

FINAL DRAINAGE STUDY
FOR
VINTNER'S FARM SUBDIVISION

November 4, 2005

Prepared For:

Robert S. Harris
170 Red Sand Road
Grand Junction, Colorado 81505

FOR REVIEW

"I hereby certify that this Final Drainage Study Vintner's Farm Subdivision was prepared by me or under my direct supervision."

Prepared By: _____
Monty D. Stroup
Project Manager

Reviewed By: _____
Maurice L. Schumann, PE
State of Colorado, #15698

FOR REVIEW

I. Location and Description of Property

A. Property Location:

Vintner's Farm Subdivision, is located in the City of Fruita, County of Mesa, State of Colorado, more particularly being part of the S 1/2, NE 1/4, Section 8, T.1 N., R.2 E., of the Ute Principal Meridian, (Exhibit A1).

Existing Streets within the vicinity of the project include 17.5 Road to the west and K.6 Road to the north, both of which provide the primary access to the site. 17.5 Road is located west of the site running north to south defining the west boundary of the project site. K.6 Road is located north of the site running from east to west defining the north boundary of the project site. Hall Street and Doug Way provide secondary access to the site from the south.

The site is bounded to the east by undeveloped pasture land and a portion of Wildwood Acres Subdivision, Filing No. 1. To the south the project is bounded by Wildwood Acres Subdivision, Filing No. 3. To the west is an undeveloped parcel and the Catholic Cemetery. To the north lies undeveloped pasture land. Land use in the vicinity of the project is best described as low to moderate density residential and pasture land.

B. Description of Property:

The project site contains approximately 27.09 acres and is not currently being used for agriculture or grazing purposes. The predominant features of the site include an existing irrigation pond located in the middle portion of the site and the Denton Drain which runs east to west adjacent to the south boundary of the project.

Topography of the site is considered flat. The site drains from northeast to southwest overland at an average slope of 0.51% towards the south property line of the site and subsequently into the Denton Drain.

Existing ground cover for the site consists of native grasses, brush and isolated pockets of willows in the lower drainage ditches. Recently the site has been mowed in anticipation of development.

The site soils are classified as (Bk) Blackston Gravelly Loam, 0 to 2 percent slopes, hydrological soils group "B", (Fp) Fruitland Fine Sandy Loam, 0 to 2 percent slopes, hydrological soils group "B", (Fr) Fruitland Fine Sandy Loam, 0 to 2 percent slopes, hydrological soils group "B", (Fp) Fruitland Fine Sandy Loam, 0 to 2 percent slopes, hydrological soils group "B", (Fs) Turley Fine Sandy Loam, 0 to 2 percent slopes, hydrological soils group "C", (Re) Sagrlite Loam, 0 to 2 percent slopes, hydrological soils group "B" and (Tr) Turley Clay Loam, 0 to 2 percent slopes, hydrological soils group "B", (Exhibits B1, B2 and Site Soils Map, Reference 2).

The entire site is defined as being in Zone X and is outside the 100 Year Floodplain as shown on the Flood Insurance Rate Map, Mesa County, Colorado Community Panel #080115 0265 C dated July 15, 1992 (Exhibit A2, Reference 4)

II. Drainage Basins

A. Major Basin Description:

The project site is located in the middle portion of the Denton Drainage Basin, (Exhibit A1). This major basin north of the project site contains approximately 244.2 Acres and is shown on the Major Basin Map contained in the map pocket of this study.

The Denton Drainage Basin north of the project site originates generally at the Grand Valley (Main Line) Canal. Land within the basin and north of the project site is best described as undeveloped pasture lands with some medium sized rural type residential parcels. Runoff from this area flows in a sheet-flow fashion into existing irrigation tailwater ditches and then south, and southwest towards K.6 Road.

The major basin is divided into 5 (five) offsite sub-basins which contribute flow to the project site. These sub-basins are labeled OF1 (124 Ac.), OF2 (52.9 Ac.), OF3 (5.6 Ac.), OF4 (43.4 Ac.) and OF5 (18.3 Ac.). These sub-basins contribute flow into the site and are routed through the property towards the Denton Drainage Ditch. See the Historic Basin Map attached.

Offsite sub-basin OF1 was studied with the development of Wildwood Acres Subdivision, Filing No. Two. The 100 Year flowrate of 9.0 CFS from this sub-basin was defined by the Final Drainage Report, Wildwood Acres Subdivision, Filing No. Two prepared by Vista Engineering Corp., February 6, 2004.

The is Denton Drainage Ditch is owned and maintained by Grand Junction Drainage District. The drain ditch runs from the east to the west and is adjacent to the south line of the project site. Flows within the drain ditch are conveyed south along 17.5 Road to the Little Salt Wash and then ultimately to the Colorado River.

