NOTICE OF MEETING
HILLSIDE REVIEW BOARD
CITY OF ST. GEORGE
WASHINGTON COUNTY, UTAH

Public Notice

Notice is hereby given that the Hillside Review Board of the City of St. George, Washington County, Utah, will hold meetings at the referenced site on **Wednesday, July 27, 2022,** commencing on-site at approximately 8:30 a.m.

The estimated site times are in bold. The agenda for the meeting is as follows:

1. Consider a request for a hillside development permit at the Divario Development. The applicant is proposing to construct in the area shown on the slope map labeled 20-29%. This is specifically in the PA-3 area which is situated west of the intersection of Canyon View Drive and Gap Canyon Parkway. The property is currently zoned PD-R (Planned Development Residential). The applicant is URE Fund 1 – Rillisante Villas, LLC. Case No. 2022-HS-012. (*See 'Meeting Place' exhibit below*). **Meeting time is approx. 8:30 am**
2. Consider approval of the meeting minutes from May 25, 2022.

Dan Boles, AICP
Senior Planner
Development Services

Reasonable Accommodation: The City of St. George will make efforts to provide reasonable accommodations to disabled members of the public in accessing City programs. Please contact the City Human Resources Office at (435) 627-4674 at least 24 hours in advance if you have special needs.

<u>Meeting Locations</u>

Item #1 Intersection of Gap Canyon Pkwy & Canyon View Dr.

St.George
Community Development

ITEM 1

Hillside Permit

HILLSIDE REVIEW BOARD AGENDA REPORT: **07/27/2022**

HILLSIDE DEVELOPMENT PERMIT
Rillisante at Divario (PA-3)
Case No. 2022-HS-012

Request: This is a request for a Hillside Development Permit to allow the applicant to construct in the area shown on the slope map labeled 20-29%. The area of concern only affects one of the proposed four-plex buildings and a piece of the access road that serves it. This is specifically in the PA-3 area which is situated just west of the Canyon View Drive and Gap Canyon Parkway. In the original rezone, the site plan left all of the buildings out of the 20%+ slope areas but through the process of the zone change, changes were made that made it necessary to bring this back through hillside. It appears that the area of disturbance is minor in size (approximately 6,500 sq ft).

Hillside History: **1) 2005 -** Case No. 2005-HS-013 "The Lakes" (7/21/2005 - agenda item #2) – An overall conceptual hillside development permit review for 730 acres. Rosenberg Associates.

2) 2008 - Case No. 2008-HS-006 "PA-17" The Lakes (7/16/2008) – 12.30 acres. Rosenberg Associates.

3) 2008 - Case No. 2008-HS-012 (10/30/2008) Determine which PA areas have sensitive slopes and will require future hillside meetings for subdivisions; being PA-3, PA-4, PA-12, PA-13, PA-14, PA-15, PA-16, and PA-17 will require HS review (*Note: PA's # 1, 2, 4, 5, 6, 7, 8, 9 (if less than 10 ft.), 10, 11, & 18 will not require hillside review*).

4) 2016 - Case No. 2016-HS-001 (1/20/2016) – Approx. 45.73 acres. The Hillside Review Board met and reviewed PA-14 and PA-16 and at that time approved the exclusion of washes and rock outcroppings in these 2 areas. However, following that review meeting, Rosenberg Associates met with City staff to revisit two additional rock outcroppings that were not looked at as closely by the board. One of these was located in PA-14, labeled as Item #1. Following the meeting with City staff it was determined to re-design the lot layout and grading around the feature and preserve it as a subdivision amenity in order to avoid scheduling another hillside review board meeting. The project design proceeded with that feature preserved.

5) 2021 – Case No. 2021-HS-001 (01/27/2021) – Approx. 19.78 acres. The Hillside Review Board reviewed a request for PA-9 to allow cuts and fills in excess of 10 feet in height. This was a requirement from the original hillside review in 2008. This was ultimately approved by the City Council.

6) 2022 – Case No. 2022-HS-003 (01/26/2022 & 02/23/2022) – Approx. 35.64 Acres. The Hillside Review Board reviewed a request for PA-4 to allow construction in areas designated between 20% -39%. They also reviewed the preservation of a small wash that runs through that area. Ultimately the City Council approved the hillside permit.

7) 2022 – Case No. 2022-HS-004 (02/23/2022) – Approx. 9.47 acres. The Hillside Review Board reviewed a request for PA-18 to allow the developer to fill in an area of a wash that had been piped and was no longer used as a drainage area. The City Council approved the request.

Exhibits Provided:

1) Exhibit A - Overall Slope Analysis – Sheet 1
"Exhibit 1" in the packet shows the overall slope analysis for the entire PA (Planning Areas). *Note: There is a chart "Hillside Review" on the sheet that shows which PA areas will require a hillside review and which will not.*

2) Exhibit B – PA-3 Site/Slope Analysis
"Exhibit B" depicts the proposed grading and layout for PA-3 at Divario.

3) Exhibit C - Drainage Report
August 2016 – Drainage report produce by Rosenberg Associates.

4) Exhibit D – Executive Geotechnical Report
July 2005 – This was produced during the initial review of the Lakes development in 2005. Produced by Rosenberg Associates.

Background:

Open Space - The total proposed undisturbed open space and improved open space area for "The Lakes" will be approximately 212 acres (*which is about 30 % of the total project area*).

Manmade Slopes - Manmade slopes were identified and excluded (see blue area in "Exhibit A")

Exclusions - The hillside board allowed exclusions for small washes and rock outcroppings (see pink area in "Exhibit A")

Future Hillside Review - In 2008 the Hillside Board didn't visit all the small washes and outcroppings but left them for future consideration as plans would be submitted (with subdivisions). It was determined that some would require further review by the Hillside Board. PA-3 was one of those areas that require further review.

Owner: URE Fund 1 – Rillisante Villas, LLC

Engineer: Rosenberg Associates

Location: PA-3 is generally located just west of the Canyon View Drive and Gap Canyon Parkway intersection.

Acreage: 24.10 Acres (64.54 with adjacent open space)

Zoning: R-1-8

Powers & Duties: Section 10-13A-8.B.1 of the "Hillside Review Board Powers and Duties" states that the hillside board can make recommendations to "adopt, modify or reject a proposal" to the Planning Commission (PC).

Permit required: Section 10-13A-7 requires that all major development (i.e., cut greater than 4', etc.) on slopes above 20% requires a 'hillside development permit' granted by the City Council upon recommendation from the Hillside Review Board and the Planning Commission.

Applicable Ordinance(s):
(Selected portions)

10-13A-1: Density and Disturbance Standards

A. The hillside development overlay zone (HDOZ) limits development densities and provides specific development incentives to transfer underlying zone densities from hillsides (sending areas), to less steep slopes or more safe development areas (receiving areas), within a development.

Percent Natural Slope	Dwelling Units (DU) / Acre
0-19	See underlying zone
20-29	2 DU/acre, provided the units are clustered on 30 percent (30%) or less of the land area within this slope category. 70 percent of this slope category shall remain undisturbed. The 70 percent area is based upon the overall area/development rather than per lot. Also see subsections A1, A2, and A3 of this section.
30-39	1 DU/10 acres, provided no more than 5 percent (5%) of the site is disturbed, and 95 percent of the site remains undisturbed. If the cumulative area is at least 1 acre but less than 10 acres, the cumulative area shall be allowed 1 DU.
40	Development is not permitted (0%), **excep**t as provided for in subsection A4 of this section.

Section 10-13A-1: Density and Disturbance Standards

F. The applicant may:

1. Transfer all development density from steeper slope categories (sending areas), to areas within the development with natural slopes of twenty percent (20%) or less (receiving areas); and
2. Develop additional bonus density, calculated from each slope category, as follows:
   a. Natural slopes twenty percent (20%) or less transferred on a one-to-one (1:1) unit basis; plus
   b. One (1) additional density unit for each density unit transferred from natural slopes of twenty-one percent (21%) to thirty percent (30%); plus
   c. Two (2) additional density units for each density unit transferred from natural slopes of thirty-one percent (31%) to forty percent (40%).
3. Unit calculation for the receiving area shall be based on the requirements of the sending area zone.

G. Density transfers to the receiving area may occur without a zone change within the receiving area even though the resulting density or configuration may exceed the density limits of the receiving area zone. Other than density, the receiving area's zoning requirements apply to development in the receiving area. For instance, lot sizes may vary, but single-family zoning districts only allow single-family detached dwellings.

H. If the applicant proposes to develop within the twenty-one percent (21%) to forty percent (40%) slope area, the applicant cannot employ partial density transfers from the sending area and must propose a design, site development plans, and a grading plan that blends and harmonizes all aspects of the proposed development into the natural topography, and that minimizes road cuts and fills.

I. Non-disturb areas within a residential lot as shown on the slope analysis map shall not be used to calculate minimum lot size.

J. Disturbance standards do not apply to the city for limited city facilities: trails, parks, and utilities.

HSRB Motion Options: The Hillside Review Board can recommend several different options to the Planning Commission and the City Council:

1. Denial
2. Approval as presented
3. Approval with specific conditions and comments added as required.

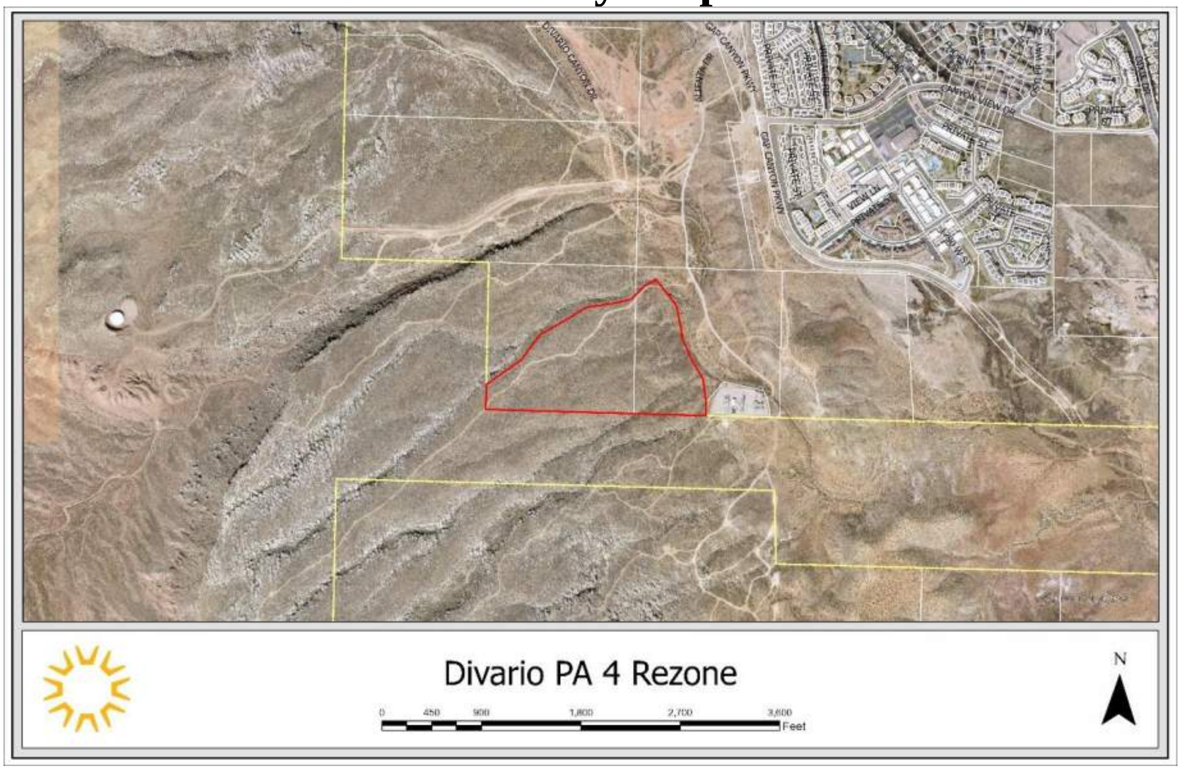
Example Motion: The Hillside Board recommends _________________________ of the request for a Hillside Development Permit to allow development of PA-3 as requested and outlined the staff report and has the following comments:

1. ____

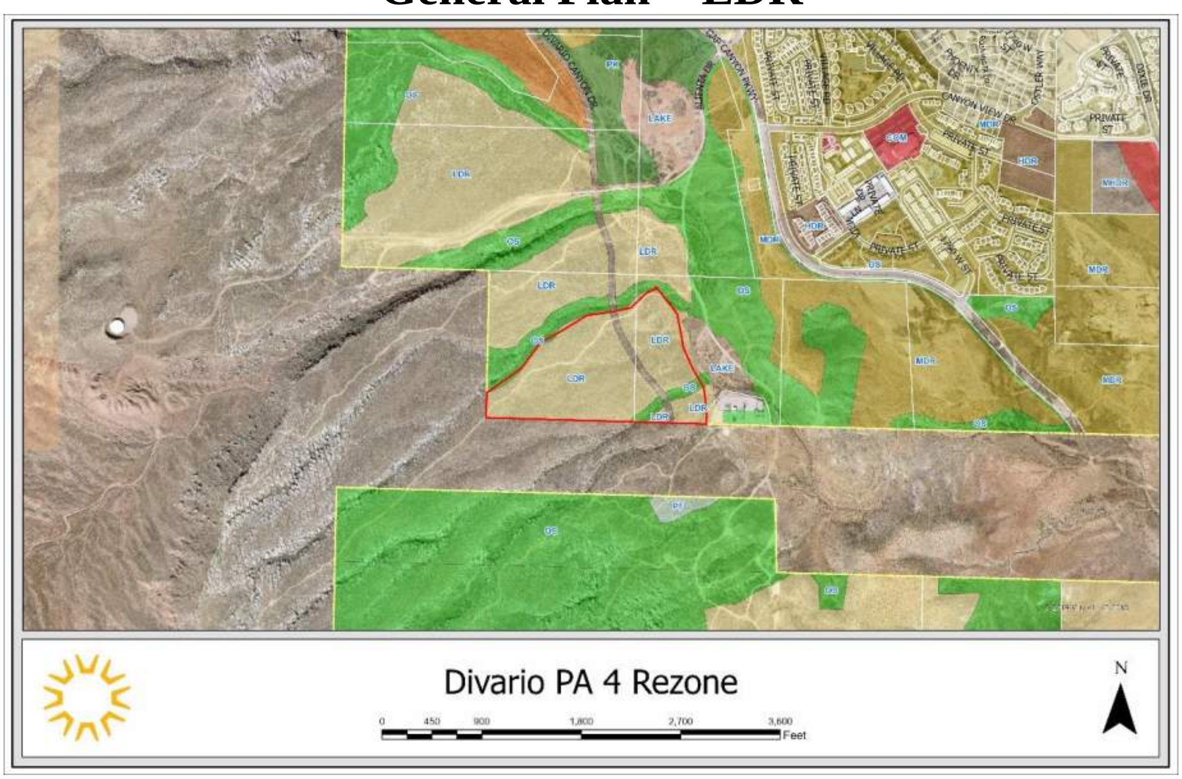
2. ____

3. ____

Vicinity Map



General Plan = LDR



Zoning = R-1-8 (Not reflected on the map)

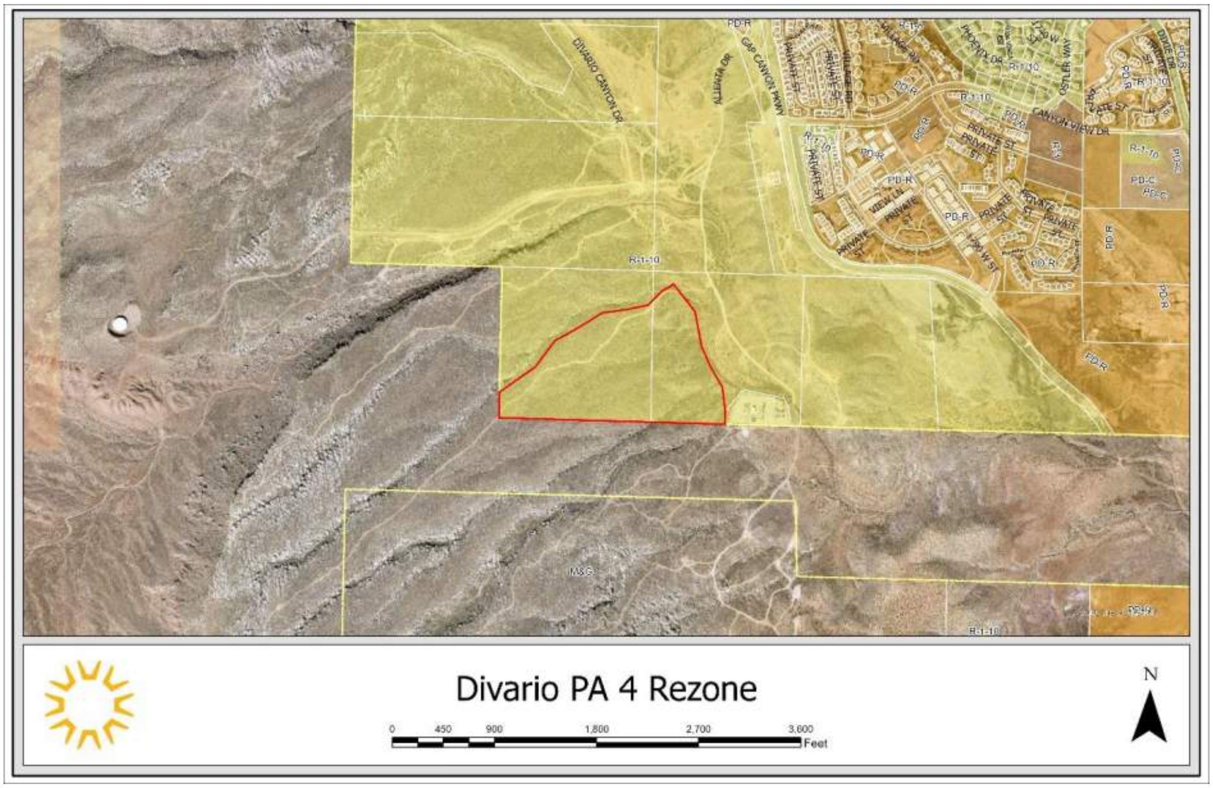
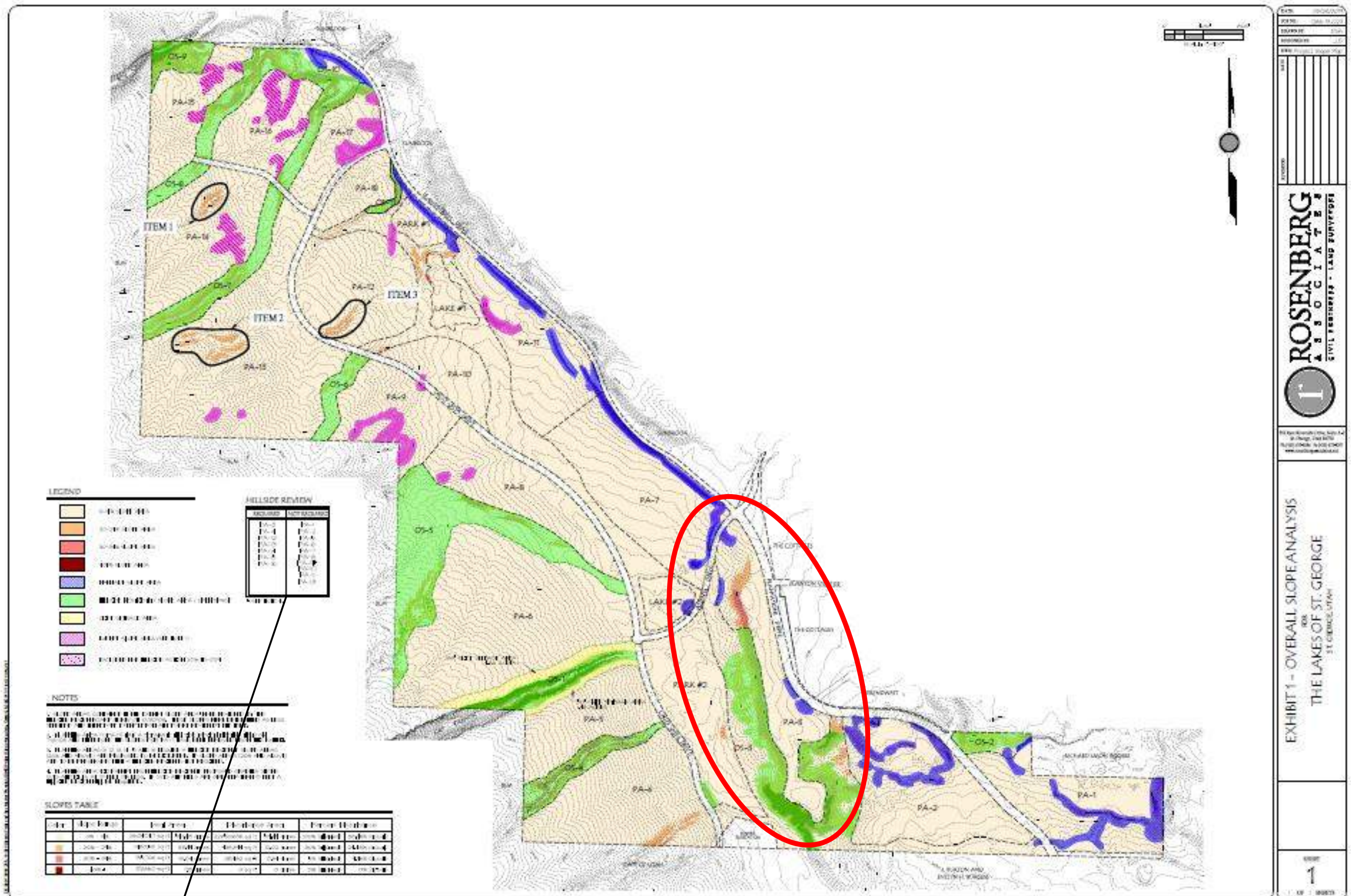


Exhibit A

Slope Map



HILLSIDE REVIEW

REQUIRED	NOT REQUIRED
PA-3	PA-1
PA-4	PA-2
PA-12	PA-5
PA-13	PA-6
PA-14	PA-7
PA-15	PA-8
PA-16	PA-9*
	PA-10
	PA-11
	PA-18

* SEE NOTE 4.

NOTES

1. SLOPE AREAS CONTAINED IN THE 'EXEMPT SLOPE AREA' WERE REVIEWED BY THE HILLSIDE REVIEW BOARD (HSRB) ON 10/30/08. THESE SLOPES WERE DETERMINED AS LESS SENSITIVE AND THEREFORE EXEMPT FROM ANY FUTURE REVIEW BY THE HSRB.

2. PLANNING AREA 17 (PA-17) HAD A SEPARATE HILLSIDE REVIEW MEETING HELD ON 7-16-08 AND THEREFORE THE SLOPES FOR PA-17 HAVE BEEN REMOVED FROM THIS EXHIBIT.

3. PLANNING AREAS 3, 12, 13, 14, 15 AND 16 REQUIRE A HILLSIDE REVIEW IF SLOPE AREAS (20% AND ABOVE) ARE PROPOSED TO BE DISTURBED. IF SLOPE AREAS (20% AND ABOVE) ARE TO BE PRESERVED, THEN A HILLSIDE REVIEW IS NOT REQUIRED.

4. PLANNING AREA 9 IS EXEMPT FROM HILLSIDE REVIEW IF PROPOSED GRADING SHOWS CUTS AND FILLS AT 10 FEET OR LESS. IF CUTS AND FILLS ARE GREATER THAN 10 FEET A HILLSIDE REVIEW WILL BE REQUIRED.

Exhibit B

Site Plan/Slope Map

PROJECT ENGINEER

ROSENBERG ASSOCIATES
352 EAST RIVERSIDE DRIVE, SUITE A2
ST. GEORGE, UT 84790
CONTACT: ALLEN HALL
(435) 673-8586

PROJECT OWNER/ DEVELOPER

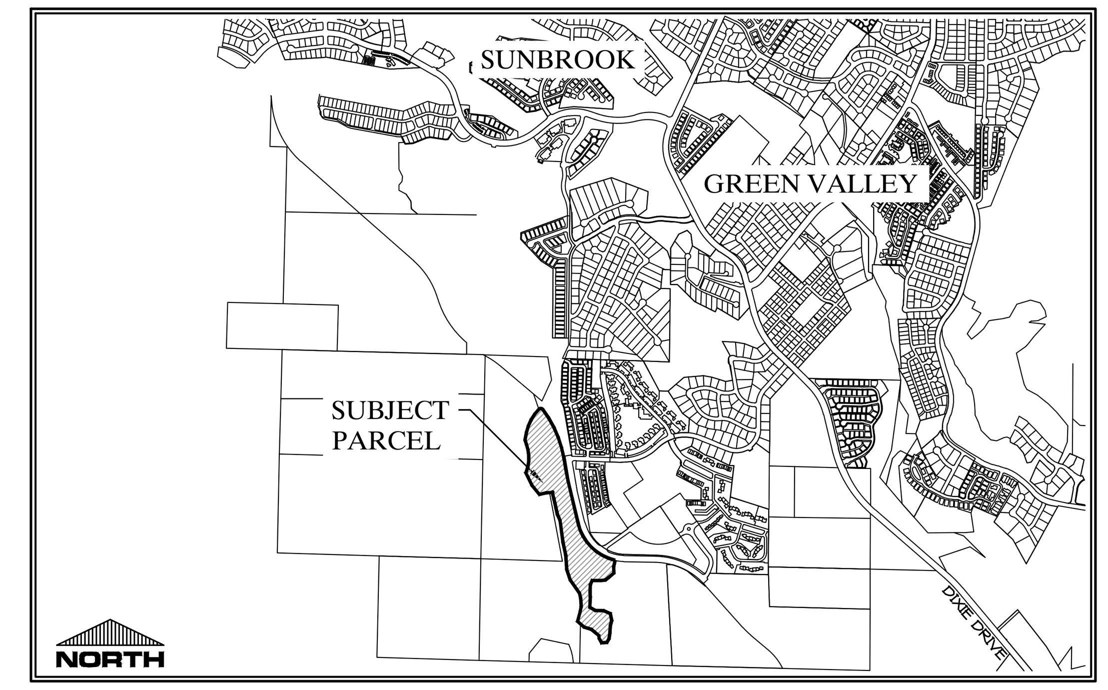
DAVIES DESIGN BUILD
240 NORTH 1200 EAST #201
LEHI, UT 84043
CONTACT: KYLE GRAY
(801) 787-1730

GEOTECHNICAL ENGINEER

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC. (AGEC)
1420 SOUTH 270 EAST
ST. GEORGE, UT 84790
CONTACT: WAYNE ROGERS
(435) 673-6850

SITE PLAN
RILASSANTE AT DIVARIO, ST. GEORGE, UTAH

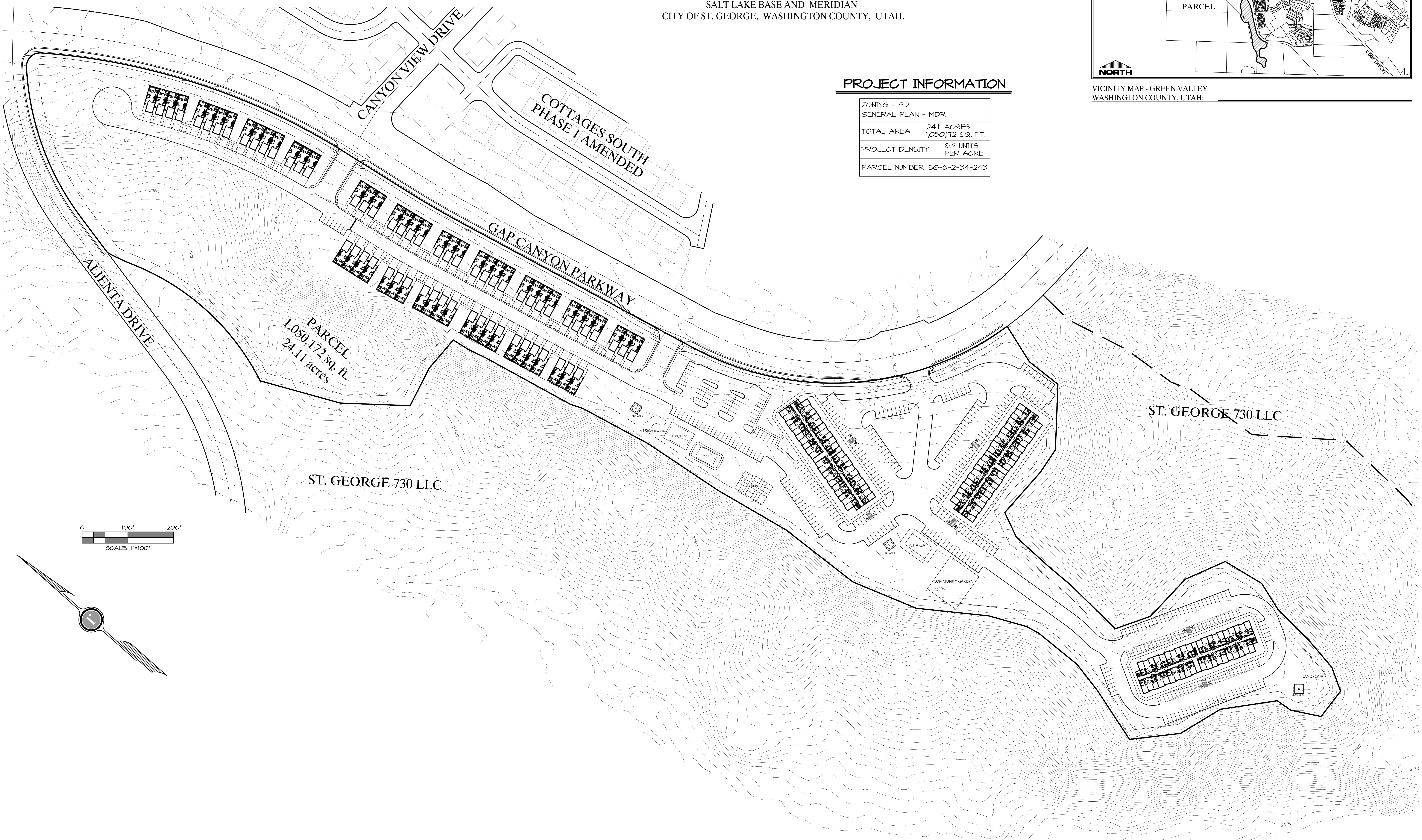
LOCATED IN SECTION 34, TOWNSHIP 42 SOUTH, RANGE 16 WEST OF THE SALT LAKE BASE AND MERIDIAN
CITY OF ST. GEORGE, WASHINGTON COUNTY, UTAH.



