

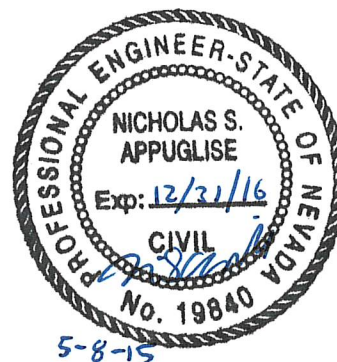
**GOWAN NORTH BUFFALO BRANCH –
LONE MOUNTAIN TO WASHBURN**

30% Preliminary Design Report

(GOBU 0112 and GOBU 0136)

May 7, 2015

**Prepared for:
City of Las Vegas**



Prepared By:

**Parsons Brinckerhoff
3753 Howard Hughes Parkway
Suite 135
Las Vegas, NV 89169
TEL: 702-697-8100
FAX: 702-697-8170**

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EXECUTIVE SUMMARY

The purpose of the Project is to provide a Clark County Regional Flood Control District (CCRFCD) Master Plan flood control facility to collect major storm flows generated within the Project watershed. The Project is located between Buffalo Drive to the east, Cimarron Road to the west, Washburn Road to the north and Lone Mountain Road to the south. The proposed improvements fall within two jurisdictions, the City of Las Vegas (City) and Clark County (County). The facility is designated within the 2013 CCRFCD Master Plan Updated (MPU) as GOBU 0112 and GOBU 0136. This facility will be the final extension of the Gowan North Buffalo Branch system.

An alternative alignment analysis was performed at the 15% design level. Three alternatives were studied. Alignment B, which runs along Conough Lane, was selected as the preferred alignment. This alignment is the most efficient storm drain system and provides the most beneficial use to the community. The following table summarizes the selection criterion and alignment ranking.

No.	Criterion	Alignment A	Alignment B	Alignment C
1	Hydraulics	54	81	63
2	Street Spread Criteria	32	72	72
3	Local Drainage Issues	20	45	35
4	Constructability	28	49	42
5	Maintenance	12	20	20
6	Right of Way	1	1	1
7	Cost	48	24	30
-	Total Alignment Score	195	292	263
-	Alignment Rank	3	1	2

During the alternative alignment analysis, it was determined that the majority of the Project watershed drains south towards Lone Mountain Road, with a minority draining east towards Buffalo Drive. A detailed hydrologic analysis was performed to determine the Project watershed drainage pattern.

The proposed storm drain is designed to capture and convey runoff from the 100-year storm. The Project watershed was delineated into Major Basins and Minor Basins. The MPU trunkline facility is designed for regional level storm events, and is therefore sized using the Major Basin flowrates. Minor Basin flows are used to determine inlet spacing, street spread, surface flow depths, and lateral pipe sizes.

A WSPG analysis was performed to evaluate the box culvert hydraulics. The culvert is designed to maintain at least one foot between finished grade and hydraulic grade line (HGL). In most cases, however, the HGL is contained within the storm drain, operating without pressure flow.

Inlets are placed in locations with curb and gutter whenever possible. Curb and gutter inlets are more efficient at capturing runoff than area drains placed within

roadside swales. Area drains are also prone to being clogged by high volumes of sediment.

The proposed storm drain addresses several existing drainage concerns within the Project watershed. The existing bubbler system at Cimarron Road and Lone Mountain Road is ineffective, causing frequent ponding and has received citizen complaints. The existing bubbler will be removed and replaced. In addition, there is existing shallow flooding at the intersection of Conough Lane and La Madre Way, significant street spread along Lone Mountain Road west of Buffalo Drive and sheet flow over a superelevated section of Buffalo Drive north of Lone Mountain Road. The proposed improvements mitigate each of these existing drainage concerns.

The following table summarizes the proposed storm drain facility sizes and associated flowrates, based on the Major Basin map.

Station		Size	Slope	100-year Flow
From	To	(W x H)	(%)	(cfs)
"LM" 9+09	"LM" 9+64	7'x4' RCB	0.75	247
"LM" 9+64	"LM" 12+09	7'x4' RCB	0.75	284
"LM" 12+09	"LM" 24+61	7'x5' RCB	0.91-0.92	284
"LM" 24+61	"LM" 37+72	8'x5' RCB	0.63-0.78	464
"W" 9+67	"W" 23+47	48" RCP	0.93-2.37	102
"CO" 37+47	"CO" 30+90	5'x5' RCB	0.52-0.54	102
"CO" 30+90	"CO" 10+03	5'x5' RCB	0.50-0.55	189
"B" 22+19	"B" 11+18	48" RCP	0.50	35

Utility conflicts have been minimized wherever possible. Unavoidable conflicts will be coordinated as the design continues. There are several potential utility conflicts that will be carefully considered as the design progresses. The corner of Cimarron Road and Lone Mountain Road is of particular interest, with an existing 42-inch water line running in Cimarron Road. See section 8.0 of this report for a full discussion of potential utility conflicts.

No additional right of way is anticipated for construction of the Project. A summary of required permits can be found in Appendix D. The "Safe Route to School" along Lone Mountain Road will be protected. The preliminary cost to construct the proposed storm drain facility is estimated to be \$4.6 Million. The following table summarizes the estimated cost to construct.

ITEM NO.	ITEM DESCRIPTION	U O M	APPROX QTY	UNIT PRICE	EXTENDED PRICE
603.01	18-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	888	\$80	\$71,015
603.02	24-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	258	\$95	\$24,492
603.03	30-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	79	\$130	\$10,258
603.04	36-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	95	\$140	\$13,293
603.05	42-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	67	\$200	\$13,384
603.06	48-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	2,431	\$225	\$547,074
603.07	5' X 5' RCB	LF	2,751	\$375	\$1,031,670
603.08	7' X 4' RCB	LF	295	\$400	\$118,080
603.09	7' X 5' RCB	LF	1,232	\$400	\$492,656
603.10	8' X 5' RCB	LF	1,311	\$450	\$589,734
609.01	10-FOOT TYPE DM DROP INLET	EA	3	\$12,000	\$36,000
609.02	20-FOOT TYPE DM DROP INLET	EA	10	\$20,000	\$200,000
609.03	NDOT TYPE 2B DROP INLET	EA	22	\$5,000	\$110,000
609.04	TYPE II STORM DRAIN MANHOLE	EA	9	\$6,000	\$54,000
609.05	ACCESS MANHOLE	EA	15	\$6,000	\$90,000
609.06	JUNCTION STRUCTURE	EA	2	\$3,000	\$6,000
107.01	TRAFFIC CONTROL	DAY	200	\$300	\$60,000
302.00	AGGREGATE BASE	CY	5,000	\$25	\$125,000
402.00	PLANT MIX SURFACING	TON	5,000	\$75	\$375,000
				SUBTOTAL	\$3,967,656
				20% CONTINGENCY	\$681,531
				SUBTOTAL CONSTRUCTION	\$4,649,188
				7% CONSTRUCTION MANAGEMENT	\$325,443
				TOTAL	\$4,974,631

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1.0 INTRODUCTION AND PURPOSE

1.1 Location of Project

The storm drain facility in this report is for Gowan North Buffalo Branch – Lone Mountain to Washburn (Project). The Project is located between Buffalo Drive to the east, Cimarron Road to the west, Washburn Road to the north and Lone Mountain Road to the south. The proposed improvements fall within two jurisdictions, the City of Las Vegas (City) and Clark County (County). The Project is located in Township 19 south, Range 60 east, in Sections 33 and 34, with a portion of the Project falling within Township 20 south, Range 60 east, Sections 3 and 4. Refer to Appendix A.1 for the vicinity map.

1.2 Project Description

The purpose of the Project is to provide a Clark County Regional Flood Control District (CCRFGD) Master Plan flood control facility to collect major storm flows generated within the Project watershed. The facility is designated within the 2013 CCRFGD Master Plan Updated (MPU) as GOBU 0112 and GOBU 0136. This facility will be the final extension of the Gowan North Buffalo Branch system.

1.3 Drainage Design Scope

The Project includes the design and preparation of contract drawings, design report, special provisions and cost estimates for the Gowan North Buffalo Branch – Lone Mountain to Washburn storm drain (GOBU 0112 and 0136). The facility will be designed according to City of Las Vegas and Clark County drainage design criteria.

The MPU facility will be designed to convey the ultimate condition 100-year storm flows. The ultimate condition assumes that all existing and proposed MPU facilities are fully functional, and all future development is constructed based on the current land use zoning. Design includes analysis of the Project watershed, evaluation of existing storm drain facilities, identification of potential utility conflicts and relocations, and proposing storm drain systems as required.

1.4 Alternative Alignment Study Results

The 15% Alternative Alignment Study evaluated three storm drain collection system alternatives to determine which alignment is the most effective. Appendix A includes a map showing the three alignments considered. Alignment B was recommended as the preferred alternative for detailed design and construction. This alignment is the most efficient storm drain system and provides the most beneficial use to the community. The following table summarizes the alignment selection criteria and ranking.

Table 1.1: Alignment Selection

No.	Criterion	Alignment A	Alignment B	Alignment C
1	Hydraulics	54	81	63
2	Street Spread Criteria	32	72	72
3	Local Drainage Issues	20	45	35
4	Constructability	28	49	42
5	Maintenance	12	20	20
6	Right of Way	1	1	1
7	Cost	48	24	30
-	Total Alignment Score	195	292	263
-	Alignment Rank	3	1	2

The study also included an evaluation of three different types of catch basins for use in roadside swales to maximize capture efficiency in undeveloped, rural roadway segments. The City of Las Vegas has agreed Alignment B will be the alternative this technical drainage study will design for and the preferred catch basin to utilize in roadside swales is the NDOT Type 2B Inlet with concrete apron. This alignment will require a Master Plan Amendment (MPA).

Refer to the Gowan North Buffalo Branch Lone Mountain to Washburn 15% Alternative Alignment Study for further discussion on the selection of the preferred alignment.

1.5 Data Collection

1.5.1 Reference Studies

The following reference materials were reviewed:

- 2013 CCRFCD MPU study is referenced to identify the most current developments and existing regional flood control facilities within the Project watershed.
- GC Wallace, 1999 Drainage Study for Road Improvements for Buffalo Drive Between Cheyenne Avenue and Lone Mountain Road. This report covers design of the existing Gowan North Buffalo Branch system.
- Technical Drainage Studies from land development within City and County.
- City of Las Vegas Flood Control Facilities Inventory and City Wide Hydrology Analysis, December 1997

A full list of references can be found in Section 11.0 References.

1.5.2 Utilities

Existing utilities located within the Project site limits were obtained by contacting the utility companies. The companies contacted include Southwest Gas, Nevada Energy, Clark County Water Reclamation District, Century Link, City of Las Vegas, Cox Communications, and Las Vegas Valley Water District. Please refer to Appendix D for the utility matrix. Based upon as-builts provided by the agencies, the existing utilities were drafted in AutoCAD. Horizontal utility designations were performed to attain more accurate locations of utilities at key

design locations. All visible utilities were surveyed along with the designated sub-surface utilities and dip elevations were surveyed for existing storm drain and sewer. See Section 6.0 for further discussion on utilities interacting with the Project.

1.5.3 Survey

Aerial topographic mapping was conducted by a sub-consultant for the Project area. Control and boundary surveys were performed by the survey sub-consultant. Vertical control is based on City of Las Vegas NAVD88 datum. A Record of Survey including roadway alignments, right-of-way lines and found survey monuments was approved by the City Surveyor.

Additional ground survey was requested at key intersections as well as for all visible surface utilities, horizontal utility designations, storm drain and sewer manhole dips, and geotechnical boring locations.

See Appendix D for the Record of Survey

1.5.4 Geotechnical

Geotechnical exploration was performed by sub-consultant. The geotechnical data report contains information about the Project site discovered during investigations, including boring logs and tests. The geotechnical interpretive report includes interpretations and recommendations. In general the site is considered suitable for construction of a storm drain. Further recommendations for design and construction can be found in the geotechnical interpretative report.

Please refer to the Geotechnical Data Report and the Geotechnical Interpretive Report for Gowan North Buffalo Branch Storm Drain both prepared by Terracon Consultants, Inc, dated March 27, 2015, which are included as supplemental material to this design report.

2.0 GENERAL DRAINAGE DESCRIPTION

2.1 Project Site Characteristics and Drainage Patterns

The limits of the watershed tributary to the Project extend from Buffalo Drive on the east to El Capitan Way on the west and from Lone Mountain Road on the south to Ann Road on the north. The Project watershed includes MPU drainage basins GD24AA-C, GD20AA-C and GC20AB-C. The watershed is mostly low density residential with some higher density residential, a school, a park, and pockets of undeveloped desert lots. Refer to Appendix A.3 - 2013 MPU Hydrologic Map.

The drainage pattern is generally from northwest to southeast, with the streets either carrying flow south or east as it flows towards the intersection of Buffalo Drive and Lone Mountain Road. The primary drainage conveyance facilities within the watershed are streets and small swales alongside the streets. There are existing inlets and storm drain pipe along Durango Road and Lone Mountain Road.

The existing Gowan North Buffalo Branch MPU facility provides flood protection for US 95 and conveys storm runoff south to the existing Upper Gowan North Detention Basin (GONO 0008). The system begins near the intersection of Alexander Road and Buffalo Drive, and extends north, terminating at the intersection of Buffalo Drive and Lone Mountain Road (GOBU 0000, GOBU 0032, GOBU 0058, and GOBU 0085). Per the MPU, runoff from the Project watershed is collected and conveyed to the upstream end of GOBU 0085. Refer to Appendix A.4 and A.4A for the 2013 MPU Facilities Map and Inventory.

2.2 Ownership and Zoning

The Project watershed is primarily within County jurisdiction, with sporadic pockets of City jurisdiction.