B. Onsite Sub-Basins Description:

As shown on the Onsite Developed Basin Map the project site is divided into 13 distinct sub-basins as follows:

Sub-Basin A1 contains approximately 2.22 Acres. Runoff from this sub-basin flows south along the Doug Way roadway improvements into the existing 18-inch storm sewer system in Wildwood Acres Subdivision. *Drains into Little Salt Wash.*

Sub-Basin A2 contains approximately 0.87 Acres. Runoff from this sub-basin flows south along the Doug Way roadway improvements into the existing 18-inch storm sewer system in Wildwood Acres Subdivision. *Drains into Little Salt Wash.*

Sub-Basin B1 contains approximately 0.27 Acres. Runoff from this sub-basin flows west along a proposed rear yard swale into the Denton Drain via the proposed storm sewer Line D. This runoff is then routed west to 17.5 Road by Line D. *Area drains ?*

Sub-Basin B2 contains approximately 0.50 Acres. Runoff from this sub-basin flows west along a proposed rear yard swale into the Denton Drain via the proposed storm sewer Line D. This runoff is then routed west to 17.5 Road by Line D. *Area Drains ?*

✓ Sub-Basin B3 contains approximately 3.63 Acres. Runoff from this sub-basin flows west and south along the Moores Diamond and St. Peppin roadway improvements into proposed storm sewer Line F & G and then into the Denton Drain via the proposed storm sewer Line D. This runoff is then routed west to 17.5 Road by Line D.

✓ Sub-Basin B4 contains approximately 1.01 Acres. Runoff from this sub-basin flows west and south along the St. Peppin and Hall Street roadway improvements into proposed storm sewer Line F & G and then into the Denton Drain via the proposed storm sewer Line D. This runoff is then routed west to 17.5 Road by Line D.

✓ Sub-Basin B5 contains approximately 2.31 Acres. Runoff from this sub-basin flows west and south along the St. Peppin and Hall Street roadway improvements into proposed storm sewer Line F & G and then into the Denton Drain via the proposed storm sewer Line D. This runoff is then routed west to 17.5 Road by Line D.

✓ Sub-Basin B6 contains approximately 8.24 Acres. Runoff from this sub-basin flows west and south along the Moores Diamond roadway improvements into proposed storm sewer Line C & E and then into the Denton Drain via the proposed storm sewer Line D. This runoff is combined with runoff from sub-basin OF2 then routed west to 17.5 Road by Line D.

? Sub-Basin B7 contains approximately 0.66 Acres. Runoff from this sub-basin flows west along a proposed rear yard swale into the Denton Drain via the proposed storm sewer Line D. This runoff is then routed west to 17.5 Road by Line D. *Area drain?*

? Sub-Basin B8 contains approximately 2.97 Acres. Runoff from this sub-basin flows south and west along existing drainage patterns into the Denton Drain via the proposed storm sewer Line D. This runoff is then routed west to 17.5 Road by Line D.

✓ Sub-Basin B9 contains approximately 1.96 Acres. Runoff from this sub-basin flows south along the Esprit Lane roadway improvements into proposed storm sewer Line A & B and then into the Denton Drain via the proposed storm sewer Line D. This runoff is combined with runoff from sub-basin OF3 then routed west to 17.5 Road by Line D.

? Sub-Basin B10 contains approximately 2.22 Acres. Runoff from this sub-basin flows south along the Esprit Lane roadway improvements into proposed storm sewer Line A & B and then into the Denton Drain via the proposed storm sewer Line D. This runoff is combined with runoff from sub-basin OF3 then routed west to 17.5 Road by Line D. *Rear lot area drains? & rear lot swales*

✓ Sub-Basin B11 contains approximately 2.46 Acres. Runoff from this sub-basin flows south along the St Croix Way, Baco Noir Lane and Corn Maiden Drive roadway improvements into proposed storm sewer Line A & B and then into the Denton Drain via the proposed storm sewer Line D. This runoff is combined with runoff from sub-basin OF3 then routed west to 17.5 Road by Line D.

? Sub-Basin B12 contains approximately 0.34 Acres. Runoff from this sub-basin flows west along a proposed rear yard swale into the Denton Drain via the proposed storm sewer Line D. This runoff is then routed west to 17.5 Road by Line D. Area drain?

? Sub-Basin B13 contains approximately 0.31 Acres. Runoff from this sub-basin flows west along a proposed rear yard swale into the Denton Drain via the proposed storm sewer Line D. This runoff is then routed west to 17.5 Road by Line D. Area drain?

The Developed 100 Year flow rates from onsite sub-basins B1 through B13 and the Historic 100 Year flow rates from offsite sub-basins OF2 and OF3 are combined with the Historic 100 Year flow rates from offsite sub-basin OF4 at the southwest corner of the project site, (MH-SD-D1). From this point the flows follow the Denton Drain south along 17.5 Road to the Little Salt Wash.

