

**MASTER DRAINAGE STUDY
UPDATE #3
(SUPPLEMENT to CLV CONDITIONS)**

Skye Canyon
City of Las Vegas, Nevada

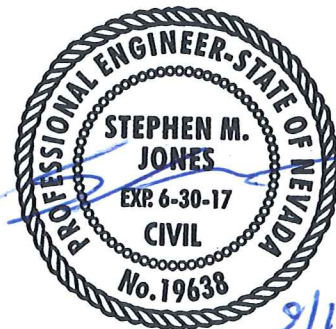
Job No.: OLY1603.000
Date: September 2016

Prepared By:

Slater Hanifan Group, Inc.
5740 S. Arville Street, Suite 216
Las Vegas, Nevada 89118
Phone: 702-284-5300 • Fax: 702-284-5399

Prepared For:

Olympia Companies
11411 Southern Highlands Parkway, Suite 300
Las Vegas, NV 89141
Phone: 702-220-6565 • Fax: 702-220-6566



Steve Jones, P.E.
NV Professional Engineer No. 19638

Assisted by: Cameron Bencini, EI
Jonathan Rocha, EI

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Skye Canyon Master Drainage Study (Supplement) Date: September 2016
 Location of Development: a) Descriptive (Cross Streets): North/South: Puli Road
East/West: Grand Teton Drive
 b) Section: 12 Township: 19 South Range: 59 East
 Section: 6, 7 Township: 19 South Range: 60 East
 c) APN: 125-06-101-001; 125-06-401-001; 125-06-501-001; 125-06-701-001; 125-07-101-005;
125-07-201-001, 002, 003; 125-07-301-001, 002; 125-07-401-001, 002; 125-07-501-005;
125-07-602-001, 003, 004, 005; 126-12-000-001; 125-07-310-001, 002; 125-07-410-001
 KAG Development South, LLC; Section 12, LLC; MF Land, LLC; G Land, LLC; Northland, LLC; Eastland,
 Name of Owner/Developer: LLC; East of 95, LLC
 Telephone No.: 702-220-6565 Fax No.: 702-220-6566 E-mail Address: mbolduc@olympiacompanies.com
 Address: 11411 Southern Highlands Parkway, Suite 300; Las Vegas, NV 89141

Contact Person – Name: Steve Jones, P.E. Telephone No.: 702-284-5300
 *E-mail Address: sjones@shg-inc.com Fax No.: 702-284-5399
 Firm: Slater Hanifan Group
 Address: 5740 S. Arville Street, Suite 216; Las Vegas, NV 89118

Type of Land Development/Land Disturbance Process:

☐ Rezoning	☐ Subdivision Map	☐ Clearing and grading Only
☐ Parcel Map	☐ Planned Unit Development	☒ Other (Please specify below)
☐ Large Parcel Map	☐ Building Permit	☐ Master Drainage Study

1. Total Owned Land Area: At Site: 1,662 +/- Acres Being Developed/Disturbed: All
2. Is a portion or all of the subject property located in a FEMA Flood Hazard Area? ☐ Yes** ☒ No
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ Yes** ☐ No
4. Proposed type of development (Residential, Commercial, Etc.): Residential, Commercial, Schools, Parks, Roadways, Gaming, etc.
5. Approximate upstream land area which drains to the subject site: 6.1 sq. miles +/-
6. Has the site drainage been evaluated in the past? ☒ Yes** ☐ No If yes, please identify documentation: Master Drainage Study, Update #1 & Update #2 for Kyle Canyon (SHG, DS4420)
Master Drainage Study for Kyle Canyon (GCW, DS4091)
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:
Intersections of Log Cabin, O'Hare, Iron Mountain, Brent and Horse along Fort Apache Road
Log Cabin (New MPU Alignment) toward Floyd Lamb State Park
U.S. Highway 95 right-of-way
8. Briefly describe your proposed schedule for the subject project: N/A



Engineer's Seal

Submit this form as part of the required drainage study to the local entity which has jurisdiction over The subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

*Newly Required Field

**Review and concurrence of the Clark County Regional Flood Control District is required

Revision	Date

Local Entity File No.

REFERENCE: SHG Job No. OLY1603.000

STANDARD FORM 1

Updated 05/01/2008

OLY1603.000

September 15, 2016

Oh Sang Kwon, P.E.
Flood Control Section
City of Las Vegas – Department of Public Works
333 N. Rancho Drive – 7th Floor
Las Vegas, Nevada 89106

**Subject: Master Drainage Study Update #3 for Skye Canyon (DS4420)
Supplement – Response to City of Las Vegas Conditions of Approval**

Dear Mr. Kwon:

This letter is submitted in response to comments contained in the August 15, 2016 conditional approval letter received from City of Las Vegas (CLV) regarding the above referenced project. A copy of the CLV conditional approval letter is included in Appendix A for reference. The following comments have been individually addressed:

1. **Comment:** *The overall concept presented in the Master Plan Update #3 for Skye Canyon appears to satisfy the intent of providing regional connectivity of proposed Master Planned facilities without impacting the National Monument. Specific Technical Drainage Studies shall be required to address the specific impacts of each proposed Master Planned facility and the interaction with proposed facilities needed for each phase of development.*

Response: The comment requiring specific technical studies is acknowledged.

2. **Comment:** *The Regional Flood Control District has requested that engineering consultants utilize the latest NRCS soils data as a part of the drainage study parameters. The Master Plan Update shall discuss the soil data used in the analysis and discuss the impacts on the overall hydraulic analysis. Provide an updated HEC-1 analysis and address local and MPU facility size modifications, if necessary based upon the revised Soil Survey data. Update the NRCS soils data in the References (Section 7). Review and revise Exhibit & Figures accordingly. This needs to be addressed as supplemental information prior to the MPA approval.*

Response: A current soils report has been obtained from the NRCS Soil Data Mart (<http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>) and these updated soil boundaries have been overlaid on the study's soils map, Exhibit A included in Appendix B, to demonstrate any changes in the soils utilized in hydrologic analysis. The methodologies for selecting curve numbers utilized in this study had observed the predominant soil group in each type and choose the appropriate curve number based on proposed land use from CCRFCD Manual tables. The below table represents a comparison of the soil groups presented in the approved study and the soil groups represented by the current NRCS soil survey in Appendix B.

Comparative Summary of Hydrologic Soil Groups			
Previous Soils Data		Current Soils Data	
Soil Number	Predominant Hydrologic Soil Group	Soil Number	Predominant Hydrologic Soil Group
155	D	155	D
191	B	191	A
400	D	400	D
540	B	314	A

Inspection of the revised Exhibit A reveals that Soils 155 and 400 have remained the same boundary and predominant soil group; therefore, it is anticipated little to no change occurs to the hydrologic analysis presented by this study. The previous Soil 191 that comprises the a small portion in the very far southwest corner of the site remains the same type but has changed to an improved hydrologic soil group "A" from the previous 'B' type. The previous Soil 540 that encompasses a majority of the east half of Skye Canyon, has been changed to Soil 314 which is considered a new soil type; however, its predominant soil group of 'A' allows for a better drainage class than the previous hydrologic group of 'B' for the same area. The Weiser portion of the composition has been re-defined to the lower 'A' hydrologic soil group. After further review of the soils composition between the two surveys, there are characteristics of the former 540 soil that are similar to the newly described 314 soil such as its alluvium formation and its sandy loam make-up that would allow for a well-drained drainage class. The new 314 soil composition shows that the restrictive layer is almost 6.5-ft deep before it can impede drainage and is described as "very rarely flooded". In conclusion, the change to 'A' soil per the new soil survey is considered acceptable; 'A' group, creates a hydrologic condition where storm runoff will not increase and in most cases improve or lessen the runoff produced by the subbasins in this study.

Through the above summary table and discussion, it is concluded that it is not necessary for this Master Drainage Study to revise its hydrologic and hydraulic analyses. It is also noted upon technical studies, that the new soils will be considered and may be utilized for design purposes. Additionally, the technical studies addressing the regional detention basin improvements for updated Detention Basin 1 (DS4698) and Detention Basin 2 (DS4813) include the new soils information in hydrologic design.

3. **Comment:** *The Master Plan shall clearly define when the proposed interim facilities will be taken out of service and the construction of the required MPU facilities. A complete Phasing Plan shall be updated and approved by the City of Las Vegas and Regional Flood Control prior to the approval of the MPA.*

Response: It is the developer's plan to construct the ultimate condition MPU facilities shown on Exhibits J and K in yellow color with cost sharing participation from the City of Las Vegas for the Log Cabin regional alignment east of Skye Village Road per the approved Development Agreement between the City and Skye Canyon. Excerpts from the development agreement have been included in Appendix E. The interim facilities that perpetuate flows across US-95 in a historic manner, and the accepting facilities remain shown on Exhibit H, however it is not the intent of the developer to construct these facilities in accordance with the language herein the Development agreement for the community.

Note that the facilities showing the larger interim flows may still remain required for smaller localized onsite flows, and the technical studies for each development phase will be required to validate the necessity for any of these facilities.

4. **Comment:** *This Update proposes to construct the Log Cabin Detention Basin #3 with flows that will increase the runoff volume routed towards the Tule Springs North Environmental Detention Basin (TSNEDB). The engineer proposes to modify the TSNEDB by removing the orifice plate at the detention basin outfall pipe to increase the outflow. Detention basin design uses the orifice plate to insure that the basin outfall remains under inlet control parameters per the HCDDM, Section 1200. Discuss the impact of removing the orifice plate and provide calculations verifying that the existing outfall will convey the proposed 78 cfs under inlet control conditions. Discuss the drain time impacts to the TSNEDB and the impacts to the downstream development. Alternatively, the TSNEDB may need modifications to meet the HCDDM requirements. This could include the expansion of the TSNEDB basin to increase the storage volume accordingly or replacement of the TSNEDB outfall. These or other modifications need to be conceptually addressed as supplemental information prior to the MPA approval.*

Response: A WSPG hydraulic model has been constructed based on design plan information for the outlet pipe to the North Environmental Detention Basin, and the outlet has been modified from a single barrel 36-inch RCP with 22-inch orifice that exists currently to a dual barrel 36-inch RCPs with 27-inch orifice plate on each barrel. This modification maintains the outlet and the detention basin to function under inlet control conditions (per CCRFCD Manual Figure 1001-b/c) for the new 100-year outflow of 80 cfs that formerly was designed as 30 cfs. The stage-discharge relationship table for the TSNEDB, identified in the HEC-1 as 'TULEDB', has been updated accordingly and the adjusted HEC-1 models have been included on a CD-ROM included in Appendix C. Note that only the following HEC-1 models that addressed the modification to the North Environmental Detention Basin have been included in this supplement:

- Prop4-TuleDB.OUT
- Ultimate3-TULEDB.OUT
- Ultimate4-BRDB.OUT

The resulting adjustments to flows and facilities from this modification have been annotated on the re-included drainage exhibits in Appendix G.

During the ultimate condition at Durango Drive and Log Cabin Way, or Concentration Point 'CNW129', where flow volume is required to be diverted to the South Environmental Detention Basin, the flow diversion has changed to improve the drain time of the South Environmental Detention Basin or 'BRDB'. As a result of improving the outfall to the North Environmental Detention Basin a smaller peak 100-year flow rate is diverted to the South Basin from what had been previously presented.

The ultimate condition outflow from the North Environmental Detention Basin (Facility XDBN) is shown as 80 cfs, which is considered an increase above the 30 cfs peak outflow designated in the *Final Drainage Report for the Floyd Lamb Park North and South Environmental Enhancement Areas*. Additionally, the drain time from the basin has extended from an estimated 2 days to 7 days. Note that the increase in runoff volume is a result of the elimination of the formerly designated regional alignment in Moccasin (LVMO) through the National Park land that had been planned to accept this runoff volume, as discussed in coordination meetings with CLV and CCRFCD.

The following demonstrates this study's evaluation of downstream property and facility impacts for the increased flow rate and duration of drain time caused by the additional runoff volume routed to the existing detention basin.

- The immediate downstream property and facilities accepting this increased volume is the existing drainage facilities in the Silverstone Ranch golf course area. Silverstone Ranch had been designed and constructed prior to the presence of the North Environmental Detention Basin; therefore, the peak 100-year flow rate that the regional alignment had been design to accommodate from the location of the detention basin's outfall was 676 cfs.
- The next major facility in the regional alignment is a six (6) cell 12-ft by 5-ft culvert crossing (MSNV-0000) designed to accommodate a watershed similar to Silverstone Ranch, pre-North Detention Basin. This location is also where the tributary watershed receives a major confluence, with consideration to MPU Facility LVMD-2632 (1.16 square miles) negating any impacts from the slight peak runoff increase of 50 cfs.
- A 100-year flow rate of 79 cfs is experienced by the Silverstone Ranch property after the 46th hour of discharge from the North Detention Basin which is within the longer time duration caused by this study. The existing Silverstone drainage channels had been designed to accommodate the larger pre-detention flows and there is connectivity of facilities; therefore, the long-term discharge does not pose adverse impacts.

It is acknowledged that the new concept of routing the runoff to the North Environmental Detention Basin instead of the previously planned Upper Las Vegas Wash Detention Basin may require additional downstream evaluations to the convergence of the two watersheds near I-15; however, it is deferred to the Las Vegas Valley Master Plan Amendment (MPA) process referred to in the comment. Note though that the continuity of the regional alignment downstream of the North Environmental Detention Basin outfall is contained within existing engineered drainage facilities, so the perceived adverse impacts for the long-term discharge is considered minimal.

5. **Comment:** *The premise of the Master Plan Update #3 for Skye Canyon is to add two (2) new CCRFCD Master Plan Detention Basins that are located outside of the Skye Canyon development. The City of Las Vegas is in the process of applying for BLM grants for these detention basin sites. These ultimate facilities shall be included in the MPA as CCRFCD facilities. The intent of the Detention Basin (157DB) is to reduce developed flows to maintain the existing condition flow rate in the ultimate condition and reduce the size of the downstream regional facilities. The intent of the Log Cabin Detention Basin (DB3) is to reduce developed flows to reduce the size of the downstream regional facilities that impact the TSNEDB. The concept for the addition of these two detention basins to the CCRFCD Master Plan is acceptable and will require the submittal of technical studies to refine the facility parameters. The construction of DB3 shall be the responsibility of the Skye Canyon development and will be of sufficient size to reduce the flow impacts to development downstream and ultimately the TSNEDB.*

Response: The comment is acknowledged. The intent of the two additional detention basins, as stated in the comment, is correct. The construction of DB3 will commence when storm runoff is diverted toward TSNEDB that had not been planned for during the design of the Environmental Enhancement Area.

6. **Comment:** *This Master Study notes that drainage study updates for both Phase 1 and Phase 2 to accommodate the increased system flows impacting these Phases are necessary. A detailed analysis & review of the required updates will determine the system impacts and if any needed system upgrades are necessary to maintain HCDDM criteria.*

Response: The impacts that the Master Drainage Study has on downstream Phase 1 and Phase 2 infrastructure currently existing or under review has been addressed in DS4739E, *Technical Drainage Study Update #2 for Skye Canyon – Phase 2 Infrastructure*.

7. **Comment: Exhibit 1:** *The developed condition Exhibit 1 shall be updated to include the coordinated Kyle Canyon Interchange drainage improvements. The size of the downstream facilities shall be reviewed based upon the interchange improvements.*

Response: The proposed (Exhibit H) and ultimate (Exhibit J) condition onsite drainage facilities exhibits have been updated to reflect the storm drain size and alignment concepts presented in the Hydraulic Supplement that SHG prepared for the Kyle Canyon and US-95 Interchange project. The concept's summary exhibit and preliminary storm drain profiles have been included in Appendix D for reference.

8. **Comment: Exhibit 1:** *The developed condition Exhibit 1 shows that a portion of the developed flows will drain north of Moccasin into the BLM land and the National Monument to mimic existing drainage patterns. Concentrated flow discharges to the north shall require BLM and National Park Service concurrence.*

Response: The north boundary along the Moccasin alignment is encompassed by a 300-ft power easement with additional 50-ft of right-of-way beyond. Per the Development Agreement excerpts in Appendix E, this area will remain largely undisturbed with no roadways or obstructions to prevent the developer from returning flows north onto the BLM land in their historic manner. Also shown in this study is that the property will not be increasing peak flow rates or runoff volume onto the BLM land. In conclusion, it is determined that BLM and National Parks concurrence is not required for this study as currently presented.

9. **Comment: Exhibit J:** *The proposed facility 14 that drains from EC18 easterly to the proposed DB3 shall be a permanent facility meeting the requirements of Title 20 and shall be constructed as a permanent MPU facility with this development.*

Response: Acknowledged. Refer to Response to Comment No. 3.

10. **Comment: Exhibit J:** *The proposed onsite DB1 & DB2 facilities shall include the collection facilities as a part of the detention basins areas.*

Response: The technical designs of Detention Basin 1 (DS4698) and Detention Basin 2 (DS4813) includes the collector channels that routes storm runoff from south to north into the storage areas. These facilities are identified as 'XC5', 'D6', 'D6-1' and 'D6-2' and annotated appropriately on Exhibit J.

Note that Facility '50' is considered a future facility to be required upon construction of Sheep Mountain Parkway in this area to properly determine locations, elevations and adjustments to the right-of-way grant from BLM. These facilities are deferred to the design

of the Grand Teton interchange with Sheep Mountain by separate party, not the Skye Canyon master developer. Until design of the Grand Teton Interchange occurs, Facility 'XC5' constructed with Detention Basin 1 is considered permanent and effectively provides the hydrologic boundary required for flood protection of the downstream Skye Canyon area.

11. **Comment:** *Exhibit J: The proposed changes to DB1 will impact the alignment and size of the ultimate collection facility that drains to DB1. The proposed facility shall remain an open channel to allow flow interception from the west in this undeveloped drainage.*

Response: Exhibits H and J have been adjusted to show the changed alignment of the collector channel, Facility 'XC5'. Facility 50 has been adjusted to a future open channel to be constructed by others as described above in Response to Comment No. 10.

12. **Comment:** *The Master Land Use Plan has been provided however, any further changes to the adopted Master Land Use Plan shall require a complete update to the Master Drainage Study.*

Response: The comment is acknowledged.

13. **Comment:** *A copy of the approved 404 Permit from the Army Corps of Engineers has been provided.*

Response: The comment is acknowledged. On-going coordination with NDEP to fulfill 401 permitting requirements will continue.

14. **Comment:** *The Phasing Plan for Phase 1 & 2 have addressed the interim condition and associated downstream impacts to address the impact of the long term discharge from the outfall of the Detention Basin #1. This includes upgrading the existing storm drain system near the intersection of Brent Lane and Fort Apache. These improvements have been included in the Detention Basin #1 improvements.*

Response: The comment is acknowledged. Refer to Detention Basin 1 plans (H#60604).

15. **Comment:** *Flood Control requires an interim condition drainage analysis in support of the Phasing Plan that clearly shows the impacts to each Phase, existing washes, upstream concentration points and the downstream concentration points. Flood Control needs to make sure that each Phase of Development is protected during the interim and full build-out of this overall project. The current Phasing Plan does not adequately address these issues beyond Phase 2.*

Response: Each phase of improvements will specifically address interim condition hydrology and hydraulics with technical studies related to the associated drainage infrastructure required to flood protect said improvements.

16. **Comment:** *The interim conditions of the Phasing Plan need to address the impact of the long term discharge from the outfall of any future detention basins. It is noted that Only Detention Basin #1 has been reviewed. The technical review of Detention Basin #2 will determine the impacts downstream along the Iron Mountain Road alignment and/or other needed facilities to mitigate that impact. The provided Basin Attenuated Outfall Exhibit is only conceptual in nature and is subject to further review as a part of the technical reviews.*

Existing flow conditions do not have a drawn out discharge from a detention basin. This discharge impact must be accounted for in the interim condition without negatively impacting the existing downstream neighborhoods.

Response: The comment is acknowledged. Note that the technical study for Detention Basin 2 (DS4813), currently under review, includes mitigation for the long-term discharge regarding its interim impacts to Iron Mountain.

17. **Comment:** *CCRFCD concurrence has previously been provided. A new concurrence for Update #3 shall be provided from CCRFCD after Conditional Approval by the City of Las Vegas.*

Response: CCRFCD concurrence requirement is acknowledged.

18. **Comment:** *CCPW concurrence has previously been provided. A new concurrence for Update #3 shall be provided from CCPW after Conditional Approval by the City of Las Vegas.*

Response: CCPW concurrence requirement is acknowledged.

19. **Comment:** *NDOT concurrence has previously been provided. A new concurrence for Update #3 shall be provided from NDOT after Conditional Approval by the City of Las Vegas.*

Response: NDOT concurrence requirement is acknowledged.

Additional Revisions:

Several drainage exhibits have been updated based on the above comments or as detailed below:

Exhibit C: The summary tables entitled "Offsite Concentration Points" and "East Diversions" have been updated to reflect the change in outflow from the North Environmental Detention Basin, per Response to Comment No. 4. The 100-year flow value shown in plan view at the intersection of Grand Canyon and Eagle Canyon now matches the HEC-1 summary table for Point 'WC18'. No other changes have been performed, all other hydrologic flow rates remain as previously presented.

Exhibit D: The summary tables entitled "Offsite Concentration Points" and "East Diversions" have been updated to reflect the change in outflow from the North Environmental Detention Basin, per Response to Comment No. 4. Flow areas summarizing hydrologic routing through Subbasin 'BLM160' are more prevalent for clarification. The 100-year flow value shown in plan view at the outlet of the North Environmental Detention Basin has also been updated per Response to Comment No. 4. No other changes have been performed, all other hydrologic flow rates remain as previously presented.

Exhibit E: The summary tables entitled "Offsite Concentration Points" and "East Diversions" have been updated to reflect the change in inflow and outflow from the North and South Environmental Detention Basins, per Response to Comment No. 4. The 100-year flow value shown in plan view at the intersection of Grand Canyon and Eagle Canyon now matches the

HEC-1 summary table for Point 'WC18'. A concentration point 'WC44D' had been erroneously labeled at the Kyle Canyon interchange, it has since been relabeled as 'WC44C'. No other changes have been performed, all other hydrologic flow rates remain as previously presented.

Exhibit F: The summary tables entitled "Offsite Concentration Points" and "East Diversions" have been updated to reflect the change in inflow and outflow from the North and South Environmental Detention Basins, per Response to Comment No. 4. The 100-year flow value shown in plan view at the outlet of the North and South Environmental Detention Basin and at the proposed flow split at Log Cabin and Durango have also been updated per Response to Comment No. 4. No other changes have been performed, all other hydrologic flow rates remain as previously presented.

Exhibit H: Several facility changes have occurred for the following reasons:

- Facilities 5 through 11 on both the west and east have changed resulting from considerations for the Kyle Interchange project, refer to Response to Comment No. 7.
- Facilities 0 through 4b have been re-evaluated to consider the infrastructure technically proposed by Detention Basin 2 (DS4813) and to maintain the 42-inch RCP outfall size or larger along the proposed regional alignment in Iron Mountain Road.
- The facility shown in Skye Canyon Park routing flow from facility 'C1' to Log Cabin has been removed to be in accordance with the hydrologic analyses in this study.
- Several facilities were re-considered to provide conservative estimates for sizing and slope estimates at this study's conceptual level. As a result, Appendix F has been provided where several full flow diameter Flowmaster computations have been provided for verification of the facilities that have undergone new estimation from the previous submittal. Note the condition that generates the largest flow rate for consideration in each facility has been annotated in the worksheet title.
- The tables have been further annotated for intent of specific facilities.

Exhibit I: The summary tables demonstrating the new modification to the Tule Springs North Environmental Detention Basin, per Response to Comment No. 4, have been updated accordingly. All other facilities remain as previously presented.

Exhibit J: Several facility changes have occurred for the following reasons:

- Facilities 5 through 11 on both the west and east have changed resulting from considerations for the Kyle Interchange project, refer to Response to Comment No. 7.
- Facilities 0 through 4b have been re-evaluated to consider the infrastructure technically proposed by Detention Basin 2 (DS4813) and to maintain the 42-inch RCP outfall size or larger along the proposed regional alignment in Iron Mountain Road.
- Facility '14-1c' in Skye Canyon Park routing flow from facility 'C1' to Log Cabin is now shown as a green facility, or future local facility by others. This facility is considered a necessity by the future developer of the adjacent BLM parcel to flood protect its site, and only a stub will be provided from Facility '14' for this future confluence.
- The future regional alignment in Moccasin, illustrated by Facilities '28' and '29', has been shown more appropriately as a purple facility, or future regional facility by others.
- Several facilities were re-considered to provide conservative estimates for sizing and slope estimates at this study's conceptual level. As a result, Appendix F has been provided where several full flow diameter Flowmaster computations have been provided for verification of the facilities that have undergone new estimation from the previous

submittal. Note the condition that generates the largest flow rate for consideration in each facility has been annotated in the worksheet title.

- The tables have been further annotated for intent of specific facilities.

Exhibit K: The summary tables demonstrating the new modification to the Tule Springs North Environmental Detention Basin, per Response to Comment No. 4, have been updated accordingly. Facility 'D6' has been changed to a red facility, because it is considered as a proposed facility not on a regional alignment required to allow for ultimate condition drainage pattern as presented in this study. All other facilities remain as previously presented.

The following comments are repeated until they are complete:

1. **Comment:** *Please note that the Traffic Study must be approved prior to final approval of the Master Drainage Study. If the street layout does not match the Master Drainage Study, an update to the Master Drainage Study must be submitted to address the changes.*

Response: Acknowledged.

2. **Comment:** *Per a meeting held in August 18, 2011 between the developer and the City of Las Vegas, it was agreed that NV Energy's approval of any proposed drainage facilities within their access easements (such as the proposed detention basins) must be obtained prior to the final approval of the Master Drainage Study. Please provide documentation for such approval or acknowledgment.*

Response: Each individual improvement that has impacts on NV Energy will receive NV Energy review and approval for permitting.

3. **Comment:** *Please note that any future technical drainage study submittals that differ from the Master Drainage Study (ie. Changes in pods, infrastructure, flows etc.) will require an update to the Master Drainage Study and this update must be approved by the City of Las Vegas Flood Control Section prior to final approval of technical drainage study.*

Response: Acknowledged.

4. **Comment:** *The proposed detention basins will require coordination with the State of Nevada, Division of Water Resources Dam Safety and will require the State's approval prior to permitting.*

Response: Acknowledged.

5. **Comment:** *Please note that the proposed 100-year flood protection facilities identified on Exhibit J must be constructed by the Master Developer as a part of the master planned infrastructure. Technical drainage studies are required for each phase of the master planned infrastructure improvements. The technical drainage studies for the infrastructure improvements may be submitted with conditional approval of this Master Drainage Study. However, final approval for the Master Drainage Study must be obtained prior to conditional approval of the infrastructure drainage studies.*

Response: Acknowledged.

6. **Comment:** *Technical drainage studies are required for each of the Pod's. The technical drainage studies for the Pod's may not be submitted until the conditional approval of the pertinent infrastructure drainage study is obtained. Final approval for the infrastructure drainage study must be obtained prior to conditional approval of the impacted Pod drainage studies.*

Response: Acknowledged.

7. **Comment:** *Building permits for the homes within the individual Pod's will not be issued until construction of the street and flood control infrastructure around the Pod is substantially complete or interim protection is provided per the approved technical drainage study.*

Response: Acknowledged.

8. **Comment:** *The design of debris basins at all major culvert entrances to limit the amount of sediment and debris entering the storm drain facilities will be required in a future infrastructure study.*

Response: Acknowledged.

9. **Comment:** *Please note that all detention basins must be designed per CCRFCD criteria including a low flow facility around the detention basin.*

Response: Acknowledged.

10. **Comment:** *Please note that all proposed interim facilities must be maintained by the master developer.*

Response: Acknowledged.

11. **Comment:** *Provide a legal description of the proposed detention basins prior to recordation of the parent final map.*

Response: Acknowledged.

12. **Comment:** *Coordinate the proposed drainage facilities with Sheep Mountain Parkway project. Please contact Greg McDermott, P.E., at 702-229-2143 to coordinate the proposed drainage facilities.*

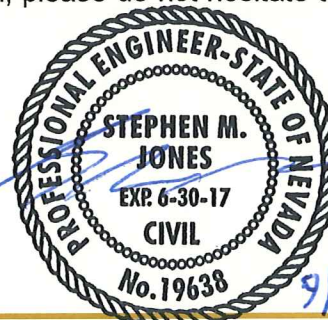
Response: Acknowledged.

If you have any questions or require additional information, please do not hesitate to contact us at 284-5300.

Respectfully Submitted,
SLATER HANIFAN GROUP

Steve Jones, P.E.
Project Manager - Flood Control Division

cc: Jerry Slater, P.E. – SHG



APPENDIX

Appendix A – City of Las Vegas Approval Letter

Appendix B – Response to Comment No. 2 (Updated Soils Evaluation)

- a) Soils Exhibit (New vs. Old Overlaid Data)
- b) New Soils Survey Information
- c) Old Soils Survey Information

Appendix C – Response to Comment No. 4 (North Environmental Detention Basin Modification)

- a) Reference Material – North Environmental Detention Basin
- b) Reference Material – Silverstone Ranch
- c) New Dual Barrel Outfall – WSPG Model
- d) New Dual Barrel Outfall – Stage-Discharge Orifice Calculation
- e) Revised HEC-1 Models (CD-ROM)

Appendix D – Response to Comment No. 7 (Excerpts from Kyle Canyon Interchange Hydraulic Supplement)

Appendix E – Response to Comments No. 3 and 8 (Excerpts from Development Agreement)

Appendix F – Additional Revisions (Supplemental Flood Control Facility Concept Calculations)

Appendix G – Updated Drainage Exhibits

- a) Exhibit C – Proposed Condition Onsite Hydrologic Map
- b) Exhibit D – Proposed Condition Offsite East Hydrologic Map
- c) Exhibit E – Ultimate Condition Onsite Hydrologic Map
- d) Exhibit F – Ultimate Condition Offsite East Hydrologic Map
- e) Exhibit H – Proposed Condition Onsite Drainage Facilities Map
- f) Exhibit I – Proposed Condition Offsite East Drainage Facilities Map
- g) Exhibit J – Ultimate Condition Onsite Drainage Facilities Map
- h) Exhibit K – Ultimate Condition Offsite East Drainage Facilities Map

APPENDIX A

City of Las Vegas Approval Letter

CITY OF LAS VEGAS			DATE:
INTER-OFFICE MEMORANDUM			August 15, 2016
TO: Land Development Services Department of Public Works			FROM: Oh Sang Kwon, P.E. Flood Control Section Department of Public Works
SUBJECT:	Drainage Study for:		COPIES TO:
	Skye Canyon Master Drainage Study – Update #3		Slater Hanifan Group
Cross Streets:	Fort Apache Road & Moccasin Road		KAG Development South, LLC
File Number:	F:\Depot\DSMemos\DS4420N.doc		Bart Anderson, P.E., DevCo
Parcel Number:	125-06-001-001		CCRFGD
Zoning Action:			CCPW
FEMA Flood Zone	YES	NO X	NDOT; NV Energy
Proposed Storm Drain	YES X	NO	PB America, Inc.

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	6/22/2010	7/13/2010	Not Approved	\$1,000.00	147216: \$1000
2 nd Submittal	9/17/2010	10/4/2010	Not Approved	\$400.00	153788: \$400
3 rd Submittal	10/15/2011	11/14/2011	Not Approved	\$400.00	153788: \$400
4 th Submittal	2/13/2012	3/1/2012	Conditional Approval	\$400.00	274196: \$400
CCRFGD	5/23/2012	5/24/2012	Concurrence Recv'd	N/C	N/C
5 th Submittal NDOT Comments	9/10/2012	9/19/2012	Conditional Approval	N/C	N/C
6 th Submittal	12/4/2014	12/30/2014	Conditional Approval	\$400.00	378889: \$400
7 th Submittal	2/17/2015	3/3/2015	Conditional Approval	\$400.00	385987: \$400
8 th Submittal	3/16/2015	4/6/2015	See Comments Below	\$400.00	388961: \$400
CCRFGD	4/2/2015	4/6/2015	Concurrence Recv'd	N/C	N/C
9 th Submittal	6/23/2015	7/21/2015	See Comments Below	\$400.00	403025: \$400
Revised Memo	8/12/2015	8/12/2015	See Comments Below	N/A	N/A
10 th Submittal	10/19/2015	11/23/2015	Conditional Approval	\$400.00	N/A
11 th Submittal	4/19/2016	5/16/2016 & 8/15/2016	See Comments Below	\$400.00	440941: \$400
TOTAL FEES (LDDRS):				\$4,600.00	----

REMARKS: 11th Submittal: Update # 3 – Overall Master Plan Revision of Skye Canyon development. The proposed size and location of MPU facilities are being changed with the concept of allowing development without impacting the National Monument.

Skye Canyon Master Drainage Study Update #3 proposes substantial changes to amend the previously approved Master Plan Amendment (MPA). A new MPA must be submitted to City of Las Vegas and CCRFGD for approval and shall be adopted by the City of Las Vegas City Council prior to the final approval of the subject Master Study Update #3.

The City of Las Vegas will not allow further residential development outside of the limits of Phase 2 at this time until the New Master Plan is approved.

10th Submittal - Phase 2 interim impacts.

Revised Memo – National Monument Drainage Impacts

The Master Drainage Study for the subject project has been reviewed and:

	is approved subject to conformance to all City standards and the following conditions:
	must be resubmitted or supplemented including the following:
X	is conditionally approved subject to Clark County Regional Flood Control District concurrence.
X	is conditionally approved subject to Clark County Department of Public Works concurrence.
X	is conditionally approved subject to Nevada Department of Transportation concurrence.
X	is conditionally approved subject to BLM concurrence/approval.

1. The overall concept presented in the Master Plan Update #3 for Skye Canyon appears to satisfy the intent of providing regional connectivity of proposed Master Planned facilities without impacting the National Monument. Specific Technical Drainage Studies shall be required to address the specific impacts of each proposed Master Planned facility and the interaction with proposed facilities needed for each phase of development.
2. The Regional Flood Control District has requested that engineering consultants utilize the latest NRCS soils data as a part of the drainage study parameters. The Master Plan Update shall discuss the soil data used in the analysis and discuss the impacts on the overall hydraulic analysis. Provide an updated HEC-1 analysis and address local and MPU facility size modifications, if necessary based upon the revised Soil Survey data. Update the NRCS soils data in the References (Section 7). Review and revise Exhibit & Figures accordingly. This needs to be addressed as supplemental information prior to the MPA approval.
3. The Master Plan shall clearly define when the proposed interim facilities will be taken out of service and the construction of the required MPU facilities. A complete Phasing Plan shall be updated and approved by the City of Las Vegas and Regional Flood Control prior to the approval of the MPA.
4. This Update proposes to construct the *Log Cabin Detention Basin #3* with flows that will increase the runoff volume routed towards the *Tule Springs North Environmental Detention Basin (TSNEDB)*. The engineer proposes to modify the TSNEDB by removing the orifice plate at the detention basin outfall pipe to increase the outflow. Detention basin design uses the orifice plate to insure that the basin outfall remains under inlet control parameters per the HCDDM, Section 1200. Discuss the impact of removing the orifice plate and provide calculations verifying that the existing outfall will convey the proposed 78 cfs under inlet control conditions. Discuss the drain time impacts to the TSNEDB and the impacts to the downstream development. Alternatively, the TSNEDB may need modifications to meet the HCDDM requirements. This could include the expansion of the TSNEDB basin to increase the storage volume accordingly or replacement of the TSNEDB outfall. These or other modifications need to be conceptually addressed as supplemental information prior to the MPA approval.
5. The premise of the Master Plan Update #3 for Skye Canyon is to add two (2) new CCRFCD Master Plan Detention Basins that are located outside of the Skye Canyon development. The City of Las Vegas is in the process of applying for BLM grants for these detention basin sites. These ultimate facilities shall be included in the MPA as CCRFCD facilities. The intent of the Detention Basin (157DB) is to reduce developed flows to maintain the existing condition flow rate in the ultimate condition and reduce the size of the downstream regional facilities. The intent of the Log Cabin Detention Basin (DB3) is to reduce developed flows to reduce the size of the downstream regional facilities that impact the TSNEDB. The concept for the addition of these two detention basins to the CCRFCD Master Plan is acceptable and will require the submittal of technical studies to refine the facility parameters. The construction of DB3 shall be the responsibility of the Skye Canyon

development and will be of sufficient size to reduce the flow impacts to development downstream and ultimately the TSNEDB.

6. This Master Study notes that drainage study updates for both Phase 1 and Phase 2 to accommodate the increased system flows impacting these Phases are necessary. A detailed analysis & review of the required updates will determine the system impacts and if any needed system upgrades are necessary to maintain HCDDM criteria.
7. **Exhibit 1:** The developed condition Exhibit 1 shall be updated to include the coordinated Kyle Canyon Interchange drainage improvements. The size of the downstream facilities shall be reviewed based upon the interchange improvements.
8. **Exhibit 1:** The developed condition Exhibit 1 shows that a portion of the developed flows will drain north of Moccasin into the BLM land and the National Monument to mimic existing drainage patterns. Concentrated flow discharges to the north shall require BLM and National Park Service concurrence.
9. **Exhibit J:** The proposed facility 14 that drains from EC18 easterly to the proposed DB3 shall be a permanent facility meeting the requirements of Title 20 and shall be constructed as a permanent MPU facility with this development.
10. **Exhibit J:** The proposed onsite DB1 & DB2 facilities shall include the collection facilities as a part of the detention basins areas.
11. **Exhibit J:** The proposed changes to DB1 will impact the alignment and size of the ultimate collection facility that drains to DB1. The proposed facility shall remain an open channel to allow flow interception from the west in this undeveloped drainage.
12. The **Master Land Use Plan** has been provided however, any further changes to the adopted Master Land Use Plan shall require a complete update to the Master Drainage Study.
13. A copy of the approved 404 Permit from the Army Corps of Engineers has been provided.
14. The Phasing Plan for Phase 1 & 2 have addressed the interim condition and associated downstream impacts to address the impact of the long term discharge from the outfall of the Detention Basin #1. This includes upgrading the existing storm drain system near the intersection of Brent Lane and Fort Apache. These improvements have been included in the Detention Basin #1 improvements.
15. Flood Control requires an interim condition drainage analysis in support of the Phasing Plan that clearly shows the impacts to each Phase, existing washes, upstream concentration points and the downstream concentration points. Flood Control needs to make sure that each Phase of Development is protected during the interim and full build-out of this overall project. The current Phasing Plan does not adequately address these issues beyond Phase 2.
16. The interim conditions of the Phasing Plan need to address the impact of the long term discharge from the outfall of any future detention basins. It is noted that Only Detention Basin #1 has been reviewed. The technical review of Detention Basin #2 will determine the impacts downstream along the Iron Mountain Road alignment and/or other needed facilities to mitigate that impact. The provided Basin Attenuated Outfall Exhibit is only conceptual in nature and is subject to further review as a part of the technical reviews. Existing flow conditions do not have a drawn out discharge from a detention basin. This discharge impact must be accounted for in the interim condition without negatively impacting the existing downstream neighborhoods.
17. CCRFCD concurrence has previously been provided. A new concurrence for Update #3 shall be provided from CCRFCD after Conditional Approval by the City of Las Vegas.

18. CCPW concurrence has previously been provided. A new concurrence for Update #3 shall be provided from CCPW after Conditional Approval by the City of Las Vegas.
19. NDOT concurrence has previously been provided. A new concurrence for Update #3 shall be provided from NDOT after Conditional Approval by the City of Las Vegas.

The following comments are repeated until they are complete:

1. Please note that the Traffic Study must be approved prior to final approval of the Master Drainage Study. If the street layout does not match the Master Drainage Study, an update to the Master Drainage Study must be submitted to address the changes.
2. Per a meeting held in August 18, 2011 between the developer and the *City of Las Vegas*, it was agreed that NV Energy's approval of any proposed drainage facilities within their access easements (such as the proposed detention basins) must be obtained prior to the final approval of the Master Drainage Study. Please provide documentation for such approval or acknowledgment.
3. Please note that any future technical drainage study submittals that differ from the Master Drainage Study (ie. Changes in pods, infrastructure, flows etc.) will require an update to the Master Drainage Study and this update must be approved by the *City of Las Vegas Flood Control Section* prior to final approval of technical drainage study.
4. The proposed detention basins will require coordination with the State of Nevada, Division of Water Resources Dam Safety and will require the State's approval prior to permitting.
5. Please note that the proposed 100-year flood protection facilities identified on Exhibit J must be constructed by the Master Developer as a part of the master planned infrastructure. Technical drainage studies are required for each phase of the master planned infrastructure improvements. The technical drainage studies for the infrastructure improvements may be submitted with conditional approval of this Master Drainage Study. However, final approval for the Master Drainage Study must be obtained prior to conditional approval of the infrastructure drainage studies.
6. Technical drainage studies are required for each of the Pod's. The technical drainage studies for the Pod's may not be submitted until the conditional approval of the pertinent infrastructure drainage study is obtained. Final approval for the infrastructure drainage study must be obtained prior to conditional approval of the impacted Pod drainage studies.
7. Building permits for the homes within the individual Pod's will not be issued until construction of the street and flood control infrastructure around the Pod is substantially complete or interim protection is provided per the approved technical drainage study.
8. The design of debris basins at all major culvert entrances to limit the amount of sediment and debris entering the storm drain facilities will be required in a future infrastructure study.
9. Please note that all detention basins must be designed per CCRFCD criteria including a low flow facility around the detention basin.
10. Please note that all proposed interim facilities must be maintained by the master developer.
11. Provide a legal description of the proposed detention basins prior to recordation of the parent final map.
12. Coordinate the proposed drainage facilities with *Sheep Mountain Parkway* project. Please contact Greg McDermott, P.E., at 702-229-2143 to coordinate the proposed drainage facilities.

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved master drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Amendment and accepted by the *City of Las Vegas Flood Control Section*. Additionally, conditional acceptance of a drainage study is valid for a period of one (1)

year. If the proposed construction has not been completed in that time period, the *City of Las Vegas* reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

NOTE: Please be advised that all land surface area disturbances over 1 acre or any area adjacent to a water way must submit to the Nevada Division of Environmental Protection a "Notice of Intent" to discharge that certifies a stormwater pollution prevention plan has been developed and is maintained on site; for inclusion in the Stormwater General Permit No. NVR100000. A phased construction unit in a contiguous subdivision is considered under construction until all stripped or disturbed surface areas have been covered by paving, building construction or planting. For more information, including forms and applications see <http://ndep.nv.gov/bwpc/storm01.htm> or call (775) 687-9429.