The City and County have different offsite requirements for land development. As a result, most of the roads within the Project watershed have intermittent curb and gutter that start and stop based on jurisdictional boundaries. Much of the Project watershed is comprised of rural residential neighborhoods. Within the County, there is a Residential Neighborhood Preservation (RNP) overlay, which was established to ensure that the rural character of residential development is preserved. As such, many communities within RNP preserve unpaved shoulders within street right of way.

2.3 FEMA Flood Insurance Rate Maps

Special Flood Hazard Areas (SFHA) for the Project are outlined in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) 32003C1745 E and 3200C2135 F, dated September 27, 2002 and November 16, 2011 respectively. These two maps have a Letter of Map Change that revalidates the determinations for properties in the referenced community, dated

November 17, 2011. Upon reviewing Map Numbers 32003C1745 E and 3200C2135 F, the proposed site lies within a FEMA designated Zone X. This area is described to be outside of the 0.2% annual chance floodplain, which indicates the Project area is not located within a FEMA floodplain. Refer to Appendix A.5.

2.4 Regional Flood Control Facilities

The following regional flood control facilities drain north to south and are referenced directly from the 2013 MPU.

Table 2.1: Regional Flood Control Facilities

Condition	Facility ID	From	To	RCB Size	MPU Flow
(-)	(-)	(-)	(-)	(W ft x H ft)	(cfs)
Proposed	GOBU 0136	Washburn Road	La Madre Way	7 x 6	344
Proposed	GOBU 0112	La Madre Way	Lone Mountain Road	8 x 6	484
Existing	GOBU 0085	Lone Mountain Road	Red Coach Avenue	11 x 5	614
Existing	GOBU 0058	Red Coach Avenue	Craig Road	(2) 11 x 4	745
Existing	GOBU 0032	Craig Road	Hickam Avenue	(2) 12 x 5	850
Existing	GOBU 0000	Hickam Avenue	Alexander Road	(2) 12 x 6	961

The Buffalo Branch system ultimately connects to the 921 ac-ft Gowan North Detention Basin (GONO 0008).

See Appendix A.4 for MPU facilities map. As-built plans for facility GOBU 0085 are provided in Appendix D.

2.5 Existing Local Facilities

The following is a summary of the existing, locally maintained storm drain facilities in the Project's watershed area. See Appendix A.4 for a map of their locations.

Lone Mountain Road System

There is an existing storm drain system located within Lone Mountain Road between Buffalo Drive and Conough Lane. The trunkline consists of a 48-inch Reinforced Concrete Pipe (RCP) which transitions to a 60-inch RCP just before connecting to Regional facility GOBU 0085. There are four (4) 20-foot long curb opening and grate inlets located on Lone Mountain Road just west of Buffalo Drive, two (2) on the north side and two (2) on the south side. There are additional inlets along the curb on the south half of Lone Mountain Road, west of Buffalo Drive. One is located approximately 80 feet east of Miller Lane. Another is at the southwest corner of the Miller Lane intersection and the last is at the southeast corner of the Conough Lane intersection.

At the corner of Cimarron Road and Lone Mountain Road, there is a bubbler system that collects runoff from the Cimarron Estates Community, conveys flow under Cimarron Road in an 18-inch RCP, then bubbles out on the east side of Cimarron Road.

A concrete swale lined with rock, located from Cimarron Road to Conough Lane, drains to an 18-inch concrete culvert at the southwest corner of Lone Mountain Road and Conough Lane. The flow continues east in a 42-inch RCP under Lone Mountain Road.

A 4-foot by 2-foot reinforced concrete box (RCB) at the southwest corner of Durango Drive and Lone Mountain Road collects flow from Mountain Crest Park. The RCB crosses underneath Durango Drive to a bubbler grate at the southeast corner. The flow spills out of the grate and continues east on Lone Mountain Road.

Durango Drive System

The Durango Drive local storm drain system runs from the intersection of Lone Mountain Road to Hammer Lane. The system starts at Hammer Lane as a 24-inch RCP and runs south to Lone Mountain Drive, increasing in size to a 30-inch RCP, 36-inch RCP and 42-inch RCP. The system connects to the 4-foot by 2-foot RCB system located in Lone Mountain Drive. Storm drain inlets are located along Durango Drive on both the west and east sides.

Buffalo Drive System

There are existing storm drain inlets at the northwest and northeast corners of the intersection of Buffalo Drive and Lone Mountain Road. These inlets connect to an existing 8-foot by 3-foot RCB in Buffalo Drive, which continues south on Buffalo Drive via the existing GOBU 0085 system.

2.6 Existing Drainage Concerns

There are several areas of local flooding within the Project watershed. Please refer to the Gowan North Buffalo Branch – Lone Mountain to Washburn 15% Alternative Alignment Study, section 2.7, for a full discussion on the existing drainage concerns, which also includes a photo log. A brief discussion on the existing drainage concerns are in the following sections.

2.6.1 Cimarron Road and Lone Mountain Road

CCRCD has received citizen complaints about the frequent flooding at this intersection. See Appendix D for a citizen complaint about this intersection, received on October 15, 2014. The complaint cites that waters continually back up to the properties. The existing bubbler system is ineffective and roadway runoff ponds at the corner.

2.6.2 Conough Lane and La Madre Way

The gradual slopes at poorly defined street sections at the intersection of Conough Lane and La Madre Way result in shallow flooding and ponding. Flow from the west enters the intersection, crosses Conough Lane, and splits to the east and south. Flow traveling south ponds south of the intersection, on the east half of Conough Lane.

2.6.3 Lone Mountain Road West of Buffalo Drive

The stretch of Lone Mountain Road between Buffalo Drive and Cimarron Road currently experiences significant spread and flow depths. As an arterial roadway, this road is expected to be subject to high traffic volumes in the future.

2.6.4 Buffalo Drive North of Lone Mountain Road

Buffalo Drive is superelevated to the east, north of Lone Mountain Road. The transition from crown to superelevation causes flow to sheet east over Buffalo Drive.

3.0 HYDROLOGY

3.1 Design Criteria

The design events evaluated for this Project were the 10-year and 100-year events, for a 6-hour return period, per the design criteria set forth in the CCRFCD Hydrologic Criteria and Drainage Design Manual (HCDDM).

3.2 Hydrologic Method

The US Army Corps of Engineers computer software HEC-1 Flood Hydrograph Package (USACOE, 1998) was used to develop peak flows to assess impacts to the Project site. The HEC-1 model for the Project is based on the Series A, SDN 3 Gowan Watershed MPU model, which was last updated in 2008. Series A is selected because the watershed is upstream of detention, where storm centering controls. The model was truncated to focus on the Project watershed, and modified to reflect the watershed parameters determined as part of this detailed study.

3.2.1 Rainfall Area and Intensities

The Project watershed site is located within the McCarran Airport Rainfall Area, in Sections 33 and 34 of Township 19 south, Range 60 east, Clark County, Nevada. Refer to Appendix A.6. The Depth-Duration-Frequency curves from Figures 503 and 506 of HCDDM are used to obtain the rainfall depths. Refer to Appendix A.7 and A.7A. The 10-year and 100-year 6-hour rainfall depths are 1.58 inches and 2.77 inches respectively. Refer to Appendix A.8. A small portion of the Project watershed is located outside of the McCarran Airport Rainfall Area. Weighted rainfall depths were calculated for these basins based on the GIS rainfall shapefile available through CCRFCD. Refer to Appendix B for weighted rainfall depth calculations. An SCS Type II SDN3 storm distribution was used due to the total drainage area being less than 8 square miles. Refer to Appendix A.9 and A.10 for the storm distribution and depth-area reduction factor tables.

3.2.2 Curve Number, Soil Types and Land Use

Precipitation losses were determined using the SCS Curve Number Method in accordance with Section 603 of HCDDM. The curve number is a parameter assigned to the drainage basin and used in the HEC-1 model to estimate rainfall loss from infiltration. The value of the curve number (CN) is based on the basin land use, soil type, and antecedent moisture condition (AMC). For the Las Vegas valley, an AMC-II condition is used for determining storm runoff.

The Project watershed lies within a partially developed rural area with most of the area being residential lots and pockets of undeveloped desert lots. The Project watershed consists of B and D soil types. The CN values utilized for the runoff calculations for the Project were calculated using the soil group and ultimate condition land use information provided in the 2013 MPU.

3.2.3 Time of Concentration and Lag Time

For the HEC-1 model, the time of concentration (T_c) and lag time calculations are performed per the procedures in the HCDDM. Refer to Appendix B for Standard Form 4 summary of Lag Time calculations.

3.3 Watershed Boundaries

The MPU basins are long and narrow, and are shown to drain from west to east until they reach Buffalo Drive. The MPU assumes that basins GD24AA-C and GD20AA-C contribute to proposed facility GOBU 0136 in Buffalo Drive. The MPU then assumes that basin GD20AB-C drains west to east to Buffalo Drive and is added to the total flow within proposed facility GOBU 0112.

The MPU takes a broad scale, planning level view of the drainage pattern within the valley and delineates basins that contribute to each facility. As part of this study, a detailed review of the Project watershed was performed to confirm watershed boundaries and flow pattern. Aerial survey was collected for the portion of the Project watershed between Cimarron Road and Buffalo Drive. Additional ground survey was attained at ten (10) key intersections. Numerous site visits were performed as well as review of Technical Drainage Studies in the neighborhoods. This extensive review resulted in a detailed view of the drainage pattern and flows that are being routed along roadways within the Project watershed.

It was confirmed that the outer boundary of the Project watershed matches what is presented in the MPU for basins GD24AA-C, GD20AA-C and GD20AB-C. The western boundary of the Project watershed is defined by the future MPU facility GOEC 0000 through GOEC 0076. This is an appropriate assumption since the MPU facility will be designed to ultimate condition, which includes construction of the GOEC system. The northern boundary of the watershed at Ann Road is preserved by a distinct highpoint within Durango Road just south of Ann Road that prevents any flow north of Ann Road entering into the Project watershed. In addition, there is a similar high point in Durango Road, just south of Lone Mountain Road, that prevents flow from leaving the watershed on the southern boundary. The only exception found is that the existing 4-foot x 2-foot RCB at the corner of Lone Mountain Road and Durango Drive contributes approximately 48 cfs in the 100-year event to the Project watershed. This runoff is generated within Mountain Crest Park, which is located outside of the watershed boundary.

3.4 Drainage Pattern

Within the Project watershed it was found that the drainage pattern differs from what is presented in the MPU. In general, it was found that a large portion of the watershed drains south to Lone Mountain Road before traveling east to the collection point at Lone Mountain Road and Buffalo Drive. This is mostly due to existing roadway geometry at certain intersections. For example, there is an

existing concrete valley gutter at the corner of Cimarron Road and La Madre Way that directs flow to drain from north to south through the intersection.

3.4.1 Noteworthy Roadway Geometry

During the 15% analysis, intersections of significance within the Project watershed were evaluated. The following summarizes a few roadway sections and intersections of note that affect the overall existing drainage pattern.

- Durango Road between Hammer Lane and Fisher Avenue: Durango Road is superelevated to the east. All flow within Durango Road will drain east.
- Durango Road at Washburn Road: Durango Road is in crown and the west half street capacity of Durango Road can contain the 100-year flow. The same goes for Durango Road at La Madre Way. Hence, all runoff generated west of Durango Road and south of Fisher Avenue drains south to Lone Mountain Road.
- Washburn Road at Tomsik Street: A flow split occurs.
- Washburn Road at Cimarron Road: A flow split occurs.
- Washburn Road between Tomsik Street and Conough Lane: Washburn Road is superelevated to the north. Between Conough Lane and Buffalo Drive, Washburn Road switches back to a crown section, with minimal runoff contributing to the south half. Runoff is conveyed east to Buffalo Drive.
- Tomsik Street at Rosada Way: A flow split occurs.
- Cimarron Road at La Madre Way: A valley gutter on the west half of the intersection contains the 100-year flow and conveys all runoff south towards Lone Mountain Road.
- Conough Lane at La Madre Way: A flow split occurs.
- Buffalo Drive at Rosada Way: There is a dip in Buffalo Drive allowing flow to drain from west to east at Rosada Way and exit the Project watershed.

3.4.2 Flow Split Estimation Approach

Flow approaching an intersection will either travel through the intersection along one roadway, or will split, dependent on the intersection geometry. Features such as valley gutters, dips, and crowns can direct flow to drain through an intersection on one road. There are two general cases.

- No Crown: Neither Road A or Road B are in crown through the intersection. When flow approaches the intersection, it will split, with a portion leaving the intersection via each downstream road. The flow will split based on the geometry of the two roads downstream of the intersection
- Crown: Road A is in crown through the intersection. Flow will be contained within Road A up to the half street capacity of Road A. Any flow in excess of the half street capacity of Road A will overtop the crown of Road A and will split as described above.

Many of the roads within the Project watershed are rural roads with paved travel lanes but no curb, gutter or sidewalk. Drainage is provided in shallow roadside ditches. Conventional methods for determining flow splits at intersections rely heavily on knowledge about the gutter flow lines. For this reason, flow split calculations have been simplified in the following way.