VICINITY MAP - GREEN VALLEY
WASHINGTON COUNTY, UTAH:

PROJECT INFORMATION

ZONING - PD GENERAL PLAN - MDR	
TOTAL AREA	24.11 ACRES 1,050,172 SQ. FT.
PROJECT DENSITY	8.9 UNITS PER ACRE
PARCEL NUMBER	SG-6-2-34-243



DATE:	6/6/22
JOB NO.:	1286-20-038
DESIGNED BY:	AMH
CHECKED BY:	
DWG:	Site Plan

DATE

REVISIONS

ROSENBERG
ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

352 East Riverside Drive, Suite A-2 St. George, Utah 84790
Ph (435) 673-8586 Fx (435) 673-8397
www.racivil.com

SITE PLAN - RILASSANTE AT DIVARIO
FOR
DAVIES DESIGN BUILD
ST. GEORGE
UTAH

SHEET
1
1 OF 2 SHEETS

SLOPE MAP
RILASSANTE AT DIVARIO, ST. GEORGE, UTAH

LOCATED IN SECTION 34, TOWNSHIP 42 SOUTH, RANGE 16 WEST OF THE SALT LAKE BASE AND MERIDIAN
CITY OF ST. GEORGE, WASHINGTON COUNTY, UTAH.

PROJECT ENGINEER

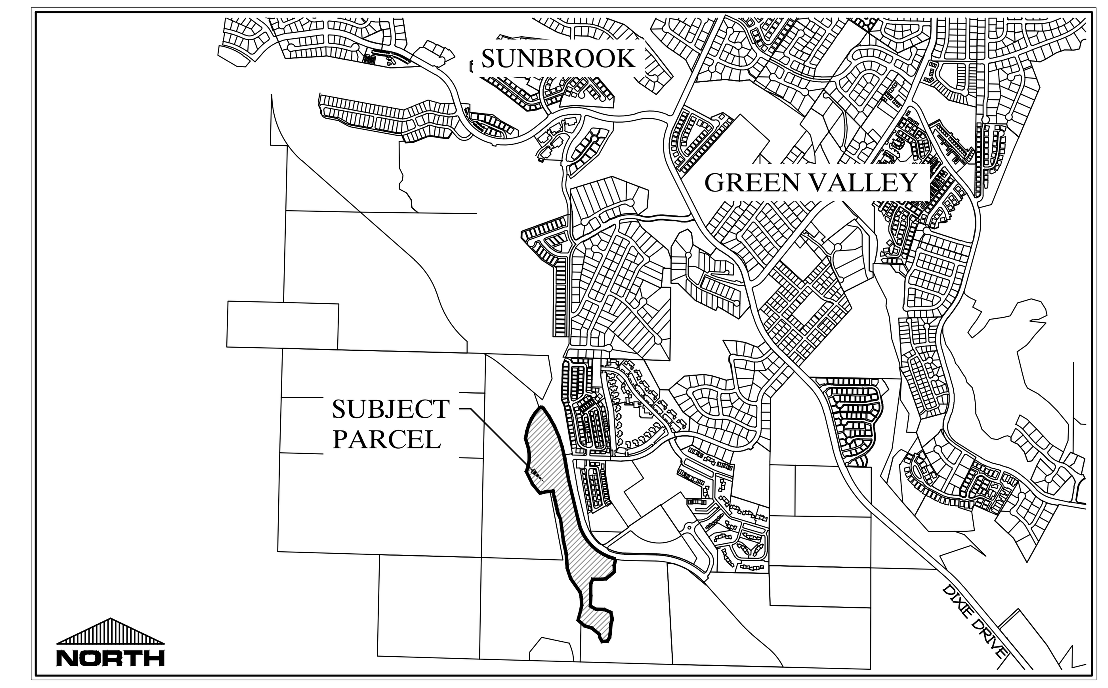
ROSENBERG ASSOCIATES
352 EAST RIVERSIDE DRIVE, SUITE A2
ST. GEORGE, UT 84790
CONTACT: ALLEN HALL
(435) 673-8586

PROJECT OWNER/ DEVELOPER

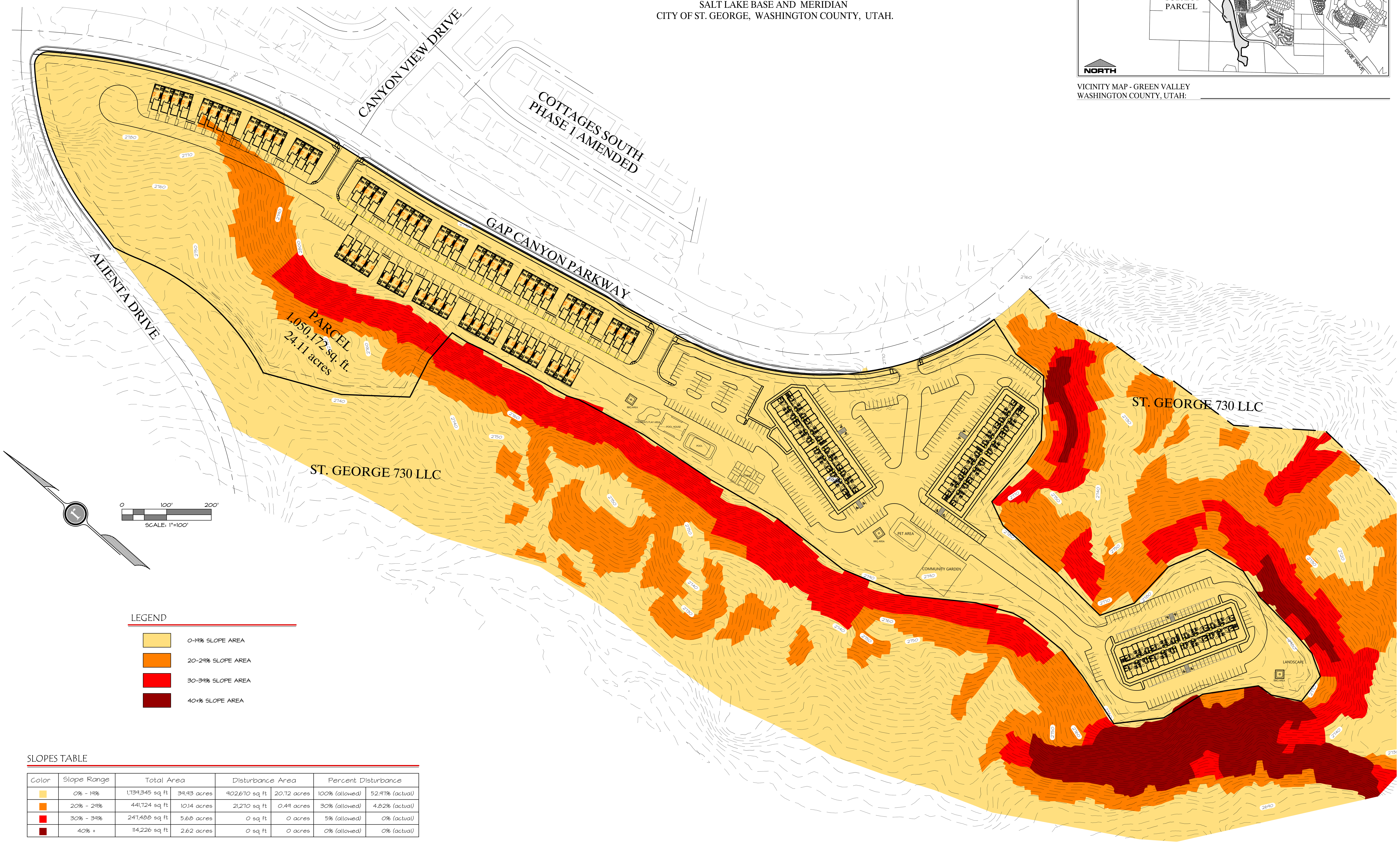
DAVIES DESIGN BUILD
240 NORTH 1200 EAST #201
LEHI, UT 84043
CONTACT: KYLE GRAY
(801) 787-1730

GEOTECHNICAL ENGINEER

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC. (AGEC)
1420 SOUTH 270 EAST
ST. GEORGE, UT 84790
CONTACT: WAYNE ROGERS
(435) 673-6850



VICINITY MAP - GREEN VALLEY
WASHINGTON COUNTY, UTAH:



LEGEND

(light yellow)	0-19% SLOPE AREA
(orange)	20-29% SLOPE AREA
(red)	30-39% SLOPE AREA
(dark red)	40+% SLOPE AREA

SLOPES TABLE

Color	Slope Range	Total Area		Disturbance Area		Percent Disturbance	
(light yellow)	0% - 19%	1,739,345 sq ft	39.93 acres	902,670 sq ft	20.72 acres	100% (allowed)	52.97% (actual)
(orange)	20% - 29%	441,724 sq ft	10.14 acres	21,270 sq ft	0.49 acres	30% (allowed)	4.82% (actual)
(red)	30% - 39%	247,488 sq ft	5.68 acres	0 sq ft	0 acres	5% (allowed)	0% (actual)
(dark red)	40% +	114,226 sq ft	2.62 acres	0 sq ft	0 acres	0% (allowed)	0% (actual)

DATE:	6/6/22
JOB NO.:	1286-20-038
DESIGNED BY:	AMH
CHECKED BY:	
DWG:	SITE PLAN

DATE
REVISIONS

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

352 East Riverside Drive, Suite A-2 St. George, Utah 84790
Ph (435) 673-8586 Fx (435) 673-8397
www.racivil.com

SLOPE MAP - RILASSANTE AT DIVARIO
FOR
DAVIES DESIGN BUILD
ST. GEORGE
UTAH

Exhibit C

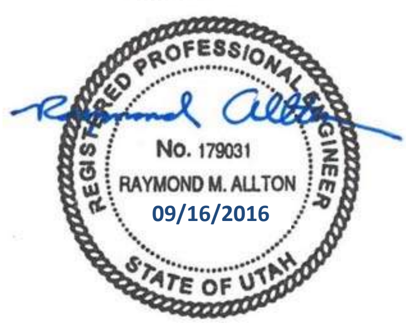
Drainage Report

TECHNICAL DRAINAGE CONTROL REPORT

Project Land Use Planning, Offsite Road Construction, and Mass Grading
The Lakes Master Plan Community
St. George, Utah

Prepared For:

730 St. George, LLC
1636 Indian Wells Drive
Boulder City, Nevada 89005



Rosenberg Associates
352 East Riverside Drive, Suite A-2
St. George, Utah 84790

August 30, 2016

ROSENBERG ASSOCIATES™
CIVIL ENGINEERS LAND SURVEYORS

TABLE OF CONTENTS

1.0 PROJECT LOCATION 1

2.0 PROPERTY DESCRIPTION 2

3.0 EXISTING OFF-SITE DRAINAGE DESCRIPTION 2

- 3.1 Upstream Drainage 2
- 3.2 Downstream Drainage 3

4.0 EXISTING ON-SITE DRAINAGE DESCRIPTION 3

5.0 MASTER PLANNED DRAINAGE CONSIDERATIONS 3

- 5.1 Master Plan Hydrologic Model 3
- 5.2 Master Plan Drainage Infrastructure 3

6.0 FEMA AND OTHER REGULATORY REQUIREMENTS 4

- 6.1 FEMA 100-Year Floodplain Delineation 4
- 6.2 Erosion Hazard Zone 4

7.0 OTHER DRAINAGE STUDIES IMPACTING THE SITE 5

8.0 PROPOSED DRAINAGE FACILITIES 5

- 8.1 Mass Grading 5
- 8.2 Detail Grading 6
- 8.3 Offsite Roadways 6
- 8.4 Open Channels 6
- 8.5 Regional Detention Facilities 7

9.0 PROPOSED DRAINAGE FACILITIES DRAINAGE COMPLIANCE 7

10.0 DESIGN RUNOFF COMPUTATIONS 8

- 10.1 Hydrologic Calculations 8
- 10.2 Comparison of Peak Flow Values 9

11.0 PROPOSED DRAINAGE FACILITIES DESIGN COMPUTATIONS 9

11.1 Culvert and Channel Capacity Design 9
11.2 Street Capacity Design 10
11.3 Storage Facilities Design 10

12.0 REQUIRED EASEMENTS AND RIGHT-OF-WAY 11

13.0 FEMA FLOODWAY AND FLOODPLAIN CALCULATIONS 11

14.0 CONCLUSIONS AND STATEMENT OF COMPLIANCE 11

15.0 APPENDIX 12

Figure 1 – Land Use Plan for The Lakes at St. George
Figure 2 – Watershed Map for The Lakes at St. George
Figure 3 – FEMA Regulatory 100-Year Floodplain
Figure 4 – Proposed Culvert Crossings
Figure 5 – Custom Soil Resource Report for Washington County Area

Watershed Hydrology Model Input Spreadsheets
Watershed Hydrology Model Hydraulic Routing Spreadsheets
Watershed Hydrology Model Curve Number Spreadsheets
Watershed Hydrology Model Lag Time Spreadsheets
HEC-HMS Model and Output Tables
Culvert Calculation Worksheets

1.0 PROJECT LOCATION

The following Drainage Control Plan and Report is submitted in support of The Lakes at St. George Master Plan Community, a proposed project, located along Plantations Drive in western St. George, Utah, spanning the distance between the Sunbrook Community at the end of Sunbrook Drive to the north, and near the Tonaquint Business Park to the South. The site is located within Sections 27, 28, 34 and 35 in Township 42 South, Range 16 West, Salt Lake Base and Meridian.

This report has been prepared to evaluate regional storm flows at key locations within the project area in order to perform mass grading operations, and to construct the following proposed off-site roadways to access the proposed development/planning areas:

- Plantations Drive
- Lago Vista Drive
- Alienta Drive
- Sentieri Vista Drive

This report has been prepared in accordance with the requirements and procedures outlined in the *Washington County Flood Control Authority Storm Drainage Systems Design and Management Manual*[1]. Conclusions and recommendations are made herein regarding drainage improvements required, floodplain impacts, and general conformance to city ordinances. Separate drainage studies will be prepared for each specific planning area to address localized drainage concerns and compliance with the city's drainage requirements.

The following supplemental figures have been prepared and included in the Appendix for reference and illustration information:

- *Figure 1 – Land Use Plan for The Lakes at St. George*, illustrating project location, project planning areas, and proposed planning area land uses and densities.
- *Figure 2 – Watershed Map for The Lakes at St. George*, illustrating the major watershed boundaries impacting the site.
- *Figure 3 – FEMA Regulatory 100-Year Floodplain Exhibit Map*, illustrating the drainage channels subject to the regulatory requirements of the Federal Emergency Management Agency (FEMA).
- *Figure 4 –Culvert Crossings*, showing the approximate location, minimum pipe diameter, and minimum slope requirements of culvert crossings and storm drain pipelines for the offsite roads including Plantations Drive, Lago Vista Drive, Alienta Drive, and Sentieri Vista Drive.
- *Figure 5 – Custom Soil Resource Report for Washington County Area*, showing soils and soil properties on the subject property.

[1] Bowen, Collins and Associates, Washington County Flood Control Authority Storm Drainage Design and Management Manual, Draft v0.3.

2.0 PROPERTY DESCRIPTION

The proposed Lakes at St. George is a 731-acre master plan community that is planned to be comprised of single-family residences, multi-family residences, parks and open spaces, commercial areas, public buildings such as churches, and associated streets of various right-of-way widths. *Figure 1 – Land Use Plan*, shows an overall view of the property. The proposed project is divided into 16 individual planning areas noted as PA-1, PA-2, etc. A legend on Figure 1 lists the master planned land uses and densities proposed for each planning area as follows:

- Low Density Residential: up to 4 units per acre, includes PA-4, PA-5, PA-6, PA-14, PA-15, and PA-16 covering approximately 174 acres.
- Medium Density Residential: up to 9 units per acre, includes PA-2, PA-3, PA-7, PA-9, PA-10, PA-11, PA-12, and PA-13 covering approximately 236 acres.
- High Density Residential: up to 15 units per acre, includes PA-1, PA-17, and PA-18 covering approximately 48 acres.
- Commercial/Mixed Use: includes PA-8 covering approximately 27 acres.

The remainder of the property will remain as undisturbed or improved open spaces to consist of parks, trails and other recreational facilities. These open spaces provide a natural break between each planning area, and most of them are located to accommodate the existing naturally flowing drainage patterns. The focal point of the open spaces will be two 5-acre lakes that will be used for detention, and to provide storage facilities for the City of St. George re-use water network.

3.0 EXISTING OFF-SITE DRAINAGE DESCRIPTION

3.1 UPSTREAM DRAINAGE

Storm water impacting the project from upstream sources generally originates on undeveloped desert land and drain in a sheet flow manner towards ephemeral washes that carry the concentrated water to the project property from the west and south.

The watershed impacting the proposed Lakes at St. George is illustrated in *Figure 2 – Watershed Map*. As seen in the exhibit, the total watershed area has been divided into a number of subareas to better pinpoint runoff amounts at specific locations within the project. Most off-site storm water enters the project from property belonging to the Bureau of Land Management (BLM). A small amount of off-site storm water enters the project along Plantations Drive from property belonging to the Sunbrook master plan community.

3.2 DOWNSTREAM DRAINAGE

In both the existing and proposed developed condition, storm water will exit the property in either the Box Canyon Wash, draining the northern portion of the property consisting of subarea Groups X, Y, A and B; or the Gap Wash, draining the rest of the property to the south and east. Flows leaving the project in the Box Canyon Wash travel through the Sunbrook Golf Course a distance of approximately 6,000 feet before discharging to the Santa Clara River just upstream of the Dixie Drive crossing at Mathis Park. Flows leaving the project in the Gap Wash travel eastward toward the Tonaquint Business Park, covering a total distance of approximately 4,800 feet before discharging to the Santa Clara River just north of the City of St. George Tonaquint Cemetery.

4.0 EXISTING ON-SITE DRAINAGE DESCRIPTION

In the undeveloped condition, the study area drains by sheet flow and washes to the Box Canyon Wash and the Gap Wash as shown in Figure 2. In the developed condition, storm water runoff will drain to the same major washes preserved in the designated open space corridors, as in the undeveloped condition.

5.0 MASTER PLANNED DRAINAGE CONSIDERATIONS

5.1 MASTER PLAN HYDROLOGIC MODEL

The Lakes property has been included in the hydrologic model prepared for the city's drainage master plan summarized in the *City of St. George Storm Drain Master Plan Update*[2]. Referencing Figure 2, Subareas A1, A2, A3, B1, B2, B3, B4, X1, X2, Y1, and Y2 in this report are part of the Box Canyon Wash BC100 master plan subarea. Subareas C1, C2, C3, C4, C5, D1, D2 in this report are part of the Gap Wash G20 master plan subarea. Subareas E1, E2, E3, E4, F1, F2, G1, G2, and H1 are part of the Gap Wash watershed G40 master plan subarea.

5.2 MASTER PLAN DRAINAGE INFRASTRUCTURE

Existing master planned drainage infrastructure impacting The Lakes project is limited to one 36-inch diameter pipe, labeled Pipe G50-2 in the city master plan and noted to carry a design flow of 65 cubic feet per second (cfs). This pipe conveys drainage from the Las Palmas and Worldmark Resort properties along 1790 West Street, discharging into the project property along the Plantations Drive right-of-way.

Proposed master planned drainage infrastructure impacting The Lakes project includes two proposed pipes linking to Pipe G50-2:

[2] Bowen, Collins and Associates and John H. Humphrey, City of St. George Storm Drain Master Plan Update, July, 2009.

- Pipe G50-1, a proposed 30-inch diameter pipe noted to carry a design flow of 65 cfs, to convey storm water along the Plantations Drive right-of-way along the Worldmark Resort frontage, and connecting to existing Pipe G50-2 at the intersection of 1790 West Street.
- Pipe G50-3, a proposed 42-inch diameter pipe noted to carry a design flow of 196 cfs, to combine flows from G50-1 and G50-2 and convey storm water south and eastward along the future Plantations Drive right-of-way.

The above existing and proposed pipelines were factored into this report analysis with some modifications to suit the drainage patterns and open space corridors proposed in The Lakes land use plan.

6.0 FEMA AND OTHER REGULATORY REQUIREMENTS

6.1 FEMA 100-YEAR FLOODPLAIN DELINEATION

Two drainage washes are located within the 100-year floodplain that are subject to the regulatory requirements of the Federal Emergency Management Agency (FEMA) including the Box Canyon Wash and the Gap Wash, as noted on the current FEMA Flood Insurance Rate Maps[3]. The 100-year floodplain boundaries for these two washes are shown in *Figure 3 – FEMA Regulatory 100-Year Floodplain Exhibit Map*.

Box Canyon Wash clips the north side of the property and receives drainage from Subareas A1, A2, A3, B1, B2, B3, Y1, Y2, X1, and X2. The remaining Subareas drain to the Gap Wash. Figure 3 illustrates the location of regulatory Zone A for both the Box Canyon and Gap washes, which is defined as the 100-year floodplain Special Flood Hazard Area with no base flood elevations established. All areas noted as Zone A are located within the designated open spaces for The Lakes master plan community. Areas proposed for development are all located within Zone X, which is defined to be outside the 0.2% annual floodplain.

6.2 EROSION HAZARD ZONE

The subject property is not located within an "Erosion Hazard Zone" as defined by the City of St. George.

[3] Federal Emergency Management Agency (FEMA) National Flood Insurance Program, Flood Insurance Rate Map, Washington County, Utah Map Numbers 49053C1007G and 49053C1009G, Effective Date April 2, 2009.

7.0 OTHER DRAINAGE STUDIES IMPACTING THE SITE

The following studies were referenced in preparing this report:

- The Lakes at St. George Hydrology Report, prepared by Rosenberg Associates, dated May 15, 2008. This report is a general overview of major drainage patterns encompassing the entire Lakes planned development property boundary. This report updates the earlier report to current city analysis and drainage design standards.
- Four Dams at The Lakes Preliminary Drainage Evaluation, prepared by Rosenberg Associates, dated September 14, 2005. This report is a hydrologic analysis of the proposed "lakes" to be constructed in the master plan community open space.
- Box Canyon Wash Hydraulic Modeling, performed by Rosenberg Associates in 2008. This work resulted in the delineation of the 100-year floodplain along the Box Canyon Wash.

8.0 PROPOSED DRAINAGE FACILITIES

Drainage facilities proposed for The Lakes master plan community will convey water through the planning areas and connecting roads by a combination of grading, street improvements, and storm drain infrastructure. Specific routing, sizing, and placement of storm drain infrastructure will be proposed during the detailed design stage of each planning area; however, this report has been prepared to evaluate regional storm flows at key locations within the project area in order to perform mass grading operations, and to construct the following proposed off-site roadways to access the proposed development/planning areas:

- Plantations Drive: Extending from the north property boundary and heading in a southeasterly direction approximately 12,400 feet to the southeastern property boundary.
- Lago Vista Drive: Extending from the point of intersection with Plantations Drive on the northwest side of the parcel, and extending in a southeasterly direction approximately 8,900 feet to the southwestern property boundary.
- Alienta Drive: Extending from Lago Vista Drive northward approximately 2,400 feet where it ties to the existing Alienta Drive.
- Sentieri Vista Drive: Extending from Lago Vista Drive in the northwest area of the project and heading in a westward direction approximately 1,300 feet through planning areas PA-14, Pa-16, and terminating in PA-15.

8.1 MASS GRADING

It is the desire of the project developers to conduct mass grading operations on portions of the master plan project. The purpose of this is to be able to move earth materials between the planning areas. Planning areas with an abundance of quality material that can be used for general fill, structural fill, and/or utility trench bedding will be mined and the excess material moved to planning areas where additional fill material is needed.

Limited grading design will be performed for various phases of mass grading. Plans will be submitted to the City of St. George engineering department and processed for a grading permit before any grading operations begin. Mass grading design will focus on maintaining the existing drainage patterns by picking up storm water offsite flows, routing storm water through the mass graded planning area to be discharged back into the open space areas as close as practicable to the historic point of discharge.

8.2 DETAIL GRADING

Detailed grading plans will be submitted with the project development plans for each planning area to include individual lot and/or building pad grading, interior road plan and profile drawings, and underground storm drain plan and profile where needed.

A detailed drainage study will be prepared for the proposed development and submitted with the project construction plans for each individual planning area.

8.3 OFFSITE ROADWAYS

Construction of the offsite roadways including Plantations Drive, Lago Vista Drive, Alienta Drive, and Sentieri Vista Drive, as noted above, will occur in phases as needed to service the development of the planning areas. The peak storm water runoff values in this drainage study were used to evaluate roadway cross section conveyance capacity, to size in-line underground storm water pipelines, and to locate and size offsite roadway culvert crossings. The approximate location, minimum pipe diameter sizing, and minimum slope requirements of culvert crossings and storm drain pipelines are illustrated in *Figure 4 – Proposed Offsite Road Culvert Crossing and Storm Drain Facilities*. Detailed construction plans for all offsite roadway drainage improvements will be submitted with the applicable planning area construction plans.