END OF REMARKS

Osk/pbj

T/R/S: T19S/R60E/6 & 7

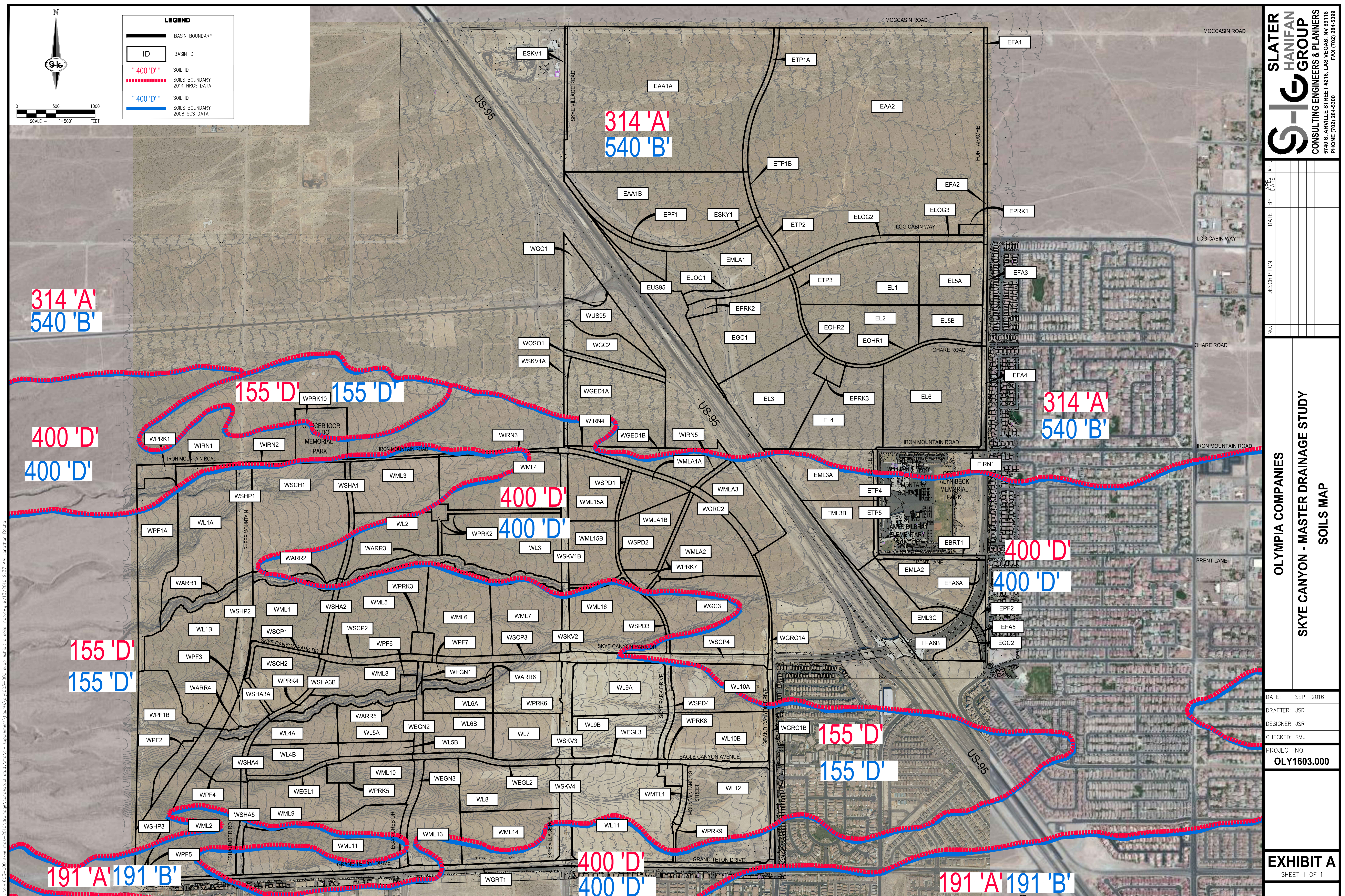
AREA G-6, 7, & F-12

APPENDIX B

Response to Comment No. 2 (Updated Soils Evaluation)

Soils Exhibit

(New vs. Old Overlaid Data)



New Soils Survey Information



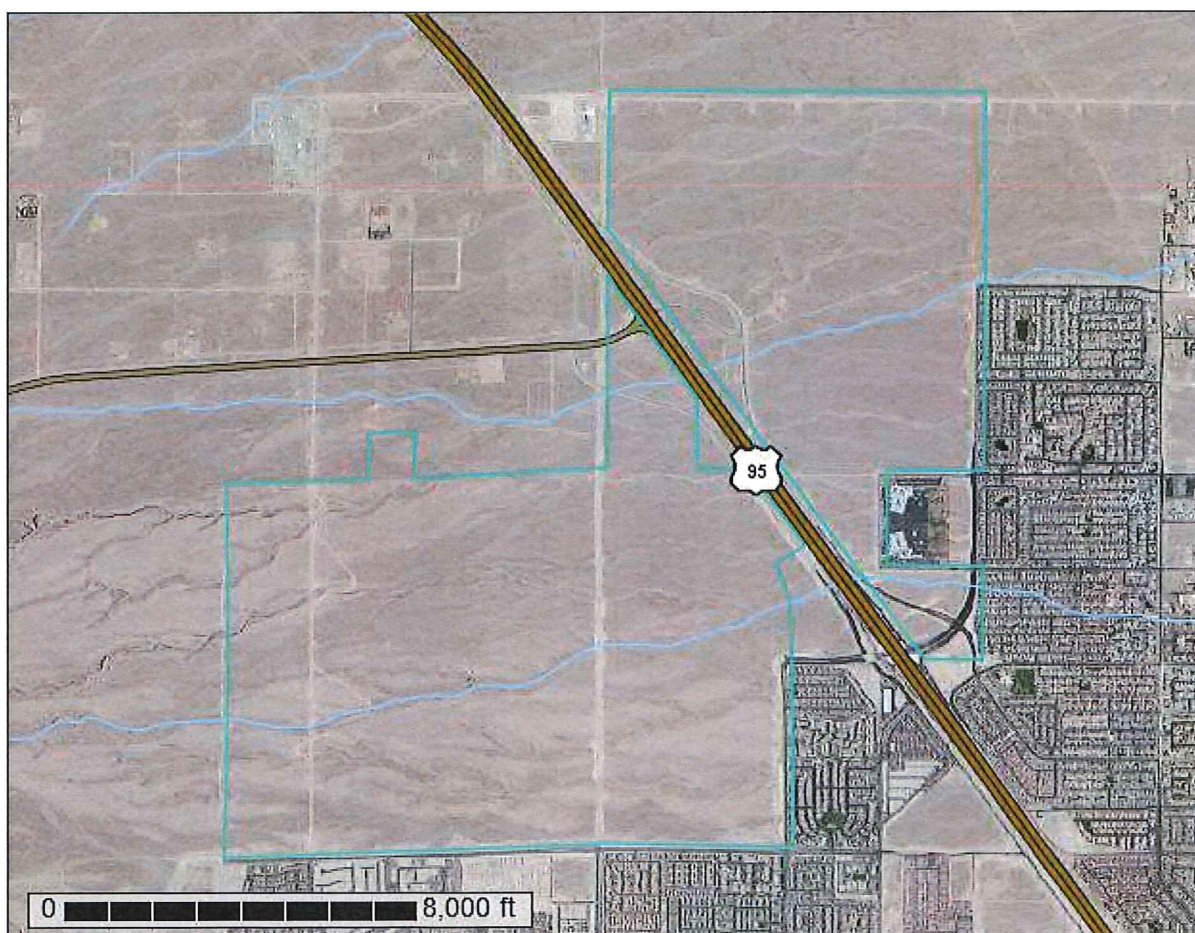
United States
Department of
Agriculture

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 Las Vegas Valley Area, Nevada, Part of Clark County



August 26, 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
Las Vegas Valley Area, Nevada, Part of Clark County.....	12
155—Cave gravelly fine sandy loam, 4 to 15 percent slopes.....	12
191—Dalian very cobbly fine sandy loam, 2 to 8 percent slopes.....	13
314—Weiser-Wechech association.....	14
400—Tencee very gravelly fine sandy loam, 2 to 8 percent slopes.....	16
Soil Information for All Uses.....	18
Soil Properties and Qualities.....	18
Soil Qualities and Features.....	18
Hydrologic Soil Group.....	18
Soil Reports.....	23
Water Features.....	23
Hydrologic Soil Group and Surface Runoff.....	23
References.....	25

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

Custom Soil Resource Report

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.

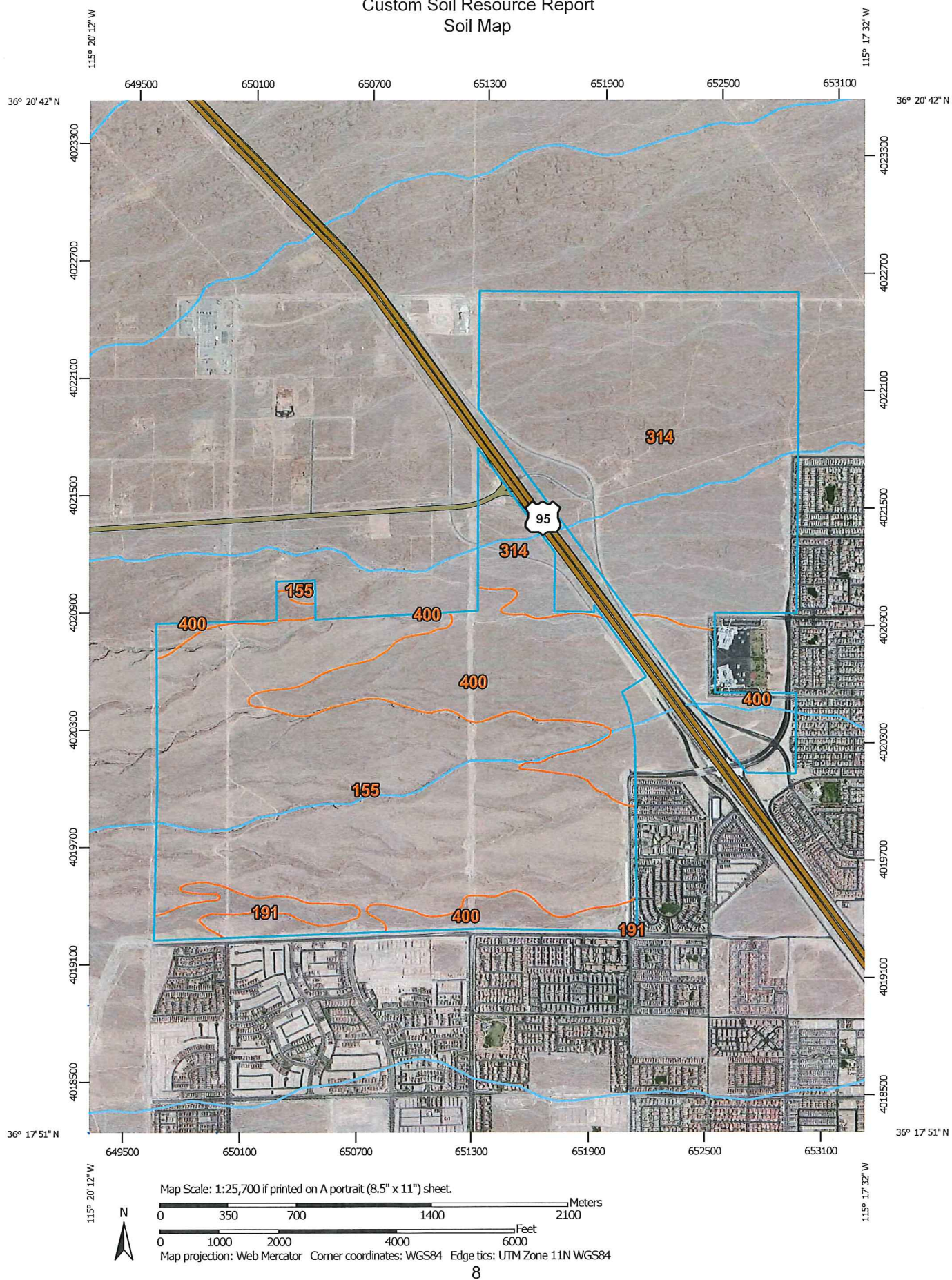
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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)		Water Features
	Area of Interest (AOI)		Streams and Canals
	Soils		Transportation
	Soil Map Unit Polygons		Rails
	Soil Map Unit Lines		Interstate Highways
	Soil Map Unit Points		US Routes
	Special Point Features		Major Roads
	Blowout		Local Roads
	Borrow Pit		Background
	Clay Spot		Aerial Photography
	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		

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: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 10, Aug 22, 2014

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

Date(s) aerial images were photographed: May 7, 2011—Jun 2, 2011

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

Las Vegas Valley Area, Nevada, Part of Clark County (NV788)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
155	Cave gravelly fine sandy loam, 4 to 15 percent slopes	698.8	41.3%
191	Dalian very cobbly fine sandy loam, 2 to 8 percent slopes	32.4	1.9%
314	Weiser-Wechech association	625.7	37.0%
400	Tencee very gravelly fine sandy loam, 2 to 8 percent slopes	333.6	19.7%
Totals for Area of Interest		1,690.5	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

Custom Soil Resource Report

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.

Las Vegas Valley Area, Nevada, Part of Clark County

155—Cave gravelly fine sandy loam, 4 to 15 percent slopes

Map Unit Setting

National map unit symbol: hr9w
Elevation: 2,000 to 4,800 feet
Mean annual precipitation: 4 to 12 inches
Mean annual air temperature: 57 to 70 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Cave

Setting

Landform: Fan remnants
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 15 inches: gravelly fine sandy loam
H2 - 15 to 60 inches: indurated

Properties and qualities

Slope: 4 to 15 percent
Depth to restrictive feature: 4 to 20 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)
Hydric soil rating: No

191—Dalian very cobbly fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: hrb4
Elevation: 2,200 to 3,400 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 61 to 66 degrees F
Frost-free period: 210 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Dalian

Setting

Landform: Fan skirts
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and dolostone

Typical profile

H1 - 0 to 5 inches: very cobbly fine sandy loam
H2 - 5 to 60 inches: very gravelly fine sandy loam

Properties and qualities

Slope: 2 to 8 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 (1.98 to 5.95 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
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

314—Weiser-Wechech association

Map Unit Setting

National map unit symbol: 1tf6l
Elevation: 1,610 to 4,850 feet
Mean annual precipitation: 5 to 7 inches
Mean annual air temperature: 57 to 70 degrees F
Frost-free period: 180 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Weiser, very rarely flooded, and similar soils: 70 percent
Wechech and similar soils: 15 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Weiser, Very Rarely Flooded

Setting

Landform: Fan remnants
Landform position (two-dimensional): Summit
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and dolomite

Typical profile

H1 - 0 to 6 inches: extremely gravelly fine sandy loam
H2 - 6 to 60 inches: extremely gravelly sandy loam

Properties and qualities

Slope: 2 to 8 percent
Percent of area covered with surface fragments: 5.0 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 (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Very rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 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 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: LIMY 5-7 P.Z. (R030XB005NV)
Hydric soil rating: No

Custom Soil Resource Report

Description of Wechech

Setting

Landform: Fan remnants
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and dolomite

Typical profile

H1 - 0 to 2 inches: very gravelly sandy loam
H2 - 2 to 7 inches: very gravelly sandy loam
H3 - 7 to 13 inches: very gravelly sandy loam
H4 - 13 to 60 inches: cemented material

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 8 to 14 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 50 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 0.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: LIMY 5-7 P.Z. (R030XB005NV)
Hydric soil rating: No

Minor Components

Threelakes

Percent of map unit: 6 percent
Landform: Fan remnants
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: CALCAREOUS LOAM 5-7 P.Z. (R030XA066NV)
Hydric soil rating: No

Weiser, very rarely flooded

Percent of map unit: 5 percent
Landform: Fan remnants
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: GRAVELLY FAN 5-7 P.Z. (R030XB075NV)
Hydric soil rating: No

Typic torriorthents, sandy-skeletal, occasionally flooded

Percent of map unit: 4 percent

Custom Soil Resource Report

Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: VALLEY WASH (R030XB028NV)
Hydric soil rating: No

400—Tencee very gravelly fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: hrc1
Elevation: 2,400 to 5,700 feet
Mean annual precipitation: 4 to 10 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 180 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Tencee

Setting

Landform: Fan remnants
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and dolomite

Typical profile

H1 - 0 to 9 inches: very gravelly fine sandy loam
H2 - 9 to 15 inches: very gravelly sandy loam
H3 - 15 to 19 inches: indurated

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 7 to 20 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Very low (about 1.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Custom Soil Resource Report

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D

Hydric soil rating: No

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

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.

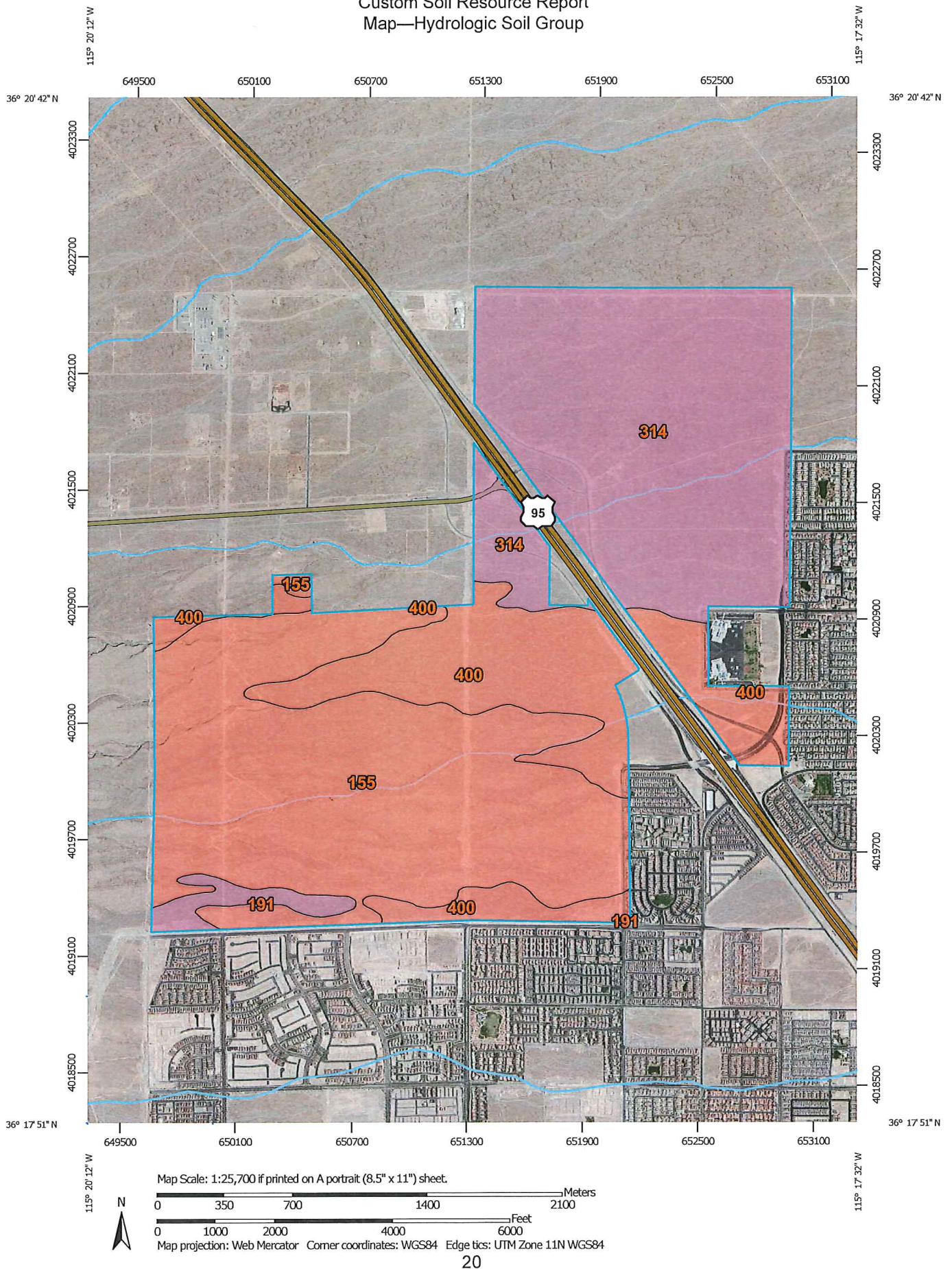
Custom Soil Resource Report

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.

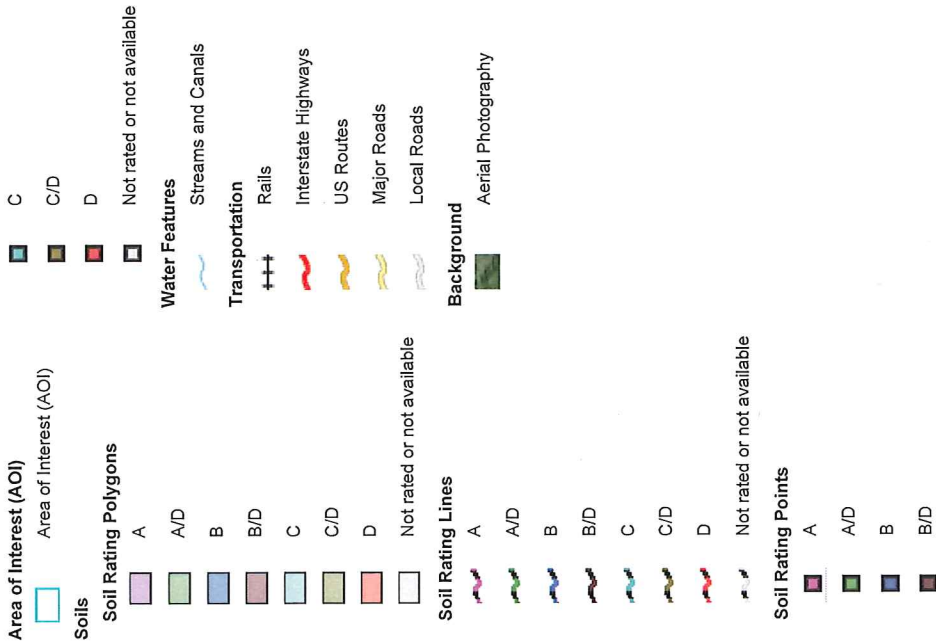
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over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

Custom Soil Resource Report Map—Hydrologic Soil Group



MAP LEGEND



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: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 10, Aug 22, 2014

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

Date(s) aerial images were photographed: May 7, 2011—Jun 2, 2011

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.

Custom Soil Resource Report

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Las Vegas Valley Area, Nevada, Part of Clark County (NV788)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
155	Cave gravelly fine sandy loam, 4 to 15 percent slopes	D	698.8	41.3%
191	Dalian very cobbly fine sandy loam, 2 to 8 percent slopes	A	32.4	1.9%
314	Weiser-Wechech association	A	625.7	37.0%
400	Tencee very gravelly fine sandy loam, 2 to 8 percent slopes	D	333.6	19.7%
Totals for Area of Interest			1,690.5	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Water Features

This folder contains tabular reports that present soil hydrology information. The reports (tables) include all selected map units and components for each map unit. Water Features include ponding frequency, flooding frequency, and depth to water table.

Hydrologic Soil Group and Surface Runoff

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

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 four hydrologic soil groups are:

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.

Custom Soil Resource Report

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

Report—Hydrologic Soil Group and Surface Runoff

Absence of an entry indicates that the data were not estimated. The dash indicates no documented presence.

Hydrologic Soil Group and Surface Runoff—Las Vegas Valley Area, Nevada, Part of Clark County			
Map symbol and soil name	Pct. of map unit	Surface Runoff	Hydrologic Soil Group
155—Cave gravelly fine sandy loam, 4 to 15 percent slopes			
Cave	100	Very high	D
191—Dalian very cobbly fine sandy loam, 2 to 8 percent slopes			
Dalian	100	Low	A
314—Weiser-Wechech association			
Weiser, very rarely flooded	70	Low	A
Wechech	15	Very high	D
Threelakes	6	Low	A
Weiser, very rarely flooded	5	Low	B
Typic torriorthents, sandy-skeletal, occasionally flooded	4	Very low	A
400—Tencee very gravelly fine sandy loam, 2 to 8 percent slopes			
Tencee	100	Very high	D

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=stelpdb1043084>

Custom Soil Resource Report

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

Old Soils Survey Information



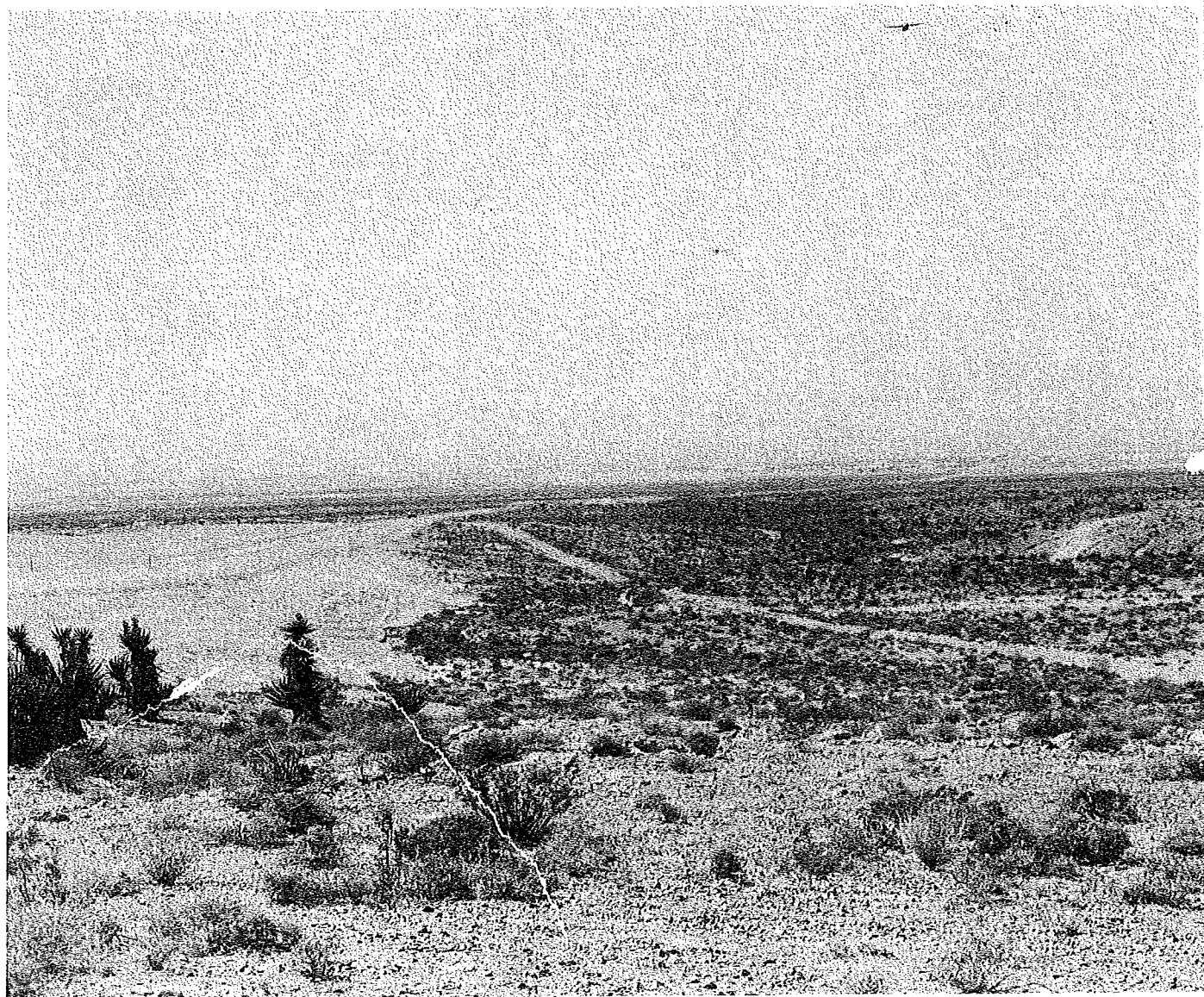
United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
United States Department
of the Interior, Bureau
of Land Management, and
University of Nevada
Agricultural Experiment
Station

Soil Survey of Las Vegas Valley Area Nevada

Part of Clark County



This unit is limited for roads because of the depth to the indurated hardpan. Roads should be designed to minimize cuts.

This map unit is in capability subclass VII_s, nonirrigated, and in horticultural group 6.

152—Cave gravelly fine sandy loam, 0 to 4 percent slopes. This shallow, well drained soil is on erosional fan remnants. It formed in alluvium derived from various kinds of rock.

Typically, about 80 percent of the surface is covered with a desert pavement of pebbles and cobbles. The surface layer is pale brown gravelly fine sandy loam about 12 inches thick. The next layer to a depth of 36 inches is an indurated, lime-cemented hardpan. The underlying material to a depth of 60 inches or more is light brown very gravelly sandy loam. Depth to the hardpan ranges from 4 to 20 inches.

Included in this unit are about 5 percent Arizo soils, flooded, in channels, 5 percent Canutio soils on inset fans, and 5 percent Grapevine soils on side slopes of erosional fan remnants. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Cave soil is moderate above the hardpan. Available water capacity is very low. Effective rooting depth is 4 to 20 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high if the surface is disturbed.

This unit is used mainly for urban development. It is also used as habitat for desert wildlife and for recreation.

This unit is poorly suited to urban development. The main limitation is the shallow depth to the hardpan. Excavation for building sites is limited by the hardpan, and heavy equipment is needed. Special design of septic tank absorption fields is needed.

Roads should be designed to minimize cuts because of the limited depth to the hardpan.

It is difficult to establish plants in areas where the pan is exposed. Mulching and fertilizing cut areas help to establish plants. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

Intermittent streams form the drainageways in this unit. These drainageways are subject to rare or occasional periods of high-velocity flooding. Care should be taken during urbanization to accommodate the runoff from the drainageways. If drains become plugged during a major flood, accelerated erosion and damage to roads, buildings, and other structures can occur.

This map unit is in capability subclass VII_s, nonirrigated, and in horticultural group 6.

155—Cave gravelly fine sandy loam, 4 to 15 percent slopes. This shallow, well drained soil is on

erosional fan remnants. It formed in alluvium derived from various kinds of rock.

Typically, about 70 percent of the surface is covered with a desert pavement of rock fragments and pan fragments. The surface layer is light brown gravelly fine sandy loam about 5 inches thick. The underlying material to a depth of 15 inches is light brown gravelly fine sandy loam. The next layer to a depth of 60 inches or more is an indurated, lime-cemented hardpan. Depth to the hardpan ranges from 4 to 20 inches.

Included in this unit are about 5 percent Arizo soils, flooded, in channels and 5 percent Caliza soils on side slopes of erosional fan remnants. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Cave soil is moderate above the hardpan. Available water capacity is very low. Effective rooting depth is 4 to 20 inches. Runoff is moderate, and the hazard of water erosion is slight. The hazard of soil blowing is high if the surface is disturbed.

This unit is used as habitat for desert wildlife and for recreation.

This unit is limited for roads because of the depth to the indurated hardpan. Roads should be designed to minimize cuts. Cutting and filling can be reduced by building roads in the less sloping areas.

This map unit is in capability subclass VII_s, nonirrigated and in horticultural group 6.

160—Destazo cobbly fine sandy loam, 0 to 2 percent slopes. This very deep, well drained soil is on relict alluvial flats. It formed in alluvium derived dominantly from limestone and dolomite.

Typically, about 60 percent of the surface is covered with a desert pavement of pebbles and cobbles. The surface layer is pink cobbly fine sandy loam about 11 inches thick. The upper 29 inches of the underlying material is light brown very gravelly sandy clay loam, and the lower part to a depth of 60 inches or more is pinkish white gravelly sandy loam containing some crystalline gypsum.

Included in this unit are about 5 percent Bracken very cobbly fine sandy loam, 2 to 8 percent slopes, on side slopes of slightly higher remnants of relict alluvial flats and 10 percent Las Vegas soils on summits of slightly higher remnants of alluvial flats. Included areas make up about 15 percent of the total acreage.

Permeability of this Destazo soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

This unit is well suited to the construction of dwellings.

The main limitation for septic tank absorption fields is restricted permeability. The operation of septic tank

sandy loam about 4 inches thick. The upper 7 inches of the underlying material is light yellowish brown extremely gravelly fine sandy loam, the next 6 inches is light yellowish brown very gravelly sandy loam, and the lower part to a depth of 61 inches is light yellowish brown extremely gravelly fine sandy loam. Pebbles cover 50 to 75 percent of the surface.

Included in this unit are about 5 percent Tencee soils on erosional fan remnants and 10 percent Arizo soils, flooded, in channels. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Dalian soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly as habitat for desert wildlife and for recreation. It is also used for urban development.

This unit is well suited to the construction of dwellings.

Septic tank absorption fields generally function well unless the density of housing is too high.

Roads are easily constructed and maintained.

The main limitation for lawns and landscaping is the pebbles on the surface and throughout the soil. Topsoil is needed for best results when landscaping, particularly in areas used for lawns. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

Intermittent streams form the drainageways in this unit. These drainageways are subject to rare or occasional periods of high-velocity flooding. Care should be taken during urbanization to accommodate the runoff from the drainageways. If drains become plugged during a major flood, accelerated erosion and damage to roads, buildings, and other structures can occur.

This map unit is in capability subclasses IVs, irrigated, and VIIs, nonirrigated. It is in horticultural group 2.

191—Dalian very cobbly fine sandy loam, 2 to 8 percent slopes. This very deep, well drained soil is on fan skirts. It formed in alluvium derived dominantly from limestone and dolomite.

Typically, about 85 percent of the surface is covered with a desert pavement of rock fragments. The surface layer is light yellowish brown very cobbly fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown very gravelly sandy loam to extremely gravelly fine sandy loam.

Included in this unit are about 10 percent Tencee soils on erosional fan remnants and 5 percent Arizo soils, flooded, in channels. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Dalian soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the surface is disturbed. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

Most areas of this unit are used as habitat for desert wildlife and for recreation. A few areas are used for urban development.

The main limitation for construction of dwellings is the hazard of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding.

Dikes and channels that have outlets for floodwater can be used to protect onsite sewage disposal systems from flooding.

Channeling and deposition can be minimized and maintenance costs reduced by protecting roads from flooding.

The main limitations for lawns and landscaping are the cobbles and pebbles on the surface and throughout the soil. Topsoil is needed for best results when landscaping, particularly in areas used for lawns. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

This map unit is in capability subclass VIIs, nonirrigated, and in horticultural group 2.

192—Dalian-McCullough complex, 0 to 4 percent slopes. This map unit is on fan skirts.

This unit is 55 percent Dalian very gravelly fine sandy loam, 0 to 4 percent slopes, and 35 percent McCullough very gravelly very fine sandy loam, gravelly substratum, 0 to 4 percent slopes. Both the Dalian and McCullough soils are on alluvial fan skirts. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 5 percent Las Vegas soils on basin floor remnants and 5 percent Tencee soils on erosional fan remnants. Included areas make up about 10 percent of the total acreage.

The Dalian soil is very deep and well drained. It formed in alluvium derived from various kinds of rock. Typically, about 75 percent of the surface is covered with a desert pavement of pebbles. The surface layer is light yellowish brown very gravelly fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown very gravelly sandy loam.

Permeability of the Dalian soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is

Because of the content of gypsum and other salts in the soil, salt-tolerant plants should be selected for lawns and landscaping. Because of the underlying hardpan, deep cuts should be avoided on this soil. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

This map unit is in capability subclasses IIIs, irrigated, and VIIs, nonirrigated. It is in horticultural group 6.

390—Spring clay loam. This very deep, moderately well drained soil is on alluvial flats. It formed in gypsiferous lacustrine sediment. Slope is 0 to 2 percent.

Typically, the surface layer is pale brown clay loam about 5 inches thick. The underlying material to a depth of 60 inches or more is stratified, light brown to pink silt loam to silty clay, averaging silty clay loam, and contains many gypsum crystals.

Included in this unit are about 10 percent Land soils on alluvial flats and 5 percent Las Vegas soils on relict alluvial flats. Included areas make up about 15 percent of the total acreage.

Permeability of the Spring soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare periods of flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks. This soil is strongly affected by salts to a depth of 5 inches, and it is moderately affected below this depth.

This unit is used mainly for urban development. It is also used as habitat for desert wildlife and for recreation.

The main limitation for construction of dwellings is the hazard of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings from flooding. Gypsum in the soil can induce electrochemical action that corrodes concrete. This limitation can be overcome by using cement that is resistant to sulfate corrosion.

The main limitation for septic tank absorption fields is restricted permeability. Special design of septic tank absorption fields is needed. Using long absorption lines and backfilling the trench with sandy material help to compensate for the restricted permeability.

The Spring soil is limited for roads because of limited ability to support a load. Roads and streets should be designed to compensate for the instability of the soil.

The main limitation for lawns and landscaping is the excess soluble salts in the soil. Intensive management is required to reduce the salinity and maintain soil productivity. Excess salts in the soil can be flushed out by using heavy periodic applications of water. Because of the content of gypsum and other salts in the soil, salt-tolerant plants should be selected.

This map unit is in capability subclasses VIIs, irrigated, and VIIs, nonirrigated. It is in horticultural group 4.

400—Tencee very gravelly fine sandy loam, 2 to 8 percent slopes. This shallow, well drained soil is on erosional fan remnants. It formed in alluvium derived dominantly from limestone and dolomite.

Typically, 75 percent of the surface is covered with a well developed desert pavement of pebbles. There is a dark desert varnish on the exposed surfaces of the rock fragments. The surface layer is light brown very gravelly fine sandy loam about 5 inches thick. The next layer is light brown very gravelly fine sandy loam and very gravelly sandy loam and is weakly cemented with lime to a depth of about 15 inches. An indurated, lime-cemented hardpan is at a depth of about 15 inches. Depth to the hardpan ranges from 7 to 20 inches.

Included in this unit are small areas of Dalian soils on side slopes of fan remnants and on inset fans. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Tencee soil is moderate above the hardpan. Available water capacity is very low. Effective rooting depth is 7 to 20 inches. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the surface is disturbed.

This unit is used as habitat for desert wildlife and for recreation.

This unit is limited for roads because of the depth to the indurated hardpan. Roads should be designed to minimize cuts. Heavy equipment is needed for excavation.

This map unit is in capability subclass VIIs, nonirrigated, and in horticultural group 6.

415—Aztec very gravelly sandy loam, 2 to 8 percent slopes. This very deep, well drained soil is on erosional fan remnants. It formed in alluvium derived from various kinds of rock.

Typically, 80 percent of the surface is covered with pebbles. The surface layer is light yellowish brown very gravelly sandy loam about 2 inches thick. The underlying material to a depth of 63 inches is stratified, light yellowish brown, light brown, and light reddish brown very gravelly sandy loam to extremely gravelly loamy coarse sand with weak, continuous gypsum cementation in some layers.

Included in this unit are about 5 percent Bracken soils on pediment remnants, 5 percent Rock outcrop on isolated ridges, and 5 percent Caliza soils on erosional fan remnants. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Aztec soil is moderately slow. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is high.

varies from one area to another. About 500 acres, east of Henderson, is mostly an Akela soil that has slopes of 8 to 15 percent. About 40 acres of Rock outcrop, gypsum, shown by symbols, is in an area in the northeastern corner of sec. 33, T. 21 S., R. 63 E.

The Akela soil is shallow and well drained. It formed in residuum derived dominantly from basalt and andesite. Typically, about 92 percent of the surface is covered with a desert pavement of pebbles, cobbles, and stones. The surface layer is pale brown very cobbly fine sandy loam about 3 inches thick. The underlying material to a depth of 11 inches is light brown very gravelly fine sandy loam. Basalt is at a depth of about 11 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Akela soil is moderate above the bedrock. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate if the surface is disturbed.

Rock outcrop consists of exposed areas of undifferentiated volcanic rock.

This unit is used as habitat for desert wildlife and for recreation.

This unit is limited for roads because of the areas of Rock outcrop, steepness of slopes, and shallow depth to bedrock. Roads should be designed to minimize cuts. Cutting and filling can be reduced by building roads in the less sloping areas of the unit. Roads should be provided with adequate surface drainage. Erosion can be controlled and maintenance costs reduced by stabilizing areas that have been disturbed.

This map unit is in capability subclass VII_s, nonirrigated. The Akela soil is in horticultural group 6.

540—Weiser extremely gravelly fine sandy loam, 2 to 8 percent slopes. This very deep, well drained soil is on summits and side slopes of erosional fan remnants (fig. 1). It formed in alluvium derived from various kinds of rock that have a high content of lime.

Typically, 80 percent of the surface is covered with a desert pavement of pebbles. There is a dark desert varnish on the exposed surfaces of the rock fragments. The surface layer is light yellowish brown extremely gravelly fine sandy loam about 1 inch thick. The underlying material to a depth of 63 inches is light brown extremely gravelly fine sandy loam and very gravelly fine sandy loam, averaging extremely gravelly fine sandy loam.

Included in this unit are about 5 percent Arizo soils, flooded, in channels and 10 percent Goodsprings soils on erosional fan remnants. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Weiser soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil

blowing is moderate if the desert pavement is disturbed. Some pedons have an indurated, lime-cemented hardpan at a depth of 40 to 60 inches or more.

Most areas of this unit are used as habitat for desert wildlife and for recreation. A few areas are used for urban development.

This unit is well suited to the construction of dwellings.

Unless the density of housing is too high, septic tank absorption fields generally function well in this unit.

Roads can easily be constructed and maintained on this unit.

The main limitations for lawns and landscaping are the presence of pebbles throughout the soil and the very low available water capacity. Topsoil is needed for best results when landscaping, particularly in areas used for lawns. Frequent irrigation of lawns, gardens, and most other plantings is needed because of the limited available water capacity of the soil. Lawn grasses, shrubs, and trees that are not sensitive to lime-induced chlorosis are well suited to use in landscaping. Annual applications of iron chelates reduce the effects of chlorosis.

Intermittent streams form the drainageways in this unit. These drainageways are subject to rare or occasional periods of high-velocity flooding. Care should be taken during urbanization to accommodate the runoff from the drainageways. If drains become plugged during a major flood, accelerated erosion and damage to roads, buildings, and other structures can occur.

This map unit is in capability subclasses IV_s, irrigated, and VII_s, nonirrigated. It is in horticultural group 2.

542—Weiser-Aztec complex, 2 to 8 percent slopes.

This map unit is on erosional fan remnants.

