

11/27/06

Drainage Report  
is acceptable.

Drain swales will have  
to be combined with  
buried pipe & area  
drains along rear lot  
lines.

# FINAL DRAINAGE REPORT

FOR

**Manley Subdivision**

Needs drainage  
basements and/or  
separate Tract for  
storm drain.

Drainage Impact Fee: Page 4  
\$ 6,333.23

November 2, 2006

Prepared for:

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I hereby certify that this Final Drainage Report was completed under my direct supervision.

Reviewed by:

  
Richard L. Atkins P.E.  
State of Colorado #12291



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## **I. General Location and Description**

### **Site and Major Basin Location**

Manley Subdivision is located at 319 Paulson Avenue, in Tract 9 of Orchard Subdivision, in the City of Fruita, State of Colorado, more particularly being part of Section 8, Township 1 North, Range 2 West of the Ute Meridian.

Existing streets within the area of the property include Paulson Drive along the western 200± feet of the southern boundary line, and North Maple Street (17½ Road) along the west boundary line. Currently, the westernmost portion of the lot is occupied by a single-family residence with various outbuildings. The eastern portion of the lot has been used primarily as agricultural purposes. Currently the residence has access to Paulson Drive. After development of the subdivision, the existing residence will still access from Paulson Drive. The remaining lots will access North Maple Street from the proposed cul-de-sac. Paulson Drive is improved to the West edge of proposed Lot 8 with curb and gutter and approximately 31 feet of asphalt. The easternmost 80 feet of Paulson Drive is graveled. North Maple Street is currently under construction with a new sewer line and new 3-lane road with curb gutter and sidewalk.

The property is bounded to the south by Steele Minor Subdivision (currently in the development process) comprised of 3 lots on approximately 1 acre. Maple Grove Subdivision is located to the southwest with lots ranging from 6,000 to 8,000 s.f. Various individual parcels with residential and agricultural uses are located along the east side of North Maple Drive. Grand Valley Subdivision is located on the north side of Little Salt Wash. Lot sizes in Grand Valley Subdivision are 7,000 s.f. and larger. West and southwest of the proposed subdivision are single family residences in the Fruita First Addition. Lot sizes in this area generally range between ¼ and ½ of an acre.

### **Site and Major Basin Description**

Manley Subdivision contains approximately 3.77 acres and is planned for 13 single-family residential lots. An existing residential structure with garage and various outbuildings is currently located in the west portion of the site. The intent is for the existing residence to remain and become a part of Manley Subdivision as Lot 1. See Exhibit 1.0 for Vicinity Map.

The residence sits on about an acre that is covered with traditional landscaping (turf grass, etc.). The remainder of the property has been used for agricultural purposes.

The site's soils are made up of three different soil types based on the Mesa County Soils Map. The site soils are of type Rs, Ustifluvents, Re, Sagrlite Loam, and Be, Green River Silty Clay Loam. Primarily the Rs, Ustifluvents soils are those that run along the Little Salt Wash. These soils have a water transmission rate of 0.60 in/hr. The Be, Green River Silty Clay Loam runs along the north portion of the project and has a water transmission rate of 0.20 in/hr. The Re, Sagrlite Loam is located in the southern portion of the property and has a water transmission rate of 0.60 in/hr. The water transmission rates are reported as the slowest permeability per the

Mesa County Soils Map. Based on these transmission rates, the Rs and Re soils area classified as soil Group A and the Be soils are classified as soil Group B. See Exhibit 1.1 for the limits of soil types within the project (Reference 3).

## **II. Existing Drainage Conditions**

### **Major Basin Drainage Description**

The major basin areas surrounding Manley Subdivision drain generally from northeast to southwest. Based on the information on the Mesa County Drainage Basins Map, the site is within the Little Salt Wash Drainage Basin, see Major Basin Drainage Map (Exhibit 2.0). The basin area is approximately 36.48 sq. miles and stretches from the Bookcliffs to the Colorado River. The area near the project site drains from east to west and to the Little Salt Wash.

An existing concrete lined irrigation ditch runs the east and south property boundaries. Irrigation water is provided to the site from the Independent Ranchman's Ditch through the concrete lined ditch. The project plans propose to pipe the irrigation ditch along the property limits of the project.

No wetlands are being affected by the development of this project. The 100-year flood plain is limited to the Little Salt Wash as indicated on Flood Insurance Rate Map, Mesa County, Colorado". (Exhibit 3.0, Reference 2). None of the proposed lots will fall within the 100-year flood plain except for the portion of parcel that lies within the Little Salt Wash. This area will remain with the existing structure and become part of Lot 1. The proposed project is defined as being in Zone X as shown on the Flood Insurance Rate Map, with the exception of that portion that falls in the Little Salt Wash.

### **Site Drainage Description**

Historically, the site drains from east to west at slopes generally around 1%. The eastern portion of the site is an agricultural field and drains from east to west. The western portion of the site is where the existing home sits. The area around the home generally drains as Type B grading. Currently the irrigation ditch along the east and south boundary acts as a barrier and drainage boundary. The southern portion of the parcel north of the project drains to the north property boundary. An existing tailwater ditch runs between the existing field and the existing house along the fence line. There is an existing 10-inch pipe in about the middle of the field (north to south) that takes the runoff from the field and surrounding area and drains northeast to Little Salt Wash.

