FINAL DRAINAGE REPORT

for

BURENHEIDE ESTATES FILING NO. 1
1130 18-½ ROAD
FRUITA, COLORADO 81521

SUBMITTED TO:

CITY OF FRUITA
PLANNING-ENGINEERING
325 EAST ASPEN STREET
FRUITA, COLORADO 81521

PREPARED FOR:

Omer and Phyllis Burenheide
1130 18-½ Road
Fruita, Colorado 81521

PREPARED BY:

Balaz & Associates, Inc.
1005 North 12th Street, #211
Grand Junction, Colorado 81501

June 14, 2002

"I hereby certify that this report for the final drainage report for Burenheide Estates, located at 1130 18-½ Road, Fruita, Colorado, (a part of Section 9, Township 1 North, Range 2 West of the Ute Meridian in Mesa County, Colorado) was prepared by me or under my direct supervision."

William P. Balaz Jr.
Registered Professional Engineer
State of Colorado No. 17129

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I. LOCATION AND PROPERTY DESCRIPTION

A. Property Location

The project site is located in the unincorporated limits of Mesa County, immediately east of the Fruita city limits. The physical address of the property is 1130 18-½ Road, Fruita, Colorado. The subject property lies east of 18-½ Road. Near the center of the property and to the west of 18-½ Road lies the intersection of K.4 Road and 18-½ Road.

The legal description of the property is the NW 1/4 SE 1/4 Section 9, Township 1 North, Range 2 West of the Ute Meridian, Mesa County, Colorado, more particularly described by metes and bounds as follows:

> BEGINNING at the C 1/4 corner of said Section 9 whence the C-S 1/16 corner of said Section 9 bears S00°00'55"E, 1318.01 feet with all other bearings contained herein being relative thereto;
> thence, S89°55'17"E along the north line of said NW 1/4 SE 1/4, 1313.38 feet to the C-E 1/16 corner of said Section 9;
> thence, S00°04'55"E along the east line of said NW 1/4 SE 1/4, 1318.28 feet to the SE 1/16 corner of said Section 9;
> thence, N89°54'35"W along the south line of said NW 1/4 SE 1/4, 1314.92 feet to the C-S 1/16 corner of said Section 9;
> thence, N00°00'55"W along the west line of said NW 1/4 SE 1/4, 1318.01 feet to the POINT OF BEGINNING;
> containing 39.77 acres.

The property is bounded by 18-½ Road on the west and the Star School Drainage Ditch on the south and on a portion of the east property line. The Grand Valley Canal is adjacent to a portion of the north property line. The Holly Park and Monument Glen No. 5 Subdivisions are on the west of the property. To the north and east lie single family residences and open fields. A large irrigated field lies to the south of the property. Please see the attached Exhibit A - Vicinity Map.

The subject property is currently zoned AFT in Mesa County and is being rezoned to Rural Residential PUD as part of the annexation into the City of Fruita.

B. Property Description

The subject property contains 39.77 acres. The site is currently used as part of a ranching operation and contains a single family residence, outbuildings and corrals in the southwest corner of the property that utilizes approximately four (4) acres. The balance of the property is an irrigated field. The site is characteristic of the landforms in the area with rolling terrain off the Grand Valley Canal grading to relatively flat fields.

The site slopes to the southwest with the grades ranging from 4.07 percent near the canal to 1.35 percent in the southern half of the property. The elevations range from 4576 to 4550, with the lowest elevations in the southwest corner of the property.

The Natural Resource Conservation Service (NCRS) soils study has identified the following soil types on the site.

- Fl - Fruitland Clay Loam - Very deep, well-drained soils formed in calcareous alluvium on terraces. The surface layer is clay loam about 6 inches thick. The upper subsoil is clay loam about 16 inches thick. The lower subsoil is loam about 10 inches thick. The substratum is silt loam that extends to 60 inches or more. The hydrologic group is B. Low corrosivity to concrete. High corrosivity to steel. Prime farmland if irrigated.
- Hj - Killpack - Moderately deep, well drained soils in broad basins formed in shale residuum. Typically, the surface layer is silty clay loam 12 inches thick. The underlying material is silty clay loam about 14 inches thick. Weathered shale is at 26 inches. The hydrologic group is C. Low corrosivity to concrete. High corrosivity to steel. Not prime farmland.
- Re - Sagrlite Loam - Very deep, well-drained soils formed in the alluvium on fans and terraces. The surface is loam about 13 inches thick. The underlying material to a depth below 60 inches is silt loam. The hydrologic group is B. Low corrosivity to concrete. High corrosivity to steel. Prime farmland if irrigated.
- Tr - Turley Clay Loam - Deep, well - drained soils with surface layer loam or clay loam 10 inches thick, then 10 inches fine sandy loam, the upper part of the underlying material is clay loam 10 inches thick and the lower part to a depth below 60 inches is a broadly stratified loam and silty clay loam. The hydrologic group is B. Moderate corrosivity to concrete. High corrosivity to steel. Prime farmland if irrigated.
- Bc - Sagers Silty Clay Loam - very deep, well-drained soils. Surface layer typically silty clay loam 12 inches thick. The upper part of the underlying material is a silty clay loam about 13 inches thick and the underlying material to a depth below 60 inches is silty clay loam. The hydrologic group is B. High corrosivity to concrete. High corrosivity to steel. Not prime farmland.
- Rc - Fruitland Sand Clay Loam - Very deep, well drained soils formed in the stratified alluvium on alluvial fans and terraces. Typically the surface layer is a sandy clay loam 8 inches thick. The next layer is stratified gravelly sandy loam and fine sandy loam 22 inches thick. The underlying material to a depth of 60 inches or more is stratified sandy loam and fine sandy loam. The hydrologic group is B. Low corrosivity to concrete. Low corrosivity to steel. Prime farmland if irrigated.

The National Resource Conservation Service, NRCS, Soil Data is attached in Appendix A.

Merritt LS completed a plat survey for the property and Filing No. 1. The property will be developed in three filings with the first filing being comprised of two - one acre lots, one - four acre lot, an outlying lot for a regional retention/detention facility and a large lot containing 29.50 acres. The later filings subdivide the large lot in the first filing with 5- ½ acre lots being in the second filing and 11 - ½ acre lots being in the third filing. The large, open lot will contain 21.11 acres after filing no. 3 is completed.

The Star School Drainage Ditch lies on the south and a portion of the east property line. The Grand Valley Canal lies to the north and the Little Salt Wash lies approximately ¼ mile to the northwest.

C. Purpose of the Drainage Report

The subject property is to be developed sequentially with up to three filings. The filing sequence is described above. This drainage report looks at the total project and the first filing developments to assess the impacts on the existing drainage patterns, estimate runoff volumes created by the proposed development, estimate detention capacity required for filing nos. 2 & 3 and provides design flows for the design of runoff control structures for future filings.

II. EXISTING DRAINAGE CONDITIONS

A. Major Drainage Basin Characteristics

The major drainage basin is defined by the Grand Valley Canal on the north, 18 ½ Road on the west, a concrete irrigation ditch on the adjacent property along the east property line and the Starr School Drainage Ditch on the east and south. The general slope of the area is from northeast to southwest. The watershed in this area includes the Starr School Drain and the Grand Valley Canal. The Star School Drain begins approximately four miles to the northeast. The Starr School Drain discharges into the Little Salt Wash and thence into the Colorado River, which lies about two miles to the southwest. Presently, the Starr School Drain flow enters a 36" culvert at 18-½ Road and stays in a buried 24" pipe until being discharged into Little Salt Wash. The 24" pipe has been identified as being undersized and causing flooding in the Stormwater Management Master Plan (SWMMP) prepared by Williams Engineering.

The soils of the watershed basin are moderately to very deep, well drained soils classed as loams, silty clay loams, or sandy clay loams. The soils at a given location depend on its position on the landscape and the geology of the specific location.

The site does not lie within any 100 year floodplain. This information is contained on the Flood Insurance Rate Map (FIRM) , Community Panel No. dated July , 1992 for Mesa County, Colorado.

B. Site Characteristics

The site drainage patterns are influenced by the Grand Valley Canal just to the north of the property which creates a slope that extends onto the property. The ground slope is steeper by the canal, approximately 4 percent and flattening to a 1.35 percent grade in the southern portion of the property. The ground slopes from the northeast to the southwest. In addition to the Grand Valley Canal ditch bank on a portion of the north property line, runoff is prevented from entering the project site by the following existing features.

- On the south and the southern half of the east property line, the Starr School Drain intercepts any off-site drainage coming into and also intercepts any runoff trying to exit the property.
- A concrete drainage ditch from the Grand Valley Canal that extends southward along the eastern property line on the adjoining property intercepts any off-site drainage coming into the property.
- On the west, 18 ½ Road

The property is irrigated with 63 water shares (0.63 cfs) from Grand Valley Irrigation. The irrigation tailwater discharges into the Starr School Drain via three 10 inch pipes.

The existing drainage pattern of the property consists of sheet flow on the canal ditch bank, shallow concentrated flow in the irrigated field and along 18-½ Road and channelized flows in the tailwater ditches or pipes. The irrigated field has creases that run north to south. Irrigation tailwater discharges into the Starr School Drain through three discharge pipes along the drain. The northwest portion of the irrigated field drains to a concrete inlet structure in the northwest corner of the existing single family residence front yard. Tailwater is conveyed via a buried pipe to a second concrete inlet structure in the southwest corner of the existing corrals and thence via an 18" buried transite pipe into the Starr School Drain near the inlet to the 36" culvert under 18-½ Road.

The NRCS has identified the following soils on the site.

- Fl - Fruitland Clay Loam - The hydrologic group is B.
- Hj - Killpack - The hydrologic group is C.
- Re - Sagrlite Loam - The hydrologic group is B.
- Tr - Turley Clay Loam - The hydrologic group is B.
- Bc - Sagers Silty Clay Loam - The hydrologic group is B.
- Rc - Fruitland Sand Clay Loam - The hydrologic group is B.

The soils descriptions are attached in Appendix A.

The existing drainage patterns are shown on the attached Exhibit B.

III. PROPOSED DRAINAGE CONDITIONS

A. Changes in Drainage Patterns

The proposed development is not expected to affect any up gradient areas of the drainage basin. Potential downstream impacts are expected to be mitigated by the construction of a regional detention/retention pond in the southeast corner of the property. This will be discussed in more detail in the General Consideration section under Design Criteria & Approach below.

The site drainage patterns will be affected by the development through the construction of roads, impervious surfaces added by homes and associated driveways and the use of irrigation water to water lawns. As stated earlier, the project will be developed in three filings. The first filing proposes two - one acre lots and an outlying lot in the southeast corner of the property, a four acre lot in the southwest corner on the property and a large lot for the remaining part of the property. A private drive adjacent to the Starr School Drain and south property line will provide access to the single family lots in the southeast corner of the lot. Borrow ditches along the private drive will collect and direct stormwater runoff to one of the three tailwater discharge pipes along the Starr School Drain. Stormwater runoff from the roofs of the single family residences and the driveways is expected to be absorbed by the landscaping on the one acre lots because the impervious surface is so small compared to the area of the lot.

The second filing proposes five - ½ acre lots along 18-½ Road. Access will be provided by shared driveways onto 18-½ Road.

The third filing proposes to develop eleven - ½ acre lots along the north property line. Access to these lots will be provided by a cul-de-sac off 18-½ Road.

Stormwater runoff from filing no. 2 will be collected and directed by a borrow ditch along 18-½ Road to the existing concrete irrigation water box in the southwest corner of filing no. 2 and thence via a buried PVC pipe to the Starr School Drain. Culverts will be installed under the shared driveways to allow stormwater to flow to the Starr School Drain as needed. Stormwater runoff from filing no. 3 will be directed via a curb and gutter to 18-½ Road. A v-pan will be installed adjacent to the intersection of the cul de sac and 18-½ Road to direct stormwater to the south side of the cul de sac and into the borrow ditch. The proposed drainage patterns are shown on Exhibit C.

B. Maintenance Issues

Maintenance of the regional detention/retention pond is expected to be provided by the Grand Junction Drainage District. Maintenance of the irrigation tailwater ditches and road ditches is expected to be provided by the developer, Omer Burenheide, or in time by the Homeowner's Association.

Access to the areas requiring maintenance will be provided by easements and stipulations in the PUD Guide and the Homeowner's Association Covenants.

IV. DESIGN CRITERIA & APPROACH

A. General Considerations

Balaz & Associates, Inc. is not aware of any previous drainage studies for the subject property. The Starr School Drain and the subject property were included in the SWMMP prepared by Williams Engineering.

The need for a regional retention/detention pond to alleviate the flooding occurring in the Holly Park Subdivision on or near the subject property was identified in the SWMMP prepared by Williams Engineering. Based on preliminary discussions with the Grand Junction Drainage District, this drainage study assumes that the project detention requirements will be provided by the regional pond for the first filing and an enlargement of the Starr School Drain for the second and third filings.

Runoff from the first filing will be directed to either the detention/retention pond or the Starr School Drain by borrow ditches along the private drive to points where the irrigation tailwater discharges into the Drain. The ditches will be graded into the existing tailwater ditch so that road runoff can enter the existing drain pipes. A "V" type borrow ditch with its flowline below the base of the road section is expected to be adequate to handle the runoff for half of the travel surface on the private drive. Irrigation water and storm water runoff will be intercepted by irrigation tail water ditches on the north side of the 44 ft. easement for the private drive and thence directed into the Starr School drain via existing discharge pipes.

Runoff from the second filing will be directed to the existing concrete inlet in the southwest corner of Lot 1 of the second filing by a borrow ditch constructed along the toe of the 18-½ Road fill. The shared driveways will be required to provide culverts to allow the stormwater to flow under the driveways.

Runoff from the third filing will be directed from the back of the cul de sac to the intersection of 18-½ Road via curb and gutter. A v-pan in the intersection will direct stormwater from the north side of the cul de sac to the south side where it will be directed to the borrow ditch constructed in Filing No. 2. through a curb cut and riprap lined ditch. The project proposes to provide sidewalks only on the north side of the cul de sac. The specific design details for the storm water control devices for the Filing Nos. 2 & 3 will be provided in the construction plans for each filing respectively.

B. Hydrology

The hydrologic analysis presented in this drainage report uses the procedures per the SWMM manual.

The design storms are the 2 year and 100 year - 24 hour precipitation events. The peak discharges are taken from the SWMM manual.

The TR-55 method is used to calculate the composite CN number and runoff, time of concentration, peak discharges and detention basin storage volume required. A specific on site detention pond is not designed in this report because the design of a regional detention basin including the enlargement of the Starr School Drain to provide storage capacity for Filing Nos. 2 and 3 is being handled by the Grand Junction Drainage District.

The following curve numbers are used in this analysis:

- 65 - Pasture forage for grazing, irrigated field
- 77 - Grand Valley Canal Bank
- 61 - Starr Drainage Ditch bank, grasses and weeds
- 74 - Existing Farmsteads
- 64 - Residences 1 acre lots
- 71 - Residences ½ acre lots
- 89 - Paved open ditches 18-½ Road
- 89 - Crushed asphalt surface open ditches Private Drive
- 98 - Impervious surfaces roofs and cul de sac

The curve numbers for the irrigated field and residential lots have been averaged for the different soil hydrologic groups, B & C, and differences in assumed impervious surfaces from the TR-55 values in the table.

The drainage basin was divided into the following subbasins based the location of irrigation field ditches, the Grand Valley Canal, and the Starr School Drainage Ditch.

