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File FP-1995-209

Date 12/9/99

Present	Scanned	
		A few items are denoted with an asterisk (*), which means they are to be scanned for permanent record on the ISYS retrieval system. In some instances, not all entries designated to be scanned are present in the file. There are also documents specific to certain files, not found on the standard list. For this reason, a checklist has been included. Remaining items, (not selected for scanning), will be marked present on the checklist. This index can serve as a quick guide for the contents of each file. Files denoted with (**) are to be located using the ISYS Query System. Planning Clearance will need to be typed in full, as well as other entries such as Ordinances, Resolutions, Board of Appeals, and etc.
X	X	***Summary Sheet – Table of Contents**
X	X	Application form
X		Receipts for fees paid for anything
X	X	***Submittal checklist**
X	X	***General project report**
		Reduced copy of final plans or drawings
		Reduction of assessor's map
		Evidence of title, deeds
		***Mailing list**
		Public notice cards
		Record of certified mail
		Legal description
		Appraisal of raw land
		Reduction of any maps – final copy
		***Final reports for drainage and soils (geotechnical reports)**
		Other bound or nonbound reports
		Traffic studies
		Individual review comments from agencies
X	X	***Consolidated review comments list**
		***Petitioner's response to comments**
		***Staff Reports**
		***Planning Commission staff report and exhibits**
		***City Council staff report and exhibits**
		***Summary sheet of final conditions**
		***Letters and correspondence dated after the date of final approval (pertaining to change in conditions or expiration date)**

DOCUMENTS SPECIFIC TO THIS DEVELOPMENT FILE:

X	X	Development Improvements Agreement - **	X	X	Letter from Kristen Ashbeck to Trevor Brown – 11/1/95
X		Request for Disbursement	X		Letter from Jody Kliska to Chris Carnes re: drainage fee- 6/2/95
X		E-mail from Shawn Cooper to Marcia Rabideaux – 12/8/95	X	X	Letter from Kristen Ashbeck to Chris Carnes re: Fee for North Valley – Filing #2 – 2/20/96
X		Declaration of Coveneants, conditions and Restrictions	X		UCC Sign-off
X		TCP Fee Excemption	X		Treasurer's Certificate of Taxes Due – 11/30/95
X		Recording of plat	X	X	Final Drainage Report
X	X	Letter from Kristen Ashbeck to Trevor Brown – 12/19/95	X		Subsurface Soils Exploration
X		Map of North Valley Subdivision – Filing One	X	X	Planning Commission Minutes - ** - 7/5/94
X		Final Plan North Valley - Filing two			
X		Utility Composite Plan			
X		Grading & Stormwater			
X		Street & Sewer Plan & Profile			
X		General Notes & Typical Sections			
X		Standard Sewer Details			

SUBMITTAL CHECKLIST

MAJOR SUBDIVISION: FINAL

Location: North Valley Project Name: 24 3/4 - N. of G Rd

Date Received ______

Receipt # ______

File # ______

ITEMS — DESCRIPTION	SSID REFERENCE	● City Community Development	● City Dev. Eng.	● City Utility Eng.	● City Property Agent	● ~~City Parks/Recreation~~ INCLUDE	● City Fire Department	● City Attorney	● ~~City G.J.P.C. (8 sets)~~	○ City Downtown Dev. Auth.	● ~~City Police~~ INCLUDE	○ County Planning	○ County Building Department	● County Surveyor	○ Walker Field	○ School Dist. #51	● Irrigation District G.V.	● Drainage District G.J.	● Water District Ute	○ Sewer District	● U.S. West	● Public Service	● GVRP	○ CDOT	○ Corps of Engineers	○ Colorado Geologic Survey	○ U.S. Postal Service	● ~~Persigo WWTF~~	● ~~TCI Cable~~	TOTAL REQ'D 15
● Application Fee $180	VII-1	1																												
● Submittal Checklist*	VII-3	1																												
● Review Agency Cover Sheet*	VII-3	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
● Application Form*	VII-1	1	1	1	1	1	1	1	8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
~~● Reduction of Assessor's Map~~	~~VII-1~~	1	1	1	1	1	1	1	8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
~~● Evidence of Title~~	~~VII-2~~	1			1			1																						
○ Appraisal of Raw Land	VII-1	1			1	1																								
~~● Names and Addresses*~~	~~VII-2~~	1																												
~~● Legal Description*~~	~~VII-2~~	1			1																									
○ Deeds	VII-1	1			1			1																						
○ Easements	VII-2	1	1	1	1			1													1	1	1						1	
○ Avigation Easement	VII-1	1			1			1							1															
○ ROW	VII-2	1	1	1	1			1													1	1	1						1	
● Covenants, Conditions & Restrictions	VII-1	1	1					1																						
○ Common Space Agreements	VII-1	1	1					1																						
● County Treasurer's Tax Cert.	VII-1	1																												
● Improvements Agreement/Guarantee*	VII-2	1	1	1				1																						
○ CDOT Access Permit	VII-3	1	1																											
○ 404 Permit	VII-3	1	1																											
○ Floodplain Permit*	VII-4	1	1																											
● General Project Report	X-7	1	1	1	1	1	1	1	8	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	
~~● Composite Plan~~	~~IX-10~~	1	2	1	1																									
~~● 11"x17" Reduction Composite Plan~~	~~IX-10~~	1				1	1	1	8	1	1	1	1				1	1	1	1	1	1	1	1	1	1		1	1	
● Final Plat	IX-15	1	2	1	1	1	1	1	8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
~~○ 11"X17" Reduction of Final Plat~~	~~IX-15~~	1							8	1	1	1			1	1	1	1	1	1	1	1	1				1		1	
~~● Cover Sheet~~	~~IX-11~~	1	2																											
● Grading & Stormwater Mgmt Plan	IX-17	1	2															1							1	1			1	
● Storm Drainage Plan and Profile	IX-30	1	2															1			1	1	1						1	
● Water and Sewer Plan and Profile	IX-34	1	2	1			1												1	1	1	1	1					1	1	
● Roadway Plan and Profile	IX-28	1	2															1												
○ Road Cross-sections	IX-27	1	2																											
● Detail Sheet	IX-12	1	2																											
○ Landscape Plan	IX-20	2	1	1					8																					
● Geotechnical Report	X-8	1	1																							1				
○ Phase I & II Environmental Report	X-10,11	1	1																											
● Final Drainage Report	X-5,6	1	2															1												
○ Stormwater Management Plan	X-14	1	2															1							1					
○ Sewer System Design Report	X-1[illegible]	1	2	1																1										
○ Water System Design Report																														
○ Traffic Impact Study																								1						
○ Site Plan																														

NOTES * An asterisk in the item descri[illegible]

Post-it® Fax Note 7671

Date 11/13/95	# of pages ▸ 1
To KRISTEN ASHBECK	From TREVOR BROWN
Co./Dept. COMMUNITY DEVELOPMENT	Co. ROLLAND ENG.
Phone # 244-1437	Phone # 243-8300
Fax # 244-1599	Fax # 241-1273

DEVELOPMENT APPLICATION

Community Development Department
250 North 5th Street, Grand Junction, CO 81501
(303) 244-1430

Receipt ______
Date ______
Rec'd By ______

File No. FP-95-209

We, the undersigned, being the owners of property situated in Mesa County, State of Colorado, as described herein do hereby petition this:

PETITION	PHASE	SIZE	LOCATION	ZONE	LAND USE
[X] Subdivision Plat/Plan	[ ] Minor [X] Major [ ] Resub	Approx. 5 acres	24 3/4 Road & G Road	PR 4.1	Residential
[ ] Rezone				From: To:	
[ ] Planned Development	[ ] ODP [ ] Prelim [ ] Final				
[ ] Conditional Use					
[ ] Zone of Annex					
[ ] Variance					
[ ] Special Use					
[ ] Vacation					[ ] Right-of Way [ ] Easement
[ ] Revocable Permit					

[X] PROPERTY OWNER	[X] DEVELOPER	[X] REPRESENTATIVE
G Road LLC (Name)	G Road LLC (Name)	ROLLAND Engineering (Name)
22 Pyramid Road (Address)	1401 N 1st (Address)	405 Ridges Blvd., Suite A (Address)
Aspen, CO 81611 (City/State/Zip)	Grand Jct., CO 81501 (City/State/Zip)	Grand Jct., CO 81503 (City/State/Zip)
( )241-4000 (Remax) (Business Phone No.)	( )241-4000(Remax) (Business Phone No.)	(970)243-8300 (Business Phone No.)

NOTE: Legal property owner is owner of record on date of submittal.

We hereby acknowledge that we have familiarized ourselves with the rules and regulations with respect to the preparation of this submittal, that the foregoing information is true and complete to the best of our knowledge, and that we assume the responsibility to monitor the status of the application and the review comments. We recognize that we or our representative(s) must be present at all required hearings. In the event that the petitioner is not represented, the item will be dropped from the agenda, and an additional fee charged to cover rescheduling expenses before it can again be placed on the agenda.

[signature] 12/1/95

Signature of Person Completing Application — Date

* [signature] 12/1/95

Signature of Property Owner(s) - attach additional sheets if necessary — Date

NARRATIVE
NORTH VALLEY SUBDIVISION, FILING NO. TWO

Date: November 30, 1995

Prepared for:
G Road, LLC
c/o Mr. Chris Carnes
1401 N. 1st
Grand Junction, CO 81501

Prepared by:
ROLLAND Engineering
405 Ridges Blvd., Suite A
Grand Junction, CO 81503

North Valley Subdivision is located at 24 3/4 Road and G Road. The site is a total of twenty acres with ten acres having been approved for construction during the initial planning process approval. The original narrative stated that the Developers, G Road LLC, were intending to develop 38 lots on the south ten acres with the construction of Filing No. One and Two. Filing No. One consists of eighteen lots and has approximately twelve houses completed. Filing No. Two will be an additional twenty lots as originally proposed and designed.

All utilities are available at the present street stubs and will only require extension up the newly constructed streets.

Storm drain analysis was originally done for the entire twenty acres. A storm drain for the southern ten acres, Filings No. One and Two, was constructed during the construction of Filing No. One.

The two north-south streets in North Valley Subdivision, North Valley Drive and Monument View Drive, will be connected by an all weather (A.B.C. Class 6), twenty foot wide, road. This access road will be constructed on a temporary easement that will be extinguished upon future filings of North Valley.

All criteria from Filing No. One such covenants and lot setbacks are being carried forward to Filing No. Two.

North Valley Subdivision , Plats for Filings One and Two, were accepted by the UCC Sign-Off Committee on August 10, 1994. The construction improvements for Filing No.One of North Valley have been accepted by the City of Grand Junction. The Developer now wishes to complete Filing No. Two. The City of Grand Junction wrote a letter, dated November 1, 1995, stating that the Developer did not need to resubmit a Filing No. Two packet to all of the review agencies. The City required the Developer to obtain all of the normal UCC sign-off signatures indicating that the various review agencies had indeed approved both Filing No. One and Filing No. Two during the original submittals of North Valley Subdivision. The Developer obtained the signatures of the various UCC entities with Phil Bertrand, the new UCC Chairman, signing off on November 15, 1995. A copy of the sign-off sheet is included in this package.

file: c:\user\letters\wp\nvfile#2.wpd

REVIEW COMMENTS

FILE #RP-95-209 **TITLE HEADING:** Final Plat - North Valley Subdivision, Filing #2

LOCATION: 24 3/4 & G Roads

PETITIONER: G Road LLC (Chris Carnes)

PETITIONER'S ADDRESS/TELEPHONE: 1401 N 1st Street
Grand Junction, CO 81501
241-4000

PETITIONER'S REPRESENTATIVE: Rolland Engineering

STAFF REPRESENTATIVE: Kristen Ashbeck

NOTE: THE PETITIONER IS REQUIRED TO SUBMIT FOUR (4) COPIES OF WRITTEN RESPONSE AND REVISED DRAWINGS ADDRESSING ALL REVIEW COMMENTS .

PARKS & RECREATION DEPARTMENT **12/8/95**
Shawn Cooper **244-3869**

Development will require Parks & Open Space fees for 20 dwelling units @ $225 = $4,500.

CITY DEVELOPMENT ENGINEER **12/12/95**
Jody Kliska **244-1591**

1. PLAT - Need a dedication for Outlot A. What is Outlot A? It is not clear on the plat what the three rectangles on the north side of the property represent.
2. Need a dedication for the temporary access easement.
3. Improvements Agreement needs to be submitted.
4. Drainage Fee - Calculated as for Filing 1 = $7,691.31.

GRAND JUNCTION FIRE DEPARTMENT **12/12/95**
Hank Masterson **244-1414**

The Fire Department has no problems with Filing 2.

CITY PROPERTY AGENT **12/13/95**
Steve Pace **256-4003**

1. The 2nd thence in the description needs a "T".
2. In the legend, should the symbol for a found R/C LS16413 be a square?
3. What is the 20'+/- x 93' +/- area at the northwest corner of this Filing No. Two?
4. Outlot A should be addressed in the dedication.
5. The temporary access easement should be addressed in the dedication. Who uses this easement? When it is extinguished, what will that area be?
6. The legend doesn't show interior lot corners.
7. What type of easement is the 5' strip along the north line of Lots 7 & 8, Block 3?

COMMUNITY DEVELOPMENT DEPARTMENT	12/13/95
Kristen Ashbeck	244-1437

See attached comments.

TO DATE, COMMENTS NOT RECEIVED FROM:

City Utility Engineer
City Attorney
Mesa County Surveyor

FP 95-209 NORTH VALLEY FILING 2
Community Development - Kristen Ashbeck 244-1437 12/12/95

FINAL PLAT

1. Dedicate right-of-way on western side and revise configuration per attached plan.

2. Label temporary access easement as a tract and provide a dedication statement for it.

3. Show temporary cul-de-sacs that are being extinguished by this plat.

4. Setbacks on plat and those in covenants should match--similar to those on Filing 1 plat. There are different setbacks for western perimeter lots.

COVENANTS

1. Received a revised page 1 from Chris Carnes (12/13/95) correcting legal descriptions of lots but also need to revise page 3, Section 8 for same.

IMRPOVEMENTS AGREEMENT/GUARANTEE

Need a separate guarantee for pavement of temporary access easement in the event that roads to north are not built/extended.

ROLLAND ENGINEERING

405 RIDGES BOULEVARD, SUITE A
GRAND JUNCTION, COLORADO 81503
(303) 243-8300

October 3, 1994

Jodie Kliska, Development Engineer
City of Grand Junction
250 North Fifth Street
Grand Junction, Colorado 81501

RE: North Valley Subdivision; letter of transmittal comments dated 9/28/94.

Dear Jodie,
The following, out of sequence to your list, are answers to your comments/questions:

1) The City of Grand Junction will take over responsibility of the maintenance of the drainage easement that runs offsite from the southwest corner of the North Valley Subdivision to Leach Creek.

2) The Storm Drain plan and profile will not show the drainage pipe under "G" Road as oversized at this time. Per discussions between Don Newton and Tom Rolland, a Change Order will be written at the time of construction of the drainage pipe under "G" Road. The Change Order will allow detailed tracking of the extra cost of oversizing the pipe for reimbursement purposes to G Road LLC.

Items 1 & 2 should be looked at together within the context of how this drainage pipe routing came about. The original plan was to run all offsite drainage down 24 3/4 Road with over sized piping all the way to Leach Creek. Mr. Don Newton suggested to Mr. Carnes and Tom Rolland that drainage alignment directly south of North Valley Subdivision might be a better alternative. The present alignment with oversizing of the pipe at "G" Road suggests that the City wants the continued use of the drainage pipe as an access to Leach Creek. The City would have maintained all of the drainage system down 24 3/4 Road if that had been the routing employed. It is in the City's best interests to maintain the presently designed offsite drainage system as designed from North Valley Subdivision to Leach Creek. The City's scheduled maintenance and review of drainage systems will keep the new oversized Leach Creek drainage access under "G" Road in the best condition for continued future use.

file: avkliska.sam

3) The drainage fee calculated for Filing No. 1 of North Valley Subdivision is $7,298.00.
Based on the Drainage Fee Equation: Fee ($) = $10,000(C_{100d}-C_{100h})A^{0.7}$
Where $C_{100d} = 0.50$, $C_{100h} = 0.25$ and $A = 4.62$ ac.

4) Documentation of easements through the Roberson and Mays properties are attached.

Sincerely,

ROLLAND Engineering
Trevor A. Brown

cc: Mr. C. Carnes

file: nvklisica.sam

June 2, 1995

City of Grand Junction, Colorado
250 North Fifth Street
81501-2668
FAX: (303) 244-1599

Mr. Chris Carnes
1401 N. 1st Street
Grand Junction, Colorado

RE: North Valley Subdivision Drainage Fee

Dear Chris,

The drainage fee in lieu of on-site detention applies to your development and was calculated by Rolland Engineering as $7298.00 as shown in the attached letter.

The fee will be reduced by the amount you paid for the oversizing of the storm sewer pipe across G Road. Please include a copy of the bill from Travis Jordan when you pay the drainage fee and that amount will be deducted from the drainage fee.

The fee may be paid through the City Community Development Department and they will give you a receipt.

If I can offer any assistance, please call me.

Sincerely,

Jody Kliska
City Development Engineer

cc: Kathy Portner

City of Grand Junction, Colorado
250 North Fifth Street
81501-2668
FAX: (303) 244-1599

November 1, 1995

Mr. Trevor Brown
Rolland Engineering
405 Ridges Boulevard Suite A
Grand Junction, Colorado 81503

RE: North Valley Subdivision Filing 2

Dear Mr. Brown,

After speaking with Mr. Dale Clawson of Public Service on October 31, 1995, it was determined that the Utilities Coordinating Committee (UCC) did sign off on both Filings 1 and 2 of the North Valley Subdivision at its August 10, 1994 meeting. Both the minutes of the meeting and the submittal package itself indicated that the various agencies had reviewed and approved of both plats. Therefore, resubmittal of Filing 2 review packets will not be required for the following agencies: Grand Valley Irrigation District, Grand Junction Drainage District, Ute Water, U.S. West, Public Service, Grand Valley Rural Power and TCI Cablevision. Instead of resubmitting review packets or scheduling the item on a regular UCC agenda, Mr. Clawson suggested that the developer hand circulate a sign-off sheet with an initialed blueline of the Filing 2 plat to each of the agencies listed above to ensure that the plat is in order as originally approved. I agree that this is a reasonable alternative to a more formal review of the plat since it has already received final approval. Please provide the sign-off sheet prior to the plat being recorded.

Sincerely,

Kristen

Kristen Ashbeck
Planner

City of Grand Junction, Colorado
250 North Fifth Street
81501-2668
FAX: (303) 244-1599

December 19, 1995

Mr. Trevor Brown
Rolland Engineering
405 Ridges Boulevard Suite A
Grand Junction, Colorado 81503

RE: North Valley Subdivision Filing 2

Dear Mr. Brown,

After further discussing the need for a separate improvement guarantee for the temporary access easement, staff has decided to eliminate that item from the comments dated December 12, 1995 by the Community Development Department. It is understood that the temporary access drive shall be surfaced with an all-weather material (A.B.C. Class 6) material. An agreement and guarantee for further improvement of the access drive will not be required.

