CANYON FUEL COMPANY, LLC.
SKYLINE MINE

WINTER QUARTERS ACCESS ROAD

JULY 2010

File in:
☐ Confidential
☒ Shelf
☐ Expandable
In C0070005, Incoming
Date: 07/27/10, For additional information
See: Confidential

C007/0005 Inc.
3597

Canyon Fuel Company, LLC.
Skyline Mine
A Subsidiary of Arch Western Bituminous Group, LLC

COPY

Gregg Galecki, Environ. Engineer
HCR 35, Box 380
Helper, UT 84526
(435) 448-2636 - Office
(435) 448-2632 - Fax

July 27, 2010

Mr. Daron R. Haddock
Division of Oil, Gas, and Mining
1594 West North Temple
Salt Lake City, Utah 84114-5801

RE: Winter Quarters Access Road, Canyon Fuel Company, LLC, Skyline Mine, C/007/005,

Dear Daron:

Attached to this letter is pertinent information for upgrading the existing road located in Winter Quarters Canyon necessary to access the Winter Quarters Ventilation Facility (WQVF) during the construction period. The road will be improved to be used as an ancillary road during construction of the Winter Quarters Ventilation Facility. The upgraded road will not be used to transport coal or spoil. After pad construction, the road will not be used for regular mining activities, and will continue to be used by the landowner for the pre- and post-mining land uses between construction and reclamation of the WQVF pad.

During lease negotiations with the Allred Family trust, Canyon Fuel Company representatives initially thought the Allred Family intended to improve and maintain the access road themselves as a condition of the lease. In the end, the Allred Family trust decided that Canyon Fuel Company - Skyline Mine would improve and maintain the access road as a condition of the lease/easement. Following the construction period, maintenance of the road will be returned to the Allred family. Had Mine representatives been aware of the Allred Family's intent on arranging an easement, Skyline Mine personnel would have included the improvements to the existing access road in the initial Winter Quarters Ventilation Facility submittal.

Attached to this cover letter are completed C1 and C2 forms, three (3) redline-strikeout copies of text of the M&RP modified information, numerous plates, an engineering report detailing the road upgrades, a cultural resource report identifying no adverse impacts with the road improvements, and one (1) Compact Disc (CD) containing the complete submittal package. The majority of the plate modifications address adding the Winter Quarters Access road to the permit area. Only plates 3.2.11-B-1 and 3.2.11-B-2 specifically address the upgrades to the existing road.

If you have any questions regarding this information, please give me a call at (435) 448-2636.

Sincerely:

Gregg A. Galecki

Gregg A. Galecki
Canyon Fuel Company, LLC.
Environmental Engineer – Skyline Mines

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Enclosures

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See Incoming For additional information

APPLICATION FOR COAL PERMIT PROCESSING

COPY

Permit Change ☒ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Canyon Fuel Company, LLC
Mine: Skyline Mine **Permit Number:** C/007/005
Title: Winter Quarters Ventilation Facility
Description, Include reason for application and timing required to implement:
Winter Quarters Access road

Instructions: If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

☒ Yes ☐ No 1. Change in the size of the Permit Area? Acres: 4.90 Disturbed Area: _____ ☐ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes ☒ No 6. Does the application require or include public notice publication?
☐ Yes ☒ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes ☒ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # _____
☐ Yes ☒ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: _____
☐ Yes ☒ No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☐ Yes ☒ No 13. Does the application require or include collection and reporting of any baseline information?
☐ Yes ☒ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes ☒ No 15. Does the application require or include soil removal, storage or placement?
☐ Yes ☒ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes ☒ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☒ Yes ☐ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☒ Yes ☐ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☐ Yes ☒ No 21. Have reclamation costs for bonding been provided?
☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

Please attach three (3) copies of the application. (This number includes a copy for the Price Field Office.)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

Wesley K Sorensen — Print Name
Wesley K Sorensen — Sign Name, Position, Date
General Manager 7/27/10

Subscribed and sworn to before me this _____ day of _____, 20_____

_____
Notary Public
My commission Expires: _____, 20____}
Attest: State of _____} } ss:
County of _____

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining
		RECEIVED JUL 27 2010 DIV. OF OIL, GAS & MINING

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

COPY

Permittee: Canyon Fuel Company, LLC
Mine: Skyline Mine **Permit Number:** C/007/005
Title: Winter Quarters Access Road

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Plates: 1.6-1, 1.6-2, 1.6-3, 2.2.1-1, 2.2.7-1, 2.2.7-2, 2.2.7-3, 2.2.7-4, 2.2.7-7, 2.3.4-2, 2.3.5.1-1, 2.3.5.2-1, 2.3.6-1, 2.3.6-2, 2.7.1-1a, 2.7.1-1b, 2.8.1-1, 2.12.1-1, 3.1.8-2, 3.3-2, 4.17.3-1A, 4.17.5-1
☐ Add	☒ Replace	☐ Remove	Section 1: page 1-37, 1-38,
☐ Add	☒ Replace	☐ Remove	Section 2.1; page 2-4c1, 2-4d
☐ Add	☒ Replace	☐ Remove	Section 2.7; page 2-63
☐ Add	☒ Replace	☐ Remove	Section 2.11; page 2-120(c)
☐ Add	☒ Replace	☐ Remove	Section 3.2; page 3-63(i)
☐ Add	☒ Replace	☐ Remove	Section 3.4; page 3-83,
☐ Add	☒ Replace	☐ Remove	Section 4.1; page 4-3(a),
☐ Add	☒ Replace	☐ Remove	Section 4.14; page 4-84,
☐ Add	☒ Replace	☐ Remove	Section 4.20; page 4-114(a)
☒ Add	☐ Replace	☐ Remove	Plates 3.2.11-B-1, 3.2.11-B-2
☒ Add	☐ Replace	☐ Remove	CONFIDENTIAL FILE - Winter Quarters Road Improvement Cultural Report - Canyon Environmental
☐ Add	☐ Replace	☐ Remove	
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.

Three (3) redline-strikeout copies of the submittal and one (1) CD to the Salt Lake Office.

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Vertical Extent of Mine Workings Workings (Life of Mine)	Surface to 1,500' max	Surface to 2,300' max	Surface to 1,500' max

The anticipated number of total surface land acres to be affected (life of mines) is less than the combined total of the affected acreages for each of the three mines due to the overlapping of mining operations which is inherent to this multi-seam mining operation. The total surface acreage to be disturbed by surface facilities associated with underground mining is 79.12 acres.

The following information was based on projection for the next five years (1997-2002).

	Mine No. 1	Mine No. 2	Mine No. 3
Extent of Horizontal Workings	240 acres	375 acres	1,870 acres
Extent of Vertical Workings	Surface to 1,250'	Surface to 2,250'	Surface to 2,125'

Permit Area

The construction/installation of surface facilities at the mine site, loading area, conveyor belt route, well houses, water tank pad, waste rock disposal site, and South Fork Breakout, and Winter Quarters Ventilation Facility comprise the Permit Area. The permit area acreage listed adequately accommodate areas of disturbance.

PERMIT AREAS

AREA	ACREAGE
Loadout	13.86
Portal Yard	42.55
Water tanks and Well pads	0.26
Conveyor Bench	14.18
Waste Rock Disposal Site and Road	32.48
South Fork Breakout	0.96
James Canyon Buried Power Line	0.30
James Canyon Buried Pipeline	1.60
James Canyon Water Wells and Road	2.95
Winter Quarters Ventilation Facility	7.93
Winter Quarters Road (not reclaimed)	4.90
TOTAL	121.97

Legal Description of Permit Area

Township 12 South, Range 7 East, SLBM

Section 32: Portion

Township 13 South, Range 6 East, SLBM

Section 1: Portion
Section 13: Portion
Section 23: Portion
Section 24: Portion
Section 25: Portion
Section 35: Portion
Section 36: Portion

Township 13 South, Range 7 East, SLBM

Section 4: Portion
Section 5: Portion
Section 6: Portion
Section 17: Portion
Section 18: Portion
Section 19: Portion

Township 14 South, Range 6 East, SLBM

Section 2: Portion
Section 3: Portion

In 2010 permitting for construction of a ventilation facility in Winter Quarters Canyon was initiated. An area approximately 7.93 acres in size was permitted to construct a pad. The site is located approximately ½-mile west of the main historic Winter Quarters town site. Skyline Mine has submitted a cultural resource survey identifying the WQVF pad site as being on the westernmost edge of the Winter Quarters mining district. In addition, Skyline submitted a second amended report that was necessary to identify changes to WQVF pad, which in turn modified the features to be impacted with the construction of the site. The pad site will potentially impact eleven (11) features which comprise of earthen and or stone foundation alignments. No standing structures exist in the area. Earlier cultural resource surveys indicate "little new evidence is expected to be found in Winter Quarters Canyon" (Cook 1981). No remnant standing structures are within 1/2-mile of the pad site. The Winter Quarters mining district is apparently eligible or qualifies for the National Historic Register, however landowners controlling the site have adamantly opposed being listed on the Registry when approached by SHPO on previous occasions.

The existing road through the Winter Quarters canyon will be improved with the addition of road base, gravel, to improve drainage from the road. The footprint of the road will not change, and historic features will be avoided.

Evaluation of the cultural resources survey and discussions with both DOGM and SHPO personnel concluded the best mitigative measure to address the impact to the westernmost edge of the Winter Quarters town site was to design and construct an interpretive sign to be placed at the mouth of the canyon that summarizes for the public aspects of the cultural history of the area. The reports detailing the initial investigation, and the second amended report are located in the CONFIDENTIAL FILE.

2.1.2 Threatened and Endangered Species

No currently approved threatened or endangered species, plant or animal, have been identified on the project or adjacent areas with the exception of an occasional transient Bald Eagle, which may pass through the project area during the winter. The mining operation has no impact on these transitory birds. However, a northern goshawk, a candidate for T&E listing, has been identified as a resident adjacent to the permit area. A plan for monitoring and protection of raptors may be found in Sec. 4.18.

Should any threatened or endangered species be identified in the future, their discovery will be promptly reported to the Division.

The Scofield Waste Rock site was expanded into approximately 5 acres of previously undisturbed ground in 2007. Surveys were conducted to identify T&E species of both plants and animals. The surveys did not find any such species. Species listed in Carbon County are found in different elevations and habitats. Results of the surveys are located in Appendix A-2, Volume 2. Additional discussions on vegetation and wildlife are discussed in Sections 2.7 and 2.9, respectively.

Winter Quarters Ventilation Facility

Permitting of the Winter Quarters Ventilation Facility consists of permitting approximately 7.93 acres located along the base of the south-facing slope. Improvements to the existing road encompass approximately 4.9 acres of previously disturbed ground; additional disturbance was added. Particular attention was taken to stay outside the stream buffer zone of Winter Quarters Creek keeping construction activities a minimum of two (2) bankfull widths from the stream. Surveys were conducted to identify T&E species of both plants and animals. The surveys did not find any such species.

of riparian habitat, the Permittee commits to using the best technology currently available (BTCA)to mitigate the damage. The repair efforts will be coordinated and agreed upon by Mine, DOGM, and USFS personnel. Repairs related to disruption of a water supply are addressed in Section 2.5.3.

2.7.7 VEGETATION OF THE SCOFIELD WASTE ROCK SITE

The Scofield Waste Rock site was expanded in 2007 into areas (approximately 5.13 acres) that were previously undisturbed by mining activities. In the 1990s the northern and eastern portions of the area were disturbed with logging activities. Soils and Vegetation information that was collected in 1981-82 was updated in 2007 with information specific to the Refuse pile expansion. The 2007 information is grouped into two (2) separate reports, the first report summarizing the preliminary qualitative vegetation data with the second compiling the remaining qualitative and quantitative data. Quantitative data was not collected during the preliminary report due to the season of data collection (late Fall 2006). The 2007 reports focused on baseline information for reclamation and identification of threatened and endangered species. No threatened or endangered species were identified. The 1981-82 information is located in Appendix Volume A-2, with the 2007 reports being located in Appendix Volume A-2, Volume 2, respectively.

Vegetation resources are protected and enhanced at the Waste Rock site through contemporaneous reclamation of the site as it is being filled. The 2007 vegetation study established a reference area for a reclamation standard and also insured no sensitive, threatened or endangered species exist at the site. For additional information on revegetation of the site, see Sections 3.2.8 - Plan for Disposal of Waste Rock, and 4.7 - Revegetation Plan of the M&RP.

2.7.8 WINTER QUARTERS VENTILATION FACILITY

The Winter Quarters Ventilation Facility (WQVF) was necessary to provide ventilation for underground mining located north of Winter Quarters Canyon. Both Soils and Vegetation information specific to the WQVF site were collected in 2008 with a second revised report drafted in 2009. Plate 2.7.1-1a was qualitatively updated in 2007. In 2008, a site-specific report focused on acquiring baseline vegetation information for reclamation and identification of threatened and endangered species for the WQVF. The revised report drafted in 2009 was necessary due to changes in the pad design that eliminated impacts to the riparian areas. The modified pad design minimizes affects to the riparian areas by keeping the disturbed area a minimum of two stream widths from the stream bank (approximately 24 feet). In general, the WQVF pad site encompasses a sagebrush and mountain brush south-facing hillside, and minimal riparian areas that have had significant detrimental affects due to heavy livestock use and noxious week infestation. Conversations with vegetation consultant Dr. Patrick Collins suggest successful revegetation of the riparian areas is very likely due to the combination of vegetation species and available water. No threatened or endangered species were identified. The vegetation report is located in Appendix A-2, Volume 2. The vegetation report focused on the riparian areas is available on request. The existing Winter Quarters Canyon road was improved with additional road base, gravel, and drainage, but no vegetation was affected because the improvements remained within the footprint of the existing road.

SOILS OF THE NORTH LEASE TRACT AREA

No surface disturbance for the North Lease area was originally proposed. In 2009 the M&RP was modified to include the Winter Quarters Ventilation Facility (WQVF). Prior to the WQVF construction, a review of the soils in the area from the existing Soil Survey of Carbon County, Utah and USDA Forest Service were conducted. The soil map units in the survey are presented on Drawing No. 2.7.7-1b.

Winter Quarters Ventilation Facility Area(WQVF)
A detailed description of the soils in the WQVF area is available in Appendix A-2, Volume 2, titled,"Soils survey for the proposed Winter Quarters vent location near Scofield, Utah". The report uses United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) WEB Soil Survey (WSS) utility and associated NRCS soils reports. The vent facility will disturb approximately 1.7 acres of topsoil. Based on the soil survey 1-2 feet of suitable soil and subsoil will be separated, stored, marked with appropriate signage for protection. This material will be used during reclamation of the site. Due to the limited amount of A horizon material identified in the survey, depth of the salvaged material will be based on depth of significant rock. Attached to the soils report are the analysis of the soils collected during the survey. See Section 4.6.4.1 for additional information concerning the Topsoil/Subsoil Handling Plan.

The existing Winter Quarters Canyon road was improved with additional road base, gravel, and drainage, but no topsoil was removed because the improvements remained within the footprint of the existing road.

U. P. & L. Tract

The soils for this area are classified into six groups as determined by Daniel M. Larsen, U. S. Forest Service. The following are the soil types: 1)Pando - Adel Families Complex, 2)Bundo - Lucky Star - Scout Families Complex, 3)Adel - Merino Family Complex, 4)Gateway - Adel families Complex, 5)Lucky Star - Adel Families Complex, and 6)Lucky Star - Bundo - Adel Families Complex.

