

Final Drainage Report

# Echo Canyon Estates

October 24, 2005

Prepared for:

**Grand Valley Development**  
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. 0668-012

## TABLE OF CONTENTS

Page

Vicinity Map

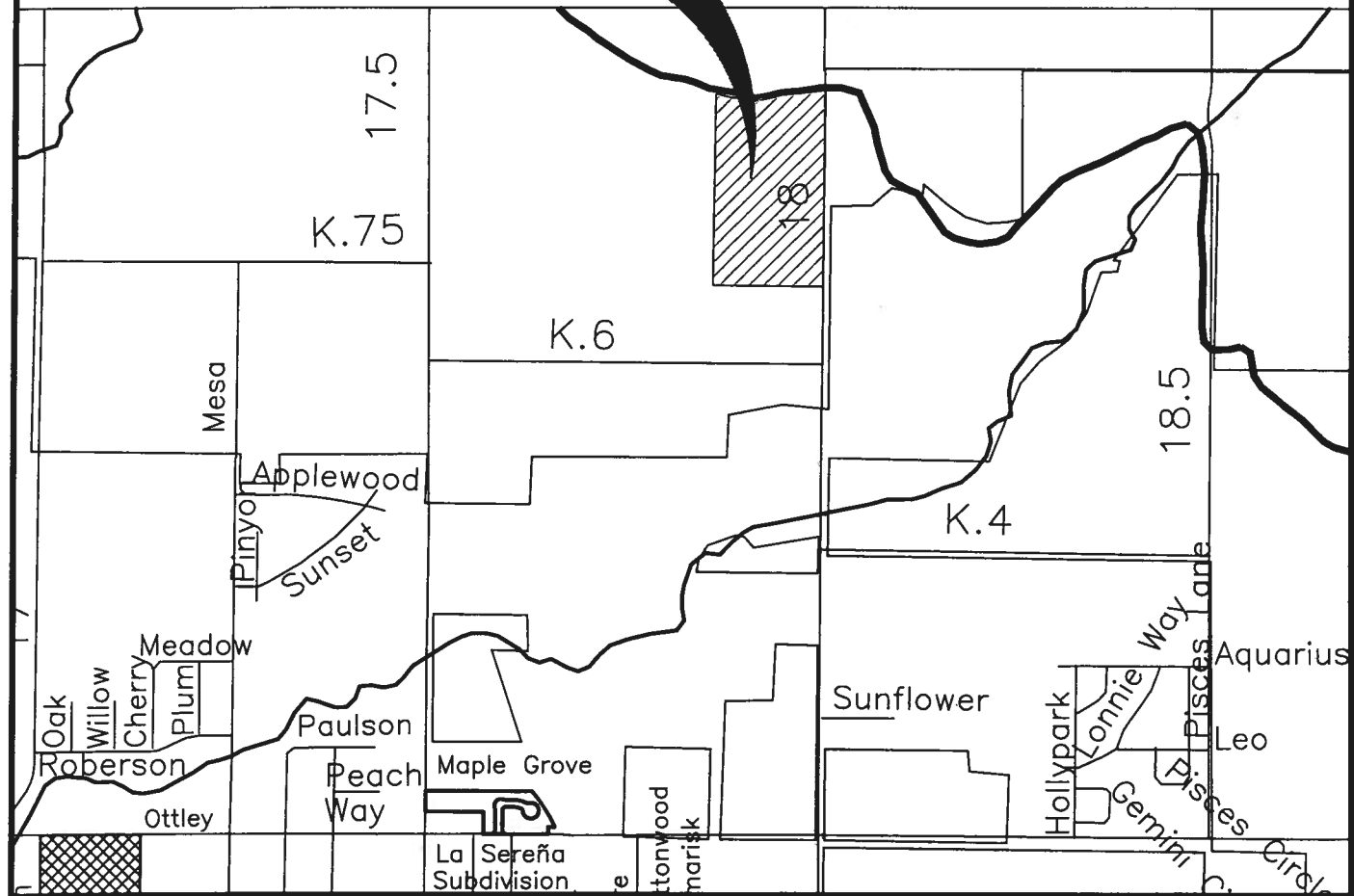
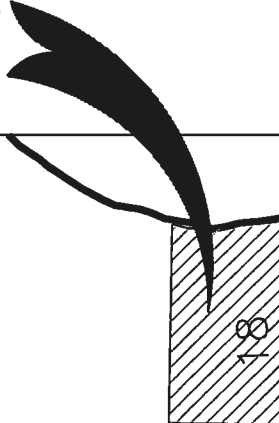
Engineer's Certification

