Final Drainage Report

# Wildcat Ranch

October 03, 2005

Prepared for:

**South Camp, LLC**
2185 Quail Court
Grand Junction, CO 81503

Prepared by:

**THOMPSON-LANGFORD CORPORATION**
**529 251/2 RD., SUITE B-210**
**Grand Junction, CO 81505**
**PH. 243-6067**

Job No. 0668-010

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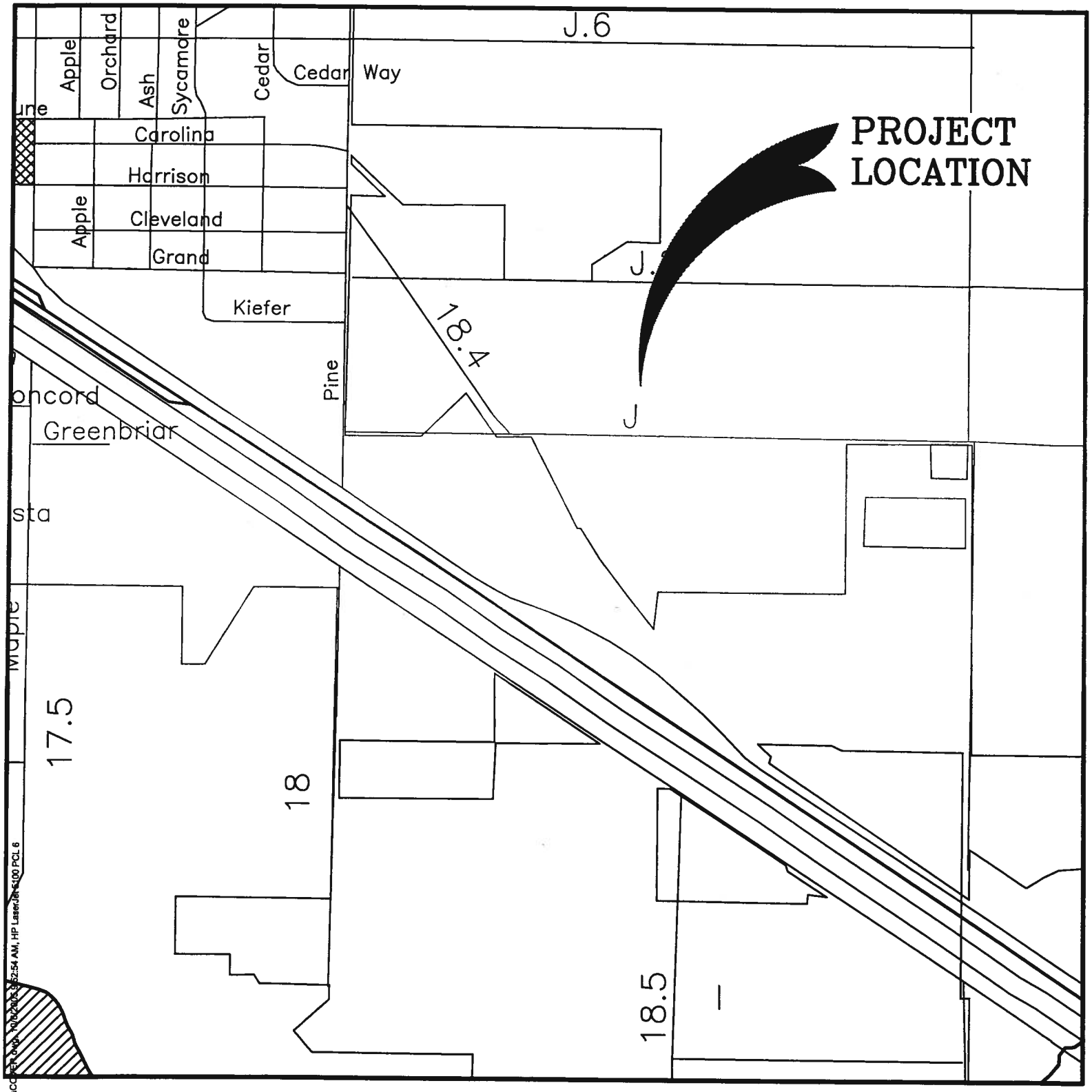
APPENDIX

VICINITY MAP
FOR
# WILDCAT RANCH SUBDIVISION





THOMPSON–LANGFORD CORP.
529 25 1/2 RD., SUITE B210
GRAND JUNCTION, COLORADO
PH. (970) 243–6067


JOB NO. 0006-053

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**Engineer's Certification**

I hereby certify that this report was prepared by me or under my direct supervision for the Owner's hereof.


Jeffrey W. Mace, P.E.
Reg. No. 37343

## I. GENERAL LOCATION AND DESCRIPTION:

### A. Site and Major Basin Location:

The proposed Wildcat Ranch development is located at 1840 J Road, along the north side of J Road just east of J.3 Road. In more legal terms, it lies with the Southern ½ of the Southeast ¼ of the Southwest ¼ of Section 16, Township 1 North, Range 2 West of the Ute Meridian.

The only existing subdivisions in the vicinity of the proposed development are Kiefer's Orchard to the east and Monument View Subdivision to the northwest. The proposed Fruita middle school will be directly south across J Road. With the exception of some larger undeveloped lots, the developments in the vicinity are of similar type and size to the proposed subdivision.

### B. Site and Major Basin Description:

The project site is approximately 4.5 acres with an existing home site on a small portion. The remainder of the site is irrigated agricultural land currently being used as pasture. Aside from the small home site, none of the property has been previously developed.

According to the GIS mapping for soil conditions available at Mesa County's internet web site, the area to be developed is included within an area of Fruitland Sandy Clay Loam. Fruitland Sandy Clay Loam is derived from alluvial deposits that came mostly from sandstone and shale. It is well drained soil with a low runoff classification and moderate permeability. These soil types are included in the SCS Hydrologic Soil Group B. More detailed information has been included in the Appendix of this report.

## II. EXISTING DRAINAGE CONDITIONS:

### A. Major Basin:

The site contributes to the Murray Drain. However, according to Mesa County GIS, the proposed development is geographically located within a major basin referred to as Basin 117. Basin 117 is situated in between the major basins of Little Salt Wash and Adobe Creek. Little Salt Wash and Adobe Creek basins originate with the Bookcliffs and terminate at the Colorado River. Basin 117 originates where these two basins intersect near the intersection of 20 and L Roads and also ends at the Colorado River.

The predominant drainage pattern for the major basin area is characterized by overland flow sloping towards the river at varying grades. Channels, ditches and canals intermittently cross the sloping ground surface collecting surface runoff as well as ground water and typically flow from northeast to southwest. The construction of major arterial roads such as J Road and 19 Road also serves to intercept and collect surface water runoff. Consideration of these parameters led to the watershed boundary definitions of the major basin.

This site is not affected by any previously determined floodplain.

**B. Site:**

Runoff from the site is collected in the Murray Drain shortly downstream of the project. Sheet flow is collected on conveyed off site by means of the roadside ditch along J Road which is intercepted by a combined open channel/underground conveyance system which discharges into the Murray Drain. The project site is gradually sloping from northeast to southwest with approximate grades varying from zero to one percent. There are existing features that define this sub basin. The upper limit to the local watershed is defined on the northern edge by the Kettles Drain. Similarly, J Road forms the lower boundary along the south edge of the property. Open ditches cut along the eastern and western property lines form the remaining boundaries.