Pando - Consists of deep, well drained, moderately permeable soils on mountain slopes. The soils are formed from colluvium from sandstone and shale. Slopes are 30 to 60 percent. Soils are classified as loamy-skeletal, mixed Boralfic Cryoborolls. A1 is zero to four inches of dark grayish brown loam; very dark brown moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; 10 percent gravel; slightly acid; clear smooth boundary. A2 is four to 11 inches of grayish brown cobbly loam, very dark grayish brown moist; weak medium subangler blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; 10 percent grave and 10 percent cobbles; moderately acid; gradual wavy boundary. E is 11 to 23 inches pale brown very cobbly silt loam, brown moist; weak medium subangler blocky structure; soft, friable, slightly sticky and nonplastic; few very fine and fine roots; 20 percent gravel and 30 percent cobbles; moderately acid; gradual wavy boundary. Bt is 23 to 45 inches of very pale brown extremely cobbly clay loam, yellowish brown moist; moderate medium subangler blocky structure; and, firm sticky and

3.2.11(b) Winter Quarters Ventilation Facility

The Winter Quarters Ventilation Facility (WQVF) was required to improve ventilation for underground mining north of Winter Quarters Canyon. The WQVF is located on a south facing slope in Winter Quarters Canyon approximately two (2) miles west of Scofield, Utah, and approximately 1/2-mile east of the United States Forest Service (USFS) boundary.

Access to the WQVF pad site is via an existing road up Winter Quarters Canyon which is maintained by Skyline Mine as part of an easement agreement outlined in the WQVF lease with the landowner. A road extending approximately 500 feet from the existing road will be constructed to access the pad site. Canyon Fuel Company, LLC. leases approximately 12.7 acres that encompasses the WQVF site, with an additional approximately 4.9 acres of existing road that is maintained in the easement agreement . lease with the landowner, Canyon

Power is being provided to the WQVF site by Rocky Mountain Power. Similar to the power arrangement at the Eccles Canyon Mine site, Rocky Mountain Power policy dictated the separation of responsibility would be at the connection to the electrical sub-station. The power line corridor, line construction, and maintenance of the power line up to the sub-station remain the responsibility of Rocky Mountain Power.
As construction is initiated, topsoil and brush will be collectively salvaged, separated and stored for reclamation purposes. Any large trees will be segregated as well for placement on the topsoil pile or other interim habitat enhancement.

Initial construction will include upgrades to the existing Winter Quarters Canyon road (See plates 3.2.11-B-1 and 3.2.11-B-2 for details), then construction of an access road from the existing road to access the WQVF pad site to create a pad for an electrical substation to provide power for further site construction. Initial drainage control will be established through concentrating runoff to ditches along the access road as it is being developed. Sediment control along the road will be treated through a combination of armoring of the ditch with rock, gravel filtering, and energy dissipaters. Areas of drainage not reporting to a specific temporary ditch and representing sheet flow from the site will be treated with silt fencing. Silt fencing will line the toe of the construction site serving as a barrier between the construction site and the creek.

Once power is established at the site, further pad construction will continue with extending the substation bench west to the location of the Declined Slope Portal for those activities to begin. Material generated from boring of the slope will be used to create the remainder of the WQVF pad. Construction of the Declined Slope is scheduled to begin in Spring 2011 with the Vertical Shaft construction to begin in Spring 2012. Once pad construction is complete, the WQVF pad and

3.4 AREA AFFECTED BY EACH PHASE OF OPERATIONS

The area affected by the Skyline Mines project can be divided into two major categories:

(a) Surface acreage disturbed by construction/installation of coal handling and associated facilities or permitted areas, and

(b) Surface acreage overlying underground mine workings or adjacent areas.

PermittedAcreage

The offices, bathhouse, workshop, portal, fans, and other necessary facilities utilize a site of 42.55 acres. Approximately 0.26 acres is used for water tank and well pads. The coal loading and handling facility at the mouth of Eccles Canyon utilizes approximately 13.86 acres. The covered pipe belt conveyor, transporting material from the mine portals to loading points, disturbs approximately 14.18 acres. The waste rock disposal site is permitted to include approximately 32.48 acres. The South Fork breakout area has disturbed 0.96 acres. The James Canyon buried power line, buried pipeline, water wells pad and road include 4.85 acres. The Winter Quarters Ventilation Facility utilizes 7.93 acres with an additional 4.9 acres permitted to include the existing Winter Quarters Canyon road. In total, the permitted area is 118.89 acres. The permitted area and bonded area for the Mine Portal area, Loadout area, Waste Rock Disposal area, Winter Quarters Ventilation Facility area, and miscellaneous areas are shown on maps 3.2.1-1, 3.2.1-3, 3.2.8-1, 3.2.4-3a , and3.2.3-3 through 3.2.3-3f, respectively.

The pre-mining phase of earth work and dirt removal commenced in the spring of 1980 and was completed in 1981. The actual construction and installation of facilities necessary for coal mining and handling began in early 1981.

4.1.1 Reclamation Plan - Rock Disposal Site

Reclamation activities will be conducted on portions of the affected areas as twenty foot lifts are filled to design capacity. The final contours of the rock disposal site are presented in Drawing 4.16.1-1B. Part of diversion ditch DD-16 will be removed during final reclamation as needed. Diversion ditch UD-6 will remain after final reclamation. Part of the disturbed are affected by the disposal operation will, at the request of the property owner's representative, be leveled off and reclaimed to native rangeland for subsequent use as a corral. The access road to the site will not be reclaimed except for the removal of the guard rail (Exhibit 4.1.1-1).

4.1.2 Reclamation Plan - Winter Quarters Ventilation Facility

Reclamation activities will include removing any existing structures such as the fan structure, retaining walls, a mobile field office for emergency evacuation, substation with associated pad, fencing, etc. Compliant to both State Regulations R645-301-551 and MSHA 30 CFR 1711, both the vent shaft and emergency escape shaft will be sealed and backfilled with an engineered fill. The shafts will be backfilled above the pad surface with the excess fill allowed to settle for approximately one year prior to removing the pad (See Section 4.9 for details). Consistent with the same regulations, the slope will be sealed with solid, substantial, incombustible material such as concrete blocks, bricks or tile, or shall be completely filled with incombustible material for a distance of at least 25-feet into the opening. Once all structures are removed and openings sealed, the slopes will be reclaimed to the approximate original contours (AOC) using extreme surface roughening (pocking) as the primary form of sediment control. The site will be reseeded as outlined in Section 4.7 of the M&RP, and the sediment pond removed. In the event the extreme surface roughening shows signs of failure, additional work will be conducted to insure sediment is controlled on site. Improvements that were made to the preexisting Winter Quarters Canyon road while the WQVF was operational will remain intact for the landowner as outlined in the easement of the lease.

4.14 PROTECTION OF PUBLIC PARKS AND HISTORIC PLACES

No public parks or registered historic places are located in areas affected by the Skyline mining operation. The Permittee agrees, however, to notify the regulatory authority and the Utah State Historic Preservation Office (SHPO) of previously unidentified cultural resources discovered in the course of mining operations. The Permittee also agrees to have any such cultural resources evaluated in terms of National Register of Historic Places eligibility criteria. Protection of eligible cultural resources will be in accordance with regulatory authority and Utah SHPO requirements.

The Winter Quarters Ventilation Facility (WQVF) is located on the westernmost edge of the Winter Quarters town site. A historical survey was conducted by Earth Touch, Inc. and is located in the Confidential File. A second report submitted by Canyon Environmental serves as an addendum to the first report due to changes in the pad design which ultimately had the potential to affect other features. The cultural resources in the Winter Quarters town site has been evaluated numerous times in terms of the National Register of Historic Places eligibility criteria and been determined to qualify. However, the affected landowners have expressed to SHPO (on numerous occasions), that they adamantly do not want the site to be listed. The vast majority of features with historical significance associated with the Winter Quarters town site are located at least ½- mile east of the ventilation facility and do not compromise the integrity of the site. A total of ten (10) dilapidated earthen and/or stone foundations may possibly be impacted by the ventilation facility. Sites located along the existing road up Winter Quarters Canyon were avoided when conducting road improvements. A meeting conducted with Skyline Mine, SHPO, DOGM, and Public Lands Policy Coordination Office personnel determined the most suitable protection of the Winter Quarters Canyon site was to create a booklet on the Winter Quarters area that provides the public with an awareness of the cultural activities that were historically in the area. An Memorandum of Understanding (MOU) was drafted that outlines the direction of the booklet that is scheduled to be completed in 2011.

Winter Quarters Access Road Hydrology Report

Canyon Fuel Company, LLC
Skyline Mine
Scofield, Utah

July 2010

EarthFax Engineering, Inc.

Engineers / Scientists
www.earthfax.com

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WINTER QUARTERS ACCESS ROAD HYDROLOGY REPORT, SKYLINE MINE

CHAPTER 1

INTRODUCTION

Canyon Fuel Company is planning the construction of a vertical ventilation shaft, a sloped mine portal, and an emergency escape shaft in Winter Quarters Canyon to service the Skyline Mine. The surface pad for these additional shafts will be constructed about 2 miles southwest of the town of Scofield in Carbon County, Utah. To allow for access to the site Winter Quarters Canyon Road (an existing road) will be improved. These improvements will include the addition of a stable road base, diversion ditches, culverts, and riprap pads at culvert outfalls. The road will be classified as an ancillary road. This report details the design of the diversion ditches, culverts, and riprap pads.

A series of storm water runoff undisturbed area diversion ditches are being designed to direct runoff from the undisturbed areas above the road to culverts and then under the road. The diversion ditches, culverts, and riprap pads have been designed to conform to the applicable criteria outlined in the Utah Administrative Code Titles R645-300 and 301. This document has been prepared for Canyon Fuel Company by EarthFax Engineering, Inc., and contains the following information:

- Location and background information;
- Hydrologic analyses to determine runoff discharge for design storm events;
- Diversion ditch, culvert, and riprap pad sizing and design criteria;

Engineering calculations are included as attachments to this document.

CHAPTER 2
LOCATION AND BACKGROUND INFORMATION

The general layout of the proposed road drainage improvements is shown on Winter Quarters Access Road Plan and Details Plate. The road is currently maintained by both Scofield Town and the Allred Family Trust. Scofield Town owns and maintains the section of road east of the gate on section line 5 and 6. The Allred Family Trust owns and maintains the road west of the gate and section line. Skyline Mine will improve the road west of the gate on the section line to the pad site. During the construction and reclamation phases of the Winter Quarters Ventilation Pad and Facilities Skyline Mine will maintain the road west of the gate on the section line. Scofield Town will upgrade and maintain the section of road east of the gate on the section line. Between construction and reclamation the Allred Family Trust will again be responsible for the road. The watershed area to be diverted above the road by the diversion ditches is approximately 396.68 acres, which includes the road and the undisturbed areas above the road. Construction is planned for 2010.

The diversion ditches have been designed to safely convey storm water runoff discharge as specified in the Utah Administrative Code Titles R645-301-742 and 743. To assure long term stability the diversion ditches have been designed above the required 2-year, 6-hour storm event. Thus, the ditches have been designed to comply with the following criteria:

- The diversion ditches will safely convey runoff from a 25-year, 6-hour storm event.
- The diversion ditches will be constructed from native or imported materials. The diversion ditches will not be constructed from coal mine waste rock.
- Diversion ditches will be riprap lined to prevent channel degradation as necessary.

The culverts have been designed to safely convey storm water runoff discharge as specified in the Utah Administrative Code Titles R645-301-527, 534, 742 and 743. Riprap pads have been added at the outfall of all culverts to reduce velocity and prevent erosion. As with the

diversion ditches the culverts have been designed to withstand a larger storm event than required. Thus, the culverts have been designed to comply with the following criteria:

- The culverts and riprap pads will safely convey runoff from a 25-year, 6-hour storm event.
- The culverts will be installed to withstand traffic loads.
- Culverts will be designed to allow for maintenance and cleaning.

CHAPTER 3
OPERATIONAL HYDROLOGY

3.1 Hydrology Introduction

Storm water discharge for the area was calculated using HydroCAD version 9.1. The curve number (CN) value used for the area above the road was based on sub-basin soil types and vegetation cover type. According to Natural Resources Conservation Service native soil types are categorized as Hydrologic Soil Group B except for UW-9 and DW-9 which is a type D soil. The vegetation varies from sagebrush range in good condition with some trees to sagebrush range and grassland in poor condition. The area was modeled as sagebrush range in poor to fair condition to allow for a more conservative design. UW-9 was modeled as sagebrush range in fair condition. The road was modeled as a gravel road.

Design storm magnitudes were taken from the National Oceanic and Atmospheric Administration (NOAA) ATLAS 14, Point Precipitation Frequency Estimates web page (http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut_pfds.html). Upstream and site watershed areas and average slopes were calculated from 10-foot contour interval topographic map provided by Psomas Engineering (Psomas 10/15/08) using AutoCad 2008 software and . All storm runoff calculations are included in Attachment A.

3.2 Drainage Area Characteristics

The drainage areas contributing to the diversion ditches and culverts are delineated in Figure 1. DW-1 thru DW-9 consist of gravel roads. Slopes within the road vary between 2 to 14 percent. UW-1 thru UW-9 consist of undisturbed areas. Slopes within the undisturbed area vary between 25 to 50 percent. As stated in section 3.1 undisturbed areas in UW-1 through UW-8 consist of type B soils with a mixture of poor to good sagebrush and grass land cover with some

trees. UW-9 consists of type D soils with sagebrush range in fair condition. UW-4, UW-5, DW-4, and DW-5 all drain into ditch 4. See Attachment A for full list of watersheds and their characteristics.

3.3 Ditch and Culvert Capacities

The peak flow for the runoff conveyance systems were calculated using HydroCAD version 9.1. Maximum flow rates and flow depths were calculated using FlowMaster version 6.0. For a summarized of velocities and depths of flows see Table 1 and for full calculations see attachment A. Location of the culverts and details for the diversion ditches, culverts, and riprap pads can be found on the Road Plan and Details Plate. The access road drainage system was designed assuming the existing road would be upgraded, but will remain an ancillary road. To assure long term stability of the road the drainage system has been designed above the required 2-year, 6-hour event. Therefore, it was modeled using the 25-year, 6-hour storm event.

Velocities for D1-D8 will not be greater than 5 fps. The greatest depths within the D1-D7 will be 0.57 ft. This leaves more than 40% freeboard within the ditch. The greatest depth in D8 will be 0.96, leaving more then 35% freeboard.

To prevent material from blocking the culverts and to allow for ease of maintenance the culverts will be a minimum of 18 inches in diameter. Culverts will be installed to match existing grade and prevent disturbing the undisturbed area surrounding the existing road as much as possible. Therefore, the slopes within the culvert will vary between 2 to 10 percent. Velocities within all culverts were calculated using a 10 percent slope. Maximum depths within culverts were calculated using a 2 percent slope. A 5-foot wide and 10-foot long D_{50} = 6-inch riprap pad will be placed at the outfall of all culverts to prevent erosion.

CHAPTER 4
RECLAMATION HYDROLOGY

After the Winter Quarters Canyon Ventilation Pad and Facilities are closed and reclaimed the access road will remain. To prevent degradation and to protect Winter Quarters Canyon in the long term the road will remain upgraded. Maintenance of the road will be turned over to the Allred Family Trust and Scofield Town.

CHAPTER 5

REFERENCES

Heastad Methods, Inc. 1998. FlowMaster I Computer Program, Version 6.0 Waterbury, Connecticut.

HydroCAD Software Solutions LLC. 2009. HydroCAD Version 9.1 Chocorua, New Hampshire.