If a well defined crown is present in one of the intersecting roads, a half street capacity calculation was performed. If the half street capacity exceeds the total runoff contributing to the intersection, it is assumed that all flow is contained within the half street. If the flowrate contributing to the intersection exceeds the half street capacity, the excess flow is split. Flow that splits will leave the intersection either to the south or the east. The amount of flow splitting to each direction is estimated using the following approach

By simplifying the Manning's equation and eliminating negligible terms, it can be shown that the total flow contributing to an intersection Q_T can be represented as a function of roadway width W and longitudinal slope S .

$$Q_T \propto WS^{\frac{1}{2}}$$

By conservation of mass and energy, it can also be said that the total flow entering the intersection Q_T must equal the combined flow leaving the intersection via the south and east roads

$$Q_T = Q_S + Q_E$$

It is then possible to solve the two equations to estimate the flow splitting to the south versus east using a ratio based on the width and slope of the south and east roads.

$$Q_S = \frac{Q_T \left(\frac{W_S S_S^{1/2}}{W_E S_E^{1/2}} \right)}{\left[1 + \left(\frac{W_S S_S^{1/2}}{W_E S_E^{1/2}} \right) \right]}$$

See Appendix B for a worksheet showing the dimensional simplification of the Manning's equation to a ratio based on roadway geometry.

As a sanity check, the results obtained using the above approach were compared to the results obtained using the Pima County flow split method for several sample intersections. It was found that the results were consistently similar between the two methods.

3.5 Ultimate Condition Hydrology

Two HEC-1 models are developed to design the Gowan North Buffalo Branch storm drain system. The Major Basin model is used to design the mainline systems on Lone Mountain Road, Conough Lane, and Washburn Road. The Minor Basin model is used to analyze the size of the drop inlets, their respective laterals, and street spread criteria. The Minor Basin model will provide higher flow values than the Major Basin model at combination point locations. This

difference in flows can be attributed to smaller basins yielding higher flow rates than a model with larger basins due in part to shorter lag times. Hence, the Minor Basin model shall not be used to design the mainline, as it will be a highly conservative design. A detailed description of the models is presented below.

3.5.1 Major Basin Model

Nine (9) sub-basins are delineated on the Major Basin model. Refer to the Major Basin map provided in Appendix B to follow the routing description provided in this section. Runoff from sub-basin WAS1 will travel east to the intersection of Washburn Road and Tomsik Street. WAS1 flow will have a flow split at this intersection with flow splitting east and south. Flow going east on Washburn Road, from the intersection of Washburn Road and Tomsik Street, will travel through sub-basin WAS2 and combine with it at combination point CPWAS2 at the intersection of Washburn Road and Conough Lane. Flow traveling along Washburn Road between Cimarron Road and Conough Lane will be collected via drop inlets. The flow collected by these inlets will drain south at the intersection of Washburn Road and Conough Lane, via the proposed storm drain system in Conough Lane.

Any bypass flow not collected by the drop inlets will continue east on Washburn Road, through sub-basin BFN, to combination point CPBFN at the intersection of Washburn Road and Buffalo Drive. Washburn Road, between Tomsik Street and Conough Lane is superelevated to the north. Between Conough Lane and Buffalo Drive, Washburn Road switches back to a crown section, with minimal runoff contributing to the south half. Flow at the intersection of Washburn Road and Buffalo Drive will continue east on Washburn Road, outside the Project area, towards Rancho Drive and US Interstate 95.

The flow going south at the intersection of Washburn Road and Tomsik Street will travel through sub-basin LNM2 to combination point CPLNM2, at the intersection of Rosada Way and Tomsik Street. A flow split occurs at this intersection, with flow going south towards Lone Mountain Road and the remaining going east through sub-basin CON to combination point CPCON, just north of the intersection of Lone Mountain Road and Conough Lane. Flow going south at the intersection of Rosada Way and Tomsik Street will travel through sub-basin LNM1 to combination point CPLNM1 at the intersection of Lone Mountain Road and Cimarron Road. Additional offsite flow from Mountain Crest Park, located at the southwest corner of Lone Mountain Road and Durango Drive, contributes 48 cfs in the 100-year storm event to Lone Mountain Drive via a 4-foot x 2-foot RCB bubbler system. This bubbler system daylights flow at the southeast corner of Lone Mountain Drive and Durango Drive, via a drop inlet grate located in the sidewalk. A dummy sub-basin titled Park is created to represent this offsite flow. The reference study for Mountain Crest Park does not specify a 10-year flow for this bubbler system. For the purpose of this analysis,

the dummy basin parameters were left unchanged, and run with the 10-year rainfall depth, which resulted in a flowrate of 15 cfs for the 10-year storm.

This offsite park flow combines with combination point CPLNM1, and then continues east thru sub-basin LNM3 to combination point CPLNM3, just west of the intersection of Lone Mountain Road and Conough Lane. Combination point CPCON and CPLNM3 combine to form combination point CPCON1 at the intersection of Lone Mountain Road and Conough Lane. CPCON1 travels east through sub-basin LNM4 to just west of the intersection of Lone Mountain Road and Buffalo Drive. Sub-basin BFS flows south to the intersection of Lone Mountain Road and Buffalo Drive, and combines with CPLNM4 to form combination point CPBFS. Flow collected by the proposed Gowan North Buffalo Branch storm drain system will continue south on Buffalo Drive via the existing RFCD storm drain system GOBU 0085.

Table 3.1 summarizes the flows of sub-basins and concentration points of the Major Basin model.

Table 3.1: Sub-basins and Combination Points - Major Basin Model

Sub-basin ID	Area (acres)	Q10 (cfs)	Q100 (cfs)	Combination Points	Q10 (cfs)	Q100 (cfs)
BFN	20.5	10	32	CPBFN	10	32
BFS	29.2	11	35	CPBFS	116	498
CON	63.9	14	56	CPCON	52	189
LN1	348.1	50	225	CPCON1	106	464
LN2	15.3	4	17	CPLNM1	55	268
LN3	29.2	8	30	CPLNM2	4	66
LN4	31.0	14	43	CPLNM3	57	284
WAS1	179.8	35	146	CPLNM4	111	480
WAS2	22.5	10	30	CPWAS2	41	102

In general, 480 cfs from combination point CPLNM4 will be conveyed within the Project facility in Lone Mountain Road. In addition, flow from sub-basin BFS would be captured by the lateral facility within Buffalo Drive, totaling a 100-year flow of 498 cfs at combination point CPBFS at the downstream tie-in.

The following 100-year flows will leave the Project watershed and ultimately contribute to the future GOAL 0247 MPU facility.

- Sub-basin BFN, which generates 32 cfs in the 100-year storm event. Flow would leave the Project watershed, draining east on Washburn Road and Rosada Way. This is a minimal addition to the peak flow for the GOAL facility, which is planned to convey 757 cfs.
- Bypass flow from the inlets at the corner of Conough Lane and Rosada Way will leave the Project watershed, draining east on Rosada Way. This bypass is expected to be negligible as 100% capture rate is the goal.
- Bypass from the inlets at the corner of Lone Mountain Road and Buffalo Drive. The combined inlet bypass at this intersection is estimated to be 17 cfs.

The cumulative flow impacts to the future downstream GOAL facility are minimal.

3.5.2 Minor Basin Model

Forty three (43) sub-basins are delineated on the Minor Basin model. Sub-basins are delineated according to points of design interest such as drop inlet locations, storm drain pipe size changes, and flow split at intersections. Refer to the Minor Basin map provided in Appendix B to follow the routing description provided in this section. Runoff from sub-basin DR-HM will travel east to the intersection of Hammer Lane and Durango Drive. Based on roadway geometry flow at this intersection will travel south through sub-basin DR-FS and meet at the intersection of Fisher Avenue and Durango Drive as combination point CPDR-FS. All flow on Durango Road, between Hammer Lane and Fisher Avenue, will drain east due to Durango Road being superelevated. Combination point CPDR-FS will travel east through sub-basin WS-TM1 and combine with sub-basin WS-TM2 as combination point CPWS-TM at the intersection of Washburn Road and Tomsik Street.

CPWS-TM will have a flow split with flow going east on Washburn Road and south on Tomsik Street. Sub-basin WS-CM combines with the flow going east on Washburn Road, and forms combination point CPWS-CM at the intersection of Washburn Road and Cimarron Road. CPWS-CM travels east thru sub-basin WS-CN to form combination point CPWS-CN at the intersection of Washburn Road and Conough Lane. Washburn Road is superelevated to the north between Tomsik Street and Conough Lane, therefore flow on this stretch of Washburn Road stays on the north side of the street.

Flow traveling along Washburn Road between Cimarron Road and Conough Lane will be collected via drop inlets. The flow collected by these inlets will continue south at the intersection of Washburn Road and Conough Lane, via the proposed storm drain system in Conough Lane. The remaining flow not collected by the drop inlets will continue east on Washburn Road, through sub-basin WS-BF to combination point CPWS-BF at the intersection of Washburn Road and Buffalo Drive. Between Conough Lane and Buffalo Drive, Washburn Road switches back to a crown section, with minimal runoff contributing to the south half. Flow at the intersection of Washburn Road and Buffalo Drive will continue east on Washburn Road.

The flow that travels south, from the flow split at the intersection of Washburn Road and Tomsik Street, will travel thru sub-basin TM-RS to combination point CPTM-RS at the intersection of Rosada Way and Tomsik Street. The flow at this intersection will split east on Rosada Way and south on Tomsik Street. The flow traveling east will travel through sub-basin RS-CN1 and, along with sub-basin RS-CN2, will form combination point CPRS-CN1 just west of the intersection of Rosada Way and Conough Lane. The flow that travels south, from the flow split at Washburn Road and Conough Lane, will travel through sub-basin CN-RS1 and combine with sub-basin CN-RS2 to form combination point CPCN-RS, just

north of the intersection of Rosada Way and Conough Lane. Combination points CPRS-CN1 and CPCN-RS combine to form combination point CPCNRS at the intersection of Rosada Way and Conough Lane.

Proposed inlets at this intersection will collect flow traveling south on Conough Lane and east on Rosada Way, with bypass flow going east to the intersection of Rosada Way and Buffalo Drive. The flow that bypasses to the east will travel through sub-basin RS-BF to form combination point CPRS-BF at the intersection of Rosada Way and Buffalo Drive. Flow at this intersection will continue offsite to the east along Rosada Way towards Tenaya Way.

Durango Drive has a crown that separates sub-basins DR-LM and CM-LA, such that flow on the east half of Durango Drive, between Washburn Road and La Madre Way, will travel through sub-basin CM-LA. Sub-basin CM-LA will combine with flow traveling south from the intersection of Rosada Way and Tomsik Street. This flow will create combination point CPCM-LA at the intersection of La Madre Way and Cimarron Road. There is a valley gutter present on the west half of this intersection that allows all flow at this intersection to travel south towards Lone Mountain Road.

Sub-basin LA-CN2 will continue east at the intersection of La Madre Way and Valadez Street due to a valley gutter being present on the south side of the intersection. Flow travels south from combination point CPCNRS, at the intersection of Rosada Way and Conough Lane, and combines with sub-basins LA-CN2, CN-LA1, LA-CN1, and CN-LA2, which are located on Conough Lane between Rosada Way and La Madre Way. They form combination point CPLA-CO at the intersection of La Madre Way and Conough Lane. Proposed inlets at this intersection will collect flow traveling south on Conough Lane and east on La Madre Way, with bypass flow going east to the intersection of La Madre Way and Buffalo Drive. The flow that bypasses to the east will travel through sub-basin LA-BF to form combination point CPLA-BF at the intersection of La Madre Way and Buffalo Drive. Flow at this intersection will be collected by a proposed storm drain within Buffalo Drive.

Due to the crown in Durango Drive between Fisher Avenue and Washburn Road, sub-basin DR-WS will remain on the west side of Durango Drive and travel through sub-basin DR-LM. This flow combines at the intersection of Lone Mountain Road and Durango Drive to form combination point CPDR-LM at the southwest corner of the intersection. Additional offsite flow from Mountain Crest Park, located at the southwest corner of Lone Mountain Road and Durango Drive, contributes 48 cfs in the 100-year storm event and 15 cfs in the 10-year storm event to Lone Mountain Drive via a 4-foot x 2-foot RCB bubbler system. CPDR-LM and sub-basin Park form combination point CPPark at the intersection of Lone Mountain Road and Durango Drive. CPPark continues east on Lone Mountain Road and combines with sub-basins LM-CM2 and LM-CM1 to form

combination point CPLM-CM just west of the intersection of Lone Mountain Road and Cimarron Road.

The flow traveling south through the intersection of La Madre Way and Cimarron Road, as combination point CPCM-LA, continues south on Cimarron Road to the intersection of Lone Mountain Road and Cimarron Road. Ultimately, it combines with sub-basins CM-LM1 and CM-LM2 to form combination point CPCM-LM, just north of the Lone Mountain Road and Cimarron Road intersection. Sub-basin LM-CM comes from the neighborhood at the northwest corner of Lone Mountain Road and Cimarron Road, and drains through the wall via a concrete drainage swale just west of the Lone Mountain Road and Cimarron Road intersection. Once this flow has left the neighborhood, it is collected by a concrete drainage swale behind the back of the sidewalk, and connects to a concrete drainage channel at the northwest corner of the intersection. Flow from sub-basin LM-CM then enters the storm drain system via a dual elliptical RCP culvert entrance behind the back of curb in Cimarron Road. LM-CM then combines east of the intersection with combination points CPLM-CM and CPCM-LM to form combination point CPCM-LM2. The existing bubbler system will be removed and replaced with drop inlets that connect to the proposed storm drain facility. Proposed inlets at the northwest and northeast corners of the Lone Mountain Road and Cimarron Road intersection will alleviate flooding that is inundating this intersection during storm events.

Combination point CPCM-LM2 travels east to the intersection of Lone Mountain Road and Conough Lane, where it combines with sub-basins LM-CN2 and LM-CN3. Sub-basins LM-VD, VD-LM1, and VD-LM2 travel south on Valadez Street, from the intersection of La Madre Way and Valadez Street, to form combination point CPVD-LM just north of the intersection of Lone Mountain Road and Valadez Street. CPVD-LM travels east on Lone Mountain Road to combine with CPCM-LM2, LM-CN2, and LM-CN3 to form combination point CPLM-CN just west of the intersection of Lone Mountain Road and Conough Lane.

