

TULE WIND PROJECT

PRELIMINARY DRAINAGE REPORT

DRAFT

Prepared for:

Iberdrola Renewables, Inc.

1125 NW Couch Street, Suite 700
Portland, Oregon



Prepared by:

HDR Engineering, Inc.

8690 Balboa Avenue, Suite 200
San Diego, California 92123
858-712-8400



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EXECUTIVE SUMMARY

The purpose of this Preliminary Hydrology Report is to investigate the hydrologic impacts of developing approximately 513 acres in eastern San Diego County. Results from hydrologic analysis will be included in the Tule Wind Environmental Impact Statement (EIS)/Environmental Impact Report (EIR). Analysis detail is appropriate for an EIR level hydrology study.

This report discusses the methodology and assumptions for the hydrologic analysis performed for the Project. Discussion and comparison of existing and proposed hydrologic conditions identifies qualitative and quantitative Project impacts on local hydrologic conditions.

The hydrologic analysis was completed per the June 2003 *San Diego County Hydrology Manual*. Existing conditions hydrologic modeling was completed. Proposed conditions were determined to be identical within the accuracy of hydrology calculations, therefore, no impacts were identified.

1.0 PROJECT DESCRIPTION

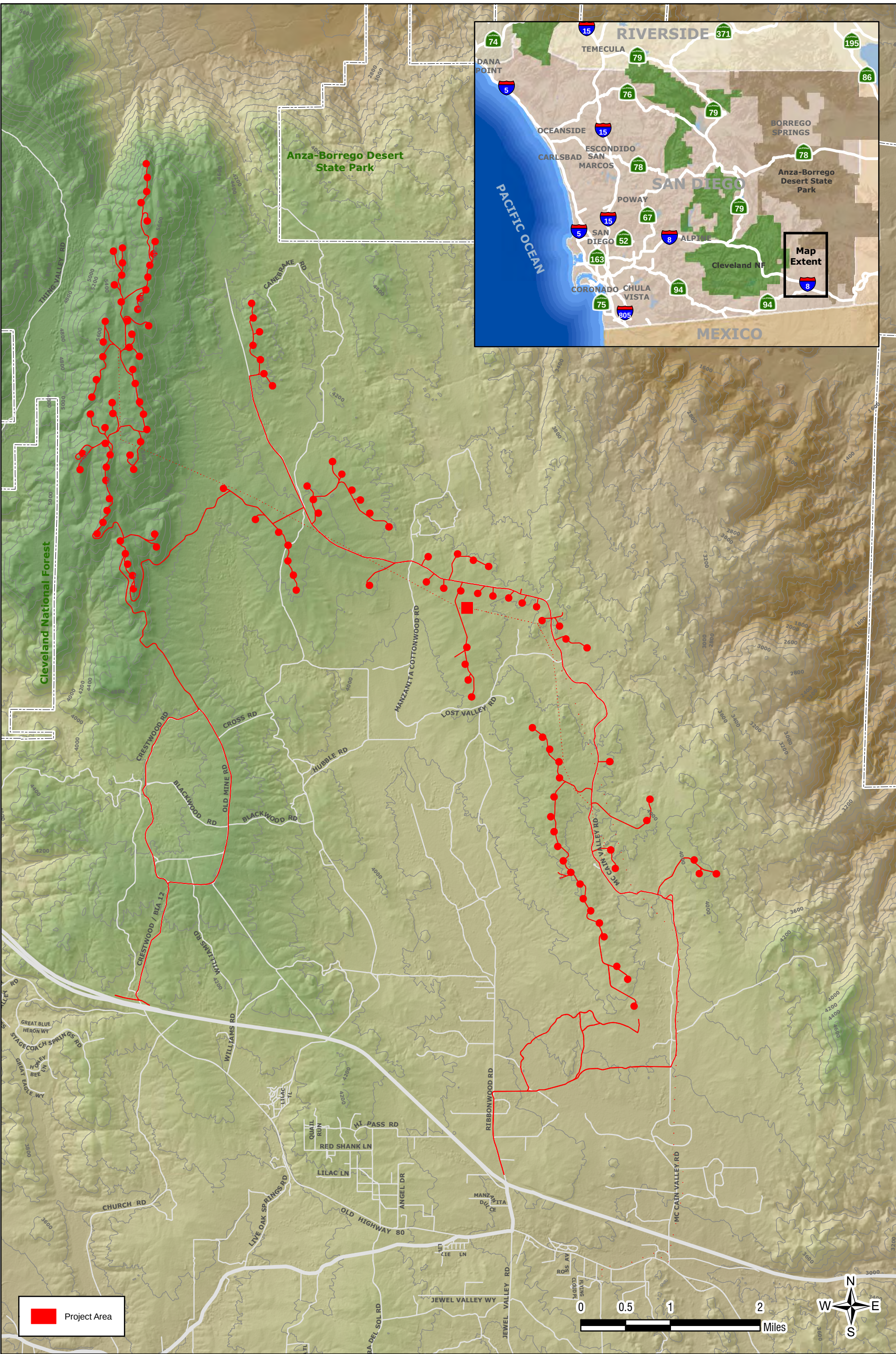
The Tule Wind Project proposes to develop a wind turbine “farm” for power generation, in the County of San Diego in the State of California. The project area is located in the eastern portion of San Diego County, approximately 50 miles east of City of San Diego, 90 miles west of Arizona, and north of the community of Boulevard (see Figure 1). The area is accessible via Interstate 8 (I-8), State Route 94 (SR-94) and Ribbonwood Road junction, and McCain Valley Road off of Old Highway 80. The majority of the project area lies in the In-Ko-Pah Mountains adjacent to the Tecate Divide, south of the Cleveland National Forest. The topography of the area is gently-to-steep sloping with an elevation ranging between about 3,600 and 5,600 feet above mean sea level. The project area contains lands administered by the BLM, the Ewiiapaayp Reservation, the Campo and Manzanita Reservations (access only), the California State Lands Commission (CSLC), and privately-owned parcels under the jurisdiction of the County of San Diego.

Under existing conditions the Project site is mainly undeveloped naturally vegetated rocky hills. A number of existing access roads traverse the area, providing service routes to existing utility facilities, rural houses, agricultural facilities, and a landing strip. Naturally occurring native vegetation is predominant throughout the site, with periodic scattered unvegetated rock outcroppings.

Development will consist of up to 128 wind turbines, 34.5 kilovolt (kV) overhead and underground collector lines, 138 kV overhead transmission line, 5-acre collector substation site, 5-acre operation and maintenance building site, access road between turbines, improvements to existing roads to provide site access, 5-acre temporary batch plant, 10-acre temporary parking lot, 19 2-acre lay down areas, two meteorological towers, and a sonic detection and ranging system (SODAR) unit. Proposed site configuration is shown in Figure 2.

Project development proposes wind turbines ranging in size between 328 feet in height to 492 feet in height, to produce 200 megawatts total power. Turbines are constructed with a 48-foot diameter concrete foundation. Concrete foundations slope away from the centrally located turbine and will be buried greater than half a foot, so that exposed concrete foundations are approximately 6-inches to 8-inches thick and 18-feet to 20-feet in diameter. Turbines also include five-foot by nine-foot concrete pads for transformer foundations. Graded dirt pads around the turbines will be approximately 200-feet in radius.

Access roads between turbines will be 36-feet wide to accommodate self propelled cranes and supply trucks, while access roads to the turbine strings will only need to be 24-feet wide, as the crane and other assembly equipment can be brought onsite in pieces. Thirty-six foot access roads between turbines are intended to be temporary for construction activities and will be allowed to revegetate to a 20-foot width, pending construction completion. Roads under San Diego County jurisdiction will revegetate to a 24-foot width to comply with County standards. Proposed access road alignments will follow existing access roads to the maximum extent practicable to limit the amount of additional disturbed areas. New access roads will follow existing contours to maximum extent practicable to limit the amount of disturbed areas resulting from grading cuts.

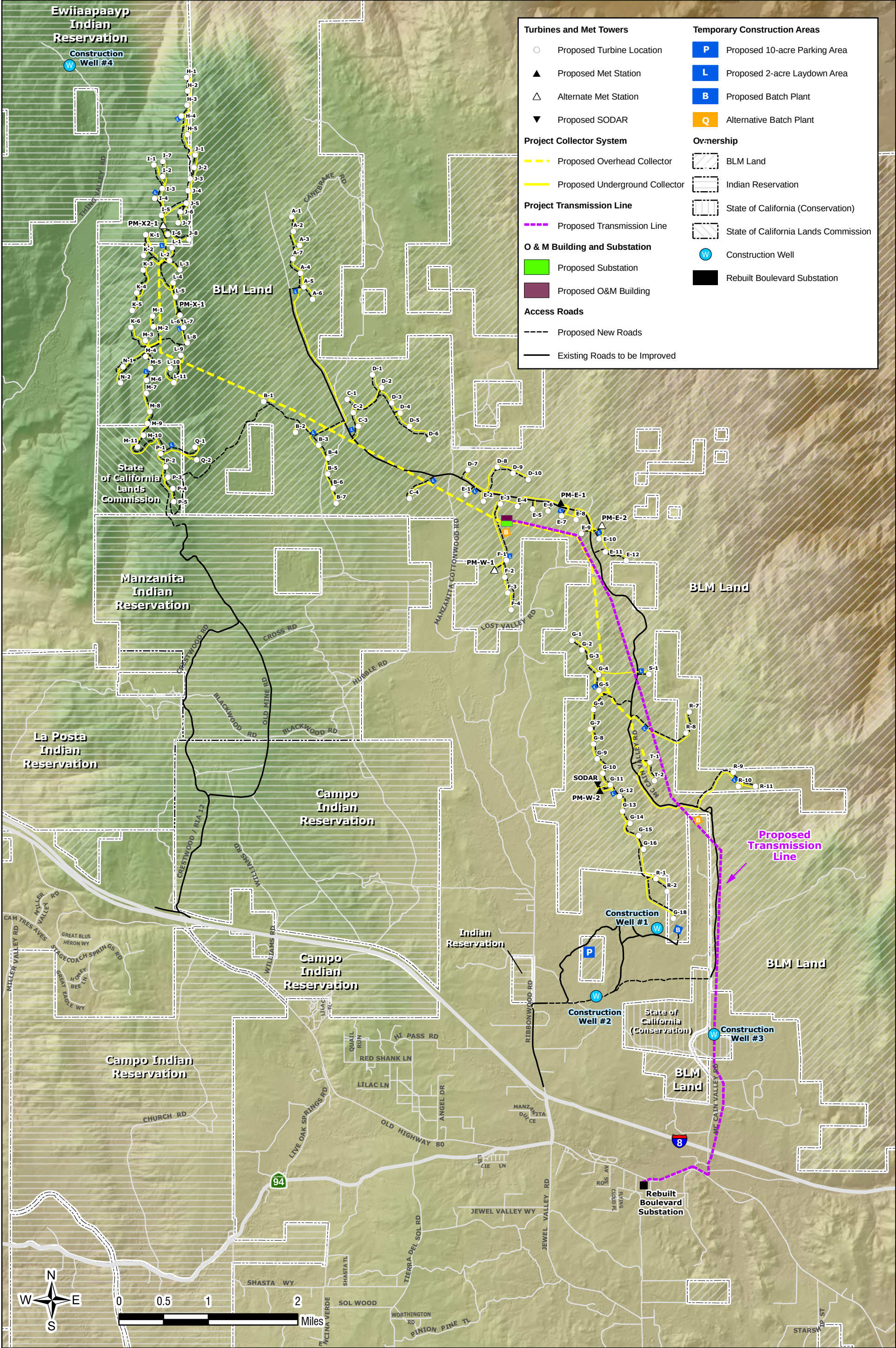


1.0 Project Description

Electrical collector lines for the Project will be a combination of overhead and buried, with a majority being buried. Overhead collector lines will be supported by single steel or wood poles; typically 60-feet to 80-feet in height. Foundation footprints for collector line poles will be similar to the diameter of the pole itself. Collector line temporary disturbed widths are assumed to be 24-feet to allow construction vehicle access and trenching or pole erection. Transmission lines will be carried by approximately 75-foot tall poles spaced 600-feet to 700-feet. Temporary transmission line disturbed areas are assumed to be 24-feet to allow construction vehicle access and pole erection. After construction native vegetation will be established over collector line and transmission line access roads. All buried collector lines will be completely re-vegetated.

Temporary parking lot, batch plant, and lay down areas will be re-vegetated to existing conditions and are not deemed a permanent impact. In addition, all naturally occurring vegetation around proposed grading and facilities will be returned to a naturally vegetated state upon completion of construction activities.

Project development will increase impervious areas by a very small amount. Each turbine pad represents approximately 360 square feet of impermeable area. Overall Project development proposes to increase impervious area by approximately 55,000 square feet or 0.3% for the overall 513 acre site. Permanent Project impacts investigated for drainage are approximately 513-acres.



2.0 DRAINAGE PATTERNS

Existing and proposed drainage patterns are defined below.

2.1 EXISTING DRAINAGE PATTERNS

A number of existing streams will convey flows generated by the Project. A majority of the Project drains to the east ultimately discharging into the Salton Sea. Approximately one sixth of the Project drains runoff to the west, ultimately discharging into the Pacific Ocean at the Tijuana Estuary.

A northeastern ridgeline crosses the easterly draining portions of the Project, dividing Salton Sea bound flows southwest into Tule Creek and northeast into Carrizo Wash, Bow Willow Creek, and Canebrake Wash. Approximately one third of the Project drains to Tule Creek via McCain Valley and Lark Canyon. Tule Creek flows are conveyed southeast into Tule Lake, which discharges into Tule Canyon, then converges with Carrizo Wash in Carrizo Gorge. Basin No. 100 and 200 drain to Canebrake Wash, a tributary to Vallecito Creek, which conveys flows into Carrizo Wash. Basin 1300 conveys flows southerly under Interstate 8 into Walker Creek, which then conveys flows northeasterly into Carrizo Wash. All flows in Carrizo Wash are then conveyed into San Felipe Creek and the Salton Sea. The Salton Sea is a minimum of approximately 45 miles downstream of the Project.

Westerly draining flows (Simmons Canyon, Unnamed Western Wash, and Basin No. 300 - 1000) are conveyed into La Posta Creek, which conveys flows into Cottonwood Creek, discharging into Lake Morena. The dam at Lake Morena discharges back into Cottonwood Creek, which then discharges into Barrett Lake. Barrett Lake dam releases flows back into Cottonwood Creek, which discharges into the Tijuana River and into the Pacific Ocean. Cottonwood creek is a natural unconfined stream. Lake Morena is a minimum of approximately 14 miles downstream of the Project.

Southerly draining flow (Basin No. 1100) is conveyed into Miller Creek, which conveys flows into Campo Creek, which then conveys into Tijuana River and into the Pacific Ocean. Both the Miller Creek and Campo Creek are natural streams.

2.1.1 Tule Creek Basin

Tule Creek Basin containing the Project site includes an expansive upstream area draining approximately 18,250 acres and has an approximately 12.1 mile long flow path. The highest upstream point in the basin is at approximately 5,800 feet and the downstream most point is at approximately 3,475 feet. Upper reaches of Tule Creek and its tributaries are generally fairly steep and confined to mountainous gullies. Tule Creek in the vicinity of the Project flattens out and takes on the form of a meandering stream in a wider valley with floodplains and flatter fields.

Runoff sheet flows across the ground surface until it encounters rivulets which then discharge into larger streams which ultimately discharge into Tule Creek. Precipitation that falls on typical access roads sheet flows off the side of the road where it is collected either in swales running parallel to the road or sheet flows across the surrounding terrain. Swales carry runoff to streams crossing the access road, where it is then conveyed to Tule Creek. There are no major improvements to the drainage features within the basin. However, a number of culverts have been installed on the northeast portion of the drainage basin to facilitate the construction of access roads across the smaller drainage features. An unnamed tributary to Tule Creek along the northeastern edge of the basin crosses a number of public and private roads via culverts just east of the landing strip. Crossings relevant to this Project include two 36-inch culverts for a private road and one 36-inch culvert for McCain

Valley Road. Several access roads utilize a depressed on grade type crossing, where flows are conveyed across the top of the road, rather than constructing culverts to carry flows under the road. An existing access road crossing Tule Creek within the Project limits near the downstream half of the basin has this type of crossing.

2.1.2 Bow Willow Creek North

Northern portions of the Project site lie within an approximately 2,747 acre basin, having an approximately 4.9 mile long flow path. The highest upstream point in the basin is at approximately 5,620 feet and the downstream most point is at approximately 3,930 feet. Upper reaches of Bow Willow Creek North and its tributaries are generally fairly steep and confined to mountainous gullies. The stream makes its way across a north to south fractured landscape, gaining flow from numerous tributaries. Flow continues generally to the southeast, where it leaves the limits of this study and merges with other washes to form Bow Willow Creek.

Runoff sheet flows across the ground surface until it encounters rivulets which then discharge into larger streams which ultimately discharge into Bow Willow Creek North. Precipitation that falls on typical access roads sheet flows off the side of the road where it is collected either in swales running parallel to the road or sheet flows across the surrounding terrain. Swales carry runoff to streams crossing the access road, where it is then conveyed to natural drainages. There are no major improvements to the drainage features within the basin.

2.1.3 Bow Willow Creek South

Northern portions of the Project site lie within an approximately 5197 acre basin, having an approximately 6.55 mile long flow path. The highest upstream point in the basin is at approximately 5,640 feet and the downstream most point is at approximately 3,410 feet. Upper reaches of Bow Willow Creek South and its tributaries are generally fairly steep and confined to mountainous gullies. The stream makes its way across a north to south fractured landscape, gaining flow from numerous tributaries. Flow continues generally to the southeast, where it leaves the limits of this study and merges with other washes to form Bow Willow Creek.

Runoff sheet flows across the ground surface until it encounters rivulets which then discharge into larger streams which ultimately discharge into Bow Willow Creek South. Precipitation that falls on typical access roads sheet flows off the side of the road where it is collected either in swales running parallel to the road or sheet flows across the surrounding terrain. Swales carry runoff to streams crossing the access road, where it is then conveyed to natural drainages. There are no major improvements to the drainage features within the basin.

2.1.4 Unnamed Northern Wash

Eastern portions of the Project site lie within an approximately 1542 acre basin that drains to an unnamed wash. Basin drainage has a maximum flow path of approximately 2.5 miles, with a maximum elevation of 4156 feet and a minimum elevation of 3765 feet. The Unnamed Northern Wash basin drains to confined mountainous gullies that are steep and rocky.

Drainage patterns are similar to the previously discussed basins; precipitation will sheet flow into small rivulets that will join with surrounding streams and eventually discharge into Carrizo Wash. Roads in the Unnamed Northern Wash basin are primarily double track trails and do not have any associated drainage improvements.

2.1.5 Unnamed Eastern Wash

Eastern portions of the Project site lie within an approximately 734 acre basin that drains to an unnamed wash. Basin drainage has a maximum flow path of approximately 1.9 miles, with a maximum elevation of 4,125 feet and a minimum elevation of 3,620 feet. The Unnamed Eastern Wash basin drains to confined mountainous gullies that are steep and rocky.

Drainage patterns are similar to the previously discussed basins; precipitation will sheet flow into small rivulets that will join with surrounding streams and eventually discharge into Carrizo Wash. Roads in the Unnamed Eastern Wash basin are primarily double track trails and do not have any associated drainage improvements.

2.1.6 Unnamed Western Wash

Western portions of the Project site lie within an approximately 1440 acre basin that drains to an unnamed wash. Basin drainage has a maximum flow path of 2.06 miles, with a maximum elevation of 4,795 feet and a minimum elevation of 4,140 feet. Upper reaches of Unnamed Western Wash and its tributaries are generally fairly steep and confined to mountainous gullies. The lower reaches are significantly less steep and are crossed numerous times by unimproved dirt tracks. A small earthen impoundment just outside of the study area creates ponding in the extreme lower reach.

Drainage patterns are similar to the previously discussed basins; precipitation will sheet flow into small rivulets that will join with surrounding streams and eventually leave the analyzed portion of the basin and discharge into La Posta Creek. Roads in the Unnamed Western Wash basin are primarily double track trails and do not have any associated drainage improvements.

2.1.7 Simmons Canyon

Western portions of the Project site lie within an approximately 878 acre basin that drains to Simmons Canyon Creek. Basin drainage has a maximum flow path of 2.19 miles, with a maximum elevation of 5,652 feet and a minimum elevation of 4,120 feet. The entire reach of Simmons Canyon and its tributaries are generally fairly steep and confined to mountainous gullies.

Drainage patterns are similar to the previously discussed basins; precipitation will sheet flow into small rivulets that will join with surrounding streams and eventually discharge into La Posta Creek. Roads in the Simmons Canyon basin are primarily double track trails and do not have any associated drainage improvements.

2.1.8 Basin 100 and 200

Basins 100 and 200 are approximately 86 and 375 acres, respectively in size and drain to Canebrake Wash, a tributary of Carrizo Wash. Both generally drain mountainous and rocky terrain to the north of the Project site and have maximum elevations of around 5665 feet.

Drainage patterns are similar to the previously discussed basins; precipitation will sheet into small rivulets, combining with other runoff, into larger and larger flows. These flows confluence into the major drainages of these basins and confluence to the major course of flow for the analyzed basin. There are few current roads in these basins and have no improved drainage features.

2.1.9 Basins 300 to 800

Basins 300 to 800 range in size from 73 to 475 acres and lie west of the Tecate Divide. These basins drain western portions of the project area, contributing flows to La Posta Creek. Beginning in

confined mountain ravines, these flows meet La Posta Creek in Thing Valley. Basins 300 to 500 are first to join La Posta Creek, and do so within a reach of less than 2000 feet. Basin 600 empties to La Posta Creek 4,500 feet below Basin 500, followed by Basin 700 1200 feet downstream. Basin 800 is the last to directly join La Posta Creek about a mile downstream of Basin 700.

Drainage patterns are similar to the previously discussed basins; precipitation will sheet into small rivulets, combing with other runoff, into larger and larger flows. These flows confluence into the major drainages of these basins and confluence to the major course of flow for the analyzed basin. There are few current roads in these basins and have no improved drainage features.

2.1.10 Basin 900 and 1000

Basins 900 and 100 are approximately 188 and 101 acres, respectively and drain western portions of the Project site. These basins contribute flows to Simmons Canyon Creek, a tributary to La Posta Creek. Both drain mountainous and rocky terrain, with maximum elevations of over 5600 feet. These two systems converge shortly downstream of the studied area, where they flow for approximately 2.5 miles prior to meeting Simmons Canyon Creek. After joining Simmons Canyon, these flows continue another 1.5 miles before joining La Posta Creek.

Drainage patterns are similar to the previously discussed basins; precipitation will sheet into small rivulets, combing with other runoff, into larger and larger flows. These flows confluence into the major drainages of these basins and confluence to the major course of flow for the analyzed basin. There are few current roads in these basins and have no improved drainage features.

2.1.11 Basin 1100

Basin 1100 is 635 acres in size and drains southern portions of the Project site, specifically an alternative access road leading from Interstate-8. The basin has a maximum elevation of 4,580 feet and a flow path of 1.52 miles. The main flow path flows through an open and gently sloped valley. The studied basin terminates upon intersection with Interstate-8, where flows pass via culvert.

Drainage patterns are similar to the previously discussed basins; precipitation will sheet flow into small rivulets that will join with surrounding streams and eventually merge to form the main flow leaving the studied area. Roads in the basin vary from double track trails to improved surface roads.

2.1.12 Basin 1200

A portion of the Project site is located in an approximately 484 acre basin that drains to Carrizo Gorge. The drainage basin has a maximum flow path of 1.5 miles with a maximum elevation of 4,065 feet and a minimum elevation of 3,200 feet. A ridge divides the basin into a northern and southern portion, each draining into two respective streams. Both streams then join at a confluence at the bottom of the drainage basin, as shown on Exhibit A. Topography for Basin 1200 is mountainous with streams confined in steep gullies.

Generally, drainage is similar to the Unnamed Basin East and other easterly draining basins; Rainfall sheet flows into rivulets and then into larger streams. Terrain is predominantly rocky and steep and will not provide substantial opportunity for infiltration. There are an extremely limited number of roads in the basin; most are single track trails. There are no existing improvements to the drainage features in the basin, given the limited amount of development in the basin.

2.1.13 Basin 1300

Portions of the Project are located in an approximately 71 acre basin immediately north of Interstate 8 surrounding Ribbonwood Road. Flows generated from Basin 1300 are conveyed southerly under Interstate 8 and into Walker Creek. Walker Creek flows to the east and discharges into Carizzo Wash, which conveys flows northerly.

Drainage from Basin 1300 is facilitated similarly to the rest of the Project, with rainfall sheet flowing into rivulets and then into larger streams. Terrain is somewhat flat with a number of scattered graded pads for rural houses and barns. Ribbonwood Road crosses through the basin along with a number of private rural access roads. There are a number of culvert crossings for access road crossing of minor drainages.

2.2 PROPOSED DRAINAGE PATTERNS

Proposed Project improvements will aim to mimic existing drainage patterns and will minimize redirection of any flows. Improvements include graded pads, access roads, utility lines, and engineered crossings at each drainage feature. Project improvements propose minimal additional impervious areas. Any increase in runoff resulting from these impacts is assumed to be negligible, from a flood impact standpoint, with water quality impacts addressed in the Storm Water Management Plan published under a separate cover by HDR.

2.2.1 Tule Creek Basin

Tule Creek Basin drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 0.95% of the area. Existing drainage patterns within the basin will be substantially maintained.

Access roads will be improved or created throughout the basin connecting multiple strings of turbines. McCain Valley road serves as a central corridor for this access. Drainage of access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 14,366 square feet impervious areas or 0.002% of basin total area). Impervious areas include the area of 40 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located mainly in the northeastern corner of the basin. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.2 Bow Willow Creek North

Bow Willow Creek North drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 1.1% of the area. Existing drainage patterns within the basin will be substantially maintained.

Two main roads are proposed to provide access to two strings of turbines. One parallels McCain Valley Road and the other is to follow the ridge on the western edge of the basin. Drainage of access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 3,771 square feet impervious areas or 0.003% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 10.5 turbine pads (some pads are located on basin boundaries). Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located mainly in the western and center of the basin, following the two strings of turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.3 Bow Willow Creek South

Bow Willow Creek South drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 1.6% of the area. Existing drainage patterns within the basin will be substantially maintained.

Access roads connect multiple strings of turbines, mainly to the west and south, roughly along the present course of McCain Valley Road. Drainage of access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 7,722 square feet impervious areas or 0.003% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 21.5 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located mainly in the western and southern portions of the basin, connecting the strings of turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.4 Unnamed Northern Wash Basin

Unnamed Northern Wash Basin drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 4.0% of the area. Existing drainage patterns within the basin will be substantially maintained.

Access roads connect multiple strings of turbine, mainly along the northern and western boundaries. As with most of the east basins, McCain Valley Road serves as the main corridor to which strings of turbines connect. Drainage of access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 13,849 square feet impervious areas or 0.02% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 13.5 turbine pads, 1 O&M facility and 1 substation. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines and the substation. Transmission lines leaving the substation are also proposed. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.5 Unnamed Eastern Wash Basin

Unnamed Eastern Wash Drainage Basin drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 1.6% of the area. Existing drainage patterns within the basin will be substantially maintained.

Access roads connect two strings of turbines, located roughly in the center of the basin. These connect to McCain Valley Road. Drainage of access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 1,077 square feet impervious areas or 0.003% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 3 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Transmission lines traverse the basin. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.6 Unnamed Western Basin Drainage Pattern

Unnamed Western Wash Drainage Basin drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 0.7% of the area. Existing drainage patterns within the basin will be substantially maintained.

Two existing access roads cross the site, North to South, and represent the only project improvements in the basin. There are no turbines, facilities, or transmission lines located in this basin. Precipitation falling on the exposed portions of the roads will sheet flow off the roads as under current conditions and flow into surrounding brow ditches/swales.

2.2.7 Simmons Canyon Basin

Simmons Canyon Basin drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 2.2% of the area. Existing drainage patterns within the basin will be substantially maintained.

Access roads connect two strings of turbines, located in the northern portion of the basin. Two other access roads cross the basin to the south. Drainage of access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 1,616 square feet impervious areas or 0.004% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 4.5 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.8 Basin 100

Basin 100 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 7.3% of the area. Existing drainage patterns within the basin will be substantially maintained.

Access roads connect a single string of turbines, located in the western edge of the basin. Drainage of access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 718 square feet impervious areas or 0.02% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 2 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.9 Basin 200

Basin 200 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 2.4% of the area. Existing drainage patterns within the basin will be substantially maintained.

Access roads connect a single string of turbines, located in the eastern edge of the basin. Drainage of this access road will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 1,077 square feet impervious areas or 0.007% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 3 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.10 Basin 300

Basin 300 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 8.5% of the area. Existing drainage patterns within the basin will be substantially maintained.

Access roads connect two strings of turbines, located in the center and eastern edge of the basin. Drainage of access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 1,975 square feet impervious areas or 0.02% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 5.5 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.11 Basin 400

Basin 400 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 1.5% of the area. Existing drainage patterns within the basin will be substantially maintained.

A single access road connects one turbine located on the basin boundary. Drainage of this access road will be facilitated by brow ditches/swales parallel to the proposed road, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 539 square feet impervious areas or 0.02% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 1.5 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff

will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.12 Basin 500

Basin 500 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 6.9% of the area. Existing drainage patterns within the basin will be substantially maintained.

Access roads connects two strings of turbines located though the center and on the basin's eastern boundary. Drainage of these access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 1,077 square feet impervious areas or 0.01% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 3 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.13 Basin 600

Basin 600 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 2.1% of the area. Existing drainage patterns within the basin will be substantially maintained.

A single access road connects one string of turbines located on the basin's eastern boundary. Drainage of this access road will be facilitated by brow ditches/swales parallel to the proposed road, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 359 square feet impervious areas or 0.005% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 1 turbine pad. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.14 Basin 700

Basin 700 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 2.8% of the area. Existing drainage patterns within the basin will be substantially maintained.

A single access road connects one string of turbines located on the basin's eastern boundary. Drainage of this access road will be facilitated by brow ditches/swales parallel to the proposed road, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 359 square feet impervious areas or 0.01% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 1 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.15 Basin 800

Basin 800 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 8.1% of the area. Existing drainage patterns within the basin will be substantially maintained.

Multiple access roads connect strings of turbines located on the basin's northern, eastern, and southern boundary. Drainage of these access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 4,310 square feet impervious areas or 0.02% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 12 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.16 Basin 900

Basin 900 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 6.5% of the area. Existing drainage patterns within the basin will be substantially maintained.

A single access road connects one string of turbines located on the basin's northern boundary. Drainage of this access road will be facilitated by brow ditches/swales parallel to the proposed road, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 1,257 square feet impervious areas or 0.02% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 3.5 turbine pad. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.17 Basin 1000

Basin 1000 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 1.9% of the area. Existing drainage patterns within the basin will be substantially maintained.

A single access road connects one string of turbines located on the basin's northern boundary. Another access road traverses the basin north to south through the center. Drainage of these access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 180 square feet impervious areas or 0.004% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 0.5 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.18 Basin 1100

Basin 1100 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 0.8% of the area. Existing drainage patterns within the basin will be substantially maintained.

A single access road connects traverses the basin from north to south, roughly in the center. The road is to be improved, but currently exists. Drainage of this access road will be facilitated by brow ditches/swales parallel to the road, which will convey flows to existing surface drainage features, as it does currently. There are no turbines, facilities, or transmission lines located in this basin.

2.2.19 Basin 1200

Basin 1200 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 1.2% of the area. Existing drainage patterns within the basin will be substantially maintained.

A single access road connects one string of turbines located on the basin's northern boundary. Drainage of this access road will be facilitated by brow ditches/swales parallel to the proposed road, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 718 square feet impervious areas or 0.003% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of 2 turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.20 Basin 1300

Basin 1300 drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 1.4% of the area. Existing drainage patterns within the basin will be substantially maintained.

Improvements will be completed to Ribbonwood Road, which will maintain the existing alignment. Drainage of the improved Ribbonwood Road will remain unchanged, with existing flow patterns maintained. There are no turbines, facilities, or transmission lines located in this basin.

3.0 HYDROLOGY

Hydrologic analysis was completed for the entire project area in order to determine a baseline existing condition and to account for changes due to proposed development. The three distinct watersheds dividing the project area were studied for existing and proposed conditions. Sub-basins formed by grading and requiring a hydraulically designed road crossing structure were analyzed under proposed conditions.

3.1 HYDROLOGY METHODOLOGY

Existing and proposed hydrology calculations were both completed per the *San Diego County Hydrology Manual*, June 2003 Rational Method criteria. A summary of the hydrology criteria is presented in Table 2. Appendix A contains *County of San Diego Hydrology Manual* runoff coefficient, rainfall intensity, and overland flow time of concentration figures used in calculations.

Table 1: Hydrology Methodology

Land Use:	SANDAG provided land use overlay dated 2009 and associated cover descriptions in Table 4-2 of 2003 <i>County of San Diego Hydrology Manual</i> .
Precipitation Zone Number	Per PZN Map (Appendix C) of 2003 <i>County of San Diego Hydrology Manual</i> .
Design Storm:	100 year.
Rainfall Intensity:	Per Isopluvial Maps (Appendix B) of 2003 <i>County of San Diego Hydrology Manual</i> .
Soil Data:	NRCS, SSURGO Database
Topographic Data:	2' Project Flown Contours 20' IFSAR Topo provided by SANDAG

Land use was defined based on data provided by SANDAG, which was then used to select the runoff coefficient from Table 4-2 of the *County of San Diego Hydrology Manual*. Soil type data was derived from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) Database for California. Rainfall intensities and Precipitation Zone Numbers (PZN) were taken from Appendices B and C of the *County of San Diego Hydrology Manual*, respectively.

ArcMap 9.3.1 was utilized to process all geographic data and to determine appropriate inputs for hydrologic modeling. Existing and proposed drainage basins, flow paths and basin area centroids were all developed within ArcMap. The hydrologic modeling was completed through the use of Civil Design Hydrology software (Civild) and the San Diego County specific module.

3.2 EXISTING CONDITIONS

3.2.1 Universal Unit Hydrograph

The Universal Unit Hydrograph Method was used to analyze all nodes with basins larger than 640 acres. Basin areas, flow path lengths and length to centroid values were all determined using ArcMap.

Area averaged rainfall intensities were determined for each individual basin for the 100-year 24-hour and 100-year 6-hr events. Precipitation zone numbers (PZN), important in San Diego County's method for curve number adjustment, were interpolated for each basin using the basin area centroid.

An area averaged composite runoff curve number (CN) was determined for each basin through tabulating data for combinations of land use and soil type. Land use information was matched to the

cover descriptions assigned in the *County of San Diego Hydrology Manual*, Table 4-2 and were verified through site visits. Curve numbers were manually adjusted per Tables 4-6 and Table 4-10 of the *County of San Diego Hydrology Manual*, using the interpolated PZN values.

Basin lag time was entered into CivilD directly and calculated independently using the United States Army Corps of Engineers (Corps lag) empirical equation, as referenced in *County of San Diego Hydrology Manual*.

Separate hydrologic models were created for the 100-year 24-hour and 100-year 6-hr events, with the intent of determining the maximum peak discharge of the two.

3.2.2 Rational Method

The San Diego County 2003 Rational Method program within CivilD was utilized in calculating runoff for all basins smaller than 640 acres in size. Initial areas and basin subareas were developed within ArcMap per the *County of San Diego Hydrology Manual*.

The 6-hr and 24-hour rainfall intensities were determined through the interpolation of isopluvial information using the basin area centroid.

Land use development type was assumed to be low density residential, specifically, one density unit per acre or less, with an impervious fraction of 10%. Per the *County of San Diego Hydrology Manual* this is the land use type to be used for open undeveloped areas. Soil type data was again derived from the NRCS SSURGO Database and analyzed for each basin subarea for model input.

3.3 PROPOSED CONDITIONS

3.3.1 Universal Unit Hydrograph

Identical methods and assumptions were made for proposed conditions Unit Hydrograph analysis. Disturbed areas due to proposed conditions were assumed to be bare earth for the cover description. Composite curve numbers were recalculated to account for proposed conditions. It was determined that the PZN adjusted curve numbers for input into CivilD were within rounding error of the existing condition curve numbers and therefore proposed conditions results did not vary from existing conditions results (see Appendix D). As stated in the Section 1.0 Project Description, drainage analysis conservatively included the cumulative proposed impacts from multiple alternatives. This is a further indication that actual differences between existing and proposed conditions are even closer than the rounding errors determined in this study, and again indicating that drainage patterns within the Project area will be maintained. See Appendices B and D to review existing and proposed summaries.

3.3.2 Rational Method

Identical methods and assumptions were made for proposed conditions Rational Method analysis. Existing conditions assumed a land use development type of low density residential, specifically, one density unit per acre or less, with an impervious fraction of 10%. Proposed conditions would not increase developed density or impervious fraction past the 10% threshold, and therefore proposed condition results would not vary from existing conditions results. Existing drainage patterns within the Project area will be maintained.

3.4 HYDROLOGY RESULTS

Existing condition hydrology results are summarized for each major drainage basin/system in Table 3 and Table 4. Per *County of San Diego Hydrology Manual* methodology, inputs for modeling proposed conditions did not vary from existing conditions. As such existing and proposed runoff was identical. Due to small overall project footprint, even smaller impervious area increases, and the imprecise nature of current hydrologic modeling, this conclusion is justified. See Appendix C for CivilD output.

Table 2: Existing Conditions Hydrology Results, Unit Hydrograph

Basin	Area (acres)	Adjusted PZN (>35yr)	Adjusted CN (>35yr)	Peak Flow (cfs)
Tule Creek	18250	2.58	82	12730
Bow Willow Creek North	2747	2.63	90	3058
Bow Willow Creek South	5197	2.60	88	8127
Northern Unnamed Wash	1542	2.49	83	1428
Eastern Unnamed Wash	734	2.45	85	808
Western Unnamed Wash	1440	2.70	80	2052
Simmons Canyon	878	2.77	89	1684

Table 3: Existing Conditions Hydrology Results, Rational Method

Basin / System	Area (acres)	Effective C Value	Discharge (cfs)
100	86.22	0.36	138.5
200	375.66	0.384	736.254
300	241.52	0.358	239.447
400	73.46	0.372	195.488
500	191.71	0.365	320.324
600	164.61	0.345	412.396
700	122.03	0.342	295.442
800	475.25	0.351	710.737
900	188.92	0.355	336.506
1000	102.10	0.36	200.22
1100	635.56	0.315	759.278
1200	485.64	0.393	422.228
1300	70.62	0.32	67.93

4.0 CONCLUSION

Based on a preliminary investigation of the proposed Project plan and the existing drainage patterns, impacts from proposed development are less than significant. Project development will not significantly affect existing drainage patterns and the amount of redirected flows will be minimal. Increases in runoff resulting from low frequency storm events associated with flooding will be less than significant, due to the limited amount of proposed impervious area.

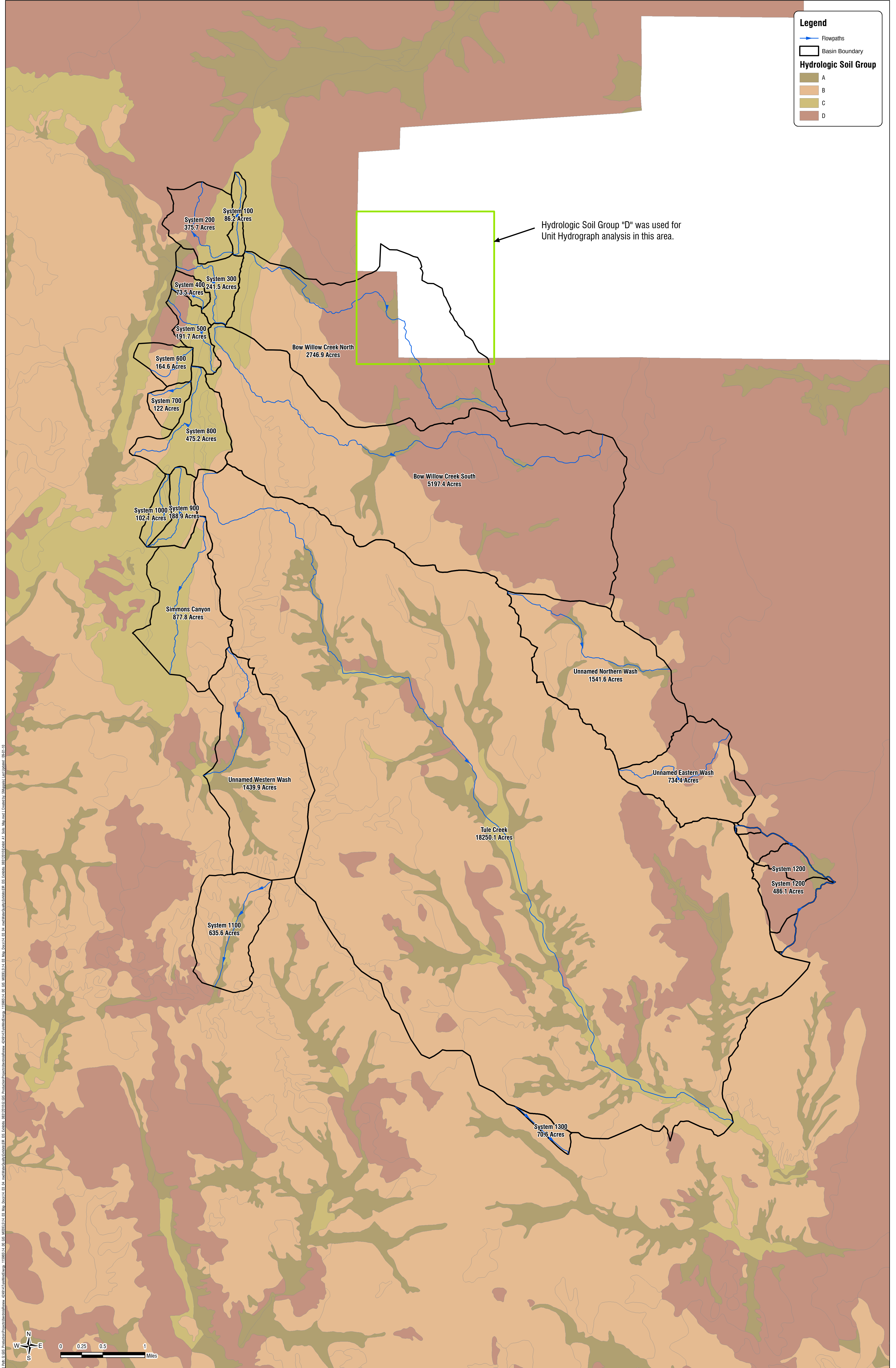
Additional hydrologic and hydraulic analysis will be completed for the Project to determine flow rates at specific locations within the studied basins in order to size proposed drainage facilities.

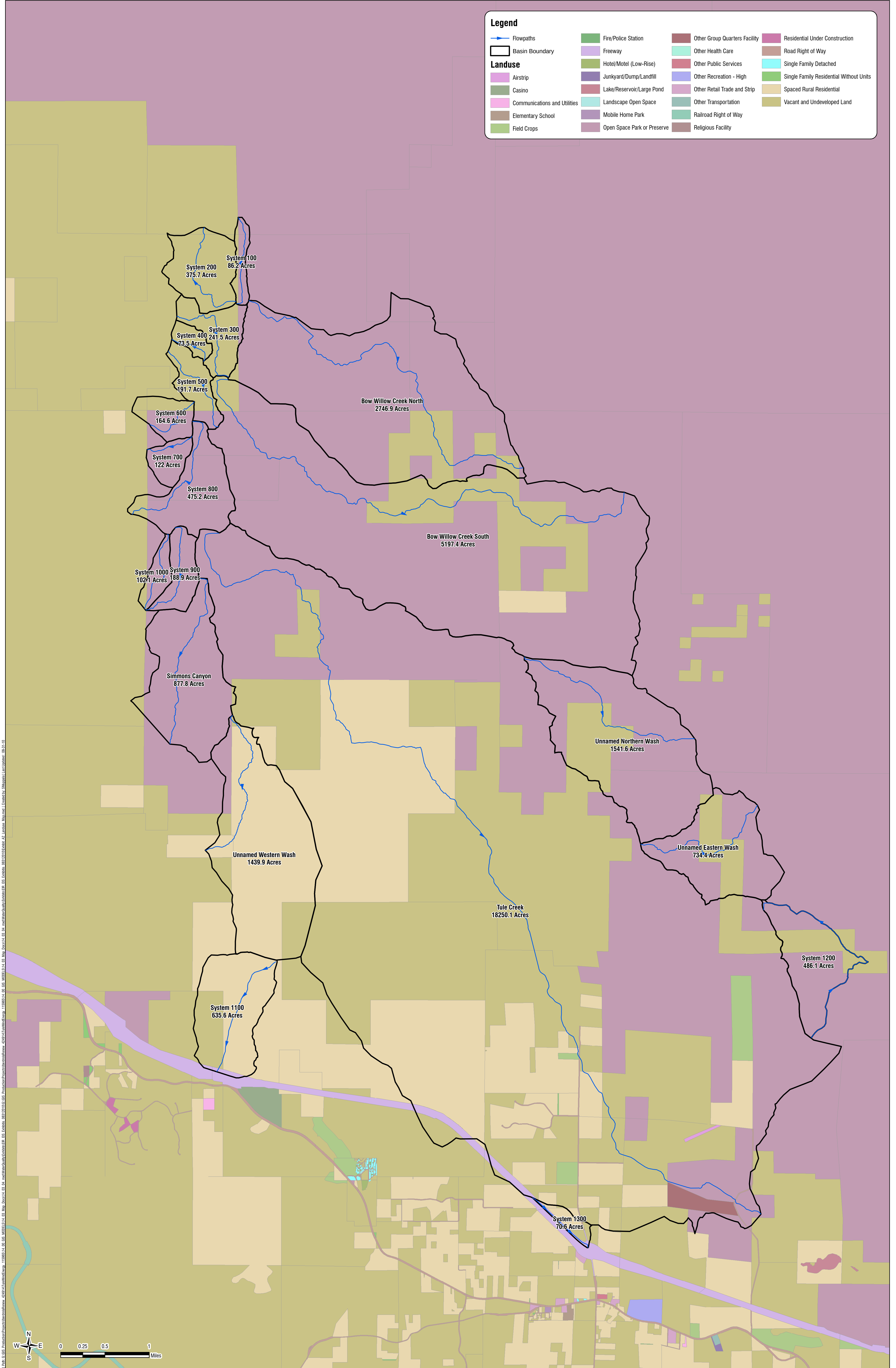
Tule Wind Project Preliminary EIS/EIR Drainage Report

APPENDIX A – Hydrology Exhibits

Exhibits A-1: Soils

Exhibits A-2: Land Use





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APPENDIX B – Existing Conditions Hydrology Summary Tables



Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

No: Rev 1

Existing Conditions, Unit Hydrograph

Watershed Loss

Watershed	A (mi ²)	A (ac)	CN (AMC II)	PZN	PZN (>35yr)	CN (>35yr)	Soil Type
Tule Creek	28.52	18250	74	3.42	2.58	82	2.1
Bow Willow Creek North	4.29	2747	84	3.37	2.63	90	3.3
Bow Willow Creek South	8.12	5197	81	3.40	2.60	88	3.0
Northern Unnamed Wash	2.41	1542	76	3.51	2.49	83	2.1
Eastern Unnamed Wash	1.15	734	80	3.55	2.45	85	2.7
Western Unnamed Wash	2.25	1440	69	3.30	2.70	80	2.0
Simmons Canyon	1.37	878	80	3.23	2.77	89	2.5

Watershed Lag Time

Watershed	Elev US (ft)	Elev DS (ft)	L (mi)	Lca (mi)	Slope (ft/mi)	Basin n	m	lag (hr)
Tule Creek	5802.5	3473	12.13	5.14	192	0.040	0.38	1.70
Bow Willow Creek North	5620	3930	4.91	2.33	344	0.040	0.38	0.80
Bow Willow Creek South	5642	3410	6.55	2.65	341	0.040	0.38	0.94
Northern Unnamed Wash	4156	3765	2.51	0.83	156	0.040	0.38	0.49
Eastern Unnamed Wash	4125	3620	1.91	0.74	265	0.040	0.38	0.38
Western Unnamed Wash	4795	4140	2.06	0.43	318	0.040	0.38	0.31
Simmons Canyon	5652	4120	2.19	0.79	701	0.040	0.38	0.34

Precipitation Data

Watershed	100Yr 6Hr	100Yr 24Hr
Tule Creek	3.36	6.41
Bow Willow Creek North	3.26	6.43
Bow Willow Creek South	3.37	9.70
Northern Unnamed Wash	3.00	6.31
Eastern Unnamed Wash	3.00	5.40
Western Unnamed Wash	3.92	5.01
Simmons Canyon	4.12	8.00

$$lag = 24n \left(\frac{L \bullet L_{ca}}{S^{0.5}} \right)^m$$

Hydrology Results (Civil D), cfs

Watershed	100Yr 6Hr	100Yr 24Hr
Tule Creek	8790.33	12729.94
Bow Willow Creek North	3058.28	2843.87
Bow Willow Creek South	5059.61	8126.84
Northern Unnamed Wash	1328.54	1428.08
Eastern Unnamed Wash	808.32	597.93
Western Unnamed Wash	2051.85	909.54
Simmons Canyon	1683.55	1240.35

HDR	Project: Tule Wind
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Existing Conditions, Rational Method