National Oceanic and Atmospheric Administration, 2009. *Point Precipitation Frequency Estimates from NOAA ATLAS 14.* http://hdsc.nws.noaa.gov/hdsc /index.html

Natural Resources Conservation Service, Web Soil Survey, Carbon Area, Utah, Carbon County Ver. 4, 2008, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Psomas Engineering Topographic Survey, 10/15/08, for Skyline Mine.

U.S. Department of Transportation. 1978. Use of Riprap for Bank Protection. Hydrology Engineering Circular No. 11. Federal Highway Administration. Washington, D.C.

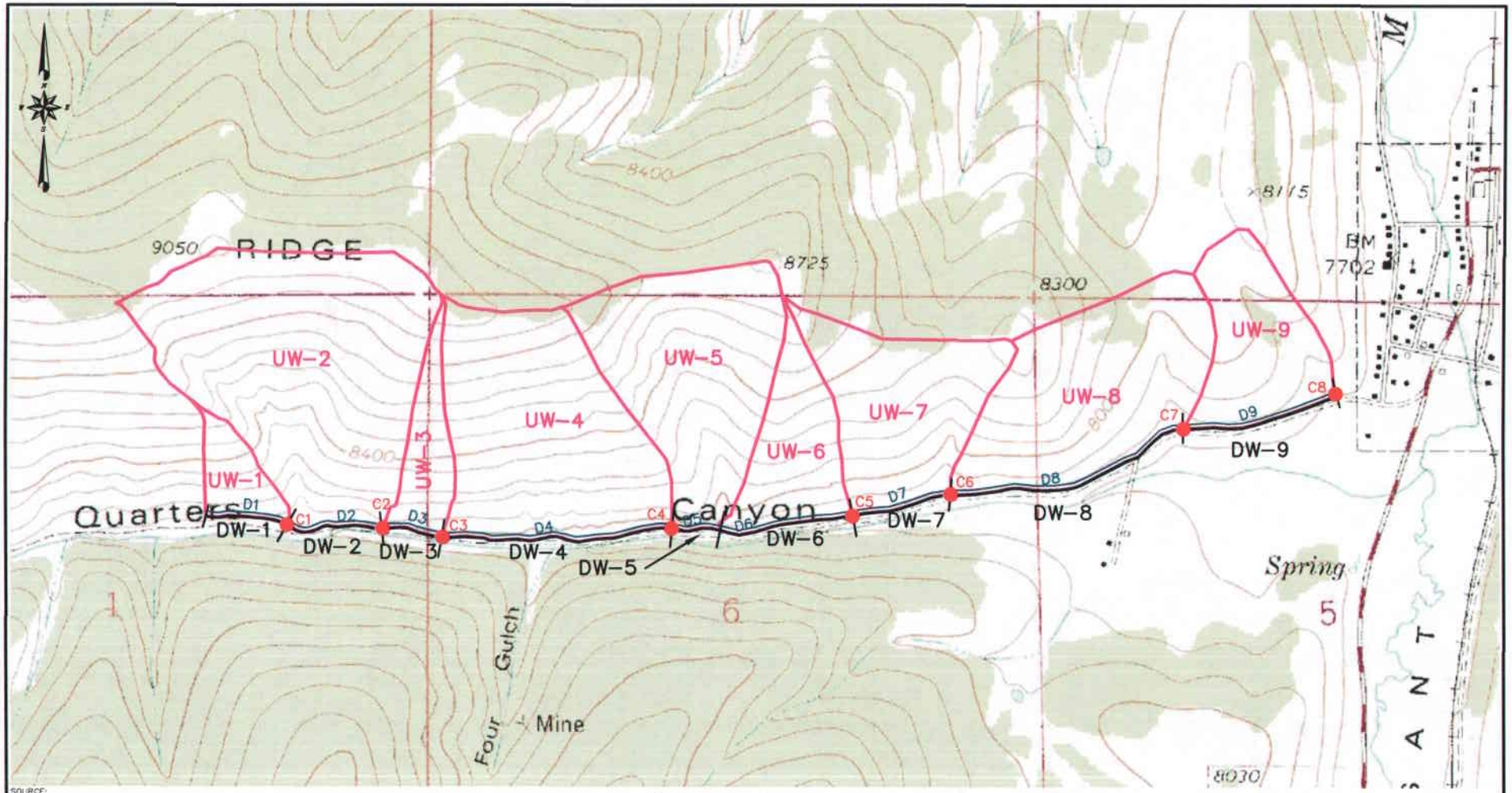
U.S. Geographic Service. 2008. Scanned Topographic Maps (1:24,000). Q2125, Scofield.

TABLE 1

Runoff Conveyance Summary

Runoff Conveyance Summary		
Runoff Conveyance	Velocity (fps)[a]	Depth (ft)[a]
D1	2.89	0.27
D2	4.02	0.40
D3	3.07	0.26
D4	4.42	0.46
D5	3.79	0.36
D6	2.73	0.35
D7	3.27	0.57
D8	4.34	0.96
C1	3.70	0.19
C2	4.88	0.29
C3	3.52	0.17
C4	5.96	0.41
C5	4.40	0.25
C6	4.34	0.24
C7	5.39	0.35
C8	8.10	0.73
C1 Riprap[b]	1.45	N/A
C2 Riprap[b]	2.57	N/A
C3 Riprap[b]	1.68	N/A
C4 Riprap[b]	2.17	N/A
C5 Riprap[b]	1.47	N/A
C6 Riprap[b]	1.79	N/A
C7 Riprap[b]	2.37	N/A
C8 Riprap[b]	3.22	N/A

[a] From FlowMaster version 6.0 Worksheets, see Attachment A.
[b] All riprap has a D_{50} = 6 inches.



SOURCE:
USGS 7.5' QUADRANGLE, Q2125 SCOFIELD
PDOMAS ENGINEERING TOPOGRAPHIC SURVEY
10/15/08 FOR SKYLINE MINE

0' 800'

FIGURE 1. SITE WATERSHEDS

EarthFax

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Utah 39.7235 N 111.1805 W 8251 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Tue Jun 8 2010

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.14	0.21	0.26	0.34	0.42	0.52	0.58	0.76	0.96	1.17	1.38	1.72	2.03	2.32	3.07	3.77	4.69	5.48
2	0.17	0.26	0.33	0.44	0.55	0.66	0.73	0.94	1.18	1.44	1.71	2.13	2.51	2.88	3.82	4.68	5.83	6.81
5	0.24	0.36	0.45	0.61	0.76	0.88	0.94	1.16	1.44	1.75	2.07	2.59	3.06	3.50	4.68	5.68	7.08	8.28
10	0.30	0.45	0.56	0.76	0.94	1.07	1.13	1.35	1.66	2.00	2.37	2.96	3.50	3.99	5.35	6.45	8.03	9.39
25	0.39	0.59	0.73	0.98	1.22	1.38	1.44	1.62	1.95	2.33	2.76	3.46	4.09	4.64	6.24	7.45	9.26	10.82
50	0.47	0.71	0.88	1.19	1.47	1.65	1.70	1.87	2.19	2.58	3.05	3.84	4.54	5.13	6.91	8.19	10.16	11.87
100	0.56	0.85	1.05	1.42	1.76	1.97	2.01	2.17	2.45	2.84	3.35	4.23	4.99	5.62	7.59	8.91	11.06	12.89
200	0.67	1.01	1.25	1.69	2.09	2.34	2.37	2.51	2.77	3.09	3.66	4.62	5.45	6.10	8.25	9.62	11.92	13.88
500	0.83	1.27	1.57	2.12	2.62	2.92	2.95	3.08	3.31	3.42	4.06	5.14	6.05	6.73	9.12	10.52	13.01	15.13
1000	0.98	1.49	1.85	2.49	3.09	3.45	3.48	3.60	3.82	3.86	4.36	5.54	6.50	7.20	9.78	11.19	13.80	16.02

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.16	0.25	0.31	0.41	0.51	0.62	0.69	0.86	1.07	1.32	1.56	1.98	2.36	2.69	3.65	4.44	5.56	6.40
2	0.21	0.32	0.39	0.53	0.66	0.79	0.86	1.07	1.32	1.63	1.94	2.46	2.91	3.33	4.53	5.51	6.91	7.97
5	0.29	0.44	0.54	0.73	0.91	1.05	1.11	1.32	1.61	1.98	2.35	2.99	3.55	4.06	5.57	6.72	8.42	9.69
10	0.36	0.55	0.68	0.91	1.13	1.28	1.34	1.54	1.85	2.26	2.68	3.41	4.06	4.63	6.40	7.62	9.55	10.99
25	0.47	0.71	0.88	1.19	1.47	1.66	1.70	1.86	2.19	2.64	3.12	3.98	4.75	5.40	7.48	8.81	11.04	12.69
50	0.56	0.86	1.07	1.44	1.78	1.99	2.02	2.16	2.48	2.93	3.46	4.43	5.28	5.97	8.31	9.69	12.14	13.97
100	0.68	1.03	1.28	1.72	2.13	2.39	2.40	2.54	2.78	3.22	3.81	4.88	5.82	6.57	9.12	10.56	13.23	15.20
200	0.81	1.24	1.53	2.07	2.56	2.85	2.86	2.95	3.18	3.52	4.18	5.33	6.37	7.15	9.96	11.45	14.31	16.40
500	1.03	1.57	1.95	2.63	3.25	3.62	3.63	3.68	3.86	3.92	4.66	5.97	7.14	7.94	11.09	12.58	15.70	17.98
1000	1.24	1.89	2.34	3.15	3.90	4.36	4.40	4.45	4.51	4.56	5.03	6.47	7.72	8.53	11.95	13.44	16.77	19.16

* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

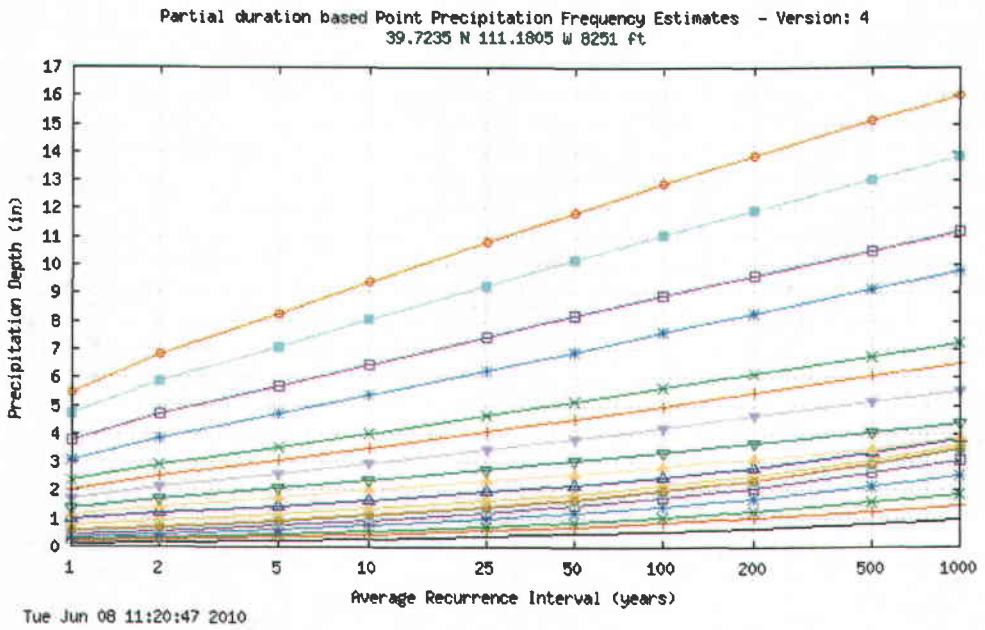
* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

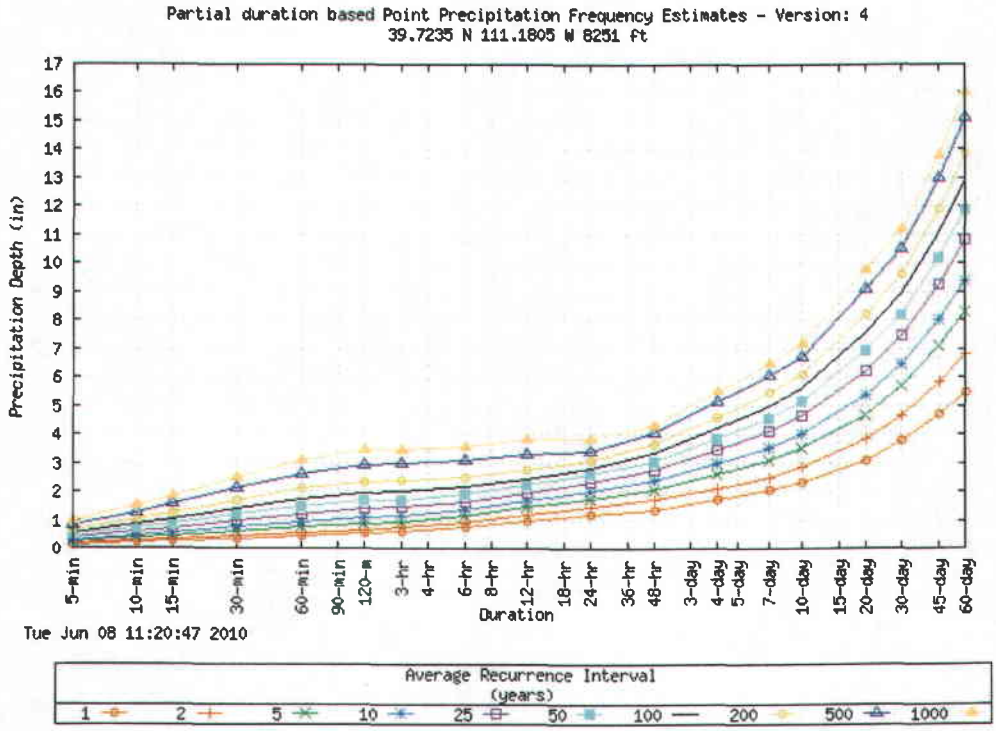
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.12	0.18	0.22	0.29	0.36	0.45	0.51	0.67	0.87	1.04	1.22	1.51	1.79	2.02	2.66	3.26	4.06	4.76
2	0.15	0.23	0.28	0.38	0.47	0.57	0.64	0.83	1.07	1.29	1.51	1.87	2.21	2.51	3.31	4.04	5.03	5.91
5	0.20	0.31	0.38	0.52	0.64	0.75	0.82	1.02	1.29	1.56	1.83	2.26	2.69	3.05	4.03	4.88	6.08	7.16
10	0.25	0.38	0.47	0.64	0.79	0.91	0.98	1.19	1.48	1.78	2.08	2.58	3.06	3.46	4.59	5.53	6.88	8.11
25	0.32	0.48	0.60	0.81	1.00	1.14	1.22	1.41	1.73	2.06	2.41	2.99	3.55	3.99	5.33	6.34	7.89	9.29
50	0.38	0.57	0.71	0.95	1.18	1.34	1.41	1.61	1.92	2.27	2.65	3.30	3.91	4.39	5.85	6.93	8.62	10.13
100	0.44	0.67	0.83	1.11	1.38	1.56	1.64	1.83	2.12	2.48	2.90	3.60	4.28	4.78	6.37	7.49	9.34	10.93
200	0.51	0.77	0.96	1.29	1.59	1.80	1.89	2.08	2.37	2.67	3.14	3.90	4.63	5.15	6.88	8.02	9.99	11.68
500	0.61	0.92	1.15	1.54	1.91	2.15	2.26	2.49	2.78	2.93	3.44	4.28	5.09	5.61	7.50	8.67	10.79	12.59
1000	0.69	1.05	1.30	1.76	2.17	2.45	2.58	2.84	3.15	3.18	3.66	4.55	5.42	5.95	7.95	9.14	11.37	13.23

* The lower bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables





Maps -

overview map

These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

detailed map

Please read disclaimer for more information.

map legend

Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; **USGS Aerial Photograph** may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to NOAA Atlas 14 Document.