1. East Portion
2. West Portion
3. Existing Farmstead
4. Starr School Drainage Ditch
5. Grand Valley Canal Bank (off site and up gradient)
6. Residence and yard above northwest corner of property (off site and up gradient)

Subbasin areas 5 and 6 have been included in the runoff estimate for subbasins 1 & 2 and separately to assess to historic runoff flows to design drainage control structures to convey the historic runoff through the project site to the Starr Drainage Ditch. The drainage subbasins and existing drainage patterns are shown on the attached Exhibit B. The proposed cul de sac development in Filing No. 3 has been included in the runoff estimate for Subbasin 2 as the cul de

sac will be designed to drain toward 18 ½ Road. The TR-55 worksheets are included in the attached Appendices B through G.

The runoff estimates using the graphical method for the existing and developed conditions for the subbasins above are summarized in the table below.

	Existing Runoff, cfs		Developed Runoff, cfs	
Subbasin	2 yr-24 hr	100 yr-24 hr	2 yr-24 hr	100 yr-24 hr
1	0.0027	8.3489	0.0017	5.8472
2	0.0395	3.6800	0.1137	6.5229
3	0.0409	2.3060	N/A	N/A
4	0.0051	0.0939	N/A	N/A
5	0.0002	0.7945	N/A	N/A
6	0.1286	5.2589	N/A	N/A

The runoff for the developed conditions in Subbasin 1 is reduced by the fact that approximately 1.13 acres in the southeast corner of the subbasin will be a regional detention/retention facility. The existing farmstead and the Starr School Drainage Ditch subbasins are expected to have minimal, if any, increases in runoff because the area of the private drive is very small when compared to the total subbasin area and a portion of each subbasin will be developed as a detention/retention pond which lessens the runoff from the developed conditions when using the TR-55 method. Therefore, this study assumes that stormwater runoff does not increase from these two subbasins due to development.

The runoff control structures for the area along 18 ½ Road down gradient from the cul de sac will be sized using the following flows:

	Developed Runoff, cfs
Subbasin	100 yr-24 hr
6	5.25
5	0.4
2	6.52
Total	12.16

For the borrow ditch along 18 ½ Road above gradient from the cul de sac, the ditch will be sized using a flow of 6.95 cfs.

The detention pond capacity was estimated using the methodology from Chapter 6 Storage Volume For Detention Basins from the Urban Hydrology for Small Watersheds Handbook, TR-55 Method. The detention pond capacity for the 100 yr-24 hr storm event for the developed conditions created by Filing Nos. 2 & 3, and the private access drive is 7,361 cu. ft. It is expected that this capacity will be gained by enlarging the channel in the bottom of the Starr School

Drainage Ditch and will be finalized as part of the regional detention/retention pond preliminary design. See Appendix H.

The capacity of the existing drain pipes along the southern property line that discharge into the Starr School Drainage Ditch was estimated using Haested Method's Flowmaster software and Manning's equation. The estimated capacity of the existing 10" and 18" discharge pipes using capacity curves is:

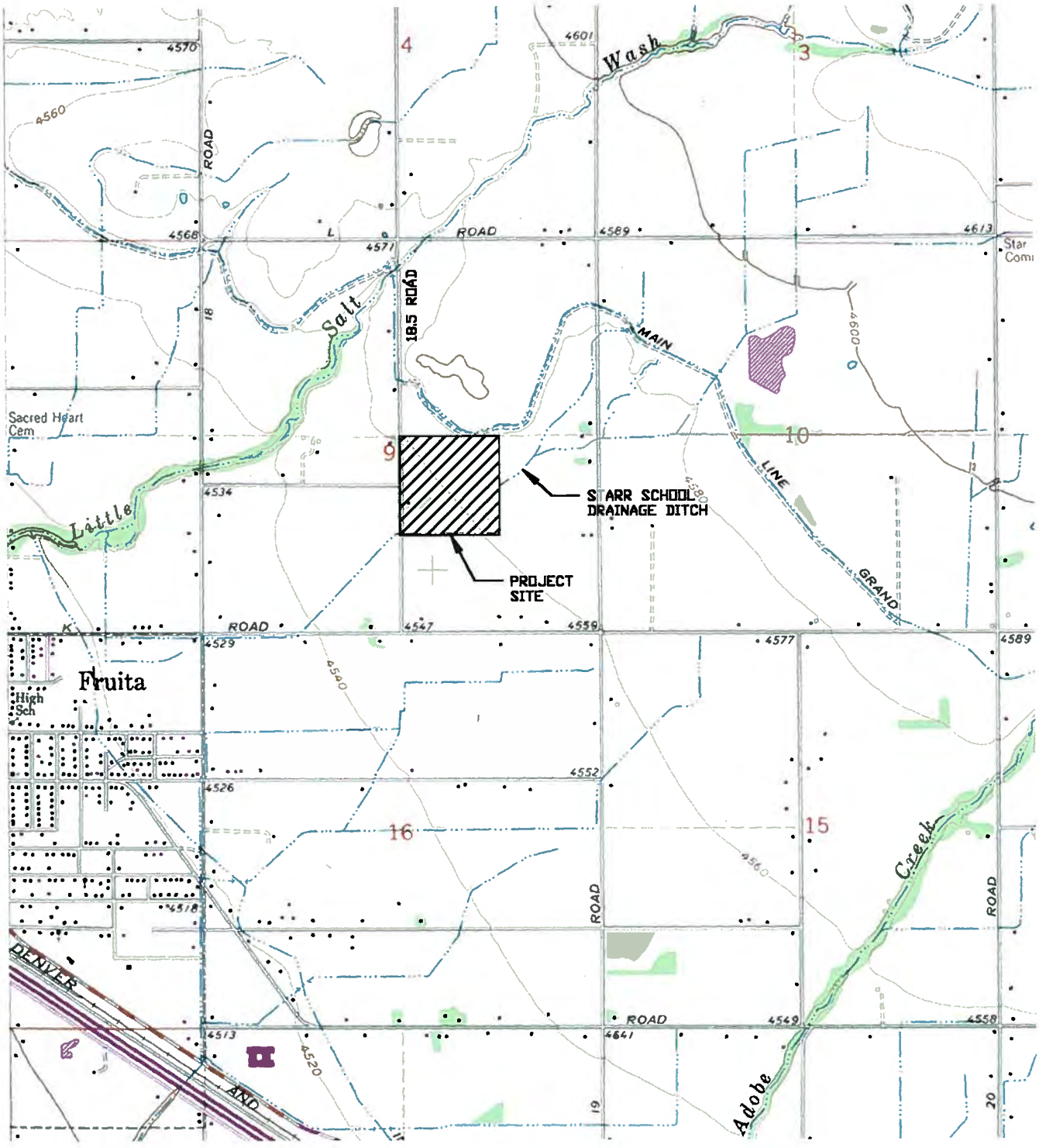
Diameter, In.	Grade, %	Capacity, cfs
10	0.0175	3.11
10	0.0486	5.20
10	0.0482	5.17
18	0.0175	10.12

The drain pipe grades are based on measurements made with a level and 300 ft. Surveyor's chain. The capacity curves are attached in Appendix I.

To aid in the calculation of the drainage fees, the Rational Method "C" factors for the existing and developed conditions are presented in the table below.

	"C" factor	
	Existing	Developed
Subbasin	Condition	Condition
1	0.38	0.39
2	0.40	0.45
3	0.33	0.35
4	0.36	0.40

The "C" factors above are a composite value based on the soil type, impervious surface %, vegetative cover, etc. The calculations are presented in Appendix J. Subbasins 5 and 6 are assumed not to be impacted by the proposed development because they are off site.



NORTH

1000 0 500 1000 2000 4000

1 inch = 2,000 ft. Horizontal

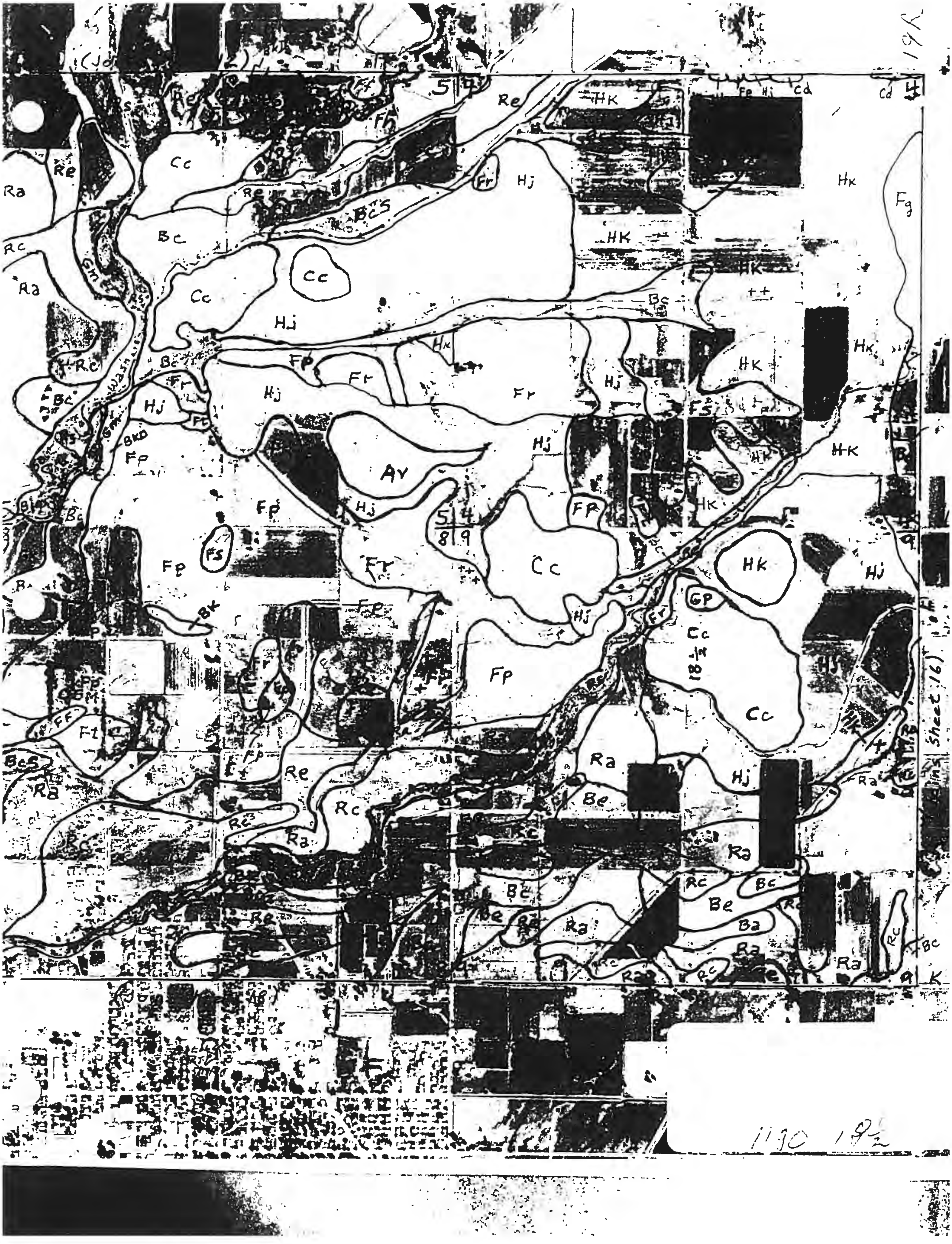
DATE:	5/31/02
DRAWN BY:	WPB
ENGINEER:	WPB
CHECKED BY:	WPB

BURENHEIDE ESTATES FILING NO. 1
VICINITY MAP

Bailey & Associates, Inc.
1005 N. 12th ST #211
Grand Junction, CO 81501
Tel#: 970-263-9733 Fax#: 970-263-9736

EXHIBIT A

APPENDIX A - NRCS SOILS DATA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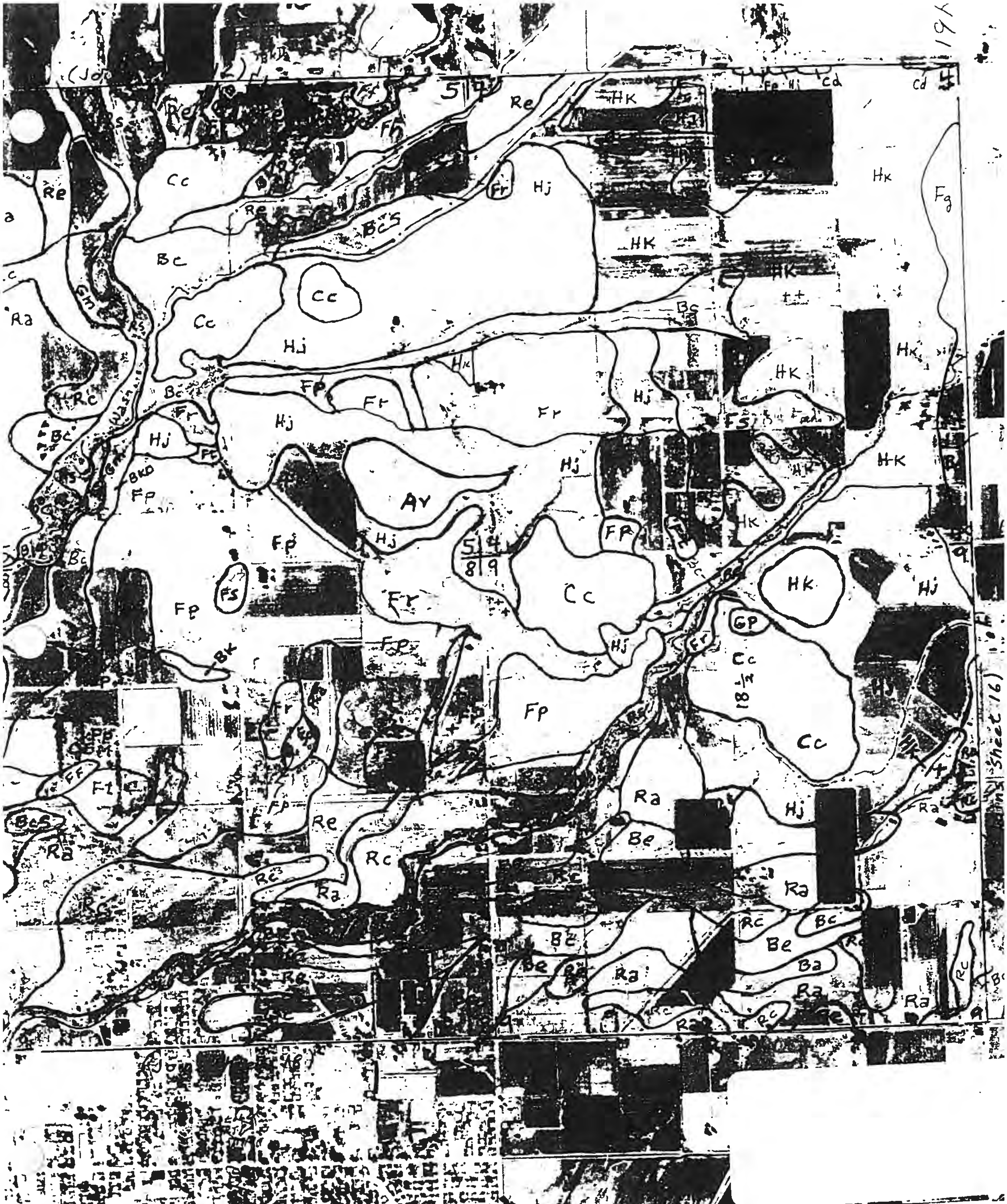
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Cc
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Rc
Ra
Bc
Be
Ba
Ra
Ft
BcS
Ra
Re
Rc
Bk

Mapunit Component Descriptions

Soil Survey Area: **CO680** **Mesa County Area, Colorado**

Mapunit Symbol **Bc** SAGERS SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES

Component Name ***SAGERS*** ***Comp %*** ***90***

THE SAGERS FAMILY CONSISTS OF VERY DEEP, WELL DRAINED SOILS FORMED IN ALLUVIUM FROM SHALE ON TERRACES AND BASIN FLOORS. TYPICALLY, THE SURFACE LAYER IS SILTY CLAY LOAM ABOUT 12 INCHES THICK. THE UNDERLYING MATERIAL IS SILTY CLAY LOAM TO A DEPTH OF 60 INCHES OR MORE.