## III PROPOSED DRAINAGE CONDITIONS:

### A. Changes in Drainage Patterns

The overall drainage patterns for the major basin are not being significantly altered. Due to the increase in impervious from development, some increase in runoff will be noticed from historic to developed conditions. While there may be a slight increase over historic rates leaving the site, the major basin will not notice an appreciable increase in the 2-year or 100-year flows as a result of retention. Release from the retention facility will be at a rate high enough to empty the pond within 48 hours but not to exceed 50% of the properties historic release rate.

Historic drainage patterns within the site will remain intact, where possible, in an effort to minimize the impact of the development of this parcel on surrounding properties. The majority of developed runoff will be collected in curb and gutter and swales and conveyed off site in a route similar to historic.

**B. Maintenance Issues:**

Maintenance of the on-site collection and conveyance facilities within the right of way will be the responsibility of the City of Fruita. Facilities outside of the right of way will be maintained by the Homeowners Association.

## IV DESIGN CRITERIA AND APPROACH:

### A. General Considerations:

As previously mentioned, the site contributes to the Murray Drain. At some locations downstream from the site, the Murray Drain is reportedly at or above capacity. As a means to help alleviate this, the retention pond will discharge at a rate considerably less than historic. Developed discharge will be limited to less than 50% of historic flows at the request of the city.

Storm water runoff for the 2-year and 100-year events were quantified using the Rational Method as detailed in Section VI "Hydrology" of the Storm water Management Manual for the City of Grand Junction and Mesa County dated May 1996.

The 2-year and the 100-year design storms will be considered when sizing all proposed drainage features. On-site swales and culverts will be sized to carry the 2-year and 100-year storm water flows. For areas where storm sewer pipe crosses through private property, or within easements, the storm sewer will be designed to carry the 100-year runoff volume while flowing 80% full.

The analysis and design procedures as outlined in the Storm Water Management Manual for the City of Grand Junction and Mesa County (SWMM) were adhered to during the design of all on-site collection and storm conveyance facilities proposed for the subdivision.

### B. Hydrology:

Runoff coefficients used in the Rational equation were based on the hydrologic soil group index for the soil type found within the project. According to the GIS website for Mesa County, the dominant soil types have a hydrologic soil group index of "B".

For historic conditions the runoff coefficient for "Bare Ground" was used. For post-developed conditions coefficients representing residential development at a density of 1/3 acre per unit were used. These coefficients were determined from Appendix "B" of the Mesa County/City of Grand Junction Stormwater Management Manual.

The maximum times of concentration used by the Modified Rational Method to determine maximum flow quantities for individual sub-basins will be a cumulative result of overland, curb and gutter, asphalt sheeting, graded swales and culvert flow times.

### C. Hydraulics:

Flow capacity of curb and gutter, natural swales and underground conduits were calculated using Manning's Equation with the required flow resistance coefficients taken from appendices "G" and "H" of the SWWM.

## V. CONCLUSIONS AND RECOMMENDATIONS:

### A. Runoff Rates for 2 and 100 Year Storm Events

The results of the analyses performed on all basins are summarized in the following table. Please refer to the included drainage maps for basin and design point locations.

Runoff Rates

| Basin ID | 2 Year Runoff | 100 Year Runoff |
|---|---|---|
| Developed | | |
| D1a | 0.27 | 1.97 |
| D1b | 0.09 | 0.63 |
| D1c | 0.06 | 0.41 |
| D1 | 0.40 | 2.90 |
| Historic | | |
| H1 | 0.36 | 2.54 |

The on site storm sewer system carrying the 2-Year and 100-Year design storm flows was designed to convey the 100-Year flows with pipe flows at less than 80% full. Table II summarizes the calculations performed for the on site storm sewer. Off site storm sewer was sized comparably in capacity to downstream facilities.

Table II, On Site Storm Sewer

| Reach No./ Description | Type/Size | Slope | 100-Year Flow ($ft^3$/sec) | % of Capacity |
|---|---|---|---|---|
| Inlet 1 | Single Curb | SAG | 0.94 | 7.2 |
| Inlet 2 | Single Curb | SAG | 1.97 | 15 |
| Line A | 15" HDPE | 0.40 % | 2.90 | 59 |
| Line B | 8" HDPE | 0.50% | 0.41 | 47 |

## B. Retention

The values used to determine the total retention volume have been reproduced in the following table.

Total Retention Volume Calculation

| Developed Runoff Coefficient, $C_{100d}$ | Area Acres ($ft^2$) | Precipitation, $P_{100, 24hr}$ in (ft) | Volume ($ft^3$) |
|---|---|---|---|
| 0.37 | 4.26 (185,565) | 2.01 | 11,500 |

The time required to drain the 24 hour, 100 year storm water runoff out of the retention pond within 48 hours is approximately 30 gpm or 0.07 cfs, well below the required discharge of 50 % historic equal to 1.27 cfs or 570 gpm. The parameters used in this estimation are reproduced in the following table.

| Retention Volume ($ft^3$) | Allowable Time (hours) | Minimum Required Pump Rate (gpm) | Minimum Required Pump Rate (cfs) |
|---|---|---|---|
| 11,500 | 48 | 30.0 | 0.07 |

## C. Overall Compliance

The calculations performed for the hydraulic elements of the proposed development indicate that the drainage system is capable of draining the project during the 2-year and 100-year storm events.

The development exceeds typical requirements in retaining developed runoff and discharging at a rate significantly lower than historic amounts contributed to the basin.

This report has been prepared using the joint City/County Storm Water Management Manual as a guide. The methods of analysis, recommendations and conclusions presented in this report are in conformance with these guidelines.

# APPENDIX

## COMPOSITE RUNOFF COEFICIENTS

**For: Wildcat Ranch**

**USING**

**GRAND JUNCTION RECOMMENDED RUNOFF COEFICIENTS**

| Description Surface Area | Hydro. Soils Group | Slope <2% Runoff Coeff.'s | Sel. Coeff. | | BASIN H1 Unit Area | BASIN H1 Wt'd Value | BASIN D1a Unit Area | BASIN D1a Wt'd Value | BASIN D1b Unit Area | BASIN D1b Wt'd Value | BASIN D1c Unit Area | BASIN D1c Wt'd Value | BASIN D1 Unit Area | BASIN D1 Wt'd Value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pavement and Roofs | B | 0.93 | 0.93 | 2-Yr. | 0.20 | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | B | 0.95 | 0.95 | 100-Yr. | 0.20 | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bare Ground, Green | B | 0.22 to 0.30 | 0.28 | 2-Yr. | 4.12 | 1.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| landscaping, lawns | B | 0.28 to 0.36 | 0.34 | 100-Yr. | 4.12 | 1.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| and parks | | | | | | | | | | | | | | |
| Non-green and gravel | B | 0.42 to 0.50 | 0.48 | 2-Yr. | 0.19 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| landscaping | B | 0.48 to 0.56 | 0.54 | 100-Yr. | 0.19 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Residential Areas | B | 0.25 to 0.33 | 0.29 | 2-Yr. | 0.00 | 0.00 | 2.88 | 0.84 | 0.92 | 0.27 | 0.46 | 0.13 | 4.26 | 1.24 |
| 1/3 Acre per Unit | B | 0.33 to 0.41 | 0.37 | 100-Yr. | 0.00 | 0.00 | 2.88 | 1.07 | 0.92 | 0.34 | 0.46 | 0.17 | 4.26 | 1.58 |

| | | | | | |
|---|---|---|---|---|---|
| **Total Basin Area:** | 4.51 | 2.88 | 0.92 | 0.46 | 4.26 |
| **COMPOSITE "C" VALUE (2-year)** | 0.32 | 0.29 | 0.29 | 0.29 | 0.29 |
| **COMPOSITE "C" VALUE (100-year)** | 0.38 | 0.37 | 0.37 | 0.37 | 0.37 |