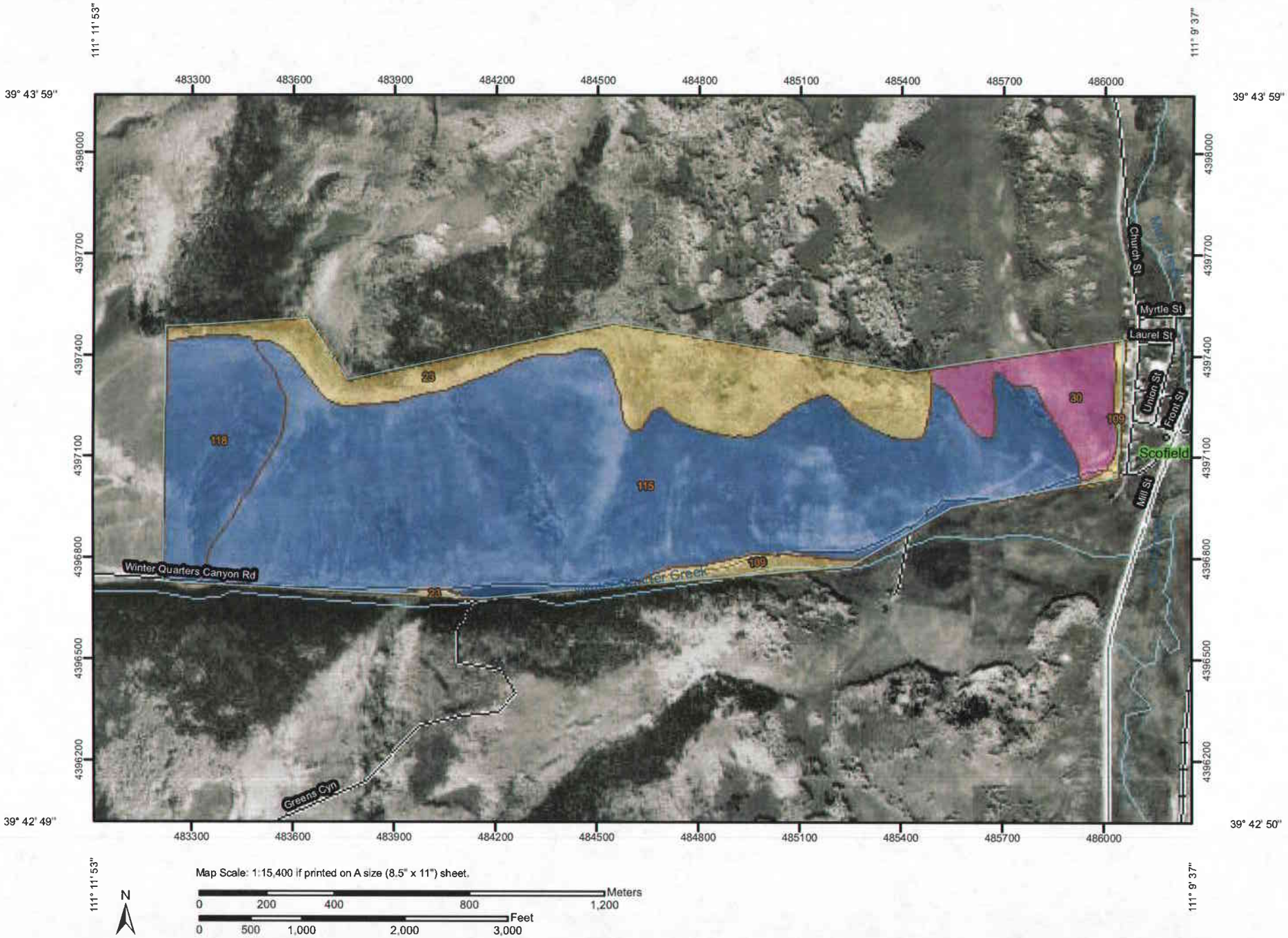
Using the **National Climatic Data Center's (NCDC)** station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (39.7235/-111.1805). Digital ASCII data can be obtained directly from **NCDC**.

Find Natural Resources Conservation Service (NRCS) SNOTEL (SNOwpack TELemetry) stations by visiting the **Western Regional Climate Center's state-specific SNOTEL station maps**.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910
(301) 713-1669
Questions? HDSC.Questions@noaa.gov

Disclaimer


111° 11' 53"
111° 9' 37"
39° 43' 59"
39° 42' 49"
39° 42' 50"
483300
483600
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485700
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4397700
4397400
4397100
4396800
4396500
4396200
28
118
115
30
109
23
Winter Quarters Canyon Rd
Greens Cyn
Church St
Myrtle St
Laurel St
Union St
Front St
Scofield
Mill St
Map Scale: 1:15,400 if printed on A size (8.5" x 11") sheet.
N
Meters
0
200
400
800
1,200
Feet
0
500
1,000
2,000
3,000

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

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

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:15,400 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

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

Soil Survey Area: Carbon Area, Utah, Parts of Carbon and Emery Counties
Survey Area Data: Version 5, Sep 3, 2009

Date(s) aerial images were photographed: 9/30/1997

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Carbon Area, Utah, Parts of Carbon and Emery Counties				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
23	Curecanti family-Pathead complex	C	74.8	16.6%
30	Falcon-Rock outcrop complex	D	25.8	5.7%
109	Silas-Brycan loams	C	10.2	2.3%
115	Trag stony loam, 30 to 60 percent slopes	B	294.1	65.1%
118	Trag-Croydon complex	B	46.6	10.3%
Totals for Area of Interest			**451.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

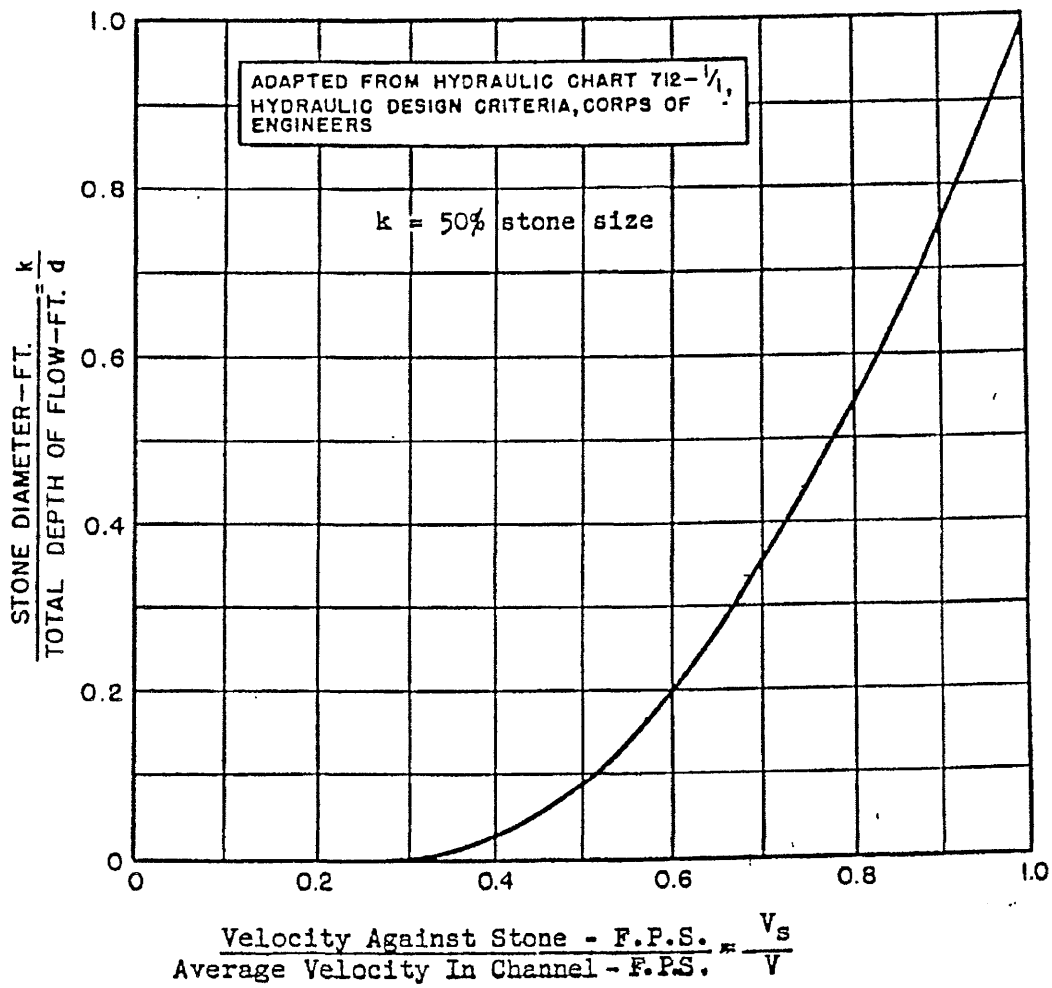


FIGURE 5-1 Velocity Against Stone on Channel Bottom (U.S. Department of Transportation, 1978).

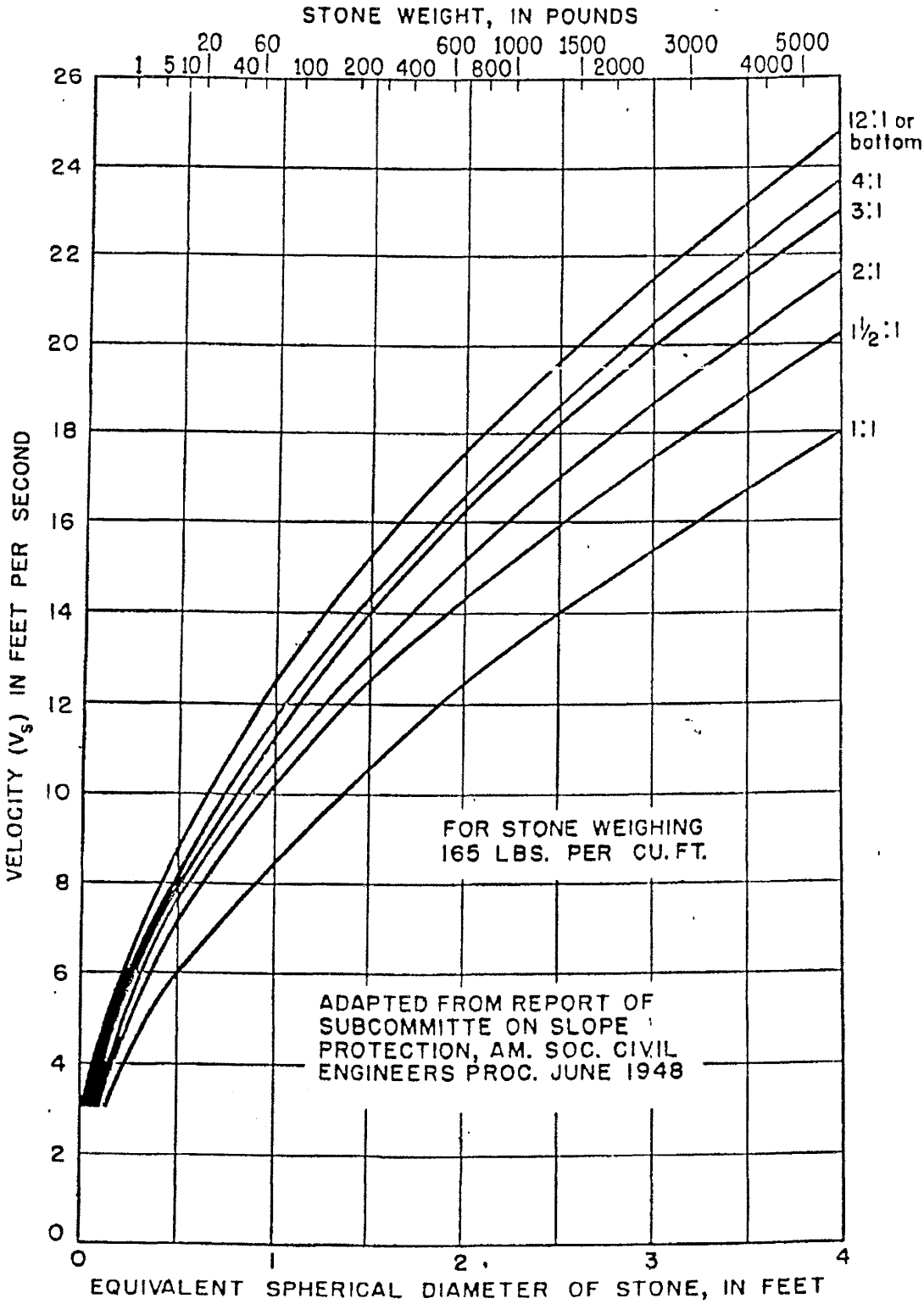
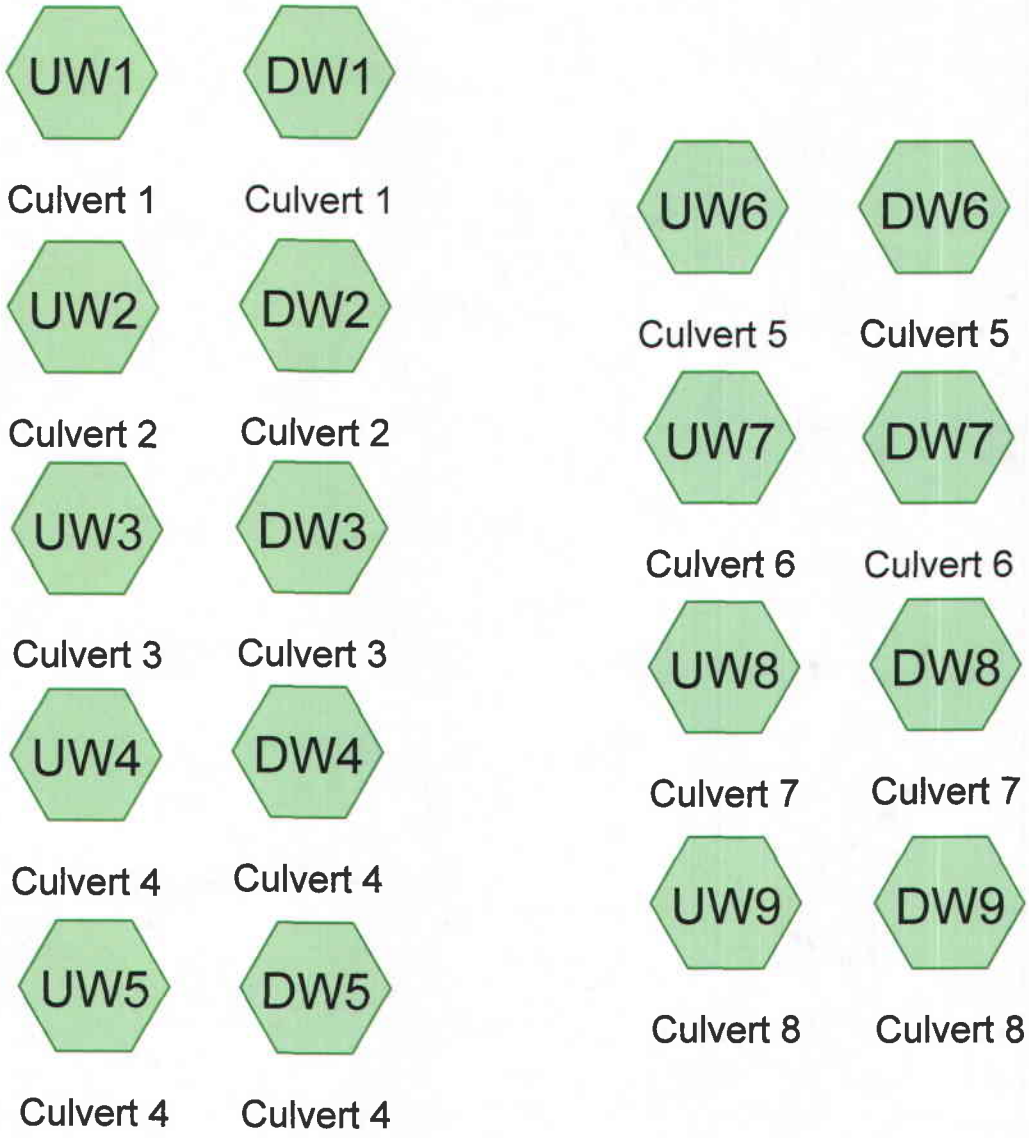
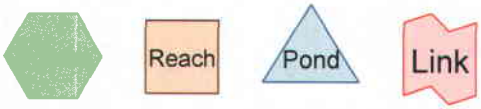


FIGURE 5-2 Size of Stone that will Resist Displacement for Various Velocities and Side Slopes (U.S. Department of Transportation, 1978).