8.4 OPEN CHANNELS

Construction of open channels are proposed to convey storm water through the disturbed open space areas. The proposed routing location, size, minimum design slope and capacity of these channels will be addressed with the detailed drainage design of the adjacent planning areas or design of open space area. The channels are generally located as follows:

- Between Lake 1 and Lake 2 adjacent to Lago Vista Drive
- Routing the Gap Wash through Park 2 adjacent to Lago Vista Drive, between Lake 2 and the power substation.
- Routing the Gap Wash through planning areas PA-1 and PA-2 inside the boundaries of the delineated floodplain.

Additional temporary man-made open channels may need to be constructed to route storm water through mass-graded planning areas, then directed back into the natural drainages located in the adjacent open space areas. The peak flow values of this report will be used to size these temporary channels, which will be called out as needed on the individual mass grading construction plans. Once the planning area goes into final design, these channels will be replaced with improved streets, storm drains, or culverts.

8.5 REGIONAL DETENTION

It is the desire of the project developers to detain increased storm water caused by development. Rather than design numerous smaller detention facilities for each planning area, storm water will be routed into regional facilities adjacent to the two 5-acre lake amenities, as discussed below. Storm water won't be routed directly in the lake amenities, but into a containment area next to the lake to help maintain the quality of the city's re-use water that will be stored in the lake facilities. Master Plan Model results indicate that detention may be minimal or not required. Finalization of detention needs will be addressed with detailed drainage design of each planning area.

- Lake 1 Detention Basin: Increased storm water runoff generated in Subareas B2 and B3 will be routed directly into a detention basin adjacent to Lake 1, then discharged into the Box Canyon Wash. Additional capacity and outlet control facilities will be installed in this detention basin to also detain the total combined increase from Subareas A2, A3, X2, and Y2. This will allow the increase from these subareas to discharge directly to Box Canyon Wash while limiting the total peak flow discharging from the property to the peak "pre-developed" design condition.
- Lake 2 Detention Basin: Increased storm water runoff generated in Subareas C2, C3 and D2 will be routed directly into a detention basin adjacent to Lake 2, then discharged into the Gap Wash. Additional capacity and outlet control facilities will be installed in this detention basin to also detain the total combined increase from Subareas E2, E3, E4, F2 and G2. This will allow the increase from these subareas to discharge directly to the Gap Wash while limiting the total peak flow discharging from the property to the peak "pre-developed" design condition.

9.0 PROPOSED DRAINAGE FACILITIES COMPLIANCE

The hydrologic and hydraulic analysis utilized for design of The Lakes master plan community storm water drainage facilities were performed in accordance with the requirements of the Washington County Flood Control Authority (WCFCA) *Storm drainage Systems Design and Management Manual*. Specific compliance measures were as follows:

- Hydrologic Analysis: The hydraulic analyses performed for The Lakes off-site and on-site watershed was performed in accordance with Section 4 of the drainage manual utilizing the US Army Corps of Engineers HEC-HMS Version 4.1[4] modeling software. The hydrologic

[4] U.S. Army Corps of Engineers, Hydraulic Engineering Circular Hydrologic Modeling System (HEC-HMS) software, Version 3.5.

analysis is discussed in greater detail in Section 10 of this report, with detailed information included in the appendix.

- Street Design: Street drainage design was performed in accordance with Section 3 of the drainage manual assuming that Sentieri Vista Drive is a minor collector, Lago Vista Drive and Alienta Drive are major collectors, and Plantations Drive is a major arterial in accordance with Table 3-1.
- Storm Drain Design: Storm drain design for Sentieri Vista Drive, Lago Vista Drive, Alienta Drive, and Plantations Drive was performed in accordance with Section 3 of the drainage manual assuming an open-channel flow condition.
- Culvert Design: Culverts for the offsite road system were designed in accordance with Section 3 of the drainage manual to fully convey the 100-year design storm event in an open channel flow condition.
- Open Channel Design: Open channels conveying storm water from detention areas to the Box Canyon Wash and Gap Wash, and conveying flows adjacent to Lago Vista Drive, will be designed with future phases. Open channels will be designed to match the natural channel flow characteristics of the existing channels.
- Storage Facilities Design: The two regional detention facilities have been sited and will designed with future phases as needed.

10.0 DESIGN RUNOFF COMPUTATIONS

10.1 HYDROLOGIC CALCULATIONS

The US Army Corps of Engineers HEC-HMS Version 4.1 was used to perform the hydrologic analysis for this study. The Farmer-Fletcher distribution is used for the 3-hour storm events and the SCS Type II distribution is used for the 24-hour storm events. The SCS Composite Curve Number method was utilized to determine the runoff curve number since all areas within the watershed evaluated are currently undeveloped.

Tables summarizing model input for the following values have been included in the appendix:

- Watershed areas, longest length, and average slope for the pre-developed and proposed post-developed condition.
- SCS composite curve number values for the pre-developed and proposed post-developed condition.
- Hydrologic model junction and routing characteristics.
- Calculated times of concentration and lag time.

10.2 COMPARISON OF PEAK FLOW VALUES

Modeling for The Lakes master plan development considered both the existing pre-developed condition and the assumed post-developed condition, in order to size storm drainage facilities and to compare impacts to storm water peak flow values caused by proposed development. HEC-HMS model peak storm values for all subareas, junctions, and routing conditions for the pre-developed and proposed post-developed condition are included in the appendix.

Post-developed conditions were assumed to match the proposed uses and densities described in Section 2 of this report and illustrated in *Figure 1 – Land Use Plan*. Since exact layout for each of the 16 individual planning areas is not known at this point, detailed drainage study update reports will be submitted with the development of each planning area.

11.0 PROPOSED DRAINAGE FACILITIES DESIGN COMPUTATIONS

Computations for the hydraulic design of The Lakes master plan community storm water drainage facilities were performed in accordance with the requirements of the Washington County Flood Control Authority *Storm Drainage Systems Design and Management Manual*. Output tables for calculations are included in the appendix.

11.1 CULVERT AND CHANNEL CAPACITY DESIGN

Culvert and channel capacities utilized Manning's equation for open channel flow:[5]

$$Q = \frac{1.49\,(A)^{5/3}(S)^{1/2}}{n(P)^{2/3}}$$

Where	Q	= Hydraulic Capacity, in cubic feet per second (cfs)
	A	= Cross Sectional Flow Area, in square feet
	S	= Average Slope, in feet per foot
	n	= Manning's Roughness Coefficient
	P	= Wetted Perimeter, in feet

[5] Flammer, Jeppson, and Keedy, Fundamental Principles and Applications of Fluid Mechanics, Utah State University, 1986, p. 289.

Table 11-1 lists the Manning's roughness coefficients used in the model evaluation:

TABLE 11-1: MANNING'S ROUGHNESS COEFFICIENTS

Surface Description	Manning's n Value
High Density Polyethylene Pipe (HDPE)	0.010
Concrete Pipe (RCP)	0.013
Open Channels	0.078
Asphalt Pavement	0.015

The following parameters were assumed for each evaluation:

- All culvert capacities were evaluated as flowing full in the open channel flow condition, assuming no surcharge.
- The slope of each culvert was assumed to be the average slope of the drainage basin or routing, unless additional information was known to justify a different value.
- If existing drainage or future road drainage infrastructure was determined to be inadequate to accommodate the modeled design storm, the culvert or open channel was sized to accommodate the full modeled design storm value.

11.2 STREET CAPACITY DESIGN

Street capacities were modeled using Manning's equation for open channel flow based on the master planned street cross-section, assuming full street improvements were constructed. Minimum slopes for all street sections were assumed to be at 0.5%.

11.3 STORAGE FACILITIES DESIGN

The two regional detention facilities are proposed, as discussed in Section 8.5. The master plan calculations summarized in this report do not include a proposed size for these two facilities, since overall post-development values do not exceed the pre-development values. If localized post-developed drainage values are determined to exceed pre-developed values during detailed drainage design of the planning areas, the storage facilities will be designed utilizing HEC-HMS output files, sizing for the 10-year 24-hour design storm, and sizing for the worst-case condition (whichever yielded the greatest volume) of the 100-year 3-hour design storm or the 100-year 24-hour design storm. Since not all subareas will be able to be routed directly through one of the detention basins, it is assumed that the regional facilities may need to be oversized to compensate for the total increased flow where storm water exits the property in the Box Canyon Wash for Lake 1, or in the Gap Wash for Lake 2, as discussed in Section 8.5 of this report.

12.0 REQUIRED EASEMENTS AND RIGHTS-OF-WAY

No additional easements or rights-of-way are being proposed for storm water drainage with the master plan, mass grading, or construction of offsite roadways. Major drainage channels within the proposed project are to remain in the open space areas shown in Figure 1, the master land use plan. Specific drainage easements, if needed within the individual planning areas, will be noted with the submittal of the planning area detailed drainage study report and project construction plans.

13.0 FEMA FLOODWAY AND FLOODPLAIN CALCULATIONS

No additional hydrologic or hydraulic calculations were performed for the purposes of modifying the existing floodplain as delineated on the FEMA flood insurance rate maps. It is the intention of the project developer to leave all designated floodplain areas for the Box Canyon Wash and Gap Wash out of the residential development areas.

14.0 CONCLUSIONS AND STATEMENT OF COMPLIANCE

This report for the drainage design of The Lakes Master Plan was prepared under my direct supervision in accordance with the provisions of Washington County Flood Control Authority (WCFCA) Storm Drainage Systems Design and Management Manual, and was designed to comply with the provisions thereof. I understand that the City of St. George and WCFCA do not and will not assume liability for drainage facilities design.

APPENDIX

Figure 1 – Land Use Plan for The Lakes at St. George
Figure 2 – Watershed Map for The Lakes at St. George
Figure 3 – FEMA Regulatory 100-Year Floodplain
Figure 4 – Proposed Culvert Crossing Calculations
Figure 5 – Custom Soil Resource Report for Washington County Area

Watershed Hydrology Model Input Spreadsheets
Watershed Hydrology Model Hydraulic Routing Spreadsheets
Watershed Hydrology Model Curve Number Spreadsheets
Watershed Hydrology Model Lag Time Spreadsheets
HEC-HMS Model and Output Tables
Culvert Calculation Worksheets

AREA TOTALS

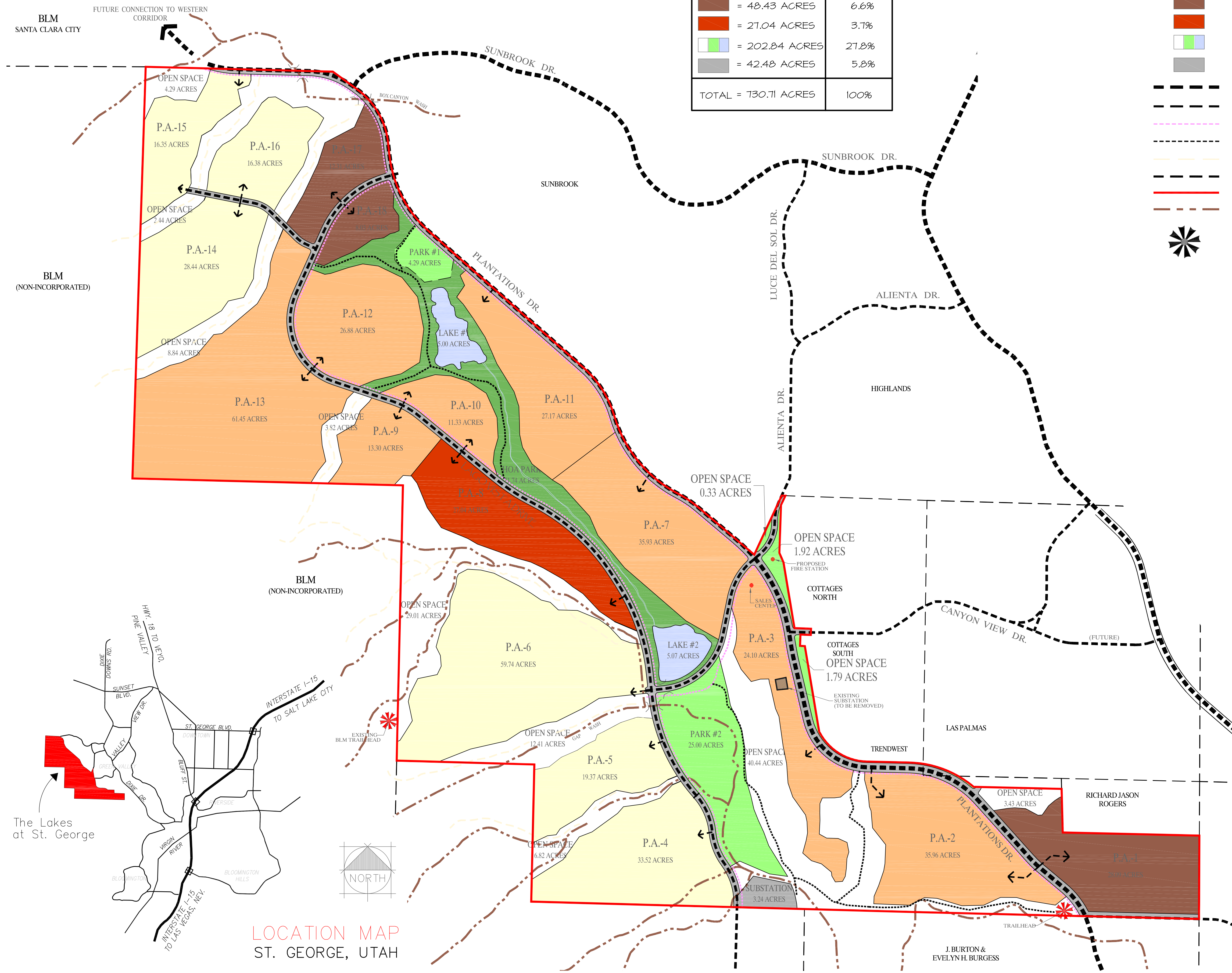
Low density residential	= 173.80 ACRES	23.8%
Medium density residential	= 236.12 ACRES	32.3%
High density residential	= 48.43 ACRES	6.6%
Commercial/mixed use	= 27.04 ACRES	3.7%
Open space / parks / lakes	= 202.84 ACRES	27.8%
Roadways / city property	= 42.48 ACRES	5.8%
TOTAL	= 730.71 ACRES	100%

NOTE

THE BOUNDARIES DESIGNATED FOR LAKES AND PARKS ARE SUBJECT TO CHANGE AT THE DEVELOPERS DISCRETION.

LEGEND

- LOW DENSITY RESIDENTIAL (UP TO 4 UNITS PER ACRES)
- MEDIUM DENSITY RESIDENTIAL (UP TO 9 UNITS PER ACRE)
- HIGH DENSITY RESIDENTIAL (UP TO 15 UNITS PER ACRE)
- COMMERCIAL/MIXED USE
- OPEN SPACE / PARKS / LAKES (SEE NOTE BELOW)
- ROADWAYS / CITY PROPERTY
- MAJOR ARTERIALS
- MINOR ARTERIALS
- REGIONAL TRAILS (PAVED)
- LOCAL TRAILS (PAVED)
- RECREATION TRAILS (DIRT)
- FUTURE ROADWAYS
- PROPERTY LINE
- WASHES
- TRAILHEAD SITE



LOCATION MAP
ST. GEORGE, UTAH

PLANNING AREAS

AREA	ZONE	ACRES	DENSITY
P.A.-1	HDR	28.09	UP TO 15 UNITS/ACRE
P.A.-2	MDR	35.96	UP TO 9 UNITS/ACRE
P.A.-3	MDR	24.10	UP TO 9 UNITS/ACRE
P.A.-4	LDR	33.52	UP TO 4 UNITS/ACRE
P.A.-5	LDR	19.37	UP TO 4 UNITS/ACRE
P.A.-6	LDR	59.74	UP TO 4 UNITS/ACRE
P.A.-7	MDR	35.93	UP TO 9 UNITS/ACRE
P.A.-8	MIXED USE	27.04	UP TO 10 UNITS/ACRE
P.A.-9	MDR	13.30	UP TO 9 UNITS/ACRE
P.A.-10	MDR	11.33	UP TO 9 UNITS/ACRE
P.A.-11	MDR	27.17	UP TO 9 UNITS/ACRE
P.A.-12	MDR	26.88	UP TO 9 UNITS/ACRE
P.A.-13	MDR	61.45	UP TO 9 UNITS/ACRE
P.A.-14	LDR	28.44	UP TO 4 UNITS/ACRE
P.A.-15	LDR	16.35	UP TO 4 UNITS/ACRE
P.A.-16	LDR	16.38	UP TO 4 UNITS/ACRE
P.A.-17	HDR	12.31	UP TO 15 UNITS/ACRE
P.A.-18	HDR	8.03	UP TO 15 UNITS/ACRE

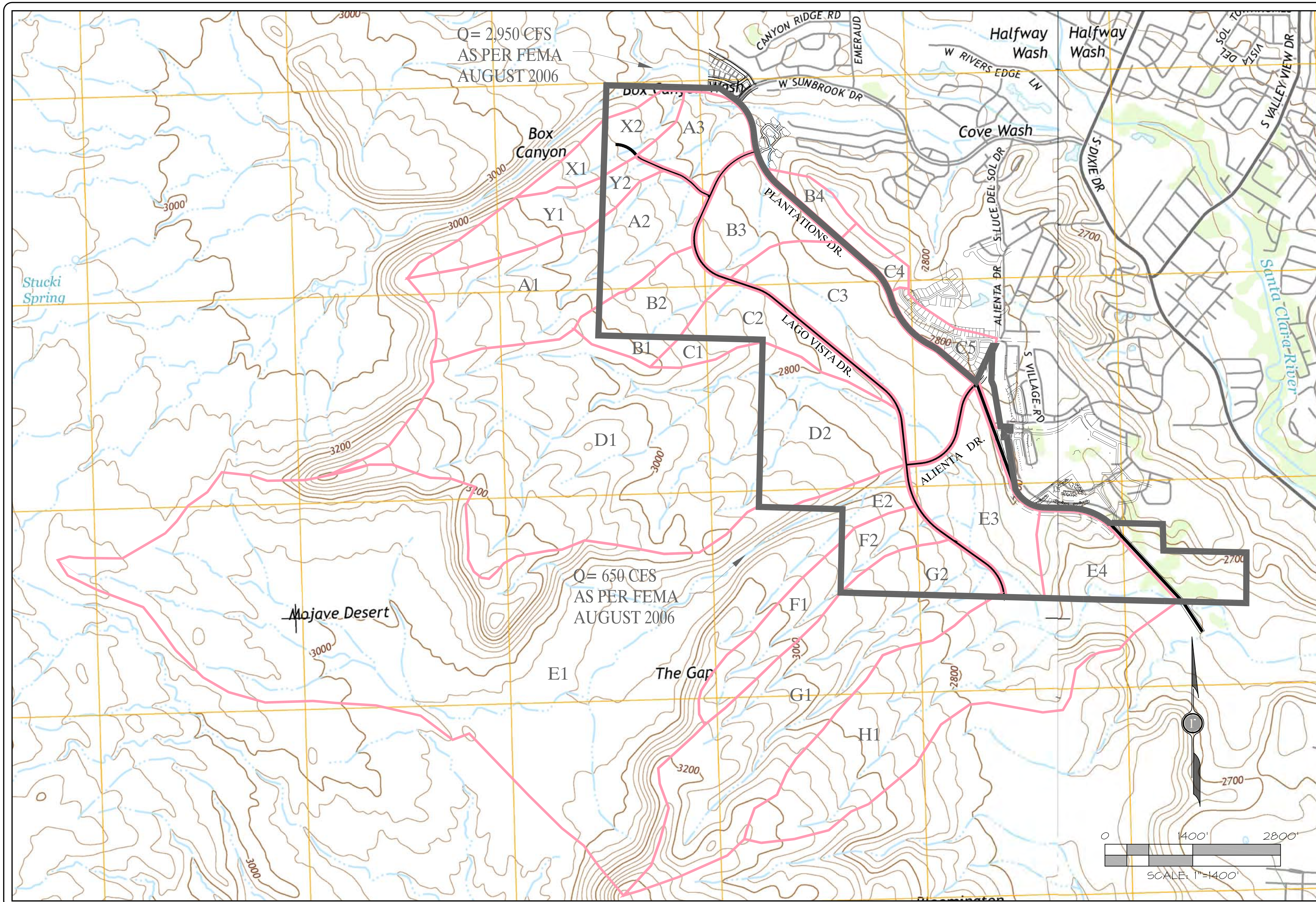
DATE:	8/31/2016
JOB NO.:	1286-14-014
DESIGNED BY:	JLW
CHECKED BY:	RMA
DWG:	Land Use Plan

DATE
REVISIONS

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS
352 East Riverside Drive, Suite A-2
St. George, Utah 84790
Ph (435) 673-8586 Fx (435) 673-8397
www.racivil.com

Land Use Plan FOR The Lakes at St. George
St. GeorgE, Utah

SHEET
Fig. 1
1 OF 1 SHEETS



DATE: 4-14-08
JOB NO.: 1286-PDA
DRAWN BY: JRH
DESIGNED BY:
DWG: WATERSHED MAP

DATE
REVISIONS

ROSENBERG
ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS
352 East Riverside Drive, Suite A-2
St. George, Utah 84790
Ph (435) 673-8586 Fx (435) 673-8397
www.rosenbergassociates.net

FIGURE 2 WATERSHED MAP
FOR
THE LAKES AT ST. GEORGE
ST. GEORGE, UTAH

SHEET
Fig. 2
1 OF 1 SHEETS

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 12N. **Horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided in digital format by the U.S. Farm Service National Agriculture Imagery Program (NAIP), dated summer 2004, and by the U.S. Geological Survey Digital Orthophoto Quadrangles, dated 1993 and later, produced at a scale of 1:24000. The data was obtained from the State Geographic Information Dataset (SGID) maintained by the Automated Geographic Reference Center (AGRC).

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and /or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip/.

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1007G

FIRM
FLOOD INSURANCE RATE MAP

WASHINGTON COUNTY, UTAH
AND INCORPORATED AREAS

PANEL 1007 OF 1225
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SANTA CLARA, CITY OF	490178	1007	G
ST. GEORGE, CITY OF	490177	1007	G
WASHINGTON COUNTY	490224	1007	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
49053C1007G

EFFECTIVE DATE
APRIL 2, 2009

Federal Emergency Management Agency

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1009G

FIRM
FLOOD INSURANCE RATE MAP

WASHINGTON COUNTY, UTAH
AND INCORPORATED AREAS

PANEL 1009 OF 1225
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ST. GEORGE, CITY OF	490177	1009	G
WASHINGTON COUNTY	490224	1009	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
49053C1009G

EFFECTIVE DATE
APRIL 2, 2009

Federal Emergency Management Agency

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1028G

FIRM
FLOOD INSURANCE RATE MAP

WASHINGTON COUNTY, UTAH
AND INCORPORATED AREAS

PANEL 1028 OF 1225
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

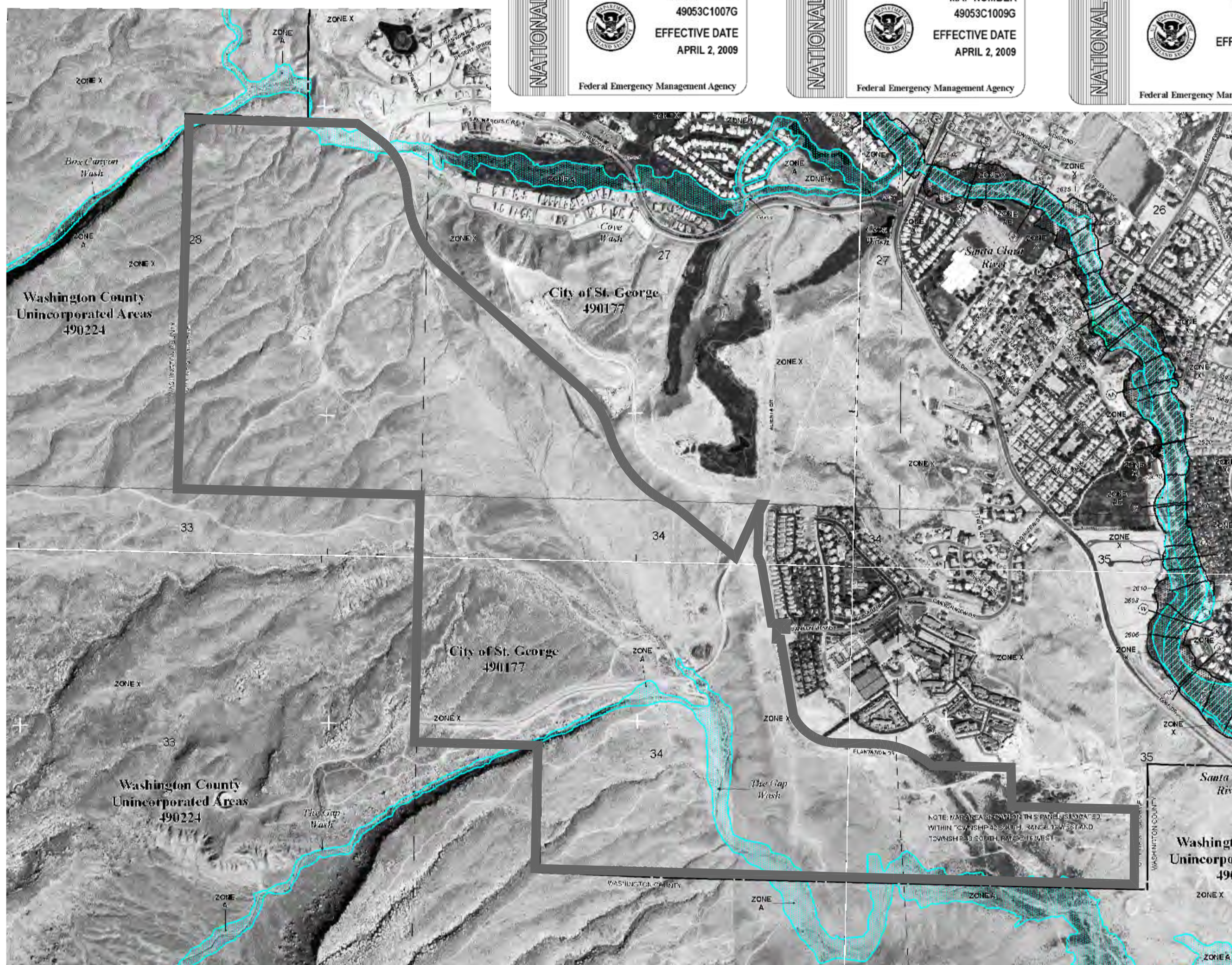
COMMUNITY	NUMBER	PANEL	SUFFIX
ST. GEORGE, CITY OF	490177	1028	G
WASHINGTON COUNTY	490224	1028	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
49053C1028G

EFFECTIVE DATE
APRIL 2, 2009

Federal Emergency Management Agency



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAS)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

(A)—(A) Cross section line
(23)—(23) Transect line
87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4276000mE — 1000-meter Universal Transverse Mercator grid values, zone 12
600000 FT — 5000-foot grid ticks: Utah State Plane coordinate system, south zone (FIPSZONE 4303), Lambert Conformal Conic projection
DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
APRIL 2, 2009

