PAPIO-MISSOURI RIVER
NATURAL
RESOURCES
DISTRICT
8901 S. 154TH ST.
OMAHA, NE 68138-3621

Programs, Projects & Operations
Subcommittee Meeting
July 6, 2004
7:00 p.m.
Agenda

Programs, Projects & Operations:

John Conley, Chairperson
Rich Jansen, Vice-Chairperson
Tim Fowler
Joe Neary
Rich Tesar

Alternate Members: Dick Connealy

Staff Liaison: Gerry Bowen
Jerry Herbster
Ralph Puls *
Paul Woodward

1. Meeting Called to Order – Chairperson John Conley
2. Quorum Call
3. Adoption of Agenda
4. Proof of Publication of Meeting Notice
5. Update on USGS Water Quality Monitoring – Virginia McGuire, USGS; and Gerry Bowen
6. Review and Recommendation on Development and Management Agreement with Nebraska Wildlife Rehab, Inc for Rumsey Station Wetland – Margaret Lehning, NE Wildlife Rehab, Inc.; and Jim Becic
7. Review and Recommendation on Sarpy Water/Wastewater Study (South Half of Sarpy County) with Sarpy County and Others – Mark Wayne, Sarpy County; and Marlin Petermann
8. Review and Recommendation on Big Papio Trail (Center to Blondo) Cracking – Joe Waxse, Terracon, Inc.; and Gerry Bowen
9. Review and Recommendation on Site Grading for Amphitheater at Walnut Creek Lake and Recreation Area -- Randy Lee
10. Other Items of Interest
11. Adjourn

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PAPIO-MISSOURI RIVER GROUND-WATER MONITORING NETWORK, 2004

By Virginia (Ginny) L. McGuire
U.S. Department of the Interior
U.S. Geological Survey

The U.S. Geological Survey (USGS), in cooperation with the Papio-Missoui River Natural Resources District (PMNRD), monitors ground-water quality in the PMNRD using a monitoring well network that consists of domestic, irrigation, public supply, and well nests. The monitoring well network includes wells screened in the five aquifers, which underlie the PMNRD—the Dakota, Elkhorn alluvial, Missouri alluvial, Platte alluvial, and Upland aquifers. Figure 1 shows the location of the wells in the monitoring well network and the aquifer that is the source of the well's water.

Ground-water monitoring in the domestic, irrigation, and public supply wells

The sampling schedule for the domestic, irrigation, and public supply wells generally is based on the aquifer that is the source of the well's water. About 25 to 40 domestic, irrigation, public supply wells are sampled during the summer on a three-year schedule; wells screened in the Platte and Elkhorn alluvial aquifers are sampled one summer, wells screened in the Missouri alluvial aquifer are sampled the second summer, and wells screened in the Dakota and Upland aquifers are sampled the third summer. The PMNRD can change this schedule or ask the USGS to add wells to the network. The water samples are analyzed to determine the concentration of nitrate and pesticides in the water. Figure 2 shows the nitrate concentrations from the latest available results in each well in the monitoring well network; the latest available results in a given well may be from samples collected from Summer 1992 to Summer 2003.

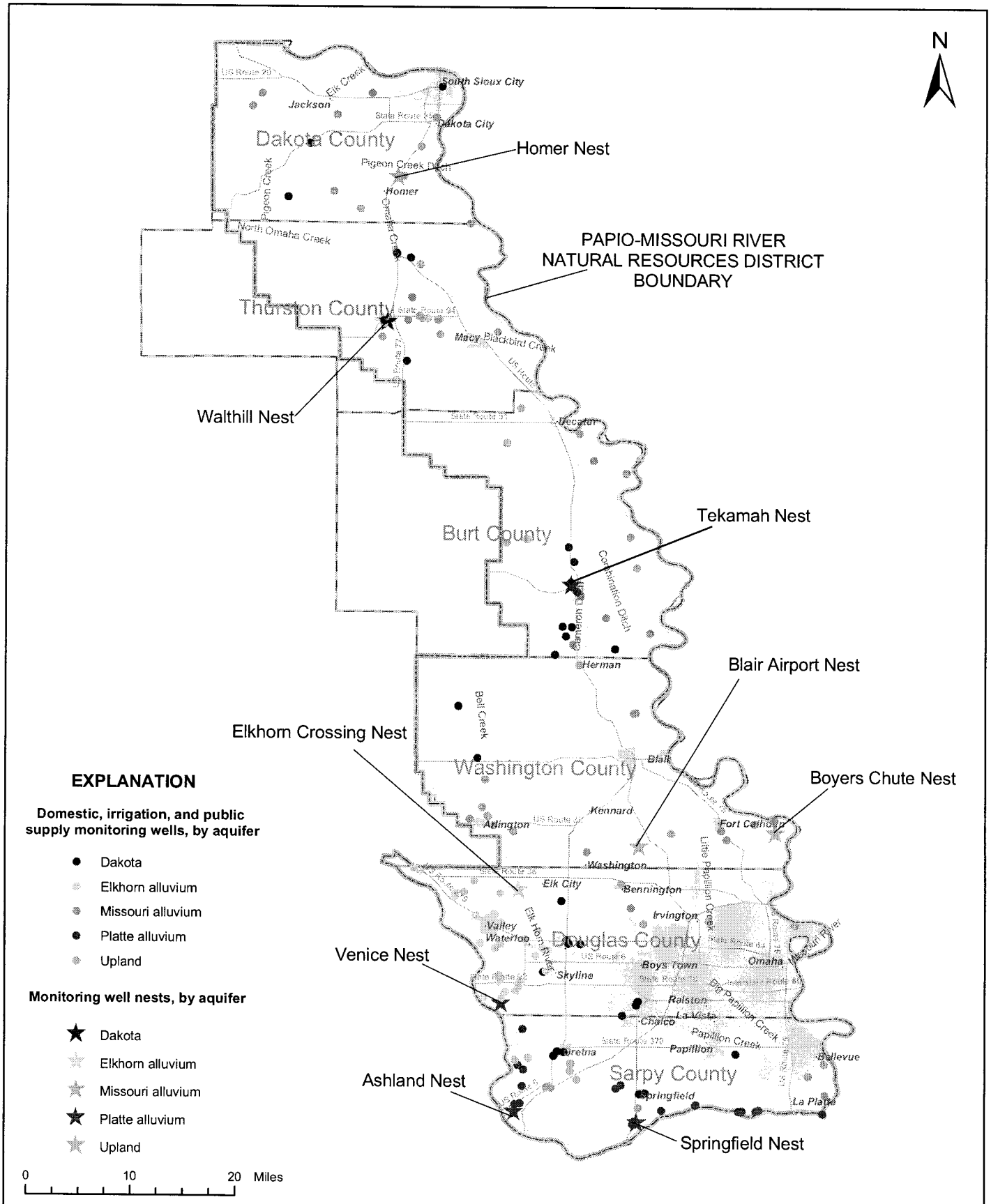

Figure 1. Ground-water monitoring network, Papio-Missouri River Natural Resources District, 2004 (Preliminary data. Do not quote or release. Subject to revision until approved by the Director of the U.S. Geological Survey)

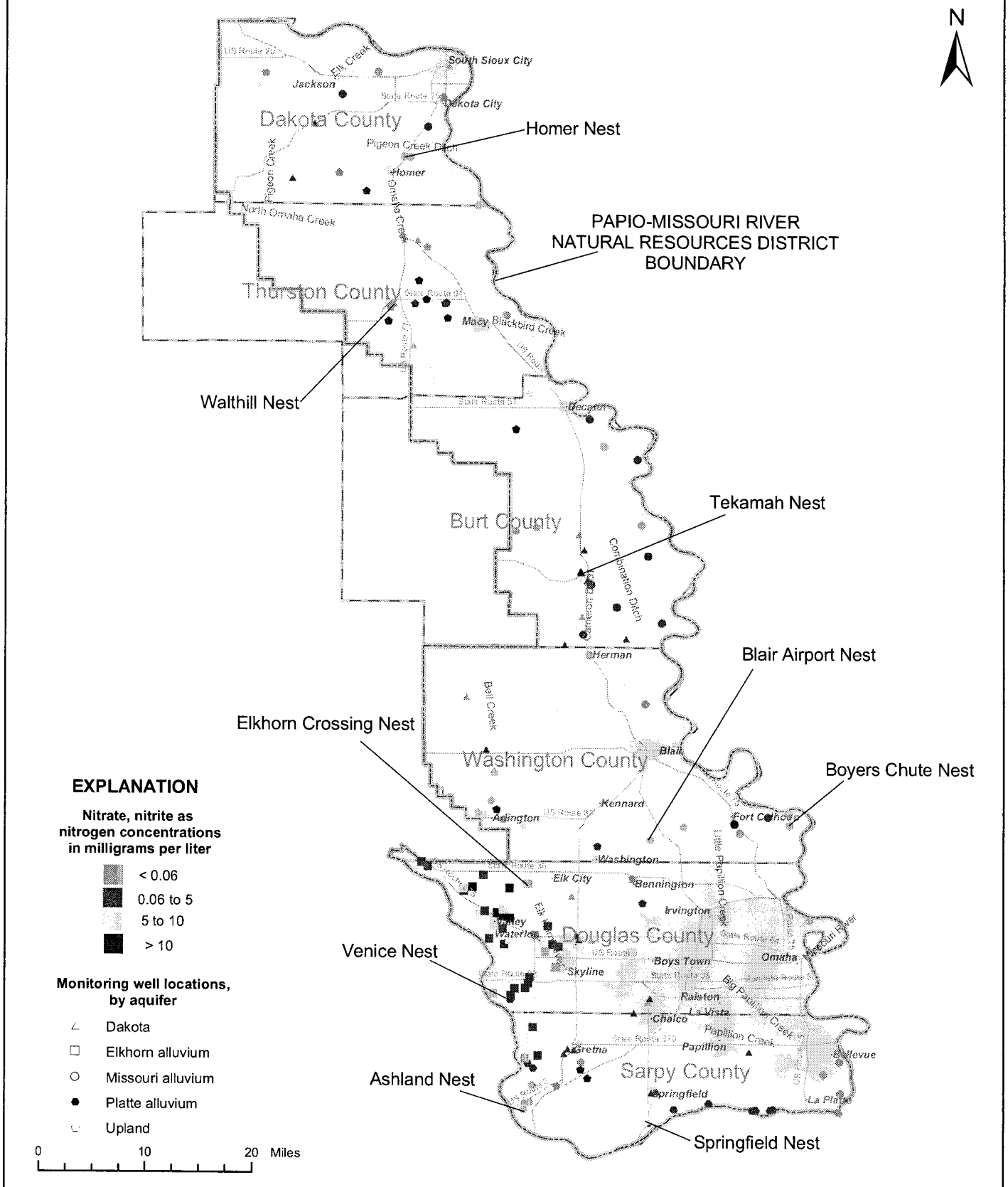

Figure 2. Distribution of latest nitrate plus nitrite concentrations in each well in the ground-water monitoring network, Papio-Missouri River Natural Resources district, 1992 through 2004 (Preliminary data. Do not quote or release. Subject to revision until approved by the Director of the U.S. Geological Survey)

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The range of nitrate plus nitrite as nitrogen concentration in all samples from the domestic, irrigation, and public supply wells vary by aquifer (Table 1). The highest median concentration (2.77 milligrams/liter) and the maximum concentration (74.6 milligrams/liter) were in wells screened in the Upland aquifer. The latest available nitrate plus nitrite as nitrogen concentration exceed 10 milligrams per liter for at least one well screened in the Dakota, Elkhorn alluvial, Missouri alluvial, and Upland aquifers.

Table 1. Maximum, minimum, and median nitrate plus nitrite as nitrogen concentration, in milligrams per liter in domestic, irrigation and public supply wells in the monitoring well network, Papio-Missouri Natural Resources District, through Summer 2003. (Preliminary data. Do not quote or release. Subject to revision until approved by the Director of the U.S. Geological Survey)

[<, less than]

Aquifer	Maximum	Minimum	Median
Dakota	13.00	< 0.03	0.85
Elkhorn alluvium	24.1	< 0.04	1.5
Missouri alluvium	12.5	< 0.03	0.05
Platte alluvium	9.23	< 0.03	0.72
Upland	74.6	< 0.03	2.77
All Aquifers	**74.6**	**< 0.03**	**0.32**

In Summer 2004, about 30 wells screened in the Missouri alluvial aquifer and 10 wells screened in the Platte alluvial aquifer well be sampled. The constituents that will be measured in the samples from these wells are nitrate plus nitrite and pesticides.

Ground-water monitoring in the well nests

The well nests were designed for water quality monitoring. There are two to three wells in each well nest; the well nests have 5 to 10 foot screens generally placed at the top, middle, and bottom of the aquifer. At least one well nest is screened in each aquifer in the PMNRD—there are

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two well nests screened in the Dakota aquifers, one nest screened in the Elkhorn alluvial aquifer, two nests screened in the Missouri alluvial aquifer, three nests screened in the Platte alluvial aquifer, and one nest screened in the Upland aquifer.

The sampling schedule for the well nests has changed over time. The well nests were initially sampled monthly and then bimonthly. The constituents that were measured in the samples have included trace metals, major ions, nutrients, pesticides, dissolved gases, and chlorofluorocarbons. The May 2004 nitrate plus nitrite as nitrogen concentrations in the well nests are shown in Figure 2. The well nests with the higher nitrate concentration are the Springfield, Tekamah, and Venice well nests (Table 2).

Table 2. Maximum, minimum, and median nitrate plus nitrite as nitrogen concentration, in milligrams per liter in the well nests in the monitoring well network, Papio-Missouri Natural Resources District, through May 2004. (Preliminary data. Do not quote or release. Subject to revision until approved by the Director of the U.S. Geological Survey)

[<, less than]

Well Nest/Aquifer	Maximum	Minimum	Median
Dakota Aquifer			
Tekamah	40.6	< 0.02	2.16
Walthill	0.15	< 0.02	0.05
Elkhorn alluvium			
Elkhorn Crossing	< 0.06	< 0.02	0.05
Missouri alluvium			
Boyers Chute	0.08	< 0.02	0.05
Homer	0.11	< 0.02	0.05
Platte alluvium			
Springfield	7.08	1.47	4.96
Ashland	0.1	< 0.02	0.05
Venice	10.3	0.15	2.05
Upland			
Blair	0.09	< 0.02	0.05
All Nests	**40.6**	**< 0.02**	**0.06**

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Starting Summer 2004, plans are to sample the well nests with low nitrate concentrations two times a year and the wells with high nitrate concentrations bimonthly. The constituents that will be measured in samples from all well nests are nutrients (nitrate, nitrite, ammonium, and phosphate), pesticides, and major ions. The additional constituents that will be measured in the samples from the well nests with high nitrate concentrations are nitrogen isotopes and dissolved gases. Nitrogen isotopes are used to determine whether the source of nitrate is from fertilizer or biological processes. Dissolved gases are used to determine if denitrification is occurring.

MEMO TO: Programs, Projects and Operations Subcommittee

RE: Nebraska Wildlife Rehab, Inc – Development and Management Agreement for Rumsey Station Wetlands

FROM: Jim Becic

Date: 28 June, 2004

The P-MRNRD Board entered into a Development and Management Agreement for the District's Rumsey Station Wetland site on 3 July, 2000 with the Nebraska Wildlife Rehab, Inc. (NWRI). The purpose of the agreement was to allow NWRI one year of time to complete the design of their proposed Center for Environmental Education and Wildlife Rehabilitation; secure the necessary approvals and permits and to raise the required funding of $1 million dollars - or the estimated building/facilities costs. All of these steps were required to be accomplished by NWRI, prior to any physical changes to the site.

This Agreement would allow NWRI to approach potential donors and show them that they indeed had a site that would be a good location for the proposed facility and that it was "tied up" for a year. IF NWRI progressed through the Agreement successfully and through construction completion – the land would be theirs to use for an additional 99 years.

Following this initial Agreement, NWRI approached the Board on three succeeding years and received approval for annual extensions to this Agreement in 2001, 2002, and 2003.

During the PPO Subcommittee meeting in 2003, several subcommittee members voiced reluctance to approving the third addendum to the agreement and several subcommittee members indicated that this would be their final vote of approval. To date, the NWRI has not been able to provide facility plans or show evidence of construction funding.

In the past, the District has had little to lose by approving extensions to this Agreement, since there has been little interest shown by other entities desiring to develop and manage the site. This is currently not the case.

It is the staff recommendation that the Programs, Projects, and Operations Subcommittee recommend that the Board not approve an additional addendum to NWRI for the Rumsey Station Wetlands.

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THIRD ADDENDUM TO
DEVELOPMENT AND MANAGEMENT AGREEMENT
BETWEEN
PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT
AND
NEBRASKA WILDLIFE REHAB, INC.
FOR
RUMSEY STATION WETLANDS

THIS ADDENDUM (hereinafter referred to as "**this Addendum**") is entered into by and between the **PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT** (hereinafter referred to as "**the NRD**"), a governmental subdivision of the State of Nebraska, and **NEBRASKA WILDLIFE REHAB, INC.** (hereinafter referred to as "**NWRI**"), a non-profit corporation organized and existing under the laws of the State of Nebraska.

WHEREAS, the NRD and NWRI entered into an Agreement, effective as of July 3, 2000, entitled "DEVELOPMENT AND MANAGEMENT AGREEMENT BETWEEN PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT AND NEBRASKA WILDLIFE REHAB, INC. FOR RUMSEY STATION WETLANDS" (hereinafter referred to as "**the Agreement**"); and,

WHEREAS, by a FIRST ADDENDUM, the Agreement previously was amended to extend by one year certain deadlines provided by the Agreement; and,

WHEREAS, by a SECOND ADDENDUM, the Agreement previously was again amended to extend by one year certain deadlines provided by the Agreement; and,

WHEREAS, NWRI has requested that the NRD agree to extend by one additional year the deadline provided by paragraph 6 of the Agreement for the verification of financing

NOW, THEREFORE, in consideration of their mutual covenants contained herein, it is hereby agreed between the parties as follows, to-wit:

A. **AMENDMENT.** Paragraph 6 of the Agreement, as previously amended, is hereby further amended as follows, to-wit:

> 6. **VERIFICATION OF FINANCING.** Within sixty (60) days after the NRD's approval of the Final Plans and Specifications and of the itemized estimates of the cost of construction of the NWRI Facilities and of the NRD Facilities as shown in the Final Plans and Specifications, but not later than July 1, 2004, NWRI shall submit to the NRD written evidence satisfactory to the NRD that NWRI has obtained construction financing in the amount of the Architects/Engineers' estimates of the costs of construction of the NWRI Facilities shown in the Final Plans and Specifications, or in the amount of one million dollars, whichever amount is greater. Such construction financing may consist of: (a) unencumbered NWRI funds on deposit in a bank authorized to do business in the State of Nebraska, (b) enforceable pledges, grants, and donations of money to NWRI or the NRD for purposes of construction of the NWRI Facilities; and, (c) enforceable pledges, grants, and donations to NWRI or to the NRD of materials and in-kind services usable for construction of the NWRI Facilities, or any combination thereof. Such construction financing may not be secured by liens upon the Premises or upon any of the NWRI Facilities nor NRD Facilities, nor be secured by any rents or profits therefrom, nor permit or contemplate the imposition of construction liens or other encumbrances upon the Premises. If the requisite verification of financing has not been submitted to the NRD on or before such date then the NRD may declare this Agreement terminated. The identities of anonymous donor(s) providing financing for the NWRI Facilities, or written verification thereof, shall not be disclosed to the public in the absence of such disclosure being ordered by a Nebraska court of general jurisdiction upon a showing of good cause.

and that, except as so amended by this Addendum, the Agreement as previously amended and all provisions thereof are ratified and confirmed in all respects,

B. EFFECTIVE DATE OF ADDENDUM. This Addendum shall be effective upon execution hereof by both parties.

Executed by **NWRI** on this 22 day of September, 2003.

NEBRASKA WILDLIFE REHAB, INC., a Nebraska non-profit corporation

Attest:

By Margaret Lehning
President

_____
Secretary

Executed by the **NRD** on this _____ day of _____, 2003.

PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT

By _____
General Manager

STATE OF NEBRASKA)
) SS.
COUNTY OF SARPY)

On this ____ day of _____, 2003, before me, a Notary Public in and for said County, personally came the above-named STEVEN G. OLTMANS, General Manager of the PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT, and acknowledged the execution of the above instrument as his voluntary act and deed and the voluntary act and deed of said natural resources district.

WITNESS my hand and Notarial Seal the date last aforesaid.

_____
Notary Public

Memorandum

To: PPO Subcommittee

Subject: Sarpy County Water/Wastewater Infrastructure Study Interlocal Agreement

By: Marlin Petermann, Assistant General Manager

Date: June 28, 2004

Sarpy County is requesting that the District enter into an Interlocal Agreement (draft attached) with the County and other governmental entities for the preparation of a Study Report on Water Quality issues related to Regional Water and Wastewater Systems for Platte River tributary basins in Sarpy County. Sarpy wishes to use the results of the study in conjunction with its Comprehensive Plan as a guide to address existing and future infrastructure needs in the county while protecting water quality.

The purpose for this study is to determine the viability of developing regional water and wastewater systems to protect water quality in the region generally described as that portion of Sarpy County that drains to the Platte River (see attached map). The deliverable product will be a final report that documents the steps of the study process, including identification of stakeholders and their involvement, documentation of environmental and water quality issues, and recommends an overall plan for the proposed systems and a recommended implementation schedule.

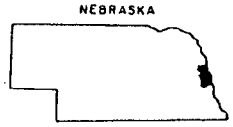
The study will identify and recommend infrastructure systems that work with the environment to maintain the character of the area, and protect and preserve water quality, while allowing growth to occur.

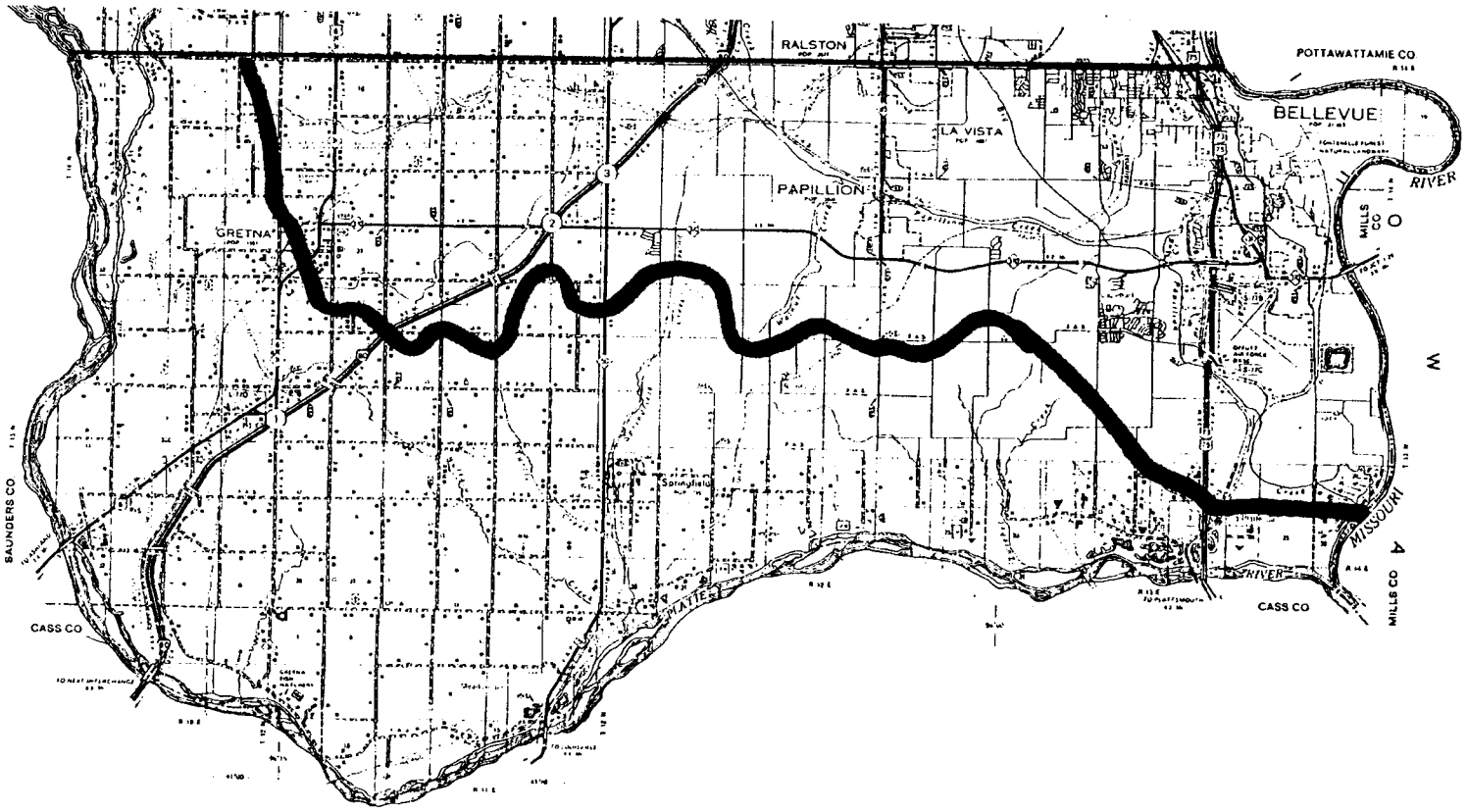
The interlocal agreement includes the following entities and cost shared funding:

Sarpy County	$100,000
MAPA	$100,000
P-MRNRD	$ 50,000
City of Papillion	$ 60,000
City of Bellevue	$ 50,000
City of Omaha	$ 15,000
City of Springfield	$ 10,000
City of Gretna	$ 5,000

Management recommends that the Subcommittee recommend to the Board that the General Manager be authorized to execute an interlocal agreement for a Sarpy County Water and Wastewater Infrastructure Study with Sarpy County and others, for a maximum District contribution of $50,000, subject to changes deemed necessary by the General Manager and approved as to form by District Legal Council.

SARPY COUNTY





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INTERLOCAL COOPERATION AGREEMENT
WATER AND WASTEWATER INFRASTRUCTURE STUDY
Sarpy County Platte River Basin

This Interlocal Cooperation Agreement ("this Agreement") is entered into by and among Sarpy County, Nebraska ("the County"); the Cities of Papillion, Bellevue, Springfield, Gretna and Omaha, Nebraska; the Metropolitan Area Planning Agency ("MAPA"); and, the Papio-Missouri River NRD ("P-MRNRD") (all collectively "The Sarpy County Water and Wastewater Coalition" or "the Coalition").

WHEREAS, each member of the Coalition is a public agency, duly created and validly existing under the laws of the State of Nebraska, within the meaning of the Nebraska Interlocal Cooperation Act (§13-1801 et.seq.) (herein the "Interlocal Cooperation Act"); and,

WHEREAS, the Coalition has an interest in protecting the environment and public health from being compromised due to an inadequate water and wastewater infrastructure; and,

WHEREAS, the Coalition members have agreed that a Study on Water and Wastewater Systems in the Platte River Basin of Sarpy County ("the Study") must be conducted; and,

WHEREAS, the Coalition members have agreed that the cost of the Study is to be defrayed as herein provided.

NOW, THEREFORE, IT IS AGREED as follows:

1. Study Description:

   A. Requests for Proposals ("RFPs") to Provide Professional Engineering Services for the Study will be received by the County and reviewed by the members of the Coalition.

   B Based upon Coalition input on the RFPs received, the County will select an engineering firm to negotiate a detailed:
      1. Scope of Work
      2. Time Schedule
      3. Study Cost

2. Study Administration:

   The County shall be the Study Administrator and shall have general supervision and control of the Study, including scope of work, contract award, supervision and control of the work.

3. Study Financing:

As Study Administrator, the County shall make all payments that become due in respect to the Study and shall invoice Coalition members for their agreed shares of the Study costs as the Study is conducted. The full amount of invoices shall be due thirty (30) days after the billing date.

4. Coalition Member's Shares of the Study Cost:

Sarpy County	$100,000
MAPA	$100,000
P-MRNRD	$ 50,000
City of Papillion	$ 60,000
City of Bellevue	$ 50,000
City of Omaha	$ 15,000
City of Springfield	$ 10,000
City of Gretna	$ 5,000

5. Right to Study Report:

Each Coalition member shall have complete property rights to use and reproduce any and all Study data, or any other information developed in connection with this Study, for its own use.

6. Interlocal Cooperation Act:

This agreement is entered into among the Coalition members pursuant to the Interlocal Cooperation Act. The Coalition members agree:

A. This Agreement shall continue in force and effect until the later of the following, to-wit: (a) one (1) year after the date of completion of the Study, (b) the date upon which all terms and conditions of the Study have been paid and discharged in accordance with the terms and conditions of the resolution, contract or other instrument creating such obligation, or (c) such other date as may be determined by mutual agreement of the Coalition. No member shall have the right to withdraw from this Agreement or to modify, amend or alter its obligations hereunder prior to the termination of this Agreement unless approved by the governing body of each Coalition member.

A. There is no joint entity, separate legal entity or administrative entity created hereby.

B. The purpose hereof is as stated in the preambles to this Agreement.

C. No joint financing is necessary to the implementation of this Agreement.

D. This Agreement may be partially or completely terminated or modified only by mutual agreement of the Coalition as authorized and evidenced by resolutions of their respective governing bodies.

E. The County shall be the party responsible for administering this cooperative undertaking.

F. It is not anticipated that any Coalition member will need to acquire, hold or dispose of real or personal property in this cooperative undertaking, but to the extent any must do so, they shall do so in their separate corporate capacities and not jointly.

G. The Coalition hereto acknowledges, stipulates and agrees that this Agreement shall not relieve any public agency of any obligation or responsibility imposed upon it by law.

7. Effective Date:

This Agreement shall become effective upon execution by all Coalition members.

8. General Provisions:

A. Evidence of Action: Each Coalition member shall furnish the other members with a certified copy of the resolution of its governing board authorizing execution and implementation of this Agreement.

B. Notice: Notices under this Agreement shall be in writing and delivered personally or by certified mail to the Coalition members at the addresses below:

To: Attention: Deb Houghtaling
Sarpy County Clerk
Sarpy county courthouse, Ste 1118
Papillion, NE 68046

To: Attention:...
Papillion City ...
123 East 3rd
Papillion, NE 68046

To: Attention:...
Bellevue City ...

210 West Mission
Bellevue, NE 68005

To: Attention: ...
Springfield City ...
PO Box 189
Springfield, NE 68059

To: Attention: ...
Gretna city ...
PO Box 69
Gretna, NE 68028

To: Attention: ...
Omaha city ...
1819 Farnam St.
Omaha, NE 68183

To: Attention: ...
MAPA
2222 Cummings St
Omaha, NE 68102

To: Attention: ...
P-MRNRD
8901 South 154th St
Omaha, NE 68138

or to such substitute person and/or address which a Coalition member may advise the other members of in writing.

C. Waivers: Any waiver must be specific and in writing to be effective. The failure of a Coalition member to insist upon strict performance of any obligation under this Agreement shall not constitute or be deemed a waiver of any rights or remedies that a member might have and shall not be deemed a waiver of any subsequent breach or default.

D. Severability: The invalidity or unenforceability of any covenant, restriction, condition, limitation or any other provision of this Agreement, as the case may be and finally determined by a court of competent jurisdiction, shall not render the remainder of this Agreement nor any part hereof invalid or unenforceable.

E. Governing Law: The law of the State of Nebraska shall govern this Agreement.

F. Amendments: This Agreement shall be amended only by a written amendment signed by all Coalition members.

G. Counterparts: This Agreement may be executed in one or more counterparts, each of which shall be deemed an original and all of which shall constitute one and the same instrument.

H. Entire Agreement: This Agreement constitutes the entire agreement and understanding of the Coalition with respect to the subject matter contained herein, and supersedes all prior agreements or understandings regarding the same subject matter, whether oral or written.

IN WITNESS WHEREOF, the Coalition members have caused this Agreement to be executed by their duly authorized officers on the date and year first written above.

ATTEST:

THE COUNTY OF SARPY, NEBRASKA

_____
County Clerk

By _____

Title: _____

APPROVED AS TO FORM:

_____
Deputy County Attorney

ATTEST:

THE CITY OF PAPILLION

_____
City Clerk

By _____

Title: _____

APPROVED AS TO FORM:

_____
City Attorney

One signature page for each Coalition Member needs to be made up!!

Saved in WP under Water and Wastewater Treatment Interlocal Agreement 6-24-04

Memo to the Programs, Projects, and Operations Subcommittee

Subject: Big Papio Trail

Date: July 2, 2004

From: Gerry Bowen

The recently-constructed Big Papio Trail Project between Center and Blondo has experienced cracking of the concrete trail on 4,008 of the 14,025 feet (29%) of trail installed. The project was designed by Kirkham Michael and constructed by Hawkins Construction Company of Omaha. The first concrete was poured on July 22, 2002.

The District then hired Terracon, Inc. to conduct the necessary scientific tests to determine the causes(s) of the cracking. Their report (see attached) indicates two periods of cracking occurred (early and late). The early cracking is concluded to be primarily caused by placement of "fly ash" concrete on a dry sub-grade during hot, dry, and windy afternoons.

The later cracking is concluded to be primarily caused by poor sub-grade support (compaction) which allowed the concrete to fail under traffic load.

The early cracks were routed and sealed, or sections replaced, by the contractor. The later cracks have not been repaired.

Management recommends that the Subcommittee recommend to the Board that the General Manager be authorized to negotiate with the responsible parties for correction of the pavement cracking in the District's bicycle and pedestrian trail along the Big Papillion Creek between West Center Road and Blondo Street, and report back to the Board at its August meeting.

GEOTECHNICAL ENGINEERING REPORT

BIG PAPIO TRAIL PAVEMENT DISTRESS
WEST CENTER ROAD TO BLONDO STREET
OMAHA, NEBRASKA
PROJECT NO. STPB-28(74)
TERRACON PROJECT NO. 05035181

July 1, 2004

Prepared for:

PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT
Omaha, Nebraska

Prepared by:

TERRACON
Omaha, Nebraska

Terracon

July 1, 2004

Terracon
Consulting Engineers & Scientists

2211 South 156th Circle
Omaha, Nebraska 68130-2506
Phone 402.330.2202
Fax 402.330.7606
www.terracon.com

Papio-Missouri River Natural Resources District
8901 South 154th Street
Omaha, NE 68138-3621

Attention: Mr. Gerry Bowen

Re: Geotechnical Engineering Report
Big Papio Trail Pavement Distress
West Center Road to Blondo Street
Omaha, Nebraska
Project No. STPB-28(74)
Terracon Project No. 05035181

Dear Mr. Bowen:

Terracon has completed geotechnical engineering services for the referenced project in accordance with our Proposal-Agreement dated December 5, 2003. The purpose of this report is to present the data collected, describe our interpretation and evaluation of the data relative to factors that apparently contributed to pavement distress, and provide recommendations to help remediate the distressed pavements and reduce recurrence of the problem on future trail projects.

PROJECT INFORMATION

The project consists of approximately 4½ miles of Portland cement concrete (PCC) paved trail. The trail pavement is 6 inches thick, 10 feet wide, and reportedly bears on 6 inches of compacted soil subgrade. The pavement has a surface cross-slope of about 2% that varies towards and away from the creek, depending on drainage design requirements. The trail generally is located within the creek floodway on an alignment that entailed minimal cut and fill. Exceptions to this occur below bridges at 105th Street, Interstate 680, and West Dodge Road and in the vicinity of STA 192+00 where several feet of fill was required.

The trail pavement was placed primarily from late July to early September, 2002. The portion of the trail along One Pacific Place was placed later, on December 5, 2002. The earthen shoulders adjacent to the trail were reportedly graded and seeded in the Fall of 2002. From June 6 to 9, 2003, sections of the trail pavement surface were milled by Hawkins Construction to produce the specified smoothness.

Following completion of milling operations in June, 2003, longitudinal cracks were noticed by NRD personnel in the trail pavement. The observed cracks were routed and sealed relatively

soon after they were noted. Localized distressed areas were also removed and replaced around the same time.

Subsequent to repair of approximately 1,300 lineal feet of cracks, an additional 2,000 lineal feet of cracks were noted. The cracks do not extend the full length of the trail but are generally continuous along relatively long stretches. A summary of the crack locations, prepared by Kirkham Michael in late 2003, was provided to Terracon and is referenced later in this report.