Sincerely,

Kristen

Kristen Ashbeck
Planner

SUBSURFACE SOILS EXPLORATION

NORTH VALLEY SUBDIVISION

GRAND JUNCTION, CO

Prepared For:

ROLLAND ENGINEERING
405 RIDGES BLVD.
GRAND JUNCTION, CO

Prepared By:

LINCOLN-DeVORE, INC.
1441 Motor Street
Grand Junction, CO 81505

MAY 26, 1994

Lincoln DeVore, Inc.
Geotechnical Consultants
1441 Motor St.
Grand Junction, CO 81505
TEL: (303) 242-8968
FAX: (303) 242-1561

May 26, 1994

Rolland Engineering
405 Ridges Blvd.
Grand Junction, CO 81503

Re: Subsurface Soils Exploration
North Valley Subdivision
Grand Junction, CO

Gentlemen:

Transmitted herein are the results of a Subsurface Soils Exploration for the proposed construction of North Valley Subdivision, a single family residential subdivision to contain approximately 38 building sites.

If you have any questions after reviewing this report, please feel free to contact this office at any time. This opportunity to provide Geotechnical Engineering services is sincerely appreciated.

Respectfully submitted,
LINCOLN-DeVORE, INC.

By:
Edward M. Morris, E.I.T.
Western Slope Branch Manager
Grand Junction, Office

Reviewed by: 5/31/94
George D. Morris, P.E.
Colorado Springs Office

LD Job #80635-J

EMM/ss

Lincoln DeVore, Inc.
Geotechnical Consultants
1441 Motor St.
Grand Junction, CO 81505

TEL: (303) 242-8968
FAX: (303) 242-1561

May 26, 1994

Rolland Engineering
405 Ridges Blvd.
Grand Junction, CO 81503

Re: Subsurface Soils Exploration
North Valley Subdivision
Grand Junction, CO

Gentlemen:

Transmitted herein are the results of a Subsurface Soils Exploration for the proposed construction of North Valley Subdivision, a single family residential subdivision to contain approximately 38 building sites.

If you have any questions after reviewing this report, please feel free to contact this office at any time. This opportunity to provide Geotechnical Engineering services is sincerely appreciated.

Respectfully submitted,
LINCOLN-DeVORE, INC.

By: ______________________
Edward M. Morris, E.I.T.
Western Slope Branch Manager
Grand Junction, Office

Reviewed by: ______________________
George D. Morris, P.E.
Colorado Springs Office

LD Job #80635-J

EMM/ss

TABLE OF CONTENTS

INTRODUCTION

PROJECT DESCRIPTION

This report presents the results of our geotechnical evaluation performed to determine the general subsurface conditions of the site applicable to construction of a single family residential subdivision containing approximately 38 building sites. A vicinity map is included in the Appendix of this report.

To assist in our exploration, we were provided with a copy of the preliminary plat prepared by Rolland Engineering. The Boring Location Plan attached to this report is based on that plan provided to us.

We understand that the proposed structures will consist of one and two story, wood framed structures with no basements and the possibility of concrete floor slabs-on-grade. Lincoln DeVore has not seen a full set of building plans, but structures of this type typically develop wall loads on the order of 600 to 1700 plf and column loads on the order of 5 to 16 kips.

The characteristics of the subsurface materials encountered were evaluated with regard to the type of construction described above. Recommendations are included herein to match the described construction to the soil characteristics found. The information contained herein may or may not be valid for other purposes. If the proposed site use is changed or types of construction proposed, other than noted herein, Lincoln DeVore should be contacted to determine if the information in this report can be used for the new construction without further field evaluations.

PROJECT SCOPE

The purpose of our exploration was to evaluate the surface and subsurface soil and geologic conditions of the site and, based on the conditions encountered, to provide recommendations pertaining to the geotechnical aspects of the site development as previously described. The conclusions and recommendations included herein are based on an analysis of the data obtained from our field explorations, laboratory testing program, and on our experience with similar soil and geologic conditions in the area.

The scope of our geotechnical exploration consisted of a surface reconnaissance, a geophoto study, subsurface exploration, obtaining representative samples, laboratory testing, analysis of field and laboratory data, and a review of geologic literature.

Specifically, the intent of this study is to:

1. Explore the subsurface conditions to the depth expected to be influenced by the proposed construction.
2. Evaluate by laboratory and field tests the general engineering properties of the various strata which could influence the development.
3. Define the general geology of the site including likely geologic hazards which could have an effect on site development.
4. Develop geotechnical criteria for site grading and earthwork.
5. Identify potential construction difficulties and provide recommendations concerning these problems.

6. Recommend an appropriate foundation system for the anticipated structure and develop criteria for foundation design.

FIELD EXPLORATION AND LABORATORY TESTING

A field evaluation was performed on May 19, 1994, and consisted of a site reconnaissance by our geotechnical personnel and the drilling of 5 shallow exploration borings. These shallow exploration borings were drilled within the proposed building envelopes near the locations indicated on the Boring Location Plan and along 24-3/4 Road which is to be improved. The exploration borings were located to obtain a reasonably good profile of the subsurface soil conditions. All exploration borings were drilled using a CME 45B, truck mounted drill rig with continuous flight auger to depths of approximately 8 to 18 feet. Samples were taken with a standard split spoon sampler, California lined sampler, thin wall Shelby tubes, and by bulk methods. Logs describing the subsurface conditions are presented in the attached figures.

Laboratory tests were performed on representative soil samples to determine their relative engineering properties. Tests were performed in accordance with test methods of the American Society for Testing and Materials or other accepted standards. The results of our laboratory tests are included in this report. The in-place moisture content and the standard penetration test values are presented on the attached drilling logs.

FINDINGS

SITE DESCRIPTION

The project site is located in the Southwest Quarter of the Southeast Quarter of Section 33, Township 1 North, Range 1 West of the Ute Principal Meridian, in Mesa County, Colorado. More specifically the site is located on the East side of 24-3/4 Road and approximately 800 feet North of G Road. The tract is approximately 3 to 3-1/2 miles Northwest of the main downtown business district of the City of Grand Junction and is within the City of Grand Junction limits.

The topography of the site is relatively flat, being located on an outwash plain of ancient mud flows which originated in the Bookcliffs to the North. The ground surface in the vicinity of the site has an overall gradient to the South. The exact direction of surface runoff on this site will be controlled to an extent by the proposed new construction and will be variable. Surface and subsurface drainage on this site can be described as poor.

GENERAL GEOLOGY AND SUBSURFACE DESCRIPTION

The geologic materials encountered under the site consist of a thick sequence of alluvial soils which overlie the Mancos Shale Formation which is bedrock beneath this site. The geologic and engineering properties of the materials found in our 5 shallow exploration borings will be discussed in the following sections.

The soils on this site consist of a series of silty clay and sandy silt soils which are a product of mud flow/debris flow features which originate on the south-facing slopes of the Bookcliffs. These mud flow/debris flow features are a small part of a very extensive mud flow/debris flow complex along the base of the Bookcliffs and extending to the Colorado River. Utilizing recent events and standard evaluation techniques, this tract is not considered to be within with an active debris flow hazard area. The surface soils are an erosional product of the upper Mancos Shale and the Mount Garfield Formations which are exposed on the slopes of the Bookcliffs. The soils contained within these mud flow/debris flow features normally exhibit a metastable condition which can range from very slight to severe. Metastable soil is subject to internal collapse and is very sensitive to changes in the soil moisture content. Based on the field and laboratory testing of the soils on this site, the severity of the metastable soils can be described as slight.

The alluvial soils encountered in the exploration borings can be broadly described as sandy silts and silty clays with relatively thin interbeds of silty sand. For purposes of this report, these soils have been grouped together and designated Soil Type I.

This Soil Type was classified as a sandy silt (ML) under the Unified Classification System. This material is of very low plasticity, of low to moderate permeability, and was encountered in a low density, wet condition. If this soil is found in a relatively dry condition, it may undergo mild expansion with the entry of small amounts of moisture, but will undergo long-term consolidation upon the addition of larger amounts of moisture. This soil will settle after being loaded. The maximum allowable bearing capacity for this soil was found to be 1000 psf, with 150 psf minimum dead load pressure required. The finer grained portion of Soil Type I contains sulfates in detrimental quantities.

These alluvial soils overlie the Mancos Shale Formation which is considered bedrock beneath this site. The Mancos Shale Formation was not encountered in any of the exploration borings, to the depths drilled. Based on information from nearby sites, it is anticipated the expansive clays of the Mancos Shale Formation are deeper than 25 feet below the existing ground surface. It is not anticipated the expansive clays of the formational shale will affect the construction and performance of foundations within this subdivision.

The lines defining the change between soil types or rock materials on the attached boring logs and soil profiles are determined by interpolation and therefore are approximations. The transition between soil types may be abrupt or may be gradual.

The boring logs and related information show subsurface conditions at the date and location of this exploration. Soil conditions may differ at locations other than those of the exploratory borings. If the structure is moved any appreciable distance from the locations of the borings, the soil conditions may not be the same as those reported here. The passage of time may also result in a change in the soil conditions at the boring locations.

GROUND WATER:

A free water table came to equilibrium during drilling at 5-1/2 to 8 feet, with saturated soils at 3-1/2 to 5 feet below the present ground surface. This is probably not a true phreatic surface but is an accumulation of subsurface seepage moisture (perched water). In our opinion the subsurface water conditions shown are a permanent feature on this site. The depth to free water would be subject to fluctuation, depending upon external environmental effects.

Because of capillary rise, the soil zone within a few feet above the free water level identified in the borings will be quite wet. Pumping and rutting may occur during the excavation process, particularly if the bottom of the foundations are near the capillary fringe. Pumping is a temporary, quick condition caused by vibration of excavating equipment on the site. If pumping occurs, it can often be stopped by removal of the equipment and greater care exercised in the excavation process. In other cases, geotextile fabric layers can be designed or cobble sized material can be introduced into the bottom of the excavation and worked into the soft soils. Such a geotextile or cobble raft is designed to stabilize the bottom of the excavation and to provide a firm base for equipment.

Data presented in this report concerning ground water levels are representative of those levels at the time of our field exploration. Groundwater levels are subject to change seasonally or by changed environmental conditions.

Quantitative information concerning rates of flow into excavations or pumping capacities necessary to dewater excavations is not included and is beyond the scope of this report. If this information is desired, permeability and field pumping tests will be required.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL DISCUSSION

No geologic conditions were apparent during our reconnaissance which would preclude the site development as planned, provided the recommendations contained herein are fully complied with. Based on our investigation to date and the knowledge of the proposed construction, the site condition which would have the greatest effect on the planned development is the low density soils and the very high water table.

Since the exact magnitude and nature of the foundation loads are not precisely known at the present time, the following recommendations must be somewhat general in nature. Any special loads or unusual design conditions should be reported to Lincoln DeVore so that changes in these recommendations may be made, if necessary. However, based upon our analysis of the soil conditions and project characteristics previously outlined, the following recommendations are made.

OPEN FOUNDATION OBSERVATION

Since the recommendations in this report are based on information obtained through random borings, it is possible that the subsurface materials between the boring points could vary. Therefore, prior to placing forms or pouring concrete, an open excavation observation should be performed by representatives of Lincoln DeVore. The purpose of this observation is to determine if the subsurface soils directly below the proposed foundations are similar to those encountered in our exploration borings. If the materials below the proposed foundations differ from those encountered, or in our opinion, are not capable of supporting the applied loads, additional recommendations could be provided at that time.

DRAINAGE AND GRADIENT:

Adequate site drainage should be provided in the foundation area within each building site both during and after construction to prevent the ponding of water and the saturation of the subsurface soils. We recommend that the ground surface around the structure be graded so that surface water will be carried quickly away from the building. The minimum gradient within 10 feet of the building will depend on surface landscaping. We recommend that paved areas maintain a minimum gradient of 2%, and that landscaped areas maintain a minimum gradient of 8%. It is further recommended that roof drain downspouts be carried across all backfilled areas and discharged at least 10 feet away from the structure. Proper discharge of roof drain downspouts may require the use subsurface piping in some areas. Planters, if any, should be so constructed that moisture is not allowed to seep into foundation areas or beneath slabs or pavements.

If adequate surface drainage cannot be maintained, or if subsurface seepage is encountered during excavation for foundation construction, a full perimeter drain is recommended for this building. It is recommended that this drain consist of a perforated drain pipe and a gravel collector, the whole being fully wrapped in a geotextile filter fabric. We recommend that this drain be constructed with a gravity outlet. If sufficient grade does not exist on the site for a gravity outlet, then a sealed sump and pump is recommended. Under no circumstances should a dry well be used on this site.

The high water level found on this site should be controlled to prevent large upward fluctuations of this water surface. For this purpose, we recommend that this be accomplished by construction of an area drain beneath the building areas for any structures with a finished floor or crawl space elevation within 2 feet of the high ground water level. To control water surface movement, it is recommended that the drain outfall in a free gravity drain. If a gravity outfall is not possible, a sealed sump and pump is recommended to remove the water.

Should an automatic lawn irrigation system be used on this site, we recommend that the sprinkler heads be installed no less than 5 feet from the building. In addition, these heads should be adjusted so that spray from the system does not fall onto the walls of the building and that such water does not excessively wet the backfill soils.

It is recommended that lawn and landscaping irrigation be reasonably limited, so as to prevent complete saturation of subsurface soils. Several methods of irrigation water control are possible, to include, but not limited to:

* Metering the Irrigation water.
* Sizing the irrigation distribution service piping to limit on-site water usage.
* Encourage efficient landscaping practices.
* Enforcing reasonable limits on the size of high water usage landscaping for each lot and any park areas.

EXCAVATION & STRUCTURAL FILL:

Subgrade

Site preparation in all areas to receive structural fill should begin with the removal of all topsoil, vegetation, and other deleterious materials. Prior to placing any fill, the subgrade should be observed by representatives of Lincoln DeVore to determine if the existing vegetation has been adequately removed and that the subgrade is capable of supporting the proposed fills. The subgrade should then be scarified to a depth of 10 inches, brought to near optimum moisture conditions and compacted to at least 90% of its maximum modified Proctor dry density [ASTM D-1557]. The moisture content of this material should be within + or - 2% of optimum moisture, as determined by ASTM D-1557.

Structural Fill

In general, we recommend all structural fill in the area beneath any proposed structure or roadway be compacted to a minimum of 90% of its maximum modified Proctor dry density (ASTM D1557). We recommend that fill be placed and compacted at approximately its optimum moisture content (+/-2%) as determined by ASTM D 1557. Structural fill should be a granular, coarse grained, non-free draining, non-expansive soil. This structural fill should be placed in the overexcavated portion of this site in lifts not to exceed 6 inches after compaction. This Structural Fill must be brought to the required density by mechanical means. No soaking, jetting or puddling techniques of any type should be used in placement of fill on this site.

Non-Structural Fill

We recommend that all backfill placed around the exterior of the building, and in utility trenches which are outside the perimeter of the building and not located beneath roadways or parking lots, be compacted to a minimum of 80% of its maximum modified Proctor dry density (ASTM D-1557).

Fill Limits

To provide adequate lateral support, we recommend that the zone of overexcavation extend at least 3 feet beyond the perimeter of the building on all sides. The Structural Fill should be a minimum of 3 feet in final compacted thickness.

No major difficulties are anticipated in the course of excavating into the surficial soils on the site. It is probable that safety provisions such as sloping or bracing the sides of excavations over 4 feet deep will be necessary. Any such safety provisions shall conform to reasonable industry safety practices and to applicable OSHA regulations. The OSHA Classification for excavation purposes on this site is Soil Class C.

Field Observation & Testing:

During the placement of any structural fill, it is recommended that a sufficient amount of field tests and observation be performed under the direction of the geotechnical engineer. The geotechnical engineer should determine the amount of observation time and field density tests required to determine substantial conformance with these recommendations. It is recommended that surface density tests be taken at maximum 2 foot vertical interval.

The opinions and conclusions of a geotechnical report are based on the interpretation of information obtained by random borings. Therefore the actual site conditions may vary somewhat from those indicated in this report. It is our opinion that field observations by the geotechnical engineer who has prepared this report are critical to the continuity of the project.

Slope Angles

Allowable slope angle for cuts in the native soils is dependent on soil conditions, slope geometry, the moisture content and other factors. Should deep cuts be planned for this site, we recommend that a slope stability analysis be performed when the location and depth of the cut is known.

FOUNDATIONS

Assuming that some amount of differential movement can be tolerated, then a conventional shallow foundation system, possibly underlain by structural fill if required by the geotechnical engineer, placed in accordance with the recommendations contained within this report may be utilized. The foundation would consist of continuous spread footings beneath all bearing walls and isolated spread footings beneath all columns and other points of concentrated load. Such a shallow foundation system, resting on the properly constructed structural fill, may be designed on the basis of an allowable bearing capacity of 1000 psf maximum.

Recommendations pertaining to balancing, reinforcing, drainage, and inspection are considered extremely important and must be followed. Contact stresses beneath all continuous walls should be balanced to within + or - 150 psf at all points. Isolated interior column footings should be designed for contact stresses of about 150 psf less than the average used to balance the continuous walls. The criteria for balancing will depend somewhat on the nature of the structure.

Single-story, slab-on-grade structures may be balanced on the basis of dead load only. Multi story structures may be balanced on the basis of dead load plus one half live load, for up to and including two stories.

If it is desired to utilize structural fill beneath any buildings on this site, the recommendations of a previous section of this report, entitled Excavation and Structural Fill, should be followed. The amount of soil bearing capacity improvement which can be realized is dependent upon the amount of structural fill used and the actual building configuration.

Structural Slab

If the design of the upper structure is such that loads can be balanced reasonably well, a floating structural slab type of foundation could be used on this site. Such a slab would require heavy reinforcing to resist differential bending along the rim wall. It is possible to design such a slab either as a thickened edge only, a solid or a ribbed slab. A rim wall must be used for confinement purposes. Any such slab must be specifically designed for the anticipated loading.

Such a foundation system may settle to some degree however, the use of a structural fill beneath the slab and rim wall will help reduce settlement and hold differential movement to a minimum. Relatively large slabs will tend to experience minor cracking and heave of lightly loaded interior portions, unless the slabs are specifically designed with this movement in mind.

The placement of a geotextile fabric for separation between the native soils and the structural fill may be recommended to aid the fill placement and to improve the stability of the completed fill.

When The structural fill is completed

and if the fill is a minimum of 2 feet in thickness below the footing areas, an allowable bearing capacity of 1700 psf maximum may be assumed for proportioning the footings.

The placement of the structural fill a minimum of two feet beyond the edge of the structural slab should provide additional support for the eccentrically placed wall loads on the slab edges.

SETTLEMENT:

Close estimates of total and differential settlement will not be provided in this report since Lincoln DeVore has not been given exact foundation loads. Upon completion of the structural plans, the predicted settlements can be supplied upon request.

FROST PROTECTION

We recommend that the bottom of all foundation components rest a minimum of 2 feet below finished grade or as required by the local building codes. Foundation components must not be placed on frozen soils.

Monolithic slab-on-grade foundation systems typically have an effective soil cover of less than 12 inches. Under normal use, the building and foundation system radiates sufficient heat that frost heave from the underlying soils is not normally a problem. However, additional protection can be provided by applying an insulation board to the exterior of the foundation and extending this board to approximately 18 inches below the final ground surface grade. This board may be applied either prior to or after the concrete is cast and it is very important that all areas of soil backfill be compacted. Local building officials should be consulted for regulatory frost protection depths.