All Report

Label	Worksheet Type	Discharge (cfs)	Depth (ft)	Slope (ft/ft)	Mannings Coefficient	Diameter (in)	Velocity (ft/s)	Left Side Slope (V : H)	Right Side Slope (V : H)
Culvert 1 M.D.	Circular	0.27	0.19	0.020000	0.024	18	2.11		
Culvert 1 M.V.	Circular	0.27	0.13	0.100000	0.024	18	3.70		
Culvert 1 Riprap	Trapezoidal	0.27	0.04	0.200000	0.050		1.45	0.50	0.50
Culvert 2 M.D.	Circular	0.68	0.29	0.020000	0.024	18	2.77		
Culvert 2 M.V.	Circular	0.68	0.20	0.100000	0.024	18	4.88		
Culvert 2 Riprap	Trapezoidal	0.68	0.05	0.400000	0.050		2.57	0.50	0.50
Culvert 3 M.D.	Circular	0.23	0.17	0.020000	0.024	18	2.01		
Culvert 3 M.V.	Circular	0.23	0.12	0.100000	0.024	18	3.52		
Culvert 3 Riprap	Trapezoidal	0.23	0.03	0.400000	0.050		1.68	0.50	0.50
Culvert 4 M.D.	Circular	1.33	0.41	0.020000	0.024	18	3.37		
Culvert 4 M.V.	Circular	1.33	0.28	0.100000	0.024	18	5.96		
Culvert 4 Riprap	Trapezoidal	1.33	0.12	0.100000	0.050		2.17	0.50	0.50
Culvert 5 M.D.	Circular	0.48	0.25	0.020000	0.024	18	2.50		
Culvert 5 M.V.	Circular	0.48	0.17	0.100000	0.024	18	4.40		
Culvert 5 Riprap	Trapezoidal	0.48	0.06	0.100000	0.050		1.47	0.50	0.50
Culvert 6 M.D.	Circular	0.46	0.24	0.020000	0.024	18	2.47		
Culvert 6 M.V.	Circular	0.46	0.17	0.100000	0.024	18	4.34		
Culvert 6 Riprap	Trapezoidal	0.46	0.05	0.200000	0.050		1.79	0.50	0.50
Culvert 7 M.D.	Circular	0.95	0.35	0.020000	0.024	18	3.06		
Culvert 7 M.V.	Circular	0.95	0.23	0.100000	0.024	18	5.39		
Culvert 7 Riprap	Trapezoidal	0.95	0.08	0.200000	0.050		2.37	0.50	0.50
Culvert 8 M.D.	Circular	3.85	0.73	0.020000	0.024	18	4.50		
Culvert 8 M.V.	Circular	3.85	0.47	0.100000	0.024	18	8.10		
Culvert 8 Riprap	Trapezoidal	3.85	0.22	0.100000	0.050		3.22	0.50	0.50
Ditch 1 M.D.	Triangular	0.27	0.27	0.040000	0.035		2.05	0.67	0.50
Ditch 1 M.V.	Triangular	0.27	0.23	0.100000	0.035		2.89	0.67	0.50
Ditch 2 M.D.	Triangular	0.68	0.40	0.033000	0.035		2.41	0.67	0.50
Ditch 2 M.V.	Triangular	0.68	0.31	0.130000	0.035		4.02	0.67	0.50
Ditch 3 M.D.	Triangular	0.23	0.26	0.040000	0.035		1.97	0.67	0.50
Ditch 3 M.V.	Triangular	0.23	0.21	0.130000	0.035		3.07	0.67	0.50
Ditch 4 M.D.	Triangular	0.94	0.46	0.030000	0.035		2.52	0.67	0.50
Ditch 4 M.V.	Triangular	0.94	0.35	0.135000	0.035		4.42	0.67	0.50
Ditch 5 M.D.	Triangular	0.48	0.36	0.030000	0.035		2.13	0.67	0.50
Ditch 5 M.V.	Triangular	0.48	0.27	0.140000	0.035		3.79	0.67	0.50
Ditch 6 M.D.	Triangular	0.46	0.35	0.030000	0.035		2.11	0.67	0.50
Ditch 6 M.V.	Triangular	0.46	0.31	0.060000	0.035		2.73	0.67	0.50
Ditch 7 M.D.	Triangular	0.95	0.57	0.010000	0.035		1.67	0.67	0.50
Ditch 7 M.V.	Triangular	0.95	0.41	0.060000	0.035		3.27	0.67	0.50
Ditch 8 M.D.	Triangular	3.85	0.96	0.010000	0.035		2.37	0.67	0.50
Ditch 8 M.V.	Triangular	3.85	0.71	0.050000	0.035		4.34	0.67	0.50





Drainage Diagram for 25yr, 6hr
Prepared by EarthFax Engineering, Inc., Printed 7/26/2010
HydroCAD® 9.10 s/n 03900 © 2010 HydroCAD Software Solutions LLC

Summary for Subcatchment DW1: Culvert 1

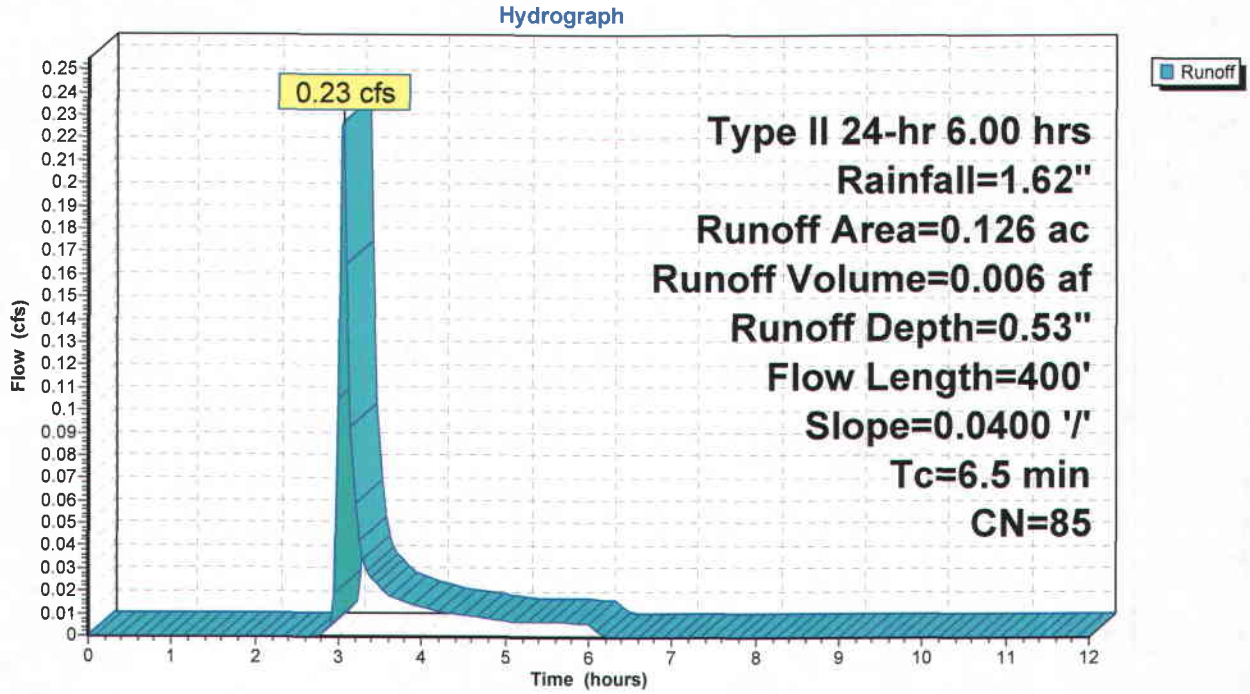
Runoff = 0.23 cfs @ 3.06 hrs, Volume= 0.006 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

Area (ac)	CN	Description
0.126	85	Gravel roads, HSG B
0.126		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	400	0.0400	1.03		**Lag/CN Method,**

Subcatchment DW1: Culvert 1



Summary for Subcatchment DW2: Culvert 2

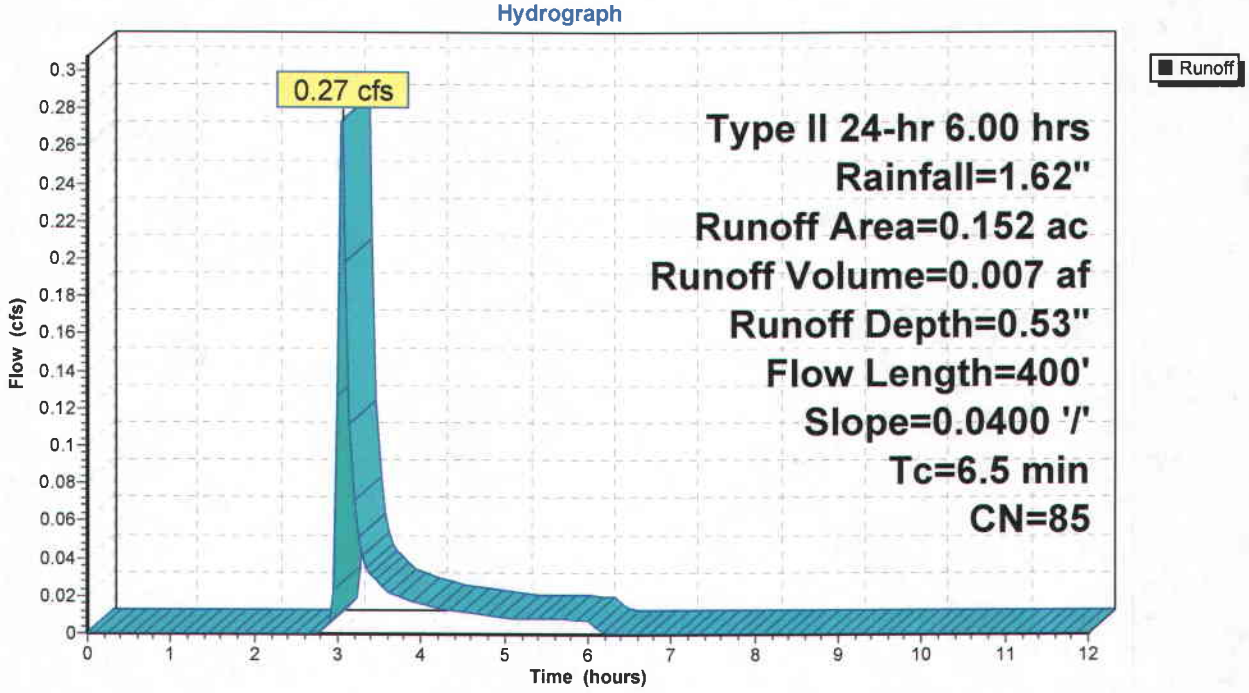
Runoff = 0.27 cfs @ 3.06 hrs, Volume= 0.007 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

Area (ac)	CN	Description
0.152	85	Gravel roads, HSG B
0.152		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	400	0.0400	1.03		**Lag/CN Method,**

Subcatchment DW2: Culvert 2



Summary for Subcatchment DW3: Culvert 3

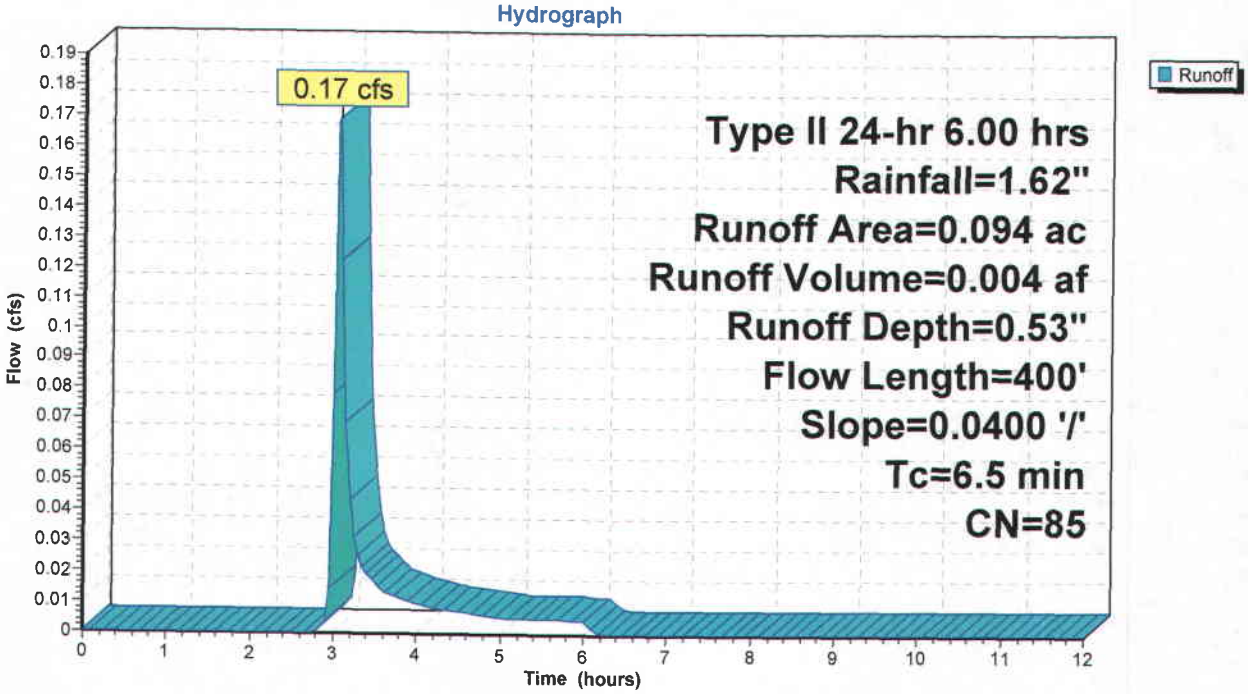
Runoff = 0.17 cfs @ 3.06 hrs, Volume= 0.004 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

Area (ac)	CN	Description
0.094	85	Gravel roads, HSG B
0.094		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	400	0.0400	1.03		**Lag/CN Method,**