FIELD SERVICES

Terracon performed Heavy Weight Deflectometer testing on April 13, 2004. Testing was conducted in a single pass along the centerline of the trail at intervals of 100-feet for a total of 190 test locations. A target load level of 6,000 lbf was used and actual load and deflection measurements were automatically recorded along with distance from the start location. This data was analyzed using techniques published in Appendix L of the AASHTO Guide for Design of Pavement Structures, 1993.

Ground Penetrating Radar measurements were made on April 14, 2004 in an effort to determine Portland Cement Concrete thickness along the entire length of the trail. Measurements were obtained along the centerline of the trail and recorded at one-foot intervals. The GPR data was analyzed using techniques presented in ASTM D-4748 “Standard Test Method for Determining the Thickness of Bound Pavement Layers Using Short-Pulse Radar,” with software incorporating enhanced processing functionality for automatic determination of layer dielectric constant. Horizontal control was maintained using a commercial distance-measuring instrument connected to the transmission of the survey vehicle. All GPR data collected was referenced to existing landmarks (including core locations) and our reference stationing established for this project. (Plan Station minus 370 feet). GPR measurements were cross-referenced to measured core lengths and strengths to verify the types and thicknesses of pavement and subgrade materials and to provide ground truth for calibration of the GPR data.

Sets of three, 3-foot deep borings were performed at each of the following sections:

- Two locations (at sealed and new cracks) in Section No. 1, one location (at new crack) in Section No. 2, one “control” location (no cracking) in Section No. 3, Two locations (at sealed and new cracks) in Section No. 4, and one “control” location (no cracking) in Section No. 5.
- At each referenced location, one boring was performed about 1-foot in from each pavement edge and one boring was performed near the center of the trail.
  - At each boring location, the pavement was cored using a 4-inch I.D. core barrel.
  - At locations of cracks, the center core was centered on the crack.

At each referenced station, transverse elevation profiles were obtained with a FACE Dipstick 2000 across the trail pavement at locations about one-foot north and south of the cores. The elevation profiles are included in the Appendix of this report.

Sampling in the soil borings was performed in accordance with our standard procedures wherein thin-walled samples (ASTM D-1587) are obtained in cohesive soils. In each boring, two samples were obtained in the top 2 ½ feet of soil subgrade. In addition, bulk samples of the auger cuttings were collected.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification Symbols. A brief description of this classification system is attached to this report. All classification was by visual-manual procedures and was performed by experienced personnel

Boring layout was approximate. Distances from available reference features were measured using a calibrated wheel. The locations of the borings should be considered accurate only to the degree implied by these methods. The bore holes were backfilled after completion of sampling and the pavement surface was patched with non-shrink cement grout mix.

Laboratory Evaluations: Unconfined compressive strength or hand penetrometer tests, water content, and density tests were performed on representative portions of thin-walled tube samples. Each of the tube samples obtained in the field was tested and classified. In addition to this standard soil testing, selected samples of the soil subgrade were tested for moisture-density relationship (Standard Proctor) and plasticity index (Atterberg Limits). Shrinkage limits of the soils were estimated based on empirical relationship with the Atterberg Limits. The results of the laboratory soil tests are presented on the Boring Logs and in attachments included in the Appendix of this report.

Four of the concrete cores were selected by Terracon and sent to Mr. Tom Patty of Wiss Janney Elstner Associates, Inc. in Austin, Texas to have petrographic examinations performed. Cores from each of the following conditions were examined petrographically: a sealed crack, an open crack and two “control” cores from non-cracked areas. Core length and density were measured on each of the cores that were not obtained on a crack. One of the uncracked cores obtained from each location was tested for compressive strength and the other uncracked core

was tested for split-tensile strength. Results of the core testing are presented in a summary included in the report appendix.

ENGINEERING ANALYSES

Detailed monthly and daily weather records from Eppley Airfield for July and August, 2002 were obtained from the National Oceanic and Atmospheric Administration (NOAA). This information, as presented in the report appendix, was used to estimate evaporative loss rates for the pour dates from a nomograph in ACI 305 "Guide for Hot Weather Concreting". Monthly summaries of daily high and average temperatures, wind speed, and total precipitation were also compiled and are included in the appendix.

Other interpretive aids that have been produced and are included in the appendix include:

- The Petrographic Analysis Report
- Plots, for each day of concrete placement, of individual and averaged modulus of subgrade reaction values, GPR pavement thickness measurements and variations in pavement condition; annotated with the time and direction of concrete placement, core set locations, core thickness measurements, evaporative loss rate, soil compaction test data, and percent occurrence of different pavement conditions.
- Plots comparing measured strengths, water contents, and densities vs. depth for each set of soil borings.
- Plots of changes in pavement elevation and horizontal movements derived from selected data summaries from surveys performed and provided to Terracon by NRD staff on six occasions between November, 2003 and May, 2004, and
- Plots of pavement elevation profiles taken at each core set location

HWD and GPR Analyses: Determining pavement layer properties from HWD deflection data requires layer thickness. We analyzed the GPR data to determine the thickness of the slab for each data record. From this set of results we selected the thickness value (D) corresponding to each location of an HWD test. The HWD data (load, deflections) for each test were used along with the thickness value to calculate structural properties including elastic modulus of the PCC (E_{PCC}), flexural strength of the PCC (S'_c), and static modulus of subgrade reaction (k).

Table 1 presents the statistics for the results obtained from the analyses. Variability of the results is indicated by the C_V (coefficient of variance; the ratio of standard deviation to the mean). The thickness variation is low indicating fairly consistent construction of the slabs. Subgrade variation is much higher indicating support conditions are much less consistent. The PCC elastic modulus is highly variable reflecting the observed conditions; cracked slabs will have reduced elastic modulus relative to uncracked slabs constructed of the same lot of fresh concrete placed at the same time.

Table 1 - Summary of Analysis Results

Property	Average	Maximum	Minimum	Std. Dev.	C_V
D_{GPR}	6.2	8.6	4.8	0.7	11%
E_{PCC}	3.5×10^6	10.1×10^6	0.147×10^6	1.49×10^6	42%
S'_c	641	929	495	64.8	10%
k	50	92	12	15.7	31%

Note: One outlier removed, statistics are based on remaining189 values

All HWD testing was performed at the slab centerline. The majority of cracking observed was longitudinal cracking also generally located near the centerline. Because the cracks were mostly narrow and did not appear to exhibit signs of movement (they were not "working" cracks) we believe the deflection measurements are reasonable and consistent with the assumptions used in developing the AASHTO relationships cited above. In some cases the cracks may have been more active and the resulting poor results indicative of conditions outside the range assumed for the relationships. Overall, we believe the data and analysis results reflect field conditions despite the presence of cracks at some test locations.

Pavement Load analyses: We understand normal traffic along the trail consists of occasional maintenance truck traffic (2-axle, 6-tire configuration) and occasional traffic due to mowing equipment (John Deere 4020 type tractors). We also understand portions of the trail may have received occasional heavier truck or equipment traffic during construction (milling machine, graders, etc.).

Based on our analysis of the load-deflection and laboratory test data, the subgrade soils exhibit a significantly softer response than is normally associated with similar soil materials. Based on our analysis, an average modulus of subgrade reaction of 30 to 50 pci appears to be representative of the majority of the project. We anticipate that seasonal moisture variation at and under the edges of the trail pavement could also create zones of alternating shrinkage and swelling in the underlying subgrade soils, causing further loss of support during periods of the year.

We analyzed the existing slabs using the data collected from the field and laboratory test programs to evaluate whether load effects combined with seasonal subgrade stiffness variation could result in cracking similar to that observed in the field. The analysis was based on a finite element analysis of the slab-subgrade interaction under various load combinations in addition to Ionnides' modified forms of the original Westergard formulations for maximum stresses due to edge loading. Based on these analyses, the load due to a tractor tire, if applied near the edge of the slab, could result in bending stresses in the slab on the order of 75 to 95 percent of the concrete modulus of rupture. The load due to a loaded concrete transit truck applied near the edge of the slab could also result in bending stresses in the slab on the order of 80 to 100 percent of the concrete modulus of rupture. The load due to a heavily loaded, single axle

maintenance truck (at 16,000 to 24,000 GVW) could cause bending stresses in the slab on the order of 60 to 75 percent of the concrete modulus of rupture. These values are for a uniform 50 pci subgrade with no loss or concentration of support at the edges. The presence of non-uniform edge support and softer subgrade below the center would increase the risk of structural failure.

Based on these analyses, it appears the occasional heavier loads that the trail has experienced may have a significant role in the later longitudinal cracking that has been observed. At stress levels greater than about 85 percent of the concrete rupture strength, it would only require a few passes to initiate cracking in the slab. These load conditions combined with the other seasonally related subgrade support issues and the potential for some built in tensile stresses due to plastic and drying shrinkage could easily result in the observed cracking.

CONCLUSIONS

The first observed cracking in the trail, most of that which was routed and sealed, typically appears to have a different general pattern than most of the cracking that has occurred since. The early cracks generally do not as often run continuous through the transverse sawed joints, and are more prone to deviate from the center line of the trail and to sometimes curve towards the pavement edge near the transverse joints. A dual crack occasionally splits off the original crack at these locations in the early cracking areas. The later cracking is more often continuous through the transverse joints and tends to more commonly follow the pavement centerline.

The petrographic analyses indicates that the crack from the routed and sealed location did not appear to go through as much aggregate as the core with the later open crack. This suggests earlier crack development, or initiation, before the concrete had gained full strength in the routed and sealed location. Although the petrographic examination did not detect signs of severe water deprivation, such as excessive amounts of unhydrated cement, there was likely some water loss and internal tension stresses developed.

Both the more random cracking patterns and the petrographic findings indicate that the initial cracks were more likely affected by internal tension stresses generated by concrete shrinkage, while the later cracks appear to generally be more characteristic of a typical traffic load-induced failures. The concrete shrinkage affecting the early cracks was probably a result of not only the high evaporative loss rate during hot, dry and windy afternoons, but also by absorption of water from the fluid concrete by relatively dry subgrade soils. Due to the design slope of the subgrade, water contents were probably higher on the low side if rainwater ponded in areas exposed to rain events. This could have caused variable non-uniformity in the subgrade absorption and support conditions

In areas of relatively dry subgrade, wetting of the edge soils due to rains subsequent to pavement placement could also have caused local subgrade heave along the pavement edges due to swelling of the underlying clays. This non-uniform support condition, combined with internal shrinkage stress, could have significantly reduced the traffic load required to initiate cracking in the bottom of the pavement section. These cracks may not have become apparent until hot and dry weather and vegetative water withdrawal caused the edge soils to dry and shrink again, allowing the crack to propagate to the surface.

The characteristics observed to be most commonly associated with the areas of later crack development are comparatively low subgrade modulus, soil strength and density. The drying of the edge soils due to hot, dry weather and vegetative demand also likely caused shrinkage of the soils to some distance under the pavement edges. The volumetric shrinkage of the soil mass along the pavement edges could have also resulted in development of some outward tensile stress due to subgrade adhesion on the bottom of the pavement. These effects could have reduced the effective edge support of the pavement and significantly reduced the traffic loads required to cause cracking. It is our opinion that the majority of the later cracking was caused by traffic loading combined with relatively poor subgrade support capacity. This appears to typically have been primarily caused by inadequate subgrade strength, but may have been exacerbated by internal shrinkage stresses due to the effect of the flyash on the concrete mix.

The subgrade compaction tests that were performed indicated that the subgrade compaction met project specifications, except for the tests performed at STA 117. However, the number, frequency and/or locations of the compaction tests do not appear to have been adequate to be sufficiently representative of the actual subgrade conditions, based on the borings and deflectometer tests. The reports indicated that after three failing tests at STA 117, the engineer's on-site representative stated the subgrade was deemed adequate, regardless of the test results. This is one of the most marked areas of low subgrade strength and later crack development.

In general, the concrete characteristics (strengths, air content, density, and thickness) appear not to have typically been a major contributor to the cracking problems. However, the flyash utilized in the concrete mix reduces the bleed rate and increases the likelihood for evaporation rates to exceed the bleed rate, increasing the risk of plastic shrinkage problems. Plastic shrinkage generally appeared to play a more significant role in the early cracking. But it is difficult to quantify whether internal tension stresses due to plastic shrinkage could have persisted long enough in the pavement section to play a significant role in the later cracking.

There has also been mention by a Lyman Richey representative that the combined effects of the flyash and water reducer may have caused an adverse effect on the normal hydration regulation action of the sulfates (gypsum) provided in the Portland cement. Little information appears available about the specifics of this problem termed "sulfate deprivation", but there is

anecdotal evidence that it may increase the risk of shrinkage cracking. A new procedure for calorimetric testing of the PCC mixes to help evaluate the effect on hydration characteristics of flyash and admixture combinations appears to warrant consideration to help better evaluate the potential for future problems in this regard. Persistent internal tension stress due to this type of shrinkage could have exacerbated the later cracking problems the trail has exhibited.

ENGINEERING RECOMMENDATIONS

The existing cracked pavements will necessitate increased maintenance, on a regular basis, to rout and keep the cracks effectively sealed. This will be required to control against progressive deterioration due to water infiltration and local spalling of the crack edges. Although some additional cracking would be expected, the amount of new cracking would generally be expected to be progressively less over time. Protecting the trail from exposure to heavy equipment loads will also be important in reducing additional cracking. Establishing vegetation selected for low water demand and limited root system depth along the edges of the trail would also help reduce the potential magnitude of subgrade shrinkage along the pavement edges. With these factors adequately addressed, the trail in affected areas would be expected to remain relatively intact and serviceable for its intended use for support of light traffic loads.

From the perspective of reducing the risks of similar cracking problems on future projects, improvement of the strength and uniformity of the subgrade is considered the most important factor. Increasing the number, frequency and reliance on compaction and moisture testing is considered central to this issue. Visual observations can be particularly misleading when the subgrade surface appears relatively dry.

It would also be prudent to increase the level of subgrade improvement by specifying deeper compaction or chemical stabilization with flyash or cement. Alternatively, design of the pavement section on a more pronounced embankment to increase drainage, or use of impermeable shoulders could be considered to reduce shrink/swell of the subgrade soils along the pavement edges. High water demand vegetation should be avoided in close proximity to the pavements.

Not using flyash in the PCC mix, or possibly performing testing to help avoid adverse admixture interactions, may reduce the potential for shrinkage crack development during hot, dry and windy placement conditions. Alternatively, placing the concrete during the early morning or late afternoon, or other times of low evaporation rate, may help in this regard. If the flyash is causing long-term shrinkage, its elimination may also reduce the pavement's sensitivity to cracking in soft subgrade areas.

We appreciate the opportunity to be of service to you on this project. Please contact Joe Waxse at (402) 330-2202 if you have any questions regarding this report or if we can be of further service to you.

Sincerely,
TERRACON

Scott G. Miller, E.I.
Construction Services Manager

Joseph A. Waxse, P.E.
Principal Engineer

PROFESSIONAL CIVIL ENGINEER
JOSEPH A. WAXSE
E-6070
STATE OF NEBRASKA

SGM/JAW:sgm/leb/yms

Attachment – Appendix A

Copies to: Addressee (3)

TABLE 1
CONCRETE CORE TEST SUMMARY

Core No.	1A	1B	1C	2A	2B	2C	3A
Station No.	3+12 Lt	3+12 Cen	3+12 Rt	13+09 Lt	13+09 Cen	13+09 Rt	47+06 Lt
length	6.5	6.1	6.15	5.85	6	6.1	5.4
density	141.5		140.2	140.7		139.6	140.6
Condition	no	r&s	no	no	open	no	no
Split Tensile Strength, psi			385			450	
Compressive strength, psi	5380			6170			5670

Core No.	3B	3C	4A	4B	4C	5A	5B
Station No.	47+06 Cen	47+06 Rt	94+20 Lt	94+20 Cen	94+20 Rt	111+19 L	111+19 C
length	5.7	5.95	5.95	6.45	7.3	5.95	5.3
density		140.2	139.4	140	139	140.5	
Condition	open	no	no	no	no	no	open
Split Tensile Strength, psi		500			445		
Compressive strength, psi			5650			5680	

Core No.	5C	6A	6B	6C	7A	7B	7C
Station No.	111+19 R	129+10 L	129+10 C	129+10 R	155+06 L	155+06 C	155+06 R
length	6	5.6	5.5	6	8.3	5.65	5.95
density	142.1			141.3	140.8	142.7	141
Condition	no	r&s	r&s	no	no	no	no
Split Tensile Strength, psi	450			480			555
Compressive strength, psi		(cracked)			6610		

NOTES:
no= no Crack
R&S = routed and sealed
open = open crack

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS	:	Split Spoon - 1⅜" I.D., 2" O.D., unless otherwise noted	PS	:	Piston Sample
ST	:	Thin-Walled Tube - 3" O.D., Unless otherwise noted	WS	:	Wash Sample
PA	:	Power Auger	FT	:	Fish Tail Bit
HA	:	Hand Auger	RB	:	Rock Bit
DB	:	Diamond Bit - 4", N, B	BS	:	Bulk Sample
AS	:	Auger Sample	PM	:	Pressuremeter
HS	:	Hollow Stem Auger	DC	:	Dutch Cone
			WB	:	Wash Bore

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL	:	Water Level	WS	:	While Sampling
WCI	:	Wet Cave In	WD	:	While Drilling
DCI	:	Dry Cave In	BCR	:	Before Casing Removal
AB	:	After Boring	ACR	:	After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION:

Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

Unconfined Compressive Strength, Qu, psf	Consistency
< 500	Very Soft
500 - 1,000	Soft
1,001 - 2,000	Medium
2,001 - 4,000	Stiff
4,001 - 8,000	Very Stiff
8,001 -16,000	Hard
> -16,000	Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS:

N-Blows/ft.	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense
80+	Extremely Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component Of Sample	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

Terracon

LOG OF BORING NO. 1A

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 312

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	
	6" PCC at surface	0.5			PA						
	(FILL) LEAN CLAY, trace sand Dark brown			1	ST	11		26	95	9000*	
		1.5						28	90	5500*	
	LEAN CLAY, trace sand Dark brown Stiff Trace roots at 2' to 2.5'		CL	2	ST	12		27	91	990	5000*
		3						27	87	2160	6000*
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 1B

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 312

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Brown to dark brown			1	ST	12		25	95	2500*
								28	89	3000*
		2		2	ST	13		26	90	7000*
	LEAN CLAY, trace sand Dark brown, stiff		CL					26	87	8000*
		3								
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 1C

CLIENT
Papio-Missouri River NRD

ARCHITECT/ENGINEER

SITE **Big Papio Creek from Center St. to Blondo St.**
Omaha, Nebraska

PROJECT
Big Papio Trail Pavement Distress

Boring Location: STA 312

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Dark brown Trace gravel			1	ST	12		24	94	3500*
								25	93	7000*
				2	ST	5		20	91	9000+*
								19	104	9000+*
		3								
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 2A

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 309

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Dark brown			1	ST	10		28	90	2000*
		1.5						26	95	3000*
	LEAN CLAY, trace sand Dark brown Medium		CL	2	ST	9		31	87	1500*
		3						31	85	3000*
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 2B

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 309

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	
	6" PCC at surface	0.5			PA						
	(FILL) LEAN CLAY, trace sand Dark brown	1.5		1	ST	14		28	87	420	500*
								31	87	440	1500*
	LEAN CLAY, trace sand Very dark brown Soft Trace root holes at 1' to 2'	3	CL	2	ST	12		34	76	500*	
								34	76	500*	
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 2C

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 309

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Dark brown			1	ST	10		27	84	2000*
								25	95	6500*
		2	CL	2	ST	6		25	88	7500*
	LEAN CLAY, trace sand (Possible natural) Very dark brown							26	90	6500*
		3								
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: In-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 3A

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 4706

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	LEAN CLAY, trace sand Brown		CL	1	ST	12		27	93	2000*
								28	92	2000*
			CL	2	ST	NR				
		3								
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 3B

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 4706

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Brown	1	CL	1	ST	15		26	94	2500*
	LEAN CLAY, trace sand Brown							29	89	1500*
			CL	2	ST	12		29	88	1000*
		3						28	88	3000*
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 3C

CLIENT
Papio-Missouri River NRD

ARCHITECT/ENGINEER

SITE **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT
Big Papio Trail Pavement Distress

Boring Location: STA 4706

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	
	6" PCC at surface	0.5			PA						
		1.5		1	ST	NR					
	LEAN CLAY, trace sand Brown Medium	3	CL	2	ST	17		25	93	1680	2000*
								29	90	1510	1500*
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 4A

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 9420

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN TO FAT CLAY, trace sand Brown to dark brownish gray	1		1	ST	12		24	93	4500*
	(FILL) LEAN CLAY, trace sand Brown	1.5						23	96	7500*
	(FILL) LEAN CLAY, trace sand Brown to light brown	2		2	ST	17		17	91	9000+*
	LEAN CLAY, trace sand Light brown, stiff Trace root holes and root channels	3	CL					15	86	9000*
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 4B

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 9420

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Brown With sand seams and pockets			1	ST	9		25	87	3000*
								24	94	2500*
		2		2	ST	11		23	87	2500*
	LEAN CLAY, trace sand Brown With silty fine sand pockets		CL					17	96	6000*
		3								
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Callbrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 4C

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 9420

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	LEAN CLAY, trace sand (Possible fill) Dark brown		CL	1	ST	10		30	78	2000*
								27	87	3500*
		2	CL	2	ST	15		24	85	7000*
	LEAN CLAY, trace sand Brown							22	82	
		3								
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/29/04

LOG OF BORING NO. 5A

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 1119

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface				PA					
	0.5									
	(FILL) LEAN CLAY, trace sand Brown to dark brown			1	ST	10		22	88	2000
								21	101	8500*
	2			2	ST	11		15	97	
	LEAN CLAY, trace sand Dark brown		CL					24	88	7500*
	3									
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 5B

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 1119

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	
	6" PCC at surface	0.5			PA						
	LEAN CLAY, trace sand Brown	1	CL	1	ST	12		28	89	590	2500*
	LEAN CLAY, trace sand Very dark brown Stiff							34	87	1500*	
			CL	2	ST	16		36	72	2500*	
		3						32	81		
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: In-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 5C

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 1119

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Brown	1		1	ST	12		31	80	1000*
	LEAN CLAY, trace sand Very dark brown		CL					32	78	3500*
			CL	2	ST	10		33	88	1500*
		3						34	85	2500*
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 6A

CLIENT
Papio-Missouri River NRD

ARCHITECT/ENGINEER

SITE **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT
Big Papio Trail Pavement Distress

Boring Location: STA 12910

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Dark brown	1.5		1	ST	12		26	91	1500*
								21	103	4000*
	LEAN CLAY, trace sand Dark brown	3	CL	2	ST	10		28	87	2000*
								28		3000*
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/29/04

LOG OF BORING NO. 6B

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 12910

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Dark brown	1.5		1	ST	15		23	96	2000*
								20	102	
	LEAN CLAY, trace sand Dark brown	3	CL	2	ST	8		28	83	3500*
								30	88	4500*
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 6C

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 12910

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Dark brown			1	ST	10		21	99	6500*
								17	108	8500*
		1.5								
	LEAN CLAY, trace sand Dark brown		CL	2	ST	12		26	89	4000*
								27	65	2500*
		3								
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 7A

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 15506

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Dark brown			1	ST	6		20	104	8500*
								19	109	7500*
				2	ST	7		21	103	6000*
								19	102	6500*
		3								
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 7B

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 15506

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface				PA					
	0.5									
	(FILL) LEAN CLAY, trace sand Dark brown to light brown			1	ST	10		23	99	2500*
								21	106	8000*
				2	ST	4		21	101	8000*
								21	105	5500*
	3									
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

LOG OF BORING NO. 7C

CLIENT: **Papio-Missouri River NRD**

ARCHITECT/ENGINEER:

SITE: **Big Papio Creek from Center St. to Blondo St. Omaha, Nebraska**

PROJECT: **Big Papio Trail Pavement Distress**

Boring Location: STA 15506

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
	6" PCC at surface	0.5			PA					
	(FILL) LEAN CLAY, trace sand Dark brown to light brown			1	ST	9		24	99	5500*
								20	107	8500*
				2	ST	11		21	104	6500*
		3						20	105	9000+*
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft		
WL	▽	▼
WL	▽	▼
WL		

Terracon

BORING STARTED	5-27-04		
BORING COMPLETED	5-27-04		
RIG	SIMCO	DRILLER	DM
APPROVED	JAW	JOB #	05035181

BOREHOLE 05035181 LOGS.GPJ TERRACON.GDT 6/28/04

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel[F, G, H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[E]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G, H, I]
			Fines classify as CL or CH	SC	Clayey sand[G, H, I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K, L, M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K, L, M]
		organic	Liquid limit — oven dried / Liquid limit — not dried < 0.75	OL	Organic clay[K, L, M, N] / Organic silt[K, L, M, O]
	Silts and Clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay[K, L, M]
			PI plots below "A" line	MH	Elastic silt[K, L, M]
		organic	Liquid limit — oven dried / Liquid limit — not dried < 0.75	OH	Organic clay[K, L, M, P] / Organic silt[K, L, M, Q]
Highly organic soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.

[L] If soil contains ≥ 30% plus. No. 200 predominantly sand, add "sandy" to group name.

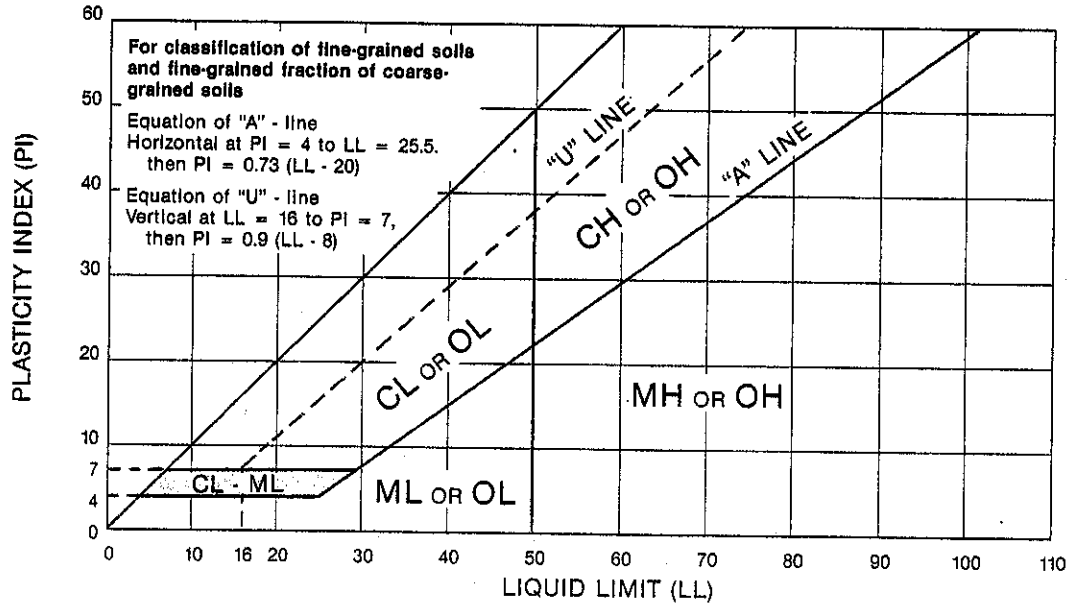
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Terracon

Form 111—6-85

Laboratory Compaction Characteristics of Soil

Terracon
2211 South 156th Circle
Omaha, Nebraska 68130
(402) 330-2202

Client Name:
Project Name: Papio Trail
Location: Omaha, NE.

Source Material: Borings 1A-3C, 5A-6C
Sample Description:

Material Designation: Sample date:
Test Method: Method A
Test Procedure: ASTM D698
Sample Preparation:
Rammer: X Mechanical ___ Manual

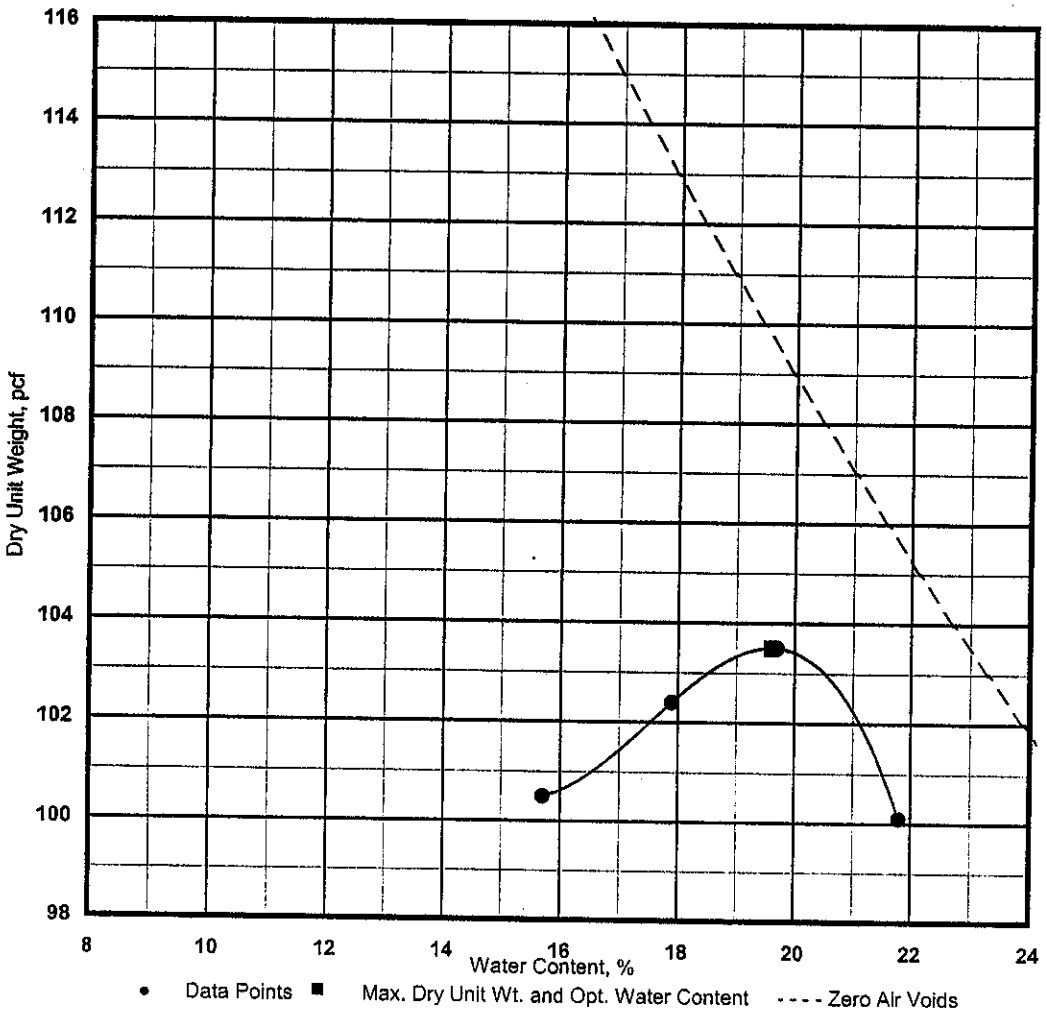
Project No.: 05035181 Date: 6/22/2004

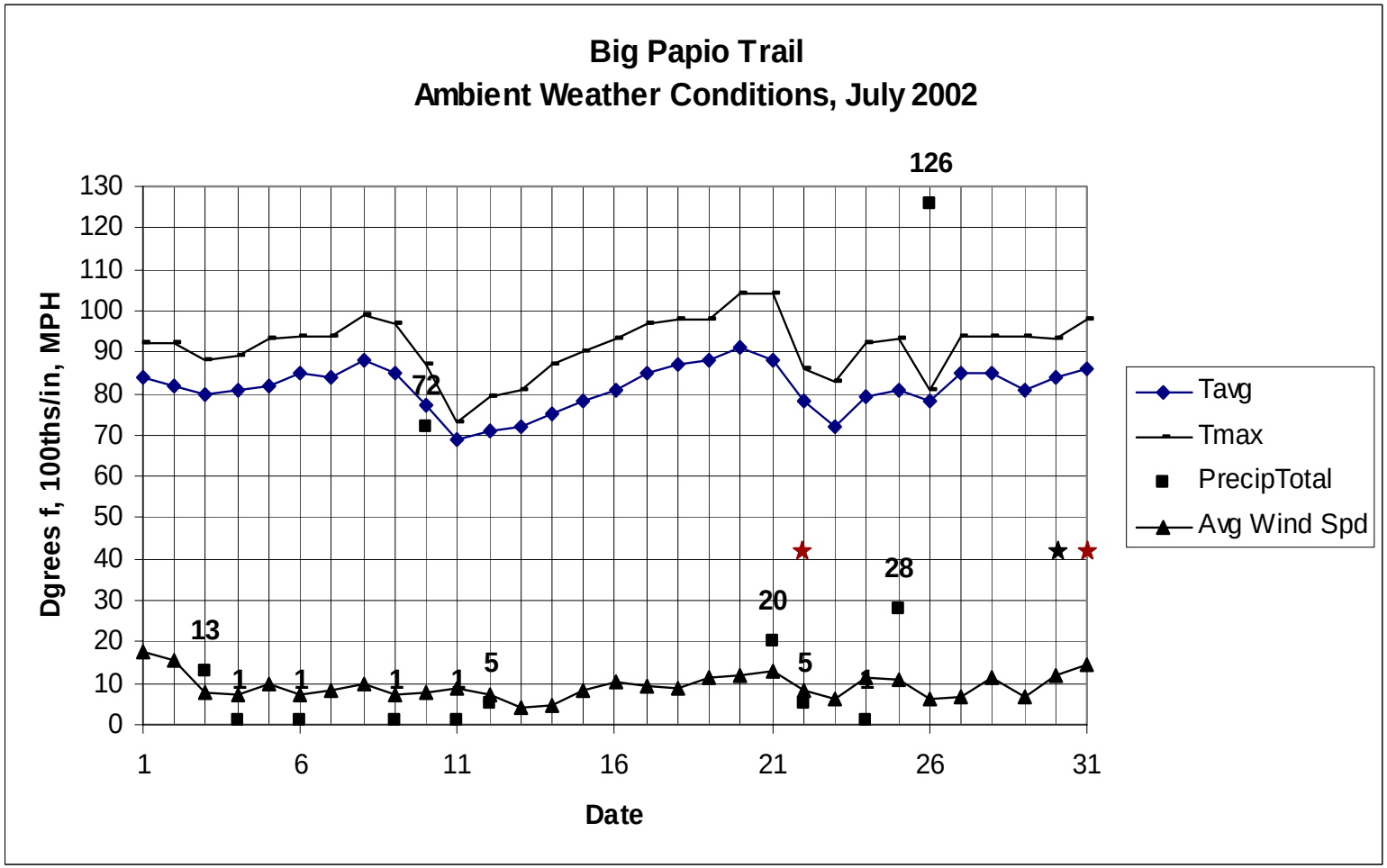
TEST RESULTS
Maximum Dry Unit Wt.: 103.5 pcf
Optimum Water Content: 19.6 %