CONCRETE SLABS ON GRADE

Slabs could be placed directly on the natural soils or on a structural fill. We recommend that all slabs on grade be constructed to act independently of the other structural portions of the building. One method of allowing the slabs to float freely is to use expansion material at the slab-structure interface.

Any partitions which will be located on slabs on grade should be constructed with a minimum space of 1-1/2 inches at the bottom of the wall. This space should allow for any future potential upward movement of the floor slabs and minimize damage to the walls and roof sections above the slabs. If a structural fill is placed beneath the slab, the geotechnical engineer may determine that this space between the slab and the wall may not be required.

It is recommended that slabs on grade be constructed over a capillary break of approximately 6 inches in thickness. We recommend that the material used to form the capillary break be free draining, granular material and not contain significant fines. A free draining outlet is also recommended for this break so that it will not trap water beneath the slab. A vapor barrier is recommended beneath the floor slab and above the capillary break. To prevent difficulty in finishing concrete, a 2 inch sand layer should be placed above the break. An alternate method of reducing finishing problems would be to place the vapor barrier beneath approximately 6 inches of a minus 3/4 inch gravel fill. This method must be very carefully accomplished to minimize excessive puncturing and tearing of the vapor barrier. This vapor barrier and capillary break may be incorporated into any structural fill which is placed beneath the slab.

It is recommended that floor slabs on grade be constructed with control joints placed to divide the floor into sections not exceeding 360 square feet, maximum. Also, additional control joints are recommended at all inside corners and at all columns to control cracking in these areas.

Problems associated with slab 'curling' are usually minimized by proper curing of the placed concrete slab. This period of curing usually is most critical within the first 5 days after placement. Proper curing can be accomplished by continuous water application to the concrete surface or by the placement of a 'heavy' curing compound, formulated to minimize water evaporation from the concrete. Curing by continuous water application must be carefully undertaken to prevent the wetting or saturation of the subgrade soils.

EARTH RETAINING STRUCTURES

The active soil pressure for the design of earth retaining structures may be based on an equivalent fluid pressure of 48 pounds per cubic foot. The active pressure should be used for retaining structures which are free to move at the top (unrestrained walls). For earth retaining structures which are fixed at the top, such as basement walls, an equivalent fluid pressure of 60 pounds per cubic foot may be used. It should be noted that the above values should be modified to take into account any surcharge loads, sloping backfill or other externally applied forces. The above equivalent fluid pressures should also be modified for the effect of free water, if any.

The passive pressure for resistance to lateral movement may be considered to be 231 pcf per foot of depth. The coefficient of friction for concrete to soil may be assumed to be .27 for resistance to lateral movement. When combining frictional and passive resistance, the latter must be reduced by approximately 1/3.

Drainage behind retaining walls is considered critical. If the backfill behind the wall is not well drained, hydrostatic pressures are allowed to build up and lateral earth pressures will be considerably increased. Therefore, we recommend a vertical drain be installed behind any impermeable retaining walls. Because of the difficulty in placement of a gravel drain, we recommend the use of a composite drainage mat similar to Exxon Battledrain or Tensar MD Series NS-1100. An outfall must be provided for this drain.

REACTIVE SOILS

Since groundwater in the Grand Junction and Appleton area typically contains sulfates in quantities detrimental to a Type I cement, a Type II or Type I-II or Type II-V cement is recommended for all concrete which is in contact with the subsurface soils and bedrock. Calcium chloride should not be added to a Type II, Type I-II or Type II-V cement under any circumstances.

PAVEMENTS

Samples of the surficial native soils at this site that may be required to support pavements have been evaluated using the Hveem-Carmany method (ASTM D-2844) to determine their support characteristics. The results of the laboratory testing are as follows:

R = 20
Expansion @ 300 psi = 1.0
Displacement @ 300 psi = 3.95

No estimates of traffic volumes have been provided to Lincoln DeVore. However, we assume that the roads will be classified as residential. The design procedures utilized are those recognized by the Colorado Department of Highways and the 1986 AASHTO design procedure. The terminal Serviceability Index of 2.0, a Reliability of 70 and a design life of 20 years have been utilized, based on recommendations by the Highway Department. An 18 kip ESAL of 5, also recommended by the Highway Department, was used for the analysis.

PROPOSED PAVEMENT SECTIONS

Based on the soil support characteristics outlined above, the following pavement sections are recommended:

Residential Roadway:

3 inches of asphaltic concrete pavement
on 6 inches of aggregate base course
on 12 inches of recompacted native material

Full Depth Asphalt:

5 inches of asphaltic concrete pavement
on 12 inches of recompacted native material

Rigid Concrete:

6 inches of portland cement pavement
on 4 inches of aggregate base course
on 8 inches of recompacted native material

Due to the very high soil moisture in the subgrade soils, the use of a Geotextile Fabric for separation and minor reinforcement (such as Mirafi 500-X or 140-N), placed beneath either the Aggregate Base Course or an additional 12 inches of granular Pit Run material, will probably be required on this site.

PAVEMENT SECTION CONSTRUCTION

We recommend that the asphaltic concrete pavement meet the State of Colorado requirements for a Grade C mix. In addition, the asphaltic concrete pavement should be compacted to a minimum of 95% of its maximum Hveem density. The aggregate base course should meet the requirements of State of Colorado Class 5 or Class 6 material, and have a minimum R value of 78. We recommend that the base course be compacted to a minimum of 95% of its maximum Modified Proctor dry density (ASTM D-1557), at a moisture content within + or -2% of optimum moisture. The native subgrade shall be scarified and recompacted to a minimum of 90% of their maximum Modified Proctor day density (ASTM D-1557) at a moisture content within + or -2% of optimum moisture.

All pavement should be protected from moisture migrating beneath the pavement structure. If surface drainage is allowed to pond behind curbs, islands or other areas of the site and allowed to seep beneath pavement, premature deterioration or possibly pavement failure could result.

Concrete Pavement

We recommend that the rigid concrete pavement have a minimum flexural strength (F_t) of 650 psi at 28 days. This strength requirement can be met using Class P or AX or A or B Concrete as defined in Section 600 of the Standard Specifications for Road and Bridge Construction, Colorado DOT. It is recommended that field control of the concrete mix be made utilizing compressive strength criteria.

Flexural Strength should **only** be used for the design process. Concrete with a lower flexural strength may be allowed by the agency having jurisdiction however, the design section thicknesses should be confirmed. In addition, the final durability of the pavement should be carefully considered.

Control joints should be placed at a minimum distance of 12 feet in all directions. If it is desired to increase the spacing of control joints, then 66-66 welded wire fabric should be placed in the mid-point of the slab. If the welded wire fabric is used, the control joint spacing can be increased to 40 feet. Construction joints designed so that positive joint transfer is maintained by the use of dowels is recommended.

The concrete should be placed at the lowest slump practical for the method of placement. In all circumstances, the maximum slump should be limited to 4 inches. Proper consolidation of the plastic concrete is important. The placed concrete must be properly protected and cured.

LIMITATIONS

This report is issued with the understanding that it is the responsibility of the owner, or his representative to ensure that the information and recommendations contained herein are brought to the attention of the individual lot purchasers for the subdivision. In addition, it is the responsibility of the individual lot owners that the information and recommendations contained herein are brought to the attention of the architect and engineer for the individual projects and the necessary steps are taken to see that the contractor and his subcontractors carry out the appropriate recommendations during construction.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in acceptable or appropriate standards may occur or may result from legislation or the broadening of engineering knowledge. Accordingly, the findings of this report may be invalid, wholly or partially, by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of 3 years.

The recommendations of this report pertain only to the site investigated and are based on the assumption that the soil conditions do not deviate from those described in this report. If any variations or undesirable conditions are encountered during construction or the proposed construction will differ from that planned on the day of this report, Lincoln DeVore should be notified so that supplemental recommendations can be provided, if appropriate.

Lincoln DeVore makes no warranty, either expressed or implied, as to the findings, recommendations, specifications or professional advice, except that they were prepared in accordance with generally accepted professional engineering practice in the field of geotechnical engineering.

SOILS DESCRIPTIONS:

USCS	DESCRIPTION
—	Topsoil
—	Man-made Fill
GW	Well-graded Gravel
GP	Poorly-graded Gravel
GM	Silty Gravel
GC	Clayey Gravel
SW	Well-graded Sand
SP	Poorly-graded Sand
SM	Silty Sand
SC	Clayey Sand
ML	Low-plasticity Silt
CL	Low-plasticity Clay
OL	Low-plasticity Organic Silt and Clay
MH	High-plasticity Silt
CH	High-plasticity Clay
OH	High-plasticity Organic Clay
Pt	Peat
GW/GM	Well-graded Gravel, Silty
GW/GC	Well-graded Gravel, Clayey
GP/GM	Poorly-graded Gravel, Silty
GP/GC	Poorly-graded Gravel, Clayey
GM/GC	Silty Gravel, Clayey
GC/GM	Clayey Gravel, Silty
SW/SM	Well-graded Sand, Silty
SW/SC	Well-graded Sand, Clayey
SP/SM	Poorly-graded Sand, Silty
SP/SC	Poorly-graded Sand, Clayey
SM/SC	Silty Sand, Clayey
SC/SM	Clayey Sand, Silty
CL/ML	Silty Clay

ROCK DESCRIPTIONS:

DESCRIPTION
SEDIMENTARY ROCKS
CONGLOMERATE
SANDSTONE
SILTSTONE
SHALE
CLAYSTONE
COAL
LIMESTONE
DOLOMITE
MARLSTONE
GYPSUM
Other Sedimentary Rocks
IGNEOUS ROCKS
GRANITIC ROCKS
DIORITIC ROCKS
GABBRO
RHYOLITE
ANDESITE
BASALT
TUFF & ASH FLOWS
BRECCIA & Other Volcanics
Other Igneous Rocks
METAMORPHIC ROCKS
GNEISS
SCHIST
PHYLLITE
SLATE
METAQUARTZITE
MARBLE
HORNFELS
SERPENTINE
Other Metamorphic Rocks

SYMBOLS & NOTES:

SYMBOL	DESCRIPTION
	9/12 Standard penetration drive. Numbers indicate 9 blows to drive the spoon 12" into ground.
	ST 2-1/2" Shelby thin wall sample
	W_o Natural Moisture Content
	W_x Weathered Material
Free water	Free water table
	γ^o Natural dry density
	T.B. – Disturbed Bulk Sample
	② Soil type related to samples in report
15' W_x Form.	Top of formation
	Test Boring Location
	Test Pit Location
	Seismic or Resistivity Station. Lineation indicates approx. length & orientation of spread (S = Seismic, R = Resistivity)

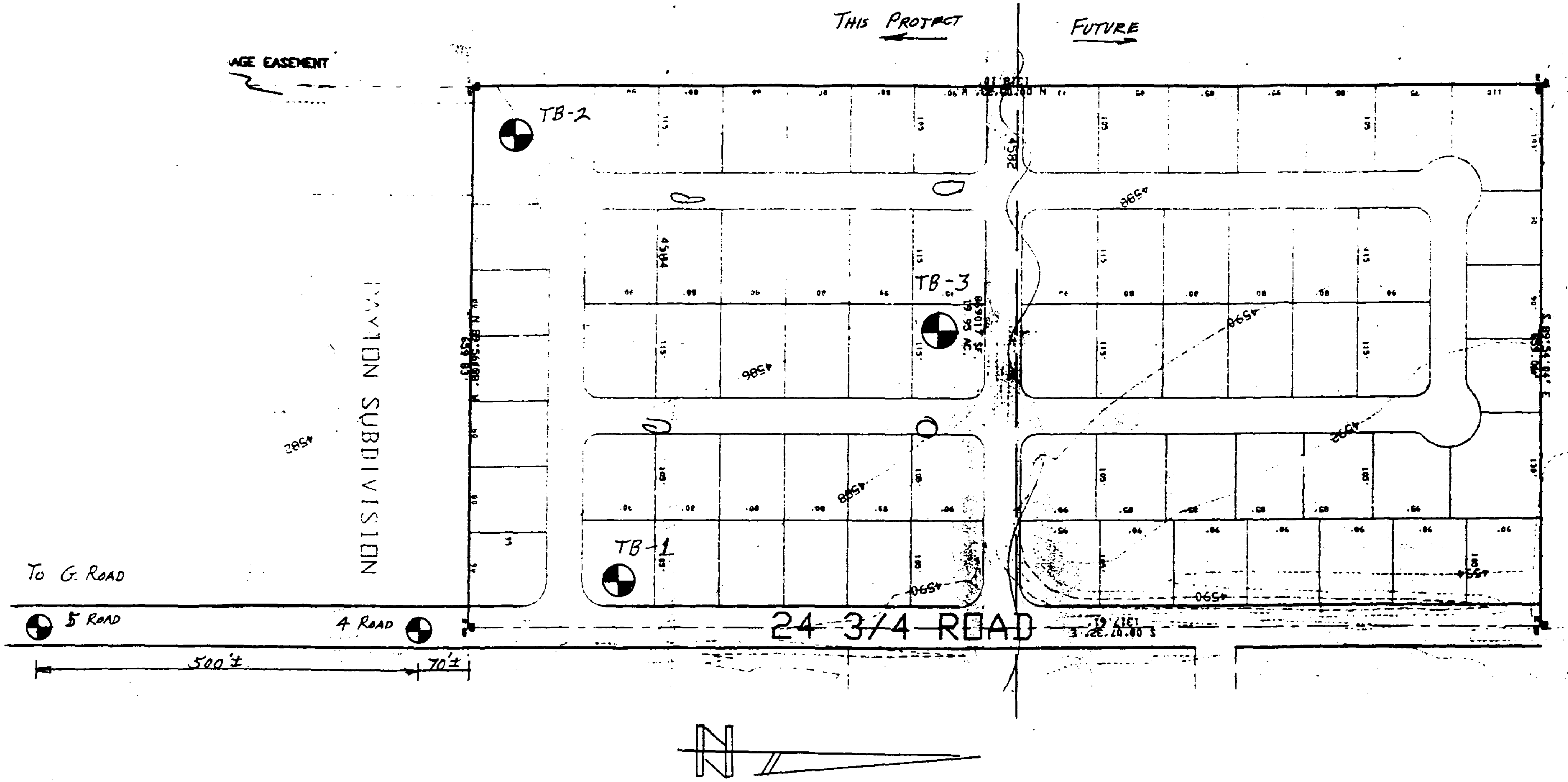
Standard Penetration Drives are made by driving a standard 1.4" split spoon sampler into the ground by dropping a 140 lb. weight 30". ASTM test des. D-1586.

Samples may be bulk, standard split spoon (both disturbed) or 2-1/2" I.D. thin wall ("undisturbed") Shelby tube samples. See log for type.

The boring logs show subsurface conditions at the dates and locations shown, and it is not warranted that they are representative of subsurface conditions at other locations and times.

LINCOLN DeVORE TESTING LABORATORY — COLORADO: Colorado Springs, Pueblo, Glenwood Springs, Montrose, Gunnison, Grand Junction.– WYO.– Rock Springs

EXPLANATION OF BOREHOLE LOGS AND LOCATION DIAGRAMS



EXPLORATION BORING LOCATION

NORTH VALLEY SUB. GRAND JUNCTION

LINCOLN DeVORE ENGINEERS· GEOLOGISTS	1441 MOTOR STREET GRAND JCT., COLORADO COLO. SPRINGS–PUEBLO		
	80635-J	SHEET 1 OF	
DRAWN BY J.L. SPARKS	SCALE None	DATE 5-31-94	
CHECKED BY E.M. MORRIS	CONT. INT.	REV.	

SUMMARY SHEET

Soil Sample: SANDY SILT (ML)

Test No.: 80635-J

Location: North Valley Sub. Grd. Jct.

Date: 5-24-94

Boring No.: 1 Depth: 3'

Sample No.: I

Test by: JLS

Natural Water Content (w): 22.3 %

Specific Gravity (Gs): ____

In Place Density (γ_o): 101.3 pcf

SIEVE ANALYSIS:

Sieve No.	% Passing
1 1/2"	
1"	
3/4"	
1/2"	100
4	99
10	90
20	83
40	82
100	77
200	65

HYDROMETER ANALYSIS:

Grain size (mm)	%
.02	40
.005	32

Plastic Limit P.L. 18 %
Liquid Limit L. L. 22 %
Plasticity Index P.I. 4 %
Shrinkage Limit ____ %
Flow Index ____
Shrinkage Ratio ____ %
Volumetric Change ____ %
Lineal Shrinkage ____ %

MOISTURE DENSITY: ASTM METHOD

Optimum Moisture Content - w_o ____ %
Maximum Dry Density - γ_d ____ pcf
California Bearing Ratio (av) ____ %
Swell: ____ Days ____ %
Swell against ____ psf Wo gain ____ %

BEARING:

Housel Penetrometer (av) 900 psf
Unconfined Compression (qu) ____ psf
Plate Bearing: ____ psf
Inches Settlement ____
Consolidation 1.2% under 940 psf
2.8% under 2040 psf

PERMEABILITY:

K (at 20°C) ____
Void Ratio ____

Sulfates 1000 ppm.

SOIL ANALYSIS

LINCOLN-DeVORE TESTING LABORATORY
COLORADO SPRINGS, COLORADO

SOIL SAMPLE Sandy Silt (ML)

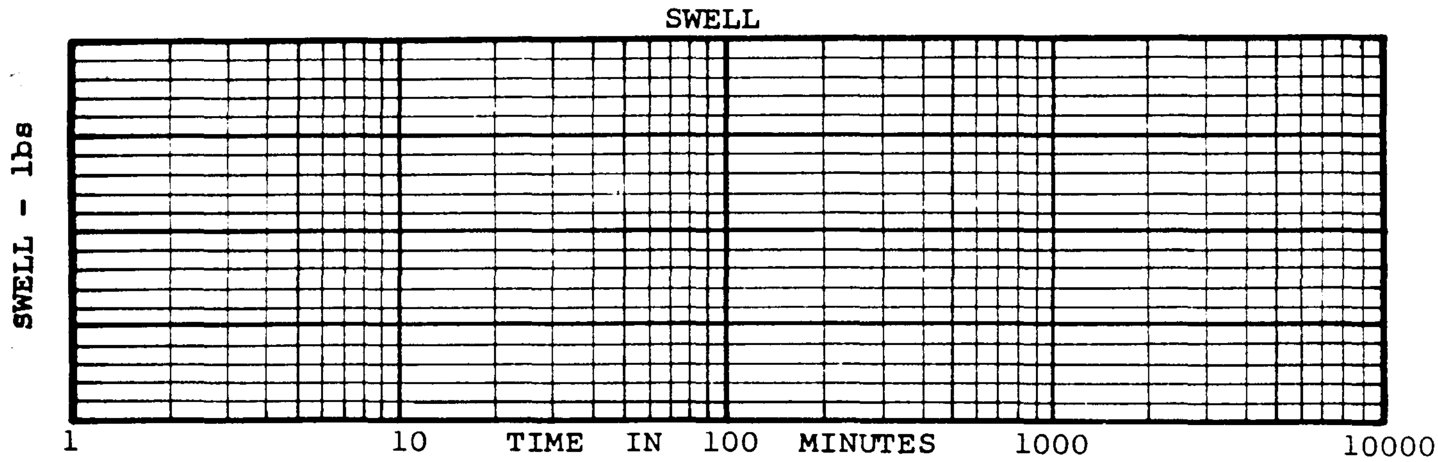
Project North Valley Sub - Grd. Jct.