I.	GENERAL LOCATION AND DESCRIPTION	
	A. Site and Major Basin Location	1
	B. Site and Major Basin Description	1
II.	EXISTING DRAINAGE CONDITIONS	
	A. Major Basin	1
	B. Site	2
III.	PROPOSED DRAINAGE CONDITIONS	
	A. Changes in Drainage Patterns	2
	B. Maintenance Issues	2
IV.	DESIGN CRITERIA AND APPROACH	
	A. General Considerations	3
	B. Hydrology	3
	C. Hydraulics	3
V.	CONCLUSIONS AND RECOMMENDATIONS	
	A. Runoff Rates for 2 and 100 Year Storm Events	4
	B. Detention	5
	B. Overall Compliance	6

## APPENDIX

Runoff Coefficients  
Time of Concentration, Rainfall Intensities and Runoff Rates  
Detention Volume  
Stage vs. Storage  
Two Stage Outlet  
Capacity Calculations  
SCS Soils Map and narrative  
Hydrologic Soils Group Reference  
Major Basin Map  
Drainage Conditions Map, Historic  
Drainage Conditions Map, Developed

**PROJECT  
LOCATION**



**VICINITY MAP**

**THOMPSON-LANGFORD CORP.**

**529 25 1/2 RD., SUITE B210  
GRAND JUNCTION, COLORADO  
PH. (970) 243-6067**

**JOB NO. 0668-012**

**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 Echo Canyon development is located at 1185 18 Road, along the west side of 18 Road just south of L Road. In more legal terms, it lies with the Eastern ½ of the Northeast ¼ of the Northeast ¼ of Section 8, Township 1 North, Range 2 West of the Ute Meridian.

Existing subdivisions in the vicinity of the proposed development are Village at Country Creek to the south and east and the Kiser and Mathes Simple Land Divisions to the west and southwest respectively. With the exception of the larger undeveloped lots, development in the vicinity is of similar type and size to the proposed subdivision.

### **B. Site and Major Basin Description:**

The project site is approximately 17.5 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 Fine Sandy Loam. Fruitland Fine Sandy Loam is derived from sandy eolian deposits over alluvium that came mostly from sandstone and shale. It is well drained soil with a very low runoff classification and moderately rapid 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:**

According to Mesa County GIS, the proposed development is geographically located within a major basin which contributes to Little Salt Wash. The Little Salt Wash basin originates in the Bookcliffs and terminates 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 18 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:**

The project site generally slopes from north to south at varying grades of approximately 1 ½ to 2 percent. Sheet flow is collected in the Wilkie Drain which dissects the project and conveys flows off site near the center of the southern boundary. There are existing features defining this sub basin. The upper limit to the local watershed is defined on the northern edge by the Grand Valley Irrigation Mainline Canal. Along the east and west the site is isolated by 18 Road and a topographical ridge, respectively. However, off site flows are allowed to enter the Wilkie Drain by means of a culvert under 18 Road. Along the southern boundary, a ditch intercepts and directs flows into the Wilkie Drain.

## **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 detention. Release from the detention facility will be controlled in a way such that a net increase over historic rates will not be realized.

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. Overlot grading will direct flows to the street or into backyard swales. Developed runoff will be collected in curb and gutter and swales and routed off site in a manner similar to historic. Flows will be routed through the detention pond or released directly off site. Regardless, the detention pond will be designed to ensure there is no net increase compared to pre-developed conditions.

### **B. Maintenance Issues:**

Maintenance of the on-site collection and conveyance facilities within the <sup>18 Road (?)</sup> 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:**

The site historically accepts upstream runoff into the Wilkie Drain via an 18" culvert under 18 Road. The Wilkie Drain will be replaced by storm sewer which will connect to the existing 18" culvert. Developed flows from the site will be discharged into the piped Wilkie Drain at no more than historic rates.