Flow traveling south of the intersection of La Madre Way and Conough Lane, via the storm drain system or on the roadway itself, combines with sub-basin CN-HH and CN-CN to form combination point CPCN-HH. CPCN-HH is located on the west side of Conough Lane within curb and gutter. CPCN-HH travels south to combine with sub-basin CN-LM1 and CN-LM2 to form combination point CPCN-LM, just north of the intersection of Lone Mountain Road and Conough Lane.

CPLM-CN combines with CPCN-LM to form combination point CPCNLM at the intersection of Lone Mountain Road and Conough Lane. This flow continues east on Lone Mountain Road to combine with sub-basins LM-QD1, LM-QD2, and LM-BF2, to form combination point CPLM-BF just west of the intersection of Lone Mountain Road and Buffalo Drive. The Minor Basin flowrates are used for street capacity calculations, drop inlet spacing, and lateral storm drain sizing.

Table 3.2: Sub-basins and Combination Points - Minor Basin Model

Sub-basin ID	Area (acres)	Q10 (cfs)	Q100 (cfs)	Combination Points	Q10 (cfs)	Q100 (cfs)
BF-LM	8.1	5	14	CPBFLM	123	608
CM-LA	55.8	11	51	CPCM-LA	14	91
CM-LM1	0.9	1	2	CPCM-LM	14	94
CM-LM2	1.6	1	2	CPCM-LM2	61	341
CN-CN	1.8	1	3	CPCN-HH	53	206
CN-HH	7.5	3	11	CPCNLM	113	557
CN-LA1	5.3	1	6	CPCN-LM	54	207
CN-LA2	1.2	1	2	CPCNRS	50	190
CN-LM1	2.9	1	5	CPCN-RS	46	117
CN-LM2	1.6	1	3	CPDR-FS	31	123
CN-RS1	3.6	1	4	CPDR-LM	39	178
CN-RS2	1.2	0	2	CPLA-BF	8	28
DR-FS	36.6	17	65	CPLA-CO	52	205
DR-HM	95.5	24	100	CPLM-BF	117	580
DR-LM	156.5	31	126	CPLM-BF2	3	8
DR-WS	50.8	12	53	CPLM-CM	49	247
LA-BF	21.5	8	28	CPLM-CN	64	358
LA-CN1	1.5	1	2	CPLM-QD2	3	7
LA-CN2	12.3	4	15	CPPARK	42	197
LM-BF1	31.6	14	44	CPRS-BF	7	22
LM-BF2	0.6	1	1	CPRS-CN1	6	75
LM-CM	28.8	5	27	CPTM-RS	4	75
LM-CM1	53.4	11	46	CPVD-LM	62	353
LM-CM2	3.3	2	6	CPWS-BF	3	10
LM-CM3	0.4	0	1	CPWS-CM	46	130
LM-CN1	8.7	3	10	CPWS-CN	46	118
LM-CN2	1.7	1	3	CPWS-TM	41	165
LM-CN3	0.6	0	1			
LM-QD1	2.1	2	5			
LM-QD2	0.9	1	2			
LM-VD	5.1	1	6			
PARK	--	15	48			
RS-BF	15.3	7	22			
RS-CN1	24.3	6	24			
RS-CN2	0.7	0	1			
TM-RS	15.3	4	17			
VD-LM1	142	4	15			
VD-LM2	1.3	1	2			
WS-BF	5.8	3	10			
WS-CM	18.4	10	28			
WS-CN	5.1	2	8			
WS-TM1	42.2	9	39			
WS-TM2	5.5	2	7			

4.0 HYDRAULICS

The hydraulic analysis of the storm drain system is performed according to the procedures and criteria presented in CCRFCD HCDDM. The HCDDM criteria are presented below.

4.1 Design Criteria

4.1.1 Street Capacity

Street capacity calculations are based on CCRFCD criteria for the allowable capacity of a street in minor (10-year) and major (100-year) storm events:

Minor Storm – 10-year (Street right-of-way width $\geq$ 80 feet)

- A 12-foot wide dry lane shall be maintained in each direction (center turning lane cannot be used for a dry lane)
- The depth of flow at intersections with other streets with right of way widths greater than or equal to 80 feet shall be curb height (typically 6 inches) or less.
- The product of the flow depth (feet) in the gutter flow line times the average flow velocity (feet per second (fps)) shall be less than or equal to 6.

Minor Storm – 10-year (Street right-of-way width $<$ 80 feet)

- The depth of flow in the gutter flow line shall be less than or equal to 1 foot.
- The product of the flow depth (feet) in the gutter flow line times the average flow velocity (fps) shall be less than or equal to 6.

Major Storm – 100-year

- The product of the flow depth (feet) in the gutter flowline times the average flow velocity (fps) shall be less than or equal to 8.
- The depth of flow in the gutter flowline shall be less than or equal to 2 feet.
- The transverse street flow on through traffic streets shall be at a depth less than or equal to 1 foot and a depth times velocity less than or equal to 8. This shall not be used to determine the allowable transverse flow depth for a culvert.

4.1.2 Drop Inlets

- A clogging factor of 50% has been applied to all drop inlets.
- Type-DM drop inlets are used in some locations for this Project, with same length of grate and curb opening. A maximum opening size of 20 foot is used for drop inlets. Any inlet 10 feet or longer will have the most upstream 2.5 foot grate covered with a metal plate.
- NDOT TYPE 2B area drain inlets, with concrete collars, are used for this Project.

4.1.3 Storm Drain

- The minimum slope for storm drains is 0.25% and a minimum velocity of 3 fps shall be maintained.
- The minimum pipe size for storm drain laterals is 18 inches.
- The Hydraulic Grade Line (HGL) for storm drains will be 1 foot below the finished grade.
- Manholes are spaced at a maximum of 400 feet.

4.2 Existing Regional Facility Capacity

The existing MPU facility GOBU 0085 was designed prior to the 2008 MPU. During the 2008 update land use values were revised throughout the valley to reflect current zoning, resulting in higher peak flows in many watersheds. For the Project watershed, the MPU flows increased from 354 cfs (2002 MPU) to 484 cfs (2008 MPU). GOBU 0085 was designed for lower peak flows. As the downstream tie-in facility for the Project, it is critical to be sure that the proposed storm drain system would not surcharge the existing GOBU 0085 system.

A WSPG hydraulic model was developed to establish the conveyance capacity of the existing GOBU system. The existing Buffalo Storm Drain system was modeled based on as-builts of the system. The system was modeled from south of Red Coach Avenue up to the Lone Mountain Road and Buffalo Drive intersection. This section of the system consists of an existing 11-foot by 5-foot RCB which transitions to two (2) parallel 11-foot by 4-foot RCBs. A lateral system west of Red Coach Avenue connects to the system in Buffalo Drive. Storm drain inlets are located on both the west and east sides of the roadway throughout this stretch of the existing system.

The existing storm drain capacity of the regional facility was determined by seeing what peak flow rate could be placed in the system, while maintaining the CCRFCD requirement of having at least 1 foot of separation between the HGL and the finished grade. First, a duplicate model was created for the existing storm drain. For this analysis minor lateral storm drains are not modeled. A Manning's n value of 0.015 was selected. This is higher than the 0.013 value that the system was originally designed to. The selection of 0.015 is a conservative approach to account for deterioration with age as well as sedimentation. The model was then run with increased flow to determine the maximum capacity. The WSPG model shows that the existing regional facility can take approximately 555 cfs before the 1-foot HGL criteria is not met in the 11-foot by 5-foot RCB. The capacity of the existing system is sufficient for the Project watershed. The Project watershed generates a total of 498 cfs, which is less than the 555 cfs capacity of the system.

The GC Wallace study performed in 1999 shows that the facility was designed to convey 441 cfs. The study included independent hydrology and complex routing which resulted in higher peak flows than the 2002 MPU. The GC Wallace as-builts also show that the HGL is contained within the box culvert, and is

approximately four (4) feet below finished grade. This helps to confirm the findings that additional conveyance capacity is available.

4.3 Storm Drain Hydraulics

A WSPG model was built to assess the hydraulic function of the proposed storm drain. This model is preliminary at the 30% level. The following assumptions were made:

- The model begins along the existing GOBU facility at station "B" 235+25.00, with the stationing being based off of the GC Wallace Study Plans.
- The downstream control water surface elevation was set to 2343.38 feet which is equivalent to the box flowing full.
- 100-year Major Basin flowrates are used to design the mainline storm drain.
- Flowrates from downstream combination points are used for each reach.
- Laterals are not modeled using WSPG.
- A Manning's n value of 0.015 was used.

The tie-in invert of the existing GOBU 0085 facility is a controlling factor. The existing system is relatively shallow, which limits the available slope for the proposed system. The system has been optimized to maximize slope and reduce facility size while still meeting cover and HGL criteria. The following facility sizes are proposed:

Lone Mountain Road from Buffalo Drive to Conough Lane

- 8-foot x 5-foot RCB @ 0.63% to 0.78% slope

Lone Mountain Road from Conough Lane to Cimarron Road

- 7-foot x 5-foot RCB @ 0.91% slope

Lone Mountain Road at Cimarron Road

- 7-foot x 4-foot RCB @ 0.75%

Conough Lane from Lone Mountain Road to Washburn Drive

- 5-foot x 5-foot RCB @ 0.50% to 0.55% slope

Washburn Drive from Conough Lane to Cimarron Road.

- 48-inch RCP @ 0.93% to 1.45% slope

Buffalo Drive from Lone Mountain Road to La Madre Way

- 48-inch RCP @ 0.50% slope

A curved RCB is proposed to connect the proposed Lone Mountain Road system to the existing Buffalo Drive system to reduce head losses and improve hydraulic performance. The proposed storm drain meets all hydraulic design criteria with exception to the lateral pipe connecting LMDI-3 to the mainline. The storm drain design is limited vertically at the corner of Lone Mountain Road and Cimarron Road due to an existing 42-inch water line. Further refinement of the storm drain design at this intersection will be required with the 70% submittal.

See Appendix C for WSPG analysis and results.

4.4 Lateral Pipes

For the 30% design, lateral pipes are evaluated by normal depth calculation using Flowmaster software. Lateral pipes are sized to convey the 100-year Minor Basin flows.

See Appendix C for Flowmaster output for lateral pipes.

4.5 Drop Inlet Analysis

Throughout the Project, curb and gutter inlets are used wherever possible. Curb and gutter inlets perform significantly better than area drains located in roadside swales. Area drain inlets are known to have poor capture rates and can become clogged with sediment in high magnitude storms. However, due to the rural nature of the Project watershed, area drains are unavoidable in some locations. Various methods were tested to evaluate drop inlets in order to ensure a conservative estimate for inlet capture rates, particularly for area drains. Several software applications were tested and compared to the results obtained using simple hand calculations for weir and orifice flow. It was found that Flowmaster software closely duplicated the weir and orifice capture rates, and provided sufficiently conservative results when applying 50% clogging. Therefore, drop inlet capture rates are evaluated using Flowmaster software. The system is designed to achieve maximum capture rate for a 100-year storm, with the goal being as close to zero bypass leaving the Project watershed as possible. Large inlets are used at the upstream end of the storm drain system to draw down as much flow as possible, leaving minimal flow in the street.

See Appendix C for a Drop Inlet Analysis summary table including intercept and bypass.

See Appendix E, on CD, for Flowmaster output of all drop inlet calculations.

See Appendix C for a Surface Flow Exhibit summarizing the street surface flows after construction of the proposed storm drain system.

4.6 Street Capacity

Cross sections are taken upstream and downstream of each drop inlet to evaluate the street depth, spread and velocity before and after each inlet. Flowmaster software is used to perform the normal depth calculation.

Additional cross sections are taken when necessary to assist in the analysis. For example, if the flow depth is higher than the crown height, a full street cross section is taken using the total flow at that location to determine the water surface elevation. This water surface elevation is then used in a half street calculation to determine what portion of the total flow is conveyed in each half of the street. The half street flow obtained is then used to evaluate the capture rate of the drop inlet. If the flow depth is still above the crown height, a full street cross section is again taken to establish the new reduced water surface elevation, and so on.

See Appendix C for Street Capacity summary table.

See Appendix E, on CD, for Flowmaster output of normal depth street capacity calculations.

See Appendix C for a Surface Flow Exhibit summarizing the street surface flows after construction of the proposed storm drain system.

5.0 INTERIM CONDITION

The interim condition is defined as the condition where the Project improvements are in place while development and storm drain facilities within the watershed remain as it exists today. The Project watershed is partially developed, with numerous vacant lots pending development. Typically, as development occurs, impervious area increases and stormwater runoff increases. Therefore, the ultimate condition flowrates are often higher than the interim condition flows.

In the ultimate condition, the future GOEC MPU facility upstream of the Project will cut off flow at El Capitan Way. However in the interim condition, the GOEC facility is not in place, resulting in higher flows to the Project facility. In this case the interim flows will be higher than ultimate. Table 5.1 summarizes the design and construction schedule for the future GOEC facility between Lone Mountain Road and Washburn Road according to the CCRFCD 10-year Construction Program.

Table 5.1: CCRFCD Facility Construction Timeline

Facility	GOBU 0112-0136	GOEC 0000-0026	Time Gap
Design	FY 13/14	FY 15/16	2-years
Construction	FY 16/17	FY 18/19	2-years

Source: CCRFCD Ten-Year Construction Program Fiscal Year 2015 Through Fiscal year 2024, Adopted June 12, 2014

It is anticipated that there will be a 2-year time period between when the Project facility is constructed and when the future GOBU facility is constructed. During this period, the Project facility may experience higher flows than it is designed for. The probability of a 100-year storm occurring in this 2-year period is given as follows.

$$P = 1 - \left[1 - \left(\frac{1}{T} \right) \right]^n$$

Where:

P = Probability of exceedance

T = Return period, 100-years

n = Number of years, 2-years

The exceedance probability of a 100-year storm within the 2-year construction gap is approximately 2%.