System	Leg (HDR Node to HDR Node)	Acres	Reach Length	US Elevation	DS Elevation	Soil Group	Soil Group Fraction	Precip 100Yr-6Hr	Precip 100Yr-24Hr	100 Year Runoff
100	Initial Area	0.09	76.2	5664.0	5644.0	C	1.00	3.53	7.84	138.5
	100.2 to 100.3	3.96	456.0	5644.0	5557.0	C	1.00			
	100.3 to 100.4	38.30	2269.6	5557.0	5380.0	C	1.00			
	100.4 to 100.5	43.87	2897.5	5380.0	4272.0	C	1.00			
	Total Basin Area	86.22								
200	Initial Area	0.10	68.1	5677.0	5665.4	C	1.00	3.75	8.60	736.3
	200.2 to 200.3	5.00	639.0	5665.4	5460.0	C	1.00			
	200.3 to 200.4	58.69	2637.2	5460.0	4797.3	C	0.89			
						D	0.11			
	200.4 to 200.5	311.66	3957.3	4797.3	3885.0	A	0.03			
	Total Basin Area					B	0.04			
						C	0.29			
300	Initial Area	0.04	44.6	5636.0	5623.5	C	1.00	3.82	8.82	239.45
	300.2 to 300.3	3.70	772.3	5623.5	5460.0	C	1.00			
	300.3 to 300.4	70.36	2622.1	5460.0	5347.3	C	1.00			
	300.4 to 300.5	167.42	3682.2	5347.3	4840.0	A	0.11			
	Total Basin Area	241.52				C	0.75			
400	Initial Area	0.04	75.2	5513.5	5501.0	C	1.00	3.98	9.31	195.5
	400.2 to 400.3	8.45	739.5	5501.0	5346.8	C	1.00			
	400.3 to 400.4	64.98	1933.8	5346.8	4800.0	A	0.11			
	Total Basin Area	73.46				C	0.41			
						D	0.48			
500	Initial Area	0.07	71.9	5535.0	5529.5	C	1.00	4.06	9.44	320.3
	500.2 to 500.3	17.34	1056.7	5529.5	5491.5	B	0.24			
						C	0.76			
	500.3 to 500.4	59.58	2216.7	5491.5	5361.5	B	0.03			
						C	0.97			
	500.4 to 500.5	114.72	2975.1	5361.5	4800.0	A	0.09			
	Total Basin Area	191.71				C	0.53			
600	Initial Area	0.06	69.4	5666.7	5656.0	C	1.00	4.24	10.00	412.4
	600.2 to 600.3	7.27	749.7	5656.0	5480.5	C	1.00			
	600.3 to 600.4	157.28	2981.0	5480.5	4740.0	B	0.48			
	Total Basin Area	164.61				C	0.44			
						D	0.08			
700	Initial Area	0.04	85.6	5566.0	5558.0	C	1.00	4.27	9.95	295.4
	700.2 to 700.3	4.61	671.7	5558.0	5292.3	C	1.00			
	700.3 to 700.4	117.37	2270.0	5292.3	4740.5	B	0.46			
	Total Basin Area	122.03				C	0.54			
800	Initial Area	0.09	71.7	5675.0	5658.5	C	1.00	4.19	9.56	710.7
	800.2 to 800.3	3.46	759.0	5658.5	5519.3	C	1.00			
	800.3 to 800.4	35.24	2005.0	5519.3	5451.8	C	1.00			
	800.4 to 800.5	286.60	2536.5	5451.8	5341.8	B	0.13			
						C	0.87			
	800.5 to 800.6	149.86	3795.3	5341.8	4670.0	B	0.47			
	Total Basin Area	475.25				C	0.53			
900	Initial Area	0.06	76.5	5646.5	5634.8	C	1.00	4.25	9.55	336.5
	900.2 to 900.3	6.99	788.8	5634.8	5455.7	C	1.00			
	900.3 to 900.4	74.82	2298.3	5455.7	5217.5	B	0.10			
						C	0.90			
	900.4 to 900.5	107.05	3731.4	5217.5	4931.7	B	0.14			
1000	Initial Area	0.04	74.9	5684.0	5674.5	C	1.00	4.32	9.76	200.2
	1000.2 to 1000.3	10.59	1283.0	5674.5	5350.0	C	1.00			
	1000.3 to 1000.4	91.22	3982.2	5350.0	4927.5	C	1.00			
	Total Basin Area	101.85								
1100	Initial Area	0.15	76.5	4580.0	4570.8	B	1.00	3.76	7.38	759.3
	1100.2 to 1100.3	26.79	1661.7	4570.8	4441.0	B	1.00			
	1100.3 to 1100.4	278.62	2733.0	4441.0	4230.3	A	0.12			
						B	0.87			
						C	0.01			
	1100.4 to 1100.5	330.00	3542.3	4230.3	4140.0	A	0.15			
	Total Basin Area	635.56	8013.5			B	0.83			
1200	Initial Area	0.63	307.19	4047.50	4025.00			3.00	5.05	422.2
	1200.2 to 1200.5	211.79	7965.33	4025.00	3200.0	A	0.07			
						B	0.13			
						D	0.80			
	Initial Area	0.6	203.19	3965.00	3935.00					
	1200.4 to 1200.5	272.62	6390.38	3935.00	3200.0	A	0.04			
	Total Basin Area	485.64				B	0.12			
1300	Initial Area	0.38	339.6	3807.0	3800.0	B	1.00	3.03	5.40	67.9
	1300.2 to 1300.3	9.41	1338.8	3800.0	3720.0	B	1.00			
	1300.3 to 1300.4	60.82	2883.3	3720.0	3614.0	B	1.00			
	Total Basin Area	70.62								

Tule Wind Project Preliminary EIS/EIR Drainage Report

APPENDIX C – Existing Conditions CivilD Output

Tule100yr6hr.out

UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: tule100yr6hr.out

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Program License Serial Number 4055

Tule Wind Project
Tule Creek
Existing 100 Year 6 Hour
Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
18250.00	3.36

Rainfall Distribution pattern used in study:
Type B for SCS (small dam) or San Diego 6 hour storms

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***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
18250.00	1.000	82.0	82.0	0.050	B

Area-averaged catchment SCS Curve Number AMC(2) = 81.960
Area-averaged Fm value using values listed = 0.050(In/Hr)

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Direct entry of lag time by user
Watershed area = 18250.00(Ac.)
Catchment Lag time = 1.700 hours
Unit interval = 15.000 minutes
Unit interval percentage of lag time = 14.7059
Hydrograph baseflow = 0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 81.960

Rainfall depth area reduction factors:
Using a total area of 18250.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 0.974
Rainfall entered for study = 3.360(In)
Adjusted rainfall = 3.272(In)

Tule100yr6hr.out

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

UNIT HYDROGRAPH

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
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Tule100yr6hr.out
(K = 73608.33 (CFS))

0.15	0.250	0.016	179.694	0.002
0.29	0.500	0.051	575.802	0.010
0.44	0.750	0.117	1315.646	0.028
0.59	1.000	0.256	2889.871	0.067
0.74	1.250	0.632	7133.846	0.164
0.88	1.500	0.934	10536.976	0.307
1.03	1.750	1.000	11283.813	0.461
1.18	2.000	0.830	9370.747	0.588
1.32	2.250	0.571	6441.859	0.676
1.47	2.500	0.453	5115.019	0.745
1.62	2.750	0.355	4007.166	0.800
1.76	3.000	0.283	3187.900	0.843
1.91	3.250	0.229	2582.427	0.878
2.06	3.500	0.187	2104.743	0.906
2.21	3.750	0.152	1711.233	0.930
2.35	4.000	0.124	1401.420	0.949
2.50	4.250	0.098	1107.826	0.964
2.65	4.500	0.077	868.940	0.976
2.79	4.750	0.060	671.923	0.985
2.94	5.000	0.043	484.343	0.991
3.09	5.250	0.033	375.400	0.996
3.24	5.500	0.018	198.006	0.999
3.38	5.750	0.006	63.670	1.000
3.53	6.000	0.000	0.061	1.000

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For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

where:

Q = direct runoff, P = depth of precipitation, I_a = Initial Abstraction and S is the watershed storage in inches. S and I_a are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad I_a = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In)	Total SCS Runoff (In)	Rainfall Amount (In)	Runoff Amount (In)	Infiltration (In)	Revised Runoff Min Loss Rate
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	P	Q	Tule100yr6hr.out dP	dQ	dP-dQ	
0.25	0.0573	0.0000	0.0573	0.0000	0.0573	-----
0.50	0.1145	0.0000	0.0573	0.0000	0.0573	-----
0.75	0.1914	0.0000	0.0769	0.0000	0.0769	-----
1.00	0.2683	0.0000	0.0769	0.0000	0.0769	-----
1.25	0.3632	0.0000	0.0949	0.0000	0.0949	-----
1.50	0.4581	0.0001	0.0949	0.0001	0.0948	-----
1.75	0.6054	0.0115	0.1473	0.0114	0.1359	-----
2.00	0.7527	0.0388	0.1473	0.0273	0.1200	-----
2.25	1.3580	0.2701	0.6054	0.2313	0.3741	-----
2.50	1.9634	0.6230	0.6054	0.3529	0.2525	-----
2.75	2.1271	0.7319	0.1636	0.1089	0.0547	-----
3.00	2.2907	0.8452	0.1636	0.1133	0.0503	-----
3.25	2.4232	0.9398	0.1325	0.0947	0.0379	-----
3.50	2.5557	1.0368	0.1325	0.0970	0.0356	-----
3.75	2.6441	1.1026	0.0884	0.0658	0.0225	-----
4.00	2.7325	1.1694	0.0884	0.0667	0.0216	-----
4.25	2.8061	1.2256	0.0736	0.0562	0.0174	-----
4.50	2.8797	1.2824	0.0736	0.0568	0.0168	-----
4.75	2.9501	1.3372	0.0704	0.0548	0.0156	-----
5.00	3.0204	1.3924	0.0704	0.0552	0.0151	-----
5.25	3.0810	1.4403	0.0605	0.0479	0.0127	-----
5.50	3.1415	1.4885	0.0605	0.0482	0.0124	-----
5.75	3.2070	1.5409	0.0654	0.0524	0.0130	-----
6.00	3.2724	1.5937	0.0654	0.0528	0.0127	-----

Total soil rain loss = 1.68(In)
Total effective runoff = 1.59(In)

Peak flow rate this hydrograph = 8790.33(CFS)
Total runoff volume this hydrograph = 105575794.9(Ft3)

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6 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2200.0	4400.0	6600.0	8800.0
0+15	0.0000	0.00	Q				
0+30	0.0000	0.00	Q				
0+45	0.0000	0.00	Q				
1+ 0	0.0000	0.00	Q				
1+15	0.0000	0.00	Q				
1+30	0.0005	0.03	Q				
1+45	0.0445	2.13	Q				
2+ 0	0.2853	11.65	Q				
2+15	1.7869	72.68	Q				
2+30	7.2918	266.44	VQ				
2+45	21.5208	688.68	V	Q			
3+ 0	53.1750	1532.06	V	Q			
3+15	121.6185	3312.66	V	V	Q		
3+30	243.6367	5905.68		V		Q	
3+45	407.9811	7954.27		V			Q
4+ 0	589.5995	8790.33		V			Q
4+15	765.1249	8495.43		V			Q
4+30	928.5726	7910.87			V		Q
4+45	1083.1311	7480.63			V		Q
5+ 0	1226.9882	6962.68			V	Q	

			Tule100yr6hr.out			
5+15	1360.4103	6457.63			v	Q
5+30	1484.4980	6005.84			v	Q
5+45	1601.0315	5640.22			Qv	
6+ 0	1711.1007	5327.35			Q	v
6+15	1815.2382	5040.26			Q	v
6+30	1913.3419	4748.22			Q	
6+45	2005.6635	4468.36			Q	
7+ 0	2091.5144	4155.19				v
7+15	2167.2394	3665.09				v
7+30	2229.3862	3007.91		Q		v
7+45	2276.8745	2298.43		Q		v
8+ 0	2312.3371	1716.39		Q		v
8+15	2339.6758	1323.19		Q		v
8+30	2360.8722	1025.91		Q		v
8+45	2377.2859	794.42		Q		v
9+ 0	2389.9841	614.59		Q		v
9+15	2399.7394	472.15		Q		v
9+30	2407.1586	359.09		Q		v
9+45	2412.6999	268.20		Q		v
10+ 0	2416.7241	194.77		Q		v
10+15	2419.5508	136.81		Q		v
10+30	2421.4502	91.93		Q		v
10+45	2422.6451	57.83		Q		v
11+ 0	2423.3323	33.26		Q		v
11+15	2423.6172	13.79		Q		v
11+30	2423.6867	3.36		Q		v
11+45	2423.6868	0.00		Q		v

Tule100yr24hr.out

UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: tule100yr24hr.out

Program License Serial Number 4055

Tule Wind Project
Tule Creek
Existing 100 Year 24 Hour
Aug 25, 2010

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
Sub-Area(Ac.) Rainfall (In)
18250.00 6.41

Rainfall Distribution pattern used in study:
Type B for San Diego area of California

***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
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Area-averaged catchment SCS Curve Number AMC(2) = 81.960
Area-averaged Fm value using values listed = 0.050(In/Hr)

Direct entry of lag time by user
Watershed area = 18250.00(Ac.)
Catchment Lag time = 1.700 hours
Unit interval = 15.000 minutes
Unit interval percentage of lag time = 14.7059
Hydrograph baseflow = 0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 81.960

Rainfall depth area reduction factors:
Using a total area of 18250.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 0.974
Rainfall entered for study = 6.410(In)
Adjusted rainfall = 6.243(In)

Tule100yr24hr.out

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

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0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
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UNIT HYDROGRAPH

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
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Tule100yr24hr.out
(K = 73608.33 (CFS))

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1.47	2.500	0.453	5115.019	0.745
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1.76	3.000	0.283	3187.900	0.843
1.91	3.250	0.229	2582.427	0.878
2.06	3.500	0.187	2104.743	0.906
2.21	3.750	0.152	1711.233	0.930
2.35	4.000	0.124	1401.420	0.949
2.50	4.250	0.098	1107.826	0.964
2.65	4.500	0.077	868.940	0.976
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2.94	5.000	0.043	484.343	0.991
3.09	5.250	0.033	375.400	0.996
3.24	5.500	0.018	198.006	0.999
3.38	5.750	0.006	63.670	1.000
3.53	6.000	0.000	0.061	1.000

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For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

where:

Q = direct runoff, P = depth of precipitation, I_a = Initial Abstraction and S is the watershed storage in inches. S and I_a are given by the following equations:

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Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In)	Total SCS Runoff (In)	Rainfall Amount (In)	Runoff Amount (In)	Infiltr- ation (In)	Revised Runoff Min Loss Rate
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	Tule100yr24hr.out					
	P	Q	dP	dQ	dP-dQ	
0.25	0.0281	0.0000	0.0281	0.0000	0.0281	-----
0.50	0.0562	0.0000	0.0281	0.0000	0.0281	-----
0.75	0.0780	0.0000	0.0219	0.0000	0.0219	-----
1.00	0.0999	0.0000	0.0219	0.0000	0.0219	-----
1.25	0.1280	0.0000	0.0281	0.0000	0.0281	-----
1.50	0.1561	0.0000	0.0281	0.0000	0.0281	-----
1.75	0.1842	0.0000	0.0281	0.0000	0.0281	-----
2.00	0.2123	0.0000	0.0281	0.0000	0.0281	-----
2.25	0.2466	0.0000	0.0343	0.0000	0.0343	-----
2.50	0.2809	0.0000	0.0343	0.0000	0.0343	-----
2.75	0.3090	0.0000	0.0281	0.0000	0.0281	-----
3.00	0.3371	0.0000	0.0281	0.0000	0.0281	-----
3.25	0.3715	0.0000	0.0343	0.0000	0.0343	-----
3.50	0.4058	0.0000	0.0343	0.0000	0.0343	-----
3.75	0.4432	0.0000	0.0375	0.0000	0.0375	-----
4.00	0.4807	0.0007	0.0375	0.0007	0.0367	-----
4.25	0.5213	0.0029	0.0406	0.0021	0.0384	-----
4.50	0.5619	0.0064	0.0406	0.0035	0.0371	-----
4.75	0.6056	0.0116	0.0437	0.0052	0.0385	-----
5.00	0.6493	0.0181	0.0437	0.0066	0.0371	-----
5.25	0.6992	0.0273	0.0499	0.0091	0.0408	-----
5.50	0.7491	0.0380	0.0499	0.0108	0.0392	-----
5.75	0.8022	0.0511	0.0531	0.0131	0.0400	-----
6.00	0.8553	0.0659	0.0531	0.0147	0.0383	-----
6.25	0.9177	0.0851	0.0624	0.0193	0.0432	-----
6.50	0.9801	0.1064	0.0624	0.0212	0.0412	-----
6.75	1.0519	0.1330	0.0718	0.0267	0.0451	-----
7.00	1.1237	0.1620	0.0718	0.0289	0.0429	-----
7.25	1.2174	0.2028	0.0936	0.0408	0.0528	-----
7.50	1.3110	0.2468	0.0936	0.0441	0.0496	-----
7.75	1.4515	0.3183	0.1405	0.0715	0.0690	-----
8.00	1.5919	0.3956	0.1405	0.0773	0.0632	-----
8.25	1.8011	0.5199	0.2091	0.1243	0.0848	-----
8.50	2.0102	0.6536	0.2091	0.1337	0.0754	-----
8.75	2.2849	0.8411	0.2747	0.1875	0.0872	-----
9.00	2.5596	1.0396	0.2747	0.1986	0.0761	-----
9.25	2.8592	1.2666	0.2997	0.2269	0.0727	-----
9.50	3.1589	1.5024	0.2997	0.2358	0.0639	-----
9.75	3.4149	1.7096	0.2560	0.2073	0.0487	-----
10.00	3.6708	1.9215	0.2560	0.2118	0.0441	-----
10.25	3.7988	2.0289	0.1280	0.1074	0.0205	-----
10.50	3.9268	2.1373	0.1280	0.1084	0.0196	-----
10.75	4.0111	2.2091	0.0843	0.0718	0.0124	-----
11.00	4.0953	2.2813	0.0843	0.0722	0.0121	-----
11.25	4.1671	2.3431	0.0718	0.0618	0.0100	-----
11.50	4.2389	2.4051	0.0718	0.0620	0.0098	-----
11.75	4.3045	2.4619	0.0656	0.0568	0.0087	-----
12.00	4.3700	2.5190	0.0656	0.0570	0.0085	-----
12.25	4.4325	2.5734	0.0624	0.0545	0.0080	-----
12.50	4.4949	2.6280	0.0624	0.0546	0.0078	-----
12.75	4.5542	2.6801	0.0593	0.0520	0.0073	-----
13.00	4.6135	2.7322	0.0593	0.0522	0.0071	-----
13.25	4.6666	2.7790	0.0531	0.0468	0.0063	-----
13.50	4.7196	2.8259	0.0531	0.0469	0.0062	-----
13.75	4.7696	2.8701	0.0499	0.0442	0.0057	-----
14.00	4.8195	2.9145	0.0499	0.0443	0.0056	-----
14.25	4.8757	2.9644	0.0562	0.0500	0.0062	-----
14.50	4.9319	3.0145	0.0562	0.0501	0.0061	-----
14.75	4.9631	3.0423	0.0312	0.0279	0.0034	-----
15.00	4.9943	3.0702	0.0312	0.0279	0.0033	-----
15.25	5.0443	3.1149	0.0499	0.0447	0.0053	-----

Tule100yr24hr.out

15.50	5.0942	3.1596	0.0499	0.0448	0.0052	-----
15.75	5.1410	3.2017	0.0468	0.0420	0.0048	-----
16.00	5.1878	3.2438	0.0468	0.0421	0.0047	-----
16.25	5.2315	3.2831	0.0437	0.0393	0.0044	-----
16.50	5.2752	3.3225	0.0437	0.0394	0.0043	-----
16.75	5.3221	3.3648	0.0468	0.0423	0.0046	-----
17.00	5.3689	3.4071	0.0468	0.0423	0.0045	-----
17.25	5.4063	3.4410	0.0375	0.0339	0.0036	-----
17.50	5.4438	3.4750	0.0375	0.0339	0.0035	-----
17.75	5.4844	3.5118	0.0406	0.0368	0.0038	-----
18.00	5.5250	3.5486	0.0406	0.0369	0.0037	-----
18.25	5.5562	3.5770	0.0312	0.0284	0.0028	-----
18.50	5.5874	3.6054	0.0312	0.0284	0.0028	-----
18.75	5.6186	3.6338	0.0312	0.0284	0.0028	-----
19.00	5.6498	3.6623	0.0312	0.0284	0.0028	-----
19.25	5.6779	3.6879	0.0281	0.0256	0.0025	-----
19.50	5.7060	3.7135	0.0281	0.0256	0.0025	-----
19.75	5.7372	3.7421	0.0312	0.0285	0.0027	-----
20.00	5.7684	3.7706	0.0312	0.0285	0.0027	-----
20.25	5.8028	3.8020	0.0343	0.0314	0.0029	-----
20.50	5.8371	3.8334	0.0343	0.0314	0.0029	-----
20.75	5.8683	3.8621	0.0312	0.0286	0.0026	-----
21.00	5.8995	3.8907	0.0312	0.0286	0.0026	-----
21.25	5.9276	3.9165	0.0281	0.0258	0.0023	-----
21.50	5.9557	3.9423	0.0281	0.0258	0.0023	-----
21.75	5.9838	3.9681	0.0281	0.0258	0.0023	-----
22.00	6.0119	3.9939	0.0281	0.0258	0.0023	-----
22.25	6.0400	4.0198	0.0281	0.0258	0.0022	-----
22.50	6.0681	4.0456	0.0281	0.0259	0.0022	-----
22.75	6.0962	4.0715	0.0281	0.0259	0.0022	-----
23.00	6.1243	4.0974	0.0281	0.0259	0.0022	-----
23.25	6.1555	4.1262	0.0312	0.0288	0.0024	-----
23.50	6.1867	4.1550	0.0312	0.0288	0.0024	-----
23.75	6.2148	4.1809	0.0281	0.0259	0.0021	-----
24.00	6.2429	4.2069	0.0281	0.0260	0.0021	-----

Total soil rain loss = 2.04(In)
Total effective runoff = 4.21(In)

Peak flow rate this hydrograph = 12729.94(CFS)
Total runoff volume this hydrograph = 278697131.9(Ft3)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	3200.0	6400.0	9600.0	12800.0
0+15	0.0000	0.00	Q					
0+30	0.0000	0.00	Q					
0+45	0.0000	0.00	Q					
1+ 0	0.0000	0.00	Q					
1+15	0.0000	0.00	Q					
1+30	0.0000	0.00	Q					
1+45	0.0000	0.00	Q					
2+ 0	0.0000	0.00	Q					
2+15	0.0000	0.00	Q					
2+30	0.0000	0.00	Q					
2+45	0.0000	0.00	Q					

			Tule100yr24hr.out			
3+ 0	0.0000	0.00	Q			
3+15	0.0000	0.00	Q			
3+30	0.0000	0.00	Q			
3+45	0.0000	0.00	Q			
4+ 0	0.0028	0.13	Q			
4+15	0.0195	0.81	Q			
4+30	0.0780	2.83	Q			
4+45	0.2412	7.90	Q			
5+ 0	0.6586	20.20	Q			
5+15	1.5960	45.37	Q			
5+30	3.3855	86.61	Q			
5+45	6.3692	144.42	Q			
6+ 0	10.8425	216.51	Q			
6+15	17.1135	303.51	Q			
6+30	25.4676	404.34	VQ			
6+45	36.1834	518.64	VQ			
7+ 0	49.5280	645.88	V Q			
7+15	65.9163	793.20	V Q			
7+30	85.8278	963.71	V Q			
7+45	109.9483	1167.43	V Q			
8+ 0	139.0896	1410.44	V Q			
8+15	174.7255	1724.78	V Q			
8+30	218.7898	2132.71	V Q			
8+45	274.5783	2700.17	V Q			
9+ 0	345.7514	3444.78	V Q			
9+15	437.3751	4434.59	V Q			
9+30	553.9603	5642.72	V Q			
9+45	699.8940	7063.19	V Q			
10+ 0	877.4999	8596.13	V Q			
10+15	1086.0227	10092.50	V Q			
10+30	1321.8367	11413.40	V Q			
10+45	1576.2290	12312.59	V Q			
11+ 0	1839.2444	12729.94	V Q			
11+15	2096.2586	12439.49	V Q			
11+30	2336.5239	11628.84	V Q			
11+45	2554.1326	10532.26	V Q			
12+ 0	2748.8195	9422.85	V Q			
12+15	2924.2585	8491.25	V Q			
12+30	3082.8764	7677.11	V Q			
12+45	3227.7878	7013.71	VQ			
13+ 0	3360.9639	6445.72	QV			
13+15	3484.2396	5966.54	V			
13+30	3598.8847	5548.82	V			
13+45	3706.0344	5186.05	V			
14+ 0	3806.4028	4857.83	V			
14+15	3900.5737	4557.87	V			
14+30	3989.0939	4284.38	V			
14+45	4072.5711	4040.30	V			
15+ 0	4151.8703	3838.08	V			
15+15	4228.1148	3690.23	V			
15+30	4302.0655	3579.21	V			
15+45	4372.8783	3427.34	V			
16+ 0	4439.8259	3240.26	V			
16+15	4503.9461	3103.42	V			
16+30	4567.2598	3064.38	V			
16+45	4631.1113	3090.42	V			
17+ 0	4695.2077	3102.26	V			
17+15	4758.7820	3077.00	V			
17+30	4821.7003	3045.25	V			
17+45	4884.1151	3020.87	V			
18+ 0	4946.1050	3000.31	V			
18+15	5007.1815	2956.10	V			
18+30	5066.7635	2883.77	V			

			Tule100yr24hr.out			
18+45	5124.7593	2807.00		Q		V
19+ 0	5181.4172	2742.24		Q		V
19+15	5236.5097	2666.48		Q		V
19+30	5289.5151	2565.46		Q		V
19+45	5340.2574	2455.93		Q		V
20+ 0	5389.0775	2362.89		Q		V
20+15	5436.3614	2288.54		Q		V
20+30	5482.2650	2221.74		Q		V
20+45	5527.2068	2175.19		Q		V
21+ 0	5571.7227	2154.57		Q		V
21+15	5616.3609	2160.49		Q		V
21+30	5661.2815	2174.16		Q		V
21+45	5706.2140	2174.73		Q		V
22+ 0	5750.7873	2157.35		Q		V
22+15	5794.5535	2118.29		Q		V
22+30	5837.3825	2072.92		Q		V
22+45	5879.3752	2032.45		Q		V
23+ 0	5920.6972	1999.99		Q		V
23+15	5961.5664	1978.07		Q		V
23+30	6002.1275	1963.15		Q		V
23+45	6042.5090	1954.46		Q		V
24+ 0	6082.8470	1952.36		Q		V
24+15	6123.2897	1957.43		Q		V
24+30	6163.7649	1959.00		Q		V
24+45	6203.6977	1932.75		Q		V
25+ 0	6241.9407	1850.96		Q		V
25+15	6276.0107	1648.99		Q		V
25+30	6304.1245	1360.71		Q		V
25+45	6325.9961	1058.59		Q		V
26+ 0	6342.6965	808.30		Q		V
26+15	6355.8389	636.09		Q		V
26+30	6366.1678	499.92		Q		V
26+45	6374.2965	393.43		Q		V
27+ 0	6380.6774	308.83	Q			V
27+15	6385.6401	240.20	Q			V
27+30	6389.4444	184.13	Q			V
27+45	6392.3067	138.53	Q			V
28+ 0	6394.3956	101.10	Q			V
28+15	6395.8735	71.53	Q			V
28+30	6396.8689	48.18	Q			V
28+45	6397.4858	29.85	Q			V
29+ 0	6397.8312	16.72	Q			V
29+15	6397.9716	6.79	Q			V
29+30	6398.0058	1.65	Q			V
29+45	6398.0058	0.00	Q			V

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UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: bwn100yr6hr.out

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Program License Serial Number 4055

Tule Wind Project
Bow Willow Creek North
Existing 100 Year 6 Hour
Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
2747.00	3.26

Rainfall Distribution pattern used in study:

Type B for SCS (small dam) or San Diego 6 hour storms

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***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
2747.00	1.000	89.8	89.8	0.050	C

Area-averaged catchment SCS Curve Number AMC(2) = 89.800

Area-averaged Fm value using values listed = 0.050(In/Hr)

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Direct entry of lag time by user

Watershed area = 2747.00(Ac.)

Catchment Lag time = 0.800 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 10.4167

Hydrograph baseflow = 0.00(CFS)

Minimum watershed loss rate(Fm) = 0.000(In/Hr)

Average adjusted SCS Curve Number = 89.800

Rainfall depth area reduction factors:

Using a total area of 2747.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used

Areal factor ratio (rainfall reduction) = 1.000

Rainfall entered for study = 3.260(In)

Adjusted rainfall = 3.260(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS (Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Q_p vs. T/T_p values into an S-Graph based on $\text{lag} = T_p/0.9$. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/T_p step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

UNIT HYDROGRAPH

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
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(K = BWN100Yr6Hr.out
33238.70 (CFS))

0.10	0.083	0.015	57.476	0.002
0.21	0.167	0.033	123.457	0.005
0.31	0.250	0.075	283.934	0.014
0.42	0.333	0.112	424.234	0.027
0.52	0.417	0.218	825.528	0.052
0.63	0.500	0.390	1480.878	0.096
0.73	0.583	0.700	2656.186	0.176
0.83	0.667	0.884	3353.690	0.277
0.94	0.750	1.000	3794.500	0.391
1.04	0.833	0.889	3374.694	0.493
1.15	0.917	0.794	3012.105	0.583
1.25	1.000	0.557	2113.850	0.647
1.35	1.083	0.486	1842.943	0.702
1.46	1.167	0.413	1566.606	0.749
1.56	1.250	0.341	1292.615	0.788
1.67	1.333	0.296	1122.607	0.822
1.77	1.417	0.243	922.165	0.850
1.87	1.500	0.219	831.642	0.875
1.98	1.583	0.184	697.224	0.896
2.08	1.667	0.162	614.300	0.914
2.19	1.750	0.140	532.443	0.930
2.29	1.833	0.119	452.627	0.944
2.40	1.917	0.107	404.979	0.956
2.50	2.000	0.084	318.914	0.966
2.60	2.083	0.074	281.523	0.974
2.71	2.167	0.061	231.072	0.981
2.81	2.250	0.049	185.702	0.987
2.92	2.333	0.040	150.896	0.991
3.02	2.417	0.032	122.997	0.995
3.13	2.500	0.026	100.032	0.998
3.23	2.583	0.012	43.735	0.999
3.33	2.667	0.006	22.937	1.000
3.44	2.750	0.000	0.207	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

where:

Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal

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loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr- ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0190	0.0000	0.0190	0.0000	0.0190	-----
0.17	0.0380	0.0000	0.0190	0.0000	0.0190	-----
0.25	0.0571	0.0000	0.0190	0.0000	0.0190	-----
0.33	0.0761	0.0000	0.0190	0.0000	0.0190	-----
0.42	0.0951	0.0000	0.0190	0.0000	0.0190	-----
0.50	0.1141	0.0000	0.0190	0.0000	0.0190	-----
0.58	0.1396	0.0000	0.0255	0.0000	0.0255	-----
0.67	0.1652	0.0000	0.0255	0.0000	0.0255	-----
0.75	0.1907	0.0000	0.0255	0.0000	0.0255	-----
0.83	0.2162	0.0000	0.0255	0.0000	0.0255	-----
0.92	0.2418	0.0002	0.0255	0.0002	0.0254	-----
1.00	0.2673	0.0014	0.0255	0.0012	0.0244	-----
1.08	0.2988	0.0043	0.0315	0.0029	0.0286	-----
1.17	0.3303	0.0086	0.0315	0.0043	0.0272	-----
1.25	0.3619	0.0143	0.0315	0.0057	0.0258	-----
1.33	0.3934	0.0212	0.0315	0.0069	0.0246	-----
1.42	0.4249	0.0293	0.0315	0.0081	0.0234	-----
1.50	0.4564	0.0385	0.0315	0.0092	0.0223	-----
1.58	0.5053	0.0547	0.0489	0.0162	0.0327	-----
1.67	0.5542	0.0731	0.0489	0.0184	0.0305	-----
1.75	0.6031	0.0935	0.0489	0.0204	0.0285	-----
1.83	0.6520	0.1156	0.0489	0.0222	0.0267	-----
1.92	0.7009	0.1394	0.0489	0.0238	0.0251	-----
2.00	0.7498	0.1647	0.0489	0.0253	0.0236	-----
2.08	0.9508	0.2816	0.2010	0.1169	0.0841	-----
2.17	1.1519	0.4150	0.2010	0.1333	0.0677	-----
2.25	1.3529	0.5603	0.2010	0.1454	0.0557	-----
2.33	1.5539	0.7148	0.2010	0.1545	0.0466	-----
2.42	1.7550	0.8763	0.2010	0.1615	0.0395	-----
2.50	1.9560	1.0433	0.2010	0.1670	0.0340	-----
2.58	2.0103	1.0893	0.0543	0.0460	0.0084	-----
2.67	2.0647	1.1355	0.0543	0.0463	0.0081	-----
2.75	2.1190	1.1821	0.0543	0.0465	0.0078	-----
2.83	2.1733	1.2289	0.0543	0.0468	0.0075	-----
2.92	2.2277	1.2760	0.0543	0.0471	0.0073	-----
3.00	2.2820	1.3233	0.0543	0.0473	0.0070	-----
3.08	2.3260	1.3618	0.0440	0.0385	0.0055	-----
3.17	2.3700	1.4005	0.0440	0.0387	0.0054	-----
3.25	2.4140	1.4393	0.0440	0.0388	0.0052	-----
3.33	2.4580	1.4782	0.0440	0.0389	0.0051	-----
3.42	2.5021	1.5173	0.0440	0.0391	0.0049	-----
3.50	2.5461	1.5565	0.0440	0.0392	0.0048	-----
3.58	2.5754	1.5827	0.0293	0.0262	0.0031	-----
3.67	2.6047	1.6089	0.0293	0.0262	0.0031	-----
3.75	2.6341	1.6352	0.0293	0.0263	0.0030	-----
3.83	2.6634	1.6616	0.0293	0.0263	0.0030	-----
3.92	2.6928	1.6880	0.0293	0.0264	0.0029	-----
4.00	2.7221	1.7144	0.0293	0.0264	0.0029	-----
4.08	2.7466	1.7365	0.0245	0.0221	0.0024	-----
4.17	2.7710	1.7586	0.0244	0.0221	0.0023	-----
4.25	2.7954	1.7807	0.0244	0.0221	0.0023	-----
4.33	2.8199	1.8029	0.0244	0.0222	0.0023	-----

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4.42	2.8443	1.8251	0.0245	0.0222	0.0023	-----
4.50	2.8688	1.8473	0.0244	0.0222	0.0022	-----
4.58	2.8922	1.8686	0.0234	0.0213	0.0021	-----
4.67	2.9155	1.8899	0.0234	0.0213	0.0021	-----
4.75	2.9389	1.9112	0.0234	0.0213	0.0020	-----
4.83	2.9623	1.9325	0.0234	0.0213	0.0020	-----
4.92	2.9856	1.9539	0.0234	0.0214	0.0020	-----
5.00	3.0090	1.9753	0.0234	0.0214	0.0020	-----
5.08	3.0291	1.9937	0.0201	0.0184	0.0017	-----
5.17	3.0492	2.0121	0.0201	0.0184	0.0017	-----
5.25	3.0693	2.0306	0.0201	0.0185	0.0016	-----
5.33	3.0894	2.0491	0.0201	0.0185	0.0016	-----
5.42	3.1095	2.0676	0.0201	0.0185	0.0016	-----
5.50	3.1296	2.0861	0.0201	0.0185	0.0016	-----
5.58	3.1513	2.1061	0.0217	0.0200	0.0017	-----
5.67	3.1731	2.1261	0.0217	0.0200	0.0017	-----
5.75	3.1948	2.1462	0.0217	0.0201	0.0017	-----
5.83	3.2165	2.1663	0.0217	0.0201	0.0017	-----
5.92	3.2383	2.1864	0.0217	0.0201	0.0016	-----
6.00	3.2600	2.2065	0.0217	0.0201	0.0016	-----

Total soil rain loss = 1.05(In)
Total effective runoff = 2.21(In)

Peak flow rate this hydrograph = 3058.28(CFS)
Total runoff volume this hydrograph = 22001982.2(Ft3)

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6 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	775.0	1550.0	2325.0	3100.0
0+ 5	0.0000		0.00	Q				
0+10	0.0000		0.00	Q				
0+15	0.0000		0.00	Q				
0+20	0.0000		0.00	Q				
0+25	0.0000		0.00	Q				
0+30	0.0000		0.00	Q				
0+35	0.0000		0.00	Q				
0+40	0.0000		0.00	Q				
0+45	0.0000		0.00	Q				
0+50	0.0000		0.00	Q				
0+55	0.0001		0.01	Q				
1+ 0	0.0007		0.09	Q				
1+ 5	0.0032		0.36	Q				
1+10	0.0102		1.02	Q				
1+15	0.0263		2.34	Q				
1+20	0.0594		4.81	Q				
1+25	0.1242		9.40	Q				
1+30	0.2449		17.53	Q				
1+35	0.4568		30.76	Q				
1+40	0.7981		49.56	Q				
1+45	1.3081		74.05	Q				
1+50	2.0182		103.11	VQ				
1+55	2.9631		137.20	VQ				
2+ 0	4.1836		177.21	V Q				
2+ 5	5.7798		231.76	V Q				
2+10	7.8487		300.41	V Q				

			BWN100Yr6Hr.out			
2+15	10.5421	391.08	V	Q		
2+20	13.9763	498.65	V	Q		
2+25	18.4327	647.07	V	Q		
2+30	24.3557	860.02	V	Q		
2+35	32.5304	1186.96	V	Q		
2+40	43.5240	1596.27	V	Q		
2+45	57.6754	2054.79	V	Q		
2+50	74.7921	2485.33	V	Q		
2+55	94.3890	2845.47	V	Q		
3+ 0	115.3609	3045.12	V	Q		
3+ 5	136.4234	3058.28	V	Q		
3+10	156.6721	2940.11	V	Q		
3+15	175.4036	2719.83	V	Q		
3+20	192.7171	2513.91	V	Q		
3+25	208.6513	2313.66	V	Q		
3+30	223.7726	2195.61	V	Q		
3+35	238.0753	2076.74	V	Q		
3+40	251.6260	1967.57	V	Q		
3+45	264.5095	1870.68	V	Q		
3+50	276.7866	1782.64	V	Q		
3+55	288.5432	1707.05	V	Q		
4+ 0	299.7649	1629.40	V	Q		
4+ 5	310.4169	1546.67	V	Q		
4+10	320.4617	1458.50	V	Q		
4+15	329.8863	1368.46	V	Q		
4+20	338.7578	1288.14	V	Q		
4+25	347.1118	1212.99	V	Q		
4+30	355.0565	1153.58	V	Q		
4+35	362.5711	1091.12	V	Q		
4+40	369.6778	1031.89	V	Q		
4+45	376.4028	976.46	V	Q		
4+50	382.7957	928.25	V	Q		
4+55	388.9011	886.51	V	Q		
5+ 0	394.7690	852.02	V	Q		
5+ 5	400.4570	825.89	V	Q		
5+10	405.9934	803.89	V	Q		
5+15	411.4088	786.30	V	Q		
5+20	416.7168	770.73	V	Q		
5+25	421.9234	755.99	V	Q		
5+30	427.0323	741.82	V	Q		
5+35	432.0323	726.00	V	Q		
5+40	436.9194	709.62	V	Q		
5+45	441.6957	693.52	V	Q		
5+50	446.3776	679.81	V	Q		
5+55	450.9816	668.50	V	Q		
6+ 0	455.5380	661.59	V	Q		
6+ 5	460.0635	657.10	V	Q		
6+10	464.5656	653.71	V	Q		
6+15	469.0362	649.13	V	Q		
6+20	473.4565	641.82	V	Q		
6+25	477.7721	626.64	V	Q		
6+30	481.8861	597.35	V	Q		
6+35	485.6372	544.65	V	Q		
6+40	488.9281	477.84	V	Q		
6+45	491.6971	402.06	V	Q		
6+50	494.0021	334.68	V	Q		
6+55	495.8919	274.41	V	Q		
7+ 0	497.4918	232.31	V	Q		
7+ 5	498.8388	195.58	V	Q		
7+10	499.9713	164.44	V	Q		
7+15	500.9273	138.81	V	Q		
7+20	501.7301	116.57	V	Q		
7+25	502.4074	98.35	V	Q		

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7+30	502.9713	81.87	Q					V
7+35	503.4410	68.20	Q					V
7+40	503.8279	56.18	Q					V
7+45	504.1433	45.79	Q					V
7+50	504.3977	36.94	Q					V
7+55	504.5975	29.01	Q					V
8+ 0	504.7543	22.77	Q					V
8+ 5	504.8726	17.18	Q					V
8+10	504.9593	12.58	Q					V
8+15	505.0203	8.86	Q					V
8+20	505.0604	5.83	Q					V
8+25	505.0835	3.36	Q					V
8+30	505.0928	1.34	Q					V
8+35	505.0960	0.47	Q					V
8+40	505.0960	0.00	Q					V

UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: bwn100yr24hr.out

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Program License Serial Number 4055

 Tule Wind Project
 Bow Willow Creek North
 Existing 100 Year 24 Hour
 Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
2747.00	6.43

Rainfall Distribution pattern used in study:
 Type B for San Diego area of California

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***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
2747.00	1.000	89.8	89.8	0.050	C

Area-averaged catchment SCS Curve Number AMC(2) = 89.800

Area-averaged Fm value using values listed = 0.050(In/Hr)

+++++

Direct entry of lag time by user

Watershed area = 2747.00(Ac.)

Catchment Lag time = 0.800 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 10.4167

Hydrograph baseflow = 0.00(CFS)

Minimum watershed loss rate(Fm) = 0.000(In/Hr)

Average adjusted SCS Curve Number = 89.800

Rainfall depth area reduction factors:

Using a total area of 2747.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used

Areal factor ratio (rainfall reduction) = 1.000

Rainfall entered for study = 6.430(In)

Adjusted rainfall = 6.430(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS (Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Q_p vs. T/T_p values into an S-Graph based on $\text{lag} = T_p/0.9$. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/T_p step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

UNIT HYDROGRAPH

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
-----------------------	---------------	-------------------------------	------------	--------------------------------

(K = BWN100Yr24Hr.out
33238.70 (CFS))

0.10	0.083	0.015	57.476	0.002
0.21	0.167	0.033	123.457	0.005
0.31	0.250	0.075	283.934	0.014
0.42	0.333	0.112	424.234	0.027
0.52	0.417	0.218	825.528	0.052
0.63	0.500	0.390	1480.878	0.096
0.73	0.583	0.700	2656.186	0.176
0.83	0.667	0.884	3353.690	0.277
0.94	0.750	1.000	3794.500	0.391
1.04	0.833	0.889	3374.694	0.493
1.15	0.917	0.794	3012.105	0.583
1.25	1.000	0.557	2113.850	0.647
1.35	1.083	0.486	1842.943	0.702
1.46	1.167	0.413	1566.606	0.749
1.56	1.250	0.341	1292.615	0.788
1.67	1.333	0.296	1122.607	0.822
1.77	1.417	0.243	922.165	0.850
1.87	1.500	0.219	831.642	0.875
1.98	1.583	0.184	697.224	0.896
2.08	1.667	0.162	614.300	0.914
2.19	1.750	0.140	532.443	0.930
2.29	1.833	0.119	452.627	0.944
2.40	1.917	0.107	404.979	0.956
2.50	2.000	0.084	318.914	0.966
2.60	2.083	0.074	281.523	0.974
2.71	2.167	0.061	231.072	0.981
2.81	2.250	0.049	185.702	0.987
2.92	2.333	0.040	150.896	0.991
3.02	2.417	0.032	122.997	0.995
3.13	2.500	0.026	100.032	0.998
3.23	2.583	0.012	43.735	0.999
3.33	2.667	0.006	22.937	1.000
3.44	2.750	0.000	0.207	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

where:

Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal

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loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr- ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0096	0.0000	0.0096	0.0000	0.0096	-----
0.17	0.0193	0.0000	0.0096	0.0000	0.0096	-----
0.25	0.0289	0.0000	0.0096	0.0000	0.0096	-----
0.33	0.0386	0.0000	0.0096	0.0000	0.0096	-----
0.42	0.0482	0.0000	0.0096	0.0000	0.0096	-----
0.50	0.0579	0.0000	0.0096	0.0000	0.0096	-----
0.58	0.0654	0.0000	0.0075	0.0000	0.0075	-----
0.67	0.0729	0.0000	0.0075	0.0000	0.0075	-----
0.75	0.0804	0.0000	0.0075	0.0000	0.0075	-----
0.83	0.0879	0.0000	0.0075	0.0000	0.0075	-----
0.92	0.0954	0.0000	0.0075	0.0000	0.0075	-----
1.00	0.1029	0.0000	0.0075	0.0000	0.0075	-----
1.08	0.1125	0.0000	0.0096	0.0000	0.0096	-----
1.17	0.1222	0.0000	0.0096	0.0000	0.0096	-----
1.25	0.1318	0.0000	0.0096	0.0000	0.0096	-----
1.33	0.1415	0.0000	0.0096	0.0000	0.0096	-----
1.42	0.1511	0.0000	0.0096	0.0000	0.0096	-----
1.50	0.1608	0.0000	0.0096	0.0000	0.0096	-----
1.58	0.1704	0.0000	0.0096	0.0000	0.0096	-----
1.67	0.1800	0.0000	0.0096	0.0000	0.0096	-----
1.75	0.1897	0.0000	0.0096	0.0000	0.0096	-----
1.83	0.1993	0.0000	0.0096	0.0000	0.0096	-----
1.92	0.2090	0.0000	0.0096	0.0000	0.0096	-----
2.00	0.2186	0.0000	0.0096	0.0000	0.0096	-----
2.08	0.2304	0.0000	0.0118	0.0000	0.0118	-----
2.17	0.2422	0.0002	0.0118	0.0002	0.0116	-----
2.25	0.2540	0.0006	0.0118	0.0004	0.0114	-----
2.33	0.2658	0.0013	0.0118	0.0007	0.0111	-----
2.42	0.2776	0.0021	0.0118	0.0009	0.0109	-----
2.50	0.2894	0.0032	0.0118	0.0011	0.0107	-----
2.58	0.2990	0.0043	0.0096	0.0010	0.0086	-----
2.67	0.3086	0.0055	0.0096	0.0012	0.0085	-----
2.75	0.3183	0.0068	0.0096	0.0013	0.0083	-----
2.83	0.3279	0.0082	0.0096	0.0014	0.0082	-----
2.92	0.3376	0.0098	0.0096	0.0016	0.0081	-----
3.00	0.3472	0.0115	0.0096	0.0017	0.0080	-----
3.08	0.3590	0.0137	0.0118	0.0022	0.0096	-----
3.17	0.3708	0.0161	0.0118	0.0024	0.0094	-----
3.25	0.3826	0.0187	0.0118	0.0026	0.0092	-----
3.33	0.3944	0.0215	0.0118	0.0027	0.0090	-----
3.42	0.4062	0.0244	0.0118	0.0029	0.0089	-----
3.50	0.4179	0.0274	0.0118	0.0031	0.0087	-----
3.58	0.4308	0.0310	0.0129	0.0035	0.0093	-----
3.67	0.4437	0.0347	0.0129	0.0037	0.0092	-----
3.75	0.4565	0.0385	0.0129	0.0039	0.0090	-----
3.83	0.4694	0.0426	0.0129	0.0040	0.0088	-----
3.92	0.4822	0.0468	0.0129	0.0042	0.0087	-----
4.00	0.4951	0.0511	0.0129	0.0044	0.0085	-----
4.08	0.5090	0.0560	0.0139	0.0049	0.0090	-----
4.17	0.5230	0.0611	0.0139	0.0051	0.0089	-----
4.25	0.5369	0.0664	0.0139	0.0052	0.0087	-----
4.33	0.5508	0.0718	0.0139	0.0054	0.0085	-----

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4.42	0.5648	0.0773	0.0139	0.0056	0.0084	-----
4.50	0.5787	0.0831	0.0139	0.0057	0.0082	-----
4.58	0.5937	0.0894	0.0150	0.0063	0.0087	-----
4.67	0.6087	0.0959	0.0150	0.0065	0.0085	-----
4.75	0.6237	0.1026	0.0150	0.0067	0.0083	-----
4.83	0.6387	0.1095	0.0150	0.0068	0.0082	-----
4.92	0.6537	0.1164	0.0150	0.0070	0.0080	-----
5.00	0.6687	0.1236	0.0150	0.0071	0.0079	-----
5.08	0.6859	0.1320	0.0171	0.0084	0.0088	-----
5.17	0.7030	0.1405	0.0171	0.0085	0.0086	-----
5.25	0.7202	0.1492	0.0171	0.0087	0.0084	-----
5.33	0.7373	0.1581	0.0171	0.0089	0.0083	-----
5.42	0.7545	0.1672	0.0171	0.0091	0.0081	-----
5.50	0.7716	0.1764	0.0171	0.0092	0.0079	-----
5.58	0.7898	0.1864	0.0182	0.0100	0.0082	-----
5.67	0.8080	0.1965	0.0182	0.0102	0.0081	-----
5.75	0.8263	0.2069	0.0182	0.0103	0.0079	-----
5.83	0.8445	0.2174	0.0182	0.0105	0.0077	-----
5.92	0.8627	0.2280	0.0182	0.0106	0.0076	-----
6.00	0.8809	0.2388	0.0182	0.0108	0.0074	-----
6.08	0.9023	0.2517	0.0214	0.0129	0.0085	-----
6.17	0.9238	0.2648	0.0214	0.0131	0.0083	-----
6.25	0.9452	0.2781	0.0214	0.0133	0.0081	-----
6.33	0.9666	0.2916	0.0214	0.0135	0.0080	-----
6.42	0.9881	0.3052	0.0214	0.0137	0.0078	-----
6.50	1.0095	0.3191	0.0214	0.0138	0.0076	-----
6.58	1.0342	0.3352	0.0246	0.0161	0.0085	-----
6.67	1.0588	0.3515	0.0246	0.0163	0.0083	-----
6.75	1.0835	0.3681	0.0246	0.0165	0.0081	-----
6.83	1.1081	0.3848	0.0246	0.0167	0.0079	-----
6.92	1.1328	0.4017	0.0246	0.0169	0.0077	-----
7.00	1.1574	0.4188	0.0246	0.0171	0.0075	-----
7.08	1.1895	0.4414	0.0321	0.0226	0.0096	-----
7.17	1.2217	0.4643	0.0322	0.0229	0.0093	-----
7.25	1.2538	0.4874	0.0321	0.0231	0.0090	-----
7.33	1.2860	0.5108	0.0321	0.0234	0.0087	-----
7.42	1.3181	0.5345	0.0322	0.0237	0.0085	-----
7.50	1.3503	0.5584	0.0321	0.0239	0.0082	-----
7.58	1.3985	0.5947	0.0482	0.0363	0.0119	-----
7.67	1.4468	0.6315	0.0482	0.0368	0.0114	-----
7.75	1.4950	0.6687	0.0482	0.0372	0.0110	-----
7.83	1.5432	0.7064	0.0482	0.0377	0.0106	-----
7.92	1.5914	0.7444	0.0482	0.0381	0.0101	-----
8.00	1.6397	0.7829	0.0482	0.0385	0.0098	-----
8.08	1.7115	0.8408	0.0718	0.0579	0.0139	-----
8.17	1.7833	0.8995	0.0718	0.0587	0.0131	-----
8.25	1.8551	0.9588	0.0718	0.0594	0.0125	-----
8.33	1.9269	1.0188	0.0718	0.0600	0.0118	-----
8.42	1.9987	1.0794	0.0718	0.0606	0.0112	-----
8.50	2.0705	1.1405	0.0718	0.0611	0.0107	-----
8.58	2.1648	1.2215	0.0943	0.0810	0.0133	-----
8.67	2.2591	1.3033	0.0943	0.0818	0.0125	-----
8.75	2.3534	1.3859	0.0943	0.0825	0.0118	-----
8.83	2.4477	1.4691	0.0943	0.0832	0.0111	-----
8.92	2.5420	1.5529	0.0943	0.0838	0.0105	-----
9.00	2.6363	1.6372	0.0943	0.0844	0.0099	-----
9.08	2.7392	1.7298	0.1029	0.0926	0.0103	-----
9.17	2.8421	1.8230	0.1029	0.0932	0.0097	-----
9.25	2.9449	1.9167	0.1029	0.0937	0.0092	-----
9.33	3.0478	2.0109	0.1029	0.0942	0.0087	-----
9.42	3.1507	2.1055	0.1029	0.0946	0.0083	-----
9.50	3.2536	2.2005	0.1029	0.0950	0.0079	-----
9.58	3.3415	2.2820	0.0879	0.0815	0.0064	-----