Subcatchment DW3: Culvert 3



Summary for Subcatchment DW4: Culvert 4

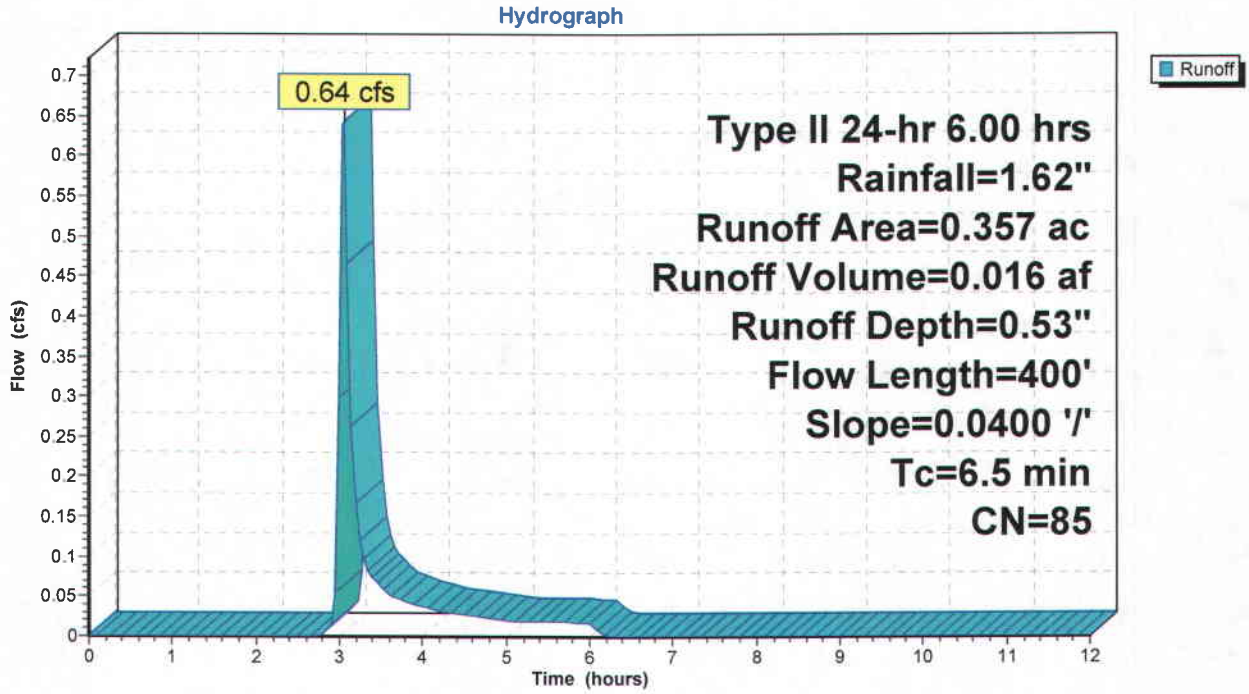
Runoff = 0.64 cfs @ 3.06 hrs, Volume= 0.016 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

Area (ac)	CN	Description
0.357	85	Gravel roads, HSG B
0.357		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	400	0.0400	1.03		**Lag/CN Method,**

Subcatchment DW4: Culvert 4



Summary for Subcatchment DW5: Culvert 4

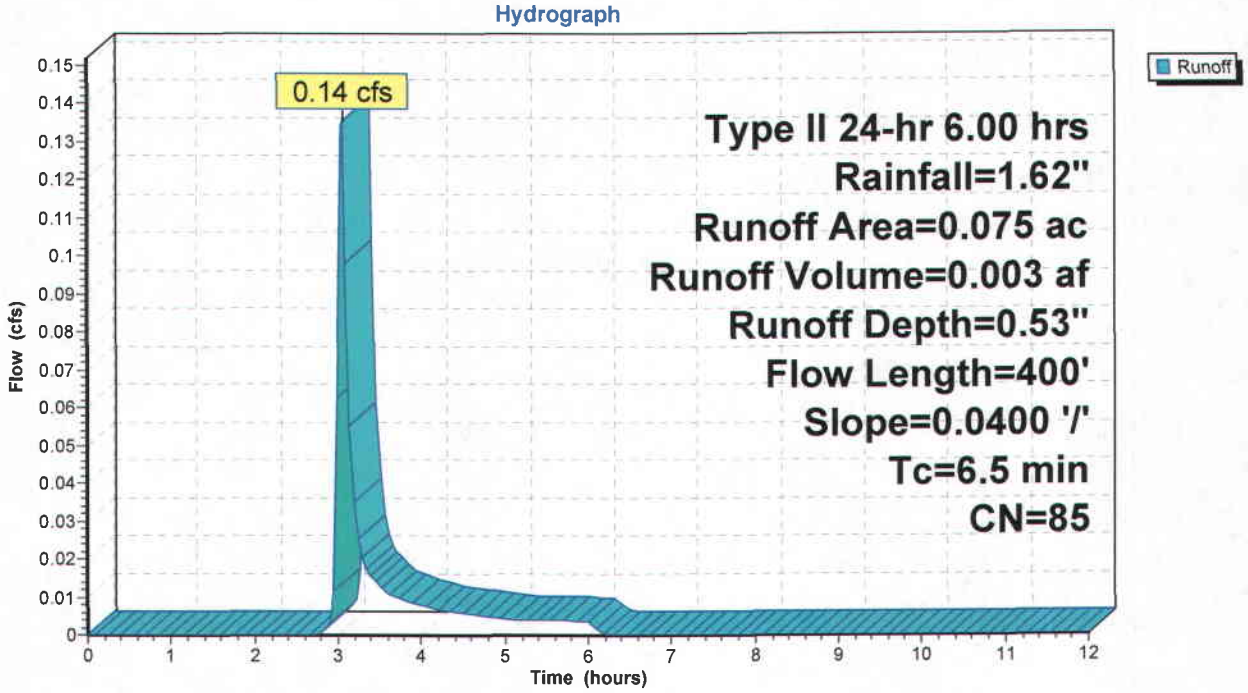
Runoff = 0.14 cfs @ 3.06 hrs, Volume= 0.003 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

Area (ac)	CN	Description
0.075	85	Gravel roads, HSG B
0.075		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	400	0.0400	1.03		**Lag/CN Method,**

Subcatchment DW5: Culvert 4



Summary for Subcatchment DW6: Culvert 5

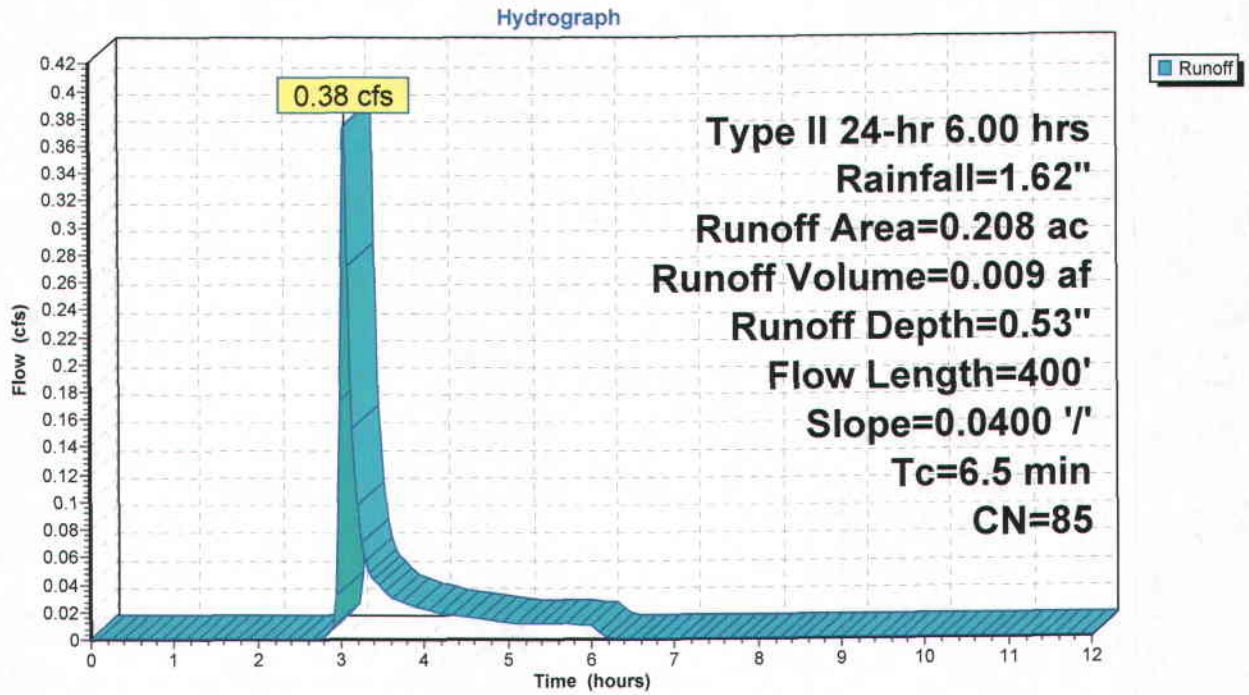
Runoff = 0.38 cfs @ 3.06 hrs, Volume= 0.009 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

Area (ac)	CN	Description
0.208	85	Gravel roads, HSG B
0.208		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	400	0.0400	1.03		**Lag/CN Method,**

Subcatchment DW6: Culvert 5



Summary for Subcatchment DW7: Culvert 6

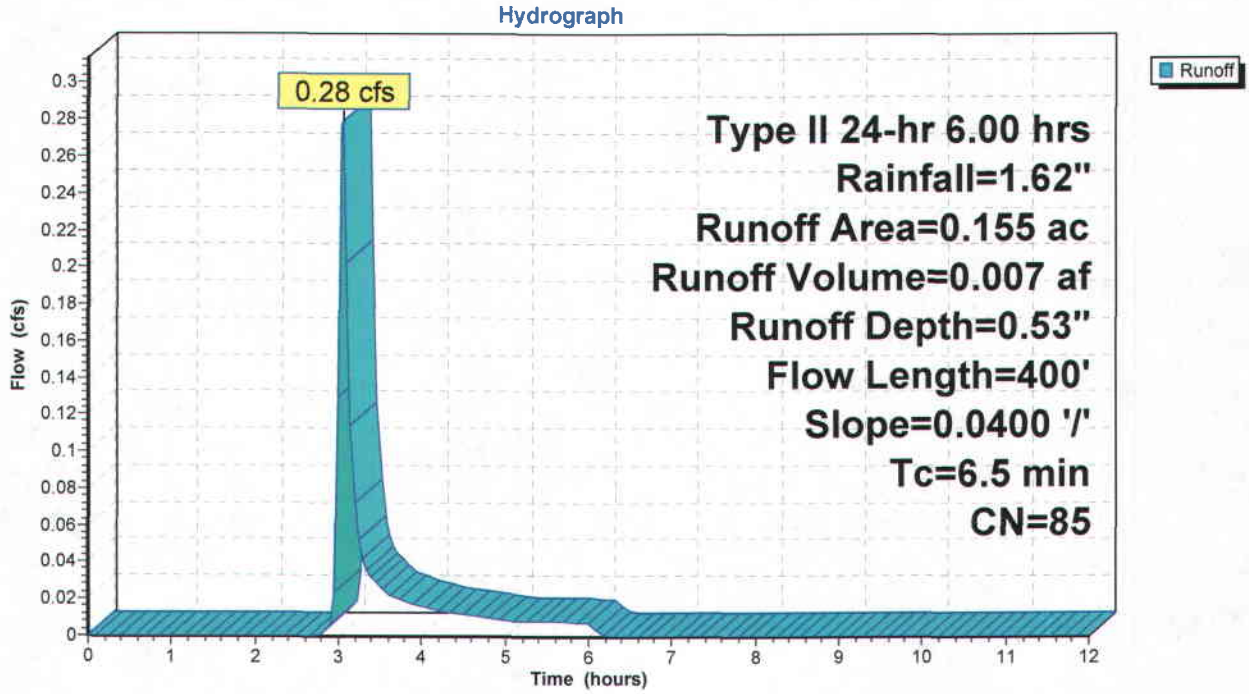
Runoff = 0.28 cfs @ 3.06 hrs, Volume= 0.007 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

Area (ac)	CN	Description
0.155	85	Gravel roads, HSG B
0.155		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	400	0.0400	1.03		**Lag/CN Method,**

Subcatchment DW7: Culvert 6



Summary for Subcatchment DW8: Culvert 7

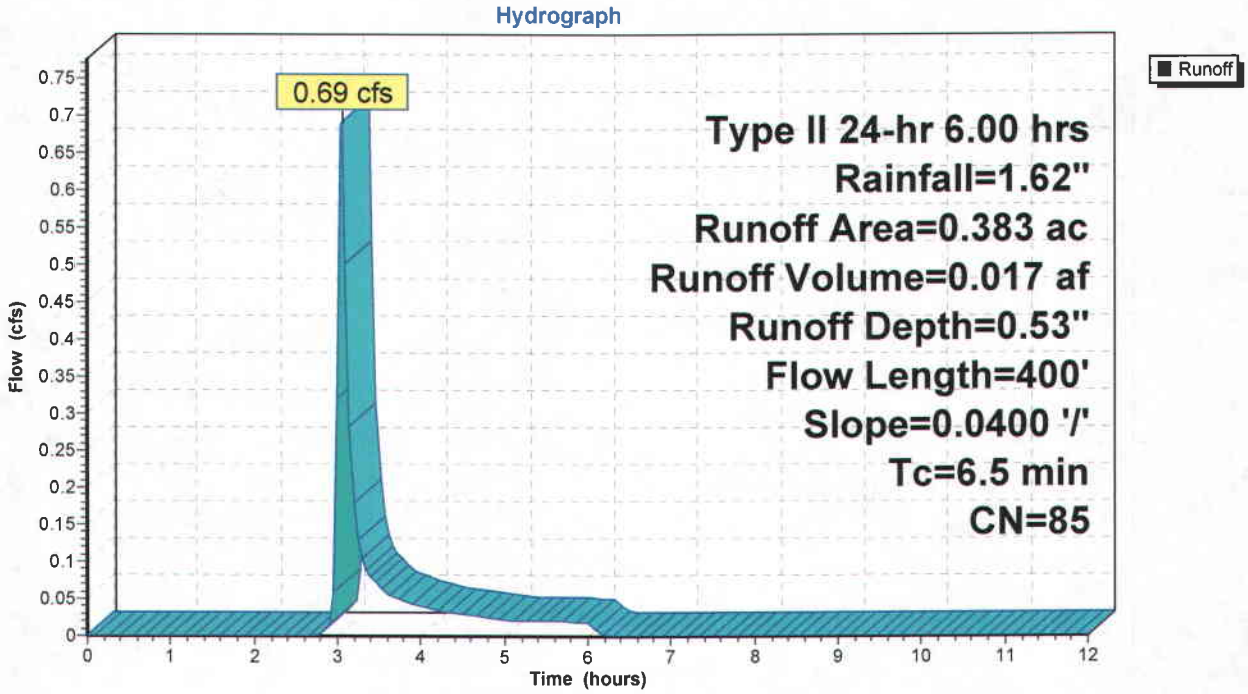
Runoff = 0.69 cfs @ 3.06 hrs, Volume= 0.017 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

Area (ac)	CN	Description
0.383	85	Gravel roads, HSG B
0.383		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	400	0.0400	1.03		**Lag/CN Method,**