Existing hydrology is referenced from the Northwest Neighborhood Flood Control Master Plan (NNS), dated December 1997. There has been some land development within the watershed since the study was performed, which would increase storm runoff. However, the construction of the I-215 Beltway since 1997 effectively cuts off a portion of the existing watershed, thereby drastically reducing flows. Therefore, the existing flow rates referenced from the NNS are considered conservative for application to the Project interim condition.

According to the NNS, the total existing 100-year flow at Lone Mountain Road and Buffalo Drive is 1,114 cfs. This well exceeds the capacity of the downstream tie-in facility, GOBU 0085. In the event of a 100-year storm occurring during the two year interim period, the Gowan North system capacity will be exceeded, and surcharge will bypass toward US 95. However, the flood impact to US 95 will be reduced with the construction of the Project.

6.0 UTILITY CONFLICTS

The proposed storm drain pipes, laterals, manholes, and drop inlets are designed to meet utility clearance criteria wherever possible. A summary table of possible horizontal and vertical utility conflicts encountered thus far in design can be found in Appendix D. At this stage, dry utilities have been designated horizontally and dip elevations have only been taken for the inverts of existing storm drain facilities and sanitary sewer facilities in the Project area. All other vertical information provided is based on as-builts and will require potholing prior to the 70% submittal.

A major area of concern is the intersection of Lone Mountain Road and Cimarron Road. Running north/south in Cimarron Road there is a 42-inch water line and a 10-inch waterline. From as-built information to avoid the 42-inch water line, the storm drain will have to go over the top of the 42-inch water line with only approximately 10-inches of clearance. A concrete encasement will have to be provided. There is a blow-off valve and two water valves off of the 42-inch water line that will need to be relocated based on the necessity for drop inlets on the north west corner of the street. Going over the top of the 42-inch water will likely cause an interference with the 10-inch water line running parallel in Cimarron Road, but that cannot be confirmed until accurate depth information is acquired. There is a 12-inch water line running east/west in Lone Mountain Road that will not meet horizontal clearance and based on as-built information will most likely interfere vertically as well. Relocation of this line may be required. Running east/west on the south side of Lone Mountain Road is a 16-inch gas line that crosses two lateral systems. The water as-built plans show an approximate vertical location that will likely cause interference with the lateral systems. Lastly, within this intersection there is a survey monument well that will need to be relocated due to the proposed storm drain alignment.

At the intersection of Conough Lane and Lone Mountain Road there is a water line crossing that will be a key point in the design once its depth is confirmed. The 5-foot x 5-foot RCB proposed in Conough Lane will cross a 16-inch water line running east/west within Lone Mountain Road. The storm drain system is designed at a minimum slope, which could require relocation of the water line. There is also a drop inlet on the north east corner of the intersection that does not meet horizontal clearance from an 8-inch water line running north/south in Conough Lane.

Along Conough Lane there are two more locations where horizontal clearance requirements are not met for existing water lines. At La Madre Way and Conough Lane there is a drop inlet on the north west corner that is approximately 4.5 feet south of a 10-inch water line. Also, at Conough Lane and Rosada Way there is a lateral that is approximately 3.5 feet away from a water line lateral connected to a fire hydrant on the north east corner of the intersection.

There is an asphalt sidewalk along the north half of Lone Mountain Road west of Miller Lane which is part of the "Safe Route to School" program. This sidewalk will be protected in place or replaced in kind if it is impacted by construction activities.

See Appendix D for a summary of possible utility conflicts.

7.0 RIGHT OF WAY

Additional right-of-way is not expected to be required as part of the Project. Appendix D includes a preliminary list of Authorization to Enter Property (AEP) areas that may be required to facilitate construction.

8.0 PERMITS

A list of permits anticipated to be required as part of design and construction of the proposed Project can be found in Appendix D.

9.0 QUANTITY AND COST ESTIMATE

A preliminary cost estimate for the proposed storm drain facility is provided below. It should be noted that this estimate does not include other factors contributing to Project costs such as special transition structures, removals, utility relocation, driveway reconstruction, curb, gutter and sidewalk reconstruction, signing and striping. A 20% contingency has been added to approximate the cost of these items.

Table 6.1: Preliminary Cost Estimate

ITEM NO.	ITEM DESCRIPTION	U O M	APPROX QTY	UNIT PRICE	EXTENDED PRICE
603.01	18-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	888	\$80	\$71,015
603.02	24-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	258	\$95	\$24,492
603.03	30-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	79	\$130	\$10,258
603.04	36-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	95	\$140	\$13,293
603.05	42-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	67	\$200	\$13,384
603.06	48-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	2,431	\$225	\$547,074
603.07	5' X 5' RCB	LF	2,751	\$375	\$1,031,670
603.08	7' X 4' RCB	LF	295	\$400	\$118,080
603.09	7' X 5' RCB	LF	1,232	\$400	\$492,656
603.10	8' X 5' RCB	LF	1,311	\$450	\$589,734
609.01	10-FOOT TYPE DM DROP INLET	EA	3	\$12,000	\$36,000
609.02	20-FOOT TYPE DM DROP INLET	EA	10	\$20,000	\$200,000
609.03	NDOT TYPE 2B DROP INLET	EA	22	\$5,000	\$110,000
609.04	TYPE II STORM DRAIN MANHOLE	EA	9	\$6,000	\$54,000
609.05	ACCESS MANHOLE	EA	15	\$6,000	\$90,000
609.06	JUNCTION STRUCTURE	EA	2	\$3,000	\$6,000
107.01	TRAFFIC CONTROL	DAY	200	\$300	\$60,000
302.00	AGGREGATE BASE	CY	5,000	\$25	\$125,000
402.00	PLANT MIX SURFACING	TON	5,000	\$75	\$375,000
				SUBTOTAL	\$3,967,656
				20% CONTINGENCY	\$681,531
				SUBTOTAL CONSTRUCTION	\$4,649,188
				7% CONSTRUCTION MANAGEMENT	\$325,443
				TOTAL	\$4,974,631

10.0 CONCLUSION

The proposed storm drain system effectively captures 100-year storm runoff from the Project watershed, and conveys it to downstream master plan facilities. The system is designed to meet all drainage design criteria as determined in the CCRFCD HCDDM. The storm drain hydraulics function well within minimum criteria, with the HGL being at least one foot below finished grade. Minimum street spread, depth, and velocity requirements are met. In addition, the proposed storm drain addresses several existing drainage concerns within the Project watershed. The mitigation of these local drainage issues is a betterment for the local community and the selected alignment provides for future expansion of the storm drain, if warranted. No additional right of way is anticipated to be necessary for this Project. Utility conflicts have been minimized wherever possible. Unavoidable conflicts will be coordinated as the design continues. The "Safe Route to School" sidewalk will be protected in place or replaced in kind if it is impacted by construction activities. The following table summarizes the proposed storm drain facility sizes and associated flowrates, based on the Major Basin map.

Table 10.1: Proposed Facility Summary

Station		Size	Slope	100-year Flow
From	To	(W x H)	(%)	(cfs)
"LM" 9+09	"LM" 9+64	7'x4' RCB	0.75	247
"LM" 9+64	"LM" 12+09	7'x4' RCB	0.75	284
"LM" 12+09	"LM" 24+61	7'x5' RCB	0.91-0.92	284
"LM" 24+61	"LM" 37+72	8'x5' RCB	0.63-0.78	464
"W" 9+67	"W" 23+47	48" RCP	0.93-2.37	102
"CO" 37+47	"CO" 30+90	5'x5' RCB	0.52-0.54	102
"CO" 30+90	"CO" 10+03	5'x5' RCB	0.50-0.55	189
"B" 22+19	"B" 11+18	48" RCP	0.50	35

11.0 REFERENCES

[CCRFCD, 1999]. *Hydrologic Criteria and Drainage Design Manual*.
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[MPU, 2008]. *Las Vegas Valley Flood Control Master Plan Update*,
Prepared by: PBS&J in association with Louis Berger Group and Parsons Brinckerhoff, September 2008.

[HEC, 1997]. *HEC-1 Flood Hydrograph Package Version 4.1*,
U.S. Army Corps of Engineers, Hydrologic Engineering Center, January 1997.

FlowMaster 2008 Bentley Systems, Inc. Haestad Methods Solution Center.

Drainage Study For The Road Improvements for Buffalo Drive Between Cheyenne Avenue and Lone Mountain Road 90 Percent Submittal
Prepared by: G.C. Wallace, Inc., January 1999, for City of Las Vegas

HTE# 01-16754, *Technical Drainage Study for MSM 86-01 4-Lot Minor Subdivision, Southeast Corner of Conough Lane and Rosada Way*, Prepared by: The Sear-Brown Group, May 23, 2001, for Phillip E. Cortney

HTE# 01-31616, *Technical Drainage Study for PM 90-99, Southeast Corner of La Madre Way and Janell Drive*, Prepared by: EMS Engineering, August 18, 1999, for Willie Earl Spann Scott

HTE# 02-9764, *Technical Drainage Study for Wellspring Ministries, Lone Mountain Road and Janell Drive*, Prepared by: AZTEC Engineering, March 26, 2002, for George Stover

HTE# 02-37398, *Technical Drainage Study for MSM 86-01 4-Lot Subdivision, Conough and Rosada Intersection, Parcel Number 125-33-707-001*, Prepared by: Redrock Engineering, October 30, 2002, for William D Childs

HTE# 05-37441, *Hydrology Study for MSM 04-0073*, Prepared by: Baughman & Turner, Inc., October 26, 2004, for Gary Perron

HTE# 06-52938, *Hydrology Study for Lone Mountain/Miller 2 Lot Division*, Prepared by: KJE Consulting Engineers, Inc., December 11, 2006, for Michael Ignatowicz and Cheryl Frischknecht

HTE# 93-1217, *Technical Drainage Study for Rosada and Conough Parcel Map PM 213-92*, Prepared by: FES Consulting Engineers, Inc., January 15, 1993, for James R. Zurschmiede

HTE# 93-19979, *Hydrology Study for Angel Estates*, Prepared by: C.S.A. Engineers, October 21, 1993, for Richard Dufor

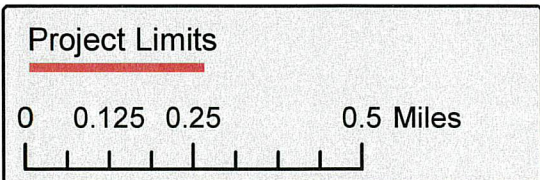
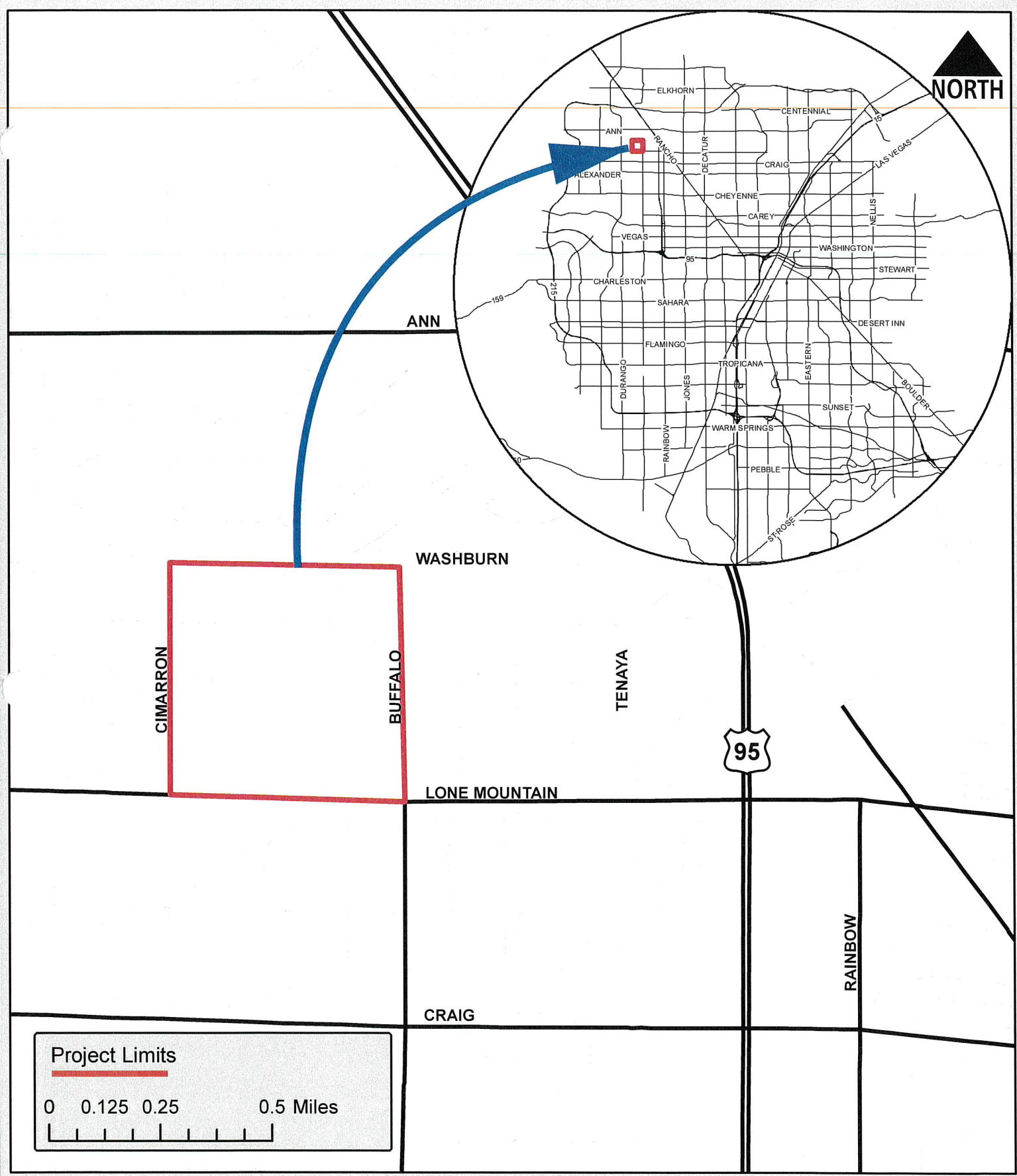
HTE# 94-21839, *Drainage Study for Cimarron Estates*, Prepared by: Baughman & Turner, Inc., December 23, 1994, for Jon Venteau