Component Name ***Other soils*** ***Comp %*** ***5***

Component Name ***SAGERS, WET*** ***Comp %*** ***5***

Mapunit Symbol **Hj** KILLPACK SILTY CLAY LOAM, 2 TO 5 PERCENT SLOPES

Component Name ***KILLPACK*** ***Comp %*** ***85***

KILLPACK FAMILY CONSISTS OF MODERATELY DEEP, WELL DRAINED SOILS IN BROAD BASINS FORMED IN SHALE RESIDUUM. TYPICALLY, THE SURFACE LAYER IS SILTY CLAY LOAM 12 INCHES THICK. THE UNDERLYING MATERIAL IS SILTY CLAY LOAM ABOUT 14 INCHES THICK. WEATHERED SHALE IS AT 26 INCHES.

Component Name ***Other soils*** ***Comp %*** ***15***

Mapunit Symbol **Rc** FRUITLAND SANDY CLAY LOAM, 0 TO 2 PERCENT SLOPES

Component Name *FRUITLAND* *Comp %* *90*

FRUITLAND FAMILY CONSISTS OF VERY DEEP, WELL DRAINED SOILS FORMED IN STRATIFIED ALLUVIUM ON ALLUVIAL FANS AND TERRACES. TYPICALLY, THE SURFACE LAYER IS A SANDY CLAY LOAM 8 INCHES THICK. THE NEXT LAYER IS STRATIFIED GRAVELLY SANDY LOAM AND FINE SANDY LOAM 22 INCHES THICK. THE UNDERLYING MATERIAL TO A DEPTH OF 60 INCHES OR MORE IS STRATIFIED SANDY LOAM AND FINE SANDY LOAM.

Component Name *Other soils* *Comp %* *10*

Mapunit Symbol **Re** SAGRLITE LOAM, 0 TO 2 PERCENT SLOPES

Component Name *SAGRLITE* *Comp %* *90*

SAGRLITE SERIES CONSISTS OF VERY DEEP, WELL DRAINED SOILS FORMED IN ALLUVIUM ON FANS AND TERRACES. TYPICALLY, THE SURFACE IS LOAM ABOUT 13 INCHES THICK. THE UNDERLYING MATERIAL TO A DEPTH BELOW 60 INCHES IS SILT LOAM.

Component Name *Other soils* *Comp %* *10*

Mapunit Symbol **Tr** TURLEY CLAY LOAM, 0 TO 2 PERCENT SLOPES

Component Name *TURLEY* *Comp %* *90*

TURLEY, ELEVATION <4800 FAMILY CONSISTS OF VERY DEEP, WELL DRAINED SOILS FORMED IN MIXED ALLUVIUM FROM SANDSTONE AND SHALE ON ALLUVIAL FANS AND TERRACES. TYPICALLY, THE SURFACE LAYER IS LOAM OR CLAY LOAM 10 INCHES THICK. THE NEXT LAYER IS FINE SANDY LOAM 10 INCHES THICK. THE UPPER PART OF THE UNDERLYING MATERIAL IS CLAY LOAM ABOUT 10 INCHES THICK, AND THE LOWER PART TO A DEPTH BELOW 60 INCHES IS BROADLY STRATIFIED LOAM, AND SILTY CLAY LOAM.

Component Name *Other soils* *Comp %* *10*

Engineering Index Properties

Soil Survey Area: **CO680 Mesa County Area, Colorado**

Mapunit: Bc SAGERS SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES

Component: ***SAGERS*** ***% of Mapunit*** 90

Hydrologic Group B ***Frost Action:*** Low ***Corrosivity to Concrete:*** Moderate ***Corrosivity to Steel:*** High

Depth in inches	*Fragments %*		*Percentage passing sieve*				*Liquid Limit*	*Plasticity Index*	*Classification*	
	> 10	*3-10*	*#4*	*#10*	*#40*	*#200*			*Unified*	*AASHTO*
0 12	0 0	0 0	95 100	95 100	95 100	85 95	35 45	10 15		
									ML	A-7
									ML	A-6
12 60	0 0	0 0	95 100	95 100	95 100	85 95	35 45	10 15		
									ML	A-6
									ML	A-7

Mapunit: Hj KILLPACK SILTY CLAY LOAM, 2 TO 5 PERCENT SLOPES

Component: ***KILLPACK*** ***% of Mapunit*** 85

Hydrologic Group C ***Frost Action:*** Low ***Corrosivity to Concrete:*** High ***Corrosivity to Steel:*** High

Depth in inches	*Fragments %*		*Percentage passing sieve*				*Liquid Limit*	*Plasticity Index*	*Classification*	
	> 10	*3-10*	*#4*	*#10*	*#40*	*#200*			*Unified*	*AASHTO*
0 12	0 0	0 0	95 100	90 100	80 100	80 95	35 45	10 15		
									ML	A-6
									ML	A-7
12 26	0 0	0 0	95 100	90 100	80 100	80 95	35 45	10 15		
									ML	A-6
									ML	A-7

Mapunit: Rc FRUITLAND SANDY CLAY LOAM, 0 TO 2 PERCENT SLOPES

Component: *FRUITLAND* *% of Mapunit* 90

Hydrologic Group B *Frost Action:* Low *Corrosivity to Concrete:* Low *Corrosivity to Steel:* Moderate

Depth in inches	*Fragments %*		*Percentage passing sieve*				*Liquid Limit*	*Plasticity Index*	*Classification*	
	> 10	*3-10*	*#4*	*#10*	*#40*	*#200*			*Unified*	*AASHTO*
0 7.9	0 0	0 0	95 100	90 100	75 90	35 50	25 30	5 10		
									SC-SM	A-4
									SC	A-4
7.9 30	0 0	0 0	75 100	65 100	40 85	20 55	20 25	0 5		
									SC-SM	A-4
									SC-SM	A-2
									SC-SM	A-1
									ML	A-4
									ML	A-2
									ML	A-1
									CL-ML	A-4
									CL-ML	A-1
									SM	A-4
									CL-ML	A-2
									SM	A-1
									SM	A-2
30 60	0 0	0 0	95 100	90 100	55 85	30 55	20 25	0 5		
									SM	A-4
									CL-ML	A-2
									CL-ML	A-4
									ML	A-2
									ML	A-4
									SC-SM	A-2
									SC-SM	A-4
									SM	A-2

Mapunit: Re SAGRLITE LOAM, 0 TO 2 PERCENT SLOPES

Component: *SAGRLITE* *% of Mapunit* 90

Hydrologic Group B *Frost Action:* Low *Corrosivity to Concrete:* Low *Corrosivity to Steel:* High

Depth in inches	*Fragments %*		*Percentage passing sieve*				*Liquid Limit*	*Plasticity Index*	*Classification*	
	> 10	*3-10*	*#4*	*#10*	*#40*	*#200*			*Unified*	*AASHTO*
0 13	0 0	0 0	100 100	100 100	85 95	65 75	25 30	5 10		
									CL	A-4
									CL-ML	A-4
13 60	0 0	0 0	100 100	100 100	90 100	75 85	30 35	5 10		
									ML	A-4

Mapunit: Tr TURLEY CLAY LOAM, 0 TO 2 PERCENT SLOPES

Component: *TURLEY* *% of Mapunit* 90

Hydrologic Group B *Frost Action:* Low *Corrosivity to Concrete:* Moderate *Corrosivity to Steel:* High

Depth in inches	*Fragments %*		*Percentage passing sieve*				*Liquid Limit*	*Plasticity Index*	*Classification*	
	> 10	*3-10*	*#4*	*#10*	*#40*	*#200*			*Unified*	*AASHTO*
0 9.8	0 0	0 0	95 100	90 100	85 90	65 75	30 40	10 20		
									CL	A-6
9.8 20	0 0	0 0	95 100	90 100	65 85	40 55	25 30	5 10		
									CL	A-4
									CL-ML	A-4
									SC	A-4
									SC-SM	A-4
20 30	0 0	0 0	95 100	90 100	85 90	65 75	30 40	10 20		
									CL	A-6
30 60	0 0	0 0	95 100	90 100	75 100	60 95	25 30	5 10		
									CL-ML	A-4
									CL	A-4

Prime Farmland

CO680 - Mesa County Area, Colorado

Map Unit Symbol	Map Unit Name	Prime Classification
Bc	SAGERS SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	Prime farmland if irrigated
Hj	KILLPACK SILTY CLAY LOAM, 2 TO 5 PERCENT SLOPES	Not prime farmland
Rc	FRUITLAND SANDY CLAY LOAM, 0 TO 2 PERCENT SLOPES	Prime farmland if irrigated
Re	SAGRLITE LOAM, 0 TO 2 PERCENT SLOPES	Prime farmland if irrigated
Tr	TURLEY CLAY LOAM, 0 TO 2 PERCENT SLOPES	Prime farmland if irrigated

Physical and Chemical Properties

Soil Survey Area: **CO680** **Mesa County Area, Colorado**

Mapunit: Bc SAGERS SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES

Component: SAGERS *Percent of Mapunit:* 90

Depth in inches	Clay %	Organic Matter %	Permeability in/hr	Average Waterholding Capacity in/in	Moist Bulk Density g/cc	pH	Calcium Carbonate %	Salinity mmhos/cm	Gypsum %
0 12	27 34	0.5 1	0.2 0.6	0.17 0.2	1.15 1.25	7.9 8	5 15	0 2	0 0
12 60	27 34	0 0.5	0.2 0.6	0.17 0.2	1.15 1.25	7.9 8	5 10	0 0	1 5

Component: Other soils *Percent of Mapunit:* 5

Depth in inches	Clay %	Organic Matter %	Permeability in/hr	Average Waterholding Capacity in/in	Moist Bulk Density g/cc	pH	Calcium Carbonate %	Salinity mmhos/cm	Gypsum %

Mapunit: Hj KILLPACK SILTY CLAY LOAM, 2 TO 5 PERCENT SLOPES

Component: KILLPACK *Percent of Mapunit:* 85

Depth in inches	Clay %	Organic Matter %	Permeability in/hr	Average Waterholding Capacity in/in	Moist Bulk Density g/cc	pH	Calcium Carbonate %	Salinity mmhos/cm	Gypsum %
0 12	27 37	0.5 1	0.2 0.6	0.16 0.19	1.15 1.25	7.9 8	20 30	0 0	0 1
12 26	27 34	0 0.5	0.2 0.6	0.16 0.19	1.15 1.25	7.4 8	30 50	0 2	1 5
26 30			0.06 0.2						

Component: Other soils *Percent of Mapunit:* 15

Depth in inches	Clay %	Organic Matter %	Permeability in/hr	Average Waterholding Capacity in/in	Moist Bulk Density g/cc	pH	Calcium Carbonate %	Salinity mmhos/cm	Gypsum %

Mapunit: Rc FRUITLAND SANDY CLAY LOAM, 0 TO 2 PERCENT SLOPE

Component: FRUITLAND *Percent of Mapunit:* 90

Depth in inches	Clay %	Organic Matter %	Permeability in/hr	Average Waterholding Capacity in/in	Moist Bulk Density g/cc	pH	Calcium Carbonate %	Salinity mmhos/cm	Gypsum %
0 8	20 27	0.5 1	0.6 2	0.13 0.16	1.25 1.35	7.4 8	0 10	0 2	0 0
8 30	10 20	0.5 1	0.6 6	0.09 0.14	1.35 1.45	7.4 8	0 10	0 2	0 0
30 60	10 20	0.5 1	0.6 6	0.11 0.14	1.35 1.45	7.4 8	0 10	0 2	0 0

Component: Other soils *Percent of Mapunit:* 10

Depth in inches	Clay %	Organic Matter %	Permeability in/hr	Average Waterholding Capacity in/in	Moist Bulk Density g/cc	pH	Calcium Carbonate %	Salinity mmhos/cm	Gypsum %

Mapunit: Re SAGRLITE LOAM, 0 TO 2 PERCENT SLOPES

Component: SAGRLITE *Percent of Mapunit:* 90

Depth in inches	Clay %	Organic Matter %	Permeability in/hr	Average Waterholding Capacity in/in	Moist Bulk Density g/cc	pH	Calcium Carbonate %	Salinity mmhos/cm	Gypsum %
0 13	18 25	0.5 1	0.6 2	0.13 0.17	1.25 1.4	7.4 8	10 20	0 4	0 0
13 60	18 25	0 0.5	0.6 2	0.13 0.18	1.15 1.3	7.4 8	10 20	2 8	0 1

Component: Other soils *Percent of Mapunit:* 10

Depth in inches	Clay %	Organic Matter %	Permeability in/hr	Average Waterholding Capacity in/in	Moist Bulk Density g/cc	pH	Calcium Carbonate %	Salinity mmhos/cm	Gypsum %

Mapunit: Tr TURLEY CLAY LOAM, 0 TO 2 PERCENT SLOPES

Component: TURLEY *Percent of Mapunit:* 90

Depth in inches	Clay %	Organic Matter %	Permeability in/hr	Average Waterholding Capacity in/in	Moist Bulk Density g/cc	pH	Calcium Carbonate %	Salinity mmhos/cm	Gypsum %
0 10	27 34	1 2	0.2 0.6	0.17 0.2	1.25 1.35	7.9 8	5 10	0 2	0 0
10 20	12 19	0 0.5	0.6 6	0.13 0.15	1.35 1.5	7.9 8	5 10	0 2	0 0
20 30	27 34	0 0.5	0.2 0.6	0.17 0.2	1.25 1.35	7.9 8	5 10	0 2	0 0
30 60	18 32	0 0.5	0.2 2	0.14 0.21	1.15 1.35	7.9 8	5 10	0 2	0 0

Component: Other soils *Percent of Mapunit:* 10

Depth in inches	Clay %	Organic Matter %	Permeability in/hr	Average Waterholding Capacity in/in	Moist Bulk Density g/cc	pH	Calcium Carbonate %	Salinity mmhos/cm	Gypsum %

Restrictions

Soil Survey Area: Mesa County Area, Colorado

Map Unit Symbol	Map Unit Name	Percent	Component Name	Restriction Type	Depth range (inches)	
Bc	SAGERS SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES					
		90	SAGERS			
				None identified		
		5	SAGERS, WET			
				None identified		
				None identified		
Hj	KILLPACK SILTY CLAY LOAM, 2 TO 5 PERCENT SLOPES					
		85	KILLPACK			
				Bedrock (paralithic)	20	40
		15	Other soils			
				None identified		
Rc	FRUITLAND SANDY CLAY LOAM, 0 TO 2 PERCENT SLOPES					
		90	FRUITLAND			
				None identified		
		10	Other soils			
				None identified		
Re	SAGRLITE LOAM, 0 TO 2 PERCENT SLOPES					
		90	SAGRLITE			
				None identified		
		10	Other soils			
				None identified		
Tr	TURLEY CLAY LOAM, 0 TO 2 PERCENT SLOPES					
		90	TURLEY			
				None identified		
		10	Other soils			
				None identified		