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9.67	3.4293	2.3637	0.0879	0.0817	0.0061	-----
9.75	3.5172	2.4457	0.0879	0.0820	0.0059	-----
9.83	3.6051	2.5279	0.0879	0.0822	0.0057	-----
9.92	3.6930	2.6103	0.0879	0.0824	0.0055	-----
10.00	3.7808	2.6929	0.0879	0.0826	0.0053	-----
10.08	3.8248	2.7343	0.0439	0.0414	0.0026	-----
10.17	3.8687	2.7757	0.0439	0.0414	0.0025	-----
10.25	3.9127	2.8172	0.0439	0.0415	0.0025	-----
10.33	3.9566	2.8587	0.0439	0.0415	0.0024	-----
10.42	4.0005	2.9003	0.0439	0.0416	0.0024	-----
10.50	4.0445	2.9419	0.0439	0.0416	0.0023	-----
10.58	4.0734	2.9693	0.0289	0.0274	0.0015	-----
10.67	4.1023	2.9968	0.0289	0.0274	0.0015	-----
10.75	4.1313	3.0242	0.0289	0.0275	0.0015	-----
10.83	4.1602	3.0517	0.0289	0.0275	0.0015	-----
10.92	4.1891	3.0792	0.0289	0.0275	0.0014	-----
11.00	4.2181	3.1067	0.0289	0.0275	0.0014	-----
11.08	4.2427	3.1301	0.0246	0.0234	0.0012	-----
11.17	4.2674	3.1536	0.0246	0.0235	0.0012	-----
11.25	4.2920	3.1771	0.0246	0.0235	0.0012	-----
11.33	4.3167	3.2006	0.0246	0.0235	0.0012	-----
11.42	4.3413	3.2240	0.0246	0.0235	0.0012	-----
11.50	4.3660	3.2475	0.0246	0.0235	0.0011	-----
11.58	4.3885	3.2690	0.0225	0.0215	0.0010	-----
11.67	4.4110	3.2905	0.0225	0.0215	0.0010	-----
11.75	4.4335	3.3120	0.0225	0.0215	0.0010	-----
11.83	4.4560	3.3335	0.0225	0.0215	0.0010	-----
11.92	4.4785	3.3550	0.0225	0.0215	0.0010	-----
12.00	4.5010	3.3765	0.0225	0.0215	0.0010	-----
12.08	4.5224	3.3970	0.0214	0.0205	0.0009	-----
12.17	4.5439	3.4175	0.0214	0.0205	0.0009	-----
12.25	4.5653	3.4380	0.0214	0.0205	0.0009	-----
12.33	4.5867	3.4585	0.0214	0.0205	0.0009	-----
12.42	4.6082	3.4790	0.0214	0.0205	0.0009	-----
12.50	4.6296	3.4995	0.0214	0.0205	0.0009	-----
12.58	4.6500	3.5190	0.0204	0.0195	0.0009	-----
12.67	4.6703	3.5385	0.0204	0.0195	0.0008	-----
12.75	4.6907	3.5581	0.0204	0.0195	0.0008	-----
12.83	4.7110	3.5776	0.0204	0.0195	0.0008	-----
12.92	4.7314	3.5971	0.0204	0.0195	0.0008	-----
13.00	4.7518	3.6167	0.0204	0.0195	0.0008	-----
13.08	4.7700	3.6342	0.0182	0.0175	0.0007	-----
13.17	4.7882	3.6516	0.0182	0.0175	0.0007	-----
13.25	4.8064	3.6691	0.0182	0.0175	0.0007	-----
13.33	4.8246	3.6866	0.0182	0.0175	0.0007	-----
13.42	4.8429	3.7042	0.0182	0.0175	0.0007	-----
13.50	4.8611	3.7217	0.0182	0.0175	0.0007	-----
13.58	4.8782	3.7381	0.0171	0.0165	0.0007	-----
13.67	4.8954	3.7546	0.0171	0.0165	0.0007	-----
13.75	4.9125	3.7711	0.0171	0.0165	0.0007	-----
13.83	4.9297	3.7876	0.0171	0.0165	0.0007	-----
13.92	4.9468	3.8041	0.0171	0.0165	0.0006	-----
14.00	4.9640	3.8206	0.0171	0.0165	0.0006	-----
14.08	4.9833	3.8392	0.0193	0.0186	0.0007	-----
14.17	5.0025	3.8578	0.0193	0.0186	0.0007	-----
14.25	5.0218	3.8763	0.0193	0.0186	0.0007	-----
14.33	5.0411	3.8949	0.0193	0.0186	0.0007	-----
14.42	5.0604	3.9135	0.0193	0.0186	0.0007	-----
14.50	5.0797	3.9321	0.0193	0.0186	0.0007	-----
14.58	5.0904	3.9424	0.0107	0.0103	0.0004	-----
14.67	5.1011	3.9528	0.0107	0.0103	0.0004	-----
14.75	5.1119	3.9631	0.0107	0.0103	0.0004	-----
14.83	5.1226	3.9735	0.0107	0.0103	0.0004	-----

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14.92	5.1333	3.9838	0.0107	0.0103	0.0004	-----
15.00	5.1440	3.9941	0.0107	0.0103	0.0004	-----
15.08	5.1611	4.0107	0.0171	0.0165	0.0006	-----
15.17	5.1783	4.0272	0.0171	0.0165	0.0006	-----
15.25	5.1954	4.0438	0.0171	0.0166	0.0006	-----
15.33	5.2126	4.0603	0.0171	0.0166	0.0006	-----
15.42	5.2297	4.0769	0.0171	0.0166	0.0006	-----
15.50	5.2469	4.0934	0.0171	0.0166	0.0006	-----
15.58	5.2630	4.1090	0.0161	0.0155	0.0005	-----
15.67	5.2790	4.1245	0.0161	0.0155	0.0005	-----
15.75	5.2951	4.1400	0.0161	0.0155	0.0005	-----
15.83	5.3112	4.1556	0.0161	0.0155	0.0005	-----
15.92	5.3273	4.1711	0.0161	0.0155	0.0005	-----
16.00	5.3433	4.1867	0.0161	0.0155	0.0005	-----
16.08	5.3583	4.2012	0.0150	0.0145	0.0005	-----
16.17	5.3733	4.2157	0.0150	0.0145	0.0005	-----
16.25	5.3883	4.2302	0.0150	0.0145	0.0005	-----
16.33	5.4033	4.2447	0.0150	0.0145	0.0005	-----
16.42	5.4183	4.2592	0.0150	0.0145	0.0005	-----
16.50	5.4333	4.2738	0.0150	0.0145	0.0005	-----
16.58	5.4494	4.2893	0.0161	0.0156	0.0005	-----
16.67	5.4655	4.3049	0.0161	0.0156	0.0005	-----
16.75	5.4816	4.3204	0.0161	0.0156	0.0005	-----
16.83	5.4976	4.3360	0.0161	0.0156	0.0005	-----
16.92	5.5137	4.3516	0.0161	0.0156	0.0005	-----
17.00	5.5298	4.3672	0.0161	0.0156	0.0005	-----
17.08	5.5427	4.3796	0.0129	0.0125	0.0004	-----
17.17	5.5555	4.3921	0.0129	0.0125	0.0004	-----
17.25	5.5684	4.4045	0.0129	0.0125	0.0004	-----
17.33	5.5812	4.4170	0.0129	0.0125	0.0004	-----
17.42	5.5941	4.4295	0.0129	0.0125	0.0004	-----
17.50	5.6070	4.4419	0.0129	0.0125	0.0004	-----
17.58	5.6209	4.4555	0.0139	0.0135	0.0004	-----
17.67	5.6348	4.4690	0.0139	0.0135	0.0004	-----
17.75	5.6488	4.4825	0.0139	0.0135	0.0004	-----
17.83	5.6627	4.4960	0.0139	0.0135	0.0004	-----
17.92	5.6766	4.5095	0.0139	0.0135	0.0004	-----
18.00	5.6906	4.5230	0.0139	0.0135	0.0004	-----
18.08	5.7013	4.5334	0.0107	0.0104	0.0003	-----
18.17	5.7120	4.5438	0.0107	0.0104	0.0003	-----
18.25	5.7227	4.5542	0.0107	0.0104	0.0003	-----
18.33	5.7334	4.5646	0.0107	0.0104	0.0003	-----
18.42	5.7441	4.5750	0.0107	0.0104	0.0003	-----
18.50	5.7549	4.5854	0.0107	0.0104	0.0003	-----
18.58	5.7656	4.5958	0.0107	0.0104	0.0003	-----
18.67	5.7763	4.6063	0.0107	0.0104	0.0003	-----
18.75	5.7870	4.6167	0.0107	0.0104	0.0003	-----
18.83	5.7977	4.6271	0.0107	0.0104	0.0003	-----
18.92	5.8084	4.6375	0.0107	0.0104	0.0003	-----
19.00	5.8191	4.6479	0.0107	0.0104	0.0003	-----
19.08	5.8288	4.6573	0.0096	0.0094	0.0003	-----
19.17	5.8384	4.6666	0.0096	0.0094	0.0003	-----
19.25	5.8481	4.6760	0.0096	0.0094	0.0003	-----
19.33	5.8577	4.6854	0.0096	0.0094	0.0003	-----
19.42	5.8674	4.6947	0.0096	0.0094	0.0003	-----
19.50	5.8770	4.7041	0.0096	0.0094	0.0003	-----
19.58	5.8877	4.7145	0.0107	0.0104	0.0003	-----
19.67	5.8985	4.7250	0.0107	0.0104	0.0003	-----
19.75	5.9092	4.7354	0.0107	0.0104	0.0003	-----
19.83	5.9199	4.7458	0.0107	0.0104	0.0003	-----
19.92	5.9306	4.7562	0.0107	0.0104	0.0003	-----
20.00	5.9413	4.7666	0.0107	0.0104	0.0003	-----
20.08	5.9531	4.7781	0.0118	0.0115	0.0003	-----

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20.17	5.9649	4.7896	0.0118	0.0115	0.0003	-----
20.25	5.9767	4.8010	0.0118	0.0115	0.0003	-----
20.33	5.9885	4.8125	0.0118	0.0115	0.0003	-----
20.42	6.0003	4.8240	0.0118	0.0115	0.0003	-----
20.50	6.0121	4.8354	0.0118	0.0115	0.0003	-----
20.58	6.0228	4.8459	0.0107	0.0104	0.0003	-----
20.67	6.0335	4.8563	0.0107	0.0104	0.0003	-----
20.75	6.0442	4.8667	0.0107	0.0104	0.0003	-----
20.83	6.0549	4.8772	0.0107	0.0104	0.0003	-----
20.92	6.0656	4.8876	0.0107	0.0104	0.0003	-----
21.00	6.0763	4.8980	0.0107	0.0104	0.0003	-----
21.08	6.0860	4.9074	0.0096	0.0094	0.0003	-----
21.17	6.0956	4.9168	0.0096	0.0094	0.0003	-----
21.25	6.1053	4.9262	0.0096	0.0094	0.0003	-----
21.33	6.1149	4.9356	0.0096	0.0094	0.0003	-----
21.42	6.1246	4.9450	0.0096	0.0094	0.0003	-----
21.50	6.1342	4.9544	0.0096	0.0094	0.0003	-----
21.58	6.1439	4.9638	0.0096	0.0094	0.0003	-----
21.67	6.1535	4.9732	0.0096	0.0094	0.0002	-----
21.75	6.1632	4.9826	0.0096	0.0094	0.0002	-----
21.83	6.1728	4.9920	0.0096	0.0094	0.0002	-----
21.92	6.1824	5.0014	0.0096	0.0094	0.0002	-----
22.00	6.1921	5.0108	0.0096	0.0094	0.0002	-----
22.08	6.2017	5.0202	0.0096	0.0094	0.0002	-----
22.17	6.2114	5.0296	0.0096	0.0094	0.0002	-----
22.25	6.2210	5.0390	0.0096	0.0094	0.0002	-----
22.33	6.2307	5.0484	0.0096	0.0094	0.0002	-----
22.42	6.2403	5.0578	0.0096	0.0094	0.0002	-----
22.50	6.2500	5.0672	0.0096	0.0094	0.0002	-----
22.58	6.2596	5.0766	0.0096	0.0094	0.0002	-----
22.67	6.2692	5.0860	0.0096	0.0094	0.0002	-----
22.75	6.2789	5.0954	0.0096	0.0094	0.0002	-----
22.83	6.2885	5.1048	0.0096	0.0094	0.0002	-----
22.92	6.2982	5.1142	0.0096	0.0094	0.0002	-----
23.00	6.3078	5.1236	0.0096	0.0094	0.0002	-----
23.08	6.3185	5.1340	0.0107	0.0105	0.0003	-----
23.17	6.3293	5.1445	0.0107	0.0105	0.0003	-----
23.25	6.3400	5.1549	0.0107	0.0105	0.0003	-----
23.33	6.3507	5.1654	0.0107	0.0105	0.0003	-----
23.42	6.3614	5.1758	0.0107	0.0105	0.0003	-----
23.50	6.3721	5.1863	0.0107	0.0105	0.0003	-----
23.58	6.3818	5.1957	0.0096	0.0094	0.0002	-----
23.67	6.3914	5.2051	0.0096	0.0094	0.0002	-----
23.75	6.4011	5.2145	0.0096	0.0094	0.0002	-----
23.83	6.4107	5.2239	0.0096	0.0094	0.0002	-----
23.92	6.4204	5.2334	0.0096	0.0094	0.0002	-----
24.00	6.4300	5.2428	0.0096	0.0094	0.0002	-----

Total soil rain loss = 1.19(In)
Total effective runoff = 5.24(In)

Peak flow rate this hydrograph = 2843.87(CFS)
Total runoff volume this hydrograph = 52278910.3(Ft3)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m) Volume Ac.Ft Q(CFS) 0 725.0 1450.0 2175.0 2900.0
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0+ 5	0.0000	0.00	Q				
0+10	0.0000	0.00	Q				
0+15	0.0000	0.00	Q				
0+20	0.0000	0.00	Q				
0+25	0.0000	0.00	Q				
0+30	0.0000	0.00	Q				
0+35	0.0000	0.00	Q				
0+40	0.0000	0.00	Q				
0+45	0.0000	0.00	Q				
0+50	0.0000	0.00	Q				
0+55	0.0000	0.00	Q				
1+ 0	0.0000	0.00	Q				
1+ 5	0.0000	0.00	Q				
1+10	0.0000	0.00	Q				
1+15	0.0000	0.00	Q				
1+20	0.0000	0.00	Q				
1+25	0.0000	0.00	Q				
1+30	0.0000	0.00	Q				
1+35	0.0000	0.00	Q				
1+40	0.0000	0.00	Q				
1+45	0.0000	0.00	Q				
1+50	0.0000	0.00	Q				
1+55	0.0000	0.00	Q				
2+ 0	0.0000	0.00	Q				
2+ 5	0.0000	0.00	Q				
2+10	0.0001	0.01	Q				
2+15	0.0004	0.05	Q				
2+20	0.0014	0.15	Q				
2+25	0.0038	0.34	Q				
2+30	0.0086	0.70	Q				
2+35	0.0180	1.37	Q				
2+40	0.0357	2.56	Q				
2+45	0.0663	4.44	Q				
2+50	0.1152	7.10	Q				
2+55	0.1866	10.37	Q				
3+ 0	0.2834	14.07	Q				
3+ 5	0.4063	17.83	Q				
3+10	0.5551	21.61	Q				
3+15	0.7300	25.40	Q				
3+20	0.9319	29.31	Q				
3+25	1.1622	33.43	Q				
3+30	1.4240	38.02	Q				
3+35	1.7217	43.22	Q				
3+40	2.0584	48.89	Q				
3+45	2.4371	54.99	Q				
3+50	2.8582	61.15	Q				
3+55	3.3227	67.44	Q				
4+ 0	3.8301	73.68	VQ				
4+ 5	4.3829	80.27	VQ				
4+10	4.9826	87.06	VQ				
4+15	5.6301	94.03	VQ				
4+20	6.3252	100.92	VQ				
4+25	7.0677	107.82	VQ				
4+30	7.8577	114.71	VQ				
4+35	8.6975	121.94	VQ				
4+40	9.5885	129.37	VQ				
4+45	10.5318	136.96	VQ				
4+50	11.5261	144.38	VQ				
4+55	12.5713	151.77	V Q				
5+ 0	13.6666	159.04	V Q				
5+ 5	14.8150	166.74	V Q				
5+10	16.0180	174.67	V Q				

5+15	17.2772	182.84	V	Q					
5+20	18.5917	190.86	V	Q					
5+25	19.9624	199.04	V	Q					
5+30	21.3909	207.41	V	Q					
5+35	22.8844	216.85	V	Q					
5+40	24.4471	226.91	V	Q					
5+45	26.0821	237.40	V	Q					
5+50	27.7864	247.47	V	Q					
5+55	29.5586	257.31	V	Q					
6+ 0	31.3942	266.53	V	Q					
6+ 5	33.2961	276.16	V	Q					
6+10	35.2656	285.97	V	Q					
6+15	37.3042	296.00	V	Q					
6+20	39.4104	305.82	V	Q					
6+25	41.5863	315.95	V	Q					
6+30	43.8361	326.66	V	Q					
6+35	46.1738	339.45	V	Q					
6+40	48.6084	353.50	V	Q					
6+45	51.1466	368.55	V	Q					
6+50	53.7842	382.98	V	Q					
6+55	56.5214	397.43	V	Q					
7+ 0	59.3549	411.42	V	Q					
7+ 5	62.2995	427.57	V	Q					
7+10	65.3640	444.96	V	Q					
7+15	68.5567	463.59	V	Q					
7+20	71.8747	481.76	V	Q					
7+25	75.3247	500.94	V	Q					
7+30	78.9165	521.53	V	Q					
7+35	82.6923	548.25	V	Q					
7+40	86.6791	578.89	V	Q					
7+45	90.9031	613.32	V	Q					
7+50	95.3594	647.05	V	Q					
7+55	100.0668	683.51	V	Q					
8+ 0	105.0470	723.13	V	Q					
8+ 5	110.3961	776.68	V	Q					
8+10	116.1733	838.85	V	Q					
8+15	122.4300	908.47	V	Q					
8+20	129.1475	975.38	V	Q					
8+25	136.3446	1045.02	V	Q					
8+30	144.0321	1116.22	V	Q					
8+35	152.3476	1207.42	V	Q					
8+40	161.3712	1310.23	V	Q					
8+45	171.1628	1421.73	V	Q					
8+50	181.6757	1526.47	V	Q					
8+55	192.9025	1630.14	V	Q					
9+ 0	204.8062	1728.41	V	Q					
9+ 5	217.5004	1843.20	V	Q					
9+10	231.0406	1966.04	V	Q					
9+15	245.4535	2092.75	V	Q					
9+20	260.6638	2208.55	V	Q					
9+25	276.6150	2316.11	V	Q					
9+30	293.2023	2408.47	V	Q					
9+35	310.4217	2500.27	V	Q					
9+40	328.2494	2588.57	V	Q					
9+45	346.6387	2670.13	V	Q					
9+50	365.5145	2740.78	V	Q					
9+55	384.7799	2797.33	V	Q					
10+ 0	404.2939	2833.44	V	Q					
10+ 5	423.8798	2843.87	V	Q					
10+10	443.4109	2835.92	V	Q					
10+15	462.7587	2809.31	V	Q					
10+20	481.8919	2778.13	V	Q					
10+25	500.7030	2731.37	V	Q					

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10+30	519.0651	2666.19			V	
10+35	536.6373	2551.48			V	
10+40	553.2193	2407.71			V	
10+45	568.6752	2244.19			V	
10+50	583.1111	2096.09			V	
10+55	596.5977	1958.25			V	
11+ 0	609.3224	1847.64			V	
11+ 5	621.2448	1731.13			V	
11+10	632.3718	1615.63			VQ	
11+15	642.7324	1504.36			QV	
11+20	652.4148	1405.89			QV	
11+25	661.5007	1319.27			Q	
11+30	670.0900	1247.17			Q	
11+35	678.2124	1179.37			Q	
11+40	685.9000	1116.25			Q	
11+45	693.1901	1058.51			Q	
11+50	700.1337	1008.22			Q	
11+55	706.7703	963.63			Q	
12+ 0	713.1505	926.40			Q	
12+ 5	719.2934	891.95			Q	
12+10	725.2203	860.59			Q	
12+15	730.9543	832.57			Q	
12+20	736.5223	808.48			Q	
12+25	741.9445	787.31			Q	
12+30	747.2462	769.80			Q	
12+35	752.4457	754.97			Q	
12+40	757.5545	741.80			Q	
12+45	762.5854	730.48			Q	
12+50	767.5482	720.61			Q	
12+55	772.4496	711.68			Q	
13+ 0	777.2970	703.85			Q	
13+ 5	782.0917	696.18			Q	
13+10	786.8342	688.61			Q	
13+15	791.5257	681.21			Q	
13+20	796.1705	674.42			Q	
13+25	800.7682	667.59			Q	
13+30	805.3183	660.68			Q	
13+35	809.8088	652.02			Q	
13+40	814.2330	642.39			Q	
13+45	818.5873	632.24			Q	
13+50	822.8788	623.13			Q	
13+55	827.1119	614.65			Q	
14+ 0	831.2963	607.57			Q	
14+ 5	835.4302	600.24			Q	
14+10	839.5147	593.07			Q	
14+15	843.5540	586.51			Q	
14+20	847.5563	581.13			Q	
14+25	851.5332	577.45			Q	
14+30	855.5024	576.33			Q	
14+35	859.4819	577.81			Q	
14+40	863.4813	580.72			Q	
14+45	867.5015	583.73			Q	
14+50	871.5310	585.09			Q	
14+55	875.5442	582.72			Q	
15+ 0	879.4930	573.36			Q	
15+ 5	883.3109	554.36			Q	
15+10	886.9586	529.63			Q	
15+15	890.4151	501.89			Q	
15+20	893.7089	478.27			Q	
15+25	896.8757	459.82			Q	
15+30	899.9943	452.81			Q	
15+35	903.1288	455.14			Q	
15+40	906.3240	463.94			Q	

			BWN100Yr24Hr.out			
15+45	909.6126	477.50	Q		V	
15+50	912.9844	489.59	Q		V	
15+55	916.4321	500.60	Q		V	
16+ 0	919.9167	505.96	Q		V	
16+ 5	923.4254	509.46	Q		V	
16+10	926.9450	511.05	Q		V	
16+15	930.4638	510.93	Q		V	
16+20	933.9805	510.63	Q		V	
16+25	937.4886	509.38	Q		V	
16+30	940.9905	508.48	Q		V	
16+35	944.4758	506.06	Q		V	
16+40	947.9408	503.13	Q		V	
16+45	951.3844	500.01	Q		V	
16+50	954.8103	497.44	Q		V	
16+55	958.2248	495.80	Q		V	
17+ 0	961.6375	495.52	Q		V	
17+ 5	965.0599	496.93	Q		V	
17+10	968.4972	499.09	Q		V	
17+15	971.9509	501.49	Q		V	
17+20	975.4155	503.05	Q		V	
17+25	978.8802	503.08	Q		V	
17+30	982.3249	500.17	Q		V	
17+35	985.7216	493.20	Q		V	
17+40	989.0540	483.85	Q		V	
17+45	992.3116	473.00	Q		V	
17+50	995.5040	463.54	Q		V	
17+55	998.6410	455.49	Q		V	
18+ 0	1001.7466	450.94	Q		V	
18+ 5	1004.8336	448.23	Q		V	
18+10	1007.9113	446.89	Q		V	
18+15	1010.9853	446.34	Q		V	
18+20	1014.0527	445.40	Q		V	
18+25	1017.1067	443.43	Q		V	
18+30	1020.1281	438.70	Q		V	
18+35	1023.0927	430.46	Q		V	
18+40	1025.9851	419.99	Q		V	
18+45	1028.7956	408.08	Q		V	
18+50	1031.5333	397.51	Q		V	
18+55	1034.2053	387.98	Q		V	
19+ 0	1036.8321	381.41	Q		V	
19+ 5	1039.4184	375.53	Q		V	
19+10	1041.9700	370.50	Q		V	
19+15	1044.4920	366.18	Q		V	
19+20	1046.9870	362.28	Q		V	
19+25	1049.4568	358.62	Q		V	
19+30	1051.8985	354.54	Q		V	
19+35	1054.3079	349.85	Q		V	
19+40	1056.6824	344.77	Q		V	
19+45	1059.0218	339.68	Q		V	
19+50	1061.3316	335.38	Q		V	
19+55	1063.6181	332.00	Q		V	
20+ 0	1065.8942	330.48	Q		V	
20+ 5	1068.1709	330.59	Q		V	
20+10	1070.4568	331.91	Q		V	
20+15	1072.7589	334.27	Q		V	
20+20	1075.0772	336.61	Q		V	
20+25	1077.4140	339.30	Q		V	
20+30	1079.7686	341.90	Q		V	
20+35	1082.1494	345.69	Q		V	
20+40	1084.5600	350.01	Q		V	
20+45	1087.0014	354.49	Q		V	
20+50	1089.4690	358.30	Q		V	
20+55	1091.9562	361.15	Q		V	

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21+ 0	1094.4519	362.38	Q	V
21+ 5	1096.9446	361.93	Q	V
21+10	1099.4265	360.37	Q	V
21+15	1101.8911	357.86	Q	V
21+20	1104.3388	355.41	Q	V
21+25	1106.7679	352.70	Q	V
21+30	1109.1789	350.07	Q	V
21+35	1111.5644	346.39	Q	V
21+40	1113.9208	342.14	Q	V
21+45	1116.2459	337.61	Q	V
21+50	1118.5432	333.57	Q	V
21+55	1120.8163	330.05	Q	V
22+ 0	1123.0714	327.44	Q	V
22+ 5	1125.3107	325.15	Q	V
22+10	1127.5364	323.17	Q	V
22+15	1129.7504	321.48	Q	V
22+20	1131.9544	320.02	Q	V
22+25	1134.1499	318.79	Q	V
22+30	1136.3380	317.72	Q	V
22+35	1138.5196	316.76	Q	V
22+40	1140.6954	315.93	Q	V
22+45	1142.8662	315.20	Q	V
22+50	1145.0329	314.60	Q	V
22+55	1147.1959	314.07	Q	V
23+ 0	1149.3560	313.65	Q	V
23+ 5	1151.5144	313.40	Q	V
23+10	1153.6720	313.28	Q	V
23+15	1155.8304	313.41	Q	V
23+20	1157.9910	313.72	Q	V
23+25	1160.1568	314.47	Q	V
23+30	1162.3327	315.94	Q	V
23+35	1164.5271	318.63	Q	V
23+40	1166.7448	322.01	Q	V
23+45	1168.9879	325.70	Q	V
23+50	1171.2523	328.80	Q	V
23+55	1173.5327	331.11	Q	V
24+ 0	1175.8178	331.80	Q	V
24+ 5	1178.0935	330.43	Q	V
24+10	1180.3485	327.42	Q	V
24+15	1182.5672	322.15	Q	V
24+20	1184.7423	315.83	Q	V
24+25	1186.8490	305.89	Q	V
24+30	1188.8506	290.63	Q	V
24+35	1190.6718	264.45	Q	V
24+40	1192.2689	231.89	Q	V
24+45	1193.6145	195.39	Q	V
24+50	1194.7367	162.93	Q	V
24+55	1195.6599	134.05	Q	V
25+ 0	1196.4424	113.62	Q	V
25+ 5	1197.1025	95.84	Q	V
25+10	1197.6583	80.70	Q	V
25+15	1198.1278	68.17	Q	V
25+20	1198.5224	57.30	Q	V
25+25	1198.8552	48.32	Q	V
25+30	1199.1325	40.27	Q	V
25+35	1199.3630	33.46	Q	V
25+40	1199.5521	27.46	Q	V
25+45	1199.7053	22.25	Q	V
25+50	1199.8282	17.84	Q	V
25+55	1199.9239	13.90	Q	V
26+ 0	1199.9982	10.79	Q	V
26+ 5	1200.0540	8.10	Q	V
26+10	1200.0946	5.90	Q	V

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26+15	1200.1232	4.15	Q					V
26+20	1200.1420	2.73	Q					V
26+25	1200.1528	1.57	Q					V
26+30	1200.1571	0.63	Q					V
26+35	1200.1586	0.22	Q					V
26+40	1200.1586	0.00	Q					V

BWS100Yr6Hr.out

UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: bws100yr6hr.out

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Program License Serial Number 4055

Tule Wind Project
Bow Willow Creek South
Existing 100 Year 6 Hour
Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
5197.00	3.37

Rainfall Distribution pattern used in study:

Type B for SCS (small dam) or San Diego 6 hour storms

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***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
5197.00	1.000	88.0	88.0	0.050	C

Area-averaged catchment SCS Curve Number AMC(2) = 88.050

Area-averaged Fm value using values listed = 0.050(In/Hr)

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Direct entry of lag time by user

Watershed area = 5197.00(Ac.)

Catchment Lag time = 0.940 hours

Unit interval = 10.000 minutes

Unit interval percentage of lag time = 17.7305

Hydrograph baseflow = 0.00(CFS)

Minimum watershed loss rate(Fm) = 0.000(In/Hr)

Average adjusted SCS Curve Number = 88.050

Rainfall depth area reduction factors:

Using a total area of 5197.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used

Areal factor ratio (rainfall reduction) = 1.000

Rainfall entered for study = 3.370(In)

Adjusted rainfall = 3.370(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS (Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Q_p vs. T/T_p values into an S-Graph based on $lag = T_p/0.9$. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/T_p step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

UNIT HYDROGRAPH

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
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(K = BWS100Yr6Hr.out
31441.85 (CFS))

0.18	0.167	0.016	92.543	0.003
0.35	0.333	0.063	364.589	0.015
0.53	0.500	0.167	961.225	0.045
0.71	0.667	0.475	2739.226	0.132
0.89	0.833	0.889	5131.983	0.295
1.06	1.000	1.000	5771.063	0.479
1.24	1.167	0.768	4431.497	0.620
1.42	1.333	0.517	2982.476	0.715
1.60	1.500	0.394	2271.884	0.787
1.77	1.667	0.294	1694.984	0.841
1.95	1.833	0.227	1312.122	0.883
2.13	2.000	0.178	1028.502	0.915
2.30	2.167	0.140	805.323	0.941
2.48	2.333	0.108	622.145	0.961
2.66	2.500	0.080	458.945	0.975
2.84	2.667	0.058	336.197	0.986
3.01	2.833	0.040	232.321	0.993
3.19	3.000	0.027	152.980	0.998
3.37	3.167	0.009	49.538	1.000
3.55	3.333	0.000	2.309	1.000

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For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

Where:

Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad I_a = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.17	0.0393	0.0000	0.0393	0.0000	0.0393	-----
0.33	0.0786	0.0000	0.0393	0.0000	0.0393	-----

BWS100Yr6Hr.out

0.50	0.1180	0.0000	0.0393	0.0000	0.0393	-----
0.67	0.1707	0.0000	0.0528	0.0000	0.0528	-----
0.83	0.2235	0.0000	0.0528	0.0000	0.0528	-----
1.00	0.2763	0.0000	0.0528	0.0000	0.0528	-----
1.17	0.3415	0.0034	0.0652	0.0034	0.0617	-----
1.33	0.4066	0.0122	0.0652	0.0088	0.0563	-----
1.50	0.4718	0.0258	0.0652	0.0135	0.0516	-----
1.67	0.5729	0.0548	0.1011	0.0290	0.0721	-----
1.83	0.6740	0.0921	0.1011	0.0373	0.0638	-----
2.00	0.7751	0.1363	0.1011	0.0442	0.0569	-----
2.17	1.1907	0.3712	0.4156	0.2349	0.1807	-----
2.33	1.6064	0.6619	0.4156	0.2907	0.1249	-----
2.50	2.0220	0.9861	0.4156	0.3241	0.0915	-----
2.67	2.1343	1.0777	0.1123	0.0917	0.0207	-----
2.83	2.2467	1.1708	0.1123	0.0931	0.0193	-----
3.00	2.3590	1.2651	0.1123	0.0943	0.0180	-----
3.17	2.4500	1.3423	0.0910	0.0772	0.0138	-----
3.33	2.5410	1.4202	0.0910	0.0779	0.0131	-----
3.50	2.6320	1.4988	0.0910	0.0786	0.0124	-----
3.67	2.6926	1.5515	0.0607	0.0527	0.0080	-----
3.83	2.7533	1.6045	0.0607	0.0530	0.0077	-----
4.00	2.8140	1.6577	0.0607	0.0532	0.0075	-----
4.17	2.8645	1.7022	0.0505	0.0445	0.0060	-----
4.33	2.9150	1.7468	0.0505	0.0447	0.0059	-----
4.50	2.9656	1.7916	0.0506	0.0448	0.0057	-----
4.67	3.0139	1.8346	0.0483	0.0429	0.0054	-----
4.83	3.0622	1.8776	0.0483	0.0431	0.0052	-----
5.00	3.1105	1.9208	0.0483	0.0432	0.0051	-----
5.17	3.1521	1.9581	0.0416	0.0373	0.0043	-----
5.33	3.1936	1.9954	0.0416	0.0373	0.0042	-----
5.50	3.2352	2.0329	0.0416	0.0374	0.0041	-----
5.67	3.2801	2.0734	0.0449	0.0405	0.0044	-----
5.83	3.3251	2.1140	0.0449	0.0406	0.0043	-----
6.00	3.3700	2.1548	0.0449	0.0407	0.0042	-----

Total soil rain loss = 1.22(In)
Total effective runoff = 2.15(In)

Peak flow rate this hydrograph = 5059.61(CFS)
Total runoff volume this hydrograph = 40649910.3(Ft3)

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6 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 10 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	1275.0	2550.0	3825.0	5100.0
0+10	0.0000	0.00	Q					
0+20	0.0000	0.00	Q					
0+30	0.0000	0.00	Q					
0+40	0.0000	0.00	Q					
0+50	0.0000	0.00	Q					
1+ 0	0.0000	0.00	Q					
1+10	0.0045	0.32	Q					
1+20	0.0331	2.08	Q					
1+30	0.1406	7.80	Q					
1+40	0.4925	25.55	Q					
1+50	1.4405	68.83	Q					
2+ 0	3.4745	147.67	VQ					

			BWS100Yr6Hr.out			
2+10	7.4508	288.68	V	Q		
2+20	14.7992	533.50	V	Q		
2+30	27.6896	935.85	V		Q	
2+40	50.9209	1686.59	V		Q	
2+50	91.0414	2912.75	V			Q
3+ 0	149.9593	4277.44		V		Q
3+10	219.6509	5059.61		V		Q
3+20	287.6356	4935.69		V		Q
3+30	348.0152	4383.56		V		Q
3+40	401.8149	3905.86		V		Q
3+50	451.1304	3580.31		V		Q
4+ 0	496.4618	3291.06		V	Q	
4+10	538.2585	3034.44			Q	
4+20	576.3304	2764.02			Q	
4+30	610.7029	2495.44			Q	
4+40	641.8921	2264.33			Q	
4+50	670.3068	2062.91			Q	
5+ 0	696.3210	1888.63			Q	
5+10	720.2957	1740.56			Q	
5+20	742.5810	1617.92			Q	
5+30	763.4911	1518.07			Q	
5+40	783.3970	1445.17			Q	
5+50	802.4288	1381.71			Q	
6+ 0	820.6887	1325.67			Q	
6+10	838.4160	1287.00			Q	
6+20	855.7554	1258.85			Q	
6+30	872.5109	1216.45			Q	
6+40	887.7302	1104.92			Q	
6+50	900.0697	895.84			Q	
7+ 0	909.1718	660.81			Q	
7+10	915.7924	480.66			Q	
7+20	920.7481	359.79			Q	
7+30	924.4387	267.93			Q	
7+40	927.1891	199.68			Q	
7+50	929.2147	147.06			Q	
8+ 0	930.6731	105.88			Q	
8+10	931.6919	73.97			Q	
8+20	932.3728	49.43			Q	
8+30	932.8035	31.27			Q	
8+40	933.0483	17.77			Q	
8+50	933.1632	8.34			Q	
9+ 0	933.1922	2.11			Q	
9+10	933.1935	0.09			Q	

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UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: bws100yr24hr.out

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Program License Serial Number 4055

Tule Wind Project
Bow Willow Creek South
Existing 100 Year 24 Hour
Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
5197.00	9.70

Rainfall Distribution pattern used in study:
Type B for San Diego area of California

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***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
5197.00	1.000	88.0	88.0	0.050	C

Area-averaged catchment SCS Curve Number AMC(2) = 88.050
Area-averaged Fm value using values listed = 0.050(In/Hr)

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Direct entry of lag time by user

Watershed area = 5197.00(Ac.)

Catchment Lag time = 0.940 hours

Unit interval = 10.000 minutes

Unit interval percentage of lag time = 17.7305

Hydrograph baseflow = 0.00(CFS)

Minimum watershed loss rate(Fm) = 0.000(In/Hr)

Average adjusted SCS Curve Number = 88.050

Rainfall depth area reduction factors:

Using a total area of 5197.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used

Areal factor ratio (rainfall reduction) = 1.000

Rainfall entered for study = 9.700(In)

Adjusted rainfall = 9.700(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Q_p vs. T/T_p values into an S-Graph based on $lag = T_p/0.9$. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/T_p step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

UNIT HYDROGRAPH

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
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(K = BWS100Yr24Hr.out
31441.85 (CFS))

0.18	0.167	0.016	92.543	0.003
0.35	0.333	0.063	364.589	0.015
0.53	0.500	0.167	961.225	0.045
0.71	0.667	0.475	2739.226	0.132
0.89	0.833	0.889	5131.983	0.295
1.06	1.000	1.000	5771.063	0.479
1.24	1.167	0.768	4431.497	0.620
1.42	1.333	0.517	2982.476	0.715
1.60	1.500	0.394	2271.884	0.787
1.77	1.667	0.294	1694.984	0.841
1.95	1.833	0.227	1312.122	0.883
2.13	2.000	0.178	1028.502	0.915
2.30	2.167	0.140	805.323	0.941
2.48	2.333	0.108	622.145	0.961
2.66	2.500	0.080	458.945	0.975
2.84	2.667	0.058	336.197	0.986
3.01	2.833	0.040	232.321	0.993
3.19	3.000	0.027	152.980	0.998
3.37	3.167	0.009	49.538	1.000
3.55	3.333	0.000	2.309	1.000

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For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

Where:

Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad I_a = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.17	0.0291	0.0000	0.0291	0.0000	0.0291	-----
0.33	0.0582	0.0000	0.0291	0.0000	0.0291	-----

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0.50	0.0873	0.0000	0.0291	0.0000	0.0291	-----
0.67	0.1099	0.0000	0.0226	0.0000	0.0226	-----
0.83	0.1326	0.0000	0.0226	0.0000	0.0226	-----
1.00	0.1552	0.0000	0.0226	0.0000	0.0226	-----
1.17	0.1843	0.0000	0.0291	0.0000	0.0291	-----
1.33	0.2134	0.0000	0.0291	0.0000	0.0291	-----
1.50	0.2425	0.0000	0.0291	0.0000	0.0291	-----
1.67	0.2716	0.0000	0.0291	0.0000	0.0291	-----
1.83	0.3007	0.0006	0.0291	0.0006	0.0285	-----
2.00	0.3298	0.0024	0.0291	0.0018	0.0273	-----
2.17	0.3654	0.0061	0.0356	0.0037	0.0319	-----
2.33	0.4009	0.0113	0.0356	0.0052	0.0304	-----
2.50	0.4365	0.0179	0.0356	0.0066	0.0289	-----
2.67	0.4656	0.0243	0.0291	0.0064	0.0227	-----
2.83	0.4947	0.0315	0.0291	0.0072	0.0219	-----
3.00	0.5238	0.0396	0.0291	0.0080	0.0211	-----
3.17	0.5594	0.0504	0.0356	0.0108	0.0247	-----
3.33	0.5949	0.0623	0.0356	0.0119	0.0237	-----
3.50	0.6305	0.0751	0.0356	0.0129	0.0227	-----
3.67	0.6693	0.0902	0.0388	0.0151	0.0237	-----
3.83	0.7081	0.1063	0.0388	0.0161	0.0227	-----
4.00	0.7469	0.1234	0.0388	0.0171	0.0217	-----
4.17	0.7889	0.1429	0.0420	0.0195	0.0225	-----
4.33	0.8310	0.1633	0.0420	0.0205	0.0215	-----
4.50	0.8730	0.1847	0.0420	0.0214	0.0206	-----
4.67	0.9183	0.2088	0.0453	0.0240	0.0212	-----
4.83	0.9635	0.2337	0.0453	0.0250	0.0203	-----
5.00	1.0088	0.2596	0.0453	0.0258	0.0194	-----
5.17	1.0605	0.2901	0.0517	0.0305	0.0212	-----
5.33	1.1123	0.3217	0.0517	0.0315	0.0202	-----
5.50	1.1640	0.3541	0.0517	0.0325	0.0193	-----
5.67	1.2190	0.3896	0.0550	0.0354	0.0195	-----
5.83	1.2739	0.4259	0.0550	0.0363	0.0186	-----
6.00	1.3289	0.4631	0.0550	0.0372	0.0178	-----
6.17	1.3936	0.5079	0.0647	0.0448	0.0199	-----
6.33	1.4582	0.5537	0.0647	0.0458	0.0189	-----
6.50	1.5229	0.6004	0.0647	0.0467	0.0179	-----
6.67	1.5973	0.6552	0.0744	0.0548	0.0196	-----
6.83	1.6716	0.7110	0.0744	0.0559	0.0185	-----
7.00	1.7460	0.7678	0.0744	0.0568	0.0175	-----
7.17	1.8430	0.8433	0.0970	0.0755	0.0215	-----
7.33	1.9400	0.9201	0.0970	0.0768	0.0202	-----
7.50	2.0370	0.9982	0.0970	0.0781	0.0189	-----
7.67	2.1825	1.1175	0.1455	0.1192	0.0263	-----
7.83	2.3280	1.2389	0.1455	0.1215	0.0240	-----
8.00	2.4735	1.3624	0.1455	0.1234	0.0221	-----
8.17	2.6901	1.5493	0.2166	0.1869	0.0297	-----
8.33	2.9068	1.7395	0.2166	0.1902	0.0265	-----
8.50	3.1234	1.9324	0.2166	0.1929	0.0237	-----
8.67	3.4079	2.1892	0.2845	0.2568	0.0277	-----
8.83	3.6925	2.4493	0.2845	0.2601	0.0244	-----
9.00	3.9770	2.7122	0.2845	0.2629	0.0217	-----
9.17	4.2874	3.0016	0.3104	0.2894	0.0210	-----
9.33	4.5978	3.2933	0.3104	0.2917	0.0187	-----
9.50	4.9082	3.5869	0.3104	0.2936	0.0168	-----
9.67	5.1733	3.8390	0.2651	0.2521	0.0130	-----
9.83	5.4385	4.0922	0.2651	0.2532	0.0120	-----
10.00	5.7036	4.3463	0.2651	0.2541	0.0110	-----
10.17	5.8362	4.4737	0.1326	0.1274	0.0052	-----
10.33	5.9687	4.6012	0.1326	0.1276	0.0050	-----
10.50	6.1013	4.7290	0.1326	0.1278	0.0048	-----
10.67	6.1886	4.8132	0.0873	0.0842	0.0031	-----
10.83	6.2759	4.8975	0.0873	0.0843	0.0030	-----

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11.00	6.3632	4.9819	0.0873	0.0844	0.0029 -----
11.17	6.4376	5.0538	0.0744	0.0719	0.0024 -----
11.33	6.5119	5.1257	0.0744	0.0720	0.0024 -----
11.50	6.5863	5.1978	0.0744	0.0720	0.0023 -----
11.67	6.6542	5.2636	0.0679	0.0658	0.0021 -----
11.83	6.7221	5.3294	0.0679	0.0658	0.0021 -----
12.00	6.7900	5.3953	0.0679	0.0659	0.0020 -----
12.17	6.8547	5.4580	0.0647	0.0628	0.0019 -----
12.33	6.9193	5.5208	0.0647	0.0628	0.0019 -----
12.50	6.9840	5.5836	0.0647	0.0628	0.0018 -----
12.67	7.0454	5.6433	0.0614	0.0597	0.0017 -----
12.83	7.1069	5.7031	0.0614	0.0597	0.0017 -----
13.00	7.1683	5.7628	0.0614	0.0598	0.0017 -----
13.17	7.2233	5.8163	0.0550	0.0535	0.0015 -----
13.33	7.2782	5.8698	0.0550	0.0535	0.0015 -----
13.50	7.3332	5.9234	0.0550	0.0535	0.0014 -----
13.67	7.3849	5.9738	0.0517	0.0504	0.0013 -----
13.83	7.4367	6.0242	0.0517	0.0504	0.0013 -----
14.00	7.4884	6.0746	0.0517	0.0504	0.0013 -----
14.17	7.5466	6.1314	0.0582	0.0568	0.0014 -----
14.33	7.6048	6.1881	0.0582	0.0568	0.0014 -----
14.50	7.6630	6.2449	0.0582	0.0568	0.0014 -----
14.67	7.6953	6.2765	0.0323	0.0316	0.0008 -----
14.83	7.7277	6.3080	0.0323	0.0316	0.0008 -----
15.00	7.7600	6.3396	0.0323	0.0316	0.0008 -----
15.17	7.8117	6.3901	0.0517	0.0505	0.0012 -----
15.33	7.8635	6.4407	0.0517	0.0505	0.0012 -----
15.50	7.9152	6.4912	0.0517	0.0506	0.0012 -----
15.67	7.9637	6.5386	0.0485	0.0474	0.0011 -----
15.83	8.0122	6.5860	0.0485	0.0474	0.0011 -----
16.00	8.0607	6.6335	0.0485	0.0474	0.0011 -----
16.17	8.1060	6.6777	0.0453	0.0443	0.0010 -----
16.33	8.1512	6.7220	0.0453	0.0443	0.0010 -----
16.50	8.1965	6.7663	0.0453	0.0443	0.0010 -----
16.67	8.2450	6.8138	0.0485	0.0475	0.0010 -----
16.83	8.2935	6.8613	0.0485	0.0475	0.0010 -----
17.00	8.3420	6.9088	0.0485	0.0475	0.0010 -----
17.17	8.3808	6.9468	0.0388	0.0380	0.0008 -----
17.33	8.4196	6.9848	0.0388	0.0380	0.0008 -----
17.50	8.4584	7.0228	0.0388	0.0380	0.0008 -----
17.67	8.5004	7.0640	0.0420	0.0412	0.0008 -----
17.83	8.5425	7.1052	0.0420	0.0412	0.0008 -----
18.00	8.5845	7.1464	0.0420	0.0412	0.0008 -----
18.17	8.6168	7.1781	0.0323	0.0317	0.0006 -----
18.33	8.6492	7.2098	0.0323	0.0317	0.0006 -----
18.50	8.6815	7.2415	0.0323	0.0317	0.0006 -----
18.67	8.7138	7.2732	0.0323	0.0317	0.0006 -----
18.83	8.7462	7.3049	0.0323	0.0317	0.0006 -----
19.00	8.7785	7.3366	0.0323	0.0317	0.0006 -----
19.17	8.8076	7.3652	0.0291	0.0286	0.0005 -----
19.33	8.8367	7.3937	0.0291	0.0286	0.0005 -----
19.50	8.8658	7.4223	0.0291	0.0286	0.0005 -----
19.67	8.8981	7.4540	0.0323	0.0317	0.0006 -----
19.83	8.9305	7.4857	0.0323	0.0317	0.0006 -----
20.00	8.9628	7.5175	0.0323	0.0317	0.0006 -----
20.17	8.9984	7.5524	0.0356	0.0349	0.0006 -----
20.33	9.0339	7.5873	0.0356	0.0349	0.0006 -----
20.50	9.0695	7.6223	0.0356	0.0349	0.0006 -----
20.67	9.1018	7.6540	0.0323	0.0318	0.0006 -----
20.83	9.1342	7.6858	0.0323	0.0318	0.0006 -----
21.00	9.1665	7.7175	0.0323	0.0318	0.0006 -----
21.17	9.1956	7.7461	0.0291	0.0286	0.0005 -----
21.33	9.2247	7.7747	0.0291	0.0286	0.0005 -----

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21.50	9.2538	7.8033	0.0291	0.0286	0.0005	-----
21.67	9.2829	7.8319	0.0291	0.0286	0.0005	-----
21.83	9.3120	7.8605	0.0291	0.0286	0.0005	-----
22.00	9.3411	7.8891	0.0291	0.0286	0.0005	-----
22.17	9.3702	7.9177	0.0291	0.0286	0.0005	-----
22.33	9.3993	7.9464	0.0291	0.0286	0.0005	-----
22.50	9.4284	7.9750	0.0291	0.0286	0.0005	-----
22.67	9.4575	8.0036	0.0291	0.0286	0.0005	-----
22.83	9.4866	8.0322	0.0291	0.0286	0.0005	-----
23.00	9.5157	8.0608	0.0291	0.0286	0.0005	-----
23.17	9.5480	8.0926	0.0323	0.0318	0.0005	-----
23.33	9.5804	8.1244	0.0323	0.0318	0.0005	-----
23.50	9.6127	8.1562	0.0323	0.0318	0.0005	-----
23.67	9.6418	8.1849	0.0291	0.0286	0.0005	-----
23.83	9.6709	8.2135	0.0291	0.0286	0.0005	-----
24.00	9.7000	8.2422	0.0291	0.0286	0.0005	-----

Total soil rain loss = 1.46(In)
Total effective runoff = 8.24(In)

Peak flow rate this hydrograph = 8126.84(CFS)
Total runoff volume this hydrograph = 155489177.1(Ft3)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 10 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2050.0	4100.0	6150.0	8200.0
0+10	0.0000	0.00	Q				
0+20	0.0000	0.00	Q				
0+30	0.0000	0.00	Q				
0+40	0.0000	0.00	Q				
0+50	0.0000	0.00	Q				
1+ 0	0.0000	0.00	Q				
1+10	0.0000	0.00	Q				
1+20	0.0000	0.00	Q				
1+30	0.0000	0.00	Q				
1+40	0.0000	0.00	Q				
1+50	0.0008	0.06	Q				
2+ 0	0.0062	0.39	Q				
2+10	0.0280	1.59	Q				
2+20	0.1001	5.23	Q				
2+30	0.2944	14.11	Q				
2+40	0.7188	30.81	Q				
2+50	1.4836	55.52	Q				
3+ 0	2.6588	85.32	Q				
3+10	4.2486	115.42	Q				
3+20	6.2149	142.76	Q				
3+30	8.5433	169.04	Q				
3+40	11.2879	199.26	Q				
3+50	14.5377	235.94	VQ				
4+ 0	18.3382	275.91	VQ				
4+10	22.7029	316.88	VQ				
4+20	27.6501	359.16	VQ				
4+30	33.1899	402.19	VQ				
4+40	39.3255	445.44	V Q				
4+50	46.0767	490.14	V Q				
5+ 0	53.4493	535.26	V Q				