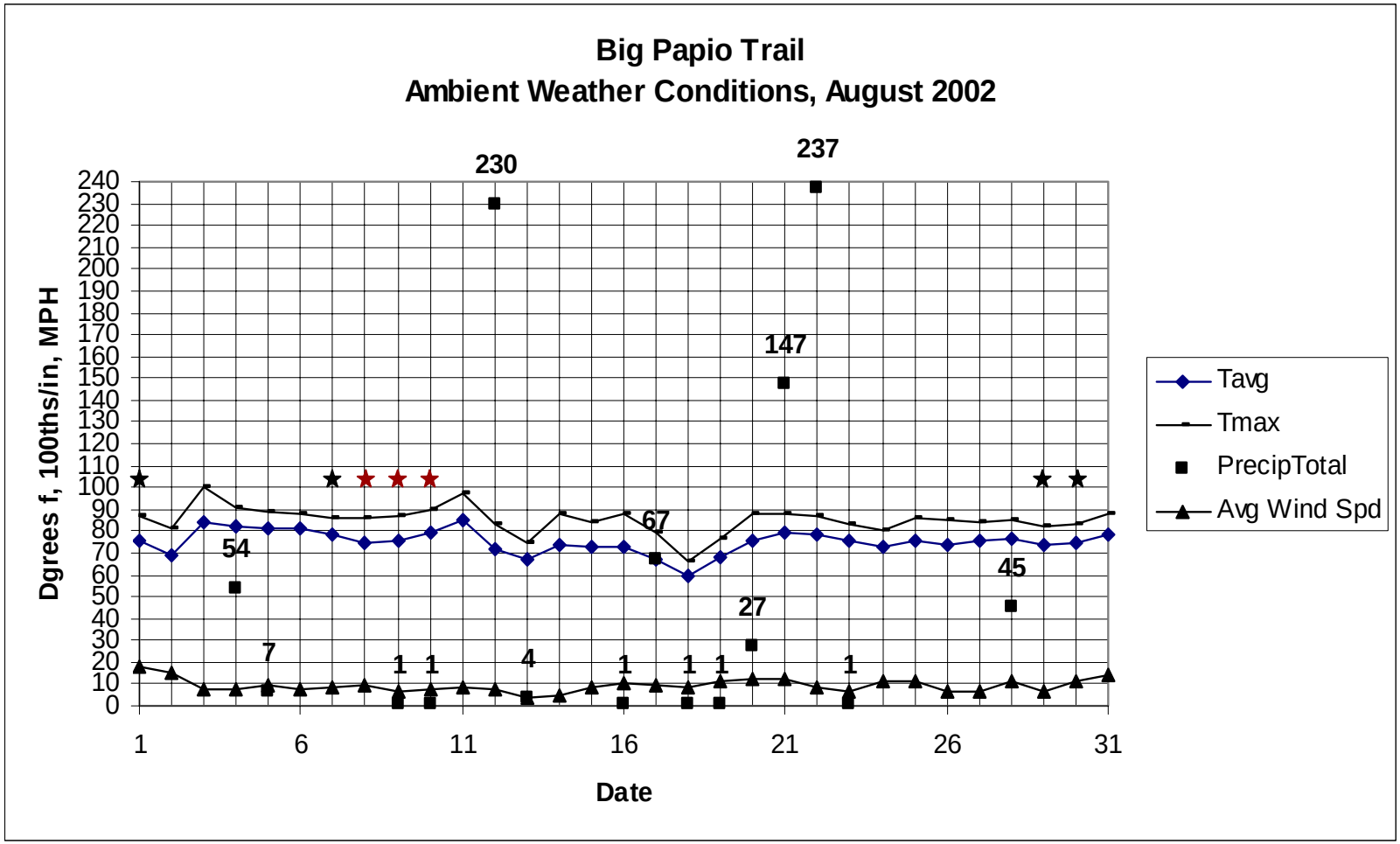
Liquid Limit: ___ Plastic Limit: ___
Plasticity Index: ___
% passing # 200 sieve: ___

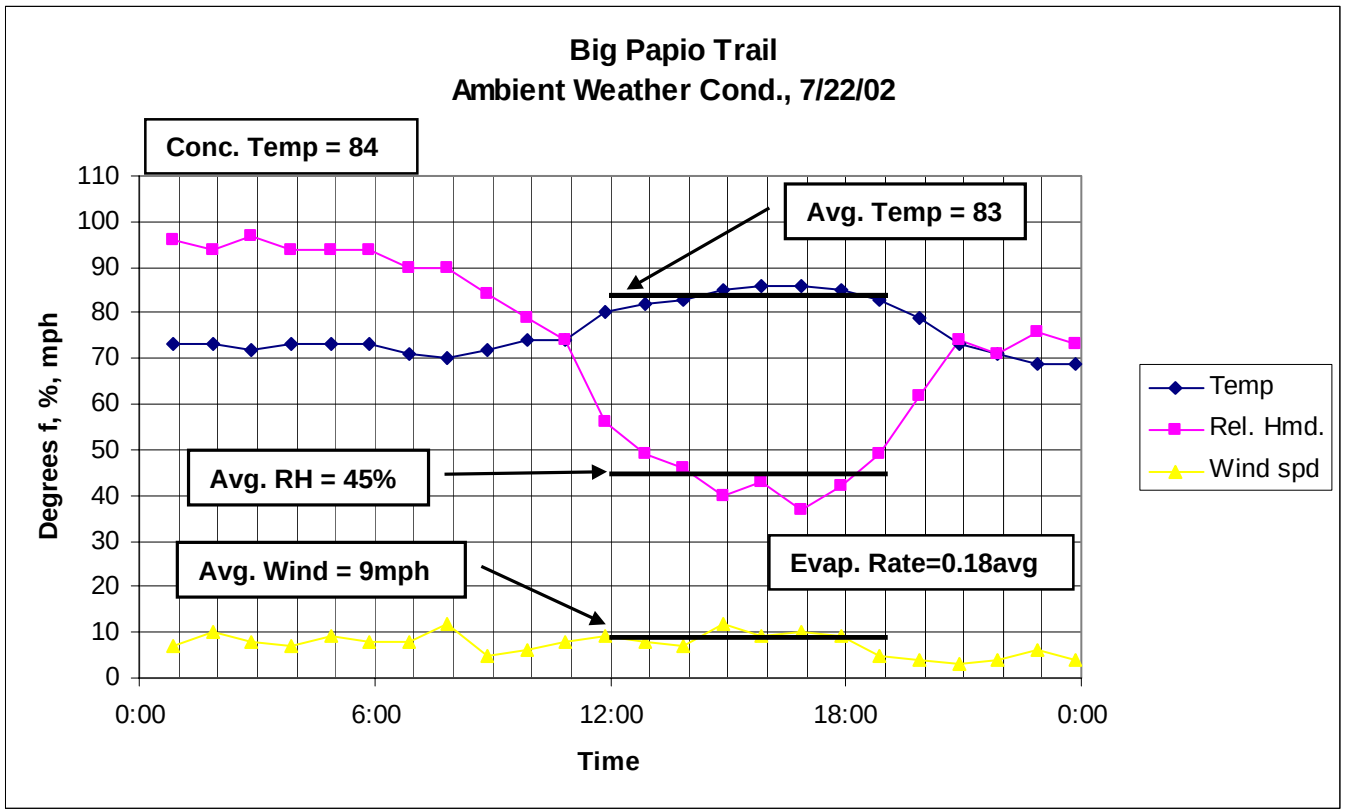
Reviewed by:

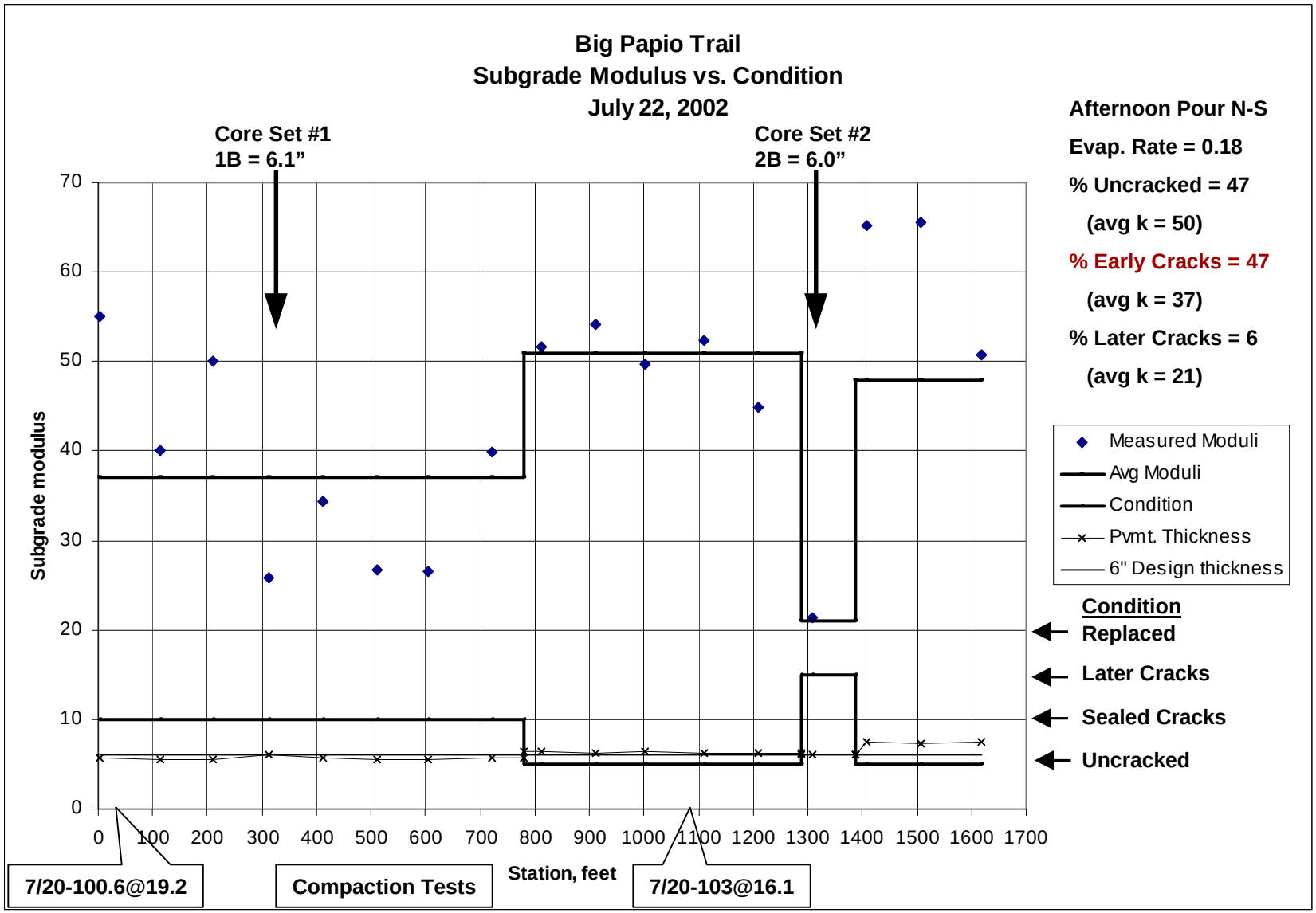
Zero air voids for specific gravity of 2.68

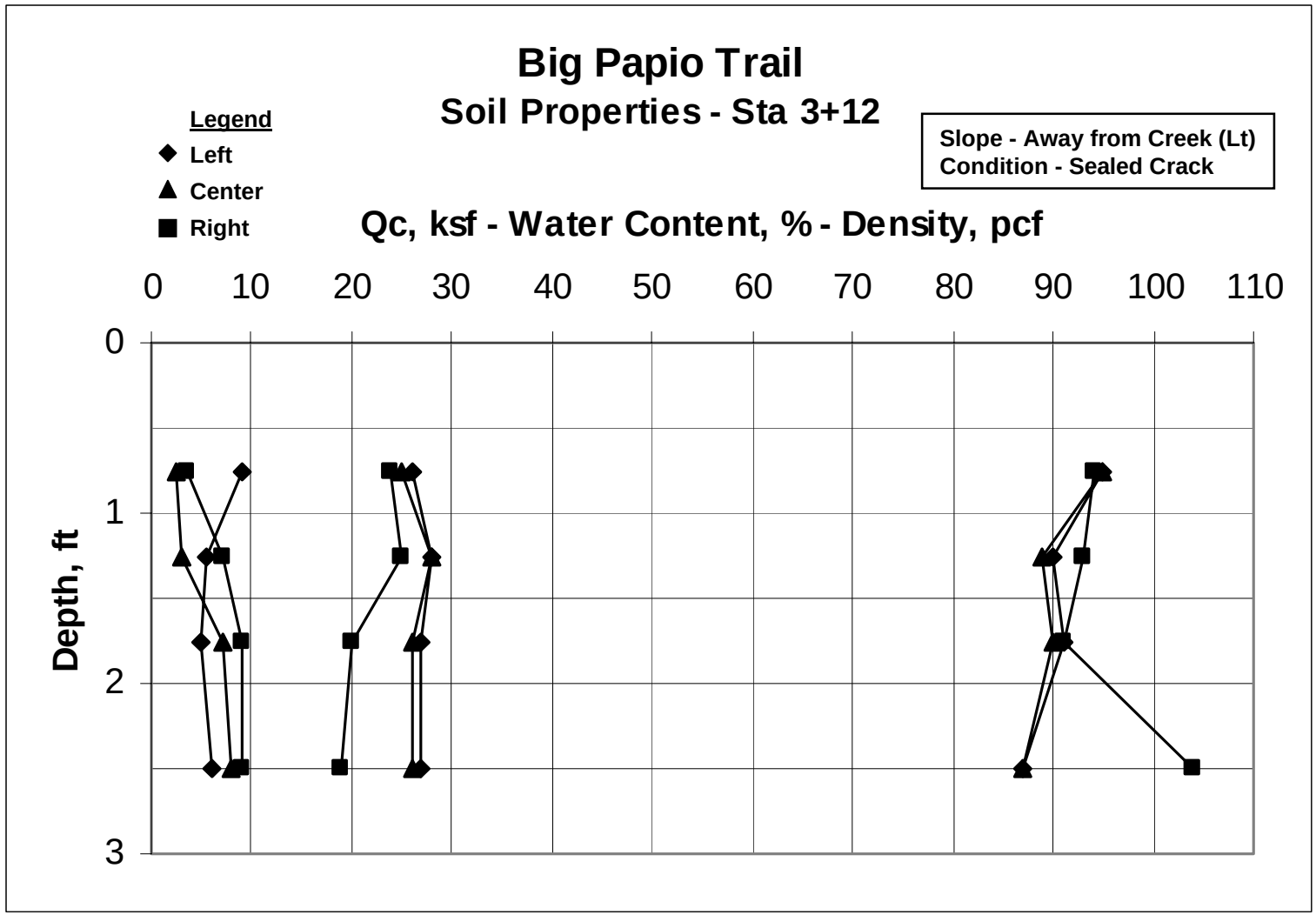


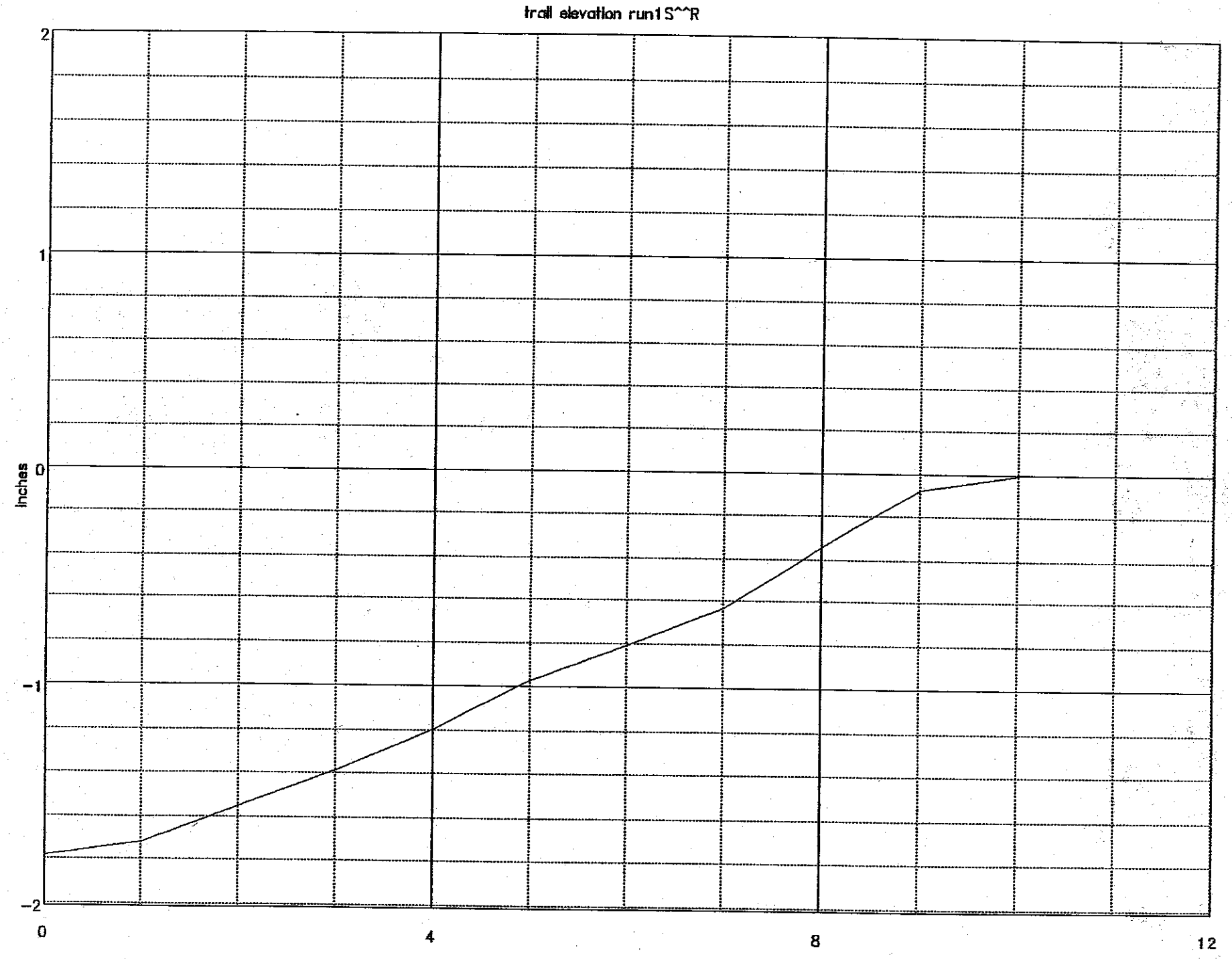

Big Papio Trail
Ambient Weather Conditions, July 2002
Dgrees f, 100ths/in, MPH
Date
Tavg
Tmax
PrecipTotal
Avg Wind Spd
126
72
13
1
1
1
1
5
20
5
28
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1
6
11
16
21
26
31

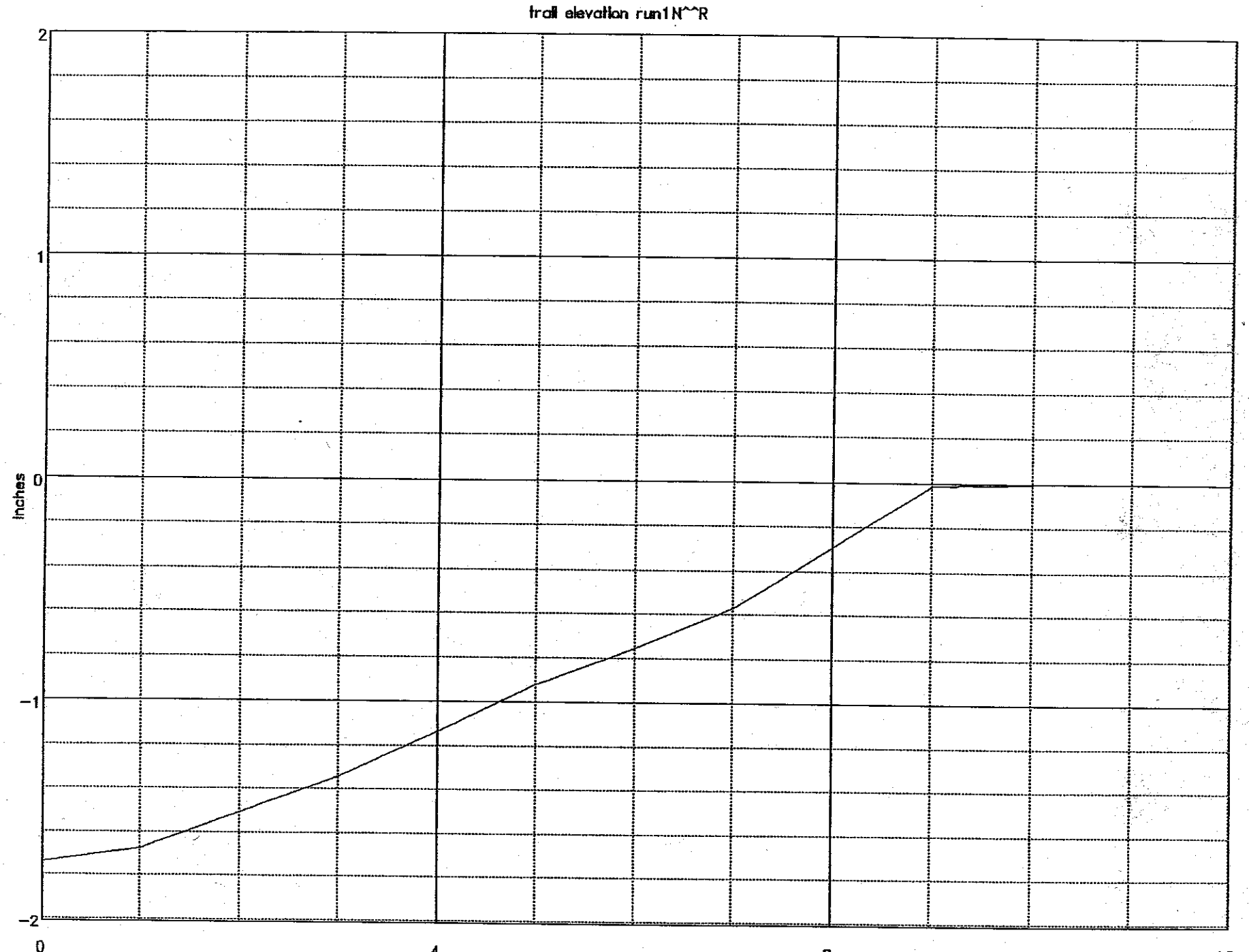

Big Papio Trail
Ambient Weather Conditions, August 2002
Dgrees f, 100ths/in, MPH
Date
Tavg
Tmax
PrecipTotal
Avg Wind Spd
230
237
147
67
54
45
27
7
1
1
4
1
1
1
1
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1
6
11
16
21
26
31

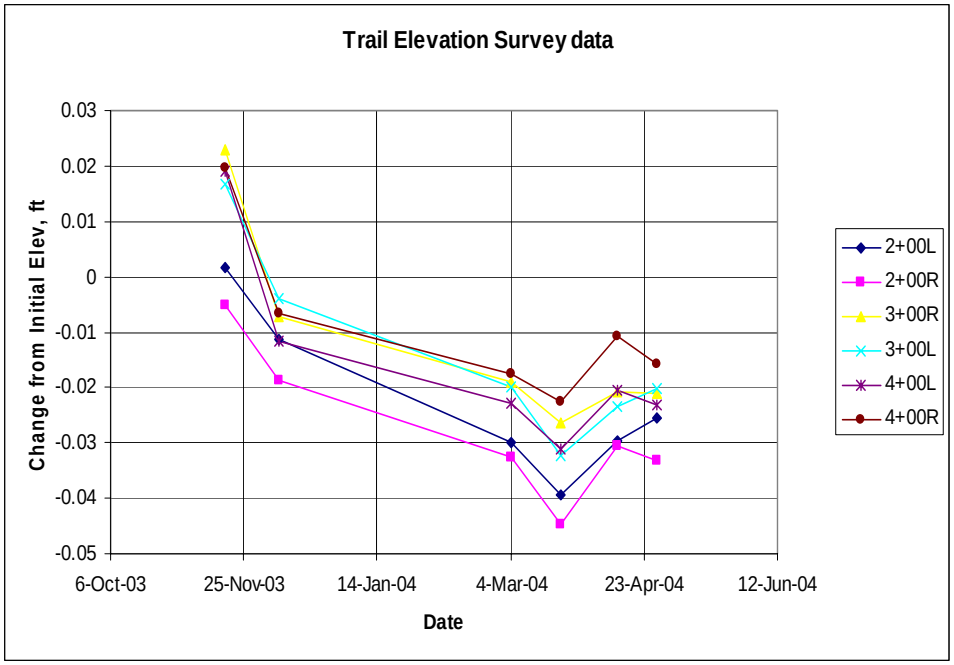

Big Papio Trail
Ambient Weather Cond., 7/22/02
Conc. Temp = 84
Avg. Temp = 83
Avg. RH = 45%
Avg. Wind = 9mph
Evap. Rate=0.18avg
Degrees f, %, mph
110
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
0:00
Time
Temp
Rel. Hmd.
Wind spd

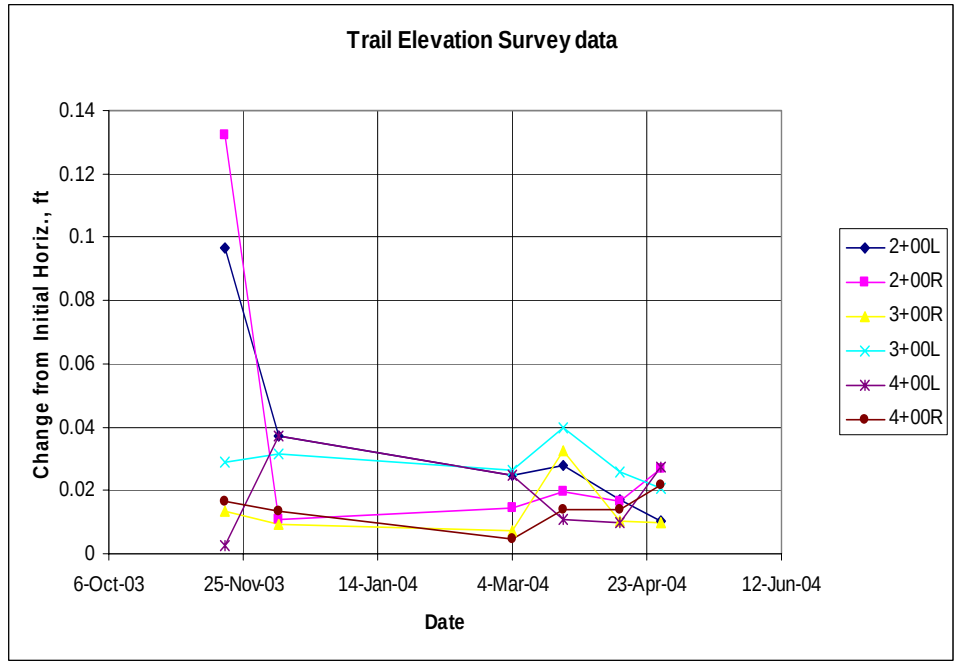

Big Papio Trail
Subgrade Modulus vs. Condition
July 22, 2002
Core Set #1
1B = 6.1”
Core Set #2
2B = 6.0”
Afternoon Pour N-S
Evap. Rate = 0.18
% Uncracked = 47
(avg k = 50)
% Early Cracks = 47
(avg k = 37)
% Later Cracks = 6
(avg k = 21)
Subgrade modulus
Station, feet
Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" Design thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked
7/20-100.6@19.2
Compaction Tests
7/20-103@16.1

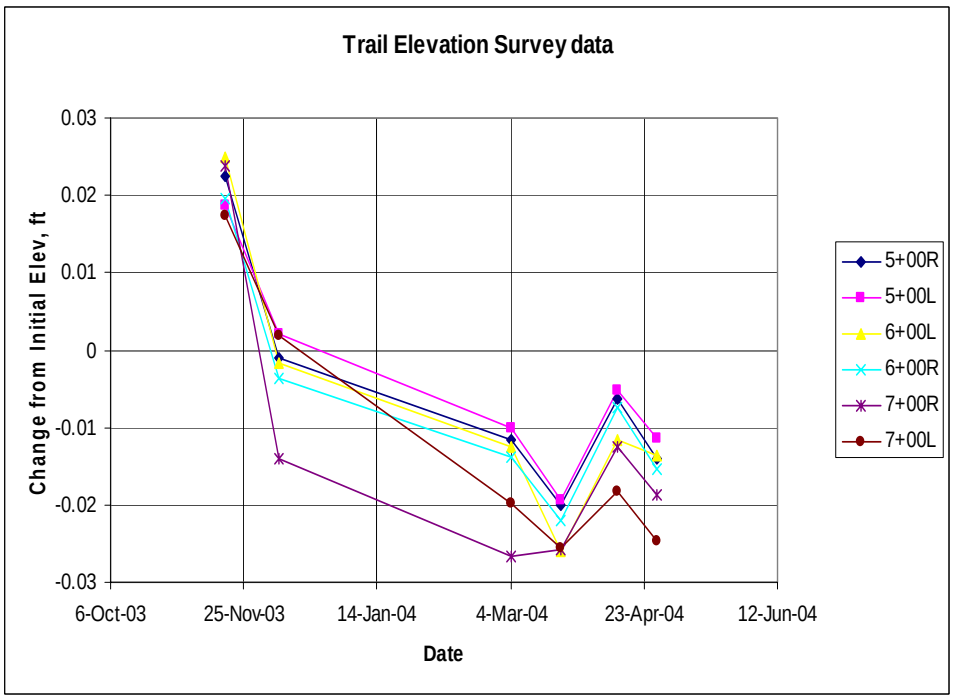

Big Papio Trail
Soil Properties - Sta 3+12
Legend
Left
Center
Right
Slope - Away from Creek (Lt)
Condition - Sealed Crack
Qc, ksf - Water Content, % - Density, pcf
0
10
20
30
40
50
60
70
80
90
100
110
Depth, ft
0
1
2
3

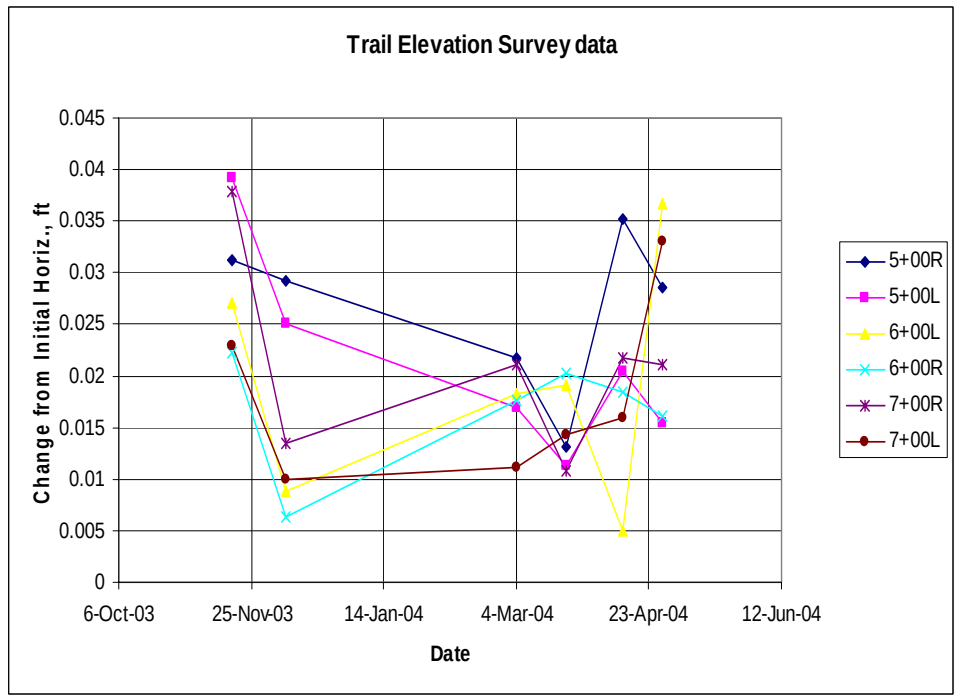

trail elevation run1 S^^R
2
1
0
−1
−2
Inches
0
4
8
12

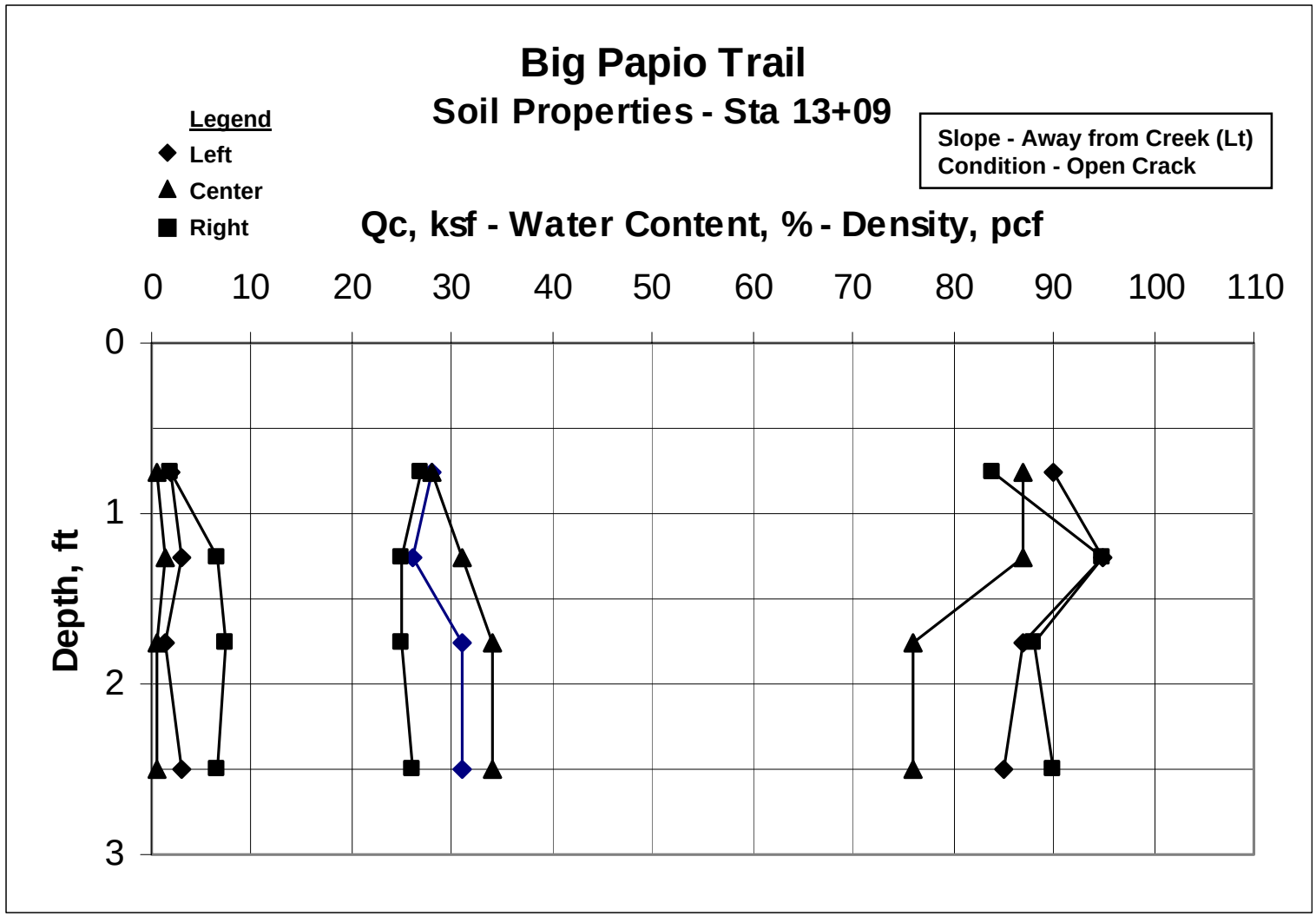

trail elevation run1N^^R
2
1
0
−1
−2
Inches
0
4
8
12

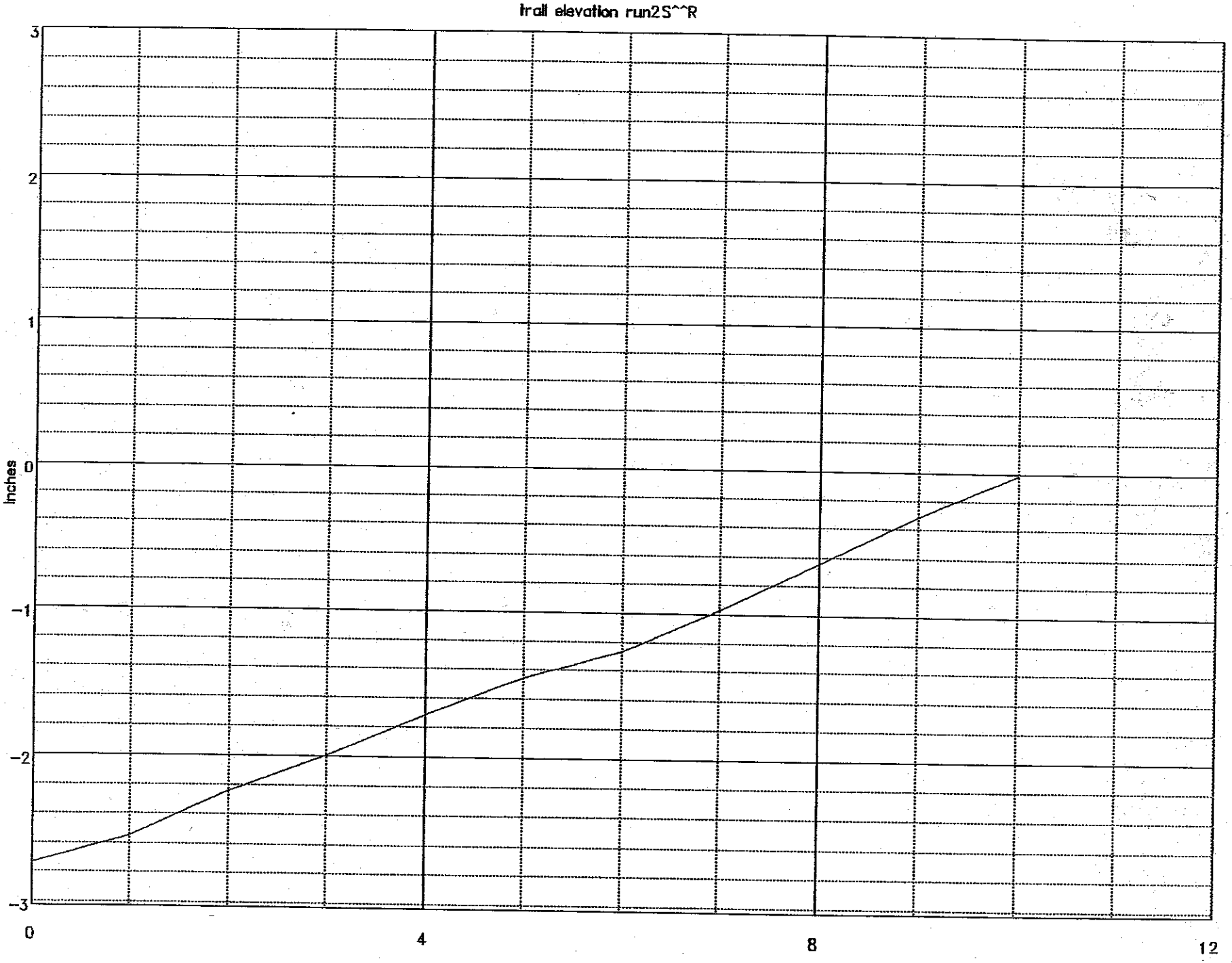

Trail Elevation Survey data
Change from Initial Elev, ft
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
2+00L
2+00R
3+00R
3+00L
4+00L
4+00R