This unit is 55 percent Weiser extremely gravelly fine sandy loam, 2 to 8 percent slopes, and 30 percent Aztec very gravelly fine sandy loam, 2 to 8 percent slopes. The Weiser soil is on summits and side slopes of the fan remnants, and the Aztec soil is on side slopes of the fan remnants. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 5 percent Arizo soils, flooded, in channels and 10 percent Goodsprings soils on erosional fan remnants. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Weiser soil is very deep and well drained. It formed in alluvium derived dominantly from limestone and dolomite. Typically, 95 percent of the surface is covered with a desert pavement of pebbles. There is a dark desert varnish on the exposed surfaces of the rock fragments. The surface layer is light yellowish brown extremely gravelly fine sandy loam about 1 inch thick. The underlying material to a depth of 63 inches is light brown extremely gravelly fine sandy loam and very

TABLE 15.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare" and "occasional" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding		High water table		Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Months	Depth	Months	Depth	Thick-ness	Depth	Hard-ness	Uncoated steel	Concrete
				<u>Ft</u>		<u>In</u>		<u>In</u>			
105*: McCullough-----	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	High.
Jean-----	A	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Low.
Bluepoint-----	A	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
107----- Arizo	A	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Low.
112----- Arizo	A	Occasional	Mar-Sep	>6.0	---	>60	---	---	---	High-----	Low.
113----- Arizo	A	Rare-----	---	>6.0	---	>60	---	---	---	High-----	High.
117----- Arizo	A	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
120----- Bluepoint	A	Rare-----	---	4.0-6.0	Jun-Sep	>60	---	---	---	High-----	Moderate.
127, 128, 129----- Bluepoint	A	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
130*: Bracken-----	B	None-----	---	>6.0	---	40-60	Soft	---	---	High-----	High.
Destazo-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	High.
132----- Bracken	B	None-----	---	>6.0	---	40-60	Soft	---	---	High-----	High.
133*: Bracken-----	B	None-----	---	>6.0	---	40-60	Soft	---	---	High-----	High.
Rock outcrop.											
134----- Bracken	B	None-----	---	>6.0	---	40-60	Soft	---	---	High-----	High.
140----- Casaga	C	None-----	---	>6.0	---	>60	---	---	---	High-----	High.
150----- Cave	D	None-----	---	>6.0	---	>60	---	4-20	Thick	High-----	Low.
151----- Cave	D	None-----	---	>6.0	---	>60	---	10-20	Thick	High-----	Low.
152, 155----- Cave	D	None-----	---	>6.0	---	>60	---	4-20	Thick	High-----	Low.
160----- Destazo	B	None-----	---	>6.0	---	>60	---	---	---	High-----	High.
181*: Caliza-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
Pittman-----	C	None-----	---	>6.0	---	>60	---	20-30	Thick	High-----	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding		High water table		Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Months	Depth	Months	Depth	Thick-ness	Depth	Hard-ness	Uncoated steel	Concrete
				<u>Ft</u>		<u>In</u>		<u>In</u>			
182*: Caliza-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
Pittman-----	C	None-----	---	>6.0	---	>60	---	20-30	Thick	High-----	Low.
Arizo-----	A	Occasional	Mar-Sep	>6.0	---	>60	---	---	---	High-----	Low.
183----- Caliza	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
184----- Caliza	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Low.
187----- Caliza	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
190----- Dalian	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
191----- Dalian	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Low.
192*: Dalian-----	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Low.
McCullough-----	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Low.
200----- Glencarb	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Moderate.
206----- Glencarb	C	Occasional	Jul-Sep	3.0-5.0	Jul-Jun	>60	---	---	---	High-----	High.
222----- Glencarb	C	Rare-----	---	3.0-5.0	Jul-Jun	>60	---	---	---	High-----	High.
236----- Glencarb	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	High.
237----- Glencarb	B	Rare-----	---	>6.0	---	>60	---	40-60	Thick	High-----	Low.
240----- Goodsprings	D	None-----	---	>6.0	---	>60	---	9-20	Thick	High-----	Low.
252, 255----- Grapevine	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	High.
260----- Jean	A	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Low.
262*: Jean-----	A	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Low.
Jean-----	A	Occasional	Jun-Sep	>6.0	---	>60	---	---	---	High-----	Low.
Goodsprings-----	D	Rare-----	---	>6.0	---	>60	---	9-20	Thick	High-----	Low.
263*: Jean-----	A	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Low.
Jean-----	A	Occasional	Jun-Sep	>6.0	---	>60	---	---	---	High-----	Low.
264----- Jean	A	Rare-----	---	>6.0	---	>60	---	---	---	High-----	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding		High water table		Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Months	Depth	Months	Depth	Thick-ness	Depth	Hard-ness	Uncoated steel	Concrete
270----- Land	B	Rare-----	---	<u>Ft</u> 3.5-6.0	Mar-Sep	>60	---	---	---	High-----	High.
278----- Land	D	Rare-----	---	1.5-3.0	Jan-Dec	>60	---	---	---	High-----	High.
282----- Land	C	Rare-----	---	3.0-3.5	Jan-Dec	>60	---	---	---	High-----	High.
300, 301----- Las Vegas	D	Rare-----	---	>6.0	---	>60	---	3-14	Thick	High-----	High.
302*: Las Vegas-----	D	Rare-----	---	>6.0	---	>60	---	3-14	Thick	High-----	High.
McCarran-----	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	High.
Grapevine-----	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	High.
305*: Las Vegas-----	D	Rare-----	---	>6.0	---	>60	---	3-14	Thick	High-----	High.
Destazo-----	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	High.
307*: Las Vegas-----	D	Rare-----	---	>6.0	---	>60	---	3-14	Thick	High-----	High.
Skyhaven-----	C	Rare-----	---	>6.0	---	>60	---	24-40	Thick	High-----	High.
325, 326----- McCarran	B	Rare-----	---	>6.0	---	>60	---	---	---	High-----	High.
341----- Paradise	C	Rare-----	---	3.0-5.0	Dec-Mar	>60	---	---	---	High-----	Low.
360*: Rock outcrop.											
St. Thomas-----	D	None-----	---	>6.0	---	4-20	Hard	---	---	High-----	Low.
380----- Skyhaven	C	Rare-----	---	>6.0	---	>60	---	24-40	Thick	High-----	High.
390----- Spring	C	Rare-----	---	>6.0	---	>60	---	---	---	High-----	High.
400----- Tencee	D	None-----	---	>6.0	---	>60	---	7-20	Thick	High-----	Low.
415----- Aztec	B	None-----	---	>6.0	---	>60	---	---	---	High-----	High.
417*: Aztec-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	High.
Rock outcrop.											
418*: Aztec-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	High.
Nickel-----	B	None-----	---	>6.0	---	40-60	Hard	---	---	High-----	Low.
Knob Hill-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding		High water table		Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Months	Depth	Months	Depth	Thick-ness	Depth	Hard-ness	Uncoated steel	Concrete
				<u>Ft</u>		<u>In</u>		<u>In</u>			
419*: Aztec-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	High.
Bracken-----	B	None-----	---	>6.0	---	40-60	Soft	---	---	High-----	High.
430----- Knob Hill	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
440----- Nickel	B	None-----	---	>6.0	---	40-60	Hard	---	---	High-----	Low.
450----- Cave Variant	D	None-----	---	>6.0	---	>60	---	5-18	Thick	High-----	High.
481, 484----- Hobog	D	None-----	---	>6.0	---	8-20	Hard	---	---	High-----	Low.
500* Canutio-----	B	None-----	---	>6.0	---	40-60	Hard	---	---	High-----	Low.
Akela-----	D	None-----	---	>6.0	---	10-20	Hard	---	---	High-----	Low.
501----- Canutio	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
502*: Canutio-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
Cave-----	D	None-----	---	>6.0	---	>60	---	4-20	Thick	High-----	Low.
505* Canutio-----	B	None-----	---	>6.0	---	40-60	Hard	---	---	High-----	Low.
Akela-----	D	None-----	---	>6.0	---	10-20	Hard	---	---	High-----	Low.
510*: Akela-----	D	None-----	---	>6.0	---	10-20	Hard	---	---	High-----	Low.
Rock outcrop.											
540----- Weiser	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
542*: Weiser-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
Aztec-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	High.
545*: Weiser-----	B	None-----	---	>6.0	---	>60	---	---	---	High-----	Low.
Goodsprings-----	D	None-----	---	>6.0	---	>60	---	9-20	Thick	High-----	Low.
600*. Slickens											
605*. Dumps											
610*. Pits											
615*. Urban land											
630*. Badlands											
635*, 640*. Rock outcrop											
645*. Pits											

* See description of the map unit for composition and behavior characteristics of the map unit.

APPENDIX C

Response to Comment No. 4 (North Environmental Detention Basin Modification)

Reference Material –
North Environmental Detention Basin

riprap size in Appendix B.2.a is 24 inches, giving a total thickness of 48 inches. Flow depths were calculated using WSPG and the output is located in Appendix B.2.a. The system is located close to the existing 8" sanitary sewer line located in the Buffalo Drive alignment. A transition structure is located at the upstream end that reduces the bottom width from 40 feet to 30 feet. The 40-foot width helps increase inflow at the upstream end and prevents excessive ponding on the area to the west. The trail will cross the channel with a bridge.

6.2.2 "C4" Channel

This system consists of a riprap line channel and is located near the midpoint of the north side of the NEEA (See Figure 6.1 and design plans). The purpose of this system is to capture flow from the park property to the west and convey it into the detention basin. Future and interim flow rates are 480 and 380 cfs, respectively. Riprap sizing is based on future conditions. The design velocity is 10.7 feet per second. The calculated D50 riprap size in Appendix B.2.a is 24 inches, giving a total thickness of 48 inches. Flow depths were calculated using WSPG and the output is located in Appendix B.2.a. Flow calculations were not provided for interim condition since the flow rate is less than in the future. A transition structure is located at the upstream end that reduces the bottom width from 40 feet to 20 feet. The 40-foot width helps increase inflow at the upstream end and prevents excessive ponding on the area to the north. The trail will cross the channel with a bridge.

The channels are designed to be riprap lined to reduce flows to manageable levels before discharge into the detention basin. Flow depth and riprap sizing calculations for both channels and the berms are included in Appendix B.

6.2.3 NEEA Outfall Pipe

This outfall system consists of an approximately 320 foot length of 36" RCP at a 0.3% slope that is connected to the primary outfall structures inside of the basin (See Figure 6.1). It is located inside of the Park, south of the NEEA, where it runs southeast and discharges onto an existing riprap structure in an existing drainage easement on the Silverstone Golf Course property (see design plans). The discharge velocity is approximately 6 feet/sec. The purpose of the system is to provide a controlled drainage of the detention basin. Future and interim flow rates are 26 cfs and 29 cfs, respectively. Normal depth calculations from Flowmaster show that the flow is not pressurized. The flow depth calculations are included in Appendix B.2.d. The primary outfall structure is similar to the one proposed for the SEEA. It has an inclined 4-foot x 6-foot grate. The low end of the grate sits at the lowest elevation of the detention basin. Calculations in Appendix B.2.d show that the velocity through the grate, assuming a 50% clogging factor, is 2.3 feet per second which is within the acceptable range. An outflow monitoring sensor is located inside of the structure. A 22-inch orifice plate is located inside the structure to maintain non-pressurized flow inside the downstream outfall pipe.



2ND CHANNEL ADDITION
REQUIRED TO RE-ACHIEVE
THIS DESIGN CONDITION

An NDOT Type 2B drop inlet has been added in tandem to the outlet structure to provide redundancy to the system.



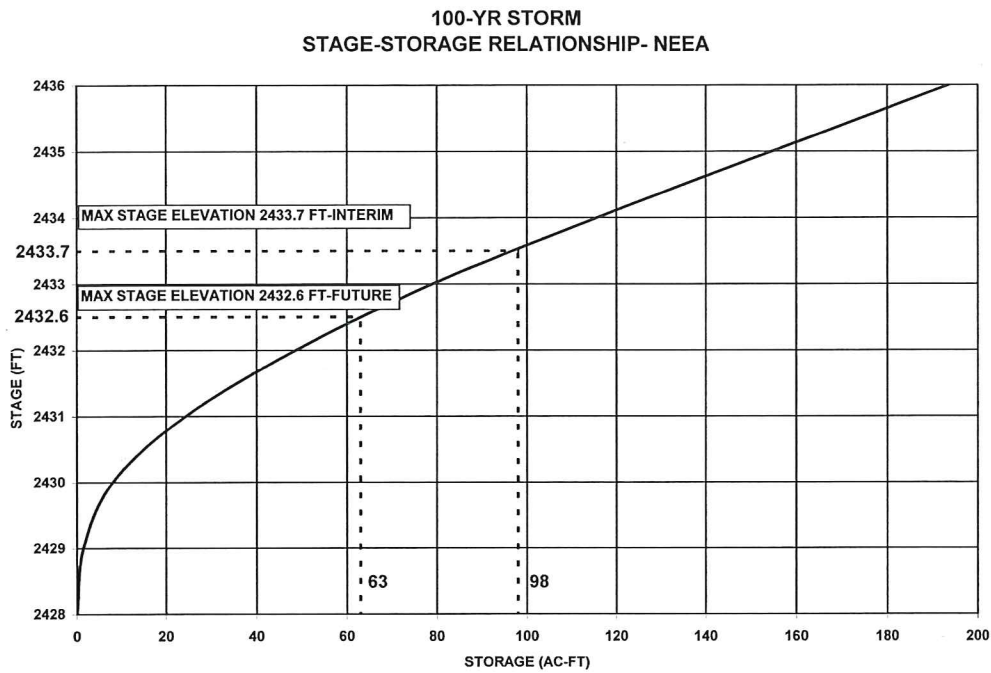


Figure 7.4 - NEEA Stage-Storage

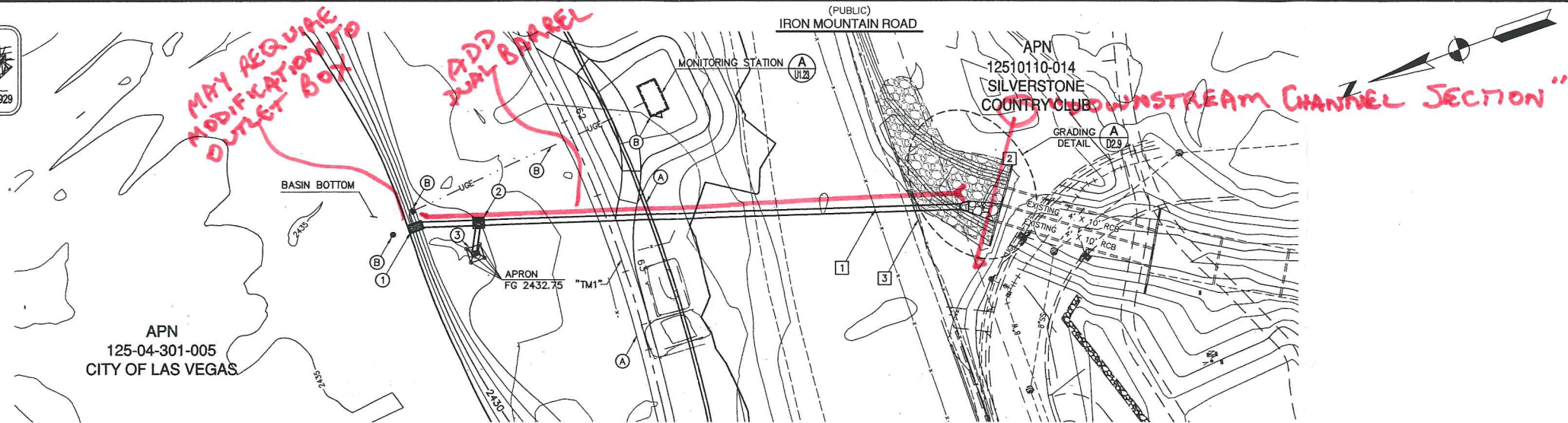
Table 7.4 - NEEA Design Parameters

Basin Characteristics	Spillway Elevation (ft)	2434.0
	Basin Invert at Outflow - Elevation (ft)	2428.00
	Outfall Pipe Size (in)	36
	Orifice Size (in)	22
	Net Excavation (cubic yds)	500,000
	Footprint Area (acres)	64
	Final Clear Water Storage Volume Spillway Crest (ac-ft)	115

**NEW 100-YR
WSE =
2433.7'**

**NOW (2) BARREL
NOW 27"**





CONSTRUCTION ITEMS:

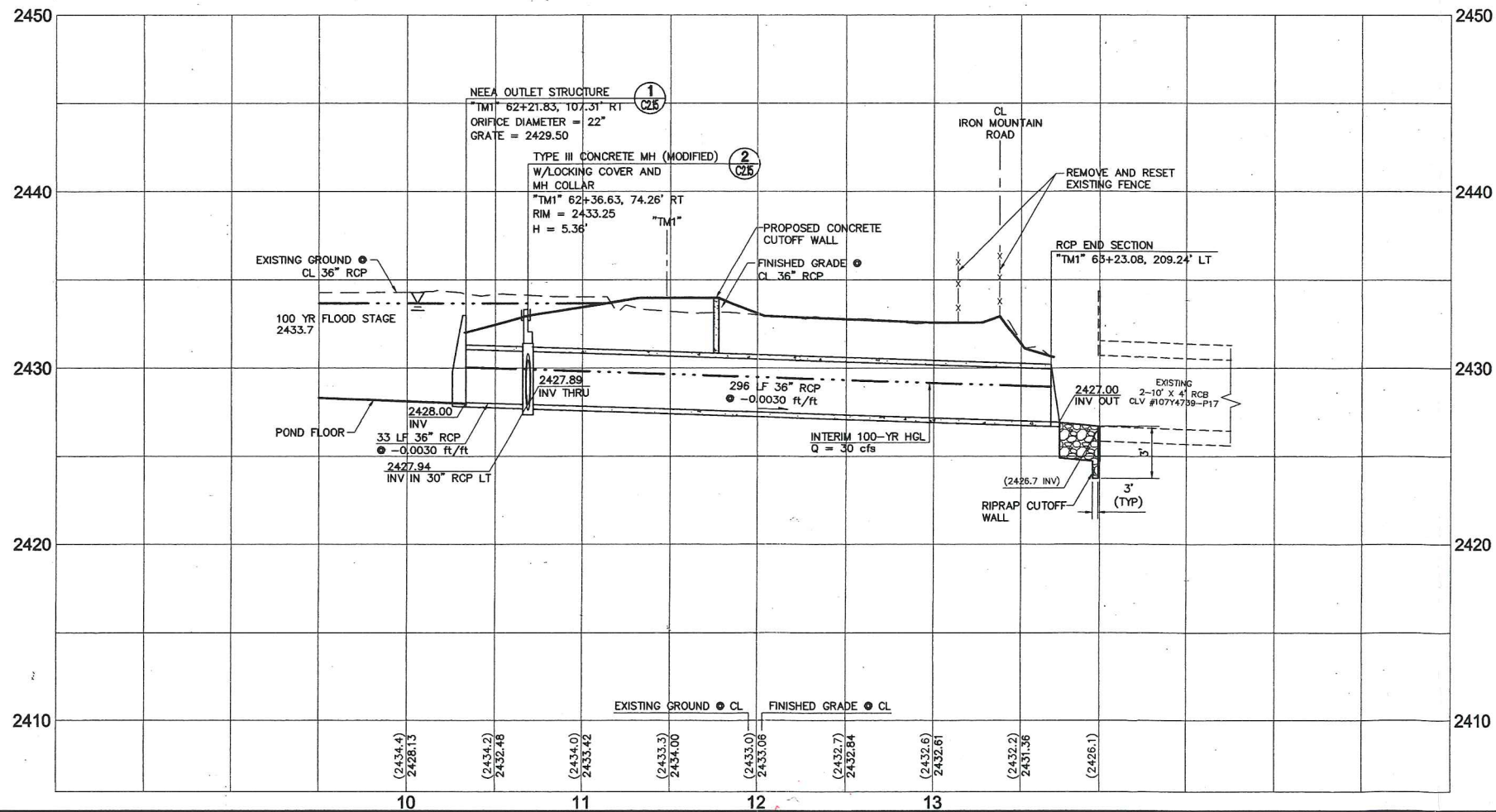
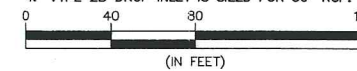
- "TM1" 62+21.85, 107.00' RT TO "TM1" 62+21.02, 115.45' RT
CONSTRUCT NEEA OUTLET STRUCTURE W/22" ORIFICE PLATE. INSTALL 33 LF OF 36" RCP. (SEE BELOW DETAIL AND A/D-2.10).
- "TM1" 62+36.63, 74.26' RT
CONSTRUCT TYPE III MH (MODIFIED). INSTALL 296 LF OF 36" RCP WITH RCP END SECTION. (SEE BELOW, DETAIL B/D2.111, DETAIL B/D2.16, DETAIL A/D2.9, AND LP1.9)
- "TM1" 62+54.87, 83.22' RT
CONSTRUCT NDOT TYPE 2B DROP INLET W/CONCRETE APRON. INSTALL 15 LF OF 30" RCP. (SEE DETAILS A&B/D2.17 AND LATERAL #39 SHEET LP1.9)

REMOVAL ITEMS:

- "TM1" 63+06.5, 158.6' LT TO "TM1" 63+16.9, 158.9' LT
"TM1" 63+11.5, 181.6' LT TO "TM1" 63+21.9, 181.9' LT
REMOVE AND RESET 20 LF OF WIRE FENCE.
 - "TM1" 63+24.2, 214.5' LT
REMOVE AND RESET 100 SF OF RIPRAP APRON.
 - "TM1" 63+11.5, 181.6' LT TO "TM1" 63+21.9, 181.9' LT
REMOVE AND RESET 20 LF OF CHAIN LINK FENCE.
- (A) SEE SHEET C2.5 FOR CONSTRUCTION NOTES.
(B) SEE SHEET U1.15 FOR CONSTRUCTION NOTES.

NOTES:

- PROTECT IN PLACE ALL EXISTING IMPROVEMENTS NOT DESIGNATED FOR REMOVAL.
- ALL RCP SHALL BE CLASS III PIPE UNLESS OTHERWISE SPECIFIED.
- SEE A/D2.18 FOR RCP TRENCH DETAIL.
- TYPE 2B DROP INLET IS SIZED FOR 36" RCP.



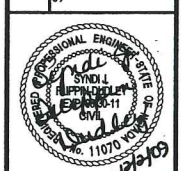
NO	DATE	DESCRIPTION	BY

SCALE (H): AS SHOWN	SCALE (V): AS SHOWN	WA #	DESIGN BY: FKR
FIELD BOOK #	DATE: 12/02/2009		
THE Louis Berger Group, INC. 500 E. Amigo Court, Suite 100 Las Vegas, Nevada 89119 Voice: 702-736-6632 Fax: 702-736-0704			

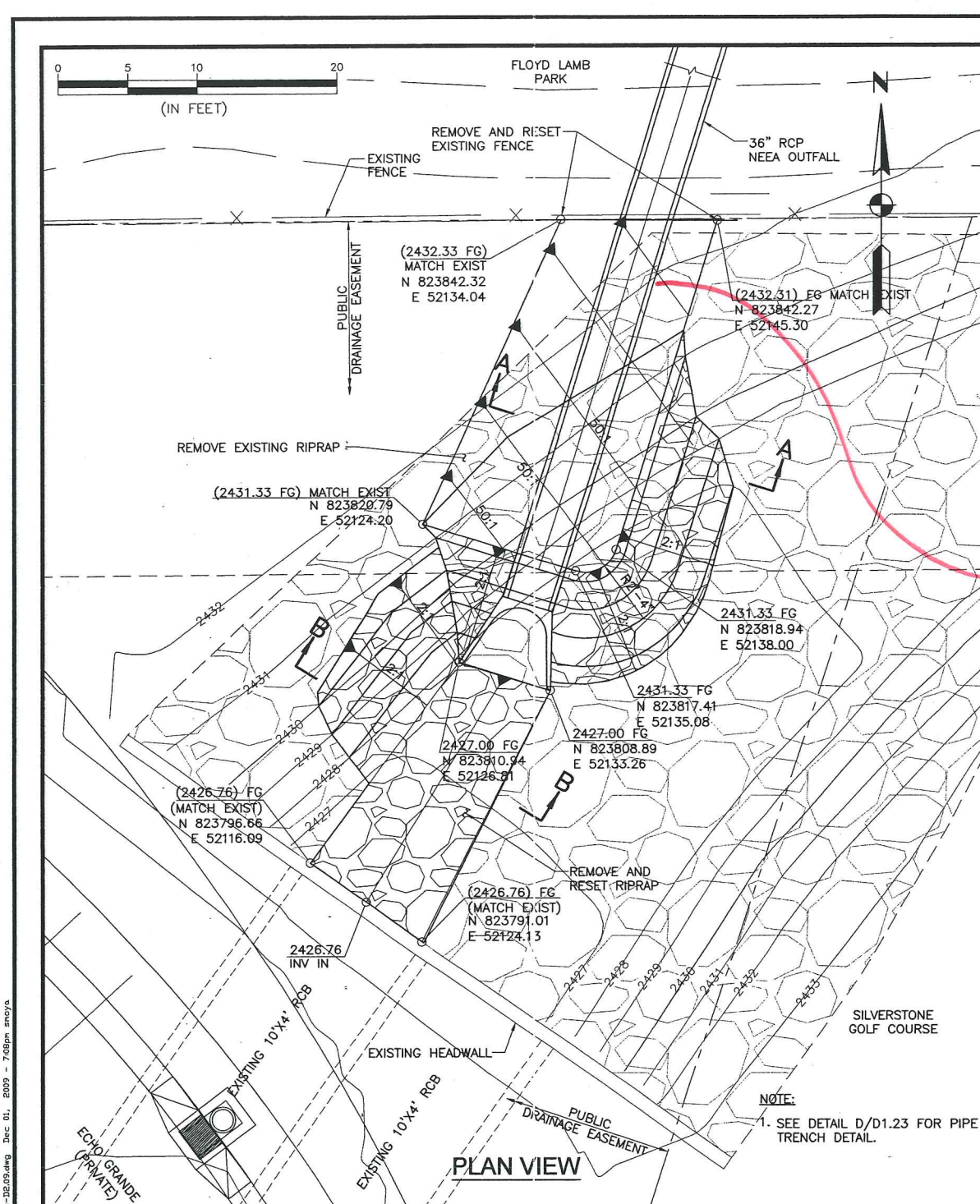


DEPARTMENT OF PUBLIC WORKS
PROJECT TITLE:
NORTH AND SOUTH
ENVIRONMENTAL
ENHANCEMENT AREAS
AT FLOYD LAMB PARK

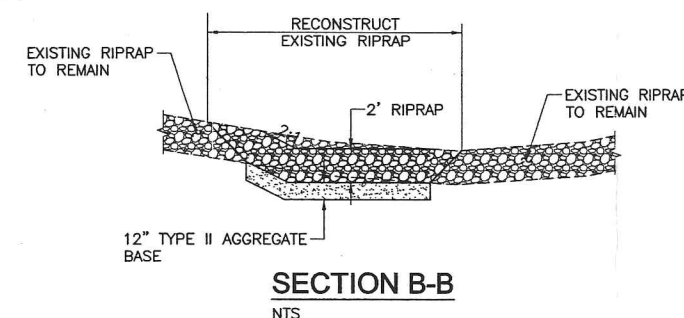
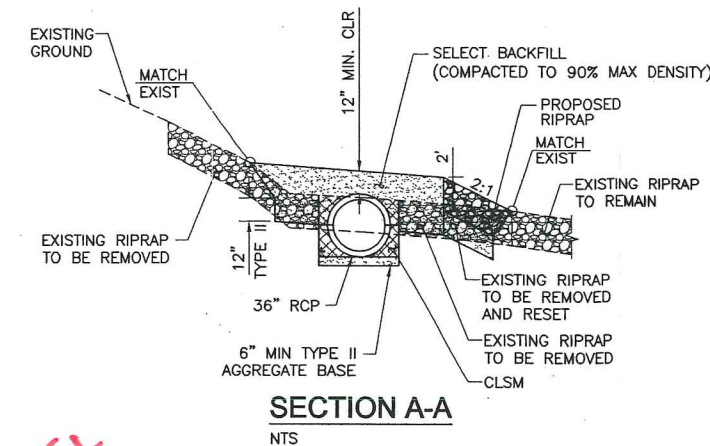
SHEET:
NEEA
36" RCP OUTFALL
PLAN AND PROFILE



SHEET:
C2.15
77 OF 314
CLV DRAWING NO:
327V202



ADD 2ND PARALLEL BARREL



A NEEA OUTFALL PIPE GRADING DETAIL
2.9 SCALE: AS SHOWN

DEPARTMENT OF PUBLIC WORKS NORTH AND SOUTH ENVIRONMENTAL ENHANCEMENT AREAS DRAINAGE DETAILS	PROJECT TITLE NORTH AND SOUTH ENVIRONMENTAL ENHANCEMENT AREAS AT FLOYD LAMB PARK	SHEET D2.9 138 OF 314 CLV DRAWING NO: 327V282	PROFESSIONAL ENGINEER STATE OF NEVADA EXPIRATION DATE 12/31/2010
	SCALE (N): AS SHOWN SCALE (V): NONE FIELD BOOK #	DATE: 12/02/2009 DESIGN BY: FKR	NO. DATE DESCRIPTION BY

Reference Material –
Silverstone Ranch

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		December 23, 2005
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT: Drainage Study for: Silverstone Ranch – Parcel 17		COPIES TO:
Cross Streets:	SEC of Iron Mountain & Buffalo Alignment	Pulte Homes
File Number:	F:\Depot\DSMemos\DS3649D.doc	Bart Anderson, P.E., DevCo
Parcel Number:	125-10-110-015	CCRFGD
Zoning Action:	TMP-4601	CCDDS
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	9/15/2004	9/29/2004	Not Approved	\$400.00	9460: \$400
2 nd Submittal	11/26/2004	12/10/2004	Conditional Approval	\$400.00	12831: \$400
CCPW & CCRFGD	2/14/2005 & 3/4/2005	3/14/2005	Concurrences	N/C	N/C
Supplement	12/19/2005	12/23/2005	See Comments Below	N/C	N/C
TOTAL FEES (LDDRS):				\$800.00	—

REMARKS:

The Drainage Study for the subject project has been reviewed and:

X	is approved subject to conformance to all City standards and the following conditions:
	must be resubmitted or supplemented including the following:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.
	is conditionally approved subject to Clark County Department of Development Services concurrence

1. Per City of Las Vegas Street and Sanitation Division, a note to signify that Golf Course Owner will maintain and repair all drainage improvements in the golf course must be placed on the improvement plans and the final map to reflect/reference such agreement.

The following comments are repeated until they are complete:

2. The response to previous comment #7 had not been complete: The CLV drawing number provided is for improvement plans for the concrete channel at the northwest corner: What was asked before is the recorded document number for the drainage easement, such as the map, file and book number etc. Provide the information on the grading plan accordingly.
3. Previous comment #11 requiring a 3'-cut off wall at the beginning of the 90" system, ie, at Station 2+00 had not been completed. Provide the 3'-cutoff wall accordingly in Sheet 8.
4. Sheet 8, in the profile, the outlet invert of the 18" nuisance pipe must match the invert of the existing 6" drain.

5. All solid grout portion of walls must be 8"-CMU.
6. The engineer must provide a table on the grading plans that shows a quantity estimate of all drainage improvements within Public Drainage Easements. All drainage improvements within Public Drainage Easements must be bonded and inspected.

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Amendment and accepted by the City of Las Vegas Flood Control Section. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the City of Las Vegas reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

NOTE: Please be advised that all land surface area disturbances over 1 acre or any area adjacent to a water way must submit to the Nevada Division of Environmental Protection a "Notice of Intent" to discharge that certifies a stormwater pollution prevention plan has been developed and is maintained on site; for inclusion in the Stormwater General Permit No. NVR100000. A phased construction unit in a contiguous subdivision is considered under construction until all stripped or disturbed surface areas have been covered by paving, building construction or planting. For more information, including forms and applications see <http://ndep.nv.gov/bwpc/storm01.htm> or call (775) 687-9429.

END OF REMARKS
ays

T/R/S: T19S/R60E/10
AREA G-10

Post-it® Fax Note	7671	Date	12/23/05	# of pages	2
To	Sami Alkayek	From	Albert S. 467		
Co./Dept.	Stantec	Co.	CLV		
Phone #		Phone #	229-2001		
Fax #	258-4956	Fax #			

2. R-1 (depicted on the HEC-RAS Section map, Appendix C) flows from the northeast to the east section of Parcel 17 (from the Floyd Lamb State Park), where the flow is intercepted at a 2-cell, 4-foot rise by 10-foot span culvert (formerly 4 cell 60-in RCP) under Echo Grande Drive (Northeast Channel). The flows drain into the existing golf course. (See Appendix D, HEC-RAS Cross Sections)
3. Basin OFF-7 drains along Buffalo Drive in a drainage swale to the south into a public drainage easement (privately maintained), Common Lot "H", at the south end of Parcel 17. This flow drains into the existing golf course channel per the Addendum to the Second Update to the Conceptual Drainage Study for Silverstone Ranch (formerly Mountain Spa). (See grading plan sheet 4.)

(See Figure H-4 Appendix A, *Clark County Regional Flood Control 2002-Updated Oct. 2003 Las Vegas Valley Flood Control Master Plan update, Hydrologic Sub areas, Land Use & Soils* in Appendix A, Northwest Neighborhood Studies in Appendix D).

3. DEVELOPED ON-SITE DRAINAGE DESCRIPTION

a) ULTIMATE CONDITION

As indicated in reference *Figure 3 -Ultimate Condition Drainage Basin Map (Appendix F)*, Basin P1B runs from north to south, producing approximately 7 (seven) cfs. One modified drop inlet systems with two grates on the east side of Echo Grande at Common lot "G", and an 18-inch diameter pipe will convey the storm water and nuisance flow to the golf course.

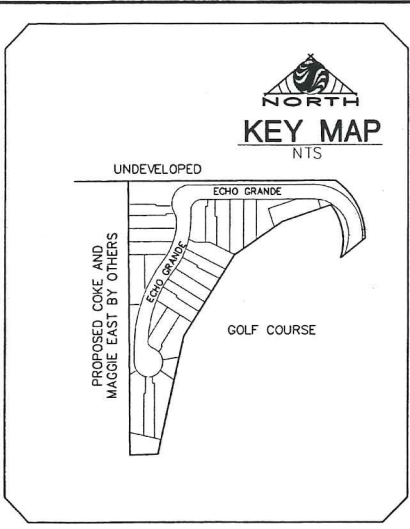
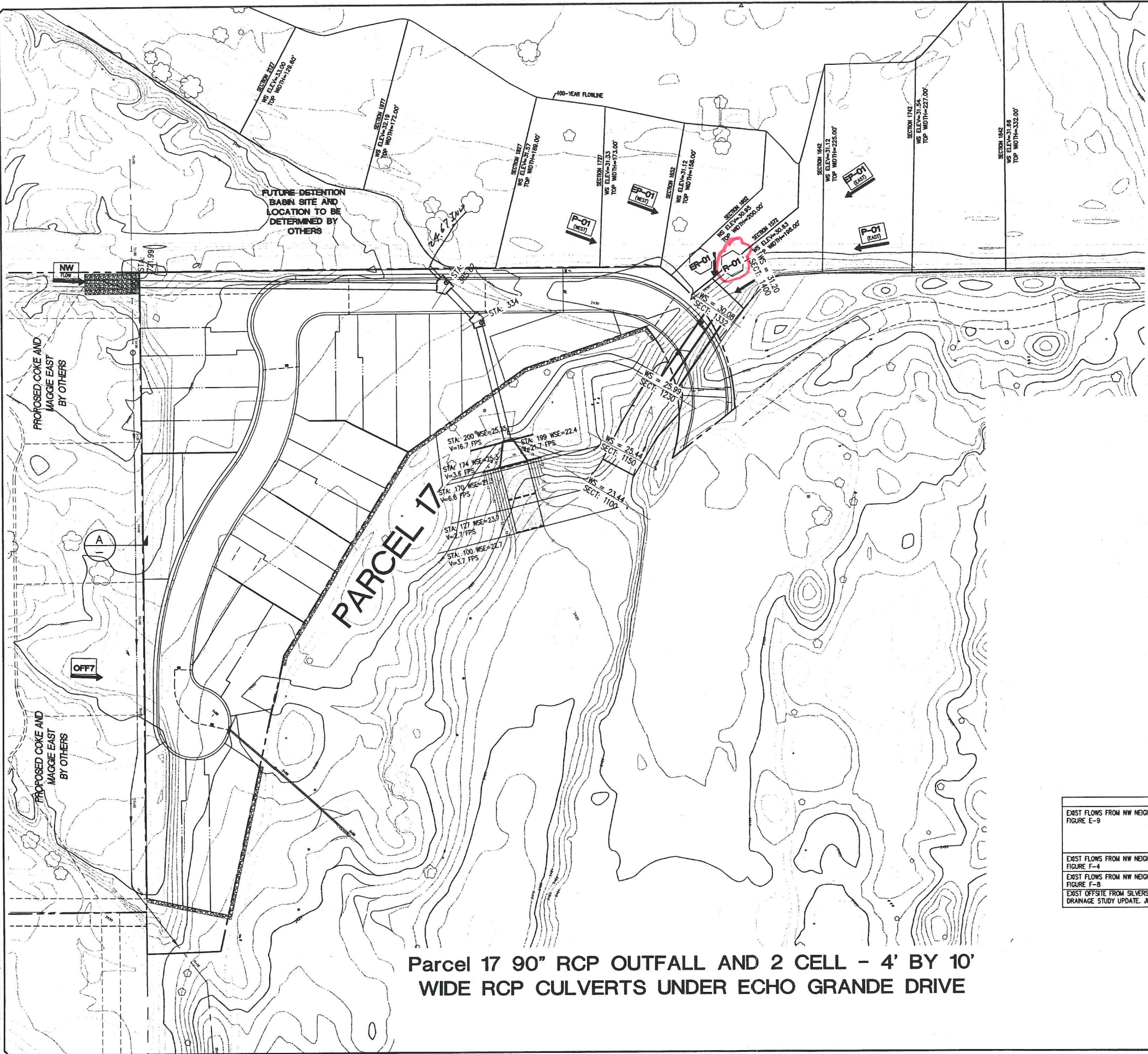
Under ultimate condition, Basin P1A runs in the direction of west to east, producing a maximum of 3 (three) cfs under 100-year flows. Two-drop inlets at the northeast channel will drain the excess flow from P1A to prevent runoff from reaching Parcel 14.

(See reference *Figure 3 -Technical Drainage Exhibit Ultimate Condition Drainage Basin Map* in Appendix C.)

Proposed Drainage Facilities

- The Master Study describes 4 60-inch diameter culvert at the entrance to Parcel 17 on Echo Grande, however the culvert has been replaced by two 4-foot by 10-foot wide box culverts per discussions with Randy Fultz and Gregg Medermit on August 3, 2004. Flows from this channel account for 676 cfs per the proposed 100-year event. (See HEC-RAS Model Appendix D)
- As described in the Master Planning section of this report a 90-inch RCP will transfer flows from the northwestern corner of the property along Iron Mountain Road Alignment to the golf course. Flows are from the Coke and Maggie East drainage channel on Iron Mountain Road. Approximately *577 cfs (interim and capacity of the trapezoidal channel along the south side of Iron Mountain) will

W:\Active\08147651\Grading\Parcel17\drainage\VEC-RAS_GROSS_SECTION.dwg nwnmks Tue, 28 Sep 2004 - 8:05am



STORM FLOW SUMMARY				
EXIST FLOWS FROM NW NEIGHBORHOOD STUDY FIGURE E-9	BASIN/CONC. POINT	AREA (Acres)	Q100 (CFS)	Q10 (CFS)
	EP-01 (WEST)	120	33	
	EP-01 (EAST)	207	56	
	ER-01	327	89	
	P-01 (WEST)	248	78	
EXIST FLOWS FROM NW NEIGHBORHOOD STUDY FIGURE F-4	P-01 (EAST)	428	135	
EXIST FLOWS FROM NW NEIGHBORHOOD STUDY FIGURE F-8	R-01	676	213	
EXIST OFFSITE FROM SILVERSTONE RANCH MASTER DRAINAGE STUDY UPDATE, JULY, 2004	NW FLOW	952	316	
	OFF 7	14	20	8

This grading plan is a part of drainage study # 3649 which was received on 9/28/04 and Rejected on 9/28/04. Page 6 Of 14.