			BWS100Yr24Hr.out			
5+10	61.4433	580.36	V	Q		
5+20	70.0838	627.30	V	Q		
5+30	79.3902	675.64	V	Q		
5+40	89.4060	727.15	V	Q		
5+50	100.2166	784.85	V	Q		
6+ 0	111.8468	844.35	V	Q		
6+10	124.2633	901.44	V	Q		
6+20	137.4651	958.45	V	Q		
6+30	151.4727	1016.95	V	Q		
6+40	166.3777	1082.11	V	Q		
6+50	182.3592	1160.26	V	Q		
7+ 0	199.4991	1244.36	V	Q		
7+10	217.8433	1331.79	V	Q		
7+20	237.5408	1430.04	V	Q		
7+30	258.7227	1537.81	V	Q		
7+40	281.6812	1666.79	V	Q		
7+50	306.9741	1836.26	V	Q		
8+ 0	335.0085	2035.30	V	Q		
8+10	366.4637	2283.64	V	Q		
8+20	402.5227	2617.89	V	Q		
8+30	443.8988	3003.90	V	Q		
8+40	491.3451	3444.60	V	Q		
8+50	546.2865	3988.74	V	Q		
9+ 0	609.3854	4580.98	V	Q		
9+10	680.7358	5180.03	V	Q		
9+20	761.0144	5828.23	V	Q		
9+30	850.2013	6474.97	V	Q		
9+40	947.0703	7032.69	V	Q		
9+50	1050.5552	7513.00	V	Q		
10+ 0	1159.5167	7910.61	V	Q		
10+10	1271.4566	8126.84	V	Q		
10+20	1383.3580	8124.04	V	Q		
10+30	1493.0286	7962.09	V	Q		
10+40	1597.4353	7579.92	V	Q		
10+50	1692.5675	6906.60	V	Q		
11+ 0	1776.9554	6126.56	V	Q		
11+10	1851.8425	5436.81	V	Q		
11+20	1918.2454	4820.85	V	Q		
11+30	1976.9066	4258.81	V	Q		
11+40	2029.2848	3802.66	V	Q		
11+50	2076.4833	3426.61	V	Q		
12+ 0	2119.3044	3108.81	V	Q		
12+10	2158.5758	2851.10	V	Q		
12+20	2194.9093	2637.82	V	Q		
12+30	2228.8372	2463.16	V	Q		
12+40	2260.8953	2327.42	V	Q		
12+50	2291.4737	2219.99	V	Q		
13+ 0	2320.8635	2133.70	V	Q		
13+10	2349.3783	2070.17	V	Q		
13+20	2377.1615	2017.06	V	Q		
13+30	2404.2677	1967.91	V	Q		
13+40	2430.7230	1920.66	V	Q		
13+50	2456.4487	1867.69	V	Q		
14+ 0	2481.4348	1813.99	V	Q		
14+10	2505.7905	1768.22	V	Q		
14+20	2529.6020	1728.72	V	Q		
14+30	2552.9810	1697.32	V	Q		
14+40	2576.1814	1684.34	V	Q		
14+50	2599.4285	1687.74	V	Q		
15+ 0	2622.6364	1684.89	V	Q		
15+10	2645.1485	1634.38	V	Q		
15+20	2666.1163	1522.26	V	Q		
15+30	2685.4404	1402.93	V	Q		

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15+40	2704.0207	1348.93	Q	V
15+50	2722.9589	1374.91	Q	V
16+ 0	2742.6324	1428.30	Q	V
16+10	2762.8060	1464.60	Q	V
16+20	2783.1115	1474.18	Q	V
16+30	2803.3975	1472.77	Q	V
16+40	2823.5698	1464.51	Q	V
16+50	2843.5558	1450.98	Q	V
17+ 0	2863.3602	1437.80	Q	V
17+10	2883.1073	1433.64	Q	V
17+20	2902.9297	1439.10	Q	V
17+30	2922.8051	1442.96	Q	V
17+40	2942.4854	1428.79	Q	V
17+50	2961.6199	1389.16	Q	V
18+ 0	2980.1193	1343.06	Q	V
18+10	2998.1870	1311.72	Q	V
18+20	3016.0648	1297.92	Q	V
18+30	3033.7927	1287.05	Q	V
18+40	3051.1549	1260.50	Q	V
18+50	3067.8234	1210.13	Q	V
19+ 0	3083.7166	1153.85	Q	V
19+10	3099.0089	1110.22	Q	V
19+20	3113.8828	1079.84	Q	V
19+30	3128.4107	1054.73	Q	V
19+40	3142.5964	1029.88	Q	V
19+50	3156.4006	1002.19	Q	V
20+ 0	3169.8618	977.28	Q	V
20+10	3183.1575	965.27	Q	V
20+20	3196.4931	968.17	Q	V
20+30	3209.9720	978.56	Q	V
20+40	3223.6460	992.73	Q	V
20+50	3237.5728	1011.09	Q	V
21+ 0	3251.7460	1028.97	Q	V
21+10	3266.0233	1036.53	Q	V
21+20	3280.2221	1030.84	Q	V
21+30	3294.2525	1018.60	Q	V
21+40	3308.0654	1002.82	Q	V
21+50	3321.5992	982.56	Q	V
22+ 0	3334.8411	961.36	Q	V
22+10	3347.8640	945.47	Q	V
22+20	3360.7377	934.63	Q	V
22+30	3373.4951	926.19	Q	V
22+40	3386.1613	919.56	Q	V
22+50	3398.7544	914.26	Q	V
23+ 0	3411.2903	910.11	Q	V
23+10	3423.7837	907.02	Q	V
23+20	3436.2571	905.56	Q	V
23+30	3448.7469	906.76	Q	V
23+40	3461.3370	914.04	Q	V
23+50	3474.1270	928.55	Q	V
24+ 0	3487.1221	943.45	Q	V
24+10	3500.1539	946.11	Q	V
24+20	3512.9488	928.91	Q	V
24+30	3525.2124	890.33	Q	V
24+40	3536.2765	803.25	Q	V
24+50	3545.2438	651.03	Q	V
25+ 0	3551.8809	481.85	Q	V
25+10	3556.7313	352.14	Q	V
25+20	3560.3753	264.56	Q	V
25+30	3563.0984	197.70	Q	V
25+40	3565.1326	147.68	Q	V
25+50	3566.6322	108.87	Q	V
26+ 0	3567.7129	78.45	Q	V

BWS100Yr24Hr.out								
26+10	3568.4633	54.48	Q					V
26+20	3568.9583	35.94	Q					V
26+30	3569.2656	22.31	Q					V
26+40	3569.4382	12.53	Q					V
26+50	3569.5190	5.87	Q					V
27+ 0	3569.5394	1.48	Q					V
27+10	3569.5403	0.07	Q					V

North100Yr6Hr.out

UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: north100yr6hr.out

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Program License Serial Number 4055

Tule wind Project
Unnamed Northern Wash
Existing 100 Year 6 Hour
Aug 25, 2010

+++++

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
1542.00	3.00

Rainfall Distribution pattern used in study:
Type B for SCS (small dam) or San Diego 6 hour storms

+++++

***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
1542.00	1.000	82.7	82.7	0.050	B

Area-averaged catchment SCS Curve Number AMC(2) = 82.730
Area-averaged Fm value using values listed = 0.050(In/Hr)

+++++

Direct entry of lag time by user
Watershed area = 1542.00(Ac.)
Catchment Lag time = 0.490 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 17.0068
Hydrograph baseflow = 0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 82.730

Rainfall depth area reduction factors:
Using a total area of 1542.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study = 3.000(In)
Adjusted rainfall = 3.000(In)

+++++

The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS (Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Q_p vs. T/T_p values into an S-Graph based on $\text{lag} = T_p/0.9$. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/T_p step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

UNIT HYDROGRAPH

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
-----------------------	---------------	-------------------------------	------------	--------------------------------

(K = North100Yr6Hr.out
18658.20 (CFS))

0.17	0.083	0.016	52.675	0.003
0.34	0.167	0.059	198.756	0.013
0.51	0.250	0.151	507.441	0.041
0.68	0.333	0.408	1365.747	0.114
0.85	0.417	0.818	2742.251	0.261
1.02	0.500	1.000	3350.925	0.440
1.19	0.583	0.827	2770.295	0.589
1.36	0.667	0.554	1856.539	0.688
1.53	0.750	0.424	1420.176	0.765
1.70	0.833	0.319	1068.004	0.822
1.87	0.917	0.247	826.450	0.866
2.04	1.000	0.195	653.065	0.901
2.21	1.083	0.154	515.905	0.929
2.38	1.167	0.122	409.102	0.951
2.55	1.250	0.093	310.128	0.967
2.72	1.333	0.070	233.636	0.980
2.89	1.417	0.050	167.340	0.989
3.06	1.500	0.036	120.679	0.995
3.23	1.583	0.021	69.730	0.999
3.40	1.667	0.006	19.310	1.000
3.57	1.750	0.000	0.046	1.000

+++++
For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0175	0.0000	0.0175	0.0000	0.0175	-----

North100Yr6Hr.out					
0.17	0.0350	0.0000	0.0175	0.0000	0.0175
0.25	0.0525	0.0000	0.0175	0.0000	0.0175
0.33	0.0700	0.0000	0.0175	0.0000	0.0175
0.42	0.0875	0.0000	0.0175	0.0000	0.0175
0.50	0.1050	0.0000	0.0175	0.0000	0.0175
0.58	0.1285	0.0000	0.0235	0.0000	0.0235
0.67	0.1520	0.0000	0.0235	0.0000	0.0235
0.75	0.1755	0.0000	0.0235	0.0000	0.0235
0.83	0.1990	0.0000	0.0235	0.0000	0.0235
0.92	0.2225	0.0000	0.0235	0.0000	0.0235
1.00	0.2460	0.0000	0.0235	0.0000	0.0235
1.08	0.2750	0.0000	0.0290	0.0000	0.0290
1.17	0.3040	0.0000	0.0290	0.0000	0.0290
1.25	0.3330	0.0000	0.0290	0.0000	0.0290
1.33	0.3620	0.0000	0.0290	0.0000	0.0290
1.42	0.3910	0.0000	0.0290	0.0000	0.0290
1.50	0.4200	0.0000	0.0290	0.0000	0.0290
1.58	0.4650	0.0011	0.0450	0.0011	0.0439
1.67	0.5100	0.0039	0.0450	0.0029	0.0421
1.75	0.5550	0.0085	0.0450	0.0046	0.0404
1.83	0.6000	0.0147	0.0450	0.0062	0.0388
1.92	0.6450	0.0224	0.0450	0.0077	0.0373
2.00	0.6900	0.0315	0.0450	0.0091	0.0359
2.08	0.8750	0.0822	0.1850	0.0508	0.1342
2.17	1.0600	0.1512	0.1850	0.0690	0.1160
2.25	1.2450	0.2349	0.1850	0.0837	0.1013
2.33	1.4300	0.3307	0.1850	0.0958	0.0892
2.42	1.6150	0.4365	0.1850	0.1058	0.0792
2.50	1.8000	0.5508	0.1850	0.1143	0.0707
2.58	1.8500	0.5830	0.0500	0.0322	0.0178
2.67	1.9000	0.6156	0.0500	0.0327	0.0173
2.75	1.9500	0.6488	0.0500	0.0331	0.0169
2.83	2.0000	0.6824	0.0500	0.0336	0.0164
2.92	2.0500	0.7164	0.0500	0.0340	0.0160
3.00	2.1000	0.7509	0.0500	0.0345	0.0155
3.08	2.1405	0.7791	0.0405	0.0282	0.0123
3.17	2.1810	0.8076	0.0405	0.0285	0.0120
3.25	2.2215	0.8363	0.0405	0.0287	0.0118
3.33	2.2620	0.8652	0.0405	0.0290	0.0115
3.42	2.3025	0.8945	0.0405	0.0292	0.0113
3.50	2.3430	0.9239	0.0405	0.0294	0.0111
3.58	2.3700	0.9436	0.0270	0.0197	0.0073
3.67	2.3970	0.9635	0.0270	0.0198	0.0072
3.75	2.4240	0.9834	0.0270	0.0199	0.0071
3.83	2.4510	1.0034	0.0270	0.0200	0.0070
3.92	2.4780	1.0235	0.0270	0.0201	0.0069
4.00	2.5050	1.0437	0.0270	0.0202	0.0068
4.08	2.5275	1.0606	0.0225	0.0169	0.0056
4.17	2.5500	1.0776	0.0225	0.0170	0.0055
4.25	2.5725	1.0946	0.0225	0.0170	0.0055
4.33	2.5950	1.1117	0.0225	0.0171	0.0054
4.42	2.6175	1.1289	0.0225	0.0171	0.0054
4.50	2.6400	1.1461	0.0225	0.0172	0.0053
4.58	2.6615	1.1625	0.0215	0.0165	0.0050
4.67	2.6830	1.1791	0.0215	0.0165	0.0050
4.75	2.7045	1.1956	0.0215	0.0166	0.0049
4.83	2.7260	1.2123	0.0215	0.0166	0.0049
4.92	2.7475	1.2289	0.0215	0.0167	0.0048
5.00	2.7690	1.2457	0.0215	0.0167	0.0048
5.08	2.7875	1.2601	0.0185	0.0144	0.0041
5.17	2.8060	1.2746	0.0185	0.0145	0.0040
5.25	2.8245	1.2890	0.0185	0.0145	0.0040
5.33	2.8430	1.3036	0.0185	0.0145	0.0040

North100Yr6Hr.out

5.42	2.8615	1.3181	0.0185	0.0146	0.0039	-----
5.50	2.8800	1.3327	0.0185	0.0146	0.0039	-----
5.58	2.9000	1.3485	0.0200	0.0158	0.0042	-----
5.67	2.9200	1.3644	0.0200	0.0158	0.0042	-----
5.75	2.9400	1.3803	0.0200	0.0159	0.0041	-----
5.83	2.9600	1.3962	0.0200	0.0159	0.0041	-----
5.92	2.9800	1.4121	0.0200	0.0160	0.0040	-----
6.00	3.0000	1.4281	0.0200	0.0160	0.0040	-----

Total soil rain loss = 1.57(In)
Total effective runoff = 1.43(In)

Peak flow rate this hydrograph = 1328.54(CFS)
Total runoff volume this hydrograph = 7993792.1(Ft3)

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6 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	350.0	700.0	1050.0	1400.0
0+ 5	0.0000	0.00	Q					
0+10	0.0000	0.00	Q					
0+15	0.0000	0.00	Q					
0+20	0.0000	0.00	Q					
0+25	0.0000	0.00	Q					
0+30	0.0000	0.00	Q					
0+35	0.0000	0.00	Q					
0+40	0.0000	0.00	Q					
0+45	0.0000	0.00	Q					
0+50	0.0000	0.00	Q					
0+55	0.0000	0.00	Q					
1+ 0	0.0000	0.00	Q					
1+ 5	0.0000	0.00	Q					
1+10	0.0000	0.00	Q					
1+15	0.0000	0.00	Q					
1+20	0.0000	0.00	Q					
1+25	0.0000	0.00	Q					
1+30	0.0000	0.00	Q					
1+35	0.0004	0.06	Q					
1+40	0.0029	0.36	Q					
1+45	0.0122	1.35	Q					
1+50	0.0407	4.14	Q					
1+55	0.1148	10.77	Q					
2+ 0	0.2718	22.79	Q					
2+ 5	0.5603	41.89	VQ					
2+10	1.0493	71.00	V Q					
2+15	1.8590	117.58	V Q					
2+20	3.2884	207.55	V Q					
2+25	5.8657	374.22	V Q					
2+30	10.0355	605.46	V Q					
2+35	15.8953	850.84	V Q					
2+40	23.2662	1070.25	V Q					
2+45	31.8600	1247.82	V Q					
2+50	41.0097	1328.54	V Q					
2+55	49.6959	1261.24	V Q					
3+ 0	57.3289	1108.31	V Q					
3+ 5	64.0426	974.83	V Q					
3+10	70.2161	896.40	V Q					

			North100Yr6Hr.out			
3+15	75.9762	836.36			V	Q
3+20	81.4003	787.58			V	Q
3+25	86.4937	739.56			V	Q
3+30	91.2709	693.65			Q	
3+35	95.7829	655.13			Q	V
3+40	100.0772	623.53			Q	V
3+45	104.1770	595.30			Q	V
3+50	108.0626	564.18			Q	V
3+55	111.6737	524.33			Q	V
4+ 0	114.9915	481.75			Q	V
4+ 5	118.0816	448.68			Q	V
4+10	121.0319	428.39			Q	V
4+15	123.8780	413.25			Q	V
4+20	126.6254	398.92			Q	V
4+25	129.2596	382.49			Q	V
4+30	131.7789	365.80			Q	V
4+35	134.2066	352.50			Q	V
4+40	136.5716	343.40			Q	V
4+45	138.8893	336.52			Q	V
4+50	141.1677	330.83			Q	V
4+55	143.4093	325.48			Q	V
5+ 0	145.6175	320.63			Q	V
5+ 5	147.8008	317.01			Q	V
5+10	149.9671	314.55			Q	V
5+15	152.1172	312.20			Q	V
5+20	154.2407	308.33			Q	V
5+25	156.3178	301.60			Q	V
5+30	158.3404	293.68			Q	V
5+35	160.3198	287.41			Q	V
5+40	162.2734	283.66			Q	V
5+45	164.2114	281.40			Q	V
5+50	166.1468	281.02			Q	V
5+55	168.0950	282.88			Q	V
6+ 0	170.0639	285.89			Q	V
6+ 5	172.0456	287.74			Q	V
6+10	174.0183	286.44			Q	V
6+15	175.9462	279.92			Q	V
6+20	177.7326	259.39			Q	V
6+25	179.2245	216.62			Q	V
6+30	180.3534	163.91			Q	V
6+35	181.1822	120.34			Q	V
6+40	181.8110	91.30			Q	V
6+45	182.2870	69.12			Q	V
6+50	182.6481	52.44			Q	V
6+55	182.9202	39.51			Q	V
7+ 0	183.1219	29.28			Q	V
7+ 5	183.2676	21.16			Q	V
7+10	183.3687	14.68			Q	V
7+15	183.4358	9.74			Q	V
7+20	183.4772	6.02			Q	V
7+25	183.5003	3.35			Q	V
7+30	183.5101	1.42			Q	V
7+35	183.5122	0.31			Q	V
7+40	183.5122	0.00			Q	V

UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: north100yr24hr.out

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Program License Serial Number 4055

Tule wind Project
Unnamed Northern Wash
Existing 100 Year 24 Hour
Aug 25, 2010

+++++

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input values Used

Area averaged rainfall isohyetal data:
Sub-Area(Ac.) Rainfall (In)
1542.00 6.31

Rainfall Distribution pattern used in study:
Type B for San Diego area of California

+++++

***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
1542.00	1.000	82.7	82.7	0.050	B

Area-averaged catchment SCS Curve Number AMC(2) = 82.730
Area-averaged Fm value using values listed = 0.050(In/Hr)

+++++

Direct entry of lag time by user
Watershed area = 1542.00(Ac.)
Catchment Lag time = 0.490 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 17.0068
Hydrograph baseflow = 0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 82.730

Rainfall depth area reduction factors:
Using a total area of 1542.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study = 6.310(In)
Adjusted rainfall = 6.310(In)

+++++

The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS (Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Q_p vs. T/T_p values into an S-Graph based on $lag = T_p/0.9$. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/T_p step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

UNIT HYDROGRAPH

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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
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(K = North100Yr24Hr.out
18658.20 (CFS))

0.17	0.083	0.016	52.675	0.003
0.34	0.167	0.059	198.756	0.013
0.51	0.250	0.151	507.441	0.041
0.68	0.333	0.408	1365.747	0.114
0.85	0.417	0.818	2742.251	0.261
1.02	0.500	1.000	3350.925	0.440
1.19	0.583	0.827	2770.295	0.589
1.36	0.667	0.554	1856.539	0.688
1.53	0.750	0.424	1420.176	0.765
1.70	0.833	0.319	1068.004	0.822
1.87	0.917	0.247	826.450	0.866
2.04	1.000	0.195	653.065	0.901
2.21	1.083	0.154	515.905	0.929
2.38	1.167	0.122	409.102	0.951
2.55	1.250	0.093	310.128	0.967
2.72	1.333	0.070	233.636	0.980
2.89	1.417	0.050	167.340	0.989
3.06	1.500	0.036	120.679	0.995
3.23	1.583	0.021	69.730	0.999
3.40	1.667	0.006	19.310	1.000
3.57	1.750	0.000	0.046	1.000

+++++
For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

where:

Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0095	0.0000	0.0095	0.0000	0.0095	-----

North100Yr24Hr.out					
0.17	0.0189	0.0000	0.0095	0.0000	0.0095
0.25	0.0284	0.0000	0.0095	0.0000	0.0095
0.33	0.0379	0.0000	0.0095	0.0000	0.0095
0.42	0.0473	0.0000	0.0095	0.0000	0.0095
0.50	0.0568	0.0000	0.0095	0.0000	0.0095
0.58	0.0642	0.0000	0.0074	0.0000	0.0074
0.67	0.0715	0.0000	0.0074	0.0000	0.0074
0.75	0.0789	0.0000	0.0074	0.0000	0.0074
0.83	0.0862	0.0000	0.0074	0.0000	0.0074
0.92	0.0936	0.0000	0.0074	0.0000	0.0074
1.00	0.1010	0.0000	0.0074	0.0000	0.0074
1.08	0.1104	0.0000	0.0095	0.0000	0.0095
1.17	0.1199	0.0000	0.0095	0.0000	0.0095
1.25	0.1294	0.0000	0.0095	0.0000	0.0095
1.33	0.1388	0.0000	0.0095	0.0000	0.0095
1.42	0.1483	0.0000	0.0095	0.0000	0.0095
1.50	0.1577	0.0000	0.0095	0.0000	0.0095
1.58	0.1672	0.0000	0.0095	0.0000	0.0095
1.67	0.1767	0.0000	0.0095	0.0000	0.0095
1.75	0.1861	0.0000	0.0095	0.0000	0.0095
1.83	0.1956	0.0000	0.0095	0.0000	0.0095
1.92	0.2051	0.0000	0.0095	0.0000	0.0095
2.00	0.2145	0.0000	0.0095	0.0000	0.0095
2.08	0.2261	0.0000	0.0116	0.0000	0.0116
2.17	0.2377	0.0000	0.0116	0.0000	0.0116
2.25	0.2492	0.0000	0.0116	0.0000	0.0116
2.33	0.2608	0.0000	0.0116	0.0000	0.0116
2.42	0.2724	0.0000	0.0116	0.0000	0.0116
2.50	0.2839	0.0000	0.0116	0.0000	0.0116
2.58	0.2934	0.0000	0.0095	0.0000	0.0095
2.67	0.3029	0.0000	0.0095	0.0000	0.0095
2.75	0.3123	0.0000	0.0095	0.0000	0.0095
2.83	0.3218	0.0000	0.0095	0.0000	0.0095
2.92	0.3313	0.0000	0.0095	0.0000	0.0095
3.00	0.3407	0.0000	0.0095	0.0000	0.0095
3.08	0.3523	0.0000	0.0116	0.0000	0.0116
3.17	0.3639	0.0000	0.0116	0.0000	0.0116
3.25	0.3754	0.0000	0.0116	0.0000	0.0116
3.33	0.3870	0.0000	0.0116	0.0000	0.0116
3.42	0.3986	0.0000	0.0116	0.0000	0.0116
3.50	0.4101	0.0000	0.0116	0.0000	0.0116
3.58	0.4228	0.0000	0.0126	0.0000	0.0126
3.67	0.4354	0.0002	0.0126	0.0001	0.0125
3.75	0.4480	0.0004	0.0126	0.0003	0.0123
3.83	0.4606	0.0009	0.0126	0.0004	0.0122
3.92	0.4732	0.0015	0.0126	0.0006	0.0120
4.00	0.4859	0.0022	0.0126	0.0007	0.0119
4.08	0.4995	0.0031	0.0137	0.0009	0.0127
4.17	0.5132	0.0042	0.0137	0.0011	0.0126
4.25	0.5269	0.0054	0.0137	0.0013	0.0124
4.33	0.5406	0.0068	0.0137	0.0014	0.0123
4.42	0.5542	0.0084	0.0137	0.0016	0.0121
4.50	0.5679	0.0101	0.0137	0.0017	0.0120
4.58	0.5826	0.0121	0.0147	0.0020	0.0127
4.67	0.5973	0.0143	0.0147	0.0022	0.0126
4.75	0.6121	0.0166	0.0147	0.0023	0.0124
4.83	0.6268	0.0191	0.0147	0.0025	0.0122
4.92	0.6415	0.0217	0.0147	0.0026	0.0121
5.00	0.6562	0.0245	0.0147	0.0028	0.0119
5.08	0.6731	0.0279	0.0168	0.0034	0.0135
5.17	0.6899	0.0314	0.0168	0.0036	0.0133
5.25	0.7067	0.0352	0.0168	0.0038	0.0131
5.33	0.7235	0.0391	0.0168	0.0039	0.0129

North100Yr24Hr.out

5.42	0.7404	0.0432	0.0168	0.0041	0.0127	-----
5.50	0.7572	0.0475	0.0168	0.0043	0.0125	-----
5.58	0.7751	0.0523	0.0179	0.0048	0.0131	-----
5.67	0.7930	0.0572	0.0179	0.0049	0.0129	-----
5.75	0.8108	0.0624	0.0179	0.0051	0.0128	-----
5.83	0.8287	0.0677	0.0179	0.0053	0.0126	-----
5.92	0.8466	0.0732	0.0179	0.0055	0.0124	-----
6.00	0.8645	0.0788	0.0179	0.0057	0.0122	-----
6.08	0.8855	0.0857	0.0210	0.0069	0.0142	-----
6.17	0.9065	0.0928	0.0210	0.0071	0.0139	-----
6.25	0.9276	0.1002	0.0210	0.0073	0.0137	-----
6.33	0.9486	0.1077	0.0210	0.0076	0.0135	-----
6.42	0.9696	0.1155	0.0210	0.0078	0.0133	-----
6.50	0.9907	0.1235	0.0210	0.0080	0.0131	-----
6.58	1.0149	0.1329	0.0242	0.0094	0.0148	-----
6.67	1.0390	0.1426	0.0242	0.0097	0.0145	-----
6.75	1.0632	0.1526	0.0242	0.0100	0.0142	-----
6.83	1.0874	0.1628	0.0242	0.0102	0.0140	-----
6.92	1.1116	0.1732	0.0242	0.0104	0.0137	-----
7.00	1.1358	0.1839	0.0242	0.0107	0.0135	-----
7.08	1.1673	0.1982	0.0315	0.0143	0.0173	-----
7.17	1.1989	0.2128	0.0316	0.0147	0.0169	-----
7.25	1.2304	0.2279	0.0315	0.0150	0.0165	-----
7.33	1.2620	0.2432	0.0315	0.0154	0.0162	-----
7.42	1.2935	0.2590	0.0316	0.0157	0.0158	-----
7.50	1.3251	0.2750	0.0315	0.0161	0.0155	-----
7.58	1.3724	0.2997	0.0473	0.0247	0.0226	-----
7.67	1.4197	0.3251	0.0473	0.0254	0.0219	-----
7.75	1.4671	0.3512	0.0473	0.0260	0.0213	-----
7.83	1.5144	0.3778	0.0473	0.0267	0.0206	-----
7.92	1.5617	0.4051	0.0473	0.0273	0.0200	-----
8.00	1.6090	0.4330	0.0473	0.0279	0.0195	-----
8.08	1.6795	0.4755	0.0705	0.0425	0.0280	-----
8.17	1.7500	0.5191	0.0705	0.0437	0.0268	-----
8.25	1.8204	0.5639	0.0705	0.0447	0.0257	-----
8.33	1.8909	0.6096	0.0705	0.0458	0.0247	-----
8.42	1.9614	0.6564	0.0705	0.0467	0.0237	-----
8.50	2.0318	0.7040	0.0705	0.0476	0.0228	-----
8.58	2.1244	0.7678	0.0925	0.0638	0.0287	-----
8.67	2.2169	0.8330	0.0925	0.0652	0.0273	-----
8.75	2.3095	0.8995	0.0925	0.0665	0.0261	-----
8.83	2.4020	0.9672	0.0925	0.0677	0.0249	-----
8.92	2.4946	1.0359	0.0925	0.0688	0.0238	-----
9.00	2.5871	1.1057	0.0925	0.0698	0.0227	-----
9.08	2.6881	1.1830	0.1010	0.0772	0.0237	-----
9.17	2.7890	1.2613	0.1010	0.0783	0.0226	-----
9.25	2.8900	1.3406	0.1010	0.0793	0.0216	-----
9.33	2.9909	1.4209	0.1010	0.0803	0.0207	-----
9.42	3.0919	1.5020	0.1010	0.0811	0.0198	-----
9.50	3.1929	1.5840	0.1010	0.0820	0.0190	-----
9.58	3.2791	1.6546	0.0862	0.0706	0.0156	-----
9.67	3.3653	1.7257	0.0862	0.0712	0.0151	-----
9.75	3.4516	1.7974	0.0862	0.0717	0.0146	-----
9.83	3.5378	1.8696	0.0862	0.0721	0.0141	-----
9.92	3.6240	1.9422	0.0862	0.0726	0.0136	-----
10.00	3.7103	2.0152	0.0862	0.0730	0.0132	-----
10.08	3.7534	2.0519	0.0431	0.0367	0.0064	-----
10.17	3.7965	2.0887	0.0431	0.0368	0.0063	-----
10.25	3.8396	2.1255	0.0431	0.0369	0.0062	-----
10.33	3.8828	2.1625	0.0431	0.0370	0.0061	-----
10.42	3.9259	2.1996	0.0431	0.0371	0.0060	-----
10.50	3.9690	2.2368	0.0431	0.0372	0.0060	-----
10.58	3.9974	2.2613	0.0284	0.0245	0.0039	-----

North100Yr24Hr.out					
10.67	4.0258	2.2858	0.0284	0.0246	0.0038 -----
10.75	4.0542	2.3104	0.0284	0.0246	0.0038 -----
10.83	4.0826	2.3351	0.0284	0.0246	0.0038 -----
10.92	4.1110	2.3598	0.0284	0.0247	0.0037 -----
11.00	4.1394	2.3845	0.0284	0.0247	0.0037 -----
11.08	4.1635	2.4055	0.0242	0.0211	0.0031 -----
11.17	4.1877	2.4266	0.0242	0.0211	0.0031 -----
11.25	4.2119	2.4478	0.0242	0.0211	0.0031 -----
11.33	4.2361	2.4689	0.0242	0.0212	0.0030 -----
11.42	4.2603	2.4901	0.0242	0.0212	0.0030 -----
11.50	4.2845	2.5113	0.0242	0.0212	0.0030 -----
11.58	4.3066	2.5307	0.0221	0.0194	0.0027 -----
11.67	4.3287	2.5501	0.0221	0.0194	0.0027 -----
11.75	4.3507	2.5695	0.0221	0.0194	0.0027 -----
11.83	4.3728	2.5890	0.0221	0.0194	0.0026 -----
11.92	4.3949	2.6084	0.0221	0.0195	0.0026 -----
12.00	4.4170	2.6279	0.0221	0.0195	0.0026 -----
12.08	4.4380	2.6465	0.0210	0.0186	0.0025 -----
12.17	4.4591	2.6650	0.0210	0.0186	0.0024 -----
12.25	4.4801	2.6836	0.0210	0.0186	0.0024 -----
12.33	4.5011	2.7023	0.0210	0.0186	0.0024 -----
12.42	4.5222	2.7209	0.0210	0.0186	0.0024 -----
12.50	4.5432	2.7395	0.0210	0.0187	0.0024 -----
12.58	4.5632	2.7573	0.0200	0.0177	0.0022 -----
12.67	4.5832	2.7750	0.0200	0.0177	0.0022 -----
12.75	4.6031	2.7928	0.0200	0.0178	0.0022 -----
12.83	4.6231	2.8106	0.0200	0.0178	0.0022 -----
12.92	4.6431	2.8284	0.0200	0.0178	0.0022 -----
13.00	4.6631	2.8462	0.0200	0.0178	0.0022 -----
13.08	4.6810	2.8621	0.0179	0.0159	0.0019 -----
13.17	4.6988	2.8781	0.0179	0.0160	0.0019 -----
13.25	4.7167	2.8940	0.0179	0.0160	0.0019 -----
13.33	4.7346	2.9100	0.0179	0.0160	0.0019 -----
13.42	4.7525	2.9260	0.0179	0.0160	0.0019 -----
13.50	4.7704	2.9420	0.0179	0.0160	0.0019 -----
13.58	4.7872	2.9570	0.0168	0.0151	0.0018 -----
13.67	4.8040	2.9721	0.0168	0.0151	0.0018 -----
13.75	4.8208	2.9872	0.0168	0.0151	0.0017 -----
13.83	4.8377	3.0023	0.0168	0.0151	0.0017 -----
13.92	4.8545	3.0174	0.0168	0.0151	0.0017 -----
14.00	4.8713	3.0325	0.0168	0.0151	0.0017 -----
14.08	4.8902	3.0495	0.0189	0.0170	0.0019 -----
14.17	4.9092	3.0665	0.0189	0.0170	0.0019 -----
14.25	4.9281	3.0835	0.0189	0.0170	0.0019 -----
14.33	4.9470	3.1006	0.0189	0.0170	0.0019 -----
14.42	4.9660	3.1176	0.0189	0.0171	0.0019 -----
14.50	4.9849	3.1347	0.0189	0.0171	0.0019 -----
14.58	4.9954	3.1442	0.0105	0.0095	0.0010 -----
14.67	5.0059	3.1537	0.0105	0.0095	0.0010 -----
14.75	5.0164	3.1632	0.0105	0.0095	0.0010 -----
14.83	5.0270	3.1726	0.0105	0.0095	0.0010 -----
14.92	5.0375	3.1821	0.0105	0.0095	0.0010 -----
15.00	5.0480	3.1916	0.0105	0.0095	0.0010 -----
15.08	5.0648	3.2069	0.0168	0.0152	0.0016 -----
15.17	5.0817	3.2221	0.0168	0.0152	0.0016 -----
15.25	5.0985	3.2373	0.0168	0.0152	0.0016 -----
15.33	5.1153	3.2525	0.0168	0.0152	0.0016 -----
15.42	5.1321	3.2678	0.0168	0.0152	0.0016 -----
15.50	5.1490	3.2830	0.0168	0.0152	0.0016 -----
15.58	5.1647	3.2973	0.0158	0.0143	0.0015 -----
15.67	5.1805	3.3116	0.0158	0.0143	0.0015 -----
15.75	5.1963	3.3259	0.0158	0.0143	0.0015 -----
15.83	5.2121	3.3402	0.0158	0.0143	0.0015 -----

North100Yr24Hr.out					
15.92	5.2278	3.3546	0.0158	0.0143	0.0014 -----
16.00	5.2436	3.3689	0.0158	0.0143	0.0014 -----
16.08	5.2583	3.3823	0.0147	0.0134	0.0013 -----
16.17	5.2731	3.3957	0.0147	0.0134	0.0013 -----
16.25	5.2878	3.4091	0.0147	0.0134	0.0013 -----
16.33	5.3025	3.4225	0.0147	0.0134	0.0013 -----
16.42	5.3172	3.4359	0.0147	0.0134	0.0013 -----
16.50	5.3319	3.4493	0.0147	0.0134	0.0013 -----
16.58	5.3477	3.4637	0.0158	0.0144	0.0014 -----
16.67	5.3635	3.4780	0.0158	0.0144	0.0014 -----
16.75	5.3793	3.4924	0.0158	0.0144	0.0014 -----
16.83	5.3950	3.5068	0.0158	0.0144	0.0014 -----
16.92	5.4108	3.5212	0.0158	0.0144	0.0014 -----
17.00	5.4266	3.5356	0.0158	0.0144	0.0014 -----
17.08	5.4392	3.5472	0.0126	0.0115	0.0011 -----
17.17	5.4518	3.5587	0.0126	0.0115	0.0011 -----
17.25	5.4645	3.5702	0.0126	0.0115	0.0011 -----
17.33	5.4771	3.5818	0.0126	0.0115	0.0011 -----
17.42	5.4897	3.5933	0.0126	0.0115	0.0011 -----
17.50	5.5023	3.6049	0.0126	0.0115	0.0011 -----
17.58	5.5160	3.6174	0.0137	0.0125	0.0012 -----
17.67	5.5297	3.6299	0.0137	0.0125	0.0012 -----
17.75	5.5433	3.6424	0.0137	0.0125	0.0011 -----
17.83	5.5570	3.6550	0.0137	0.0125	0.0011 -----
17.92	5.5707	3.6675	0.0137	0.0125	0.0011 -----
18.00	5.5843	3.6800	0.0137	0.0125	0.0011 -----
18.08	5.5949	3.6897	0.0105	0.0096	0.0009 -----
18.17	5.6054	3.6993	0.0105	0.0096	0.0009 -----
18.25	5.6159	3.7090	0.0105	0.0097	0.0009 -----
18.33	5.6264	3.7186	0.0105	0.0097	0.0009 -----
18.42	5.6369	3.7283	0.0105	0.0097	0.0009 -----
18.50	5.6474	3.7380	0.0105	0.0097	0.0009 -----
18.58	5.6580	3.7476	0.0105	0.0097	0.0009 -----
18.67	5.6685	3.7573	0.0105	0.0097	0.0009 -----
18.75	5.6790	3.7669	0.0105	0.0097	0.0008 -----
18.83	5.6895	3.7766	0.0105	0.0097	0.0008 -----
18.92	5.7000	3.7863	0.0105	0.0097	0.0008 -----
19.00	5.7105	3.7960	0.0105	0.0097	0.0008 -----
19.08	5.7200	3.8047	0.0095	0.0087	0.0008 -----
19.17	5.7295	3.8134	0.0095	0.0087	0.0008 -----
19.25	5.7389	3.8221	0.0095	0.0087	0.0008 -----
19.33	5.7484	3.8308	0.0095	0.0087	0.0008 -----
19.42	5.7579	3.8395	0.0095	0.0087	0.0007 -----
19.50	5.7673	3.8482	0.0095	0.0087	0.0007 -----
19.58	5.7779	3.8579	0.0105	0.0097	0.0008 -----
19.67	5.7884	3.8676	0.0105	0.0097	0.0008 -----
19.75	5.7989	3.8773	0.0105	0.0097	0.0008 -----
19.83	5.8094	3.8870	0.0105	0.0097	0.0008 -----
19.92	5.8199	3.8967	0.0105	0.0097	0.0008 -----
20.00	5.8304	3.9064	0.0105	0.0097	0.0008 -----
20.08	5.8420	3.9171	0.0116	0.0107	0.0009 -----
20.17	5.8536	3.9278	0.0116	0.0107	0.0009 -----
20.25	5.8651	3.9384	0.0116	0.0107	0.0009 -----
20.33	5.8767	3.9491	0.0116	0.0107	0.0009 -----
20.42	5.8883	3.9598	0.0116	0.0107	0.0009 -----
20.50	5.8998	3.9705	0.0116	0.0107	0.0009 -----
20.58	5.9104	3.9802	0.0105	0.0097	0.0008 -----
20.67	5.9209	3.9899	0.0105	0.0097	0.0008 -----
20.75	5.9314	3.9997	0.0105	0.0097	0.0008 -----
20.83	5.9419	4.0094	0.0105	0.0097	0.0008 -----
20.92	5.9524	4.0191	0.0105	0.0097	0.0008 -----
21.00	5.9629	4.0288	0.0105	0.0097	0.0008 -----
21.08	5.9724	4.0376	0.0095	0.0088	0.0007 -----

North100Yr24Hr.out

21.17	5.9819	4.0464	0.0095	0.0088	0.0007	-----
21.25	5.9913	4.0551	0.0095	0.0088	0.0007	-----
21.33	6.0008	4.0639	0.0095	0.0088	0.0007	-----
21.42	6.0103	4.0726	0.0095	0.0088	0.0007	-----
21.50	6.0197	4.0814	0.0095	0.0088	0.0007	-----
21.58	6.0292	4.0902	0.0095	0.0088	0.0007	-----
21.67	6.0387	4.0990	0.0095	0.0088	0.0007	-----
21.75	6.0481	4.1077	0.0095	0.0088	0.0007	-----
21.83	6.0576	4.1165	0.0095	0.0088	0.0007	-----
21.92	6.0671	4.1253	0.0095	0.0088	0.0007	-----
22.00	6.0765	4.1341	0.0095	0.0088	0.0007	-----
22.08	6.0860	4.1428	0.0095	0.0088	0.0007	-----
22.17	6.0955	4.1516	0.0095	0.0088	0.0007	-----
22.25	6.1049	4.1604	0.0095	0.0088	0.0007	-----
22.33	6.1144	4.1692	0.0095	0.0088	0.0007	-----
22.42	6.1239	4.1780	0.0095	0.0088	0.0007	-----
22.50	6.1333	4.1867	0.0095	0.0088	0.0007	-----
22.58	6.1428	4.1955	0.0095	0.0088	0.0007	-----
22.67	6.1522	4.2043	0.0095	0.0088	0.0007	-----
22.75	6.1617	4.2131	0.0095	0.0088	0.0007	-----
22.83	6.1712	4.2219	0.0095	0.0088	0.0007	-----
22.92	6.1806	4.2307	0.0095	0.0088	0.0007	-----
23.00	6.1901	4.2395	0.0095	0.0088	0.0007	-----
23.08	6.2006	4.2493	0.0105	0.0098	0.0007	-----
23.17	6.2111	4.2591	0.0105	0.0098	0.0007	-----
23.25	6.2217	4.2688	0.0105	0.0098	0.0007	-----
23.33	6.2322	4.2786	0.0105	0.0098	0.0007	-----
23.42	6.2427	4.2884	0.0105	0.0098	0.0007	-----
23.50	6.2532	4.2982	0.0105	0.0098	0.0007	-----
23.58	6.2627	4.3070	0.0095	0.0088	0.0007	-----
23.67	6.2721	4.3158	0.0095	0.0088	0.0007	-----
23.75	6.2816	4.3246	0.0095	0.0088	0.0007	-----
23.83	6.2911	4.3334	0.0095	0.0088	0.0007	-----
23.92	6.3005	4.3422	0.0095	0.0088	0.0007	-----
24.00	6.3100	4.3511	0.0095	0.0088	0.0006	-----

Total soil rain loss = 1.96(In)
Total effective runoff = 4.35(In)

Peak flow rate this hydrograph = 1428.08(CFS)
Total runoff volume this hydrograph = 24354896.9(Ft3)

+++++
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	375.0	750.0	1125.0	1500.0
0+ 5	0.0000	0.00	Q					
0+10	0.0000	0.00	Q					
0+15	0.0000	0.00	Q					
0+20	0.0000	0.00	Q					
0+25	0.0000	0.00	Q					
0+30	0.0000	0.00	Q					
0+35	0.0000	0.00	Q					
0+40	0.0000	0.00	Q					
0+45	0.0000	0.00	Q					
0+50	0.0000	0.00	Q					
0+55	0.0000	0.00	Q					

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1+ 0	0.0000	0.00	Q				
1+ 5	0.0000	0.00	Q				
1+10	0.0000	0.00	Q				
1+15	0.0000	0.00	Q				
1+20	0.0000	0.00	Q				
1+25	0.0000	0.00	Q				
1+30	0.0000	0.00	Q				
1+35	0.0000	0.00	Q				
1+40	0.0000	0.00	Q				
1+45	0.0000	0.00	Q				
1+50	0.0000	0.00	Q				
1+55	0.0000	0.00	Q				
2+ 0	0.0000	0.00	Q				
2+ 5	0.0000	0.00	Q				
2+10	0.0000	0.00	Q				
2+15	0.0000	0.00	Q				
2+20	0.0000	0.00	Q				
2+25	0.0000	0.00	Q				
2+30	0.0000	0.00	Q				
2+35	0.0000	0.00	Q				
2+40	0.0000	0.00	Q				
2+45	0.0000	0.00	Q				
2+50	0.0000	0.00	Q				
2+55	0.0000	0.00	Q				
3+ 0	0.0000	0.00	Q				
3+ 5	0.0000	0.00	Q				
3+10	0.0000	0.00	Q				
3+15	0.0000	0.00	Q				
3+20	0.0000	0.00	Q				
3+25	0.0000	0.00	Q				
3+30	0.0000	0.00	Q				
3+35	0.0000	0.00	Q				
3+40	0.0001	0.01	Q				
3+45	0.0004	0.05	Q				
3+50	0.0016	0.17	Q				
3+55	0.0049	0.49	Q				
4+ 0	0.0131	1.19	Q				
4+ 5	0.0294	2.37	Q				
4+10	0.0567	3.96	Q				
4+15	0.0969	5.85	Q				
4+20	0.1520	8.00	Q				
4+25	0.2239	10.43	Q				
4+30	0.3138	13.05	Q				
4+35	0.4225	15.78	Q				
4+40	0.5503	18.56	Q				
4+45	0.6978	21.41	Q				
4+50	0.8659	24.41	Q				
4+55	1.0563	27.64	Q				
5+ 0	1.2698	31.00	Q				
5+ 5	1.5063	34.34	Q				
5+10	1.7655	37.64	VQ				
5+15	2.0480	41.01	VQ				
5+20	2.3558	44.70	VQ				
5+25	2.6932	48.98	VQ				
5+30	3.0622	53.58	VQ				
5+35	3.4618	58.03	VQ				
5+40	3.8900	62.18	VQ				
5+45	4.3462	66.24	VQ				
5+50	4.8311	70.40	VQ				
5+55	5.3466	74.85	VQ				
6+ 0	5.8936	79.43	V Q				
6+ 5	6.4712	83.86	V Q				
6+10	7.0783	88.15	V Q				

			North100Yr24Hr.out			
6+15	7.7161	92.60	V	Q		
6+20	8.3897	97.81	V	Q		
6+25	9.1089	104.42	V	Q		
6+30	9.8783	111.72	V	Q		
6+35	10.6949	118.57	V	Q		
6+40	11.5538	124.71	V	Q		
6+45	12.4545	130.78	V	Q		
6+50	13.4020	137.58	V	Q		
6+55	14.4067	145.89	V	Q		
7+ 0	15.4735	154.89	V	Q		
7+ 5	16.5985	163.35	V	Q		
7+10	17.7772	171.15	V	Q		
7+15	19.0127	179.40	V	Q		
7+20	20.3219	190.10	V	Q		
7+25	21.7354	205.23	V	Q		
7+30	23.2678	222.52	V	Q		
7+35	24.9103	238.49	V	Q		
7+40	26.6509	252.73	V	Q		
7+45	28.4976	268.15	V	Q		
7+50	30.4925	289.66	V	Q		
7+55	32.7117	322.22	V	Q		
8+ 0	35.1920	360.14	V	Q		
8+ 5	37.9093	394.56	V	Q		
8+10	40.8283	423.84	V	Q		
8+15	43.9549	453.98	V	Q		
8+20	47.3538	493.51	V	Q		
8+25	51.1488	551.04	V	Q		
8+30	55.3985	617.06	V	Q		
8+35	60.0549	676.11	V	Q		
8+40	65.0457	724.66	V	Q		
8+45	70.3589	771.47	V	Q		
8+50	76.0493	826.25	V	Q		
8+55	82.2394	898.80	V	Q		
9+ 0	88.9816	978.98	V	Q		
9+ 5	96.2092	1049.45	V	Q		
9+10	103.8234	1105.58	V	Q		
9+15	111.7814	1155.50	V	Q		
9+20	120.0752	1204.25	V	Q		
9+25	128.7319	1256.96	V	Q		
9+30	137.7542	1310.04	V	Q		
9+35	147.0906	1355.63	V	Q		
9+40	156.6685	1390.72	V	Q		
9+45	166.4258	1416.75	V	Q		
9+50	176.2610	1428.08	V	Q		
9+55	186.0344	1419.10	V	Q		
10+ 0	195.6736	1399.60	V	Q		
10+ 5	205.1926	1382.16	V	Q		
10+10	214.6121	1367.72	V	Q		
10+15	223.8767	1345.23	V	Q		
10+20	232.7882	1293.94	V	Q		
10+25	241.0071	1193.39	V	Q		
10+30	248.3820	1070.83	V	Q		
10+35	255.0541	968.80	V	Q		
10+40	261.2406	898.27	V	Q		
10+45	267.0261	840.06	V	Q		
10+50	272.4264	784.12	V	Q		
10+55	277.3835	719.77	V	Q		
11+ 0	281.8882	654.09	V	Q		
11+ 5	286.0259	600.79	V	Q		
11+10	289.9017	562.77	V	Q		
11+15	293.5709	532.77	V	Q		
11+20	297.0607	506.72	V	Q		
11+25	300.3732	480.96	V	Q		

			North100Yr24Hr.out			
11+30	303.5189	456.76		Q	V	
11+35	306.5361	438.10		Q	V	
11+40	309.4676	425.64		Q	V	
11+45	312.3335	416.13		Q	V	
11+50	315.1384	407.27		Q	V	
11+55	317.8763	397.55		Q	V	
12+ 0	320.5479	387.91		Q	V	
12+ 5	323.1678	380.41		Q	V	
12+10	325.7537	375.47		Q	V	
12+15	328.3132	371.64		Q	V	
12+20	330.8472	367.94		Q	V	
12+25	333.3515	363.62		Q	V	
12+30	335.8255	359.23		Q	V	
12+35	338.2755	355.74		Q	V	
12+40	340.7090	353.35		Q	V	
12+45	343.1285	351.31		Q	V	
12+50	345.5316	348.93		Q	V	
12+55	347.9118	345.61		Q	V	
13+ 0	350.2669	341.95		Q	V	
13+ 5	352.6013	338.95		Q	V	
13+10	354.9202	336.71		Q	V	
13+15	357.2234	334.43		Q	V	
13+20	359.5025	330.92		Q	V	
13+25	361.7416	325.11		Q	V	
13+30	363.9341	318.35		Q	V	
13+35	366.0884	312.80		Q	V	
13+40	368.2162	308.96		Q	V	
13+45	370.3219	305.75		Q	V	
13+50	372.4048	302.45		Q	V	
13+55	374.4597	298.37		Q	V	
14+ 0	376.4850	294.07		Q	V	
14+ 5	378.4872	290.72		Q	V	
14+10	380.4759	288.75		Q	V	
14+15	382.4591	287.97		Q	V	
14+20	384.4515	289.29		Q	V	
14+25	386.4732	293.56		Q	V	
14+30	388.5340	299.23		Q	V	
14+35	390.6252	303.64		Q	V	
14+40	392.7285	305.41		Q	V	
14+45	394.8231	304.14		Q	V	
14+50	396.8600	295.76		Q	V	
14+55	398.7646	276.53		Q	V	
15+ 0	400.5027	252.38		Q	V	
15+ 5	402.1054	232.71		Q	V	
15+10	403.6248	220.62		Q	V	
15+15	405.0947	213.43		Q	V	
15+20	406.5661	213.65		Q	V	
15+25	408.1049	223.43		Q	V	
15+30	409.7434	237.91		Q	V	
15+35	411.4651	249.99		Q	V	
15+40	413.2381	257.44		Q	V	
15+45	415.0482	262.83		Q	V	
15+50	416.8800	265.98		Q	V	
15+55	418.7184	266.94		Q	V	
16+ 0	420.5551	266.68		Q	V	
16+ 5	422.3908	266.54		Q	V	
16+10	424.2288	266.89		Q	V	
16+15	426.0673	266.95		Q	V	
16+20	427.8998	266.08		Q	V	
16+25	429.7163	263.75		Q	V	
16+30	431.5119	260.73		Q	V	
16+35	433.2899	258.16		Q	V	
16+40	435.0558	256.41		Q	V	