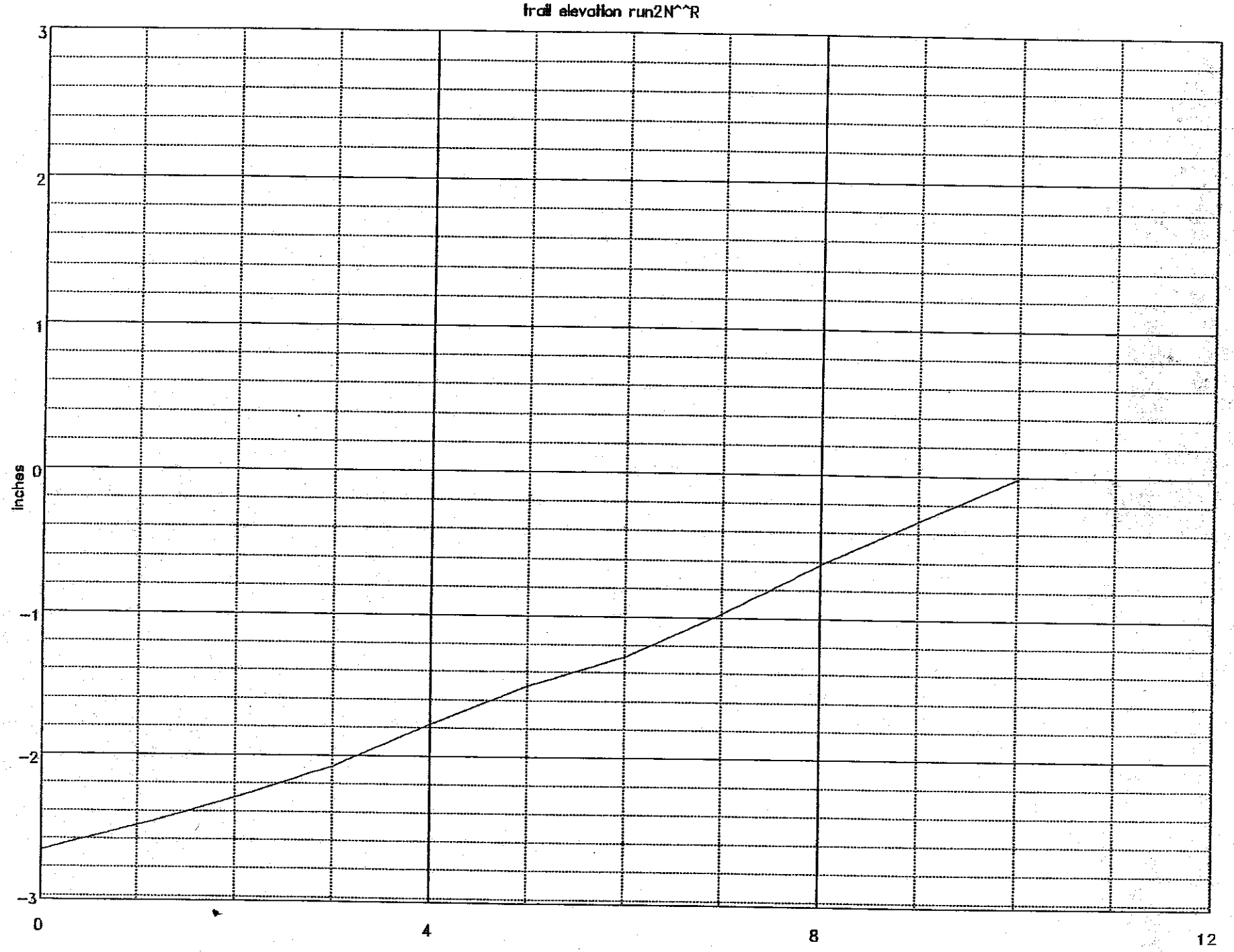

Trail Elevation Survey data
Change from Initial Horiz., ft
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
2+00L
2+00R
3+00R
3+00L
4+00L
4+00R

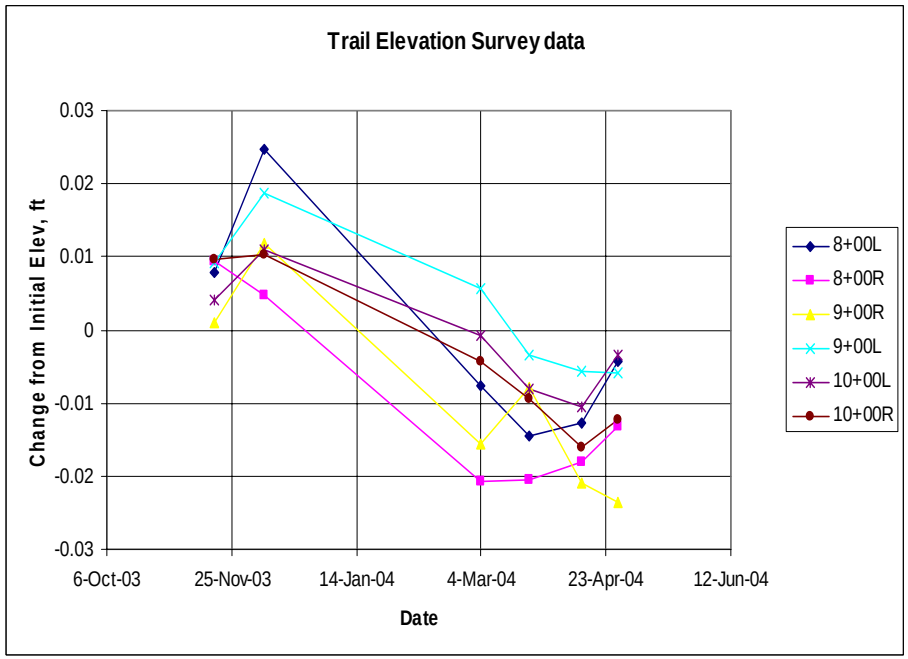

Trail Elevation Survey data
Change from Initial Elev, ft
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
5+00R
5+00L
6+00L
6+00R
7+00R
7+00L

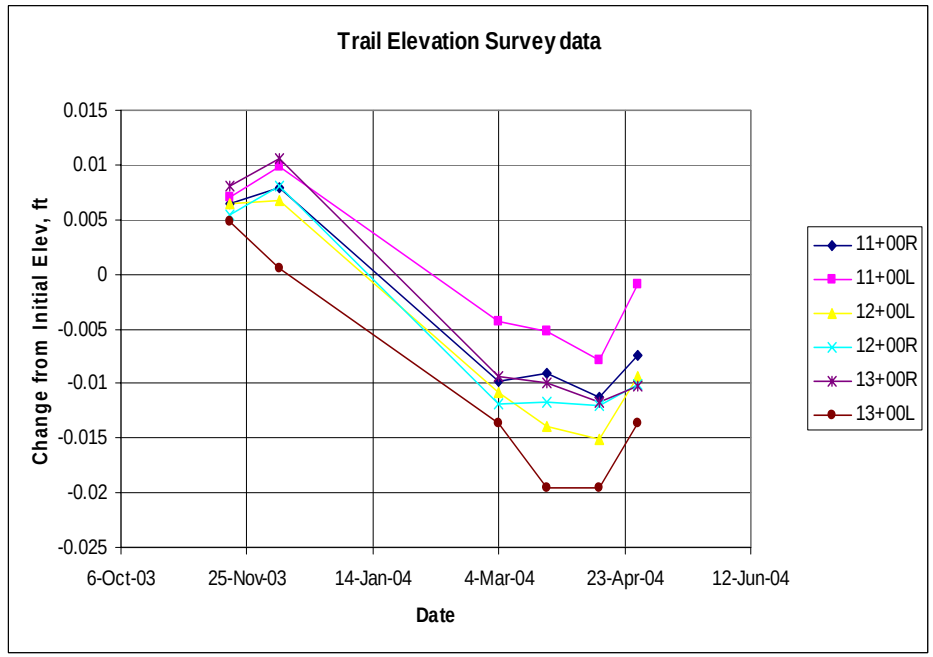

Trail Elevation Survey data
Change from Initial Horiz., ft
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
5+00R
5+00L
6+00L
6+00R
7+00R
7+00L

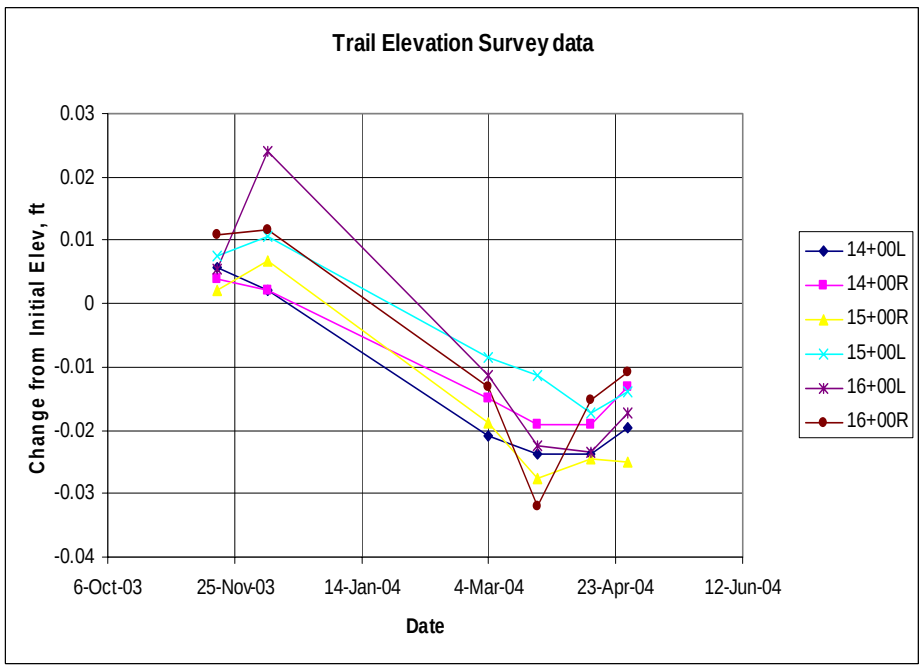

Big Papio Trail
Soil Properties - Sta 13+09
Legend
Left
Center
Right
Slope - Away from Creek (Lt)
Condition - Open Crack
Qc, ksf - Water Content, % - Density, pcf
0
10
20
30
40
50
60
70
80
90
100
110
Depth, ft
0
1
2
3

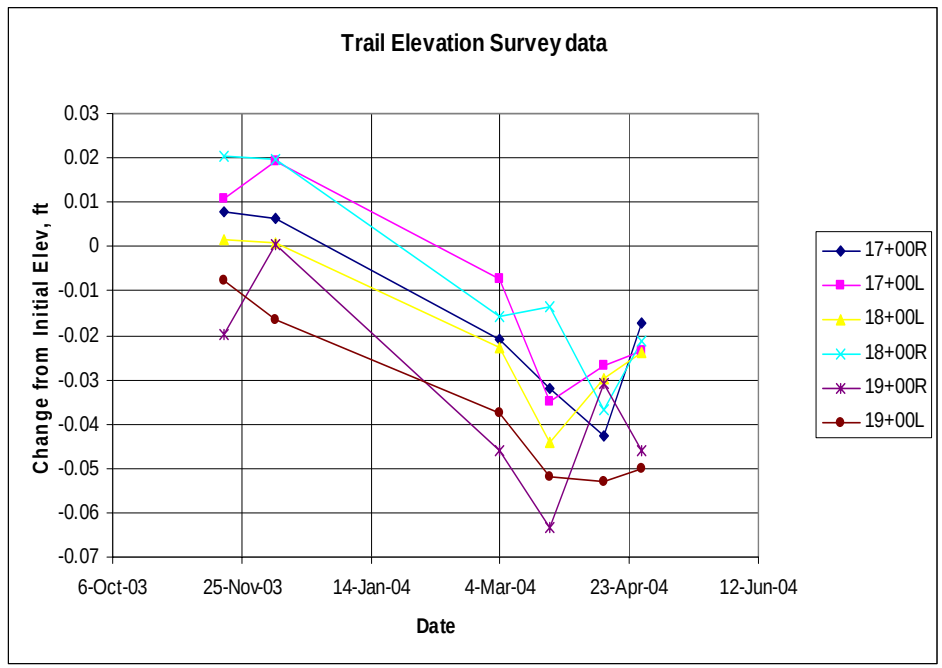

trail elevation run2S^^R
3
2
1
0
−1
−2
−3
Inches
0
4
8
12

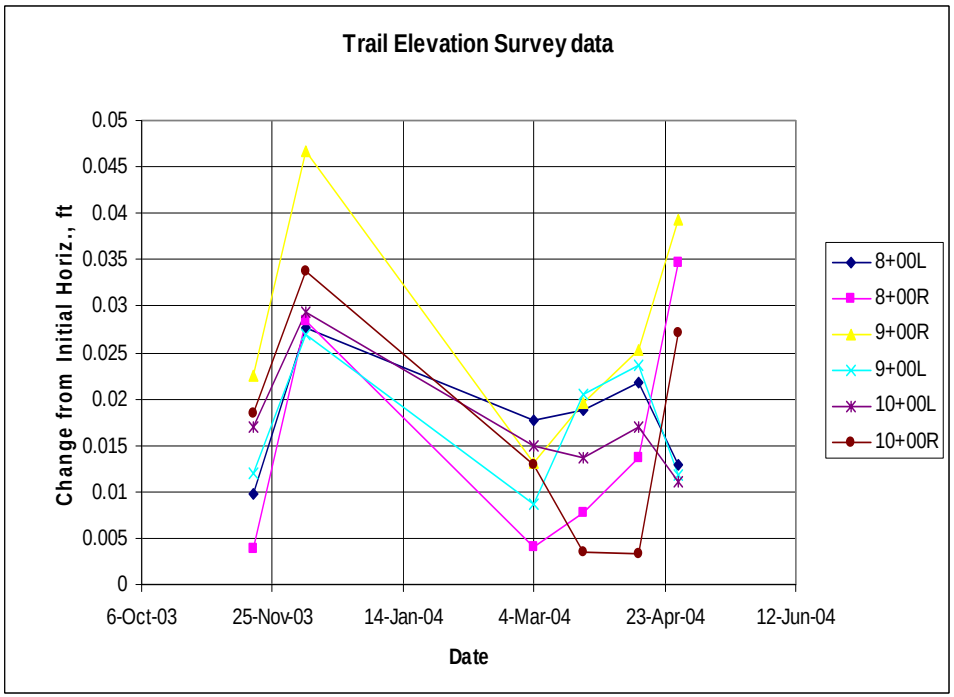

trail elevation run2N^^R
inches
3
2
1
0
-1
-2
-3
0
4
8
12

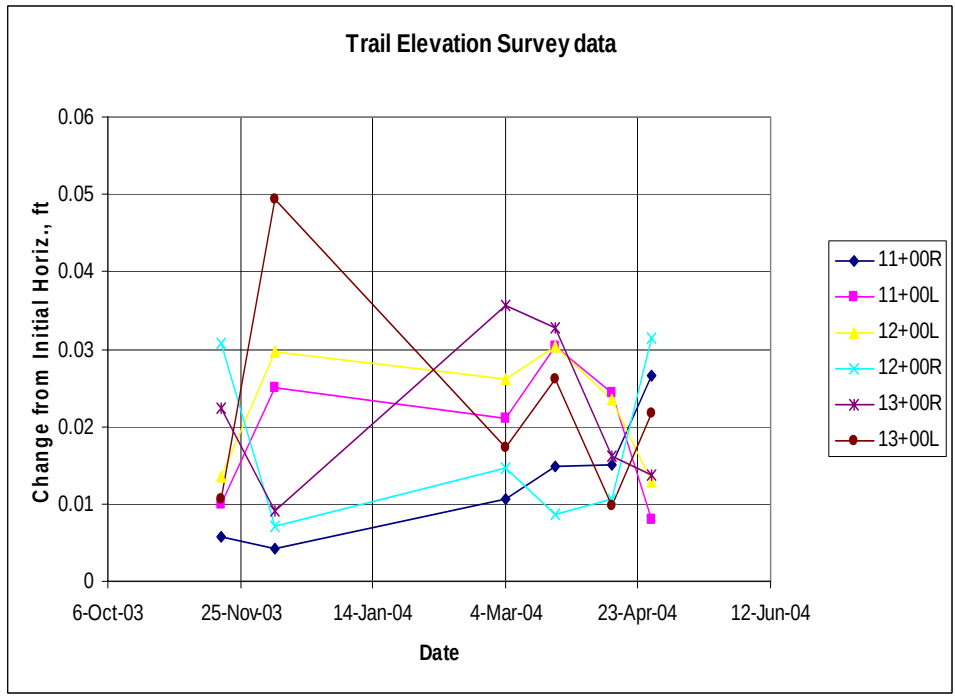

Trail Elevation Survey data
Change from Initial Elev, ft
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
8+00L
8+00R
9+00R
9+00L
10+00L
10+00R

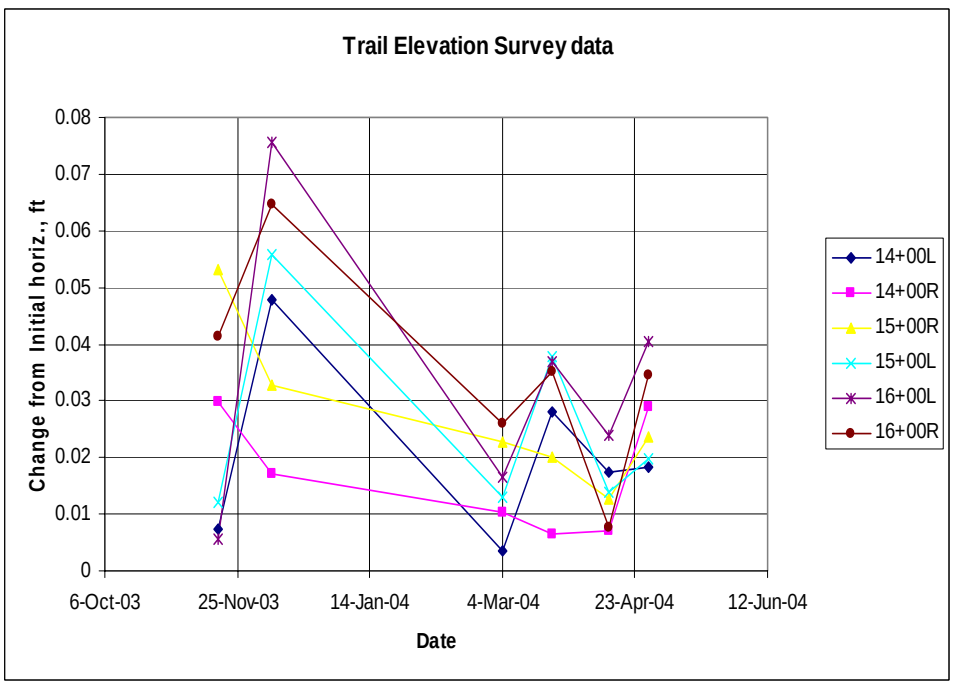

Trail Elevation Survey data
Change from Initial Elev, ft
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
11+00R
11+00L
12+00L
12+00R
13+00R
13+00L

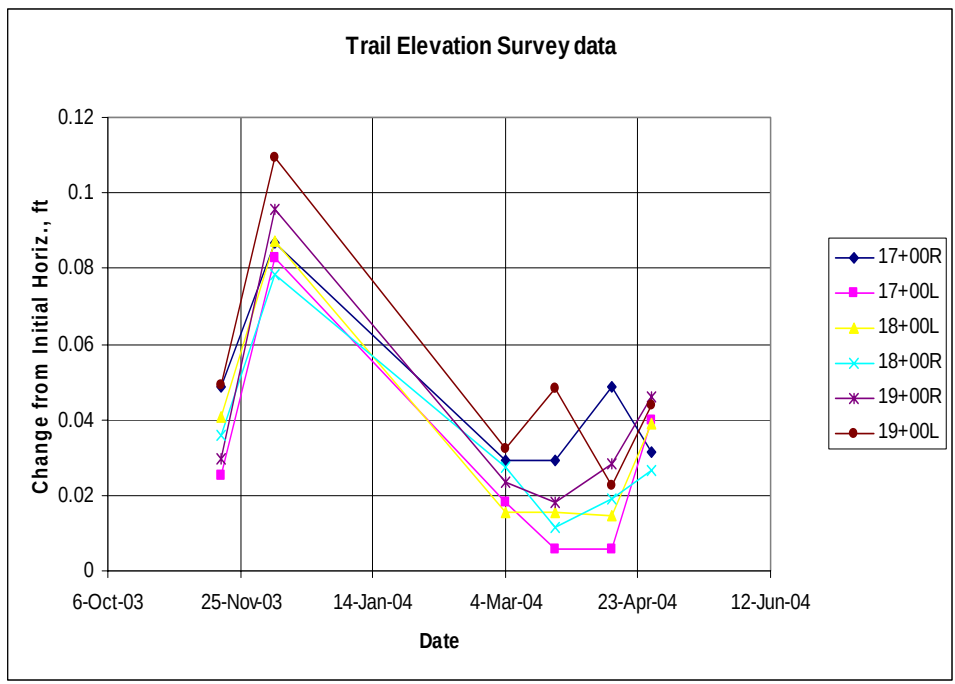

Trail Elevation Survey data
Change from Initial Elev, ft
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
14+00L
14+00R
15+00R
15+00L
16+00L
16+00R

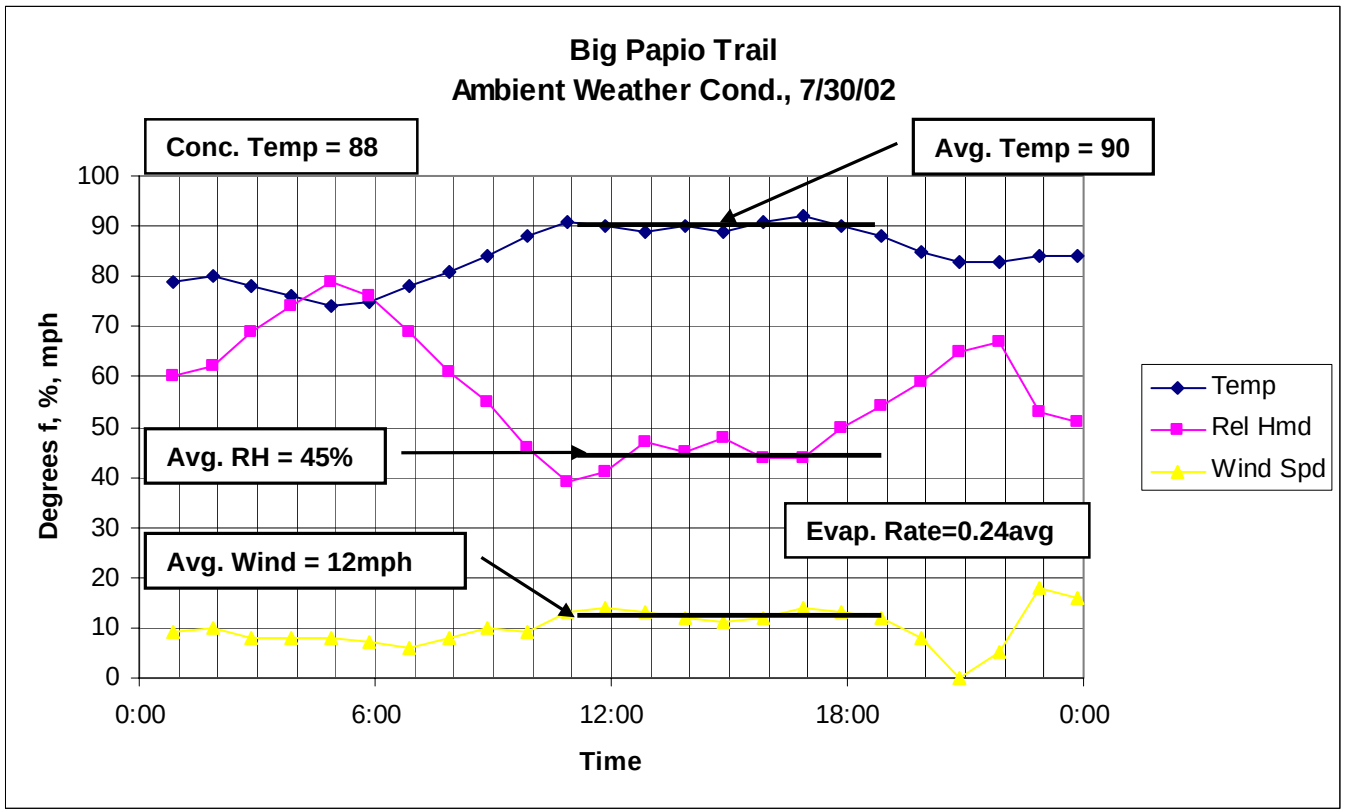

Trail Elevation Survey data
Change from Initial Elev, ft
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
17+00R
17+00L
18+00L
18+00R
19+00R
19+00L

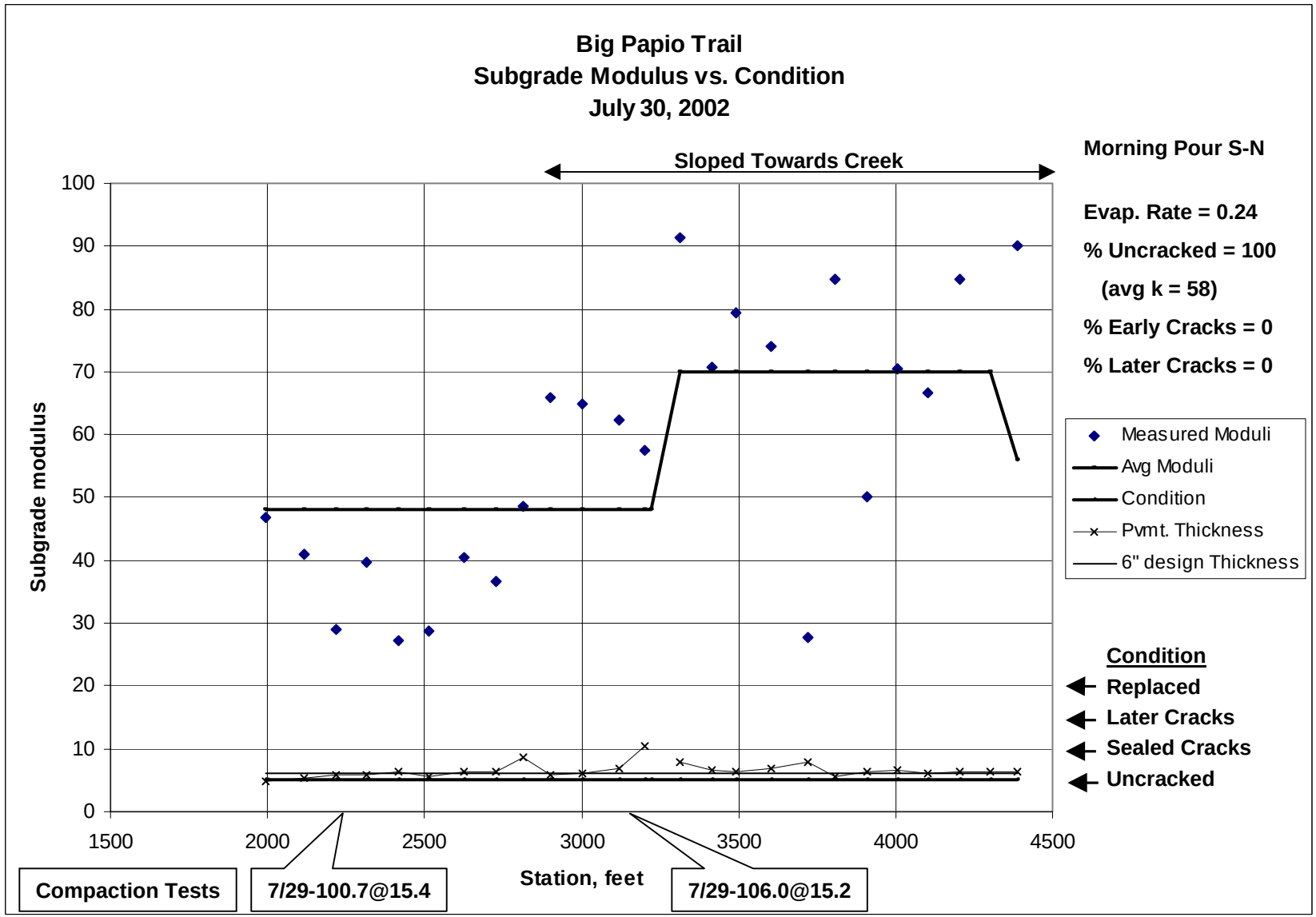

Trail Elevation Survey data
Change from Initial Horiz., ft
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
8+00L
8+00R
9+00R
9+00L
10+00L
10+00R

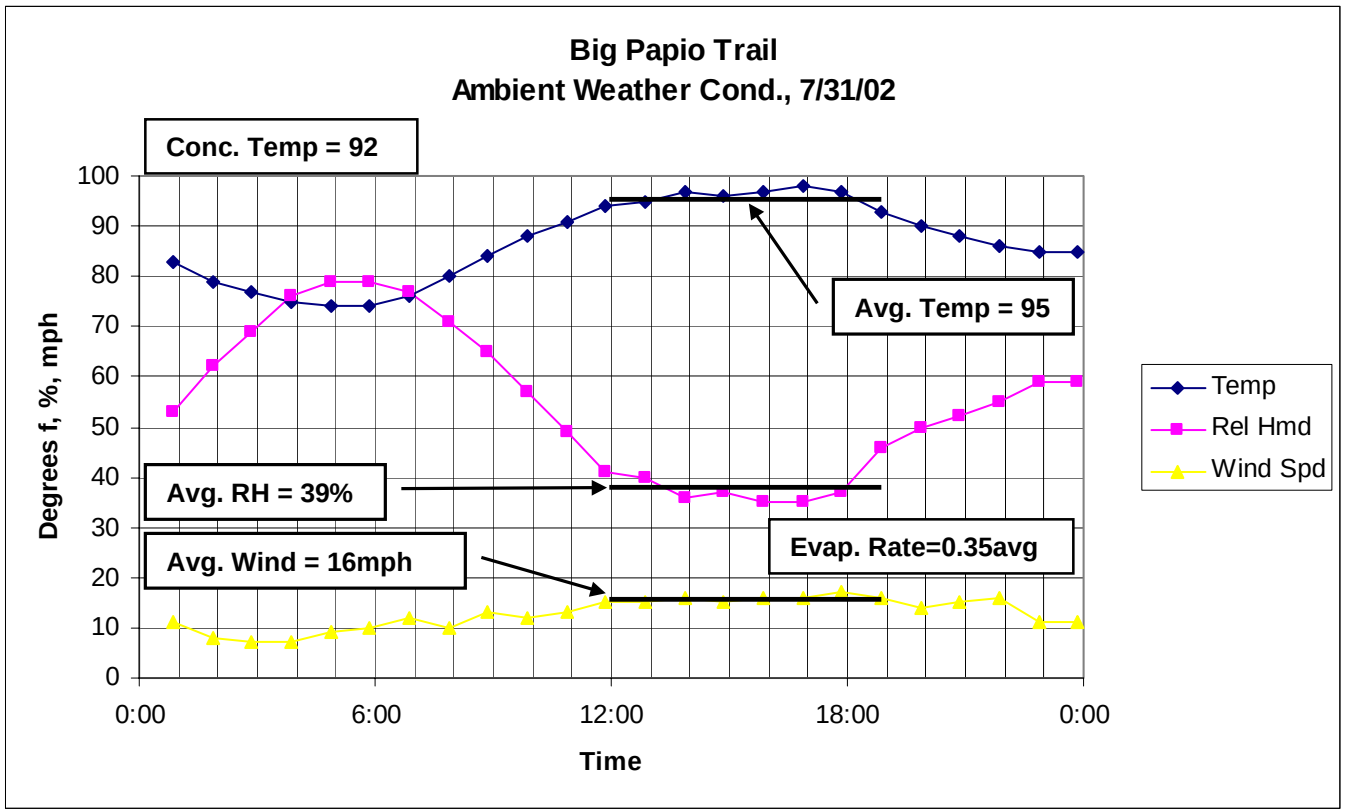

Trail Elevation Survey data
Change from Initial Horiz., ft
0.06
0.05
0.04
0.03
0.02
0.01
0
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
11+00R
11+00L
12+00L
12+00R
13+00R
13+00L


Trail Elevation Survey data
Change from Initial horiz., ft
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
14+00L
14+00R
15+00R
15+00L
16+00L
16+00R