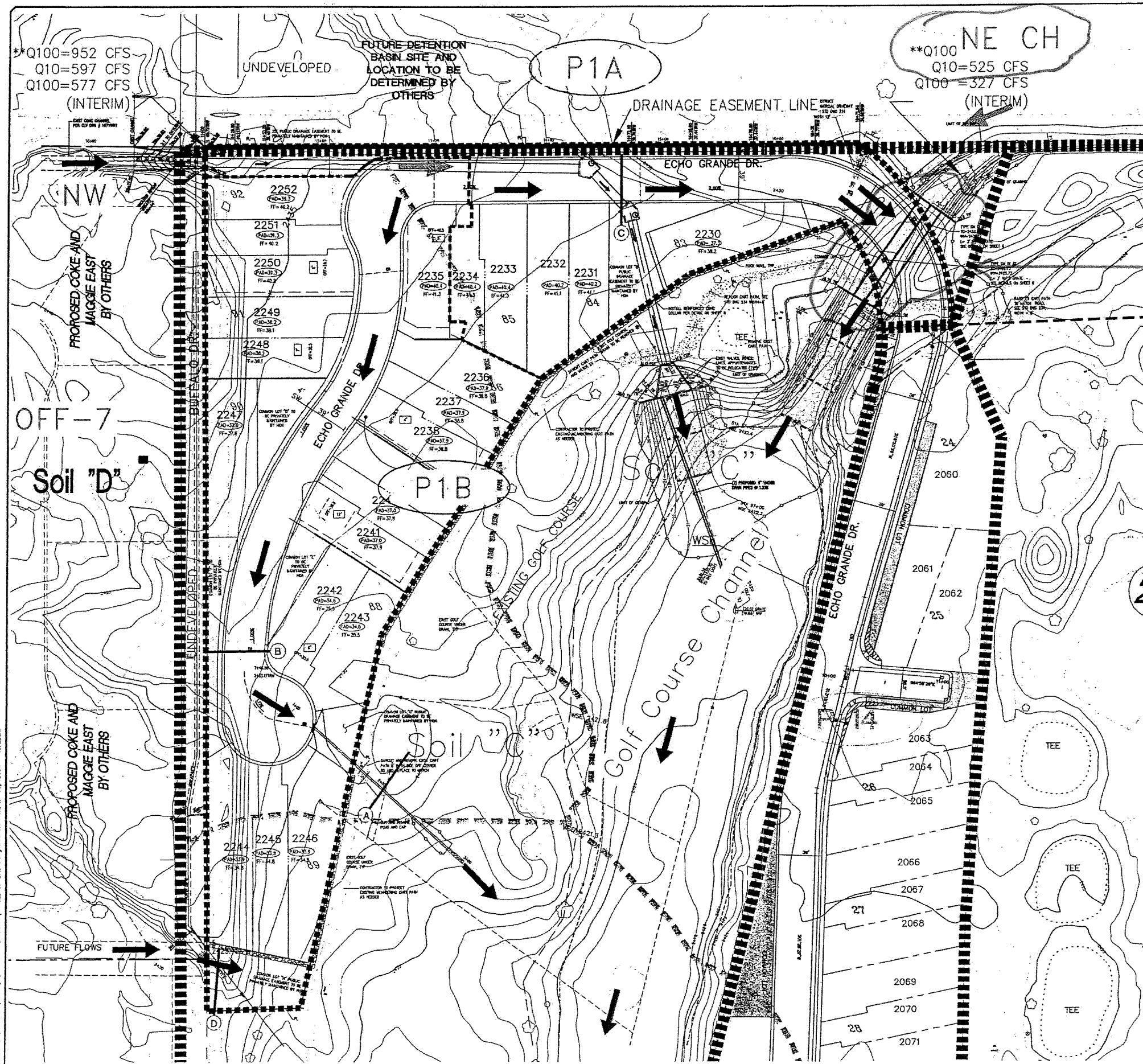
DATE : 9/28/2004
PM :
DRAWN BY : MH
DESIGNED BY : MH
CHECKED BY : SA
ADA CHECKED :
JOB NO. :
SCALE :
JOB -# :
DESCRIPTION :
NO. :
DATE :
APPD :

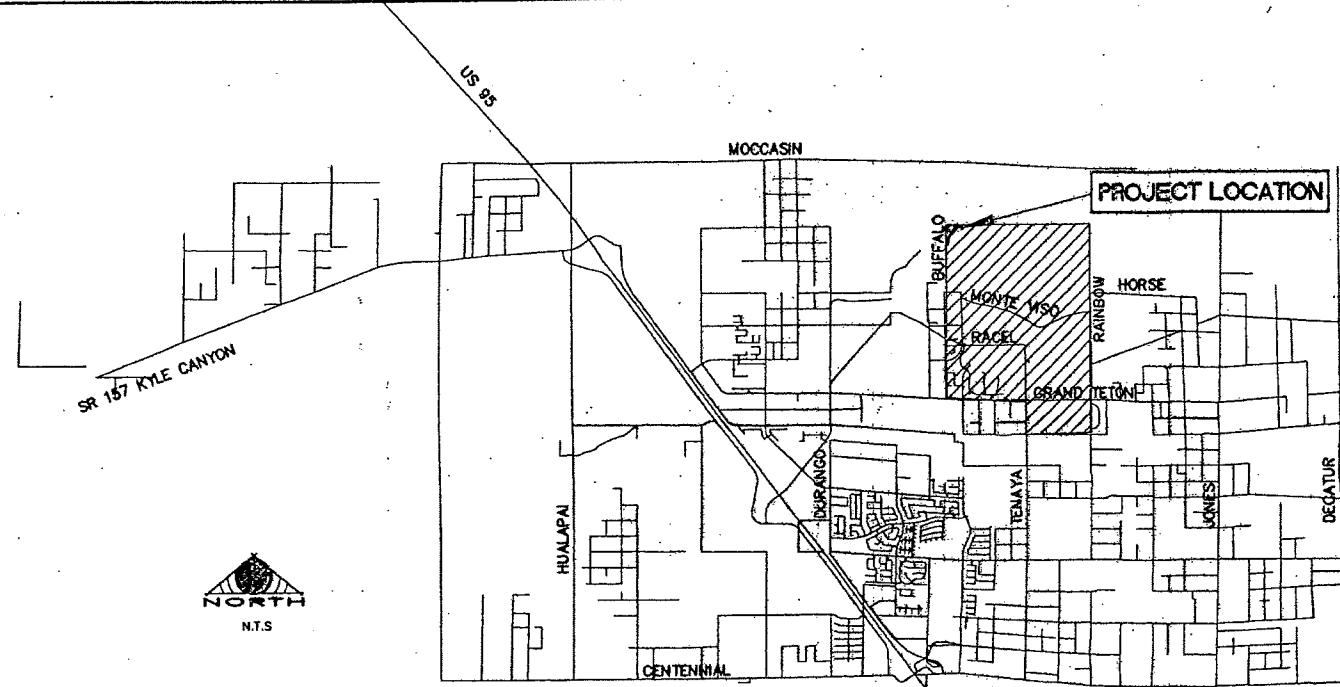
Stantec Consulting Inc.
7251 W. Charleston Blvd.
Las Vegas NV U.S.A.
89117
Tel. 702.258.0115
Fax. 702.258.4956
www.stantec.com

Pulte Homes

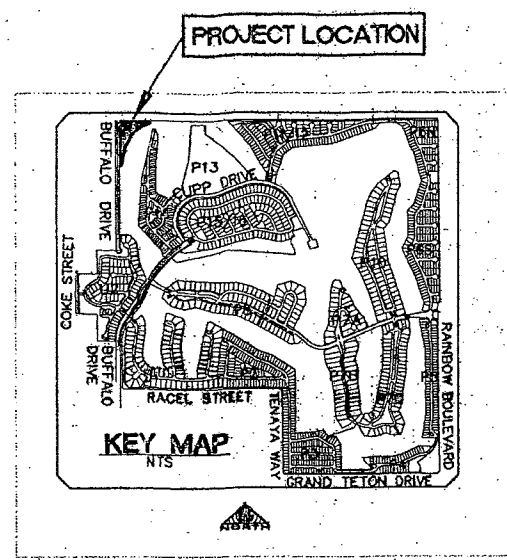
PULTE HOMES
SILVERSTONE RANCH TDS P-17
HEC RAS / WSPG SECTIONS

SHEET 1 OF TOTAL
C.L.V.DWG.#





VICINITY MAP
NOT TO SCALE



IMPROVEMENT PLANS FOR SILVERSTONE RANCH PARCEL 17

CITY OF LAS VEGAS
STATE OF NEVADA

APN #125-10-110-015
Project Number: 188147079

NOTE:
ALL LAND SURFACE AREA DISTURBANCES OVER 1 ACRE REQUIRE A STORMWATER DISCHARGE PERMIT ISSUED BY THE NEVADA DIVISION OF ENVIRONMENTAL PROTECTION (NDPE). A PHASED CONSTRUCTION UNIT IN A CONTIGUOUS SUBDIVISION IS CONSIDERED UNDER CONSTRUCTION UNTIL ALL STOPPED OR DISTURBED SURFACE AREAS HAVE BEEN COVERED BY PAVING, BUILDING CONSTRUCTION OR PLANTING. A STORMWATER DISCHARGE PERMIT APPLICATION AND ASSOCIATED INFORMATION MAY BE DOWNLOADED FROM THE WEB SITE: <http://www.ndpe.state.nv.us/ndpe/Stormwater/Stormwater.htm>
PROJECTS THAT DISTURB MORE THAN ONE ACRE OF LAND MUST SUBMIT TO NDPE A "NOTICE OF INTENT" FOR INCLUSION UNDER STORMWATER PERMIT NO. HW100000 ALONG WITH THE APPROPRIATE FILING FEE.

SHEET NO	DESCRIPTION
1	COVER SHEET
2	GENERAL NOTES
3	GRADING PLAN 1
4	GRADING PLAN 2
5	GRADING PLAN DETAILS 1
6	GRADING PLAN DETAILS AND WALL FOOTING PROFILES 2
7	WEST BOUNDARY WALL PLAN & PROFILE
8A	STORM DRAIN PROFILE 1
8	STORM DRAIN PROFILE 2
9	SANDY 13.1E DRIVE - 6+50 TO 12+25: PLAN & PROFILE
10	ECHO GRANDE STREET - 12+25 TO 18+00: PLAN & PROFILE
11	UTILITY PLAN 1
12	UTILITY PLAN 2
13	MASTER FIRE HYDRANT AND UTILITY PLAN, UTILITY NOTES AND DETAILS
14	HORIZONTAL CONTROL PLAN 1
15	GENERAL STRUCTURAL NOTES AND TYPICAL DETAILS
16	NORTH RETAINING WALLS
17	OUTLET STRUCTURE AND DETAILS
18	INLET STRUCTURE & CUTOFF WALL DETAILS
19	INLET STRUCTURE DETAILS & WEST WALL RETAINING WALLS
20	RCB#1 PLAN AND DETAILS
21	RCB#1 DETAILS
22	RCB#2 PLAN, SECTION, AND DETAILS

CAUTION TO CONTRACTOR:
THE CONTRACTOR SHALL BE RESPONSIBLE TO INVESTIGATE AND VERIFY THE ACTUAL LOCATION AND DEPTH OF ALL EXISTING UNDERGROUND FACILITIES AT LEAST 48 HOURS IN ADVANCE OF THE PERFORMANCE OF ANY WORK.

APPROVALS	
<i>Charles Kalkowski, Jr.</i> CHARLES KALKOWSKI, JR., PE #4784 CITY ENGINEER	11-21-2005 DATE
APPROVAL OF THESE PLANS IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHTS-OF-WAY AND/OR DEDICATED EASEMENTS. THIS APPROVAL DOES NOT AUTHORIZE THE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS, EXCEPT THOSE SPECIFICALLY LISTED UNDER DEVIATIONS FROM STANDARD. THE ENGINEER SHALL RESOLVE ANY DEVIATION OTHER THAN THOSE LISTED IN DEVIATIONS FROM STANDARDS IN FAVOR OF THE UNIFORM STANDARD DRAWINGS AND SPECIFICATIONS, CLARK COUNTY AREA OF NEVADA.	
<i>M. Margo Wheeler</i> M. MARGO WHEELER ACP, DIRECTOR OF PLANNING AND DEVELOPMENT. THIS PLAN MEETS THE APPLICABLE STANDARDS OF THE PLANNING AND DEVELOPMENT DEPARTMENT.	DATE
<i>Angie Hill</i> ANGIE HILL CITY FIRE MARSHAL	10/31/05 DATE
<i>Las Vegas Valley Water District</i> LAS VEGAS VALLEY WATER DISTRICT PROJECT # 109300 (SHEETS 1, 2, 5, 9-13)	11-9-05 DATE
<i>Southwest Gas Corporation</i> SOUTHWEST GAS CORPORATION	11/7/05 DATE
<i>Nevada Power Company</i> NEVADA POWER COMPANY	11/9/05 DATE
NEVADA POWER COMPANY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NEVADA POWER COMPANY RESERVES THE RIGHT TO ADDRESS ANY EXISTING OR FUTURE CONFLICTS ONCE THE FINAL DESIGN IS COMPLETE. THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICTS WILL BE ACCOMPLISHED PURSUANT TO THE NEVADA PUBLIC UTILITY COMMISSION'S RULES AND REGULATIONS.	
<i>COX COMMUNICATIONS LAS VEGAS, INC.</i> COX COMMUNICATIONS LAS VEGAS, INC.	11/10/05 DATE
<i>SPRINT</i> SPRINT	11-9-2005 DATE
THE AFFIRMED SPRINT NEVADA APPROVAL DOES NOT ASSUME OR GUARANTEE LIABILITY FOR KNOWN OR UNKNOWN CONFLICTS WITH EXISTING OR PROPOSED IMPROVEMENTS. RESOLUTION OF ANY CONFLICT SHALL BE ACCOMPLISHED PURSUANT TO LOCAL ORDINANCES, NEVADA REVISED STATUTES AND/OR PUBLIC UTILITY COMMISSION RULES AND REGULATIONS.	

DATE: 10/24/2005	SA	DATE: 11/21/2005	APPROVED
DRAWN BY: M.H.A.P.	SA	NO. DESCRIPTION	DATE
DESIGNED BY: M.H.A.P.	SA		
CHECKED BY: M.H.A.P.	SA		
ADA CHECKED: M.H.A.P.	SA		
JOB NO.: 188147079	SA		
SCALE: N.T.S.	SA		

Copyright Reserved

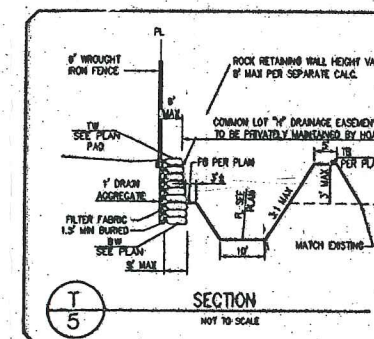
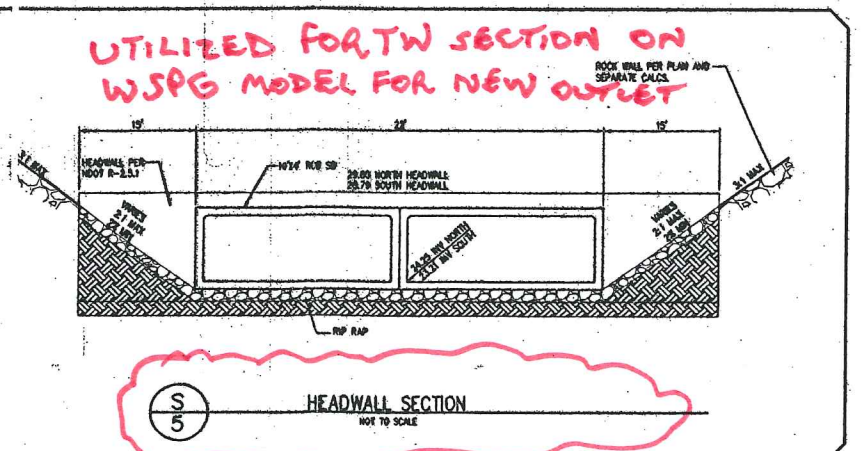
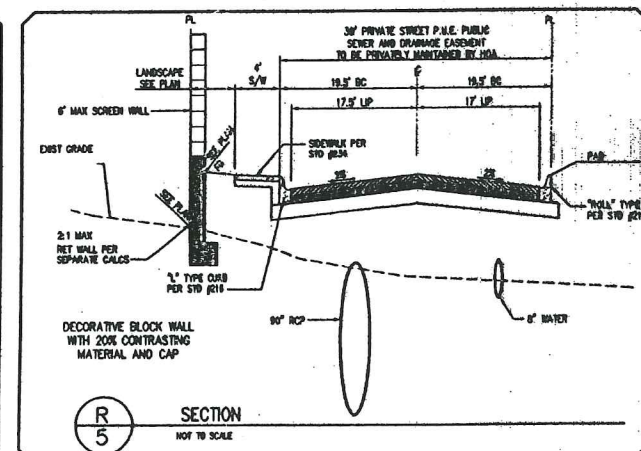
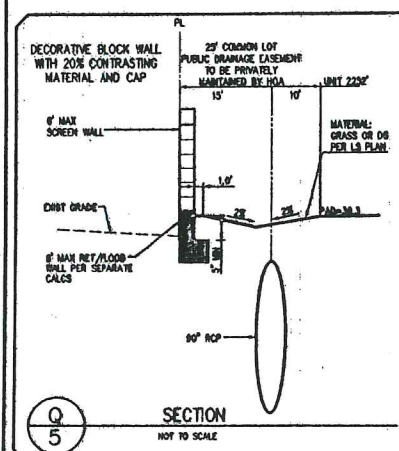
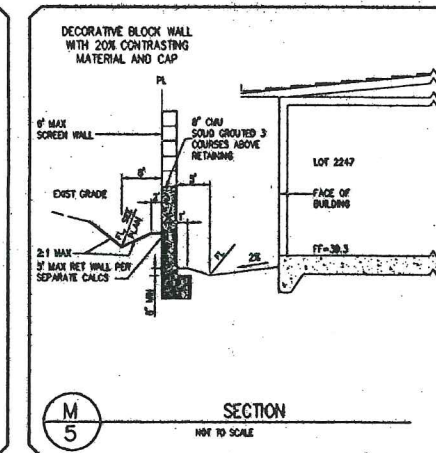
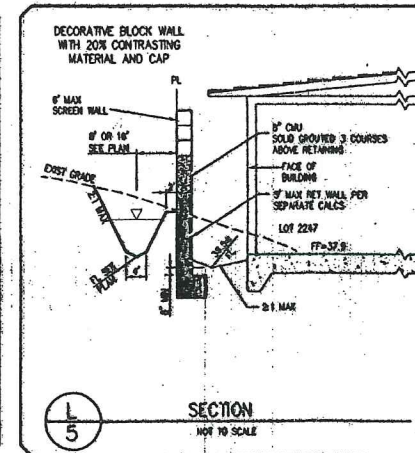
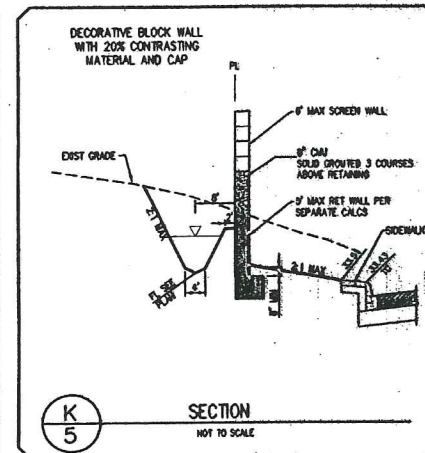
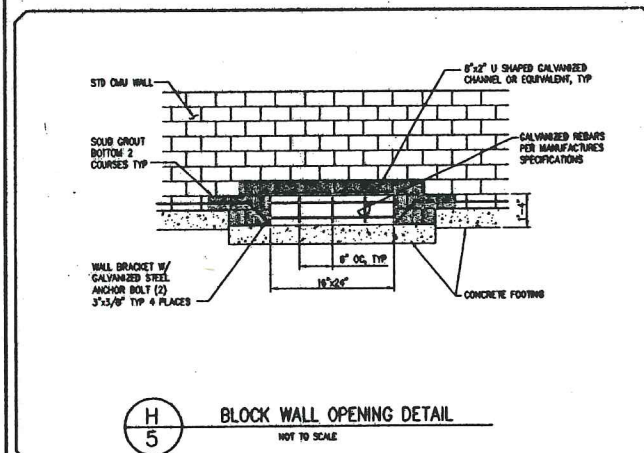
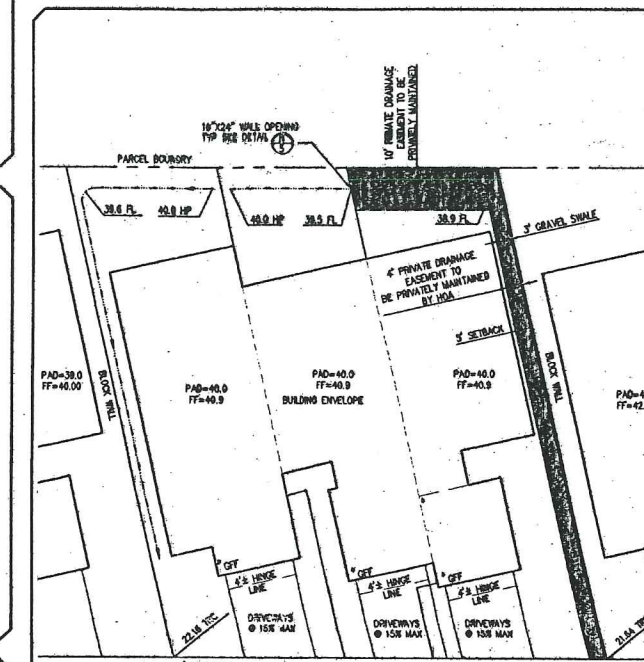
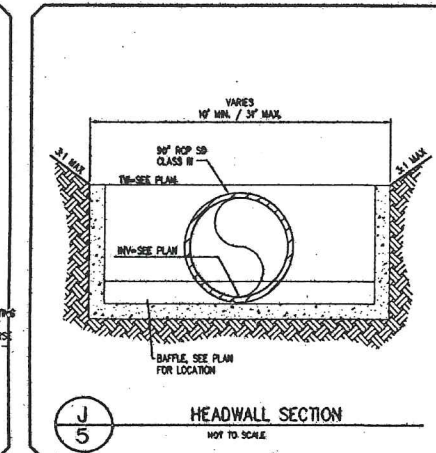
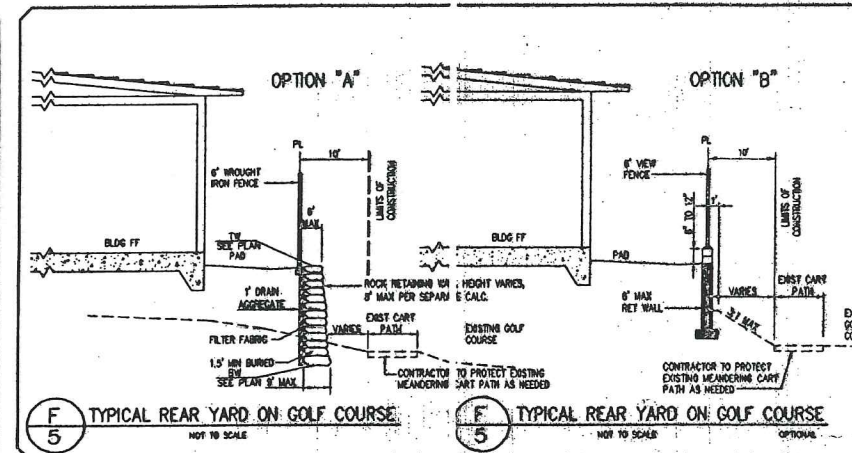
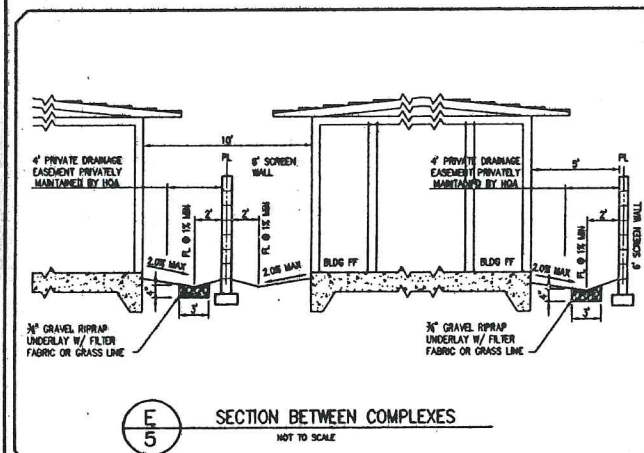
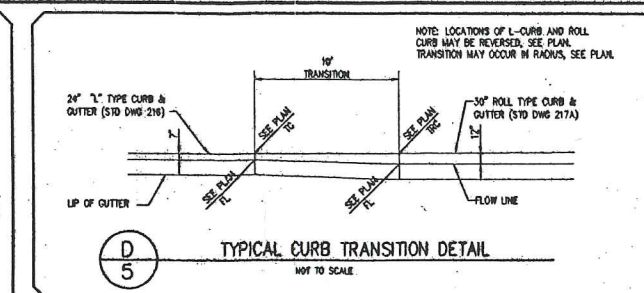
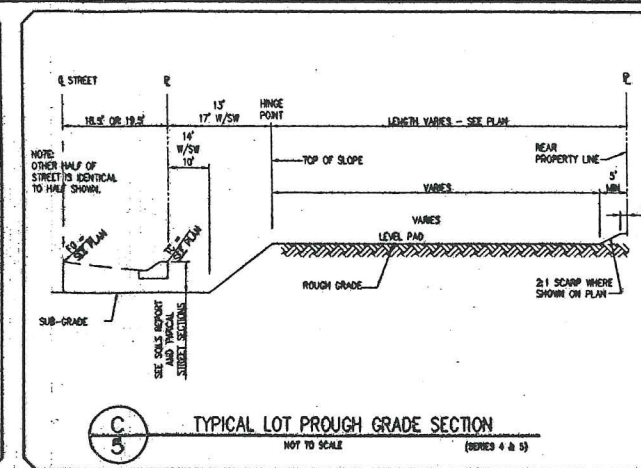
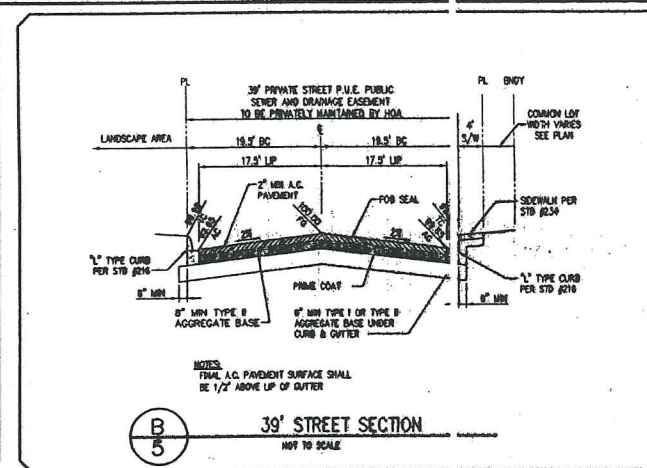
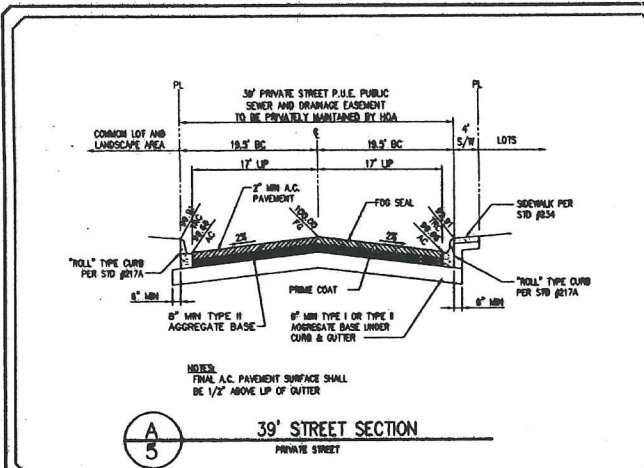
Stanley Consulting Inc.
7251 W. Charleston Blvd.
Las Vegas, NV 89117
Tel: 702.258.0115
Fax: 702.258.4958
www.stanleyinc.com

State of Nevada
188147079
(702) 258-7800

PULTE HOMES
SILVERSTONE RANCH
PARCEL 17
COVER SHEET

SAVING ALIQUOTS
11-21-05
CIVIL
188147079

SHEET 1 OF 22
CLV.DWG. 188147079



CALL BEFORE
UNDERGROUND

AVOID THE TRIP AND
STREET LIGHTS AND
CROSSING

Call
before you
Underground

1-702-465-7373
1-702-465-7373
1-702-465-7373
1-702-465-7373

CLARK
LAS VEGAS, NV 89102

avoid hitting overhead
power lines. It's simple.

avoid hitting overhead
utility lines. It's simple.

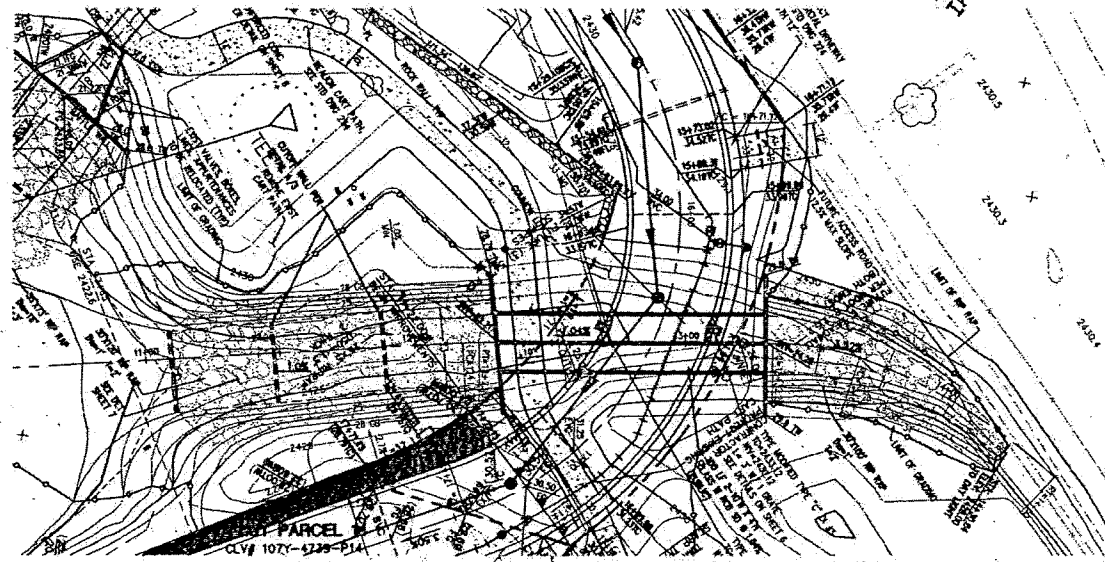
Call
before you do
Overhead

Call
before you do
Dig.

1-702-227-2929 1-800-227-2860

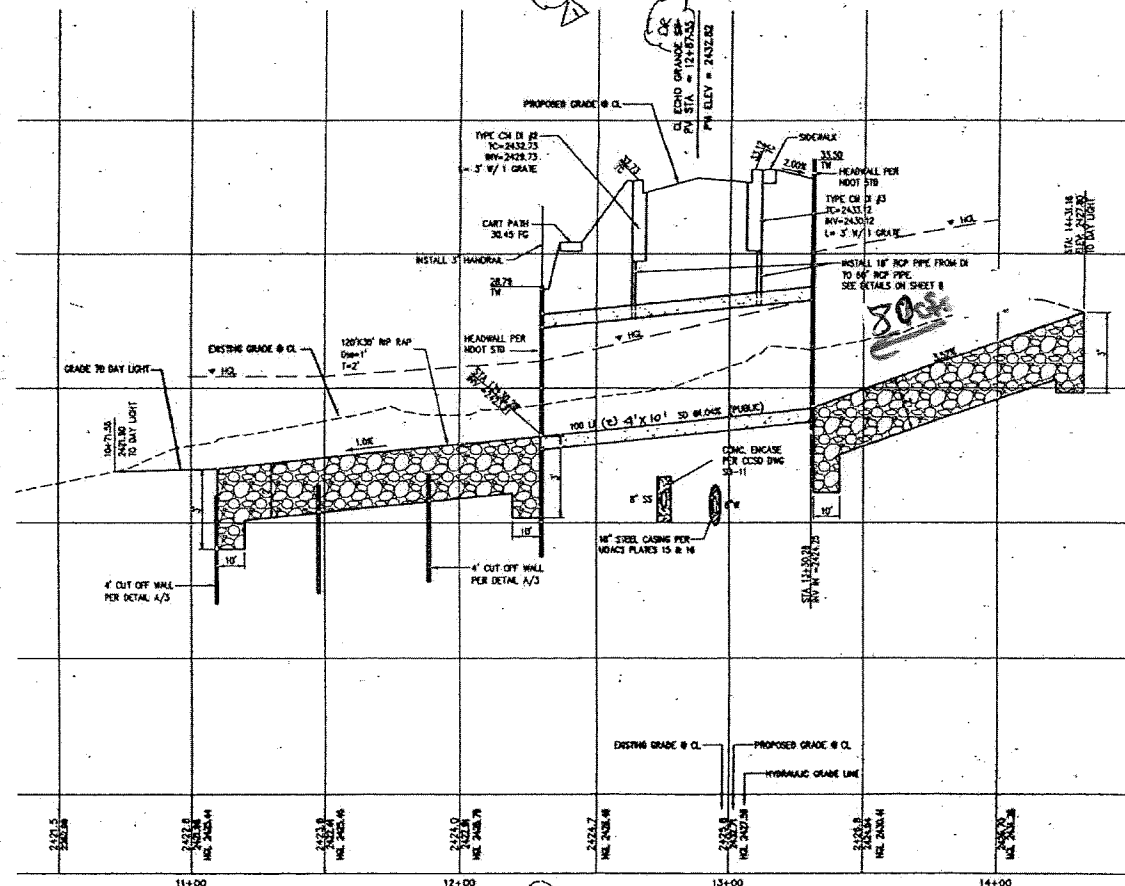
©1999 HANSON

PULTE HOMES SILVERSTONE RANCH PARCEL 17 GRADING PLAN DETAILS		Static Consulting Inc. 7231 W. Charleston Blvd. Las Vegas NV U.S.A. 88117 702.258.0115 Fax 702.258.4936 www.static.com  Static Pulte Homes 1432 VILLAGE CENTER CIRCLE, SUITE 250 LAS VEGAS, NEVADA 89134 (702) 258-7800	
DATE :	10/26/2000	N. D.	DATE
PH :	SA	N. T.S.	APPRO
DRAWN BY :	MH, AP		
DESIGNED BY :	MH, AP		
CHECKED BY :	SA		
ADA CHECKED :			
300 NO. :	1381/97979		
SCALE :			



ECHO GRANDE ST 2'-4'x10' RCB SD (PUBLIC)

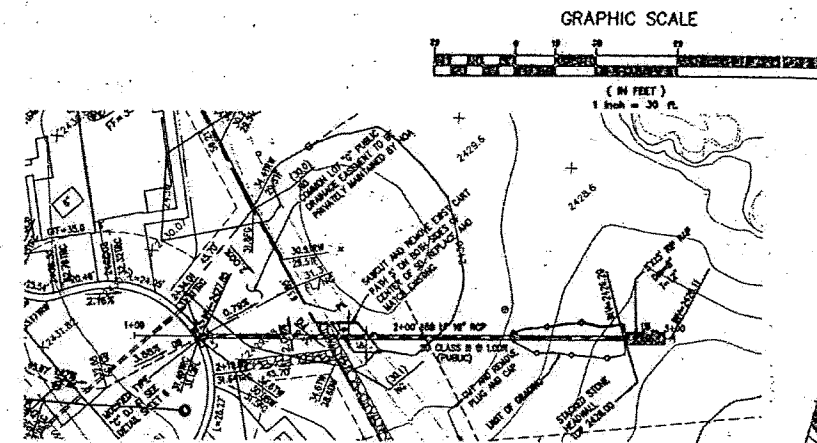
PLAN



ECHO GRANDE ST 2'-4'x10' RCB SD (PUBLIC)

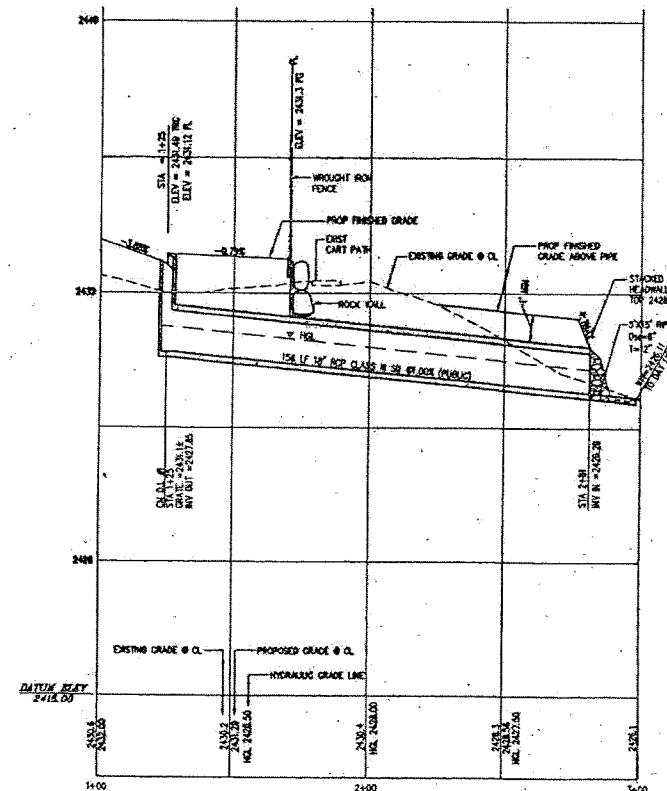
PROFILE

SCALE: HORIZ. 1" = 30'
VERT. 1" = 3'



18" RCP SD (PUBLIC)

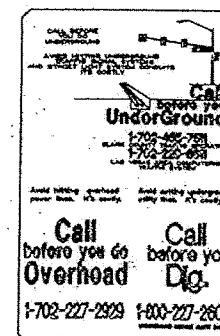
PLAN



18" RCP SD (PUBLIC)

PROFILE

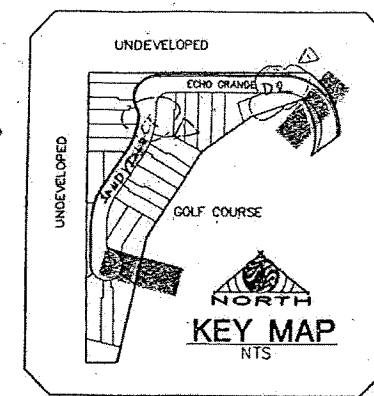
SCALE: HORIZ. 1" = 30'
VERT. 1" = 3'



NOTE:
1. ALL PRIVATE STREETS ARE P.U.E., PUBLIC SEWER EASEMENTS, AND PUBLIC DRAINAGE EASEMENTS TO BE PRIVATELY MAINTAINED BY HOA.

UTILITY DISCLAIMER NOTE

UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXISTING HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.



DATE:	11/25/2006	SA
DESIGNED BY:	MM, AP	SA
CHECKED BY:	MM, AP	SA
ADA CHECKED:		SA
JOB NO.:	18817079	
SCALE:	1" = 30'	

Starline Consulting Inc.
7225 W. Charleston Blvd.
Las Vegas, NV 89117
Tel: 702.258.0115
Fax: 702.258.4956
www.starlineinc.com

Pulte Homes
LAS VEGAS, NEVADA 89117
(702) 258-7800

PULTE HOMES
SILVERSTONE RANCH
PARCEL 17
STORM DRAIN PROFILE 1

SEAL
CIVIL
18-07-05
SHEET 7 OF 22
CLV, DWG. 10974337-P17

Rec'd 7/8/04
DS 3176-1
G-10
\$ 400 -

Addendum to 2nd Update to the
Conceptual Drainage Study
For
Silverstone Ranch
(Formerly Mountain Spa)
July, 2004
88147079

Prepared for:

Pulte Homes
1150 South Eastern
Henderson, NV 89052
Ph: (702) 914-4700
Fax: (702) 914-4997

Prepared by:

Stantec Consulting INC
7251 W Charleston Boulevard
Las Vegas, Nevada 89117
PH: (702) 258-0115
Fax: (702) 258-4956

Hydraulic Analyses:

Proposed 90" RCP Outfall:

In the May 3, 2004 Drainage Meeting mentioned above, we were informed of the possibility of detention basin at the Northeast corner of Buffalo and Iron Mountain road. This facility was analyzed for both the interim flows and ultimate flows. Appropriate stubs will be provided at the Junction Box Structures where the inflow and outflow pipes will be located should the detention basin be constructed in the future. The Detention Basin, located north of Parcel 17, will be designed/constructed to handle future ultimate flows totaling 1805 cfs. A segment of the 90" RCP (approximately 275 feet) will be plugged and abandoned and the westerly flows of 952 cfs will be discharged directly into the Detention Basin. This westerly flows of 952 cfs will be combined with the northerly flows including 676 cfs for a total 1805 cfs as shown in the Northwest Master Study Update. Based on the WSPGW Culvert Hydraulic Analysis, the depth of water at the inlet and at the outlet are 12.46 and 4.61 respectively.

Proposed 4-Cell - 60" RCP Road Crossing Culverts:

These culverts were analyzed for both existing flows (327 cfs) and ultimate northerly flows (676 cfs). As per CCRFCD Drainage Manual – Headwater Criteria, that if the design flow exceeds 500 cfs in an Urban area, the maximum Headwater shall not exceed the height of the culvert for an ultimate condition. A flow split calculation was performed to determine the amount of overland flows coming from the NW and the NE swales that discharges into the 4-cell – 60" RCP . There is no overtopping of the Echo Grande Drive as shown in the HEC-RAS Analyses.

In summary the purpose of this update is to quantify the flows impacting Parcel 17 and fulfill the requirement of a drainage study update as required in the city portion of the Buffalo vacation. A future Technical Drainage Study for Parcel 17 will address in details the above structures.

Comment 4: A Land Use Map with all the Unit Numbers and Parcel Numbers delineated must be provided prior to final approval of the Master Drainage Update.

Response: The land use map requested above was previously provided to the city. For convenience, another copy of the land use map is included with this submittal.

Comment 5: Future update and improvement for the two (2) parcels (delineated in Basins P22 and P24) south of the north boundary must include designing and constructing the berm per Regional Flood Control Standard. Although the berm is existing, it may need to be lined or modified per hydraulic calculation of the pertinent drainage update.

Plan: 2 golf course cour 1 RS: 1465 Culv Group: Culvert #1 Profile: PF 1

Q Culv Group (cfs)	676.00	Culv Full Len (ft)	
# Barrels	4	Culv Vel US (ft/s)	10.77
Q Barrel (cfs)	169.00	Culv Vel DS (ft/s)	9.00
E.G. US (ft)	30.55	Culv Inv El Up (ft)	24.13
W.S. US (ft)	30.13	Culv Inv El Dn (ft)	23.25
E.G. DS (ft)	28.22	Culv Frctn Ls (ft)	0.59
W.S. DS (ft)	27.80	Culv Exit Loss (ft)	0.85
Delta EG (ft)	2.34	Culv Entr Loss (ft)	0.90
Delta WS (ft)	2.33	Q Weir (cfs)	
E.G. IC (ft)	30.38	Weir Sta Lft (ft)	
E.G. OC (ft)	30.55	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	27.85	Weir Max Depth (ft)	
Culv WS Outlet (ft)	27.80	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.73	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.73	Min El Weir Flow (ft)	31.60

HEC-RAS Plan 2 Profile: PF 1

River	Reach	River Sta	Profile	Max Chl Dpth	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Cn
golf course cou	1	1530	PF 1	5.63	676.00	24.50	30.13	28.90	30.56	0.002830	5.20	131.23	61.53	0.64
golf course cou	1	1465		Culvert										
golf course cou	1	1410	PF 1	4.80	676.00	23.00	27.80		28.22	0.002226	5.25	137.26	51.87	0.50
golf course cou	1	1360	PF 1	4.36	676.00	22.50	26.86	26.86	27.96	0.007098	8.94	87.70	42.00	0.88
golf course cou	1	1310	PF 1	3.58	676.00	22.00	25.38	26.00	27.35	0.017600	11.87	64.93	38.95	1.33
northwest channe	1	2127	PF 1	1.10	248.00	31.90	33.00	32.50	33.18	0.009710	3.86	73.20	128.57	0.81
northwest channe	1	1977	PF 1	1.18	248.00	31.00	32.19		32.29	0.003750	2.84	104.91	172.77	0.53
northwest channe	1	1827	PF 1	1.17	248.00	30.40	31.57		31.88	0.004504	2.76	98.20	169.38	0.58
northwest channe	1	1727	PF 1	1.23	248.00	30.10	31.33		31.40	0.001802	2.07	126.00	173.20	0.37
northwest channe	1	1652	PF 1	1.22	248.00	29.80	31.12		31.22	0.003126	2.68	102.85	157.72	0.45
northwest channe	1	1602	PF 1	1.05	248.00	29.80	30.95		31.04	0.003448	2.82	111.35	200.01	0.50
northwest channe	1	1572	PF 1	0.83	248.00	30.00	30.63	30.63	30.84	0.015629	3.65	69.83	180.48	0.98
northeast channe	1	1842	PF 1	2.06	428.00	29.60	31.66	31.26	31.72	0.001708	2.59	248.69	331.64	0.38
northeast channe	1	1742	PF 1	2.54	428.00	29.00	31.54		31.58	0.000866	2.24	254.18	227.01	0.29
northeast channe	1	1642	PF 1	2.72	428.00	28.40	31.12	31.12	31.38	0.004807	5.50	141.06	224.53	0.67

New Dual Barrel Outfall – WSPG Model

		NEEA-New.WSW		0	
T1 SKYE CANYON MASTER DRAINAGE STUDY UPDATE #3					
T2 NORTH ENVIRONMENTAL DETENTION BASIN MODIFICATION					
T3 ADD PARALLEL 36-INCH RCP OUTLET PIPE					
SO	1000.0002427.000	1		2427.670	
R	1296.0002427.890	1	.013	.000	.000 1
R	1329.0002428.000	1	.013	.000	.000 0
SH	1329.0002428.000	1			
CD	1 4	2	.000	.000	.000
Q		80.000	.0		

← REFERENCED FROM ^U DOWNSTREAM SILVEASTONE CHANNEL "CALC."