HTE# 97-26411, *Technical Drainage Study for PM 227-97 Lone Mountain/Conough Lane*, Prepared by: PBS&J, Inc., September 18, 1997, for Larkin-Gifford Developments, LLC

HTE# 98-22970, *Technical Drainage Study for Eagle Dancer*, Prepared by: Alpha Engineering, Inc., August 10, 1998, for Guy Bennallack

Appendix A - Figures & Maps

- A.1 - Vicinity Map
- A.2 - Alternative Alignments Map
- A.3 - 2013 MPU Hydrologic Map
- A.4 - 2013 MPU Facilities Map
- A.4A - 2013 MPU Facility Inventory
- A.5 - FEMA FIRM Panels
- A.6 - McCarran Airport Rainfall Area - HCDDM Figure 513
- A.7 - 10-year Depth-Duration-Frequency - Values - HCDDM Figure 503
- A.7A - 100-year Depth-Duration-Frequency - Values - HCDDM Figure 506
- A.8 - Depth-Duration-Frequency-Values - HCDDM Table 505
- A.9 - Six Hour Storm Distributions (SDN3) - HCDDM Table 503
- A.10 - Six Hour Depth - Area Reduction Factors - HCDDM Table 502



Vicinity Map

Appendix A.1



GOWAN NORTH
BUFFALO BRANCH
LONE MNT. TO WASHBURN



Legend

Alignment A
Main
Lateral

Alignment B
Main
Lateral

Alignment C
Main
Lateral

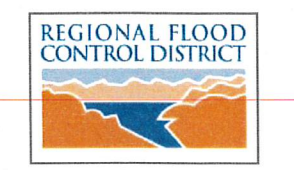
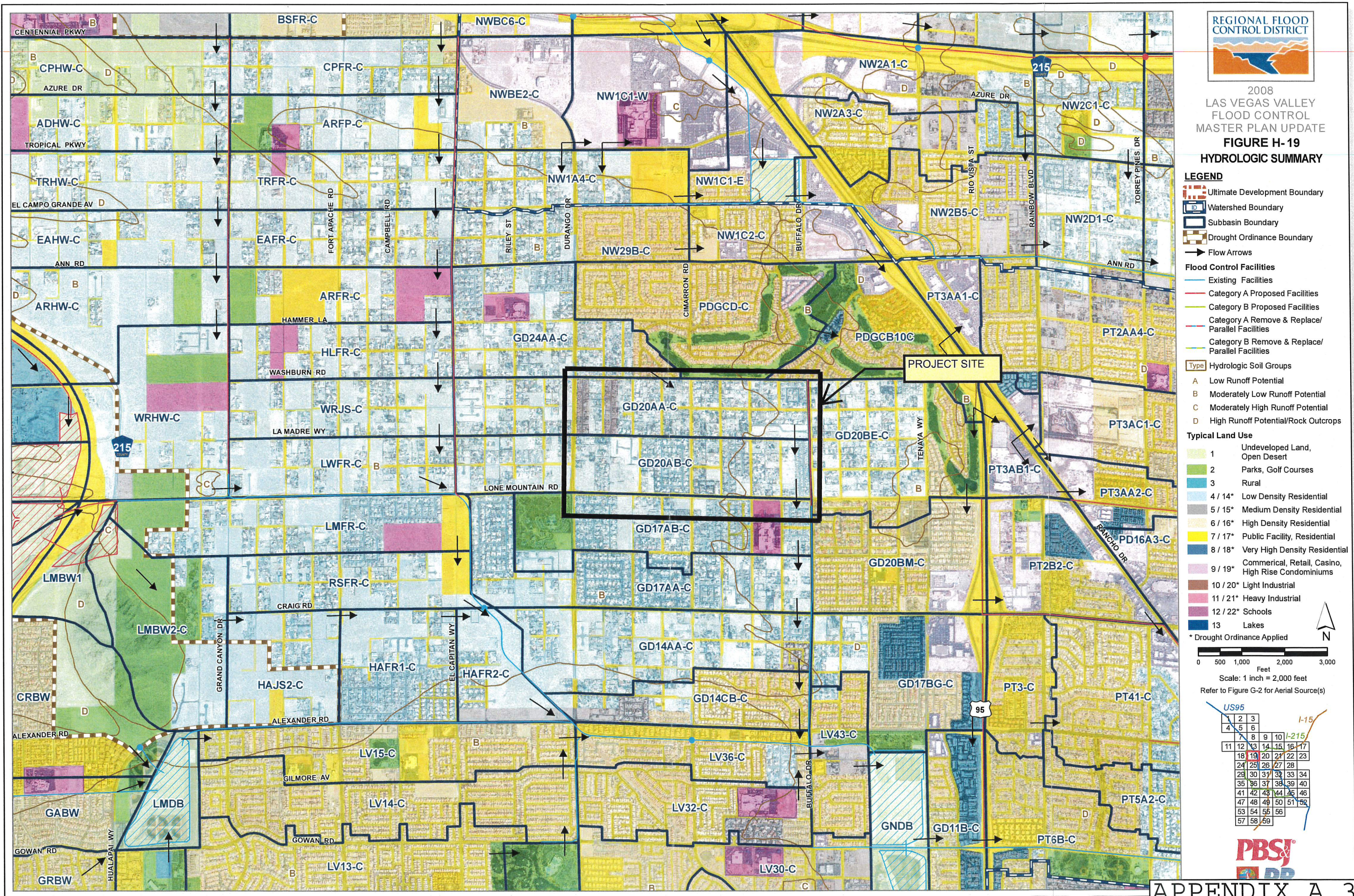
Existing Facilities
CLV Existing Facilities
City Ownership
10 ft Contour

APPENDIX A.2
ALTERNATIVE
ALIGNMENTS MAP



Scale: 1 inch = 200 feet

**PARSONS
BRINCKERHOFF**



2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE H-19
HYDROLOGIC SUMMARY

- LEGEND**
- Ultimate Development Boundary
 - Watershed Boundary
 - Subbasin Boundary
 - Drought Ordinance Boundary
 - Flow Arrows
- Flood Control Facilities**
- Existing Facilities
 - Category A Proposed Facilities
 - Category B Proposed Facilities
 - Category A Remove & Replace/Parallel Facilities
 - Category B Remove & Replace/Parallel Facilities
- Hydrologic Soil Groups**
- A Low Runoff Potential
 - B Moderately Low Runoff Potential
 - C Moderately High Runoff Potential
 - D High Runoff Potential/Rock Outcrops
- Typical Land Use**
- 1 Undeveloped Land, Open Desert
 - 2 Parks, Golf Courses
 - 3 Rural
 - 4 / 14* Low Density Residential
 - 5 / 15* Medium Density Residential
 - 6 / 16* High Density Residential
 - 7 / 17* Public Facility, Residential
 - 8 / 18* Very High Density Residential
 - 9 / 19* Commercial, Retail, Casino, High Rise Condominiums
 - 10 / 20* Light Industrial
 - 11 / 21* Heavy Industrial
 - 12 / 22* Schools
 - 13 Lakes
- * Drought Ordinance Applied
- 0 500 1,000 2,000 3,000 Feet
Scale: 1 inch = 2,000 feet
Refer to Figure G-2 for Aerial Source(s)