## **III. Proposed Drainage Conditions**

### **Changes in Drainage Patterns**

Once developed the west edge of North Maple Street will act as the drainage boundary. Ultimately a drainage pan will be constructed in the gutter line of N. Maple Street at the

proposed Silver Plum Court to prevent offsite flows from entering the site. A drainage swale will be installed on the north side of the project to collect any offsite discharge north of the project and the north half of the lots on the north side of the proposed cul-de-sac. A drainage swale will also be installed along the southern boundary of the project to collect the south half of the lots on the south side of the proposed cul-de-sac. A drain line is proposed along the division line between Lot 1 and the remaining lots. This drain line will collect any runoff that was previously draining to the tailwater ditch in the same location. This drain line will also collect the runoff from Lots 2 – 13 and will outfall to the west into Little Salt Wash. Lot 1 will continue to drain the way it currently does. Lots 2 – 13 will use Type B drainage.

The cul-de-sac is designed to have a high point at the curb return inside the project. This will ensure the runoff from N. Maple Avenue will continue to the south and not enter the site. The remaining portion of the cul-de-sac will drain to the west where a 3-ft combination curb inlet will be constructed. This curb inlet will tie into the storm drain proposed along the west property line of Lots 7 and 8.

### **Maintenance Issues**

Access to the property will be via the proposed residential streets, built to city standards and maintained by the City of Fruita. The Manley Subdivision HOA will be responsible for maintaining open space areas.

## **IV. Design Criteria and Approach**

### **General Considerations**

We are not aware of any previous drainage studies performed in this area specific to this site. Due to this site's location, it is not apparent there should be any large-scale negative effects on drainage due to this development. The development of the proposed site will not impose any constraints to future development in this area.

### **Hydrology**

The "Mesa County Stormwater Management Manual" (Reference 1) was used as the basis for drainage facility analysis.

As the project is a single-family residential development containing approximately 3.77 acres, the "Rational Method" was used to calculate historic and developed flow rates. The 2-year frequency rainfall event was considered the minor storm and the 100-year frequency rainfall event the major storm. Due to the proximity to the Little Salt Wash, direct discharge will be utilized and no detention will be provided.

The Intensity Duration Frequency data (IDF) shown on Exhibit 6.0 was used for design and analysis.

Manley Subdivision has 13 lots with the existing house (Lot 1) situated on about 1.25 acres and the remaining lots ranging in size between 7,000 and 8,000 s.f. Based on the soil types (both Type A and Type B) at the site and the slopes (0-2%), historic and developed runoff coefficient composite C values were calculated utilizing the areas of pasture, landscaping, paved surfaces, etc. Therefore, the developed runoff coefficients were derived by utilizing C Values from Table "B-1" in the Stormwater Management Manual for Residential Areas (Reference 1 and shown on Exhibit 5.0). Calculations were performed to arrive at a composite site 2-year Developed C-Value of 0.36 and a 100-year Developed C-Value of 0.45. This values only represent the new developed area where Lots 2 to 13 are located. The calculation was performed in this manner so as to compare the pre-developed and post developed C-Values for the area that will actually undergo a change. In comparison, for the same area, 2-year and 100-year Historic C-Values were calculated to be 0.17 and 0.22 respectively. For this particular site and proposed development, these appear to be reasonable C-values. See summary of Historic and Developed C-Values below. Calculations for determining composite C-Values can be seen in Exhibit 9.0.

Runoff C-Values for Area Being Developed		
	2-Year	100-Year
Historic	0.17	0.22
Developed	0.36	0.45

Times of Concentration were calculated based on the Average Velocities for Overland Flow (Exhibit 7.0) and Manning's equation to calculate gutter flow velocities.

Peak Discharge flow rates were computed for historic and developed values using the "Rational Method".

### Hydraulics

Calculations were performed to analyze the historic and developed 2-year and 100-year storm event. Calculations were also performed to ensure that the proposed streets, proposed catch basins, and proposed storm drain pipes have the capacity to handle the 100-year event.

Historic drainage calculations were completed considering one drainage basin, H1.

In order to calculate the developed runoff, the site was divided into several drainage basins. Developed runoff will be directed towards the streets, and the back-of-lot swales. Once the site was divided into several basins, calculations were performed to find the peak flow from each

$$\begin{aligned}
 \text{Impact Fee} &= \$14,364 (C_D - C_H) A^{0.7} = 14,364 (0.45 - 0.22) 2.534^{0.7} \\
 &= \$14,364 (0.23) 1.917 = \underline{\underline{\$6,333.23}}
 \end{aligned}$$

area. After the peak flows for each area were determined, calculations were completed to create a hydrograph for the peak discharge for the total site. Refer to Exhibit 4.1 for the design points and discharges for the developed conditions.

After calculating the runoff to the cul-de-sac, it was determined the 100-year peak discharge in the street is 2.69 cfs which would be fairly equally distributed to both halves of the street. From Figure "G-5", SWMM, the maximum half street flows with a slope of 0.5% is around 8.0 cfs. Therefore, the street has the capacity for the developed 100-year peak discharge. Additionally, this same discharge enters the curb inlet at the west end of the cul-de-sac. According to Table "G-1", SWMM, a single combination inlet has a capacity of 13 cfs for the 100-year condition. Therefore the inlet has capacity for the 100-year peak discharge.

Storm drain calculations were performed based on the developed discharges and are shown in Exhibit 9.1. This Exhibit shows that the storm rains have the capacity to carry the 100-year storm event.

## **V. Results and Conclusion**

The proposed drainage plan includes streets, swales and storm drains designed to carry the 100-year runoff to Little Salt Wash.

The Final Drainage Study was prepared to address site-specific drainage concerns in accordance with the requirements of the City of Fruita, Colorado. The grading and supporting infrastructure design will ensure the developed flow will be captured and released downstream without causing damage to the proposed development. The Appendix of this report includes criteria, exhibits, tables, design nomographs, and calculations to support the infrastructure proposed.