			North100Yr24Hr.out			
16+45	436.8144	255.35	Q		V	
16+50	438.5742	255.53	Q		V	
16+55	440.3463	257.31	Q		V	
17+ 0	442.1362	259.90	Q		V	
17+ 5	443.9403	261.95	Q		V	
17+10	445.7507	262.86	Q		V	
17+15	447.5590	262.58	Q		V	
17+20	449.3466	259.55	Q		V	
17+25	451.0848	252.38	Q		V	
17+30	452.7606	243.34	Q		V	
17+35	454.3854	235.92	Q		V	
17+40	455.9779	231.22	Q		V	
17+45	457.5481	228.00	Q		V	
17+50	459.1083	226.54	Q		V	
17+55	460.6719	227.04	Q		V	
18+ 0	462.2462	228.58	Q		V	
18+ 5	463.8285	229.75	Q		V	
18+10	465.4117	229.88	Q		V	
18+15	466.9886	228.97	Q		V	
18+20	468.5412	225.45	Q		V	
18+25	470.0419	217.90	Q		V	
18+30	471.4782	208.55	Q		V	
18+35	472.8618	200.89	Q		V	
18+40	474.2111	195.92	Q		V	
18+45	475.5345	192.16	Q		V	
18+50	476.8385	189.35	Q		V	
18+55	478.1276	187.17	Q		V	
19+ 0	479.4047	185.44	Q		V	
19+ 5	480.6721	184.02	Q		V	
19+10	481.9304	182.71	Q		V	
19+15	483.1794	181.37	Q		V	
19+20	484.4151	179.41	Q		V	
19+25	485.6294	176.32	Q		V	
19+30	486.8193	172.77	Q		V	
19+35	487.9900	169.98	Q		V	
19+40	489.1495	168.36	Q		V	
19+45	490.3032	167.52	Q		V	
19+50	491.4591	167.85	Q		V	
19+55	492.6281	169.74	Q		V	
20+ 0	493.8154	172.40	Q		V	
20+ 5	495.0184	174.67	Q		V	
20+10	496.2327	176.31	Q		V	
20+15	497.4580	177.92	Q		V	
20+20	498.6983	180.09	Q		V	
20+25	499.9616	183.44	Q		V	
20+30	501.2512	187.25	Q		V	
20+35	502.5623	190.36	Q		V	
20+40	503.8873	192.40	Q		V	
20+45	505.2209	193.63	Q		V	
20+50	506.5543	193.62	Q		V	
20+55	507.8764	191.96	Q		V	
21+ 0	509.1815	189.50	Q		V	
21+ 5	510.4720	187.37	Q		V	
21+10	511.7518	185.84	Q		V	
21+15	513.0211	184.31	Q		V	
21+20	514.2760	182.21	Q		V	
21+25	515.5084	178.94	Q		V	
21+30	516.7150	175.20	Q		V	
21+35	517.9003	172.11	Q		V	
21+40	519.0708	169.96	Q		V	
21+45	520.2300	168.31	Q		V	
21+50	521.3807	167.08	Q		V	
21+55	522.5250	166.15	Q		V	

North100Yr24Hr.out									
22+ 0	523.6643	165.43	Q						V
22+ 5	524.7999	164.89	Q						V
22+10	525.9328	164.51	Q						V
22+15	527.0640	164.24	Q						V
22+20	528.1937	164.04	Q						V
22+25	529.3226	163.91	Q						V
22+30	530.4508	163.82	Q						V
22+35	531.5789	163.79	Q						V
22+40	532.7070	163.80	Q						V
22+45	533.8353	163.83	Q						V
22+50	534.9638	163.86	Q						V
22+55	536.0925	163.89	Q						V
23+ 0	537.2215	163.92	Q						V
23+ 5	538.3510	164.01	Q						V
23+10	539.4821	164.23	Q						V
23+15	540.6168	164.76	Q						V
23+20	541.7609	166.12	Q						V
23+25	542.9237	168.84	Q						V
23+30	544.1093	172.14	Q						V
23+35	545.3134	174.83	Q						V
23+40	546.5288	176.49	Q						V
23+45	547.7507	177.42	Q						V
23+50	548.9708	177.16	Q						V
23+55	550.1782	175.32	Q						V
24+ 0	551.3677	172.71	Q						V
24+ 5	552.5389	170.07	Q						V
24+10	553.6886	166.93	Q						V
24+15	554.8002	161.40	Q						V
24+20	555.8234	148.57	Q						V
24+25	556.6758	123.77	Q						V
24+30	557.3212	93.72	Q						V
24+35	557.7955	68.87	Q						V
24+40	558.1546	52.13	Q						V
24+45	558.4253	39.31	Q						V
24+50	558.6297	29.68	Q						V
24+55	558.7828	22.23	Q						V
25+ 0	558.8954	16.36	Q						V
25+ 5	558.9763	11.74	Q						V
25+10	559.0322	8.12	Q						V
25+15	559.0693	5.38	Q						V
25+20	559.0922	3.32	Q						V
25+25	559.1049	1.85	Q						V
25+30	559.1103	0.79	Q						V
25+35	559.1115	0.17	Q						V
25+40	559.1115	0.00	Q						V

East100Yr6Hr.out

UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: east100yr6hr.out

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Program License Serial Number 4055

Tule wind Project
Unnamed Eastern Wash
Existing 100 Year 6 Hour
Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
734.00	3.00

Rainfall Distribution pattern used in study:
Type B for SCS (small dam) or San Diego 6 hour storms

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***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
734.00	1.000	85.1	85.1	0.050	C

Area-averaged catchment SCS Curve Number AMC(2) = 85.130
Area-averaged Fm value using values listed = 0.050(In/Hr)

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Direct entry of lag time by user
Watershed area = 734.00(Ac.)
Catchment Lag time = 0.380 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 21.9298
Hydrograph baseflow = 0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 85.130

Rainfall depth area reduction factors:
Using a total area of 734.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study = 3.000(In)
Adjusted rainfall = 3.000(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS (Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Q_p vs. T/T_p values into an S-Graph based on $lag = T_p/0.9$. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/T_p step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

UNIT HYDROGRAPH

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
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(K = East100Yr6Hr.out
8881.40 (CFS))

0.22	0.083	0.017	34.408	0.004
0.44	0.167	0.085	169.808	0.023
0.66	0.250	0.290	580.041	0.088
0.88	0.333	0.784	1566.642	0.265
1.10	0.417	1.000	1997.798	0.490
1.32	0.500	0.716	1430.728	0.651
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1.75	0.667	0.329	656.341	0.830
1.97	0.750	0.237	473.266	0.883
2.19	0.833	0.175	348.921	0.922
2.41	0.917	0.129	256.962	0.951
2.63	1.000	0.091	181.388	0.972
2.85	1.083	0.062	124.326	0.986
3.07	1.167	0.040	80.165	0.995
3.29	1.250	0.020	40.797	0.999
3.51	1.333	0.003	6.463	1.000

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For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0175	0.0000	0.0175	0.0000	0.0175	-----
0.17	0.0350	0.0000	0.0175	0.0000	0.0175	-----
0.25	0.0525	0.0000	0.0175	0.0000	0.0175	-----
0.33	0.0700	0.0000	0.0175	0.0000	0.0175	-----
0.42	0.0875	0.0000	0.0175	0.0000	0.0175	-----
0.50	0.1050	0.0000	0.0175	0.0000	0.0175	-----

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0.58	0.1285	0.0000	0.0235	0.0000	0.0235	-----
0.67	0.1520	0.0000	0.0235	0.0000	0.0235	-----
0.75	0.1755	0.0000	0.0235	0.0000	0.0235	-----
0.83	0.1990	0.0000	0.0235	0.0000	0.0235	-----
0.92	0.2225	0.0000	0.0235	0.0000	0.0235	-----
1.00	0.2460	0.0000	0.0235	0.0000	0.0235	-----
1.08	0.2750	0.0000	0.0290	0.0000	0.0290	-----
1.17	0.3040	0.0000	0.0290	0.0000	0.0290	-----
1.25	0.3330	0.0000	0.0290	0.0000	0.0290	-----
1.33	0.3620	0.0001	0.0290	0.0001	0.0289	-----
1.42	0.3910	0.0010	0.0290	0.0009	0.0281	-----
1.50	0.4200	0.0027	0.0290	0.0018	0.0272	-----
1.58	0.4650	0.0072	0.0450	0.0044	0.0406	-----
1.67	0.5100	0.0135	0.0450	0.0063	0.0387	-----
1.75	0.5550	0.0217	0.0450	0.0081	0.0369	-----
1.83	0.6000	0.0315	0.0450	0.0098	0.0352	-----
1.92	0.6450	0.0428	0.0450	0.0113	0.0337	-----
2.00	0.6900	0.0556	0.0450	0.0128	0.0322	-----
2.08	0.8750	0.1216	0.1850	0.0660	0.1190	-----
2.17	1.0600	0.2055	0.1850	0.0839	0.1011	-----
2.25	1.2450	0.3036	0.1850	0.0981	0.0869	-----
2.33	1.4300	0.4130	0.1850	0.1094	0.0756	-----
2.42	1.6150	0.5318	0.1850	0.1187	0.0663	-----
2.50	1.8000	0.6582	0.1850	0.1264	0.0586	-----
2.58	1.8500	0.6935	0.0500	0.0353	0.0147	-----
2.67	1.9000	0.7292	0.0500	0.0358	0.0142	-----
2.75	1.9500	0.7654	0.0500	0.0362	0.0138	-----
2.83	2.0000	0.8020	0.0500	0.0366	0.0134	-----
2.92	2.0500	0.8390	0.0500	0.0370	0.0130	-----
3.00	2.1000	0.8763	0.0500	0.0373	0.0127	-----
3.08	2.1405	0.9068	0.0405	0.0305	0.0100	-----
3.17	2.1810	0.9376	0.0405	0.0307	0.0098	-----
3.25	2.2215	0.9685	0.0405	0.0310	0.0095	-----
3.33	2.2620	0.9997	0.0405	0.0312	0.0093	-----
3.42	2.3025	1.0311	0.0405	0.0314	0.0091	-----
3.50	2.3430	1.0626	0.0405	0.0316	0.0089	-----
3.58	2.3700	1.0838	0.0270	0.0212	0.0058	-----
3.67	2.3970	1.1050	0.0270	0.0212	0.0058	-----
3.75	2.4240	1.1263	0.0270	0.0213	0.0057	-----
3.83	2.4510	1.1477	0.0270	0.0214	0.0056	-----
3.92	2.4780	1.1692	0.0270	0.0215	0.0055	-----
4.00	2.5050	1.1908	0.0270	0.0216	0.0054	-----
4.08	2.5275	1.2088	0.0225	0.0180	0.0045	-----
4.17	2.5500	1.2269	0.0225	0.0181	0.0044	-----
4.25	2.5725	1.2450	0.0225	0.0181	0.0044	-----
4.33	2.5950	1.2631	0.0225	0.0182	0.0043	-----
4.42	2.6175	1.2814	0.0225	0.0182	0.0043	-----
4.50	2.6400	1.2996	0.0225	0.0183	0.0042	-----
4.58	2.6615	1.3171	0.0215	0.0175	0.0040	-----
4.67	2.6830	1.3347	0.0215	0.0175	0.0040	-----
4.75	2.7045	1.3522	0.0215	0.0176	0.0039	-----
4.83	2.7260	1.3699	0.0215	0.0176	0.0039	-----
4.92	2.7475	1.3875	0.0215	0.0177	0.0038	-----
5.00	2.7690	1.4052	0.0215	0.0177	0.0038	-----
5.08	2.7875	1.4205	0.0185	0.0153	0.0032	-----
5.17	2.8060	1.4358	0.0185	0.0153	0.0032	-----
5.25	2.8245	1.4511	0.0185	0.0153	0.0032	-----
5.33	2.8430	1.4664	0.0185	0.0153	0.0032	-----
5.42	2.8615	1.4818	0.0185	0.0154	0.0031	-----
5.50	2.8800	1.4972	0.0185	0.0154	0.0031	-----
5.58	2.9000	1.5139	0.0200	0.0167	0.0033	-----
5.67	2.9200	1.5306	0.0200	0.0167	0.0033	-----
5.75	2.9400	1.5474	0.0200	0.0167	0.0033	-----

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5.83	2.9600	1.5641	0.0200	0.0168	0.0032	-----
5.92	2.9800	1.5809	0.0200	0.0168	0.0032	-----
6.00	3.0000	1.5978	0.0200	0.0168	0.0032	-----

Total soil rain loss = 1.40(In)
 Total effective runoff = 1.60(In)

Peak flow rate this hydrograph = 808.32(CFS)
 Total runoff volume this hydrograph = 4257090.5(Ft3)

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6 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	225.0	450.0	675.0	900.0
0+ 5	0.0000		0.00	Q				
0+10	0.0000		0.00	Q				
0+15	0.0000		0.00	Q				
0+20	0.0000		0.00	Q				
0+25	0.0000		0.00	Q				
0+30	0.0000		0.00	Q				
0+35	0.0000		0.00	Q				
0+40	0.0000		0.00	Q				
0+45	0.0000		0.00	Q				
0+50	0.0000		0.00	Q				
0+55	0.0000		0.00	Q				
1+ 0	0.0000		0.00	Q				
1+ 5	0.0000		0.00	Q				
1+10	0.0000		0.00	Q				
1+15	0.0000		0.00	Q				
1+20	0.0000		0.00	Q				
1+25	0.0003		0.05	Q				
1+30	0.0021		0.26	Q				
1+35	0.0098		1.11	Q				
1+40	0.0343		3.56	Q				
1+45	0.0935		8.60	Q				
1+50	0.2123		17.24	Q				
1+55	0.4120		29.00	VQ				
2+ 0	0.7019		42.09	VQ				
2+ 5	1.0975		57.45	V Q				
2+10	1.6519		80.49	V Q				
2+15	2.5289		127.34	V Q				
2+20	4.1401		233.94	V	Q			
2+25	6.7974		385.85	V		Q		
2+30	10.4704		533.31	V			Q	
2+35	15.0279		661.76	V				Q
2+40	20.2786		762.39	V				Q Q
2+45	25.8455		808.32	V				Q Q
2+50	30.9599		742.61		V			
2+55	35.2026		616.05		V		Q	
3+ 0	38.8239		525.81		V			
3+ 5	42.0612		470.06			V	Q	
3+10	45.0275		430.70			VQ		
3+15	47.7741		398.81			Q V		
3+20	50.2944		365.94			Q	V	
3+25	52.6021		335.08				V	
3+30	54.7581		313.05				V	
3+35	56.8108		298.06				V	

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3+40	58.7860	286.80			Q	V
3+45	60.6844	275.64			Q	V
3+50	62.4600	257.82			Q	V
3+55	64.0881	236.41			Q	V
4+ 0	65.6120	221.27		Q		V
4+ 5	67.0686	211.49		Q		V
4+10	68.4758	204.33		Q		V
4+15	69.8381	197.81		Q		V
4+20	71.1412	189.20		Q		V
4+25	72.3806	179.97		Q		V
4+30	73.5756	173.51		Q		V
4+35	74.7419	169.35		Q		V
4+40	75.8887	166.51		Q		V
4+45	77.0207	164.37		Q		V
4+50	78.1380	162.22		Q		V
4+55	79.2406	160.10		Q		V
5+ 0	80.3335	158.69		Q		V
5+ 5	81.4203	157.79		Q		V
5+10	82.5010	156.93		Q		V
5+15	83.5708	155.33		Q		V
5+20	84.6142	151.50		Q		V
5+25	85.6243	146.67		Q		V
5+30	86.6111	143.29		Q		V
5+35	87.5836	141.20		Q		V
5+40	88.5478	140.00		Q		V
5+45	89.5105	139.78		Q		V
5+50	90.4825	141.13		Q		V
5+55	91.4691	143.26		Q		V
6+ 0	92.4667	144.86		Q		V
6+ 5	93.4681	145.40		Q		V
6+10	94.4559	143.42		Q		V
6+15	95.3814	134.39		Q		V
6+20	96.1296	108.64		Q		V
6+25	96.6494	75.47		Q		V
6+30	97.0055	51.71		Q		V
6+35	97.2549	36.22		Q		V
6+40	97.4292	25.32		Q		V
6+45	97.5493	17.43		Q		V
6+50	97.6291	11.59		Q		V
6+55	97.6792	7.28		Q		V
7+ 0	97.7084	4.23		Q		V
7+ 5	97.7231	2.14		Q		V
7+10	97.7286	0.80		Q		V
7+15	97.7294	0.11		Q		V

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UNIT HYDROGRAPH ANALYSIS

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Tule wind Project
Unnamed Eastern Wash
Existing 100 Year 24 Hour
Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

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734.00 5.40

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Type B for San Diego area of California

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Rainfall entered for study = 5.400(In)
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0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
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UNIT HYDROGRAPH

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0.66	0.250	0.290	580.041	0.088
0.88	0.333	0.784	1566.642	0.265
1.10	0.417	1.000	1997.798	0.490
1.32	0.500	0.716	1430.728	0.651
1.54	0.583	0.467	933.347	0.756
1.75	0.667	0.329	656.341	0.830
1.97	0.750	0.237	473.266	0.883
2.19	0.833	0.175	348.921	0.922
2.41	0.917	0.129	256.962	0.951
2.63	1.000	0.091	181.388	0.972
2.85	1.083	0.062	124.326	0.986
3.07	1.167	0.040	80.165	0.995
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where:
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Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0081	0.0000	0.0081	0.0000	0.0081	-----
0.17	0.0162	0.0000	0.0081	0.0000	0.0081	-----
0.25	0.0243	0.0000	0.0081	0.0000	0.0081	-----
0.33	0.0324	0.0000	0.0081	0.0000	0.0081	-----
0.42	0.0405	0.0000	0.0081	0.0000	0.0081	-----
0.50	0.0486	0.0000	0.0081	0.0000	0.0081	-----

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0.58	0.0549	0.0000	0.0063	0.0000	0.0063	-----
0.67	0.0612	0.0000	0.0063	0.0000	0.0063	-----
0.75	0.0675	0.0000	0.0063	0.0000	0.0063	-----
0.83	0.0738	0.0000	0.0063	0.0000	0.0063	-----
0.92	0.0801	0.0000	0.0063	0.0000	0.0063	-----
1.00	0.0864	0.0000	0.0063	0.0000	0.0063	-----
1.08	0.0945	0.0000	0.0081	0.0000	0.0081	-----
1.17	0.1026	0.0000	0.0081	0.0000	0.0081	-----
1.25	0.1107	0.0000	0.0081	0.0000	0.0081	-----
1.33	0.1188	0.0000	0.0081	0.0000	0.0081	-----
1.42	0.1269	0.0000	0.0081	0.0000	0.0081	-----
1.50	0.1350	0.0000	0.0081	0.0000	0.0081	-----
1.58	0.1431	0.0000	0.0081	0.0000	0.0081	-----
1.67	0.1512	0.0000	0.0081	0.0000	0.0081	-----
1.75	0.1593	0.0000	0.0081	0.0000	0.0081	-----
1.83	0.1674	0.0000	0.0081	0.0000	0.0081	-----
1.92	0.1755	0.0000	0.0081	0.0000	0.0081	-----
2.00	0.1836	0.0000	0.0081	0.0000	0.0081	-----
2.08	0.1935	0.0000	0.0099	0.0000	0.0099	-----
2.17	0.2034	0.0000	0.0099	0.0000	0.0099	-----
2.25	0.2133	0.0000	0.0099	0.0000	0.0099	-----
2.33	0.2232	0.0000	0.0099	0.0000	0.0099	-----
2.42	0.2331	0.0000	0.0099	0.0000	0.0099	-----
2.50	0.2430	0.0000	0.0099	0.0000	0.0099	-----
2.58	0.2511	0.0000	0.0081	0.0000	0.0081	-----
2.67	0.2592	0.0000	0.0081	0.0000	0.0081	-----
2.75	0.2673	0.0000	0.0081	0.0000	0.0081	-----
2.83	0.2754	0.0000	0.0081	0.0000	0.0081	-----
2.92	0.2835	0.0000	0.0081	0.0000	0.0081	-----
3.00	0.2916	0.0000	0.0081	0.0000	0.0081	-----
3.08	0.3015	0.0000	0.0099	0.0000	0.0099	-----
3.17	0.3114	0.0000	0.0099	0.0000	0.0099	-----
3.25	0.3213	0.0000	0.0099	0.0000	0.0099	-----
3.33	0.3312	0.0000	0.0099	0.0000	0.0099	-----
3.42	0.3411	0.0000	0.0099	0.0000	0.0099	-----
3.50	0.3510	0.0000	0.0099	0.0000	0.0099	-----
3.58	0.3618	0.0001	0.0108	0.0001	0.0107	-----
3.67	0.3726	0.0003	0.0108	0.0002	0.0106	-----
3.75	0.3834	0.0007	0.0108	0.0003	0.0105	-----
3.83	0.3942	0.0011	0.0108	0.0005	0.0103	-----
3.92	0.4050	0.0017	0.0108	0.0006	0.0102	-----
4.00	0.4158	0.0024	0.0108	0.0007	0.0101	-----
4.08	0.4275	0.0033	0.0117	0.0009	0.0108	-----
4.17	0.4392	0.0044	0.0117	0.0010	0.0107	-----
4.25	0.4509	0.0056	0.0117	0.0012	0.0105	-----
4.33	0.4626	0.0069	0.0117	0.0013	0.0104	-----
4.42	0.4743	0.0083	0.0117	0.0014	0.0103	-----
4.50	0.4860	0.0099	0.0117	0.0016	0.0101	-----
4.58	0.4986	0.0117	0.0126	0.0018	0.0108	-----
4.67	0.5112	0.0137	0.0126	0.0020	0.0106	-----
4.75	0.5238	0.0158	0.0126	0.0021	0.0105	-----
4.83	0.5364	0.0181	0.0126	0.0023	0.0103	-----
4.92	0.5490	0.0205	0.0126	0.0024	0.0102	-----
5.00	0.5616	0.0230	0.0126	0.0025	0.0101	-----
5.08	0.5760	0.0260	0.0144	0.0030	0.0114	-----
5.17	0.5904	0.0292	0.0144	0.0032	0.0112	-----
5.25	0.6048	0.0326	0.0144	0.0034	0.0110	-----
5.33	0.6192	0.0361	0.0144	0.0035	0.0109	-----
5.42	0.6336	0.0398	0.0144	0.0037	0.0107	-----
5.50	0.6480	0.0436	0.0144	0.0038	0.0106	-----
5.58	0.6633	0.0478	0.0153	0.0042	0.0111	-----
5.67	0.6786	0.0522	0.0153	0.0044	0.0109	-----
5.75	0.6939	0.0568	0.0153	0.0045	0.0108	-----

East100Yr24Hr.out					
5.83	0.7092	0.0615	0.0153	0.0047	0.0106
5.92	0.7245	0.0663	0.0153	0.0049	0.0104
6.00	0.7398	0.0713	0.0153	0.0050	0.0103
6.08	0.7578	0.0774	0.0180	0.0061	0.0119
6.17	0.7758	0.0837	0.0180	0.0063	0.0117
6.25	0.7938	0.0902	0.0180	0.0065	0.0115
6.33	0.8118	0.0968	0.0180	0.0067	0.0113
6.42	0.8298	0.1036	0.0180	0.0068	0.0112
6.50	0.8478	0.1107	0.0180	0.0070	0.0110
6.58	0.8685	0.1189	0.0207	0.0083	0.0124
6.67	0.8892	0.1275	0.0207	0.0085	0.0122
6.75	0.9099	0.1362	0.0207	0.0087	0.0120
6.83	0.9306	0.1451	0.0207	0.0089	0.0118
6.92	0.9513	0.1543	0.0207	0.0091	0.0116
7.00	0.9720	0.1636	0.0207	0.0094	0.0113
7.08	0.9990	0.1761	0.0270	0.0125	0.0145
7.17	1.0260	0.1889	0.0270	0.0128	0.0142
7.25	1.0530	0.2021	0.0270	0.0131	0.0139
7.33	1.0800	0.2155	0.0270	0.0134	0.0136
7.42	1.1070	0.2292	0.0270	0.0137	0.0133
7.50	1.1340	0.2432	0.0270	0.0140	0.0130
7.58	1.1745	0.2647	0.0405	0.0215	0.0190
7.67	1.2150	0.2868	0.0405	0.0221	0.0184
7.75	1.2555	0.3095	0.0405	0.0227	0.0178
7.83	1.2960	0.3327	0.0405	0.0232	0.0173
7.92	1.3365	0.3564	0.0405	0.0237	0.0168
8.00	1.3770	0.3806	0.0405	0.0242	0.0163
8.08	1.4373	0.4176	0.0603	0.0369	0.0234
8.17	1.4976	0.4554	0.0603	0.0379	0.0224
8.25	1.5579	0.4942	0.0603	0.0388	0.0215
8.33	1.6182	0.5339	0.0603	0.0397	0.0206
8.42	1.6785	0.5744	0.0603	0.0405	0.0198
8.50	1.7388	0.6156	0.0603	0.0412	0.0191
8.58	1.8180	0.6708	0.0792	0.0552	0.0240
8.67	1.8972	0.7272	0.0792	0.0564	0.0228
8.75	1.9764	0.7847	0.0792	0.0575	0.0217
8.83	2.0556	0.8431	0.0792	0.0585	0.0207
8.92	2.1348	0.9025	0.0792	0.0594	0.0198
9.00	2.2140	0.9628	0.0792	0.0603	0.0189
9.08	2.3004	1.0294	0.0864	0.0667	0.0197
9.17	2.3868	1.0970	0.0864	0.0676	0.0188
9.25	2.4732	1.1654	0.0864	0.0684	0.0180
9.33	2.5596	1.2346	0.0864	0.0692	0.0172
9.42	2.6460	1.3045	0.0864	0.0699	0.0165
9.50	2.7324	1.3751	0.0864	0.0706	0.0158
9.58	2.8062	1.4359	0.0738	0.0608	0.0130
9.67	2.8800	1.4972	0.0738	0.0613	0.0125
9.75	2.9538	1.5589	0.0738	0.0617	0.0121
9.83	3.0276	1.6210	0.0738	0.0621	0.0117
9.92	3.1014	1.6835	0.0738	0.0625	0.0113
10.00	3.1752	1.7464	0.0738	0.0629	0.0109
10.08	3.2121	1.7779	0.0369	0.0316	0.0053
10.17	3.2490	1.8096	0.0369	0.0316	0.0053
10.25	3.2859	1.8413	0.0369	0.0317	0.0052
10.33	3.3228	1.8731	0.0369	0.0318	0.0051
10.42	3.3597	1.9050	0.0369	0.0319	0.0050
10.50	3.3966	1.9370	0.0369	0.0320	0.0049
10.58	3.4209	1.9580	0.0243	0.0211	0.0032
10.67	3.4452	1.9792	0.0243	0.0211	0.0032
10.75	3.4695	2.0003	0.0243	0.0212	0.0031
10.83	3.4938	2.0215	0.0243	0.0212	0.0031
10.92	3.5181	2.0427	0.0243	0.0212	0.0031
11.00	3.5424	2.0640	0.0243	0.0212	0.0031

East100Yr24Hr.out

11.08	3.5631	2.0821	0.0207	0.0181	0.0026	-----
11.17	3.5838	2.1002	0.0207	0.0181	0.0026	-----
11.25	3.6045	2.1184	0.0207	0.0182	0.0025	-----
11.33	3.6252	2.1366	0.0207	0.0182	0.0025	-----
11.42	3.6459	2.1548	0.0207	0.0182	0.0025	-----
11.50	3.6666	2.1730	0.0207	0.0182	0.0025	-----
11.58	3.6855	2.1897	0.0189	0.0167	0.0022	-----
11.67	3.7044	2.2064	0.0189	0.0167	0.0022	-----
11.75	3.7233	2.2230	0.0189	0.0167	0.0022	-----
11.83	3.7422	2.2398	0.0189	0.0167	0.0022	-----
11.92	3.7611	2.2565	0.0189	0.0167	0.0022	-----
12.00	3.7800	2.2732	0.0189	0.0167	0.0022	-----
12.08	3.7980	2.2892	0.0180	0.0160	0.0020	-----
12.17	3.8160	2.3052	0.0180	0.0160	0.0020	-----
12.25	3.8340	2.3211	0.0180	0.0160	0.0020	-----
12.33	3.8520	2.3371	0.0180	0.0160	0.0020	-----
12.42	3.8700	2.3532	0.0180	0.0160	0.0020	-----
12.50	3.8880	2.3692	0.0180	0.0160	0.0020	-----
12.58	3.9051	2.3844	0.0171	0.0152	0.0019	-----
12.67	3.9222	2.3997	0.0171	0.0153	0.0018	-----
12.75	3.9393	2.4149	0.0171	0.0153	0.0018	-----
12.83	3.9564	2.4302	0.0171	0.0153	0.0018	-----
12.92	3.9735	2.4455	0.0171	0.0153	0.0018	-----
13.00	3.9906	2.4608	0.0171	0.0153	0.0018	-----
13.08	4.0059	2.4745	0.0153	0.0137	0.0016	-----
13.17	4.0212	2.4882	0.0153	0.0137	0.0016	-----
13.25	4.0365	2.5019	0.0153	0.0137	0.0016	-----
13.33	4.0518	2.5156	0.0153	0.0137	0.0016	-----
13.42	4.0671	2.5294	0.0153	0.0137	0.0016	-----
13.50	4.0824	2.5431	0.0153	0.0137	0.0016	-----
13.58	4.0968	2.5560	0.0144	0.0129	0.0015	-----
13.67	4.1112	2.5690	0.0144	0.0129	0.0015	-----
13.75	4.1256	2.5819	0.0144	0.0130	0.0014	-----
13.83	4.1400	2.5949	0.0144	0.0130	0.0014	-----
13.92	4.1544	2.6079	0.0144	0.0130	0.0014	-----
14.00	4.1688	2.6209	0.0144	0.0130	0.0014	-----
14.08	4.1850	2.6355	0.0162	0.0146	0.0016	-----
14.17	4.2012	2.6501	0.0162	0.0146	0.0016	-----
14.25	4.2174	2.6647	0.0162	0.0146	0.0016	-----
14.33	4.2336	2.6794	0.0162	0.0146	0.0016	-----
14.42	4.2498	2.6940	0.0162	0.0146	0.0016	-----
14.50	4.2660	2.7087	0.0162	0.0147	0.0015	-----
14.58	4.2750	2.7168	0.0090	0.0081	0.0009	-----
14.67	4.2840	2.7249	0.0090	0.0081	0.0009	-----
14.75	4.2930	2.7331	0.0090	0.0082	0.0008	-----
14.83	4.3020	2.7412	0.0090	0.0082	0.0008	-----
14.92	4.3110	2.7494	0.0090	0.0082	0.0008	-----
15.00	4.3200	2.7576	0.0090	0.0082	0.0008	-----
15.08	4.3344	2.7706	0.0144	0.0131	0.0013	-----
15.17	4.3488	2.7837	0.0144	0.0131	0.0013	-----
15.25	4.3632	2.7968	0.0144	0.0131	0.0013	-----
15.33	4.3776	2.8098	0.0144	0.0131	0.0013	-----
15.42	4.3920	2.8229	0.0144	0.0131	0.0013	-----
15.50	4.4064	2.8360	0.0144	0.0131	0.0013	-----
15.58	4.4199	2.8483	0.0135	0.0123	0.0012	-----
15.67	4.4334	2.8606	0.0135	0.0123	0.0012	-----
15.75	4.4469	2.8729	0.0135	0.0123	0.0012	-----
15.83	4.4604	2.8852	0.0135	0.0123	0.0012	-----
15.92	4.4739	2.8975	0.0135	0.0123	0.0012	-----
16.00	4.4874	2.9098	0.0135	0.0123	0.0012	-----
16.08	4.5000	2.9213	0.0126	0.0115	0.0011	-----
16.17	4.5126	2.9328	0.0126	0.0115	0.0011	-----
16.25	4.5252	2.9443	0.0126	0.0115	0.0011	-----

East100Yr24Hr.out					
16.33	4.5378	2.9558	0.0126	0.0115	0.0011 -----
16.42	4.5504	2.9673	0.0126	0.0115	0.0011 -----
16.50	4.5630	2.9788	0.0126	0.0115	0.0011 -----
16.58	4.5765	2.9912	0.0135	0.0123	0.0012 -----
16.67	4.5900	3.0035	0.0135	0.0123	0.0012 -----
16.75	4.6035	3.0159	0.0135	0.0124	0.0011 -----
16.83	4.6170	3.0282	0.0135	0.0124	0.0011 -----
16.92	4.6305	3.0406	0.0135	0.0124	0.0011 -----
17.00	4.6440	3.0529	0.0135	0.0124	0.0011 -----
17.08	4.6548	3.0628	0.0108	0.0099	0.0009 -----
17.17	4.6656	3.0727	0.0108	0.0099	0.0009 -----
17.25	4.6764	3.0827	0.0108	0.0099	0.0009 -----
17.33	4.6872	3.0926	0.0108	0.0099	0.0009 -----
17.42	4.6980	3.1025	0.0108	0.0099	0.0009 -----
17.50	4.7088	3.1124	0.0108	0.0099	0.0009 -----
17.58	4.7205	3.1231	0.0117	0.0107	0.0010 -----
17.67	4.7322	3.1339	0.0117	0.0107	0.0010 -----
17.75	4.7439	3.1446	0.0117	0.0108	0.0009 -----
17.83	4.7556	3.1554	0.0117	0.0108	0.0009 -----
17.92	4.7673	3.1661	0.0117	0.0108	0.0009 -----
18.00	4.7790	3.1769	0.0117	0.0108	0.0009 -----
18.08	4.7880	3.1852	0.0090	0.0083	0.0007 -----
18.17	4.7970	3.1935	0.0090	0.0083	0.0007 -----
18.25	4.8060	3.2018	0.0090	0.0083	0.0007 -----
18.33	4.8150	3.2100	0.0090	0.0083	0.0007 -----
18.42	4.8240	3.2183	0.0090	0.0083	0.0007 -----
18.50	4.8330	3.2266	0.0090	0.0083	0.0007 -----
18.58	4.8420	3.2349	0.0090	0.0083	0.0007 -----
18.67	4.8510	3.2432	0.0090	0.0083	0.0007 -----
18.75	4.8600	3.2515	0.0090	0.0083	0.0007 -----
18.83	4.8690	3.2598	0.0090	0.0083	0.0007 -----
18.92	4.8780	3.2681	0.0090	0.0083	0.0007 -----
19.00	4.8870	3.2764	0.0090	0.0083	0.0007 -----
19.08	4.8951	3.2839	0.0081	0.0075	0.0006 -----
19.17	4.9032	3.2914	0.0081	0.0075	0.0006 -----
19.25	4.9113	3.2988	0.0081	0.0075	0.0006 -----
19.33	4.9194	3.3063	0.0081	0.0075	0.0006 -----
19.42	4.9275	3.3138	0.0081	0.0075	0.0006 -----
19.50	4.9356	3.3213	0.0081	0.0075	0.0006 -----
19.58	4.9446	3.3296	0.0090	0.0083	0.0007 -----
19.67	4.9536	3.3379	0.0090	0.0083	0.0007 -----
19.75	4.9626	3.3462	0.0090	0.0083	0.0007 -----
19.83	4.9716	3.3546	0.0090	0.0083	0.0007 -----
19.92	4.9806	3.3629	0.0090	0.0083	0.0007 -----
20.00	4.9896	3.3712	0.0090	0.0083	0.0007 -----
20.08	4.9995	3.3804	0.0099	0.0092	0.0007 -----
20.17	5.0094	3.3895	0.0099	0.0092	0.0007 -----
20.25	5.0193	3.3987	0.0099	0.0092	0.0007 -----
20.33	5.0292	3.4079	0.0099	0.0092	0.0007 -----
20.42	5.0391	3.4170	0.0099	0.0092	0.0007 -----
20.50	5.0490	3.4262	0.0099	0.0092	0.0007 -----
20.58	5.0580	3.4346	0.0090	0.0083	0.0007 -----
20.67	5.0670	3.4429	0.0090	0.0083	0.0007 -----
20.75	5.0760	3.4512	0.0090	0.0083	0.0007 -----
20.83	5.0850	3.4596	0.0090	0.0083	0.0007 -----
20.92	5.0940	3.4679	0.0090	0.0083	0.0007 -----
21.00	5.1030	3.4763	0.0090	0.0083	0.0007 -----
21.08	5.1111	3.4838	0.0081	0.0075	0.0006 -----
21.17	5.1192	3.4913	0.0081	0.0075	0.0006 -----
21.25	5.1273	3.4988	0.0081	0.0075	0.0006 -----
21.33	5.1354	3.5064	0.0081	0.0075	0.0006 -----
21.42	5.1435	3.5139	0.0081	0.0075	0.0006 -----
21.50	5.1516	3.5214	0.0081	0.0075	0.0006 -----

East100Yr24Hr.out

21.58	5.1597	3.5289	0.0081	0.0075	0.0006	-----
21.67	5.1678	3.5365	0.0081	0.0075	0.0006	-----
21.75	5.1759	3.5440	0.0081	0.0075	0.0006	-----
21.83	5.1840	3.5515	0.0081	0.0075	0.0006	-----
21.92	5.1921	3.5590	0.0081	0.0075	0.0006	-----
22.00	5.2002	3.5666	0.0081	0.0075	0.0006	-----
22.08	5.2083	3.5741	0.0081	0.0075	0.0006	-----
22.17	5.2164	3.5816	0.0081	0.0075	0.0006	-----
22.25	5.2245	3.5892	0.0081	0.0075	0.0006	-----
22.33	5.2326	3.5967	0.0081	0.0075	0.0006	-----
22.42	5.2407	3.6042	0.0081	0.0075	0.0006	-----
22.50	5.2488	3.6118	0.0081	0.0075	0.0006	-----
22.58	5.2569	3.6193	0.0081	0.0075	0.0006	-----
22.67	5.2650	3.6269	0.0081	0.0075	0.0006	-----
22.75	5.2731	3.6344	0.0081	0.0075	0.0006	-----
22.83	5.2812	3.6420	0.0081	0.0075	0.0006	-----
22.92	5.2893	3.6495	0.0081	0.0075	0.0006	-----
23.00	5.2974	3.6571	0.0081	0.0075	0.0006	-----
23.08	5.3064	3.6654	0.0090	0.0084	0.0006	-----
23.17	5.3154	3.6738	0.0090	0.0084	0.0006	-----
23.25	5.3244	3.6822	0.0090	0.0084	0.0006	-----
23.33	5.3334	3.6906	0.0090	0.0084	0.0006	-----
23.42	5.3424	3.6990	0.0090	0.0084	0.0006	-----
23.50	5.3514	3.7074	0.0090	0.0084	0.0006	-----
23.58	5.3595	3.7150	0.0081	0.0076	0.0005	-----
23.67	5.3676	3.7225	0.0081	0.0076	0.0005	-----
23.75	5.3757	3.7301	0.0081	0.0076	0.0005	-----
23.83	5.3838	3.7376	0.0081	0.0076	0.0005	-----
23.92	5.3919	3.7452	0.0081	0.0076	0.0005	-----
24.00	5.4000	3.7528	0.0081	0.0076	0.0005	-----

Total soil rain loss = 1.65(In)
Total effective runoff = 3.75(In)

Peak flow rate this hydrograph = 597.93(CFS)
Total runoff volume this hydrograph = 9998969.3(Ft3)

+++++
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	150.0	300.0	450.0	600.0
0+ 5	0.0000	0.00	Q					
0+10	0.0000	0.00	Q					
0+15	0.0000	0.00	Q					
0+20	0.0000	0.00	Q					
0+25	0.0000	0.00	Q					
0+30	0.0000	0.00	Q					
0+35	0.0000	0.00	Q					
0+40	0.0000	0.00	Q					
0+45	0.0000	0.00	Q					
0+50	0.0000	0.00	Q					
0+55	0.0000	0.00	Q					
1+ 0	0.0000	0.00	Q					
1+ 5	0.0000	0.00	Q					
1+10	0.0000	0.00	Q					
1+15	0.0000	0.00	Q					
1+20	0.0000	0.00	Q					

East100Yr24Hr.out							
1+25	0.0000	0.00	Q				
1+30	0.0000	0.00	Q				
1+35	0.0000	0.00	Q				
1+40	0.0000	0.00	Q				
1+45	0.0000	0.00	Q				
1+50	0.0000	0.00	Q				
1+55	0.0000	0.00	Q				
2+ 0	0.0000	0.00	Q				
2+ 5	0.0000	0.00	Q				
2+10	0.0000	0.00	Q				
2+15	0.0000	0.00	Q				
2+20	0.0000	0.00	Q				
2+25	0.0000	0.00	Q				
2+30	0.0000	0.00	Q				
2+35	0.0000	0.00	Q				
2+40	0.0000	0.00	Q				
2+45	0.0000	0.00	Q				
2+50	0.0000	0.00	Q				
2+55	0.0000	0.00	Q				
3+ 0	0.0000	0.00	Q				
3+ 5	0.0000	0.00	Q				
3+10	0.0000	0.00	Q				
3+15	0.0000	0.00	Q				
3+20	0.0000	0.00	Q				
3+25	0.0000	0.00	Q				
3+30	0.0000	0.00	Q				
3+35	0.0000	0.00	Q				
3+40	0.0002	0.02	Q				
3+45	0.0009	0.10	Q				
3+50	0.0032	0.34	Q				
3+55	0.0088	0.82	Q				
4+ 0	0.0192	1.50	Q				
4+ 5	0.0352	2.32	Q				
4+10	0.0575	3.24	Q				
4+15	0.0867	4.24	Q				
4+20	0.1236	5.37	Q				
4+25	0.1689	6.58	Q				
4+30	0.2226	7.79	Q				
4+35	0.2846	9.00	Q				
4+40	0.3550	10.22	Q				
4+45	0.4341	11.49	Q				
4+50	0.5228	12.88	Q				
4+55	0.6215	14.33	Q				
5+ 0	0.7299	15.73	VQ				
5+ 5	0.8475	17.08	VQ				
5+10	0.9745	18.44	VQ				
5+15	1.1117	19.93	VQ				
5+20	1.2617	21.79	VQ				
5+25	1.4260	23.84	VQ				
5+30	1.6031	25.73	VQ				
5+35	1.7922	27.45	VQ				
5+40	1.9927	29.11	VQ				
5+45	2.2048	30.79	V Q				
5+50	2.4298	32.68	V Q				
5+55	2.6684	34.65	V Q				
6+ 0	2.9195	36.46	V Q				
6+ 5	3.1823	38.16	V Q				
6+10	3.4571	39.90	V Q				
6+15	3.7459	41.94	V Q				
6+20	4.0549	44.87	V Q				
6+25	4.3871	48.23	V Q				
6+30	4.7392	51.12	V Q				
6+35	5.1085	53.63	V Q				

			East100Yr24Hr.out			
6+40	5.4944	56.04	V	Q		
6+45	5.8988	58.72	V	Q		
6+50	6.3284	62.38	V	Q		
6+55	6.7863	66.48	V	Q		
7+ 0	7.2683	69.98	V	Q		
7+ 5	7.7712	73.03	V	Q		
7+10	8.2957	76.15	V	Q		
7+15	8.8483	80.25	V	Q		
7+20	9.4485	87.14	V	Q		
7+25	10.1053	95.38	V	Q		
7+30	10.8083	102.07	V	Q		
7+35	11.5495	107.62	V	Q		
7+40	12.3303	113.36	V	Q		
7+45	13.1674	121.55	V	Q		
7+50	14.1085	136.65	V	Q		
7+55	15.1763	155.05	V	Q		
8+ 0	16.3449	169.68	V	Q		
8+ 5	17.5936	181.30	V	Q		
8+10	18.9201	192.61	V	Q		
8+15	20.3500	207.62	V	Q		
8+20	21.9613	233.97	V	Q		
8+25	23.7907	265.62	V	Q		
8+30	25.7925	290.67	V	Q		
8+35	27.9284	310.14	V	Q		
8+40	30.1866	327.88	V	Q		
8+45	32.5874	348.61	V	Q		
8+50	35.2102	380.82	V	Q		
8+55	38.0897	418.10	V	Q		
9+ 0	41.1719	447.54	V	Q		
9+ 5	44.4096	470.11	V	Q		
9+10	47.7786	489.18	V	Q		
9+15	51.2735	507.45	V	Q		
9+20	54.9164	528.96	V	Q		
9+25	58.7142	551.43	V	Q		
9+30	62.6372	569.62	V	Q		
9+35	66.6571	583.69	V	Q		
9+40	70.7474	593.90	V	Q		
9+45	74.8653	597.93	V	Q		
9+50	78.9291	590.06	V	Q		
9+55	82.8994	576.49	V	Q		
10+ 0	86.8098	567.78	V	Q		
10+ 5	90.6827	562.34	V	Q		
10+10	94.5040	554.86	V	Q		
10+15	98.1935	535.72	V	Q		
10+20	101.5409	486.04	V	Q		
10+25	104.4543	423.02	V	Q		
10+30	107.0580	378.06	V	Q		
10+35	109.4587	348.58	V	Q		
10+40	111.7074	326.51	V	Q		
10+45	113.8144	305.92	V	Q		
10+50	115.7333	278.63	V	Q		
10+55	117.4511	249.42	V	Q		
11+ 0	119.0257	228.63	V	Q		
11+ 5	120.5055	214.87	V	Q		
11+10	121.9175	205.02	V	Q		
11+15	123.2748	197.08	V	Q		
11+20	124.5725	188.43	V	Q		
11+25	125.8094	179.60	V	Q		
11+30	127.0033	173.35	V	Q		
11+35	128.1687	169.22	V	Q		
11+40	129.3134	166.21	V	Q		
11+45	130.4398	163.55	V	Q		
11+50	131.5424	160.09	V	Q		

			East100Yr24Hr.out			
11+55	132.6187	156.28		Q		V
12+ 0	133.6766	153.61		Q		V
12+ 5	134.7226	151.87		Q		V
12+10	135.7597	150.59		Q		V
12+15	136.7887	149.40		Q		V
12+20	137.8060	147.72		Q		V
12+25	138.8106	145.86		Q		V
12+30	139.8062	144.56		Q		V
12+35	140.7960	143.73		Q		V
12+40	141.7813	143.07		Q		V
12+45	142.7612	142.28		Q		V
12+50	143.7313	140.86		Q		V
12+55	144.6898	139.17		Q		V
13+ 0	145.6402	137.99		Q		V
13+ 5	146.5851	137.20		Q		V
13+10	147.5247	136.44		Q		V
13+15	148.4559	135.20		Q		V
13+20	149.3684	132.49		Q		V
13+25	150.2580	129.17		Q		V
13+30	151.1313	126.81		Q		V
13+35	151.9940	125.26		Q		V
13+40	152.8486	124.09		Q		V
13+45	153.6950	122.91		Q		V
13+50	154.5294	121.15		Q		V
13+55	155.3503	119.20		Q		V
14+ 0	156.1618	117.82		Q		V
14+ 5	156.9675	116.99		Q		V
14+10	157.7711	116.68		Q		V
14+15	158.5785	117.24		Q		V
14+20	159.4020	119.56		Q		V
14+25	160.2468	122.67		Q		V
14+30	161.1071	124.92		Q		V
14+35	161.9761	126.18		Q		V
14+40	162.8450	126.16		Q		V
14+45	163.6934	123.19		Q		V
14+50	164.4758	113.61		Q		V
14+55	165.1719	101.07		Q		V
15+ 0	165.8061	92.09		Q		V
15+ 5	166.4013	86.42		Q		V
15+10	166.9739	83.14		Q		V
15+15	167.5455	83.00		Q		V
15+20	168.1545	88.44		Q		V
15+25	168.8197	96.59		Q		V
15+30	169.5254	102.46		Q		V
15+35	170.2570	106.24		Q		V
15+40	171.0066	108.84		Q		V
15+45	171.7674	110.47		Q		V
15+50	172.5313	110.91		Q		V
15+55	173.2929	110.59		Q		V
16+ 0	174.0529	110.35		Q		V
16+ 5	174.8120	110.22		Q		V
16+10	175.5695	109.99		Q		V
16+15	176.3228	109.38		Q		V
16+20	177.0658	107.88		Q		V
16+25	177.7964	106.08		Q		V
16+30	178.5182	104.80		Q		V
16+35	179.2345	104.01		Q		V
16+40	179.9479	103.59		Q		V
16+45	180.6620	103.69		Q		V
16+50	181.3833	104.73		Q		V
16+55	182.1147	106.20		Q		V
17+ 0	182.8535	107.27		Q		V
17+ 5	183.5966	107.90		Q		V

			East100Yr24Hr.out			
17+10	184.3404	108.00		Q		V
17+15	185.0771	106.96		Q		V
17+20	185.7893	103.41		Q		V
17+25	186.4692	98.72		Q		V
17+30	187.1259	95.36		Q		V
17+35	187.7679	93.22		Q		V
17+40	188.4004	91.83		Q		V
17+45	189.0285	91.20		Q		V
17+50	189.6598	91.67		Q		V
17+55	190.2984	92.72		Q		V
18+ 0	190.9422	93.48		Q		V
18+ 5	191.5888	93.89		Q		V
18+10	192.2352	93.85		Q		V
18+15	192.8738	92.72		Q		V
18+20	193.4876	89.13		Q		V
18+25	194.0690	84.41		Q		V
18+30	194.6271	81.03		Q		V
18+35	195.1700	78.84		Q		V
18+40	195.7023	77.29		Q		V
18+45	196.2270	76.17		Q		V
18+50	196.7458	75.33		Q		V
18+55	197.2603	74.71		Q		V
19+ 0	197.7719	74.28		Q		V
19+ 5	198.2813	73.96		Q		V
19+10	198.7884	73.64		Q		V
19+15	199.2917	73.07		Q		V
19+20	199.7860	71.77		Q		V
19+25	200.2690	70.13		Q		V
19+30	200.7439	68.96		Q		V
19+35	201.2138	68.23		Q		V
19+40	201.6810	67.84		Q		V
19+45	202.1489	67.94		Q		V
19+50	202.6239	68.97		Q		V
19+55	203.1090	70.43		Q		V
20+ 0	203.6014	71.49		Q		V
20+ 5	204.0987	72.21		Q		V
20+10	204.6004	72.84		Q		V
20+15	205.1080	73.70		Q		V
20+20	205.6266	75.31		Q		V
20+25	206.1583	77.21		Q		V
20+30	206.6994	78.57		Q		V
20+35	207.2465	79.44		Q		V
20+40	207.7970	79.93		Q		V
20+45	208.3472	79.89		Q		V
20+50	208.8906	78.90		Q		V
20+55	209.4241	77.47		Q		V
21+ 0	209.9506	76.44		Q		V
21+ 5	210.4723	75.76		Q		V
21+10	210.9899	75.15		Q		V
21+15	211.5018	74.32		Q		V
21+20	212.0028	72.74		Q		V
21+25	212.4909	70.88		Q		V
21+30	212.9699	69.55		Q		V
21+35	213.4429	68.68		Q		V
21+40	213.9117	68.08		Q		V
21+45	214.3777	67.66		Q		V
21+50	214.8417	67.38		Q		V
21+55	215.3043	67.17		Q		V
22+ 0	215.7660	67.04		Q		V
22+ 5	216.2271	66.94		Q		V
22+10	216.6877	66.89		Q		V
22+15	217.1483	66.87		Q		V
22+20	217.6088	66.88		Q		V