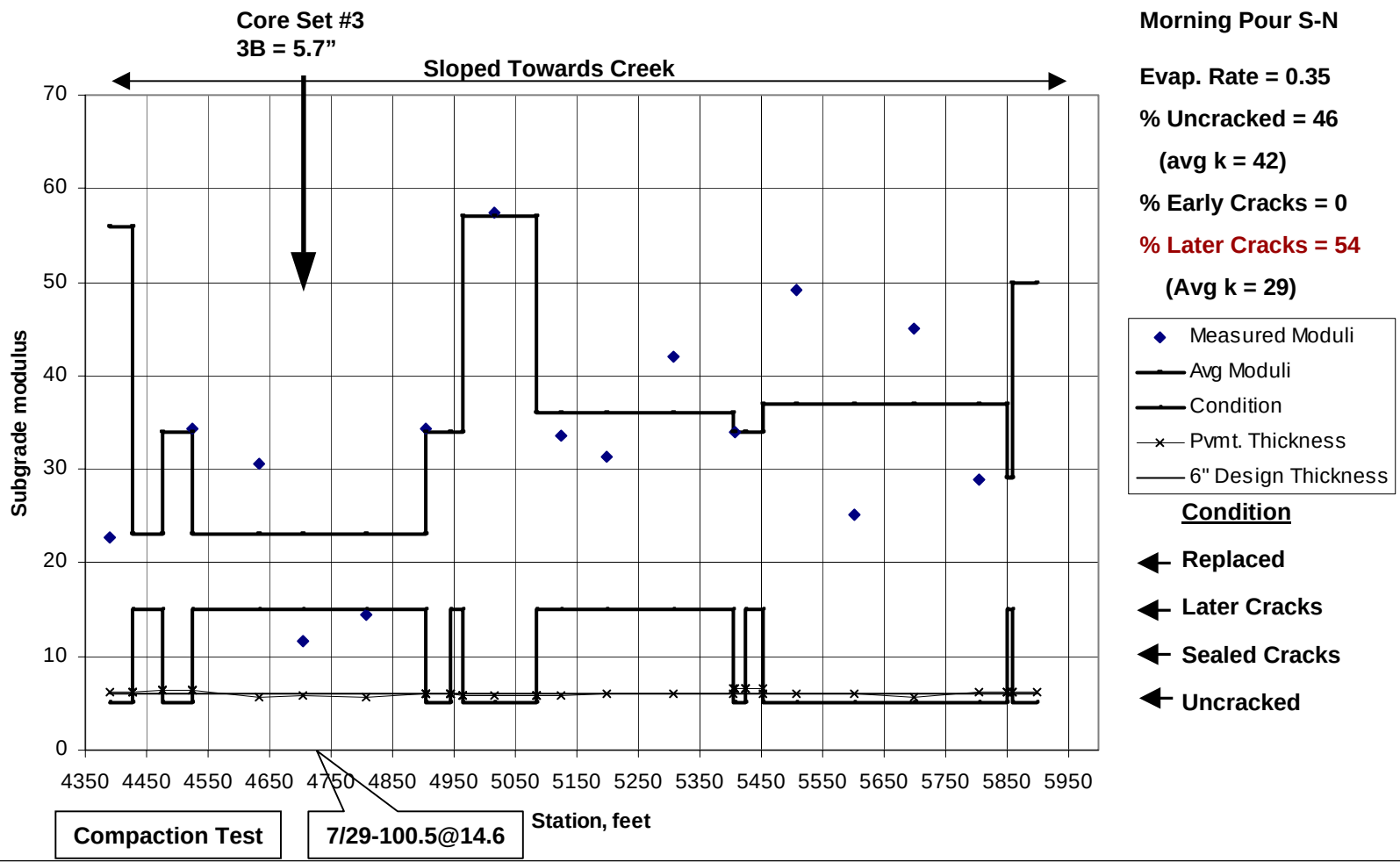

Trail Elevation Survey data
Change from Initial Horiz., ft
0.12
0.1
0.08
0.06
0.04
0.02
0
6-Oct-03
25-Nov-03
14-Jan-04
4-Mar-04
23-Apr-04
12-Jun-04
Date
17+00R
17+00L
18+00L
18+00R
19+00R
19+00L

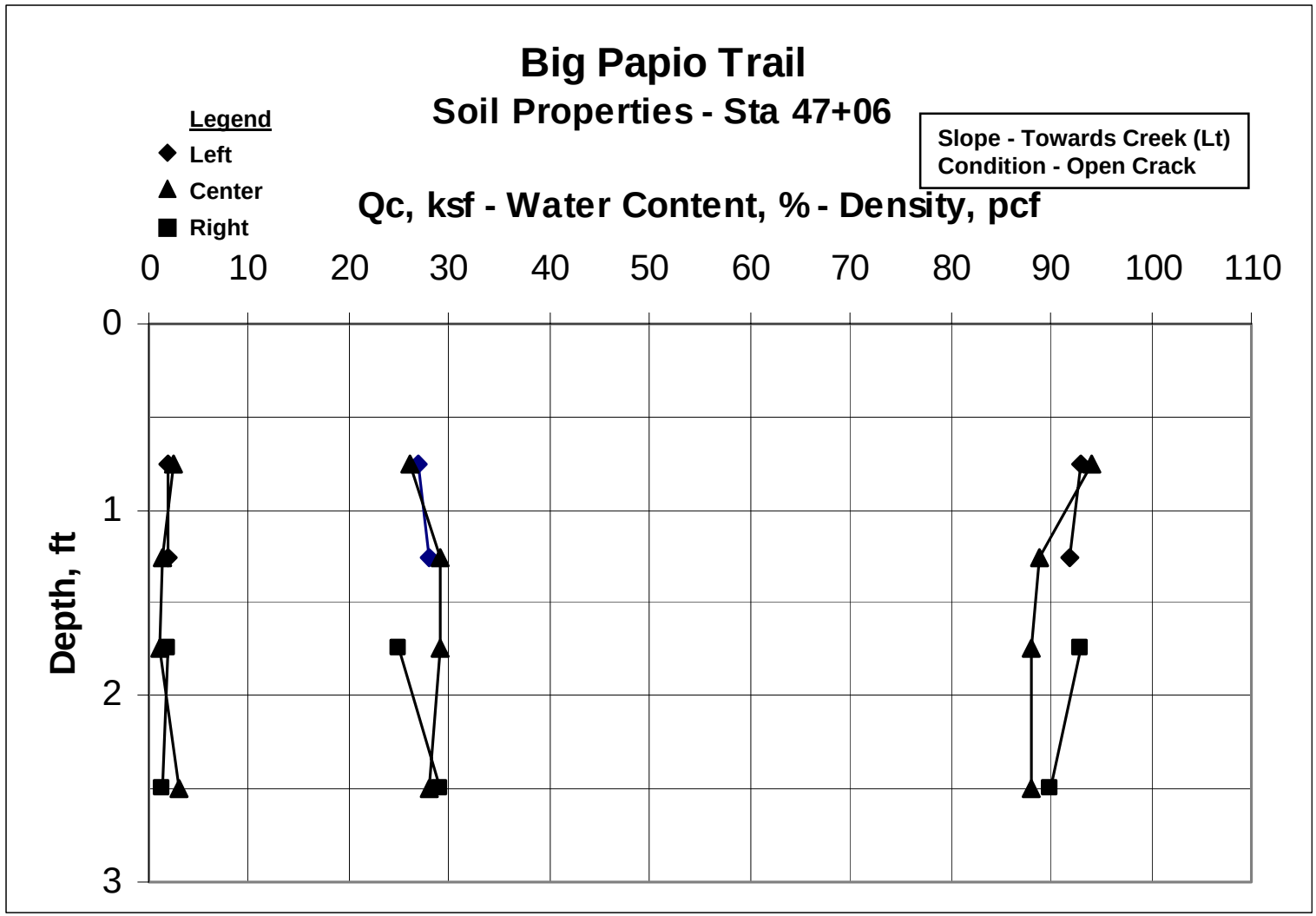

Big Papio Trail
Ambient Weather Cond., 7/30/02
Conc. Temp = 88
Avg. Temp = 90
Avg. RH = 45%
Avg. Wind = 12mph
Evap. Rate=0.24avg
Degrees f, %, mph
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
0:00
Time
Temp
Rel Hmd
Wind Spd

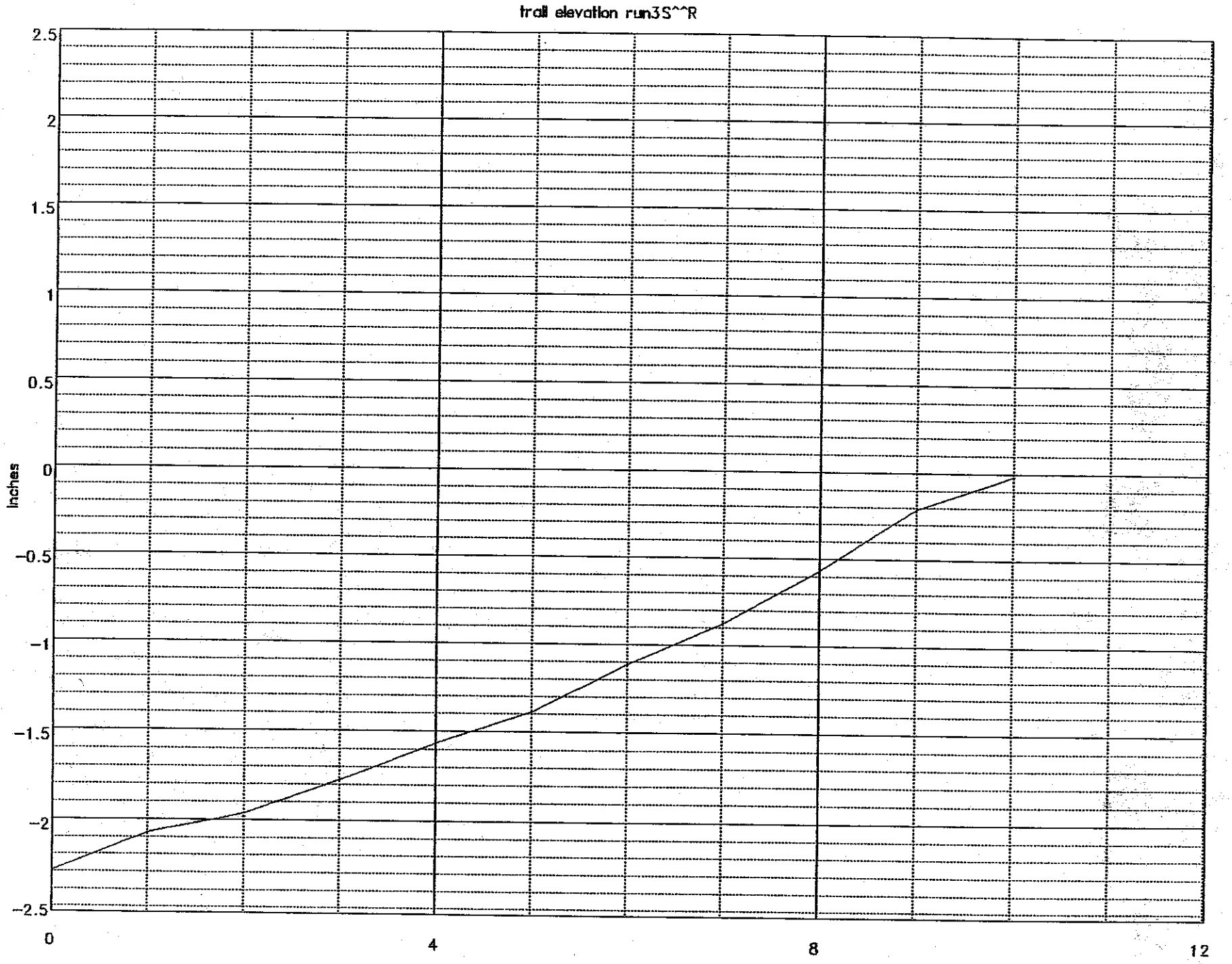

Big Papio Trail
Subgrade Modulus vs. Condition
July 30, 2002
Sloped Towards Creek
Morning Pour S-N
Evap. Rate = 0.24
% Uncracked = 100
(avg k = 58)
% Early Cracks = 0
% Later Cracks = 0
Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" design Thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked
Subgrade modulus
Station, feet
Compaction Tests
7/29-100.7@15.4
7/29-106.0@15.2

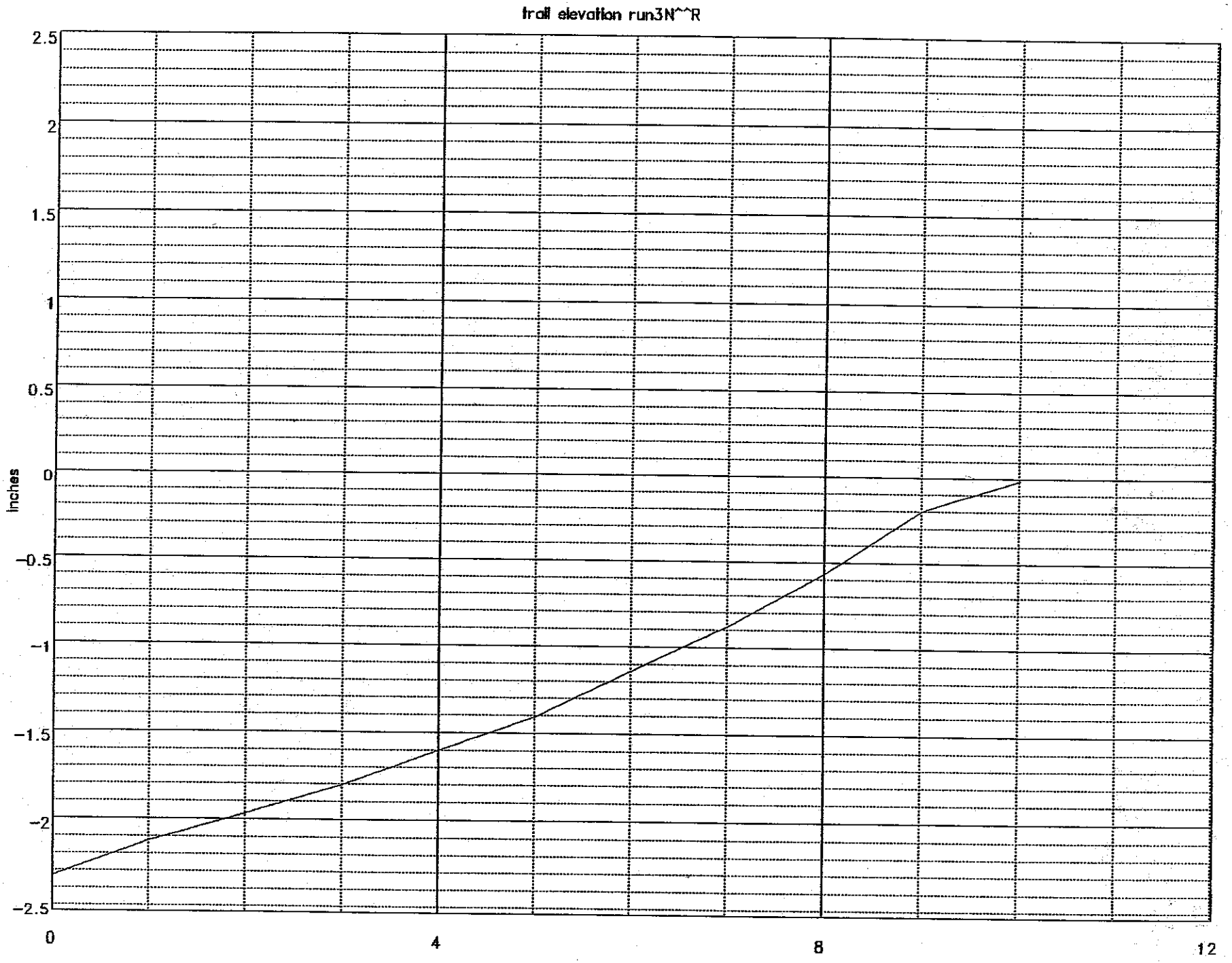

Big Papio Trail
Ambient Weather Cond., 7/31/02
Conc. Temp = 92
Avg. Temp = 95
Avg. RH = 39%
Avg. Wind = 16mph
Evap. Rate=0.35avg
Degrees f, %, mph
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
0:00
Time
Temp
Rel Hmd
Wind Spd

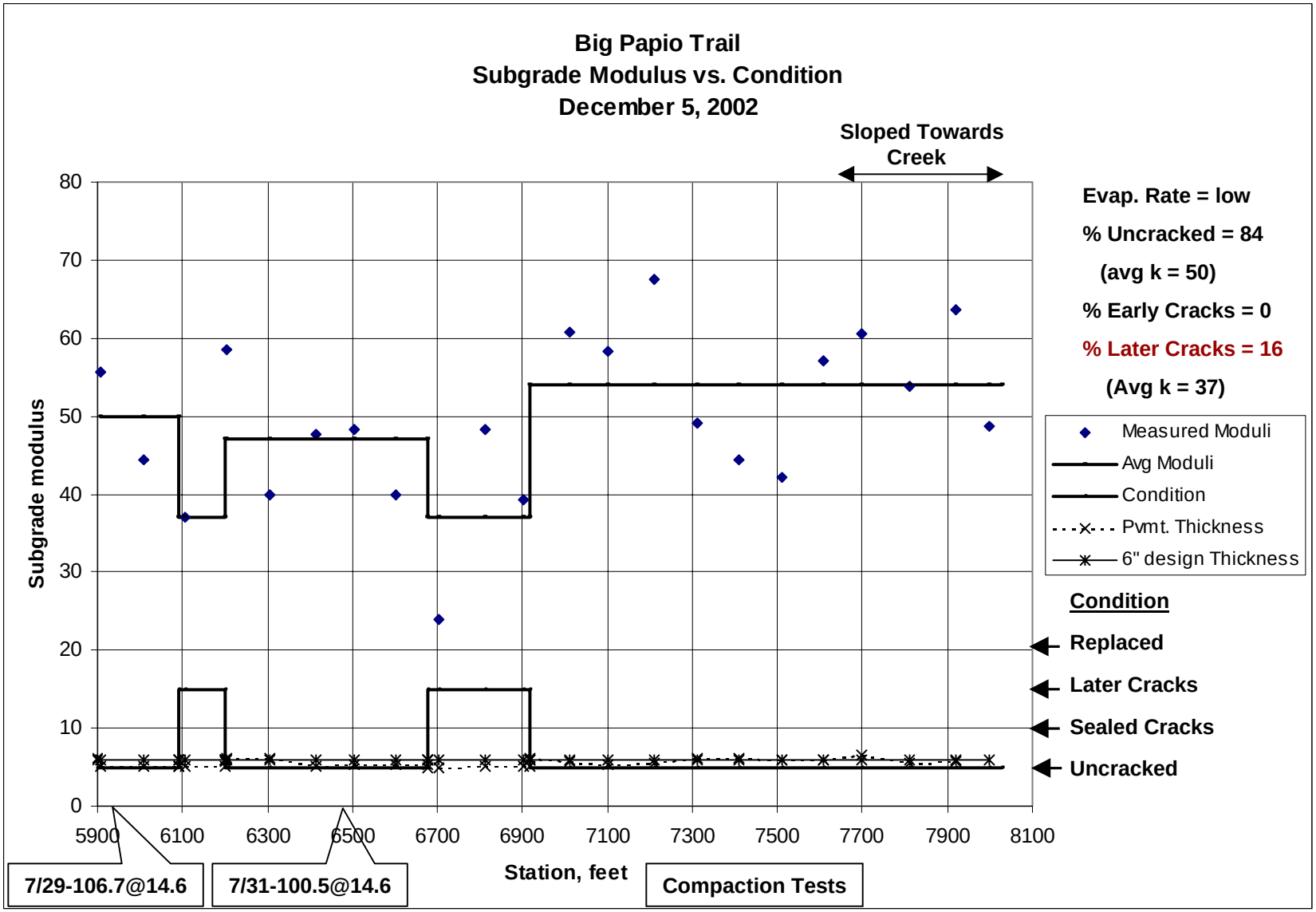
Big Papio Trail
Subgrade Modulus vs. Condition
July 31, 2002

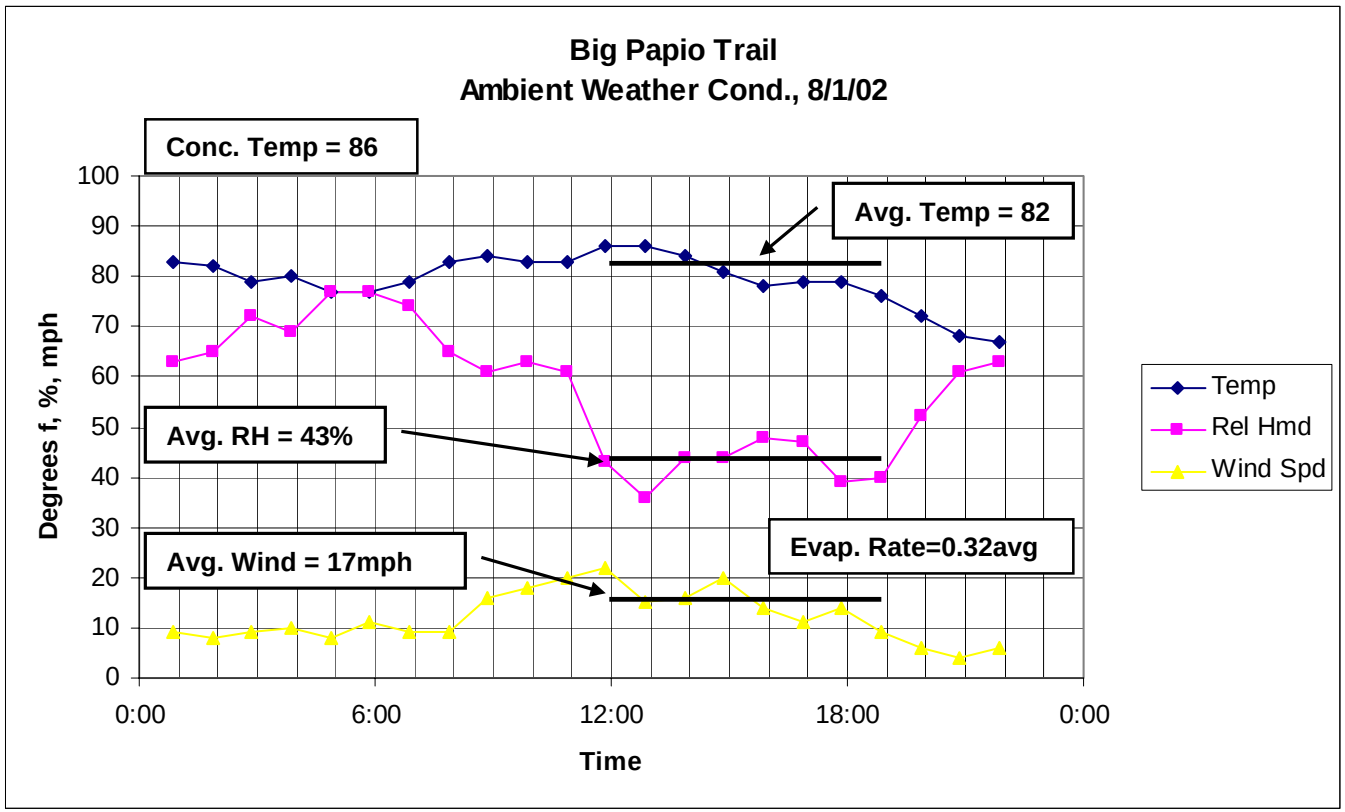



Big Papio Trail
Soil Properties - Sta 47+06
Legend
Left
Center
Right
Slope - Towards Creek (Lt)
Condition - Open Crack
Qc, ksf - Water Content, % - Density, pcf
0
10
20
30
40
50
60
70
80
90
100
110
Depth, ft
0
1
2
3

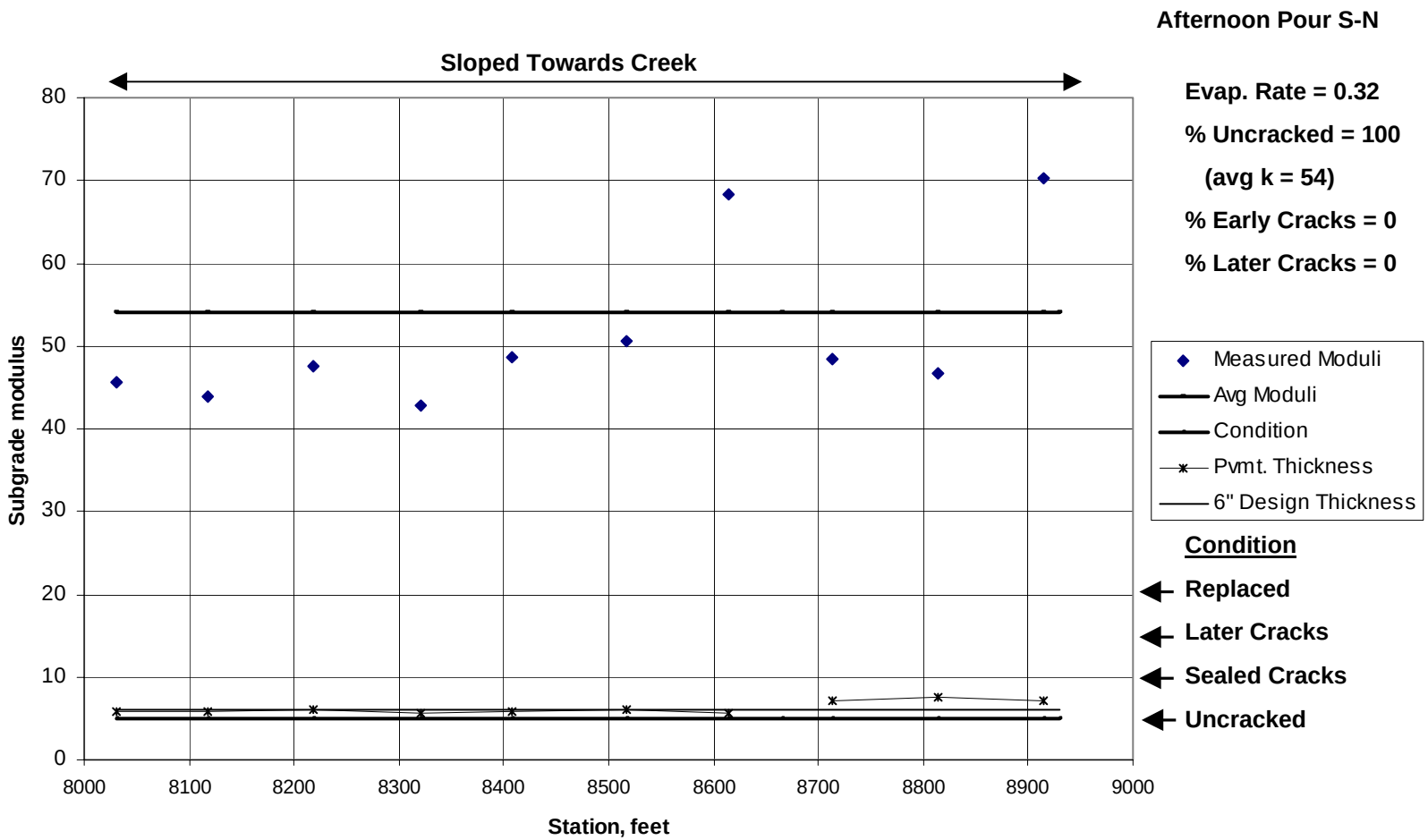

trail elevation run3S^^R
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
Inches
0
4
8
12

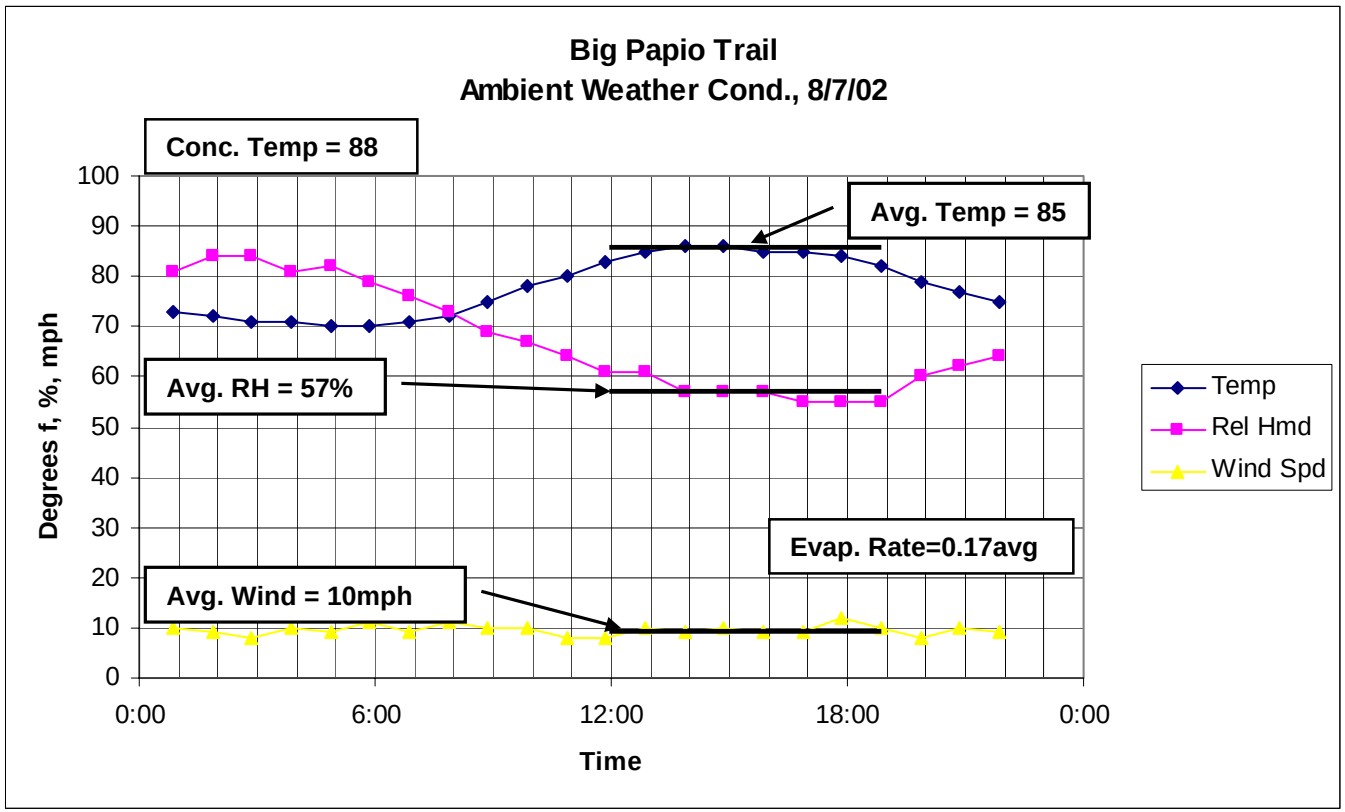

trail elevation run3N^^R
inches
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
0
4
8
12

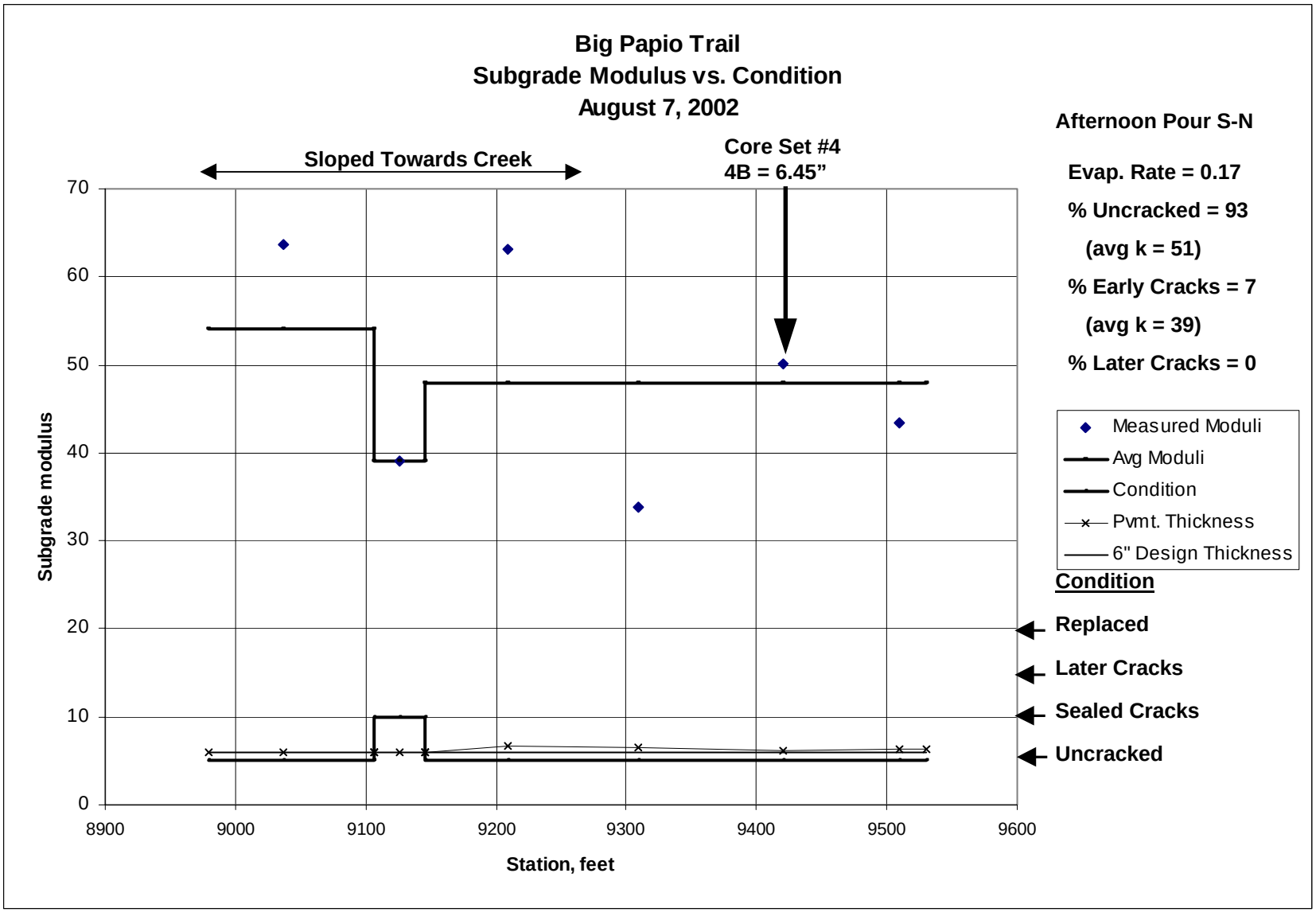

Big Papio Trail
Subgrade Modulus vs. Condition
December 5, 2002
Sloped Towards Creek
Subgrade modulus
80
70
60
50
40
30
20
10
0
5900
6100
6300
6500
6700
6900
7100
7300
7500
7700
7900
8100
Station, feet
Evap. Rate = low
% Uncracked = 84
(avg k = 50)
% Early Cracks = 0
% Later Cracks = 16
(Avg k = 37)
Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" design Thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked
7/29-106.7@14.6
7/31-100.5@14.6
Compaction Tests