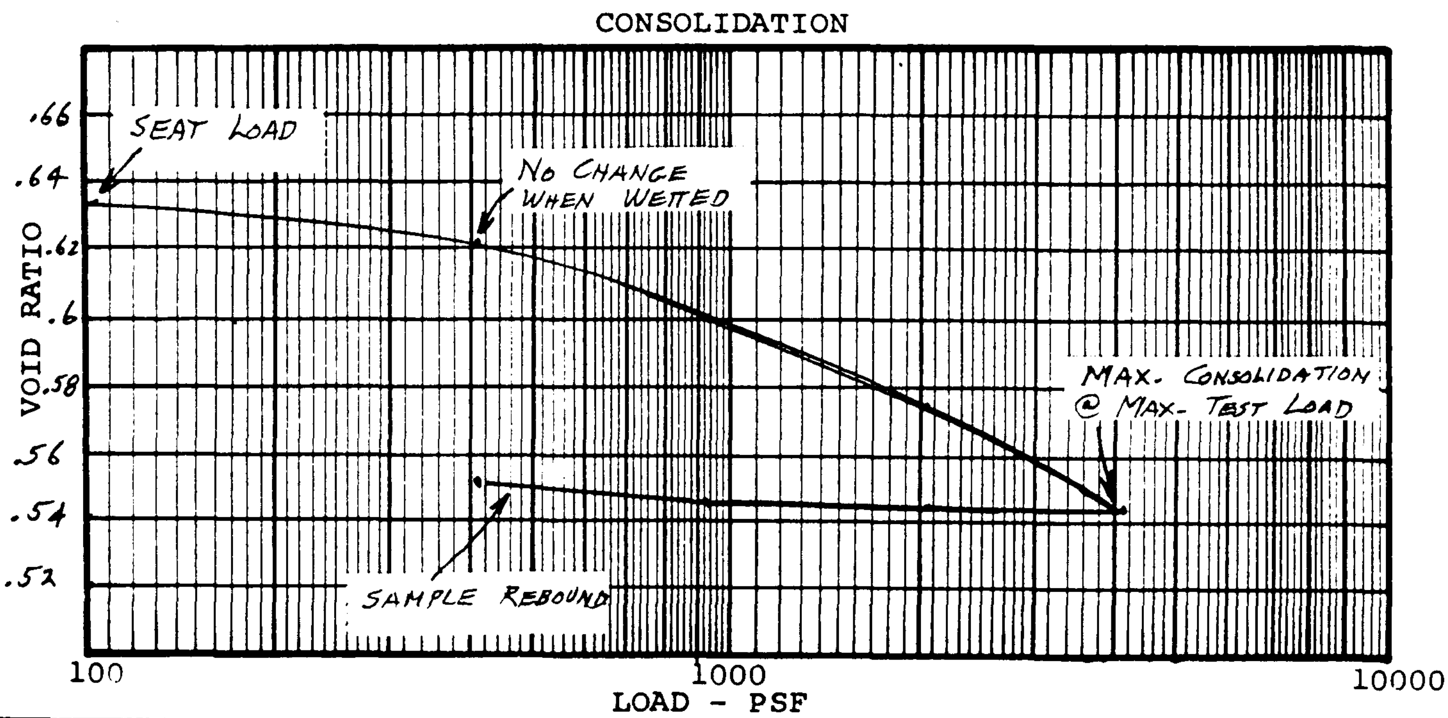
Sample Location TB 1@3'

Test No. 80635-J

Date 5-20-94

Test by LRS





Sample Conditions	Initial	Maximum Load	Expanded
Dry Density	101.3 pcf	107.2 pcf	106.5 pcf
% Moisture	22.3 %	20.5 %	20.6 %
% Saturation	93 %	100 %	100 %
Void Ratio	.632	.543	.552

Specific Gravity 2.65

Maximum Load used 416 lb.

Apparatus Densoil #3

Ring Number 140.30

Volume 2.5" Ring .002841 cu. ft.

LOAD - CONSOLIDATION

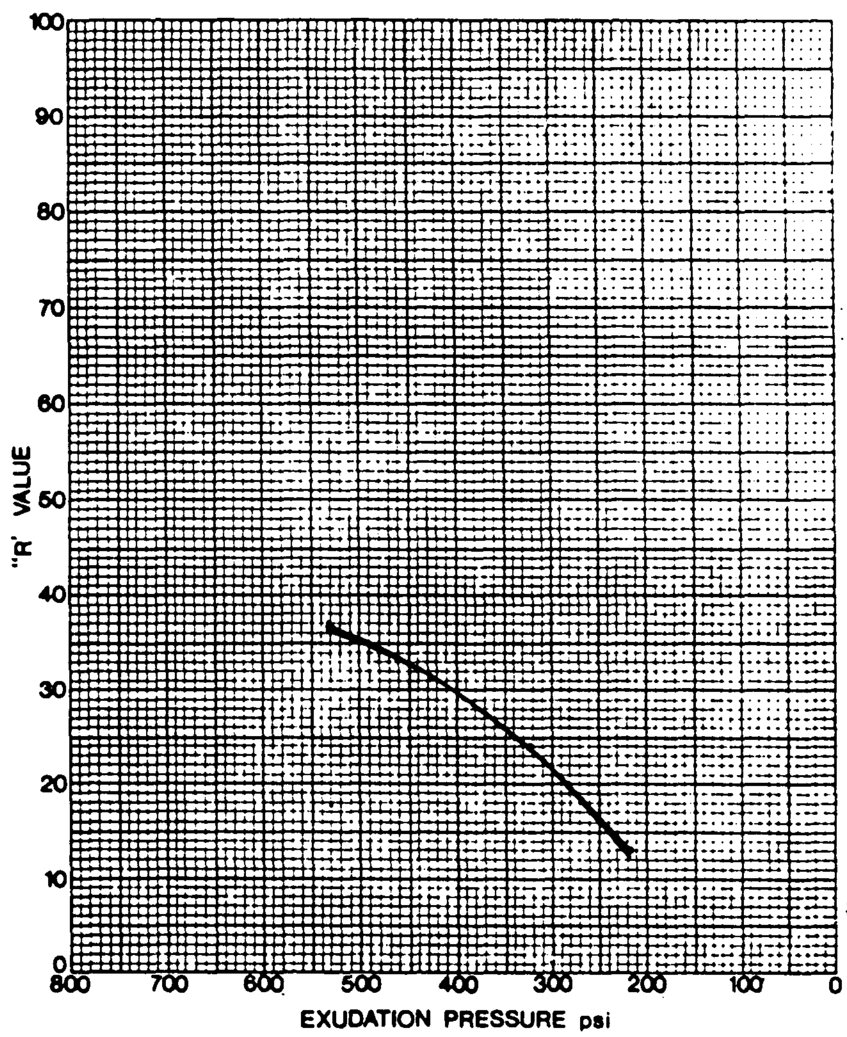
LINCOLN-DeVORE, INC.
COLORADO SPRINGS, COLORADO

SAMPLE: SANDY SILT (ML)

TEST SPECIMAN			A	B	C	D	E
DATE TESTED			5-21-94	5-21-94	5-21-94		
SPECIMEN FABRICATION	Compactor Air Pressure	psi					
	Initial Moisture	%	8.1	8.1	8.1		
	Moisture at Compaction	%	12.1	11.1	10.1		
	Briquette Height	in.	2.52	2.50	2.50		
	Density	pcf	116.9	119.5	120.9		
EXUDATION PRESSURE		psi	223	326	533		
EXPANSION PRESSURE DIAL			0.5	1.2	2.1		
STABIL-OMETER	P_h at 1000 pounds	psi	52	40	28		
	P_h at 2000 pounds	psi	127	108	85		
	Displacement	turns	4.26	3.90	3.75		
	"R" Value		13	24	37		
CORRECTED "R" VALUE							

EXPANSION @ 300 PSI EXUDATION PRESSURE 1.0
DISPLACEMENT @ 300 PSI EXUDATION PRESSURE 3.95
"R: VALUE @ 300 PSI EXUDATION PRESSURE 20

1½"	
1"	
3/4"	
1/2"	
3/8"	
4	100
10	99
20	98
40	97
100	87
200	68
.02 mm	43
.005 mm	31



LIQUID LIMIT	18
PLASTIC LIMIT	22
PLASTICITY INDEX	4
SAND EQUIVALENT	

Lincoln DeVore, Inc.
Geotechnical Consultants

NORTH VALLEY SUB. - GRAND JUNCTION, CO		
ROLLAND ENGINEERING		DATE 5-31-94
JOB NO. 80635-J	DRAWN EHM	

BORING NO. 1

BORING ELEVATION:

DEPTH (FT.)	SOIL LOG	DESCRIPTION			SAMPLE	BLOW COUNT	SOIL DENSITY pcf	WATER %
		Agriculturally Reworked soils on Surface						
		Debris Fan Deposits	Alluvial	Dessicated Surface				
	I	Low Density		'Capillary Fringe'	ST		101.3	22.3%
5	ML	Sandy Silt	High Sulfates					
		Compressible		Wet				
		Very Sandy Strata	Very Stratified					
	I	Free Water	Free water at sand strata		BULK			25.1%
10	ML	Sandy Silt	Saturated					
		Compressible	Very Soft					
		Drill Hole is squeezing Shut						
	I				BULK			26.0%
15	ML	Sandy Silt	Very Soft					
			Surface Soils are very Susceptible to 'Pumping'					
20		TD @ 13'						
25								
30								

Blow Counts are cumulative for each 6 inches of sampler penetration.

Free Water @ 8'
During Drilling 5-19-94

LOG OF SUBSURFACE EXPLORATION

LINCOLN - DeVORE, Inc. Grand Junction, Colorado	NORTH VALLEY SUB. Grand Junction, Colorado
	ROLLAND ENGINEERING — Date 5-31-94
	Job No. 80635-J — Drawn EMM

BORING NO. 2

BORING ELEVATION:

DEPTH (FT.)	SOIL LOG	DESCRIPTION				BLOW COUNT	SOIL DENSITY pcf	WATER %
		Agriculturally Reworked soils on Surface						
		Debris Fan Deposits	Dessicated Surface					
	I	Low Density	Alluvial	'Capillary Fringe'	SPT	3/6		18.6%
5	ML	Sandy Silt		High Sulfates	5	4/12		
	Free Water		Wet			5/18		
			Very Stratified			6/24		
		Very Sandy Strata						
	I	Low Density		BULK				23.3%
10	ML	Sandy Silt	Saturated		10			
			Free water at sand strata					
		Compressible	Very Soft					
			Drill Hole is squeezing Shut					
	I			BULK				25.6%
15	ML	Sandy Silt			15			
		Very Soft						
			Surface Soils are very					
			Susceptible to 'Pumping'					
20		TD @ 18'			20			
25					25			
30					30			

Blow Counts are cumulative for each 6 inches of sampler penetration.

Free Water @ 5-1/2'
During Drilling 5-19-94

LOG OF SUBSURFACE EXPLORATION

NORTH VALLEY SUB.
Grand Junction, Colorado

ROLLAND ENGINEERING

Date: 5-31-94

Job No. 80635-J

Drawn: EMM

LINCOLN - DeVORE, Inc.

Grand Junction, Colorado

BORING NO. 3

BORING ELEVATION:

DEPTH (FT.)	SOIL LOG	DESCRIPTION				BLOW COUNT	SOIL DENSITY pcf	WATER %
			Agriculturally Reworked soils on Surface					
			Debris Fan Deposits	Alluvial	Dessicated Surface			
		I	Low Density	Wet	High Sulfates	CS	3/6	97.8	20.0%
5		ML	Sandy Silt			5	5/12		
			Compressible	'Capillary Fringe'			6/18		
			Very Sandy Strata	Very Stratified			7/24		
		Free Water		Free water at sand strata					
		I			BULK				27.1%
10		ML	Sandy Silt		Saturated	10			
			Compressible	Very Soft					
				Drill Hole is squeezing Shut					
		I			BULK				25.8%
15		ML	Sandy Silt	Very Soft		15			
				Surface Soils are very					
				Susceptible to 'Pumping'					
20			TD @ 13'			20			
25						25			
30						30			

Blow Counts are cumulative for each 6 inches of sampler penetration.

Free Water @ 7'
During Drilling 5-19-94

LOG OF SUBSURFACE EXPLORATION

NORTH VALLEY SUB.
Grand Junction, Colorado

ROLLAND ENGINEERING

Date 5-31-94

Job No. 80635-J

Drawn EMM

LINCOLN - DeVORE, Inc.

Grand Junction, Colorado

FINAL
DRAINAGE REPORT
FOR
NORTH VALLEY
SUBDIVISION

PREPARED FOR:
G ROAD LLC
C/O MR. Chris Carnes

PRESENTED TO:
THE CITY OF GRAND JUNCTION

ROLLAND ENGINEERING

405 Ridges Blvd., Suite A, Grand Junction, CO 81503

file: nv-lw.sam

ROLLAND ENGINEERING

405 RIDGES BOULEVARD, SUITE A
GRAND JUNCTION, COLORADO 81503
(303) 243-8300

May 31, 1994

Ms. Jody Kliska
Development Engineer
City of Grand Junction
Public Works Department
250 North 5th Street
Grand Junction, CO 81501

RE: **FINAL DRAINAGE REPORT FOR NORTH VALLEY SUBDIVISION**

Dear Jody;

Enclosed you will find the Final Drainage Report for the North Valley Subdivision. Drainage calculations for the 2 and 100-year design storms were performed for this report.

Please call us if you have any questions or need additional information. Thank you for your time and consideration regarding this project.

Respectfully submitted,
ROLLAND ENGINEERING

Mark D. Young, E.I.T.

and Wei Li

Enclosures

file: north-lw.sam

THOMAS D. ROLLAND
REGISTERED
12896
PROFESSIONAL ENGINEER
STATE OF COLORADO

FINAL DRAINAGE REPORT
FOR
NORTH VALLEY SUBDIVISION

PREPARED FOR:

G ROAD LLC
C/O MR. CHRIS CARNES
1401 N. 1ST
GRAND JUNCTION, CO 81501

PREPARED BY:

ROLLAND ENGINEERING
405 RIDGES BOULEVARD
SUITE A
GRAND JUNCTION, CO 81503

MAY 31, 1994

file: nv-lw.sam

TABLES OF CONTENTS

file: nv-lw.sam

GENERAL LOCATION AND DESCRIPTION

NORTH VALLEY SUBDIVISION IS AN APPROXIMATE 20 ACRE SITE LOCATED AT 24 3/4 AND G ROADS. THE SITE LIES IMMEDIATELY NORTH OF PAYTON SUBDIVISION AND NORTHWEST OF FOUNTAINHEAD AND GOLDEN MEADOWS ESTATES SUBDIVISIONS. THE PROPOSED SITE IS APPROXIMATELY 660 FEET WIDE AND 1320 FEET LONG. ACCESS TO THE SITE CAN BE GAINED THROUGH 24 3/4 ROAD. THE SITE LIES AT THE TOP OF A MAJOR DRAINAGE BASIN WHICH IS BOUND ON THE NORTH BY THE GRAND VALLEY CANAL AND FLOWS SOUTHWEST FROM THE SITE. A LARGE COLLECTION DITCH THAT IS CONTROLLED BY THE GRAND JUNCTION DRAINAGE DISTRICT STARTS AT NORTHEAST CORNER OF THE PROJECT SITE, RUNS SOUTH ALONG THE 24 3/4 ROAD AND TURNS WEST AT APPROXIMATELY THE MIDDLE OF THE PROPERTY. THE DITCH IS ABOUT 8 FEET DEEP ON AVERAGE. A SMALL PART OF THE HISTORIC FLOW OF THE MAJOR BASIN IS COLLECTED BY THE DITCH, AND MOST OF THE HISTORIC FLOW FROM THE MAJOR BASIN RUNS TO THE LEACH CREEK. THE MAJOR BASIN AREA IS HARDLY DEVELOPED.

THE SOILS ON THE SITE CONSIST LARGELY OF A RAVOLA SANDY LOAM AND SOME FRUITA CLAY LOAM. THE GROUND COVER CONSISTS OF CULTIVATED STRAIGHT ROW AND SOME GRASSES, WEEDS, WILLOW ON THE WEST AND SOUTH EDGES.

EXISTING DRAINAGE CONDITIONS

THE GROUND SURFACE OF THE MAJOR DRAINAGE BASIN GENERALLY HAS GENTLE SLOPES UP TO 1% TO THE SOUTH AND WEST. THERE ARE NO PREVIOUSLY DETERMINED 100-YEAR FLOODPLAIN IN THE BASIN. RUNOFF FROM NORTH HALF OF THIS SITE PLUS SOME OUTSIDE RUNOFF CAN DRAIN TO THE DITCH. THE SOUTH HALF RUNOFF OF THIS SITE TOGETHER WITH ABOUT 15 ACRE OFFSITE RUNOFF FROM THE EAST SIDE CAN DRAIN TO THE SOUTHWEST CORNER TO A TAIL WATER DITCH THAT CONVEYS THE RUNOFF TO LEACH CREEK.

PROPOSED DRAINAGE CONDITIONS

BASED ON THE EXISTING CONDITIONS OF THIS SITE. TWO OPTIONS WERE CONSIDERED FOR THE EXISTING COLLECTION DITCH ON THE SITE. ONE OPTION IS THAT THE DITCH WILL STAY IN PLACE. UNDER THIS CONDITION, THE NORTH HALF DEVELOPED RUNOFF OF THIS SITE AND SOME OFFSITE HISTORIC RUNOFF WILL BE DRAINED TO THE DITCH. THE OTHER HALF OF THE DEVELOPED RUNOFF FROM THIS SITE AND SOME OFFSITE HISTORIC RUNOFF FROM THE EAST SIDE OF THE PROJECT SITE WILL BE DRAINED TO LEACH CREEK. ANOTHER OPTION FOR THE DITCH IS THAT THE DITCH WILL BE ADJUSTED AS SHOWN ON APPENDIX C, THEN ABOUT 35% DEVELOPED RUNOFF PLUS SOME HISTORIC RUNOFF WILL DRAIN TO THE DITCH, AND THE OTHER DEVELOPED RUNOFF OF THIS SITE AND OFFSITE HISTORIC RUNOFF WILL DRAIN TO LEACH CREEK.

ACCESS FOR THE MAINTENANCE OF THE DRAINAGE FACILITIES WILL BE VIA A COMBINATION OF PUBLIC RIGHT-OF -WAY AND DEDICATED DRAINAGE EASEMENTS. OWNERSHIP AND MAINTENANCE RESPONSIBILITY OF THE DRAINAGE FACILITIES WILL BE THAT OF THE CITY OF GRAND JUNCTION.

DESIGN CRITERIA AND APPROACH

WE ARE NOT AWARE OF ANY MASTER PLAN OR ANY OTHER LIMITATIONS ON THIS SITE. THE HYDROLOGY AND HYDRAULIC CALCULATIONS CONDUCTED FOR THIS SITE UTILIZED THE INTERIM OUTLINE OF GRADING AND DRAINAGE CRITERIA (JULY 1992) FOR THE CITY OF GRAND JUNCTION. THE RATIONAL METHOD WAS USED TO PERFORM THE ANALYSIS FOR THE 2 AND 100 YEAR DESIGN EVENTS.