			East100Yr24Hr.out				
22+25	218.0695	66.89	Q				V
22+30	218.5303	66.90	Q				V
22+35	218.9911	66.91	Q				V
22+40	219.4520	66.93	Q				V
22+45	219.9130	66.94	Q				V
22+50	220.3741	66.95	Q				V
22+55	220.8353	66.96	Q				V
23+ 0	221.2965	66.97	Q				V
23+ 5	221.7580	67.01	Q				V
23+10	222.2206	67.17	Q				V
23+15	222.6867	67.67	Q				V
23+20	223.1618	68.99	Q				V
23+25	223.6486	70.68	Q				V
23+30	224.1438	71.90	Q				V
23+35	224.6442	72.66	Q				V
23+40	225.1476	73.09	Q				V
23+45	225.6504	73.01	Q				V
23+50	226.1463	72.00	Q				V
23+55	226.6322	70.55	Q				V
24+ 0	227.1109	69.51	Q				V
24+ 5	227.5833	68.59	Q				V
24+10	228.0436	66.83	Q				V
24+15	228.4712	62.09	Q				V
24+20	228.8153	49.96	Q				V
24+25	229.0538	34.64	Q				V
24+30	229.2168	23.67	Q				V
24+35	229.3305	16.51	Q				V
24+40	229.4095	11.48	Q				V
24+45	229.4637	7.86	Q				V
24+50	229.4996	5.22	Q				V
24+55	229.5222	3.28	Q				V
25+ 0	229.5353	1.90	Q				V
25+ 5	229.5420	0.96	Q				V
25+10	229.5444	0.36	Q				V
25+15	229.5447	0.05	Q				V

West100Yr6Hr.out

UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: west100yr6hr.out

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Program License Serial Number 4055

Tule wind Project
Unnamed Western Wash
Existing 100 Year 6 Hour
Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
1440.00	3.92

Rainfall Distribution pattern used in study:
Type B for SCS (small dam) or San Diego 6 hour storms

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***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
1440.00	1.000	79.8	79.8	0.050	B

Area-averaged catchment SCS Curve Number AMC(2) = 79.840
Area-averaged Fm value using values listed = 0.050(In/Hr)

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Direct entry of lag time by user
Watershed area = 1440.00(Ac.)
Catchment Lag time = 0.310 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 26.8817
Hydrograph baseflow = 0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 79.840

Rainfall depth area reduction factors:
Using a total area of 1440.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study = 3.920(In)
Adjusted rainfall = 3.920(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS (Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Q_p vs. T/T_p values into an S-Graph based on $\text{lag} = T_p/0.9$. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/T_p step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

UNIT HYDROGRAPH

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
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(K = West100Yr6Hr.out
17424.00 (CFS))

0.27	0.083	0.020	94.729	0.005
0.54	0.167	0.119	555.238	0.037
0.81	0.250	0.521	2427.683	0.177
1.08	0.333	1.000	4660.364	0.444
1.34	0.417	0.777	3622.249	0.652
1.61	0.500	0.462	2154.448	0.776
1.88	0.583	0.302	1407.416	0.856
2.15	0.667	0.205	954.220	0.911
2.42	0.750	0.142	660.405	0.949
2.69	0.833	0.093	433.118	0.974
2.96	0.917	0.058	268.780	0.989
3.23	1.000	0.032	149.085	0.998
3.49	1.083	0.008	36.266	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

where:

Q = direct runoff, P = depth of precipitation, I_a = Initial Abstraction and S is the watershed storage in inches. S and I_a are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad I_a = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0229	0.0000	0.0229	0.0000	0.0229	-----
0.17	0.0457	0.0000	0.0229	0.0000	0.0229	-----
0.25	0.0686	0.0000	0.0229	0.0000	0.0229	-----
0.33	0.0915	0.0000	0.0229	0.0000	0.0229	-----
0.42	0.1143	0.0000	0.0229	0.0000	0.0229	-----
0.50	0.1372	0.0000	0.0229	0.0000	0.0229	-----
0.58	0.1679	0.0000	0.0307	0.0000	0.0307	-----
0.67	0.1986	0.0000	0.0307	0.0000	0.0307	-----
0.75	0.2293	0.0000	0.0307	0.0000	0.0307	-----

west100Yr6Hr.out

0.83	0.2600	0.0000	0.0307	0.0000	0.0307	-----
0.92	0.2907	0.0000	0.0307	0.0000	0.0307	-----
1.00	0.3214	0.0000	0.0307	0.0000	0.0307	-----
1.08	0.3593	0.0000	0.0379	0.0000	0.0379	-----
1.17	0.3972	0.0000	0.0379	0.0000	0.0379	-----
1.25	0.4351	0.0000	0.0379	0.0000	0.0379	-----
1.33	0.4730	0.0000	0.0379	0.0000	0.0379	-----
1.42	0.5109	0.0000	0.0379	0.0000	0.0379	-----
1.50	0.5488	0.0007	0.0379	0.0007	0.0372	-----
1.58	0.6076	0.0040	0.0588	0.0033	0.0555	-----
1.67	0.6664	0.0097	0.0588	0.0057	0.0531	-----
1.75	0.7252	0.0177	0.0588	0.0080	0.0508	-----
1.83	0.7840	0.0278	0.0588	0.0101	0.0487	-----
1.92	0.8428	0.0399	0.0588	0.0121	0.0467	-----
2.00	0.9016	0.0538	0.0588	0.0140	0.0448	-----
2.08	1.1433	0.1288	0.2417	0.0750	0.1668	-----
2.17	1.3851	0.2275	0.2417	0.0986	0.1431	-----
2.25	1.6268	0.3451	0.2417	0.1176	0.1241	-----
2.33	1.8685	0.4781	0.2417	0.1330	0.1087	-----
2.42	2.1103	0.6239	0.2417	0.1458	0.0960	-----
2.50	2.3520	0.7803	0.2417	0.1564	0.0854	-----
2.58	2.4173	0.8241	0.0653	0.0439	0.0215	-----
2.67	2.4827	0.8686	0.0653	0.0445	0.0208	-----
2.75	2.5480	0.9137	0.0653	0.0451	0.0203	-----
2.83	2.6133	0.9594	0.0653	0.0457	0.0197	-----
2.92	2.6787	1.0055	0.0653	0.0462	0.0191	-----
3.00	2.7440	1.0523	0.0653	0.0467	0.0186	-----
3.08	2.7969	1.0905	0.0529	0.0382	0.0147	-----
3.17	2.8498	1.1290	0.0529	0.0385	0.0144	-----
3.25	2.9028	1.1679	0.0529	0.0388	0.0141	-----
3.33	2.9557	1.2070	0.0529	0.0391	0.0138	-----
3.42	3.0086	1.2465	0.0529	0.0394	0.0135	-----
3.50	3.0615	1.2862	0.0529	0.0397	0.0132	-----
3.58	3.0968	1.3128	0.0353	0.0266	0.0087	-----
3.67	3.1321	1.3395	0.0353	0.0267	0.0085	-----
3.75	3.1674	1.3664	0.0353	0.0269	0.0084	-----
3.83	3.2026	1.3934	0.0353	0.0270	0.0083	-----
3.92	3.2379	1.4205	0.0353	0.0271	0.0082	-----
4.00	3.2732	1.4477	0.0353	0.0272	0.0081	-----
4.08	3.3026	1.4704	0.0294	0.0227	0.0067	-----
4.17	3.3320	1.4932	0.0294	0.0228	0.0066	-----
4.25	3.3614	1.5161	0.0294	0.0229	0.0065	-----
4.33	3.3908	1.5391	0.0294	0.0230	0.0064	-----
4.42	3.4202	1.5621	0.0294	0.0230	0.0064	-----
4.50	3.4496	1.5852	0.0294	0.0231	0.0063	-----
4.58	3.4777	1.6074	0.0281	0.0221	0.0060	-----
4.67	3.5058	1.6296	0.0281	0.0222	0.0059	-----
4.75	3.5339	1.6518	0.0281	0.0223	0.0058	-----
4.83	3.5620	1.6741	0.0281	0.0223	0.0058	-----
4.92	3.5901	1.6965	0.0281	0.0224	0.0057	-----
5.00	3.6182	1.7189	0.0281	0.0224	0.0057	-----
5.08	3.6423	1.7383	0.0242	0.0193	0.0048	-----
5.17	3.6665	1.7577	0.0242	0.0194	0.0048	-----
5.25	3.6907	1.7771	0.0242	0.0194	0.0047	-----
5.33	3.7149	1.7966	0.0242	0.0195	0.0047	-----
5.42	3.7390	1.8161	0.0242	0.0195	0.0047	-----
5.50	3.7632	1.8356	0.0242	0.0195	0.0046	-----
5.58	3.7893	1.8568	0.0261	0.0212	0.0050	-----
5.67	3.8155	1.8780	0.0261	0.0212	0.0049	-----
5.75	3.8416	1.8993	0.0261	0.0213	0.0049	-----
5.83	3.8677	1.9206	0.0261	0.0213	0.0048	-----
5.92	3.8939	1.9419	0.0261	0.0213	0.0048	-----
6.00	3.9200	1.9633	0.0261	0.0214	0.0047	-----

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Total soil rain loss = 1.96(In)
Total effective runoff = 1.96(In)

Peak flow rate this hydrograph = 2051.85(CFS)
Total runoff volume this hydrograph = 10262628.5(Ft3)

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6 - H O U R S T O R M
R u n o f f H y d r o g r a p h
+++++

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	525.0	1050.0	1575.0	2100.0
0+ 5	0.0000		0.00	Q				
0+10	0.0000		0.00	Q				
0+15	0.0000		0.00	Q				
0+20	0.0000		0.00	Q				
0+25	0.0000		0.00	Q				
0+30	0.0000		0.00	Q				
0+35	0.0000		0.00	Q				
0+40	0.0000		0.00	Q				
0+45	0.0000		0.00	Q				
0+50	0.0000		0.00	Q				
0+55	0.0000		0.00	Q				
1+ 0	0.0000		0.00	Q				
1+ 5	0.0000		0.00	Q				
1+10	0.0000		0.00	Q				
1+15	0.0000		0.00	Q				
1+20	0.0000		0.00	Q				
1+25	0.0000		0.00	Q				
1+30	0.0005		0.08	Q				
1+35	0.0057		0.75	Q				
1+40	0.0346		4.19	Q				
1+45	0.1399		15.29	Q				
1+50	0.3951		37.06	Q				
1+55	0.8498		66.01	VQ				
2+ 0	1.5271		98.35	VQ				
2+ 5	2.4754		137.70	V Q				
2+10	3.8985		206.63	V Q				
2+15	6.6378		397.75	V Q				
2+20	11.9454		770.66	V V	Q			
2+25	20.0033		1170.00	V V	Q	Q		
2+30	30.5344		1529.11	V V	Q	Q	Q	
2+35	43.1915		1837.81	V V	Q	Q	Q	Q
2+40	57.3227		2051.85	V V	Q	Q	Q	Q
2+45	71.0912		1999.19	V V	Q	Q	Q	Q
2+50	82.2847		1625.30	V V	Q	Q	Q	Q
2+55	91.3582		1317.47	V V	Q	Q	Q	Q
3+ 0	99.2290		1142.83	V V	Q	Q	Q	Q
3+ 5	106.3054		1027.50	VQ	Q	Q	Q	Q
3+10	112.8057		943.84	VQ	Q	Q	Q	Q
3+15	118.7781		867.19	VQ	Q	Q	Q	Q
3+20	124.2185		789.95	VQ	Q	Q	Q	Q
3+25	129.2907		736.48	VQ	Q	Q	Q	Q
3+30	134.1621		707.34	VQ	Q	Q	Q	Q
3+35	138.9518		695.47	VQ	Q	Q	Q	Q
3+40	143.6707		685.18	VQ	Q	Q	Q	Q
3+45	148.1617		652.09	VQ	Q	Q	Q	Q
3+50	152.2291		590.59	VQ	Q	Q	Q	Q

			west100Yr6Hr.out			
3+55	155.9725	543.55		Q		V
4+ 0	159.5298	516.51		Q		V
4+ 5	162.9707	499.62		Q		V
4+10	166.3228	486.73		Q		V
4+15	169.5530	469.02		Q		V
4+20	172.6104	443.94		Q		V
4+25	175.5412	425.55		Q		V
4+30	178.4010	415.25		Q		V
4+35	181.2223	409.65		Q		V
4+40	184.0188	406.05		Q		V
4+45	186.7860	401.80		Q		V
4+50	189.5149	396.23		Q		V
4+55	192.2175	392.42		Q		V
5+ 0	194.9078	390.62		Q		V
5+ 5	197.5922	389.78		Q		V
5+10	200.2650	388.09		Q		V
5+15	202.8876	380.80		Q		V
5+20	205.4129	366.67		Q		V
5+25	207.8639	355.89		Q		V
5+30	210.2729	349.78		Q		V
5+35	212.6575	346.24		Q		V
5+40	215.0326	344.87		Q		V
5+45	217.4250	347.37		Q		V
5+50	219.8639	354.13		Q		V
5+55	222.3417	359.77		Q		V
6+ 0	224.8449	363.47		Q		V
6+ 5	227.3539	364.30		Q		V
6+10	229.7964	354.66		Q		V
6+15	231.8927	304.39		Q		V
6+20	233.3101	205.80		Q		V
6+25	234.1985	129.00		Q		V
6+30	234.7724	83.32		Q		V
6+35	235.1400	53.38		Q		V
6+40	235.3676	33.04		Q		V
6+45	235.4981	18.95		Q		V
6+50	235.5649	9.70		Q		V
6+55	235.5922	3.96		Q		V
7+ 0	235.5975	0.78		Q		V

west100Yr24Hr.out

UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: west100yr24hr.out

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Program License Serial Number 4055

Tule wind Project
Unnamed Western Wash
Existing 100 Year 24 Hour
Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input values Used

Area averaged rainfall isohyetal data:
Sub-Area(Ac.) Rainfall (In)
1440.00 5.01

Rainfall Distribution pattern used in study:
Type B for San Diego area of California

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***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
1440.00	1.000	79.8	79.8	0.050	B

Area-averaged catchment SCS Curve Number AMC(2) = 79.840
Area-averaged Fm value using values listed = 0.050(In/Hr)

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Direct entry of lag time by user
Watershed area = 1440.00(Ac.)
Catchment Lag time = 0.310 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 26.8817
Hydrograph baseflow = 0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 79.840

Rainfall depth area reduction factors:
Using a total area of 1440.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study = 5.010(In)
Adjusted rainfall = 5.010(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS (Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Q_p vs. T/T_p values into an S-Graph based on $\text{lag} = T_p/0.9$. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/T_p step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

UNIT HYDROGRAPH

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
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(K = west100Yr24Hr.out
17424.00 (CFS))

0.27	0.083	0.020	94.729	0.005
0.54	0.167	0.119	555.238	0.037
0.81	0.250	0.521	2427.683	0.177
1.08	0.333	1.000	4660.364	0.444
1.34	0.417	0.777	3622.249	0.652
1.61	0.500	0.462	2154.448	0.776
1.88	0.583	0.302	1407.416	0.856
2.15	0.667	0.205	954.220	0.911
2.42	0.750	0.142	660.405	0.949
2.69	0.833	0.093	433.118	0.974
2.96	0.917	0.058	268.780	0.989
3.23	1.000	0.032	149.085	0.998
3.49	1.083	0.008	36.266	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

where:

Q = direct runoff, P = depth of precipitation, I_a = Initial Abstraction and S is the watershed storage in inches. S and I_a are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad I_a = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0075	0.0000	0.0075	0.0000	0.0075	-----
0.17	0.0150	0.0000	0.0075	0.0000	0.0075	-----
0.25	0.0225	0.0000	0.0075	0.0000	0.0075	-----
0.33	0.0301	0.0000	0.0075	0.0000	0.0075	-----
0.42	0.0376	0.0000	0.0075	0.0000	0.0075	-----
0.50	0.0451	0.0000	0.0075	0.0000	0.0075	-----
0.58	0.0509	0.0000	0.0058	0.0000	0.0058	-----
0.67	0.0568	0.0000	0.0058	0.0000	0.0058	-----
0.75	0.0626	0.0000	0.0058	0.0000	0.0058	-----

west100Yr24Hr.out					
0.83	0.0685	0.0000	0.0058	0.0000	0.0058
0.92	0.0743	0.0000	0.0058	0.0000	0.0058
1.00	0.0802	0.0000	0.0058	0.0000	0.0058
1.08	0.0877	0.0000	0.0075	0.0000	0.0075
1.17	0.0952	0.0000	0.0075	0.0000	0.0075
1.25	0.1027	0.0000	0.0075	0.0000	0.0075
1.33	0.1102	0.0000	0.0075	0.0000	0.0075
1.42	0.1177	0.0000	0.0075	0.0000	0.0075
1.50	0.1253	0.0000	0.0075	0.0000	0.0075
1.58	0.1328	0.0000	0.0075	0.0000	0.0075
1.67	0.1403	0.0000	0.0075	0.0000	0.0075
1.75	0.1478	0.0000	0.0075	0.0000	0.0075
1.83	0.1553	0.0000	0.0075	0.0000	0.0075
1.92	0.1628	0.0000	0.0075	0.0000	0.0075
2.00	0.1703	0.0000	0.0075	0.0000	0.0075
2.08	0.1795	0.0000	0.0092	0.0000	0.0092
2.17	0.1887	0.0000	0.0092	0.0000	0.0092
2.25	0.1979	0.0000	0.0092	0.0000	0.0092
2.33	0.2071	0.0000	0.0092	0.0000	0.0092
2.42	0.2163	0.0000	0.0092	0.0000	0.0092
2.50	0.2254	0.0000	0.0092	0.0000	0.0092
2.58	0.2330	0.0000	0.0075	0.0000	0.0075
2.67	0.2405	0.0000	0.0075	0.0000	0.0075
2.75	0.2480	0.0000	0.0075	0.0000	0.0075
2.83	0.2555	0.0000	0.0075	0.0000	0.0075
2.92	0.2630	0.0000	0.0075	0.0000	0.0075
3.00	0.2705	0.0000	0.0075	0.0000	0.0075
3.08	0.2797	0.0000	0.0092	0.0000	0.0092
3.17	0.2889	0.0000	0.0092	0.0000	0.0092
3.25	0.2981	0.0000	0.0092	0.0000	0.0092
3.33	0.3073	0.0000	0.0092	0.0000	0.0092
3.42	0.3165	0.0000	0.0092	0.0000	0.0092
3.50	0.3257	0.0000	0.0092	0.0000	0.0092
3.58	0.3357	0.0000	0.0100	0.0000	0.0100
3.67	0.3457	0.0000	0.0100	0.0000	0.0100
3.75	0.3557	0.0000	0.0100	0.0000	0.0100
3.83	0.3657	0.0000	0.0100	0.0000	0.0100
3.92	0.3757	0.0000	0.0100	0.0000	0.0100
4.00	0.3858	0.0000	0.0100	0.0000	0.0100
4.08	0.3966	0.0000	0.0109	0.0000	0.0109
4.17	0.4075	0.0000	0.0109	0.0000	0.0109
4.25	0.4183	0.0000	0.0109	0.0000	0.0109
4.33	0.4292	0.0000	0.0109	0.0000	0.0109
4.42	0.4400	0.0000	0.0109	0.0000	0.0109
4.50	0.4509	0.0000	0.0109	0.0000	0.0109
4.58	0.4626	0.0000	0.0117	0.0000	0.0117
4.67	0.4743	0.0000	0.0117	0.0000	0.0117
4.75	0.4860	0.0000	0.0117	0.0000	0.0117
4.83	0.4977	0.0000	0.0117	0.0000	0.0117
4.92	0.5093	0.0000	0.0117	0.0000	0.0117
5.00	0.5210	0.0001	0.0117	0.0001	0.0116
5.08	0.5344	0.0003	0.0134	0.0002	0.0131
5.17	0.5478	0.0007	0.0134	0.0004	0.0130
5.25	0.5611	0.0012	0.0134	0.0005	0.0129
5.33	0.5745	0.0019	0.0134	0.0006	0.0127
5.42	0.5878	0.0026	0.0134	0.0008	0.0126
5.50	0.6012	0.0035	0.0134	0.0009	0.0125
5.58	0.6154	0.0046	0.0142	0.0011	0.0131
5.67	0.6296	0.0059	0.0142	0.0012	0.0130
5.75	0.6438	0.0072	0.0142	0.0014	0.0128
5.83	0.6580	0.0087	0.0142	0.0015	0.0127
5.92	0.6722	0.0104	0.0142	0.0016	0.0126
6.00	0.6864	0.0122	0.0142	0.0018	0.0124

west100Yr24Hr.out					
6.08	0.7031	0.0144	0.0167	0.0023	0.0144 -----
6.17	0.7198	0.0168	0.0167	0.0024	0.0143 -----
6.25	0.7365	0.0194	0.0167	0.0026	0.0141 -----
6.33	0.7532	0.0222	0.0167	0.0028	0.0139 -----
6.42	0.7699	0.0251	0.0167	0.0029	0.0138 -----
6.50	0.7866	0.0282	0.0167	0.0031	0.0136 -----
6.58	0.8058	0.0320	0.0192	0.0038	0.0154 -----
6.67	0.8250	0.0360	0.0192	0.0040	0.0152 -----
6.75	0.8442	0.0402	0.0192	0.0042	0.0150 -----
6.83	0.8634	0.0445	0.0192	0.0044	0.0148 -----
6.92	0.8826	0.0491	0.0192	0.0046	0.0146 -----
7.00	0.9018	0.0539	0.0192	0.0048	0.0144 -----
7.08	0.9268	0.0604	0.0251	0.0065	0.0185 -----
7.17	0.9519	0.0672	0.0251	0.0068	0.0182 -----
7.25	0.9769	0.0743	0.0251	0.0071	0.0179 -----
7.33	1.0020	0.0817	0.0250	0.0074	0.0176 -----
7.42	1.0270	0.0894	0.0251	0.0077	0.0173 -----
7.50	1.0521	0.0974	0.0251	0.0080	0.0171 -----
7.58	1.0897	0.1099	0.0376	0.0125	0.0251 -----
7.67	1.1273	0.1230	0.0376	0.0131	0.0245 -----
7.75	1.1648	0.1367	0.0376	0.0137	0.0239 -----
7.83	1.2024	0.1509	0.0376	0.0142	0.0233 -----
7.92	1.2400	0.1657	0.0376	0.0148	0.0228 -----
8.00	1.2776	0.1810	0.0376	0.0153	0.0223 -----
8.08	1.3335	0.2047	0.0559	0.0237	0.0323 -----
8.17	1.3894	0.2294	0.0559	0.0247	0.0312 -----
8.25	1.4454	0.2552	0.0559	0.0258	0.0302 -----
8.33	1.5013	0.2819	0.0559	0.0267	0.0292 -----
8.42	1.5573	0.3095	0.0559	0.0276	0.0283 -----
8.50	1.6132	0.3380	0.0559	0.0285	0.0274 -----
8.58	1.6867	0.3767	0.0735	0.0387	0.0348 -----
8.67	1.7602	0.4168	0.0735	0.0400	0.0334 -----
8.75	1.8337	0.4581	0.0735	0.0413	0.0322 -----
8.83	1.9071	0.5006	0.0735	0.0425	0.0310 -----
8.92	1.9806	0.5443	0.0735	0.0437	0.0298 -----
9.00	2.0541	0.5890	0.0735	0.0447	0.0287 -----
9.08	2.1343	0.6390	0.0802	0.0500	0.0302 -----
9.17	2.2144	0.6901	0.0802	0.0511	0.0291 -----
9.25	2.2946	0.7423	0.0802	0.0522	0.0280 -----
9.33	2.3747	0.7955	0.0802	0.0532	0.0270 -----
9.42	2.4549	0.8496	0.0802	0.0542	0.0260 -----
9.50	2.5351	0.9047	0.0802	0.0551	0.0251 -----
9.58	2.6035	0.9525	0.0685	0.0477	0.0207 -----
9.67	2.6720	1.0008	0.0685	0.0483	0.0201 -----
9.75	2.7405	1.0497	0.0685	0.0489	0.0195 -----
9.83	2.8089	1.0992	0.0685	0.0495	0.0190 -----
9.92	2.8774	1.1492	0.0685	0.0500	0.0185 -----
10.00	2.9459	1.1997	0.0685	0.0505	0.0180 -----
10.08	2.9801	1.2252	0.0342	0.0254	0.0088 -----
10.17	3.0143	1.2508	0.0342	0.0256	0.0087 -----
10.25	3.0486	1.2764	0.0342	0.0257	0.0086 -----
10.33	3.0828	1.3022	0.0342	0.0258	0.0084 -----
10.42	3.1171	1.3281	0.0342	0.0259	0.0083 -----
10.50	3.1513	1.3542	0.0342	0.0260	0.0082 -----
10.58	3.1738	1.3714	0.0225	0.0172	0.0054 -----
10.67	3.1964	1.3886	0.0225	0.0172	0.0053 -----
10.75	3.2189	1.4059	0.0225	0.0173	0.0053 -----
10.83	3.2415	1.4232	0.0225	0.0173	0.0052 -----
10.92	3.2640	1.4406	0.0225	0.0174	0.0052 -----
11.00	3.2866	1.4580	0.0225	0.0174	0.0051 -----
11.08	3.3058	1.4729	0.0192	0.0149	0.0043 -----
11.17	3.3250	1.4878	0.0192	0.0149	0.0043 -----
11.25	3.3442	1.5027	0.0192	0.0149	0.0043 -----

west100Yr24Hr.out						
11.33	3.3634	1.5177	0.0192	0.0150	0.0042	-----
11.42	3.3826	1.5327	0.0192	0.0150	0.0042	-----
11.50	3.4018	1.5477	0.0192	0.0150	0.0042	-----
11.58	3.4193	1.5614	0.0175	0.0137	0.0038	-----
11.67	3.4369	1.5752	0.0175	0.0138	0.0038	-----
11.75	3.4544	1.5890	0.0175	0.0138	0.0037	-----
11.83	3.4719	1.6028	0.0175	0.0138	0.0037	-----
11.92	3.4895	1.6167	0.0175	0.0138	0.0037	-----
12.00	3.5070	1.6305	0.0175	0.0139	0.0037	-----
12.08	3.5237	1.6437	0.0167	0.0132	0.0035	-----
12.17	3.5404	1.6570	0.0167	0.0132	0.0035	-----
12.25	3.5571	1.6703	0.0167	0.0133	0.0034	-----
12.33	3.5738	1.6835	0.0167	0.0133	0.0034	-----
12.42	3.5905	1.6969	0.0167	0.0133	0.0034	-----
12.50	3.6072	1.7102	0.0167	0.0133	0.0034	-----
12.58	3.6231	1.7229	0.0159	0.0127	0.0032	-----
12.67	3.6389	1.7356	0.0159	0.0127	0.0032	-----
12.75	3.6548	1.7483	0.0159	0.0127	0.0031	-----
12.83	3.6707	1.7610	0.0159	0.0127	0.0031	-----
12.92	3.6865	1.7738	0.0159	0.0128	0.0031	-----
13.00	3.7024	1.7865	0.0159	0.0128	0.0031	-----
13.08	3.7166	1.7980	0.0142	0.0114	0.0028	-----
13.17	3.7308	1.8094	0.0142	0.0115	0.0027	-----
13.25	3.7450	1.8209	0.0142	0.0115	0.0027	-----
13.33	3.7592	1.8324	0.0142	0.0115	0.0027	-----
13.42	3.7734	1.8438	0.0142	0.0115	0.0027	-----
13.50	3.7876	1.8554	0.0142	0.0115	0.0027	-----
13.58	3.8009	1.8662	0.0134	0.0108	0.0025	-----
13.67	3.8143	1.8770	0.0134	0.0109	0.0025	-----
13.75	3.8276	1.8879	0.0134	0.0109	0.0025	-----
13.83	3.8410	1.8988	0.0134	0.0109	0.0025	-----
13.92	3.8544	1.9097	0.0134	0.0109	0.0025	-----
14.00	3.8677	1.9206	0.0134	0.0109	0.0025	-----
14.08	3.8828	1.9328	0.0150	0.0123	0.0028	-----
14.17	3.8978	1.9451	0.0150	0.0123	0.0027	-----
14.25	3.9128	1.9574	0.0150	0.0123	0.0027	-----
14.33	3.9278	1.9697	0.0150	0.0123	0.0027	-----
14.42	3.9429	1.9821	0.0150	0.0123	0.0027	-----
14.50	3.9579	1.9944	0.0150	0.0123	0.0027	-----
14.58	3.9663	2.0013	0.0084	0.0069	0.0015	-----
14.67	3.9746	2.0081	0.0083	0.0069	0.0015	-----
14.75	3.9830	2.0150	0.0084	0.0069	0.0015	-----
14.83	3.9913	2.0219	0.0084	0.0069	0.0015	-----
14.92	3.9996	2.0288	0.0083	0.0069	0.0015	-----
15.00	4.0080	2.0356	0.0084	0.0069	0.0015	-----
15.08	4.0214	2.0467	0.0134	0.0110	0.0023	-----
15.17	4.0347	2.0577	0.0134	0.0110	0.0023	-----
15.25	4.0481	2.0687	0.0134	0.0110	0.0023	-----
15.33	4.0614	2.0798	0.0134	0.0111	0.0023	-----
15.42	4.0748	2.0909	0.0134	0.0111	0.0023	-----
15.50	4.0882	2.1019	0.0134	0.0111	0.0023	-----
15.58	4.1007	2.1123	0.0125	0.0104	0.0021	-----
15.67	4.1132	2.1227	0.0125	0.0104	0.0021	-----
15.75	4.1257	2.1331	0.0125	0.0104	0.0021	-----
15.83	4.1383	2.1435	0.0125	0.0104	0.0021	-----
15.92	4.1508	2.1540	0.0125	0.0104	0.0021	-----
16.00	4.1633	2.1644	0.0125	0.0104	0.0021	-----
16.08	4.1750	2.1741	0.0117	0.0097	0.0019	-----
16.17	4.1867	2.1839	0.0117	0.0098	0.0019	-----
16.25	4.1984	2.1936	0.0117	0.0098	0.0019	-----
16.33	4.2101	2.2034	0.0117	0.0098	0.0019	-----
16.42	4.2218	2.2132	0.0117	0.0098	0.0019	-----
16.50	4.2334	2.2230	0.0117	0.0098	0.0019	-----

west100Yr24Hr.out						
16.58	4.2460	2.2334	0.0125	0.0105	0.0020	-----
16.67	4.2585	2.2439	0.0125	0.0105	0.0020	-----
16.75	4.2710	2.2544	0.0125	0.0105	0.0020	-----
16.83	4.2836	2.2650	0.0125	0.0105	0.0020	-----
16.92	4.2961	2.2755	0.0125	0.0105	0.0020	-----
17.00	4.3086	2.2860	0.0125	0.0105	0.0020	-----
17.08	4.3186	2.2944	0.0100	0.0084	0.0016	-----
17.17	4.3286	2.3029	0.0100	0.0084	0.0016	-----
17.25	4.3387	2.3113	0.0100	0.0084	0.0016	-----
17.33	4.3487	2.3197	0.0100	0.0084	0.0016	-----
17.42	4.3587	2.3282	0.0100	0.0084	0.0016	-----
17.50	4.3687	2.3366	0.0100	0.0085	0.0016	-----
17.58	4.3796	2.3458	0.0109	0.0092	0.0017	-----
17.67	4.3904	2.3550	0.0109	0.0092	0.0017	-----
17.75	4.4013	2.3641	0.0109	0.0092	0.0017	-----
17.83	4.4121	2.3733	0.0109	0.0092	0.0017	-----
17.92	4.4230	2.3825	0.0109	0.0092	0.0017	-----
18.00	4.4338	2.3917	0.0109	0.0092	0.0017	-----
18.08	4.4422	2.3988	0.0084	0.0071	0.0013	-----
18.17	4.4505	2.4059	0.0084	0.0071	0.0013	-----
18.25	4.4589	2.4129	0.0084	0.0071	0.0013	-----
18.33	4.4672	2.4200	0.0084	0.0071	0.0013	-----
18.42	4.4756	2.4271	0.0084	0.0071	0.0013	-----
18.50	4.4840	2.4342	0.0084	0.0071	0.0013	-----
18.58	4.4923	2.4413	0.0084	0.0071	0.0013	-----
18.67	4.5006	2.4484	0.0083	0.0071	0.0013	-----
18.75	4.5090	2.4555	0.0084	0.0071	0.0013	-----
18.83	4.5174	2.4626	0.0084	0.0071	0.0012	-----
18.92	4.5257	2.4697	0.0083	0.0071	0.0012	-----
19.00	4.5340	2.4768	0.0084	0.0071	0.0012	-----
19.08	4.5416	2.4832	0.0075	0.0064	0.0011	-----
19.17	4.5491	2.4896	0.0075	0.0064	0.0011	-----
19.25	4.5566	2.4960	0.0075	0.0064	0.0011	-----
19.33	4.5641	2.5024	0.0075	0.0064	0.0011	-----
19.42	4.5716	2.5088	0.0075	0.0064	0.0011	-----
19.50	4.5791	2.5152	0.0075	0.0064	0.0011	-----
19.58	4.5875	2.5224	0.0084	0.0071	0.0012	-----
19.67	4.5958	2.5295	0.0084	0.0071	0.0012	-----
19.75	4.6042	2.5366	0.0084	0.0071	0.0012	-----
19.83	4.6125	2.5438	0.0084	0.0071	0.0012	-----
19.92	4.6209	2.5509	0.0084	0.0071	0.0012	-----
20.00	4.6292	2.5581	0.0084	0.0071	0.0012	-----
20.08	4.6384	2.5659	0.0092	0.0079	0.0013	-----
20.17	4.6476	2.5738	0.0092	0.0079	0.0013	-----
20.25	4.6568	2.5817	0.0092	0.0079	0.0013	-----
20.33	4.6660	2.5895	0.0092	0.0079	0.0013	-----
20.42	4.6752	2.5974	0.0092	0.0079	0.0013	-----
20.50	4.6844	2.6053	0.0092	0.0079	0.0013	-----
20.58	4.6927	2.6125	0.0084	0.0072	0.0012	-----
20.67	4.7010	2.6196	0.0083	0.0072	0.0012	-----
20.75	4.7094	2.6268	0.0084	0.0072	0.0012	-----
20.83	4.7177	2.6340	0.0084	0.0072	0.0012	-----
20.92	4.7261	2.6412	0.0084	0.0072	0.0012	-----
21.00	4.7344	2.6483	0.0084	0.0072	0.0012	-----
21.08	4.7420	2.6548	0.0075	0.0065	0.0010	-----
21.17	4.7495	2.6613	0.0075	0.0065	0.0010	-----
21.25	4.7570	2.6677	0.0075	0.0065	0.0010	-----
21.33	4.7645	2.6742	0.0075	0.0065	0.0010	-----
21.42	4.7720	2.6807	0.0075	0.0065	0.0010	-----
21.50	4.7795	2.6872	0.0075	0.0065	0.0010	-----
21.58	4.7871	2.6936	0.0075	0.0065	0.0010	-----
21.67	4.7946	2.7001	0.0075	0.0065	0.0010	-----
21.75	4.8021	2.7066	0.0075	0.0065	0.0010	-----

west100Yr24Hr.out

21.83	4.8096	2.7131	0.0075	0.0065	0.0010	-----
21.92	4.8171	2.7196	0.0075	0.0065	0.0010	-----
22.00	4.8246	2.7261	0.0075	0.0065	0.0010	-----
22.08	4.8321	2.7326	0.0075	0.0065	0.0010	-----
22.17	4.8397	2.7391	0.0075	0.0065	0.0010	-----
22.25	4.8472	2.7456	0.0075	0.0065	0.0010	-----
22.33	4.8547	2.7521	0.0075	0.0065	0.0010	-----
22.42	4.8622	2.7586	0.0075	0.0065	0.0010	-----
22.50	4.8697	2.7651	0.0075	0.0065	0.0010	-----
22.58	4.8772	2.7716	0.0075	0.0065	0.0010	-----
22.67	4.8847	2.7781	0.0075	0.0065	0.0010	-----
22.75	4.8923	2.7846	0.0075	0.0065	0.0010	-----
22.83	4.8998	2.7911	0.0075	0.0065	0.0010	-----
22.92	4.9073	2.7976	0.0075	0.0065	0.0010	-----
23.00	4.9148	2.8041	0.0075	0.0065	0.0010	-----
23.08	4.9232	2.8114	0.0084	0.0072	0.0011	-----
23.17	4.9315	2.8186	0.0083	0.0072	0.0011	-----
23.25	4.9399	2.8259	0.0084	0.0072	0.0011	-----
23.33	4.9482	2.8331	0.0084	0.0073	0.0011	-----
23.42	4.9566	2.8404	0.0084	0.0073	0.0011	-----
23.50	4.9649	2.8477	0.0084	0.0073	0.0011	-----
23.58	4.9724	2.8542	0.0075	0.0065	0.0010	-----
23.67	4.9799	2.8607	0.0075	0.0065	0.0010	-----
23.75	4.9875	2.8673	0.0075	0.0065	0.0010	-----
23.83	4.9950	2.8738	0.0075	0.0065	0.0010	-----
23.92	5.0025	2.8803	0.0075	0.0065	0.0010	-----
24.00	5.0100	2.8869	0.0075	0.0065	0.0010	-----

Total soil rain loss = 2.12(In)
Total effective runoff = 2.89(In)

Peak flow rate this hydrograph = 909.54(CFS)
Total runoff volume this hydrograph = 15090338.2(Ft3)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	250.0	500.0	750.0	1000.0
0+ 5	0.0000	0.00	Q					
0+10	0.0000	0.00	Q					
0+15	0.0000	0.00	Q					
0+20	0.0000	0.00	Q					
0+25	0.0000	0.00	Q					
0+30	0.0000	0.00	Q					
0+35	0.0000	0.00	Q					
0+40	0.0000	0.00	Q					
0+45	0.0000	0.00	Q					
0+50	0.0000	0.00	Q					
0+55	0.0000	0.00	Q					
1+ 0	0.0000	0.00	Q					
1+ 5	0.0000	0.00	Q					
1+10	0.0000	0.00	Q					
1+15	0.0000	0.00	Q					
1+20	0.0000	0.00	Q					
1+25	0.0000	0.00	Q					
1+30	0.0000	0.00	Q					
1+35	0.0000	0.00	Q					

west100Yr24Hr.out							
1+40	0.0000	0.00	Q				
1+45	0.0000	0.00	Q				
1+50	0.0000	0.00	Q				
1+55	0.0000	0.00	Q				
2+ 0	0.0000	0.00	Q				
2+ 5	0.0000	0.00	Q				
2+10	0.0000	0.00	Q				
2+15	0.0000	0.00	Q				
2+20	0.0000	0.00	Q				
2+25	0.0000	0.00	Q				
2+30	0.0000	0.00	Q				
2+35	0.0000	0.00	Q				
2+40	0.0000	0.00	Q				
2+45	0.0000	0.00	Q				
2+50	0.0000	0.00	Q				
2+55	0.0000	0.00	Q				
3+ 0	0.0000	0.00	Q				
3+ 5	0.0000	0.00	Q				
3+10	0.0000	0.00	Q				
3+15	0.0000	0.00	Q				
3+20	0.0000	0.00	Q				
3+25	0.0000	0.00	Q				
3+30	0.0000	0.00	Q				
3+35	0.0000	0.00	Q				
3+40	0.0000	0.00	Q				
3+45	0.0000	0.00	Q				
3+50	0.0000	0.00	Q				
3+55	0.0000	0.00	Q				
4+ 0	0.0000	0.00	Q				
4+ 5	0.0000	0.00	Q				
4+10	0.0000	0.00	Q				
4+15	0.0000	0.00	Q				
4+20	0.0000	0.00	Q				
4+25	0.0000	0.00	Q				
4+30	0.0000	0.00	Q				
4+35	0.0000	0.00	Q				
4+40	0.0000	0.00	Q				
4+45	0.0000	0.00	Q				
4+50	0.0000	0.00	Q				
4+55	0.0000	0.00	Q				
5+ 0	0.0001	0.01	Q				
5+ 5	0.0007	0.09	Q				
5+10	0.0037	0.43	Q				
5+15	0.0126	1.29	Q				
5+20	0.0313	2.71	Q				
5+25	0.0621	4.47	Q				
5+30	0.1064	6.44	Q				
5+35	0.1652	8.53	Q				
5+40	0.2391	10.73	Q				
5+45	0.3293	13.10	Q				
5+50	0.4373	15.68	Q				
5+55	0.5629	18.24	Q				
6+ 0	0.7058	20.74	Q				
6+ 5	0.8657	23.23	Q				
6+10	1.0436	25.83	VQ				
6+15	1.2438	29.07	VQ				
6+20	1.4722	33.16	VQ				
6+25	1.7275	37.08	VQ				
6+30	2.0071	40.61	VQ				
6+35	2.3100	43.97	VQ				
6+40	2.6367	47.44	VQ				
6+45	2.9932	51.76	V Q				
6+50	3.3874	57.23	V Q				

			west100Yr24Hr.out			
6+55	3.8166	62.33	V	Q		
7+ 0	4.2765	66.78	V	Q		
7+ 5	4.7656	71.01	V	Q		
7+10	5.2872	75.74	V	Q		
7+15	5.8606	83.26	V	Q		
7+20	6.5107	94.39	V	Q		
7+25	7.2296	104.38	V	Q		
7+30	8.0038	112.41	V	Q		
7+35	8.8290	119.82	V	Q		
7+40	9.7143	128.55	V	Q		
7+45	10.7124	144.94	V	Q		
7+50	11.8914	171.18	V	Q		
7+55	13.2289	194.21	V	Q		
8+ 0	14.6879	211.84	V	Q		
8+ 5	16.2536	227.34	V	Q		
8+10	17.9391	244.73	V	Q		
8+15	19.8399	276.00	V	Q		
8+20	22.0797	325.22	V	Q		
8+25	24.6139	367.96	V	Q		
8+30	27.3702	400.21	V	Q		
8+35	30.3151	427.61	V	Q		
8+40	33.4539	455.75	V	Q		
8+45	36.8924	499.26	V	Q		
8+50	40.7689	562.88	V	Q		
8+55	45.0219	617.53	V	Q		
9+ 0	49.5585	658.71	V	Q		
9+ 5	54.3286	692.63	V	Q		
9+10	59.3128	723.70	V	Q		
9+15	64.5434	759.47	V	Q		
9+20	70.0687	802.27	V	Q		
9+25	75.8483	839.21	V	Q		
9+30	81.8304	868.60	V	Q		
9+35	87.9768	892.46	V	Q		
9+40	94.2409	909.54	V	Q		
9+45	100.5020	909.12	V	Q		
9+50	106.6185	888.11	V	Q		
9+55	112.6323	873.21	V	Q		
10+ 0	118.6132	868.44	V	Q		
10+ 5	124.5766	865.88	V	Q		
10+10	130.4600	854.27	V	Q		
10+15	135.9446	796.36	V	Q		
10+20	140.6403	681.83	V	Q		
10+25	144.7252	593.13	V	Q		
10+30	148.4537	541.37	V	Q		
10+35	151.9513	507.85	V	Q		
10+40	155.2673	481.48	V	Q		
10+45	158.3351	445.44	V	Q		
10+50	161.0542	394.82	V	Q		
10+55	163.5143	357.20	V	Q		
11+ 0	165.8243	335.41	V	Q		
11+ 5	168.0469	322.72	V	Q		
11+10	170.2074	313.71	V	Q		
11+15	172.2899	302.39	V	Q		
11+20	174.2682	287.24	V	Q		
11+25	176.1700	276.15	V	Q		
11+30	178.0286	269.87	V	Q		
11+35	179.8631	266.37	V	Q		
11+40	181.6794	263.73	V	Q		
11+45	183.4658	259.38	V	Q		
11+50	185.2060	252.67	V	Q		
11+55	186.9120	247.71	V	Q		
12+ 0	188.5990	244.96	V	Q		
12+ 5	190.2754	243.40	V	Q		

			west100Yr24Hr.out			
12+10	191.9435	242.21		Q		V
12+15	193.5975	240.16		Q		V
12+20	195.2292	236.92		Q		V
12+25	196.8446	234.56		Q		V
12+30	198.4515	233.32		Q		V
12+35	200.0537	232.65		Q		V
12+40	201.6516	232.01		Q		V
12+45	203.2377	230.31		Q		V
12+50	204.8028	227.25		Q		V
12+55	206.3523	224.99		Q		V
13+ 0	207.8935	223.78		Q		V
13+ 5	209.4293	223.00		Q		V
13+10	210.9578	221.93		Q		V
13+15	212.4628	218.53		Q		V
13+20	213.9246	212.25		Q		V
13+25	215.3535	207.47		Q		V
13+30	216.7634	204.73		Q		V
13+35	218.1615	203.00		Q		V
13+40	219.5497	201.58		Q		V
13+45	220.9222	199.28		Q		V
13+50	222.2704	195.77		Q		V
13+55	223.6008	193.17		Q		V
14+ 0	224.9211	191.72		Q		V
14+ 5	226.2369	191.05		Q		V
14+10	227.5548	191.36		Q		V
14+15	228.8939	194.43		Q		V
14+20	230.2761	200.70		Q		V
14+25	231.6926	205.68		Q		V
14+30	233.1302	208.74		Q		V
14+35	234.5789	210.35		Q		V
14+40	236.0171	208.83		Q		V
14+45	237.3713	196.63		Q		V
14+50	238.5547	171.83		Q		V
14+55	239.6047	152.46		Q		V
15+ 0	240.5755	140.96		Q		V
15+ 5	241.4968	133.78		Q		V
15+10	242.3985	130.93		Q		V
15+15	243.3450	137.43		Q		V
15+20	244.4084	154.41		Q		V
15+25	245.5656	168.03		Q		V
15+30	246.7796	176.26		Q		V
15+35	248.0328	181.97		Q		V
15+40	249.3117	185.69		Q		V
15+45	250.5990	186.91		Q		V
15+50	251.8774	185.63		Q		V
15+55	253.1474	184.40		Q		V
16+ 0	254.4124	183.68		Q		V
16+ 5	255.6724	182.94		Q		V
16+10	256.9261	182.05		Q		V
16+15	258.1662	180.05		Q		V
16+20	259.3828	176.65		Q		V
16+25	260.5817	174.09		Q		V
16+30	261.7706	172.62		Q		V
16+35	262.9538	171.81		Q		V
16+40	264.1361	171.66		Q		V
16+45	265.3277	173.03		Q		V
16+50	266.5407	176.12		Q		V
16+55	267.7707	178.60		Q		V
17+ 0	269.0113	180.13		Q		V
17+ 5	270.2580	181.03		Q		V
17+10	271.5023	180.66		Q		V
17+15	272.7154	176.15		Q		V
17+20	273.8638	166.76		Q		V

			west100Yr24Hr.out			
17+25	274.9618	159.42	Q		V	
17+30	276.0299	155.09	Q		V	
17+35	277.0790	152.32	Q		V	
17+40	278.1175	150.79	Q		V	
17+45	279.1588	151.20	Q		V	
17+50	280.2171	153.67	Q		V	
17+55	281.2897	155.75	Q		V	
18+ 0	282.3713	157.05	Q		V	
18+ 5	283.4585	157.86	Q		V	
18+10	284.5429	157.45	Q		V	
18+15	285.5956	152.86	Q		V	
18+20	286.5829	143.36	Q		V	
18+25	287.5191	135.94	Q		V	
18+30	288.4251	131.54	Q		V	
18+35	289.3111	128.65	Q		V	
18+40	290.1836	126.68	Q		V	
18+45	291.0468	125.34	Q		V	
18+50	291.9041	124.48	Q		V	
18+55	292.7579	123.97	Q		V	
19+ 0	293.6099	123.71	Q		V	
19+ 5	294.4613	123.62	Q		V	
19+10	295.3103	123.28	Q		V	
19+15	296.1479	121.61	Q		V	
19+20	296.9629	118.35	Q		V	
19+25	297.7606	115.82	Q		V	
19+30	298.5481	114.34	Q		V	
19+35	299.3294	113.45	Q		V	
19+40	300.1091	113.21	Q		V	
19+45	300.8978	114.52	Q		V	
19+50	301.7076	117.58	Q		V	
19+55	302.5342	120.02	Q		V	
20+ 0	303.3710	121.50	Q		V	
20+ 5	304.2153	122.60	Q		V	
20+10	305.0674	123.73	Q		V	
20+15	305.9351	125.99	Q		V	
20+20	306.8282	129.68	Q		V	
20+25	307.7409	132.52	Q		V	
20+30	308.6653	134.23	Q		V	
20+35	309.5968	135.25	Q		V	
20+40	310.5307	135.60	Q		V	
20+45	311.4562	134.39	Q		V	
20+50	312.3613	131.42	Q		V	
20+55	313.2502	129.07	Q		V	
21+ 0	314.1296	127.69	Q		V	
21+ 5	315.0021	126.69	Q		V	
21+10	315.8676	125.66	Q		V	
21+15	316.7181	123.49	Q		V	
21+20	317.5437	119.88	Q		V	
21+25	318.3504	117.13	Q		V	
21+30	319.1460	115.52	Q		V	
21+35	319.9348	114.53	Q		V	
21+40	320.7191	113.88	Q		V	
21+45	321.5005	113.45	Q		V	
21+50	322.2799	113.18	Q		V	
21+55	323.0584	113.03	Q		V	
22+ 0	323.8363	112.96	Q		V	
22+ 5	324.6144	112.97	Q		V	
22+10	325.3927	113.01	Q		V	
22+15	326.1713	113.05	Q		V	
22+20	326.9502	113.09	Q		V	
22+25	327.7293	113.13	Q		V	
22+30	328.5088	113.17	Q		V	
22+35	329.2884	113.21	Q		V	

			west100Yr24Hr.out				
22+40	330.0684	113.25	Q				V
22+45	330.8486	113.29	Q				V
22+50	331.6291	113.33	Q				V
22+55	332.4098	113.36	Q				V
23+ 0	333.1908	113.40	Q				V
23+ 5	333.9726	113.51	Q				V
23+10	334.7573	113.95	Q				V
23+15	335.5545	115.75	Q				V
23+20	336.3752	119.16	Q				V
23+25	337.2142	121.83	Q				V
23+30	338.0643	123.43	Q				V
23+35	338.9212	124.43	Q				V
23+40	339.7805	124.76	Q				V
23+45	340.6312	123.52	Q				V
23+50	341.4610	120.49	Q				V
23+55	342.2744	118.10	Q				V
24+ 0	343.0780	116.68	Q				V
24+ 5	343.8707	115.11	Q				V
24+10	344.6339	110.82	Q				V
24+15	345.2846	94.48	Q				V
24+20	345.7232	63.69	Q				V
24+25	345.9973	39.80	Q				V
24+30	346.1736	25.60	Q				V
24+35	346.2863	16.37	Q				V
24+40	346.3561	10.13	Q				V
24+45	346.3960	5.81	Q				V
24+50	346.4165	2.97	Q				V
24+55	346.4249	1.21	Q				V
25+ 0	346.4265	0.24	Q				V

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UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: simmons100yr6hr.out

+++++

Program License Serial Number 4055

Tule wind Project
Simmons Canyon
Existing 100 Year 6 Hour
Aug 25, 2010

+++++

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
878.00	4.12

Rainfall Distribution pattern used in study:
Type B for SCS (small dam) or San Diego 6 hour storms

+++++

***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
878.00	1.000	88.8	88.8	0.050	B

Area-averaged catchment SCS Curve Number AMC(2) = 88.780
Area-averaged Fm value using values listed = 0.050(In/Hr)