Soil Interpretations

CO680 - Mesa County Area, Colorado

Map Unit Symbol	Map Unit Name	Percent	Component Name	Interpretation	
Bc	SAGERS SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES				
		90	SAGERS		
				ENG - Dwellings W/O Basements	
					Somewhat limited
					Shrink-swell
				ENG - Dwellings With Basements	
					Somewhat limited
					Shrink-swell
				ENG - Local Roads and Streets	
					Somewhat limited
					Shrink-swell
				ENG - Septic Tank Absorption Fields	
					Very limited
					Restricted permeability
Hj	KILLPACK SILTY CLAY LOAM, 2 TO 5 PERCENT SLOPES				

Soil Interpretations

CO680 - Mesa County Area, Colorado

Map Unit Symbol	Map Unit Name	Percent	Component Name	Interpretation	
		85	KILLPACK		
				ENG - Dwellings W/O Basements	
					Somewhat limited
					Shrink-swell
				ENG - Dwellings With Basements	
					Somewhat limited
					Shrink-swell
					Depth to soft bedrock
				ENG - Local Roads and Streets	
					Somewhat limited
					Shrink-swell
				ENG - Septic Tank Absorption Fields	
					Very limited
					Restricted permeability
					Depth to bedrock

Soil Interpretations

CO680 - Mesa County Area, Colorado

Map Unit Symbol	Map Unit Name	Percent	Component Name	Interpretation
Rc	FRUITLAND SANDY CLAY LOAM, 0 TO 2 PERCENT SLOPES			
		90	FRUITLAND	
				ENG - Dwellings W/O Basements
				Not limited
				ENG - Dwellings With Basements
				Not limited
				ENG - Local Roads and Streets
				Not limited
				ENG - Septic Tank Absorption Fields
				Not limited
Re	SAGRLITE LOAM, 0 TO 2 PERCENT SLOPES			
		90	SAGRLITE	
				ENG - Dwellings W/O Basements
				Not limited

Soil Interpretations

CO680 - Mesa County Area, Colorado

Map Unit Symbol	Map Unit Name	Percent	Component Name	Interpretation
				ENG - Dwellings With Basements
				Not limited
				ENG - Local Roads and Streets
				Not limited
				ENG - Septic Tank Absorption Fields
				Somewhat limited
				Restricted permeability
Tr	TURLEY CLAY LOAM, 0 TO 2 PERCENT SLOPES			
		90	TURLEY	
				ENG - Dwellings W/O Basements
				Not limited
				ENG - Dwellings With Basements
				Not limited

Soil Interpretations

CO680 - Mesa County Area, Colorado

Map Unit Symbol	Map Unit Name	Percent	Component Name	Interpretation
				ENG - Local Roads and Streets
				Not limited
				ENG - Septic Tank Absorption Fields
				Very limited
				Restricted permeability

APPENDIX B - SUBBASIN 1 TR-55 WORKSHEETS

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 1-East Side
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

1. Runoff Curve Number (CN)

Soil Name and Hydrologic Group (APPENDIX A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area _X__ acres ___ sq. mi. ___ %	Product of CN x Area
Killpack Silty Clay Loam, C	Pasture w/ grazing, Irrigated Field	65			26.57	1727.05
Sagrlite Loam, B						
Turley Clay Loam, B						
Sagers Silty Clay Loam, B						
Killpack Silty Clay Loam, C	Grand Valley Canal Bank, Brush, poor	77			1.46	112.42
NOTE: USE ONLY 1 CN SOURCE PER LINE				TOTALS	28.03	1839.47

CN (Weighted) = $\frac{\text{Total Product}}{\text{Total Area}} = \frac{1839.47}{28.03} = 65.625045$ Use CN = 66

2. Runoff

		Storm # 1	Storm # 2	Storm # 3
Frequency	yr.	(2)	(100)	
Rainfall, P (24-hour)	in.	1	2.6	
Runoff, Q	in.	0.0002	0.3666	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 or 2-4)

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 1-East Side
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	22-Mar-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?		1			

Worksheet 3: Time of Concentration

Time of Concentration (1) or Travel Time through subarea (2) 1

NOTES: Space for as many as four segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID	Canal Bank					
1. Surface Description (Table 3-1)			Bare Soil					
2. Manning's Roughness Coefficient, n (Table 3-1)			0.011					
3. Flow Length, L (total L<= 300 ft.)	ft		105					
4. Two Year 24 Hour Rainfall, P2	in		1					
5. Land slope, s	ft/ft		0.0666667					
6. Tt = 0.007(nL)**0.8 / P2**0.5(s**0.4)	Compute Tt	hr	0.023206	N/A	N/A	N/A	N/A	0.023206

Shallow Concentrated Flow		Segment ID	Field				
7. Surface Description (Paved or Unpaved)			Unpaved				
8. Flow Length, L	ft		1274				
9. Watercourse Slope, s.	ft/ft		0.0133438				
10. Average Velocity, V (Figure 3-1)	ft/s		1.8				
11. Tt = L/3600V	Compute Tt	hr	0.1966049	N/A	N/A	N/A	0.1966049

Channel Flow		Segment ID	TW Ditch		12 in. PVC		
12. Cross Sectional Flow Area, a	ft2		2		0.785		
13. Wetted Perimeter, Pw	ft		3.6		3.14		
14. Hydraulic Radius, r = a/Pw Compute r	ft		0.5555556	N/A	0.25		
15. Channel Slope, s	ft/ft		0.0070632		0.01		
16. Manning's Roughness Coefficient, n			0.024		0.01		
17. V = 1.49*(r**2/3)*(s**1/2)/n	Compute V	ft/s	3.5191932	N/A	5.8858078		
18. Flow Length, L	ft		269		28		
19. Tt = L/3600V	Compute Tt	hr	0.0212328	N/A	0.0013214		0.0225542
20. Watershed or subarea Tc or Tt (Add Tt in steps 6,11,and 19)		hr					0.2423651

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 1-East Side
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

Worksheet 4; Graphical Peak Discharge Method
Land Status : 1

1. Data:
Drainage Area..... Am = 0.0437969 mi2 (Acres/640)
Runoff Curve Number..... CN = 66 (From worksheet 2)
Time of Concentration..... Tc = 0.2423651 hr (From worksheet 3)
Rainfall Distribution Type..... = II (I,IA,II, III)
Pond and Swamp Areas Spread
Throughout Watershed..... = 0 percent of Am (_____ Acres or mi2 covered)

	Storm # 1	Storm # 2	Storm # 3
2. Frequency..... yr	2		100
3. Rainfall, P (24-Hour)..... in	1		2.6
4. Initial abstraction, Ia..... in (Use CN with Table 4-1)	1.03		1.03
5. Compute Ia/P.....	1.03	N/A	0.3961538
6. Unit Peak Discharge, qu..... csm/in (Use Tc and Ia/P with Exhibit 4-II)	340		520
7. Runoff, Q..... in	0.0001793		0.3666
8. Pond and Swamp Adjustment Factor, Fp..... (Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)	1		1
9. Peak Discharge, qp..... cfs (Where qp = qu(Am)(Q)Fp)	0.0026701		8.348924

Historical

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 1-East Side
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 2

1. Runoff Curve Number (CN)

Soil Name and Hydrologic Group (APPENDIX A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area _X__ acres ___ sq. mi. ___ %	Product of CN x Area
Killpack Silty Clay Loam, C	Pasture w/ grazing, Irrigated Field	65			18.55	1205.75
Sagrlite Loam, B						
Turley Clay Loam, B						
Sagers Silty Clay Loam, B						
Killpack Silty Clay Loam, C	Grand Valley Canal Bank, Brush, poor	77			1.46	112.42
Turley Clay Loam, B	Private Drive, Recycled asphalt surface	89			0.49	43.61
Fruitland Sandy Clay Loam,	B					
Turley Clay Loam, B	Residences 1.0 acre lot	64			2.00	128
Turley Clay Loam, B	Detention Pond	61	98 or 100		1.13	68.93
Sagers Silty Clay Loam, B						
NOTE: USE ONLY 1 CN SOURCE PER LINE				TOTALS	23.63	1558.71

CN (Weighted) = Total Product / Total Area = 1558.71 / 23.63 = 65.963182 Use CN = 66

2. Runoff

		Storm # 1	Storm # 2	Storm # 3
Frequency	yr.	2	100	
Rainfall, P (24-hour)	in.	1	2.6	
Runoff, Q	in.	0.0002	0.3666	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 or 2-4)

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 1-East Side
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 2

Worksheet 3: Time of Concentration

Time of Concentration (1) or Travel Time through subarea (2) 2

NOTES: Space for as many as four segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID	Canal Bank					
1. Surface Description (Table 3-1)			Bare Soil					
2. Manning's Roughness Coefficient, n (Table 3-1)			0.011					
3. Flow Length, L (total L<= 300 ft.)	ft		105					
4. Two Year 24 Hour Rainfall, P2	in		1					
5. Land slope, s	ft/ft		0.0666667					
6. Tt = 0.007(nL)**0.8 / P2**0.5(s**0.4)	Compute Tt	hr	0.023206	N/A	N/A	N/A	N/A	0.023206

Shallow Concentrated Flow		Segment ID	Field	Field			
7. Surface Description (Paved or Unpaved)			Unpaved	Unpaved			
8. Flow Length, L	ft		402	559			
9. Watercourse Slope, s.	ft/ft		0.0298507	0.0107335			
10. Average Velocity, V (Figure 3-1)	ft/s		2.8	1.6			
11. Tt = L/3600V	Compute Tt	hr	0.039881	0.0970486	N/A	N/A	0.1369296

Channel Flow		Segment ID	TW Ditch	Borrow Ditch	12 in. PVC		
12. Cross Sectional Flow Area, a	ft2		2	2	0.785		
13. Wetted Perimeter, Pw	ft		3.6	3.6	3.14		
14. Hydraulic Radius, r = a/Pw Compute r	ft		0.5555556	0.5555556	0.25		
15. Channel Slope, s	ft/ft		0.01	0.01	0.01		
16. Manning's Roughness Coefficient, n			0.025	0.025	0.01		
17. V = 1.49*(r**2/3)*(s**1/2)/n	Compute V	ft/s	4.0198855	4.0198855	5.8858078		
18. Flow Length, L	ft		493	386.34	38		
19. Tt = L/3600V	Compute Tt	hr	0.0340668	0.0266964	0.0017934		0.0625566
20. Watershed or subarea Tc or Tt (Add Tt in steps 6,11,and 19)						hr	0.2226921

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 1-East Side
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 2

Worksheet 4; Graphical Peak Discharge Method
Land Status : 2

1. Data:
Drainage Area..... Am = 0.0369219 mi2 (Acres/640)
Runoff Curve Number..... CN = 66 (From worksheet 2)
Time of Concentration..... Tc = 0.2226921 hr (From worksheet 3)
Rainfall Distribution Type..... = II (I,IA,II, III)
Pond and Swamp Areas Spread
Throughout Watershed..... = 0 percent of Am (_____ Acres or mi2 covered)

	Storm # 1	Storm # 2	Storm # 3
2. Frequency..... yr	2		100
3. Rainfall, P (24-Hour)..... in	1		2.6
4. Initial abstraction, Ia..... in (Use CN with Table 4-1)	1.03		1.03
5. Compute Ia/P.....	1.03	N/A	0.3961538
6. Unit Peak Discharge, qu..... csm/in (Use Tc and Ia/P with Exhibit 4-II)	350		600
7. Runoff, Q..... in	0.0001793		0.3666
8. Pond and Swamp Adjustment Factor, Fp..... (Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)	0.72		0.72
9. Peak Discharge, qp..... cfs (Where qp = qu(Am)(Q)Fp)	0.0016683		5.8472482

Developed

APPENDIX C - SUBBASIN 2 TRE-55 WORKSHEETS

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 2 - West Portion includes Cul de Sac in Developed
Date: 12-Feb-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 12-Feb-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

1. Runoff Curve Number (CN)

Soil Name and Hydrologic Group (APPENDIX A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area _X__ acres ___ sq. mi. ___ %	Product of CN x Area
Sagrlite Loam, B	Pasture w/ grazing, Irrigated Field, Fair	71			7.33	520.43
Sagrlite Loam, B	18.5 Road with ROW	89			0.46	40.94
NOTE: USE ONLY 1 CN SOURCE PER LINE				**TOTALS**	7.79	561.37

CN (Weighted) = Total Product / Total Area = 561.37 / 7.79 = 72.062901 Use CN = 72

2. Runoff

		Storm # 1	Storm # 2	Storm # 3
Frequency	yr.	2	100	
Rainfall, P (24-hour)	in.	1	2.6	
Runoff, Q	in.	0.0120	0.5814	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 or 2-4)

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 2 - West Portion includes Cul de Sac in Developed
Date: 12-Feb-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 12-Feb-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

Worksheet 3: Time of Concentration

Time of Concentration (1) or Travel Time through subarea (2) 2

NOTES: Space for as many as four segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID						
1. Surface Description (Table 3-1)								
2. Manning's Roughness Coefficient, n (Table 3-1)								
3. Flow Length, L (total L<= 300 ft.)	ft							
4. Two Year 24 Hour Rainfall, P2	in							
5. Land slope, s	ft/ft							
6. Tt = 0.007(nL)**0.8 / P2**0.5(s**0.4)	Compute Tt hr	N/A	N/A	N/A	N/A	N/A		0

Shallow Concentrated Flow		Segment ID	Field					
7. Surface Description (Paved or Unpaved)			Unpaved					
8. Flow Length, L	ft		854					
9. Watercourse Slope, s	ft/ft		0.0187354					
10. Average Velocity, V (Figure 3-1)	ft/s		2.2					
11. Tt = L/3600V	Compute Tt hr		0.1078283	N/A	N/A	N/A	N/A	0.1078283

Channel Flow		Segment ID	TW Ditch		8 in. PVC	12 in. PVC		
12. Cross Sectional Flow Area, a	ft2		1		0.341946	0.785		
13. Wetted Perimeter, Pw	ft		2.6		2.1038	3.14		
14. Hydraulic Radius, r = a/Pw Compute r	ft		0.3846154	N/A	0.1625373	0.25		
15. Channel Slope, s	ft/ft		0.0074627		0.01	0.01		
16. Manning's Roughness Coefficient, n			0.024		0.01	0.01		
17. V = 1.49*(r**2/3)*(s**1/2)/n	Compute V ft/s		2.827421	N/A	4.4108758	5.8858078		
18. Flow Length, L	ft		335		425	28		
19. Tt = L/3600V	Compute Tt hr		0.0329118	N/A	0.0267647	0.0013214		0.0609979
20. Watershed or subarea Tc or Tt (Add Tt in steps 6,11,and 19)							hr	0.1688262

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 2 - West Portion includes Cul de Sac in Developed
Date: 12-Feb-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	12-Feb-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?	1				

Worksheet 4; Graphical Peak Discharge Method
Land Status : 1
Storm Event 100 yr - 24 hr