## TIME OF CONCENTRATION and RAINFALL INTENSITIES

**For:** Wildcat Ranch

**BASIN H1**

| Description of Flow | L Length ft. | S Slope % | N* Mannings coef. | $V_2$ Vel. fps | $V_{100}$ Vel. fps | $Tt_2$ Travel Time min. | $Tt_{100}$ Travel Time min. | $Tc_2$ Time of Concentration min. | $Tc_{100}$ min. | 2-Year i Intensity Grd. Jctn. Curves | 100-Year i Intensity Grd. Jctn. Curves |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Overland* | 200 | 1.00% | 0.200 | | | 60.58 | 35.75 | 85.8 | 51.3 | 0.25 | 1.50 |
| Shallow Concentrated Flow** | 484.1 | 0.80% | 0.255 | 0.32 | 0.52 | 25.21 | 15.52 | | | | |
| Channel Flow*** | 0.00 | 0.56% | 0.023 | 1.99 | 3.25 | 0.00 | 0.00 | | | | |
| Curb and Gutter Flow*** | 0.00 | 0.50% | 0.016 | 1.34 | 2.39 | 0.00 | 0.00 | | | | |

(from Flowmaster - d=2" for 2-Yr. & d=5" for 100-Yr.)

* $T_0$ based on SCS formula pg. E-2 Storm Water Management Manual

** Figure "E-3", Pg. E-9, Storm Water Management Manual was used for shallow flows.

*** Mannings Equation was used to determine gutter and concrete pan flow velocities
an N value of 0.016 was used for conrete gutters and pans
For natural swales a flow of .25 cfs/AC was assumed for a 2 Year Storm and
a flow of 1.25 cfs/AC was assumed for 100 Year Storm

## RUNOFF RATES (Q)

**For:** Wildcat Ranch

**USING RATIONAL METHOD Q=CxCfxIxA**

| BASIN H1 | Q Volume cfs | C Composite Coefficient n/a | Cf Antecedent Precip. Fac. n/a | I* Rainfall Intensity in/hr | A Basin Area acres |
|---|---|---|---|---|---|
| 2-Yr | 0.36 | 0.32 | 1 | 0.25 | 4.51 |
| 100-Yr | 2.54 | 0.38 | 1 | 1.50 | 4.51 |

## TIME OF CONCENTRATION and RAINFALL INTENSITIES

**For:** Wildcat Ranch

**BASIN D1a**

| Description of Flow | L Length ft. | S Slope % | N* Mannings coef. | $V_2$ Vel. fps | $V_{100}$ Vel. fps | $Tt_2$ Travel Time min. | $Tt_{100}$ Travel Time min. | $Tc_2$ Time of Concentration min. | $Tc_{100}$ min. | 2-Year i Intensity Grd. Jctn. Curves | 100-Year i Intensity Grd. Jctn. Curves |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Overland* | 128.3 | 1.70% | 0.400 | | | 59.81 | 35.29 | 63.2 | 37.9 | 0.32 | 1.85 |
| Shallow Concentrated Flow** | 0 | 0.73% | 0.255 | 0.83 | 1.35 | 0.00 | 0.00 | | | | |
| Channel Flow*** | 0.00 | 0.55% | 0.023 | 1.68 | 2.76 | 0.00 | 0.00 | | | | |
| Curb and Gutter Flow*** | 378.00 | 0.64% | 0.016 | 1.83 | 2.39 | 3.44 | 2.64 | | | | |

(from Flowmaster - d=2" for 2-Yr. & d=5" for 100-Yr.)

* $T_0$ based on SCS formula pg. E-2 Storm Water Management Manual

** Figure "E-3", Pg. E-9, Storm Water Management Manual was used for shallow flows.

*** Mannings Equation was used to determine gutter and concrete pan flow velocities
an N value of 0.016 was used for concrete gutters and pans
For natural swales a flow of .25 cfs/AC was assumed for a 2 Year Storm and
a flow of 1.25 cfs/AC was assumed for 100 Year Storm

## RUNOFF RATES (Q)

**For:** Wildcat Ranch

**USING RATIONAL METHOD Q=CxCfxIxA**

| BASIN D1a | Q Volume cfs | C Composite Coefficient n/a | Cf Antecedent Precip. Fac. n/a | I* Rainfall Intensity in/hr | A Basin Area acres |
|---|---|---|---|---|---|
| 2-Yr | 0.27 | 0.29 | 1 | 0.32 | 2.88 |
| 100-Yr | 1.97 | 0.37 | 1 | 1.85 | 2.88 |

## TIME OF CONCENTRATION and RAINFALL INTENSITIES

**For:** Wildcat Ranch

**BASIN D1b**

| Description of Flow | L Length ft. | S Slope % | N* Mannings coef. | $V_2$ Vel. fps | $V_{100}$ Vel. fps | $Tt_2$ Travel Time min. | $Tt_{100}$ Travel Time min. | $Tc_2$ Time of Concentration min. | $Tc_{100}$ min. | 2-Year i Intensity Grd. Jctn. Curves | 100-Year i Intensity Grd. Jctn. Curves |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Overland* | 126.2 | 1.50% | 0.400 | | | 62.05 | 36.62 | 64.1 | 38.2 | 0.32 | 1.84 |
| Shallow Concentrated Flow** | 0 | 0.51% | 0.255 | 0.57 | 0.92 | 0.00 | 0.00 | | | | |
| Channel Flow*** | 0.00 | 2.25% | 0.023 | 1.54 | 1.76 | 0.00 | 0.00 | | | | |
| Curb and Gutter Flow*** | 182.00 | 0.50% | 0.016 | 1.48 | 1.88 | 2.05 | 1.61 | | | | |

(from Flowmaster - d=2" for 2-Yr. & d=5" for 100-Yr.)