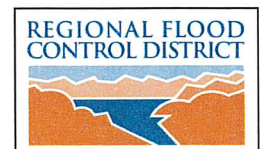
US95 I-15 I-215

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68



ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
ANRB 0000	P1	ANN ROAD CHANNEL WEST - RAINBOW 10' X 7' RCB	1320	721	CNW2B5-C	WEST3	0.99	0.40
ANWE 0245	E	ANN ROAD CHANNEL WEST 10' X 9' RCB	1721	993	CNW2D1-C	WEST3	6.84	0.80
0279	E	10' X 9' RCB	553	743	2CNW2B5C	WEST3	6.37	0.80
0290	E	8' X 8' RCB	2050	743	2CNW2B5C	WEST3	6.37	0.70
0327	E	6' X 6' RCB	2360	161	RCHOOT	WEST3	5.38	0.87
0371	E	6' X 6' RCB	760	161	RCHOOT	WEST3	5.38	0.34
0385	E	54" RCP	1950	161	RCHOOT	WEST3	5.38	1.17
CNWE 0150	P2	CENTENNIAL PKWY CHANNEL WEST Conc Chnl 42"W 10'D 0:1 SS	720	4233	CNW3B3-C	WEST3	5.64	0.40
0173	P2	42" X 10' RCBC @ Torrey Pines	190	4233	CNW3B3-C	WEST3	5.64	0.40
0176	P2	Conc Chnl 32"W 12'D 0:1 SS	795	4233	CNW3B3-C	WEST3	5.64	0.40
0189	P2	Conc Chnl 32"W 10'D 0:1 SS	1845	4067	CNW2D4-C	WEST3	5.15	0.54
0226	P2	Conc Chnl 12"W 12'D 2:1 SS	1165	4067	CNW2D4-C	WEST3	5.15	1.00
0251	P2	Conc Chnl 12"W 12'D 2:1 SS	1135	3951	CNW2D3-C	WEST3	4.65	0.59
0271	P2	Conc Chnl 32"W 10'D 0:1 SS	185	3951	CNW2D3-C	WEST3	4.65	0.59
0274	E	32' X 10' RCBC @ Tenaya	130	3951	CNW2D3-C	WEST3	4.65	0.45
0277	P2	Conc Chnl 13"W 10'D 2:1 SS	590	3951	CNW2D3-C	WEST3	4.65	0.45
0287	P2	Conc Chnl 13"W 10'D 2:1 SS	605	3593	CNW2B2-C	WEST3	3.84	1.19
0301	P2	Conc Chnl 32"W 10'D 0:1 SS	235	3593	CNW2B2-C	WEST3	3.84	1.19
0304	P2	32' X 10' RCB	6510	3593	CNW2B2-C	WEST3	3.84	1.75
GO95 0000	P1	GOWAN OUTFALL - U.S. 95 CHANNEL Conc Chnl 12"W 4'D 2:1 SS	2640	299	GD17BG-C	ALLGOW3	0.36	0.30
0050	P1	Conc Chnl 12"W 4'D 2:1 SS	2450	299	GD17BG-C	ALLGOW3	0.36	0.30
GOA2 0000	P1	GOWAN OUTFALL - ALEXANDER BRANCH 8' X 5' RCB	2281	523	CPT41-C	ALLGOW3	0.61	0.90
GOAL 0111	P1	GOWAN OUTFALL - ALEXANDER ROAD FACILITIES 10' X 8' RCB	3000	880	CPT2B2	ALLGOW3	2.28	0.83
0168	P1	10' X 8' RCB	4200	880	CPT2B2	ALLGOW3	2.28	0.50
0247	P1	Conc Chnl 12"W 5.5'D 2:1 SS	2640	757	CGD20BMC	ALLGOW3	1.98	0.30
GOBU 0000	E	GOWAN NORTH - BUFFALO BRANCH 2: 12' X 6' RCB	1705	961	CGD14CBC	ALLGOW3	2.53	0.20
0032	E	2: 12' X 5' RCB	1248	850	CGD14AAC	ALLGOW3	2.30	0.25
0058	E	2: 11' X 4' RCB	1398	745	CGD17AAC	ALLGOW3	1.90	0.25
0085	E	11' X 5' RCB	1266	614	CGD17ABC	ALLGOW3	1.52	0.25
0112	P1	8' X 6' RCB	1535	484	CGD20ABC	ALLGOW3	1.15	0.54
0136	P1	7' X 6' RCB	1400	344	CGD20AAC	ALLGOW3	0.76	0.36
GOBW 0000	E	GOWAN BELTWAY WEST 48" RCP	2527	116	LMBWDB	ALLGOW4	10.68	4.37
0048	E	72" RCP	131	116	LMBWDB	ALLGOW4	10.68	2.21
0051	P2	72" RCP Outlet	1508	116	LMBWDB	ALLGOW4	10.68	0.30
0052	P2	589 ac-ft Lone Mountain-Beltway Detention Basin		5140	CLMBW1	GW3SC	3.50	
0082	P2	51,400 cfs PMF Spillway		51400	CLMBW1	GW3SC	3.50	
0096	P1	8' X 8' RCB Connector Pipe Under Beltway	839	5140	CLMBW1	GW3SC	3.50	0.30
0097	P2	54" RCP	394	525	UVB1-2	ALLGOW3	0.34	8.09
0106	P2	8' X 8' RCB Connector Pipe Under Lone Mountain	697	5140	CLMBW1	GW3SC	3.50	0.30
0128	P2	Conc Chnl 20"W 10'D 0:1 SS	190	3429	CWRBW1	ALLGOW3	6.06	25.00
0132	P2	Conc Chnl 14"W 10'D 0:1 SS	1286	2869	CHLBW1-C	GW3SC	1.84	5.00
0156	P2	Conc Chnl 16"W 10'D 0:1 SS	221	2869	CHLBW1-C	GW3SC	1.84	1.05
0160	P2	16' X 8' RCB	1230	2869	CHLBW1-C	GW3SC	1.84	1.05
GOBX 0000	P2	GOWAN BOX CANYON 66" RCP	794	753	LWBW1	ALLGOW3	0.48	9.45
GODU 0000	E	GOWAN NORTH - DURANGO BRANCH 12' X 6' RCB	2629	1150	CLV14-C	ALLGOW3	1.40	0.91
0050	E	9' X 6' RCB	865	835	CLV20-C	ALLGOW3	0.97	1.50
GOEC 0000	P1	GOWAN NORTH - EL CAPITAN BRANCH 10' X 7' RCB	1445	1233	CLWFR-C	ALLGOW3	2.20	1.36
0026	P1	10' X 8' RCB	1320	1162	CWRJS-C	ALLGOW3	1.95	0.91
0051	P1	10' X 7' RCB	1320	1027	CHLFR-C	ALLGOW3	1.69	1.06
0076	P1	10' X 6' RCB	1320	894	CARFR-C	ALLGOW3	1.45	1.06
GOEC 0100	P1	GOWAN NORTH - EL CAPITAN BRANCH 10' X 6' RCB	1320	745	CEAFR-C	ALLGOW3	1.21	0.76
0126	P1	10' X 7' RCB	1320	635	CTRFR-C	ALLGOW3	0.96	0.38
0152	P1	7' X 6' RCB	1320	485	CARFP-C	ALLGOW3	0.70	0.77
0176	P1	78" RCP	1320	363	CCPFR-C	ALLGOW3	0.46	1.15
GOL2 0000	E	GOWAN LONE MOUNTAIN SYSTEM-BRANCH 2 5' X 4' RCB	150	461	CRBW	ALLGOW3	0.44	14.60
0003	E	66" RCP	607	461	CRBW	ALLGOW3	0.44	1.97
0014	E	84" RCPC @ Alexander	125	461	CRBW	ALLGOW3	0.44	4.00
GOLM 0000	E	GOWAN LONE MOUNTAIN SYSTEM 78" RCP	2590	345	CLV15-C	ALLGOW4	11.88	1.80
0049	E	6' X 5' RCB	585	345	CLV15-C	ALLGOW4	11.88	1.87
0060	E	66" RCP	817	345	CLV15-C	ALLGOW4	11.88	2.40
0075	E	60" RCP	1385	345	CLV15-C	ALLGOW4	11.88	2.55
0101	E	54" RCP	701	190	LMTNDB	ALLGOW4	11.52	1.74
0115	E	48" RCP	1799	190	LMTNDB	ALLGOW4	11.52	3.08
0140	E	42" RCP	439	190	LMTNDB	ALLGOW4	11.52	1.60
0142	E	48" RCP	348	190	LMTNDB	ALLGOW4	11.52	2.14
0144	E	66" RCP	196	190	LMTNDB	ALLGOW4	11.52	5.44
0145	E	66" RCP Outlet	378	190	LMTNDB	ALLGOW4	11.52	0.90
0146	E	888 ac-ft Lone Mountain Detention Basin		7252	LMTNIN	GW3SC	6.13	
0147	E	36,000 cfs PMF Spillway		36000	LMTNIN	GW3SC	6.13	
0150	E	Drop Structure	481	6323	CGABW	GW3SC	5.12	
0162	E	28' X 8' RCBC @ Hualapai	625	6323	CGABW	GW3SC	5.12	1.86
0174	E	Conc Chnl 28"W 8'D 0:1 SS	2715	6173	CCLMT5	GW3SC	4.92	3.20
GOLO 0275	P1	GOWAN OUTFALL - LONE MTN. ROAD BRANCH 8' X 6' RCB	3000	590	CPT3AA2	ALLGOW3	1.16	0.77
GONO 0000	E	GOWAN NORTH SYSTEM 8' X 8' RCB Outlet	184	558	GWNNDB	ALLGOW5	68.49	0.51
0001	E	8' X 8' RCB Outlet	156	558	GWNNDB	ALLGOW5	68.49	0.63
0006	E	30,780 cfs PMF Spillway		30780	GWNNDB	ALLGOW5	68.49	
0008	E	921 ac-ft Gowan North Detention Basin		4937	CCLV43-C*	GW4SC	11.93	
0009	E	3: 13' X 8' RCB	1662	4937	CCLV43-C	GW4SC	11.93	0.62
0012	E	Conc Chnl 30"W 8'-9.5'D 0:1 SS	2665	4117	CCLV36-C	GW4SC	8.54	1.18
0062	E	Bridge 30"W 8.5'D @ Cimarron	80	3844	CCLV15-C	GW4SC	8.03	0.30
0063	E	Conc Chnl 30"W 8.5'-10'D 0:1 SS	2302	3844	CCLV15-C	GW4SC	8.03	1.00
0110	E	2: 12' X 8' RCAC @ Alexander	547	3352	CCRSFR-C*	GW3SC	6.10	1.00
0117	E	2: 12' X 8' RCAP	424	3352	CCRSFR-C*	GW3SC	6.10	1.10
0124	E	Conc Chnl 24"W 9'D 0:1 SS	887	3352	CCRSFR-C*	GW3SC	6.10	1.36
0141	E	Conc Chnl 24"W 9'-10.5'D 0:1 SS	2064	3352	CCRSFR-C	GW3SC	6.10	0.59
0181	E	Bridge 30"W 7'D @ Craig	142	2846	CRSFR-C	GW3SC	5.20	0.65
0183	E	Conc Chnl 22"W 8'-10.6'D 0:1 SS	2193	2846	CRSFR-C	GW3SC	5.20	0.72
0225	E	Conc Chnl Width Varies Depth Varies 0:1 SS	508	2605	CCLWFR-C	GW3SC	4.54	1.05
0230	E	13' X 5' RCB	256	1486	CCWRHW-C	GW3SC	2.34	2.78
0234	E	12' X 6' RCB	2010	1486	CCWRHW-C	GW3SC	2.34	1.67
0272	E	10' X 6' RCB	2797	1486	CCWRHW-C	GW3SC	2.34	3.15
0325	E	15' X 7' RCB	291	1486	CCWRHW-C	GW3SC	2.34	1.79
0335	E	15' X 7' RCB	529	1486	CWRHW-C	ALLGOW3	2.34	1.79
0350	P1	10' X 9' RCB	3473	1486	CWRHW-C	ALLGOW3	2.34	0.88
0411	P1	10' X 9' RCB	1320	1404	CARHW-C	ALLGOW3	1.89	0.76
0436	P1	10' X 7' RCB	1320	1173	CEAHW-C	ALLGOW3	1.53	1.14
0461	P1	10' X 9' RCB	1320	959	CTRHW-C	ALLGOW3	1.22	0.38
0486	P1	8' X 7' RCB	1320	747	CADHW-C	ALLGOW3	0.90	0.76
0511	P1	7' X 6' RCB	1320	546	CCPHW-C	ALLGOW3	0.60	1.14
GOOF 0511	E	GOWAN OUTFALL FACILITIES 8' X 5' RCB	8390	699	CPT6B-C	GW3SC	1.08	0.50
0531	E	8' X 5' RCB	1300	558	GWNNDB	ALLGOW5	68.49	0.50
0551	E	72" RCP	524	558	GWNNDB	ALLGOW5	68.49	0.62
0773	E	60" RCP	803	286	LV30-C	ALLGOW3	0.42	1.40
0775	E	60" RCP	1300	286	LV30-C	ALLGOW3	0.42	1.00
RCHB 0000	E	RANCHO ROAD SYSTEM - BELTWAY 2: 12' X 8.5' RCAP	1700	2631	CNW1C-W	WEST3	4.68	0.63
0034	E	Conc Chnl 21"W 8'D 0:1 SS	1000	2631	CNW1C-W	WEST3	4.68	1.19
0053	E	2: 12' X 8' RCBC @ South Ramp Connector	85	2304	CDW1C1	WEST3	4.31	1.40
0054	E	Conc Chnl 21"W 8'D 0:1 SS	432	2304	CDW1C1	WEST3	4.31	1.51
0062	E	Transition Structure	130	2304	CDW1C1	WEST3	4.31	1.51
0065	E	24' X 7' RCB	480	2304	CDW1C1	WEST3	4.31	0.30
0074	E	24' X 6' RCB	50	2226	CNWBC6-C	WEST3	4.17	0.30
0075	E	20' X 6' RCBC @ Beltway	428	2226	CNWBC6-C	WEST3	4.17	2.81
0083	P2	20' X 6' RCB	950	2226	CNWBC6-C	WEST3	4.17	2.49
0101	P2	Conc Chnl 20"W 7'D 0:1 SS	980	2226	CNWBC6-C	WEST3	4.17	2.38
0120	E	20' X 6' RCBC @ Grand Montecito	120	2226	CNWBC6-C	WEST3	4.17	1.00
0122	P2	Conc Chnl 16'-20"W 6'D 0:1 SS	350	2226	CNWBC6-C	WEST3	4.17	1.84
0130	P2	Conc Chnl 16"W 6'D 0:1 SS	1012	2226	CNWBC6-C	WEST3	4.17	2.67
RCHO 0000	E	RANCHO ROAD SYSTEM 60" RCP with 36" Orifice Plate	1183	161	RCHODB	WEST3	5.38	0.74
0025	E	321 ac-ft Rancho Road Detention Basin		3115	RCHOIN	WEST3	5.38	
0027	E	18,000 cfs PMF Spillway		18000	RCHOIN	WEST3	5.38	
0050	E	Energy Dissipator	90	402	CNW1A4-C	WEST3	0.51	
0052	E	Conc Chnl 10"W 10'D 0:1 SS	115	402	CNW1A4-C	WEST3	0.51	11.43
0054	E	10' X 5' RCB	128	402	CNW1A4-C	WEST3	0.51	0.50
0056	E	10' X 5' RCB	815	402	CNW1A4-C	WEST3	0.51	0.47
0071	E	72" RCP	3140	402	CNW1A4-C	WEST3	0.51	1.80

* The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.
** As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.
^ For parallel facilities, the existing facility flow equals its normal depth capacity, and the proposed parallel facility flow equals the remaining flow (i.e., HEC-1 Node flow = existing facility normal depth capacity + proposed parallel facility flow).



2008 LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FACILITY INVENTORY
FIGURE F - 19

L
E
G
E
N
D

ID (Facility Identifier)
Parent Stream Name
Stream Name
River Mile
Distance Above Confluence
with Parent Stream (Miles)
Miles in Hundredths

AABB
0000

Existing Facility..... E
Proposed or Modified Facility..... P
Contingency Level
Category B..... P0
Master Plan..... P1
Preliminary Design..... P2
Design..... P3

Bottom Width..... W
Depth..... D
Side Slope, H:V..... SS

Construction Features

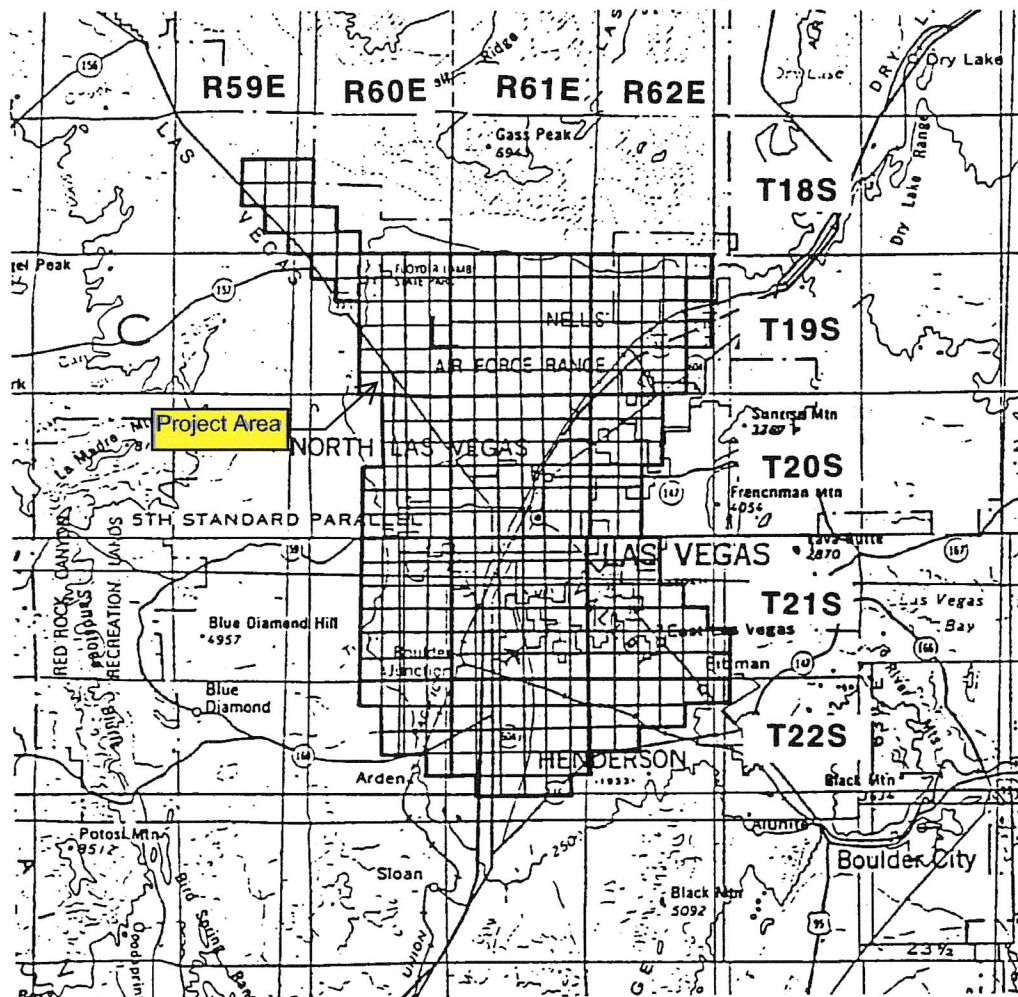
Cast in Place Concrete Pipe..... CIPCP
Corrugated Metal Arch Pipe Culvert..... CMAP
Corrugated Metal Pipe Culvert..... CMPC
High Density Polyethylene..... HDPE
Horizontal Elliptical Reinforced Concrete Pipe..... HERCP
Reinforced Concrete Arch Pipe..... RCAP
Reinforced Concrete Arch Culvert..... RCAC
Reinforced Concrete Box..... RCB
Reinforced Concrete Box Culvert..... RCBC
Reinforced Concrete Pipe..... RCP
Reinforced Concrete Pipe Culvert..... RCPCL
Storm Sewer Pipe..... SSP