1. Data:

Drainage Area.....	Am =	0.0121719	mi2 (Acres/640)
Runoff Curve Number.....	CN =	72	(From worksheet 2)
Time of Concentration.....	Tc =	0.1688262	hr (From worksheet 3)
Rainfall Distribution Type.....	=	II	(I,IA,II, III)
Pond and Swamp Areas Spread Throughout Watershed.....	=	0	percent of Am (_____ Acres or mi2 covered)

	Storm # 1	Storm # 2	Storm # 3
2. Frequency..... yr	2		100
3. Rainfall, P (24-Hour)..... in	1		2.6
4. Initial abstraction, Ia..... in (Use CN with Table 4-1)	0.778	0.778	0.778
5. Compute Ia/P.....	0.778	N/A	0.2992308
6. Unit Peak Discharge, qu..... csm/in (Use Tc and Ia/P with Exhibit 4-II)	400	N/A	715
7. Runoff, Q..... in	0.012012		0.5814
8. Pond and Swamp Adjustment Factor, Fp..... (Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)	1	1	1
9. Peak Discharge, qp..... cfs (Where qp = qu(Am)(Q)Fp)	0.0584835	0	5.0599

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 2 - West Portion includes Cul de Sac in Developed
Date: 12-Feb-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 12-Feb-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 2

1. Runoff Curve Number (CN)

Soil Name and Hydrologic Group (APPENDIX A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area _X__ acres ___ sq. mi. ___ %	Product of CN x Area
Sagrlite Loam, B	Pasture w/ grazing, Irrigated Field, Fair	71			2.56	181.76
Sagrlite Loam, B	18.5 Road with ROW	89			0.46	40.94
Killpack Silty Clay Loam,	Residences 0.5 acre Lot	71			8.65	614.15
Sagrlite Loam, B						
Killpack Silty Clay Loam,	Cul de Sac	98			0.88	86.24
Sagrlite Loam, B						
NOTE: USE ONLY 1 CN SOURCE PER LINE				TOTALS	12.55	923.09

CN (Weighted) = $\frac{\text{Total Product}}{\text{Total Area}} = \frac{923.09}{12.55} = 73.552988$ Use CN = 74

2. Runoff

		Storm # 1	Storm # 2	Storm # 3
Frequency	yr.	2	100	
Rainfall, P (24-hour)	in.	1	2.6	
Runoff, Q	in.	0.0232	0.6653	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 or 2-4)

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 2 - West Portion includes Cul de Sac in Developed
Date: 12-Feb-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	12-Feb-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?	2				

Worksheet 3: Time of Concentration

Time of Concentration (1) or Travel Time through subarea (2) 2

NOTES: Space for as many as four segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID						
1. Surface Description (Table 3-1)			Lawn					
2. Manning's Roughness Coefficient, n (Table 3-1)			Unpaved					
3. Flow Length, L (total L<= 300 ft.)		ft	0.24					
4. Two Year 24 Hour Rainfall, P2		in	65					
5. Land slope, s		ft/ft	2.6					
6. Tt = 0.007(nL)**0.8 / P2**0.5(s**0.4)	Compute Tt	hr	0.02					
			0.1869386	N/A	N/A	N/A	N/A	0.1869386

Shallow Concentrated Flow		Segment ID						
7. Surface Description (Paved or Unpaved)			Borrow Ditc					
8. Flow Length, L		ft	Unpaved					
9. Watercourse Slope, s		ft/ft	642					
10. Average Velocity, V (Figure 3-1)		ft/s	0.0156531					
11. Tt = L/3600V	Compute Tt	hr	2					
			0.0891667	N/A	N/A	N/A	N/A	0.0891667

Channel Flow		Segment ID	Gutter	V-Pan	8 in. PVC	12 in. PVC	
12. Cross Sectional Flow Area, a		ft2	0.0937125	0.5	0.341946	0.785	
13. Wetted Perimeter, Pw		ft	1.62	6	2.1038	3.14	
14. Hydraulic Radius, r = a/Pw Compute r		ft	0.0578472	0.0833333	0.1625373	0.25	
15. Channel Slope, s		ft/ft	0.01	0.005	0.01	0.01	
16. Manning's Roughness Coefficient, n			0.011	0.011	0.01	0.01	
17. V = 1.49*(r**2/3)*(s**1/2)/n	Compute V	ft/s	2.0068867	1.8122877	4.4108758	5.8858078	
18. Flow Length, L		ft	887.02	50	425	28	
19. Tt = L/3600V	Compute Tt	hr	0.1227745	0.0076637	0.0267647	0.0013214	0.1585243
20. Watershed or subarea Tc or Tt (Add Tt in steps 6,11,and 19)						hr	0.4346296

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 2 - West Portion includes Cul de Sac in Developed
Date: 12-Feb-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 12-Feb-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 2

Worksheet 4; Graphical Peak Discharge Method
Land Status : 2
Storm Event 100 yr - 24 hr

1. Data:
Drainage Area..... Am = 0.0196094 mi2 (Acres/640)
Runoff Curve Number..... CN = 74 (From worksheet 2)
Time of Concentration..... Tc = 0.4346296 hr (From worksheet 3)
Rainfall Distribution Type..... = II (I,IA,II, III)
Pond and Swamp Areas Spread
Throughout Watershed..... = 0 percent of Am (_____ Acres or mi2 covered)

	Storm # 1	Storm # 2	Storm # 3
2. Frequency..... yr	2		100
3. Rainfall, P (24-Hour)..... in	1		2.6
4. Initial abstraction, Ia..... in	0.703	0.703	0.703
(Use CN with Table 4-1)			
5. Compute Ia/P.....	0.703	N/A	0.2703846
6. Unit Peak Discharge, qu..... csm/in	250	N/A	500
(Use Tc and Ia/P with Exhibit 4-II)			
7. Runoff, Q..... in	0.0231934		0.6653
8. Pond and Swamp Adjustment Factor, Fp.....	1	1	1
(Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)			
9. Peak Discharge, qp..... cfs	0.113702	0	6.5229
(Where qp = qu(Am)(Q)Fp)			

Developed

APPENDIX D - SUBBASIN 3 TR-55 WORKSHEETS

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 3 - Existing Residence and Corrals
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

1. Runoff Curve Number (CN)

Soil Name and Hydrologic Group (APPENDIX A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area _X__ acres ___ sq. mi. ___ %	Product of CN x Area
Turley Clay Loam, B	Farm Yard	74			3.65	270.1
Turley Clay Loam, B	18.5 Road with ROW	89			0.11	9.79
NOTE: USE ONLY 1 CN SOURCE PER LINE				TOTALS	3.76	279.89

CN (Weighted) = $\frac{\text{Total Product}}{\text{Total Area}} = \frac{279.89}{3.76} = 74.43883$ Use CN = 74

2. Runoff

							Storm # 1	Storm # 2	Storm # 3
Frequency	.....	.....	.....	.....	.....	yr.	2	100	
Rainfall, P (24-hour)	.....	.....	.....	.....	.....	in.	1	2.6	
Runoff, Q	.....	.....	.....	.....	.....	in.	0.0232	0.6653	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 or 2-4)

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 3 - Existing Residence and Corrals
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	22-Mar-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?	1				

Worksheet 3: Time of Concentration

Time of Concentration (1) or Travel Time through subarea (2) 1

NOTES: Space for as many as four segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID	Corral					
1. Surface Description (Table 3-1)			Unpaved					
2. Manning's Roughness Coefficient, n (Table 3-1)			0.03					
3. Flow Length, L (total L<= 300 ft.)	ft		300					
4. Two Year 24 Hour Rainfall, P2	in		1					
5. Land slope, s	ft/ft		0.0070732					
6. Tt = 0.007(nL)**0.8 / P2**0.5(s**0.4)	Compute Tt	hr	0.2942025	N/A	N/A	N/A	N/A	0.2942025

Shallow Concentrated Flow		Segment ID	Field				
7. Surface Description (Paved or Unpaved)			Unpaved				
8. Flow Length, L	ft		110				
9. Watercourse Slope, s.	ft/ft		0.0070732				
10. Average Velocity, V (Figure 3-1)	ft/s		1.35				
11. Tt = L/3600V	Compute Tt	hr	0.0226337			N/A	0.0226337

Channel Flow		Segment ID	18 in. PVC				
12. Cross Sectional Flow Area, a	ft2		1.76625				
13. Wetted Perimeter, Pw	ft		4.71				
14. Hydraulic Radius, r = a/Pw Compute r	ft		0.375	N/A			
15. Channel Slope, s	ft/ft		0.01				
16. Manning's Roughness Coefficient, n			0.01				
17. V = 1.49*(r**2/3)*(s**1/2)/n	Compute V	ft/s	7.723021	N/A			
18. Flow Length, L	ft		50				
19. Tt = L/3600V	Compute Tt	hr	0.0017984	N/A			0.0017984
20. Watershed or subarea Tc or Tt (Add Tt in steps 6,11,and 19)						hr	0.3186346

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 3 - Existing Residence and Corrals
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	22-Mar-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?	1				

Worksheet 4; Graphical Peak Discharge Method
Land Status : 1

1. Data:

Drainage Area.....	Am =	0.005875	mi2 (Acres/640)
Runoff Curve Number.....	CN =	74	(From worksheet 2)
Time of Concentration.....	Tc =	0.3186346	hr (From worksheet 3)
Rainfall Distribution Type.....	=	II	(I,IA,II, III)
Pond and Swamp Areas Spread Throughout Watershed.....	=	0	percent of Am (_____ Acres or mi2 covered)

	Storm # 1	Storm # 2	Storm # 3
2. Frequency..... yr	2	25	100
3. Rainfall, P (24-Hour)..... in	1	0	2.6
4. Initial abstraction, Ia..... in (Use CN with Table 4-1)	0.703	0.703	0.703
5. Compute Ia/P.....	0.703	N/A	0.2703846
6. Unit Peak Discharge, qu..... csm/in (Use Tc and Ia/P with Exhibit 4-II)	300	N/A	590
7. Runoff, Q..... in	0.0231934		0.6653
8. Pond and Swamp Adjustment Factor, Fp..... (Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)	1	1	1
9. Peak Discharge, qp..... cfs (Where qp = qu(Am)(Q)Fp)	0.0408784	0	2.3060

Historical

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 3 - Existing Residence and Corrals
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 2

1. Runoff Curve Number (CN)

Soil Name and Hydrologic Group (APPENDIX A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area _X__ acres ___ sq. mi. ___ %	Product of CN x Area
Turley Clay Loam, B	Farm Yard	74			3.51	259.74
Turley Clay Loam, B	18.5 Road with ROW	89			0.11	9.79
Turley Clay Loam, B	Private Drive, Recycled Asphalt Surface	89			0.14	12.46
Fruitland Sandy Clay Loam, B						0
						0
						0
						0
NOTE: USE ONLY 1 CN SOURCE PER LINE				TOTALS	3.76	281.99

CN (Weighted) = Total Product / Total Area = 281.99 / 3.76 = 74.99734 Use CN = 75

2. Runoff

		Storm # 1	Storm # 2	Storm # 3
Frequency	yr.	2	100	
Rainfall, P (24-hour)	in.	1	2.6	
Runoff, Q	in.	0.0303	0.7097	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 or 2-4)

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 3 - Existing Residence and Corrals
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	22-Mar-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?	2				

Worksheet 3: Time of Concentration

Time of Concentration (1) or Travel Time through subarea (2) 2

NOTES: Space for as many as four segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID	Corral					
1. Surface Description (Table 3-1)			Unpaved					
2. Manning's Roughness Coefficient, n (Table 3-1)			0.03					
3. Flow Length, L (total L<= 300 ft.)	ft		300					
4. Two Year 24 Hour Rainfall, P2	in		1					
5. Land slope, s	ft/ft		0.0070732					
6. Tt = 0.007(nL)**0.8 / P2**0.5(s**0.4)	Compute Tt	hr	0.2942025	N/A	N/A	N/A	N/A	0.2942025

Shallow Concentrated Flow		Segment ID	Field				
7. Surface Description (Paved or Unpaved)			Unpaved				
8. Flow Length, L	ft		110				
9. Watercourse Slope, s.	ft/ft		0.0070732				
10. Average Velocity, V (Figure 3-1)	ft/s		1.35				
11. Tt = L/3600V	Compute Tt	hr	0.0226337			N/A	0.0226337

Channel Flow		Segment ID	18 in. PVC				
12. Cross Sectional Flow Area, a	ft2		1.76625				
13. Wetted Perimeter, Pw	ft		4.71				
14. Hydraulic Radius, r = a/Pw Compute r	ft		0.375	N/A			
15. Channel Slope, s	ft/ft		0.01				
16. Manning's Roughness Coefficient, n			0.01				
17. V = 1.49*(r**2/3)*(s**1/2)/n	Compute V ft/s		7.723021	N/A			
18. Flow Length, L	ft		50				
19. Tt = L/3600V	Compute Tt	hr	0.0017984	N/A			0.0017984
20. Watershed or subarea Tc or Tt (Add Tt in steps 6,11,and 19)						hr	0.3186346

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 3 - Existing Residence and Corrals
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	22-Mar-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?	2				

Worksheet 4; Graphical Peak Discharge Method
Land Status : 2

1. Data:

Drainage Area.....	Am =	0.005875	mi2 (Acres/640)
Runoff Curve Number.....	CN =	75	(From worksheet 2)
Time of Concentration.....	Tc =	0.3186346	hr (From worksheet 3)
Rainfall Distribution Type.....	=	II	(I,IA,II, III)
Pond and Swamp Areas Spread Throughout Watershed.....	=	0	percent of Am (_____ Acres or mi2 covered)

	Storm # 1	Storm # 2	Storm # 3
2. Frequency..... yr	2	25	100
3. Rainfall, P (24-Hour)..... in	1	0	2.6
4. Initial abstraction, Ia..... in (Use CN with Table 4-1)	0.667	0.667	0.667
5. Compute Ia/P.....	0.667	N/A	0.2565385
6. Unit Peak Discharge, qu..... csm/in (Use Tc and Ia/P with Exhibit 4-II)	300	N/A	600
7. Runoff, Q..... in	0.030303		0.7097
8. Pond and Swamp Adjustment Factor, Fp..... (Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)	1	1	1
9. Peak Discharge, qp..... cfs (Where qp = qu(Am)(Q)Fp)	0.0534091	0	2.5017

Developed

APPENDIX E - SUBBASIN 4 TR-55 WORKSHEETS

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 4 - Starr School Drainage Ditch
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

1. Runoff Curve Number (CN)

Soil Name and Hydrologic Group (APPENDIX A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area _X__ acres ___ sq. mi. ___ %	Product of CN x Area
Sagrlite Loam, B	Starr School Drainage Ditch, Grassland not grazed	61			1.77	107.97
Turley Clay Loam, B						
Sagers Silty Clay Loam, B						
Fruitland sandy clay loam, B						
				TOTALS	1.77	107.97

NOTE: USE ONLY 1 CN SOURCE PER LINE

CN (Weighted) = $\frac{\text{Total Product}}{\text{Total Area}} = \frac{107.97}{1.77} =$ 61 Use CN = 61

2. Runoff

		Storm # 1	Storm # 2	Storm # 3
Frequency	yr.	2	100	
Rainfall, P (24-hour)	in.	1	2.6	
Runoff, Q	in.	0.0127	0.2263	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 or 2-4)

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 4 - Starr School Drainage Ditch
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