III. HYDROLOGIC CALCULATIONS

A. References and Constraints:

The policies outlined by the current *Mesa County / City of Grand Junction (SWMM) Stormwater Management Manual* (Reference 1) were used as a basis to determine the study methodologies, techniques and hydrologic data presented herein.

The US Army Corps of Engineers "HEC1 Flood Hydrograph Package" (Reference 3) was used to estimate the Historic 100 Year flowrates generated by each offsite sub-basin within the major basin under consideration.

The Rational Method was used to estimate the Developed 2 Year and 100 Year flow rates generated by each onsite sub-basin within the development area.

IV. HEC1 METHODOLOGY

Precipitation Method:

The **100 Year - 24 Hour Precipitation Storm Event** was simulated based on rainfall data for the Grand Junction and Mesa County Area as shown in Appendix B, Exhibits B 1.0 and B 2.0. The 100 Year Event resultant precipitation value of **2.01 Inches** was used in the calculations. All proposed storm sewer improvements are designed to convey the 100 Year Storm Event therefore the 2 Year Storm Event is not analyzed in this report.

Loss Rate Method:

The effects of interception and infiltration were analyzed using SCS Curve Number Method. SCS Curve Numbers were assigned to distinct areas within the major basin based on soils types, ground cover and topography. A weighted SCS Curve Number was calculated for each sub-basin within the major basin. These calculations are presented in Appendix C of this report.

Basin Model:

Flow from the each sub-basin is analyzed as it converges at each design point within the system using the Muskingum-Cunge Routing Method .

Runoff Transformation Method:

Based on watershed geometry the SCS Dimensionless Unit Hydrograph method was used.

Element Application:

All sub-basins within the major basin were analyzed using 3 elements: overland flow, shallow concentrated flow and channel (or pipe) flow. Travel time (Tt) for each of these elements were calculated individually and combined to define the Time of Concentration (Tc) for each sub-basin. The Lag Time (TLAG) for each basin was calculated based on the relationship of $TLAG=0.6 * Tc$ as defined in Reference 3. The preceding input data is compiled and presented in Appendix D of this report.

V. HEC1 RESULTS

Historic Conditions:

Total routed runoff flowrates associated with **100 Year - 24 Hour Precipitation Storm Event** were calculated at each design point as shown on the HistoricBasin Map and are summarized as follows:

<u>Design Point</u>	<u>Runoff (CFS)</u>	
#1	9	Calculated by Vista Engineering Study
#2	7	
#3	1	
#4	6	
#5	14	

The computer runs and results are presented as Appendix C of this report.

VI. Drainage Facility Design

A. General Concept:

All onsite storm sewer conveyance elements are designed for the 100 Year Storm Event.

The development of the project site is affected by two drainage related items as follows:

Item #1: The project site is directly affected by offsite runoff from sub-basins OF1, OF2, OF3, OF4 and OF5.

Item #2: The size of onsite storm sewer pipe must be increased in size to convey offsite runoff from sub-basins OF1, OF2, OF3, and OF4.

B. Onsite Detailed Design:

The Rational Method was used to calculate the developed 2 Year and 100 Year Storm Events. All proposed storm sewer improvements are designed to convey the developed 100 Year Storm Event.

A hydraulic design for the proposed storm sewer improvements as shown on the Onsite Developed Basin Map was prepared and is presented as Appendix E of this study.

VII. Fee In Place of Onsite Detention Storage

A calculation of the drainage fee is based on the proposed development of 27.09 Acres. The total calculated drainage fee is \$6,983.09. The drainage fee calculations are presented as Appendix F of this study.

VIII. Conclusion

The calculated hydraulic grade line for various proposed storm sewer pipes within the development exceed expectations indicating that further consideration be given to the disposition of **offsite drainage impacts** to the project site.

The storm-water management improvements as defined herein are considered to be an “area wide improvement” as they will be used by and will benefit all land owners within the major basin herein described.

This Drainage Report has been prepared to address site-specific drainage concerns in accordance with the requirements of the City of Fruita, Mesa County, Colorado. The Appendix of this report includes criteria, exhibits and tables used in the final design of this project.

IX. References

1. (SWMM) Stormwater Management Manual, City of Grand Junction, Mesa County Colorado, January, 1996.
2. Soils Survey, Mesa County Colorado, prepared by USDA, Natural Resources Conservation Service. dated December 7, 2004.
3. HEC1 Flood Hydrograph Package, Hydrologic Engineering Center, US Army Corps of Engineers, Davis, CA., September, 1990.
4. Flood Insurance Rate Map, Mesa County, Colorado, (Unincorporated Areas), Community Panel Number 080115 0265B, Federal Emergency Management Agency, Map Revised July 15th, 1992.
5. Storm Sewers, 2005, Computer Program, Intel Solve, Copyright 2003 and 2005.