CARD SECT CHN NO OF AVE PIER HEIGHT 1 BASE ZL ZR INV Y(1) Y(2) Y(3) Y(4) Y(5) Y(6) Y(7) Y(8) Y(9) Y(10)
 CODE NO TYPE PIER/PIP WIDTH DIAMETER WIDTH DROP

CD 1 4 2 3.000
 WATER SURFACE PROFILE - TITLE CARD LISTING
 W S P G W
 PAGE NO 1

HEADING LINE NO 1 IS -
 SKYE CANYON MASTER DRAINAGE STUDY UPDATE #3
 HEADING LINE NO 2 IS -
 NORTH ENVIRONMENTAL DETENTION BASIN MODIFICATION
 HEADING LINE NO 3 IS -
 ADD PARALLEL 36-INCH RCP OUTLET PIPE
 W S P G W
 PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING				W S P G W				W S ELEV				ANG PT MAN H			
ELEMENT NO	1	IS	A	SYSTEM OUTLET	STATION	INVERT	SECT	1	2427.670	RADIUS	ANGLE	ANG PT	MAN	H	
ELEMENT NO	2	IS	A	REACH	1000.000	2427.000	1	*		.000	.000	.000	1		
ELEMENT NO	3	IS	A	REACH	1296.000	2427.890	1	*		.013	.000	.000			
ELEMENT NO	4	IS	A	SYSTEM HEADWORKS	1329.000	2428.000	1	*		.013	.000	.000	0		
				U/S DATA	STATION	INVERT	SECT	1							
					1329.000	2428.000	1								
					1329.000	2428.000	1								

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top width	Height/Dia.-FT or I.D.	No With Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	"N" X-Fall	ZR	Type Ch	
1000.000	2427.000	2.059	2429.059	80.00	7.73	.93	2429.99	.00	2.06	2.78	3.000	.00
3.152	.0030					.0051	.02	2.06	.71	3.00	.013	.00
1003.152	2427.010	2.150	2429.160	80.00	7.37	.84	2430.00	.00	2.06	2.70	3.000	.00
14.846	.0030					.0046	.07	2.15	.65	3.00	.013	.00
1017.998	2427.054	2.250	2429.304	80.00	7.03	.77	2430.07	.00	2.06	2.60	3.000	.00
36.582	.0030					.0041	.15	2.25	.59	3.00	.013	.00
1054.580	2427.164	2.360	2429.524	80.00	6.70	.70	2430.22	.00	2.06	2.46	3.000	.00
84.441	.0030					.0037	.31	2.36	.54	3.00	.013	.00
1139.021	2427.418	2.483	2429.901	80.00	6.39	.63	2430.54	.00	2.06	2.27	3.000	.00
156.979	.0030					.0034	.54	2.48	.48	3.00	.013	.00
1296.000	2427.890	2.595	2430.485	80.00	6.16	.59	2431.07	.00	2.06	2.05	3.000	.00
33.000	.0033					.0033	.11	2.59	.43	2.58	.013	.00
1329.000	2428.000	2.593	2430.593	80.00	6.16	.59	2431.18	.00	2.06	2.05	3.000	.00
1329.000	2428.000	2.059	2430.059	80.00	7.73	.93	2430.99	.00	2.06	2.78	3.000	.00

TW Elev. on Stage-Discharge Orifice Calc.

SKYE CANYON MASTER DRAINAGE STUDY UPDATE #3

NORTH ENVIRONMENTAL DETENTION BASIN MODIFICATION

ADD PARALLEL 36-INCH RCP OUTLET PIPE

1000.00	.I	NEEA-New.OUT W	H	.	R
1006.71	.I	C W	H	.	R
1013.43	.			.	
1020.14	. I	C W	H	.	R
1026.86	.			.	
1033.57	.			.	
1040.29	.			.	
1047.00	.			.	
1053.71	.			.	
1060.43	. I	C W	H E	.	R
1067.14	.			.	
1073.86	.			.	
1080.57	.			.	
1087.29	.			.	
1094.00	.			.	
1100.71	.			.	
1107.43	.			.	
1114.14	.			.	
1120.86	.			.	

	NEEA-NEW.001	.	1255.14	.	I	C	W	H	E	.	R
		.	1261.86	.						.	
		.	1268.57	.						.	
		.	1275.29	.						.	
		.	1282.00	.						.	
		.	1288.71	.						.	
		.	1295.43	.						.	
		.	1302.14	.	I	C	W	H	E	.	R
		.	1308.86	.						.	
		.	1315.57	.						.	
		.	1322.29	.						.	
		.	1329.00	.	I	C	W	H	E	.	R

NOTES

1. GLOSSARY

GLOSSARY
I = INVERT ELEVATION

I = INVERT ELEVATION
C = CRITICAL DEPTH

C = CRITICAL DEPTH
W = WATER SURFACE ELEVATION

W = WATER SURFACE ELEVATION
S = SUPER-ELEVATION

S = SUPER-ELEVATION
H = HEIGHT OF CHANNEL

H = HEIGHT OF CHANNEL
E = ENERGY GRADE LINE

E = ENERGY GRADE LINE
V = CURVES CROSSING OVER

X = CURVES CROSSING OVER

B = BRIDGE ENTRANCE OR EXIT

2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY

Downstream Silverstone Channel

Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Downstream Silverstone Channel
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.040
Channel Slope	3.52 %
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	22.00 ft
Discharge	80.00 cfs

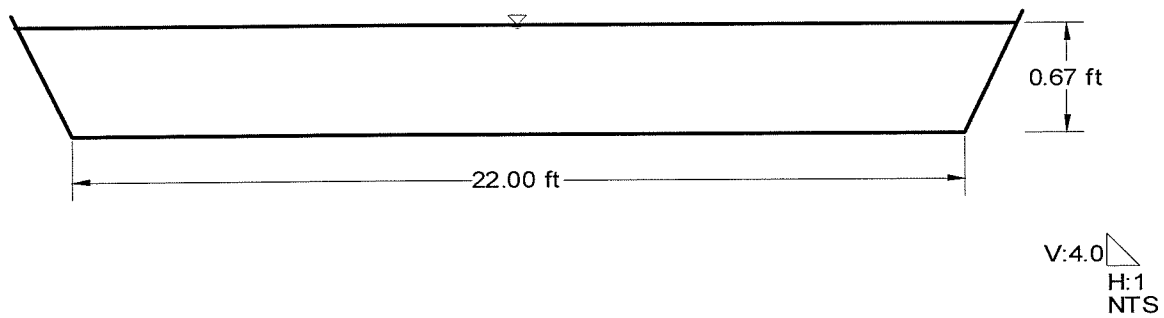
Results	
Depth	0.67 ft
Flow Area	15.7 ft ²
Wetted Perimeter	25.00 ft
Top Width	24.68 ft
Critical Depth	0.73 ft
Critical Slope	2.70 %
Velocity	5.11 ft/s
Velocity Head	0.41 ft
Specific Energy	1.08 ft
Froude Number	1.13
Flow Type	Supercritical

Downstream Silverstone Channel

Cross Section for Trapezoidal Channel

Project Description	
Worksheet	Downstream Silverstone Channel
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.040
Channel Slope	3.52 %
Depth	0.67 ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	22.00 ft
Discharge	80.00 cfs



New Dual Barrel Outfall – Stage-Discharge Orifice Calc.

North Environmental Enhancement DB Outfall Modification

Rating Table for Circular Orifice

Project Description	
Worksheet	TULEDB Outfall Pipe - Stage-Discharge
Type	Circular Orifice
Solve For	Discharge

Input Data	
Centroid Elevation	2,429.50 ft
Tailwater Elevation	2,430.06 ft
Discharge Coefficient	0.65
Diameter	27.0 in

Attribute	Minimum	Maximum	Increment
Headwater Elevation (ft)	2,428.00	2,434.00	1.00

Headwater Elevation (ft)	Discharge (cfs)	Velocity (ft/s)
2,428.00	N/A	N/A
2,429.00	N/A	N/A
2,430.00	N/A	N/A
2,431.00	20.10	5.06
2,432.00	28.88	7.26
2,433.00	35.55	8.94
2,434.00	41.15	10.35

TOTAL Q (cfs)

[2-BARREL OUTLET]

40.20
57.76
71.11
82.30

TULEDB Outlet - Stage-Discharge Table

Worksheet for Circular Orifice

Project Description	
Worksheet	TULEDB Outfall Pipe - Stage-Discharge
Type	Circular Orifice
Solve For	Discharge

Input Data	
Headwater Elevation	2,434.00 ft
Centroid Elevation	2,429.50 ft
Tailwater Elevation	2,430.06 ft
Discharge Coefficient	0.65
Diameter	27.0 in

Results	
Discharge	41.15 cfs
Headwater Height Above Centroid	4.50 ft
Tailwater Height Above Centroid	0.56 ft
Flow Area	4.0 ft ²
Velocity	10.35 ft/s

Notes: Outlet Invert = 2428.0-ft
2 parallel barrel outlets

Revised HEC-1 Models
(On CD-ROM)

APPENDIX D

Response to Comment No. 7

(Excerpts from Kyle Canyon Interchange Hydraulic Supplement)

OLY1608.000

August 10, 2016

Mr. Oh Sang Kwon, P.E.
Flood Control Project Manager
City of Las Vegas Department of Public Works
333 N. Rancho Drive – 7th Floor
Las Vegas, Nevada 89106

Subject: Response to City of Las Vegas Public Works Comments on the Supplement for US95/Kyle Canyon Road Interchange – Conceptual Design for CCRFCD Regional Facility Crossing

Dear Mr. Kwon:

This letter is submitted in response to the comments in your review memorandum dated August 2, 2016, regarding the above referenced project. A copy of the City of Las Vegas (CLV) Department of Public Works comments is provided behind this letter, and the comments have been individually addressed as follows:

Sheet 3

1. **Comment:** *Correct the match line station reference in left plan view to 54+50.00.*

Response: The match line reference station has been updated accordingly.

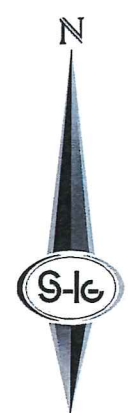
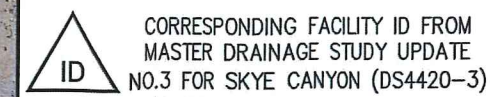
2. **Comment:** *Minor discrepancies in slope between the hydraulic model and profile are shown between Stations 48+50 and 54+50.*

Response: Acknowledged. The slope callout on the profile sheets has been updated to adequately reflect the slope on the hydraulic models in Appendix A. Note that there is a slope of 0.0% shown in the model at Station 5363.30, because the hydraulic model has analyzed where the storm flows from the Skye Village and SR157 alignments enter the 25-ft wide junction structure as a point confluence with zero length.

3. **Comment:** *Verify the width of the Junction Structure in the hydraulic model. The model shows a width of 25 feet and the two RCBs connecting are 13 feet wide.*

Response: Anticipating the connection of two (2) RCB's, one is 13-ft wide and the second is 9-ft wide, each with a wall thickness of 1-ft, and 1-ft of separation between the two boxes at the junction structure, the hydraulic models showing a junction structure width of 25 feet is considered accurate and no changes to the model are necessary.

4. **Comment:** *The HGL is shown up to 11 feet above the top of the 13-foot wide by 6-foot high RCB near the Sky Village Road and Oso Blanca Road Intersection. Will the surcharged HGL at this location allow flexibility for future connections to the CCRFCD Facility (i.e. the 10-foot wide by 4-foot high laterals at Stations 45+50, 46+00, and 46+50)?*



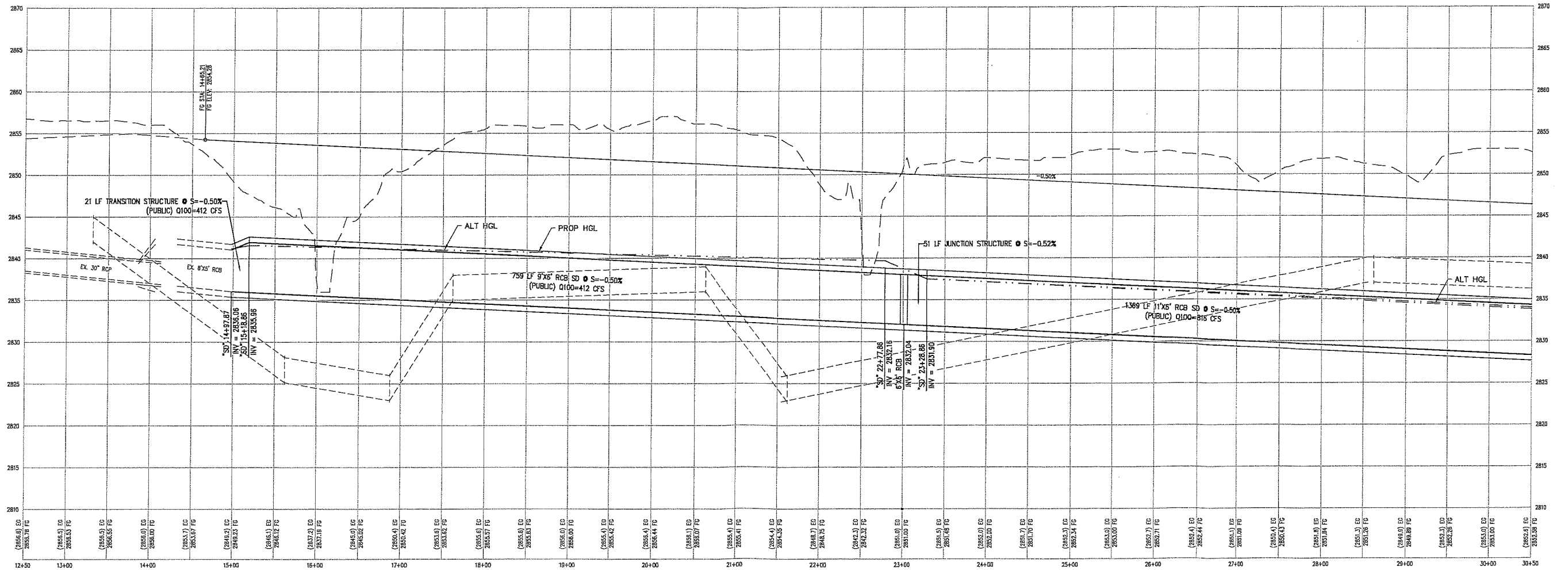
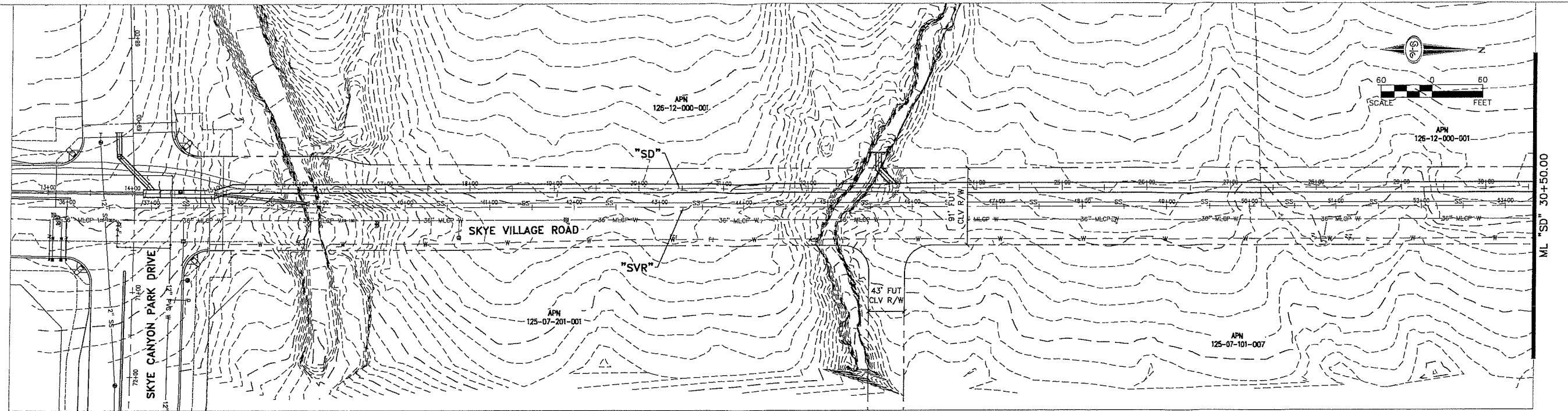
S-I-G
SLATER
HANIFAN
GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

[illegible]

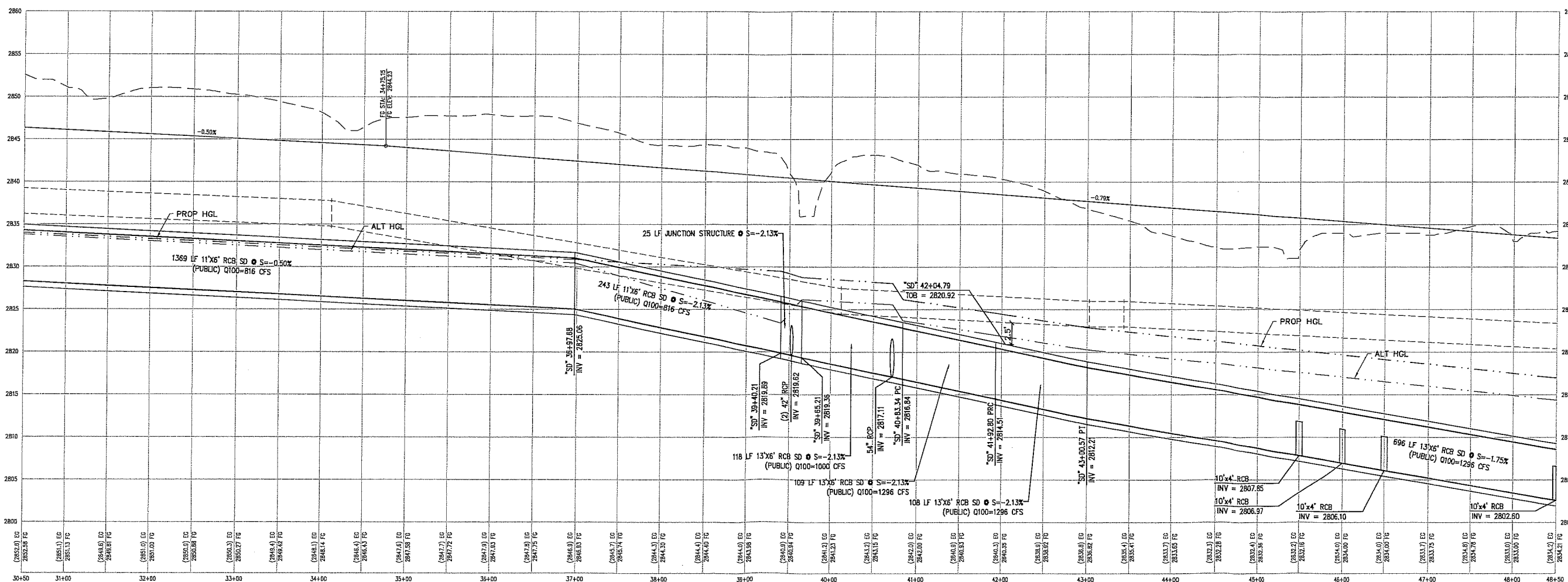
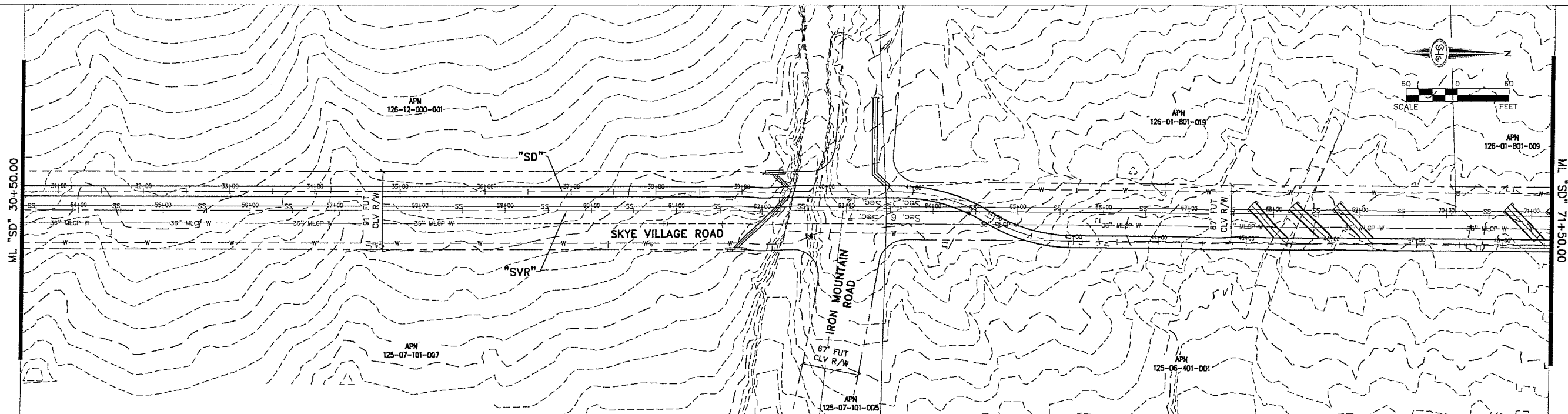
OLYMPIA COMPANIES (COOP. GCW, CLV, NDOT)
US-95 / KYLE CANYON INTERCHANGE
CCRFCD REGIONAL FACILITY CONCEPT

DATE: AUGUST 2016
DRAFTER: CAA
DESIGNER: CAA
CHECKED: SMJ
PROJECT NO. OLY1608.000

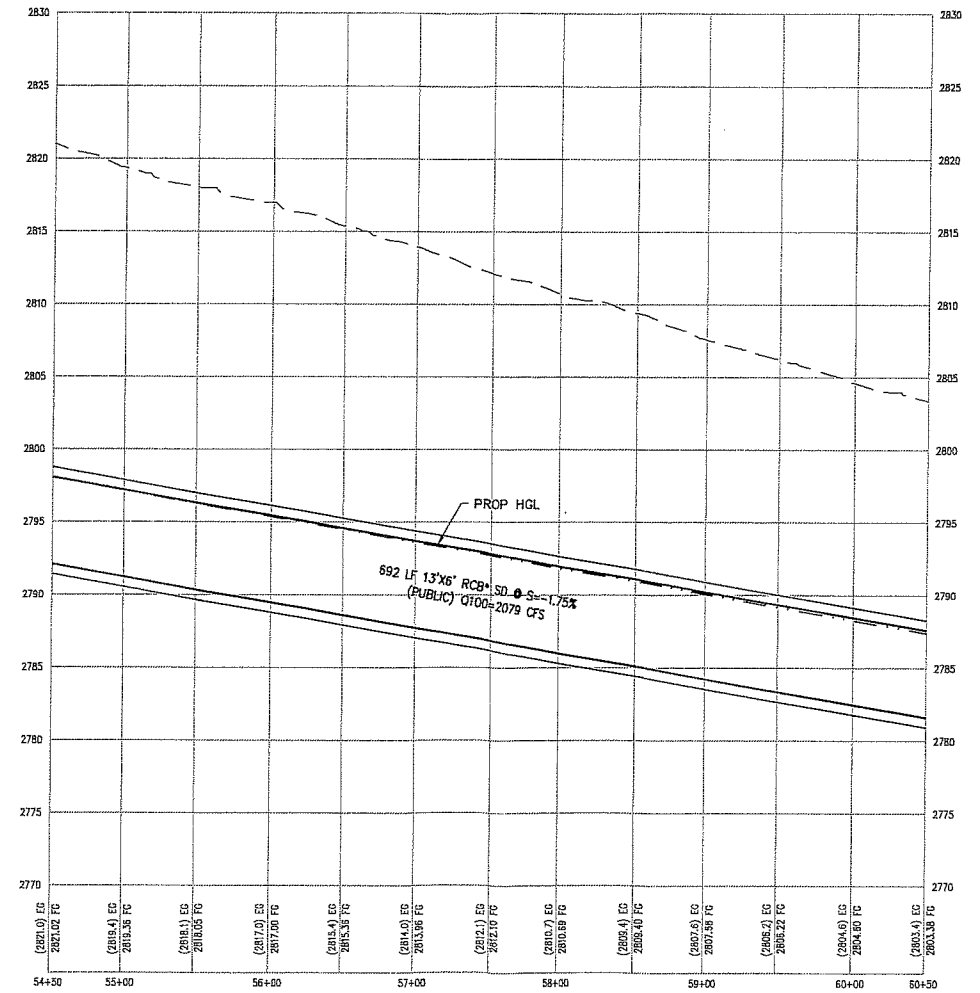
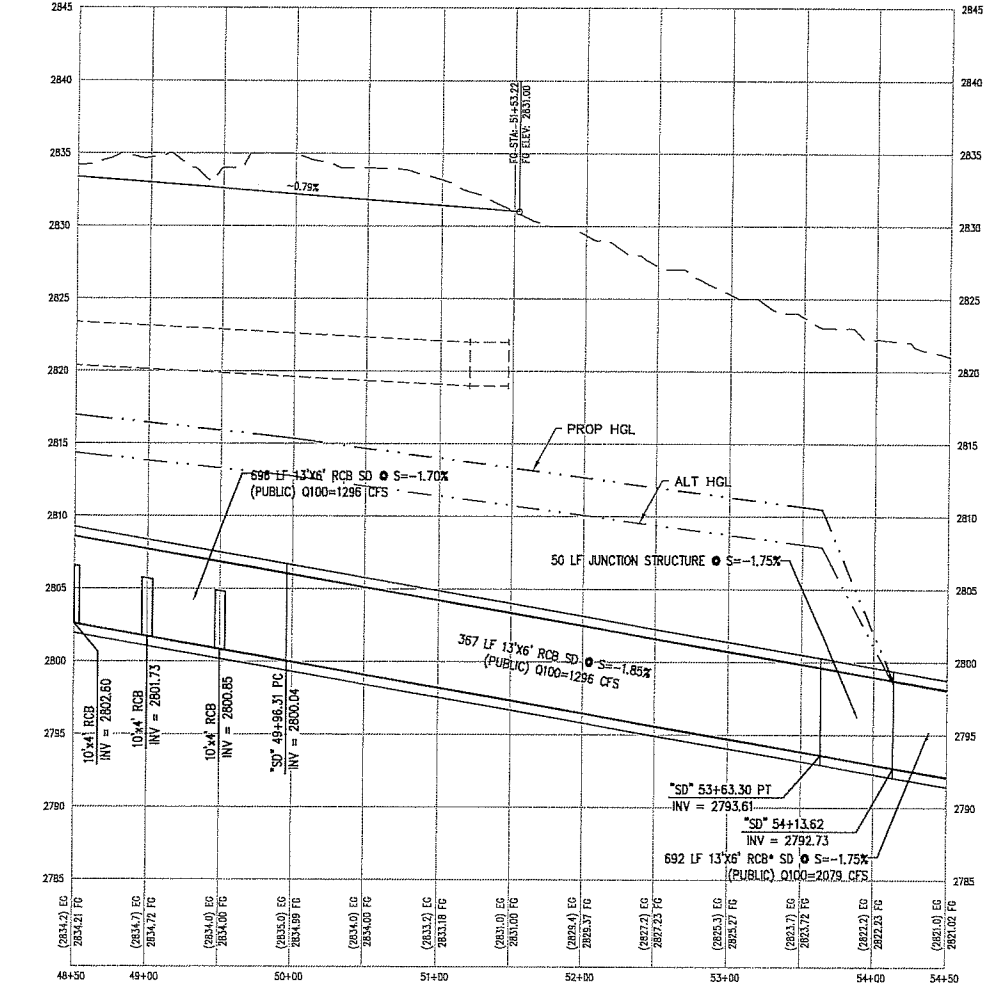
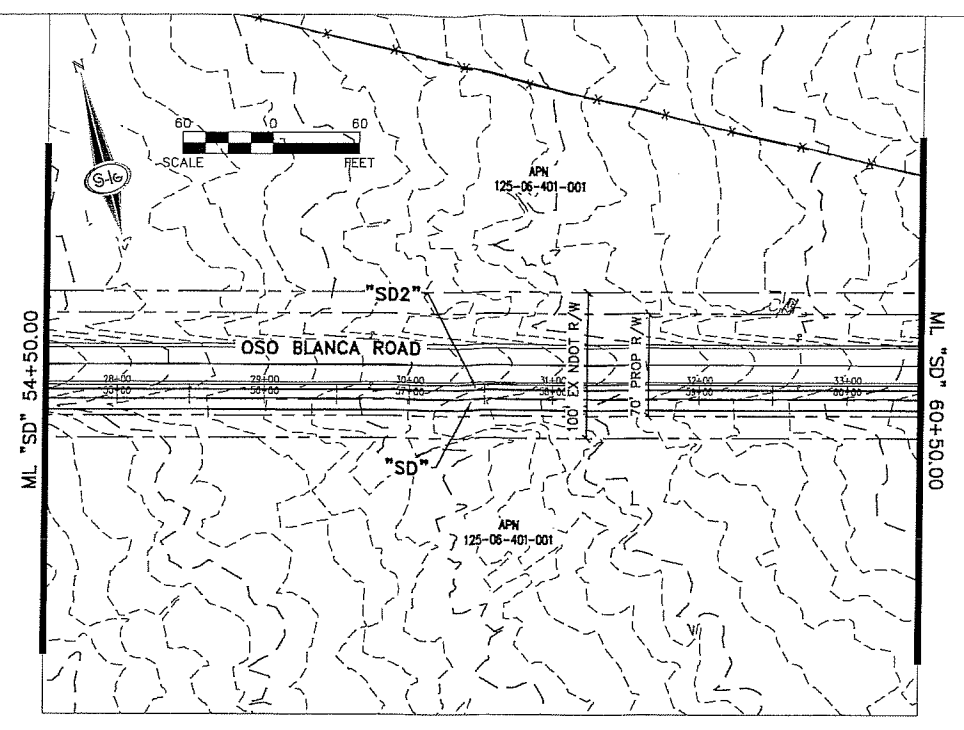
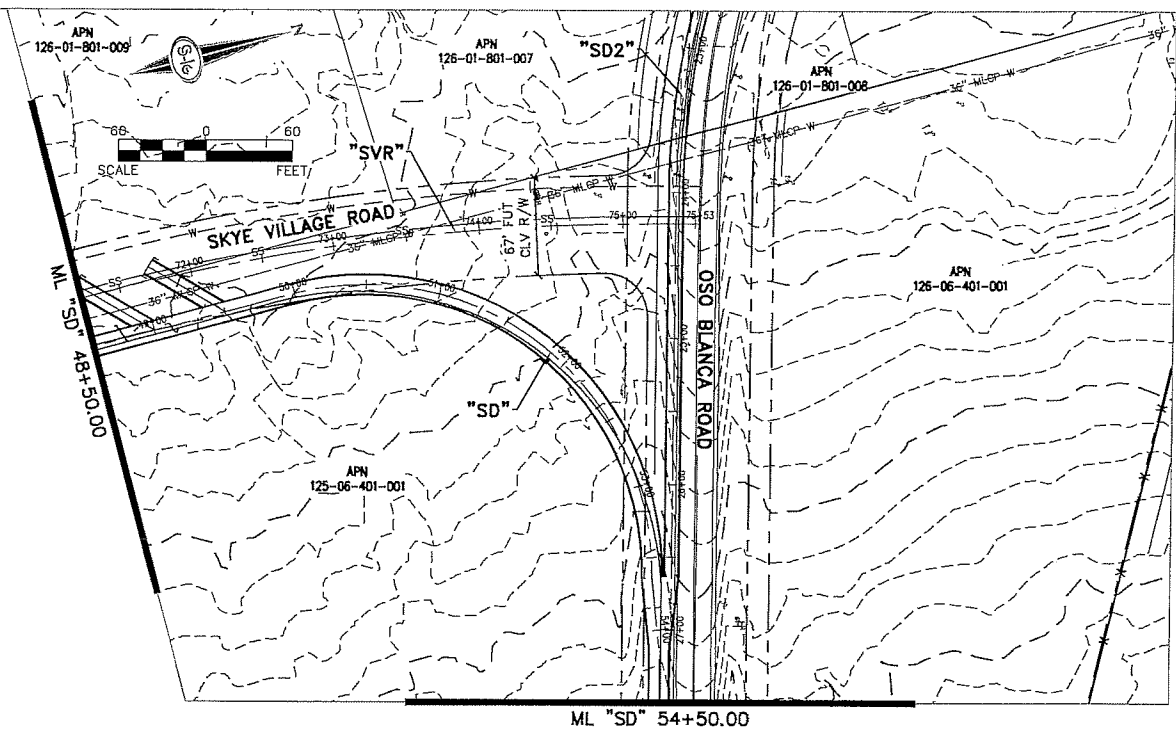
EXHIBIT
SHEET 1 OF 1



NOTE: EQUIVALENT RCA SIZE MAY BE UTILIZED OUTSIDE NDOT R/W



NOTE: EQUIVALENT RCA SIZE MAY BE UTILIZED OUTSIDE NDOT R/W



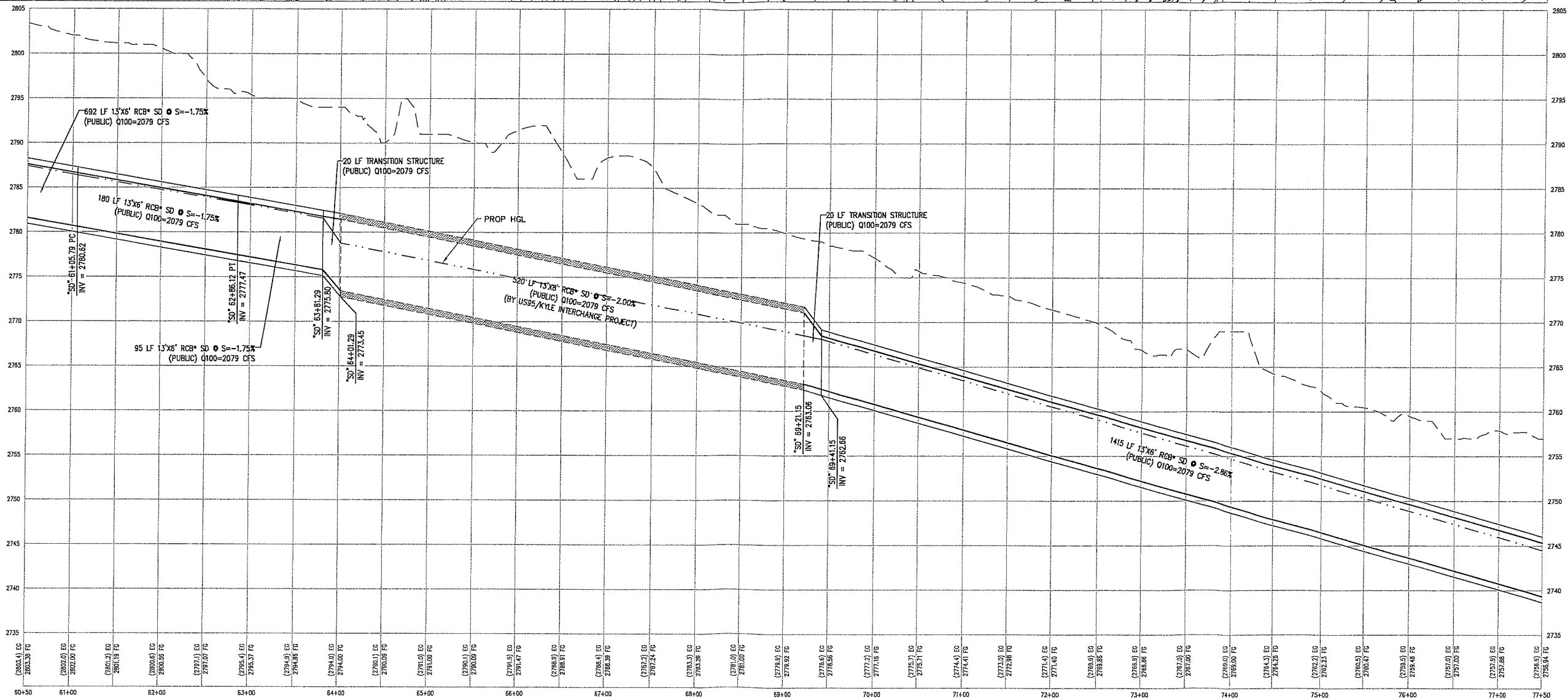
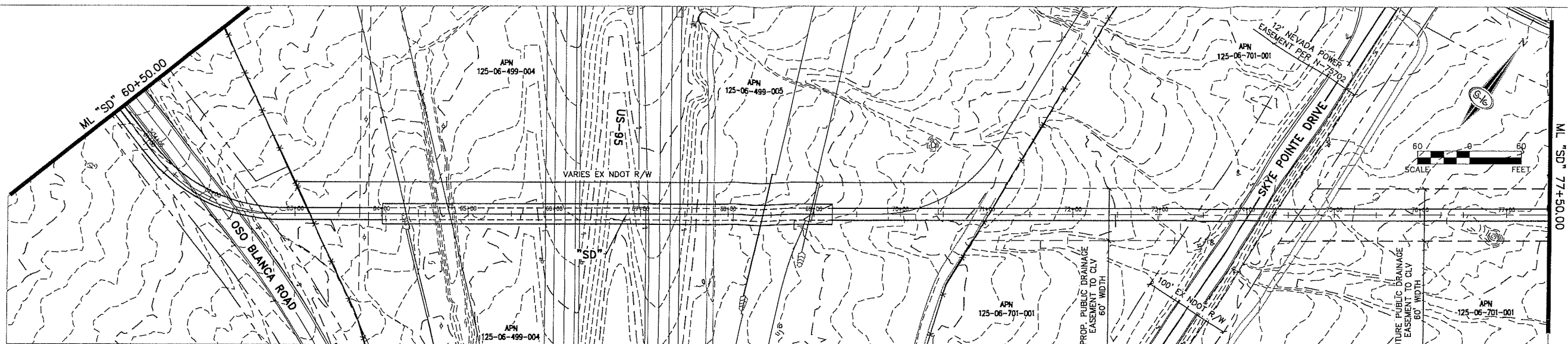
NOTE: EQUIVALENT RCA SIZE MAY BE UTILIZED OUTSIDE NDOT R/W

*-SEE RCB SHOP DRAWING

S-I SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

**KYLE CANYON INTERCHANGE
SKYE VILLAGE-LOG CABIN REGIONAL ALIGNMENT
PROPOSED STORM DRAIN-CONCEPTUAL PROFILE
(PROFILE SUBJECT TO CHANGE UPON TECHNICAL DESIGN)**

J:\OL\1608-000 Kyle Interchange SD\Draw Design\OL\1608_000_SD_NTWK.dwg, 8/9/2016 8:27:29 PM, dmyhve



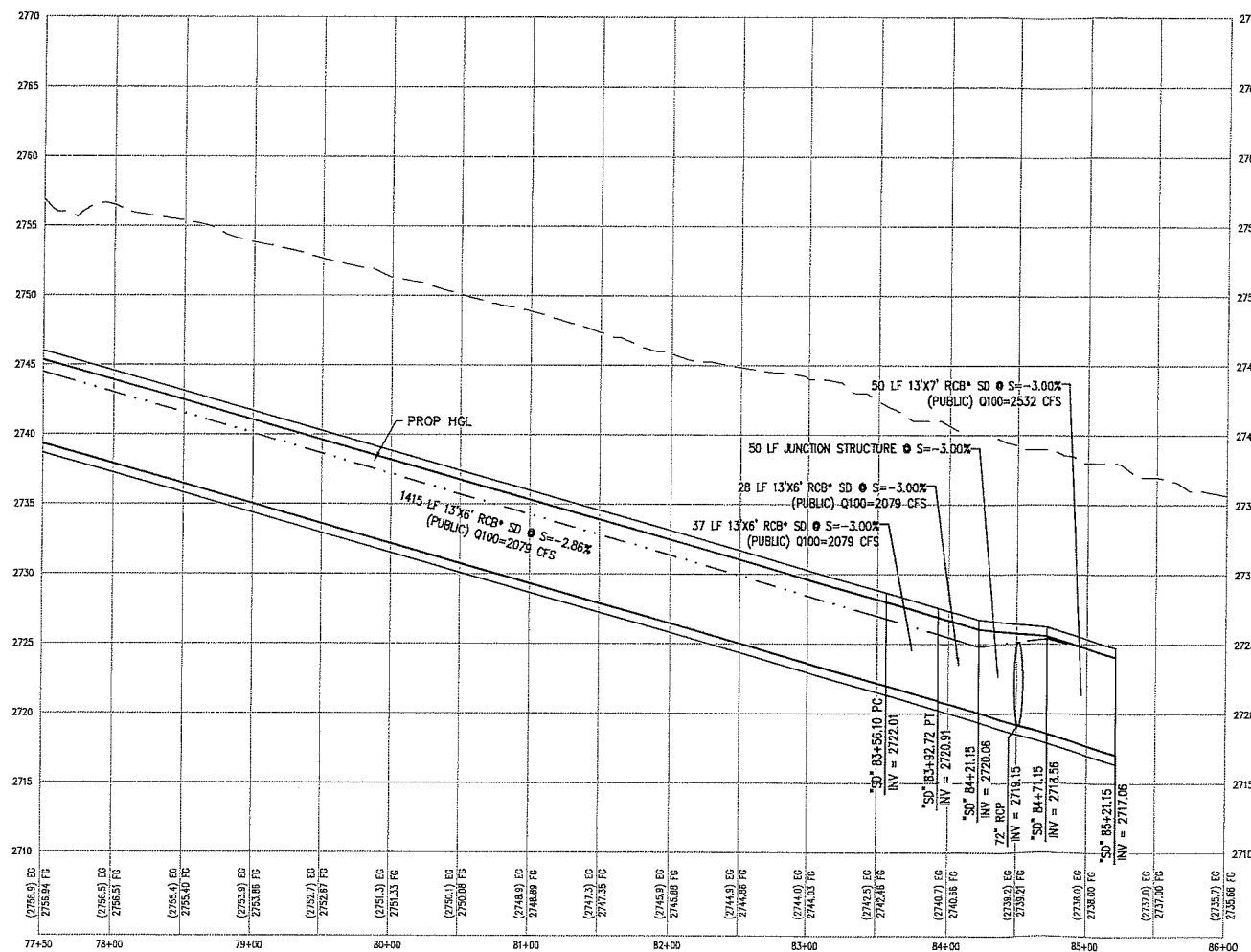
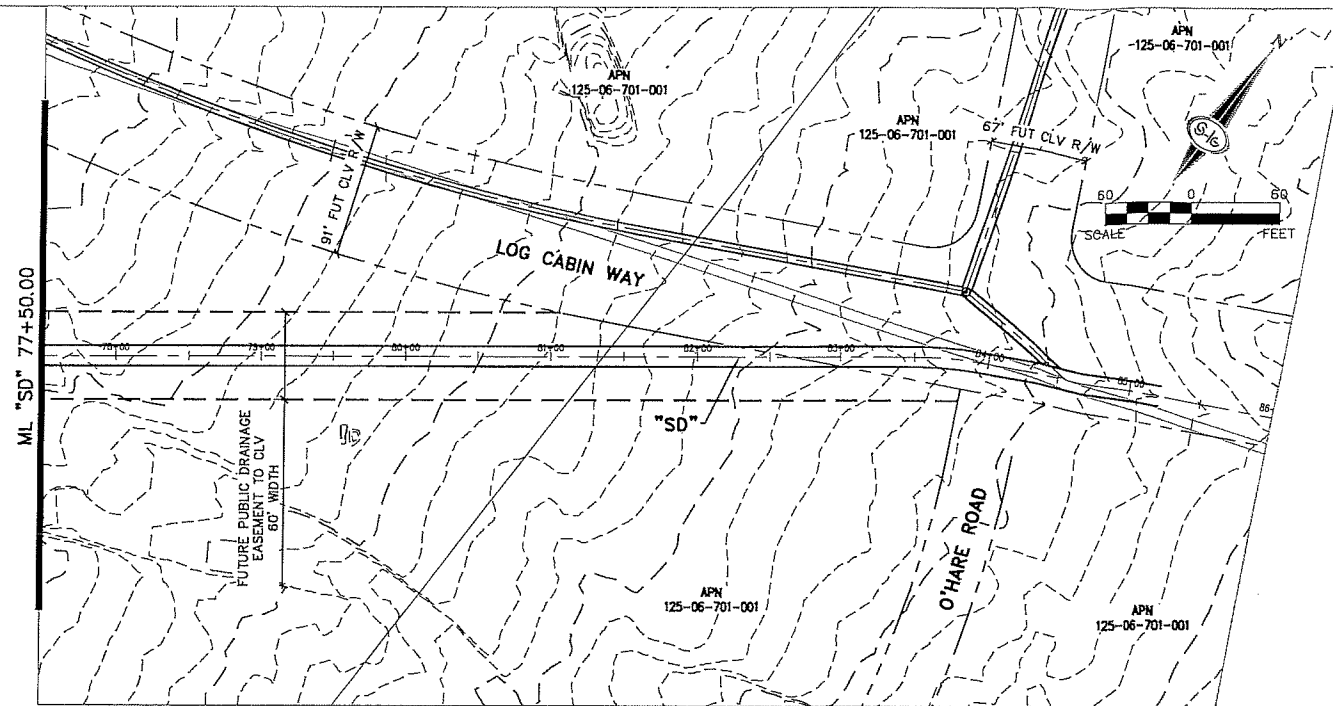
NOTE, EQUIVALENT RCA SIZE MAY BE UTILIZED OUTSIDE NDOT R/W