+++++

Direct entry of lag time by user
Watershed area = 878.00(Ac.)
Catchment Lag time = 0.340 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 24.5098
Hydrograph baseflow = 0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 88.780

Rainfall depth area reduction factors:
Using a total area of 878.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study = 4.120(In)
Adjusted rainfall = 4.120(In)

+++++

The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
+++++	+++++	+++++	+++++	+++++

(K = Simmons100Yr6Hr.out
10623.80 (CFS))

0.25	0.083	0.020	49.323	0.005
0.49	0.167	0.110	269.643	0.030
0.74	0.250	0.429	1050.076	0.129
0.98	0.333	1.000	2450.464	0.360
1.23	0.417	0.973	2384.552	0.584
1.47	0.500	0.601	1473.325	0.723
1.72	0.583	0.397	973.956	0.814
1.96	0.667	0.273	669.261	0.877
2.21	0.750	0.195	476.759	0.922
2.45	0.833	0.138	337.031	0.954
2.70	0.917	0.093	228.604	0.975
2.94	1.000	0.060	146.385	0.989
3.19	1.083	0.035	86.922	0.997
3.43	1.167	0.011	27.498	1.000

+++++
For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

Where:

Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad I_a = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of $\Delta P(dP) - \Delta Q(dQ)$ then the $dP-dQ$ column equals $f_m = 0.000(\text{In})$ (for time interval = $0.000(\text{In})$) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0240	0.0000	0.0240	0.0000	0.0240	-----
0.17	0.0481	0.0000	0.0240	0.0000	0.0240	-----
0.25	0.0721	0.0000	0.0240	0.0000	0.0240	-----
0.33	0.0961	0.0000	0.0240	0.0000	0.0240	-----
0.42	0.1202	0.0000	0.0240	0.0000	0.0240	-----
0.50	0.1442	0.0000	0.0240	0.0000	0.0240	-----
0.58	0.1765	0.0000	0.0323	0.0000	0.0323	-----
0.67	0.2087	0.0000	0.0323	0.0000	0.0323	-----

Simmons100Yr6Hr.out

0.75	0.2410	0.0000	0.0323	0.0000	0.0323	-----
0.83	0.2733	0.0003	0.0323	0.0003	0.0319	-----
0.92	0.3056	0.0021	0.0323	0.0018	0.0305	-----
1.00	0.3378	0.0054	0.0323	0.0032	0.0290	-----
1.08	0.3777	0.0112	0.0398	0.0059	0.0340	-----
1.17	0.4175	0.0190	0.0398	0.0078	0.0321	-----
1.25	0.4573	0.0285	0.0398	0.0095	0.0303	-----
1.33	0.4971	0.0396	0.0398	0.0111	0.0287	-----
1.42	0.5370	0.0522	0.0398	0.0126	0.0272	-----
1.50	0.5768	0.0661	0.0398	0.0139	0.0259	-----
1.58	0.6386	0.0902	0.0618	0.0241	0.0377	-----
1.67	0.7004	0.1171	0.0618	0.0268	0.0350	-----
1.75	0.7622	0.1464	0.0618	0.0293	0.0325	-----
1.83	0.8240	0.1778	0.0618	0.0315	0.0303	-----
1.92	0.8858	0.2113	0.0618	0.0334	0.0284	-----
2.00	0.9476	0.2465	0.0618	0.0352	0.0266	-----
2.08	1.2017	0.4069	0.2541	0.1604	0.0936	-----
2.17	1.4557	0.5867	0.2541	0.1797	0.0743	-----
2.25	1.7098	0.7803	0.2541	0.1936	0.0605	-----
2.33	1.9639	0.9842	0.2541	0.2039	0.0501	-----
2.42	2.2179	1.1960	0.2541	0.2118	0.0422	-----
2.50	2.4720	1.4140	0.2541	0.2180	0.0361	-----
2.58	2.5407	1.4738	0.0687	0.0598	0.0089	-----
2.67	2.6093	1.5339	0.0687	0.0601	0.0085	-----
2.75	2.6780	1.5944	0.0687	0.0605	0.0082	-----
2.83	2.7467	1.6552	0.0687	0.0608	0.0079	-----
2.92	2.8153	1.7162	0.0687	0.0610	0.0076	-----
3.00	2.8840	1.7775	0.0687	0.0613	0.0074	-----
3.08	2.9396	1.8273	0.0556	0.0498	0.0058	-----
3.17	2.9952	1.8774	0.0556	0.0500	0.0056	-----
3.25	3.0509	1.9275	0.0556	0.0502	0.0055	-----
3.33	3.1065	1.9778	0.0556	0.0503	0.0053	-----
3.42	3.1621	2.0283	0.0556	0.0505	0.0052	-----
3.50	3.2177	2.0789	0.0556	0.0506	0.0050	-----
3.58	3.2548	2.1127	0.0371	0.0338	0.0033	-----
3.67	3.2919	2.1465	0.0371	0.0339	0.0032	-----
3.75	3.3290	2.1804	0.0371	0.0339	0.0032	-----
3.83	3.3660	2.2144	0.0371	0.0340	0.0031	-----
3.92	3.4031	2.2484	0.0371	0.0340	0.0031	-----
4.00	3.4402	2.2825	0.0371	0.0341	0.0030	-----
4.08	3.4711	2.3109	0.0309	0.0284	0.0025	-----
4.17	3.5020	2.3393	0.0309	0.0285	0.0024	-----
4.25	3.5329	2.3678	0.0309	0.0285	0.0024	-----
4.33	3.5638	2.3964	0.0309	0.0285	0.0024	-----
4.42	3.5947	2.4249	0.0309	0.0286	0.0023	-----
4.50	3.6256	2.4535	0.0309	0.0286	0.0023	-----
4.58	3.6551	2.4809	0.0295	0.0273	0.0022	-----
4.67	3.6847	2.5082	0.0295	0.0274	0.0022	-----
4.75	3.7142	2.5356	0.0295	0.0274	0.0021	-----
4.83	3.7437	2.5631	0.0295	0.0274	0.0021	-----
4.92	3.7732	2.5905	0.0295	0.0275	0.0021	-----
5.00	3.8028	2.6180	0.0295	0.0275	0.0020	-----
5.08	3.8282	2.6417	0.0254	0.0237	0.0017	-----
5.17	3.8536	2.6653	0.0254	0.0237	0.0017	-----
5.25	3.8790	2.6890	0.0254	0.0237	0.0017	-----
5.33	3.9044	2.7128	0.0254	0.0237	0.0017	-----
5.42	3.9298	2.7365	0.0254	0.0237	0.0017	-----
5.50	3.9552	2.7603	0.0254	0.0238	0.0017	-----
5.58	3.9827	2.7859	0.0275	0.0257	0.0018	-----
5.67	4.0101	2.8117	0.0275	0.0257	0.0017	-----
5.75	4.0376	2.8374	0.0275	0.0257	0.0017	-----
5.83	4.0651	2.8632	0.0275	0.0258	0.0017	-----
5.92	4.0925	2.8889	0.0275	0.0258	0.0017	-----

Simmons100Yr6Hr.out
 6.00 4.1200 2.9147 0.0275 0.0258 0.0017 -----

Total soil rain loss = 1.21(In)
 Total effective runoff = 2.91(In)

Peak flow rate this hydrograph = 1863.55(CFS)
 Total runoff volume this hydrograph = 9289625.3(Ft3)

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 6 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	475.0	950.0	1425.0	1900.0
0+ 5	0.0000	0.00	Q					
0+10	0.0000	0.00	Q					
0+15	0.0000	0.00	Q					
0+20	0.0000	0.00	Q					
0+25	0.0000	0.00	Q					
0+30	0.0000	0.00	Q					
0+35	0.0000	0.00	Q					
0+40	0.0000	0.00	Q					
0+45	0.0000	0.00	Q					
0+50	0.0001	0.02	Q					
0+55	0.0013	0.18	Q					
1+ 0	0.0081	0.99	Q					
1+ 5	0.0346	3.85	Q					
1+10	0.1073	10.54	Q					
1+15	0.2549	21.44	Q					
1+20	0.5052	36.34	Q					
1+25	0.8726	53.35	VQ					
1+30	1.3595	70.69	VQ					
1+35	1.9677	88.31	VQ					
1+40	2.7080	107.49	V Q					
1+45	3.6263	133.34	V Q					
1+50	4.8137	172.40	V Q					
1+55	6.2841	213.51	V Q					
2+ 0	7.9957	248.53	V Q					
2+ 5	9.9617	285.46	V Q					
2+10	12.3527	347.17	V Q					
2+15	15.8453	507.13	V Q					
2+20	21.7325	854.83	V Q					
2+25	30.1981	1229.20	V Q					
2+30	40.6262	1514.16	V Q					
2+35	52.5396	1729.83	V Q					
2+40	65.3739	1863.55	V Q					
2+45	78.0080	1834.46	V Q					
2+50	88.6506	1545.31	V Q					
2+55	97.1580	1235.27	V Q					
3+ 0	104.3758	1048.03	V Q					
3+ 5	110.7399	924.06	V Q					
3+10	116.4748	832.71	V Q					
3+15	121.6728	754.75	V Q					
3+20	126.3501	679.14	V Q					
3+25	130.6149	619.26	V Q					
3+30	134.6212	581.71	V Q					
3+35	138.4629	557.82	V Q					
3+40	142.2017	542.87	V Q					
3+45	145.7911	521.18	V Q					

			Simmons100Yr6Hr.out					
3+50	149.0779	477.24			Q	V		
3+55	152.0768	435.44			Q	V		
4+ 0	154.8990	409.79			Q	V		
4+ 5	157.6046	392.85			Q	V		
4+10	160.2245	380.41			Q	V		
4+15	162.7522	367.03			Q	V		
4+20	165.1488	347.98			Q	V		
4+25	167.4289	331.07		Q		V		
4+30	169.6373	320.67		Q		V		
4+35	171.7999	314.01		Q		V		
4+40	173.9334	309.77		Q		V		
4+45	176.0414	306.09		Q		V		
4+50	178.1172	301.40		Q		V		
4+55	180.1653	297.39		Q		V		
5+ 0	182.1969	294.99		Q		V		
5+ 5	184.2174	293.37		Q		V		
5+10	186.2258	291.62		Q		V		
5+15	188.2042	287.26		Q		V		
5+20	190.1166	277.69		Q		V		
5+25	191.9658	268.49		Q		V		
5+30	193.7762	262.87		Q		V		
5+35	195.5622	259.33		Q		V		
5+40	197.3353	257.45		Q		V		
5+45	199.1111	257.84		Q		V		
5+50	200.9118	261.46		Q		V		
5+55	202.7395	265.38		Q		V		
6+ 0	204.5842	267.85		Q		V		
6+ 5	206.4321	268.32		Q		V		
6+10	208.2416	262.74		Q		V		
6+15	209.8721	236.75		Q		V		
6+20	211.0727	174.32		Q		V		
6+25	211.8533	113.34		Q		V		
6+30	212.3745	75.68		Q		V		
6+35	212.7241	50.76		Q		V		
6+40	212.9554	33.58		Q		V		
6+45	213.1021	21.30		Q		V		
6+50	213.1889	12.62		Q		V		
6+55	213.2352	6.72		Q		V		
7+ 0	213.2556	2.95		Q		V		
7+ 5	213.2605	0.71		Q		V		

Simmons100Yr24Hr.out

UNIT HYDROGRAPH ANALYSIS

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Study date 08/30/10 File: simmons100yr24hr.out

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Program License Serial Number 4055

Tule wind Project
Simmons Canyon
Existing 100 Year 24 Hour
Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
Sub-Area(Ac.) Rainfall (In)
878.00 8.00

Rainfall Distribution pattern used in study:
Type B for San Diego area of California

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***** Area-Averaged SCS Curve Number and Fm *****

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
878.00	1.000	88.8	88.8	0.050	B

Area-averaged catchment SCS Curve Number AMC(2) = 88.780
Area-averaged Fm value using values listed = 0.050(In/Hr)

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Direct entry of lag time by user
Watershed area = 878.00(Ac.)
Catchment Lag time = 0.340 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 24.5098
Hydrograph baseflow = 0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 88.780

Rainfall depth area reduction factors:
Using a total area of 878.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study = 8.000(In)
Adjusted rainfall = 8.000(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabriel River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. office, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph is interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)
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(K = Simmons100Yr24Hr.out
10623.80 (CFS))

0.25	0.083	0.020	49.323	0.005
0.49	0.167	0.110	269.643	0.030
0.74	0.250	0.429	1050.076	0.129
0.98	0.333	1.000	2450.464	0.360
1.23	0.417	0.973	2384.552	0.584
1.47	0.500	0.601	1473.325	0.723
1.72	0.583	0.397	973.956	0.814
1.96	0.667	0.273	669.261	0.877
2.21	0.750	0.195	476.759	0.922
2.45	0.833	0.138	337.031	0.954
2.70	0.917	0.093	228.604	0.975
2.94	1.000	0.060	146.385	0.989
3.19	1.083	0.035	86.922	0.997
3.43	1.167	0.011	27.498	1.000

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For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

Where:

Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad I_a = 0.2 S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of $\Delta P(dP) - \Delta Q(dQ)$ then the $dP-dQ$ column equals $f_m = 0.000(\text{In})$ (for time interval = $0.000(\text{In})$) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0120	0.0000	0.0120	0.0000	0.0120	-----
0.17	0.0240	0.0000	0.0120	0.0000	0.0120	-----
0.25	0.0360	0.0000	0.0120	0.0000	0.0120	-----
0.33	0.0480	0.0000	0.0120	0.0000	0.0120	-----
0.42	0.0600	0.0000	0.0120	0.0000	0.0120	-----
0.50	0.0720	0.0000	0.0120	0.0000	0.0120	-----
0.58	0.0813	0.0000	0.0093	0.0000	0.0093	-----
0.67	0.0907	0.0000	0.0093	0.0000	0.0093	-----

Simmons100Yr24Hr.out

0.75	0.1000	0.0000	0.0093	0.0000	0.0093	-----
0.83	0.1093	0.0000	0.0093	0.0000	0.0093	-----
0.92	0.1187	0.0000	0.0093	0.0000	0.0093	-----
1.00	0.1280	0.0000	0.0093	0.0000	0.0093	-----
1.08	0.1400	0.0000	0.0120	0.0000	0.0120	-----
1.17	0.1520	0.0000	0.0120	0.0000	0.0120	-----
1.25	0.1640	0.0000	0.0120	0.0000	0.0120	-----
1.33	0.1760	0.0000	0.0120	0.0000	0.0120	-----
1.42	0.1880	0.0000	0.0120	0.0000	0.0120	-----
1.50	0.2000	0.0000	0.0120	0.0000	0.0120	-----
1.58	0.2120	0.0000	0.0120	0.0000	0.0120	-----
1.67	0.2240	0.0000	0.0120	0.0000	0.0120	-----
1.75	0.2360	0.0000	0.0120	0.0000	0.0120	-----
1.83	0.2480	0.0000	0.0120	0.0000	0.0120	-----
1.92	0.2600	0.0000	0.0120	0.0000	0.0120	-----
2.00	0.2720	0.0003	0.0120	0.0002	0.0118	-----
2.08	0.2867	0.0009	0.0147	0.0006	0.0141	-----
2.17	0.3013	0.0018	0.0147	0.0009	0.0138	-----
2.25	0.3160	0.0030	0.0147	0.0012	0.0135	-----
2.33	0.3307	0.0045	0.0147	0.0015	0.0132	-----
2.42	0.3453	0.0063	0.0147	0.0018	0.0129	-----
2.50	0.3600	0.0084	0.0147	0.0021	0.0126	-----
2.58	0.3720	0.0103	0.0120	0.0019	0.0101	-----
2.67	0.3840	0.0123	0.0120	0.0021	0.0099	-----
2.75	0.3960	0.0146	0.0120	0.0022	0.0098	-----
2.83	0.4080	0.0170	0.0120	0.0024	0.0096	-----
2.92	0.4200	0.0195	0.0120	0.0026	0.0094	-----
3.00	0.4320	0.0223	0.0120	0.0027	0.0093	-----
3.08	0.4467	0.0258	0.0147	0.0035	0.0111	-----
3.17	0.4613	0.0295	0.0147	0.0038	0.0109	-----
3.25	0.4760	0.0335	0.0147	0.0040	0.0107	-----
3.33	0.4907	0.0377	0.0147	0.0042	0.0105	-----
3.42	0.5053	0.0421	0.0147	0.0044	0.0103	-----
3.50	0.5200	0.0466	0.0147	0.0046	0.0101	-----
3.58	0.5360	0.0519	0.0160	0.0052	0.0108	-----
3.67	0.5520	0.0573	0.0160	0.0054	0.0106	-----
3.75	0.5680	0.0629	0.0160	0.0056	0.0104	-----
3.83	0.5840	0.0688	0.0160	0.0059	0.0101	-----
3.92	0.6000	0.0748	0.0160	0.0061	0.0099	-----
4.00	0.6160	0.0811	0.0160	0.0063	0.0097	-----
4.08	0.6333	0.0881	0.0173	0.0070	0.0103	-----
4.17	0.6507	0.0953	0.0173	0.0072	0.0101	-----
4.25	0.6680	0.1027	0.0173	0.0074	0.0099	-----
4.33	0.6853	0.1103	0.0173	0.0076	0.0097	-----
4.42	0.7027	0.1181	0.0173	0.0078	0.0095	-----
4.50	0.7200	0.1261	0.0173	0.0080	0.0093	-----
4.58	0.7387	0.1349	0.0187	0.0088	0.0098	-----
4.67	0.7573	0.1440	0.0187	0.0090	0.0096	-----
4.75	0.7760	0.1532	0.0187	0.0092	0.0094	-----
4.83	0.7947	0.1626	0.0187	0.0094	0.0092	-----
4.92	0.8133	0.1722	0.0187	0.0096	0.0091	-----
5.00	0.8320	0.1820	0.0187	0.0098	0.0089	-----
5.08	0.8533	0.1935	0.0213	0.0114	0.0099	-----
5.17	0.8747	0.2051	0.0213	0.0116	0.0097	-----
5.25	0.8960	0.2170	0.0213	0.0119	0.0095	-----
5.33	0.9173	0.2290	0.0213	0.0121	0.0093	-----
5.42	0.9387	0.2413	0.0213	0.0123	0.0091	-----
5.50	0.9600	0.2538	0.0213	0.0125	0.0089	-----
5.58	0.9827	0.2672	0.0227	0.0135	0.0092	-----
5.67	1.0053	0.2809	0.0227	0.0137	0.0090	-----
5.75	1.0280	0.2947	0.0227	0.0139	0.0088	-----
5.83	1.0507	0.3088	0.0227	0.0141	0.0086	-----
5.92	1.0733	0.3230	0.0227	0.0142	0.0084	-----

Simmons100Yr24Hr.out

6.00	1.0960	0.3375	0.0227	0.0144	0.0082	-----
6.08	1.1227	0.3547	0.0267	0.0172	0.0095	-----
6.17	1.1493	0.3721	0.0267	0.0174	0.0092	-----
6.25	1.1760	0.3897	0.0267	0.0177	0.0090	-----
6.33	1.2027	0.4076	0.0267	0.0179	0.0088	-----
6.42	1.2293	0.4257	0.0267	0.0181	0.0086	-----
6.50	1.2560	0.4440	0.0267	0.0183	0.0084	-----
6.58	1.2867	0.4652	0.0307	0.0213	0.0094	-----
6.67	1.3173	0.4867	0.0307	0.0215	0.0092	-----
6.75	1.3480	0.5085	0.0307	0.0217	0.0089	-----
6.83	1.3787	0.5305	0.0307	0.0220	0.0087	-----
6.92	1.4093	0.5527	0.0307	0.0222	0.0085	-----
7.00	1.4400	0.5751	0.0307	0.0224	0.0083	-----
7.08	1.4800	0.6046	0.0400	0.0295	0.0105	-----
7.17	1.5200	0.6345	0.0400	0.0299	0.0101	-----
7.25	1.5600	0.6647	0.0400	0.0302	0.0098	-----
7.33	1.6000	0.6951	0.0400	0.0305	0.0095	-----
7.42	1.6400	0.7259	0.0400	0.0308	0.0092	-----
7.50	1.6800	0.7570	0.0400	0.0310	0.0090	-----
7.58	1.7400	0.8040	0.0600	0.0471	0.0129	-----
7.67	1.8000	0.8516	0.0600	0.0476	0.0124	-----
7.75	1.8600	0.8998	0.0600	0.0481	0.0119	-----
7.83	1.9200	0.9484	0.0600	0.0486	0.0114	-----
7.92	1.9800	0.9974	0.0600	0.0491	0.0109	-----
8.00	2.0400	1.0469	0.0600	0.0495	0.0105	-----
8.08	2.1293	1.1214	0.0893	0.0744	0.0149	-----
8.17	2.2187	1.1966	0.0893	0.0753	0.0141	-----
8.25	2.3080	1.2727	0.0893	0.0760	0.0133	-----
8.33	2.3973	1.3494	0.0893	0.0767	0.0126	-----
8.42	2.4867	1.4267	0.0893	0.0774	0.0120	-----
8.50	2.5760	1.5047	0.0893	0.0780	0.0114	-----
8.58	2.6933	1.6079	0.1173	0.1032	0.0141	-----
8.67	2.8107	1.7120	0.1173	0.1041	0.0132	-----
8.75	2.9280	1.8169	0.1173	0.1049	0.0124	-----
8.83	3.0453	1.9225	0.1173	0.1056	0.0117	-----
8.92	3.1627	2.0288	0.1173	0.1063	0.0111	-----
9.00	3.2800	2.1357	0.1173	0.1069	0.0105	-----
9.08	3.4080	2.2529	0.1280	0.1172	0.0108	-----
9.17	3.5360	2.3707	0.1280	0.1178	0.0102	-----
9.25	3.6640	2.4891	0.1280	0.1184	0.0096	-----
9.33	3.7920	2.6080	0.1280	0.1189	0.0091	-----
9.42	3.9200	2.7273	0.1280	0.1194	0.0086	-----
9.50	4.0480	2.8472	0.1280	0.1198	0.0082	-----
9.58	4.1573	2.9498	0.1093	0.1027	0.0067	-----
9.67	4.2667	3.0527	0.1093	0.1029	0.0064	-----
9.75	4.3760	3.1559	0.1093	0.1032	0.0061	-----
9.83	4.4853	3.2594	0.1093	0.1034	0.0059	-----
9.92	4.5947	3.3630	0.1093	0.1037	0.0057	-----
10.00	4.7040	3.4669	0.1093	0.1039	0.0055	-----
10.08	4.7587	3.5189	0.0547	0.0520	0.0026	-----
10.17	4.8133	3.5710	0.0547	0.0521	0.0026	-----
10.25	4.8680	3.6231	0.0547	0.0521	0.0025	-----
10.33	4.9227	3.6753	0.0547	0.0522	0.0025	-----
10.42	4.9773	3.7275	0.0547	0.0522	0.0025	-----
10.50	5.0320	3.7797	0.0547	0.0523	0.0024	-----
10.58	5.0680	3.8142	0.0360	0.0344	0.0016	-----
10.67	5.1040	3.8486	0.0360	0.0345	0.0015	-----
10.75	5.1400	3.8831	0.0360	0.0345	0.0015	-----
10.83	5.1760	3.9176	0.0360	0.0345	0.0015	-----
10.92	5.2120	3.9521	0.0360	0.0345	0.0015	-----
11.00	5.2480	3.9866	0.0360	0.0345	0.0015	-----
11.08	5.2787	4.0160	0.0307	0.0294	0.0012	-----
11.17	5.3093	4.0455	0.0307	0.0294	0.0012	-----

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11.25	5.3400	4.0749	0.0307	0.0294	0.0012	-----
11.33	5.3707	4.1044	0.0307	0.0295	0.0012	-----
11.42	5.4013	4.1339	0.0307	0.0295	0.0012	-----
11.50	5.4320	4.1633	0.0307	0.0295	0.0012	-----
11.58	5.4600	4.1903	0.0280	0.0269	0.0011	-----
11.67	5.4880	4.2172	0.0280	0.0269	0.0011	-----
11.75	5.5160	4.2441	0.0280	0.0269	0.0011	-----
11.83	5.5440	4.2711	0.0280	0.0270	0.0010	-----
11.92	5.5720	4.2981	0.0280	0.0270	0.0010	-----
12.00	5.6000	4.3250	0.0280	0.0270	0.0010	-----
12.08	5.6267	4.3507	0.0267	0.0257	0.0010	-----
12.17	5.6533	4.3764	0.0267	0.0257	0.0010	-----
12.25	5.6800	4.4021	0.0267	0.0257	0.0010	-----
12.33	5.7067	4.4279	0.0267	0.0257	0.0009	-----
12.42	5.7333	4.4536	0.0267	0.0257	0.0009	-----
12.50	5.7600	4.4793	0.0267	0.0257	0.0009	-----
12.58	5.7853	4.5038	0.0253	0.0245	0.0009	-----
12.67	5.8107	4.5282	0.0253	0.0245	0.0009	-----
12.75	5.8360	4.5527	0.0253	0.0245	0.0009	-----
12.83	5.8613	4.5772	0.0253	0.0245	0.0009	-----
12.92	5.8867	4.6017	0.0253	0.0245	0.0009	-----
13.00	5.9120	4.6261	0.0253	0.0245	0.0008	-----
13.08	5.9347	4.6481	0.0227	0.0219	0.0008	-----
13.17	5.9573	4.6700	0.0227	0.0219	0.0007	-----
13.25	5.9800	4.6919	0.0227	0.0219	0.0007	-----
13.33	6.0027	4.7138	0.0227	0.0219	0.0007	-----
13.42	6.0253	4.7358	0.0227	0.0219	0.0007	-----
13.50	6.0480	4.7577	0.0227	0.0219	0.0007	-----
13.58	6.0693	4.7784	0.0213	0.0207	0.0007	-----
13.67	6.0907	4.7990	0.0213	0.0207	0.0007	-----
13.75	6.1120	4.8197	0.0213	0.0207	0.0007	-----
13.83	6.1333	4.8403	0.0213	0.0207	0.0007	-----
13.92	6.1547	4.8610	0.0213	0.0207	0.0007	-----
14.00	6.1760	4.8817	0.0213	0.0207	0.0007	-----
14.08	6.2000	4.9049	0.0240	0.0233	0.0007	-----
14.17	6.2240	4.9282	0.0240	0.0233	0.0007	-----
14.25	6.2480	4.9515	0.0240	0.0233	0.0007	-----
14.33	6.2720	4.9747	0.0240	0.0233	0.0007	-----
14.42	6.2960	4.9980	0.0240	0.0233	0.0007	-----
14.50	6.3200	5.0213	0.0240	0.0233	0.0007	-----
14.58	6.3333	5.0342	0.0133	0.0129	0.0004	-----
14.67	6.3467	5.0472	0.0133	0.0129	0.0004	-----
14.75	6.3600	5.0601	0.0133	0.0129	0.0004	-----
14.83	6.3733	5.0731	0.0133	0.0129	0.0004	-----
14.92	6.3867	5.0860	0.0133	0.0129	0.0004	-----
15.00	6.4000	5.0990	0.0133	0.0129	0.0004	-----
15.08	6.4213	5.1197	0.0213	0.0207	0.0006	-----
15.17	6.4427	5.1404	0.0213	0.0207	0.0006	-----
15.25	6.4640	5.1611	0.0213	0.0207	0.0006	-----
15.33	6.4853	5.1818	0.0213	0.0207	0.0006	-----
15.42	6.5067	5.2026	0.0213	0.0207	0.0006	-----
15.50	6.5280	5.2233	0.0213	0.0207	0.0006	-----
15.58	6.5480	5.2427	0.0200	0.0194	0.0006	-----
15.67	6.5680	5.2622	0.0200	0.0194	0.0006	-----
15.75	6.5880	5.2816	0.0200	0.0194	0.0006	-----
15.83	6.6080	5.3011	0.0200	0.0194	0.0006	-----
15.92	6.6280	5.3205	0.0200	0.0195	0.0005	-----
16.00	6.6480	5.3400	0.0200	0.0195	0.0005	-----
16.08	6.6667	5.3581	0.0187	0.0182	0.0005	-----
16.17	6.6853	5.3763	0.0187	0.0182	0.0005	-----
16.25	6.7040	5.3945	0.0187	0.0182	0.0005	-----
16.33	6.7227	5.4126	0.0187	0.0182	0.0005	-----
16.42	6.7413	5.4308	0.0187	0.0182	0.0005	-----

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16.50	6.7600	5.4490	0.0187	0.0182	0.0005	-----
16.58	6.7800	5.4684	0.0200	0.0195	0.0005	-----
16.67	6.8000	5.4879	0.0200	0.0195	0.0005	-----
16.75	6.8200	5.5074	0.0200	0.0195	0.0005	-----
16.83	6.8400	5.5269	0.0200	0.0195	0.0005	-----
16.92	6.8600	5.5464	0.0200	0.0195	0.0005	-----
17.00	6.8800	5.5658	0.0200	0.0195	0.0005	-----
17.08	6.8960	5.5814	0.0160	0.0156	0.0004	-----
17.17	6.9120	5.5970	0.0160	0.0156	0.0004	-----
17.25	6.9280	5.6126	0.0160	0.0156	0.0004	-----
17.33	6.9440	5.6282	0.0160	0.0156	0.0004	-----
17.42	6.9600	5.6438	0.0160	0.0156	0.0004	-----
17.50	6.9760	5.6594	0.0160	0.0156	0.0004	-----
17.58	6.9933	5.6763	0.0173	0.0169	0.0004	-----
17.67	7.0107	5.6932	0.0173	0.0169	0.0004	-----
17.75	7.0280	5.7101	0.0173	0.0169	0.0004	-----
17.83	7.0453	5.7270	0.0173	0.0169	0.0004	-----
17.92	7.0627	5.7439	0.0173	0.0169	0.0004	-----
18.00	7.0800	5.7608	0.0173	0.0169	0.0004	-----
18.08	7.0933	5.7739	0.0133	0.0130	0.0003	-----
18.17	7.1067	5.7869	0.0133	0.0130	0.0003	-----
18.25	7.1200	5.7999	0.0133	0.0130	0.0003	-----
18.33	7.1333	5.8129	0.0133	0.0130	0.0003	-----
18.42	7.1467	5.8259	0.0133	0.0130	0.0003	-----
18.50	7.1600	5.8389	0.0133	0.0130	0.0003	-----
18.58	7.1733	5.8519	0.0133	0.0130	0.0003	-----
18.67	7.1867	5.8649	0.0133	0.0130	0.0003	-----
18.75	7.2000	5.8780	0.0133	0.0130	0.0003	-----
18.83	7.2133	5.8910	0.0133	0.0130	0.0003	-----
18.92	7.2267	5.9040	0.0133	0.0130	0.0003	-----
19.00	7.2400	5.9170	0.0133	0.0130	0.0003	-----
19.08	7.2520	5.9287	0.0120	0.0117	0.0003	-----
19.17	7.2640	5.9405	0.0120	0.0117	0.0003	-----
19.25	7.2760	5.9522	0.0120	0.0117	0.0003	-----
19.33	7.2880	5.9639	0.0120	0.0117	0.0003	-----
19.42	7.3000	5.9756	0.0120	0.0117	0.0003	-----
19.50	7.3120	5.9873	0.0120	0.0117	0.0003	-----
19.58	7.3253	6.0004	0.0133	0.0130	0.0003	-----
19.67	7.3387	6.0134	0.0133	0.0130	0.0003	-----
19.75	7.3520	6.0264	0.0133	0.0130	0.0003	-----
19.83	7.3653	6.0395	0.0133	0.0130	0.0003	-----
19.92	7.3787	6.0525	0.0133	0.0130	0.0003	-----
20.00	7.3920	6.0655	0.0133	0.0130	0.0003	-----
20.08	7.4067	6.0799	0.0147	0.0143	0.0003	-----
20.17	7.4213	6.0942	0.0147	0.0143	0.0003	-----
20.25	7.4360	6.1085	0.0147	0.0143	0.0003	-----
20.33	7.4507	6.1229	0.0147	0.0143	0.0003	-----
20.42	7.4653	6.1372	0.0147	0.0143	0.0003	-----
20.50	7.4800	6.1515	0.0147	0.0143	0.0003	-----
20.58	7.4933	6.1646	0.0133	0.0130	0.0003	-----
20.67	7.5067	6.1776	0.0133	0.0130	0.0003	-----
20.75	7.5200	6.1907	0.0133	0.0130	0.0003	-----
20.83	7.5333	6.2037	0.0133	0.0130	0.0003	-----
20.92	7.5467	6.2167	0.0133	0.0130	0.0003	-----
21.00	7.5600	6.2298	0.0133	0.0130	0.0003	-----
21.08	7.5720	6.2415	0.0120	0.0117	0.0003	-----
21.17	7.5840	6.2533	0.0120	0.0117	0.0003	-----
21.25	7.5960	6.2650	0.0120	0.0117	0.0003	-----
21.33	7.6080	6.2768	0.0120	0.0117	0.0003	-----
21.42	7.6200	6.2885	0.0120	0.0117	0.0003	-----
21.50	7.6320	6.3002	0.0120	0.0117	0.0003	-----
21.58	7.6440	6.3120	0.0120	0.0117	0.0003	-----
21.67	7.6560	6.3237	0.0120	0.0117	0.0003	-----

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21.75	7.6680	6.3355	0.0120	0.0117	0.0003	-----
21.83	7.6800	6.3472	0.0120	0.0117	0.0003	-----
21.92	7.6920	6.3590	0.0120	0.0117	0.0003	-----
22.00	7.7040	6.3707	0.0120	0.0117	0.0003	-----
22.08	7.7160	6.3825	0.0120	0.0117	0.0003	-----
22.17	7.7280	6.3942	0.0120	0.0117	0.0003	-----
22.25	7.7400	6.4060	0.0120	0.0117	0.0003	-----
22.33	7.7520	6.4177	0.0120	0.0118	0.0002	-----
22.42	7.7640	6.4295	0.0120	0.0118	0.0002	-----
22.50	7.7760	6.4412	0.0120	0.0118	0.0002	-----
22.58	7.7880	6.4530	0.0120	0.0118	0.0002	-----
22.67	7.8000	6.4647	0.0120	0.0118	0.0002	-----
22.75	7.8120	6.4765	0.0120	0.0118	0.0002	-----
22.83	7.8240	6.4882	0.0120	0.0118	0.0002	-----
22.92	7.8360	6.5000	0.0120	0.0118	0.0002	-----
23.00	7.8480	6.5117	0.0120	0.0118	0.0002	-----
23.08	7.8613	6.5248	0.0133	0.0131	0.0003	-----
23.17	7.8747	6.5379	0.0133	0.0131	0.0003	-----
23.25	7.8880	6.5509	0.0133	0.0131	0.0003	-----
23.33	7.9013	6.5640	0.0133	0.0131	0.0003	-----
23.42	7.9147	6.5771	0.0133	0.0131	0.0003	-----
23.50	7.9280	6.5901	0.0133	0.0131	0.0003	-----
23.58	7.9400	6.6019	0.0120	0.0118	0.0002	-----
23.67	7.9520	6.6136	0.0120	0.0118	0.0002	-----
23.75	7.9640	6.6254	0.0120	0.0118	0.0002	-----
23.83	7.9760	6.6372	0.0120	0.0118	0.0002	-----
23.92	7.9880	6.6489	0.0120	0.0118	0.0002	-----
24.00	8.0000	6.6607	0.0120	0.0118	0.0002	-----

Total soil rain loss = 1.34(In)
Total effective runoff = 6.66(In)

Peak flow rate this hydrograph = 1240.35(CFS)
Total runoff volume this hydrograph = 21228551.1(Ft3)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	325.0	650.0	975.0	1300.0
0+ 5	0.0000	0.00	Q					
0+10	0.0000	0.00	Q					
0+15	0.0000	0.00	Q					
0+20	0.0000	0.00	Q					
0+25	0.0000	0.00	Q					
0+30	0.0000	0.00	Q					
0+35	0.0000	0.00	Q					
0+40	0.0000	0.00	Q					
0+45	0.0000	0.00	Q					
0+50	0.0000	0.00	Q					
0+55	0.0000	0.00	Q					
1+ 0	0.0000	0.00	Q					
1+ 5	0.0000	0.00	Q					
1+10	0.0000	0.00	Q					
1+15	0.0000	0.00	Q					
1+20	0.0000	0.00	Q					
1+25	0.0000	0.00	Q					
1+30	0.0000	0.00	Q					

1+35	0.0000	0.00	Q
1+40	0.0000	0.00	Q
1+45	0.0000	0.00	Q
1+50	0.0000	0.00	Q
1+55	0.0000	0.00	Q
2+ 0	0.0002	0.02	Q
2+ 5	0.0011	0.14	Q
2+10	0.0050	0.57	Q
2+15	0.0163	1.64	Q
2+20	0.0402	3.47	Q
2+25	0.0804	5.84	Q
2+30	0.1388	8.47	Q
2+35	0.2163	11.25	Q
2+40	0.3126	13.99	Q
2+45	0.4256	16.40	Q
2+50	0.5502	18.09	Q
2+55	0.6850	19.57	Q
3+ 0	0.8310	21.20	Q
3+ 5	0.9888	22.92	Q
3+10	1.1595	24.78	Q
3+15	1.3464	27.14	Q
3+20	1.5564	30.48	Q
3+25	1.7900	33.92	VQ
3+30	2.0441	36.90	VQ
3+35	2.3171	39.64	VQ
3+40	2.6084	42.30	VQ
3+45	2.9197	45.19	VQ
3+50	3.2545	48.62	VQ
3+55	3.6126	51.99	VQ
4+ 0	3.9910	54.95	VQ
4+ 5	4.3882	57.67	VQ
4+10	4.8036	60.31	VQ
4+15	5.2391	63.24	VQ
4+20	5.6997	66.87	V Q
4+25	6.1847	70.43	V Q
4+30	6.6907	73.48	V Q
4+35	7.2158	76.24	V Q
4+40	7.7594	78.93	V Q
4+45	8.3239	81.96	V Q
4+50	8.9147	85.79	V Q
4+55	9.5313	89.53	V Q
5+ 0	10.1694	92.66	V Q
5+ 5	10.8271	95.49	V Q
5+10	11.5046	98.38	V Q
5+15	12.2087	102.23	V Q
5+20	12.9525	108.01	V Q
5+25	13.7356	113.70	V Q
5+30	14.5489	118.09	V Q
5+35	15.3875	121.77	V Q
5+40	16.2493	125.14	V Q
5+45	17.1364	128.80	V Q
5+50	18.0548	133.36	V Q
5+55	19.0033	137.72	V Q
6+ 0	19.9759	141.23	V Q
6+ 5	20.9701	144.36	V Q
6+10	21.9873	147.69	V Q
6+15	23.0397	152.82	V Q
6+20	24.1519	161.48	V Q
6+25	25.3226	169.99	V Q
6+30	26.5357	176.15	V Q
6+35	27.7832	181.12	V Q
6+40	29.0632	185.87	V Q
6+45	30.3872	192.24	V Q

6+50	31.7796	202.18	V	Q					
6+55	33.2378	211.73	V	Q					
7+ 0	34.7434	218.61	V	Q					
7+ 5	36.2881	224.29	V	Q					
7+10	37.8753	230.47	V	Q					
7+15	39.5380	241.43	V	Q					
7+20	41.3409	261.77	V	Q					
7+25	43.2804	281.62	V	Q					
7+30	45.3130	295.14	V	Q					
7+35	47.4198	305.90	V	Q					
7+40	49.6091	317.88	V	Q					
7+45	51.9560	340.78	V	Q					
7+50	54.6075	385.00	V	Q					
7+55	57.5556	428.06	V	Q	Q				
8+ 0	60.7012	456.75	V	Q	Q	Q			
8+ 5	63.9972	478.57	V	Q	Q	Q			
8+10	67.4452	500.65	V	Q	Q	Q			
8+15	71.1554	538.71	V	Q	Q	Q			
8+20	75.3513	609.25	V	Q	Q	Q			
8+25	80.0162	677.34	V	Q	Q	Q			
8+30	84.9919	722.47	V	Q	Q	Q			
8+35	90.1975	755.85	V	Q	Q	Q			
8+40	95.6122	786.22	V	Q	Q	Q			
8+45	101.3326	830.61	V	Q	Q	Q			
8+50	107.5741	906.27	V	Q	Q	Q			
8+55	114.3106	978.13	V	Q	Q	Q			
9+ 0	121.3754	1025.81	V	Q	Q	Q			
9+ 5	128.6765	1060.12	V	Q	Q	Q			
9+10	136.1652	1087.36	V	Q	Q	Q			
9+15	143.8543	1116.47	V	Q	Q	Q			
9+20	151.8125	1155.52	V	Q	Q	Q			
9+25	160.0154	1191.06	V	Q	Q	Q			
9+30	168.3860	1215.41	V	Q	Q	Q			
9+35	176.8724	1232.22	V	Q	Q	Q			
9+40	185.4147	1240.35	V	Q	Q	Q			
9+45	193.8983	1231.82	V	Q	Q	Q			
9+50	202.1412	1196.87	V	Q	Q	Q			
9+55	210.1402	1161.45	V	Q	Q	Q			
10+ 0	217.9963	1140.71	V	Q	Q	Q			
10+ 5	225.7456	1125.20	V	Q	Q	Q			
10+10	233.3398	1102.67	V	Q	Q	Q			
10+15	240.5183	1042.32	V	Q	Q	Q			
10+20	246.7934	911.14	V	Q	Q	Q			
10+25	252.1982	784.78	V	Q	Q	Q			
10+30	257.0663	706.84	V	Q	Q	Q			
10+35	261.5758	654.77	V	Q	Q	Q			
10+40	265.8146	615.48	V	Q	Q	Q			
10+45	269.7581	572.60	V	Q	Q	Q			
10+50	273.2834	511.87	V	Q	Q	Q			
10+55	276.4366	457.83	V	Q	Q	Q			
11+ 0	279.3584	424.25	V	Q	Q	Q			
11+ 5	282.1295	402.36	V	Q	Q	Q			
11+10	284.8006	387.84	V	Q	Q	Q			
11+15	287.3776	374.17	V	Q	Q	Q			
11+20	289.8281	355.81	V	Q	Q	Q			
11+25	292.1676	339.70	V	Q	Q	Q			
11+30	294.4383	329.70	V	Q	Q	Q			
11+35	296.6641	323.18	V	Q	Q	Q			
11+40	298.8590	318.71	V	Q	Q	Q			
11+45	301.0196	313.71	V	Q	Q	Q			
11+50	303.1258	305.82	V	Q	Q	Q			
11+55	305.1826	298.65	V	Q	Q	Q			
12+ 0	307.2089	294.23	V	Q	Q	Q			

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12+ 5	309.2153	291.33	Q	V
12+10	311.2072	289.22	Q	V
12+15	313.1821	286.75	Q	V
12+20	315.1300	282.83	Q	V
12+25	317.0533	279.27	Q	V
12+30	318.9617	277.09	Q	V
12+35	320.8600	275.64	Q	V
12+40	322.7501	274.44	Q	V
12+45	324.6272	272.56	Q	V
12+50	326.4802	269.05	Q	V
12+55	328.3105	265.76	Q	V
13+ 0	330.1270	263.75	Q	V
13+ 5	331.9337	262.33	Q	V
13+10	333.7299	260.81	Q	V
13+15	335.5037	257.56	Q	V
13+20	337.2314	250.87	Q	V
13+25	338.9152	244.49	Q	V
13+30	340.5720	240.56	Q	V
13+35	342.2106	237.93	Q	V
13+40	343.8350	235.87	Q	V
13+45	345.4421	233.34	Q	V
13+50	347.0217	229.36	Q	V
13+55	348.5764	225.74	Q	V
14+ 0	350.1157	223.51	Q	V
14+ 5	351.6460	222.20	Q	V
14+10	353.1749	222.00	Q	V
14+15	354.7186	224.15	Q	V
14+20	356.3033	230.09	Q	V
14+25	357.9286	236.00	Q	V
14+30	359.5793	239.67	Q	V
14+35	361.2433	241.61	Q	V
14+40	362.9001	240.57	Q	V
14+45	364.4908	230.98	Q	V
14+50	365.9132	206.53	Q	V
14+55	367.1699	182.47	Q	V
15+ 0	368.3244	167.63	Q	V
15+ 5	369.4138	158.18	Q	V
15+10	370.4706	153.44	Q	V
15+15	371.5497	156.68	Q	V
15+20	372.7360	172.25	Q	V
15+25	374.0338	188.44	Q	V
15+30	375.4001	198.39	Q	V
15+35	376.8122	205.03	Q	V
15+40	378.2559	209.63	Q	V
15+45	379.7159	212.00	Q	V
15+50	381.1724	211.48	Q	V
15+55	382.6200	210.20	Q	V
16+ 0	384.0626	209.46	Q	V
16+ 5	385.5009	208.84	Q	V
16+10	386.9325	207.87	Q	V
16+15	388.3507	205.92	Q	V
16+20	389.7442	202.33	Q	V
16+25	391.1145	198.97	Q	V
16+30	392.4706	196.90	Q	V
16+35	393.8178	195.62	Q	V
16+40	395.1614	195.09	Q	V
16+45	396.5103	195.86	Q	V
16+50	397.8782	198.63	Q	V
16+55	399.2657	201.46	Q	V
17+ 0	400.6652	203.21	Q	V
17+ 5	402.0715	204.19	Q	V
17+10	403.4765	204.00	Q	V
17+15	404.8577	200.56	Q	V

			Simmons100Yr24Hr.out			
17+20	406.1764	191.47	Q		V	
17+25	407.4332	182.50	Q		V	
17+30	408.6520	176.96	Q		V	
17+35	409.8460	173.37	Q		V	
17+40	411.0248	171.16	Q		V	
17+45	412.2003	170.69	Q		V	
17+50	413.3888	172.58	Q		V	
17+55	414.5927	174.81	Q		V	
18+ 0	415.8060	176.17	Q		V	
18+ 5	417.0245	176.92	Q		V	
18+10	418.2411	176.65	Q		V	
18+15	419.4339	173.19	Q		V	
18+20	420.5640	164.09	Q		V	
18+25	421.6321	155.09	Q		V	
18+30	422.6621	149.55	Q		V	
18+35	423.6667	145.87	Q		V	
18+40	424.6537	143.31	Q		V	
18+45	425.6280	141.46	Q		V	
18+50	426.5933	140.16	Q		V	
18+55	427.5525	139.28	Q		V	
19+ 0	428.5078	138.72	Q		V	
19+ 5	429.4605	138.33	Q		V	
19+10	430.4101	137.88	Q		V	
19+15	431.3503	136.52	Q		V	
19+20	432.2686	133.34	Q		V	
19+25	433.1656	130.25	Q		V	
19+30	434.0495	128.34	Q		V	
19+35	434.9251	127.14	Q		V	
19+40	435.7973	126.63	Q		V	
19+45	436.6746	127.39	Q		V	
19+50	437.5709	130.15	Q		V	
19+55	438.4867	132.97	Q		V	
20+ 0	439.4144	134.71	Q		V	
20+ 5	440.3506	135.94	Q		V	
20+10	441.2950	137.13	Q		V	
20+15	442.2533	139.13	Q		V	
20+20	443.2366	142.78	Q		V	
20+25	444.2434	146.19	Q		V	
20+30	445.2648	148.31	Q		V	
20+35	446.2954	149.64	Q		V	
20+40	447.3300	150.21	Q		V	
20+45	448.3594	149.48	Q		V	
20+50	449.3700	146.73	Q		V	
20+55	450.3612	143.93	Q		V	
21+ 0	451.3407	142.21	Q		V	
21+ 5	452.3117	141.00	Q		V	
21+10	453.2747	139.82	Q		V	
21+15	454.2240	137.84	Q		V	
21+20	455.1484	134.22	Q		V	
21+25	456.0493	130.82	Q		V	
21+30	456.9358	128.71	Q		V	
21+35	457.8127	127.34	Q		V	
21+40	458.6835	126.44	Q		V	
21+45	459.5500	125.82	Q		V	
21+50	460.4136	125.39	Q		V	
21+55	461.2752	125.10	Q		V	
22+ 0	462.1355	124.92	Q		V	
22+ 5	462.9950	124.81	Q		V	
22+10	463.8544	124.78	Q		V	
22+15	464.7138	124.79	Q		V	
22+20	465.5733	124.80	Q		V	
22+25	466.4328	124.80	Q		V	
22+30	467.2924	124.81	Q		V	

Simmons100Yr24Hr.out								
22+35	468.1520	124.82	Q					V
22+40	469.0117	124.83	Q					V
22+45	469.8715	124.83	Q					V
22+50	470.7312	124.84	Q					V
22+55	471.5911	124.85	Q					V
23+ 0	472.4509	124.85	Q					V
23+ 5	473.3113	124.93	Q					V
23+10	474.1742	125.29	Q					V
23+15	475.0465	126.66	Q					V
23+20	475.9410	129.87	Q					V
23+25	476.8569	133.00	Q					V
23+30	477.7862	134.93	Q					V
23+35	478.7238	136.14	Q					V
23+40	479.6651	136.67	Q					V
23+45	480.6012	135.93	Q					V
23+50	481.5184	133.18	Q					V
23+55	482.4163	130.37	Q					V
24+ 0	483.3023	128.64	Q					V
24+ 5	484.1763	126.91	Q					V
24+10	485.0228	122.91	Q					V
24+15	485.7799	109.94	Q					V
24+20	486.3355	80.67	Q					V
24+25	486.6959	52.33	Q					V
24+30	486.9356	34.81	Q					V
24+35	487.0957	23.24	Q					V
24+40	487.2012	15.33	Q					V
24+45	487.2682	9.72	Q					V
24+50	487.3078	5.76	Q					V
24+55	487.3290	3.07	Q					V
25+ 0	487.3382	1.35	Q					V
25+ 5	487.3405	0.32	Q					V

System100.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

2
SYSTEM 100
100-YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.530
24 hour precipitation(inches) = 7.840
P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 100.100 to Point/Station 100.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 76.200(Ft.)
Highest elevation = 5664.000(Ft.)
Lowest elevation = 5644.000(Ft.)
Elevation difference = 20.000(Ft.) Slope = 26.247 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 26.25 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 4.48 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3600) * (100.000^{.5})] / (26.247^{(1/3)}) = 4.48$
Calculated TC of 4.482 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 9.301(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff = 0.301(CFS)
Total initial stream area = 0.090(Ac.)

System100.out

+++++
 Process from Point/Station 100.200 to Point/Station 100.300
 ***** IMPROVED CHANNEL TRAVEL TIME *****

Upstream point elevation = 5644.000(Ft.)
 Downstream point elevation = 5557.000(Ft.)
 Channel length thru subarea = 456.000(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 6.025(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 6.025(CFS)
 Depth of flow = 0.137(Ft.), Average velocity = 4.164(Ft/s)
 Channel flow top width = 11.097(Ft.)
 Flow Velocity = 4.16(Ft/s)
 Travel time = 1.83 min.
 Time of concentration = 6.31 min.
 Critical depth = 0.219(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 1.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.360
 Rainfall intensity = 8.007(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.360 CA = 1.458
 Subarea runoff = 11.372(CFS) for 3.960(Ac.)
 Total runoff = 11.674(CFS) Total area = 4.050(Ac.)
 Depth of flow = 0.203(Ft.), Average velocity = 5.323(Ft/s)
 Critical depth = 0.332(Ft.)