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 the lower end of 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
Historic		
H1	1.95	13.20
Developed		
D1a	0.49	3.46
D1b	0.88	6.02
D1c	0.37	2.54
D1	1.50	10.52
D2	0.52	2.14
D3	0.20	0.84
D4	0.29	2.01

*Handwritten notes in red ink:*  
 - A bracket groups D1a, D1b, and D1c with a value of 1.74.  
 - A bracket groups D1b and D1c with a value of 2.76.  
 - A bracket groups D1, D2, D3, and D4 with a value of 1.01.  
 - A bracket groups D1a, D1b, and D1c with a value of 12.02.  
 - A bracket groups D2, D3, and D4 with a value of 4.99.  
 - A large bracket on the right side of the entire table is labeled 17.01.

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 <sup>3</sup> /sec)	% of Capacity
Inlet D4/DP-1a	Single Curb	SAG	3.46	27
Inlet D2/DP-1b	Single Curb	SAG	6.02	46
InletC2/DP-1c	Single Curb	SAG	2.54	19.5
Line C	12" HDPE	1.27	2.54	55
Line D3	15" HDPE	0.50	3.46	62
Line D2	15" HDPE	0.50	5.53	61
Line D1	24" HDPE	0.50	10.52	56



## B. Detention

Basins D3 and D4, and related sub-basins, will release directly off site without being detained. Basin D2 will also be release undetained by entering the pipd Wilkie Drain. The required detention volume for the remaining Basin D1 during a 100 year event is 7,640 cubic feet. The proposed detention pond will have an approximate volume of 15,000 cubic feet with the water surface elevation at least one foot below the top of the pond. An outlet structure will be constructed to ensure the appropriate volumes for the 2-year and 100-year storm events will be detained and released at the allowable rates. The design characteristics of the pond and the required dimensions for the outlet structure are summarized in the following tables.

### Pond Characteristics

	Required Storage (ft <sup>3</sup> )	Water Surface Elevation (ft)	Release Rate (cfs)
2 Year Event	2,507	4544.85	1.02
100 Year Event	7,640	4546.39	8.61

*3% over  
historical  
cfs*

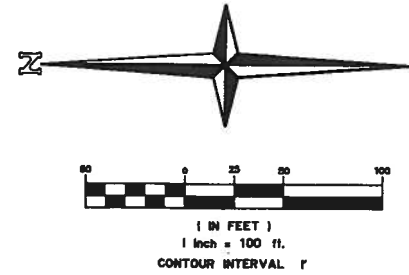
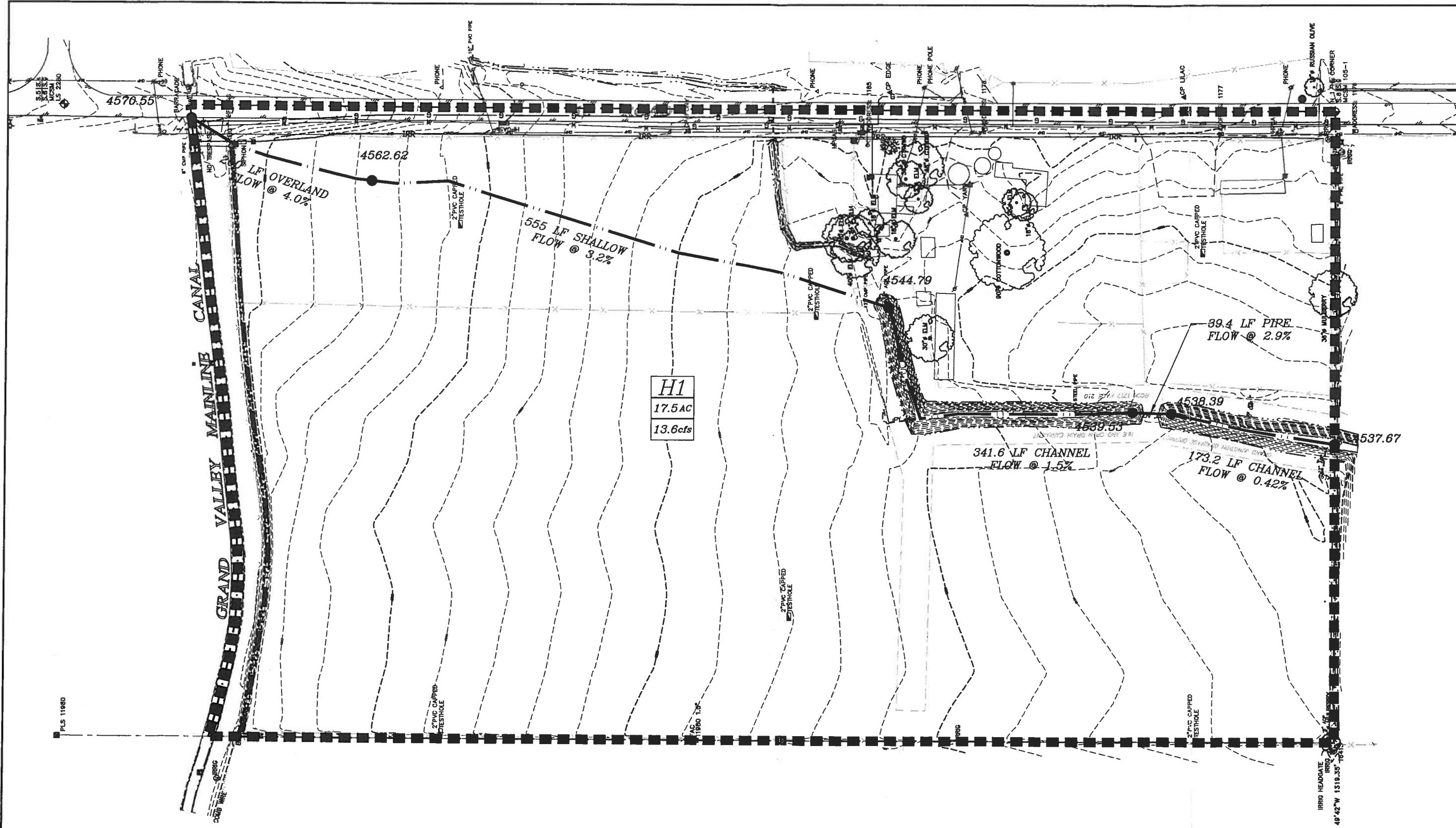
### 2-Stage Outlet Works Dimensions

