCS Curve Number

Cover Type	Hydrologic Condition	Soil Type	CN	Area (Acres)	CN x Area
Reclaim	Pre-law	C	87	2.1	

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SEDIMENT YIELD CALCULATIONS
for Pond N14T

Project Name:	PEABODY COAL
Project Number:	808-0100
Calculated by:	*TEL*
Checked by:	

Description	Value	
Surface Slope	20.0%	
Annual Rainfall Factor	40.000	
Soil Erodibility Factor	0.42	
Slope Length	50	ft
m	0.6	
Slope Angle	0.197	Rad
Slope Factor	2.795	
Length Slope Factor	2.234	
Control Practice Factor	0.240	
Annual Sediment Yield	9.009	(tons/acre/year)
Annual Sediment Yield	0.0044	(ac-ft/acre/year)
SDR	95%	
Annual Sediment Yield	0.0042	(ac-ft/acre/year)
Area	2.1	ac
Annual Sediment Yield	0.0088	(ac-ft/year)
Total Avalable Storage	0.07	ac-ft
Total Years	8.0	years

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OCT 1996

TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION

October 1, 1996
N14-T PRINCIPAL SPILLWAY
25-YEAR, 24-HOUR STORM

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	2.1
Manning's Roughness Coefficient (n-value).....	0.0220
Channel Side Slope - Left Side (horizontal/vertical)....	0.10
Channel Side Slope - Right Side (horizontal/vertical)...	0.10
Channel Bottom Width (feet).....	2.0

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Critical Depth (feet).....	0.32
Critical Slope (feet per foot).....	0.0144
Flow Velocity (feet per second).....	3.20
Froude Number.....	1.000
Velocity Head (feet).....	0.16
Energy Head (feet).....	0.48
Cross-Sectional Area of Flow (square feet).....	0.66
Top Width of Flow (feet).....	2.06

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

OCT 1996
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TRAPEZOIDAL CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

October 1, 1996
N14-T PRINCIPAL SPILLWAY
25-YEAR, 24-HOUR STORM

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	2.1
Channel Bottom Slope (feet per foot).....	0.0050
Manning's Roughness Coefficient (n-value).....	0.0220
Channel Side Slope - Left Side (horizontal/vertical)....	0.10
Channel Side Slope - Right Side (horizontal/vertical)...	0.10
Channel Bottom Width (feet).....	2.0

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	0.46
Flow Velocity (feet per second).....	2.24
Froude Number (Flow is Sub-Critical).....	0.590
Velocity Head (feet).....	0.08
Energy Head (feet).....	0.54
Cross-Sectional Area of Flow (square feet).....	0.94
Top Width of Flow (feet).....	2.09

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

APPROVED
OCT 1996

APPENDIX B

SEDCAD+ (Input and Output)
10-Year, 24-Hour Storm

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OCT 1996

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

PEABODY COAL KAYENTA MINE: POND N14-T

by

Name: TEL

Company Name: ACZ, INC.
File Name: C:\808\N14T

Date: 06-19-1996

OCT 1996
APPROVED

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: ACZ, INC.
Filename: C:\808\N14T User: TEL
Date: 06-19-1996 Time: 12:32:38
PEABODY COAL KAYENTA MINE: POND N14-T
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	2.10	87	F	0.097	0.000	0.000	0.0	0.17	2.18
		Type: Pond			Label: POND N14-T					
111	Structure	2.10							0.17	
111	Total IN	2.10							0.17	2.18
111	Total OUT								0.17	2.03

APPROVED
OCT 1996

APPENDIX C

SEDCAD+ (Input and Output)
25-Year, 24-Hour Storm

OCT 1996
APPROVED

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

POND N14-T, 25-YEAR, 24-HOUR STORM

by

Name: JGS

Company Name: PEABODY WESTERN COAL COMPANY
File Name: C:\SEDCAD3\K-MINE\N14T25

Date: 10-01-1996

APPROVED
OCT 1996

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: PEABODY WESTERN COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N14T25 User: JGS
Date: 10-01-1996 Time: 09:10:39
POND N14-T, 25-YEAR, 24-HOUR STORM
Storm: 2.50 inches, 25 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	2.10	87	F	0.097	0.000	0.000	0.0	0.23	2.84
		Type: Pond			Label: N14-T POND					
111	Structure	2.10							0.23	
111	Total IN	2.10							0.23	2.84
111	Total OUT								0.23	2.11

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OCT 1996

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: PEABODY WESTERN COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N14T25 User: JGS
Date: 10-01-1996 Time: 09:10:39
POND N14-T, 25-YEAR, 24-HOUR STORM
Storm: 2.50 inches, 25 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