THE 100 YEAR DESIGN EVENT WAS USED TO DETERMINE THE DRAINAGE PIPE SIZE. OFFSITE HISTORIC RUNOFF ON THE EAST , NORTH AND SOUTH SIDES OF THE SITE WAS ANALYZED AND INCLUDED IN DETERMINING THE PIPE SIZE. THERE WILL NOT BE ANY ON-SITE DETENTION.

CONCLUSION

SUMMARIZED BELOW ARE THE DRAINAGE CALCULATIONS FOR THIS PROJECT:

DRAINAGE CALCULATIONS

RATIONAL METHOD: 2& 100 YEAR DESIGN STORMS

EXISTING TOTAL SITE RUNOFF RATES

2-YEAR STORM HISTORIC

Q_{2h} = 2.71 cfs (to ditch)
Q_{2h} = 3.33 cfs

100-YEAR STORM HISTORIC

Q_{100h} = 17.07 cfs (to ditch)
Q_{100h} = 21.15 cfs

PROPOSED TOTAL SITE RUNOFF RATES - DITCH STAYS IN PLACE

2-YEAR STORM DEVELOPED

Q_{2d} = 7.33 cfs (to ditch)
Q_{2d} = 11.93 cfs

100-YEAR STORM DEVELOPED

Q_{100d} = 25.39 cfs (to ditch)
Q_{100d} = 52.38 cfs

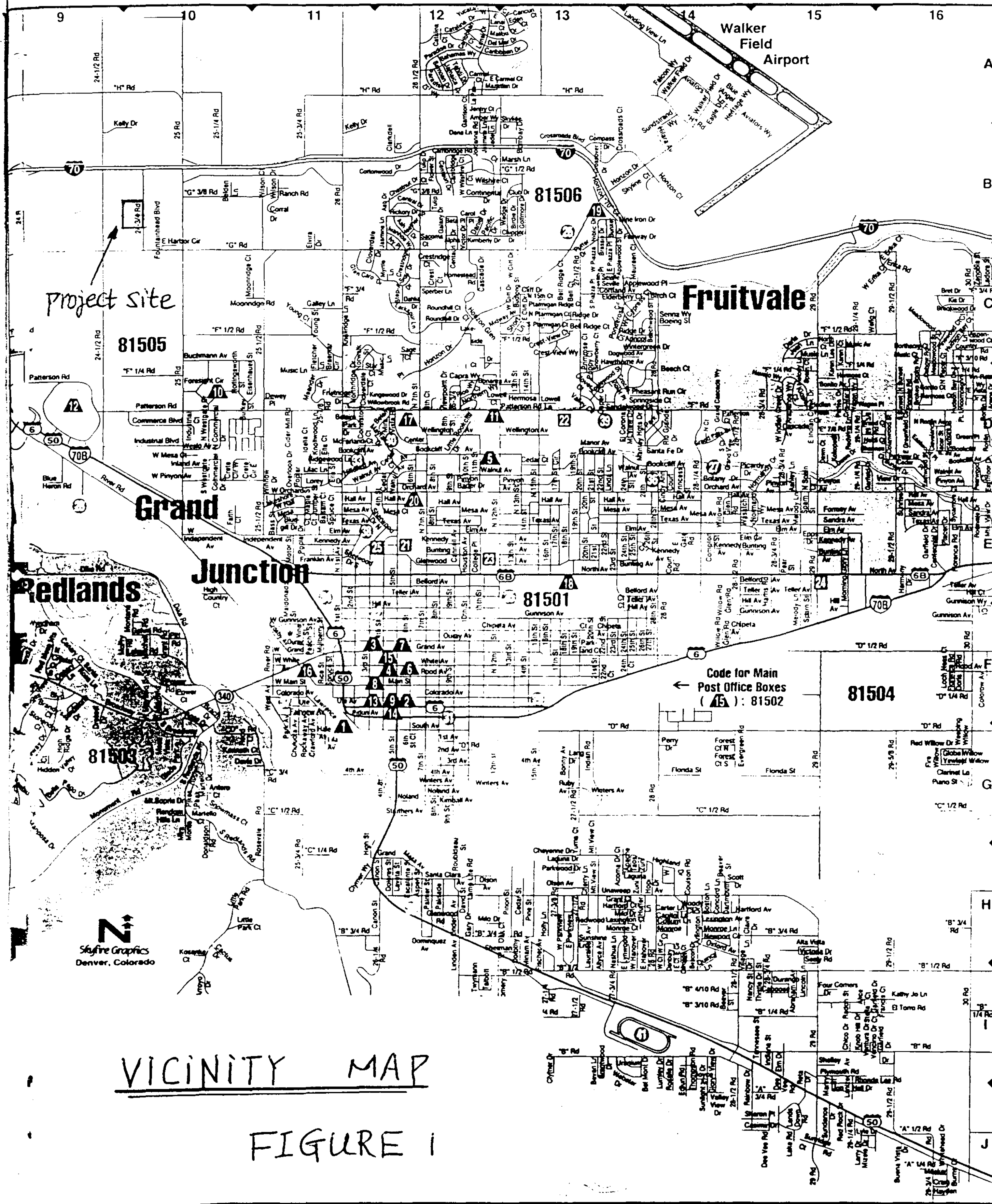
PROPOSED TOTAL SITE RUNOFF RATES - DITCH PRE-ADJUSTED

2-YEAR STORM DEVELOPED

Q_{2d} = 5.55 cfs (to ditch)
Q_{2d} = 13.45 cfs

100-YEAR STORM DEVELOPED

Q_{100d} = 20.40 cfs (to ditch)
Q_{100d} = 55.87 cfs



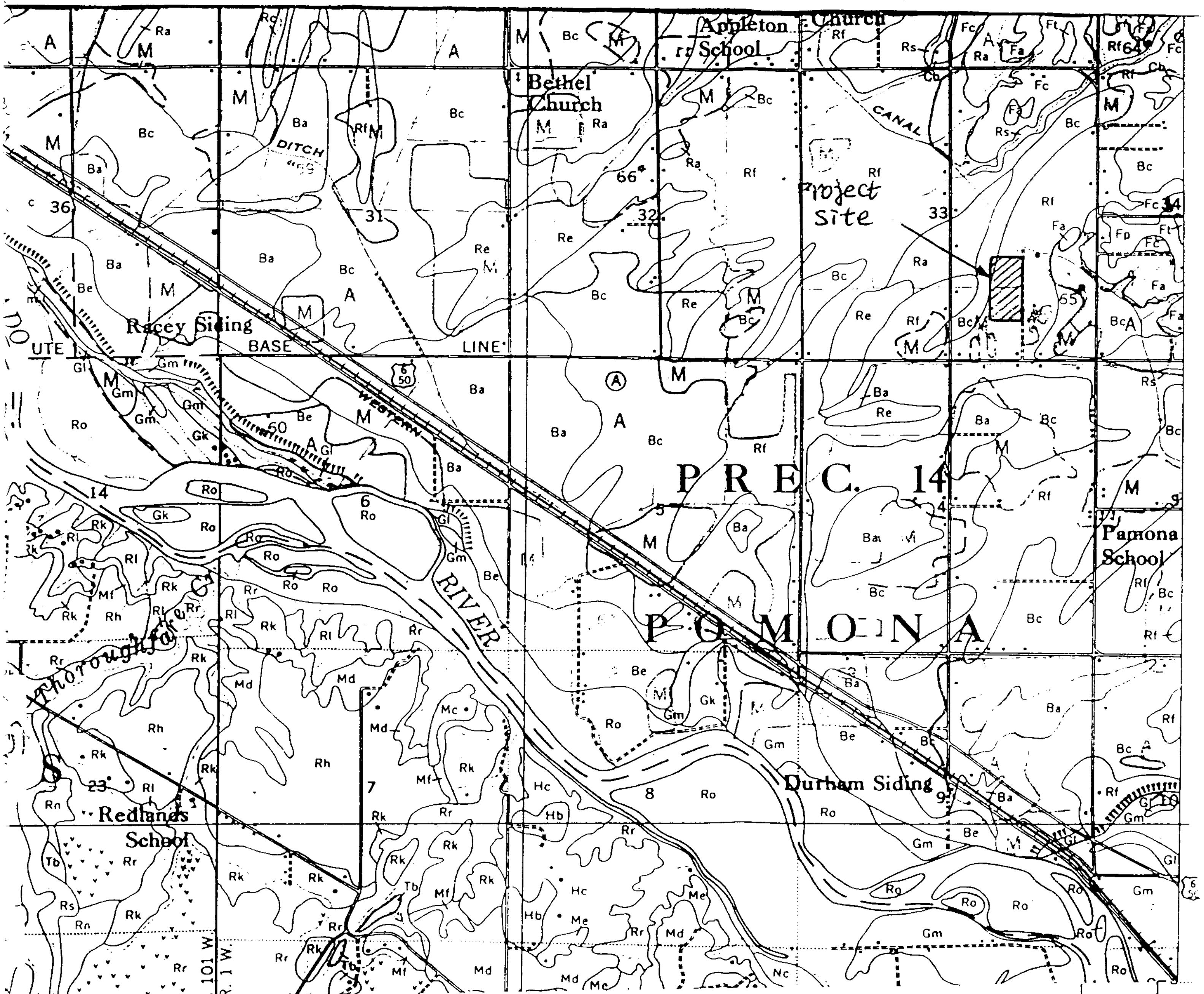
VICINITY MAP

FIGURE 1

SOIL MAP

GRAND JUNCTION AREA - COLORADC

SHEET NO. 2



SOILS OF RECENT ALLUVIAL FANS AND LOCAL STREAM FLOOD PLAINS

MODERATELY COARSE TO MEDIUM-TEXTURED SOILS WITH MODERATELY PERMEABLE SUBSOILS

- Genola fine sandy loam, deep over gravel, 0-2 percent slopes
- Genola loam, 2-5 percent slopes
- Genola very fine sandy loam, deep over gravel, 0-2 percent slopes
- Naples fine sandy loam, 0-2 percent slopes
- Ravola fine sandy loam, 0-2 percent slopes
- Ravola fine sandy loam, 2-5 percent slopes
- Ravola loam, 0-2 percent slopes
- Ravola very fine sandy loam, 0-2 percent slopes
- Ravola very fine sandy loam, 2-5 percent slopes
- Thoroughfare fine sandy loam, 0-2 percent slopes
- Thoroughfare fine sandy loam, 2-5 percent slopes
- Thoroughfare fine sandy loam, 5-10 percent slopes

FIGURE 2.

FINE-TEXTURED SO

SUBSOILS

Bill
Bill
Bill
soil
Nav

SOILS OF THE MESAS

SLIGHTLY TO MODE

MEDIUM-TEXTURED

PERMEABLE SUBSO

Fru
Fru

APPENDIX A

North Valley Drainage: Ditch stay in place

2-YEAR STORM-HISTORIC: (to ditch)

Onsite A_n = 10 ac;
Hydrologic soil group = B (Moderate infiltration);
V = 0.75 ft/s (cultivated straight row);
L = 650 ft
$T_{c2h} = (\frac{650}{0.75})/60$ = 14.44min = 14.44min;

Offsite A_f = 10.5 ac
C_{2h} = 0.10
S = 0.70%

I_{2h} = 1.32 in/hr

Q_{2hn} = (0.10)(1.32)(10) = 1.32 cfs
Q_{2hf} = (0.10)(1.32)(10.5) = 1.39 cfs
Q_{2h} = 1.32+1.39 = 2.71 cfs

100-YEAR STORM-HISTORIC: (to ditch)

C_{100h} = 0.25;
Q_{100hn} = (0.25)(3.33)(10) = 8.33cfs
Q_{100hf} = (0.25)(3.33)(10.5) = 8.74 cfs
Q_{100h} = 8.33+8.74 = 17.07 cfs

I_{100h} = 3.33 in/hr

2-YEAR STORM-HISTORIC: (to Leach Creek)

Onsite A_n = 10 ac;
Off sitet A_f= 35 ac;
S = 0.80%;
$T_{c2h} = (\frac{200}{0.80})/60$= 41.67min = 42 min;
Q_{2hn} = (0.10)(0.74)(10) = 0.74 cfs
Q_{2hf} = (0.10)(0.74)(35) = 2.59 cfs
Q_{2h} = 0.74+2.59 = 3.33 cfs

L = 2000 ft
C_{2h} = 0.10;
V = 0.80 ft/s
I_{2h} = 0.74 in/hr

100-YEAR STORM-HISTORIC: (to Leach Creek)

C_{100h} = 0.25;
Q_{100hn} = (0.25)(1.88)(10) = 4.70 cfs
Q_{100hf} = (0.25)(1.88)(35) = 16.45 cfs
Q_{100h} = 4.70+16.45 = 21.15 cfs

I_{100h} = 1.88 in/hr

2-YEAR STORM-DEVELOPED: (to ditch)

Onsite area A_n = 10ac;
Offsite area A_f = 10.5 ac;
L = 650 ft;
V = 0.75 ft/s

C_{2d} = 0.45
C_{2h} = 0.10
S = 0.70%

North Valley Drainage: Ditch stays in place

2-YEAR STORM-DEVELOPED: (to ditch) (continued)

$T_{c2d} = (\frac{650}{0.75})/60 = 14.44\text{min} = 14\text{min};$ $I_{2d} = 1.32$ in/hr

$Q_{2dn} = (0.45)(1.32)(10) = \underline{5.94 \text{ cfs}}$
$Q_{2df} = (0.10)(1.32)(10.5) = \underline{1.39 \text{ cfs}}$
$Q_{2d} = 5.94+1.39 = \underline{7.33 \text{ cfs}}$

2-YEAR STORM-DEVELOPED: storm sewer

4-3 Segment:
$A_{4-3} = 5.26$ ac; $C_{2d} = 0.45$
$S = 0.70\%$; $L = 550$ ft
$V = 1.70$ ft/s
$T_{c2d} = (\frac{550}{1.70})/60 = 5.39\text{min} = 5\text{min};$ $I_{2d} = 1.95$ in/hr

$Q_{4-3} = (0.45)(1.95)(5.26) = \underline{4.62 \text{ cfs}}$
$D_{4-3} = 12"$; $S_{4-3} = 0.86\%$
$V_{4-3} = 6.1$ ft/s; $L_{4-3} = 270$ ft
$t_{4-3} = (\frac{270}{6.1})/60 = 0.74\text{min}$

3-2 Segment:
$A_{3-2} = A_{4-3} + 3.16 = 8.42$ ac; $C_{2d} = 0.45$
$T_{c2d} = 5.39 + t_{4-3} = 6.33\text{min} = 6\text{min};$ $I_{2d} = 1.83$ in/hr

$Q_{3-2} = (0.45)(1.83)(8.42) = \underline{6.93\text{cfs}}$
$D_{3-2} = 15"$; $S_{3-2} = 0.58\%$
$V_{3-2} = 5.8$ ft/s; $L_{3-2} = 250$ ft
$t_{3-2} = (\frac{250}{5.8})/60 = 0.72\text{min}$

2-1 Segment:
Onsite area A_{n2-1} =A3-2 + 1.58 = 10 ac; $C_{2d} = 0.45$
Offsite area $A_{f2-1} = 10$ac; $C_{2h} = 0.10$
$T_{c2-1} = 6.33+t_{3-2} = 7.05\text{min} = 7.00\text{min};$ $I_{2-1} = 1.74$ in/hr

Qn2-1 = (0.45)(1.74)(10) = 7.83 cfs
Qf2-1 = (0.10)(1.74)(10) = 1.74 cfs
$Q_{2-1} = 7.83+1.74 = \underline{9.57 \text{ cfs}}$
$D_{2-1} = 18"$; $S_{2-1} = 0.45\%$
$V_{2-1} = 5.8$ ft/s; $L_{2-1} = 650$ ft
$t_{2-1} = (\frac{650}{5.8})/60 = 1.87\text{min}$

1-Leach Creek Segment:

A2

North Valley drainage: Ditch stays in place

2-YEAR STORM-DEVELOPED (continued)

Onsite area $A_{n1\text{-}Lc}$ = 10ac; $C_{2d} = 0.45$
Offsite area $A_{f1\text{-}Lc}$ = 10*3 = 30ac; $C_{2h} = 0.10$
$T_{c1\text{-}Lc} = 7.05 + t_{2\text{-}1} = 8.92\text{min} = 9.0\text{min}$; $I_{1\text{-}Lc}$ = 1.59 in/hr

$Q_{n1\text{-}Lc} = (0.45)(1.59)(10) = \underline{7.16\text{cfs}}$
$Q_{f1\text{-}Lc} = (0.10)(1.59)(30) = \underline{4.77\text{ cfs}}$
$Q_{1\text{-}Lc} = 7.16 + 4.77 = \underline{11.93\text{ cfs}}$
$D_{1\text{-}Lc}$ =18"; $S_{1\text{-}Lc} = 0.64\%$
$V_{1\text{-}Lc}$ = 6.8 ft/s

100-YEAR STORM-DEVELOPED:(to ditch)

Onsite A_n = 10 ac; $C_{100d} = 0.50$
Offsite A_f = 10.5 ac; $C_{100h} = 0.25$
L = 650 ft; S = 0.70%
V = 0.75 ft/s
$T_{c100d} = (\frac{650}{0.75})/60 = 14.44\text{min} = 14\text{min}$; I_{100d} = 3.33 in/hr

$Q_{n100d} = (0.50)(3.33)(10) = \underline{16.65\text{ cfs}}$
$Q_{f100h} = (0.25)(3.33)(10.5) = \underline{8.74\text{ cfs}}$
$Q_{100d} = 16.65 + 8.74 = \underline{25.39\text{ cfs}}$

100-YEAR STORM-DEVELOPED: (storm sewer)

4-3 Segment:

$A_{4\text{-}3}$ = 5.26 ac; $C_{100d} = 0.50$
S = 0.70%; L = 550 ft
V = 1.70 ft/s
$T_{c100d} = (\frac{550}{1.70})/60 = 5.39\text{min} = 5\text{min}$; $I_{4\text{-}3}$ = 4.83 in/hr

$Q_{4\text{-}3} = (0.50)(4.95)(3.4) = \underline{8.42\text{ cfs}}$
$D_{4\text{-}3}$ = 18"; $S_{4\text{-}3} = 0.64\%$
$V_{4\text{-}3}$ = 6.8 ft/s; $L_{4\text{-}3}$ = 270 ft
$t_{4\text{-}3} = (\frac{270}{6.8})/60 = 0.66\text{min}$

3-2 Segment:

$A_{3\text{-}2} = A_{4\text{-}3} + 3.16 = 8.42$ ac; $C_{100d} = 0.50$
$T_{c3\text{-}2} = 5.39 + t_{4\text{-}3} = 6.03\text{min} = 6\text{min}$; $I_{3\text{-}2}$ = 4.65 in/hr

$Q_{3\text{-}2} = (0.50)(4.65)(8.42) = \underline{19.58\text{ cfs}}$
$D_{3\text{-}2}$ = 24"; $S_{3\text{-}2} = 0.37\%$