Worksheet 3: Time of Concentration

Time of Concentration (1) or Travel Time through subarea (2) 1

NOTES: Space for as many as four segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID	Top of Bank					
1. Surface Description (Table 3-1)			Unpaved					
2. Manning's Roughness Coefficient, n (Table 3-1)			0.13					
3. Flow Length, L (total L<= 300 ft.)	ft		30					
4. Two Year 24 Hour Rainfall, P2	in		1					
5. Land slope, s	ft/ft		0.005					
6. Tt = 0.007(nL)**0.8 / P2**0.5(s**0.4)	Compute Tt	hr	0.1731258	N/A	N/A	N/A	N/A	0.1731258

Shallow Concentrated Flow		Segment ID	Ditch Bank				
7. Surface Description (Paved or Unpaved)			Unpaved				
8. Flow Length, L	ft		18				
9. Watercourse Slope, s.	ft/ft		0.5				
10. Average Velocity, V (Figure 3-1)	ft/s		11				
11. Tt = L/3600V	Compute Tt	hr	0.0004545	N/A	N/A	N/A	0.0004545

Channel Flow		Segment ID	Channel	Channel			
12. Cross Sectional Flow Area, a	ft2		10	15			
13. Wetted Perimeter, Pw	ft		9	11.5			
14. Hydraulic Radius, r = a/Pw Compute r	ft		1.1111111	1.3043478	N/A		
15. Channel Slope, s	ft/ft		0.0046332	0.0079523			
16. Manning's Roughness Coefficient, n			0.08	0.03515			
17. V = 1.49*(r**2/3)*(s**1/2)/n	Compute V	ft/s	1.3604875	4.5166926	N/A		
18. Flow Length, L	ft		1295	570			
19. Tt = L/3600V	Compute Tt	hr	0.2644069	0.0350551	N/A		0.299462
20. Watershed or subarea Tc or Tt (Add Tt in steps 6,11,and 19)						hr	0.4730423

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 4 - Starr School Drainage Ditch
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	22-Mar-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?	1				

Worksheet 4; Graphical Peak Discharge Method
Land Status : 1

1. Data:

Drainage Area.....	Am =	0.0027656	mi2 (Acres/640)
Runoff Curve Number.....	CN =	61	(From worksheet 2)
Time of Concentration.....	Tc =	0.4730423	hr (From worksheet 3)
Rainfall Distribution Type.....	=	II	(I,IA,II, III)
Pond and Swamp Areas Spread Throughout Watershed.....	=	0	percent of Am (_____ Acres or mi2 covered)

	Storm # 1	Storm # 2	Storm # 3
2. Frequency..... yr	2	25	100
3. Rainfall, P (24-Hour)..... in	1	0	2.6
4. Initial abstraction, Ia..... in (Use CN with Table 4-1)	1.279	1.279	1.279
5. Compute Ia/P.....	1.279	N/A	0.4919231
6. Unit Peak Discharge, qu..... csm/in (Use Tc and Ia/P with Exhibit 4-II)	195	N/A	200
7. Runoff, Q..... in	0.0127016		0.2263
8. Pond and Swamp Adjustment Factor, Fp..... (Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)	1	1	1
9. Peak Discharge, qp..... cfs (Where qp = qu(Am)(Q)Fp)	0.0068499	0	0.1252

Historical

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 4 - Starr School Drainage Ditch
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 2

1. Runoff Curve Number (CN)

Soil Name and Hydrologic Group (APPENDIX A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area _X__ acres ___ sq. mi. ___ %	Product of CN x Area
Sagrlite Loam, B	Starr School Drainage Ditch, Grassland not grazed	61			1.33	81.13
Turley Clay Loam, B						
Sagers Silty Clay Loam, B						
Fruitland sandy clay loam, B						
Sagers Silty Clay Loam, B	Detention Pond	61			0.22	13.42
Turley Clay Loam, B	Private Drive, Recycled asphalt surface	89			0.22	19.58
NOTE: USE ONLY 1 CN SOURCE PER LINE				TOTALS	1.77	114.13

CN (Weighted) = $\frac{\text{Total Product}}{\text{Total Area}} = \frac{114.13}{1.77} = 64.480226$ Use CN = 64

2. Runoff

		Storm # 1	Storm # 2	Storm # 3
Frequency	yr.	2	100	
Rainfall, P (24-hour)	in.	1	2.6	
Runoff, Q	in.	0.0028	0.3064	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 or 2-4)

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 4 - Starr School Drainage Ditch
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	22-Mar-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?		2			

Worksheet 3: Time of Concentration

Time of Concentration (1) or Travel Time through subarea (2) 2

NOTES: Space for as many as four segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID	Top of Bank					
1. Surface Description (Table 3-1)	.....		Unpaved					
2. Manning's Roughness Coefficient, n (Table 3-1)	.....		0.13					
3. Flow Length, L (total L<= 300 ft.)	.....	ft	30					
4. Two Year 24 Hour Rainfall, P2	.....	in	1					
5. Land slope, s	.....	ft/ft	0.005					
6. Tt = 0.007(nL)**0.8 / P2**0.5(s**0.4)	Compute Tt	hr	0.1731258	N/A	N/A	N/A	N/A	0.1731258

Shallow Concentrated Flow		Segment ID	Ditch Bank				
7. Surface Description (Paved or Unpaved).....	.....		Unpaved				
8. Flow Length, L.....	.....	ft	18				
9. Watercourse Slope, s.	.....	ft/ft	0.5				
10. Average Velocity, V (Figure 3-1)...	.....	ft/s	11				
11. Tt = L/3600V	Compute Tt	hr	0.0004545	N/A	N/A	N/A	0.0004545

Channel Flow		Segment ID	Channel	Channel			
12. Cross Sectional Flow Area, a.....	.....	ft2	10	15			
13. Wetted Perimeter, Pw.....	.....	ft	9	11.5			
14. Hydraulic Radius, r = a/Pw Compute r	.....	ft	1.1111111	1.3043478	N/A		
15. Channel Slope, s.....	.....	ft/ft	0.0046332	0.0079523			
16. Manning's Roughness Coefficient, n			0.08	0.035			
17. V = 1.49*(r**2/3)*(s**1/2)/n	Compute V.....	ft/s	1.3604875	4.5360498	N/A		
18. Flow Length, L.....	.....	ft	1295	570			
19. Tt = L/3600V	Compute Tt	hr	0.2644069	0.0349056	N/A		0.2993124
20. Watershed or subarea Tc or Tt (Add Tt in steps 6,11,and 19).....						.....	hr 0.4728927

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 4 - Starr School Drainage Ditch
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	22-Mar-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?	2				

Worksheet 4; Graphical Peak Discharge Method
Land Status : 2

1. Data:

Drainage Area.....	Am =	0.0027656	mi2 (Acres/640)
Runoff Curve Number.....	CN =	64	(From worksheet 2)
Time of Concentration.....	Tc =	0.4728927	hr (From worksheet 3)
Rainfall Distribution Type.....	=	II	(I,IA,II, III)
Pond and Swamp Areas Spread Throughout Watershed.....	=	0	percent of Am (_____ Acres or mi2 covered)

	Storm # 1	Storm # 2	Storm # 3
2. Frequency..... yr	2	25	100
3. Rainfall, P (24-Hour)..... in	1	0	2.6
4. Initial abstraction, Ia..... in (Use CN with Table 4-1)	1.125	1.125	1.125
5. Compute Ia/P.....	1.125	N/A	0.4326923
6. Unit Peak Discharge, qu..... csm/in (Use Tc and Ia/P with Exhibit 4-II)	195	N/A	250
7. Runoff, Q..... in	0.0028409		0.3064
8. Pond and Swamp Adjustment Factor, Fp..... (Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)	1	1	1
9. Peak Discharge, qp..... cfs (Where qp = qu(Am)(Q)Fp)	0.0015321	0	0.2119

Developed

APPENDIX F - SUBBASIN 5 TR-55 WORKSHEETS

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 5 - Grand Valley Canal Bank
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

1. Runoff Curve Number (CN)

Soil Name and Hydrologic Group (APPENDIX A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area _X__ acres ___ sq. mi. ___ %	Product of CN x Area
Killpack Silty Clay Loam,	Grand Valley Canal Bank, Brush, poor	77			1.46	112.42
						0
						0
						0
						0
						0
				TOTALS	1.46	112.42

NOTE: USE ONLY 1 CN SOURCE PER LINE

CN (Weighted) = Total Product / Total Area = 112.42 / 1.46 = 77 Use CN = 77

2. Runoff

	Storm # 1	Storm # 2	Storm # 3
Frequency ..... yr.	2	100	
Rainfall, P (24-hour) ..... in.	1	2.6	
Runoff, Q ..... in.	0.0002	0.3666	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 or 2-4)

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 5 - Grand Valley Canal Bank
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 22-Mar-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

Worksheet 3: Time of Concentration

Time of Concentration (1) or Travel Time through subarea (2) 2

NOTES: Space for as many as four segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID	Canal Bank					
1. Surface Description (Table 3-1)			Bare Soil					
2. Manning's Roughness Coefficient, n (Table 3-1)			0.011					
3. Flow Length, L (total L<= 300 ft.)	ft		105					
4. Two Year 24 Hour Rainfall, P2	in		2.6					
5. Land slope, s	ft/ft		0.0666667					
6. Tt = 0.007(nL)**0.8 / P2**0.5(s**0.4)	Compute Tt	hr	0.0143917	N/A	N/A	N/A	N/A	0.0143917

Shallow Concentrated Flow		Segment ID					
7. Surface Description (Paved or Unpaved)							
8. Flow Length, L	ft						
9. Watercourse Slope, s	ft/ft						
10. Average Velocity, V (Figure 3-1)	ft/s						
11. Tt = L/3600V	Compute Tt	hr	N/A	N/A	N/A	N/A	0

Channel Flow		Segment ID					
12. Cross Sectional Flow Area, a	ft2						
13. Wetted Perimeter, Pw	ft						
14. Hydraulic Radius, r = a/Pw Compute r	ft		N/A	N/A	N/A		
15. Channel Slope, s	ft/ft						
16. Manning's Roughness Coefficient, n							
17. V = 1.49*(r**2/3)*(s**1/2)/n	Compute V	ft/s	N/A	N/A	N/A		
18. Flow Length, L	ft						
19. Tt = L/3600V	Compute Tt	hr	N/A	N/A	N/A		0
20. Watershed or subarea Tc or Tt (Add Tt in steps 6,11,and 19)		hr	0.0143917				

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 5 - Grand Valley Canal Bank
Date: 22-Mar-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	22-Mar-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?	1				

Worksheet 4; Graphical Peak Discharge Method
Land Status : 1
Storm Event 100 yr - 24 hr

1. Data:
Drainage Area..... Am = 0.0022813 mi2 (Acres/640)
Runoff Curve Number..... CN = 77 (From worksheet 2)
Time of Concentration..... Tc = 0.0833333 hr (From worksheet 3)
Rainfall Distribution Type..... = II (I,IA,II, III)
Pond and Swamp Areas Spread
Throughout Watershed..... = 0 percent of Am (_____ Acres or mi2 covered)

	Storm # 1	Storm # 2	Storm # 3
2. Frequency..... yr	2		100
3. Rainfall, P (24-Hour)..... in	1		2.6
4. Initial abstraction, Ia..... in	0.597		0.597
(Use CN with Table 4-1)			
5. Compute Ia/P.....	0.597	N/A	0.2296154
6. Unit Peak Discharge, qu..... csm/in	550		950
(Use Tc and Ia/P with Exhibit 4-II)			
7. Runoff, Q..... in	0.0001793		0.3666
8. Pond and Swamp Adjustment Factor, Fp.....	1		1
(Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)			
9. Peak Discharge, qp..... cfs	0.000225		0.7945
(Where qp = qu(Am)(Q)Fp)			

Historical

APPENDIX G - SUBBASIN 6 TR-55 WORKSHEETS

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 6 - House above NW Corner Property
Date: 12-Feb-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 12-Feb-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

1. Runoff Curve Number (CN)

Soil Name and Hydrologic Group (APPENDIX A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area _X__ acres ___ sq. mi. ___ %	Product of CN x Area
Killpack silty clay loam, C	House & Lawn above NW corner of property	75			4.94	370.5
NOTE: USE ONLY 1 CN SOURCE PER LINE				TOTALS	4.94	370.5

CN (Weighted) = $\frac{\text{Total Product}}{\text{Total Area}} = \frac{370.5}{4.94} =$ 75 Use CN = 75

2. Runoff

		Storm # 1	Storm # 2	Storm # 3
Frequency	yr.	2	100	
Rainfall, P (24-hour)	in.	1	2.6	
Runoff, Q	in.	0.0303	0.7097	

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 or 2-4)

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 6 - House above NW Corner Property
Date: 12-Feb-02

This spread sheet was developed from the SCS worksheets

Project:	Burenheide Estates	By:	WPB	Date:	12-Feb-02
Location:	1130 18.5 Road	Checked:		Date:	
Present(1) or Developed(2)?	1				

Worksheet 3: Time of Concentration

Time of Concentration (1) or Travel Time through subarea (2) 1

NOTES: Space for as many as four segments per flow type can be used for each worksheet
Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID						
1. Surface Description (Table 3-1)								
2. Manning's Roughness Coefficient, n (Table 3-1)								
3. Flow Length, L (total L<= 300 ft.)	ft							
4. Two Year 24 Hour Rainfall, P2	in							
5. Land slope, s	ft/ft							
6. Tt = 0.007(nL)**0.8 / P2**0.5(s**0.4)	Compute Tt hr	N/A	N/A	N/A	N/A	N/A		0

Shallow Concentrated Flow		Segment ID	Yard	Borrow Ditch				
7. Surface Description (Paved or Unpaved)			Unpaved	Unpaved				
8. Flow Length, L	ft		520	60				
9. Watercourse Slope, s	ft/ft		0.0576923	0.0083333				
10. Average Velocity, V (Figure 3-1)	ft/s		3.6	1.4				
11. Tt = L/3600V	Compute Tt hr		0.0401235	0.0119048	N/A	N/A	N/A	0.0520282

Channel Flow		Segment ID					
12. Cross Sectional Flow Area, a	ft2						
13. Wetted Perimeter, Pw	ft						
14. Hydraulic Radius, r = a/Pw Compute r	ft	N/A	N/A				
15. Channel Slope, s	ft/ft						
16. Manning's Roughness Coefficient, n							
17. V = 1.49*(r**2/3)*(s**1/2)/n	Compute V ft/s	N/A	N/A				
18. Flow Length, L	ft						
19. Tt = L/3600V	Compute Tt hr	N/A	N/A				0
20. Watershed or subarea Tc or Tt (Add Tt in steps 6,11,and 19)						hr	0.0520282

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 6 - House above NW Corner Property
Date: 12-Feb-02

This spread sheet was developed from the SCS worksheets

Project: Burenheide Estates By: WPB Date: 12-Feb-02
Location: 1130 18.5 Road Checked: Date:
Present(1) or Developed(2)? 1

Worksheet 4; Graphical Peak Discharge Method
Land Status : 1
Storm Event 2 yr - 24 hr

1. Data:
Drainage Area..... Am = 0.0077188 mi2 (Acres/640)
Runoff Curve Number..... CN = 75 (From worksheet 2)
Time of Concentration..... Tc = 0.0833333 hr (From worksheet 3)
Rainfall Distribution Type..... = II (I,IA,II, III)
Pond and Swamp Areas Spread
Throughout Watershed..... = 0 percent of Am (_____ Acres or mi2 covered)

		Storm # 1	Storm # 2	Storm # 3
2. Frequency.....	yr	2		100
3. Rainfall, P (24-Hour).....	in	1		2.6
4. Initial abstraction, Ia.....	in	0.667	0.667	0.667
(Use CN with Table 4-1)				
5. Compute Ia/P.....		0.667	N/A	0.2565385
6. Unit Peak Discharge, qu.....	csm/in	550	N/A	960
(Use Tc and Ia/P with Exhibit 4-II)				
7. Runoff, Q.....	in	0.030303		0.7097
8. Pond and Swamp Adjustment Factor, Fp.....		1	1	1
(Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)				
9. Peak Discharge, qp.....	cfs	0.1286458	0	5.2589
(Where qp = qu(Am)(Q)Fp)				

Historical

APPENDIX H - DETENTION BASIN CAPACITY ESTIMATE

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 2 - West Portion includes Cul de Sac in Developed
Date: 12-Feb-02

This section sizes retention ponds using Chapter 6 Storage Volume for Detention Basins from TR-55.