*-SEE RCB SHOP DRAWING

S-I SLATER
HANIFAN
GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

**KYLE CANYON INTERCHANGE
SKYE VILLAGE-LOG CABIN REGIONAL ALIGNMENT
PROPOSED STORM DRAIN-CONCEPTUAL PROFILE
(PROFILE SUBJECT TO CHANGE UPON TECHNICAL DESIGN)**

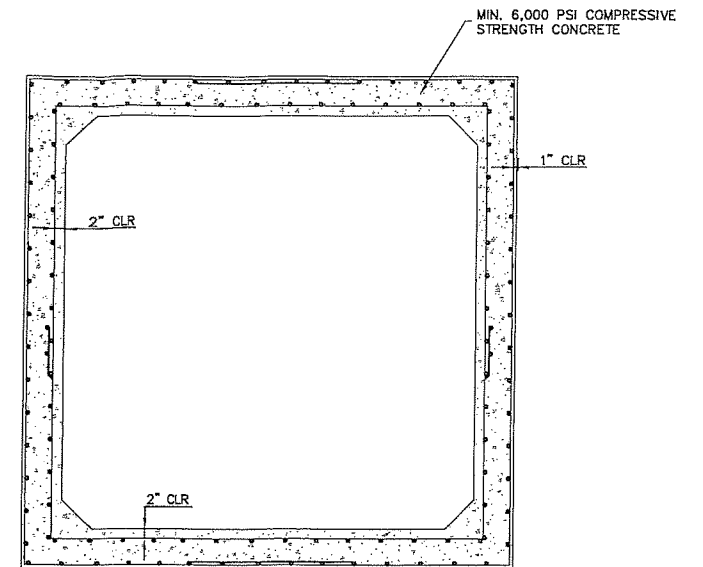
**EXHIBIT
4**



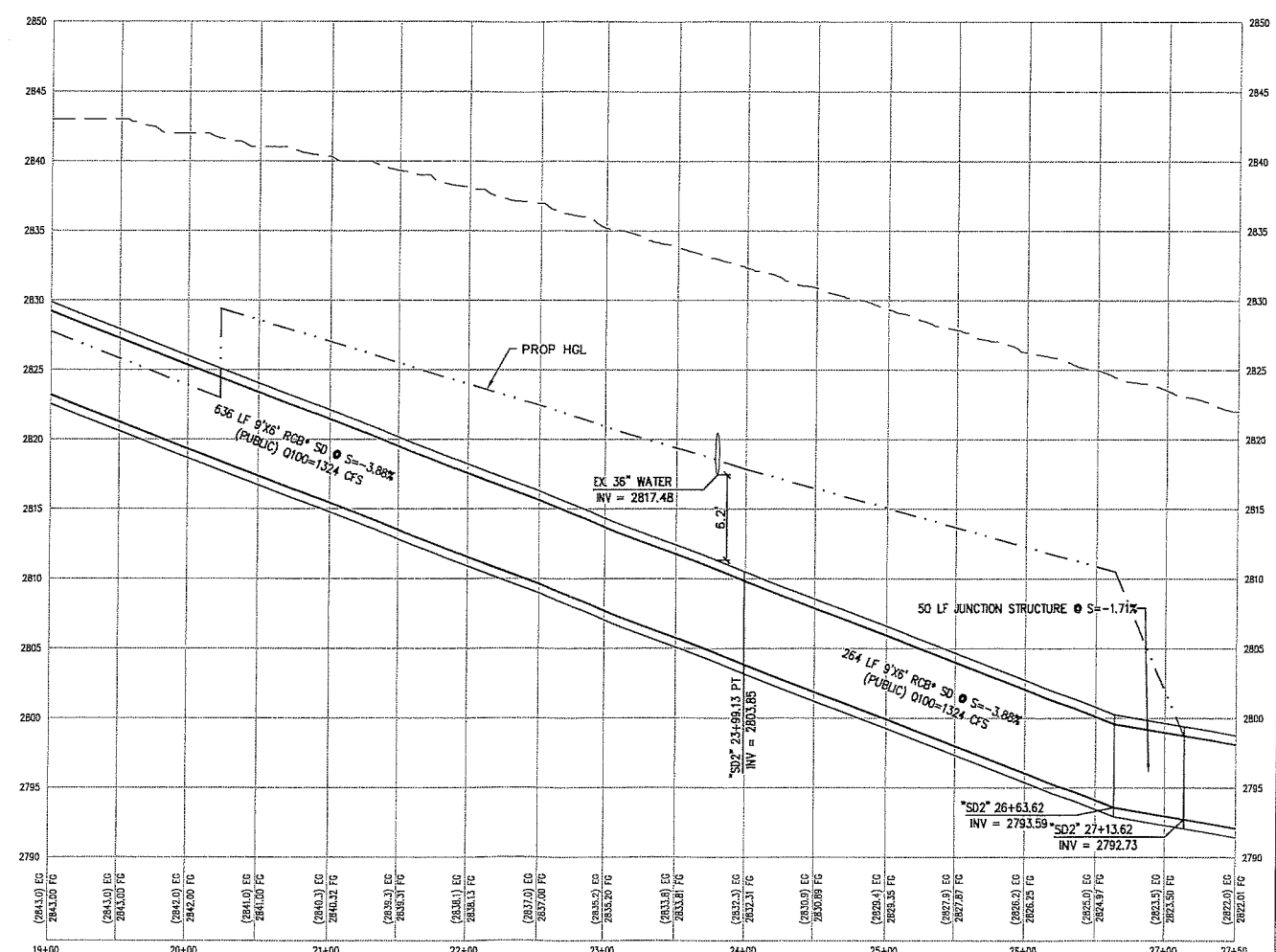
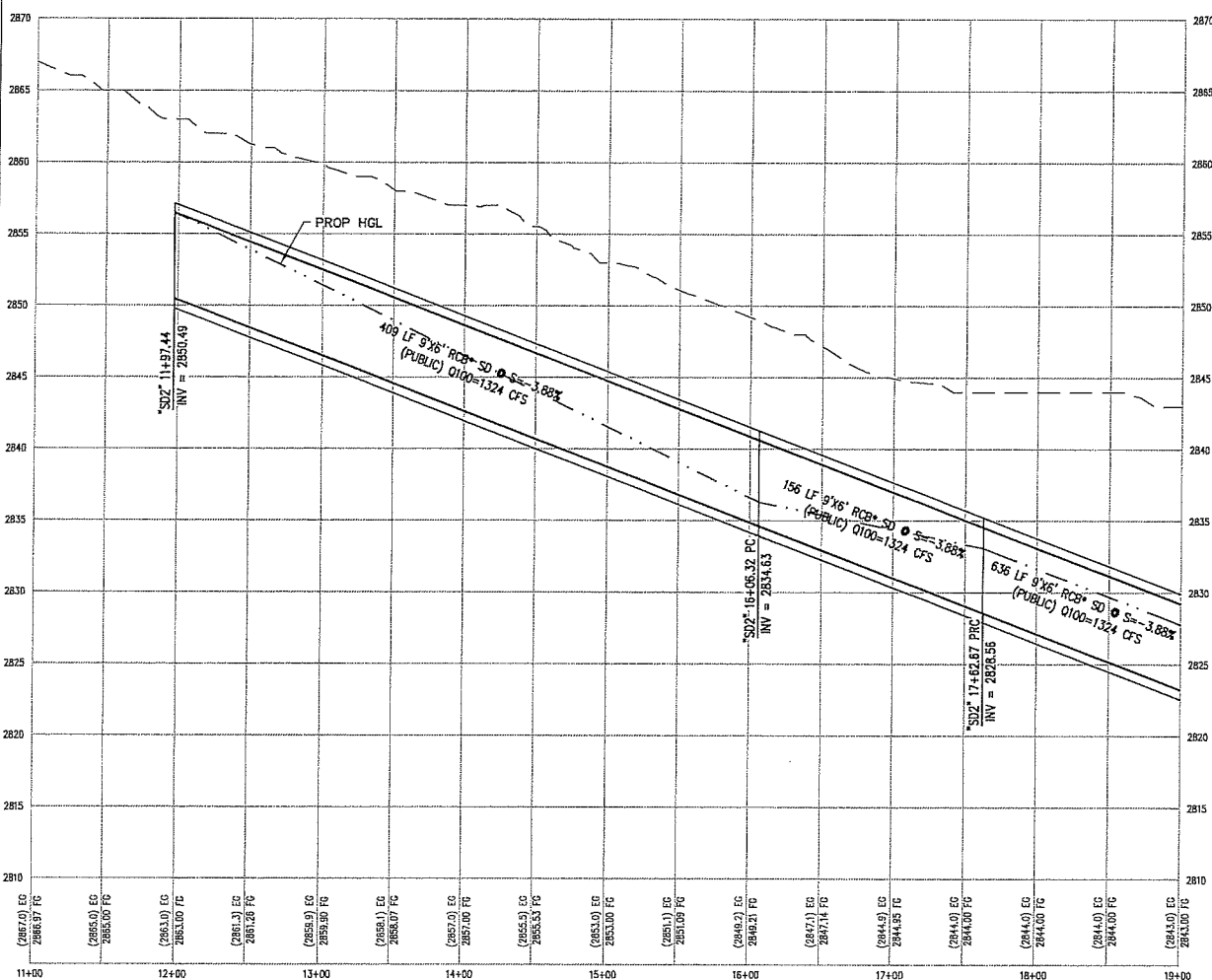
NOTE, EQUIVALENT RCA SIZE MAY BE UTILIZED OUTSIDE NDOT R/W

*-SEE RCB SHOP DRAWING

RCB SHOP DRAWING (FOR HIGH VELOCITIES)



SECTION CUT OF BOX CULVERT



*-SEE RCB SHOP DRAWING

**KYLE CANYON INTERCHANGE
SR157-OSO BLANCA REGIONAL ALIGNMENT
PROPOSED STORM DRAIN-CONCEPTUAL PROFILE
(PROFILE SUBJECT TO CHANGE UPON TECHNICAL DESIGN)**

EXHIBIT
6

APPENDIX E

Response to Comments No. 3 and 8
(Excerpts from Development Agreement)

land use category shown on the Master Land Use Plan. Upon the relinquishment of the NDOT Easement on the Property, the City will accept complete applications from the Master Developer for land use entitlements or mapping actions for any portion of the Property that had been encumbered by the NDOT Easement including a vacation application for existing City of Las Vegas easements or grants associated with the NDOT frontage road.

7.08 Flood Control.

(a) Obligation to Construct Flood Control Facilities solely on Master Developer. Master Developer shall design and construct flood control facilities that are identified as Master Developer's responsibility in the Master Drainage Study. Master Developer acknowledges and agrees that this obligation shall not be delegated to, transferred to or completed by any Designated Builder.

(b) Other Governmental Approvals. The Clark County Regional Flood Control District, the Nevada Department of Transportation and any other state or federal agencies, as required, shall approve the Master Drainage Study prior to final approval from City. Clark County Department of Public Works shall receive a copy of the Master Drainage Study and shall have the opportunity to comment.

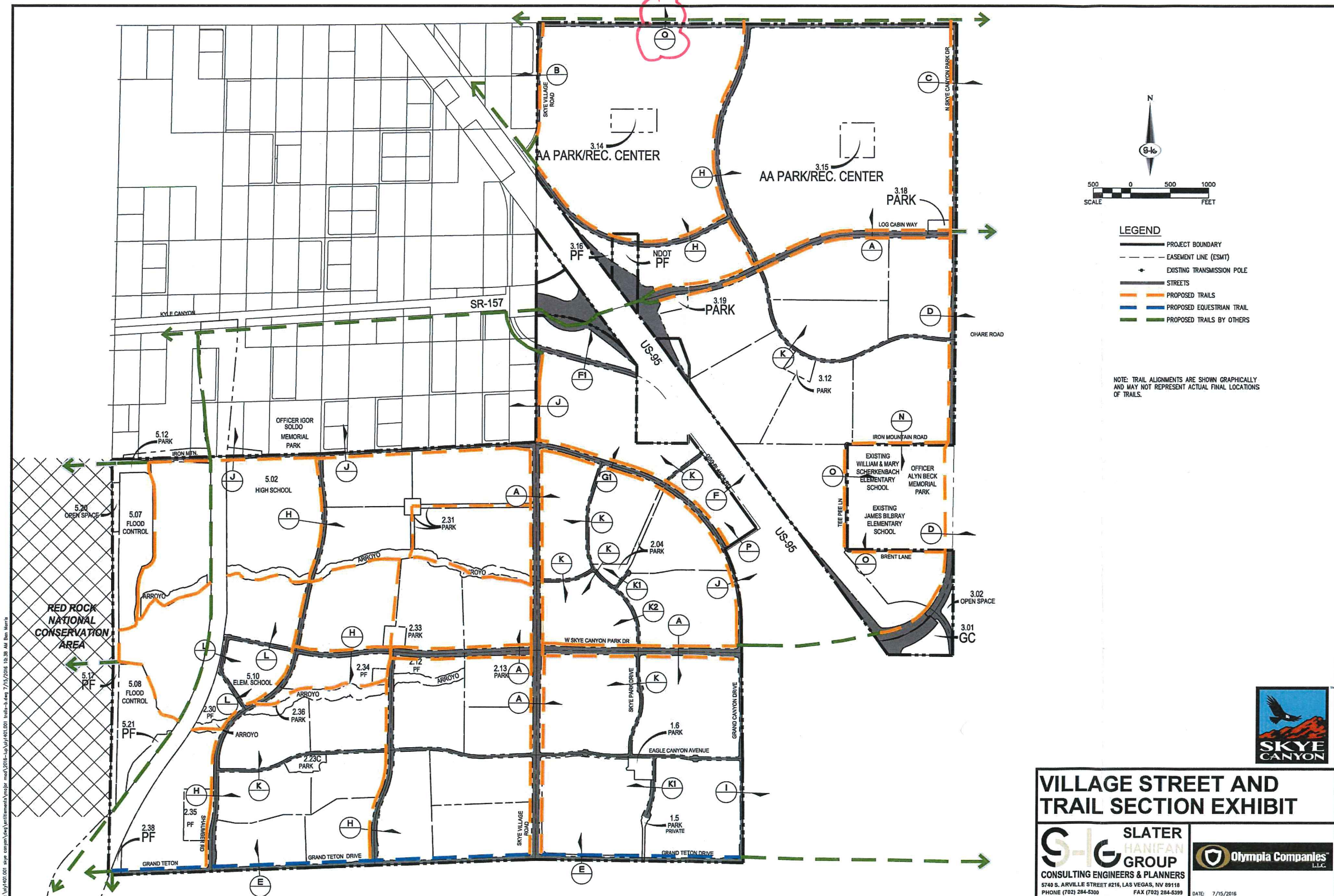
(c) Updates. The Director of Public Works may require an update to the Master Drainage Study or Master Technical Study as a condition of approval of the following land use applications: tentative map, residential or commercial; site development plan review, multifamily or commercial; or parcel map if those applications are not in substantial conformance with the approved Master Land Use Plan or Master Drainage Study. The update must be approved prior to the approval of any construction drawings and the issuance of any final grading permits. An update to the exhibit in the approved Master Drainage Study depicting proposed development phasing in accordance with the Development Agreement shall be submitted for approval by the Flood Control Section.

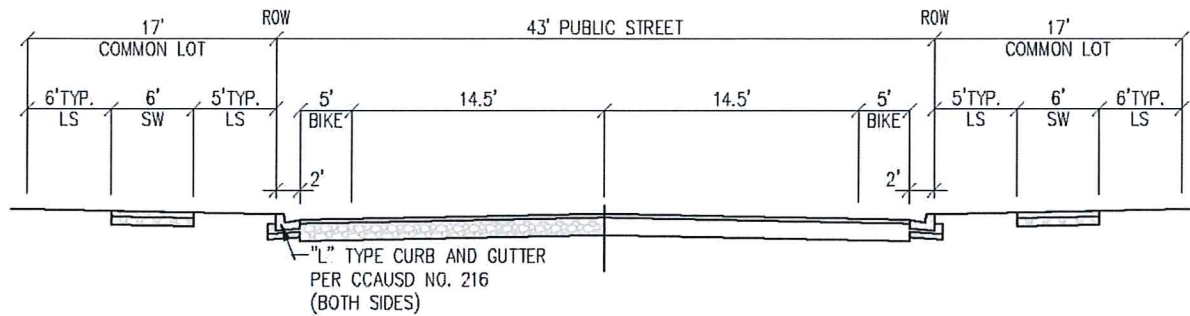
(d) Regional Flood Control Facility Construction by Master Developer. The Master Developer agrees to design and substantially complete the Clark County Regional Flood Control District facilities as defined in the Master Drainage Study pursuant to an amendment to the Regional Flood Control District 2008 Master Plan Update prior to the final inspection of the first unit within each area protected by the appropriate drainage facility.

(i) Currently, a portion of Parcel 5.06, as depicted on the Master Land Use Plan attached as Exhibit "F", is reserved by City for future flood control needs in addition to Parcels 5.07 and

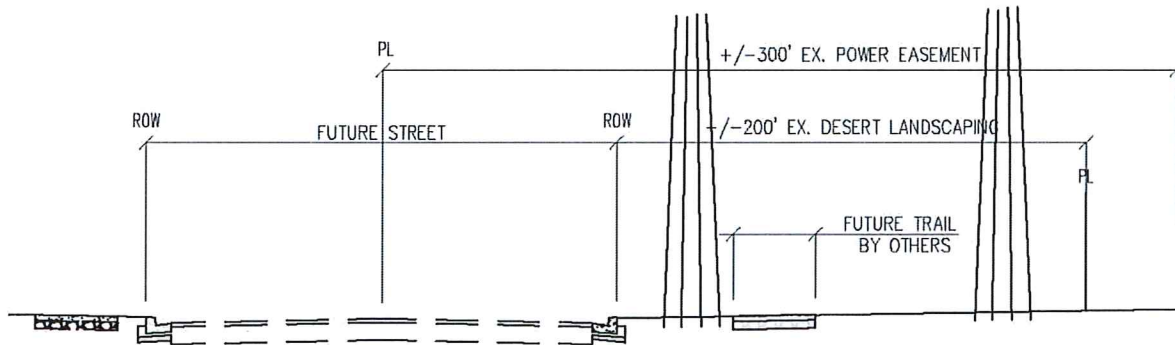
5.08. The Master Developer shall not file and the City shall not accept any applications from the Master Developer for land use entitlements or mapping actions for that portion of Parcel 5.06 reserved by City for future flood control needs. However, if City agrees that all or a portion of the reserved Property on Parcel 5.06 is not necessary for the City's flood control measures, then upon City's written notification to Master Developer of its release of any portion of Parcel 5.06 that is not needed for the City's flood control measures, said portion of Parcel 5.06 may be developed in accordance with the land use category shown on the Master Land Use Plan. Upon the City's release of its reservation of that portion of Parcel 5.06, the City may accept applications from the Master Developer for land use entitlements or mapping actions for that portion of the Property that had been reserved by the City for flood control.

(ii) Additionally, a regional MPU facility from Skye Village Road east across US 95 will be constructed with a combination of public and private monies ("MPU Facility"). The Master Developer shall pay for the design and construction of the MPU Facility as defined in the Master Drainage Study pursuant to an amendment to the Regional Flood Control District 2008 Master Plan Update. The Parties agree that Master Developer shall pay for and construct one of two (2) MPU alternatives outlined in the Master Drainage Study. Because the MPU Facility is a regional facility that will benefit downstream property owners and the City, Master Developer shall be reimbursed for 49% of the total cost of the construction of the MPU Facility pursuant to: 1) an interlocal contract between the Parties and the Regional Flood Control District in accordance with Chapter VI, Section D, Developer Participation of the District's Policies and Procedures or 2) some other reimbursement or cost sharing mechanism mutually agreed upon by the Parties. Requirements for notification of funding will be specified in a separate agreement, if necessary, between the City and the Master Developer. The Master Developer agrees, with City's assistance, to update and add the MPU Facility to the Regional Master Plan and the City agrees to prioritize affected facilities and update the 10 Year Construction Program after the approval of the Master Plan Amendment and after an estimated construction schedule is provided by the Master Developer. Master Developer shall submit and receive acceptance of 90% construction drawings for each phase. Within six (6) months after Master Developer submits and receives acceptance of the 90% construction drawings for the first phase, City agrees to facilitate the reimbursement of 49% of the total cost of the construction of the MPU Facility to Master Developer in phases. . The City's reimbursement obligation is limited to the MPU Facilities identified as shared cost in the Master Drainage Study and will





P. MINOR COLLECTOR STREET WITH BIKE LANES



Q. FUTURE STREET BY OTHERS

NOTES:

1. NOT USED FOR DIRECT RESIDENTIAL DRIVEWAY ACCESS
2. ABOVE/BELOW GROUND UTILITIES ALLOWED IN LANDSCAPE AREA
3. SIDEWALK CAN MEANDER; DETACHED WHEREVER POSSIBLE

APPENDIX F

Additional Revisions

(Supplemental Flood Control Facility Concept Calculations)

1-Prop.

Worksheet for Circular Channel

Project Description	
Worksheet	1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	2.90 %
Discharge	76.00 cfs

Results	
Depth	2.58 ft
Diameter	31.0 in
Flow Area	5.2 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.52 ft
Percent Full	100.0 %
Critical Slope	2.58 %
Velocity	14.53 ft/s
Velocity Head	3.28 ft
Specific Energy	5.86 ft
Froude Number	0.00
Maximum Discharge	81.75 cfs
Discharge Full	76.00 cfs
Slope Full	2.90 %
Flow Type	N/A

Notes: 42" RCP per Detention Basin 2 TDS

2-Prop. Worksheet for Circular Channel

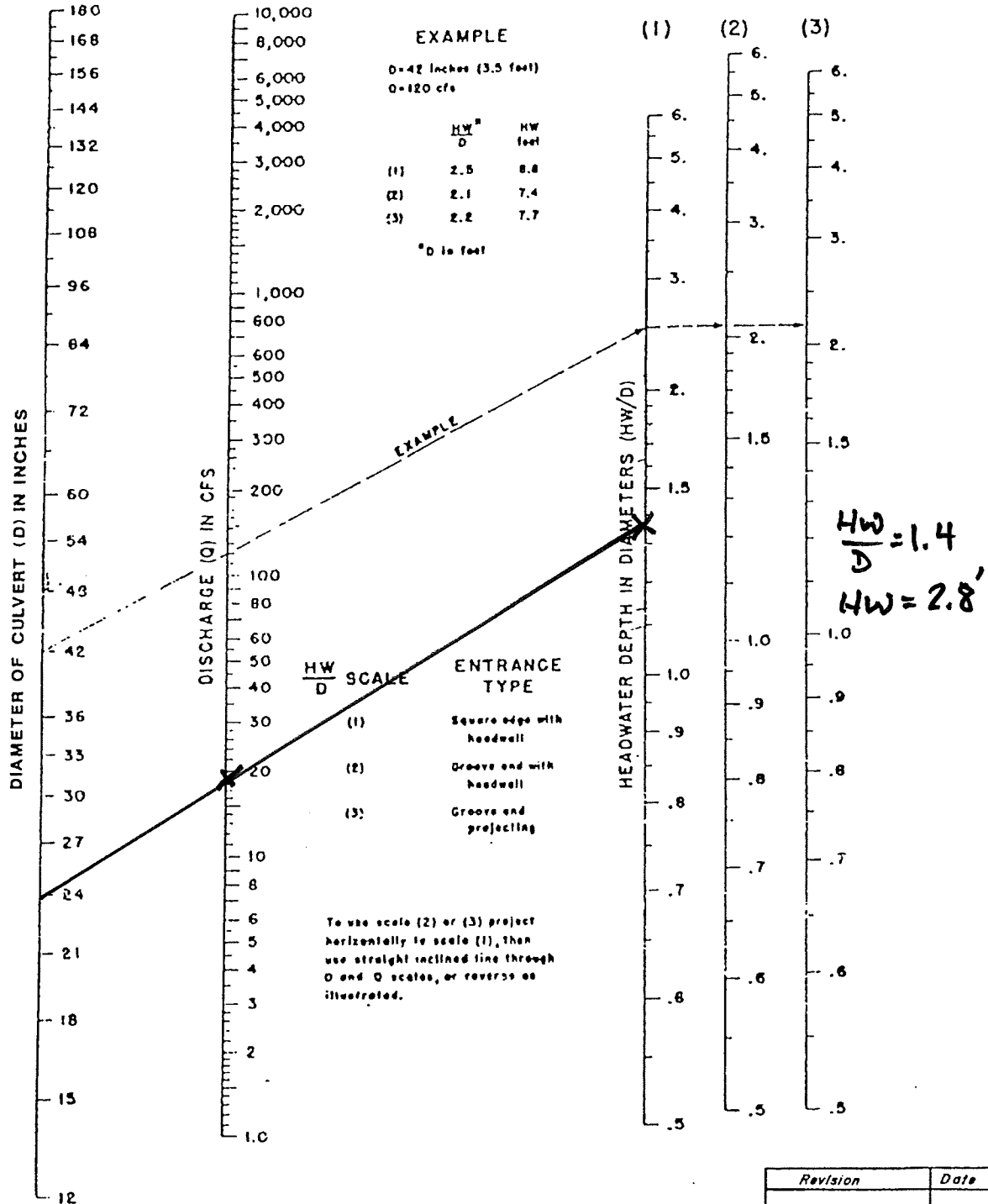
Project Description	
Worksheet	2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	5.00 %
Discharge	91.00 cfs

Results	
Depth	2.49 ft
Diameter	29.9 in
Flow Area	4.9 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.47 ft
Percent Full	100.0 %
Critical Slope	4.64 %
Velocity	18.65 ft/s
Velocity Head	5.40 ft
Specific Energy	7.90 ft
Froude Number	0.00
Maximum Discharge	97.89 cfs
Discharge Full	91.00 cfs
Slope Full	5.00 %
Flow Type	N/A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH - INLET CONTROL RCP FACILITY 2-1 (ULT. 19cfs)



Revision	Date

WRC
ENGINEERING

REFERENCE:

USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

3-Ult.

Worksheet for Circular Channel

Project Description	
Worksheet	3
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	3.20 %
Discharge	227.00 cfs

Results	
Depth	3.82 ft
Diameter	45.8 in
Flow Area	11.5 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.76 ft
Percent Full	100.0 %
Critical Slope	2.90 %
Velocity	19.82 ft/s
Velocity Head	6.11 ft
Specific Energy	9.93 ft
Froude Number	0.00
Maximum Discharge	244.19 cfs
Discharge Full	227.00 cfs
Slope Full	3.20 %
Flow Type	N/A

3-1-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	3-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	3.00 %
Discharge	112.00 cfs

Results	
Depth	2.97 ft
Diameter	35.6 in
Flow Area	6.9 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.91 ft
Percent Full	100.0 %
Critical Slope	2.69 %
Velocity	16.22 ft/s
Velocity Head	4.09 ft
Specific Energy	7.05 ft
Froude Number	0.00
Maximum Discharge	120.48 cfs
Discharge Full	112.00 cfs
Slope Full	3.00 %
Flow Type	N/A

3-2-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	3-2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	1.70 %
Discharge	40.00 cfs

Results	
Depth	2.24 ft
Diameter	26.9 in
Flow Area	3.9 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.09 ft
Percent Full	100.0 %
Critical Slope	1.47 %
Velocity	10.13 ft/s
Velocity Head	1.60 ft
Specific Energy	3.84 ft
Froude Number	0.00
Maximum Discharge	43.03 cfs
Discharge Full	40.00 cfs
Slope Full	1.70 %
Flow Type	N/A

4a-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	4a
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	4.50 %
Discharge	370.00 cfs

Results	
Depth	4.30 ft
Diameter	51.6 in
Flow Area	14.5 ft²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	4.27 ft
Percent Full	100.0 %
Critical Slope	4.20 %
Velocity	25.45 ft/s
Velocity Head	10.07 ft
Specific Energy	14.37 ft
Froude Number	0.00
Maximum Discharge	398.01 cfs
Discharge Full	370.00 cfs
Slope Full	4.50 %
Flow Type	N/A

4b-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	4b
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

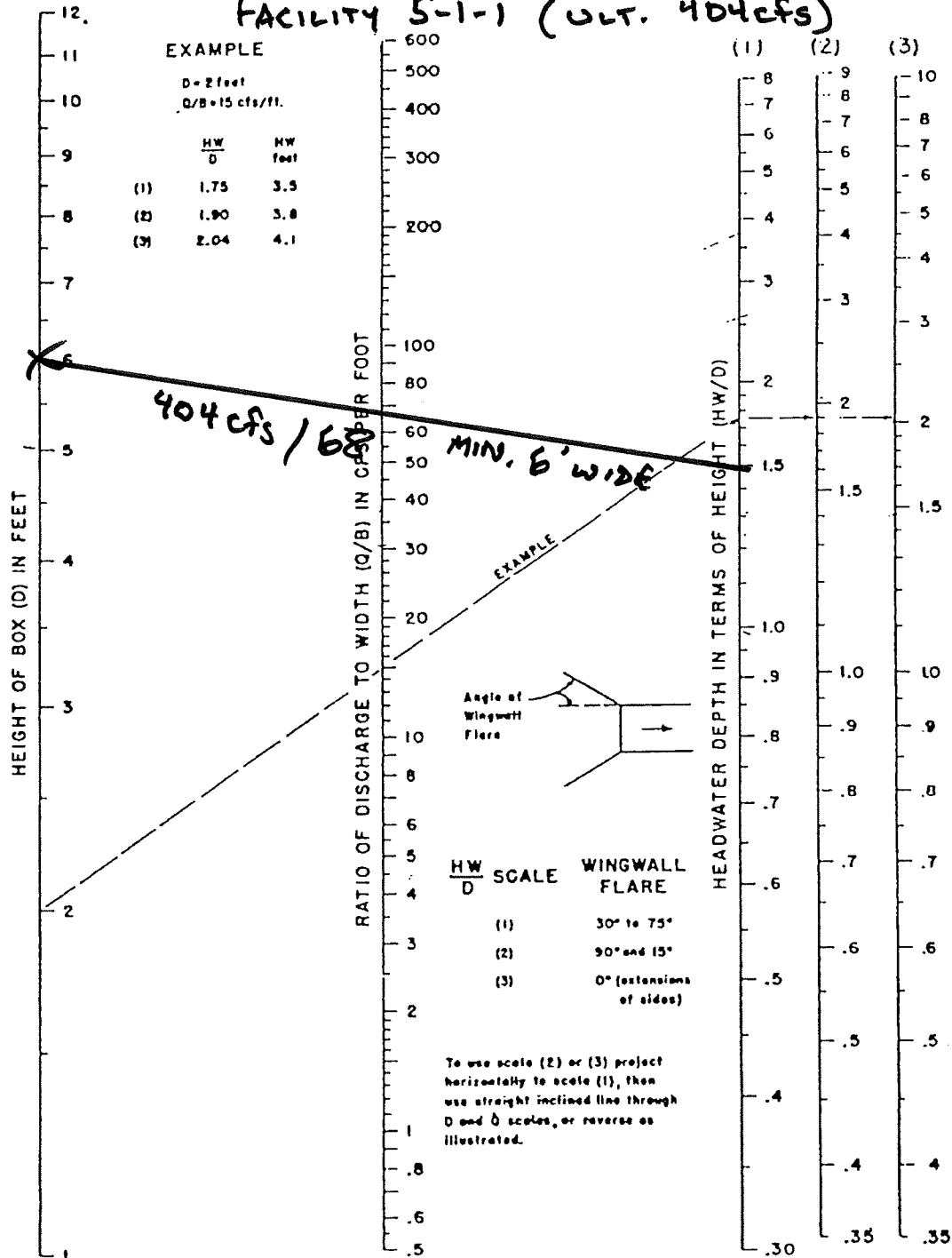
Input Data	
Mannings Coefficient	0.013
Channel Slope	4.50 %
Discharge	249.00 cfs

Results	
Depth	3.71 ft
Diameter	44.5 in
Flow Area	10.8 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.68 ft
Percent Full	100.0 %
Critical Slope	4.18 %
Velocity	23.05 ft/s
Velocity Head	8.26 ft
Specific Energy	11.97 ft
Froude Number	0.00
Maximum Discharge	267.85 cfs
Discharge Full	249.00 cfs
Slope Full	4.50 %
Flow Type	N/A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH - INLET CONTROL BOX CULVERT

FACILITY S-1-1 (ULT. 404cfs)



Revision	Date

WRC
ENGINEERING

REFERENCE:

USDOT, FHWA, HDS No.5, 1985

FIGURE 1004

9-1-Prop.
Worksheet for Circular Channel

Project Description	
Worksheet	9-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	4.00 %
Discharge	466.00 cfs

Results	
Depth	4.80 ft
Diameter	57.5 in
Flow Area	18.1 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	4.76 ft
Percent Full	100.0 %
Critical Slope	3.71 %
Velocity	25.80 ft/s
Velocity Head	10.34 ft
Specific Energy	15.14 ft
Froude Number	0.00
Maximum Discharge	501.28 cfs
Discharge Full	466.00 cfs
Slope Full	4.00 %
Flow Type	N/A

9-3-Prop.
Worksheet for Circular Channel

Project Description	
Worksheet	9-3
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	1.30 %
Discharge	466.00 cfs

Results	
Depth	5.92 ft
Diameter	71.0 in
Flow Area	27.5 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	5.55 ft
Percent Full	100.0 %
Critical Slope	1.12 %
Velocity	16.93 ft/s
Velocity Head	4.45 ft
Specific Energy	10.37 ft
Froude Number	0.00
Maximum Discharge	501.28 cfs
Discharge Full	466.00 cfs
Slope Full	1.30 %
Flow Type	N/A

11-1-Prop.
Worksheet for Circular Channel

Project Description	
Worksheet	11-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	3.00 %
Discharge	539.00 cfs

Results	
Depth	5.35 ft
Diameter	64.1 in
Flow Area	22.4 ft²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	5.27 ft
Percent Full	100.0 %
Critical Slope	2.73 %
Velocity	24.02 ft/s
Velocity Head	8.97 ft
Specific Energy	14.31 ft
Froude Number	0.00
Maximum Discharge	579.81 cfs
Discharge Full	539.00 cfs
Slope Full	3.00 %
Flow Type	N/A

11-2-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	11-2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	1.20 %
Discharge	73.00 cfs

Results	
Depth	3.00 ft
Diameter	36.0 in
Flow Area	7.1 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.70 ft
Percent Full	100.0 %
Critical Slope	1.06 %
Velocity	10.33 ft/s
Velocity Head	1.66 ft
Specific Energy	4.66 ft
Froude Number	0.00
Maximum Discharge	78.53 cfs
Discharge Full	73.00 cfs
Slope Full	1.20 %
Flow Type	N/A

11-3-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	11-3
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	1.70 %
Discharge	39.00 cfs

Results	
Depth	2.22 ft
Diameter	26.7 in
Flow Area	3.9 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.07 ft
Percent Full	100.0 %
Critical Slope	1.47 %
Velocity	10.07 ft/s
Velocity Head	1.58 ft
Specific Energy	3.80 ft
Froude Number	0.00
Maximum Discharge	41.95 cfs
Discharge Full	39.00 cfs
Slope Full	1.70 %
Flow Type	N/A

14-1a-Prop.
Worksheet for Circular Channel

Project Description	
Worksheet	14-1a
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	0.70 %
Discharge	347.00 cfs

Results	
Depth	5.95 ft
Diameter	71.4 in
Flow Area	27.8 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	5.05 ft
Percent Full	100.0 %
Critical Slope	0.66 %
Velocity	12.47 ft/s
Velocity Head	2.42 ft
Specific Energy	8.37 ft
Froude Number	0.00
Maximum Discharge	373.27 cfs
Discharge Full	347.00 cfs
Slope Full	0.70 %
Flow Type	N/A

14-1b-Prop.
Worksheet for Circular Channel

Project Description	
Worksheet	14-1b
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	0.70 %
Discharge	321.00 cfs

Results	
Depth	5.78 ft
Diameter	69.4 in
Flow Area	26.3 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	4.90 ft
Percent Full	100.0 %
Critical Slope	0.66 %
Velocity	12.23 ft/s
Velocity Head	2.32 ft
Specific Energy	8.10 ft
Froude Number	0.00
Maximum Discharge	345.30 cfs
Discharge Full	321.00 cfs
Slope Full	0.70 %
Flow Type	N/A

14-1-1-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	14-1-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	5.00 %
Discharge	181.00 cfs

Results	
Depth	3.23 ft
Diameter	38.7 in
Flow Area	8.2 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.20 ft
Percent Full	100.0 %
Critical Slope	4.66 %
Velocity	22.14 ft/s
Velocity Head	7.62 ft
Specific Energy	10.85 ft
Froude Number	0.00
Maximum Discharge	194.70 cfs
Discharge Full	181.00 cfs
Slope Full	5.00 %
Flow Type	N/A

14-1-2-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	14-1-2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	5.00 %
Discharge	36.00 cfs

Results	
Depth	1.76 ft
Diameter	21.1 in
Flow Area	2.4 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	1.74 ft
Percent Full	100.0 %
Critical Slope	4.60 %
Velocity	14.79 ft/s
Velocity Head	3.40 ft
Specific Energy	5.16 ft
Froude Number	0.00
Maximum Discharge	38.73 cfs
Discharge Full	36.00 cfs
Slope Full	5.00 %
Flow Type	N/A

14-2-Prop. Worksheet for Circular Channel

Project Description	
Worksheet	14-2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	0.40 %
Discharge	140.00 cfs

Results	
Depth	4.70 ft
Diameter	56.5 in
Flow Area	17.4 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.44 ft
Percent Full	100.0 %
Critical Slope	0.51 %
Velocity	8.05 ft/s
Velocity Head	1.01 ft
Specific Energy	5.71 ft
Froude Number	0.00
Maximum Discharge	150.60 cfs
Discharge Full	140.00 cfs
Slope Full	0.40 %
Flow Type	N/A

14-3-Prop. Worksheet for Circular Channel

Project Description	
Worksheet	14-3
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	0.40 %
Discharge	111.00 cfs

Results	
Depth	4.31 ft
Diameter	51.7 in
Flow Area	14.6 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.14 ft
Percent Full	100.0 %
Critical Slope	0.52 %
Velocity	7.60 ft/s
Velocity Head	0.90 ft
Specific Energy	5.21 ft
Froude Number	0.00
Maximum Discharge	119.40 cfs
Discharge Full	111.00 cfs
Slope Full	0.40 %
Flow Type	N/A

20-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	20
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	2.00 %
Discharge	201.00 cfs

Results	
Depth	3.98 ft
Diameter	47.8 in
Flow Area	12.5 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.84 ft
Percent Full	100.0 %
Critical Slope	1.75 %
Velocity	16.12 ft/s
Velocity Head	4.04 ft
Specific Energy	8.02 ft
Froude Number	0.00
Maximum Discharge	216.22 cfs
Discharge Full	201.00 cfs
Slope Full	2.00 %
Flow Type	N/A

20-1-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	20-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

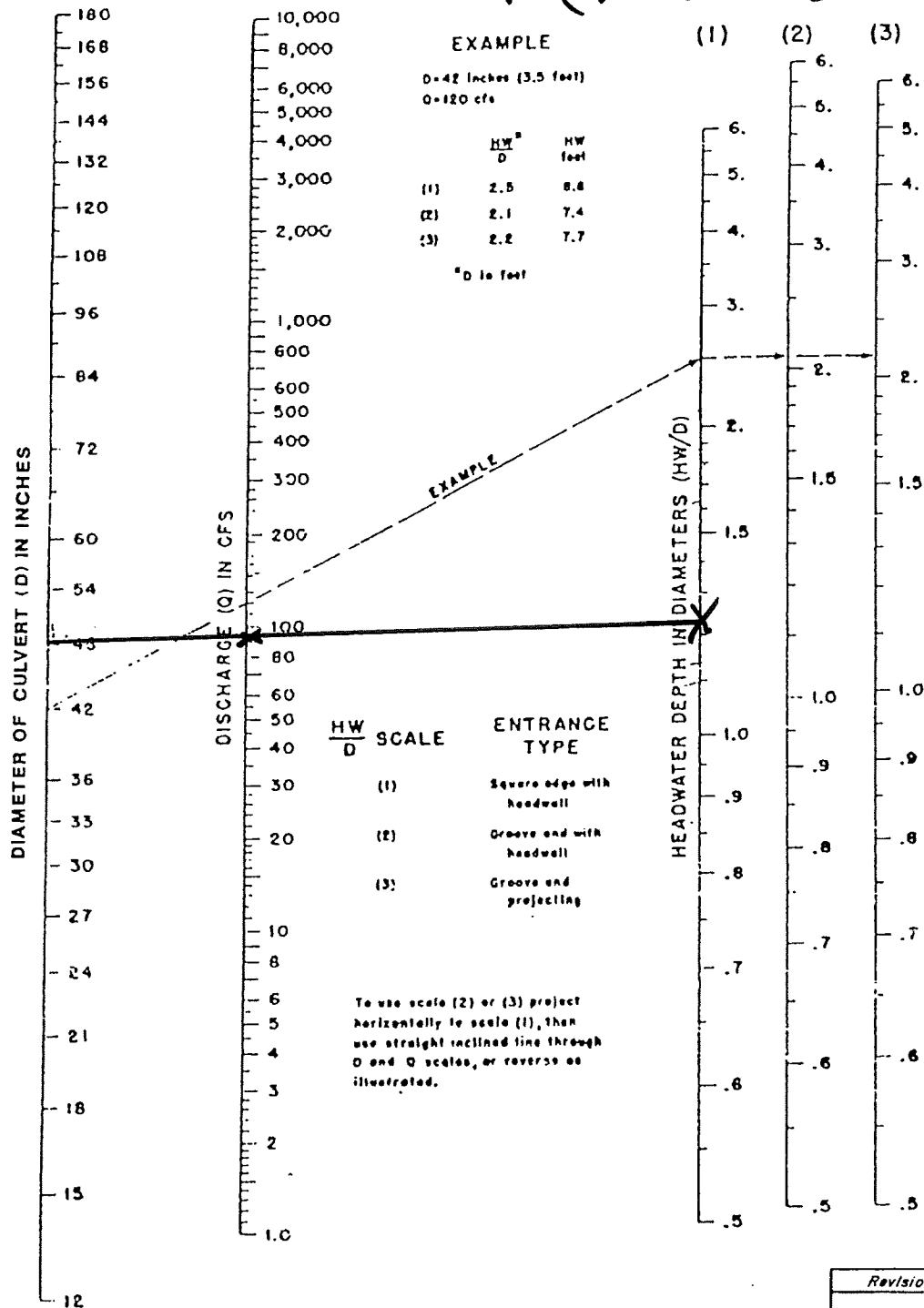
Input Data	
Mannings Coefficient	0.013
Channel Slope	2.00 %
Discharge	180.00 cfs

Results	
Depth	3.82 ft
Diameter	45.9 in
Flow Area	11.5 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.68 ft
Percent Full	100.0 %
Critical Slope	1.75 %
Velocity	15.68 ft/s
Velocity Head	3.82 ft
Specific Energy	7.65 ft
Froude Number	0.00
Maximum Discharge	193.63 cfs
Discharge Full	180.00 cfs
Slope Full	2.00 %
Flow Type	N/A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH - INLET CONTROL RCP

FACILITY 20-1-1 (94 cfs ULT.)