North Valley Drainage: Ditch stays in place

100-YEAR STORM-DEVELOPED (continued)

$V_{3-2} = 6.3$ ft/s; $L_{3-2} = 250$ ft
$t_{3-2} = (\frac{250}{6.30})/60 = 0.66$min

2-1 Segment:
Onsite $A_{n2-1} = 8.42+1.38 = 10$ ac; $C_{100d} = 0.50$
Offsite area $A_{f2-1} = 10$ ac; $C_{100h} = 0.25$
$T_{c2-1} = 6.03+t_{3-2} = 6.69$ min $= 7$min; $I_{2-1} = 4.40$ in/hr

$Q_{n2-1} = (0.50)(4.40)(10) = \underline{22\ cfs}$
$Q_{f2-1} = (0.25)(4.40)(10) = \underline{11\ cfs}$
$Q_{2-1} = 22+11 = \underline{33\ cfs}$
$D_{2-1} = 27"$; $S_{2-1} = 0.61\%$
$V_{2-1} = 8.8$ ft/s; $L_{2-1} = 650$ ft
$t_{2-1} = (\frac{650}{8.80})/60 = 1.23$min

1-Leach Creek Segment:
Onsite $A_{n1-Lc} = 7.25$ ac; $C_{100d} = 0.50$
Offsite $A_{f1-Lc} = 3*10 = 30$ ac; $C_{100h} = 0.25$
$T_{1-Lc} = 6.69+t_{2-1} = 7.92$min $= 8$min; $I_{1-Lc} = 4.19$ in/hr

$Q_{n1-Lc} = (0.50)(4.19)(10) = \underline{20.95\ cfs}$
$Q_{f1-Lc} = (0.25)(4.19)(30) = \underline{31.43cfs}$
$Q_{1-Lc} = 20.95+31.43 = \underline{52.38\ cfs}$
$D_{1-Lc} = 33"$; $S_{1-Lc} = 0.52\%$
$V_{1-Lc} = 9.2$ ft/s

North Valley Drainage: Ditch pre-adjusted

2-YEAR STORM-HISTORIC: (to ditch)

Onsite A_n = 10 ac;
Offsite A_f = 10.5 ac;
L = 650 ft;
$T_{c2h} = (\frac{650}{0.75})/60 = 14.44\text{min} = 14\text{min};$

$C_{2h} = 0.10$
S = 0.70%
V = 0.75 ft/s
I_{2h} = 1.32 in/hr

$Q_{n2h} = (0.10)(1.32)(10) = \underline{1.32 \text{ cfs}}$
$Q_{n2f} = (0.10)(1.32)(10.5) = \underline{1.39 \text{ cfs}}$
$Q_{2h} = 1.32+1.39 = \underline{2.71 \text{ cfs}}$

100-YEAR STORM-HISTORIC: (to ditch)

I_{100h} = 3.33 in/hr;
$Q_{n100h} = (0.25)(3.33)(10) = \underline{8.33 \text{ cfs}}$
$Q_{f100h} = (0.25)(3.33)(10.5) = \underline{8.74 \text{ cfs}}$
$Q_{100h} = 8.33+8.74 = \underline{17.07 \text{ cfs}}$

$C_{100h} = 0.25$

2-YEAR STORM-HISTORIC: (to Leach Creek)

Onsite A_n = 10 ac;
Offsite A_f = 35ac;
L = 2000 ft;
$T_{c2h} = \frac{2000}{0.80} * (\frac{1}{60}) = 41.67\text{min} = 42\text{min};$

S = 0.80%
$C_{2h} = 0.10$
V = 0.80 ft/s
I_{2h} = 0.74 in/hr

$Q_{n2h} = (0.10)(0.74)(10) = \underline{0.74 \text{ cfs}}$
$Q_{f2h} = (0.10)(0.74)(35) = \underline{2.59 \text{ cfs}}$
$Q_{2h} = 0.74+2.59 = \underline{3.33 \text{ cfs}}$

100-YEAR STORM-HISTORIC: (to Leach Creek)

I_{100h} = 1.88 in/hr;
$Q_{n100h} = (0.25)(1.88)(10) = \underline{4.7 \text{ cfs}}$
$Q_{f100h} = (0.25)(1.88)(35) = \underline{16.45 \text{ cfs}}$
$Q_{100h} = 4.7+16.45 = \underline{21.15 \text{ cfs}}$

$C_{100h} = 0.25$

2-YEAR STORM-DEVELOPED: (to ditch)

Onsite area A_n = 7.00 ac;
Offsite area A_f = 10.5 ac;
L = 650 ft;
V = 0.75 ft/s

$C_{2d} = 0.45$
$C_{2h} = 0.10$
S = 0.70%

North Valley Drainage : Ditch pre-adjusted

2-YEAR STORM -DEVELOPED (to ditch)(continued)

$T_{c2d} = (\frac{650}{0.75})/60 = 14.44min$; $I_{2d} = 1.32$ in/hr

$Q_{n2d} = (0.45)(1.32)(7) = \underline{4.16\ cfs}$

$Q_{f2d} = (0.10)(1.32)(10.5) = \underline{1.39\ cfs}$

$Q_{2d} = 4.16+1.39 = \underline{5.55\ cfs}$

2-YEAR STORM-DEVELOPED: (storm sewer)

5-3 Segment:

$A_{5-3} = 3$ ac; $C_{2d} = 0.45$

$L = 250$ ft; $S = 0.60\%$

$V = 1.60$ ft/s

$T_{c2d} = (\frac{250}{1.60})/60 = 2.60min = 5min$; $I_{5-3} = 1.95$ in/hr

$Q_{5-3} = (0.45)(1.95)(3) = \underline{2.63\ cfs}$

$D_{5-3} = 10"$; $S_{5-3} = 0.70\%$

$V_{5-3} = 4.80$ ft/s; $L_{5-3} = 676$ ft

$t_{5-3} = (\frac{676}{4.80})/60 = 2.35min$

4-3 Segment:

$A_{4-3} = 5.26$ ac; $C_{2d} = 0.45$

$L = 550$ ft; $S = 0.70\%$

$V = 1.70$ ft/s

$T_{c2d} = (\frac{550}{1.70})/60 = 5.39min = 5min$; $I_{4-3} = 1.95$ in/hr

$Q_{4-3} = (0.45)(1.95)(5.26) = \underline{4.62\ cfs}$

$D_{4-3} = 12"$; $S_{4-3} = 0.82\%$

$V_{4-3} = 6.10$ ft/s; $L_{4-3} = 270$ ft

$t_{4-3} = (\frac{270}{6.10})/60 = 0.74min$

3-2 Segment:

$A_{3-2} = A_{5-3}+A_{4-3}+3.16 = 11.42ac$; $C_{2d} = 0.45$

$T_{3-2} = 5+t_{5-3} = 7.35min = 7min$; $I_{3-2} = 1.74$ in/hr

$Q_{3-2} = (0.45)(1.74)(11.42) = \underline{8.94\ cfs}$

$D_{3-2} = 18"$; $S_{3-2} = 0.41\%$

$V_{3-2} = 5.5$ ft/s; $L_{3-2} = 250$ ft

$t_{3-2} = (\frac{250}{5.5})/60 = 0.76min$

2-1 Segment:

Onsite $A_{n2-1} = A_{3-2}+1.58 = \underline{13\ ac;}$ $C_{2d} = 0.45$

North Valley Drainage: Ditch pre-adjusted

2-YEAR STORM-DEVELOPED (continued)

Offsite A_{f2-1} = 10 ac; C_{2h} =0.10
T_{c2-1} = 7.35+t_{3-2} = 8.11min = 8min; I_{2-1} = 1.66 in/hr

Q_{n2-1} = (0.45)(1.66)(13) = 9.71 cfs
Q_{f2-1} = (0.10)(1.66)(10) = 1.66
Q_{2-1} = 9.71+1.66 = 11.37 cfs
D_{2-1} = 18"; S_{2-1} = 0.66%
V_{2-1} = 6.80 ft/s; L_{2-1} = 650ft
$t_{2-1} = (\frac{650}{6.80})/60$ = 1.59min

1-Leach Creek Segment:
Onsite A_{n1-Lc} = 13.00ac; C_{2d} = 0.45
Offsite A_{f1-Lc} = 10*3 = 30 ac; C_{2h} = 0.10
T_{c1-Lc} = 8.11+t_{2-1} = 9.7min = 10min; I_{1-Lc} = 1.52 in/hr

Q_{n1-Lc} = (0.45)(1.52)(13) = 8.89 cfs
Q_{f1-Lc} = (0.10)(1.52)(30) = 4.56 cfs
Q_{1-Lc} = 8.89+4.56 = 13.45 cfs
D_{1-Lc} = 18"; S_{1-Lc} = 0.8%
V_{1-Lc} = 7.6 ft/s

100-YEAR STORM-DEVELOPED: (to ditch)

Onsite A_n = 7.00 ac; C_{100d} = 0.50
Offsite A_f = 10.5 ac; C_{100h} = 0.25
L = 650 ft; S = 0.70%
V = 0.75 ft/s
$T_{c100d} = (\frac{650}{0.75})/60$ = 14.44min = 14min; I_{100d} = 3.33 in/hr

Q_{n100d} = (0.50)(3.33)(7) = 11.66 cfs
Q_{f100h} = (0.25)(3.33)(10.5) = 8.74 cfs
Q_{100d} = 11.66+8.74 = 20.40cfs

100-YEAR STORM-DEVELOPED: (storm sewer)

5-3 Segment:
A_{5-3} = 3 ac; C_{100d} = 0.50
L = 250 ft; S = 0.60%
V = 1.60 ft/s
$T_{c100d} = (\frac{250}{1.60})/60$ = 2.60min = 5min; I_{5-3} = 4.95 in/hr

North Valley Drainage: Ditch pre-adjusted

100-YEAR STORM-DEVELOPED (continued)

$Q_{5-3} = (0.50)(4.95)(3) = \underline{7.43\ cfs}$
$D_{5-3} = 15"$; $S_{5-3} = 0.67\%$
$L_{5-3} = 676$ ft; $V_{5-3} = 6.2$ ft/s
$t_{5-3} = (\frac{676}{6.2})/60 = 1.82min$

4-3 Segment:
$A_{4-3} = 4.68$ ac; $C_{100d} = 0.50$
$L = 550$ ft; $S = 0.70\%$
$V = 1.70$ ft/s;
$T_{c100d} = (\frac{550}{1.70})/60 = 5.39min$; $I_{4-3} = 4.83$ in/hr

$Q_{4-3} = (0.50)(4.83)(5.26) = \underline{12.70\ cfs}$
$D_{4-3} = 18"$; $S_{4-3} = 0.64\%$
$V_{4-3} = 7.0$ ft/s; $L_{4-3} = 270$ ft
$t_{4-3} = (\frac{270}{7.0})/60 = 0.64min$

3-2 Segment:
$A_{3-2} = 11.42$ ac; $C_{100d} = 0.50$
$T_{c3-2} = 5.00 + t_{5-3} = 6.82min = 7.00min$; $I_{3-2} = 4.40$ in/hr

$Q_{3-2} = (0.50)(4.40)(11.42) = \underline{25.12\ cfs}$
$D_{3-2} = 24"$; $S_{3-2} = 0.64\%$
$V_{3-2} = 8.20$ ft/s; $L_{3-2} = 250$ ft
$t_{3-2} = (\frac{250}{8.20})/60 = 0.51$ min

2-1 Segment:
Onsite $A_{n2-1} = 13ac$; $C_{100d} = 0.50$
Offsite $A_{f2-1} = 10$ ac; $C_{100h} = 0.25$
$T_{c2-1} = 6.82 + t_{3-2} = 7.33min = 7.00min$; $I_{2-1} = 4.33in/hr$

$Q_{n2-1} = (0.50)(4.33)(13) = \underline{28.15\ cfs}$
$Q_{f2-1} = (0.25)(4.33)(10) = \underline{10.83\ cfs}$
$Q_{2-1} = 28.15 + 10.83 = \underline{38.98cfs}$
$D_{2-1} = 30"$; $S_{2-1} = 0.49\%$
$V_{2-1} = 8.4$ ft/s; $L_{2-1} = 650$ ft
$t_{2-1} = (\frac{650}{8.40})/60 = 1.31min$

1- Leach Creek Segment:
Onsite $A_{n1-Lc} = 13.00$ ac; $C_{100d} = 0.50$
Offsite $A_{f1-Lc} = 3*10 = 30$ ac; $C_{100h} = 0.25$

North Valley Drainage: Ditch pre-adjusted

100-YEAR STORM-DEVELOPED (continued)

$T_{c1\text{-}Lc} = 7.33 + t_{2\text{-}1} = 8.64\text{min} = 9.00\text{min};$ $I_{1\text{-}Lc} = 3.99$ in/hr

$Q_{n\text{-}Lc} = (0.50)(3.99)(13) =$ 25.94 cfs
$Q_{f\text{-}Lc} = (0.25)(3.99)(30) =$ 29.93 cfs
Q1-Lc = 25.94+29.93 = 55.87 cfs
$D_{1\text{-}Lc} = 33"$; $S_{1\text{-}Lc} = 0.58$ %
$V_{1\text{-}Lc} = 9.6$ ft/s

North Valley Drainage: Sub-basin Drainage

Sub-basin Area (1): A_1 = 5.26 ac

Historic Condition:

2-YEAR STORM

$C_{2h} = 0.10$;	$S = 0.60\%$
$L = 650$ ft;	$V = 1.60$ ft/s
$T_{c2h} = (650/1.60)/60 = 6.77\text{min} = 7\text{min}$;	$I_{2h1} = 1.74$ in/hr
$Q_{2h1} = (0.10)(1.74)(5.26) = \underline{0.92\text{ cfs}}$	

100-YEAR STORM

$C_{100h} = 0.25$;	$I_{100h1} = 4.40$ in/hr
$Q_{100h1} = (0.25)(4.40)(5.26) = \underline{5.79\text{ cfs}}$	

Developed Condition:

2-YEAR STORM

$C_{2d} = 0.45$;	$S = 0.70\%$
$L = 550$ ft;	$V = 1.70$ ft/s
$T_{c2d} = (550/1.70)/60 = 5.39\text{min} = 5\text{min}$;	$I_{2d1} = 1.95$ in/hr
$Q_{2d1} = (0.45)(1.95)(5.26) = \underline{4.62\text{ cfs}}$	

100-YEAR STORM

$C_{100d} = 0.50$;	$I_{100d1} = 4.83$ in/hr
$Q_{100d1} = (0.50)(4.83)(5.26) = \underline{12.70\text{ cfs}}$	

Sub-basin Area (2): A_2 = 3.16 ac

Historic Condition:

2-YEAR STORM

$C_{2h} = 0.10$;	$S = 0.60\%$
$L = 550$ ft;	$V = 1.60$ ft/s
$T_{c2h} = (550/1.6)/60 = 5.73\text{min} = 6\text{ min}$;	$I_{2h2} = 1.83$ in/hr
$Q_{2h2} = (0.10)(1.83)(3.16) = \underline{0.58\text{ cfs}}$	

100-YEAR STORM

$C_{100h} = 0.25$;	$I_{100h2} = 4.65$ in/hr
$Q_{100h2} = (0.25)(4.65)(3.16) = \underline{3.67\text{ cfs}}$	

Developed Condition:

2-YEAR STORM

$C_{2d} = 0.45$;	$S = 0.70\%$

North Valley Drainage: Sub-basin Drainage

Sub-basin Area (2): A_2 = 3.16ac (continued)

L = 550 ft; V = 1.70 ft/s
T_{c2d} = (550/1.70)/60 = 5.39min = 5min; I_{2d2} = 1.95 in/hr
Q_{2d2} = (0.45)(1.95)(3.16) = <u>2.13 cfs</u>

100-YEAR STORM
C_{100d} = 0.50; I_{100d2} = 4.95 in/hr
Q_{100d2} = (0.50)(4.95)(3.16) = <u>7.82 cfs</u>

Sub-basin Area (3): A_3 = 1.58 ac

Historic Condition:

2-YEAR STORM
C_{2h} = 0.10; S = 0.60%
L = 550 ft; V = 1.60 ft/s
T_{c2h} = (550/1.60)/60 = 5.73min = 6min; I_{2h3} = 1.83 in/hr
Q_{2h3} = (0.10)(1.83)(1.58) = <u>0.29 cfs</u>

100-YEAR STORM
C_{100h} = 0.25; I_{100h} = 4.65 in/hr
Q_{100h3} = (0.25)(4.65)(1.58) = <u>1.84 cfs</u>

Developed Condition:

2-YEAR STORM
C_{2d} = 0.45; S = 0.70%
L = 550 ft; V = 1.70 ft/s
T_{c2d} = (550/1.70)/60 = 5.39min = 5min; I_{2d3} = 1.95 in/hr
Q_{2d3} = (0.45)(1.95)(1.58) = <u>1.39 cfs</u>

100-YEAR STORM
C_{100d} =0.50; I_{100d3} = 4.95 in/hr
Q_{100d3} = (0.50)(4.95)(1.58) = <u>3.91 cfs</u>

Sub-basin Area (4): A_4 = 3ac

Historic Condition:

2-YEAR STORM
C_{2h} = 0.10; S = 0.70 %
L = 250 ft; V = 0.75 ft/s
T_{c2h} = (250/0.75)/60 = 5.55min = 6min; I_{2h4} = 1.83 in/hr

North Valley Drainage: Sub-basin drainage

Sub-basin Area (4): A_4 = 3 ac (continued)

$Q_{2h4} = (0.10)(1.83)(3) = \underline{0.55\ cfs}$

100-YEAR STORM

$C_{100h} = 0.25$; $I_{100h4} = 4.65$ in/hr

$Q_{100h4} = (0.25)(4.65)(3) = \underline{3.49\ cfs}$

Developed Conditions

2-YEAR STORM

$C_{2d} = 0.45$; S = 0.70%

L = 250 ft; V = 1.70 ft/s

$T_{c2d} = (250/1.70)/60 = 2.45min = 5min$; $I_{2d4} = 1.95$ in/hr

$Q_{2d4} = (0.45)(1.95)(3) = \underline{2.63\ cfs}$

100-YEAR STORM

$C_{100d} = 0.50$; $I_{100d4} = 4.95$ in/hr

$Q_{100d4} = (0.50)(4.95)(3) = \underline{7.43\ cfs}$

Sub-basin Area (5): A_5 = 10 ac (to ditch)- ditch stays in place

For the runoff flowrate from this sub-basin, see Q_n under 2-YEAR STORM HISTORIC (to ditch), 100-YEAR STORM HISTORIC (to ditch), 2-YEAR STORM DEVELOPED (to ditch) and 100-YEAR STORM DEVELOPED (to ditch) respectively.

Sub-basin Area (6): A_6 = 7 ac (to ditch)- ditch pre-adjusted

For the runoff flowrate from this sub-basin, see Q_n under 2-YEAR STORM HISTORIC (to ditch), 100-YEAR STORM HISTORIC (to ditch), 2-YEAR STORM DEVELOPED (to ditch) and 100-YEAR STORM DEVELOPED (to ditch) respectively.