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

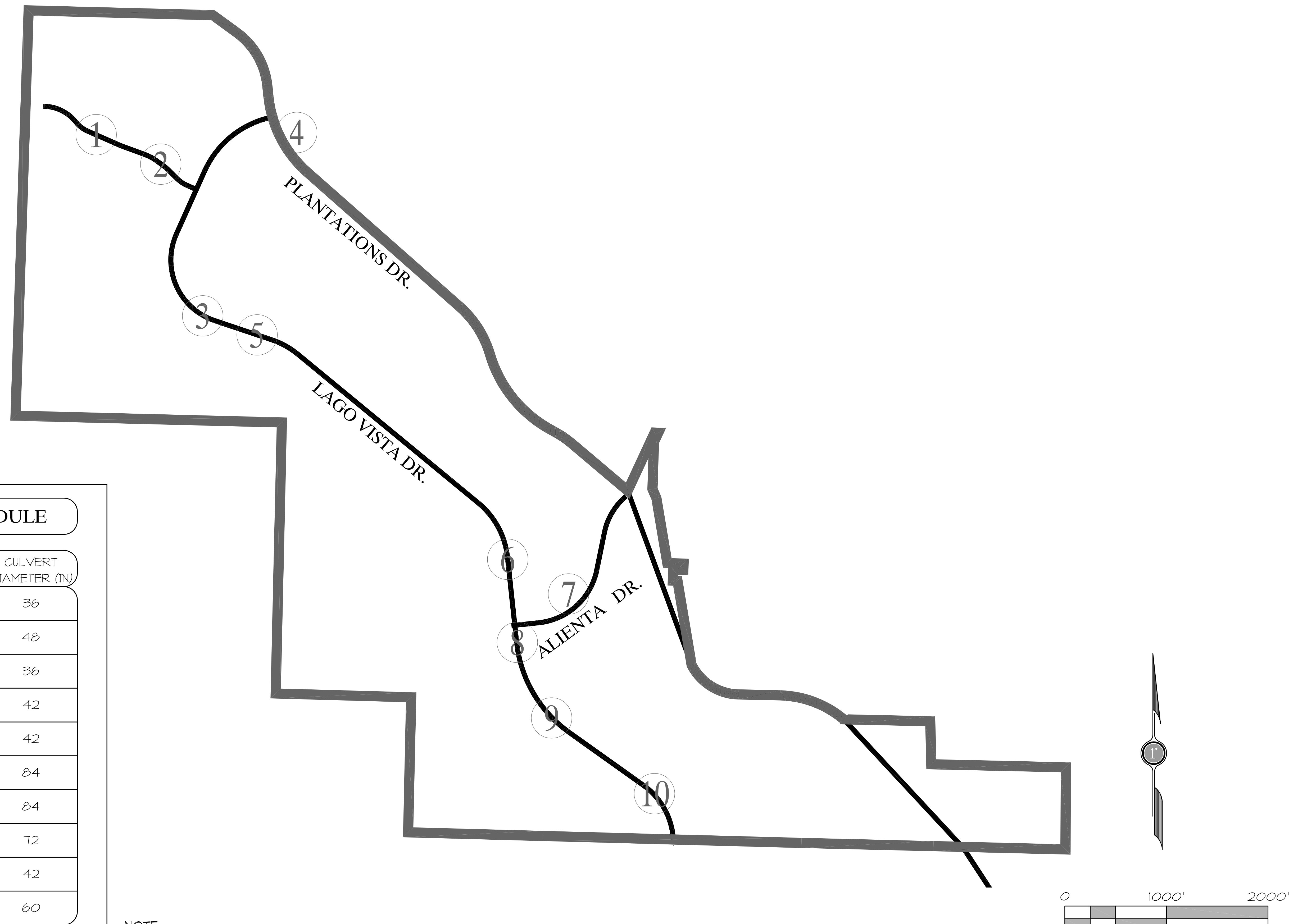
DATE:	4-14-08
JOB NO.:	1286-PDA
DRAWN BY:	JRH
DESIGNED BY:	
DWG:	WATERSHED MAP

DATE
REVISIONS

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS
352 East Riverside Drive, Suite A-2
St. George, Utah 84790
Ph (435) 673-8586 Fx (435) 673-8397
www.rosenbergassociates.net

FIGURE 3- FEMA Regulatory 100-YR Floodplain
FOR
The Lakes at St. George
St. George, Utah

SHEET
Fig. 3
1 OF 1 SHEETS



CULVERT SCHEDULE

CULVERT ID	100-YR FLOW (CFS)	CULVERT DIAMETER (IN)
1	80.7	36
2	191.9	48
3	88.1	36
4	139.9	42
5	104.5	42
6	654.3	84
7	810.0	84
8	456.7	72
9	134.7	42
10	249.4	60

NOTE
CULVERT DIAMETER CALCULATIONS
ASSUME 1.0% SLOPE.

DATE: 4-14-08
JOB NO.: 1286-PDA
DRAWN BY: JLW
DESIGNED BY: RMA
DWG: WATERSHED MAP

DATE
REVISIONS

ROSENBERG
ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

352 East Riverside Drive, Suite A-2
St. George, Utah 84790
Ph (435) 673-8586 Fx (435) 673-8397
www.rosenbergassociates.net

FIGURE 4 CULVERT CROSSINGS
FOR
THE LAKES AT ST. GEORGE
ST. GEORGE, UTAH

SHEET
Fig. 4
1 OF 1 SHEETS

United States Department of Agriculture

NRCS

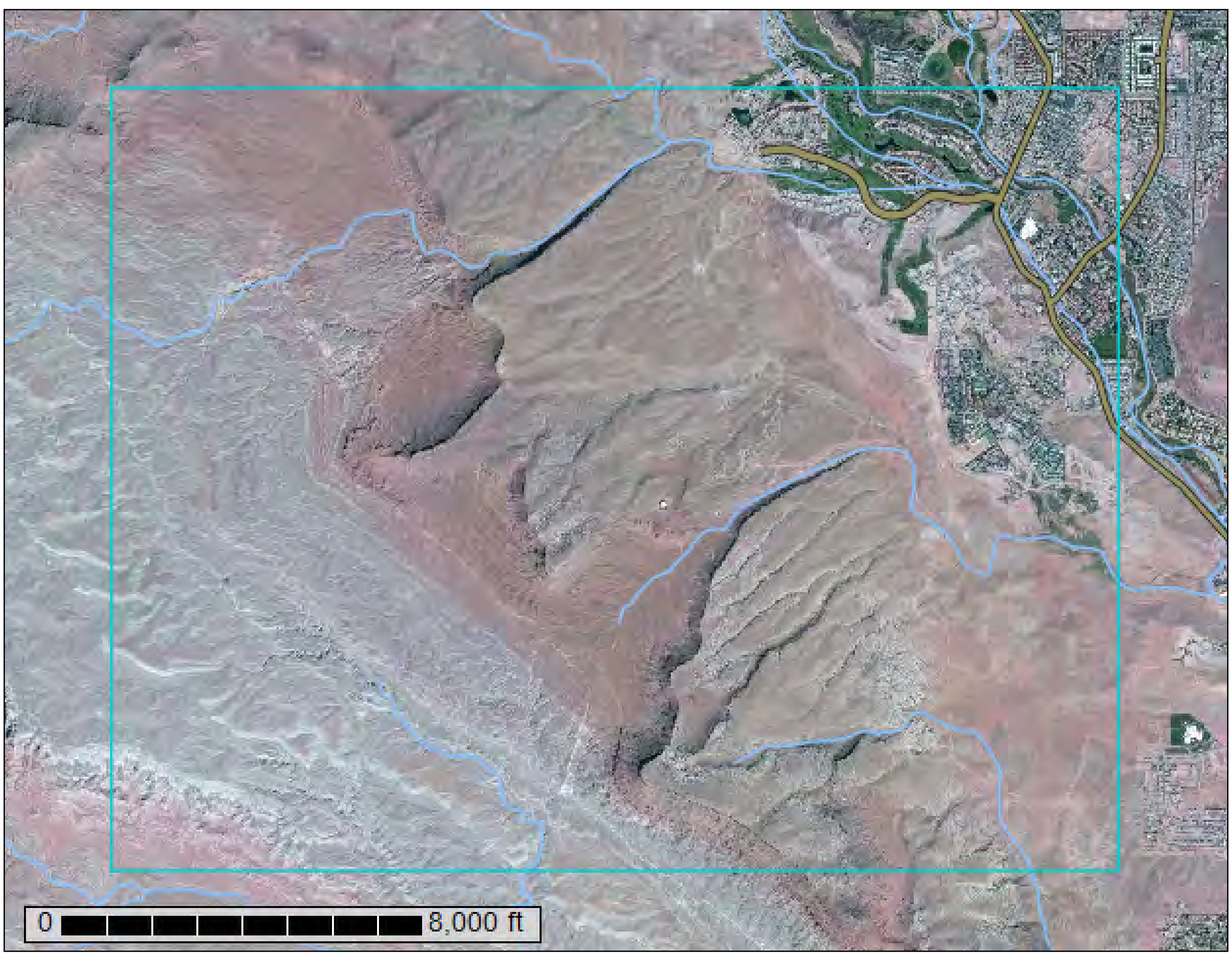
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Washington County Area, Utah

The Lakes



August 19, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface......2
How Soil Surveys Are Made......5
Soil Map......7
Soil Map......8
Legend......9
Map Unit Legend......10
Map Unit Descriptions......10
Washington County Area, Utah......13
BA—Badland......13
BB—Badland, very steep......13
EB—Eroded land-Shalet complex, warm......13
FA—Fluvaquents and torrifluvents, sandy......15
GA—Gullied land......17
GP—Gravel pits......17
Ha—Hantz silty clay loam......17
HG—Hobog-Rock land association......18
IAF—Isom cobbly sandy loam, 3 to 30 percent slopes......20
JaC—Junction fine sandy loam, 2 to 5 percent slopes......21
LcC—Laverkin fine sandy loam, 2 to 5 percent slopes......22
LeB—Leeds silty clay loam, 1 to 2 percent slopes......23
NLE—Nikey sandy loam, 3 to 15 percent slopes......24
PnC—Pintura loamy fine sand, 1 to 5 percent slopes......26
PoD—Pintura loamy fine sand, hummocky, 1 to 10 percent slopes......27
RE—Renbac-Rock land association......28
RO—Rock land......29
Tc—Tobler fine sandy loam......30
Td—Tobler silty clay loam......31
W—Water......32
WBD—Winkel gravelly fine sandy loam, 1 to 8 percent slopes......32
Soil Information for All Uses......34
Soil Properties and Qualities......34
Soil Qualities and Features......34
Hydrologic Soil Group (The Lakes)......34
References......40

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

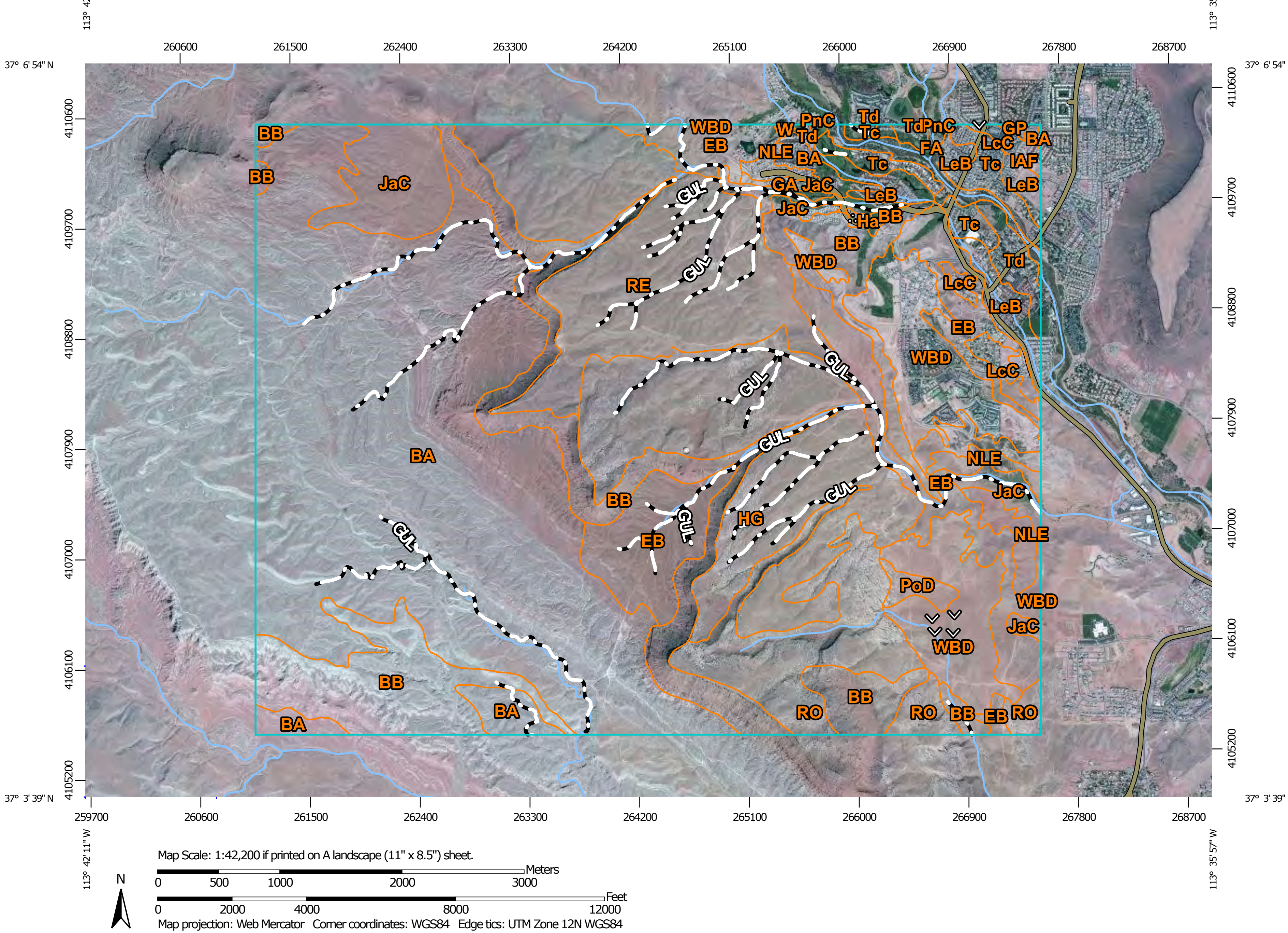
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Washington County Area, Utah
Survey Area Data: Version 9, Sep 23, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 11, 2010—Nov 3, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Washington County Area, Utah (UT641)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BA	Badland	2,583.6	32.5%
BB	Badland, very steep	1,031.7	13.0%
EB	Eroded land-Shalet complex, warm	727.4	9.1%
FA	Fluvaquents and torrifluvents, sandy	63.4	0.8%
GA	Gullied land	35.1	0.4%
GP	Gravel pits	4.1	0.1%
Ha	Hantz silty clay loam	9.7	0.1%
HG	Hobog-Rock land association	870.7	10.9%
IAF	Isom cobbly sandy loam, 3 to 30 percent slopes	15.6	0.2%
JaC	Junction fine sandy loam, 2 to 5 percent slopes	250.5	3.1%
LcC	Laverkin fine sandy loam, 2 to 5 percent slopes	49.5	0.6%
LeB	Leeds silty clay loam, 1 to 2 percent slopes	142.6	1.8%
NLE	Nikey sandy loam, 3 to 15 percent slopes	100.1	1.3%
PnC	Pintura loamy fine sand, 1 to 5 percent slopes	3.1	0.0%
PoD	Pintura loamy fine sand, hummocky, 1 to 10 percent slopes	30.4	0.4%
RE	Renbac-Rock land association	893.1	11.2%
RO	Rock land	431.7	5.4%
Tc	Tobler fine sandy loam	129.0	1.6%
Td	Tobler silty clay loam	71.5	0.9%
W	Water	2.7	0.0%
WBD	Winkel gravelly fine sandy loam, 1 to 8 percent slopes	507.9	6.4%
Totals for Area of Interest		**7,953.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Washington County Area, Utah

BA—Badland

Map Unit Composition

Badland: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Badland

Setting

Landform: Escarpments, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Free face, side slope
Down-slope shape: Convex
Across-slope shape: Convex

BB—Badland, very steep

Map Unit Composition

Badland: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Badland

Setting

Landform: Escarpments, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Free face, side slope
Down-slope shape: Convex
Across-slope shape: Convex

EB—Eroded land-Shalet complex, warm

Map Unit Setting

National map unit symbol: j8ds
Elevation: 3,600 to 5,550 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 52 to 56 degrees F
Frost-free period: 165 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Eroded land: 78 percent
Shalet and similar soils: 20 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eroded Land

Setting

Landform: Erosion remnants
Parent material: Residuum weathered from shale

Description of Shalet

Setting

Landform: Swales
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Residuum weathered from shale

Typical profile

H1 - 0 to 4 inches: clay loam
H2 - 4 to 12 inches: clay loam
H3 - 12 to 16 inches: weathered bedrock

Properties and qualities

Slope: 2 to 20 percent
Depth to restrictive feature: 4 to 15 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 20 percent
Gypsum, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Desert Shallow Loam (Creosotebush) (R030XY134UT)
Hydric soil rating: No

Minor Components

Badland

Percent of map unit: 2 percent

FA—Fluvaquents and torrifluvents, sandy

Map Unit Setting

National map unit symbol: j8dt
Elevation: 2,500 to 3,000 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 67 degrees F
Frost-free period: 190 to 205 days
Farmland classification: Not prime farmland

Map Unit Composition

Fluvaquents and similar soils: 55 percent
Torrifluvents and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents

Setting

Landform: Swales
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy alluvium derived from limestone, sandstone, and shale

Typical profile

H1 - 0 to 5 inches: fine sand
H2 - 5 to 60 inches: stratified fine sand to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: Rare
Calcium carbonate, maximum in profile: 20 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A/D
Ecological site: Loamy Bottom (Basin Big Sagebrush) (R035XY011UT)

Hydric soil rating: Yes

Description of Torrifluvents

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone, sandstone, and shale

Typical profile

H1 - 0 to 5 inches: loamy fine sand
H2 - 5 to 60 inches: stratified loamy fine sand to silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 42 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum in profile: 20 percent
Salinity, maximum in profile: Nonsaline to moderately saline (0.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: Loamy Bottom (Basin Big Sagebrush) (R035XY011UT)
Other vegetative classification: Loamy Bottom (Basin Big Sagebrush) (035XY011UT)
Hydric soil rating: No

Minor Components

Riverwash

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Tobler, fine sandy loam

Percent of map unit: 3 percent

Tobler, silty clay loam

Percent of map unit: 3 percent

GA—Gullied land

Map Unit Composition

Gullied land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

GP—Gravel pits

Map Unit Composition

Gravel pit: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gravel Pit

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Ha—Hantz silty clay loam

Map Unit Setting

National map unit symbol: j8dy
Elevation: 2,700 to 3,300 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 65 degrees F
Frost-free period: 190 to 195 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hantz and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hantz

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Mixed alluvium derived from limestone, sandstone, and shale

Typical profile

H1 - 0 to 9 inches: silty clay loam

H2 - 9 to 19 inches: silty clay
H3 - 19 to 47 inches: silty clay
H4 - 47 to 70 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 20 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Leeds

Percent of map unit: 5 percent

Tobler

Percent of map unit: 5 percent

St. george, moderately saline

Percent of map unit: 5 percent

HG—Hobog-Rock land association

Map Unit Setting

National map unit symbol: j8dx
Elevation: 2,600 to 3,800 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 67 degrees F
Frost-free period: 190 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Hobog and similar soils: 50 percent
Rock land: 40 percent

Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hobog

Setting

Landform: Mesas
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Material weathered from sandstone

Typical profile

H1 - 0 to 4 inches: very cobbly loam
H2 - 4 to 13 inches: very flaggy loam
H3 - 13 to 17 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 40 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Very low (about 0.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Desert Shallow Loam (Creosotebush) (R030XY134UT)
Hydric soil rating: No

Description of Rock Land

Setting

Landform: Ridges
Down-slope shape: Convex
Across-slope shape: Convex

Minor Components

Rock outcrop

Percent of map unit: 5 percent

Renbac

Percent of map unit: 5 percent

IAF—Isom cobbly sandy loam, 3 to 30 percent slopes

Map Unit Setting

National map unit symbol: j8f0
Elevation: 2,700 to 3,900 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 67 degrees F
Frost-free period: 175 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Isom and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Isom

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Cobbly alluvium derived from limestone, sandstone, and shale

Typical profile

H1 - 0 to 2 inches: very cobbly sandy loam
H2 - 2 to 10 inches: very cobbly sandy loam
H3 - 10 to 22 inches: very cobbly sandy loam
H4 - 22 to 60 inches: extremely cobbly sandy loam

Properties and qualities

Slope: 3 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Gypsum, maximum in profile: 10 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A

Ecological site: Desert Shallow Loam (Creosotebush) (R030XY134UT)
Hydric soil rating: No

Minor Components

Shallow soils
Percent of map unit: 5 percent

Nickey
Percent of map unit: 5 percent

JaC—Junction fine sandy loam, 2 to 5 percent slopes

Map Unit Setting
National map unit symbol: j8f4
Elevation: 2,700 to 3,400 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 67 degrees F
Frost-free period: 190 to 195 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Junction and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Junction

Setting
Landform: Alluvial fans, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, convex
Across-slope shape: Convex

Typical profile
H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 9 inches: fine sandy loam
H3 - 9 to 21 inches: fine sandy loam
H4 - 21 to 32 inches: fine sandy loam
H5 - 32 to 60 inches: fine sandy loam

Properties and qualities
Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum in profile: 20 percent
Gypsum, maximum in profile: 7 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups
Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: Desert Loam (Creosotebush) (R030XY110UT)
Hydric soil rating: No

Minor Components

Tobler
Percent of map unit: 5 percent

Harrisburg
Percent of map unit: 5 percent

Junction
Percent of map unit: 5 percent

LcC—Laverkin fine sandy loam, 2 to 5 percent slopes

Map Unit Setting
National map unit symbol: j8fg
Elevation: 2,550 to 3,300 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 67 degrees F
Frost-free period: 190 to 195 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Laverkin and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Laverkin

Setting
Landform: Alluvial fans, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Convex, concave
Parent material: Alluvium derived from limestone, sandstone, and shale

Typical profile
H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 16 inches: fine sandy loam
H3 - 16 to 30 inches: sandy clay loam
H4 - 30 to 42 inches: sandy clay loam

H5 - 42 to 60 inches: sandy clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Desert Loam (Creosotebush) (R030XY110UT)
Hydric soil rating: No

Minor Components

Tobler

Percent of map unit: 5 percent

Nikey

Percent of map unit: 5 percent

LeB—Leeds silty clay loam, 1 to 2 percent slopes

Map Unit Setting

National map unit symbol: j8fk
Elevation: 2,550 to 3,300 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 67 degrees F
Frost-free period: 190 to 200 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Leeds and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leeds

Setting

Landform: Flood plains

Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone, sandstone, and shale

Typical profile

H1 - 0 to 8 inches: silty clay loam
H2 - 8 to 15 inches: silty clay loam
H3 - 15 to 23 inches: sandy loam
H4 - 23 to 60 inches: silt loam

Properties and qualities

Slope: 1 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 20 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Hydrologic Soil Group: C
Ecological site: Desert Loam (Creosotebush) (R030XY110UT)
Hydric soil rating: No

Minor Components

Hantz

Percent of map unit: 4 percent

St george

Percent of map unit: 4 percent

Leeds

Percent of map unit: 4 percent

Tobler

Percent of map unit: 3 percent

NLE—Nikey sandy loam, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: j8fw
Elevation: 2,650 to 3,350 feet
Mean annual precipitation: 8 to 11 inches

Mean annual air temperature: 59 to 62 degrees F
Frost-free period: 180 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Nikey and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nikey

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Gravelly alluvium derived from limestone, sandstone, and shale

Typical profile

H1 - 0 to 3 inches: sandy loam
H2 - 3 to 26 inches: fine sandy loam
H3 - 26 to 38 inches: very gravelly loam
H4 - 38 to 46 inches: very gravelly loam
H5 - 46 to 60 inches: very gravelly loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Gypsum, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Desert Loam (Creosotebush) (R030XY110UT)
Hydric soil rating: No

Minor Components

Harrisburg

Percent of map unit: 5 percent

Isom

Percent of map unit: 5 percent

Nikey

Percent of map unit: 5 percent

PnC—Pintura loamy fine sand, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: j8g9
Elevation: 2,600 to 3,600 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 67 degrees F
Frost-free period: 190 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Pintura and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pintura

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Eolian sands derived from sandstone

Typical profile

H1 - 0 to 3 inches: loamy fine sand
H2 - 3 to 65 inches: fine sand

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: Desert Sand (Indian ricegrass) (R030XY120UT)
Hydric soil rating: No

Minor Components

Toquerville

Percent of map unit: 4 percent

Harrisburg

Percent of map unit: 4 percent

Tobler

Percent of map unit: 4 percent

Ivins

Percent of map unit: 3 percent

PoD—Pintura loamy fine sand, hummocky, 1 to 10 percent slopes

Map Unit Setting

National map unit symbol: j8gb
Elevation: 2,600 to 3,600 feet
Mean annual precipitation: 7 to 8 inches
Mean annual air temperature: 57 to 67 degrees F
Frost-free period: 190 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Pintura and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pintura

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Hummocky eolian sands derived from sandstone

Typical profile

H1 - 0 to 3 inches: loamy fine sand
H2 - 3 to 65 inches: fine sand

Properties and qualities

Slope: 1 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups
Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: Desert Sand (Indian ricegrass) (R030XY120UT)
Hydric soil rating: No

Minor Components

Dune land
Percent of map unit: 5 percent

Pintura
Percent of map unit: 5 percent

Toquerville
Percent of map unit: 5 percent

RE—Renbac-Rock land association

Map Unit Setting
National map unit symbol: j8gd
Elevation: 2,800 to 4,000 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 190 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Renbac and similar soils: 60 percent
Rock land: 25 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Renbac

Setting
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Material weathered from sandstone, conglomerate, and shale

Typical profile
H1 - 0 to 2 inches: channery clay loam
H2 - 2 to 5 inches: very channery clay
H3 - 5 to 9 inches: very channery clay

H4 - 9 to 12 inches: very flaggy sandy loam
H5 - 12 to 16 inches: unweathered bedrock

Properties and qualities
Slope: 2 to 30 percent
Depth to restrictive feature: 8 to 17 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 1.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Semidesert Shallow Hardpan (Blackbrush) (R030XY230UT)
Hydric soil rating: No

Minor Components

Hobog
Percent of map unit: 5 percent

RO—Rock land

Map Unit Composition
Rock land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Land

Setting
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex

Minor Components

Shallow soils
Percent of map unit: 20 percent

Tc—Tobler fine sandy loam

Map Unit Setting

National map unit symbol: j8h2
Elevation: 2,500 to 3,500 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 160 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Tobler and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tobler

Setting

Landform: Alluvial fans, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, convex
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone and shale

Typical profile

H1 - 0 to 4 inches: fine sandy loam
H2 - 4 to 13 inches: fine sandy loam
H3 - 13 to 38 inches: fine sandy loam
H4 - 38 to 60 inches: fine sandy loam

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: Desert Loam (Creosotebush) (R030XY110UT)
Hydric soil rating: No

Minor Components

Harrisburg

Percent of map unit: 4 percent

Ivins

Percent of map unit: 4 percent

Pintura

Percent of map unit: 4 percent

Junction

Percent of map unit: 3 percent

Td—Tobler silty clay loam

Map Unit Setting

National map unit symbol: j8h3
Elevation: 2,500 to 3,500 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 160 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Tobler and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tobler

Setting

Landform: Flood plains, valleys
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear, concave
Parent material: Alluvium derived from sandstone and shale

Typical profile

H1 - 0 to 10 inches: silty clay loam
H2 - 10 to 13 inches: fine sandy loam
H3 - 13 to 38 inches: fine sandy loam
H4 - 38 to 60 inches: fine sandy loam

Properties and qualities

Slope: 1 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups
Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Desert Loam (Creosotebush) (R030XY110UT)
Hydric soil rating: No

Minor Components

Tobler
Percent of map unit: 3 percent

Leeds
Percent of map unit: 3 percent

Leeds
Percent of map unit: 2 percent

Leeds
Percent of map unit: 2 percent

W—Water

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WBD—Winkel gravelly fine sandy loam, 1 to 8 percent slopes

Map Unit Setting
National map unit symbol: j8h9
Elevation: 2,800 to 4,000 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 190 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition
Winkel and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Winkel

Setting

Landform: Mesas
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous material weathered from basalt, limestone, and wind-deposited sand.