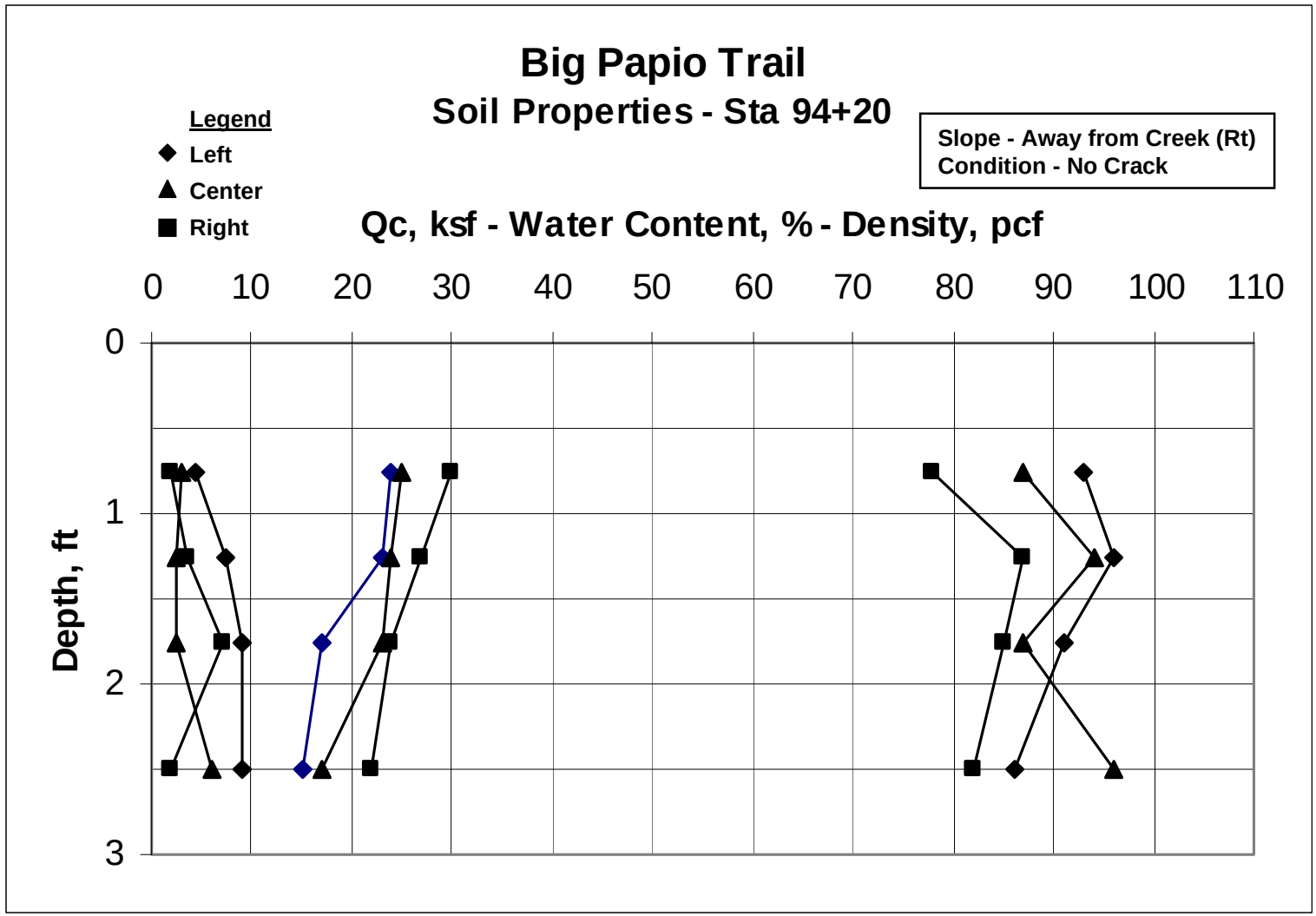

Big Papio Trail
Ambient Weather Cond., 8/1/02
Conc. Temp = 86
Avg. Temp = 82
Avg. RH = 43%
Avg. Wind = 17mph
Evap. Rate=0.32avg
Degrees f, %, mph
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
0:00
Time
Temp
Rel Hmd
Wind Spd

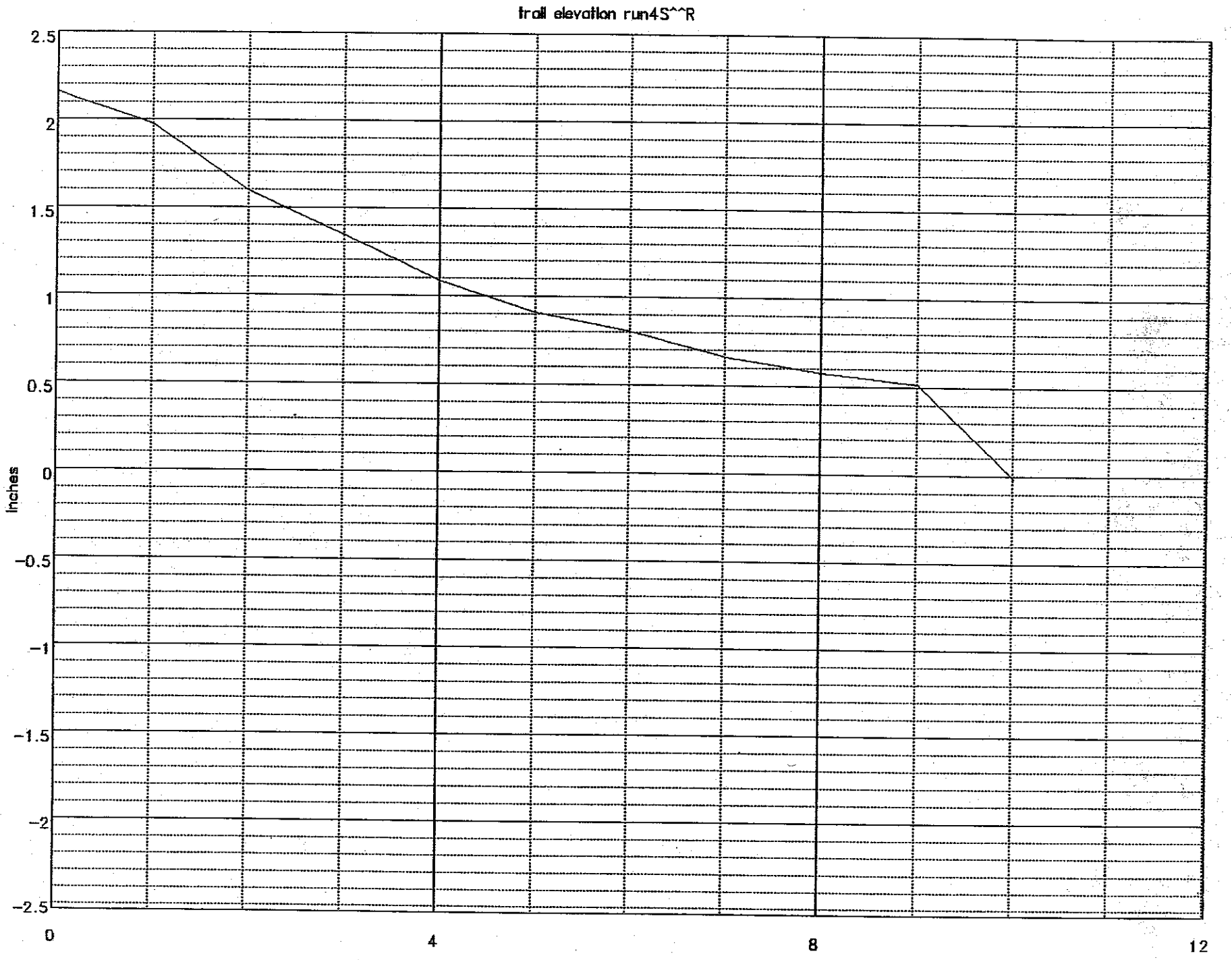
Big Papio Trail
Subgrade Modulus vs. Condition
August 1, 2002

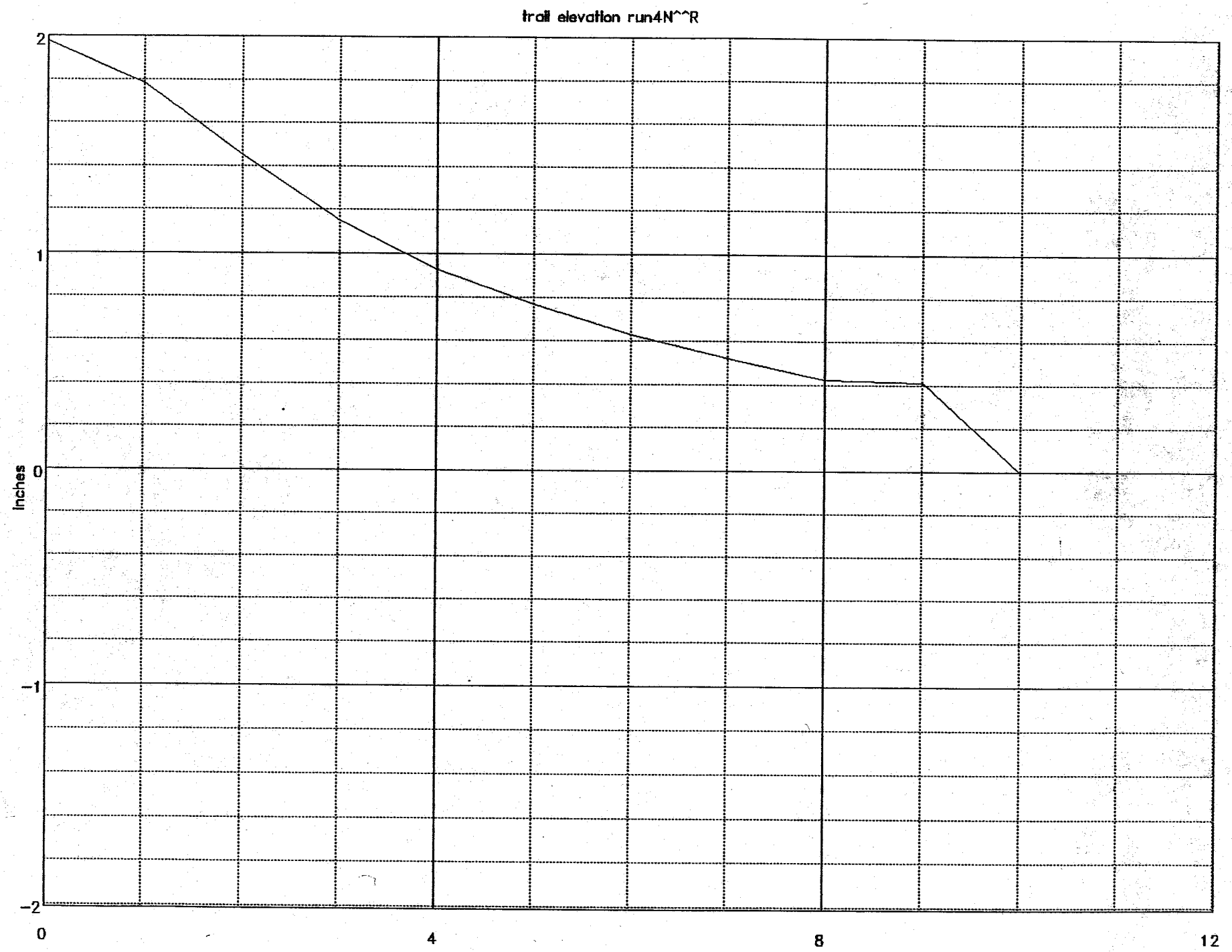


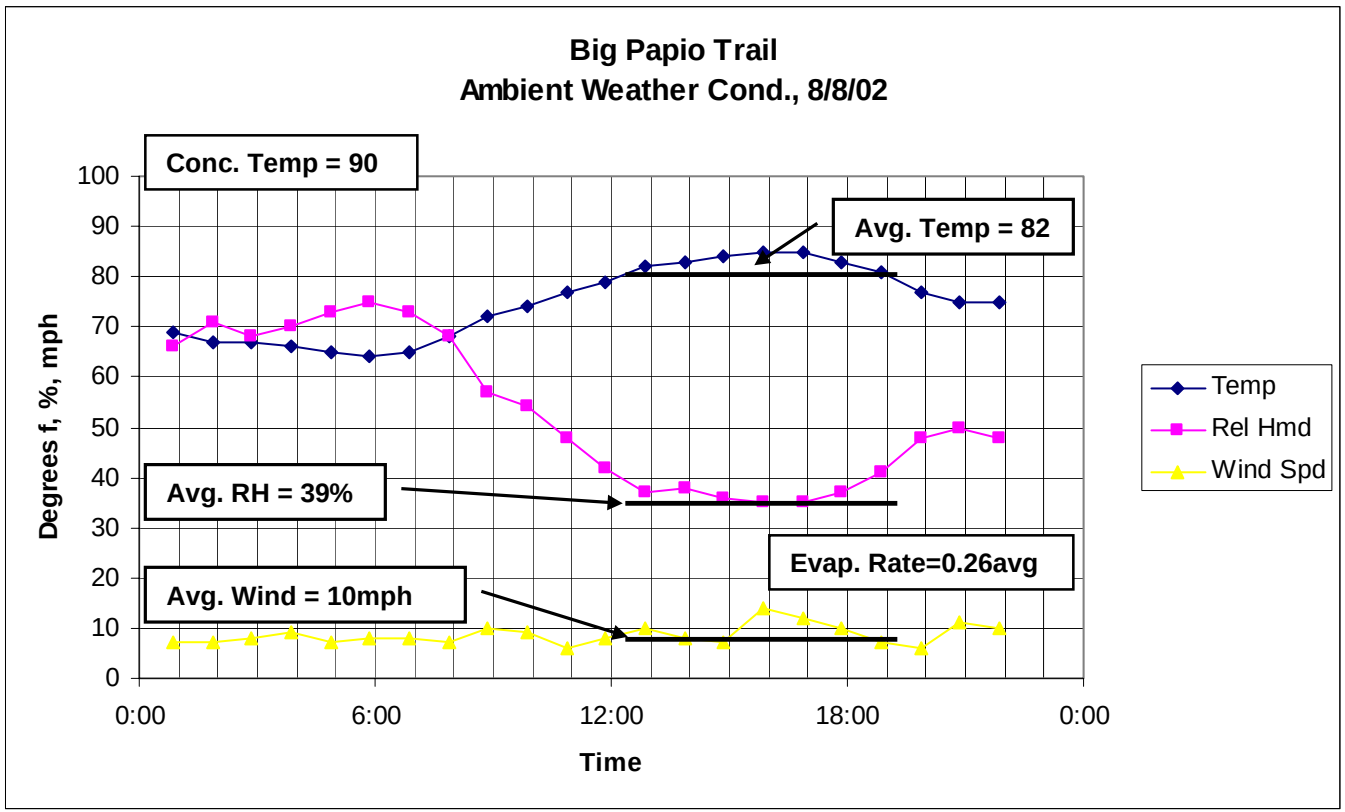

Big Papio Trail
Ambient Weather Cond., 8/7/02
Conc. Temp = 88
Avg. Temp = 85
Avg. RH = 57%
Evap. Rate=0.17avg
Avg. Wind = 10mph
Degrees f, %, mph
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
0:00
Time
Temp
Rel Hmd
Wind Spd

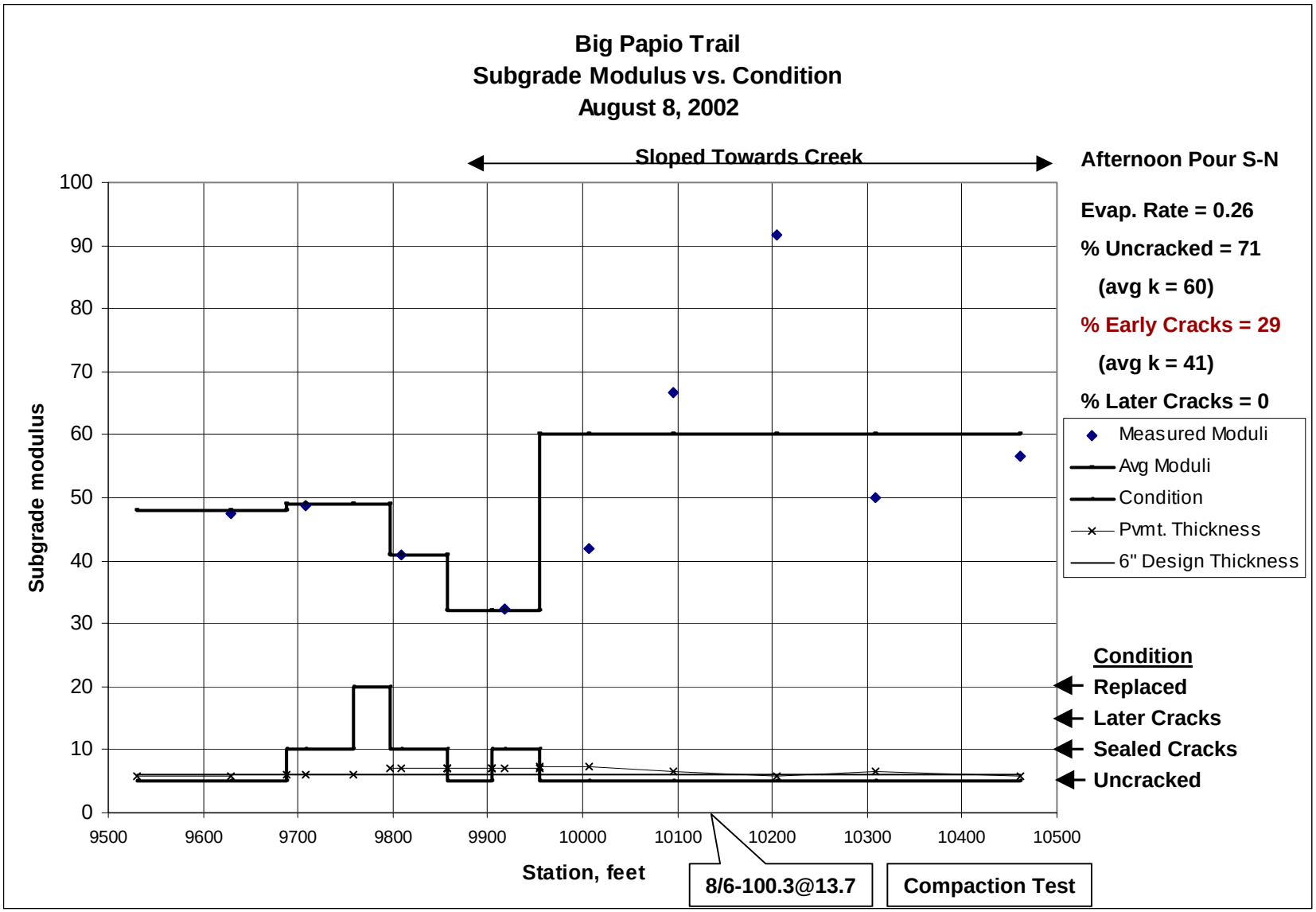

Big Papio Trail
Subgrade Modulus vs. Condition
August 7, 2002
Sloped Towards Creek
Core Set #4
4B = 6.45”
Afternoon Pour S-N
Evap. Rate = 0.17
% Uncracked = 93
(avg k = 51)
% Early Cracks = 7
(avg k = 39)
% Later Cracks = 0
Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" Design Thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked
Subgrade modulus
0
10
20
30
40
50
60
70
8900
9000
9100
9200
9300
9400
9500
9600
Station, feet

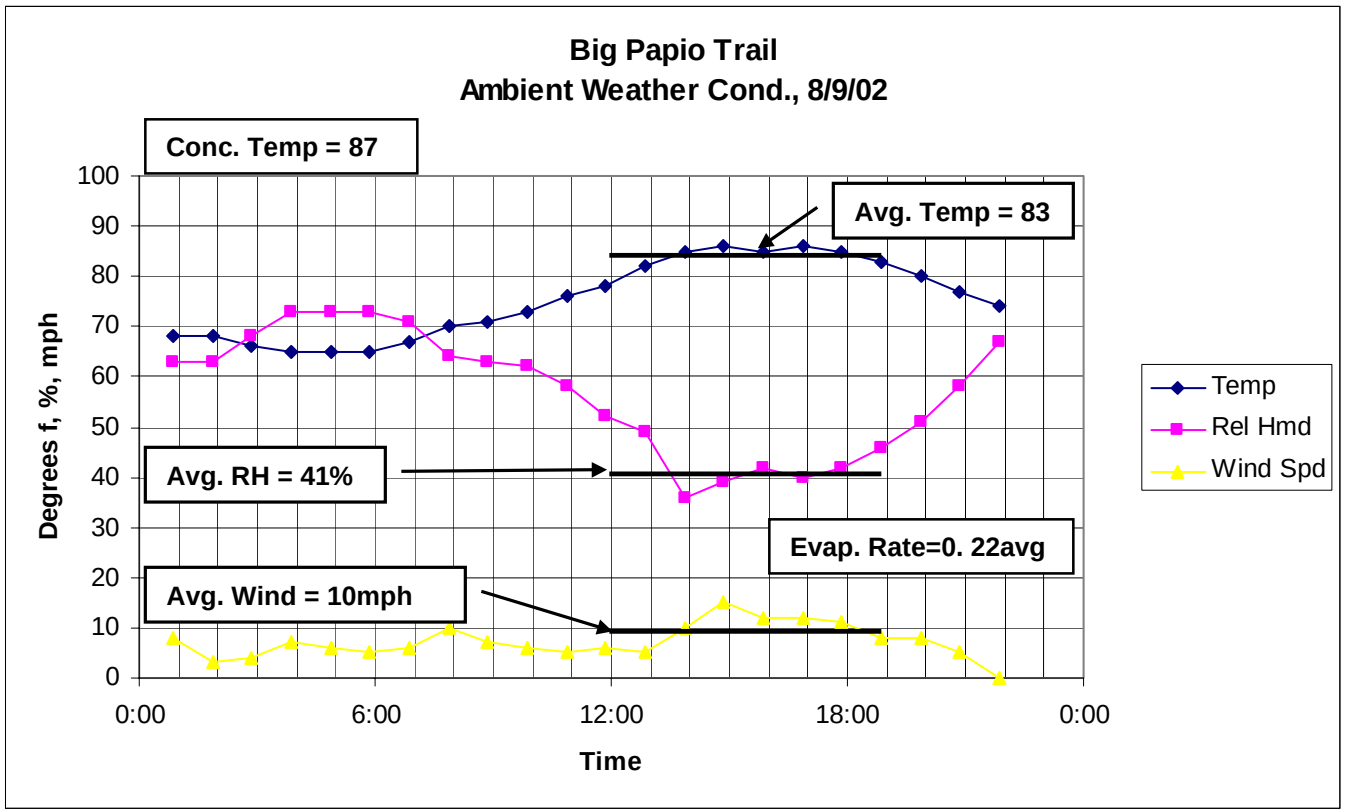

Big Papio Trail
Soil Properties - Sta 94+20
Legend
Left
Center
Right
Slope - Away from Creek (Rt)
Condition - No Crack
Qc, ksf - Water Content, % - Density, pcf
0
10
20
30
40
50
60
70
80
90
100
110
Depth, ft
0
1
2
3

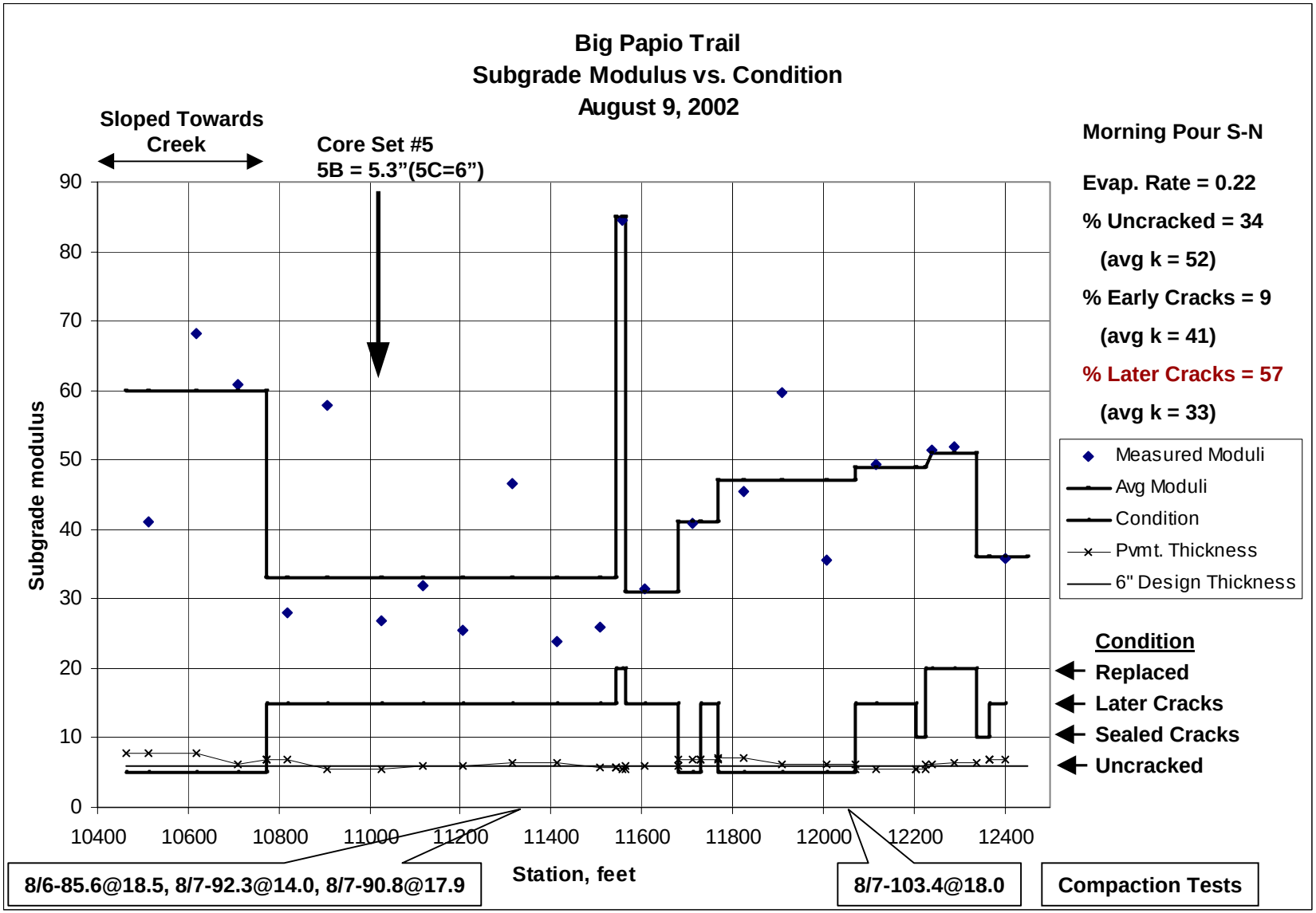

trail elevation run4S^^R
Inches
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
0
4
8
12

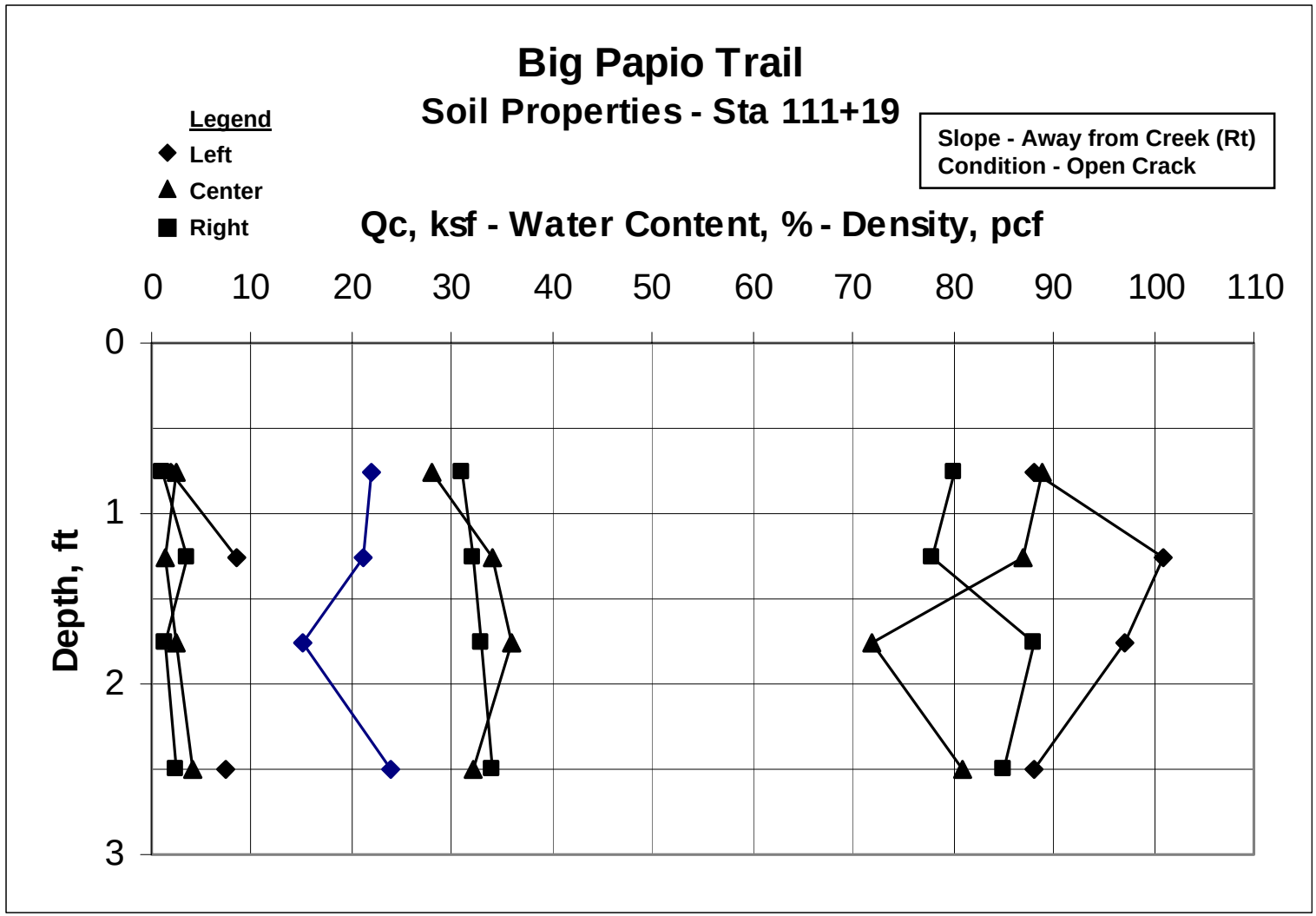

trail elevation run4N^^R
2
1
0
−1
−2
Inches
0
4
8
12

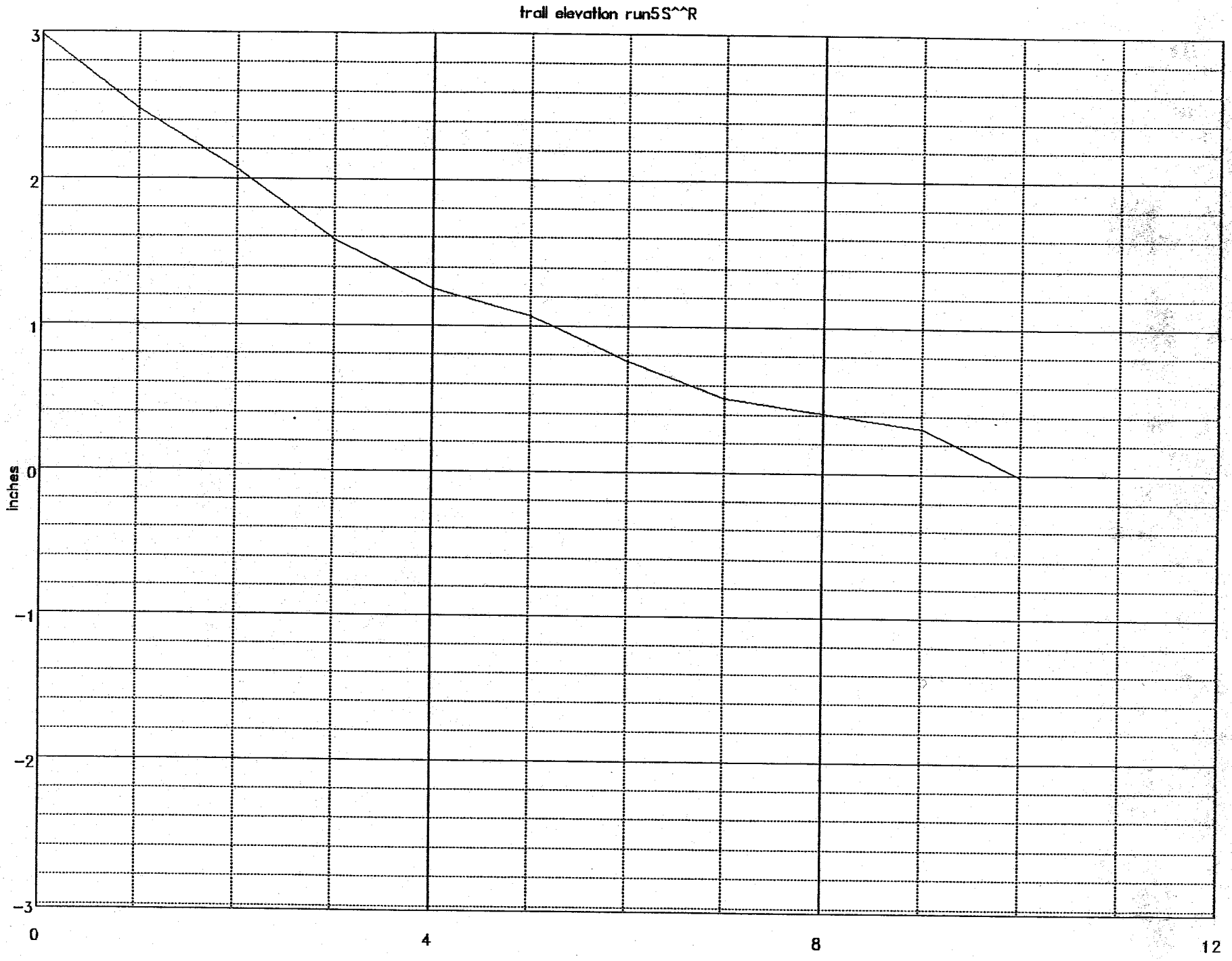

Big Papio Trail
Ambient Weather Cond., 8/8/02
Conc. Temp = 90
Avg. Temp = 82
Avg. RH = 39%
Evap. Rate=0.26avg
Avg. Wind = 10mph
Degrees f, %, mph
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
0:00
Time
Temp
Rel Hmd
Wind Spd

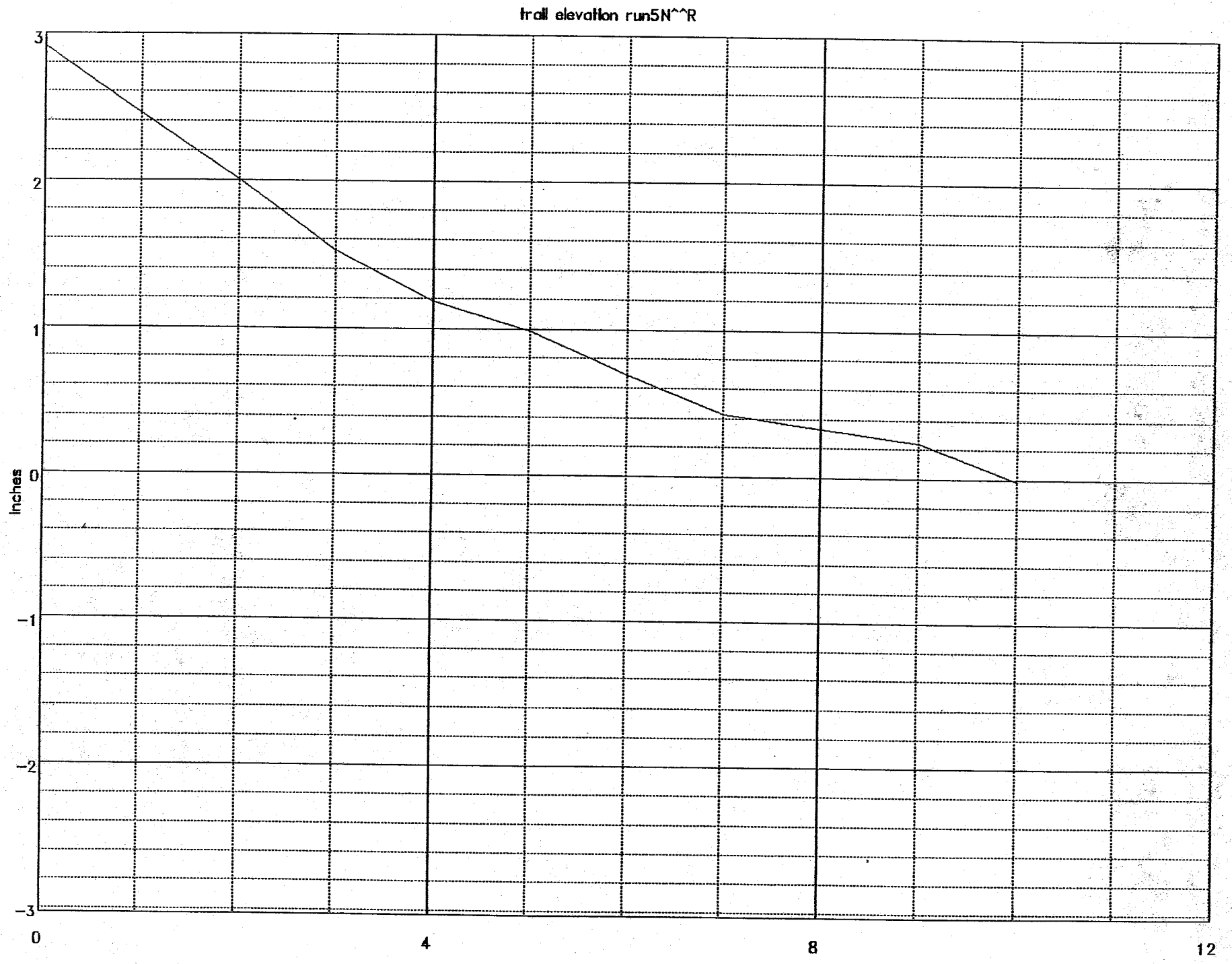

Big Papio Trail
Subgrade Modulus vs. Condition
August 8, 2002
Sloped Towards Creek
Afternoon Pour S-N
Evap. Rate = 0.26
% Uncracked = 71
(avg k = 60)
% Early Cracks = 29
(avg k = 41)
% Later Cracks = 0
Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" Design Thickness
Subgrade modulus
Station, feet
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked
8/6-100.3@13.7
Compaction Test