SUMMARY OF RUNOFF CALCULATIONS

DITCH STAYS IN PLACE

HISTORIC RUNOFF: (To Ditch)

Onsite Area A_n = 10ac;	Q_{2hn} = 1.32 cfs;	Q_{100hn} = 8.33 cfs
Offsite Area A_f = 10.5 ac;	Q_{2hf} = 1.39 cfs;	Q_{100hf} = 8.74 cfs
Total Area A_T = 20.5 ac;	Q_{2h} = 2.71 cfs;	Q_{100h} = 17.07 cfs

DEVELOPED RUNOFF: (To Ditch)

Onsite Area A_n = 10 ac;	Q_{2dn} = 5.94 cfs;	Q_{100dn} = 16.65 cfs
Offsite AreaA_f = 10.5 ac;	Q_{2hf} = 1.39 cfs;	Q_{100hf} = 8.74 cfs
Total Area A_T = 20.5 ac;	Q_{2d} = 7.33 cfs;	Q_{100d} = 25.39 cfs

HISTORIC RUNOFF: (Storm Sewer)

Onsite Area A_n = 10 ac;	Q_{2hn} = 0.74 ac;	Q_{100hn} = 4.70 cfs
Offsite Area A_f = 35 ac;	Q_{2hf} = 2.59 ac;	Q_{100hf} = 16.45 cfs
Total Area A_T = 45 ac;	Q_{2h} = 3.33 cfs;	Q_{100h} = 21.15 cfs

DEVELOPED RUNOFF: (Storm Sewer)

Onsite Area A_n = 10ac;	Q_{2dn} = 7.16 cfs;	Q_{100dn} = 20.95 cfs
Offsite Area A_f= 30 ac;	Q_{2hf} = 4.77 cfs;	Q_{100hf} = 31.43 cfs
Total Area A_T = 40 ac;	Q_{2d} = 11.93 cfs;	Q_{100d} = 52.38 cfs

DITCH PRE-ADJUSTED

HISTORIC RUNOFF: (To Ditch)

Onsite Area A_n = 10ac;	Q_{2hn} = 1.32 cfs;	Q_{100hn} = 8.33 cfs
Offsite Area A_f = 10.5 ac;	Q_{2hf} = 1.39 cfs;	Q_{100hf} = 8.74 cfs
Total Area A_T = 17.5 ac;	Q_{2h} = 2.71 cfs;	Q_{100h} = 17.07 cfs

DEVELOPED RUNOFF: (To Ditch)

Onsite Area A_n = 7 ac;	Q_{2dn} = 4.16 cfs;	Q_{100dn} = 11.66cfs
Offsite Area A_f = 10.5 ac;	Q_{2hf} = 1.39 cfs;	Q_{100hf} = 8.74 cfs
Total Area A_T = 17.5 ac;	Q_{2d} = 5.55 cfs;	Q_{100d} = 20.40 cfs

HISTORIC RUNOFF: (Storm Sewer)

Onsite Area A_n = 10 ac;	Q_{2hn} = 0.74 ac;	Q_{100hn} = 4.70 cfs
Offsite Area A_f = 35 ac;	Q_{2hf} = 2.59 ac;	Q_{100hf} = 16.45 cfs
Total Area A_T = 45 ac;	Q_{2h} = 3.33 cfs;	Q_{100h} = 21.15 cfs

DEVELOPED RUNOFF: (Storm Sewer)

Onsite Area A_n = 13ac;	Q_{2dn} = 8.89 cfs;	Q_{100dn} = 25.49 cfs
Offsite Area A_f= 30 ac;	Q_{2hf} = 4.56cfs;	Q_{100hf} = 29.93 cfs
Total Area A_T = 43 ac;	Q_{2d} = 13.45 cfs;	Q_{100d} = 55.87cfs

SUMMARY OF SUB-BASINS DRAINAGE

Sub-basin Area (1): A_1 = 5.26 ac

Historic Runoff:	Q_{2h1} = 0.92 cfs;	Q_{100h1} = 5.79 cfs
Developed Runoff:	Q_{2d1} = 4.62 cfs;	Q_{100d1} = 12.70 cfs

Sub-basin Area (2): A_2 = 3.16 ac

Historic Runoff:	Q_{2h2} = 0.58 cfs;	Q_{100h2} = 3.67 cfs
Developed Runoff:	$Q_{2d}2$ = 2.13 cfs;	Q_{100d2} = 7.82 cfs

Sub-basin Area (3): A_3 = 1.58 ac

Historic Runoff:	Q_{2h3} = 0.29 cfs;	Q_{100h3} = 1.84 cfs
Developed Runoff:	Q_{2d3} = 1.39 cfs;	Q_{100d3} = 3.91 cfs

Sub-basin Area (4): A_4 = 3ac

Historic Runoff:	Q_{2h4} = 0.55 cfs;	Q_{100h4} = 3.49 cfs
Developed Runoff:	Q_{2d4} = 2.63 cfs;	Q_{100d4} = 7.43 cfs

Sub-basin Area (5): A_5 = 10 ac (to ditch, ditch stays in place)

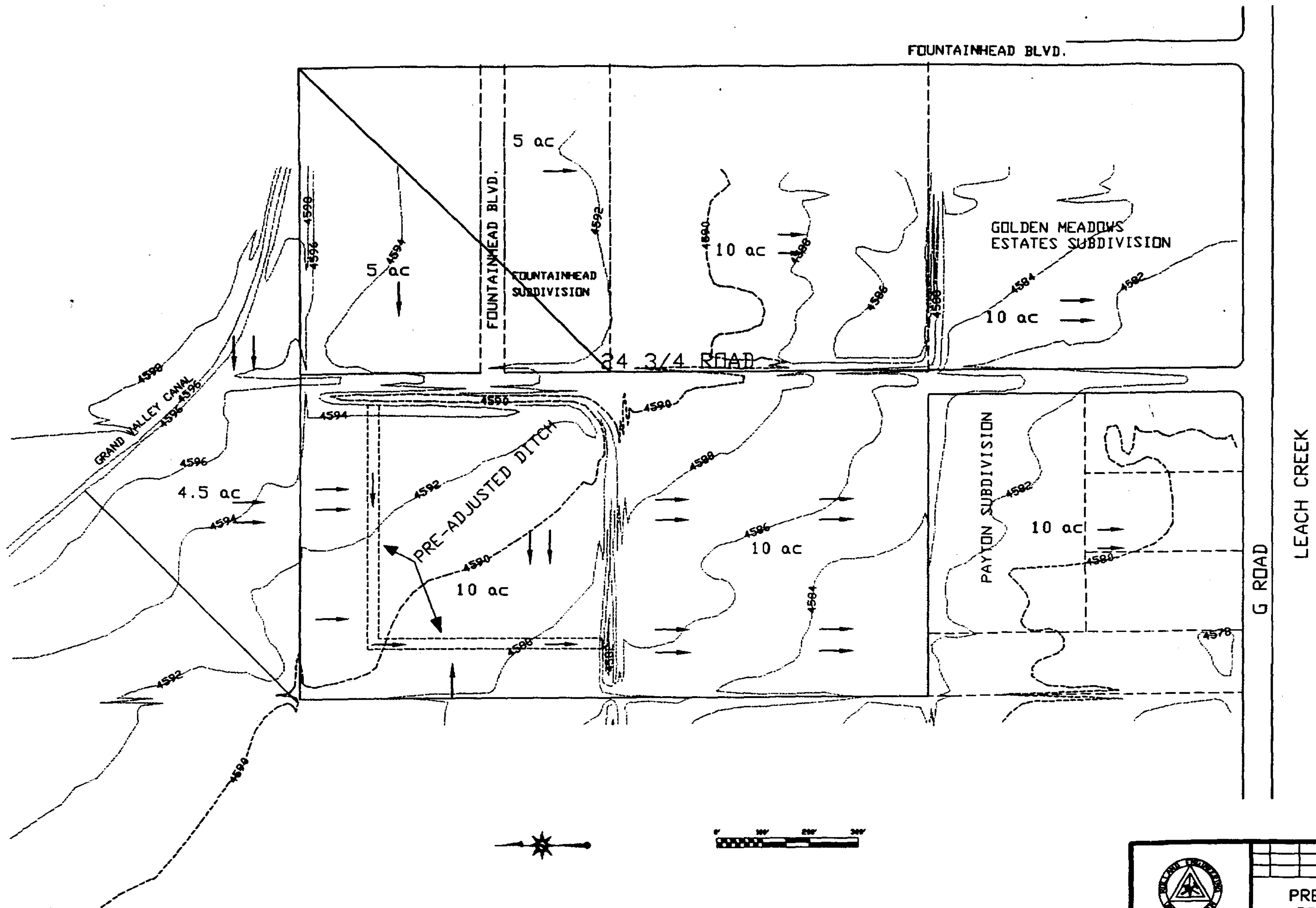
Historic Runoff:	Q_{2h5} = 1.32 cfs;	Q_{100h5} = 8.33 cfs
Developed Runoff:	Q_{2d5} = 5.94 cfs;	Q_{100d5} =16.65cfs

Sub-basin Area (6): A6 = 7ac (to ditch, ditch pre-adjusted)

Historic Runoff:	Q_{2h6} = 0.92 cfs;	Q_{100h6} = 5.83cfs
Developed Runoff:	Q_{2d6} = 4.16 cfs;	Q_{100d6} = 11.66 cfs

APPENDIX B

APPENDIX C



PRE-DEVELOPED DRAINAGE MAP

- DITCH PRE-ADJUSTED

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Grand Jct, CO 81503
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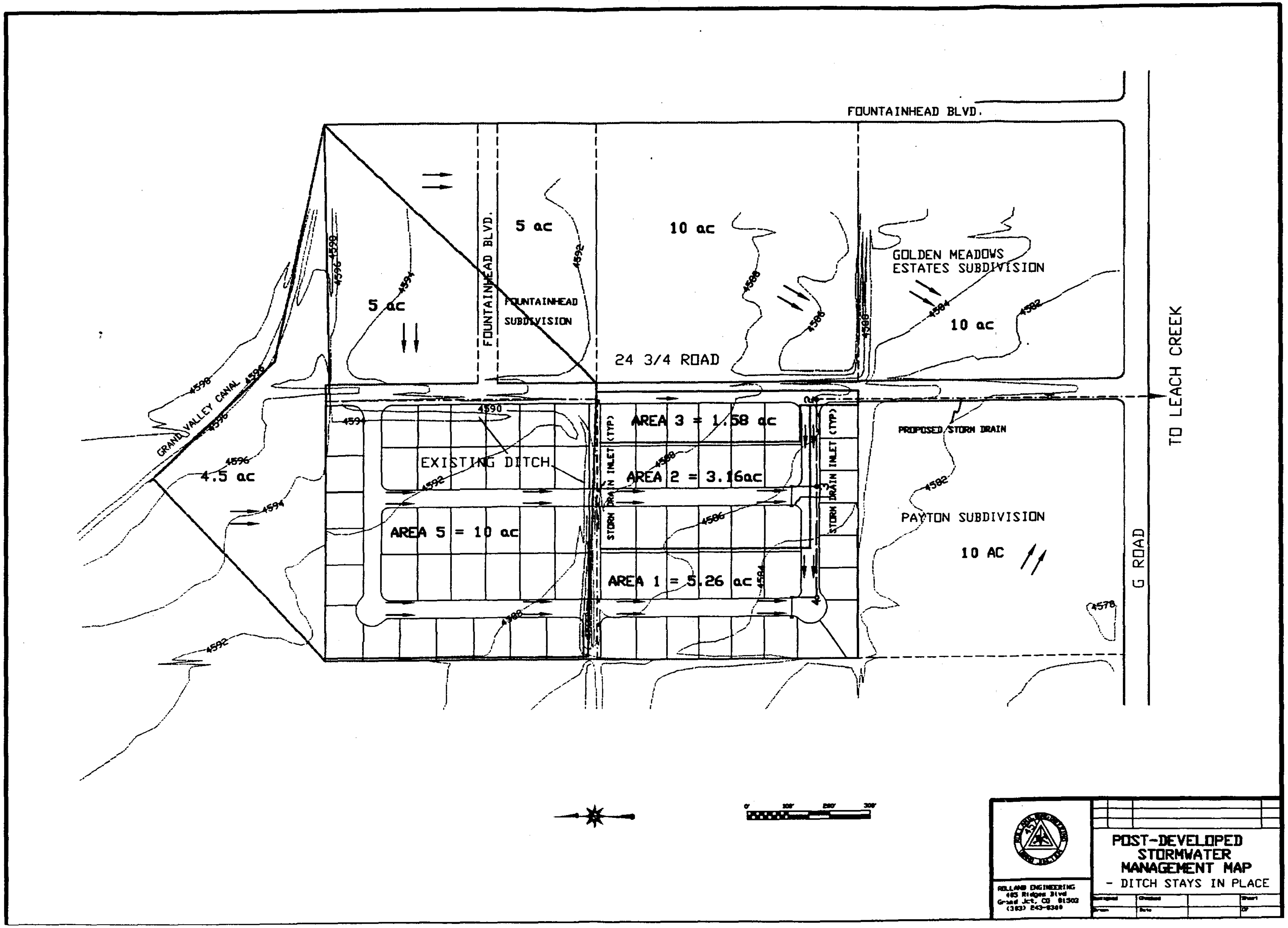
Designed	Checked		Sheet
Drawn	Date		Of

APPENDIX D


FOUNTAINHEAD BLVD.
FOUNTAINHEAD BLVD.
FOUNTAINHEAD SUBDIVISION
5 ac
5 ac
10 ac
10 ac
GOLDEN MEADOWS ESTATES SUBDIVISION
24 3/4 ROAD
TO LEACH CREEK
GRAND VALLEY CANAL
4.5 ac
EXISTING DITCH
AREA 3 = 1.58 ac
AREA 2 = 3.16ac
AREA 5 = 10 ac
AREA 1 = 5.26 ac
STORM DRAIN INLET (TYP)
STORM DRAIN INLET (TYP)
PROPOSED STORM DRAIN
PAYTON SUBDIVISION
10 AC
G ROAD
POST-DEVELOPED STORMWATER MANAGEMENT MAP
- DITCH STAYS IN PLACE
ROLLAND ENGINEERING
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Grand Jct, CO 81503
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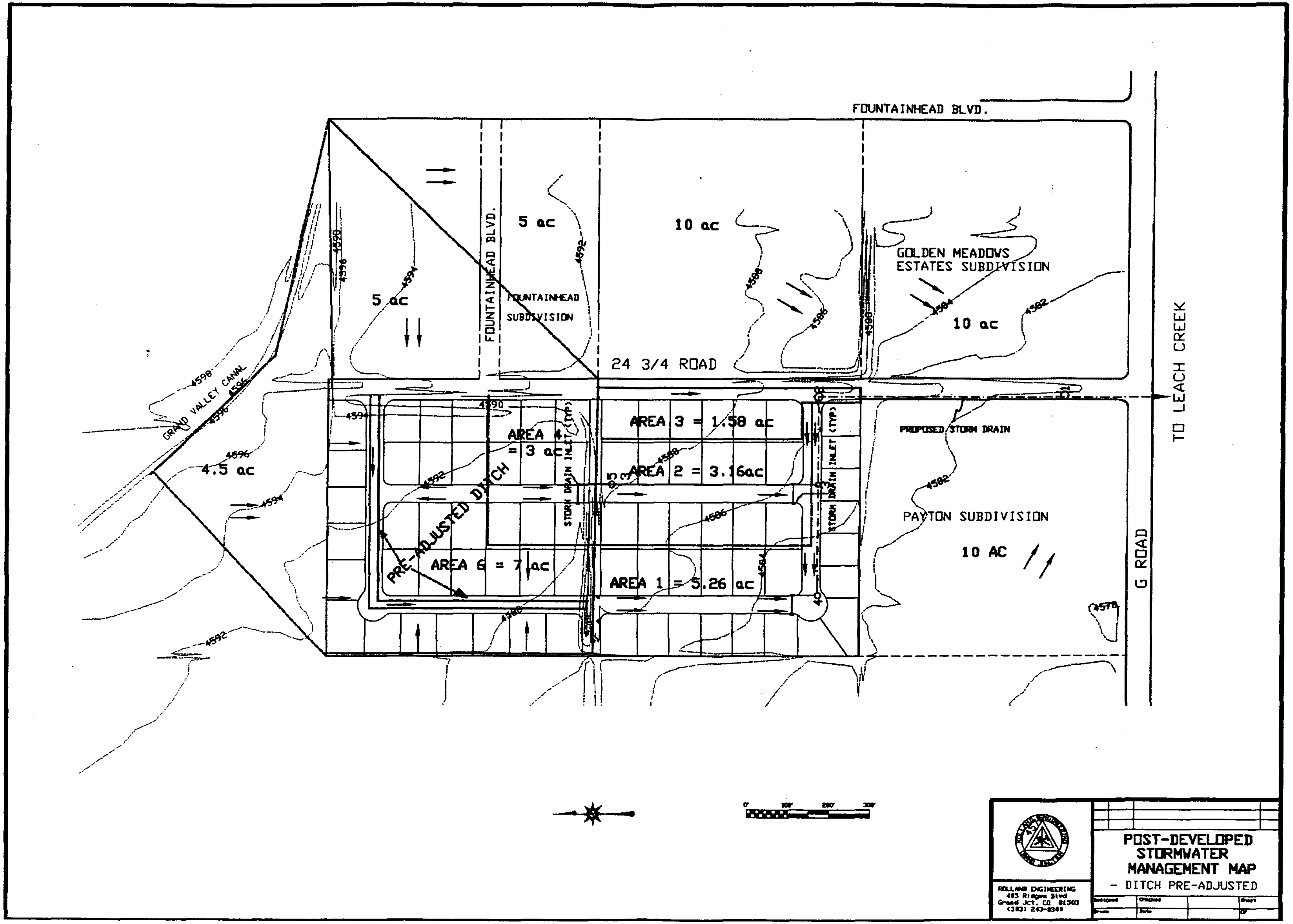
APPENDIX E



FOUNTAINHEAD BLVD.
5 ac
10 ac
GOLDEN MEADOWS
ESTATES SUBDIVISION
5 ac
FOUNTAINHEAD BLVD.
FOUNTAINHEAD
SUBDIVISION
10 ac
24 3/4 ROAD
TO LEACH CREEK
GRAND VALLEY CANAL
4.5 ac
AREA 4
= 3 ac
AREA 3 = 1.58 ac
AREA 2 = 3.16ac
PROPOSED STORM DRAIN
STORM DRAIN INLET (TYP)
PRE-ADJUSTED DITCH
PAYTON SUBDIVISION
10 AC
AREA 6 = 7 ac
AREA 1 = 5.26 ac
G ROAD
ROLLAND ENGINEERING
POST-DEVELOPED
STORMWATER
MANAGEMENT MAP
- DITCH PRE-ADJUSTED

SUPPLEMENT 1

comparatively ...
5 percent that extend 4 to 6 feet above the prevailing level or in small irregularly shaped bodies on relatively smooth topography. Wherever the areas of Chipeta soil occur, they are too small and too intricately associated with the Persayo soil to be mapped separately.

Use and management.—About 25 percent of this complex is cultivated, but practically all of it could be. The Chipeta soil is not difficult to level, but the expense of leveling and the isolated location of the areas have not favored development for irrigation and cropping. The kinds of crops grown, the management practiced, and the yields produced are approximately the same as for Persayo-Chipeta silty clay loams, 0 to 2 percent slopes.