Subcatchment DW8: Culvert 7



Summary for Subcatchment DW9: Culvert 8

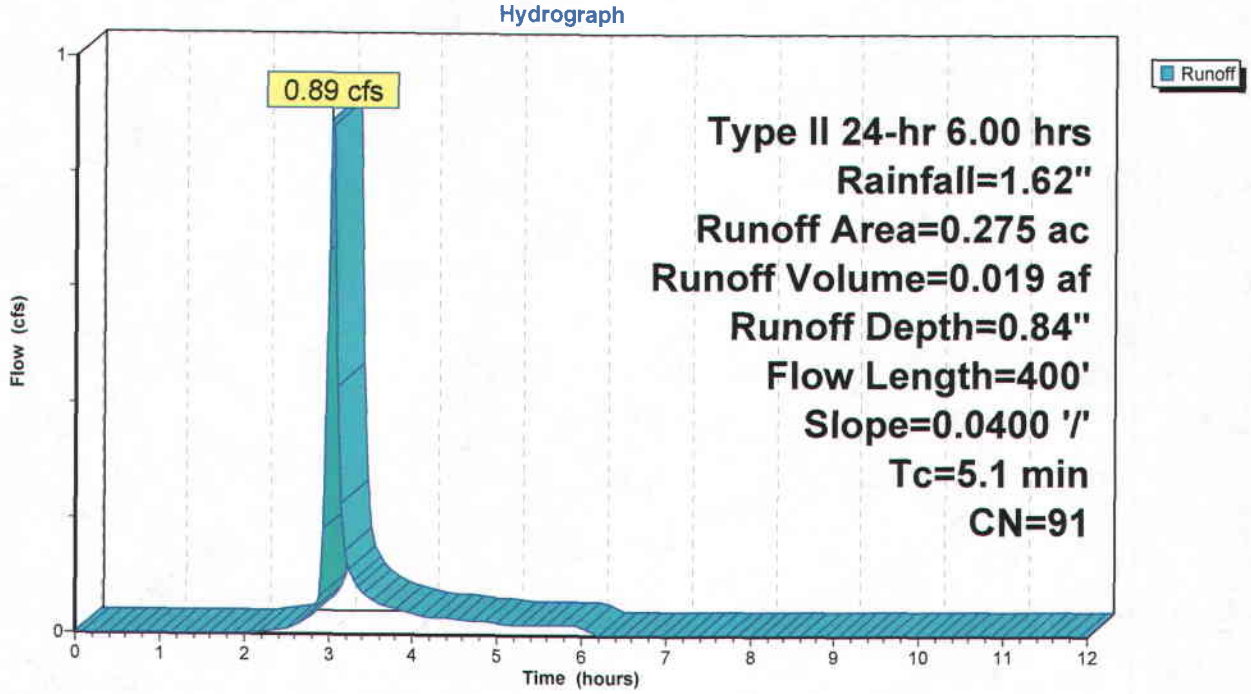
Runoff = 0.89 cfs @ 3.04 hrs, Volume= 0.019 af, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

Area (ac)	CN	Description
0.275	91	Gravel roads, HSG D
0.275		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	400	0.0400	1.30		**Lag/CN Method,**

Subcatchment DW9: Culvert 8



Summary for Subcatchment UW1: Culvert 1

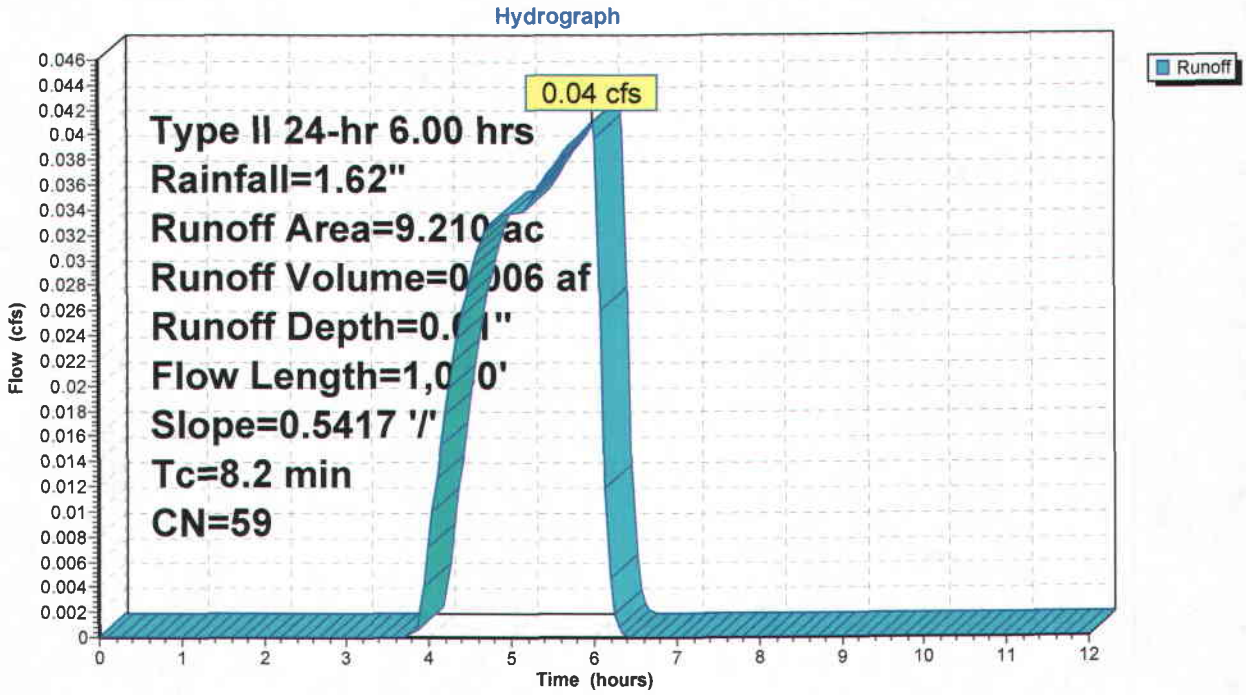
Runoff = 0.04 cfs @ 6.00 hrs, Volume= 0.006 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

	Area (ac)	CN	Description
*	9.210	59	
	9.210		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	1,080	0.5417	2.21		**Lag/CN Method, Slope from 8,680 to 8,095**

Subcatchment UW1: Culvert 1



Summary for Subcatchment UW2: Culvert 2

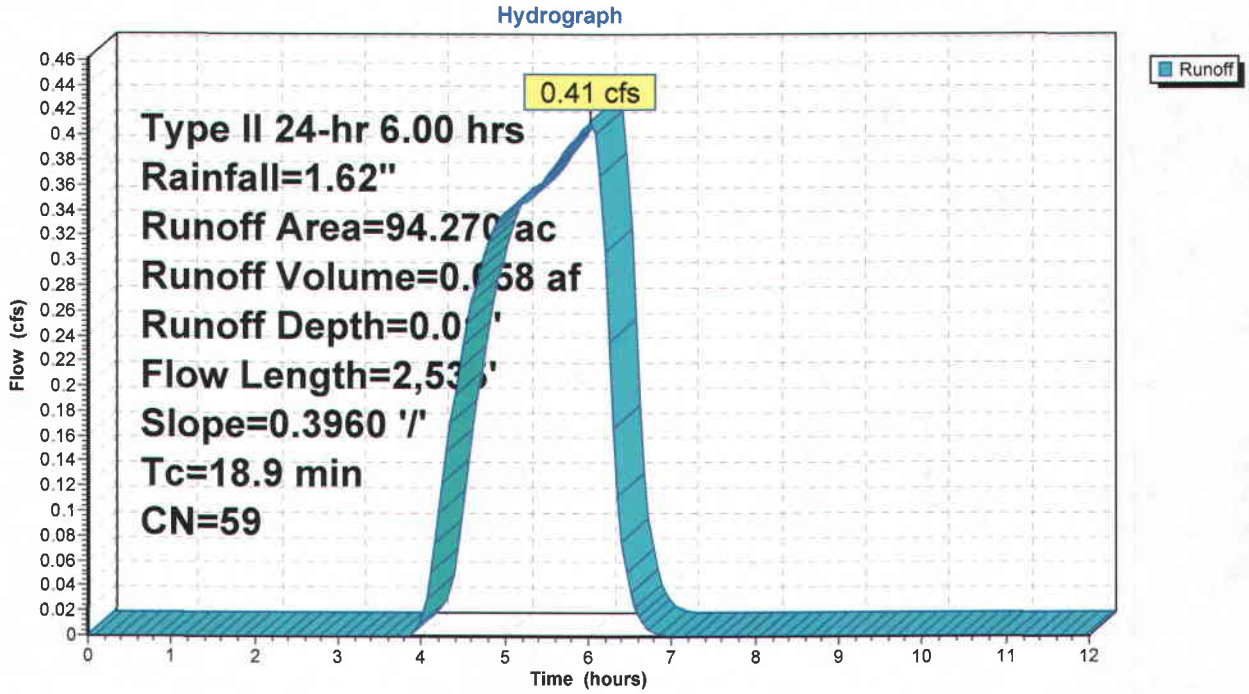
Runoff = 0.41 cfs @ 6.03 hrs, Volume= 0.058 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

	Area (ac)	CN	Description
*	94.270	59	
	94.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	2,535	0.3960	2.24		**Lag/CN Method, Slope from 9,030 to 8,025**

Subcatchment UW2: Culvert 2



Summary for Subcatchment UW3: Culvert 3

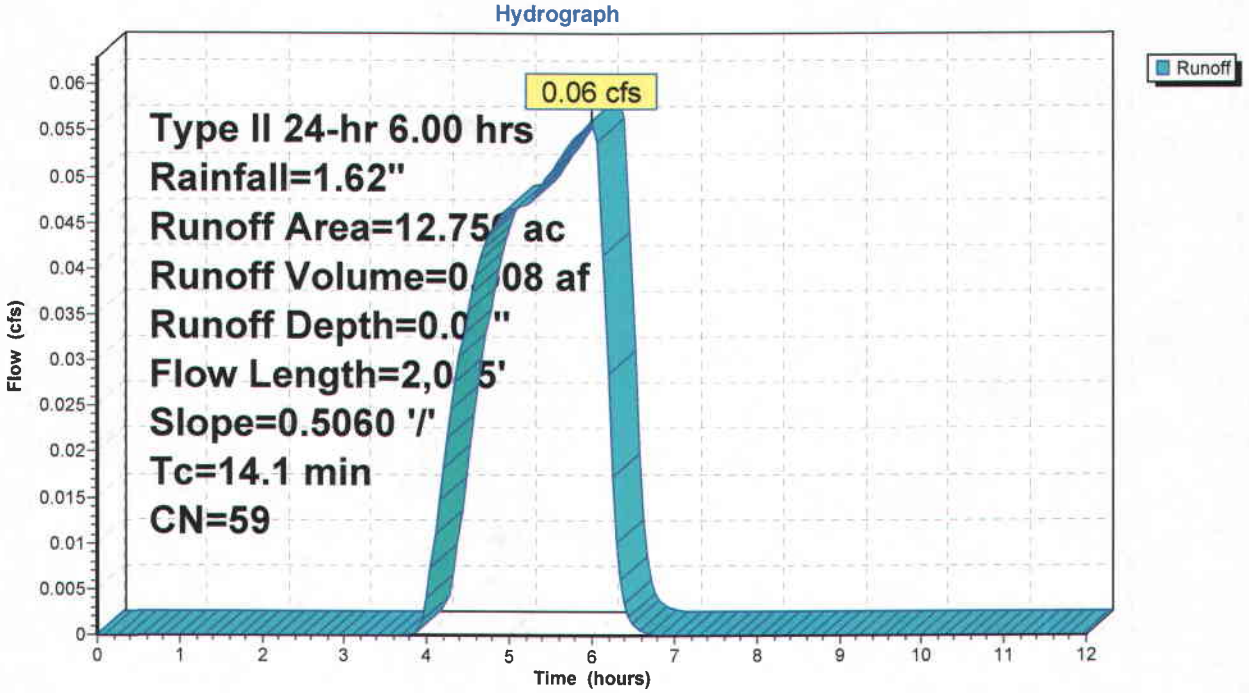
Runoff = 0.06 cfs @ 6.01 hrs, Volume= 0.008 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

	Area (ac)	CN	Description
*	12.750	59	
	12.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	2,045	0.5060	2.42		**Lag/CN Method, Slope from 9,010 to 7,975**

Subcatchment UW3: Culvert 3



Summary for Subcatchment UW4: Culvert 4

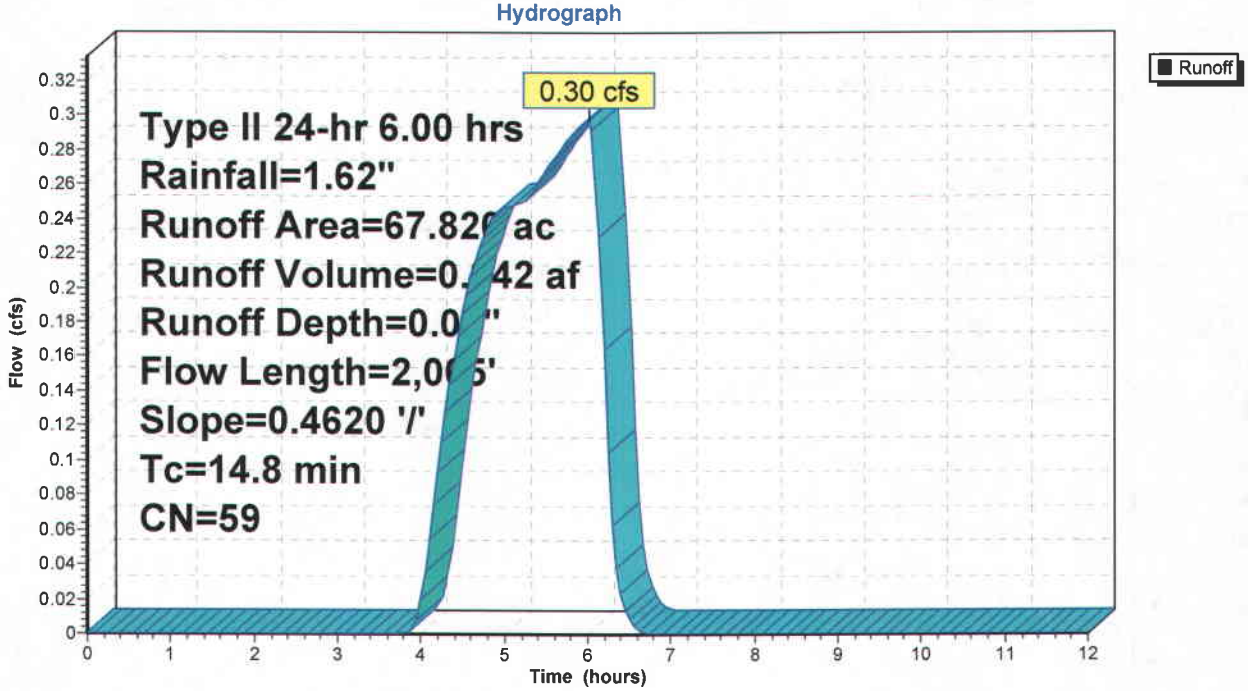
Runoff = 0.30 cfs @ 6.01 hrs, Volume= 0.042 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

	Area (ac)	CN	Description
*	67.820	59	
	67.820		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	2,065	0.4620	2.32		**Lag/CN Method, Slope from 8,880 to 7,925**