Size pond for 100 yr 24 hr event.

Drainage Area:	0.0196094	sq. mi.	
Rainfall Distribution Type:	II		

		1st Stage		
Frequency:	yr	10	25	100
Peak Inflow Discharge qi:	cfs	0.1137		6.5229
Peak Outflow Discharge qo:	cfs	0.0585		5.0599
Compute qo\qi		0.514		0.776
Vs/Vr (use qo/qi with Figure 6.1)		0.27		0.18
Runoff, Q	in	0.0231934		0.6653
Runoff Volume, Vr (Vr=Q*Am*53.33)	ac-ft	0.0242549		0.6957
Storage Volume, Vs (Vs=Vr*(Vs/Vr))	ac-ft	0.0065488		0.1252323
Maximum Stage	Emax			
Storage Volume	cu ft	285.26698		5455.1179
Runoff Volume	cu ft	1056.5444		30306.21

Check:
Vw=Q*Acres*43560/12 1056.6104

Estimate Sediment Volume

Calculate R based on P2-6	0.55	inches	2 yr 6 hr event from SWMM
Rainfall Factor, R (R=27*(P2-6)^2.2	7.2470571		
Soil Erodability Factor, K	0.32		Table 5.5, Barfield Warner and Haan
Length Slope Factor, LS	0.4		Figure 5.15, Barfield Warner and Haan
Control Practice Factor, CP	0.06		
Average Annual Erosion, A	0.0556574	Tons/Acre-Year	
	0.6985003	Tons/year	
	19.957153	cu ft/year	
Sediment storage for three years	59.871458		
Total Storage Volume - 2 yr.	345		
Total Storage Volume - 100 yr	5,515		

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 3 - Existing Residence and Corrals
Date: 22-Mar-02

This section sizes retention ponds using Chapter 6 Storage Volume for Detention Basins from TR-55.

Size pond for 100 yr 24 hr event.
Location: Burenheide Estates
Subbasin: Subbasin 3 - Existing Residence and Corrals
Landstatus 2
Drainage Area: 0.005875 sq. mi.
Rainfall Distribution Type: II

		1st Stage		
Frequency:	yr	10	25	100
Peak Inflow Discharge qi:	cfs	0.0534		2.5017
Peak Outflow Discharge qo:	cfs	0.0408		2.3060
Compute qo\qi		0.764		0.922
Vs/Vr (use qo/qi with Figure 6.1)		0.138		0.135
Runoff, Q	in	0.030303		0.7097
Runoff Volume, Vr (Vr=Q*Am*53.33)	ac-ft	0.0094944		0.2224
Storage Volume, Vs (Vs=Vr*(Vs/Vr))	ac-ft	0.0013102		0.0300186
Maximum Stage	Emax			
Storage Volume	cu ft	57.073233		1307.6115
Runoff Volume	cu ft	413.57415		9686.0113

Check:
Vw=Q*Acres*43560/12 413.6

Estimate Sediment Volume

Calculate R based on P2-6	0.55 inches	2 yr 6 hr event from SWMM
Rainfall Factor, R (R=27*(P2-6)^2.2	7.2470571	
Soil Erodability Factor, K	0.32	Table 5.5, Barfield Warner and Haan
Length Slope Factor, LS	0.4	Figure 5.15, Barfield Warner and Haan
Control Practice Factor, CP	0.06	
Average Annual Erosion, A	0.0556574	Tons/Acre-Year
	0.2092718	Tons/year
	5.9791948	cu ft/year
Sediment storage for three years	17.937584	
Total Storage Volume - 2 yr.	75	
Total Storage Volume - 100 yr	1,326	

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 4 - Starr School Drainage Ditch
Date: 22-Mar-02

This section sizes retention ponds using Chapter 6 Storage Volume for Detention Basins from TR-55.

Size pond for 100 yr 24 hr event.
Location: Burenheide Estates
Subbasin: Subbasin 4 - Starr School Drainage Ditch
Landstatus 2
Drainage Area: 0.0027656 sq. mi.
Rainfall Distribution Type: II

		1st Stage		
Frequency:	yr	10	25	100
Peak Inflow Discharge qi:	cfs	0.0015		0.2119
Peak Outflow Discharge qo:	cfs	0.0068		0.1252
Compute qo\qi		4.471		0.591
Vs/Vr (use qo/qi with Figure 6.1)		0.18		0.26
Runoff, Q	in	0.0028409		0.3064
Runoff Volume, Vr (Vr=Q*Am*53.33)	ac-ft	0.000419		0.0452
Storage Volume, Vs (Vs=Vr*(Vs/Vr))	ac-ft	0.0000754		0.0117507
Maximum Stage	Emax			
Storage Volume	cu ft	3.2853572		511.8607
Runoff Volume	cu ft	18.251984		1968.695

Check:
Vw=Q*Acres*43560/12 18.253125

Estimate Sediment Volume

Calculate R based on P2-6	0.55	inches 2 yr 6 hr event from SWMM
Rainfall Factor, R (R=27*(P2-6)^2.2	7.2470571	
Soil Erodability Factor, K	0.32	Table 5.5, Barfield Warner and Haan
Length Slope Factor, LS	0.4	Figure 5.15, Barfield Warner and Haan
Control Practice Factor, CP	0.06	
Average Annual Erosion, A	0.0556574	Tons/Acre-Year
	0.0985136	Tons/year
	2.8146741	cu ft/year
Sediment storage for three years	8.4440224	
Total Storage Volume - 2 yr.	12	
Total Storage Volume - 100 yr	520	

APPENDIX I - STARR DRAIN DISCHARGE

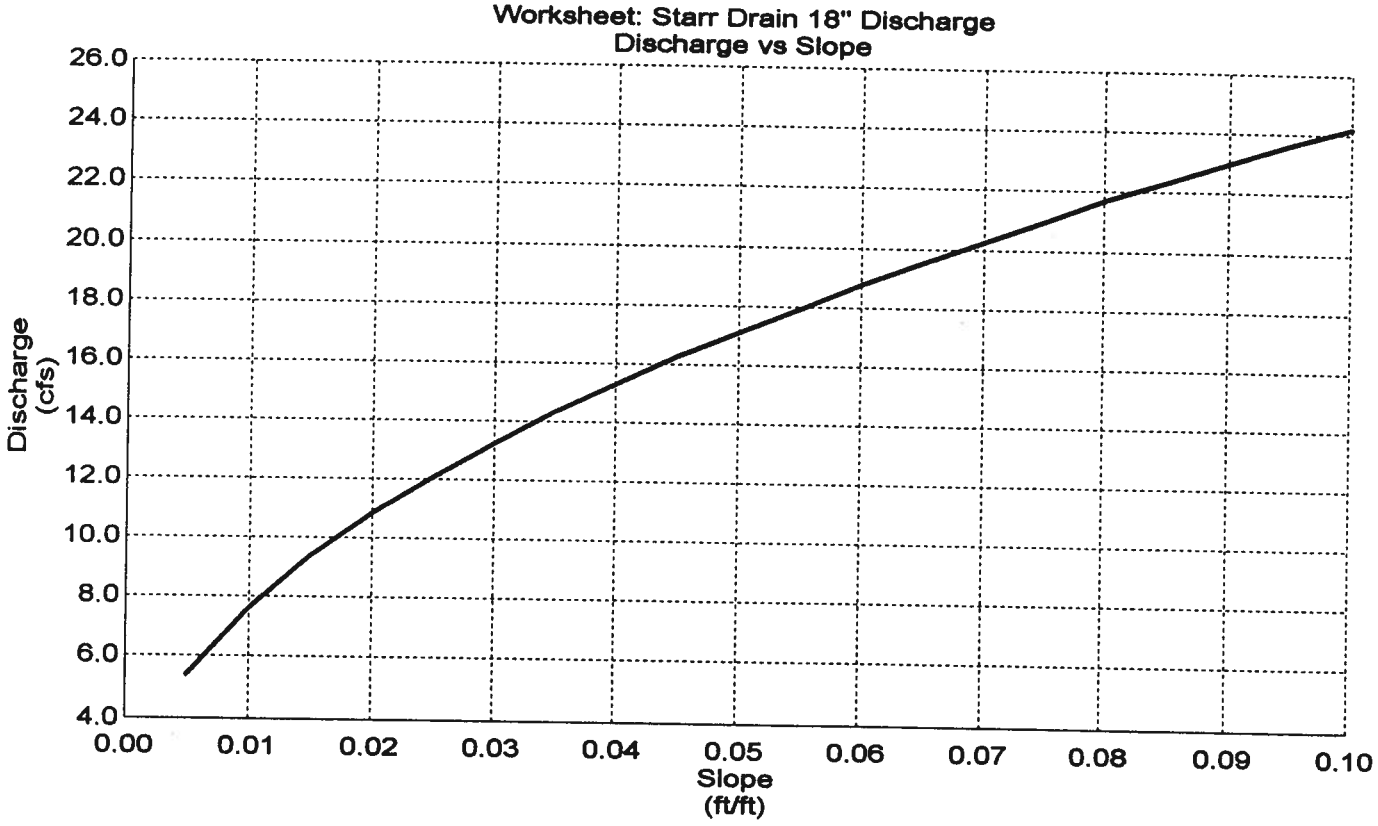
PIPE CAPACITY CURVES

Curve
Plotted Curves for Circular Channel

Project Description	
Worksheet	Starr Drain 18" Disch
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coeffic	0.013	
Depth	0.95	ft
Diameter	18	in

Attribute	Minimum	Maximum	Increment
Slope (ft/ft)	0.000000	0.100000	0.005000

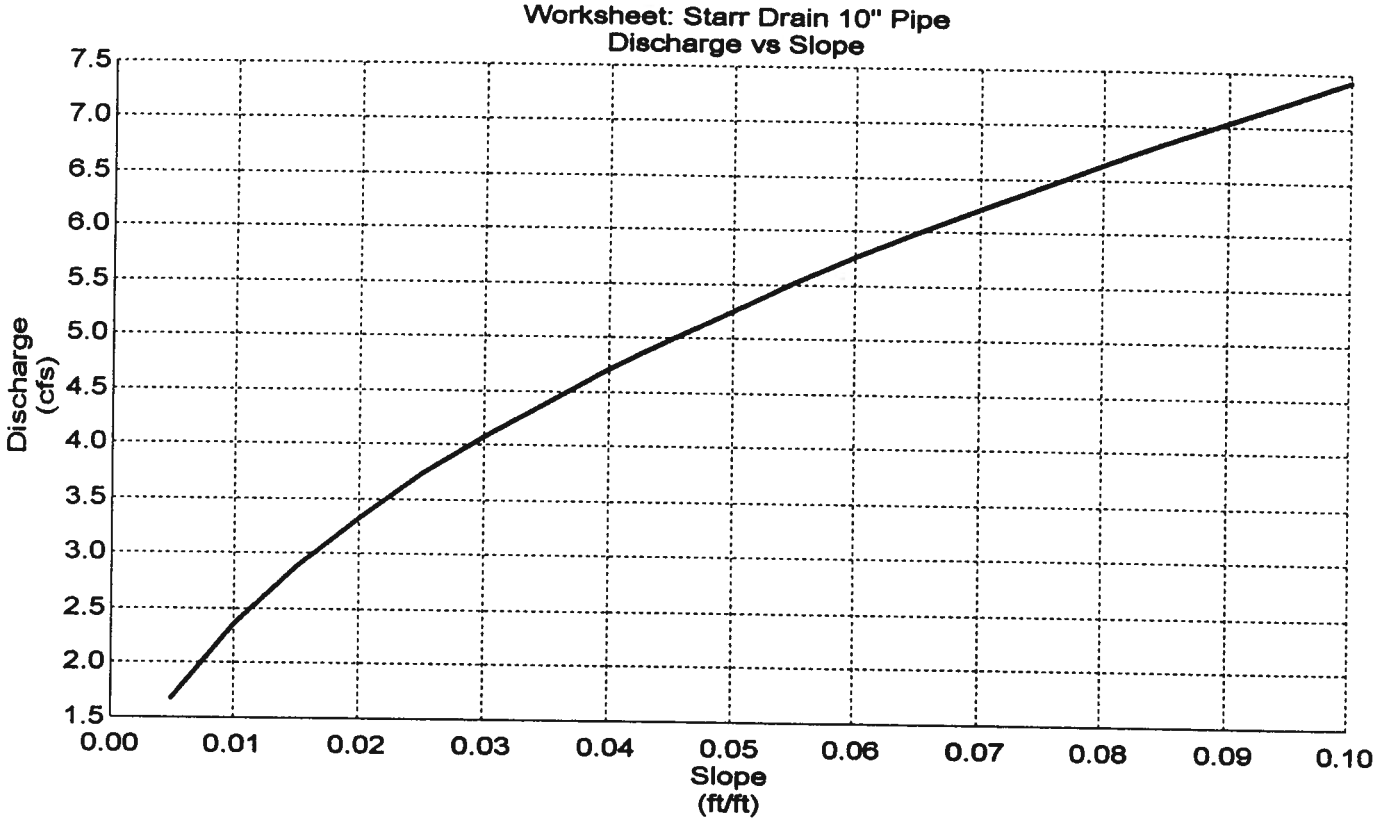


Curve
Plotted Curves for Circular Channel

Project Description	
Worksheet	Starr Drain 10" Pi
Flow Element	Circular Channel
Method	Manning's Formu
Solve For	Discharge

Input Data	
Mannings Coeffic	0.013
Depth	0.80 ft
Diameter	10 in

Attribute	Minimum	Maximum	Increment
Slope (ft/ft)	0.005000	0.100000	0.005000



APPENDIX J - RATIONAL METHOD "C"

FACTOR CALCULATIONS

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 1-East Side
Date: 07-Jun-02

Present(1) or Developed(2)? 1

Rational Method - Composite C Calculation Only

q=CiA
q=peak flow rate, cfs
C=Coefficient from Table 2.27, p 111 Barfield Warner and Haan and SWWM
i=rainfall intensity, iph
A=Area, acres

Runoff estimate for subbbasin 1 - East portion of property
Developed condition does not include cul de sac.

Area:		
Pasutre w/ grazing, Irrigated Field	26.57	Acres
Grand Valley Canal Bank, Brush, poor	1.46	Acres
		Acres
		Acres
		Acres
Total	28.03	

Average C		Product C*A
Pasutre w/ grazing, Irrigated Field	0.38	10.10
Grand Valley Canal Bank, Brush, poor	0.44	0.64
		0.00
		0.00
		0.00
		10.74
Average C		0.38 Historical

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 1-East Side
Date: 07-Jun-02

Present(1) or Developed(2)? 2

Rational Method - Composite C Calculation Only

q=CiA
q=peak flow rate, cfs
C=Coefficient from Table 2.27, p 111 Barfield Warner and Haan and SWWM
i=rainfall intensity, iph
A=Area, acres

Runoff estimate for subbbasin 1 - East portion of property
Developed condition does not include cul de sac.