==========
POND INPUT/OUTPUT TABLE
==========

J1, B1, S1
N14-T POND

Drainage Area from J1, B1, S1, SWS(s)1: 2.1 acres
Total Contributing Drainage Area: 2.1 acres

DISCHARGE OPTIONS:

	Emergency Spillway	Emergency Spillway
Riser Diameter (in)	----	----
Riser Height (ft)	----	----
Barrel Diameter (in)	----	----
Barrel Length (ft)	----	----
Barrel Slope (%)	----	----
Manning's n of Pipe	----	----
Spillway Elevation	----	----
Lowest Elevation of Holes	----	----
# of Holes/Elevation	----	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	6603.0	6604.0
Crest Length (ft)	10.0	10.0
Z:1 (Left and Right)	0.1 0.1	3.0 3.0
Bottom Width (ft)	2.0	5.0

POND RESULTS:

Permanent Pool (ac-ft)
0.2

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	0.23	2.84

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OUT 0.23 2.11

Peak Elevation	Hydrograph Detention Time (hrs)
6603.6	0.04

****

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: PEABODY WESTERN COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N14T25 User: JGS
Date: 10-01-1996 Time: 09:10:39
POND N14-T, 25-YEAR, 24-HOUR STORM
Storm: 2.50 inches, 25 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
N14-T POND

Drainage Area from J1, B1, S1, SWS(s)1: 2.1 acres
Total Contributing Drainage Area: 2.1 acres

Elevation	Emergency Spillway (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
6598.00	0.0	0.0	0.0
6599.00	0.0	0.0	0.0
6600.00	0.0	0.0	0.0
6601.00	0.0	0.0	0.0
6602.00	0.0	0.0	0.0
6603.00	0.0	0.0	0.0
6603.60	2.2	0.0	2.2
6603.70	2.9	0.0	2.9
6603.80	3.6	0.0	3.6
6603.90	4.5	0.0	4.5
6604.00	5.2	0.0	5.2
6604.50	10.7	5.3	16.0
6604.60	12.0	6.4	18.4
6604.70	13.3	8.7	22.0
6604.80	14.6	11.4	26.0
6604.90	15.9	14.4	30.3
6605.00	17.2	17.4	34.6
6605.50	24.8	40.7	65.5
6606.00	33.5	73.1	106.6

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Company Name: PEABODY WESTERN COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N14T25 User: JGS
Date: 10-01-1996 Time: 09:10:39
POND N14-T, 25-YEAR, 24-HOUR STORM
Storm: 2.50 inches, 25 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
N14-T POND

Drainage Area from J1, B1, S1, SWS(s)1: 2.1 acres
Total Contributing Drainage Area: 2.1 acres

SW#1: Emergency Spillway
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6598.00	0.00	0.03	0.00	0.00	
6599.00	1.00	0.03	0.03	0.00	
6600.00	2.00	0.04	0.07	0.00	
6601.00	3.00	0.05	0.12	0.00	
6602.00	4.00	0.06	0.17	0.00	
6603.00	5.00	0.07	0.24	0.00	Stage of SW#1
6603.59	5.59	0.08	0.28	2.11	Peak Stage
6603.60	5.60	0.08	0.28	2.15	
6603.70	5.70	0.08	0.29	2.85	
6603.80	5.80	0.08	0.29	3.62	
6603.90	5.90	0.08	0.30	4.45	
6604.00	6.00	0.08	0.31	5.25	Stage of SW#2
6604.50	6.50	0.09	0.35	16.02	
6604.60	6.60	0.09	0.36	18.38	
6604.70	6.70	0.09	0.37	22.01	
6604.80	6.80	0.09	0.38	25.99	
6604.90	6.90	0.09	0.39	30.31	
6605.00	7.00	0.09	0.40	34.63	
6605.50	7.50	0.10	0.44	65.49	
6606.00	8.00	0.10	0.49	106.60	

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Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: ACZ, INC.
Filename: C:\808\N14T User: TEL
Date: 06-19-1996 Time: 12:52:02
PEABODY COAL KAYENTA MINE: POND N14-T
Storm: 1.90 inches, 25 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
POND N14-T