* $T_0$ based on SCS formula pg. E-2 Storm Water Management Manual

** Figure "E-3", Pg. E-9, Storm Water Management Manual was used for shallow flows.

*** Mannings Equation was used to determine gutter and concrete pan flow velocities
an N value of 0.016 was used for conrete gutters and pans
For natural swales a flow of .25 cfs/AC was assumed for a 2 Year Storm and
a flow of 1.25 cfs/AC was assumed for 100 Year Storm

## RUNOFF RATES (Q)

**For:** Wildcat Ranch

**USING RATIONAL METHOD Q=CxCfxIxA**

| BASIN D1b | Q Volume cfs | C Composite Coefficient n/a | Cf Antecedent Precip. Fac. n/a | I* Rainfall Intensity in/hr | A Basin Area acres |
|---|---|---|---|---|---|
| 2-Yr | 0.09 | 0.29 | 1 | 0.32 | 0.92 |
| 100-Yr | 0.63 | 0.37 | 1 | 1.84 | 0.92 |

## TIME OF CONCENTRATION and RAINFALL INTENSITIES

**For:** Wildcat Ranch

**BASIN D1c**

| Description of Flow | L Length ft. | S Slope % | N* Mannings coef. | $V_2$ Vel. fps | $V_{100}$ Vel. fps | $Tt_2$ Travel Time min. | $Tt_{100}$ Travel Time min. | $Tc_2$ Time of Concentration min. | $Tc_{100}$ min. | 2-Year i Intensity Grd. Jctn. Curves | 100-Year i Intensity Grd. Jctn. Curves |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Overland* | 88.8 | 2.00% | 0.400 | | | 41.75 | 24.64 | 42.7 | 25.3 | 0.43 | 2.38 |
| Shallow Concentrated Flow** | 0 | 0.47% | 0.255 | 0.58 | 0.95 | 0.00 | 0.00 | | | | |
| Channel Flow*** | 51.00 | 1.00% | 0.023 | 0.86 | 1.39 | 0.99 | 0.61 | | | | |
| Curb and Gutter Flow*** | 0.00 | 0.60% | 0.016 | 1.80 | 2.72 | 0.00 | 0.00 | | | | |

(from Flowmaster - d=2" for 2-Yr. & d=5" for 100-Yr.)

* $T_0$ based on SCS formula pg. E-2 Storm Water Management Manual

** Figure "E-3", Pg. E-9, Storm Water Management Manual was used for shallow flows.

*** Mannings Equation was used to determine gutter and concrete pan flow velocities
an N value of 0.016 was used for conrete gutters and pans
For natural swales a flow of .25 cfs/AC was assumed for a 2 Year Storm and
a flow of 1.25 cfs/AC was assumed for 100 Year Storm

## RUNOFF RATES (Q)

**For:** Wildcat Ranch

**USING RATIONAL METHOD Q=CxCfxIxA**

| BASIN D1c | Q Volume cfs | C Composite Coefficient n/a | Cf Antecedent Precip. Fac. n/a | I* Rainfall Intensity in/hr | A Basin Area acres |
|---|---|---|---|---|---|
| 2-Yr | 0.06 | 0.29 | 1 | 0.43 | 0.46 |
| 100-Yr | 0.41 | 0.37 | 1 | 2.38 | 0.46 |

## TIME OF CONCENTRATION and RAINFALL INTENSITIES

**For: Wildcat Ranch**

**BASIN D1**

| Description of Flow | L Length ft. | S Slope % | N* Mannings coef. | $V_2$ Vel. fps | $V_{100}$ Vel. fps | $Tt_2$ Travel Time min. | $Tt_{100}$ Travel Time min. | $Tc_2$ Time of Concentration min. | $Tc_{100}$ min. | 2-Year i Intensity Grd. Jctn. Curves | 100-Year i Intensity Grd. Jctn. Curves |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Overland* | 126.2 | 1.50% | 0.400 | | | 62.05 | 36.62 | 64.1 | 38.2 | 0.32 | 1.84 |
| Shallow Concentrated Flow** | 0 | 0.51% | 0.255 | 0.57 | 0.92 | 0.00 | 0.00 | | | | |
| Channel Flow*** | 0.00 | 2.25% | 0.023 | 1.54 | 1.76 | 0.00 | 0.00 | | | | |
| Curb and Gutter Flow*** | 182.00 | 0.50% | 0.016 | 1.48 | 1.88 | 2.05 | 1.61 | | | | |

(from Flowmaster - d=2" for 2-Yr. & d=5" for 100-Yr.)

* $T_0$ based on SCS formula pg. E-2 Storm Water Management Manual

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a flow of 1.25 cfs/AC was assumed for 100 Year Storm

## RUNOFF RATES (Q)

**For: Wildcat Ranch**

**USING RATIONAL METHOD Q=CxCfxIxA**

| BASIN D1 | Q Volume cfs | C Composite Coefficient n/a | Cf Antecedent Precip. Fac. n/a | I* Rainfall Intensity in/hr | A Basin Area acres |
|---|---|---|---|---|---|
| 2-Yr | 0.40 | 0.29 | 1 | 0.32 | 4.26 |
| 100-Yr | 2.90 | 0.37 | 1 | 1.84 | 4.26 |

**STORMWATER RETENTION (Within Grand Valley only)**
**For: Wildcat Ranch Subdivision**
Date: 10/5/2005
Job. No. 0576-002

**Total Retention (without overflow)**

$V = P_{10024hr} \times A \times C_{100d}$

$P_{10024hr}$= 2.01 (See Table A-2, Pg A-4, SWMM)

Area= 4.26 Ac. = 185565.60 $Ft^2$

$C_{100d}$ = 0.37 (See Table B-1, Pg B-3, SWMM)

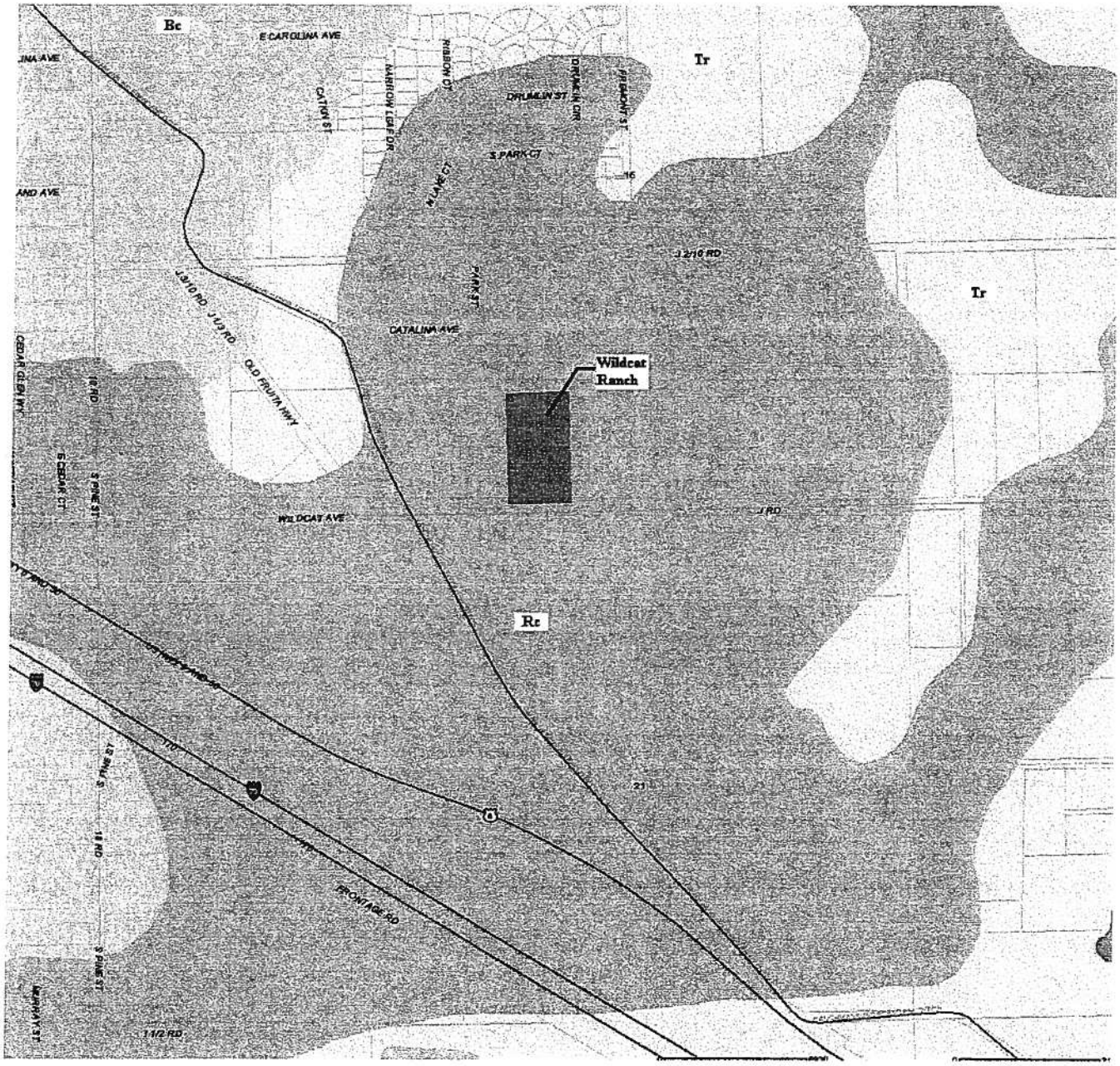
$$V(FT^3) = \frac{P_{10024hr}\ (inches)}{12} \times AREA\ (FT^2) \times C_{100d}$$