Area:		
Pasutre w/ grazing, Irrigated Field	18.55	Acres
Grand Valley Canal Bank, Brush, poor	1.46	Acres
Private Drive, Recycled asphalt surface	0.49	Acres
Residences 1.0 acre lot	2.00	Acres
Detention Pond	1.13	Acres
Total	23.63	

Average C		Product C*A
Pasutre w/ grazing, Irrigated Field	0.38	7.05
Grand Valley Canal Bank, Brush, poor	0.44	0.64
Private Drive, Recycled asphalt surface	0.80	0.39
Residences 1.0 acre lot	0.36	0.72
Detention Pond	0.32	0.36
		9.17
Average C		0.39 Developed

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 2-West Side
Date: 07-Jun-02

Present(1) or Developed(2)? 1

Rational Method - Composite C Calculation Only

q=CiA
q=peak flow rate, cfs
C=Coefficient from Table 2.27, p 111 Barfield Warner and Haan, SWMM
i=rainfall intensity, iph
A=Area, acres

Runoff estimate for west side of project site. Developed condition includes cul de sac.

Area:		
Pasture w/ grazing, Irrigated Field, Fair	7.33	Acres
18.5 Road with ROW	0.46	Acres
		Acres
		Acres
Total	7.79	Acres

Average C		Product C*A
Pasture w/ grazing, Irrigated Field, Fair	0.38	2.7854
18.5 Road with ROW	0.70	0.322
	0.40	0
	0.96	0
		3.1074
Average C		0.40

Historical

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 2-West Side
Date: 07-Jun-02

Present(1) or Developed(2)? 2

Rational Method - Composite C Calculation Only

q=CiA
q=peak flow rate, cfs
C=Coefficient from Table 2.27, p 111 Barfield Warner and Haan, SWMM
i=rainfall intensity, iph
A=Area, acres

Runoff estimate for west side of project site. Developed condition includes cul de sac.

Area:		
Pasture w/ grazing, Irrigated Field, Fair	2.56	Acres
18.5 Road with ROW	0.46	Acres
Residences 0.5 acre Lot	8.65	Acres
Cul de Sac	0.88	Acres
Total	12.55	Acres

Average C		Product C*A
Pasture w/ grazing, Irrigated Field, Fair	0.38	0.9728
18.5 Road with ROW	0.70	0.322
Residences 0.5 acre Lot	0.40	3.46
Cul de Sac	0.96	0.8448
		5.5996
Average C		0.45 Developed

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 3-Existing Farmstead
Date: 07-Jun-02

Present(1) or Developed(2)? 1

Rational Method - Composite C Calculation Only

q=CiA
q=peak flow rate, cfs
C=Coefficient from Table 2.27, p 111 Barfield Warner and Haan, SWMM
i=rainfall intensity, iph
A=Area, acres

Runoff estimate for existing residence, corrals and out buildings.
Developed conditions includes a portion of the private access drive.

Area:		
Farm Yard	3.65	Acres
18.5 Road with ROW	0.11	Acres
		Acres
Total	3.76	

Average C		Product C*A
Farm Yard	0.32	1.168
18.5 Road with ROW	0.70	0.077
	0.80	0
		0
		1.245
Average C		0.33 Historical

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 3-Existing Farmstead
Date: 07-Jun-02

Present(1) or Developed(2)? 2

Rational Method - Composite C Calculation Only

q=CiA
q=peak flow rate, cfs
C=Coefficient from Table 2.27, p 111 Barfield Warner and Haan, SWMM
i=rainfall intensity, iph
A=Area, acres

Runoff estimate for existing residence, corrals and out buildings.
Developed conditions includes a portion of the private access drive.

Area:		
Farm Yard	3.51	Acres
18.5 Road with ROW	0.11	Acres
Private Drive, Recycled Asphalt Surface	0.14	Acres
Total	3.76	

Average C		Product C*A
Farm Yard	0.32	1.1232
18.5 Road with ROW	0.70	0.077
Private Drive, Recycled Asphalt Surface	0.80	0.112
		0
		1.3122
Average C		0.35 Developed

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 4-Starr School Drainage Ditch
Date: 07-Jun-02

Present(1) or Developed(2)? 1

Rational Method - Composite C Calculation Only

q=CiA
q=peak flow rate, cfs
C=Coefficient from Table 2.27, p 111 Barfield Warner and Haan, SWMM
i=rainfall intensity, iph
A=Area, acres

Developed conditions includes the private drive and a portion of the detention pond.

Area:		
Starr School Drainage Ditch, Grassland	1.77	Acres
		Acres
		Acres
Total	1.77	

Average C		Product C*A
Starr School Drainage Ditch, Grassland	0.36	0.6372
		0
		0
		0
		0.6372
Average C		0.36 Historical

Burenheide Estates
1130 18.5 Road
Drainage Study
Subbasin 4-Starr School Drainage Ditch
Date: 07-Jun-02

Present(1) or Developed(2)? 2

Rational Method - Composite C Calculation Only

q=CiA
q=peak flow rate, cfs
C=Coefficient from Table 2.27, p 111 Barfield Warner and Haan, SWMM
i=rainfall intensity, iph
A=Area, acres

Developed conditions includes the private drive and a portion of the detention pond.

Area:		
Starr School Drainage Ditch, Grassland	1.55	Acres
Private Drive, Recycled Asphalt Surface	0.22	Acres
Detention Pond	0.22	Acres
Total	1.99	

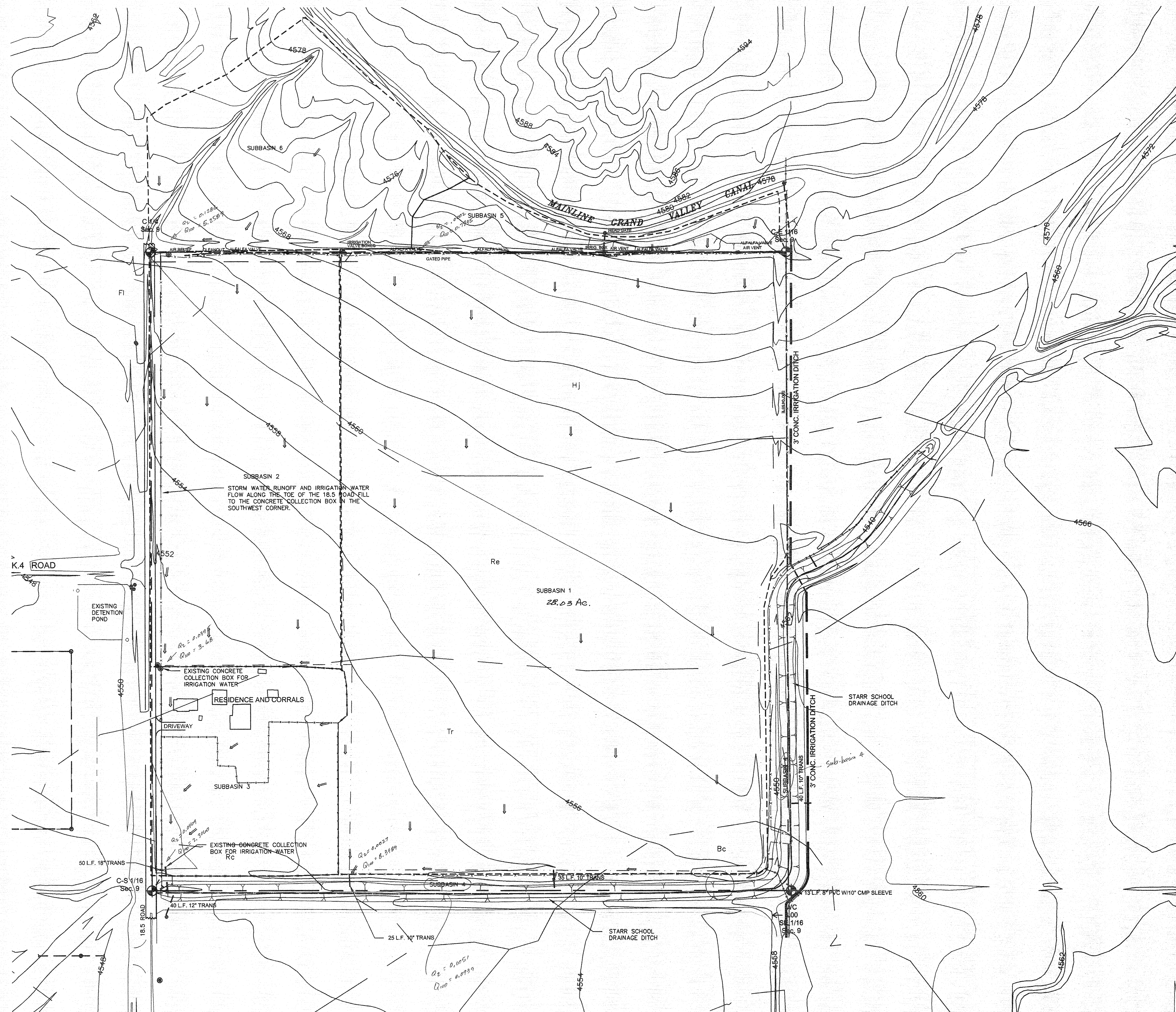
Average C		Product C*A
Starr School Drainage Ditch, Grassland	0.36	0.558
Private Drive, Recycled Asphalt Surface	0.80	0.176
Detention Pond	0.32	0.0704
		0
		0.8044
Average C		0.40

Developed

SOILS LEGEND

Fl – Fruitvale Clay Loam
Hj – Killpack Silty Clay Loam
Re – Sagrlite Loam
Tr – Turley Clay Loam
Bc – Sagers Silty Clay Loam
Rc – Fruitland Sandy Clay Loam

SOIL TYPE BOUNDARY
DRAINAGE SUBBASIN BOUNDARY
EXISTING DRAINAGE FLOW DIRECTION
EXISTING IRRIGATION DITCH/SWALE
EXISTING FENCE



GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft. Horizontal

NORTH

Balaz & Associates, Inc.
1005 N. 12th St. #211
Grand Junction, Colorado 81501
Tel.#: (970) 263-9733
Fax#: (970) 263-9736

IMPROVEMENT PLAN

BURENHEIDE ESTATES
EXISTING DRAINAGE PATTERNS

CITY OF FRUITA COLORADO

SCALE: 1" = 100'
DATE: 05/30/02
DRAWN BY: WPB
ENGINEER: WPB
CHECKED BY: WPB
FB: PG.

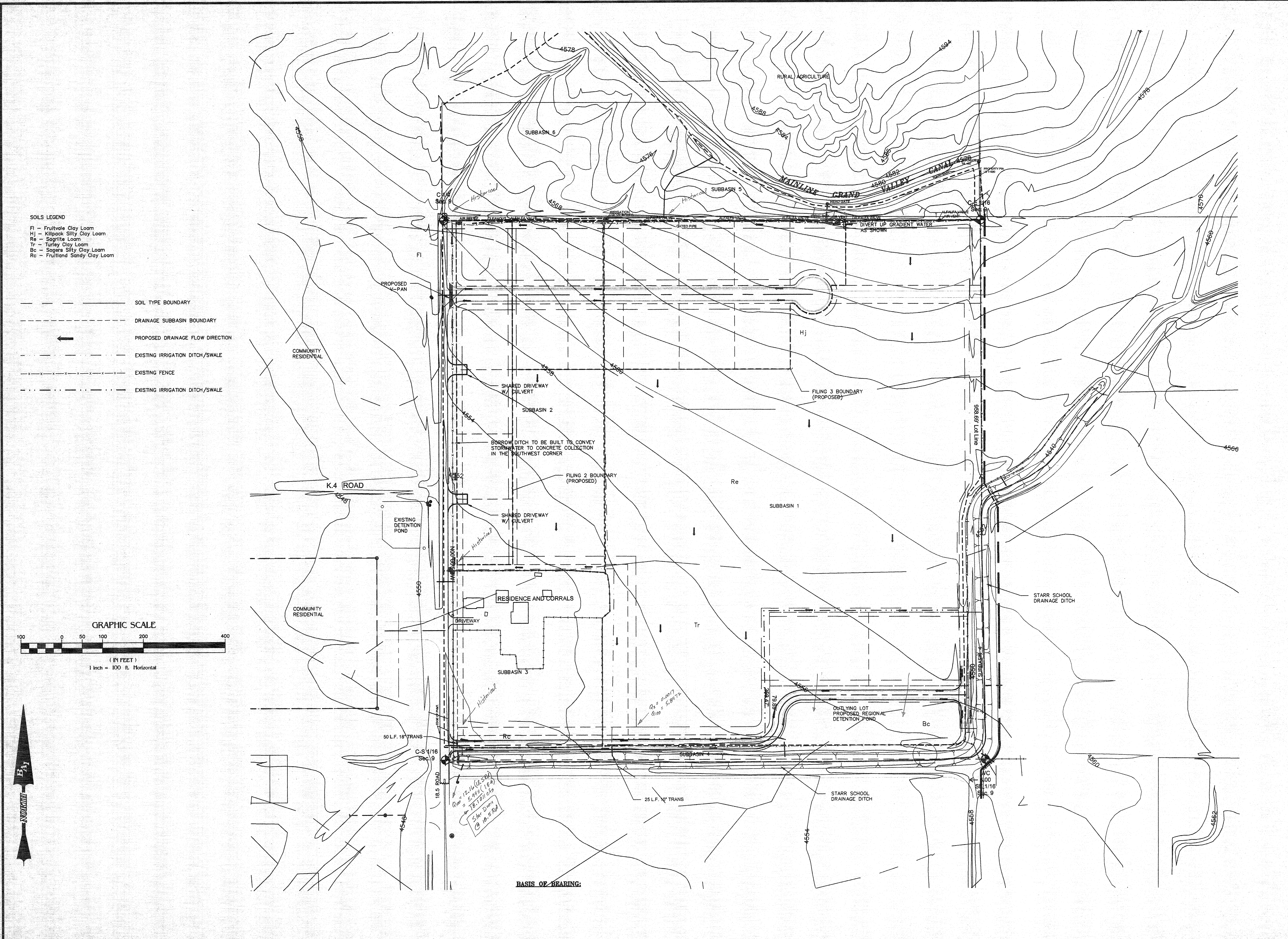
PREPARED UNDER THE SUPERVISION OF
WM. P. BALAZ JR. PE# 17129

NO.	BY	DATE	REVISION BLOCK
1			
2			
3			
4			
5			

EXHIBIT B

JOB No. GJDD-OB

C:\BAI\Colorado\burenheide\08-GJD.DWG Thu Jun 13 17:50:14 2002 JEV



IMPROVEMENT PLAN

BURENHEIDE ESTATES PROPOSED DRAINAGE PATTERNS

CITY OF FRUITA COLORADO

SCALE: 1" = 100'
DATE: 05/30/02
DRAWN BY: WPB
ENGINEER: WPB
CHECKED BY: WPB

Balaz & Associates, Inc.
1005 N. 12th St. #211
Grand Junction, Colorado 81501
Tel.# (970) 263-9733
Fax#: (970) 263-9736

PREPARED UNDER THE SUPERVISION OF WM. P. BALAZ, JR. PE#

REVISION BLOCK

NO	BY	DATE
1		
2		
3		
4		
5		

EXHIBIT C

JOB No. GJDD-OB