Subcatchment UW4: Culvert 4



Summary for Subcatchment UW5: Culvert 4

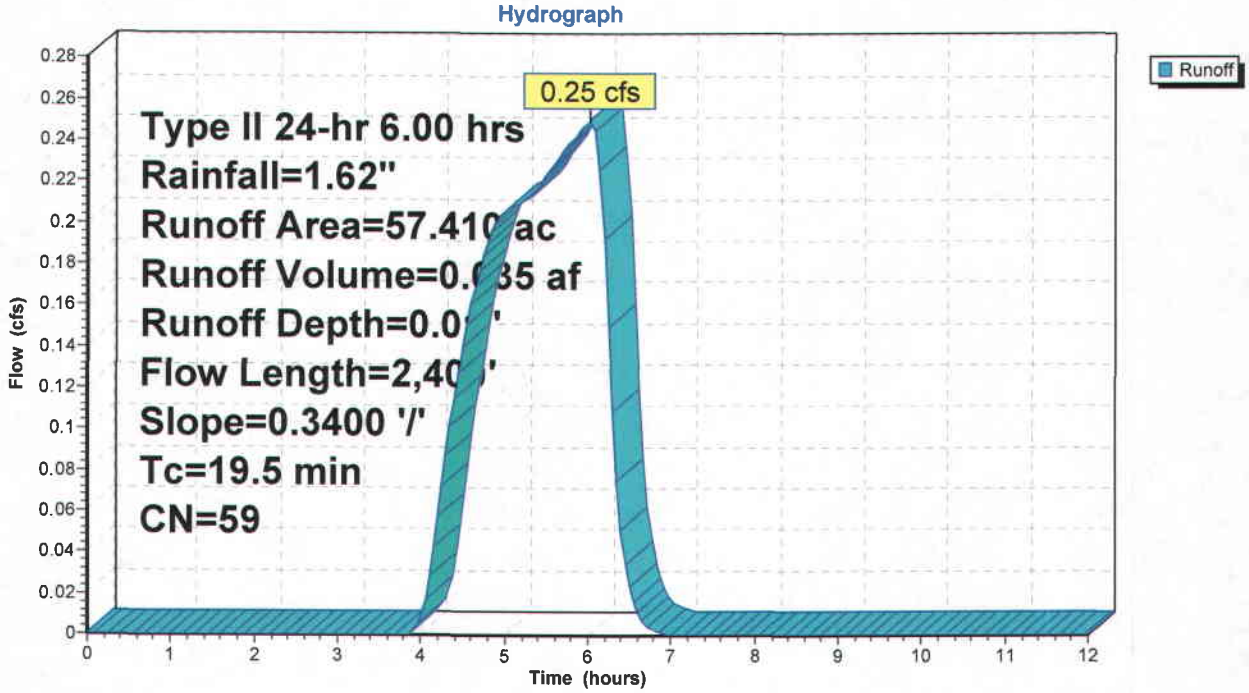
Runoff = 0.25 cfs @ 6.03 hrs, Volume= 0.035 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

	Area (ac)	CN	Description
*	57.410	59	
	57.410		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.5	2,400	0.3400	2.05		**Lag/CN Method, Slope from 8,725 to 7,910**

Subcatchment UW5: Culvert 4



Summary for Subcatchment UW6: Culvert 5

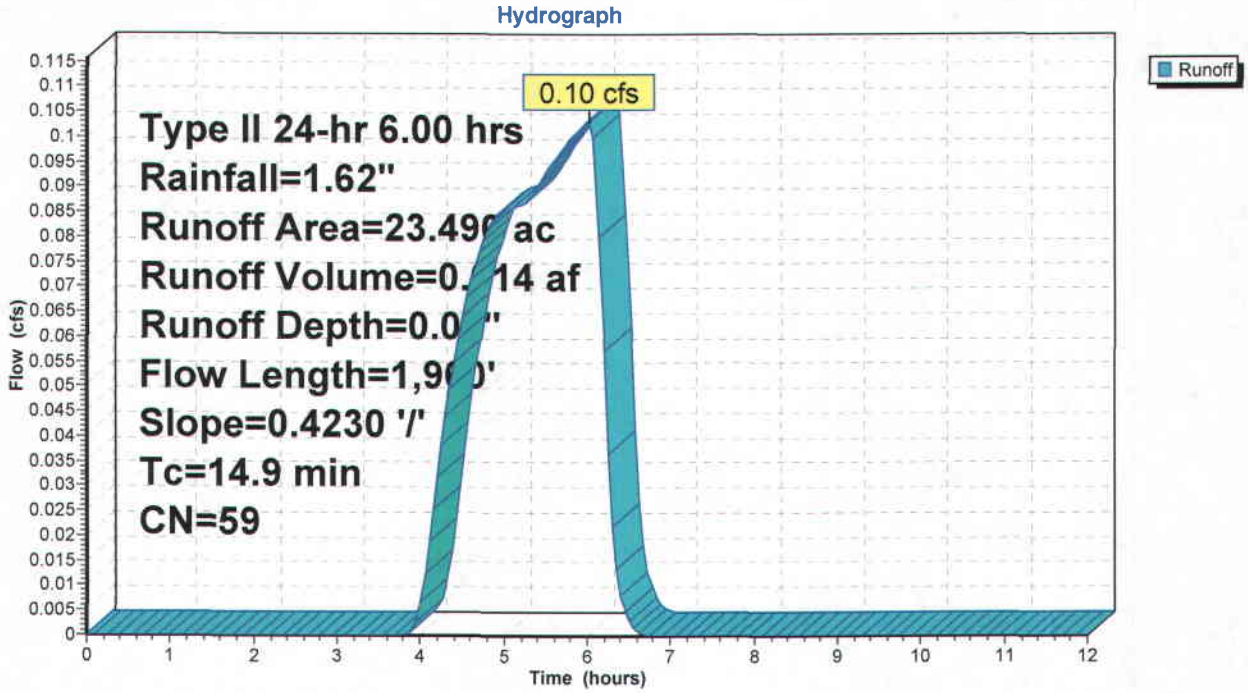
Runoff = 0.10 cfs @ 6.02 hrs, Volume= 0.014 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

	Area (ac)	CN	Description
*	23.490	59	
	23.490		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	1,960	0.4230	2.20		**Lag/CN Method, Slope from 8,680 to 7,850**

Subcatchment UW6: Culvert 5



Summary for Subcatchment UW7: Culvert 6

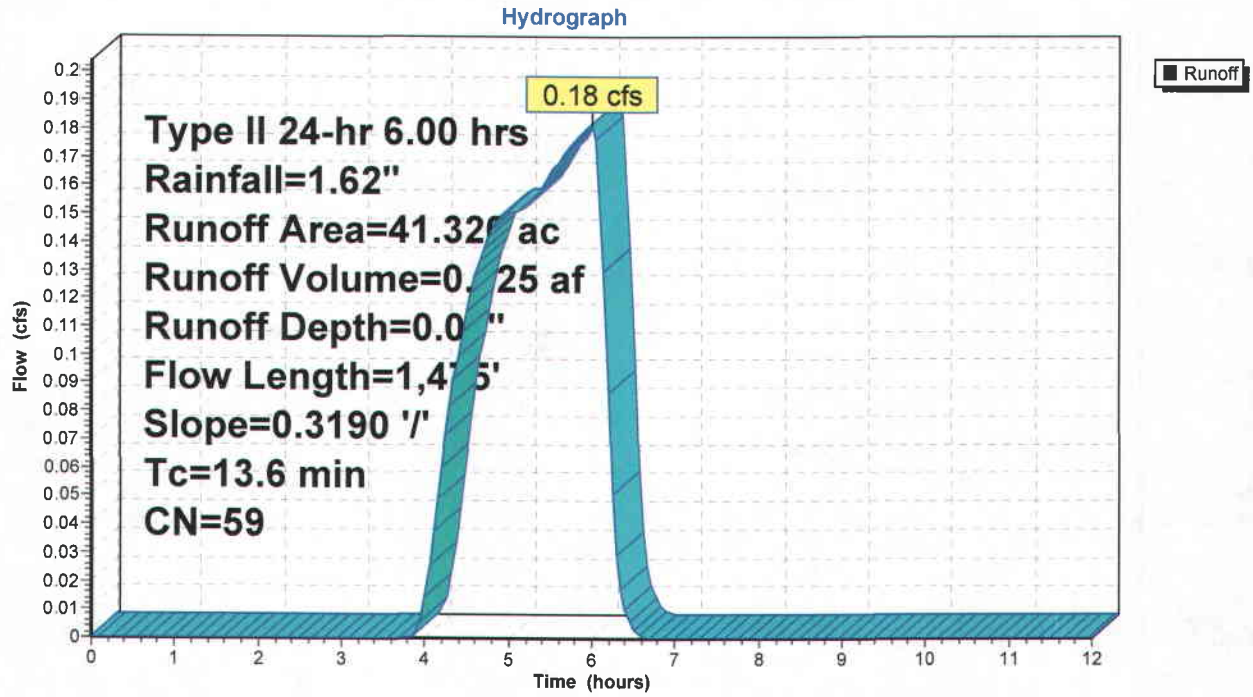
Runoff = 0.18 cfs @ 6.00 hrs, Volume= 0.025 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

	Area (ac)	CN	Description
*	41.320	59	
	41.320		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	1,475	0.3190	1.80		**Lag/CN Method, Slope from 8,300 to 7,830**

Subcatchment UW7: Culvert 6



Summary for Subcatchment UW8: Culvert 7

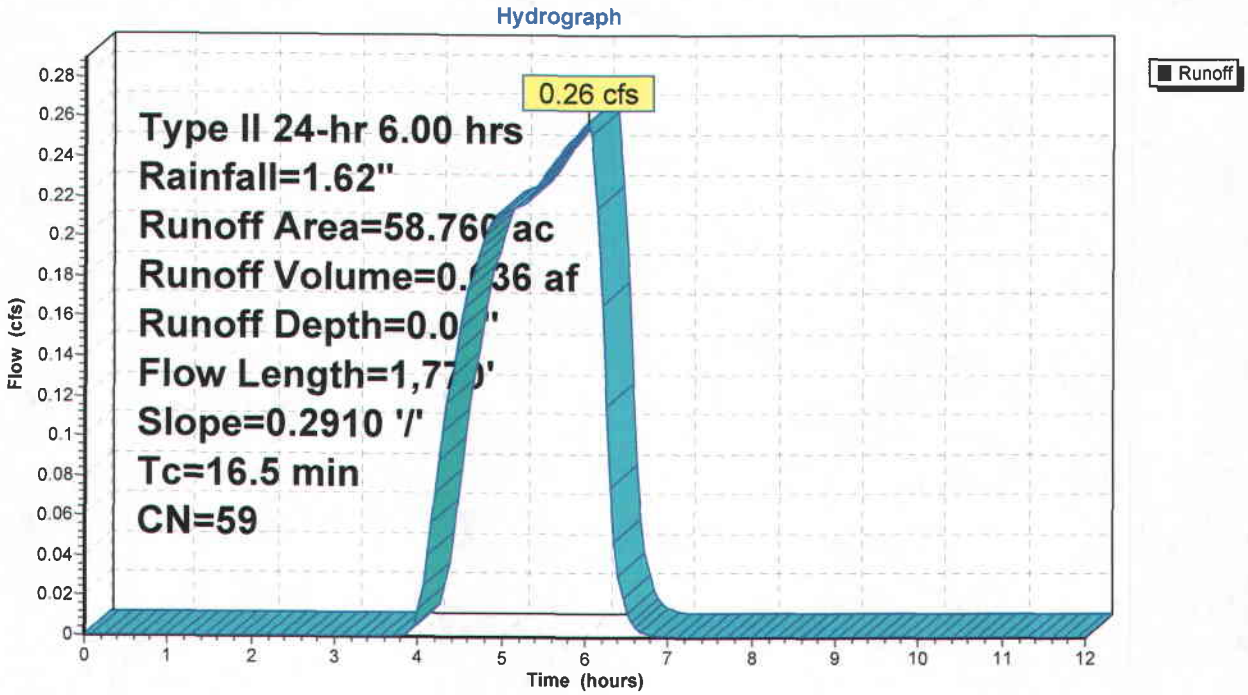
Runoff = 0.26 cfs @ 6.03 hrs, Volume= 0.036 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

	Area (ac)	CN	Description
*	58.760	59	
	58.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	1,770	0.2910	1.79		**Lag/CN Method, Slope from 8,300 to 7,785**

Subcatchment UW8: Culvert 7

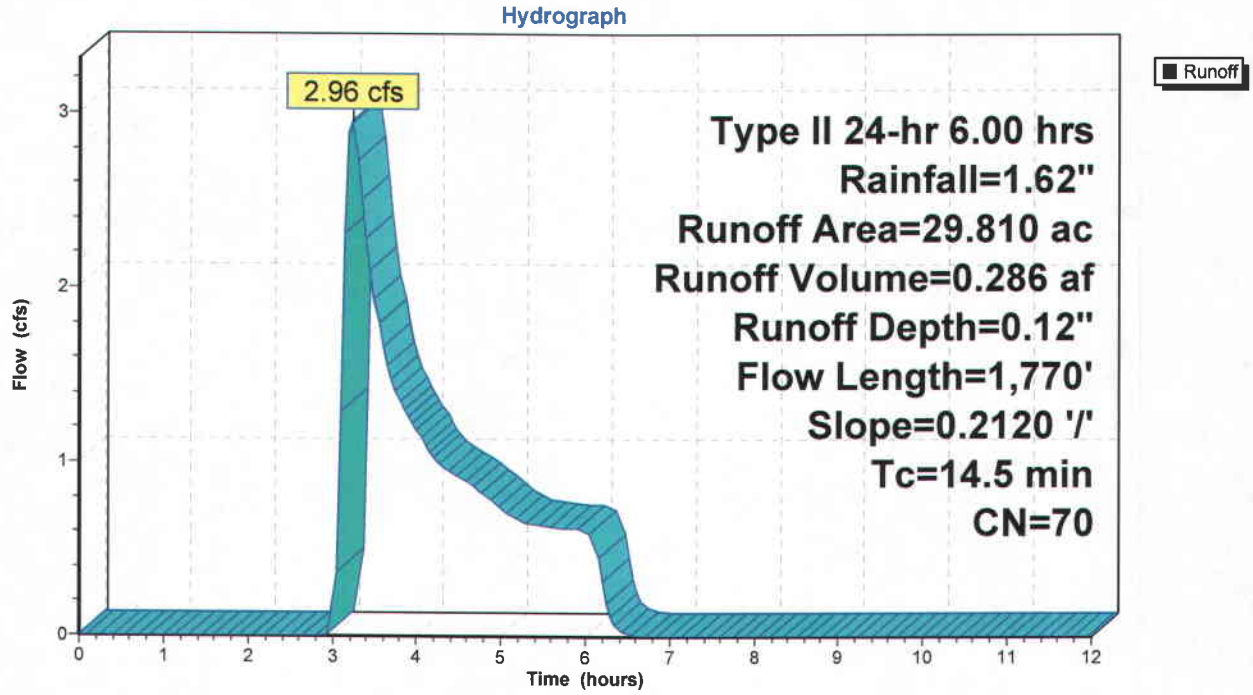


Summary for Subcatchment UW9: Culvert 8

Runoff = 2.96 cfs @ 3.24 hrs, Volume= 0.286 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 24-hr 6.00 hrs Rainfall=1.62"

Area (ac)	CN	Description
29.810	70	Sagebrush range, Fair, HSG D
29.810		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	1,770	0.2120	2.03		**Lag/CN Method, Slope from 8,110 to 7,735**

Subcatchment UW9: Culvert 8