$= 11500.43\ Ft^3$

Minimum Drain Time

| | | | |
|---|---|---|---|
| Allowable Drain Time (Hrs.) | 48 | | |
| 100 Year Storage Volume ($Ft^3$) | 11500.43 | | |
| | | $Ft^3$/Sec | Gallon/Min |
| Minimum Drain Time | | 0.07 | 29.87 |

# Wildcat Ranch Subdivision
# Soils Type Map




## Soils

| Rec | Map Unit Symbol | Map Unit Name | Percent Slope | FARMLAND | Hot Link |
|---|---|---|---|---|---|
| 1 | Rc | Fruitland Sandy Clay Loam | 0-2 | Prime if Irrigated | Rc |
| 1 | Tr | Turley Clay Loam | 0-2 | Prime if Irrigated | Tr |
| 1 | Bc | Sagers Silty Clay Loam | 0-2 | Prime if Irrigated | Bc |

Rc-Fruitland sandy clay loam, 0 to 2 percent slopes

Map Unit Setting

MLRA:

Elevation: 4,600 to 4,800 feet (1,402 to 1,463 meters)

Mean annual precipitation: 7 to 10 inches (178 to 254 millimeters)

Average annual air temperature: 50 to 54 degrees F. (10 to 12 degrees C.)

Frost-free period: 150 to 190 days

Map Unit Composition

Fruitland and similar soils: 90 percent

Minor components: 10 percent

Component Descriptions

Fruitland soils

Landform: Alluvial fan

Geomorphic position: Unspecified

Parent material: Alluvium derived from sandstone and shale

Slope: 0 to 2 percent

Surface fragments: Unspecified

Depth to restrictive feature: Unspecified

Drainage class: Well drained

Slowest permeability: About 0.60 in/hr (moderate)

Available water capacity: About 7.6 inches (moderate)

Shrink-swell potential: About 1.5 LEP (low)

Flooding hazard: None

Ponding hazard: Unspecified

Seasonal water table minimum depth: Greater than 6 feet

Runoff class: Low

Calcium carbonate maximum: About 10 percent

Gypsum maximum: None

Salinity maximum: About 2 mmhos/cm (nonsaline)

Sodicity maximum: About 0 SAR (nonsodic)

Ecological site: Unspecified

Potential native vegetation: Unspecified

Land capability (irrigated): 2e

Land capability (non irrigated): 7c

##

Typical Profile:

Ap-0 to 8 inches; sandy clay loam

C1-8 to 30 inches; stratified gravelly sandy loam to fine sandy loam

C2-30 to 60 inches; stratified sandy loam to fine sandy loam

##

Minor Components

Other Soils and similar soils

Composition: About 10 percent

Landform: Unspecified

Geomorphic Position: Unspecified

Slope: Unspecified

Depth to restrictive feature: Unspecified

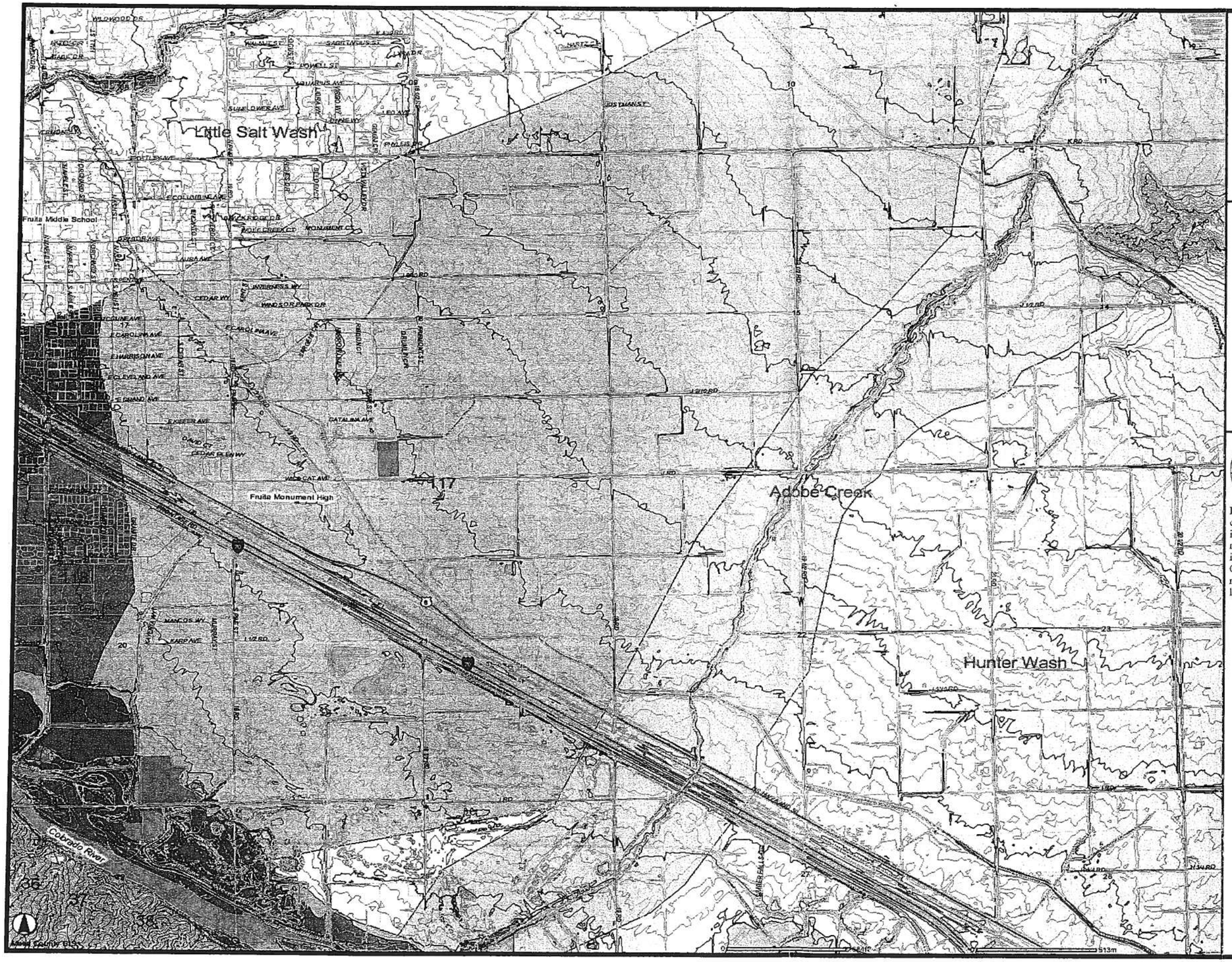
Drainage class: Unspecified

Ecological site: Unspecified

# Exhibit A-1, continued: Hydrologic soil groups for United States soils

| | |
|---|---|
| FREEST | C |
| FREESTONE | C |
| FREETOWN | D |
| FREEWATER | B |
| FREEZENER | B |
| FREEZEOUT | B |
| FRELSBURG | D |
| FREMONT | C |
| FREN | B |
| FRENCH | C |
| FRENCHCREEK | B |
| FRENCHJOHN | C |
| FRENCHMAN | B |
| FRENCHTOWN | D |
| FRESHWATER | D |
| FRESNO, SALINE-ALKALI | D |
| FRESNO, THICK SOLUM | C |
| FRESNO | B |
| FREZNIK | D |
| FRIANA | D |
| FRIANT | D |
| FRIDLO | C |
| FRIEDLANDER | C |
| FRIEDMAN | C |
| FRIENDS | C |
| FRIENDSHIP | A |
| FRIES | D |
| FRIESLAND | B |
| FRIJOLES | B |
| FRINDLE | C |
| FRINES | C |
| FRIO | B |
| FRIONA | C |
| FRIOTON | C |
| FRIPP | A |
| FRISCO | B |
| FRISITE | B |
| FRITZ | B |
| FRIZZELL | C |
| FROBERG | D |
| FRODO | D |
| FROHMAN | C |
| FROLIC | B |
| FROLIC, ELEVATION<3000 | C |
| FROLIC, FLOODED | C |
| FRONDORF | C |
| FRONTENAC | B |
| FRONTIER | C |
| FRONTON | D |
| FROST | D |
| FROZARD | C |
| FRUITA | B |
| FRUITFIELD | A |
| FRUITHURST | C |
| FRUITLAND | B |
| FRUITLAND, MODERATELY WET | C |
| FRUITLAND, WET | C |
| FRYE | C |
| FRYEBURG | B |
| FT. DRUM | C |
| FT. GREEN | D |
| FUBAR | C |
| FUBBLE | D |
| FUEGO | C |
| FUEGOSTA | D |
| FUERA | C |
| FUGAWEE | B |
| FUGHES | C |
| FULCHER | C |
| FULDA | C/D |
| FULLAM | C |
| FULLER | D |
| FULLERTON | B |
| FULMER | D |
| FULMER, DRAINED | C |
| FULSHEAR | C |
| FULSTONE | C |
| FULTON | D |
| FULTS | B |
| FULWIDER | B |
| FUNTER | D |
| FUQUAY | C |
| FURNISS | B |
| FURSHUR | C |
| FURY | B |
| FURY, DRAINED | C |
| FUSULINA | B |
| FUSUVAR | D |
| GAASTRA | D |
| GABALDON | D |
| GABBS | |
| GABBVALLY | C |
| GABEL | |
| GABICA | B |
| GABINO | D |
| GACEY | D |
| GACHADO | D |
| GACIBA | C |
| GADDES | C |
| GADDY | C |
| GADSDEN | C |
| GADSDEN, WET | A |
| SUBSTRATUM | D |
| GADWELL | B |
| GAGEBY | B |
| GAGETOWN | C |
| GAGIL | C |
| GAHEE | B |
| GAIR | C |
| GAILA | C |
| GAINES | A |
| GAINESBORO | B |
| GAINESVILLE | B |
| GALATA | B |
| GALBRETH | C |
| GALCHUTT | D |
| GALE | D |
| GALEN | C |
| GALEPPI | B |
| GALESTINA | C |
| GALESTOWN | |
| GALEY | C |
| GALILEE | C |
| GALISTEO | B |
| GALISTEO, SALINE-ALKALI | C |
| GALLAND | D |
| GALLATIN | C |
| GALLEGOS | B |
| GALLEN | A |
| GALLIA | C |
| GALLIME | B |
| GALLION | C |
| GALLMAN | |
| GALLUP | C |
| GALOD | C |
| GALT | B |
| GALVA | C |
| GALVESTON | D |
| GALVEZ | C |
| GALVIN | D |
| GALWAY | C |
| GAMBLER | D |
| GAMBOA | C |
| GAMGEE | B |
| GANADO | C |
| GANCE | C |
| GANDO | C/D |
| GANIS | C |
| GANNETT | D |
| GANSNER | B |
| GANSNER, PONDED | D |
| GANY | C |
| GAPBUTTE | C |
| GAPCOT | D |
| GAPO | D |
| GAPO, DRAINED | D |
| GAPPMAYER | D |
| GARA | D |
| GARBER | B |
| GARBO | D |
| GARBUTT | D |
| GARCENO | D |
| GARCES | C |
| GARCIA | D |
| GARCITAS | D |
| GARCON | C |
| GARDELLA | B |
| GARDENA | C |
| GARDINER | D |
| GARDNER'S FORK | C |
| GARDNERVILLE | D |
| GARDONE | D |
| GAREY | D |
| GARFAN | D |
| GARFIELD | D |
| GARHILL | C |
| GARIPER | A |
| GARITA | D |
| GARLAND | C |
| GARLET | |
| GARLOCK | C |
| GARMON | B |
| GARMORE | B |
| GARNEL | B |
| GARNER | B |
| GARNES | D |
| GARO | B |
| GARR | C |
| GARRETSON | C |
| GARRETT | A |
| GARRISON | D |
| GARROCHALES | D |
| GARSID | C |
| GARTON | B |
| GARVESON | B |
| GARVIN | B |
| GARWIN | C |
| GARZA | A |
| GARZONA | B |
| GAS CREEK | C |
| GASCONADE | C |
| GASIL | D |
| GASQUET | |
| GASSAWAY | D |
| GASSVILLE | C |
| GASTON | B |
| GAT | B |
| GATES | B |
| GATESON | B |
| GATEVIEW | B |
| GATEWAY | B |
| GATEWOOD | B |
| GATLIN | C/D |
| GATOR | D |
| GATTON | D |
| GAULDY | A |
| GAULEY | C |
| GAVEL | D |
| GAVILAN | B |
| GAVINS | B |
| GAVIOTA | B |
| GAY | C |
| GAYLESVILLE | D |
| GAYLORD | C |
| GAYNOR | D |
| GAYVILLE | D |
| GAZELLE | D |
| GAZOS | C |
| GAZWELL | D |
| GEARHART | B |
| GEARY | B |
| GEBSON | D |
| GED | D |
| GEE | C |
| GEEBURG | B |
| GEEMORE | C |
| GEER | B |
| GEERTSEN | B |
| GEFO | B |
| GEISEL | C |
| GEKE | D |
| GELKIE | C |
| GEM | C |
| GEM, STONY | C |
| GEMID | D |
| GEMSON | D |
| GENAW | A |
| GENEGRAF | B |
| GENESEE | C |
| GENEVA | A |
| GENOA | B |
| GENOLA | B |
| GENTILLY | C |
| GENTRY | D |
| GEOCONDA | C |
| GEOHROCK | E |
| GEORGECREEK | B |
| GEORGETOWN | E |
| GEORGEVILLE | B |
| GEORGIA | C |
| GEPFORD | B |
| GEPP | D |
| GEPPERT | D |
| GERALD | B |
| GERBER | D |
| GERDRUM | D |
| GERING | D |
| GERLACH | B |
| GERLANE | E |
| GERLE | D |
| GERMANTOWN | C |
| GERMANY | C |
| GERMER | D |
| GERONI | D |
| GERRARD | B/D |
| GERRARD, DRAINED | B |
| GERST | D |
| GESSIE | D |
| GESSNER | D |
| GESTPIN | B |
| GETAWAY | E |
| GETCHELL | D |
| GETRAIL | C |
| GETTYS | C |
| GETZVILLE | B |
| GEWTER | B |
| GEYSEN | C |
| GIBBLER | B |
| GIBBON | C |
| GIBBONSCREEK | C |
| GIBBS | B |
| GIBNEY | D |
| GIBSONVILLE | B |
| GIBWELL | C |
| GIDEON | C |
| GIELOW | C |
| GIFFORD | C |
| GIGGER | D |
| GILA | D |
| GILBERT | B/D |
| GILBOA | D |
| GILBY | C |
| GILCHRIST | C |
| GILCO | D |
| GILCREST | D |
| GILEAD | C |
| GILES | C |
| GILFORD | A |
| GILFORD, STRATIFIED | B |
| SUBSTRATUM | B |
| GILISPIE | D |
| GILLAND | C |
| GILLENDER | C |
| GILLIAM | B |
| GILLIGAN | B |
| GILLS | A |
| GILLSBURG | B |
| GILMAN | C |
| GILMORE | B |
| GILPAR | C |
| GILPIN | D |
| GILROY | C |
| GILSTON | B |
| GILT EDGE | D |
| GIMLETT | B |
| GINAT | B |
| GINEX | B |
| GINGER | D |
| GINI | B |
| GINLAND | D |
| GINNIS | D |
| GINSER | C |
| GIRARD | B |
| GIRARDOT | B |
| GIRD | D |
| GIST | B |
| GITAKUP | C |
| GITAM | D |
| GIVIN | B |
| GLACIERCREEK | C |
| GLADDEN | D |
| GLADEL | D |
| GLADEVILLE | D |
| GLADEWATER | B |
| GLADSTONE | D |
| GLADWIN | B |
| GLASGOW | B |
| GLASSNER | B |
| GLEAN | B |
| GLEASON | C |
| GLEBE | B |
| GLEN | C |
| GLENBAR | E |
| GLENBAR, WET | D |
| GLENBERG | B |
| GLENBLAIR | B/D |
| GLENBROOK | B |
| GLENCARB | B |
| GLENCARB, WET, SALINE | C |
| GLENCOE | D |
| GLENCOE, PONDED | C |
| GLENDALE | D |
| GLENDALE, WET | C |
| GLENDALE, RARELY FLOODED | C |
| GLENDERSON | B |
| GLENDIVE | C |
| GLENDORA | D |
| GLENEDEN | C |
| GLENELG | D |
| GLENFORD | C |
| GLENHALL | C |
| GLENHAM | C |
| GLENMEN | D |
| GLENMORA | C |
| GLENNALLEN | B |
| GLENOMA | D |
| GLENPOOL | B |
| GLENRIO | B |
| GLENROSE | A |
| GLENROSS | B |
| GLENSTED | B |
| GLENTON | C |
| GLENTON, WET | B |
| GLENTOSH | B/D |
| GLENVIEW | D |
| GLENVILLE | |
| GLENYON | |