Typical profile

H1 - 0 to 1 inches: gravelly fine sandy loam
H2 - 1 to 6 inches: gravelly fine sandy loam
H3 - 6 to 12 inches: very gravelly fine sandy loam
H4 - 12 to 16 inches: extremely cobbly fine sandy loam
H5 - 16 to 20 inches: indurated
H6 - 20 to 24 inches: unweathered bedrock

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: 11 to 19 inches to petrocalcic; 14 to 24 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Very low (about 1.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Desert Shallow Loam (Creosotebush) (R030XY134UT)
Hydric soil rating: No

Minor Components

Lava flows

Percent of map unit: 5 percent

Harrisburg

Percent of map unit: 5 percent

Bermesa

Percent of map unit: 5 percent

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (The Lakes)

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

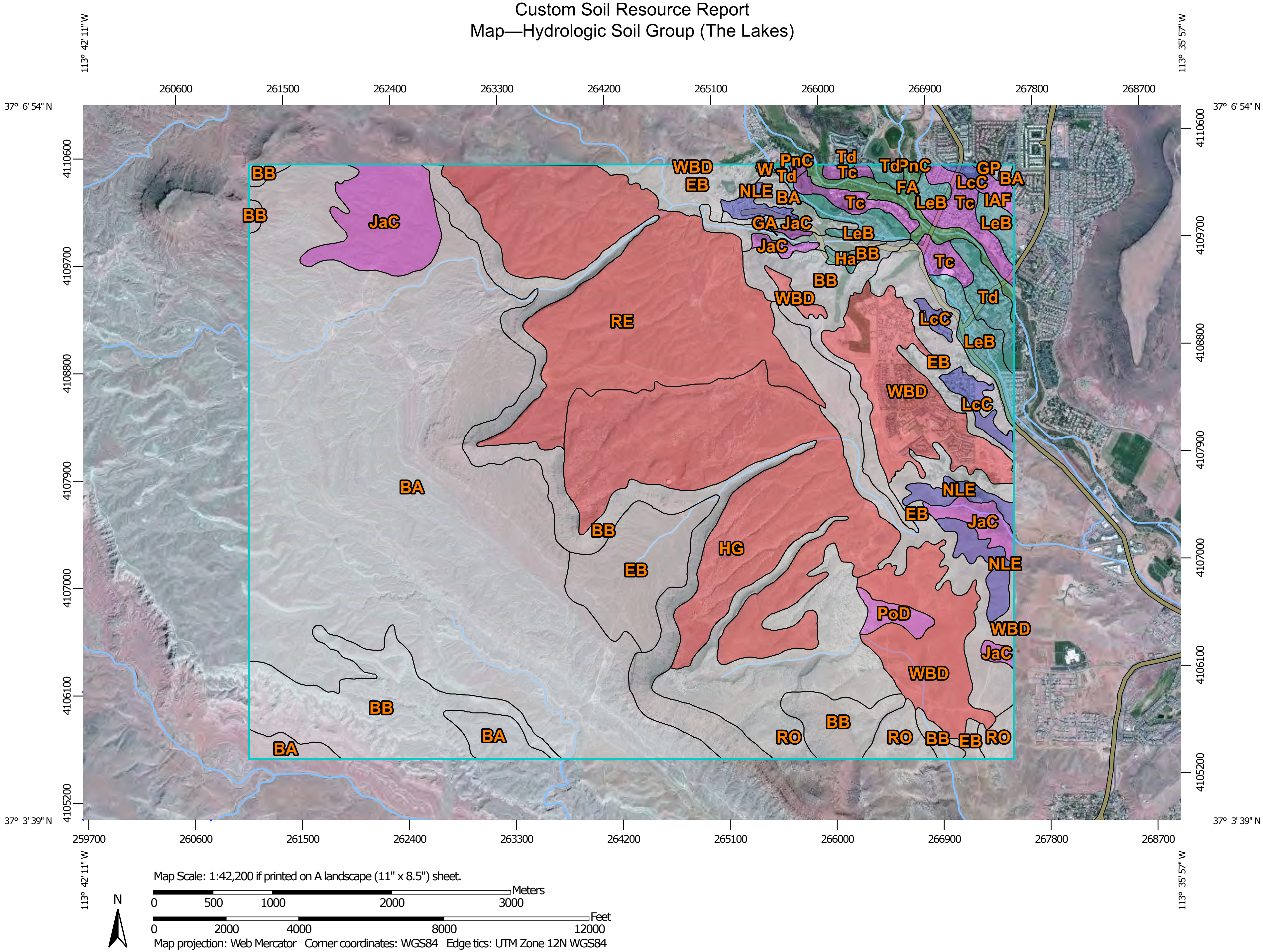
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Map—Hydrologic Soil Group (The Lakes)



Map Scale: 1:42,200 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 2000, 4000, 8000, 12000

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)
Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Washington County Area, Utah
Survey Area Data: Version 9, Sep 23, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 11, 2010—Nov 3, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group (The Lakes)

Hydrologic Soil Group— Summary by Map Unit — Washington County Area, Utah (UT641)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BA	Badland		2,583.6	32.5%
BB	Badland, very steep		1,031.7	13.0%
EB	Eroded land-Shalet complex, warm		727.4	9.1%
FA	Fluvaquents and torrifluvents, sandy	A/D	63.4	0.8%
GA	Gullied land		35.1	0.4%
GP	Gravel pits		4.1	0.1%
Ha	Hantz silty clay loam	C	9.7	0.1%
HG	Hobog-Rock land association	D	870.7	10.9%
IAF	Isom cobbly sandy loam, 3 to 30 percent slopes	A	15.6	0.2%
JaC	Junction fine sandy loam, 2 to 5 percent slopes	A	250.5	3.1%
LcC	Laverkin fine sandy loam, 2 to 5 percent slopes	B	49.5	0.6%
LeB	Leeds silty clay loam, 1 to 2 percent slopes	C	142.6	1.8%
NLE	Nikey sandy loam, 3 to 15 percent slopes	B	100.1	1.3%
PnC	Pintura loamy fine sand, 1 to 5 percent slopes	A	3.1	0.0%
PoD	Pintura loamy fine sand, hummocky, 1 to 10 percent slopes	A	30.4	0.4%
RE	Renbac-Rock land association	D	893.1	11.2%
RO	Rock land		431.7	5.4%
Tc	Tobler fine sandy loam	A	129.0	1.6%
Td	Tobler silty clay loam	C	71.5	0.9%
W	Water		2.7	0.0%
WBD	Winkel gravelly fine sandy loam, 1 to 8 percent slopes	D	507.9	6.4%
Totals for Area of Interest			**7,953.3**	**100.0%**

Rating Options—Hydrologic Soil Group (The Lakes)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

PROJECT NO. 1286-14-014

PROJECT: The Lakes - Master Plan BY: JLW DATE: 30-Aug-16

SUBJECT: Drainage Study Hydrology Information CHKD: RMA DATE: 30-Aug-16

EXISTING PRE-DEVELOPMENT CONDITION

Hydraulic Element		Area			Hydraulic Properties	
(label)	*(notes)*	*(sq ft)*	*(acre)*	*(sq mi)*	*Lo (ft)*	*S (%)*
X1	Subarea X - Offiste	625,298	14.35	0.02243	1,480	9.00
X2	Subarea X - Onsite to Plantations	908,340	20.85	0.03258	1,205	8.00
Y1	Subarea Y - Offsite	1,925,866	44.21	0.06908	3,500	9.00
Y2	Subarea Y - Onsite to Sentieri	400,265	9.19	0.01436	802	8.00
A1	Subarea A - Offiste	3,962,682	90.97	0.14214	3,779	7.00
A2	Subarea A - Onsite to Sentieri	2,138,492	49.09	0.07671	2,951	7.00
A3	Subarea A - Onsite to Plantations	1,627,354	37.36	0.05837	1,870	4.45
B1	Subarea B - Offsite	476,820	10.95	0.01710	450	7.80
B2	Subarea B - Onsite to Lago Vista	1,670,183	38.34	0.05991	1,495	7.80
B3	Subarea B - Onsite to Plantations	2,149,110	49.34	0.07709	1,943	5.60
B4	Subarea B - Offsite to Plantations	528,071	12.12	0.01894	1,880	2.00
C1	Subarea C - Offsite	465,481	10.69	0.01670	878	11.67
C2	Subarea C - Onsite to Lago Vista	1,748,993	40.15	0.06274	1,190	6.72
C3	Subarea C - Onsite to Alienta	4,733,374	108.66	0.16979	4,503	2.67
C4	Subarea C - Offsite to Plantations	435,932	10.01	0.01564	1,504	2.00
C5	Subarea C - Offsite to Plantations	979,960	22.50	0.03515	2,040	3.00
D1	Sunarea D - Offsite	16,555,867	380.07	0.59386	4,694	7.48
D2	Subarea D - Onsite to Lago Vista	4,179,275	95.94	0.14991	3,297	7.80
E1	Subarea E - Offsite (Gap Wash)	36,853,282	846.03	1.32193	14,986	2.25
E2	Subarea E - Onsite (Gap Wash) to Lago Vista	894,958	20.55	0.03210	1,303	4.27
E3	Subarea E - Onsite (Gap Wash) to Plantations	3,288,611	75.50	0.11796	3,501	4.47
E4	Subarea E - Onsite (Gap Wash) to Plantations	2,126,723	48.82	0.07629	2,949	9.50
F1	Subarea F - Offsite	1,869,681	42.92	0.06707	3,213	8.42
F2	Subarea F - Onsite to Lago Vista	991,181	22.75	0.03555	1,764	8.80
G1	Subarea G - Offsite	8,038,729	184.54	0.28835	7,531	9.56
G2	Subarea G - Onsite to Lago Vista	1,486,884	34.13	0.05333	561	3.56
H1	Subarea H - Offsite to Plantations	590,142	13.55	0.02117	1,924	4.20

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

PROJECT NO. 1286-14-014

PROJECT: The Lakes - Master Plan | BY: JLW | DATE: 30-Aug-16

SUBJECT: Drainage Study Hydrology Information | CHKD: RMA | DATE: 30-Aug-16

PROPOSED POST-DEVELOPMENT CONDITION

Hydraulic Element		Area			Hydraulic Properties	
(label)	*(notes)*	*(sq ft)*	*(acre)*	*(sq mi)*	*Lo (ft)*	*S (%)*
X1	Subarea X - Offiste	625,298	14.35	0.02243	1,480	9.00
X2	Subarea X - Onsite to Plantations	908,340	20.85	0.03258	1,205	8.00
Y1	Subarea Y - Offsite	1,925,866	44.21	0.06908	3,500	9.00
Y2	Subarea Y - Onsite to Sentieri	400,265	9.19	0.01436	802	8.00
A1	Subarea A - Offiste	3,962,682	90.97	0.14214	3,779	7.00
A2	Subarea A - Onsite to Sentieri	2,138,492	49.09	0.07671	2,951	7.00
A3	Subarea A - Onsite to Plantations	1,627,354	37.36	0.05837	1,870	4.45
B1	Subarea B - Offsite	476,820	10.95	0.01710	450	7.80
B2	Subarea B - Onsite to Lago Vista	1,670,183	38.34	0.05991	1,495	7.80
B3	Subarea B - Onsite to Plantations	2,149,110	49.34	0.07709	1,943	5.60
B4	Subarea B - Offsite to Plantations	528,071	12.12	0.01894	1,880	2.00
C1	Subarea C - Offsite	465,481	10.69	0.01670	878	11.67
C2	Subarea C - Onsite to Lago Vista	1,748,993	40.15	0.06274	1,190	6.72
C3	Subarea C - Onsite to Alienta	4,733,374	108.66	0.16979	4,503	2.67
C4	Subarea C - Offsite to Plantations	435,932	10.01	0.01564	1,504	2.00
C5	Subarea C - Offsite to Plantations	979,960	22.50	0.03515	2,040	3.00
D1	Sunarea D - Offsite	16,555,867	380.07	0.59386	4,694	7.48
D2	Subarea D - Onsite to Lago Vista	4,179,275	95.94	0.14991	3,297	7.80
E1	Subarea E - Offsite (Gap Wash)	36,853,282	846.03	1.32193	14,986	2.25
E2	Subarea E - Onsite (Gap Wash) to Lago Vista	894,958	20.55	0.03210	1,303	4.27
E3	Subarea E - Onsite (Gap Wash) to Plantations	3,288,611	75.50	0.11796	3,501	4.47
E4	Subarea E - Onsite (Gap Wash) to Plantations	2,126,723	48.82	0.07629	2,949	9.50
F1	Subarea F - Offsite	1,869,681	42.92	0.06707	3,213	8.42
F2	Subarea F - Onsite to Lago Vista	991,181	22.75	0.03555	1,764	8.80
G1	Subarea G - Offsite	8,038,729	184.54	0.28835	7,531	9.56
G2	Subarea G - Onsite to Lago Vista	1,486,884	34.13	0.05333	561	3.56
H1	Subarea H - Offsite to Plantations	590,142	13.55	0.02117	1,924	4.20

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

PROJECT NO. 1286-14-014

PROJECT: The Lakes - Master Plan BY: JLW DATE: 30-Aug-16

SUBJECT: Hydraulic Links and Routing CHKD: RMA DATE: 30-Aug-16

JUNCTIONS FOR EXISTING PRE-DEVELOPMENT CONDITION

Hydraulic Element	
J-A	Collecting A1, A2
J-Y	Collecting Y1, Y2
J-AY	Collecting CulvertY, Culvert A, A3
J-B	Collecting B1, B2
J-B3	Collecting J-B, B3, B4
Box Canyon	Collecting J-AY, J-B3, X1, X2
J-C2	Collecting C1, C2
J-C5	Collecting C4, C5
J-C3	Collecting J-C2, J-C5
J-D2	Collecting D1, D2
J-CD	Collecting J-C3, J-D2
J-E2	Collecting E1, E2
J-F2	Collecting F1, F2
J-G2	Collecting G1, G2
J-E3	Collecting J-E2, J-F2, J-G2, E3, H1
Gap Wash	Collecting J-E3, E4

JUNCTIONS FOR PROPOSED POST-DEVELOPMENT CONDITION

Hydraulic Element	
J-A	Collecting A1, A2
J-Y	Collecting Y1, Y2
J-AY	Collecting CulvertY, Culvert A, A3
J-B	Collecting B1, B2
J-B3	Collecting J-B, B3, B4
Box Canyon	Collecting J-AY, J-B3, X1, X2
J-C2	Collecting C1, C2
J-C5	Collecting C4, C5
J-C3	Collecting J-C2, J-C5
J-D2	Collecting D1, D2
J-CD	Collecting J-C3, J-D2
J-E2	Collecting E1, E2
J-F2	Collecting F1, F2
J-G2	Collecting G1, G2
J-E3	Collecting J-E2, J-F2, J-G2, E3, H1
Gap Wash	Collecting J-E3, E4

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

PROJECT NO. 1286-14-014

PROJECT: The Lakes - Master Plan | BY: JLW | DATE: 30-Aug-16

SUBJECT: Hydraulic Links and Routing | CHKD: RMA | DATE: 30-Aug-16

ROUTING CONDUITS

Hydraulic Element		Routed Length (ft)	Average Slope (%)	Manning's Roughness (n)	Culvert Diameter (in)	Bottom Width (ft)	Side Slopes (H:1V)
X to Box	Routing X1 to Box Canyon	855	2.9	0.023	N/A	N/A	6.50
Y1 to Y2	Routing Y1 to J-Y	549	3.1	0.023	N/A	N/A	6.50
Culvert Y	Routing J-Y to J-AY	900	4.5	0.023	N/A	N/A	6.50
A1 to A2	Routing A1 to J-A	2,951	7.0	0.023	N/A	N/A	6.50
Culvert A	Routing J-A to J-AY	100	5.0	0.010	48	N/A	N/A
A to Box	Routing J-AY to Box Canyon	855	2.9	0.023	N/A	N/A	6.50
B1 to B2	Routing B1 to J-B	1,495	7.8	0.023	N/A	N/A	6.50
B to B3	Routing J-B to J-B3	1,943	5.6	0.023	N/A	N/A	6.50
Culvert B	Routing J-B3 to Box Canyon	855	2.9	0.023	N/A	N/A	6.50
C to C2	Routing C1 to J-C2	1,189	6.7	0.023	N/A	N/A	6.50
C2 to C3	Routing J-C2 to J-C3	4,503	2.7	0.023	N/A	N/A	6.50
C4 to C5	Routing C4 to J-C5	2,043	2.0	0.023	N/A	N/A	6.50
C5 to C3	Routing J-C5 to J-C3	1,170	7.0	0.023	N/A	N/A	6.50
C to D	Routing J-C3 to J-CD	3,088	2.0	0.023	N/A	N/A	6.50
D1 to D2	Routing D1 to J-D2	2,390	7.8	0.023	N/A	N/A	6.50
D to E3	Routing J-D2 to J-CD	120	2.0	0.023	N/A	N/A	6.50
C to E3	Routing J-CD to J-E3	577	2.0	0.023	N/A	N/A	6.50
E1 to E2	Routing JE1 to J-E2	1,303	4.3	0.023	N/A	N/A	6.50
E2 to E3	Routing J-E2 to J-E3	3,501	2.0	0.023	N/A	N/A	6.50
F1 to F2	Routing F1 to J-F2	1,764	8.8	0.023	N/A	N/A	6.50
F to F3	Routing J-F2 to J-E3	2,651	2.0	0.023	N/A	N/A	6.50
G1 to G2	Routing G1 to J-G2	561	2.3	0.023	N/A	N/A	6.50
G to E3	Routing J-G2 to J-E3	883	2.0	0.023	N/A	N/A	6.50
E3 to E4	Routing J-E3 to Gap Wash	2,951	2.0	0.023	N/A	N/A	6.50

TYPICAL MANNING'S n VALUES

0.013 - Poly Pipe
0.017 - CM Pipe
0.015 - Concrete
0.016 - Asphalt
0.023 - Dirt
0.026 - Grass
0.035 - Gravel
0.040 - Riprap

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

PROJECT NO. 1286-14-014

PROJECT: The Lakes - Master Plan   BY: JLW   DATE: 30-Aug-16

SUBJECT: NRCS Curve Number   CHKD: RMA   DATE: 30-Aug-16

NRCS CURVE NUMBER (CN) CHART

Land Use Description	**SCS Curve Number (CN) Values**							
	Group A		**Group B**		**Group C**		**Group D**	
	CN	**%**	**CN**	**%**	**CN**	**%**	**CN**	**%**
Cultivated Land								
Cultivated Land; Without Conservation Treatment	72		81		88		91	
Cultivated Land; With Conservation Treatment	62		71		78		81	
Pasture or Range Land								
Pasture or Range Land; Poor Condition	68		79		86		89	
Pasture or Range Land; Good Condition	39		61		74		80	
Open Spaces (Lawns, Parks, etc.)								
Open Space; Poor Condition; Grass Cover < 50%	68		79		86		89	
Open Space; Fair Condition; Grass Cover 50% to 75%	49		69		79		84	
Open Space; Good Condition; Grass Cover > 75%	39		61		74		80	
Impervious Areas								
Impervious Areas; Paved Parking Lots, Roofs, Driveways	98		98		98		98	
Impervious Areas; Streets and Roads; Paved; Curbs and Storm Sewers	98		98		98		98	
Impervious Areas; Streets and Roads; Paved; Open Ditches (w/ Right-of-Way)	83		89		92		93	
Impervious Areas; Streets and Roads; Gravel (w/ Right-of-Way)	76		85		89		91	
Impervious Areas; Streets and Roads; Dirt (w/ Right-of-Way)	72		82		87		89	
Urban Commercial and Industrial Districts								
Urban Districts; Commercial and Business; Average 85% Impervious	89		92		94		95	
Urban Districts; Industrial; Average 72% Impervious	81		88		91		93	
Residential Districts								
Residential Districts; 1/8 Acre (Town Houses); Average 65% Impervious	77		85		90		92	
Residential Districts; 1/4 Acre; Average 38% Impervious	61		75		83		87	
Residential Districts; 1/3 Acre; Average 30% Impervious	57		72		81		86	
Residential Districts; 1/2 Acre; Average 25% Impervious	54		70		80		85	
Residential Districts; 1 Acre; Average 20% Impervious	51		68		79		84	
Residential Districts; 2 Acre; Average 12% Impervious	46		65		77		82	
Western Desert Urban Areas								
Natural Desert Vegetation (Pervious Areas Only)	63		77		85		88	
Artificial Desert Landscaping	96		96		96		96	
Developing Urban Area (No Vegetation)								
Newly Graded Area (Pervious Only)	77		86		91		94	

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

PROJECT NO. 1286-14-014

PROJECT: The Lakes - Master Plan BY: JLW DATE: 30-Aug-16

SUBJECT: NRCS Curve Number CHKD: RMA DATE: 30-Aug-16

NRCS WEIGHTED AVERAGE CN VALUES **EXISTING PRE-DEVELOPMENT CONDITION**

Land Use Description	SCS Curve Number (CN) Values									
	Group A		Group B		Group C		Group D		Totals	
	CN	%	CN	%	CN	%	CN	%	CN	%
X1, X2, Y1, Y2, A1, A2, A3, B1, B2, C1, C2, D1, D2, E1, E2, F1, F2, G1, G2, H1									93	100
Natural Desert Vegetation (RO Rock Outcropping, mostly impervious)	98		98		98		98	50	49	50
Natural Desert Vegetation	63		77		85		88	50	44	50
B3, B4, C3, C4, C5 E3									88	100
Natural Desert Vegetation	63		77		85		88	100	88	100
E4									79	100
Natural Desert Vegetation	63	20	77	35	85		88	45	79.2	100

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

PROJECT NO. 1286-14-014

PROJECT: The Lakes - Master Plan BY: JLW DATE: 30-Aug-16

SUBJECT: NRCS Curve Number CHKD: RMA DATE: 30-Aug-16

NRCS WEIGHTED AVERAGE CN VALUES **PROPOSED POST-DEVELOPMENT CONDITION**

Land Use Description	SCS Curve Number (CN) Values									
	Group A		Group B		Group C		Group D		Totals	
	CN	%	CN	%	CN	%	CN	%	CN	%
X1, Y1, A1,B1, C1, D1, E1 F1, G1, H1									93	100
Natural Desert Vegetation (RO Rock Outcropping, mostly impervious)	98		98		98		98	50	49	50
Natural Desert Vegetation	63		77		85		88	50	44	50
X2, Y2									89	100
Natural Desert Vegetation (RO Rock Outcropping, mostly impervious)	98		98		98		98	13	12	13
Residential Districts; 1/4 Acre; Average 38% Impervious	61		75		83		87	75	65	75
Natural Desert Vegetation	63		77		85		88	12.5	11	12.5
A2									90	100
Natural Desert Vegetation (RO Rock Outcropping, mostly impervious)	98		98		98		98	10	10	10
Residential Districts; 1/8 Acre (Town Houses); Average 65% Impervious	77		85		90		92	35	32	35
Residential Districts; 1/4 Acre; Average 38% Impervious	61		75		83		87	45	39	45
Natural Desert Vegetation	63		77		85		88	10	8.8	10
A3									91	100
Natural Desert Vegetation (RO Rock Outcropping, mostly impervious)	98		98		98		98	13	12	13
Residential Districts; 1/4 Acre; Average 38% Impervious	61		75		83		87	40	35	40
Urban Districts; Commercial and Business; Average 85% Impervious	89		92		94		95	35	33.3	35
Natural Desert Vegetation	63		77		85		88	12.5	11	12.5
B2									92	100
Residential Districts; 1/8 Acre (Town Houses); Average 65% Impervious	77		85		90		92	100	92	100
B3									88	100
Urban Districts; Commercial and Business; Average 85% Impervious	89		92		94		95	15	14.3	15
Residential Districts; 1/4 Acre; Average 38% Impervious	61		75		83		87	55	48	55
Open Space; Good Condition; Grass Cover > 75%	39		61		74		80	10	8	10
Natural Desert Vegetation	63		77		85		88	20	17.6	20
B4, C4. C5									87	100
Residential Districts; 1/4 Acre; Average 38% Impervious	61		75		83		87	100	87	100
C2									94	100
Natural Desert Vegetation (RO Rock Outcropping, mostly impervious)	98		98		98		98	10	10	10
Urban Districts; Commercial and Business; Average 85% Impervious	89		92		94		95	45	42.8	45
Residential Districts; 1/8 Acre (Town Houses); Average 65% Impervious	77		85		90		92	45	41	45
C3									91	100
Natural Desert Vegetation (NaC Naplene Silt Loam)	63		77		85		88	32	28	32
Residential Districts; 1/8 Acre (Town Houses); Average 65% Impervious	77		85		90		92	68	63	68

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

PROJECT NO. 1286-14-014

PROJECT: The Lakes - Master Plan | BY: JLW | DATE: 30-Aug-16

SUBJECT: NRCS Curve Number | CHKD: RMA | DATE: 30-Aug-16

Land Use Description	SCS Curve Number (CN) Values									
	Group A		Group B		Group C		Group D		Totals	
	CN	%	CN	%	CN	%	CN	%	CN	%
D2									91	100
Natural Desert Vegetation (RO Rock Outcropping, mostly impervious)	98		98		98		98	30	29	30
Urban Districts; Commercial and Business; Average 85% Impervious	89		92		94		95	10	9.5	10
Residential Districts; 1/4 Acre; Average 38% Impervious	61		75		83		87	60	52	60
E2									92	100
Natural Desert Vegetation (RO Rock Outcropping, mostly impervious)	98		98		98		98	45	44	45
Residential Districts; 1/4 Acre; Average 38% Impervious	61		75		83		87	55	48	55
E3									87	100
Residential Districts; 1/8 Acre (Town Houses); Average 65% Impervious	77		85		90		92	32	29	32
Open Space; Good Condition; Grass Cover > 75%	39		61		74		80	31	25	31
Natural Desert Vegetation (NaC Naplene Silt Loam)	63		77		85		88	37	32.6	37
E4									84	100
Residential Districts; 1/8 Acre (Town Houses); Average 65% Impervious	77	5	85	35	90		92	45	75	85
Natural Desert Vegetation (NaC Naplene Silt Loam)	63	15	77		85		88		9.45	15
F2									90	100
Natural Desert Vegetation (RO Rock Outcropping, mostly impervious)	98		98		98		98	29	28	29
Residential Districts; 1/4 Acre; Average 38% Impervious	61		75		83		87	71	62	71
G2									87	100
Residential Districts; 1/4 Acre; Average 38% Impervious	61		75		83		87	100	87	100

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

PROJECT NO. 1286-14-014

PROJECT: The Lakes - Master Plan BY: JLW DATE: 30-Aug-16

SUBJECT: SCS Lag Time CHKD: RMA DATE: 30-Aug-16

TIME OF CONCENTRATION

$$t_c = \frac{1.67\, L_O^{\,0.8} \left(\frac{1000}{CN} - 9 \right)^{0.7}}{1900 \sqrt{S_{percent}}}$$

Where: CN = SCS runoff curve number
S = Average slope in percent
Lo = Length in ft