Revision	Date

WRC
ENGINEERING

REFERENCE:

USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

20-2-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	20-2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	3.00 %
Discharge	84.00 cfs

Results	
Depth	2.66 ft
Diameter	31.9 in
Flow Area	5.6 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.60 ft
Percent Full	100.0 %
Critical Slope	2.68 %
Velocity	15.09 ft/s
Velocity Head	3.54 ft
Specific Energy	6.20 ft
Froude Number	0.00
Maximum Discharge	90.36 cfs
Discharge Full	84.00 cfs
Slope Full	3.00 %
Flow Type	N/A

20-3-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	20-3
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	3.50 %
Discharge	84.00 cfs

Results	
Depth	2.59 ft
Diameter	31.0 in
Flow Area	5.3 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.54 ft
Percent Full	100.0 %
Critical Slope	3.16 %
Velocity	15.99 ft/s
Velocity Head	3.97 ft
Specific Energy	6.56 ft
Froude Number	0.00
Maximum Discharge	90.36 cfs
Discharge Full	84.00 cfs
Slope Full	3.50 %
Flow Type	N/A

21-Ult.

Worksheet for Circular Channel

Project Description	
Worksheet	21
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	4.00 %
Discharge	244.00 cfs

Results	
Depth	3.76 ft
Diameter	45.1 in
Flow Area	11.1 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.73 ft
Percent Full	100.0 %
Critical Slope	3.69 %
Velocity	21.95 ft/s
Velocity Head	7.48 ft
Specific Energy	11.25 ft
Froude Number	0.00
Maximum Discharge	262.47 cfs
Discharge Full	244.00 cfs
Slope Full	4.00 %
Flow Type	N/A

21-1-Ult.
Worksheet for Circular Channel

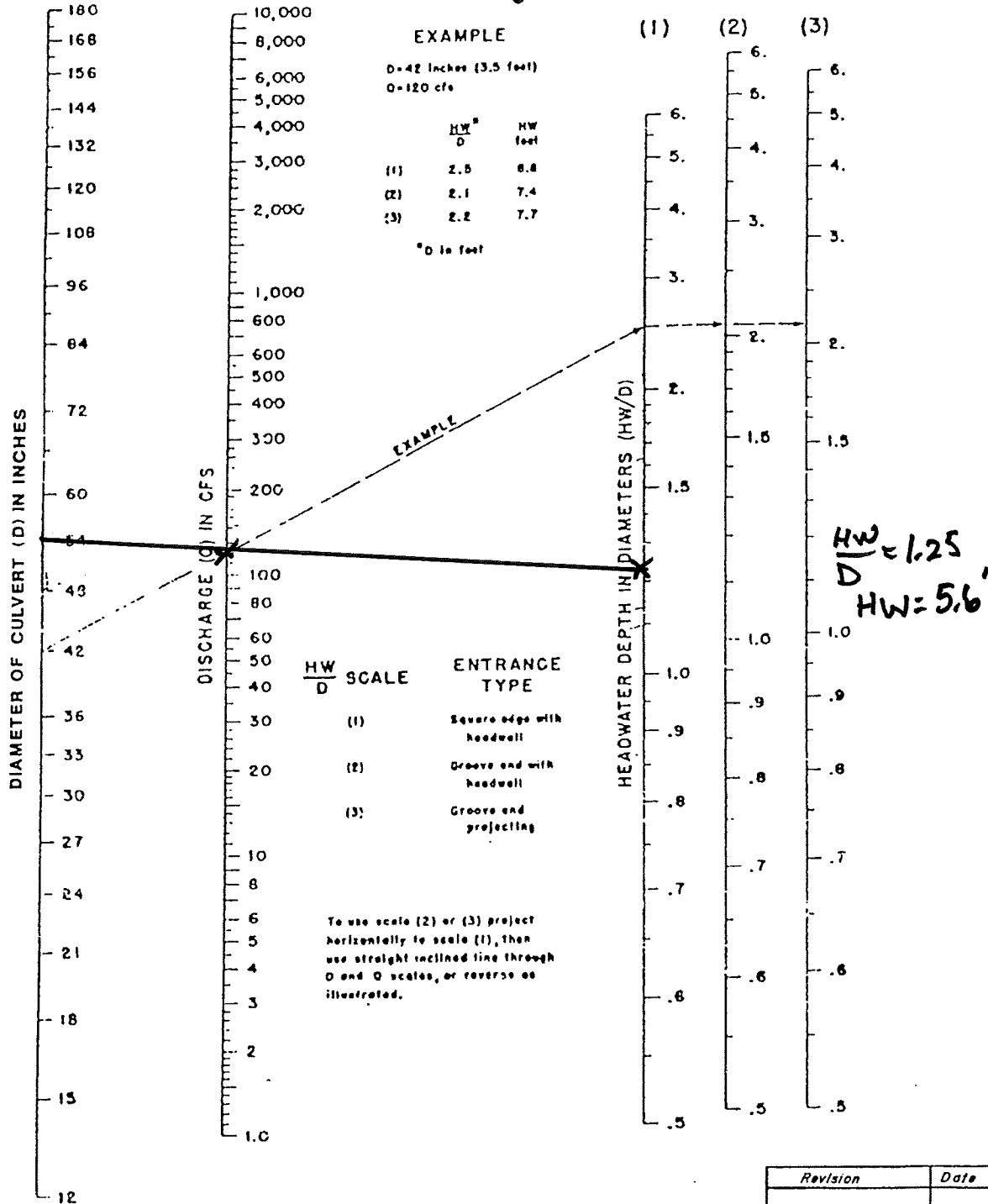
Project Description	
Worksheet	21-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	2.50 %
Discharge	124.00 cfs

Results	
Depth	3.19 ft
Diameter	38.3 in
Flow Area	8.0 ft²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.10 ft
Percent Full	100.0 %
Critical Slope	2.21 %
Velocity	15.54 ft/s
Velocity Head	3.75 ft
Specific Energy	6.94 ft
Froude Number	0.00
Maximum Discharge	133.39 cfs
Discharge Full	124.00 cfs
Slope Full	2.50 %
Flow Type	N/A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH - INLET CONTROL RCP FACILITY 21-1b (ULT. 120 cfs)



Revision	Date

WRC
ENGINEERING

REFERENCE:

USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

21-2-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	21-2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	3.40 %
Discharge	62.00 cfs

Results	
Depth	2.32 ft
Diameter	27.8 in
Flow Area	4.2 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.28 ft
Percent Full	100.0 %
Critical Slope	3.06 %
Velocity	14.66 ft/s
Velocity Head	3.34 ft
Specific Energy	5.66 ft
Froude Number	0.00
Maximum Discharge	66.69 cfs
Discharge Full	62.00 cfs
Slope Full	3.40 %
Flow Type	N/A

21-3-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	21-3
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	1.30 %
Discharge	62.00 cfs

Results	
Depth	2.78 ft
Diameter	33.3 in
Flow Area	6.1 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.52 ft
Percent Full	100.0 %
Critical Slope	1.14 %
Velocity	10.22 ft/s
Velocity Head	1.62 ft
Specific Energy	4.40 ft
Froude Number	0.00
Maximum Discharge	66.69 cfs
Discharge Full	62.00 cfs
Slope Full	1.30 %
Flow Type	N/A

28-1-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	28-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	0.80 %
Discharge	199.00 cfs

Results	
Depth	4.71 ft
Diameter	56.6 in
Flow Area	17.4 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	4.05 ft
Percent Full	100.0 %
Critical Slope	0.74 %
Velocity	11.41 ft/s
Velocity Head	2.02 ft
Specific Energy	6.73 ft
Froude Number	0.00
Maximum Discharge	214.07 cfs
Discharge Full	199.00 cfs
Slope Full	0.80 %
Flow Type	N/A

28-2-Ult.
Worksheet for Circular Channel

Project Description	
Worksheet	28-2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	0.80 %
Discharge	81.00 cfs

Results	
Depth	3.36 ft
Diameter	40.4 in
Flow Area	8.9 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	2.82 ft
Percent Full	100.0 %
Critical Slope	0.77 %
Velocity	9.11 ft/s
Velocity Head	1.29 ft
Specific Energy	4.65 ft
Froude Number	0.00
Maximum Discharge	87.13 cfs
Discharge Full	81.00 cfs
Slope Full	0.80 %
Flow Type	N/A

29-1-Prop. Worksheet for Circular Channel

Project Description	
Worksheet	29-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	4.00 %
Discharge	208.00 cfs

Results	
Depth	3.54 ft
Diameter	42.5 in
Flow Area	9.9 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.51 ft
Percent Full	100.0 %
Critical Slope	3.68 %
Velocity	21.09 ft/s
Velocity Head	6.91 ft
Specific Energy	10.45 ft
Froude Number	0.00
Maximum Discharge	223.75 cfs
Discharge Full	208.00 cfs
Slope Full	4.00 %
Flow Type	N/A

29-2-Prop. Worksheet for Circular Channel

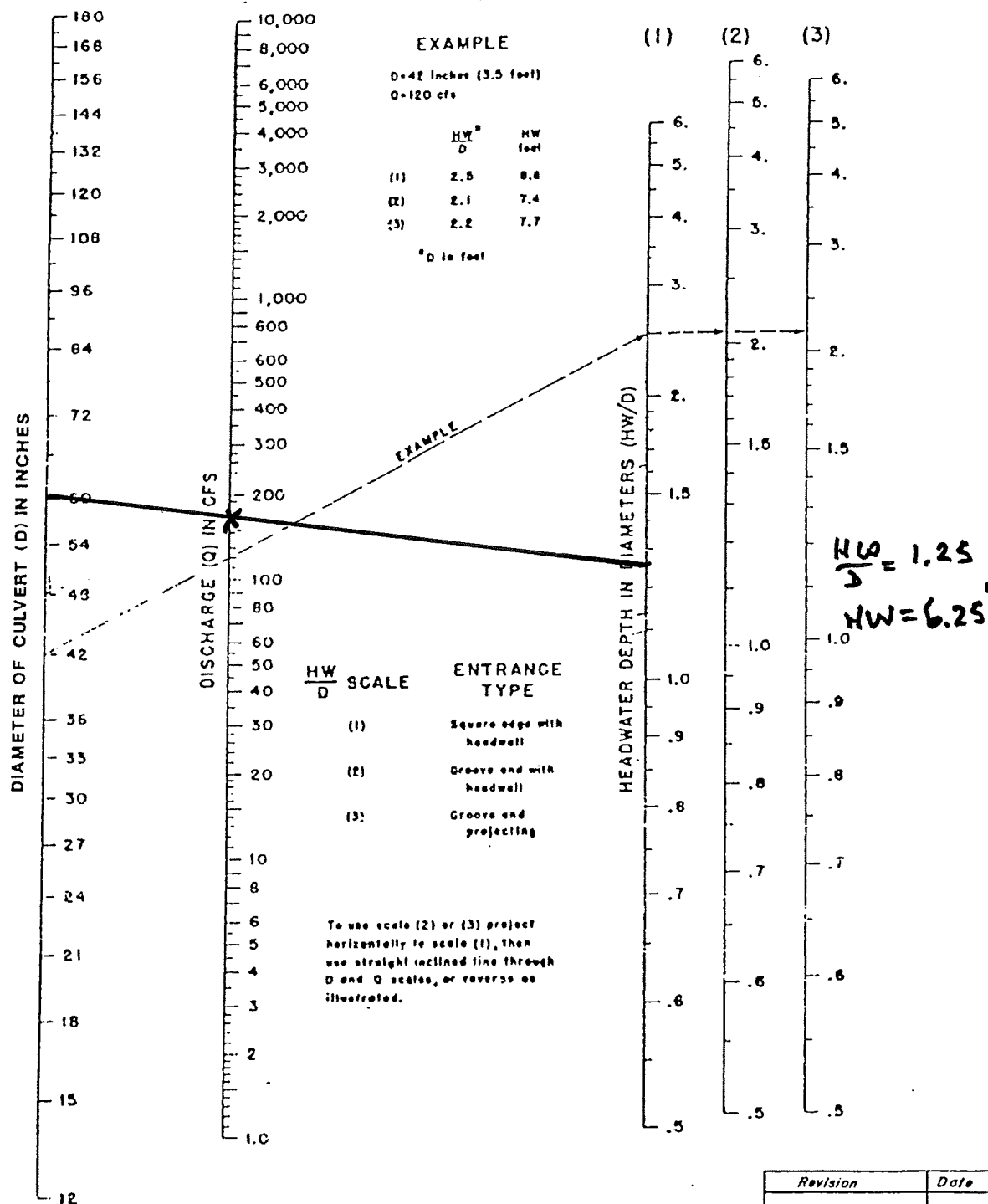
Project Description	
Worksheet	29-2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	0.60 %
Discharge	208.00 cfs

Results	
Depth	5.06 ft
Diameter	60.7 in
Flow Area	20.1 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	4.10 ft
Percent Full	100.0 %
Critical Slope	0.61 %
Velocity	10.35 ft/s
Velocity Head	1.67 ft
Specific Energy	6.72 ft
Froude Number	0.00
Maximum Discharge	223.75 cfs
Discharge Full	208.00 cfs
Slope Full	0.60 %
Flow Type	N/A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH - INLET CONTROL RCP FACILITY 29-3 (PROP. 173 cfs)



Revision	Date

WRC
ENGINEERING

REFERENCE:

USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

35-Prop.

Worksheet for Circular Channel

Project Description	
Worksheet	35
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	0.50 %
Discharge	228.00 cfs

Results	
Depth	5.42 ft
Diameter	65.0 in
Flow Area	23.0 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	4.24 ft
Percent Full	100.0 %
Critical Slope	0.55 %
Velocity	9.89 ft/s
Velocity Head	1.52 ft
Specific Energy	6.94 ft
Froude Number	0.00
Maximum Discharge	245.26 cfs
Discharge Full	228.00 cfs
Slope Full	0.50 %
Flow Type	N/A

35-1-Prop.
Worksheet for Circular Channel

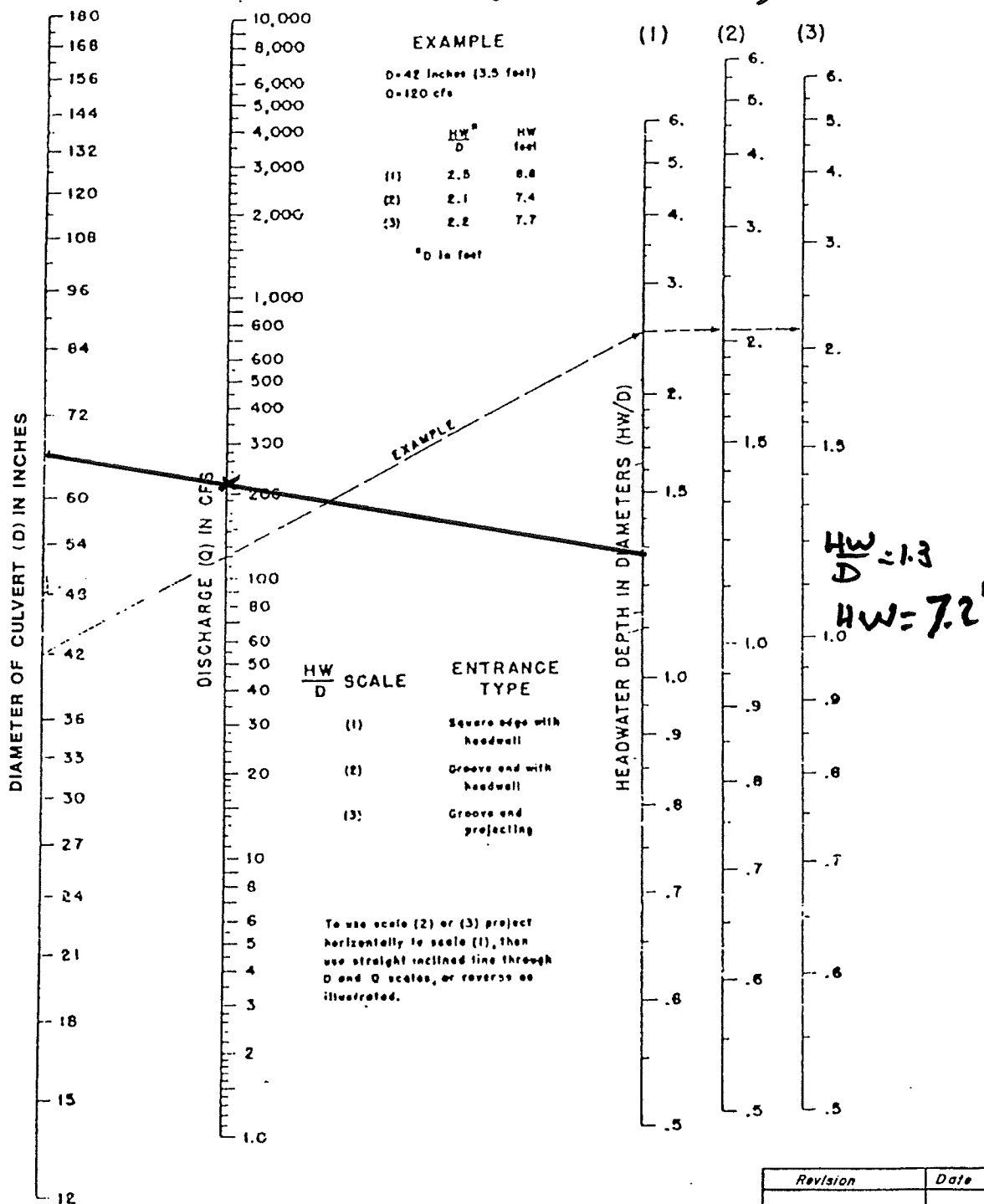
Project Description	
Worksheet	35-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	0.80 %
Discharge	228.00 cfs

Results	
Depth	4.96 ft
Diameter	59.5 in
Flow Area	19.3 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	4.27 ft
Percent Full	100.0 %
Critical Slope	0.74 %
Velocity	11.80 ft/s
Velocity Head	2.16 ft
Specific Energy	7.12 ft
Froude Number	0.00
Maximum Discharge	245.26 cfs
Discharge Full	228.00 cfs
Slope Full	0.80 %
Flow Type	N/A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH - INLET CONTROL RCP FACILITY 35-2 (PAOP. 228cfs)



Revision	Date

WRC
ENGINEERING

REFERENCE:

USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

42-Prop. Worksheet for Circular Channel

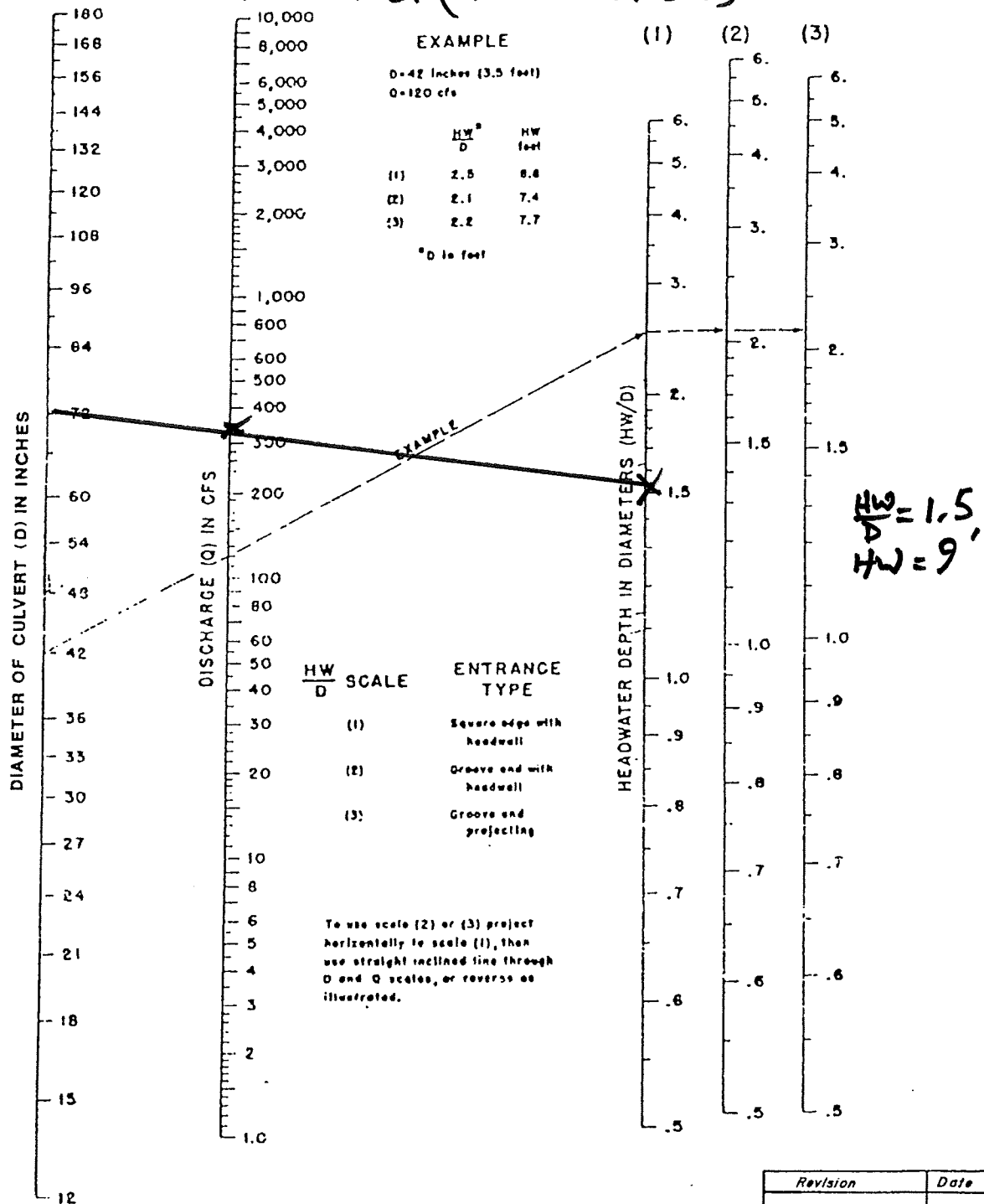
Project Description	
Worksheet	42
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Diameter

Input Data	
Mannings Coefficient	0.013
Channel Slope	2.10 %
Discharge	187.00 cfs

Results	
Depth	3.84 ft
Diameter	46.1 in
Flow Area	11.6 ft ²
Wetted Perimeter	0.00 ft
Top Width	0.00 ft
Critical Depth	3.71 ft
Percent Full	100.0 %
Critical Slope	1.84 %
Velocity	16.13 ft/s
Velocity Head	4.04 ft
Specific Energy	7.88 ft
Froude Number	0.00
Maximum Discharge	201.16 cfs
Discharge Full	187.00 cfs
Slope Full	2.10 %
Flow Type	N/A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH - INLET CONTROL RCP FACILITY C1 (PROP. 349 cfs)



Revision	Date

WRC
ENGINEERING

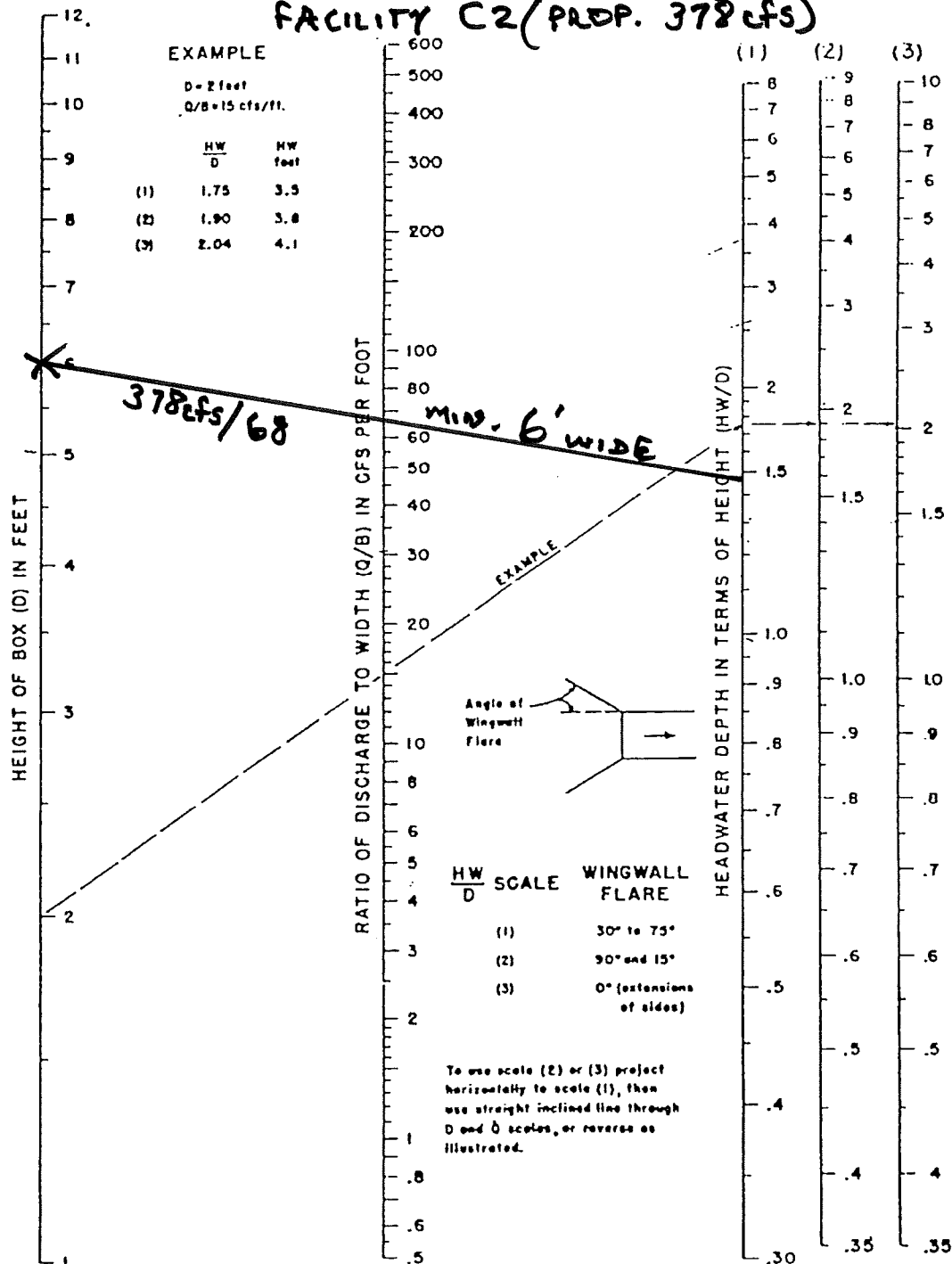
REFERENCE:

USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH - INLET CONTROL BOX CULVERT FACILITY C2 (PROP. 378 cfs)



Revision	Date

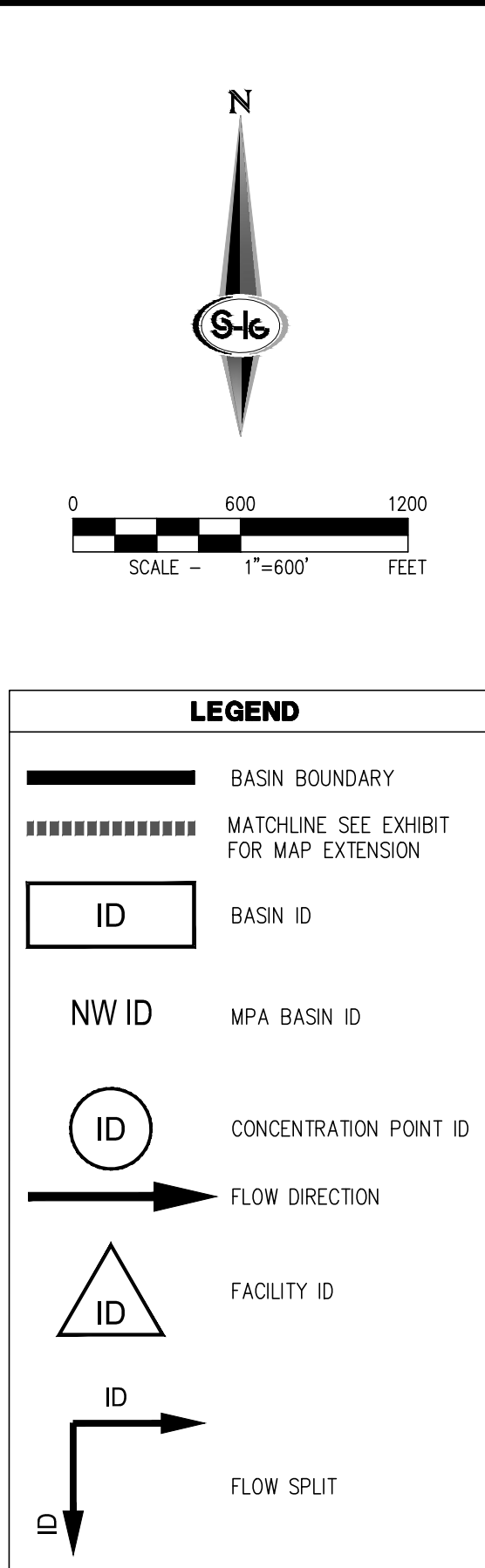
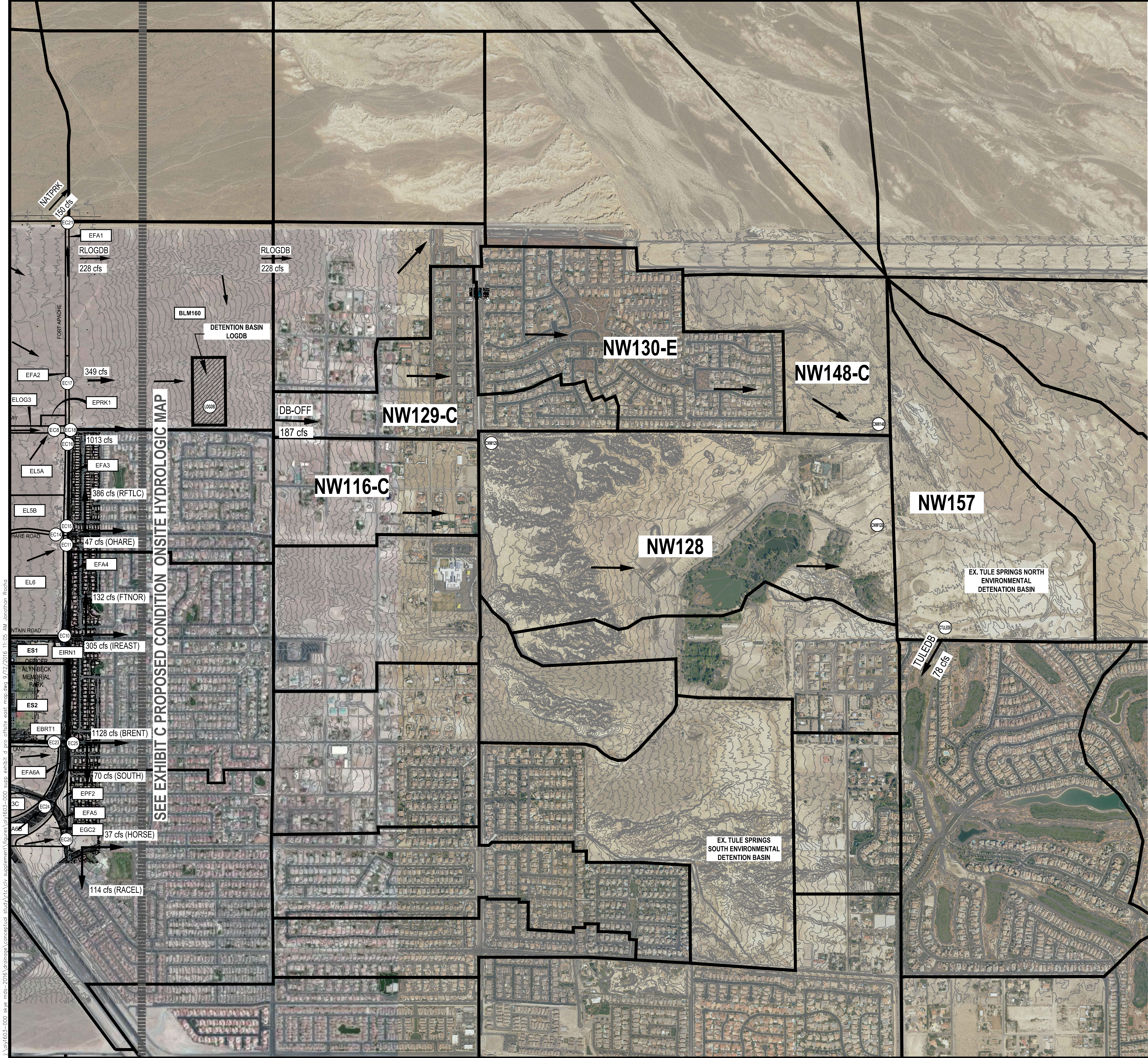
WRC
ENGINEERING

REFERENCE:
USDOT, FHWA, HDS No.5, 1985

FIGURE 1004

APPENDIX G

Updated Drainage Exhibits



Proposed Condition Flow Rate Summary Skye Canyon Offsite Basins				
Basin/Concentration Point ID	Area (sq. mi)	Q ₁₀ (cfs)	Q ₅₀ (cfs)	Q ₁₀₀ (cfs)
WEST BASINS				
ES1	0.02	29	14	
ES2	0.05	64	43	
OFF10	0.07	89	185	
OFF14	0.01	20	8	
OFF15	0.03	47	19	
OFFA	0.02	17	4	
OFFB	0.13	73	21	
OFFC	0.13	86	33	
OFFDA	0.64	343	84	
OFFDE	0.49	232	65	
OFFE	0.04	26	8	
OFFFA	0.99	843	258	
OFFFB	0.60	414	150	
OFFG	0.04	47	20	
OFFH	0.01	4	1	
OFFI	0.01	9	2	
OFFJ	0.01	8	2	
OFFK	0.05	35	8	
WOFF1	0.43	387	134	
WOFF10	0.65	467	175	
WOFF2	0.04	24	17	
WOFF3	0.03	38	14	
WOFF4	0.06	84	30	
WOFF5	0.36	236	30	
WOFF6	0.04	59	83	
WOFF7	0.01	10	4	
WOFF8	0.21	230	86	
WOFF9	0.12	144	55	
EAST BASINS				
BLM160	0.25	187	38	
NW128-C	0.14	126	44	
NW116-C	0.13	100	30	
NW129	0.45	236	54	
NW130-C	0.25	196	70	
NW148-C	0.13	76	20	
NW157	0.25	178	56	
US95 BASINS				
95-1	0.01	7	3	
95-2	0.01	7	3	
95-3	0.01	15	6	
95-4A	0.01	14	7	
95-4B	0.01	13	6	
95-4C	0.01	12	5	
95-5B	0.01	11	5	
95-7A	0.01	17	7	
95-7B	0.01	13	5	
95-7C	0.01	15	7	
95-8A	0.01	6	5	
95-8B	0.01	19	9	
95-8C	0.01	22	10	
OFFH	0.01	12	5	

Proposed Condition Flow Rate Summary Skye Canyon Offsite Concentration Points				
Basin/Concentration Point ID	Area (sq. mi)	Q ₁₀ (cfs)	Q ₅₀ (cfs)	Q ₁₀₀ (cfs)
WEST CONCENTRATION POINTS				
COFF11	2.26	1310	401	
Q = COFF11 + COFF12 + COFF13	0.36	206	57	
CP1	0.50	417	142	
Q = CP1 + COFF14 + COFF15	0.22	235	89	
CP2	1.14	463	112	
Q = CP2 + COFF16 + COFF17	0.31	173	50	
DB1	0.88	730	253	
Q = DB1 + COFF18 + COFF19 + COFF20 + COFF21	0.88	70	56	
DB2	1.02	708	262	
Q = DB2 + COFF22 + COFF23 + COFF24 + COFF25	1.02	76	43	
EP116	1.16	466	113	
EAST CONCENTRATION POINTS				
Q = COFF26 + COFF27 + COFF28 + COFF29 + COFF30	8.04	331	N/A	
Q = COFF31 + COFF32 + COFF33 + COFF34 + COFF35	7.44	188	54	
Q = COFF36 + COFF37 + COFF38 + COFF39 + COFF40	0.38	270	89	
Q = COFF41 + COFF42 + COFF43 + COFF44 + COFF45	8.81	635	N/A	
LOGDB	7.30	1365	626	
Q = LOGDB + COFF46 + COFF47 + COFF48 + COFF49 + COFF50	0.06	62	26	
Q = COFF51 + COFF52 + COFF53 + COFF54 + COFF55	0.06	56	24	
Q = COFF56 + COFF57 + COFF58 + COFF59 + COFF60	0.06	6	3	
Q = COFF61 + COFF62 + COFF63 + COFF64 + COFF65	2.38	1333	450	
Q = COFF66 + COFF67 + COFF68 + COFF69 + COFF70	2.38	200	200	
Q = COFF71 + COFF72 + COFF73 + COFF74 + COFF75	2.38	377	148	
Q = COFF76 + COFF77 + COFF78 + COFF79 + COFF80	2.38	767	62	
Q = COFF81 + COFF82 + COFF83 + COFF84 + COFF85	2.40	378	148	
Q = COFF86 + COFF87 + COFF88 + COFF89 + COFF90	2.40	228	98	
Q = COFF91 + COFF92 + COFF93 + COFF94 + COFF95	5.08	1166	386	
Q = COFF96 + COFF97 + COFF98 + COFF99 + COFF100	5.08	854	386	
Q = COFF101 + COFF102 + COFF103 + COFF104 + COFF105	5.08	312	0	
Q = COFF106 + COFF107 + COFF108 + COFF109 + COFF110	5.16	957	393	
Q = COFF111 + COFF112 + COFF113 + COFF114 + COFF115	5.16	608	286	
Q = COFF116 + COFF117 + COFF118 + COFF119 + COFF120	5.17	464	74	
Q = COFF121 + COFF122 + COFF123 + COFF124 + COFF125	5.17	232	73	
Q = COFF126 + COFF127 + COFF128 + COFF129 + COFF130	5.17	232	0	
Q = COFF131 + COFF132 + COFF133 + COFF134 + COFF135	5.25	681	187	
Q = COFF136 + COFF137 + COFF138 + COFF139 + COFF140	5.25	659	234	
Q = COFF141 + COFF142 + COFF143 + COFF144 + COFF145	5.36	777	394	
Q = COFF146 + COFF147 + COFF148 + COFF149 + COFF150	5.37	712	394	
Q = COFF151 + COFF152 + COFF153 + COFF154 + COFF155	5.37	65	0	
Q = COFF156 + COFF157 + COFF158 + COFF159 + COFF160	5.38	720	388	
Q = COFF161 + COFF162 + COFF163 + COFF164 + COFF165	5.41	106	16	
Q = COFF166 + COFF167 + COFF168 + COFF169 + COFF170	5.39	67	8	
Q = COFF171 + COFF172 + COFF173 + COFF174 + COFF175	5.38	985	635	
Q = COFF176 + COFF177 + COFF178 + COFF179 + COFF180	5.43	556	73	