NOTES: DUAL HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION.
MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.



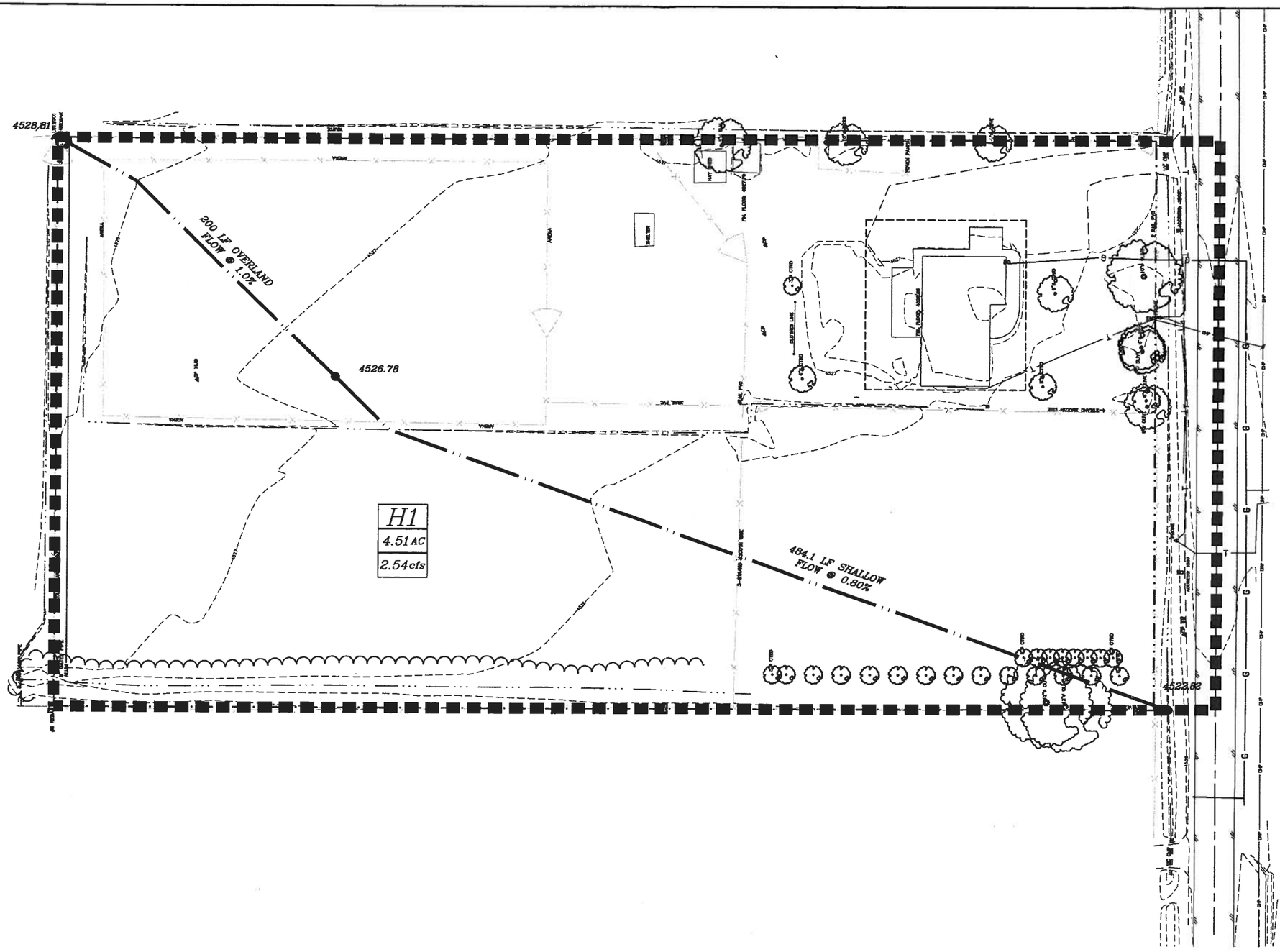

# Wildcat Ranch Major Basin

LEGEND

- Hospitals
- Police Stations
- Fire Stations
- Schools
- State Highways
- Roads
- Lakes
- Canals
- Colorado National Monument
- BLM Special Areas
- Black Ridge Canyons
- COLORADO CANYONS NATIONAL CONSERVATION AREA
- BLM
- National Forest

DISCLAIMER : The Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended or does not replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.