SCS LAG TIME

13.46 SCS Lag = 0.6*t_c

EXISTING PRE-DEVELOPMENT CONDITION

Hydrologic Element	SCS CN	Longest Length Lo (ft)	Average Slope S (%)	t_c (hr)	Lag Time (hr)	Lag Time (min)
X1	93	1,480	9.00	0.149	0.089	5.37
X2	93	1,205	8.00	0.134	0.081	4.83
Y1	93	3,500	9.00	0.297	0.178	10.69
Y2	93	802	8.00	0.097	0.058	3.49
A1	93	3,779	7.00	0.358	0.215	12.89
A2	93	2,951	7.00	0.294	0.176	10.58
A3	93	1,870	4.45	0.256	0.153	9.21
B1	93	450	7.80	0.062	0.037	2.23
B2	93	1,495	7.80	0.162	0.097	5.81
B3	88	1,943	5.60	0.290	0.174	10.43
B4	88	1,880	2.00	0.472	0.283	17.01
C1	93	878	11.67	0.086	0.052	3.11
C2	93	1,190	6.72	0.145	0.087	5.22
C3	88	4,503	2.67	0.822	0.493	29.60
C4	88	1,504	2.00	0.395	0.237	14.23
C5	88	2,040	3.00	0.412	0.247	14.82
D1	93	4,694	7.48	0.412	0.247	14.83
D2	93	3,297	7.80	0.304	0.182	10.95
E1	93	14,986	2.25	1.901	1.141	68.44
E2	93	1,303	4.27	0.196	0.117	7.04
E3	88	3,501	4.47	0.520	0.312	18.71
E4	79	2,949	9.50	0.420	0.252	15.12
F1	93	3,213	8.42	0.287	0.172	10.32
F2	93	1,764	8.80	0.174	0.104	6.25
G1	93	7,531	9.56	0.532	0.319	19.15
G2	93	561	3.56	0.109	0.065	3.93
H1	93	1,924	4.20	0.269	0.162	9.70

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

PROJECT NO. 1286-14-014

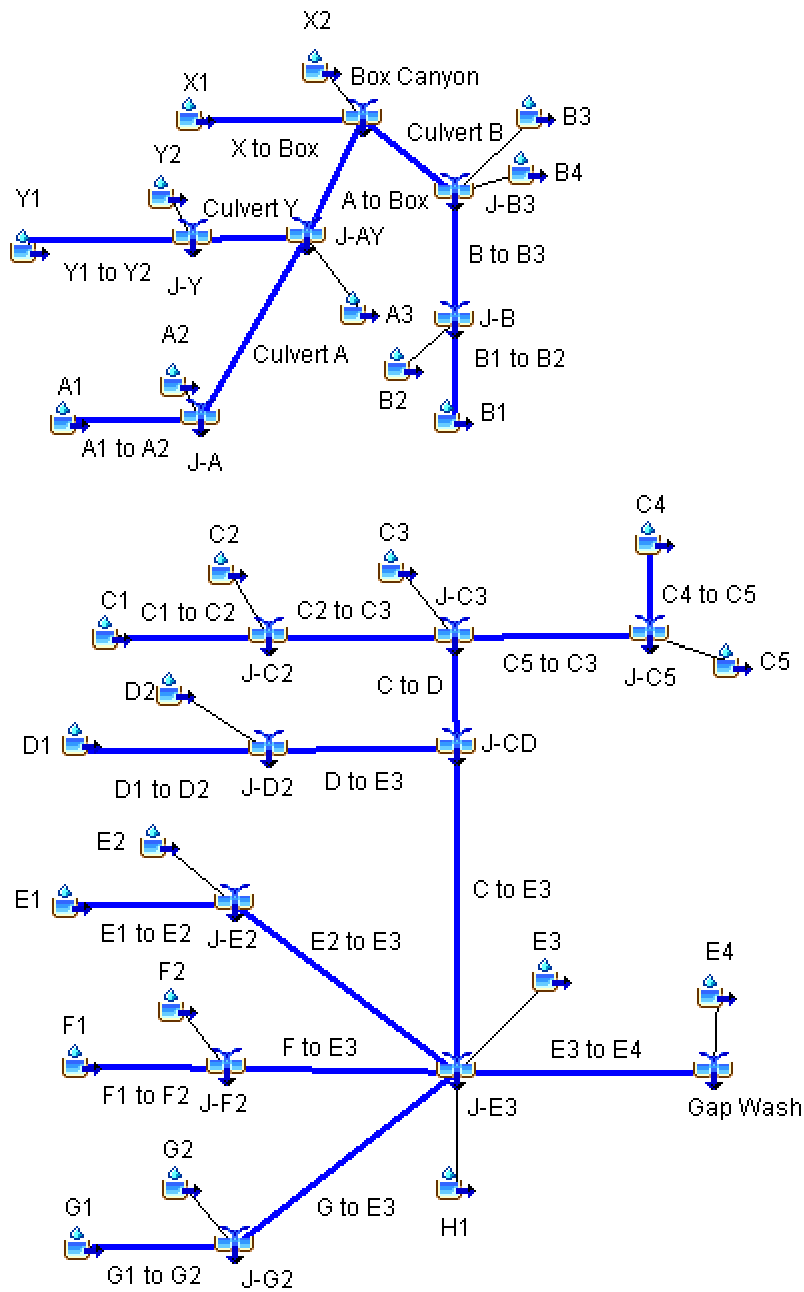
PROJECT: The Lakes - Master Plan BY: JLW DATE: 30-Aug-16

SUBJECT: SCS Lag Time CHKD: RMA DATE: 30-Aug-16

PROPOSED POST-DEVELOPMENT CONDITION

Hydrologic Element	SCS CN	Longest Length Lo (ft)	Average Slope S (%)	t_c (hr)	Lag Time (hr)	Lag Time (min)
X1	93	1,480	9.00	0.149	0.089	5.37
X2	89	1,205	8.00	0.162	0.097	5.84
Y1	93	3,500	9.00	0.297	0.178	10.69
Y2	89	802	8.00	0.117	0.070	4.22
A1	93	3,779	7.00	0.358	0.215	12.89
A2	90	2,951	7.00	0.335	0.201	12.07
A3	91	1,870	4.45	0.276	0.166	9.93
B1	93	450	7.80	0.062	0.037	2.23
B2	92	1,495	7.80	0.169	0.101	6.08
B3	88	1,943	5.60	0.293	0.176	10.55
B4	87	1,880	2.00	0.490	0.294	17.66
C1	93	878	11.67	0.086	0.052	3.11
C2	94	1,190	6.72	0.139	0.083	4.99
C3	91	4,503	2.67	0.737	0.442	26.55
C4	87	1,504	2.00	0.410	0.246	14.77
C5	87	2,040	3.00	0.428	0.257	15.39
D1	93	4,694	7.48	0.412	0.247	14.83
D2	91	3,297	7.80	0.331	0.198	11.91
E1	93	14,986	2.25	1.901	1.141	68.44
E2	92	1,303	4.27	0.205	0.123	7.38
E3	87	3,501	4.47	0.544	0.326	19.57
E4	84	2,949	9.50	0.353	0.212	12.72
F1	93	3,213	8.42	0.287	0.172	10.32
F2	90	1,764	8.80	0.196	0.118	7.06
G1	93	7,531	9.56	0.532	0.319	19.15
G2	87	561	3.56	0.140	0.084	5.03
H1	93	1,924	4.20	0.269	0.162	9.70

HEC-HMS Model



Project: The Lakes Master Simulation Run: N Pre 10 3hr

Start of Run: 01Jan2000, 12:00 Basin Model: Pre
End of Run: 01Jan2000, 20:00 Meteorologic Model: 10-3
Compute Time: 30Aug2016, 13:54:22 Control Specifications: 10-3

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A to Box	0.36066	148.6	01Jan2000, 13:00	0.45
A1	0.14214	59.6	01Jan2000, 12:55	0.45
A1 to A2	0.14214	59.4	01Jan2000, 13:00	0.45
A2	0.07671	35.5	01Jan2000, 12:55	0.45
A3	0.05837	27.7	01Jan2000, 12:55	0.45
Box Canyon	0.58871	223.2	01Jan2000, 12:55	0.41
B to B3	0.07701	40.7	01Jan2000, 12:50	0.45
B1	0.01710	10.5	01Jan2000, 12:45	0.45
B1 to B2	0.01710	9.9	01Jan2000, 12:50	0.45
B2	0.05991	32.5	01Jan2000, 12:50	0.45
B3	0.07709	18.1	01Jan2000, 12:55	0.25
B4	0.01894	0.0	01Jan2000, 12:00	0.00
Culvert A	0.21885	91.0	01Jan2000, 13:00	0.45
Culvert B	0.17304	56.5	01Jan2000, 12:55	0.31
Culvert Y	0.08344	35.4	01Jan2000, 12:55	0.45
C to D	0.30002	0.0	01Jan2000, 12:00	0.00
C to E3	1.04382	0.0	01Jan2000, 12:00	0.00
C1	0.01670	0.0	01Jan2000, 12:00	0.00
C1 to C2	0.01670	0.0	01Jan2000, 12:00	0.00
C2	0.06274	0.0	01Jan2000, 12:00	0.00
C2 to C3	0.07944	0.0	01Jan2000, 12:00	0.00
C3	0.16979	0.0	01Jan2000, 12:00	0.00
C4	0.01564	0.0	01Jan2000, 12:00	0.00
C4 to C5	0.01564	0.0	01Jan2000, 12:00	0.00
C5	0.03515	0.0	01Jan2000, 12:00	0.00
C5 to C3	0.05079	0.0	01Jan2000, 12:00	0.00
D1	0.59389	0.0	01Jan2000, 12:00	0.00

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1 to D2	0.59389	0.0	01Jan2000, 12:00	0.00
D2	0.14991	0.0	01Jan2000, 12:00	0.00
D2 to C3	0.74380	0.0	01Jan2000, 12:00	0.00
E1	1.32193	0.0	01Jan2000, 12:00	0.00
E1 to E2	1.32193	0.0	01Jan2000, 12:00	0.00
E2	0.03210	0.0	01Jan2000, 12:00	0.00
E2 to E3	1.35403	0.0	01Jan2000, 12:00	0.00
E3	0.11796	0.0	01Jan2000, 12:00	0.00
E3 to E4	3.02244	0.0	01Jan2000, 12:00	0.00
E4	0.07629	0.0	01Jan2000, 12:00	0.00
F to E3	0.14378	0.0	01Jan2000, 12:00	0.00
F1	0.06707	0.0	01Jan2000, 12:00	0.00
F1 to F2	0.06707	0.0	01Jan2000, 12:00	0.00
F2	0.07671	0.0	01Jan2000, 12:00	0.00
Gap Wash	3.02244	0.0	01Jan2000, 12:00	0.00
G to E3	0.34168	0.0	01Jan2000, 12:00	0.00
G1	0.28835	0.0	01Jan2000, 12:00	0.00
G1 to G2	0.28835	0.0	01Jan2000, 12:00	0.00
G2	0.05333	0.0	01Jan2000, 12:00	0.00
H1	0.02117	0.0	01Jan2000, 12:00	0.00
J-A	0.21885	91.0	01Jan2000, 13:00	0.45
J-AY	0.36066	149.0	01Jan2000, 12:55	0.45
J-B	0.07701	42.4	01Jan2000, 12:50	0.45
J-B3	0.17304	57.2	01Jan2000, 12:55	0.31
J-CD	1.04382	0.0	01Jan2000, 12:00	0.00
J-C2	0.07944	0.0	01Jan2000, 12:00	0.00
J-C3	0.30002	0.0	01Jan2000, 12:00	0.00
J-C5	0.05079	0.0	01Jan2000, 12:00	0.00
J-D2	0.74380	0.0	01Jan2000, 12:00	0.00
J-E2	1.35403	0.0	01Jan2000, 12:00	0.00
J-E4	3.09873	0.0	01Jan2000, 12:00	0.00

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J-F2	0.14378	0.0	01Jan2000, 12:00	0.00
J-G2	0.34168	0.0	01Jan2000, 12:00	0.00
J-Y	0.08344	36.3	01Jan2000, 12:55	0.45
X to Box	0.02243	12.0	01Jan2000, 12:50	0.45
X1	0.02243	12.3	01Jan2000, 12:50	0.45
X2	0.03258	18.0	01Jan2000, 12:50	0.45
Y1	0.06908	31.9	01Jan2000, 12:55	0.45
Y1 to Y2	0.06908	30.9	01Jan2000, 12:55	0.45
Y2	0.01436	8.4	01Jan2000, 12:45	0.45

Project: The Lakes Master Simulation Run: N Pre 10 24hr

Start of Run: 01Jan2000, 12:00 Basin Model: Pre
End of Run: 03Jan2000, 00:30 Meteorologic Model: 10-24hr
Compute Time: 30Aug2016, 13:54:14 Control Specifications: 24-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A to Box	0.36066	141.2	02Jan2000, 00:00	1.03
A1	0.14214	61.6	02Jan2000, 00:00	1.03
A1 to A2	0.14214	54.7	02Jan2000, 00:00	1.03
A2	0.07671	33.2	02Jan2000, 00:00	1.03
A3	0.05837	25.3	02Jan2000, 00:00	1.03
Box Canyon	0.58871	218.4	02Jan2000, 00:00	0.98
B to B3	0.07701	29.7	02Jan2000, 00:00	1.03
B1	0.01710	7.4	02Jan2000, 00:00	1.03
B1 to B2	0.01710	6.7	02Jan2000, 00:00	1.03
B2	0.05991	26.0	02Jan2000, 00:00	1.03
B3	0.07709	22.0	02Jan2000, 00:00	0.71
B4	0.01894	5.1	02Jan2000, 00:00	0.71
Culvert A	0.21885	87.8	02Jan2000, 00:00	1.03
Culvert B	0.17304	54.1	02Jan2000, 00:00	0.86
Culvert Y	0.08344	33.3	02Jan2000, 00:00	1.03
C to D	0.30002	65.9	02Jan2000, 00:30	0.80
C to E3	1.04382	350.4	02Jan2000, 00:00	0.97
C1	0.01670	7.2	02Jan2000, 00:00	1.03
C1 to C2	0.01670	6.7	02Jan2000, 00:00	1.03
C2	0.06274	27.2	02Jan2000, 00:00	1.03
C2 to C3	0.07944	23.6	02Jan2000, 00:00	1.03
C3	0.16979	34.1	02Jan2000, 00:30	0.71
C4	0.01564	4.5	02Jan2000, 00:00	0.71
C4 to C5	0.01564	3.3	02Jan2000, 00:00	0.72
C5	0.03515	10.0	02Jan2000, 00:00	0.71
C5 to C3	0.05079	12.4	02Jan2000, 00:00	0.72
D1	0.59389	257.3	02Jan2000, 00:00	1.03

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1 to D2	0.59389	241.9	02Jan2000, 00:00	1.03
D2	0.14991	65.0	02Jan2000, 00:00	1.03
D2 to C3	0.74380	305.4	02Jan2000, 00:00	1.03
E1	1.32193	266.6	02Jan2000, 01:00	1.03
E1 to E2	1.32193	264.1	02Jan2000, 01:00	1.03
E2	0.03210	13.9	02Jan2000, 00:00	1.03
E2 to E3	1.35403	258.5	02Jan2000, 01:00	1.03
E3	0.11796	29.7	02Jan2000, 00:00	0.71
E3 to E4	3.02244	596.6	02Jan2000, 00:30	1.00
E4	0.07629	7.5	02Jan2000, 00:00	0.35
F to E3	0.14378	50.3	02Jan2000, 00:00	1.03
F1	0.06707	29.1	02Jan2000, 00:00	1.03
F1 to F2	0.06707	26.9	02Jan2000, 00:00	1.03
F2	0.07671	33.2	02Jan2000, 00:00	1.03
Gap Wash	3.02244	644.2	02Jan2000, 00:00	0.99
G to E3	0.34168	124.3	02Jan2000, 00:00	1.03
G1	0.28835	109.3	02Jan2000, 00:00	1.03
G1 to G2	0.28835	106.8	02Jan2000, 00:00	1.03
G2	0.05333	23.1	02Jan2000, 00:00	1.03
H1	0.02117	9.2	02Jan2000, 00:00	1.03
J-A	0.21885	88.0	02Jan2000, 00:00	1.03
J-AY	0.36066	146.4	02Jan2000, 00:00	1.03
J-B	0.07701	32.7	02Jan2000, 00:00	1.03
J-B3	0.17304	56.7	02Jan2000, 00:00	0.86
J-CD	1.04382	358.2	02Jan2000, 00:00	0.96
J-C2	0.07944	33.9	02Jan2000, 00:00	1.03
J-C3	0.30002	66.6	02Jan2000, 00:30	0.80
J-C5	0.05079	13.3	02Jan2000, 00:00	0.72
J-D2	0.74380	306.9	02Jan2000, 00:00	1.03
J-E2	1.35403	267.1	02Jan2000, 01:00	1.03
J-E4	3.09873	602.2	02Jan2000, 00:30	0.98

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J-F2	0.14378	60.2	02Jan2000, 00:00	1.03
J-G2	0.34168	129.9	02Jan2000, 00:00	1.03
J-Y	0.08344	34.9	02Jan2000, 00:00	1.03
X to Box	0.02243	9.0	02Jan2000, 00:00	1.03
X1	0.02243	9.7	02Jan2000, 00:00	1.03
X2	0.03258	14.1	02Jan2000, 00:00	1.03
Y1	0.06908	29.9	02Jan2000, 00:00	1.03
Y1 to Y2	0.06908	28.7	02Jan2000, 00:00	1.03
Y2	0.01436	6.2	02Jan2000, 00:00	1.03

Project: The Lakes Master Simulation Run: N Pre 100 3hr

Start of Run: 01Jan2000, 12:00 Basin Model: Pre
End of Run: 01Jan2000, 18:30 Meteorologic Model: 100-3
Compute Time: 30Aug2016, 13:54:38 Control Specifications: 100-3

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A to Box	0.36066	344.2	01Jan2000, 12:55	0.99
A1	0.14214	139.2	01Jan2000, 12:55	0.99
A1 to A2	0.14214	135.5	01Jan2000, 13:00	0.99
A2	0.07671	80.3	01Jan2000, 12:55	0.99
A3	0.05837	64.4	01Jan2000, 12:50	0.99
Box Canyon	0.58871	541.9	01Jan2000, 12:55	0.94
B to B3	0.07701	94.8	01Jan2000, 12:50	0.99
B1	0.01710	23.5	01Jan2000, 12:40	0.99
B1 to B2	0.01710	23.4	01Jan2000, 12:45	0.99
B2	0.05991	73.1	01Jan2000, 12:45	0.99
B3	0.07709	53.9	01Jan2000, 12:55	0.68
B4	0.01894	10.6	01Jan2000, 13:05	0.68
Culvert A	0.21885	208.0	01Jan2000, 12:55	0.99
Culvert B	0.17304	145.8	01Jan2000, 12:55	0.82
Culvert Y	0.08344	82.4	01Jan2000, 12:55	0.99
C to D	0.30002	152.5	01Jan2000, 13:05	0.76
C to E3	1.04382	815.0	01Jan2000, 13:00	0.93
C1	0.01670	22.7	01Jan2000, 12:45	0.99
C1 to C2	0.01670	22.1	01Jan2000, 12:45	0.99
C2	0.06274	79.6	01Jan2000, 12:45	0.99
C2 to C3	0.07944	98.2	01Jan2000, 12:55	0.98
C3	0.16979	71.3	01Jan2000, 13:20	0.68
C4	0.01564	9.6	01Jan2000, 13:00	0.68
C4 to C5	0.01564	9.4	01Jan2000, 13:05	0.69
C5	0.03515	21.3	01Jan2000, 13:00	0.68
C5 to C3	0.05079	29.4	01Jan2000, 13:05	0.69
D1	0.59389	540.9	01Jan2000, 13:00	0.99

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1 to D2	0.59389	537.5	01Jan2000, 13:00	0.99
D2	0.14991	156.1	01Jan2000, 12:55	0.99
D2 to C3	0.74380	671.7	01Jan2000, 13:00	0.99
E1	1.32193	456.4	01Jan2000, 14:00	0.99
E1 to E2	1.32193	456.3	01Jan2000, 14:00	0.99
E2	0.03210	38.3	01Jan2000, 12:50	0.99
E2 to E3	1.35403	456.8	01Jan2000, 14:05	0.99
E3	0.11796	63.8	01Jan2000, 13:05	0.68
E3 to E4	3.02244	1331.1	01Jan2000, 13:05	0.95
E4	0.07629	19.5	01Jan2000, 13:05	0.33
F to E3	0.14378	152.6	01Jan2000, 12:55	0.99
F1	0.06707	70.4	01Jan2000, 12:55	0.99
F1 to F2	0.06707	69.9	01Jan2000, 12:55	0.99
F2	0.07671	92.3	01Jan2000, 12:50	0.99
Gap Wash	3.02244	1353.9	01Jan2000, 13:00	0.96
G to E3	0.34168	255.8	01Jan2000, 13:05	0.99
G1	0.28835	232.1	01Jan2000, 13:05	0.99
G1 to G2	0.28835	231.6	01Jan2000, 13:05	0.99
G2	0.05333	71.5	01Jan2000, 12:45	0.99
H1	0.02117	22.7	01Jan2000, 12:50	0.99
J-A	0.21885	208.4	01Jan2000, 12:55	0.99
J-AY	0.36066	351.9	01Jan2000, 12:55	0.99
J-B	0.07701	96.5	01Jan2000, 12:45	0.99
J-B3	0.17304	148.6	01Jan2000, 12:50	0.82
J-CD	1.04382	821.0	01Jan2000, 13:00	0.92
J-C2	0.07944	101.7	01Jan2000, 12:45	0.99
J-C3	0.30002	153.6	01Jan2000, 13:00	0.76
J-C5	0.05079	29.6	01Jan2000, 13:00	0.68
J-D2	0.74380	672.3	01Jan2000, 13:00	0.99
J-E2	1.35403	457.9	01Jan2000, 14:00	0.99
J-E4	3.09873	1350.6	01Jan2000, 13:05	0.94

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J-F2	0.14378	154.2	01Jan2000, 12:50	0.99
J-G2	0.34168	256.5	01Jan2000, 13:05	0.99
J-Y	0.08344	82.6	01Jan2000, 12:55	0.99
X to Box	0.02243	27.5	01Jan2000, 12:50	0.99
X1	0.02243	28.2	01Jan2000, 12:45	0.99
X2	0.03258	42.3	01Jan2000, 12:45	0.99
Y1	0.06908	72.2	01Jan2000, 12:55	0.99
Y1 to Y2	0.06908	71.6	01Jan2000, 12:55	0.99
Y2	0.01436	19.4	01Jan2000, 12:45	0.99

Project: The Lakes Master Simulation Run: N Pre 100 24hr

Start of Run: 01Jan2000, 12:00
End of Run: 03Jan2000, 00:30
Compute Time: 30Aug2016, 13:54:31

Basin Model: Pre
Meteorologic Model: 100-24hr
Control Specifications: 24-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A to Box	0.36066	251.4	02Jan2000, 00:00	1.80
A1	0.14214	107.9	02Jan2000, 00:00	1.79
A1 to A2	0.14214	97.7	02Jan2000, 00:00	1.80
A2	0.07671	58.2	02Jan2000, 00:00	1.79
A3	0.05837	44.3	02Jan2000, 00:00	1.79
Box Canyon	0.58871	396.1	02Jan2000, 00:00	1.73
B to B3	0.07701	52.9	02Jan2000, 00:00	1.80
B1	0.01710	13.0	02Jan2000, 00:00	1.79
B1 to B2	0.01710	12.0	02Jan2000, 00:00	1.80
B2	0.05991	45.5	02Jan2000, 00:00	1.79
B3	0.07709	44.8	02Jan2000, 00:00	1.39
B4	0.01894	10.3	02Jan2000, 00:00	1.39
Culvert A	0.21885	155.7	02Jan2000, 00:00	1.80
Culvert B	0.17304	104.0	02Jan2000, 00:00	1.58
Culvert Y	0.08344	59.2	02Jan2000, 00:00	1.80
C to D	0.30002	124.8	02Jan2000, 00:30	1.51
C to E3	1.04382	637.6	02Jan2000, 00:00	1.71
C1	0.01670	12.7	02Jan2000, 00:00	1.79
C1 to C2	0.01670	11.8	02Jan2000, 00:00	1.80
C2	0.06274	47.6	02Jan2000, 00:00	1.79
C2 to C3	0.07944	44.4	02Jan2000, 00:00	1.80
C3	0.16979	68.0	02Jan2000, 00:30	1.39
C4	0.01564	9.1	02Jan2000, 00:00	1.39
C4 to C5	0.01564	7.2	02Jan2000, 00:00	1.40
C5	0.03515	20.4	02Jan2000, 00:00	1.39
C5 to C3	0.05079	26.2	02Jan2000, 00:00	1.40
D1	0.59389	451.0	02Jan2000, 00:00	1.79

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1 to D2	0.59389	428.0	02Jan2000, 00:00	1.80
D2	0.14991	113.8	02Jan2000, 00:00	1.79
D2 to C3	0.74380	539.6	02Jan2000, 00:00	1.79
E1	1.32193	466.2	02Jan2000, 01:00	1.79
E1 to E2	1.32193	462.8	02Jan2000, 01:00	1.79
E2	0.03210	24.4	02Jan2000, 00:00	1.79
E2 to E3	1.35403	455.8	02Jan2000, 01:00	1.79
E3	0.11796	60.9	02Jan2000, 00:00	1.39
E3 to E4	3.02244	1088.8	02Jan2000, 00:00	1.75
E4	0.07629	23.8	02Jan2000, 00:00	0.84
F to E3	0.14378	91.3	02Jan2000, 00:00	1.80
F1	0.06707	50.9	02Jan2000, 00:00	1.79
F1 to F2	0.06707	47.8	02Jan2000, 00:00	1.80
F2	0.07671	58.2	02Jan2000, 00:00	1.79
Gap Wash	3.02244	1182.9	02Jan2000, 00:00	1.75
G to E3	0.34168	220.4	02Jan2000, 00:00	1.79
G1	0.28835	192.0	02Jan2000, 00:00	1.79
G1 to G2	0.28835	188.3	02Jan2000, 00:00	1.79
G2	0.05333	40.5	02Jan2000, 00:00	1.79
H1	0.02117	16.1	02Jan2000, 00:00	1.79
J-A	0.21885	155.9	02Jan2000, 00:00	1.80
J-AY	0.36066	259.2	02Jan2000, 00:00	1.80
J-B	0.07701	57.5	02Jan2000, 00:00	1.79
J-B3	0.17304	108.1	02Jan2000, 00:00	1.57
J-CD	1.04382	649.6	02Jan2000, 00:00	1.71
J-C2	0.07944	59.5	02Jan2000, 00:00	1.79
J-C3	0.30002	125.6	02Jan2000, 00:00	1.50
J-C5	0.05079	27.7	02Jan2000, 00:00	1.39
J-D2	0.74380	541.8	02Jan2000, 00:00	1.79
J-E2	1.35403	467.8	02Jan2000, 01:00	1.79
J-E4	3.09873	1112.6	02Jan2000, 00:00	1.73

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J-F2	0.14378	106.0	02Jan2000, 00:00	1.79
J-G2	0.34168	228.8	02Jan2000, 00:00	1.79
J-Y	0.08344	61.5	02Jan2000, 00:00	1.79
X to Box	0.02243	16.0	02Jan2000, 00:00	1.79
X1	0.02243	17.0	02Jan2000, 00:00	1.79
X2	0.03258	24.7	02Jan2000, 00:00	1.79
Y1	0.06908	52.5	02Jan2000, 00:00	1.79
Y1 to Y2	0.06908	50.6	02Jan2000, 00:00	1.79
Y2	0.01436	10.9	02Jan2000, 00:00	1.79