+++++
 Process from Point/Station 100.300 to Point/Station 100.400
 ***** IMPROVED CHANNEL TRAVEL TIME *****

Upstream point elevation = 5557.000(Ft.)
 Downstream point elevation = 5380.000(Ft.)
 Channel length thru subarea = 2269.600(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 45.708(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 45.708(CFS)
 Depth of flow = 0.580(Ft.), Average velocity = 6.392(Ft/s)
 Channel flow top width = 14.643(Ft.)
 Flow Velocity = 6.39(Ft/s)
 Travel time = 5.92 min.
 Time of concentration = 12.22 min.
 Critical depth = 0.773(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 1.000

System100.out

Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.360
 Rainfall intensity = 5.225(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.360 CA = 15.246
 Subarea runoff = 67.984(CFS) for 38.300(Ac.)
 Total runoff = 79.658(CFS) Total area = 42.350(Ac.)
 Depth of flow = 0.792(Ft.), Average velocity = 7.633(Ft/s)
 Critical depth = 1.078(Ft.)

+++++
 Process from Point/Station 100.400 to Point/Station 100.500
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5380.000(Ft.)
 Downstream point elevation = 4272.000(Ft.)
 Channel length thru subarea = 2897.500(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 109.283(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 109.283(CFS)
 Depth of flow = 0.606(Ft.), Average velocity = 14.512(Ft/s)
 Channel flow top width = 14.849(Ft.)
 Flow Velocity = 14.51(Ft/s)
 Travel time = 3.33 min.
 Time of concentration = 15.55 min.
 Critical depth = 1.297(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 1.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.360
 Rainfall intensity = 4.473(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.360 CA = 31.039
 Subarea runoff = 59.192(CFS) for 43.870(Ac.)
 Total runoff = 138.850(CFS) Total area = 86.220(Ac.)
 Depth of flow = 0.693(Ft.), Average velocity = 15.674(Ft/s)
 Critical depth = 1.484(Ft.)
 End of computations, total study area = 86.220 (Ac.)

System200.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

TULE WIND PROJECT
SYSTEM 200
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.750
24 hour precipitation(inches) = 8.600
P6/P24 = 43.6%
Adjusted 6 hour precipitation (inches) = 3.870
Adjusted P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 200.100 to Point/Station 200.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 68.100(Ft.)
Highest elevation = 5677.000(Ft.)
Lowest elevation = 5665.400(Ft.)
Elevation difference = 11.600(Ft.) slope = 17.034 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 17.03 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 5.18 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{1.5}] / (\% slope^{1/3})$
 $TC = [1.8 * (1.1 - 0.360) * (100.000^{1.5})] / (17.034^{1/3}) = 5.18$
Rainfall intensity (I) = 9.970(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff = 0.359(CFS)
Total initial stream area = 0.100(Ac.)

System200.out

++++++
 Process from Point/Station 200.200 to Point/Station 200.300
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5665.400(Ft.)
 Downstream point elevation = 5460.000(Ft.)
 Channel length thru subarea = 639.000(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 7.638(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 7.638(CFS)
 Depth of flow = 0.135(Ft.), Average velocity = 5.357(Ft/s)
 Channel flow top width = 11.082(Ft.)
 Flow Velocity = 5.36(Ft/s)
 Travel time = 1.99 min.
 Time of concentration = 7.16 min.
 Critical depth = 0.254(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 1.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.360
 Rainfall intensity = 8.085(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.360 CA = 1.836
 Subarea runoff = 14.485(CFS) for 5.000(Ac.)
 Total runoff = 14.844(CFS) Total area = 5.100(Ac.)
 Depth of flow = 0.200(Ft.), Average velocity = 6.857(Ft/s)
 Critical depth = 0.387(Ft.)

++++++
 Process from Point/Station 200.300 to Point/Station 200.400
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5460.000(Ft.)
 Downstream point elevation = 4797.300(Ft.)
 Channel length thru subarea = 2637.200(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 78.651(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 78.651(CFS)
 Depth of flow = 0.567(Ft.), Average velocity = 11.316(Ft/s)
 Channel flow top width = 14.533(Ft.)
 Flow Velocity = 11.32(Ft/s)
 Travel time = 3.88 min.
 Time of concentration = 11.05 min.
 Critical depth = 1.070(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000

System200.out

Decimal fraction soil group C = 0.890
 Decimal fraction soil group D = 0.110
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.365
 Rainfall intensity = 6.114(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.365 CA = 23.287
 Subarea runoff = 127.540(CFS) for 58.690(Ac.)
 Total runoff = 142.383(CFS) Total area = 63.790(Ac.)
 Depth of flow = 0.791(Ft.), Average velocity = 13.684(Ft/s)
 Critical depth = 1.500(Ft.)

+++++
 Process from Point/Station 200.400 to Point/Station 200.500
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 4797.300(Ft.)
 Downstream point elevation = 3885.000(Ft.)
 Channel length thru subarea = 3957.300(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 439.354(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 439.354(CFS)
 Depth of flow = 1.484(Ft.), Average velocity = 18.583(Ft/s)
 Channel flow top width = 21.870(Ft.)
 Flow Velocity = 18.58(Ft/s)
 Travel time = 3.55 min.
 Time of concentration = 14.60 min.
 Critical depth = 2.750(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.030
 Decimal fraction soil group B = 0.040
 Decimal fraction soil group C = 0.290
 Decimal fraction soil group D = 0.640
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.388
 Rainfall intensity = 5.109(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.384 CA = 144.118
 Subarea runoff = 593.871(CFS) for 311.660(Ac.)
 Total runoff = 736.254(CFS) Total area = 375.450(Ac.)
 Depth of flow = 1.933(Ft.), Average velocity = 21.479(Ft/s)
 Critical depth = 3.563(Ft.)
 End of computations, total study area = 375.450 (Ac.)

System300.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

TULE WIND PROJECT
SYSTEM 300
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.820
24 hour precipitation(inches) = 8.820
P6/P24 = 43.3%
Adjusted 6 hour precipitation (inches) = 3.969
Adjusted P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 300.100 to Point/Station 300.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 44.600(Ft.)
Highest elevation = 5636.000(Ft.)
Lowest elevation = 5623.500(Ft.)
Elevation difference = 12.500(Ft.) slope = 28.027 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 28.03 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 4.39 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3600) * (100.000^{.5})] / (28.027^{(1/3)}) = 4.39$
Calculated TC of 4.385 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 10.457(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360

System300.out
Subarea runoff = 0.151(CFS)
Total initial stream area = 0.040(Ac.)

+++++
Process from Point/Station 300.200 to Point/Station 300.300
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5623.500(Ft.)
Downstream point elevation = 5460.000(Ft.)
Channel length thru subarea = 772.300(Ft.)
Channel base width = 10.000(Ft.)
Slope or 'Z' of left channel bank = 4.000
Slope or 'Z' of right channel bank = 4.000
Estimated mean flow rate at midpoint of channel = 5.547(CFS)
Manning's 'N' = 0.040
Maximum depth of channel = 5.000(Ft.)
Flow(q) thru subarea = 5.547(CFS)
Depth of flow = 0.127(Ft.), Average velocity = 4.169(Ft/s)
Channel flow top width = 11.013(Ft.)
Flow Velocity = 4.17(Ft/s)
Travel time = 3.09 min.
Time of concentration = 7.47 min.
Critical depth = 0.207(Ft.)
Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity = 8.070(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.360 CA = 1.346
Subarea runoff = 10.715(CFS) for 3.700(Ac.)
Total runoff = 10.865(CFS) Total area = 3.740(Ac.)
Depth of flow = 0.189(Ft.), Average velocity = 5.358(Ft/s)
Critical depth = 0.316(Ft.)

+++++
Process from Point/Station 300.300 to Point/Station 300.400
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5460.000(Ft.)
Downstream point elevation = 5347.300(Ft.)
Channel length thru subarea = 2622.100(Ft.)
Channel base width = 10.000(Ft.)
Slope or 'Z' of left channel bank = 4.000
Slope or 'Z' of right channel bank = 4.000
Estimated mean flow rate at midpoint of channel = 75.260(CFS)
Manning's 'N' = 0.040
Maximum depth of channel = 5.000(Ft.)
Flow(q) thru subarea = 75.260(CFS)
Depth of flow = 0.905(Ft.), Average velocity = 6.106(Ft/s)
Channel flow top width = 17.240(Ft.)
Flow Velocity = 6.11(Ft/s)
Travel time = 7.16 min.
Time of concentration = 14.63 min.
Critical depth = 1.047(Ft.)
Adding area flow to channel

System300.out

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL
(1.0 DU/A or Less)]
Impervious value, $A_i = 0.100$
Sub-Area C Value = 0.360
Rainfall intensity = 5.232(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
($Q=KCIA$) is $C = 0.360$ $CA = 26.676$
Subarea runoff = 128.705(CFS) for 70.360(Ac.)
Total runoff = 139.571(CFS) Total area = 74.100(Ac.)
Depth of flow = 1.263(Ft.), Average velocity = 7.344(Ft/s)
Critical depth = 1.484(Ft.)

+++++
Process from Point/Station 300.400 to Point/Station 300.500
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5347.300(Ft.)
Downstream point elevation = 4840.000(Ft.)
Channel length thru subarea = 3682.200(Ft.)
Channel base width = 10.000(Ft.)
Slope or 'Z' of left channel bank = 4.000
Slope or 'Z' of right channel bank = 4.000
Estimated mean flow rate at midpoint of channel = 259.344(CFS)
Manning's 'N' = 0.040
Maximum depth of channel = 5.000(Ft.)
Flow(q) thru subarea = 259.344(CFS)
Depth of flow = 1.288(Ft.), Average velocity = 13.291(Ft/s)
Channel flow top width = 20.303(Ft.)
Flow velocity = 13.29(Ft/s)
Travel time = 4.62 min.
Time of concentration = 19.25 min.
Critical depth = 2.094(Ft.)
Adding area flow to channel
Decimal fraction soil group A = 0.110
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.750
Decimal fraction soil group D = 0.140
[LOW DENSITY RESIDENTIAL
(1.0 DU/A or Less)]
Impervious value, $A_i = 0.100$
Sub-Area C Value = 0.357
Rainfall intensity = 4.384(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
($Q=KCIA$) is $C = 0.358$ $CA = 86.462$
Subarea runoff = 239.447(CFS) for 167.420(Ac.)
Total runoff = 379.018(CFS) Total area = 241.520(Ac.)
Depth of flow = 1.571(Ft.), Average velocity = 14.820(Ft/s)
Critical depth = 2.547(Ft.)
End of computations, total study area = 241.520 (Ac.)

System400.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

TULE WIND PROJECT
SYSTEM 400
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.980
24 hour precipitation(inches) = 9.310
P6/P24 = 42.7%
Adjusted 6 hour precipitation (inches) = 4.190
Adjusted P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 400.100 to Point/Station 400.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 75.200(Ft.)
Highest elevation = 5513.500(Ft.)
Lowest elevation = 5501.000(Ft.)
Elevation difference = 12.500(Ft.) slope = 16.622 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 16.62 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 5.22 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{1.5}] / (\% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3600) * (100.000^{1.5}) / (16.622^{(1/3)})] = 5.22$
Rainfall intensity (I) = 10.737(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff = 0.155(CFS)
Total initial stream area = 0.040(Ac.)

System400.out

+++++
 Process from Point/Station 400.200 to Point/Station 400.300
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5501.000(Ft.)
 Downstream point elevation = 5346.800(Ft.)
 Channel length thru subarea = 739.500(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 13.250(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 13.250(CFS)
 Depth of flow = 0.213(Ft.), Average velocity = 5.735(Ft/s)
 Channel flow top width = 11.703(Ft.)
 Flow Velocity = 5.73(Ft/s)
 Travel time = 2.15 min.
 Time of concentration = 7.37 min.
 Critical depth = 0.359(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 1.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.360
 Rainfall intensity = 8.596(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.360 CA = 3.056
 Subarea runoff = 26.117(CFS) for 8.450(Ac.)
 Total runoff = 26.272(CFS) Total area = 8.490(Ac.)
 Depth of flow = 0.318(Ft.), Average velocity = 7.329(Ft/s)
 Critical depth = 0.555(Ft.)

+++++
 Process from Point/Station 400.300 to Point/Station 400.400
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5346.800(Ft.)
 Downstream point elevation = 4800.000(Ft.)
 Channel length thru subarea = 1933.800(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 110.924(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 110.924(CFS)
 Depth of flow = 0.665(Ft.), Average velocity = 13.165(Ft/s)
 Channel flow top width = 15.324(Ft.)
 Flow Velocity = 13.16(Ft/s)
 Travel time = 2.45 min.
 Time of concentration = 9.82 min.
 Critical depth = 1.297(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.110
 Decimal fraction soil group B = 0.000

System400.out
 Decimal fraction soil group C = 0.410
 Decimal fraction soil group D = 0.480
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.374
 Rainfall intensity = 7.144(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.372 CA = 27.365
 Subarea runoff = 169.217(CFS) for 64.980(Ac.)
 Total runoff = 195.488(CFS) Total area = 73.470(Ac.)
 Depth of flow = 0.911(Ft.), Average velocity = 15.721(Ft/s)
 Critical depth = 1.781(Ft.)
 End of computations, total study area = 73.470 (Ac.)

System500.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

TULE WIND PROJECT
SYSTEM 500
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 4.060
24 hour precipitation(inches) = 9.440
P6/P24 = 43.0%
Adjusted 6 hour precipitation (inches) = 4.248
Adjusted P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 500.100 to Point/Station 500.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 71.900(Ft.)
Highest elevation = 5535.000(Ft.)
Lowest elevation = 5529.500(Ft.)
Elevation difference = 5.500(Ft.) slope = 7.650 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 7.65 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 6.76 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{1.5}] / (\% slope^{1/3})$
 $TC = [1.8 * (1.1 - 0.3600) * (100.000^{1.5})] / (7.650^{1/3}) = 6.76$
Rainfall intensity (I) = 9.214(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff = 0.232(CFS)
Total initial stream area = 0.070(Ac.)

System500.out

++++++
 Process from Point/Station 500.200 to Point/Station 500.300
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5529.500(Ft.)
 Downstream point elevation = 5491.500(Ft.)
 Channel length thru subarea = 1056.700(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 20.166(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 20.166(CFS)
 Depth of flow = 0.454(Ft.), Average velocity = 3.761(Ft/s)
 Channel flow top width = 13.630(Ft.)
 Flow Velocity = 3.76(Ft/s)
 Travel time = 4.68 min.
 Time of concentration = 11.44 min.
 Critical depth = 0.469(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.240
 Decimal fraction soil group C = 0.760
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.350
 Rainfall intensity = 6.562(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.350 CA = 6.101
 Subarea runoff = 39.802(CFS) for 17.340(Ac.)
 Total runoff = 40.034(CFS) Total area = 17.410(Ac.)
 Depth of flow = 0.670(Ft.), Average velocity = 4.713(Ft/s)
 Critical depth = 0.719(Ft.)

++++++
 Process from Point/Station 500.300 to Point/Station 500.400
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5491.500(Ft.)
 Downstream point elevation = 5361.500(Ft.)
 Channel length thru subarea = 2216.700(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 91.075(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 91.075(CFS)
 Depth of flow = 0.923(Ft.), Average velocity = 7.210(Ft/s)
 Channel flow top width = 17.382(Ft.)
 Flow Velocity = 7.21(Ft/s)
 Travel time = 5.12 min.
 Time of concentration = 16.57 min.
 Critical depth = 1.164(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.030

System500.out

Decimal fraction soil group C = 0.970
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.359
 Rainfall intensity = 5.168(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.357 CA = 27.478
 Subarea runoff = 101.984(CFS) for 59.580(Ac.)
 Total runoff = 142.018(CFS) Total area = 76.990(Ac.)
 Depth of flow = 1.173(Ft.), Average velocity = 8.238(Ft/s)
 Critical depth = 1.500(Ft.)

+++++
 Process from Point/Station 500.400 to Point/Station 500.500
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5361.500(Ft.)
 Downstream point elevation = 4800.000(Ft.)
 Channel length thru subarea = 2975.100(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 231.210(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 231.210(CFS)
 Depth of flow = 1.114(Ft.), Average velocity = 14.360(Ft/s)
 Channel flow top width = 18.911(Ft.)
 Flow Velocity = 14.36(Ft/s)
 Travel time = 3.45 min.
 Time of concentration = 20.02 min.
 Critical depth = 1.969(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.090
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.530
 Decimal fraction soil group D = 0.380
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.371
 Rainfall intensity = 4.574(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.365 CA = 70.028
 Subarea runoff = 178.306(CFS) for 114.720(Ac.)
 Total runoff = 320.324(CFS) Total area = 191.710(Ac.)
 Depth of flow = 1.325(Ft.), Average velocity = 15.801(Ft/s)
 Critical depth = 2.328(Ft.)
 End of computations, total study area = 191.710 (Ac.)

System600.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

TULE WIND PROJECT
SYSTEM 600
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 4.240
24 hour precipitation(inches) = 10.000
P6/P24 = 42.4%
Adjusted 6 hour precipitation (inches) = 4.500
Adjusted P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 600.100 to Point/Station 600.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 69.400(Ft.)
Highest elevation = 5666.700(Ft.)
Lowest elevation = 5656.000(Ft.)
Elevation difference = 10.700(Ft.) slope = 15.418 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 15.42 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 5.35 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{1.5} / (% slope^{1/3})]$
 $TC = [1.8 * (1.1 - 0.3600) * (100.000^{1.5}) / (15.418^{1/3})] = 5.35$
Rainfall intensity (I) = 11.348(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff = 0.245(CFS)
Total initial stream area = 0.060(Ac.)

System600.out

++++++
 Process from Point/Station 600.200 to Point/Station 600.300
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5656.000(Ft.)
 Downstream point elevation = 5480.500(Ft.)
 Channel length thru subarea = 749.700(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 12.181(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 12.181(CFS)
 Depth of flow = 0.196(Ft.), Average velocity = 5.768(Ft/s)
 Channel flow top width = 11.567(Ft.)
 Flow Velocity = 5.77(Ft/s)
 Travel time = 2.17 min.
 Time of concentration = 7.52 min.
 Critical depth = 0.344(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 1.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.360
 Rainfall intensity = 9.114(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.360 CA = 2.639
 Subarea runoff = 23.805(CFS) for 7.270(Ac.)
 Total runoff = 24.050(CFS) Total area = 7.330(Ac.)
 Depth of flow = 0.292(Ft.), Average velocity = 7.375(Ft/s)
 Critical depth = 0.523(Ft.)

++++++
 Process from Point/Station 600.300 to Point/Station 600.400
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5480.500(Ft.)
 Downstream point elevation = 4740.000(Ft.)
 Channel length thru subarea = 2981.000(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 218.250(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 218.250(CFS)
 Depth of flow = 1.002(Ft.), Average velocity = 15.540(Ft/s)
 Channel flow top width = 18.020(Ft.)
 Flow Velocity = 15.54(Ft/s)
 Travel time = 3.20 min.
 Time of concentration = 10.72 min.
 Critical depth = 1.906(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.480

System600.out
 Decimal fraction soil group C = 0.440
 Decimal fraction soil group D = 0.080
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.345
 Rainfall intensity = 7.252(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.345 CA = 56.869
 Subarea runoff = 388.346(CFS) for 157.280(Ac.)
 Total runoff = 412.396(CFS) Total area = 164.610(Ac.)
 Depth of flow = 1.408(Ft.), Average velocity = 18.741(Ft/s)
 Critical depth = 2.656(Ft.)
 End of computations, total study area = 164.610 (Ac.)

System700.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

TULE WIND PROJECT
SYSTEM 700
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 4.270
24 hour precipitation(inches) = 9.950
P6/P24 = 42.9%
Adjusted 6 hour precipitation (inches) = 4.478
Adjusted P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 700.100 to Point/Station 700.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 85.600(Ft.)
Highest elevation = 5566.000(Ft.)
Lowest elevation = 5558.000(Ft.)
Elevation difference = 8.000(Ft.) slope = 9.346 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 9.35 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 6.32 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{1.5} / (\% slope^{1/3})]$
 $TC = [1.8 * (1.1 - 0.3600) * (100.000^{1.5}) / (9.346^{1/3})] = 6.32$
Rainfall intensity (I) = 10.139(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff = 0.146(CFS)
Total initial stream area = 0.040(Ac.)

System700.out

+++++
 Process from Point/Station 700.200 to Point/Station 700.300
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5558.000(Ft.)
 Downstream point elevation = 5292.300(Ft.)
 Channel length thru subarea = 671.700(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 7.208(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 7.208(CFS)
 Depth of flow = 0.123(Ft.), Average velocity = 5.591(Ft/s)
 Channel flow top width = 10.983(Ft.)
 Flow Velocity = 5.59(Ft/s)
 Travel time = 2.00 min.
 Time of concentration = 8.33 min.
 Critical depth = 0.244(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 1.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.360
 Rainfall intensity = 8.490(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.360 CA = 1.674
 Subarea runoff = 14.067(CFS) for 4.610(Ac.)
 Total runoff = 14.213(CFS) Total area = 4.650(Ac.)
 Depth of flow = 0.184(Ft.), Average velocity = 7.206(Ft/s)
 Critical depth = 0.375(Ft.)

+++++
 Process from Point/Station 700.300 to Point/Station 700.400
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5292.300(Ft.)
 Downstream point elevation = 4740.500(Ft.)
 Channel length thru subarea = 2270.000(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 154.857(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 154.857(CFS)
 Depth of flow = 0.836(Ft.), Average velocity = 13.887(Ft/s)
 Channel flow top width = 16.686(Ft.)
 Flow Velocity = 13.89(Ft/s)
 Travel time = 2.72 min.
 Time of concentration = 11.05 min.
 Critical depth = 1.578(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.460

System700.out
 Decimal fraction soil group C = 0.540
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.342
 Rainfall intensity = 7.073(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.342 CA = 41.768
 Subarea runoff = 281.229(CFS) for 117.370(Ac.)
 Total runoff = 295.442(CFS) Total area = 122.020(Ac.)
 Depth of flow = 1.187(Ft.), Average velocity = 16.879(Ft/s)
 Critical depth = 2.234(Ft.)
 End of computations, total study area = 122.020 (Ac.)

System800.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

TULE WIND PROJECT
SYSTEM 800
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 4.190
24 hour precipitation(inches) = 9.560
P6/P24 = 43.8%
Adjusted 6 hour precipitation (inches) = 4.302
Adjusted P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 800.100 to Point/Station 800.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 71.700(Ft.)
Highest elevation = 5675.000(Ft.)
Lowest elevation = 5658.500(Ft.)
Elevation difference = 16.500(Ft.) slope = 23.013 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 23.01 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 4.68 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3600) * (100.000^{.5})] / (23.013^{(1/3)}) = 4.68$
Calculated TC of 4.683 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 11.335(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360

System800.out
Subarea runoff = 0.367(CFS)
Total initial stream area = 0.090(Ac.)

+++++
Process from Point/Station 800.200 to Point/Station 800.300
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5658.500(Ft.)
Downstream point elevation = 5519.300(Ft.)
Channel length thru subarea = 759.000(Ft.)
Channel base width = 10.000(Ft.)
Slope or 'Z' of left channel bank = 4.000
Slope or 'Z' of right channel bank = 4.000
Estimated mean flow rate at midpoint of channel = 5.648(CFS)
Manning's 'N' = 0.040
Maximum depth of channel = 5.000(Ft.)
Flow(q) thru subarea = 5.648(CFS)
Depth of flow = 0.134(Ft.), Average velocity = 4.014(Ft/s)
Channel flow top width = 11.069(Ft.)
Flow Velocity = 4.01(Ft/s)
Travel time = 3.15 min.
Time of concentration = 7.83 min.
Critical depth = 0.209(Ft.)
Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity = 8.484(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.360 CA = 1.278
Subarea runoff = 10.476(CFS) for 3.460(Ac.)
Total runoff = 10.843(CFS) Total area = 3.550(Ac.)
Depth of flow = 0.196(Ft.), Average velocity = 5.116(Ft/s)
Critical depth = 0.316(Ft.)

+++++
Process from Point/Station 800.300 to Point/Station 800.400
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5519.300(Ft.)
Downstream point elevation = 5451.800(Ft.)
Channel length thru subarea = 2005.000(Ft.)
Channel base width = 10.000(Ft.)
Slope or 'Z' of left channel bank = 4.000
Slope or 'Z' of right channel bank = 4.000
Estimated mean flow rate at midpoint of channel = 44.702(CFS)
Manning's 'N' = 0.040
Maximum depth of channel = 5.000(Ft.)
Flow(q) thru subarea = 44.702(CFS)
Depth of flow = 0.726(Ft.), Average velocity = 4.773(Ft/s)
Channel flow top width = 15.807(Ft.)
Flow Velocity = 4.77(Ft/s)
Travel time = 7.00 min.
Time of concentration = 14.84 min.
Critical depth = 0.766(Ft.)
Adding area flow to channel

System800.out

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL
(1.0 DU/A or Less)]
Impervious value, $A_i = 0.100$
Sub-Area C Value = 0.360
Rainfall intensity = 5.620(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
($Q=KCIA$) is $C = 0.360$ $CA = 13.964$
Subarea runoff = 67.639(CFS) for 35.240(Ac.)
Total runoff = 78.482(CFS) Total area = 38.790(Ac.)
Depth of flow = 0.990(Ft.), Average velocity = 5.680(Ft/s)
Critical depth = 1.063(Ft.)

++++
Process from Point/Station 800.400 to Point/Station 800.500
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5451.800(Ft.)
Downstream point elevation = 5341.800(Ft.)
Channel length thru subarea = 2536.500(Ft.)
Channel base width = 10.000(Ft.)
Slope or 'Z' of left channel bank = 4.000
Slope or 'Z' of right channel bank = 4.000
Estimated mean flow rate at midpoint of channel = 312.633(CFS)
Manning's 'N' = 0.040
Maximum depth of channel = 5.000(Ft.)
Flow(q) thru subarea = 312.633(CFS)
Depth of flow = 1.913(Ft.), Average velocity = 9.262(Ft/s)
Channel flow top width = 25.300(Ft.)
Flow velocity = 9.26(Ft/s)
Travel time = 4.56 min.
Time of concentration = 19.40 min.
Critical depth = 2.313(Ft.)
Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.130
Decimal fraction soil group C = 0.870
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL
(1.0 DU/A or Less)]
Impervious value, $A_i = 0.100$
Sub-Area C Value = 0.355
Rainfall intensity = 4.727(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
($Q=KCIA$) is $C = 0.355$ $CA = 115.650$
Subarea runoff = 468.223(CFS) for 286.600(Ac.)
Total runoff = 546.706(CFS) Total area = 325.390(Ac.)
Depth of flow = 2.523(Ft.), Average velocity = 10.784(Ft/s)
Critical depth = 3.063(Ft.)

++++
Process from Point/Station 800.500 to Point/Station 800.600
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5341.800(Ft.)
Downstream point elevation = 4670.000(Ft.)
Channel length thru subarea = 3795.300(Ft.)
Channel base width = 10.000(Ft.)

System800.out

Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 628.770(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 628.770(CFS)
 Depth of flow = 1.908(Ft.), Average velocity = 18.688(Ft/s)
 Channel flow top width = 25.265(Ft.)
 Flow Velocity = 18.69(Ft/s)
 Travel time = 3.38 min.
 Time of concentration = 22.79 min.
 Critical depth = 3.313(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.470
 Decimal fraction soil group C = 0.530
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.341
 Rainfall intensity = 4.261(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.351 CA = 166.782
 Subarea runoff = 164.031(CFS) for 149.860(Ac.)
 Total runoff = 710.737(CFS) Total area = 475.250(Ac.)
 Depth of flow = 2.029(Ft.), Average velocity = 19.330(Ft/s)
 Critical depth = 3.500(Ft.)
 End of computations, total study area = 475.250 (Ac.)

System900.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

TULE WIND PROJECT
SYSTEM 900
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 4.250
24 hour precipitation(inches) = 9.550
P6/P24 = 44.5%
Adjusted 6 hour precipitation (inches) = 4.298
Adjusted P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 900.100 to Point/Station 900.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 76.500(Ft.)
Highest elevation = 5646.500(Ft.)
Lowest elevation = 5634.800(Ft.)
Elevation difference = 11.700(Ft.) slope = 15.294 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 15.29 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 5.37 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{1.5} / (\% slope^{1/3})]$
 $TC = [1.8 * (1.1 - 0.3600) * (100.000^{1.5}) / (15.294^{1/3})] = 5.37$
Rainfall intensity (I) = 10.818(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff = 0.234(CFS)
Total initial stream area = 0.060(Ac.)

System900.out

+++++
 Process from Point/Station 900.200 to Point/Station 900.300
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5634.800(Ft.)
 Downstream point elevation = 5455.700(Ft.)
 Channel length thru subarea = 788.800(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 10.974(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 10.974(CFS)
 Depth of flow = 0.186(Ft.), Average velocity = 5.498(Ft/s)
 Channel flow top width = 11.486(Ft.)
 Flow Velocity = 5.50(Ft/s)
 Travel time = 2.39 min.
 Time of concentration = 7.76 min.
 Critical depth = 0.320(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 1.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.360
 Rainfall intensity = 8.530(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.360 CA = 2.538
 Subarea runoff = 21.414(CFS) for 6.990(Ac.)
 Total runoff = 21.648(CFS) Total area = 7.050(Ac.)
 Depth of flow = 0.277(Ft.), Average velocity = 7.035(Ft/s)
 Critical depth = 0.492(Ft.)

+++++
 Process from Point/Station 900.300 to Point/Station 900.400
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5455.700(Ft.)
 Downstream point elevation = 5217.500(Ft.)
 Channel length thru subarea = 2298.300(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 105.102(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 105.102(CFS)
 Depth of flow = 0.854(Ft.), Average velocity = 9.177(Ft/s)
 Channel flow top width = 16.830(Ft.)
 Flow Velocity = 9.18(Ft/s)
 Travel time = 4.17 min.
 Time of concentration = 11.93 min.
 Critical depth = 1.266(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.100

System900.out

Decimal fraction soil group C = 0.900
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.356
 Rainfall intensity = 6.461(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.356 CA = 29.174
 Subarea runoff = 166.854(CFS) for 74.820(Ac.)
 Total runoff = 188.502(CFS) Total area = 81.870(Ac.)
 Depth of flow = 1.172(Ft.), Average velocity = 10.946(Ft/s)
 Critical depth = 1.750(Ft.)

+++++
 Process from Point/Station 900.400 to Point/Station 900.500
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5217.500(Ft.)
 Downstream point elevation = 4931.700(Ft.)
 Channel length thru subarea = 3731.400(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 262.539(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 262.539(CFS)
 Depth of flow = 1.512(Ft.), Average velocity = 10.822(Ft/s)
 Channel flow top width = 22.095(Ft.)
 Flow Velocity = 10.82(Ft/s)
 Travel time = 5.75 min.
 Time of concentration = 17.68 min.
 Critical depth = 2.094(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.140
 Decimal fraction soil group C = 0.860
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.354
 Rainfall intensity = 5.014(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.355 CA = 67.112
 Subarea runoff = 148.004(CFS) for 107.050(Ac.)
 Total runoff = 336.506(CFS) Total area = 188.920(Ac.)
 Depth of flow = 1.718(Ft.), Average velocity = 11.607(Ft/s)
 Critical depth = 2.391(Ft.)
 End of computations, total study area = 188.920 (Ac.)

System1000.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

TULE WIND PROJECT
SYSTEM 1000
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 4.320
24 hour precipitation(inches) = 9.760
P6/P24 = 44.3%
Adjusted 6 hour precipitation (inches) = 4.392
Adjusted P6/P24 = 45.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 1000.100 to Point/Station 1000.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 74.900(Ft.)
Highest elevation = 5684.000(Ft.)
Lowest elevation = 5674.500(Ft.)
Elevation difference = 9.500(Ft.) slope = 12.684 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 12.68 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 5.71 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{1.5} / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.3600) * (100.000^{1.5}) / (12.684^{(1/3)})] = 5.71$
Rainfall intensity (I) = 10.620(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff = 0.153(CFS)
Total initial stream area = 0.040(Ac.)

System1000.out

+++++
 Process from Point/Station 1000.200 to Point/Station 1000.300
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5674.500(Ft.)
 Downstream point elevation = 5350.000(Ft.)
 Channel length thru subarea = 1283.000(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 15.217(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 15.217(CFS)
 Depth of flow = 0.218(Ft.), Average velocity = 6.413(Ft/s)
 Channel flow top width = 11.746(Ft.)
 Flow Velocity = 6.41(Ft/s)
 Travel time = 3.33 min.
 Time of concentration = 9.05 min.
 Critical depth = 0.395(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 1.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.360
 Rainfall intensity = 7.894(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.360 CA = 3.827
 Subarea runoff = 30.057(CFS) for 10.590(Ac.)
 Total runoff = 30.210(CFS) Total area = 10.630(Ac.)
 Depth of flow = 0.326(Ft.), Average velocity = 8.195(Ft/s)
 Critical depth = 0.602(Ft.)

+++++
 Process from Point/Station 1000.300 to Point/Station 1000.400
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 5350.000(Ft.)
 Downstream point elevation = 4927.500(Ft.)
 Channel length thru subarea = 3982.200(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 115.259(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 115.259(CFS)
 Depth of flow = 0.892(Ft.), Average velocity = 9.518(Ft/s)
 Channel flow top width = 17.139(Ft.)
 Flow Velocity = 9.52(Ft/s)
 Travel time = 6.97 min.
 Time of concentration = 16.02 min.
 Critical depth = 1.328(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000

System1000.out

Decimal fraction soil group C = 1.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.360
 Rainfall intensity = 5.461(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.360 CA = 36.666
 Subarea runoff = 170.010(CFS) for 91.220(Ac.)
 Total runoff = 200.220(CFS) Total area = 101.850(Ac.)
 Depth of flow = 1.203(Ft.), Average velocity = 11.235(Ft/s)
 Critical depth = 1.813(Ft.)
 End of computations, total study area = 101.850 (Ac.)

System1100.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

TULE WIND PROJECT
SYSTEM 1100
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.760
24 hour precipitation(inches) = 7.380
P6/P24 = 50.9%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 1100.100 to Point/Station 1100.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance = 76.500(Ft.)
Highest elevation = 4580.000(Ft.)
Lowest elevation = 4570.800(Ft.)
Elevation difference = 9.200(Ft.) slope = 12.026 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 12.03 %, in a development type of
1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 6.13 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (\% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.320) * (100.000^{.5})] / (12.026^{(1/3)}) = 6.13$
Rainfall intensity (I) = 8.688(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff = 0.417(CFS)
Total initial stream area = 0.150(Ac.)

System1100.out

+++++
 Process from Point/Station 1100.200 to Point/Station 1100.300
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 4570.800(Ft.)
 Downstream point elevation = 4441.000(Ft.)
 Channel length thru subarea = 1661.700(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 25.351(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 25.351(CFS)
 Depth of flow = 0.414(Ft.), Average velocity = 5.252(Ft/s)
 Channel flow top width = 13.313(Ft.)
 Flow Velocity = 5.25(Ft/s)
 Travel time = 5.27 min.
 Time of concentration = 11.40 min.
 Critical depth = 0.539(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.320
 Rainfall intensity = 5.821(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.320 CA = 8.621
 Subarea runoff = 49.769(CFS) for 26.790(Ac.)
 Total runoff = 50.186(CFS) Total area = 26.940(Ac.)
 Depth of flow = 0.612(Ft.), Average velocity = 6.593(Ft/s)
 Critical depth = 0.820(Ft.)

+++++
 Process from Point/Station 1100.300 to Point/Station 1100.400
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 4441.000(Ft.)
 Downstream point elevation = 4230.300(Ft.)
 Channel length thru subarea = 2733.000(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 253.519(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 253.519(CFS)
 Depth of flow = 1.482(Ft.), Average velocity = 10.739(Ft/s)
 Channel flow top width = 21.856(Ft.)
 Flow Velocity = 10.74(Ft/s)
 Travel time = 4.24 min.
 Time of concentration = 15.64 min.
 Critical depth = 2.063(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.120
 Decimal fraction soil group B = 0.870
 Decimal fraction soil group C = 0.010
 Decimal fraction soil group D = 0.000

System1100.out

[LOW DENSITY RESIDENTIAL
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.314
Rainfall intensity = 4.747(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.315 CA = 96.219
Subarea runoff = 406.583(CFS) for 278.620(Ac.)
Total runoff = 456.769(CFS) Total area = 305.560(Ac.)
Depth of flow = 2.003(Ft.), Average velocity = 12.664(Ft/s)
Critical depth = 2.813(Ft.)

+++++
Process from Point/Station 1100.400 to Point/Station 1100.500
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 4230.300(Ft.)
Downstream point elevation = 4140.000(Ft.)
Channel length thru subarea = 3542.300(Ft.)
Channel base width = 10.000(Ft.)
Slope or 'Z' of left channel bank = 4.000
Slope or 'Z' of right channel bank = 4.000
Estimated mean flow rate at midpoint of channel = 608.056(CFS)
Manning's 'N' = 0.040
Maximum depth of channel = 5.000(Ft.)
Flow(q) thru subarea = 608.056(CFS)
Depth of flow = 3.018(Ft.), Average velocity = 9.129(Ft/s)
Channel flow top width = 34.143(Ft.)
Flow Velocity = 9.13(Ft/s)
Travel time = 6.47 min.
Time of concentration = 22.11 min.
Critical depth = 3.250(Ft.)
Adding area flow to channel
Decimal fraction soil group A = 0.150
Decimal fraction soil group B = 0.830
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.020

[LOW DENSITY RESIDENTIAL
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.314
Rainfall intensity = 3.798(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.315 CA = 199.938
Subarea runoff = 302.510(CFS) for 330.000(Ac.)
Total runoff = 759.278(CFS) Total area = 635.560(Ac.)
Depth of flow = 3.352(Ft.), Average velocity = 9.678(Ft/s)
Critical depth = 3.625(Ft.)
End of computations, total study area = 635.560 (Ac.)

system1200.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/01/10

Tule Wind Project
System 1200
Existing 100 Year
June 4, 2010

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.000
24 hour precipitation(inches) = 5.050
P6/P24 = 59.4%
San Diego hydrology manual 'C' values used

++++++
Process from Point/Station 1200.100 to Point/Station 1200.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance = 307.190(Ft.)
Highest elevation = 4047.500(Ft.)
Lowest elevation = 4025.000(Ft.)
Elevation difference = 22.500(Ft.) slope = 7.324 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 7.32 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 7.23 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.320) * (100.000^{.5})] / (7.324^{(1/3)}) = 7.23$
Rainfall intensity (I) = 6.231(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff = 1.256(CFS)
Total initial stream area = 0.630(Ac.)

++++++
Page 1

system1200.out

Process from Point/Station 1200.200 to Point/Station 1200.500
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 4025.000(Ft.)
 Downstream point elevation = 3200.000(Ft.)
 Channel length thru subarea = 7965.330(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 130.799(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 130.799(CFS)
 Depth of flow = 0.963(Ft.), Average velocity = 9.810(Ft/s)
 Channel flow top width = 17.701(Ft.)
 Flow Velocity = 9.81(Ft/s)
 Travel time = 13.53 min.
 Time of concentration = 20.76 min.
 Critical depth = 1.438(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.070
 Decimal fraction soil group B = 0.130
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.800
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.389
 Rainfall intensity = 3.155(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.388 CA = 82.482
 Subarea runoff = 259.009(CFS) for 211.790(Ac.)
 Total runoff = 260.265(CFS) Total area = 212.420(Ac.)
 Depth of flow = 1.391(Ft.), Average velocity = 12.022(Ft/s)
 Critical depth = 2.094(Ft.)

+++++
 Process from Point/Station 1200.200 to Point/Station 1200.500
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
 Stream flow area = 212.420(Ac.)
 Runoff from this stream = 260.265(CFS)
 Time of concentration = 20.76 min.
 Rainfall intensity = 3.155(In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	260.265	20.76	3.155

Qmax(1) = 1.000 * 1.000 * 260.265) + = 260.265

Total of 1 streams to confluence:
 Flow rates before confluence point:
 260.265
 Maximum flow rates at confluence using above data:
 260.265
 Area of streams before confluence:
 212.420

system1200.out

Results of confluence:

Total flow rate = 260.265(CFS)
Time of concentration = 20.762 min.
Effective stream area after confluence = 212.420(Ac.)

+++++
Process from Point/Station 1200.300 to Point/Station 1200.400
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance = 203.190(Ft.)
Highest elevation = 3965.000(Ft.)
Lowest elevation = 3935.000(Ft.)
Elevation difference = 30.000(Ft.) slope = 14.765 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 14.77 %, in a development type of
1.0 DU/A or Less
In Accordance with Figure 3-3
Initial Area Time of Concentration = 5.72 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{1.5}] / (\% slope^{1/3})$
 $TC = [1.8 * (1.1 - 0.3200) * (100.000^{1.5})] / (14.765^{1/3}) = 5.72$
Rainfall intensity (I) = 7.245(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff = 1.391(CFS)
Total initial stream area = 0.600(Ac.)

+++++
Process from Point/Station 1200.400 to Point/Station 1200.500
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 3935.000(Ft.)
Downstream point elevation = 3200.000(Ft.)
Channel length thru subarea = 6390.380(Ft.)
Channel base width = 10.000(Ft.)
Slope or 'Z' of left channel bank = 4.000
Slope or 'Z' of right channel bank = 4.000
Estimated mean flow rate at midpoint of channel = 211.854(CFS)
Manning's 'N' = 0.040
Maximum depth of channel = 5.000(Ft.)
Flow(q) thru subarea = 211.854(CFS)
Depth of flow = 1.214(Ft.), Average velocity = 11.753(Ft/s)
Channel flow top width = 19.708(Ft.)
Flow Velocity = 11.75(Ft/s)
Travel time = 9.06 min.
Time of concentration = 14.79 min.
Critical depth = 1.875(Ft.)
Adding area flow to channel
Decimal fraction soil group A = 0.040
Decimal fraction soil group B = 0.120
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.840
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)

system1200.out

Impervious value, $A_i = 0.100$
 Sub-Area C Value = 0.394
 Rainfall intensity = 3.928(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 ($Q=KCIA$) is $C = 0.393$ $CA = 107.495$
 Subarea runoff = 420.837(CFS) for 272.620(Ac.)
 Total runoff = 422.228(CFS) Total area = 273.220(Ac.)
 Depth of flow = 1.739(Ft.), Average velocity = 14.318(Ft/s)
 Critical depth = 2.688(Ft.)

++++++
 Process from Point/Station 1200.400 to Point/Station 1200.500
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
 Stream flow area = 273.220(Ac.)
 Runoff from this stream = 422.228(CFS)
 Time of concentration = 14.79 min.
 Rainfall intensity = 3.928(In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	422.228	14.79	3.928

$Q_{max}(1) = 1.000 * 1.000 * 422.228) + = 422.228$

Total of 1 streams to confluence:
 Flow rates before confluence point:
 422.228
 Maximum flow rates at confluence using above data:
 422.228
 Area of streams before confluence:
 273.220
 Results of confluence:
 Total flow rate = 422.228(CFS)
 Time of concentration = 14.785 min.
 Effective stream area after confluence = 273.220(Ac.)
 End of computations, total study area = 485.640 (Ac.)

System1300.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/04/11

TULE WIND PROJECT
SYSTEM 1300
100 YEAR EVENT

***** Hydrology Study Control Information *****

Program License Serial Number 4055

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.030
24 hour precipitation(inches) = 5.400
P6/P24 = 56.1%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 1300.100 to Point/Station 1300.200
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance = 339.600(Ft.)
Highest elevation = 3807.000(Ft.)
Lowest elevation = 3800.000(Ft.)
Elevation difference = 7.000(Ft.) slope = 2.061 %
Top of Initial Area Slope adjusted by User to 16.622 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 16.62 %, in a development type of
1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration = 5.50 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{1.5} / (% slope^{1/3})]$
 $TC = [1.8 * (1.1 - 0.320) * (100.000^{1.5}) / (16.622^{1/3})] = 5.50$
Rainfall intensity (I) = 7.506(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff = 0.913(CFS)
Total initial stream area = 0.380(Ac.)

System1300.out

+++++
 Process from Point/Station 1300.200 to Point/Station 1300.300
 ***** IMPROVED CHANNEL TRAVEL TIME *****

Upstream point elevation = 3800.000(Ft.)
 Downstream point elevation = 3720.000(Ft.)
 Channel length thru subarea = 1338.800(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 7.360(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 7.360(CFS)
 Depth of flow = 0.218(Ft.), Average velocity = 3.112(Ft/s)
 Channel flow top width = 11.741(Ft.)
 Flow Velocity = 3.11(Ft/s)
 Travel time = 7.17 min.
 Time of concentration = 12.67 min.
 Critical depth = 0.246(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.320
 Rainfall intensity = 4.382(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.320 CA = 3.133
 Subarea runoff = 12.815(CFS) for 9.410(Ac.)
 Total runoff = 13.728(CFS) Total area = 9.790(Ac.)
 Depth of flow = 0.314(Ft.), Average velocity = 3.890(Ft/s)
 Critical depth = 0.367(Ft.)

+++++
 Process from Point/Station 1300.300 to Point/Station 1300.400
 ***** IMPROVED CHANNEL TRAVEL TIME *****

Upstream point elevation = 3720.000(Ft.)
 Downstream point elevation = 3614.000(Ft.)
 Channel length thru subarea = 2883.300(Ft.)
 Channel base width = 10.000(Ft.)
 Slope or 'Z' of left channel bank = 4.000
 Slope or 'Z' of right channel bank = 4.000
 Estimated mean flow rate at midpoint of channel = 40.857(CFS)
 Manning's 'N' = 0.040
 Maximum depth of channel = 5.000(Ft.)
 Flow(q) thru subarea = 40.857(CFS)
 Depth of flow = 0.673(Ft.), Average velocity = 4.779(Ft/s)
 Channel flow top width = 15.388(Ft.)
 Flow Velocity = 4.78(Ft/s)
 Travel time = 10.05 min.
 Time of concentration = 22.73 min.
 Critical depth = 0.727(Ft.)
 Adding area flow to channel
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000

System1300.out
 Decimal fraction soil group D = 0.000
 [LOW DENSITY RESIDENTIAL]
 (1.0 DU/A or Less)
 Impervious value, Ai = 0.100
 Sub-Area C Value = 0.320
 Rainfall intensity = 3.006(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.320 CA = 22.595
 Subarea runoff = 54.202(CFS) for 60.820(Ac.)
 Total runoff = 67.930(CFS) Total area = 70.610(Ac.)
 Depth of flow = 0.893(Ft.), Average velocity = 5.605(Ft/s)
 Critical depth = 0.984(Ft.)
 End of computations, total study area = 70.610 (Ac.)

Tule Wind Project Preliminary EIS/EIR Drainage Report

APPENDIX D – Proposed Conditions Hydrology Summary



Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

No: Rev 1

**Proposed Conditions, Unit Hydrograph
Watershed Loss**

Watershed	A (mi ²)	A (ac)	CN (AMC II)	PZN	PZN (>35yr)	CN (>35yr)	Soil Type
Tule Creek	28.52	18250	74	3.42	2.58	82	2.1
Bow Willow Creek North	4.29	2747	84	3.37	2.63	90	3.3
Bow Willow Creek South	8.12	5197	81	3.40	2.60	88	3.0
Northern Unnamed Wash	2.41	1542	77	3.51	2.49	83	2.1
Eastern Unnamed Wash	1.15	734	80	3.55	2.45	85	2.7
Western Unnamed Wash	2.25	1440	69	3.30	2.70	80	2.0
Simmons Canyon	1.37	878	80	3.23	2.77	89	2.5

Watershed Lag

Watershed	Elev US (ft)	Elev DS (ft)	L (mi)	Lca (mi)	Slope (ft/mi)	Basin n	m	lag (hr)
Tule Creek	5802.5	3473	12.13	5.14	192	0.040	0.38	1.70
Bow Willow Creek North	5620	3930	4.91	2.33	344	0.040	0.38	0.80
Bow Willow Creek South	5642	3410	6.55	2.65	341	0.040	0.38	0.94
Northern Unnamed Wash	4156	3765	2.51	0.83	156	0.040	0.38	0.49
Eastern Unnamed Wash	4125	3620	1.91	0.74	265	0.040	0.38	0.38
Western Unnamed Wash	4795	4140	2.06	0.43	318	0.040	0.38	0.31
Simmons Canyon	5652	4120	2.19	0.79	701	0.040	0.38	0.34

Subwatershed Rainfall, Inches (SDC Hydrology Manual)

Watershed	100Yr 6Hr	100Yr 24Hr
Tule Creek	3.36	6.41
Bow Willow Creek North	3.26	6.43
Bow Willow Creek South	3.37	9.70
Northern Unnamed Wash	3.00	6.31
Eastern Unnamed Wash	3.00	5.40
Western Unnamed Wash	3.92	5.01
Simmons Canyon	4.12	8.00

$$lag = 24n \left(\frac{L \bullet L_{cu}}{S^{0.5}} \right)^m$$



Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

No: Rev 1

Proposed Permanent Impact Summary

Watershed	Basin Area (acres)	Perm Impacted Area	% Impacted	Turbines	O&M	Substation	Total Impervious Area (sq ft)	Total Impervious Area (acres)	% Impervious
Tule Creek	18250.10	174.13	0.95%	40			14366	0.329807071	0.002%
Bow Willow Creek North	2746.89	31.00	1.13%	10.5			3771	0.086574356	0.003%
Bow Willow Creek South	5197.41	81.47	1.57%	21.5			7722	0.177271301	0.003%
Northern Unnamed Wash	1541.63	60.82	3.95%	13.5		1	13849	0.317921457	0.021%
Eastern Unnamed Wash	734.43	11.63	1.58%	3			1077	0.02473553	0.003%
Western Unnamed Wash	1439.89	9.69	0.67%	0			0	0	0.000%
Simmons Canyon	877.79	18.99	2.16%	4.5			1616	0.037103295	0.004%
100	86.22	6.26	7.26%	2			718	0.016490354	0.019%
200	375.66	9.12	2.43%	3			1077	0.02473553	0.007%
300	241.52	20.56	8.51%	5.5			1975	0.045348472	0.019%
400	73.46	3.68	5.01%	1.5			539	0.012367765	0.017%
500	191.71	13.19	6.88%	3			1077	0.02473553	0.013%
600	164.61	3.46	2.10%	1			359	0.008245177	0.005%
700	122.03	3.41	2.79%	1			359	0.008245177	0.007%
800	475.25	38.52	8.11%	12			4310	0.098942121	0.021%
900	188.92	12.22	6.47%	3.5			1257	0.028858119	0.015%
1000	102.10	1.98	1.94%	0.5			180	0.004122588	0.004%
1100	635.56	5.08	0.80%	0			0	0	0.000%
1200	485.64	6.04	1.24%	2			718	0.016490354	0.003%
1300	70.6167	0.96	1.35%	0			0	0	0.000%
Totals	34001.44	512.21		128			54972	1.261994197	0.00%

Tule Wind Project Preliminary EIS/EIR Drainage Report

EXHIBITS

Exhibit A – Existing Conditions Hydrology Map

Exhibit B – Proposed Conditions Hydrology Map

Exhibit C – Western Proposed Conditions Hydrology Map

Exhibit D – Eastern Proposed Conditions Hydrology Map