Mesa County GIS
544 Rood Ave.
Grand Junction, CO 81501




N

30 0 15 30 60

( IN FEET )
1 inch = 60 ft.
CONTOUR INTERVAL 1'

## LEGEND

| | |
|---|---|
| R<br>3.38 AC<br>4.77 cfs | DRAINAGE BASIN<br>BASIN ACREAGE<br>Q100 FLOWRATE |
| | DRAINAGE BOUNDARY |
| | TIME OF CONCENTRATION PATH |
| ← | CURB & GUTTER FLOW DIRECTION |
| → | DITCH FLOW DIRECTION |
| ⇉ | OVERLAND FLOW DIRECTION |

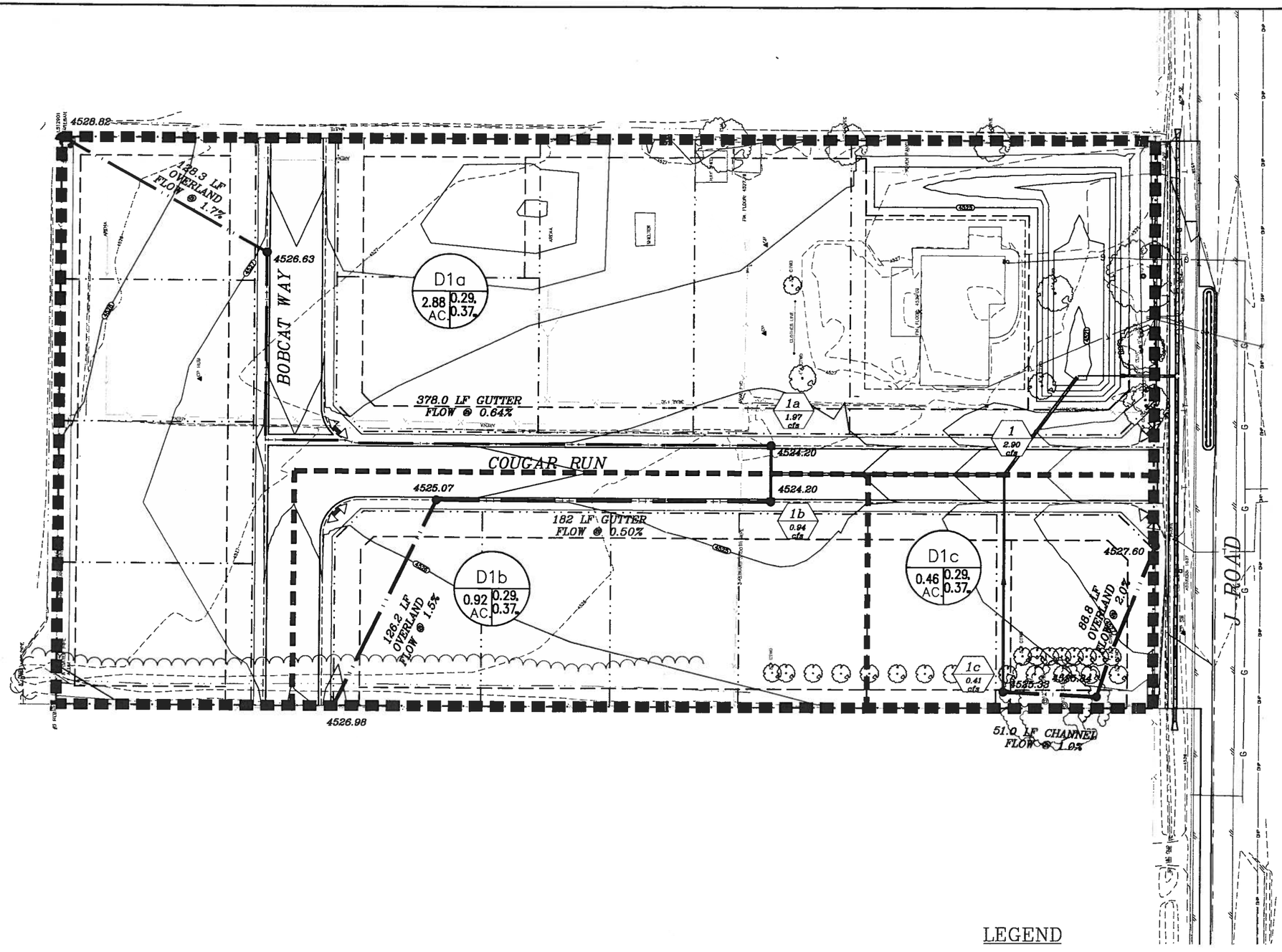
| REVISION | DATE | DESCRIPTION | BY | CHD |
|---|---|---|---|---|
| | | | | |

# WILDCAT RANCH
# DRAINAGE MAP
# HISTORIC CONDITIONS

THOMPSON-LANGFORD CORP.
ENGINEERS AND LAND SURVEYORS
529 25 1/2 RD., SUITE B210
GRAND JUNCTION, COLORADO
PH. (970) 243-8067
FAX (970) 241-2845
tlc@bresnet.com

DRAWN BY: JWM
CHECKED BY: JWM

DATE: 09/22/2005
SCALE: Horiz: 1"=60'
Project No: 0668-010
SHEET NO: 1 OF 1




## LEGEND

- D5 / 3.75 AC / 0.57 / 0.64 — DRAINAGE BASIN; BASIN ACREAGE; RUNOFF COEFFICIENTS
- 3 / 16.51 cfs — DESIGN POINT Q100 FLOWRATE
- PROPOSED STORM SEWER W/ FES AND MANHOLE
- STORM SEWER MANHOLE
- TIME OF CONCENTRATION PATH
- DRAINAGE BOUNDARY
- STORM SEWER INLET
- CURB & GUTTER FLOW DIRECTION
- DITCH FLOW DIRECTION
- OVERLAND FLOW DIRECTION

N

30 0 15 30 60

( IN FEET )
1 inch = 60 ft.
CONTOUR INTERVAL 1'

| REVISION | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | CFD |

# WILDCAT RANCH
# DRAINAGE MAP
# DEVELOPED CONDITIONS

THOMPSON-LANGFORD CORP.
ENGINEERS AND LAND SURVEYORS
559 25 1/2 RD, SUITE B210
GRAND JUNCTION, COLORADO
PH. (970) 243-8067
FAX (970) 241-2845
tlc@tlcwest.com

DRAWN BY: JWM
CHECKED BY: JWM

DATE: 09/22/2005
SCALE: Horiz: 1"=200'
Project No: 0668-010
SHEET NO: 1 OF 1