Dimension	Value
2-Year Water Surface Elevation	4544.85 ft.
100-Year Water Surface Elevation	4546.39 ft.
Weir Invert	4545.14 ft.
Weir Height	1.25 ft.(15")
Weir Length	1.68 ft.(20 3/16")
Orifice Diameter	0.393 ft. (4 3/4")
Orifice Invert Elevation	4541.75 ft.
2-Year Release Rate	1.02cfs
100-Year Release Rate	8.61 cfs

### **C. Overall Compliance**

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

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.

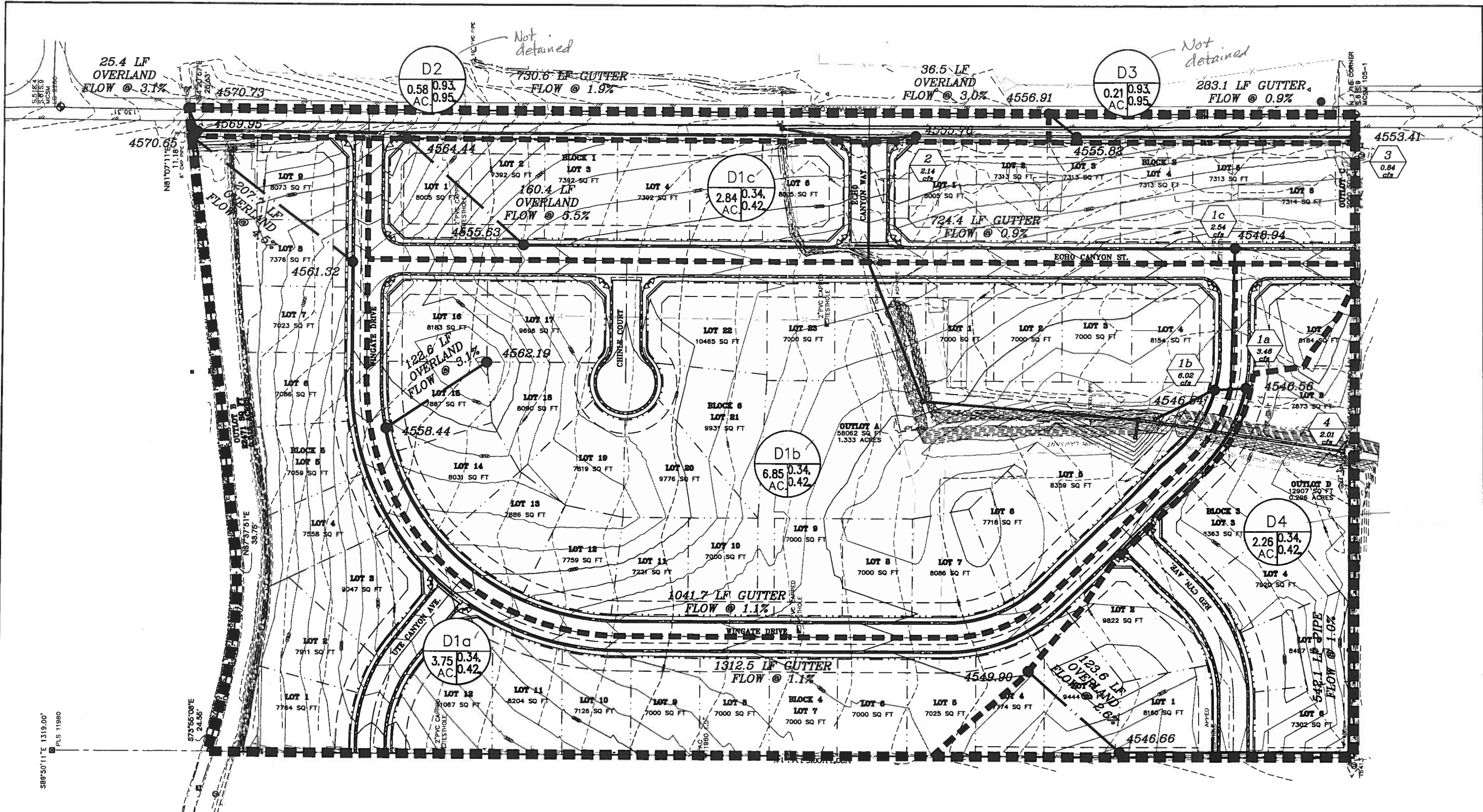


**LEGEND**

- R DRAINAGE BASIN
- 3.38AC BASIN ACREAGE
- 4.77cfs Q100 FLOWRATE
- ▬ DRAINAGE BOUNDARY
- ▬ TIME OF CONCENTRATION PATH
- ← CURB & GUTTER FLOW DIRECTION
- DITCH FLOW DIRECTION
- ▬ OVERLAND FLOW DIRECTION

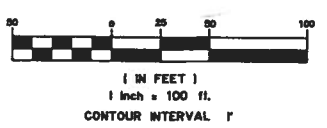
BY	CHD						
REVISION	DATE						
<b>ECHO CANYON ESTATES DRAINAGE MAP HISTORIC CONDITIONS</b>							
<b>THOMPSON-LANGFORD CORP.</b> ENGINEERS AND LAND SURVEYORS 629 S 1/2 BL. BOX 8110 GRAND JUNCTION, COLORADO PH. (970) 243-6087 FAX (970) 241-2245 <a href="mailto:tlc@tlurvey.com">tlc@tlurvey.com</a>							