Drainage Area from J1, B1, S1, SWS(s)1: 2.1 acres
Total Contributing Drainage Area: 2.1 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6598.00	0.00	0.03	0.00	0.00	
6599.00	1.00	0.03	0.03	0.00	
6600.00	2.00	0.04	0.07	0.00	
6601.00	3.00	0.05	0.11	0.00	
6602.00	4.00	0.06	0.17	0.00	
6603.00	5.00	0.07	0.24	0.00	Stage of SW#1
6603.23	5.23	0.07	0.25	2.48	Peak Stage
6603.60	5.60	0.08	0.28	6.36	
6603.70	5.70	0.08	0.29	8.70	
6603.80	5.80	0.08	0.29	11.38	
6603.90	5.90	0.08	0.30	14.40	
6604.00	6.00	0.08	0.31	17.41	

APPROVED OCT 1996

ATTACHMENT Z

Black Mesa Haul Road Ephemeral
Channel Diversion Design Report
(See Drawing No. 85400, Sheet K-9)

APPROVED
MAR 1997

Revised 03/24/97

Black Mesa Haul Road Ephemeral
Channel Diversion Design Summary

Purpose: To divert runoff from approximately 79.6 acres of natural ephemeral channel watershed area along the west side of the Black Mesa haul road (see Drawing No. 85400, Sheet K-9 for location) at PWCC coordinates N -31,000; E 27,500.

Temporary Diversion Design: (Trapezoidal Channel)

10-year, 6-hour precipitation	=	1.60 inches
Area	=	79.6 ac.
CN	=	85
Time of concentration	=	0.124 hrs.
Peak discharge	=	68.82 cfs
Critical slope	=	1.4 %
Minimum design width	=	3 ft.
Minimum design depth w/freeboard	=	3.0 ft.
Side slopes	=	3:1 or flatter

To allow construction of a diversion ditch which will safely handle the flow over the existing topography, two alternative trapezoidal ditch designs (i.e., Design A or Design B) are recommended:

Design A: Earth-lined trapezoidal ditch (subcritical flow, 0.5% to 1.4% slope)

Average slope	=	0.5 %
n	=	0.03
d_n(min)	=	3.00 ft.
Velocity	=	3.85 fps

Design B: Riprap-lined or bedrock-lined trapezoidal ditch (supercritical flow, 1.4% to 10.0% slope)

Average slope	=	10 %
n	=	0.047
d_n(min)	=	2.3 ft.
Velocity	=	8.37 fps
Riprap D_{max}	=	7.5 in
Riprap D_{50}	=	6.0 in

APPROVED MAR 1997

Note:
- Design selection will be field-fitted based on the slope of the constructed channel.
- If bedrock is encountered during excavation, Design B will not require the installation of riprap.
- Minimum 20 ft. length of riprapped ditch as a transitional channel between the two alternative designs.
- See Chapter 26 for construction specifications.
- The above two alternative ditch designs will be able to handle the design storm at slopes from 0.5% to 10% while still being stable.

Revised 03/24/97

Black Mesa Haul Road
Ephemeral Channel Diversion

Time of Concentration:

Elev. Difference = 6577 - 6365 = 212 ft.

Watercourse Length = 3500 ft. = 0.663 mi.

T_c = [11.9(W.L.)^3/(E.D.)]^0.385 = 0.205 hr.

SCS Curve Number

Cover Type	Hydro Cond.	Soil Type	CN	Area (ac)	CN*Area
S-G	Poor	D	85	79.6	6766

Weighted CN = Use 85

Drainage Basin Area

79.6 Acres 0.124 sq. miles

APPROVED
MAR 1997

Revised 03/18/97

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

BLACK MESA HAUL ROAD,EPHEMERAL CHANNEL DIV., 10-YR., 6-HR. STORM

by

Name: JGS

Company Name: PEABODY WESTERN COAL COMPANY
File Name: C:\SEDCAD3\BMRDDIV

Date: 03-13-1997

APPROVED
MAR 1997

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: PEABODY WESTERN COAL COMPANY
Filename: C:\SEDCAD3\BMRDDIV User: JGS
Date: 03-13-1997 Time: 19:15:32
BLACK MESA HAUL ROAD,EPHEMERAL CHANNEL DIV., 10-YR., 6-HR. STORM
Storm: 1.60 inches, 10 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	79.60	85	F	0.124	0.000	0.000	0.0	3.43	68.82
		Type: Null			Label: BM HAUL RD. DIV.					
111	Structure	79.60							3.43	
111	Total IN/OUT	79.60							3.43	68.82

MAR 1997
APPROVED

TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION

March 13, 1997
BLACK MESA HAUL ROAD DIV.
10-YR., 6-HR. STORM

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	68.8
Manning's Roughness Coefficient (n-value).....	0.0300
Channel Side Slope - Left Side (horizontal/vertical)....	3.00
Channel Side Slope - Right Side (horizontal/vertical)...	3.00
Channel Bottom Width (feet).....	3.0