Project: The Lakes Master Simulation Run: Post 10-3

Start of Run: 01Jan2000, 12:00 Basin Model: Post
End of Run: 01Jan2000, 20:00 Meteorologic Model: 10-3
Compute Time: 30Aug2016, 13:54:54 Control Specifications: 10-3

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A to Box	0.36066	132.3	01Jan2000, 13:00	0.40
A1	0.14214	59.6	01Jan2000, 12:55	0.45
A1 to A2	0.14214	59.4	01Jan2000, 13:00	0.45
A2	0.07671	22.3	01Jan2000, 13:00	0.32
A3	0.05837	21.3	01Jan2000, 12:55	0.36
Box Canyon	0.58871	199.4	01Jan2000, 13:00	0.37
B to B3	0.07701	35.9	01Jan2000, 12:50	0.41
B1	0.01710	10.5	01Jan2000, 12:45	0.45
B1 to B2	0.01710	9.9	01Jan2000, 12:50	0.45
B2	0.05991	28.5	01Jan2000, 12:50	0.40
B3	0.07709	18.0	01Jan2000, 12:55	0.25
B4	0.01894	3.1	01Jan2000, 13:05	0.22
Culvert A	0.21885	81.6	01Jan2000, 13:00	0.40
Culvert B	0.17304	54.4	01Jan2000, 12:55	0.32
Culvert Y	0.08344	33.9	01Jan2000, 12:55	0.42
C to D	0.30002	76.2	01Jan2000, 13:10	0.37
C to E3	1.04382	346.1	01Jan2000, 13:05	0.42
C1	0.01670	10.0	01Jan2000, 12:45	0.45
C1 to C2	0.01670	9.5	01Jan2000, 12:50	0.45
C2	0.06274	39.0	01Jan2000, 12:45	0.50
C2 to C3	0.07944	48.0	01Jan2000, 12:55	0.49
C3	0.16979	39.4	01Jan2000, 13:15	0.36
C4	0.01564	2.8	01Jan2000, 13:05	0.22
C4 to C5	0.01564	2.8	01Jan2000, 13:10	0.22
C5	0.03515	6.2	01Jan2000, 13:05	0.22
C5 to C3	0.05079	8.6	01Jan2000, 13:10	0.22
D to E3	0.74380	280.4	01Jan2000, 13:00	0.43

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1	0.59389	238.8	01Jan2000, 13:00	0.45
D1 to D2	0.59389	231.9	01Jan2000, 13:00	0.45
D2	0.14991	52.7	01Jan2000, 12:55	0.36
E1	1.32193	204.8	01Jan2000, 14:00	0.45
E1 to E2	1.32193	204.2	01Jan2000, 14:00	0.45
E2	0.03210	14.7	01Jan2000, 12:50	0.40
E2 to E3	1.35403	204.7	01Jan2000, 14:05	0.45
E3	0.11796	19.2	01Jan2000, 13:10	0.22
E3 to E4	3.02244	551.9	01Jan2000, 13:10	0.42
E4	0.07629	8.7	01Jan2000, 13:05	0.15
F to E3	0.14378	55.0	01Jan2000, 13:00	0.38
F1	0.06707	31.3	01Jan2000, 12:55	0.45
F1 to F2	0.06707	30.0	01Jan2000, 12:55	0.45
F2	0.07671	27.8	01Jan2000, 12:50	0.32
Gap Wash	3.09873	560.5	01Jan2000, 13:10	0.41
G to E3	0.34168	107.2	01Jan2000, 13:05	0.42
G1	0.28835	102.5	01Jan2000, 13:05	0.45
G1 to G2	0.28835	101.5	01Jan2000, 13:05	0.45
G2	0.05333	14.2	01Jan2000, 12:50	0.22
H1	0.02117	10.0	01Jan2000, 12:55	0.45
J-A	0.21885	81.7	01Jan2000, 13:00	0.40
J-AY	0.36066	133.7	01Jan2000, 13:00	0.40
J-B	0.07701	38.4	01Jan2000, 12:50	0.41
J-B3	0.17304	55.9	01Jan2000, 12:55	0.32
J-CD	1.04382	346.3	01Jan2000, 13:05	0.42
J-C2	0.07944	48.1	01Jan2000, 12:50	0.49
J-C3	0.30002	77.0	01Jan2000, 13:00	0.37
J-C5	0.05079	8.6	01Jan2000, 13:10	0.22
J-D2	0.74380	281.4	01Jan2000, 13:00	0.43
J-E2	1.35403	205.1	01Jan2000, 14:00	0.45
J-E3	3.02244	561.0	01Jan2000, 13:05	0.42

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J-F2	0.14378	55.5	01Jan2000, 12:55	0.38
J-G2	0.34168	109.4	01Jan2000, 13:05	0.42
J-Y	0.08344	35.1	01Jan2000, 12:55	0.42
X to Box	0.02243	12.0	01Jan2000, 12:50	0.45
X1	0.02243	12.3	01Jan2000, 12:50	0.45
X2	0.03258	10.5	01Jan2000, 12:50	0.28
Y1	0.06908	31.9	01Jan2000, 12:55	0.45
Y1 to Y2	0.06908	31.1	01Jan2000, 12:55	0.45
Y2	0.01436	5.0	01Jan2000, 12:50	0.28

Project: The Lakes Master Simulation Run: Post 10-24

Start of Run: 01Jan2000, 12:00 Basin Model: Post
End of Run: 02Jan2000, 12:00 Meteorologic Model: 10-24hr
Compute Time: 30Aug2016, 13:54:45 Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A to Box	0.36066	129.3	02Jan2000, 00:00	0.95
A1	0.14214	61.6	02Jan2000, 00:00	1.02
A1 to A2	0.14214	54.7	02Jan2000, 00:00	1.02
A2	0.07671	26.1	02Jan2000, 00:00	0.82
A3	0.05837	21.6	02Jan2000, 00:00	0.88
Box Canyon	0.58871	200.2	02Jan2000, 00:00	0.90
B to B3	0.07701	27.8	02Jan2000, 00:00	0.97
B1	0.01710	7.4	02Jan2000, 00:00	1.02
B1 to B2	0.01710	6.7	02Jan2000, 00:00	1.02
B2	0.05991	24.0	02Jan2000, 00:00	0.95
B3	0.07709	22.0	02Jan2000, 00:00	0.71
B4	0.01894	4.5	02Jan2000, 00:00	0.65
Culvert A	0.21885	80.7	02Jan2000, 00:00	0.95
Culvert B	0.17304	51.8	02Jan2000, 00:00	0.82
Culvert Y	0.08344	31.9	02Jan2000, 00:00	0.98
C to D	0.30002	75.9	02Jan2000, 00:30	0.90
C to E3	1.04382	350.7	02Jan2000, 00:00	0.96
C1	0.01670	7.2	02Jan2000, 00:00	1.02
C1 to C2	0.01670	6.7	02Jan2000, 00:00	1.02
C2	0.06274	29.3	02Jan2000, 00:00	1.09
C2 to C3	0.07944	25.4	02Jan2000, 00:00	1.08
C3	0.16979	42.8	02Jan2000, 00:30	0.88
C4	0.01564	4.1	02Jan2000, 00:00	0.66
C4 to C5	0.01564	3.0	02Jan2000, 00:00	0.66
C5	0.03515	9.0	02Jan2000, 00:00	0.66
C5 to C3	0.05079	11.2	02Jan2000, 00:00	0.66
D to E3	0.74380	295.9	02Jan2000, 00:00	0.99

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1	0.59389	257.3	02Jan2000, 00:00	1.02
D1 to D2	0.59389	241.9	02Jan2000, 00:00	1.02
D2	0.14991	55.4	02Jan2000, 00:00	0.88
E1	1.32193	266.6	02Jan2000, 01:00	1.00
E1 to E2	1.32193	264.1	02Jan2000, 01:00	1.00
E2	0.03210	12.9	02Jan2000, 00:00	0.95
E2 to E3	1.35403	258.3	02Jan2000, 01:00	1.00
E3	0.11796	27.0	02Jan2000, 00:00	0.65
E3 to E4	3.02244	590.6	02Jan2000, 00:30	0.97
E4	0.07629	14.5	02Jan2000, 00:00	0.52
F to E3	0.14378	44.0	02Jan2000, 00:00	0.92
F1	0.06707	29.1	02Jan2000, 00:00	1.02
F1 to F2	0.06707	26.9	02Jan2000, 00:00	1.02
F2	0.07671	26.1	02Jan2000, 00:00	0.82
Gap Wash	3.09873	599.6	02Jan2000, 00:30	0.95
G to E3	0.34168	115.3	02Jan2000, 00:00	0.96
G1	0.28835	109.3	02Jan2000, 00:00	1.01
G1 to G2	0.28835	106.8	02Jan2000, 00:00	1.02
G2	0.05333	13.8	02Jan2000, 00:00	0.66
H1	0.02117	9.2	02Jan2000, 00:00	1.02
J-A	0.21885	80.8	02Jan2000, 00:00	0.95
J-AY	0.36066	134.2	02Jan2000, 00:00	0.94
J-B	0.07701	30.7	02Jan2000, 00:00	0.96
J-B3	0.17304	54.3	02Jan2000, 00:00	0.82
J-CD	1.04382	358.5	02Jan2000, 00:00	0.96
J-C2	0.07944	36.0	02Jan2000, 00:00	1.08
J-C3	0.30002	76.1	02Jan2000, 00:00	0.89
J-C5	0.05079	12.0	02Jan2000, 00:00	0.66
J-D2	0.74380	297.4	02Jan2000, 00:00	0.99
J-E2	1.35403	267.0	02Jan2000, 01:00	1.00
J-E3	3.02244	625.5	02Jan2000, 00:00	0.96

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J-F2	0.14378	53.0	02Jan2000, 00:00	0.91
J-G2	0.34168	120.6	02Jan2000, 00:00	0.96
J-Y	0.08344	33.4	02Jan2000, 00:00	0.97
X to Box	0.02243	9.0	02Jan2000, 00:00	1.02
X1	0.02243	9.7	02Jan2000, 00:00	1.02
X2	0.03258	10.2	02Jan2000, 00:00	0.76
Y1	0.06908	29.9	02Jan2000, 00:00	1.02
Y1 to Y2	0.06908	28.9	02Jan2000, 00:00	1.02
Y2	0.01436	4.5	02Jan2000, 00:00	0.76

Project: The Lakes Master Simulation Run: Post 100-3

Start of Run:	01Jan2000, 12:00	Basin Model:	Post
End of Run:	01Jan2000, 18:30	Meteorologic Model:	100-3
Compute Time:	30Aug2016, 13:55:09	Control Specifications:	100-3

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A to Box	0.36066	311.8	01Jan2000, 13:00	0.92
A1	0.14214	139.2	01Jan2000, 12:55	0.99
A1 to A2	0.14214	135.5	01Jan2000, 13:00	0.99
A2	0.07671	60.1	01Jan2000, 12:55	0.79
A3	0.05837	52.7	01Jan2000, 12:55	0.86
Box Canyon	0.58871	498.1	01Jan2000, 12:55	0.87
B to B3	0.07701	88.1	01Jan2000, 12:50	0.93
B1	0.01710	23.5	01Jan2000, 12:40	0.99
B1 to B2	0.01710	23.4	01Jan2000, 12:45	0.99
B2	0.05991	67.0	01Jan2000, 12:50	0.92
B3	0.07709	53.8	01Jan2000, 12:55	0.68
B4	0.01894	9.6	01Jan2000, 13:05	0.63
Culvert A	0.21885	191.9	01Jan2000, 13:00	0.92
Culvert B	0.17304	139.9	01Jan2000, 12:55	0.79
Culvert Y	0.08344	80.7	01Jan2000, 12:55	0.95
C to D	0.30002	182.0	01Jan2000, 13:05	0.87
C to E3	1.04382	820.9	01Jan2000, 13:00	0.94
C1	0.01670	22.7	01Jan2000, 12:45	0.99
C1 to C2	0.01670	22.1	01Jan2000, 12:45	0.99
C2	0.06274	88.4	01Jan2000, 12:45	1.06
C2 to C3	0.07944	104.5	01Jan2000, 12:55	1.04
C3	0.16979	97.0	01Jan2000, 13:15	0.86
C4	0.01564	8.7	01Jan2000, 13:00	0.63
C4 to C5	0.01564	8.4	01Jan2000, 13:05	0.63
C5	0.03515	19.1	01Jan2000, 13:00	0.63
C5 to C3	0.05079	26.6	01Jan2000, 13:05	0.63
D to E3	0.74380	654.3	01Jan2000, 13:00	0.96

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1	0.59389	540.9	01Jan2000, 13:00	0.99
D1 to D2	0.59389	537.5	01Jan2000, 13:00	0.99
D2	0.14991	132.9	01Jan2000, 12:55	0.86
E1	1.32193	456.4	01Jan2000, 14:00	0.99
E1 to E2	1.32193	456.3	01Jan2000, 14:00	0.99
E2	0.03210	35.4	01Jan2000, 12:50	0.92
E2 to E3	1.35403	456.7	01Jan2000, 14:05	0.99
E3	0.11796	58.6	01Jan2000, 13:05	0.63
E3 to E4	3.02244	1317.2	01Jan2000, 13:05	0.94
E4	0.07629	31.7	01Jan2000, 13:00	0.50
F to E3	0.14378	134.7	01Jan2000, 12:55	0.89
F1	0.06707	70.4	01Jan2000, 12:55	0.99
F1 to F2	0.06707	69.9	01Jan2000, 12:55	0.99
F2	0.07671	73.2	01Jan2000, 12:50	0.79
Gap Wash	3.09873	1348.4	01Jan2000, 13:05	0.93
G to E3	0.34168	249.4	01Jan2000, 13:05	0.94
G1	0.28835	232.1	01Jan2000, 13:05	0.99
G1 to G2	0.28835	231.6	01Jan2000, 13:05	0.99
G2	0.05333	41.6	01Jan2000, 12:50	0.63
H1	0.02117	22.7	01Jan2000, 12:50	0.99
J-A	0.21885	191.9	01Jan2000, 13:00	0.92
J-AY	0.36066	321.4	01Jan2000, 12:55	0.92
J-B	0.07701	88.1	01Jan2000, 12:45	0.94
J-B3	0.17304	140.3	01Jan2000, 12:50	0.79
J-CD	1.04382	828.6	01Jan2000, 13:00	0.94
J-C2	0.07944	110.5	01Jan2000, 12:45	1.05
J-C3	0.30002	182.6	01Jan2000, 13:00	0.87
J-C5	0.05079	26.8	01Jan2000, 13:05	0.63
J-D2	0.74380	655.1	01Jan2000, 13:00	0.96
J-E2	1.35403	457.8	01Jan2000, 14:00	0.99
J-E3	3.02244	1331.5	01Jan2000, 13:00	0.95

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J-F2	0.14378	135.0	01Jan2000, 12:50	0.89
J-G2	0.34168	250.6	01Jan2000, 13:05	0.93
J-Y	0.08344	81.3	01Jan2000, 12:55	0.95
X to Box	0.02243	27.5	01Jan2000, 12:50	0.99
X1	0.02243	28.2	01Jan2000, 12:45	0.99
X2	0.03258	29.0	01Jan2000, 12:50	0.74
Y1	0.06908	72.2	01Jan2000, 12:55	0.99
Y1 to Y2	0.06908	71.7	01Jan2000, 12:55	0.99
Y2	0.01436	13.3	01Jan2000, 12:45	0.74

Project: The Lakes Master Simulation Run: Post 100-24

Start of Run: 01Jan2000, 12:00
End of Run: 03Jan2000, 00:30
Compute Time: 30Aug2016, 13:55:01

Basin Model: Post
Meteorologic Model: 100-24hr
Control Specifications: 24-Hour

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A to Box	0.36066	237.5	02Jan2000, 00:00	1.70
A1	0.14214	107.9	02Jan2000, 00:00	1.79
A1 to A2	0.14214	97.7	02Jan2000, 00:00	1.80
A2	0.07671	50.0	02Jan2000, 00:00	1.54
A3	0.05837	40.1	02Jan2000, 00:00	1.62
Box Canyon	0.58871	374.8	02Jan2000, 00:00	1.65
B to B3	0.07701	50.9	02Jan2000, 00:00	1.73
B1	0.01710	13.0	02Jan2000, 00:00	1.79
B1 to B2	0.01710	12.0	02Jan2000, 00:00	1.80
B2	0.05991	43.3	02Jan2000, 00:00	1.70
B3	0.07709	44.8	02Jan2000, 00:00	1.39
B4	0.01894	9.5	02Jan2000, 00:00	1.32
Culvert A	0.21885	147.5	02Jan2000, 00:00	1.71
Culvert B	0.17304	101.2	02Jan2000, 00:00	1.54
Culvert Y	0.08344	57.5	02Jan2000, 00:00	1.74
C to D	0.30002	136.8	02Jan2000, 00:30	1.65
C to E3	1.04382	640.6	02Jan2000, 00:00	1.73
C1	0.01670	12.7	02Jan2000, 00:00	1.79
C1 to C2	0.01670	11.8	02Jan2000, 00:00	1.80
C2	0.06274	49.9	02Jan2000, 00:00	1.88
C2 to C3	0.07944	46.4	02Jan2000, 00:00	1.88
C3	0.16979	78.0	02Jan2000, 00:30	1.62
C4	0.01564	8.6	02Jan2000, 00:00	1.32
C4 to C5	0.01564	6.8	02Jan2000, 00:00	1.33
C5	0.03515	19.0	02Jan2000, 00:00	1.32
C5 to C3	0.05079	24.4	02Jan2000, 00:00	1.33
D to E3	0.74380	528.7	02Jan2000, 00:00	1.76

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1	0.59389	451.0	02Jan2000, 00:00	1.79
D1 to D2	0.59389	428.0	02Jan2000, 00:00	1.80
D2	0.14991	103.0	02Jan2000, 00:00	1.62
E1	1.32193	466.2	02Jan2000, 01:00	1.79
E1 to E2	1.32193	462.8	02Jan2000, 01:00	1.79
E2	0.03210	23.2	02Jan2000, 00:00	1.70
E2 to E3	1.35403	455.6	02Jan2000, 01:00	1.79
E3	0.11796	57.3	02Jan2000, 00:00	1.32
E3 to E4	3.02244	1069.7	02Jan2000, 00:00	1.74
E4	0.07629	34.5	02Jan2000, 00:00	1.12
F to E3	0.14378	83.8	02Jan2000, 00:00	1.67
F1	0.06707	50.9	02Jan2000, 00:00	1.79
F1 to F2	0.06707	47.8	02Jan2000, 00:00	1.80
F2	0.07671	50.0	02Jan2000, 00:00	1.54
Gap Wash	3.09873	1104.2	02Jan2000, 00:00	1.73
G to E3	0.34168	209.4	02Jan2000, 00:00	1.72
G1	0.28835	192.0	02Jan2000, 00:00	1.79
G1 to G2	0.28835	188.3	02Jan2000, 00:00	1.79
G2	0.05333	29.2	02Jan2000, 00:00	1.32
H1	0.02117	16.1	02Jan2000, 00:00	1.79
J-A	0.21885	147.6	02Jan2000, 00:00	1.71
J-AY	0.36066	245.0	02Jan2000, 00:00	1.70
J-B	0.07701	55.3	02Jan2000, 00:00	1.72
J-B3	0.17304	105.2	02Jan2000, 00:00	1.53
J-CD	1.04382	652.6	02Jan2000, 00:00	1.73
J-C2	0.07944	61.8	02Jan2000, 00:00	1.86
J-C3	0.30002	145.1	02Jan2000, 00:00	1.64
J-C5	0.05079	25.8	02Jan2000, 00:00	1.32
J-D2	0.74380	530.9	02Jan2000, 00:00	1.76
J-E2	1.35403	467.6	02Jan2000, 01:00	1.79
J-E3	3.02244	1162.8	02Jan2000, 00:00	1.74

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J-F2	0.14378	97.7	02Jan2000, 00:00	1.66
J-G2	0.34168	217.5	02Jan2000, 00:00	1.72
J-Y	0.08344	59.8	02Jan2000, 00:00	1.74
X to Box	0.02243	16.0	02Jan2000, 00:00	1.79
X1	0.02243	17.0	02Jan2000, 00:00	1.79
X2	0.03258	20.1	02Jan2000, 00:00	1.46
Y1	0.06908	52.5	02Jan2000, 00:00	1.79
Y1 to Y2	0.06908	51.0	02Jan2000, 00:00	1.79
Y2	0.01436	8.8	02Jan2000, 00:00	1.46

Worksheet for Culvert 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	36	in
Discharge	80.70	ft³/s

Results

Normal Depth	2.29	ft
Flow Area	5.79	ft²
Wetted Perimeter	6.38	ft
Hydraulic Radius	0.91	ft
Top Width	2.55	ft
Critical Depth	2.78	ft
Percent Full	76.4	%
Critical Slope	0.00750	ft/ft
Velocity	13.93	ft/s
Velocity Head	3.02	ft
Specific Energy	5.31	ft
Froude Number	1.63	
Maximum Discharge	93.27	ft³/s
Discharge Full	86.70	ft³/s
Slope Full	0.00866	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	76.36	%
Downstream Velocity	Infinity	ft/s

Worksheet for Culvert 1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.29	ft
Critical Depth	2.78	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00750	ft/ft

Worksheet for Culvert 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	48	in
Discharge	191.90	ft³/s

Results

Normal Depth	3.39	ft
Flow Area	11.35	ft²
Wetted Perimeter	9.35	ft
Hydraulic Radius	1.21	ft
Top Width	2.88	ft
Critical Depth	3.82	ft
Percent Full	84.7	%
Critical Slope	0.00917	ft/ft
Velocity	16.91	ft/s
Velocity Head	4.44	ft
Specific Energy	7.83	ft
Froude Number	1.50	
Maximum Discharge	200.86	ft³/s
Discharge Full	186.73	ft³/s
Slope Full	0.01056	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	84.70	%
Downstream Velocity	Infinity	ft/s

Worksheet for Culvert 2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	3.39	ft
Critical Depth	3.82	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00917	ft/ft

Worksheet for Culvert 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	36	in
Discharge	88.10	ft³/s

Results

Normal Depth	2.50	ft
Flow Area	6.31	ft²
Wetted Perimeter	6.91	ft
Hydraulic Radius	0.91	ft
Top Width	2.23	ft
Critical Depth	2.83	ft
Percent Full	83.5	%
Critical Slope	0.00893	ft/ft
Velocity	13.97	ft/s
Velocity Head	3.03	ft
Specific Energy	5.54	ft
Froude Number	1.46	
Maximum Discharge	93.27	ft³/s
Discharge Full	86.70	ft³/s
Slope Full	0.01032	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	83.50	%
Downstream Velocity	Infinity	ft/s

Worksheet for Culvert 3

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.50	ft
Critical Depth	2.83	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00893	ft/ft

Worksheet for Culvert 4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	42	in
Discharge	139.90	ft³/s

Results

Normal Depth	3.18	ft
Flow Area	9.18	ft²
Wetted Perimeter	8.85	ft
Hydraulic Radius	1.04	ft
Top Width	2.01	ft
Critical Depth	3.35	ft
Percent Full	90.9	%
Critical Slope	0.00995	ft/ft
Velocity	15.23	ft/s
Velocity Head	3.61	ft
Specific Energy	6.79	ft
Froude Number	1.26	
Maximum Discharge	140.69	ft³/s
Discharge Full	130.79	ft³/s
Slope Full	0.01144	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	90.89	%
Downstream Velocity	Infinity	ft/s

Worksheet for Culvert 4

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	3.18	ft
Critical Depth	3.35	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00995	ft/ft

Worksheet for Culvert 5

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	42	in
Discharge	104.50	ft³/s

Results

Normal Depth	2.37	ft
Flow Area	6.92	ft²
Wetted Perimeter	6.76	ft
Hydraulic Radius	1.02	ft
Top Width	3.28	ft
Critical Depth	3.12	ft
Percent Full	67.6	%
Critical Slope	0.00567	ft/ft
Velocity	15.10	ft/s
Velocity Head	3.54	ft
Specific Energy	5.91	ft
Froude Number	1.83	
Maximum Discharge	140.69	ft³/s
Discharge Full	130.79	ft³/s
Slope Full	0.00638	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	67.60	%
Downstream Velocity	Infinity	ft/s

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.37	ft
Critical Depth	3.12	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00567	ft/ft

Worksheet for Culvert 6

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	84	in
Discharge	654.30	ft³/s

Results

Normal Depth	4.68	ft
Flow Area	27.37	ft²
Wetted Perimeter	13.41	ft
Hydraulic Radius	2.04	ft
Top Width	6.59	ft
Critical Depth	6.43	ft
Percent Full	66.9	%
Critical Slope	0.00539	ft/ft
Velocity	23.91	ft/s
Velocity Head	8.88	ft
Specific Energy	13.57	ft
Froude Number	2.07	
Maximum Discharge	893.31	ft³/s
Discharge Full	830.44	ft³/s
Slope Full	0.00621	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	66.91	%
Downstream Velocity	Infinity	ft/s

Worksheet for Culvert 6

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	4.68	ft
Critical Depth	6.43	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00539	ft/ft

Worksheet for Culvert 7

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	84	in
Discharge	810.00	ft³/s

Results

Normal Depth	5.59	ft
Flow Area	32.94	ft²
Wetted Perimeter	15.47	ft
Hydraulic Radius	2.13	ft
Top Width	5.62	ft
Critical Depth	6.73	ft
Percent Full	79.8	%
Critical Slope	0.00830	ft/ft
Velocity	24.59	ft/s
Velocity Head	9.40	ft
Specific Energy	14.99	ft
Froude Number	1.79	
Maximum Discharge	893.31	ft³/s
Discharge Full	830.44	ft³/s
Slope Full	0.00951	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	79.83	%
Downstream Velocity	Infinity	ft/s

Worksheet for Culvert 7

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	5.59	ft
Critical Depth	6.73	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00830	ft/ft

Worksheet for Culvert 8

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	72	in
Discharge	456.70	ft³/s

Results

Normal Depth	4.17	ft
Flow Area	20.98	ft²
Wetted Perimeter	11.83	ft
Hydraulic Radius	1.77	ft
Top Width	5.52	ft
Critical Depth	5.55	ft
Percent Full	69.5	%
Critical Slope	0.00596	ft/ft
Velocity	21.77	ft/s
Velocity Head	7.37	ft
Specific Energy	11.54	ft
Froude Number	1.97	
Maximum Discharge	592.21	ft³/s
Discharge Full	550.53	ft³/s
Slope Full	0.00688	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	69.51	%
Downstream Velocity	Infinity	ft/s

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	4.17	ft
Critical Depth	5.55	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00596	ft/ft

Worksheet for Culvert 9

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	42	in
Discharge	134.70	ft³/s

Results

Normal Depth	2.97	ft
Flow Area	8.71	ft²
Wetted Perimeter	8.21	ft
Hydraulic Radius	1.06	ft
Top Width	2.50	ft
Critical Depth	3.33	ft
Percent Full	84.9	%
Critical Slope	0.00919	ft/ft
Velocity	15.46	ft/s
Velocity Head	3.72	ft
Specific Energy	6.69	ft
Froude Number	1.46	
Maximum Discharge	140.69	ft³/s
Discharge Full	130.79	ft³/s
Slope Full	0.01061	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	84.95	%
Downstream Velocity	Infinity	ft/s

Worksheet for Culvert 9

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.97	ft
Critical Depth	3.33	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00919	ft/ft

Worksheet for Culvert 10

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	60	in
Discharge	249.40	ft³/s

Results

Normal Depth	3.19	ft
Flow Area	13.23	ft²
Wetted Perimeter	9.25	ft
Hydraulic Radius	1.43	ft
Top Width	4.81	ft
Critical Depth	4.42	ft
Percent Full	63.8	%
Critical Slope	0.00486	ft/ft
Velocity	18.85	ft/s
Velocity Head	5.52	ft
Specific Energy	8.72	ft
Froude Number	2.00	
Maximum Discharge	364.19	ft³/s
Discharge Full	338.56	ft³/s
Slope Full	0.00543	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	63.82	%
Downstream Velocity	Infinity	ft/s

Worksheet for Culvert 10

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	3.19	ft
Critical Depth	4.42	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00486	ft/ft

Exhibit D

Executive Geotechnical Summary

July 5, 2005 1286-04-ZC

City of St. George
175 East 200 North
St. George, Utah 84790

Attn: Hillside Review Committee

Subject: Executive Summary
Geotechnical Site Evaluation
Lakes At St. George Development

Gentlemen:

Introduction

The purpose of this letter is to provide a summary of the general geologic and soil conditions at the subject site, and general geotechnical requirements for development. The project site (previously known as the Plantations Development site), is approximately 730 acres in area and is located within and along a relatively small valley west of the Green Valley and Sunbrook developments in St. George, Utah. Development of the site will be in phases and will consist of a 9-hole golf course, three to four lakes, and residential construction.