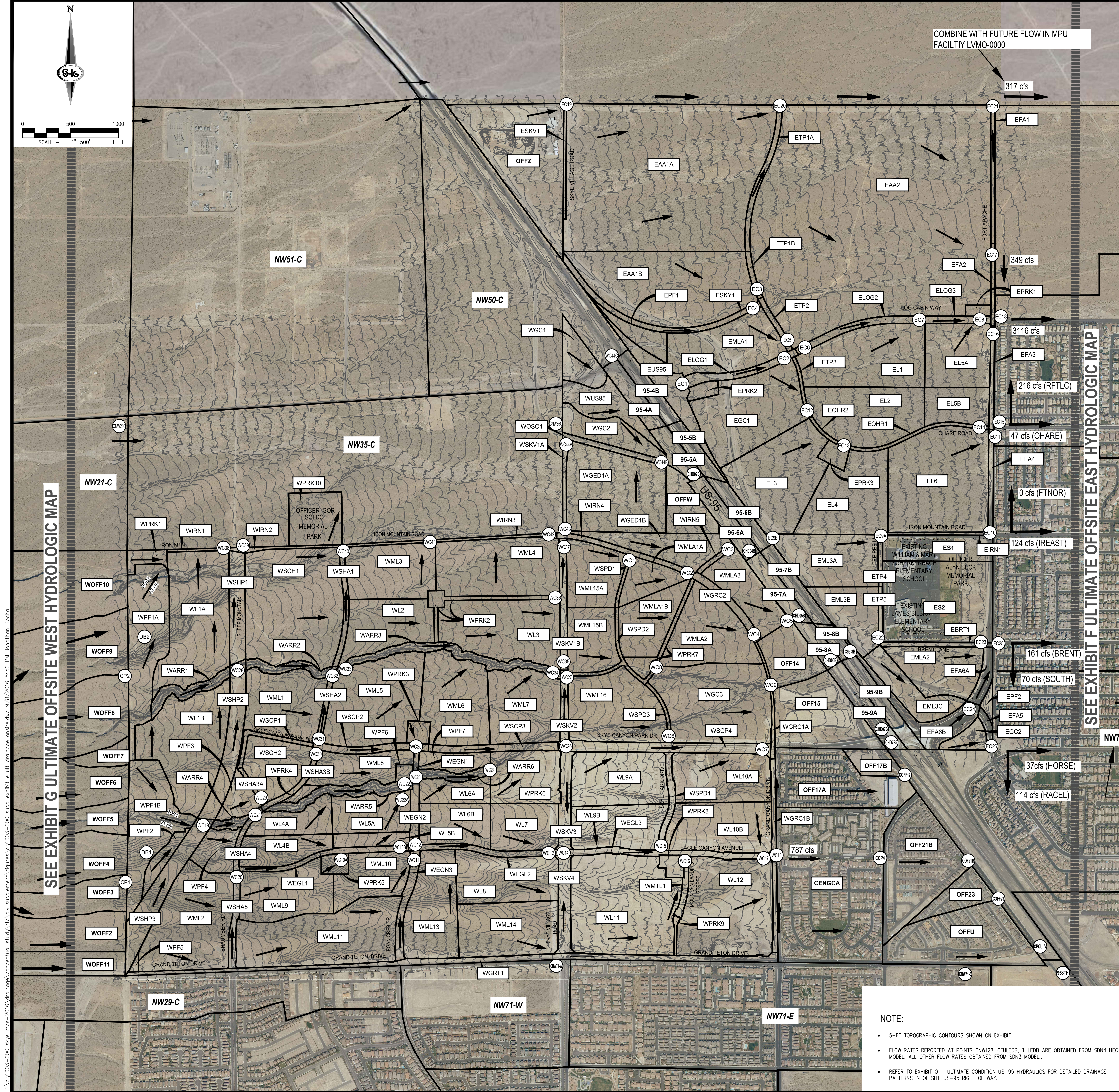
NOTE:
• 2-FT TOPOGRAPHIC CONTOURS SHOWN ON EXHIBIT

Proposed Condition Flow Rate Summary Skye Canyon East Diversions				
Diversions ID	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)	Diversed From	Diversed To
NATPRK	150	138	EC21	NATIONAL PARK
RLOGDB	228	0	EC21	N/A
DB-OFF	187	N/A	LOGDB	CTULEDB
TULEDB	78	N/A	CTULEDB	SILVERSTONE RANCH
RFTLC	386	78	EC15	FORT APACHE ROAD
OHARE	47	47	EC15	OHARE ROAD
FTNOR	132	0	EC10	FORT APACHE ROAD
IREAST	305	260	EC10	IRON MOUNTAIN EAST
BRENT	1128	724	EC25	BRENT LANE
SOUTH	70	70	EC25	RACEL STREET
HORSE	37	0	EC26	HORSE DRIVE
RACEL	114	110	EC26	RACEL STREET

SLATER
HANIFAN
GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300
FAX (702) 284-5399

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

EXHIBIT D
SHEET 1 OF 1



Ultimate Condition Flow Rate Summary Skye Canyon West Concentration Points				
Basin/Concentration Point ID	Area (ac)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)	Q ₁ (cfs)
WARR1	3.6	9	3	
WARR2	2.8	7	3	
WARR3	7.1	17	7	
WARR4	1.3	3	1	
WARR5	8.0	18	8	
WARR6	2.4	6	2	
WARR7	8.3	24	11	
WARR8	8.3	24	10	
WARR9	30.4	85	47	
WARR10	28.4	77	35	
WARR11	11.5	33	16	
WARR12	17.1	46	21	
WARR13	16.3	46	22	
WARR14	31.4	84	38	
WARR15	28.3	81	38	
WARR16	28.0	79	36	
WARR17	15.7	46	21	
WARR18	24.9	69	32	
WARR19	8.0	23	10	
WARR20	8.9	27	12	
WARR21	10.9	32	15	
WARR22	3.8	12	5	
WARR23	6.5	18	9	
WARR24	10.6	30	14	
WARR25	11.5	34	16	
WARR26	17.4	48	22	
WARR27	18.2	49	22	
WARR28	14.4	39	18	
WARR29	18.0	52	24	
WARR30	11.6	38	19	
WARR31	16.0	48	23	
WARR32	15.1	44	20	
WARR33	16.4	49	25	
WARR34	19.2	59	28	
WARR35	12.3	40	20	
WARR36	11.3	34	16	
WARR37	22.2	54	32	
WARR38	27.4	78	38	
WARR39	17.3	46	22	
WARR40	26.1	77	38	
WARR41	27.3	82	41	
WARR42	20.5	54	30	
WARR43	18.8	59	30	
WARR44	10.3	34	17	
WARR45	16.4	55	28	
WARR46	6.5	20	10	
WARR47	13.0	37	18	
WARR48	30.4	88	44	
WARR49	11.5	35	17	
WARR50	20.2	59	29	
WARR51	18.9	63	31	
WARR52	3.1	10	5	
WARR53	4.6	17	8	
WARR54	5.7	19	9	
WARR55	0.4	1	0	
WARR56	1.0	4	2	
WARR57	4.5	14	7	
WARR58	2.4	6	2	
WARR59	10.0	19	8	
WARR60	3.5	7	2	
WARR61	1.8	4	2	
WARR62	1.0	3	1	
WARR63	2.0	5	2	
WARR64	13.2	28	10	
WARR65	3.0	7	2	
WARR66	1.7	4	2	
WARR67	1.0	3	1	
WARR68	5.5	1	0	
WARR69	38.4	106	48	
WARR70	11.5	37	16	
WEST ROADWAY BASINS				
WARR71	3.4	12	6	
WARR72	3.3	12	7	
WARR73	4.8	16	9	
WARR74	0.5	2	1	
WARR75	2.1	2	1	
WARR76	3.3	10	6	
WARR77	1.3	4	2	
WARR78	3.2	10	5	
WARR79	2.7	9	5	
WARR80	11.7	30	16	
WARR81	0.5	2	1	
WARR82	2.2	7	4	
WARR83	1.3	5	3	
WARR84	2.7	9	5	
WARR85	0.7	3	2	
WARR86	1.3	5	2	
WARR87	2.2	8	4	
WARR88	1.5	6	3	
WARR89	3.0	11	6	
WARR90	3.5	13	7	
WARR91	2.3	8	4	
WARR92	1.5	5	2	
WARR93	0.7	3	1	
WARR94	1.6	6	3	
WARR95	1.4	5	3	
WARR96	2.4	8	5	
WARR97	6.4	19	9	
WARR98	9.3	27	13	
WARR99	10.4	31	15	
WARR100	1.4	5	3	
WARR101	3.5	11	6	
WARR102	2.0	19	8	
WARR103	4.2	14	7	
WARR104	4.5	15	8	
WARR105	2.1	3	2	
WARR106	0.9	3	1	
WARR107	2.1	3	2	
WARR108	0.7	3	1	
WARR109	1.0	2	1	
WARR110	8.5	28	16	
EAST ROADWAY BASINS				
WARR111	1.8	7	4	
WARR112	1.8	5	3	
WARR113	1.3	3	2	
WARR114	1.5	5	3	
WARR115	1.9	6	3	
WARR116	1.1	4	2	
WARR117	2.3	9	5	
WARR118	4.5	17	9	
WARR119	1.4	4	2	
WARR120	3.4	11	6	
WARR121	3.5	12	6	
WARR122	1.7	6	3	
WARR123	1.6	6	4	
WARR124	1.7	6	3	
WARR125	1.1	5	2	
WARR126	3.4	18	5	
WARR127	2.9	9	5	
WARR128	0.9	3	2	
WARR129	0.8	16	7	
WARR130	0.8	3	2	
WARR131	0.9	3	2	
WARR132	0.9	31	17	
Skye Canyon East Basins				
WARR133	1.8	7	4	
WARR134	1.3	3	2	
WARR135	1.5	5	3	
WARR136	1.9	6	3	
WARR137	1.1	4	2	
WARR138	2.3	9	5	
WARR139	4.5	17	9	
WARR140	1.4	4	2	
WARR141	3.4	11	6	
WARR142	3.5	12	6	
WARR143	1.7	6	3	
WARR144	1.6	6	4	
WARR145	1.7	6	3	
WARR146	1.1	5	2	
WARR147	3.4	18	5	
WARR148	2.9	9	5	
WARR149	0.9	3	2	
WARR150	0.8	16	7	
WARR151	0.8	3	2	
WARR152	0.9	3	2	
WARR153	0.9	31	17	
Skye Canyon East Diversions				
WARR154	134	N/A	LOGDB	SILVERSTONE RANCH
WARR155	216	59	EC15	FORT APACHE RANCH
WARR156	47	47	EC15	CHARE ROAD
WARR157	0	0	EC10	FORT APACHE RANCH
WARR158	124	59	EC10	IRON MOUNTAIN EAST
WARR159	161	46	EC25	BRENT LANE
WARR160	70	70	EC26	RACEL STREET
WARR161	37	0	EC26	HORSE DRIVE
WARR162	114	110	EC26	RACEL STREET

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5390 FAX (702) 284-5399

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

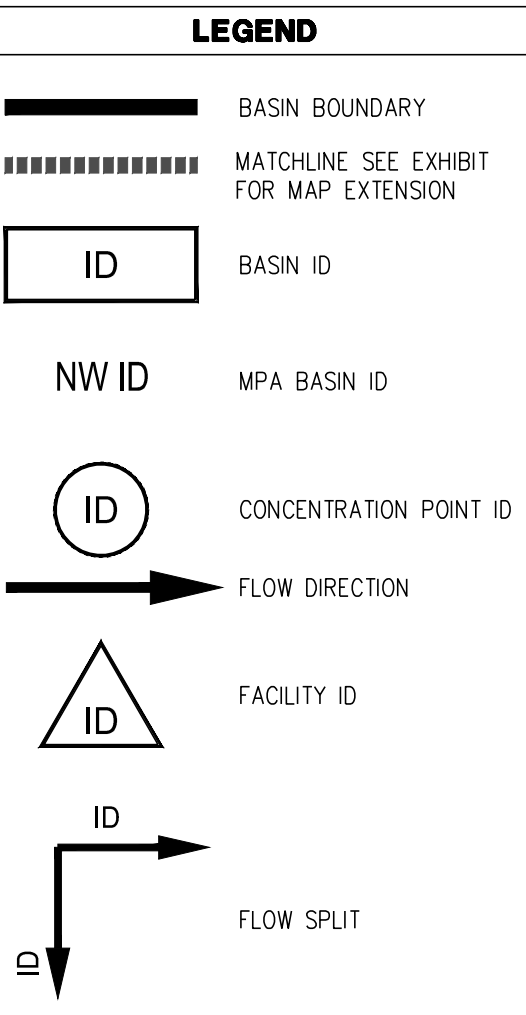
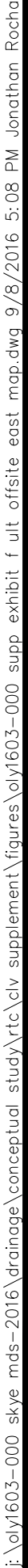
DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JSR
CHECKED: SMJ
PROJECT NO. OLY1603.000

DATE: SEPT 2016
DRAFTER: JSR
DESIGNER: JS

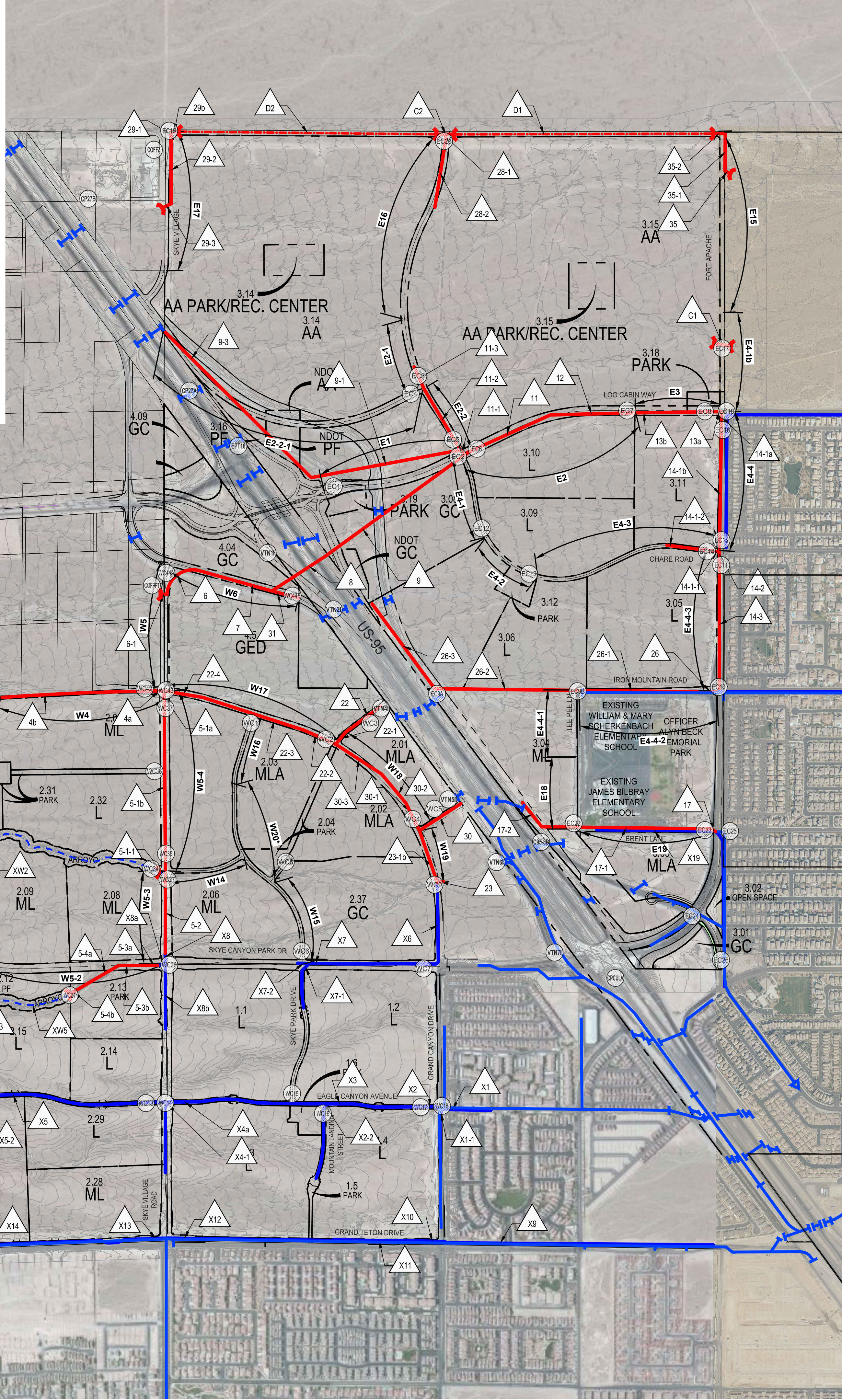


Ultimate Condition Flow Rate Summary Skye Canyon Offsets Concentration Points				
Basin/Concentration Point ID	Area (ac)	Q ₁₀₀ (cfs)	Q ₅ (cfs)	
WEST CONCENTRATION POINTS				
10708				
Q = RCW01W	2.19	1093	386	
CP1				
Q = W00F1 + W00F2 + W00F3 + W00F3.1	0.50	471	176	
CP2				
Q = W00F1 + W00F8	0.17	204	77	
CCP4				
Q = CM3C4 + W0C1B	0.51	917	431	
CNV1C				
Q = RCW01F + W0M1C	0.69	757	255	
CNV1W				
Q = RCW01F + W0M1C	1.70	1695	582	
CNV07				
Q = RCW01F + W0M1C	1.19	2213	690	
CNV21G				
Q = RCW01F + W0M1C	2.36	1139	347	
CNV35C				
Q = RCW01F + W0M1C + W0M1B.1	2.71	1324	410	
CNV71E				
Q = RCW01F + W0M1C	0.24	610	106	
Q = RCW01F + W0M1E	0.24	354	167	
CNV71W				
Q = RCW01F + W0M1C	0.24	354	167	
COF21B				
Q = C02F1 + W0F1A	0.55	990	469	
COF21D				
Q = C02F1 + W0F1A	0.01	19	9	
COF21F				
Q = C02F1 + W0F1A	0.72	871	245	
COF21H				
Q = C02F1 + W0F1A	1.02	1182	352	
COF21I				
Q = C02F1 + W0F1E	0.88	793	317	
COF21J				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21K				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21L				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21M				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21N				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21O				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21P				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21Q				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21R				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21S				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21T				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21U				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21V				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21W				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21X				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21Y				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21Z				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AA				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AB				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AC				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AD				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AE				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AF				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AG				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AH				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AI				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AJ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AK				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AL				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AM				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AN				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AO				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AP				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AQ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AR				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AS				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AT				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AU				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AV				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AW				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AX				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AY				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21AZ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BA				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BB				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BC				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BD				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BE				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BF				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BG				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BH				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BI				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BJ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BK				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BL				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BM				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BN				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BO				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BP				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BQ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BR				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BS				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BT				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BU				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BV				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BW				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BX				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BY				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21BZ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CA				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CB				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CC				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CD				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CE				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CF				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CG				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CH				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CI				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CJ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CK				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CL				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CM				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CN				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CO				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CP				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CQ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CR				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CS				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CT				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CU				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CV				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CW				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CX				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CY				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21CZ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DA				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DB				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DC				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DD				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DE				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DF				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DG				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DH				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DI				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DJ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DK				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DL				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DM				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DN				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DO				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DP				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DQ				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DR				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DS				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	
COF21DT				
Q = C02F1 + W0F1E + W0F1F + W0F1F.1	0.88	793	317	

NOTE:

• 2-FT TOPOGRAPHIC CONTOURS SHOWN ON EXHIBIT

FACILITY HYDRAULICS SUMMARY TABLE						
NETWORK	STREET ID	FACILITY ID	FACILITY TYPE	DESIGN FLOW RATE	PROPOSED FLOW RATE	COMMENTS
EX. SD	EAGLE CANYON	X1	8" x 6" RCB	800 CFS	787 CFS	
EX. SD	GRAND CANYON	X1-1	48" RCP	100 CFS	84 CFS	
EX. SD	EAGLE CANYON	X2	8" x 6" RCB	729 CFS	695 CFS	
EX. SD	MOUNTAIN LANDING	X2-2	48" RCP	110 CFS	106 CFS	
EX. SD	EAGLE CANYON	X3	72" RCP	728 CFS	695 CFS	
EX. SD	SKYE VILLAGE	X4-1	42" RCP	117 CFS	140 CFS	
EX. SD	EAGLE CANYON	X4a	72" RCP	477 CFS	485 CFS	
EX. SD	EAGLE CANYON	X5	48" RCP	216 CFS	226 CFS	
EX. SD	EAGLE CREST	X5-2	42" RCP	90 CFS	90 CFS	
EX. SD	GRAND CANYON DRIVE	X6	6" x 6" RCB	197 CFS	197 CFS	
EX. SD	HORSE	X7	42" RCP	92 CFS	92 CFS	
EX. SD	SKYE PARK	X7-1	36" RCP	47 CFS	47 CFS	
EX. SD	HORSE	X8	24" RCP	6 CFS	6 CFS	
EX. SD	SKYVILLAGE RD	X9a	6" x 6" RCB	367 CFS	413 CFS	
EX. SD	SKYVILLAGE RD	X9b	60" RCP	324 CFS	413 CFS	
EX. SD	SKYE VILLAGE	X9b	36" RCP	43 CFS	43 CFS	
EX. SD	GRAND TETON	X9	10" x 5" RCB	690 CFS	690 CFS	MPV FACILITY CNGT-0043
EX. SD	GRAND TETON	X10	10" x 5" RCB	690 CFS	690 CFS	MPV FACILITY CNGT-0043
EX. SD	GRAND TETON	X11	6" x 6" RCB	646 CFS	646 CFS	MPV FACILITY CNGT-0043
EX. SD	GRAND TETON	X12	6" x 6" RCB	646 CFS	646 CFS	MPV FACILITY CNGT-0043
EX. SD	GRAND TETON	X13	6" x 6" RCB	484 CFS	484 CFS	MPV FACILITY CNGT-0118
EX. SD	GRAND TETON	X14	6" x 6" RCB	484 CFS	484 CFS	MPV FACILITY CNGT-0118
EX. SD	GRAND TETON	X15	6" x 6" RCB	488 CFS	488 CFS	MPV FACILITY CNGT-0118
EX. SD	GRAND TETON	X16	6" x 6" RCB	363 CFS	363 CFS	MPV FACILITY CNGT-0118
EX. SD	SHAUMBER	X17	36" RCP	56 CFS	56 CFS	MPV FACILITY CNGT-0118
EX. SD	EAGLE CANYON	X18	48" RCP	128 CFS	99 CFS	MPV FACILITY CNGT-0118
EX. SD	DB1 COLLECTOR	X19	CONC TRAP CHNL	471 CFS	471 CFS	TO BE CONSTRUCTED WITH DB1
ARROYO WASH	EX. ARROYO WASH	XW1	NATURAL WASH	120 CFS	120 CFS	
ARROYO WASH	EX. ARROYO WASH	XW2	NATURAL WASH	404 CFS	404 CFS	
ARROYO WASH	EX. ARROYO WASH	XW3	NATURAL WASH	94 CFS	94 CFS	
ARROYO WASH	EX. ARROYO WASH	XW4	NATURAL WASH	308 CFS	308 CFS	
ARROYO WASH	EX. ARROYO WASH	XW5	NATURAL WASH	385 CFS	385 CFS	



FACILITY HYDRAULICS SUMMARY TABLE						
NETWORK	STREET ID	FACILITY ID	FACILITY TYPE	LENGTH	SLOPE	FLOW RATE
WEST SD	DB2 OUTLET	0	30" RCP	214'	2.0%	78 CFS
WEST SD	W1	1	42" RCP	1099'	2.9%	78 CFS
WEST SD	W2	2	42" RCP	1230'	5.0%	91 CFS
WEST SD	INFLOW FROM SHEEP MOUNTAIN CHNL	2-1	24" RCP	66'	4.4%	15 CFS
WEST SD	W3	3	54" RCP	1161'	3.2%	222 CFS
WEST SD	W3-1	3-1	42" RCP	191'	3.0%	112 CFS
WEST SD	W3-1	3-2	30" RCP	595'	1.7%	40 CFS
WEST SD	W4	4a	54" RCP	100'	4.5%	362 CFS
WEST SD	W4	4b	54" RCP	1500'	4.5%	241 CFS
WEST SD	ARROYO WASH INFLOW	5-1-1	6" x 6" RCB	51'	14.6%	398 CFS
WEST SD	W5-4	5-1a	12" x 6" RCB	100'	2.1%	967 CFS
WEST SD	W5-4	5-1b	11" x 6" RCB	1654'	0.5%	802 CFS
WEST SD	W5-3	5-2	9" x 6" RCB	779'	0.5%	404 CFS
WEST SD	W5-2	5-3a	60" RCP	79'	3.0%	404 CFS
WEST SD	W5-2	5-3b	60" RCP	301'	3.0%	362 CFS
WEST SD	CONVEYS FLOW TO SD 5-3a	5-4a	60" RCP	491'	3.0%	362 CFS
WEST SD	INFLOW FROM ARROYO WASH	5-4b	6" x 6" RCB	50'	2.8%	362 CFS
WEST SD	W5	6	12" x 6" RCB	445'	1.8%	1322 CFS
WEST SD	W5	7	12" x 6" RCB	723'	1.8%	1333 CFS
WEST SD	DISCHARGE TO ARROYO WASH	20	60" RCP	109'	2.8%	163 CFS
WEST SD	W5-2-1	20-1	48" RCP	134'	2.9%	109 CFS
WEST SD	INFLOW FROM DB1	20-1-1	48" RCP	135'	3.2%	97 CFS
WEST SD	W5-2-1	20-2	36" RCP	340'	3.0%	94 CFS
WEST SD	W5-2-1	20-3	36" RCP	193'	3.5%	94 CFS
WEST SD	DISCHARGE TO ARROYO WASH	21	54" RCP	42'	4.0%	239 CFS
WEST SD	W5-4-2	21-1	42" RCP	100'	2.5%	124 CFS
WEST SD	INFLOW FROM ARROYO WASH	21-1b	54" RCP	88'	3.4%	115 CFS
WEST SD	W5-4-2	21-3	36" RCP	863'	3.4%	62 CFS
WEST SD	W5-4-1	21-3	36" RCP	105'	1.3%	62 CFS
WEST SD	N/A	22	7" x 6" RCB	426'	2.2%	1131 CFS
WEST SD	N/A	22-1	7" x 6" RCB	146'	2.2%	1093 CFS
WEST SD	W17	22-2	8" x 6" RCB	339'	2.0%	1343 CFS
WEST SD	W17	22-3	8" x 6" RCB	1017'	2.0%	1275 CFS
WEST SD	W17	22-4	8" x 6" RCB	382'	2.6%	1275 CFS
WEST SD	W19 OUTLET TO WASH	23	36" RCP	59'	3.4%	538 CFS
WEST SD	W19	23-1b	54" RCP	529'	1.7%	260 CFS
WEST SD	N/A	30	42" RCP	476'	2.5%	135 CFS
WEST SD	W18	30-1	72" RCP	297'	1.2%	385 CFS
WEST SD	W18	30-2	54" RCP	364'	1.8%	260 CFS
WEST SD	W18	30-3	54" RCP	527'	1.4%	260 CFS
WEST SD	W6	31	8" x 6" RCB	272'	2.0%	1133 CFS
WEST SD	DISCHARGE FROM SB	50	CONC TRAP CHNL	1017'	1.5%	471 CFS
WEST SD	ARROYO WASH CULVERT	C3	6" x 6" RCB	164'	6.1%	308 CFS
WEST SD	SHEEP MOUNTAIN CHNL	D3	EARTHEN TRAP CHNL	815'	3.6%	31 CFS
WEST SD	SHEEP MOUNTAIN CHNL	D3-1	EARTHEN TRAP CHNL	1239'	1.7%	31 CFS
WEST SD	SHEEP MOUNTAIN CHNL	D4	EARTHEN TRAP CHNL	534'	4.5%	11 CFS
WEST SD	SHEEP MOUNTAIN CHNL	D4-1	EARTHEN TRAP CHNL	757'	1.5%	11 CFS
WEST SD	SHEEP MOUNTAIN CHNL	D4-2	EARTHEN TRAP CHNL	691'	1.0%	11 CFS
WEST SD	SHEEP MOUNTAIN CHNL	D5	EARTHEN TRAP CHNL	1252'	1.2%	6 CFS
WEST SD	CHANNEL TO DB2	D6	CONCRETE TRAP CHNL	723'	3.0%	235 CFS
WEST SD	CHANNEL TO DB2	D6-1	EARTHEN TRAP CHNL	451'	0.9%	10 CFS
WEST SD	CHANNEL TO DB2	D6-2	EARTHEN TRAP CHNL	145'	1.4%	10 CFS
WEST SD	N/A	6-1	(B) 10" X 4" RCB	62'	N/A	N/A

FACILITY HYDRAULICS SUMMARY TABLE						
NETWORK	STREET ID	FACILITY ID	FACILITY TYPE	LENGTH	SLOPE	FLOW RATE
EAST SD	US-95 SD CROSSING	8	12" x 6" RCB	605'	2.9%	200 CFS
EAST SD	RCP	9	60" RCP	1724'	2.5%	200 CFS
EAST SD	US-95	9-1	72" RCP	1482'	1.4%	466 CFS
EAST SD	US-95	9-3	72" RCP	1987'	1.5%	466 CFS
EAST SD	RCP	11	72" RCP	913'	2.9%	639 CFS
EAST SD	E2-2	11-1	72" RCP	57'	3.0%	539 CFS
EAST SD	E2-2	11-2	42" RCP	680'	1.2%	73 CFS
EAST SD	E2-1	11-3	30" RCP	238'	1.7%	39 CFS
EAST SD	RCP	12	72" RCP	794'	2.9%	639 CFS
EAST SD	RCP	13a	72" RCP	50'	1.6%	666 CFS
EAST SD	RCP	13b	72" RCP	809'	2.9%	639 CFS
EAST SD	E4-3	14-1-1	42" RCP	50'	5.0%	181 CFS
EAST SD	E4-3	14-1-2	24" RCP	461'	5.0%	36 CFS
EAST SD	E4-4	14-1a	72" RCP	51'	0.7%	347 CFS
EAST SD	E4-4	14-1b	72" RCP	1303'	0.7%	321 CFS
EAST SD	RCP	14-2	60" RCP	50'	0.4%	140 CFS
EAST SD	RCP	14-3	54" RCP	1299'	0.4%	111 CFS
EAST SD	E19	17	36" RCP	56'	3.0%	70 CFS
EAST SD	E19	17-1	6" x 6" RCB	1632'	3.3%	1058 CFS
EAST SD	Parcel 3.04	17-2	48" RCP	298'	2.3%	220 CFS
EAST SD	E4-4-2	26	60" RCP	209'	2.6%	416 CFS
EAST SD	E4-4-2	26-1	60" RCP	1180'	2.6%	374 CFS
EAST SD	Parcel 3.06	26-2	60" RCP	1355'	2.6%	374 CFS
EAST SD	Parcel 3.07	26-3	60" RCP	1918'	2.6%	374 CFS
EAST SD	E16	28-1	60" RCP	50'	0.8%	0 CFS
EAST SD	E16	28-2	42" RCP	660'	0.8%	0 CFS
EAST SD	E17	29-1	66" RCP	50'	4.0%	208 CFS
EAST SD	E17	29-2	66" RCP	647'	0.6%	208 CFS
EAST SD	EX WASH INFLOW	29-3	60" RCP	95'	0.5%	173 CFS
EAST SD	DISCHARGE TO MOCCASIN CHNL	29b	60" RCP	65'	1.2%	208 CFS
EAST SD	CROSSING FORT APACHE	35	66" RCP	46'	0.5%	228 CFS
EAST SD	E15	35-1	66" RCP	389'	0.8%	228 CFS
EAST SD	MOCCASIN CHNL INFLOW	35-2	66" RCP	120'	3.3%	228 CFS
EAST SD	E4-1	C1	72" RCP	147'	2.9%	378 CFS
EAST SD	RCP	C2	6" x 6" RCB	155'	1.4%	378 CFS
EAST SD	MOCCASIN CHNL	D1	RIP-RAP TRAP CHANNEL	2408'	2.6%	378 CFS
EAST SD	MOCCASIN CHNL	D2	RIP-RAP TRAP CHANNEL	2504'	3.0%	208 CFS

DETENTION BASIN HYDRAULICS SUMMARY TABLE						
FACILITY ID	INFLOW	OUTFLOW	100-YR STORAGE	TOTAL STORAGE	PMP FLOW	COMMENTS
DB1	794 CFS	71 CFS	57 AC-FT	6 AC-FT	674 CFS	EXISTING DETENTION BASIN 1
DB2	794 CFS	57 CFS	72 AC-FT	6 AC-FT	758 CFS	PROPOSED DETENTION BASIN 2

NOTES:

- REFER TO EXHIBIT M - PROPOSED CONDITION US-95 HYDRAULICS SUMMARY MAP FOR DETAILED FLOW THRU EXISTING US-95 CULVERTS & RCB FACILITIES
- REFER TO EXHIBIT L - PROPOSED CONDITION OFFSITE EAST FACILITIES MAP FOR EXTENSION OF FACILITIES REQUIRED IN MPV ALIGNMENT EAST OF SKYE CANYON.
- 5-FT TOPOGRAPHIC CONTOURS SHOWN ON EXHIBIT

LEGEND

- PROPOSED FACILITIES
- EXISTING FACILITIES
- OPEN CHANNEL FACILITIES
- STREET SEGMENT ID

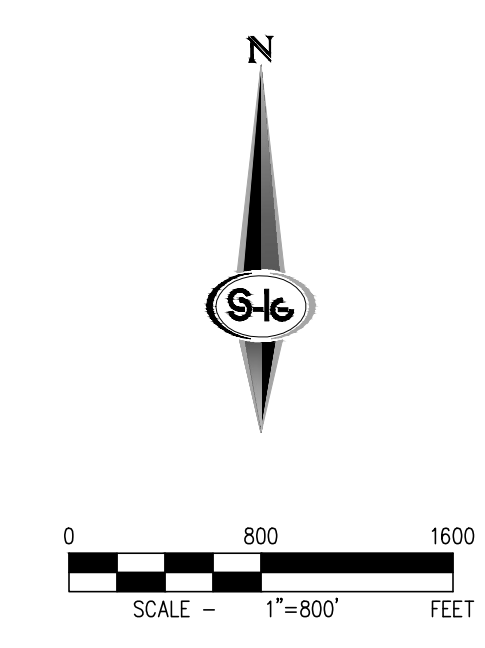
SCALE - 1"=600' FEET

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216 LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

OLYMPIA COMPANIES
SKYE CANYON - MASTER DRAINAGE STUDY
PROPOSED CONDITION ONSITE DRAINAGE FACILITIES MAP

DATE: SEPT 2016
DRAFTER: CWB/JSR
DESIGNER: CWB/JSR
CHECKED: SMJ
PROJECT NO.
OLY1603.000

EXHIBIT H
SHEET 1 OF 1



DETENTION BASIN HYDRAULICS SUMMARY TABLE							
FACILITY ID	INFLOW	OUTFLOW	100-YR STORAGE	DEBRIS STORAGE	TOTAL STORAGE	PMF FLOW	COMMENTS
DB3	1385 CFS	187 CFS	156 AC-FT	8 AC-FT	164 AC-FT	2779 CFS	PROPOSED LOG CABIN DRAINAGE BASIN 3
XD81	654 CFS	78 CFS	N/A	N/A	117 AC-FT	N/A	TULE SPRINGS NORTH ENVIRONMENTAL DETENTION BASIN

LEGEND

	PROPOSED FACILITIES
	EXISTING FACILITIES
	OPEN CHANNEL FACILITIES

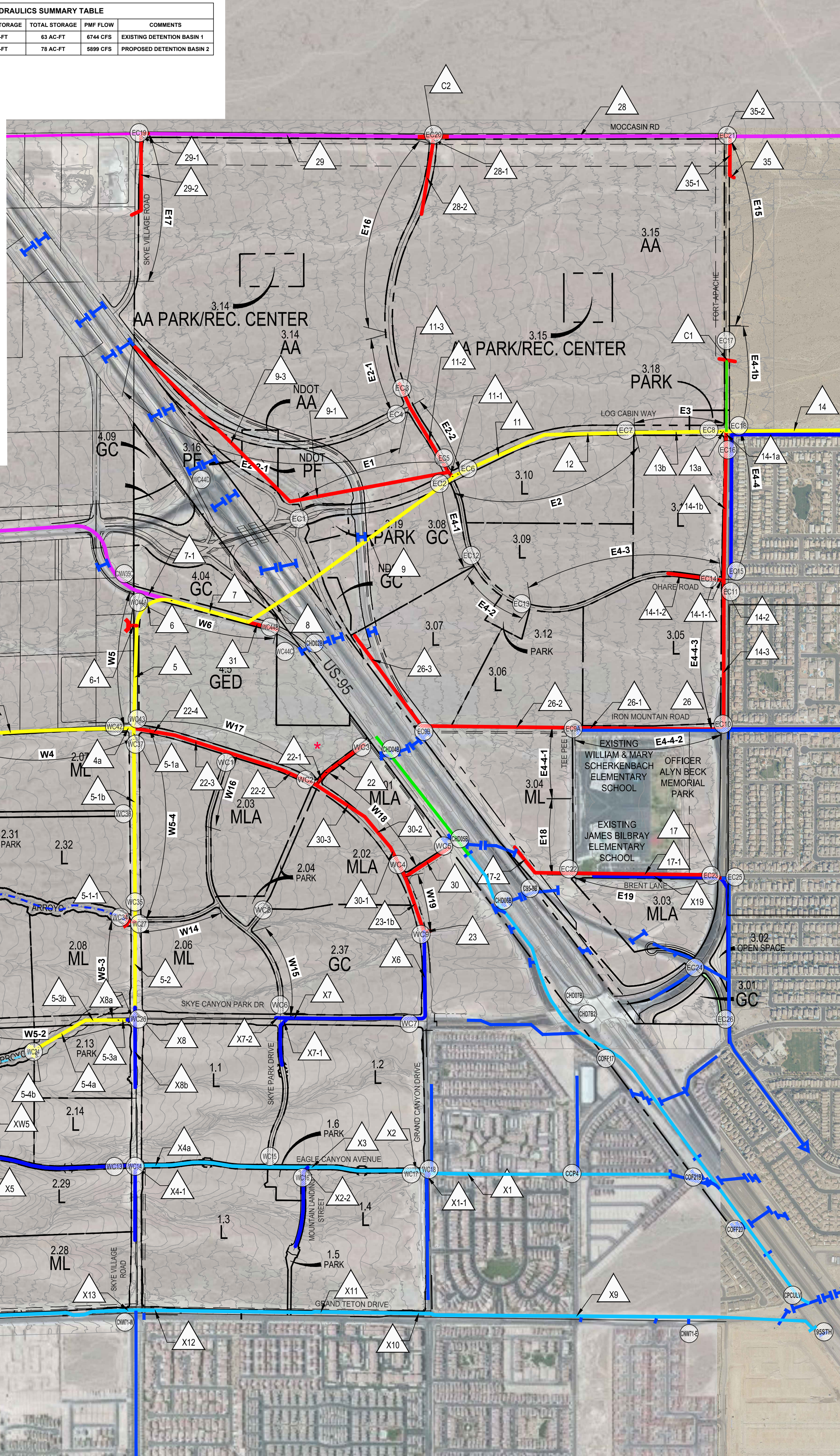
\\s\oly1603-000_skye_mds-2016\documents\conceptual_study\figures\oly1603-000_exhibit_k_ultimate_condition_offsite_drainage_facilities_map.dwg 9/13/2016 9:16 AM Jonathan Rocha

FACILITY HYDRAULICS SUMMARY TABLE						
NETWORK	STREET ID	FACILITY ID	FACILITY TYPE	DESIGN FLOWRATE	PROPOSED FLOWRATE	COMMENTS
EX. SD	EAGLE CANYON	X1	8' x 8' RCB	800 CFS	787 CFS	
EX. SD	GRAND CANYON	X1-1	48" RCP	100 CFS	84 CFS	
EX. SD	EAGLE CANYON	X2	8' x 8' RCB	729 CFS	695 CFS	
EX. SD	MOUNTAIN LANDING	X2-2	48" RCP	110 CFS	106 CFS	
EX. SD	EAGLE CANYON	X3	72" RCP	728 CFS	686 CFS	
EX. SD	SKYE VILLAGE	X4-1	42" RCP	117 CFS	140 CFS	
EX. SD	EAGLE CANYON	X4a	72" RCP	477 CFS	485 CFS	
EX. SD	EAGLE CANYON	X5	48" RCP	218 CFS	228 CFS	
EX. SD	EAGLE CREST	X5-2	42" RCP	95 CFS	80 CFS	
EX. SD	GRAND CANYON DRIVE	X6	6' x 6' RCB	197 CFS	187 CFS	
EX. SD	NORSE	X7	42" RCP	83 CFS	93 CFS	
EX. SD	SKYE PARK	X7-1	36" RCP	47 CFS	47 CFS	
EX. SD	NORSE	X7-2	24" RCP	6 CFS	5 CFS	
EX. SD	SKY VILLAGE RD	X8	8' x 6' RCB	367 CFS	412 CFS	
EX. SD	SKY VILLAGE RD	X8a	60" RCP	334 CFS	412 CFS	
EX. SD	SKYE VILLAGE	X8b	30" RCP	42 CFS	42 CFS	
EX. SD	GRAND TETON	X9	10' x 5' RCB	690 CFS	690 CFS	
EX. SD	GRAND TETON	X10	10' x 5' RCB	690 CFS	690 CFS	
EX. SD	GRAND TETON	X11	8' x 6' RCB	646 CFS	646 CFS	
EX. SD	GRAND TETON	X12	8' x 6' RCB	594 CFS	594 CFS	
EX. SD	GRAND TETON	X13	6' x 5' RCB	494 CFS	494 CFS	
EX. SD	GRAND TETON	X14	6' x 5' RCB	494 CFS	494 CFS	
EX. SD	GRAND TETON	X15	6' x 5' RCB	488 CFS	488 CFS	
EX. SD	GRAND TETON	X16	6' x 6' RCB	363 CFS	363 CFS	
EX. SD	SHAMBER	X17	36" RCP	56 CFS	56 CFS	
EX. SD	EAGLE CANYON	X18	48" RCP	128 CFS	99 CFS	
EX. SD	DB1 DISCHARGE	X29	60" RCP	71 CFS	71 CFS	
EX. SD	DB1 COLLECTOR	X28	CONC TRAP CHNL	471 CFS	471 CFS	TO BE CONSTRUCTED WITH DB1
ARROYO WASH	EX. ARROYO WASH	XW1	NATURAL WASH	120 CFS	120 CFS	
ARROYO WASH	EX. ARROYO WASH	XW2	NATURAL WASH	404 CFS	404 CFS	
ARROYO WASH	EX. ARROYO WASH	XW3	NATURAL WASH	94 CFS	94 CFS	
ARROYO WASH	EX. ARROYO WASH	XW4	NATURAL WASH	308 CFS	308 CFS	
ARROYO WASH	EX. ARROYO WASH	XW5	NATURAL WASH	385 CFS	385 CFS	

DETENTION BASIN HYDRAULICS SUMMARY TABLE						
FACILITY ID	INFLOW	OUTFLOW	100-YR STORAGE	DEBRIS STORAGE	TOTAL STORAGE	PMF FLOW
DB1	794 CFS	71 CFS	57 AC-FT	5 AC-FT	63 AC-FT	5744 CFS
DB2	708 CFS	87 CFS	72 AC-FT	8 AC-FT	78 AC-FT	5899 CFS

EXISTING DETENTION BASIN 1

PROPOSED DETENTION BASIN 2





DETENTION BASIN HYDRAULICS SUMMARY TABLE							
FACILITY ID	INFLOW	OUTFLOW	100-YR STORAGE	DEBRIS STORAGE	TOTAL STORAGE	PMF FLOW	COMMENTS
DB3	3269 CFS	134 CFS	467 AC-FT	8 AC-FT	475 AC-FT	6534 CFS	ULTIMATE LOG CABIN DETENTION BASIN 3
XDBN	769 CFS	85 CFS	N/A	N/A	117 AC-FT	N/A	TULE SPRINGS NORTH ENVIRONMENTAL DETENTION BASIN
XDBS	1482 CFS	35 CFS	N/A	N/A	117 AC-FT	N/A	TULE SPRINGS SOUTH ENVIRONMENTAL DETENTION BASIN

LEGEND

	PROPOSED LOCAL FACILITIES
	ONSITE CCRFCD REGIONAL FACILITIES
	FUTURE CCRFCD REGIONAL FACILITIES (BY OTHERS)
	FUTURE LOCAL FACILITIES
	EXISTING CCRFCD REGIONAL FACILITIES
	EXISTING LOCAL FACILITIES
	OPEN CHANNEL FACILITIES
	STREET SEGMENT ID