==========

PROGRAM RESULTS:

DESCRIPTION	VALUE
Critical Depth (feet).....	1.58
Critical Slope (feet per foot).....	0.0139
Flow Velocity (feet per second).....	5.62
Froude Number.....	1.000
Velocity Head (feet).....	0.49
Energy Head (feet).....	2.07
Cross-Sectional Area of Flow (square feet).....	12.25
Top Width of Flow (feet).....	12.49

==========

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

APPROVED
MAR 1997

SEDCAD+ NONERODIBLE CHANNEL DESIGN

BLACK MESA HAUL ROAD DIV.

INPUT VALUES:

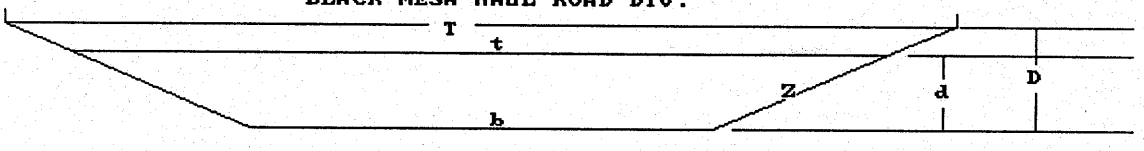
Shape	TRAPEZOIDAL	
Discharge	68.82 cfs	
Slope	0.50 %	
Sideslopes	3.00:1 (L)	3.00:1 (R)
Bottom Width	3.00 ft	
Manning's n	0.030	
Material	OTHER	
Freeboard	1 ft	

RESULTS:

Depth	1.99 ft
with Freeboard	2.99 ft
Top Width	14.96 ft
with Freeboard	20.96 ft
Velocity	3.85 fps
Cross Sectional Area	17.89 sq ft
Hydraulic Radius	1.15 ft
Froude Number	0.62

APPROVED
MAR 1997

SEDCAD+ CHANNEL DESIGN
BLACK MESA HAUL ROAD DIV.



MATERIAL: OTHER

Discharge	=	68.82 cfs	Depth (d)	=	1.99 (D = 2.99) ft
Bottom (b)	=	3.00 ft	Top width (t)	=	14.96 (T = 20.96) ft
Side slopes (Z)	=	3.0:1(L) 3.0:1(R)	Velocity	=	3.85 fps
Bed Slope	=	0.50 %	Hydraulic Radius	=	1.15 ft
Manning's n	=	0.030	Froude number	=	0.62

w/ Freeboard:

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SEDCAD+ RIPRAP CHANNEL DESIGN

BLACK MESA HAUL ROAD DIV.

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	68.82 cfs	
Slope	10.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	3.00 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	1.23 ft
with Freeboard	2.23 ft
Top Width	10.38 ft
with Freeboard	16.38 ft
Velocity	8.37 fps
Cross Sectional Area	8.22 sq ft
Hydraulic Radius	0.76 ft
Manning's n	0.047
Froude Number	1.66
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

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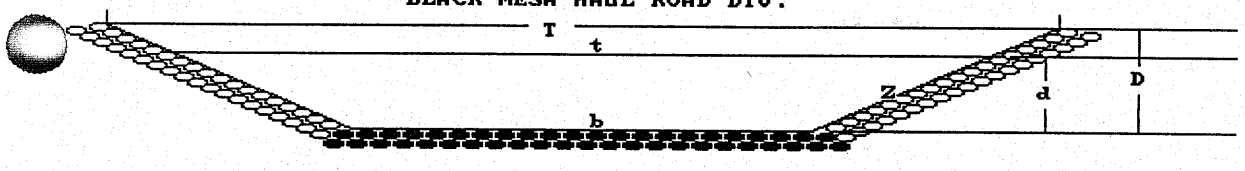
SEDCAD+ CHANNEL DESIGN
BLACK MESA HAUL ROAD DIV.



Riprap - Steep Slope Design - PADER Method

Discharge	= 68.82 cfs	Depth (d)	= 1.23	w/ Freeboard: (D =	2.23) ft
Bottom (b)	= 3.00 ft	Top width (t)	= 10.38	(T =	16.38) ft
Side slopes (Z)	= 3.0:1(L) 3.0:1(R)	Velocity	= 8.37 fps		
Bed Slope	= 10.00 %	Hydraulic Radius	= 0.76 ft		
Manning's n	= 0.047	Froude number	= 1.66		

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

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