DRAWN BY:	JWM	CHECKED BY:	JWM				
DATE:	11/02/2005						
SCALE:	1"=100'						
Project No:	0668-012						
SHEET NO:	1 OF 1						

s:\design\688-012\wll\dwg\drainage\drainage-prelim.dwg, 11/2/2005 11:10:42 AM, HP LaserJet 5100 PCL 6



**LEGEND**

- D5  
DRAINAGE BASIN  
BASIN RUNOFF  
ACREAGE COEFFICIENTS
- 3  
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 DIRECTIO



BY	CRD
DESCRIPTION	
DATE	
REVISION	
<b>ECHO CANYON ESTATES DRAINAGE MAP DEVELOPED CONDITIONS</b>	
<b>THOMPSON-LANGFORD CORP.</b> ENGINEERS AND LAND SURVEYORS 825 1/2 RD. SUITE 810 GRAND JUNCTION, COLORADO PH. (970) 243-6097 FAX (970) 241-2845 tlo@tlo-west.com	
DRAWN BY:	JWM
CHECKED BY:	JWM
DATE:	11/02/2005
SCALE:	1"=100'
Project No:	0668-012
SHEET No:	1 OF 1

S:\design\p0668-012\work\dwg\drainage\PLAN\PL-01.DWG, 11/22/2005 11:09:08 AM, HP LaserJet 5100 PCL 6  
 589°50'11"E 1319.00'  
 PLS 11980  
 S73°55'09"E 24.55'  
 N87°37'51"E 38.75'  
 N81°07'11"E 11.18'  
 6" CAP PIPE L