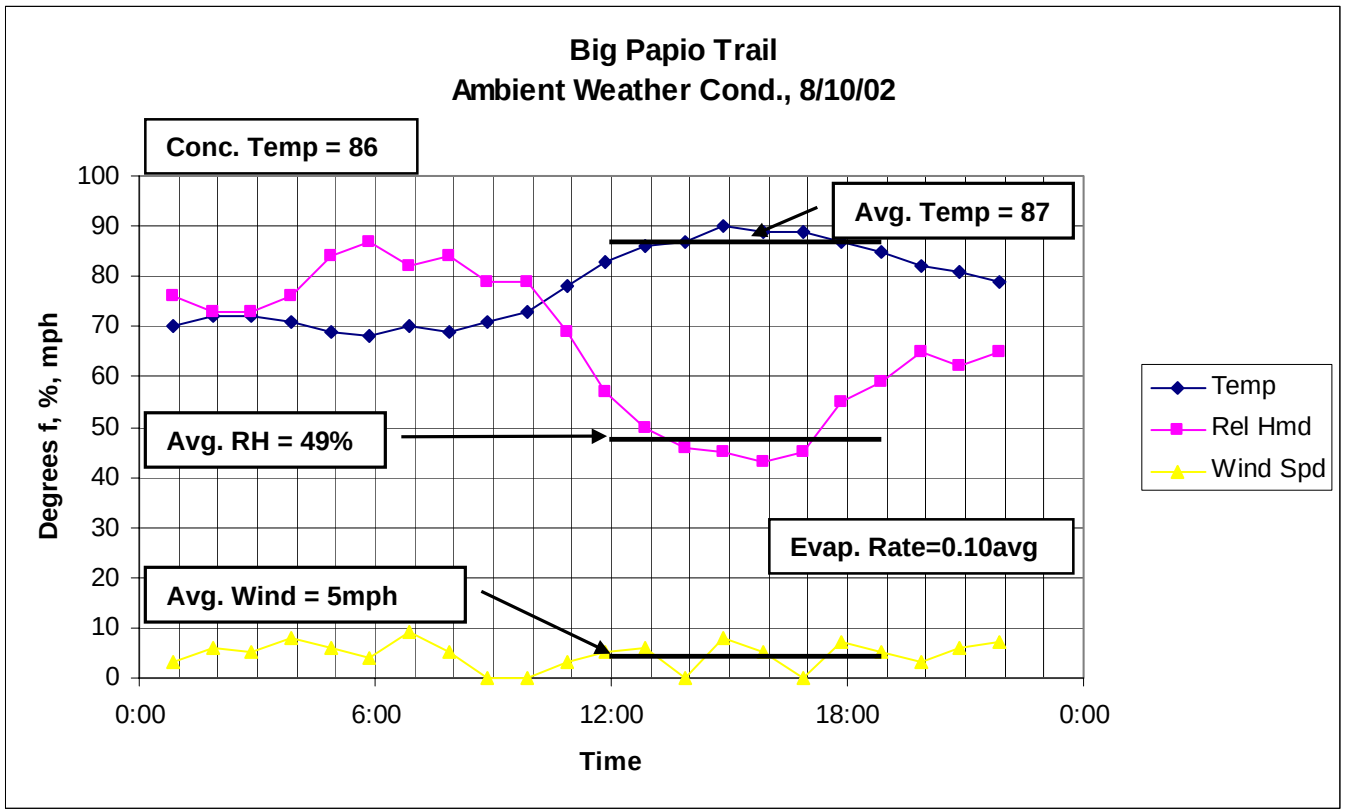

Big Papio Trail
Ambient Weather Cond., 8/9/02
Conc. Temp = 87
Avg. Temp = 83
Avg. RH = 41%
Evap. Rate=0. 22avg
Avg. Wind = 10mph
Degrees f, %, mph
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
0:00
Time
Temp
Rel Hmd
Wind Spd

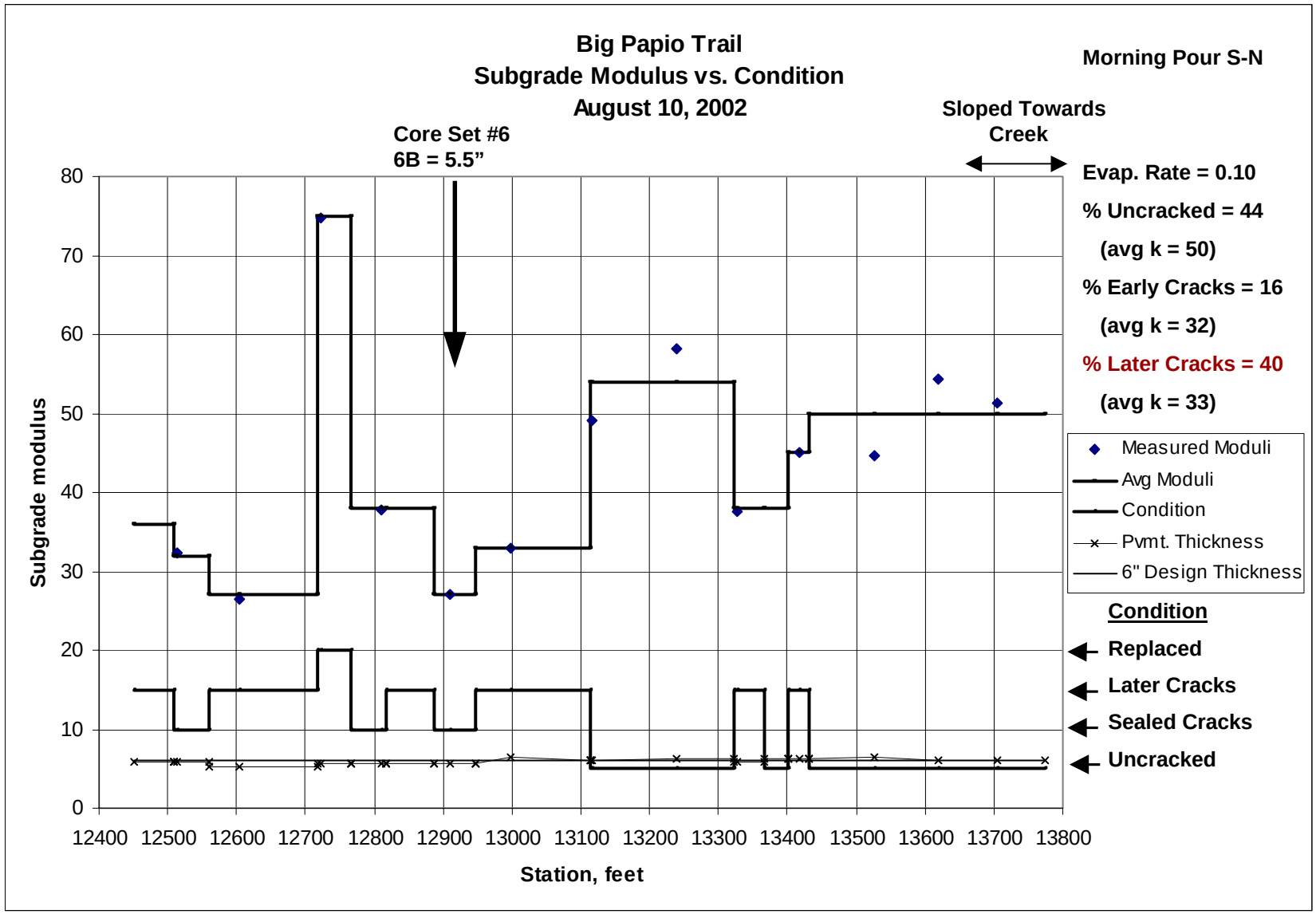

Big Papio Trail
Subgrade Modulus vs. Condition
August 9, 2002
Sloped Towards Creek
Core Set #5
5B = 5.3”(5C=6”)
Morning Pour S-N
Evap. Rate = 0.22
% Uncracked = 34
(avg k = 52)
% Early Cracks = 9
(avg k = 41)
% Later Cracks = 57
(avg k = 33)
Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" Design Thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked
Subgrade modulus
0
10
20
30
40
50
60
70
80
90
10400
10600
10800
11000
11200
11400
11600
11800
12000
12200
12400
Station, feet
8/6-85.6@18.5, 8/7-92.3@14.0, 8/7-90.8@17.9
8/7-103.4@18.0
Compaction Tests

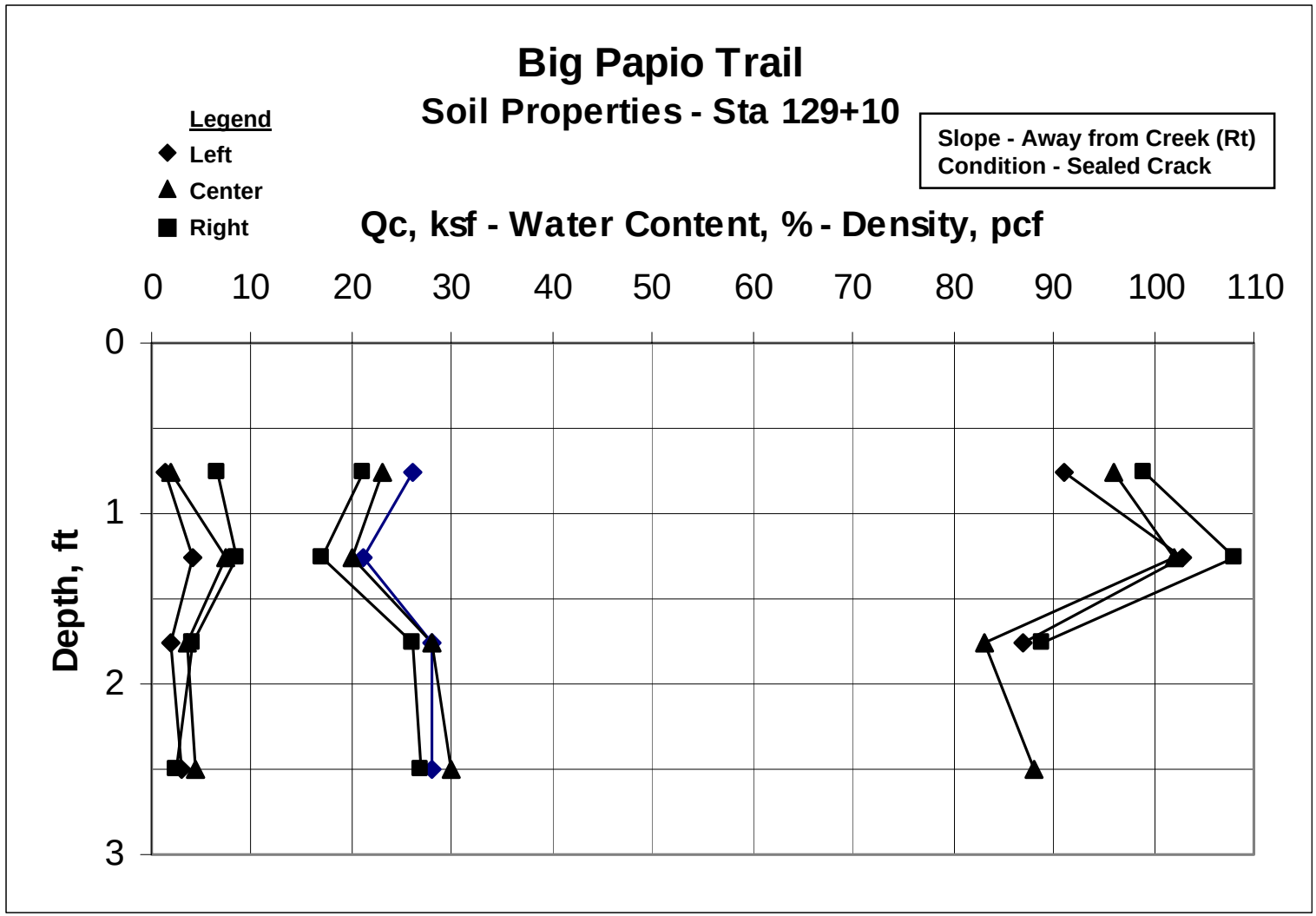

Big Papio Trail
Soil Properties - Sta 111+19
Legend
Left
Center
Right
Slope - Away from Creek (Rt)
Condition - Open Crack
Qc, ksf - Water Content, % - Density, pcf
0
10
20
30
40
50
60
70
80
90
100
110
Depth, ft
0
1
2
3

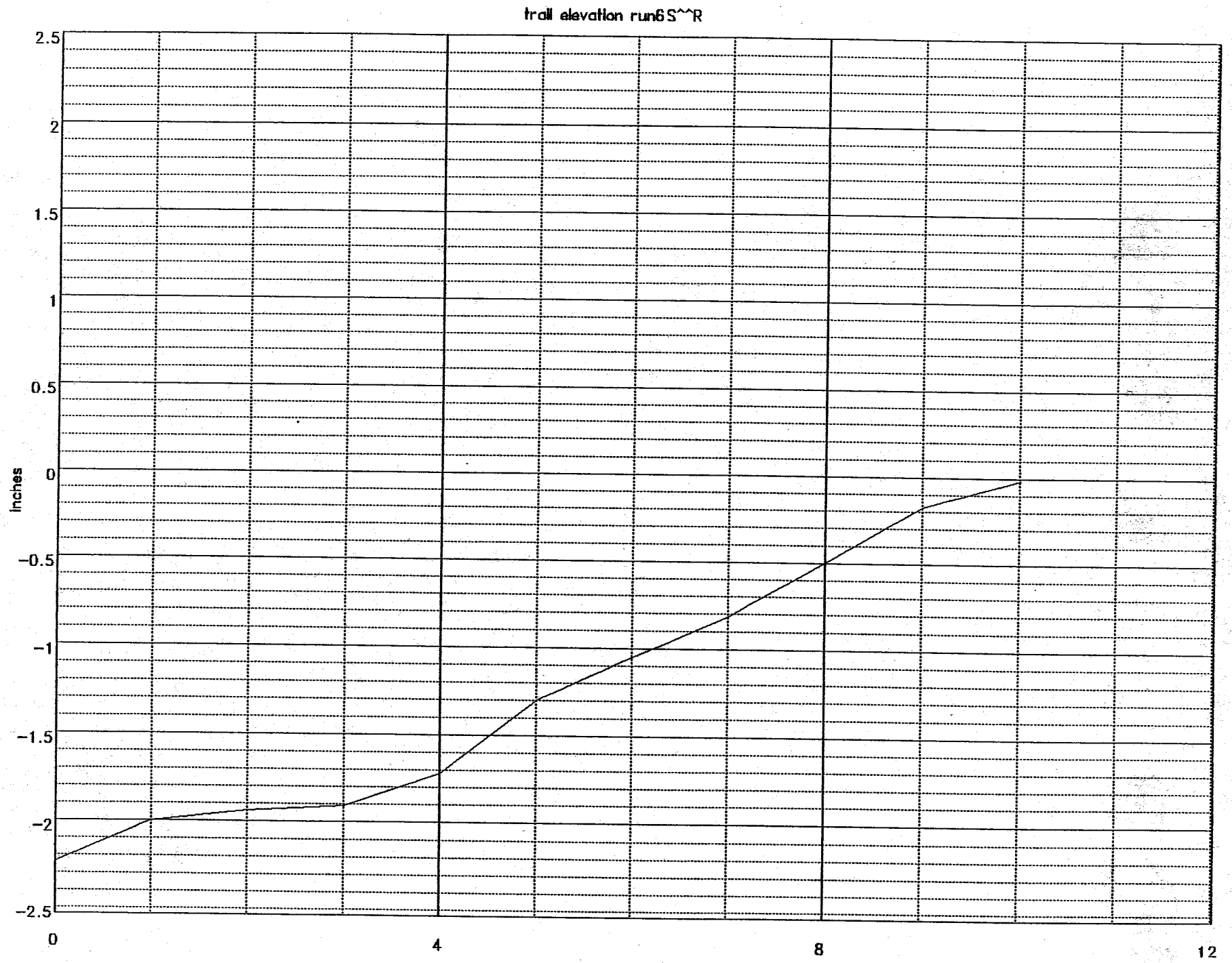

trail elevation run5S^^R
3
2
1
0
−1
−2
−3
Inches
0
4
8
12

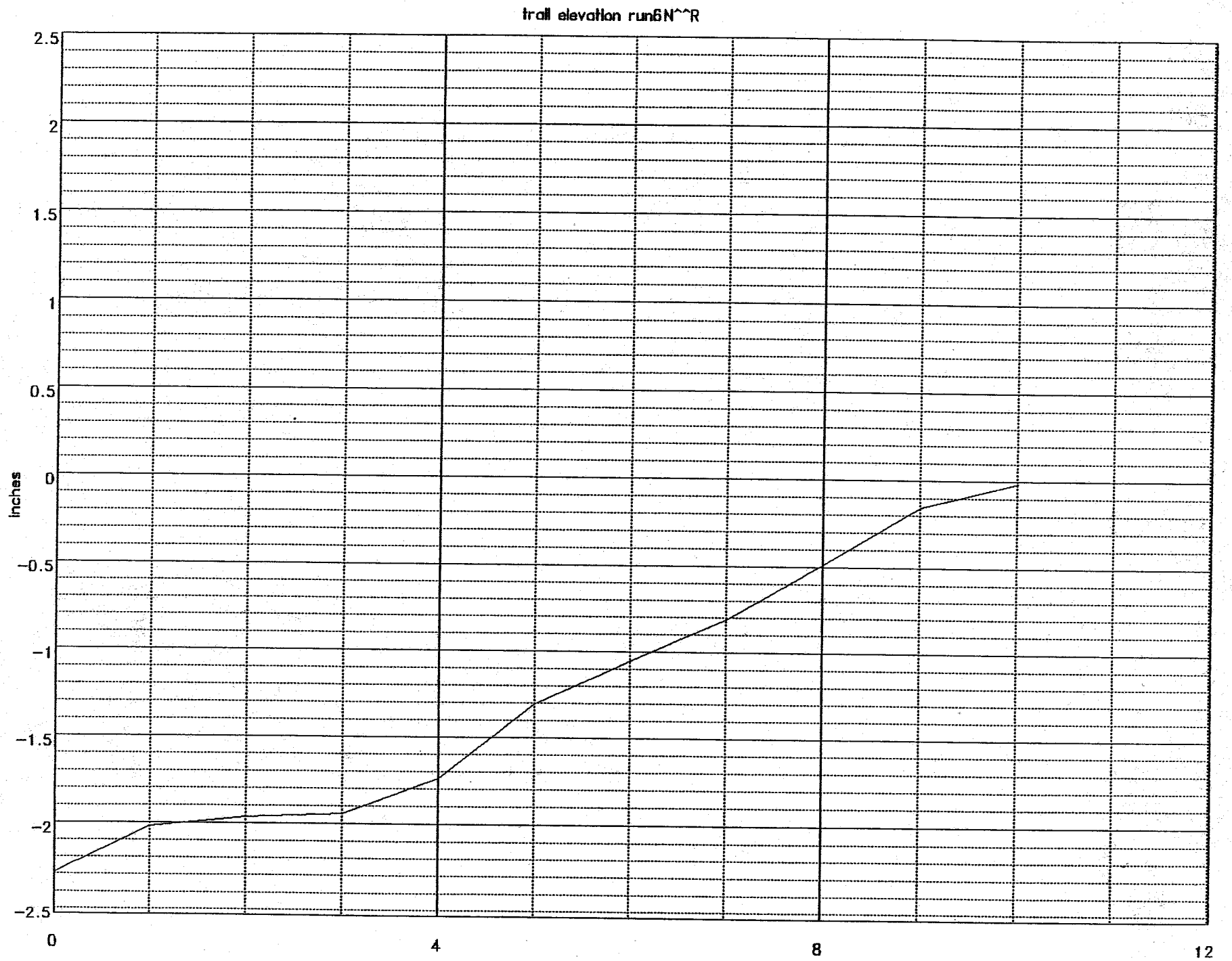

trail elevation run5N^^R
3
2
1
0
−1
−2
−3
Inches
0
4
8
12

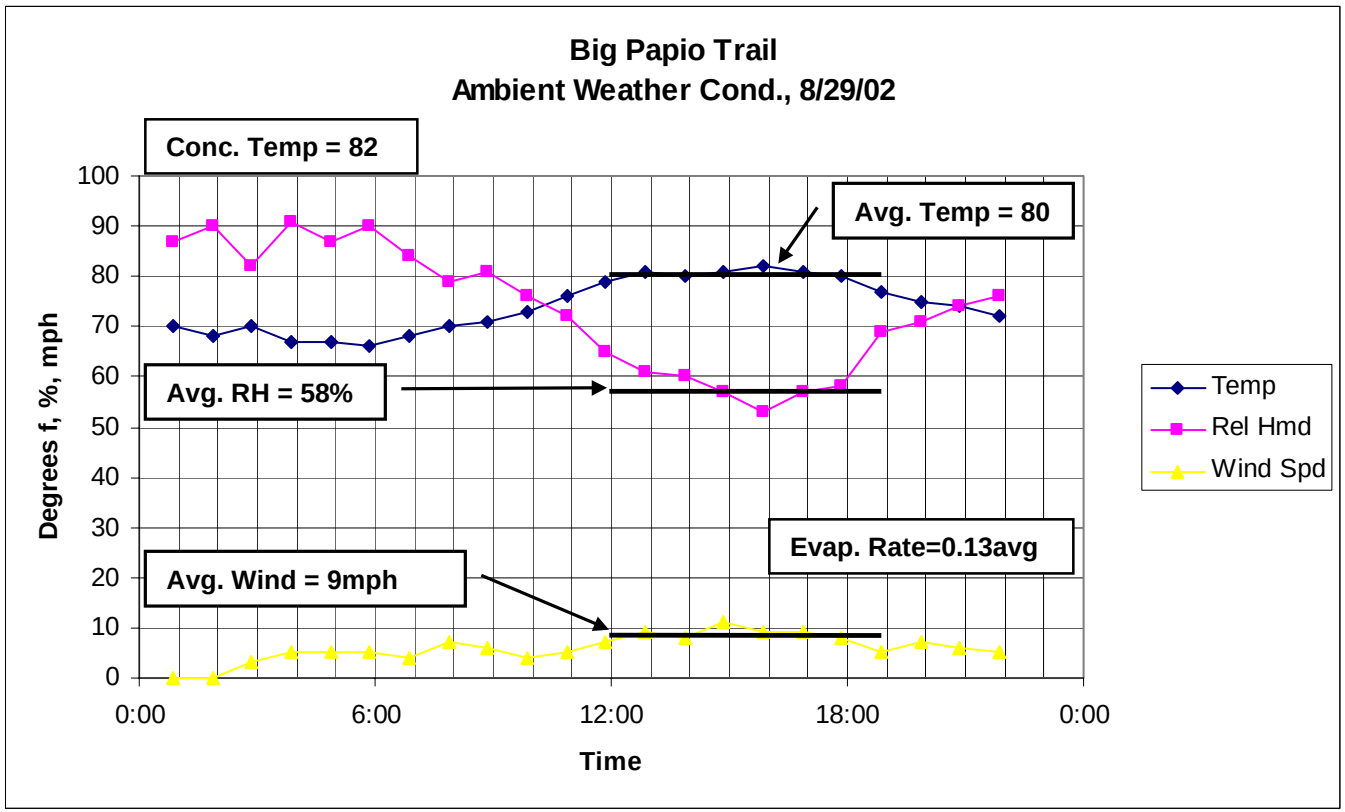

Big Papio Trail
Ambient Weather Cond., 8/10/02
Conc. Temp = 86
Avg. Temp = 87
Avg. RH = 49%
Evap. Rate=0.10avg
Avg. Wind = 5mph
Degrees f, %, mph
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
0:00
Time
Temp
Rel Hmd
Wind Spd

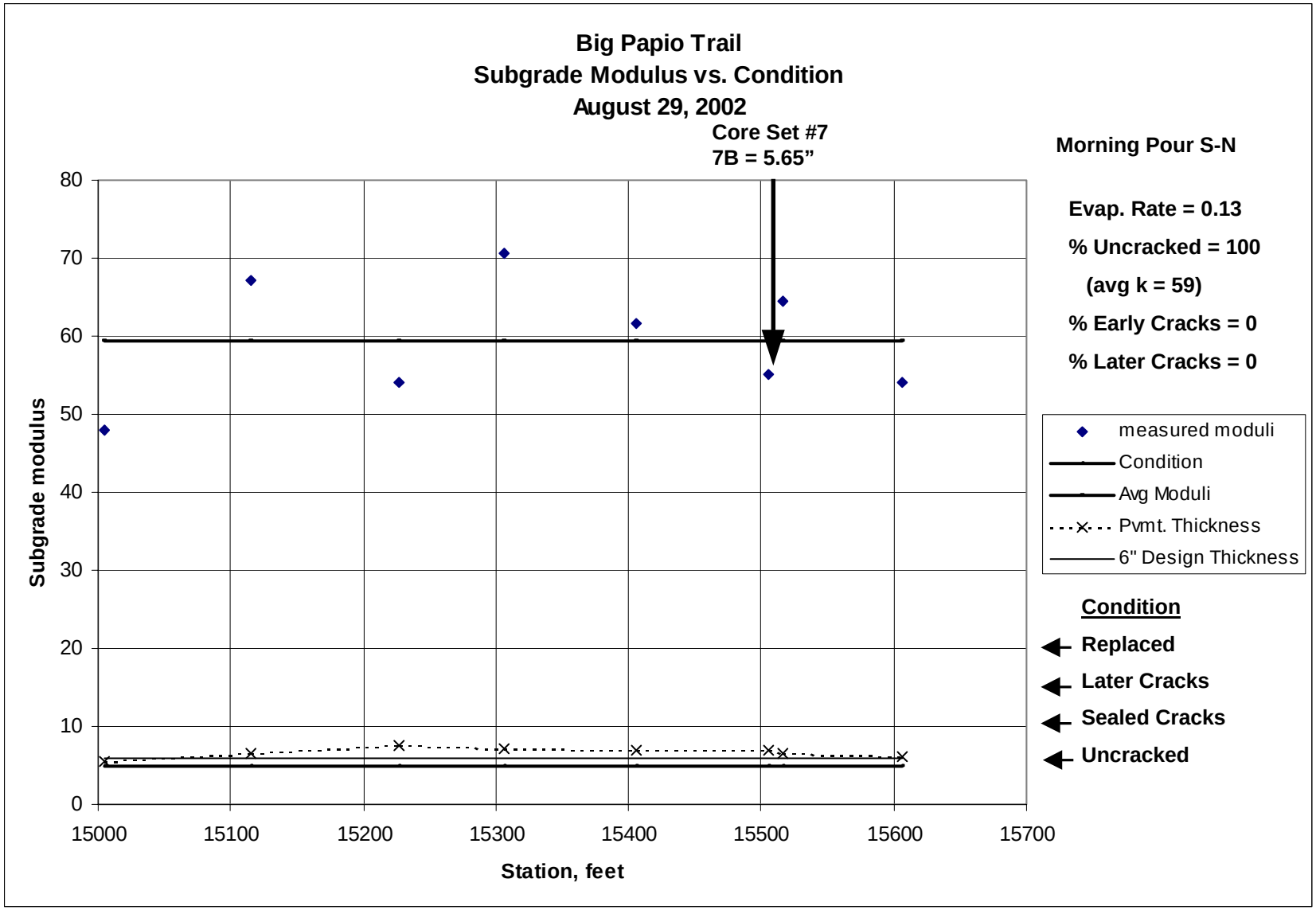

Big Papio Trail
Subgrade Modulus vs. Condition
August 10, 2002
Morning Pour S-N
Core Set #6
6B = 5.5"
Sloped Towards
Creek
Evap. Rate = 0.10
% Uncracked = 44
(avg k = 50)
% Early Cracks = 16
(avg k = 32)
% Later Cracks = 40
(avg k = 33)
Measured Moduli
Avg Moduli
Condition
Pvmt. Thickness
6" Design Thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked
Subgrade modulus
0
10
20
30
40
50
60
70
80
12400
12500
12600
12700
12800
12900
13000
13100
13200
13300
13400
13500
13600
13700
13800
Station, feet

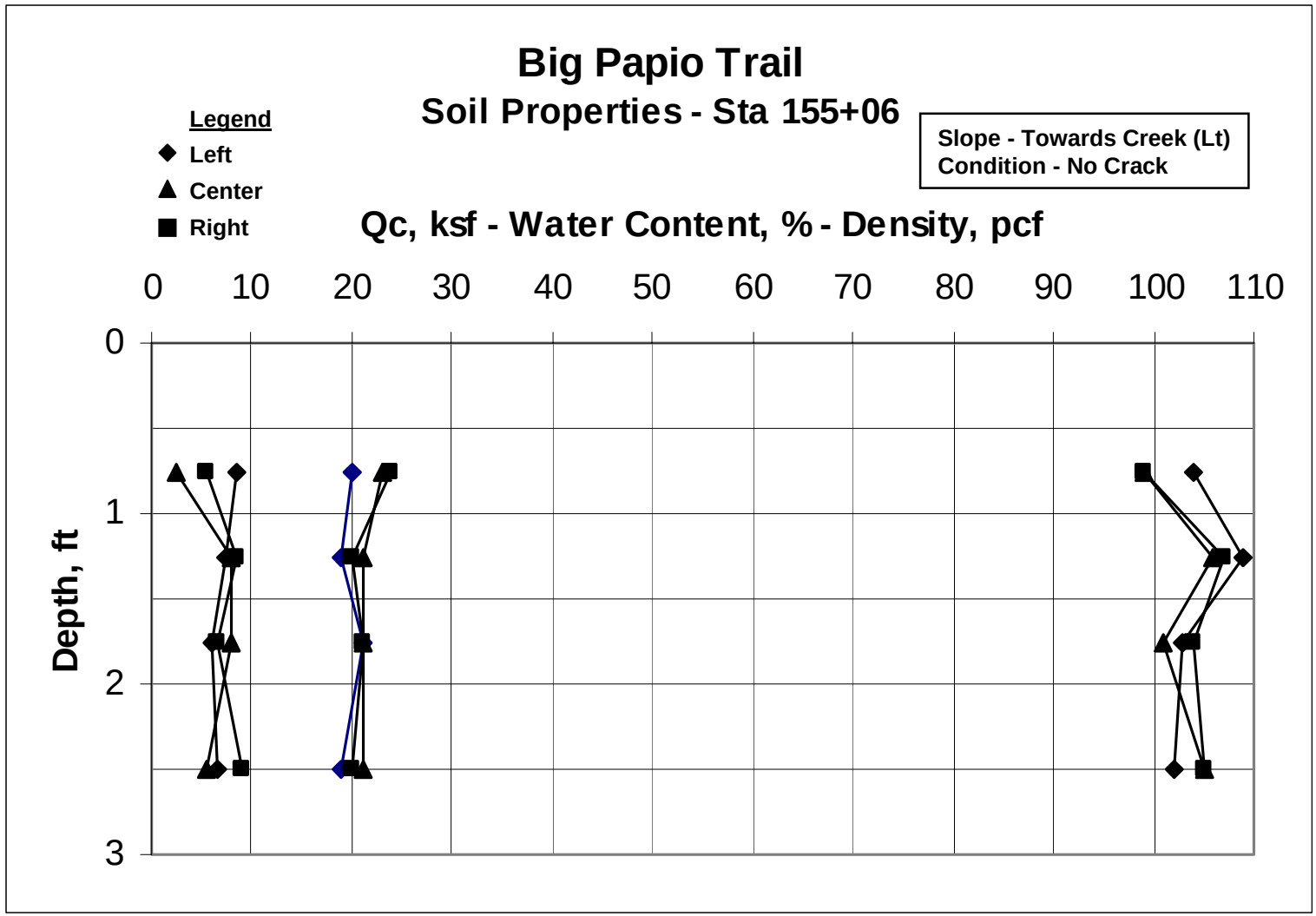

Big Papio Trail
Soil Properties - Sta 129+10
Legend
Left
Center
Right
Slope - Away from Creek (Rt)
Condition - Sealed Crack
Qc, ksf - Water Content, % - Density, pcf
0
10
20
30
40
50
60
70
80
90
100
110
Depth, ft
0
1
2
3

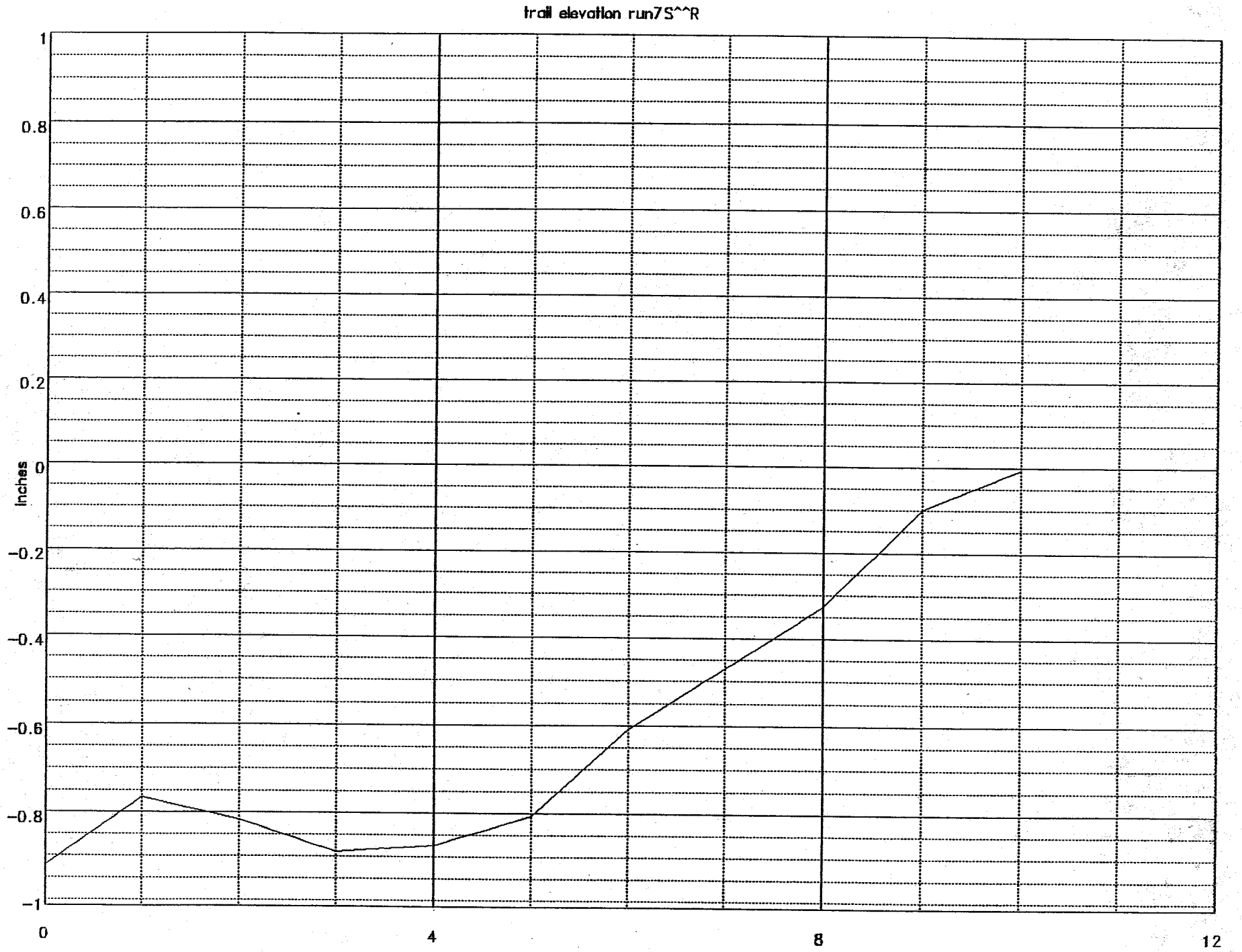

trail elevation run6S^^R
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
inches
0
4
8
12