Ravola clay loam, 0 to 2 percent slopes (RA).—This soil, the second most extensive in the area, has developed in material that consists largely of reworked Mancos shale but includes an appreciable amount of sandy alluvium from the higher Mesaverde formation. The surface of these deposits is relatively level, but the depth of the deposits ranges from 5 to 30 feet. The soil is associated with the Billings silty clay loams and the Ravola fine sandy loams. The most important areas are east, northeast, and southeast of Fruita, north and northwest of Palisade, and north and northwest of Clifton.

The soil is much like the Billings silty clay loams but more porous because it contains more fine sand, especially in the subsoil. Ordinarily, the 10- or 12-inch surface layer consists of light brownish-gray to very pale-brown light clay loam. The underlying layers vary from place to place in thickness and texture and become more sandy below depths of 4 to 5 feet. The range in the subsoil is from fine sandy loam to clay loam.

Small fragments of shale and sandstone are common from the surface downward and are especially noticeable in areas nearest the source of the soil material. The entire profile is calcareous and friable, so internal drainage is medium and development of plant roots is not restricted. The surface is smooth. Most areas are at slightly higher levels than the associated areas of Billings silty clay loams and therefore have better drainage and a lower content of salts. The soil, however, is slightly saline under native cover, and in places it has strongly saline spots and a high water table.

Use and management.—About 95 percent of this soil is cultivated. The chief crops are alfalfa, corn, pinto beans, small grains, and, where climate is favorable, orchard fruits. Practically all the acreage used for tree fruits is near Clifton and Palisade. The acreage used for field crops varies from year to year, but by rough estimate about 30 percent is cropped to corn, 25 percent to alfalfa, 15 percent to pinto beans, 13 percent to orchard fruits, 10 percent to small grains, and the rest to sugar beets, tame hay, tomatoes, and various vegetable crops.

In general, the tilth and workability of this soil are favorable. The content of organic matter is generally less than 1 percent, but many farmers are improving the supply by growing more alfalfa and by using other improved management.

Ravola clay loam, 2 to 5 percent slopes (RB).—This soil differs from Ravola clay loam, 0 to 2 percent slopes, mainly in having greater slopes. Although the combined areas total only seven-tenths of a square mile, this soil is important because the largest single area—Vinelands and is used for peach growing. The remaining areas, widely scattered over the valley, total about 150 acres and are of minor importance.

The large area occupies a position intermediate between the Green River soils and the higher Mesa soils. Its underlying gravel and stone strata consist not only of sandstone but also of granite, schist, basalt, and lava. Much of the lava was deposited by drainage from the southeast. This large area was included with the soil unit largely because its color was similar to that of the other soil areas. Not many years ago subdrainage became inadequate for existing tree fruits and it was not until a number of tile drains were laid, as deep as 7 to 8 feet in places, that subdrainage was corrected in parts of this particular area.

Use and management.—All of the large soil area is in peaches. On it peach yields average as high as in any section of the valley, primarily because the danger of frost damage is negligible. Some of the orchards are now more than 50 years old but have produced steadily and still yield more than 400 bushels an acre according to reports from local growers. About half of the small scattered areas are cultivated. They are used largely for field crops because climatic conditions are not so favorable for peach growing. In building up the organic matter content, the growing of legumes, application of manure in large amounts, and use of commercial fertilizer generally are practiced.

Ravola very fine sandy loam, 0 to 2 percent slopes (RF).—This extensive and important soil occurs either along washes or arroyas extending from the north or on broad coalescing alluvial fans. The alluvial material from which the soil has developed was derived from sandstone and shale and ranges from 4 to 20 feet deep. The principal areas of the soil are north and northwest of Grand Junction and north, northwest, and southwest of Fruita.

This soil is much like Ravola fine sandy loam, 0 to 2 percent slopes, but is generally more uniformly level. The texture is prevailingly very fine sandy loam, but the percentage of silt is noticeably higher in some places. A few small areas that have a loam texture are included.

The 10- or 12-inch surface layer consists of light brownish-gray to very pale-brown very fine sandy loam. In some places the underlying thin depositional layers vary only slightly in color or texture. In other places, especially near drainage courses, the layers are more variable and may grade to loam, silt loam, or fine sandy loam. Nevertheless, layers of very fine sandy loam are more numerous. Below depths of 4 to 5 feet, the texture is sandier, and at depths of 8 to 12 feet strata of loamy fine sand, gravel, and scattered sandstone rock are common.

Disseminated lime occurs from the surface downward. Owing to the friable consistence of the successive layers, the tilth, internal drainage, available supply of moisture for plants, permeability to plant roots, and other physical properties are favorable and assure a wide suitability range for crops. The organic-matter content, however, is low. The soil is slightly saline under native cover and has a few strongly saline spots. Occasionally the water table is high.

Use and management.—More than 99 percent of this soil is cultivated. The chief crops are alfalfa, corn, pinto beans, small grains,

SUPPLEMENT 2

SECTION 3

HYDROLOGIC SOIL GROUPS

This section gives definition of four soil groups that are used in determining hydrologic soil-cover complexes, for estimating runoff from rainfall.

Definitions

The hydrologic soil groups, according to their infiltration and transmission rates, are:

A. (Low runoff potential). Soils have high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well to excessively drained sands or gravel. These soils have a high rate of water transmission in that water readily passes through them.

B. Soils having moderate infiltration rates when thoroughly wetted. These consist chiefly of moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

C. Soils having slow infiltration rates when thoroughly wetted. These consist chiefly of soils with a layer that impeded downward movement of water or soils with moderately fine to fine texture. These soils have a slow rate of water transmission.

D. (High runoff potential). Soils having very slow infiltration rates when thoroughly wetted. These consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

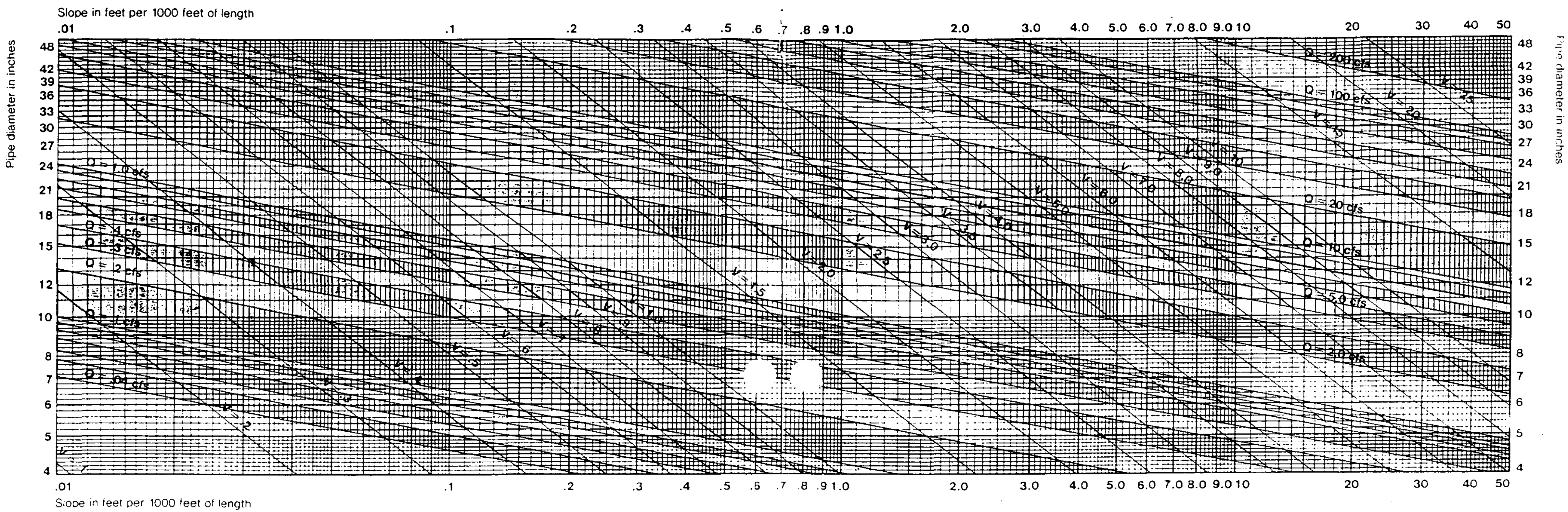
Source of Data

Local Soil Conservation Service field offices have soil survey data for their respective areas. Much of this existing data was mapped with soil symbols or with soil series names that may not be current. These symbols or soil series names may be converted to current names with assistance from respective SCS offices. The 1979 publication, "Soils of Colorado" has current soil series names and hydrologic groups. This information is included in Table S-2 of this publication.

Coefficient of flow
$n = 0.009$

Derived from the Manning Formula
$v = \frac{1.486}{n} R^{2/3} S^{1/2}$

PVC gravity sewer pipes have a coefficient of n = 0.009. Their high carrying capacities may often result in the use of flatter grades or in the use of smaller diameter pipe.



(Above Graph Based On Pipe Flowing Full)

Slope values

Slope values derived from this chart are for coefficient of flow n = 0.009. They may be converted to slopes for other coefficients of flow by means of the following multiplying factors:

0.79 for n = 0.008	1.77 for n = 0.012
1.00 for n = 0.009	2.086 for n = 0.013
1.23 for n = 0.010	2.42 for n = 0.014
1.494 for n = 0.011	2.778 for n = 0.015

Diameters

Diameters derived from this chart are for coefficient of flow n = 0.009. These may be converted to diameters for other coefficients of flow by means of the following multiplying factors

0.956 for n = 0.008	1.114 for n = 0.012
1.000 for n = 0.009	1.147 for n = 0.013
1.040 for n = 0.010	1.180 for n = 0.014
1.078 for n = 0.011	1.211 for n = 0.015

Conversion factors CFS, MGD, GPM

To convert cubic feet per second (cfs) to million gallons per day (mgd), multiply cfs by 0.646. To convert cubic feet per second (cfs) to gallons per minute, multiply cfs by 448.83.

One cubic foot of water = 7.48 gallons

Assume:

Flow coefficient n = 0.009
Length = 2800 ft
Pipe size = 8 inch
Elevations—Upstream = 215'- 0
Downstream = 213'- 0"

Required:

1) Flow rate when flowing full
2) Velocity

Difference in elevation divided by length of pipe line equals slope in ft/ft. Multiplying by 1000 = slope 0.7 ft/1000 ft. Enter graph at 0.7 slope and also at 8 inch diameter pipe. At intersection, lines for velocity and flow rate also intersect. These give flow rate of 0.5 cu. ft. per second and velocity of 1.3 feet per second.

(Based On Manning Equation. Flow Co-Efficients As Noted. A Slope Of 0.5% Or 5.0 Feet Per 1,000 Feet)

Perma-Loc (n = .009) Dia (In.)	Avg ID (In.)	Flow (CFS)	Reinforced Concrete (n = .013) Diameter Needed for Same Flow (In.)	Closest Pipe Size Available (In.)	Corrugated Metal (n = .021) Diameter Needed for Same Flow (In.)	Closest Pipe Size Available (In.)
36	35.50	32.82	40.75	42	48.78	54
30	29.50	20.03	33.86	36	40.53	42
27	26.50	15.05	30.42	33	36.41	42
24	23.50	10.92	26.97	27	32.30	33
21	20.75	7.84	23.81	24	28.51	30
18	17.65	5.09	20.26	21	24.25	27

(Above Chart Based On Pipe Flowing Half-Full)

APPENDIX A

INTENSITY - DURATION - FREQUENCY (I-D-F) TABLE

(Based upon The 1992 Mesa County Drainage Criteria Manual)

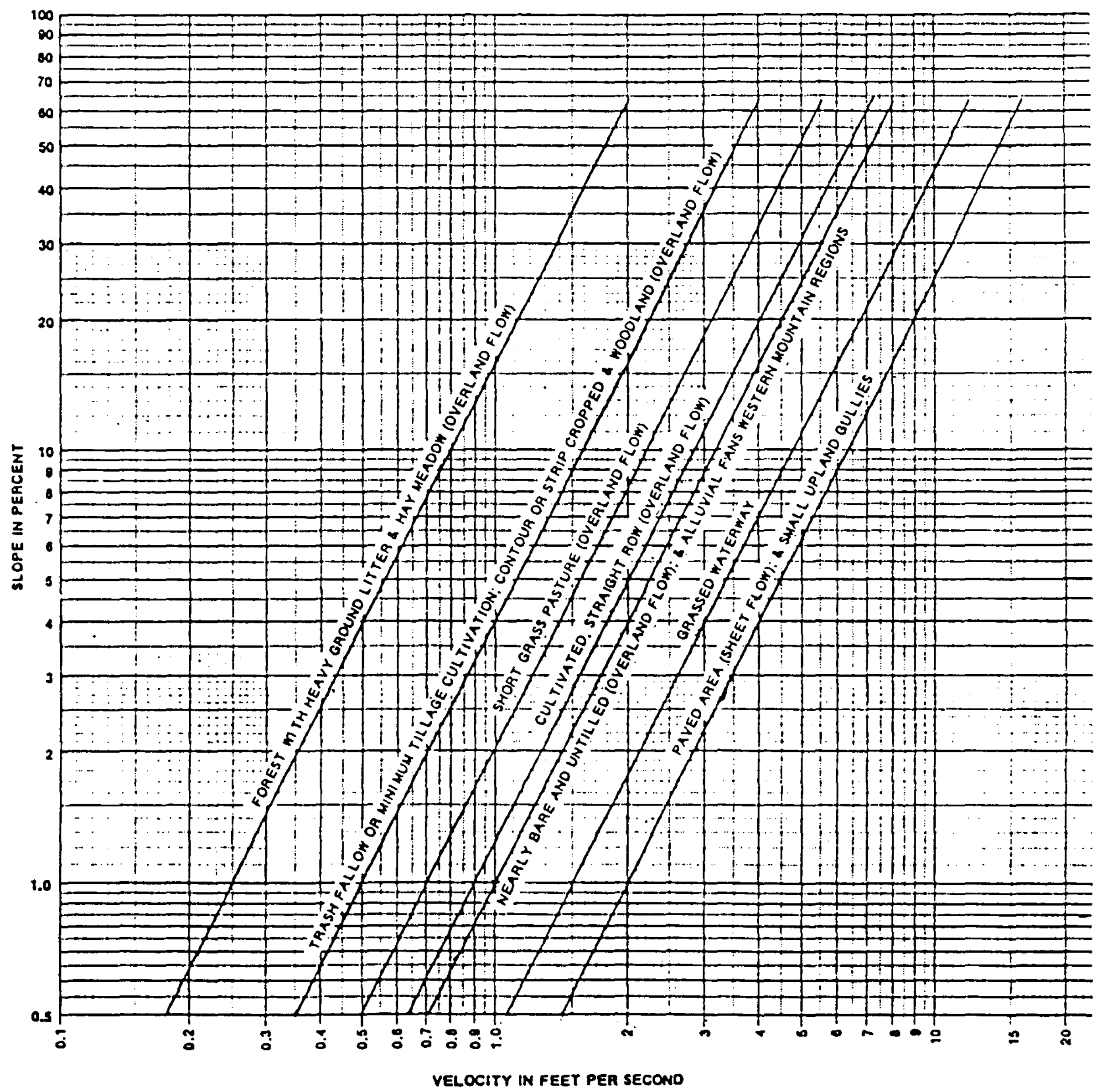
TIME (MIN)	2-YEAR ITENSITY (IN/HR)	100-YEAR ITENSITY (IN/HR)	TIME (MIN)	2-YEAR ITENSITY (IN/HR)	100-YEAR ITENSITY (IN/HR)
5	1.95	4.95	33	0.83	2.15
6	1.83	4.65	34	0.82	2.12
7	1.74	4.40	35	0.81	2.09
8	1.66	4.19	36	0.80	2.06
9	1.59	3.99	37	0.79	2.03
10	1.52	3.80	38	0.78	2.00
11	1.46	3.66	39	0.77	1.97
12	1.41	3.54	40	0.76	1.94
13	1.36	3.43	41	0.75	1.91
14	1.32	3.33	42	0.74	1.88
15	1.28	3.24	43	0.73	1.85
16	1.24	3.15	44	0.72	1.82
17	1.21	3.07	45	0.71	1.79
18	1.17	2 ~~7~~.99	46	0.70	1.76
19	1.14	2.91	47	0.69	1.73
20	1.11	2.84	48	0.68	1.70
21	1.08	2.77	49	0.69	1.67
22	1.05	2.70	50	0.66	1.64
23	1.02	2,63	51	0.65	1.61
24	1.00	2.57	52	0.64	1.59
25	0.98	2.51	53	0.63	1.57
26	0.96	2.46	54	0.62	1.55
27	0.94	2.41	55	0.61	1.53
28	0.92	2.36	56	0.60	1.51
29	0.90	2.31	57	0.59	1.49
30	0.88	2.27	58	0.58	1.47
31	0.86	2.23	59	0.57	1.45
32	0.84	2.19	60	0.56	1.43

Appendix "C"
5 of 5

MESA COUNTY
STORM DRAINAGE CRITERIAL MANUAL

FIGURE 402

Taken from TR-55 (1975) and NEH-4, both SCS publications.



AVERAGE VELOCITIES FOR OVERLAND FLOW

NARRATIVE
NORTH VALLEY SUBDIVISION, FILING NO. TWO

Date: November 30, 1995

Prepared for:
G Road, LLC
c/o Mr. Chris Carnes
1401 N. 1st
Grand Junction, CO 81501

Prepared by:
ROLLAND Engineering
405 Ridges Blvd., Suite A
Grand Junction, CO 81503

North Valley Subdivision is located at 24 3/4 Road and G Road. The site is a total of twenty acres with ten acres having been approved for construction during the initial planning process approval. The original narrative stated that the Developers, G Road LLC, were intending to develop 38 lots on the south ten acres with the construction of Filing No. One and Two. Filing No. One consists of eighteen lots and has approximately twelve houses completed. Filing No. Two will be an additional twenty lots as originally proposed and designed.

All utilities are available at the present street stubs and will only require extension up the newly constructed streets.

Storm drain analysis was originally done for the entire twenty acres. A storm drain for the southern ten acres, Filings No. One and Two, was constructed during the construction of Filing No. One.

The two north-south streets in North Valley Subdivision, North Valley Drive and Monument View Drive, will be connected by an all weather (A.B.C. Class 6), twenty foot wide, road. This access road will be constructed on a temporary easement that will be extinguished upon future filings of North Valley.

All criteria from Filing No. One such covenants and lot setbacks are being carried forward to Filing No. Two.

North Valley Subdivision , Plats for Filings One and Two, were accepted by the UCC Sign-Off Committee on August 10, 1994. The construction improvements for Filing No.One of North Valley have been accepted by the City of Grand Junction. The Developer now wishes to complete Filing No. Two. The City of Grand Junction wrote a letter, dated November 1, 1995, stating that the Developer did not need to resubmit a Filing No. Two packet to all of the review agencies. The City required the Developer to obtain all of the normal UCC sign-off signatures indicating that the various review agencies had indeed approved both Filing No. One and Filing No. Two during the original submittals of North Valley Subdivision. The Developer obtained the signatures of the various UCC entities with Phil Bertrand, the new UCC Chairman, signing off on November 15, 1995. A copy of the sign-off sheet is included in this package.

file: c:\user\letters\wp\nvfile#2.wpd