Previous geotechnical investigations conducted on the project site were referenced for this summary. The following geotechnical reports were reviewed.

2001 Geotechnical Investigation
Plantations at St. George, Phase 1
Residential Pods 12A, 12B & 15
Rosenberg Associates Project No. 95-1198-01

1995 Geotechnical Investigation
The Plantations, Phase 1
Black, Miller & Associates Project No. 95-1198-01

1992 Preliminary Geotechnical Site Assessment
730-Acre Plantations Project
Kleinfelder Project No. 31-800570

General Geologic Conditions

The majority of the site consists of a northwest trending valley flanked by a broad, shallow dip slope to the west and a plateau to the east. The southern-most portion of the site occupies a smaller, east-west trending valley separated from the remaining portion of the site by a south trending spur. The northern third of the site drains to the northeast through a series of subparallel tributary washes that join and exit the site in the northeast corner. The southern two-thirds of the site drains to the southwest from the west through a major tributary wash which enters the site through a feature known as "The Gap". The main wash flows to the south and then to the east, meandering back and forth across the southern site boundary.

Geologic deposits ranging in age from Triassic to Recent are found at the site (see Drawing No. 1 enclosed at the end of this letter). Bedrock consists chiefly of the Triassic Chinle Formation. The lower Shinarump Member consisting of sandstones and conglomerates outcrops extensively on the western portion of the site. The upper Petrified Forest Member (locally known as "Blue Clay"), underlies most of the central alluvial basin deposits and which outcrops on the eastern side of the site. Quaternary deposits consisting of Older gravels, Recent alluvial deposits, and possible landslide deposits are also present on the site as shown on Drawing No. 1 (Christenson and Deen, 1983).

General Subsurface Soil Conditions

For the purpose of this letter, we have separated the subject site into the four (4) general areas based on soil type (see Drawing No. 1). The subsurface conditions encountered on the western portion of the site (see orange colored area on Drawing No. 1), generally consisted of ½ to 1½ feet of loose, surficial silty sand or soft sandy clay soils overlying moderately hard to hard sandstone bedrock. Although generally jointed and fractured, the sandstones have a high shear strength, are relatively incompressible, and provide favorable foundation support characteristics.

The subsurface conditions at the base of the western slopes in the central and along the low ridges of the eastern portion of the site generally consist of varying thicknesses of alluvial soils (soft to stiff clayey soils, or loose to medium dense gravelly soils) overlying red-brown and green-gray highly plastic clays and mudstone bedrock associated with the Petrified Forest Member of the Chinle Formation (see the purple areas on Drawing No. 1). The Petrified Forest Member, or clay soils derived from erosion of this unit, generally have a high to critical swell potential with changes in moisture content, are of relatively low strength, and experience considerable reductions in strength when exposed to moisture.

In the northern portion of the site (see gray colored area on Drawing No. 1), the subsurface conditions generally consist predominantly of green-gray shales. The red-brown and purple mudstones, locally known as "Blue Clay" were not encountered within this area.. Clayey soils derived from the green-gray shales generally have low to moderate swell potentials.

On the plateau area to the east, the subsurface conditions are expected to consist of slightly to very well indurated (naturally cemented) sands, gravels, and cobbles associated with an Older Quaternary gravel formation. The sand and gravel deposits (see the green area on Drawing No. 2) generally provide favorable subgrade characteristics.

Groundwater was encountered during the 1992 preliminary assessment performed by Kleinfelder in the southeastern portion of the property at depths of about 4 to 12½ feet below the existing ground surface.

General Geotechnical Requirements

Based on the subsurface conditions encountered during at the site, and our experience with similar soil conditions, it is our opinion (from a geotechnical view point) that with proper preparation and design the subject site can be utilized for the proposed developments.

In the northern and western portions of the site (see orange and gray colored areas on Drawing No. 1), site grading will generally consist of reworking the existing surficial soils. The proposed structures should receive adequate support from conventional spread footings founded on competent undisturbed medium dense to dense native soils, on properly placed and compacted structural fill, or entirely on undisturbed non-expansive bedrock. The main geotechnical constraint within this area is the presence of moderately hard to hard bedrock. Rock excavating techniques should be anticipated where these materials are encountered during site grading and utility trench excavation. Steel reinforcing is recommended for footings and floor slabs constructed within the gray area due to the localized presence of low to moderately expansive soils.

Where the Petrified Forest Member of the Chinle Formation is present (see purple colored areas on Drawing No. 1), the most significant constraints to the development are related to the overall instability and generally poor foundation support characteristics this formation. Where this formation is present within slopes, the integrity of the slopes can be impaired by grading activities as well as loading and the introduction of water. Special grading and foundation considerations will be required where the Petrified Forest Member will be present within 15 feet of the planned rough pad elevations. We recommend that the structures be supported by a deep foundation systems with grade beams to support wall loads, and a raised structural floor system. Where conventional foundation systems are desired within expansive clay areas, any expansive clay soils or bedrock located within 15 feet of the final building pad elevations would require overexcavation and replacement with approved structural fill materials. Within exterior flatwork and street improvement areas, expansive native materials present within 3 feet of the planned subgrade elevation should be overexcavated and replaced with structural fill.

Older Quaternary gravels at the site (see green colored areas in the southeast portion of the site) occur primarily as a cap overlying the Petrified Forest Member in the plateau areas to the east. These materials consist of slightly to very well cemented sands, gravels, and cobbles. The sand and gravel deposits are generally anticipated to provide favorable foundation support characteristics. However, in the vicinity of slopes, overall stability anticipated to be a consideration for portions of the development within this area due to the underlying presence of the Petrified Forest Member.

Closure

It is our pleasure to be of continued service on this project. If you have any questions concerning the information contained in this letter, please contact us at your convenience.

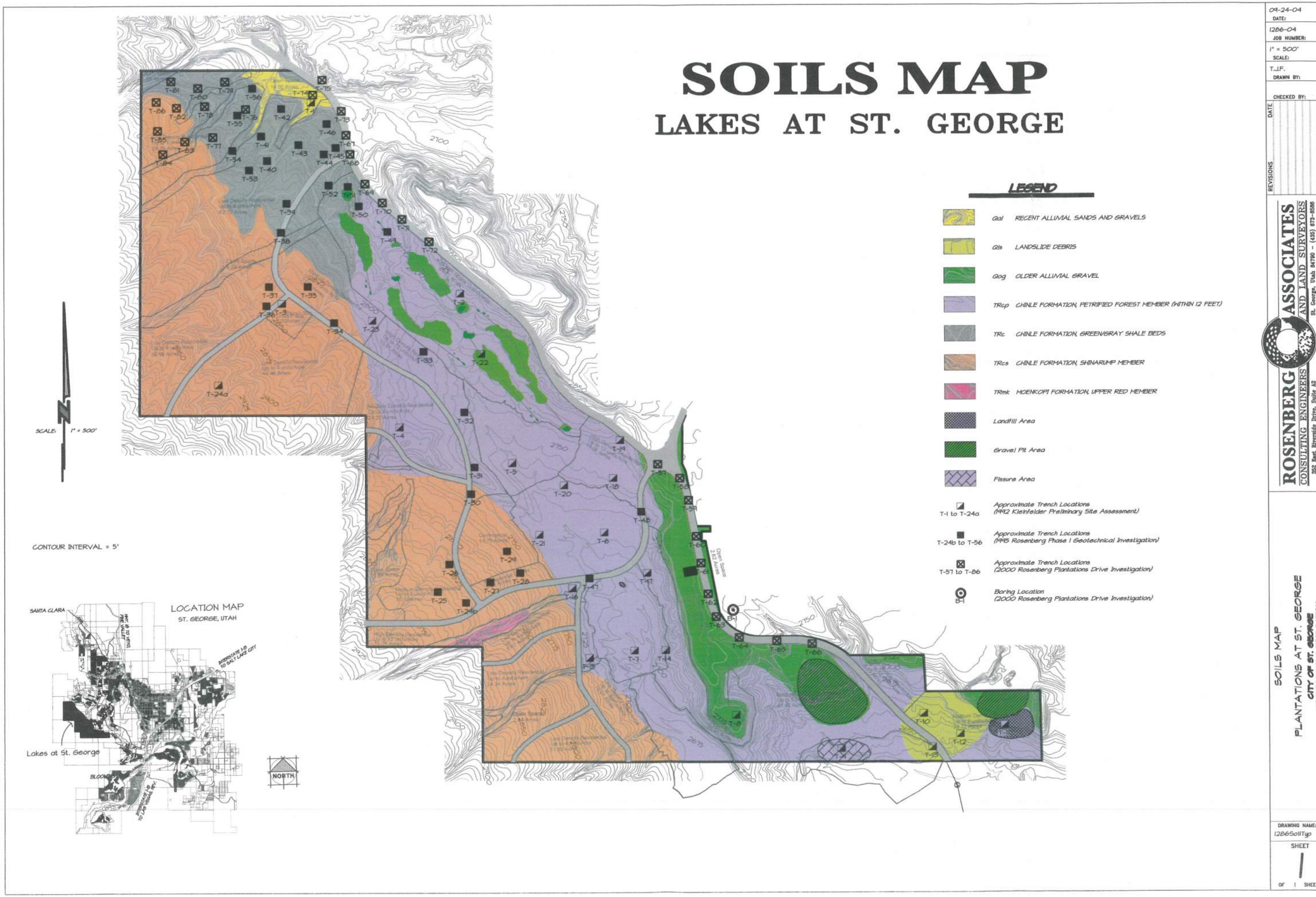
Sincerely,

ROSENBERG ASSOCIATES

REGISTERED PROFESSIONAL ENGINEER
No. 186897
DAVID R. BLACK
7/5/05
STATE OF UTAH

David R. Black, P.E.
Geotechnical Division Manager

DRB/RTR/05R-137.G


SOILS MAP
LAKES AT ST. GEORGE
LEGEND
Qal RECENT ALLUVIAL SANDS AND GRAVELS
Qls LANDSLIDE DEBRIS
Qog OLDER ALLUVIAL GRAVEL
TRcp CHINLE FORMATION, PETRIFIED FOREST MEMBER (WITHIN 12 FEET)
TRc CHINLE FORMATION, GREEN/GRAY SHALE BEDS
TRcs CHINLE FORMATION, SHINARUMP MEMBER
TRmk MOENKOPI FORMATION, UPPER RED MEMBER
Landfill Area
Gravel Pit Area
Fissure Area
T-1 to T-24a Approximate Trench Locations (1992 Kleinfelder Preliminary Site Assessment)
T-24b to T-56 Approximate Trench Locations (1995 Rosenberg Phase 1 Geotechnical Investigation)
T-57 to T-86 Approximate Trench Locations (2000 Rosenberg Plantations Drive Investigation)
B-1 Boring Location (2000 Rosenberg Plantations Drive Investigation)
SCALE: 1" = 500'
CONTOUR INTERVAL = 5'
LOCATION MAP
ST. GEORGE, UTAH
SANTA CLARA
Lakes at St. George
NORTH
09-24-04
DATE:
1286-04
JOB NUMBER:
1" = 500'
SCALE:
T.J.F.
DRAWN BY:
CHECKED BY:
DATE
REVISIONS
ROSENBERG ASSOCIATES
CONSULTING ENGINEERS AND LAND SURVEYORS
352 East Riverside Drive, Suite A2
St. George, Utah 84790 - (435) 673-8586
SOILS MAP
PLANTATIONS AT ST. GEORGE
CITY OF ST. GEORGE
WASHINGTON COUNTY, UTAH
DRAWING NAME:
1286SoilTyp
SHEET
1
OF 1 SHEETS

NOTICE OF MEETING
HILLSIDE REVIEW BOARD
CITY OF ST. GEORGE
WASHINGTON COUNTY, UTAH

Public Notice

Notice is hereby given that the Hillside Review Board of the City of St. George, Washington County, Utah, will hold meetings at the referenced site on **Wednesday, May 25, 2022,** commencing on-site at approximately **8:30 a.m.**

PRESENT:
James Sullivan
Dave Black
James Dotson
Russ Owens

EXCUSED:
Jeff Mathis

CITY STAFF:
Assistant Public Works Director, Wes Jenkins
Planner III, Dan Boles
Planner III, Carol Davidson
Development Office Supervisor, Brenda Hatch

James Sullivan called the meeting to order.

1. Consider the continuation of a request for a hillside development permit at the Commerce Point Development. The applicant is proposing to construct in the area shown on the slope map labeled 20-30%, 30-40% and 40% and above. The property is located at Southeast quadrant of the intersection of Auto Mall Drive and Blackridge Drive. The property is currently zoned Highway Commercial (C-2). The applicant is Commerce Point, LC. Case No. 2022-HS-005.

   Austin Atkin – Some of the main questions from last time were in regard to the landscape and what it was going to look like. The idea is that this slope up here it's going to be obviously xeriscape landscaping, we are talking about not even putting any kind of drip line or anything on this hillside. The idea is that we will just create something aesthetically pleasing. It's mostly going to be behind the buildings.

   James Dotson – Does that take precedence over ordinance? For landscaping along roadway and frontage?

   Chris Volksen – Stability wise we don't want to put water on this at all, just because of the materials that are under here. As a geotechnical engineer, I'm not going to recommend water on there.

Carol Davidson - With the hotel that is going in over here across the street, during their zone change amendment we did ask for provisions, so they didn't have to do the street trees and stuff.

Wes Jenkins – Didn't we add that language from the hillside to the Planning Commission?

Carol Davidson – Yes.

Dave Black – So we could put it in the motion, no landscape water on the slopes.

Carol Davidson – They are still putting stuff in, they are having a system where it is contained, it doesn't run off. They are not putting in what is required, they are putting in less. I don't know of anyone that has requested zero irrigation. They got a reduction on the required landscaping.

Chris Volksen – It's important to remember that this is just for mass grading.

Wes Jenkins – If that is something the hillside wants to recommend it should probably come forward at this time.

Austin Atkin – Everything else in the project will match the landscaping that we've done, we're just talking about the steepest portion.

Dave Black – One of the things we talked about was the timing of when the decorative rock and that landscaping would go in. The idea was to get whatever retaining walls in that you need and get the decorative landscaping in behind those upfront without knowing how long it would be before the site gets developed.

Chris Volksen – I don't think the retaining walls are a part of this now.

Austin Atkin – Yes, we need to come in to design all that.

Chris Volksen – Parr of GTS's part of the project, what we were asked to do was to go in, we had referenced 3:1 slopes on this west slope and I actually went back and looked at my design and for my slope stability analysis we had put in 2:1 slopes. We analyzed it using 2:1 slopes, I made that change in the report. We were asked for paving design for the road that is going to be put in. Right now, they are just planning on cutting these slopes down, just the 2:1 all the way down to the bottom and leaving that there. Then when the pad is developed, once whatever building they are going to put on it is defined then that wall will be installed. We gave recommendations for grading along that west slope, we're going to do it in sections instead of doing the whole thing. Our slope stability analysis assumed the retaining walls were there. That was something they asked for to see if it would change the stability of the slope, it really didn't change it at all. The 2:1 slope wasn't going to change it at all either.

Russ Owens – So why even have a retaining wall?

James Dotson – They want to push the building back up into the slope.

Russ Owens – So you cut it 2:1 and then you would cut that slope out more and put a retaining wall in?

Austin Atkin – When we know exactly what is going there, yeah.

Reid Pope – On this one over here the building gets fairly tight so we have 2 tiered walls just because we can't go over 8 foot.

Austin Atkin – That part we will be coming in and doing pretty much right away because this is the part that we do have a lease for.

James Sullivan – So I guess I'm confused because you recommended 2:1 and came back with 3:1.

Chris Volksen – It was a typo that Dave caught. I designed it at 2:1 on the first grading report, then after our meeting, I updated that to a 2:1. I think the original design I saw for that was a 3:1. That was 2 years ago or a year and a half ago.

James Sullivan – So these soils will hold a 2:1?

Chris Volksen – Yes.

Reid Pope – This whole site was actually approved for grading about 3 years ago or whatever.

James Sullivan – So you're not going to put the walls in, except for when you're going to come forth with the buildings?

Austin Atkin – Yes.

Reid Pope – We're just trying to get this, so it looks more desirable, clean up the property.

Dave Black – Are there provisions, let's just say for instance, you get the first building in and then the economy takes a dump, and it sets for 5 plus years before it starts up again and we have a scar. A 40-foot scar, unfinished slope, are there bonds to the City or something to address that? The reason we are here is because it has a potential for scarring, you are in the hillside overlay, 40-foot cut is a 40-foot scar. Your ultimate build out, I think adequately addresses the concerns. The buildings are going to hide it, your decorative landscaping addresses the concerns. But if it's 5 years down the road that was some of our conversation before to get some of that mitigation upfront as much as possible. Do you bond for that?

Wes Jenkins – Not necessarily, it can be part of the motion.

Dave Black – What if it sets for a few years, what is the magical number? And if the economy stays good, then like you say, it's probably going to go really fast and 2 years from now it's going to be completely built out, it's going to look great.

Austin Atkin - If we were talking about a really pristine area, that was really undisturbed and nice maybe it would be a little more of a thing.

Dave Black – Yes, what you do is going to be better than what you have now, that is a legitimate comment. The concern is the scarring, and you have a plan to mitigate it, it's just the timing.

Wes Jenkins – That's a good question. There are two things, whatever you approve today, say it's a 2:1 slope, we don't do temporary at the City. We just say that is permanent. There is no obligation on the City's part that would require them to do that. Whatever slope it's left in, we consider that permanent. If they come back and change that in the future as part of their development, that's up to them. Unless it's something that requires the hillside, and they go through that process. To answer your question, if you feel like mitigation needs to be in at some certain point and time then we ought to have that discussion, as far as aesthetic, and I don't know what that time frame is. That's where we look for some direction from you.

Dave Black – What's reasonable? If you get it all graded and it sets for a year, that's one thing. Can we recommend if it sits longer than a year the slope be mitigated?

Wes Jenkins – We would look to that guidance from what you guys recommend. That would go forward to Planning Commission and City Council.

James Sullivan – I think it's a really valid point, just because everything we've got here.

Austin Atkin – We're interested in it looking appealing as well, whether we build here tomorrow or not. We're long-term owners across the street and everything. That's pushing us to come in here and do the grading. We want to make it look appealing and ready to go. We're going to end up doing a lot of landscaping along this road here because it has to come through here and connect when we do this building. I don't know what it would cost to go and put gravel down on the upslope to try and make it look finished. It would be pretty costly I'm sure. And then we don't know if we are going to come and rip it all out and do it in the future anyway. When it's cut is it really that much worse than it is now? It's hard to nail it down, but we're interested in it looking nice.

James Sullivan – Are we approving the grading plan as it's drawn without the walls? One comment was that we don't approve anything temporary but we're approving temporary if we approve this plan without walls.

Wes Jenkins – So that can be that permanent condition. It could sit like that forever, as long as it's a stable slope and someone signs off on it. The City doesn't do anything beyond that. So, are you comfortable with it staying in that condition aesthetically for a long period of time or do you feel like something needs to happen, that's a good question?

James Sullivan – Worst case scenario is after 10 years it's going to look more natural than it did before. There's a good chance.

Dave Black – The stability question that you have really has been taken away from us, so we don't need to address stability. All we are looking at is disturbance, aesthetics and mitigating the cut slope. I think that there is a 3rd party review that is done separately and whatever we decide on the aesthetics of mitigation, we could make that contingent on the results of the 3rd party review, because things could change after that's done. The Hillside Committee doesn't need to worry about that, we just need to worry about the cut slope.

Austin Atkin – What about to do this building and cut in this road, we are pretty close to grade for this road, we don't have to go in and disturb a lot of this right now. We don't have to take it to that 2:1 when we do the mass grading right away. Maybe our grading comes in enough to put in this road, and we leave most of that the way it is.

Dave Black – If you clean up any previously disturbed stuff and go in there, that's not an issue.

Discussion continued on leaving the site as is until they develop the other sites.

Wes Jenkins – This is my vision; you can address it two ways. You could say, if you do concrete walls, is the concrete color good enough? Or do you feel like it should be stained or something like that? You can address that and any landscaping, a reduction in the landscaping or something like that. You could say, if they choose to not do walls, and they do a slope then they would have to do some facing on that slope. You would address both conditions now.

James Dotson – From an aesthetic and landscaping perspective a 2:1 slope is a miserable thing, and they shouldn't be allowed anywhere. At least a 3:1 allows small gravel, if you're not rip wrapping the thing with big cobble, small gravel will never stay on it. It ends up at the bottom. Every single time, I can show you a thousand places in town where it's just a mess because they decided that a 2:1 slope was acceptable as a landscape area.

Wes Jenkins – I would think you would address that now, and you would say if you're not going to do walls but you're going to slope it, then you would put those recommendations in it.

Dave Black – Even with the walls, there is a considerable portion above it that will be slope. If you flattened up the slope the walls would have to be taller.

James Sullivan – If we approve their plan then maybe we need to say that it needs to be 6-to-12-inch rock. If we go that far to say that the cut slope long term needs to be finished out like that? Do we say it needs to be done now or whenever it does get cut needs to be finished with that kind of material? And then we approve if they put walls in, we're ok with what is drawn. If they do the walls and slopes we're ok with what's drawn? If they don't disturb anything we're ok with that?

Wes Jenkins – I think that's how I would address it. Say that the applicants recommended to not disturb this right now with the grading, that will be done at a later date. And then look at the options for how to deal with that slope.

James Dotson – Based on that plan, where would that line be?

Discussion continued on what portion would be left undisturbed.

Russ Owens – I am kind of a different opinion than Dave. I don't see how you can approve the cut in the slopes unless you have the 3rd party review done. There is so much ambiguity. Is there a landslide? The first report showed there was, the second report says, now it says there's none. I've never seen anything definitive where is the landslide. I've never really seen anything on the cut slopes. How did you come up with the stabilities on your cut slopes using the proper soil?

Chris Volksen – So we found the deeper landslide that others have had in this area, we did not find.

Russ Owens – And that's based on what?

Chris Volksen – That's based on coring.

Russ Owens – How many holes have you done here recently?

Chris Volksen – We've done 2, we finished one of them yesterday. We done other holes throughout the last several years.

Russ Owens – On some of those thought, some of your test pits have said yes, we have the sheared material. Which to me has got to be some type of landslide material so I don't know how that just goes away.

Chris Volksen – Well part of it we take out, bench in, and replace. Our test pits indicated it was the upper 10 ft. We just cored a hole yesterday right up here. Our core between 5 and 10 ft we picked up an alluvial type of deposit from 10 – 12 ft we picked up more intact mudstone that wasn't sheared up at all. Coring as you know in this stuff is really difficult. You cannot get good quality cores. We tried several different things. We know it's within the upper 10 ft. We know have water coming out up on Black Ridge Drive, that's probably where the slide plane is coming through. We have no water until we got to 90 ft. Which makes sense. Our slope stability analysis showed it coming out near the road.

Russ Owens – No it didn't, it showed it coming out on the slope in the first one.

Chris Volksen – Yeah, I know, but it's not down here, it's not underneath the motel.

Russ Owens – I guess I've never seen anything that proves that or even models that.

Chris Volksen – I realize we re-ran some stuff, and I thought it got sent out because I was asking where your review on it was. I found out you didn't get it.

Russ Owens – I would like to get that; I want to the information on all these new borings. I would hate to approve something that may need to change because if we say you can do a 2:1 slope then it will always be in writing and what if a 2:1 slope won't hold, and it needs to change to a 3:1.

Chris Volksen – And we did, we modeled the slope, cut it down, we used the same parameters we used over behind Maverik for building 1200 which were the same slope parameters that AGEC.

Russ Owens – So are they going to change with your new borings?

Chris Volksen – No, there is nothing, our model has not changed. That upper slide debris that we are finding on the site, we are calling it a slide debris, it could be an alluvial deposit. It's just a material that was not naturally, it's not a bedrock, it's not a mudstone. It was washed in, slid in whatever in that upper couple feet.

Russ Owens – We can argue that later in our report.

Discussion continued on the models and reports that were done by GTS and what was in the reports that were not received.

Dave Black – I guess we have two options; one is we could table it until that gets resolve or the other is we can assume that it gets resolved and the grading plan is similar to what we've seen and make a recommendation contingent upon satisfying the concerns of the 3rd party review. I don't think we could just recommend it for approval, I think it would have to be either tabled and wait till that is done or we come up with contingencies. There is a chance that it could change, but ultimately this site will be developed.

Russ Owens – I think we have been out here enough, I kind of like your second option. We give them some guidelines no matter what the slopes are grade this is what we would like to do to minimize any scars. We can give them some guidelines on how to address whatever.

MOTION: Dave Black made a motion contingent upon the final results of the 3rd party review, we would recommend for approval the grading plan as proposed with the following contingencies: disturbed slopes, cut slopes that are exposed over 10 ft tall be mitigated at the time of construction assuming that a portion of the site will remain undisturbed for a while. That mitigation will consist of an appropriately designed landscape plan, we recommend the landscape watering on the slopes themselves be eliminated and that in other portions of the site that landscape watering be reduced as much as possible based on agreements with the City. We recommend that any retaining walls that are built be colored to match the surrounding colors, the natural environment. The slopes that are shown on the grading plan, the cut might vary, and the grade could vary with 3rd party review and where possible we encourage that slopes be constructed flatter than 2:1 to facilitate the landscaping where possible. Any slopes steeper than 3:1 need to be treated with a fractured cobble that is 6 to 12 inches in size.
Austin Akin – The only thing I want to bring up is the color of the retaining walls, there will be a 2-story bank building right here that will be 25 to 30 ft.
Dave Black – How about any exposed retaining walls that are clearly visible to the public that are not hidden behind any buildings?
James Sullivan – I am never one that is apposed to gray when it is 6-8 ft tall with a 40 ft bank behind it that is going to be multi color like that lava slope. I think gray would look better; they are not going to use red rock on the slopes.
Discussion continued on the color of the concrete walls.
MOTION: Dave Black made a motion contingent upon the final results of the 3rd party review, we would recommend approval that with this grading plan they minimize the amount of disturbance as much as possible on undisturbed portions of the property, disturbed portions of the property for any slopes taller than 10 ft be permanent slopes

and be mitigated with decorative landscaping, any slopes that are 2:1 or steeper than 3:1 be rock that consists of angular cobbles at least 6 inches in size and the recommendation for approval is contingent upon the satisfactory results of the 3rd party review realizing that the current grading plan could potentially change from it's current configuration.
SECOND: James Dotson
AYES (4)
James Sullivan
Dave Black
James Dotson
Russ Owens
NAYS (0)
Motion carries

2. Consider approval of the meeting minutes from April 27, 2022.

MOTION: Russ Owens made a motion to approve the minutes from the last meeting.
SECOND: Dave Black
AYES (4)
James Sullivan
Dave Black
James Dotson
Russ Owens
NAYS (0)
Motion carries

James Sullivan moved to Adjourn the meeting.