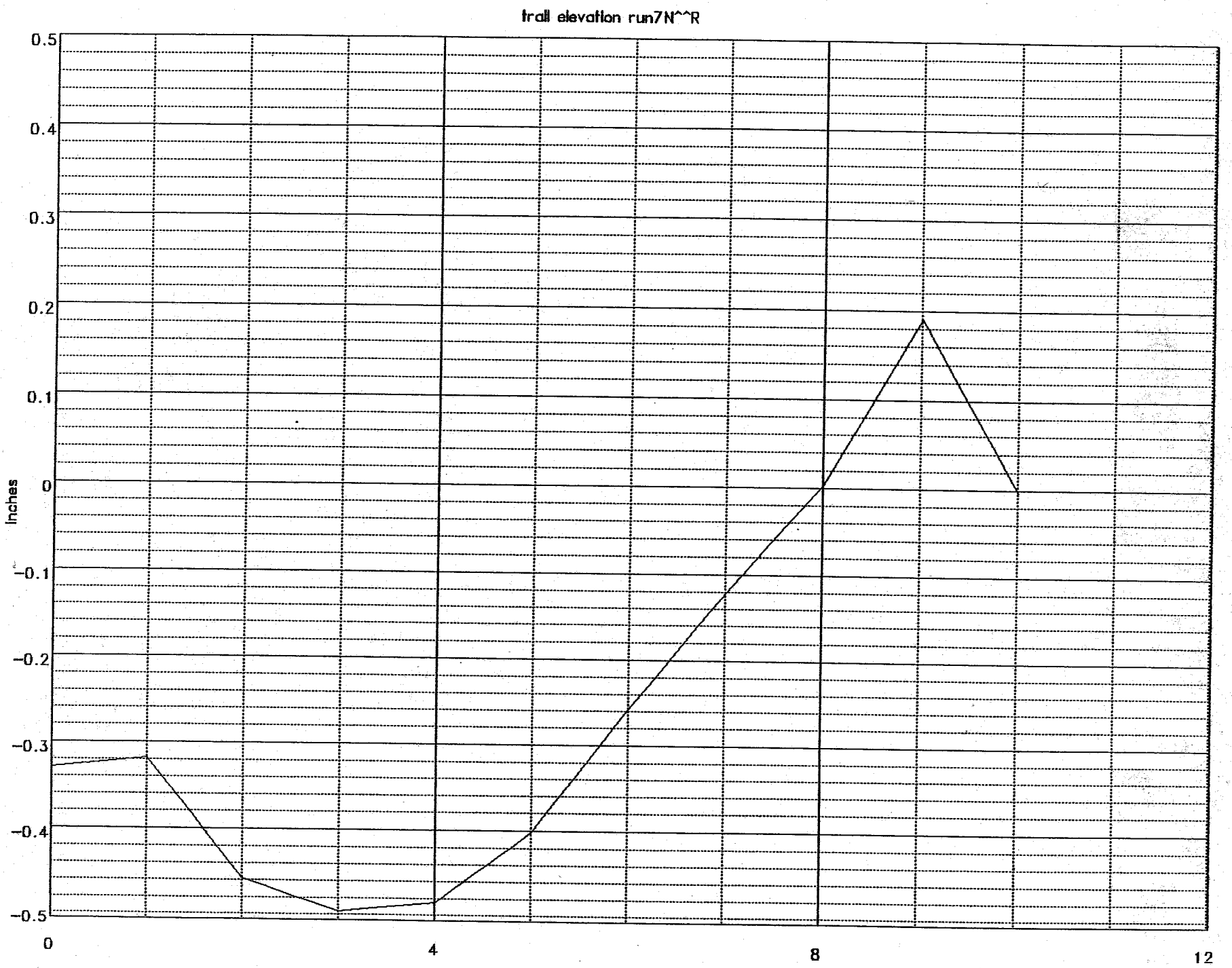

trail elevation run6N^^R
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
inches
0
4
8
12

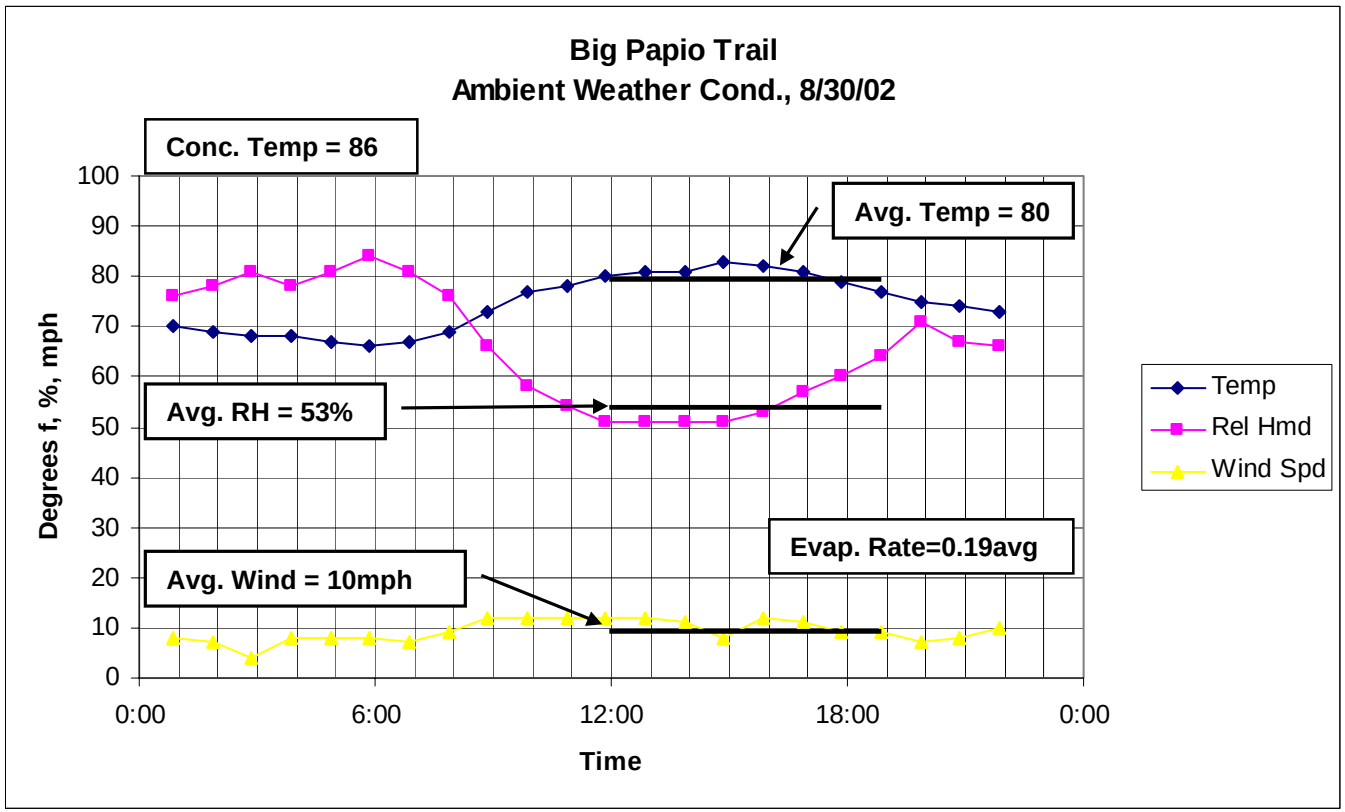

Big Papio Trail
Ambient Weather Cond., 8/29/02
Conc. Temp = 82
Avg. Temp = 80
Avg. RH = 58%
Evap. Rate=0.13avg
Avg. Wind = 9mph
Degrees f, %, mph
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
0:00
Time
Temp
Rel Hmd
Wind Spd

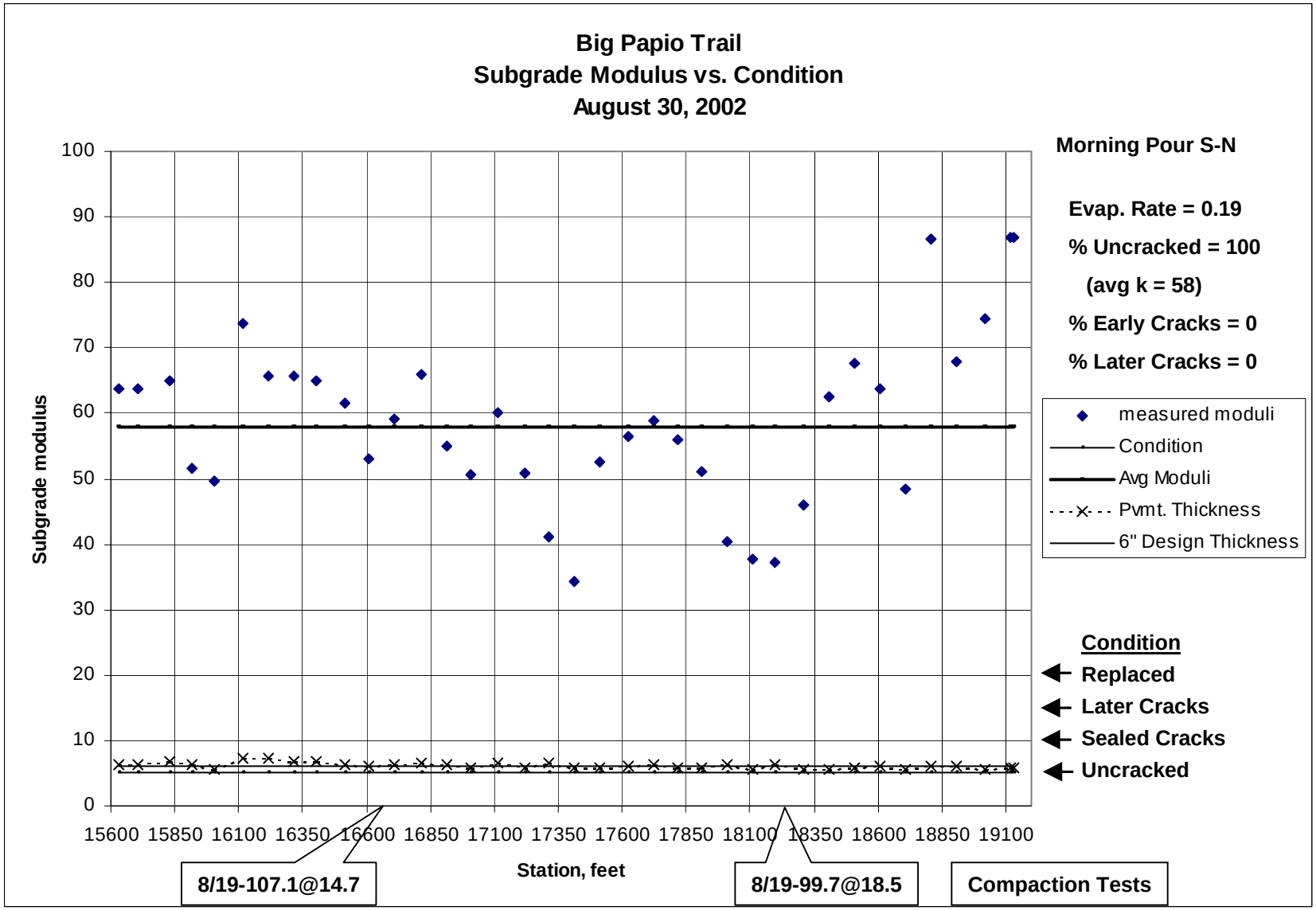

Big Papio Trail
Subgrade Modulus vs. Condition
August 29, 2002
Core Set #7
7B = 5.65”
Morning Pour S-N
Evap. Rate = 0.13
% Uncracked = 100
(avg k = 59)
% Early Cracks = 0
% Later Cracks = 0
Subgrade modulus
Station, feet
0
10
20
30
40
50
60
70
80
15000
15100
15200
15300
15400
15500
15600
15700
measured moduli
Condition
Avg Moduli
Pvmt. Thickness
6" Design Thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked

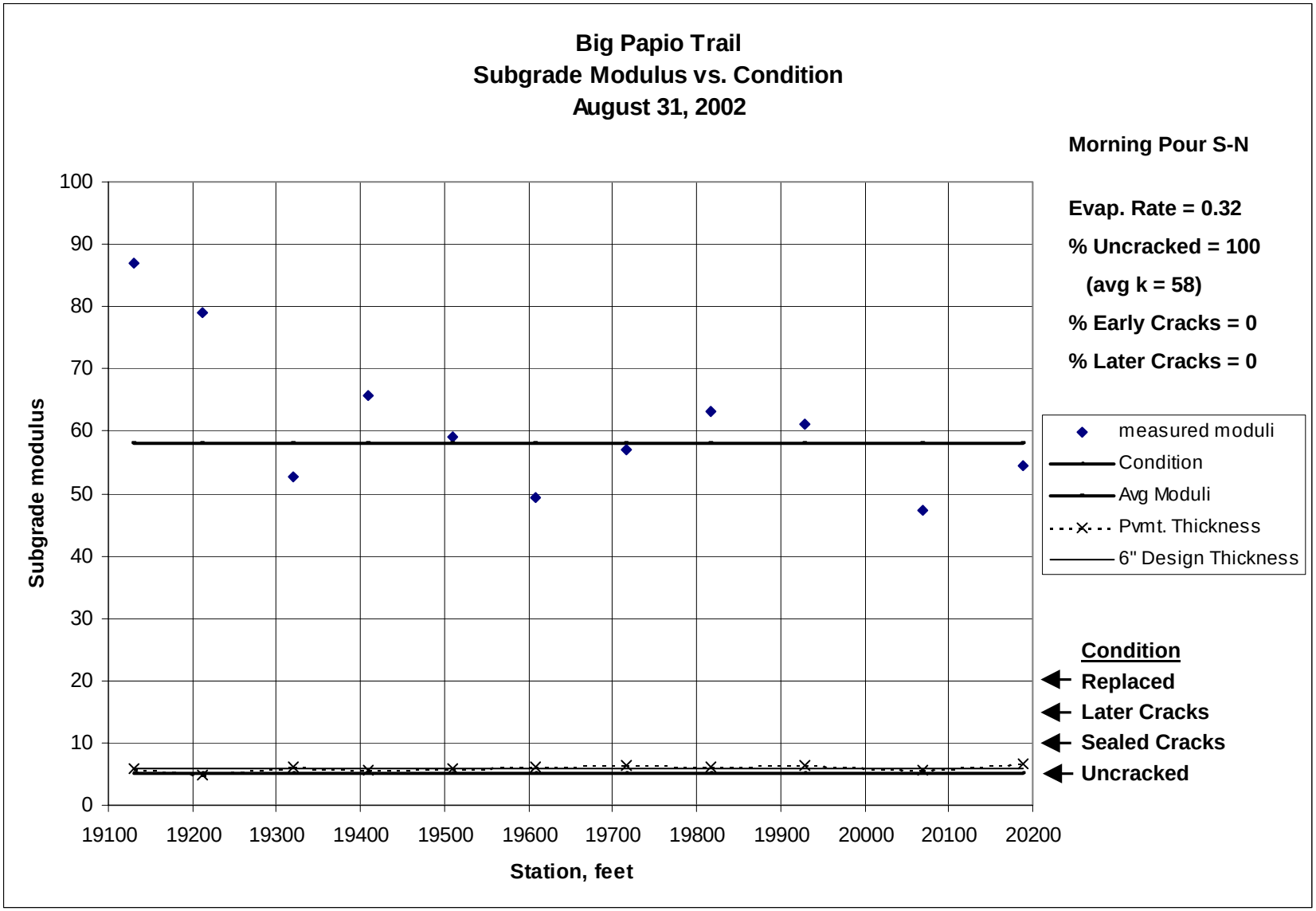

Big Papio Trail
Soil Properties - Sta 155+06
Legend
Left
Center
Right
Slope - Towards Creek (Lt)
Condition - No Crack
Qc, ksf - Water Content, % - Density, pcf
0
10
20
30
40
50
60
70
80
90
100
110
Depth, ft
0
1
2
3


trail elevation run7S^^R
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
Inches
0
4
8
12


trail elevation run7N^^R
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5
Inches
0
4
8
12


Big Papio Trail
Ambient Weather Cond., 8/30/02
Conc. Temp = 86
Avg. Temp = 80
Avg. RH = 53%
Evap. Rate=0.19avg
Avg. Wind = 10mph
Degrees f, %, mph
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
0:00
Time
Temp
Rel Hmd
Wind Spd


Big Papio Trail
Subgrade Modulus vs. Condition
August 30, 2002
Subgrade modulus
100
90
80
70
60
50
40
30
20
10
0
15600 15850 16100 16350 16600 16850 17100 17350 17600 17850 18100 18350 18600 18850 19100
Station, feet
Morning Pour S-N
Evap. Rate = 0.19
% Uncracked = 100
(avg k = 58)
% Early Cracks = 0
% Later Cracks = 0
measured moduli
Condition
Avg Moduli
Pvmt. Thickness
6" Design Thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked
8/19-107.1@14.7
8/19-99.7@18.5
Compaction Tests


Big Papio Trail
Subgrade Modulus vs. Condition
August 31, 2002
Morning Pour S-N
Evap. Rate = 0.32
% Uncracked = 100
(avg k = 58)
% Early Cracks = 0
% Later Cracks = 0
Subgrade modulus
100
90
80
70
60
50
40
30
20
10
0
19100
19200
19300
19400
19500
19600
19700
19800
19900
20000
20100
20200
Station, feet
measured moduli
Condition
Avg Moduli
Pvmt. Thickness
6" Design Thickness
Condition
Replaced
Later Cracks
Sealed Cracks
Uncracked

Big Papio Trail Pavement Distress

Pavement Condition Summary

Location	Condition	KM Summary	Current	Change
0+00 to Ped Bridge	Routed and Sealed (or rpl.)	714	775	+61?
(2025')	Open Cracks	242	100	?
Ped Bridge to Pacific	Routed and Sealed (or rpl.)	0	0	0
(7000')	Open Cracks	592	811	+219
Pacific to I-680	Routed and Sealed(or rpl.)	246	260	~
(1530')	Open Cracks	21	0	~
I-680 to ACC Trail	Routed and Sealed (or rpl.)	323	394	+62
(3470')	Open Cracks	1169	1668	+499
North Bridge to Blondo	Routed and Sealed	0	0	0
	Open Cracks	0	0	0

Approximately 2579' of open crack
Approximately 1429' of sealed crack
Total = 4008'/14025' = 29%

BIG PAPIO TRAIL
Petrographic Examination of Four Concrete Cores

Center to Blondo Streets
Omaha, Nebraska

Tom S. Patty
Consultant/Petrographer

Final Report
28 June 2004
WJE No. 2004.2668

Prepared for:
Terracon
2221 South 156th Circle
Omaha, Nebraska 68130

Prepared by:
Wiss, Janney, Elstner Associates, Inc.
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WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

BIG PAPIO TRAIL
Petrographic Examination of Four Concrete Cores

Center to Blondo Streets
Omaha, Nebraska

INTRODUCTION

At the request of Mr. Joe Waxse of Terracon located in Omaha, Nebraska, Wiss, Janney, Elstner Associates, Inc., (WJE) has performed petrographic studies for four concrete cores removed from the Omaha hike and bike facility known as Big Papio Trail. It is our understanding that the concrete for the four-mile long hike and bike trail was placed during 2003, and soon after placement significant longitudinal cracks developed in some areas. Some cracks have since been routed and sealed. The purpose of the studies was to assess the basic composition of the cores and characterize the cracks to aid in determining if properties of the mix contributed to the cracking. Accordingly, the cores, identified as 1-B, 3-B, 4-B, and 7-B, were examined using methods given in ASTM C856, *Petrographic Examination of Hardened Concrete*.

STUDIES

Sample Description

The four cores had diameters of 4 in. and lengths ranging from 5-7/8 in. to 6-3/8 in. Each core was marked with the Terracon Job No. 05035181 and identified with the following station numbers:

Core No.	Station Number
1-B	312
3-B	4706
4-B	9420
7-B	15506

Cores 1-B and 3-B were drilled over cracks, and elastomeric joint filler was in the routed crack in Core 1-B (see Figure 1).

The top surfaces of the cores had received broom-texture finishes; however, the surface of Core 1-B had been tine-grooved using diamond-blade equipment. The bottom surfaces of the cores showed that placement was on a granular-clay loam base material.

Mix Design

A mix design, marked as Lyman Richey and reportedly used on the “NRD Trail Project” from Center Street to Blondo Street, called for 513 lbs. cement, 51 lbs. fly ash, and 0.45 lb. /lb. water. The strength requirement was reported to be 4000 psi.

Petrographic Examination

The concrete mix represented by all four cores contained a crushed limestone coarse aggregate having a nominal top size of 3/4 in. The fine aggregate was natural siliceous sand. The aggregates appeared normal in gradation, distribution, and soundness.

The cementitious materials content (cement plus fly ash) was estimated at 5-1/2 to 6 bags per cubic yard. The fly ash component was estimated at 15 to 20 percent of the total cementitious materials. The optical and textural features of the hydration products were consistent with concrete having a water-cementitious materials ratio (w/cm) in the range of 0.45 to 0.50. Although consolidation appeared normal and adequate, entrapped air voids were present in all four cores.

Each of the cores was air-entrained with estimated air contents as follows:

Core No.	Estimated Air (%)
1-B	6 to 6-1/2
3-B	5-1/2 to 6
4-B	6 to 6-1/2
7B	5 to 5-1/2

Crack Features

The cracks observed in Core 1-B passed vertically through some of the coarse limestone aggregate particles and several of the coarse particles in Core 3-B indicating that the slab had gained significant strength before the cracking occurred. Indications of some water loss into the base material were slight, but a zone of darker paste adjacent to the bottom of Core 1-B was readily apparent. Dark zones at the bottoms of Cores 3-B, 4-B, and 7-B were less apparent (see Figures 2, 3, and 4).

CONCLUSIONS

The petrographic studies indicated that all four cores were consistent with the submitted mix design. Features of the mix did not indicate the cause of the cracking. Since the cracks are longitudinal and passed through some of the coarse aggregate particles, the cause for the cracking may be related to environmental influences (soil mechanics) and/or loading by equipment using the trail as a roadway.

NOTE: Samples will be discarded after 90 days unless other disposition is requested. Charges will be made for storage after that period.

Figure 1. Scanned image of section through Core 1-B showing routed crack with sealer and full-depth view of crack. Note the darkened paste zone adjacent to the bottom, indicating water loss into the base material while the mix was still plastic.

Figure 2. Full-depth crack in Core 3-B. The cracks pass through limestone coarse aggregates and some of the siliceous granitic gravel particles.

Figure 3. Scanned image of Core 4-B.

Figure 4. Scanned image of Core 7-B.

Memorandum

TO: PPO Subcommittee

SUBJ: Site Grading for Amphitheater at Walnut Creek

DATE: June 28, 2004

FROM: Randy Lee, Assistant Park Superintendent

The Papillion Area Concert Band (PACB) has requested a joint effort between the City of Papillion and the Papio-Missouri River Natural Resources District to work together to grade the future Amphitheater site. The City of Papillion City Council has approved a resolution to allow their Public Works staff to assist with the grading project and provide the necessary equipment available from the city to complete the grading project.

The grading will require approximately 31,000 cubic yards of material to be cut and placed on the site. I consulted with Jeff Ray the Civil Engineer with Schemmer & Associates for the Amphitheater project about an estimate for the cost of grading. He concluded that a job of this size would cost approximately $1.25 per cubic yard to be cut and placed on the site.

This agreement if approved will begin to foster a working relationship between the City of Papillion and the NRD at the recreation area and possibly co-sponsor other projects and begin a process over the next several years to prepare for the eventual transfer of the Recreation Area to the City of Papillion.

Management recommends that the subcommittee recommend to the Board that the General Manager be authorized to coordinate with the City of Papillion to provide manpower and equipment for the purpose of grading the Amphitheater site.

From: Ray, Jeff [mailto:jray@schemmer.com]
Sent: Thursday, June 24, 2004 2:39 PM
To: RLEE@WALNUTCRK.ORG
Subject: FW: Site balance - adjustment of compaction factor.

RANDY

THE DIRT NUMBERS FOR THE AMPHITHEATER NOTE THE CUT IS THE SAME NUMBER FOR ALL AND WE CAN ADJUST THE FILL ON SITE TO MAKE IT WORK

THANKS

JEFF RAY

-----Original Message-----
From: Jorgensen, Brent
Sent: Wednesday, April 07, 2004 3:05 PM
To: Ray, Jeff
Subject: Site balance - adjustment of compaction factor.

Site Balances:

35% Compaction:
Current stratum: Fg_Eg
Site name = 441402
Cut = 30886 yards Fill = 33411 yards
Net = 2525 yards FILL

30% Compaction:
Site name = 441402
Cut = 30886 yards Fill = 32173 yards
Net = 1287 yards FILL

25% Compaction:
Current stratum: Fg_Eg
Site name = 441402
Cut = 30886 yards Fill = 30936 yards
Net = 50 yards FILL

Brent Jorgensen, RLS
The Schemmer Associates

1044 N 115th Street, Suite 300
Omaha NE, 68154-4436
402.493.4800
402.493.7951 Fax

NRD FILE COPY

DEVELOPMENT AGREEMENT

BETWEEN

THE PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT

AND

PAPILLION AREA CONCERT BAND

THIS AGREEMENT (hereinafter referred to as "this Agreement") is entered into as of this 12th day of August, 1999, by and between the **PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT** (hereinafter referred to as "the **NRD**"), a governmental subdivision of the State of Nebraska, for itself and for its successors and assigns, and **PAPILLION AREA CONCERT BAND** (hereinafter referred to as "PACB") a non-profit corporation organized and existing under the laws of the State of Nebraska.

WHEREAS, the NRD is the owner of a tract of land (hereinafter referred to as "the Recreation Area") located southwest of the intersection of 96th Street and State Highway 370, near Papillion, in Sarpy County, Nebraska, which was acquired by the NRD for the NRD's Dam Site 21 Project, now known as the Walnut Creek Recreation Area; and,

WHEREAS, PACB has proposed that the NRD grant to PACB a lease permitting PACB to construct, operate, maintain and use outdoor amphitheater facilities on approximately three (3) acres of land (hereinafter referred to as "the Amphitheater Complex") within the Recreation Area, east of Walnut Creek Lake and north of the existing parking area, such facilities to consist of an outdoor performing arts amphitheater, public restrooms and a concession area (all hereinafter collectively referred to as "the PACB Facilities"), the proposed lease (hereinafter referred to as "the

PACB Lease") to be in the form as attached hereto as Exhibit "A" and incorporated herein by reference; and,

WHEREAS, a diagram showing the approximate boundaries of the Amphitheater Complex, and showing the expected location and configuration of the PACB Facilities therein, is attached hereto as Exhibit "B" and incorporated herein by reference; and,

WHEREAS, PACB has proposed that PACB design and that the NRD construct and maintain an 80-110-car expansion (hereinafter referred to as "the PACB Parking Expansion") of the existing NRD public parking area east of Walnut Creek Lake, constructed to the same standards as such existing parking area; and,

WHEREAS, the NRD is willing to accept PACB's proposals and willing to grant the Lease, subject to the approval of this Agreement by the Mayor and Council of the City of Papillion, Nebraska (which expects to assume responsibility for the Recreation Area in the future), and subject to compliance by PACB with the terms and conditions hereinafter provided.

NOW, THEREFORE, in consideration of the mutual covenants of the parties, contained herein, it is hereby agreed between the parties as follows:

1. **SCHEMATIC DESIGN OF THE PACB FACILITIES**. - Within 1460 days after the effective date of this Agreement, with the aid of such architects and engineers as PACB deems necessary and at PACB's sole cost and expense, PACB shall prepare written schematic plans and preliminary cost estimates for the PACB Facilities in the Amphitheater Complex, and for the PACB Parking Expansion, and shall submit such schematic plans and cost estimates to the NRD for its approval, which approval shall not be withheld unreasonably.

2. **PRELIMINARY DESIGN OF THE PACB FACILITIES.** - Within 90 days after the NRD's approval of PACB's written schematic plan for the PACB Facilities and for the PACB Parking Expansion, with the aid of such architects and engineers as PACB deems necessary and at PACB's sole cost and expense, PACB shall prepare design development drawings and cost estimates for the PACB Facilities and for the PACB Parking Expansion and shall submit such drawings, cost estimates to the NRD for its approval of such drawings. It shall be the responsibility of NRD to prepare the a proposed metes and bounds legal description of the Amphitheater Complex and surrounding area.

3. **FINAL DESIGN OF THE PACB FACILITIES.** - Within 90 days after the NRD's approval of the design development drawings for the PACB Facilities and for the PACB Parking Expansion, and with the aid of such architects and engineers as PACB deems necessary, PACB, at its sole cost and expense, shall prepare final plans, specifications and cost estimates for the PACB Facilities, and final plans, specifications and cost estimates for the PACB Parking Expansion, and shall submit such final plans, specifications and cost estimates to NRD for its written approval.

4. **AMPHITHEATER FINANCING.** - Within ten (10) years after the effective date of this Agreement PACB shall submit to the NRD for its approval a written verification from a bank authorized to do business in the State of Nebraska that PACB has unencumbered funds on deposit in such bank in an amount equal to or greater than the architect's estimate of the costs of construction of the PACB Facilities. If such submission to the NRD occurs more than one year after the date of the NRD"s written approval of PACB's final plans, specifications and cost estimates for the PACB Facilities, such submission shall be accompanied by an architect's up-dated estimate of the cost of the PACB Facilities. The NRD, as a condition to its approval of such verification, may require that PACB give sufficient

security that the PACB Facilities to be constructed will be completed free and clear of liens and in a manner satisfactory to the NRD.

5. **EXECUTION OF LEASE.** - After PACB's submission of the aforesaid bank verification, if within ten (10) years after the effective date of this Agreement, the NRD and PACB shall execute the PACB Lease in the form as attached hereto as Exhibit "A," the PACB Lease to relate to the tract of land described in the legal description of the Amphitheater Complex submitted by PACB and approved by the NRD. The PACB Lease and this Agreement shall be construed together. If such bank verification has not been submitted to the NRD within ten (10) years after the effective date of this Agreement, then the NRD may, without demand of any kind or notice to PACB or any other person, declare this Agreement terminated.

6. **AMPHITHEATER CONSTRUCTION.** - Within 6 months after the execution of the PACB Lease, and, with the aid of such contractors and other assistants as PACB deems necessary, PACB, at its cost and expense, shall commence construction of the PACB Facilities in the Amphitheater Complex; and within eighteen (18) months after the commencement of such construction, PACB shall finish construction of the PACB Facilities, such construction to be performed in a good and workmanlike manner, at PACB's sole cost and expense, and in accordance with the final plans and specifications approved by the NRD. NRD may approve granting of an extension if the majority of the construction is finished within 18 months which approval shall not be withheld unreasonably.

7. **CONSTRUCTION OF SUBSEQUENT PACB FACILITIES.** - During or after construction of the PACB Facilities, and with the aid of such contractors and other assistants as PACB deems necessary, PACB, at its cost and expense, may construct the additional facilities of the PACB Facilities in the Amphitheater Complex in

accordance with plans and specifications of the PACB Facilities submitted by PACB and approved by the NRD. Such construction to be performed in a good and workmanlike manner, at PACB's sole cost and expense.

8. **CONSTRUCTION OF PARKING FACILITIES.** - Within ninety (90) days after PACB's commencement of construction of the PACB Facilities, with the aid of such contractors as the NRD deems necessary and at NRD's sole cost and expense, the NRD shall commence construction of the PACB Parking Area in the Amphitheater Complex, and the NRD shall finish construction of such PACB Parking Area within six (6) months after the commencement of construction thereof, all at the NRD's sole cost and expense and in accordance with the final plans and specifications prepared by PACB and approved by the NRD. Upon completion of construction thereof, the PACB Parking Area shall be opened and remain equally available to the public and to the patrons of the PACB.

9. **ENTRANCE SIGN.** - After PACB's construction of the PACB Facilities, PACB, and at its own cost and expense, may construct and maintain a sign at the 96th Street entrance to the Recreation Area identifying the PACB Facilities, in accordance with plans and specifications for such sign prepared by PACB and approved in writing by the NRD which approval shall not be withheld unreasonably.

10. **EFFECTIVE DATE OF AGREEMENT.** - This Agreement shall be effective after execution hereof by both parties and upon approval hereof being endorsed at the foot of this Agreement by the Mayor of the City of Papillion, Nebraska, such approval to be made pursuant to an authorizing resolution adopted by the City Council of the City of Papillion, Nebraska.

11. **APPLICABLE LAW.** - Each party to this Agreement shall follow all statutes, both federal and state, together with existing ordinances as may be applicable, in carrying out the faithful performance and terms of this Agreement. Each party hereto shall, whenever applicable, require performance under the Fair Labor Standards Act.

12. **AUTHORIZED OFFICIALS.** - The President of PACB and the General Manager of the NRD are authorized to take such actions and make such determinations on behalf of their respective parties as are required or permitted for the respective parties by this Agreement and as such officers in their discretion determine necessary.

13. **DURATION.** - This Agreement shall have permanent duration, commencing upon the execution hereof by the parties.

14. **USE COVENANTS.** - Except as otherwise provided herein or otherwise authorized in writing by the NRD, PACB shall use the Amphitheater Complex solely for musical and/or theatrical performances and/or educational functions, and/or community activities related thereto, including without limitation the sale of refreshments and food in connection with such performances, and may charge reasonable attendance fees for such performances.

15. **CONSTRUCTION OF IMPROVEMENTS** - Except as otherwise provided herein or otherwise authorized in writing by the NRD, PACB shall not make any improvement to or alteration or modification of the Amphitheater Complex or other portion of the Recreation Area without written plans and specifications for such improvement, alteration or modification being first submitted to and approved in writing by the NRD. Any improvements, alterations or modifications made by PACB to the Amphitheater Complex shall become part of the Recreation Area and the property of the NRD.

16. **PERSONAL PROPERTY** - All personal property of PACB or any of its members in the Recreation Area shall be at the sole risk of PACB.

17. **HOLD HARMLESS** - PACB agrees to defend, indemnify and hold the NRD harmless from and against any and all claims and causes of action for personal injury, property damage, or property loss arising out of, in the course of, or as a result of the use or occupancy of the Recreation Area by PACB or any of its officers, agents, employees, contractors, permittees, patrons or invitees, except as may be solely and proximately caused by the negligence of the NRD, its officers, agents or employees.

18. **DEFAULT.** - Should PACB make default in the performing, fulfilling, keeping or observing of any of PACB's covenants, conditions, provisions or agreements herein contained, or should a petition in bankruptcy be filed by PACB or should PACB be adjudged bankrupt or insolvent by any court or should a trustee or receiver in bankruptcy or a receiver of any property of PACB be appointed in any suit or proceeding by or against PACB or should this Agreement by operation of law pass to any person other than PACB, then an in any of such events, the NRD may, without demand of any kind or notice to PACB or any other person, at once declare this Agreement terminated.

19. **AMENDMENT** - The terms and conditions of this Agreement may be amended only in writing by the mutual agreement of the parties.

20. **ASSIGNMENT** - PACB may not transfer, assign or hypothecate this Agreement or transfer, assign or hypothecate any of the rights granted thereby without written approval, excepting only transfer, assignment or hypothecation to the City of Papillion for which this document shall constitute such written approval.

Executed by **PACB** on this 26th day of September, 1999

PAPILLION AREA CONCERT BAND, a Nebraska non-profit corporation

By _____
President

Attest:

_____
Secretary

Executed by the **NRD** on this 12th day of August, 1999.

PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT

By _____
General Manager

Approved by the **CITY OF PAPILLION, NEBRASKA**, on this 21st day of October, 1999.

CITY OF PAPILLION CORPORATE SEAL MAY 9, 1893 NEBRASKA

CITY OF PAPILLION, NEBRASKA

By _____
Mayor