APPENDIX A.4A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP	RANGE	SECTIONS	TOWNSHIP	RANGE	SECTIONS
18 South	59 East	13-15,22-26,36	20 South	62 East	4-9,16-20,29-32
18 South	60 East	30-32	21 South	60 East	1-4,9-16,21-28,33-36
19 South	60 East	1-6,8-16,21-28,33-36	21 South	61 East	ALL SECTIONS
19 South	61 East	ALL SECTIONS	21 South	62 East	4-9,15-23, 25-36
19 South	62 East	2-11,14-23,27-34	22 South	60 East	1-4,10-15,24
20 South	60 East	1-3,10-15,21-28,33-36	22 South	61 East	1-24,26-29
20 South	61 East	ALL SECTIONS	22 South	62 East	1-10,17-18

Notes:

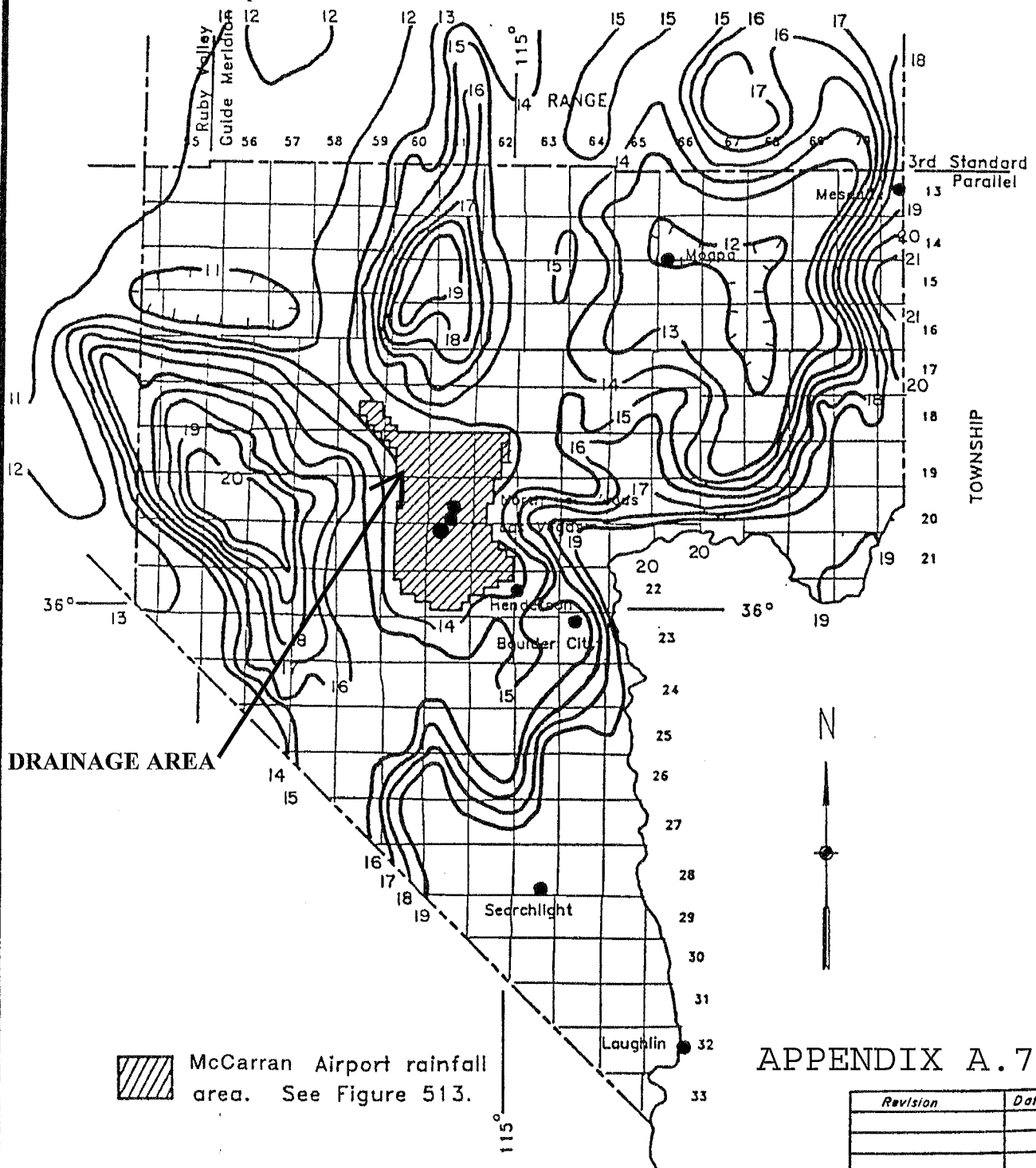
1. Refer to Table 505 and Figure 516 Depth-Duration-Frequency values in the McCarran Airport Rainfall Area.
2. Refer to Table 506 and Figure 517 for Time-Intensity-Frequency values on the McCarran Airport Rainfall Area.

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RAINFALL DEPTH-DURATION-FREQUENCY 10-YEAR, 6-HOUR

(DEPTHS IN TENTHS OF INCHES)



APPENDIX A.7

Revision	Date

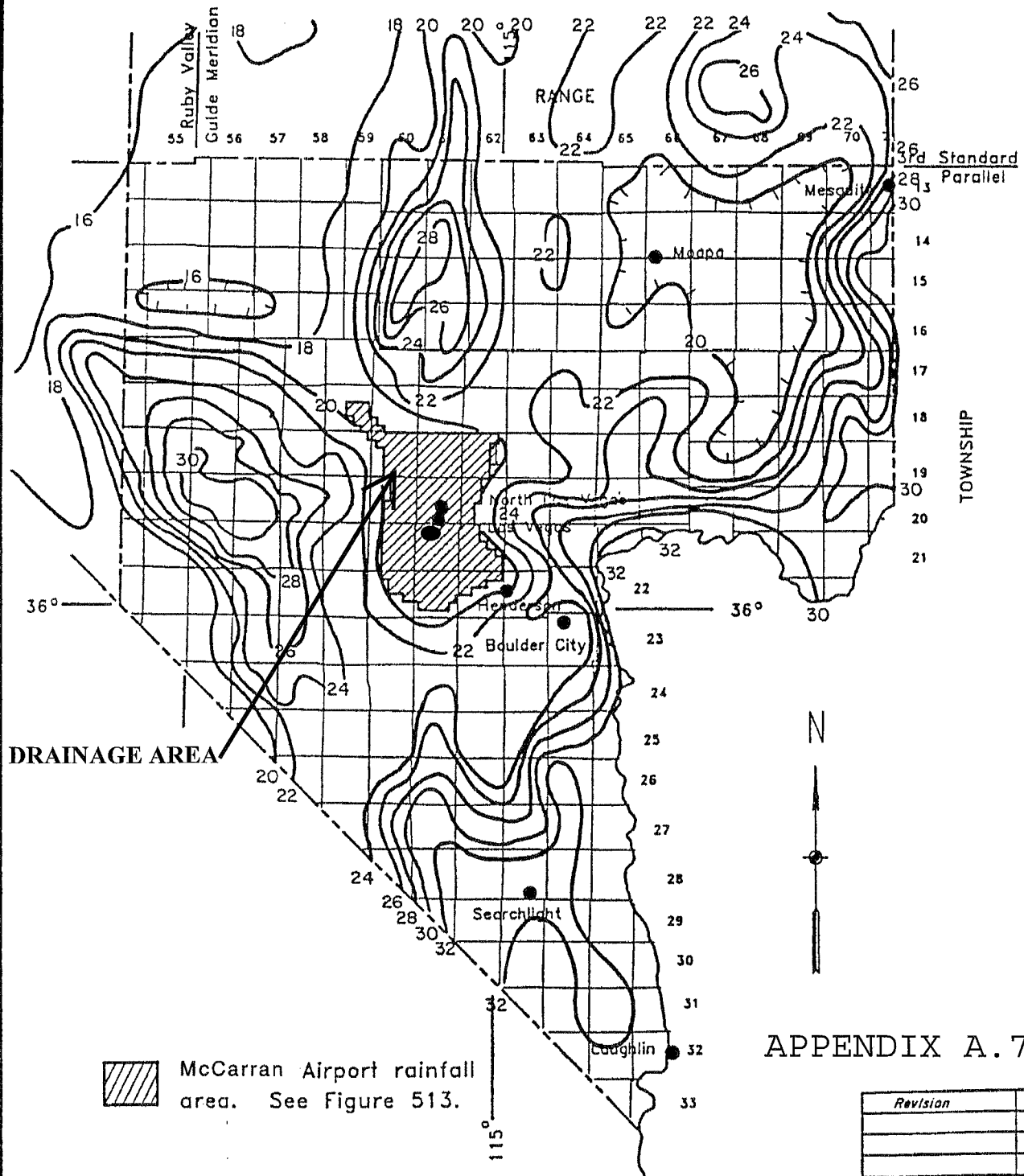
WRC
ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 503

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RAINFALL DEPTH-DURATION-FREQUENCY 100-YEAR, 6-HOUR (DEPTHS IN TENTHS OF INCHES)



HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA (IN INCHES)

TIME	RECURRENCE INTERVAL					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5 min.	0.15	0.27	0.35	0.46	0.54	0.63
10 min.	0.25	0.44	0.57	0.74	0.89	1.02
15 min.	0.33	0.57	0.74	0.97	1.15	1.32
30 min.	0.44	0.78	1.01	1.31	1.55	1.79
1 hour	0.52	0.89	1.15	1.50	1.78	2.06
2 hour	0.59	1.01	1.30	1.70	2.01	2.30
3 hour	0.64	1.08	1.39	1.82	2.15	2.48
6 hour	0.72	1.22	1.58	2.05	2.41	2.77
24 hour (TR-55)	1.20	1.60	1.80	2.40	2.70	2.96

- NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.
2. The 24 hour values presented above are for use with TR-55 only.
3. Table 501 adjustments not required.

APPENDIX A.8

Revision	Date

WRC
ENGINEERING

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 505

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

Percent of Total Storm Depth				Percent of Total Storm Depth			
Storm Time (In Minutes)	SDN3	SDN4	SDN5	Storm Time (In Minutes)	SDN3	SDN4	SDN5
0	0.0	0.0	0.0	185	32.2	37.6	43.0
5	2.0	2.0	2.0	190	35.2	41.5	47.7
10	5.7	5.8	5.9	195	40.9	46.2	51.4
15	7.0	7.5	8.0	200	49.9	53.0	56.1
20	8.7	9.9	11.0	205	59.0	61.0	63.0
25	10.8	12.6	14.4	210	71.0	71.0	71.0
30	12.4	13.7	15.0	215	74.4	73.2	72.0
35	13.0	14.5	16.0	220	78.1	75.6	73.1
40	13.0	14.9	16.8	225	81.2	78.2	75.2
45	13.0	15.1	17.1	230	81.9	79.9	77.9
50	13.0	15.5	18.0	235	83.5	81.3	79.0
55	13.0	15.6	18.2	240	85.1	82.3	79.5
60	13.0	15.9	18.7	245	85.6	83.0	80.4
65	13.3	16.2	19.0	250	86.0	83.5	81.0
70	14.0	16.9	19.7	255	86.8	84.4	82.0
75	14.2	17.2	20.2	260	87.6	85.1	82.6
80	14.8	17.9	21.0	265	88.8	86.4	84.0
85	15.8	18.9	22.0	270	91.0	88.5	85.9
90	17.2	20.1	23.0	275	92.6	90.8	88.9
95	18.1	21.1	24.1	280	93.7	92.4	91.0
100	19.0	22.0	25.0	285	95.0	94.4	93.8
105	19.7	22.8	25.9	290	97.0	96.8	96.6
110	19.9	23.2	26.5	295	97.6	97.3	97.0
115	20.0	24.0	28.0	300	98.2	97.8	97.4
120	20.1	24.6	29.0	305	98.5	98.2	97.9
125	20.4	25.2	30.0	310	98.7	98.4	98.1
130	21.4	26.0	30.5	315	98.9	98.6	98.3
135	22.9	26.9	30.9	320	99.0	98.8	98.5
140	24.1	27.6	31.0	325	99.3	99.1	98.9
145	24.9	28.3	31.7	330	99.3	99.2	99.0
150	25.1	28.6	32.1	335	99.4	99.3	99.2
155	25.6	29.2	32.7	340	99.5	99.4	99.3
160	27.0	30.2	33.3	345	99.8	99.7	99.6
165	27.8	31.2	34.6	350	99.8	99.8	99.7
170	28.1	32.1	36.1	355	99.9	99.9	99.9
175	28.3	33.2	38.1	360	100.0	100.0	100.0
180	29.5	35.2	40.8				

- Notes: 1. For drainage areas less than 8 square miles in size, use SDN 3.
 2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
 3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
 4. A graphical representation of these values is presented on **Figure 515**.

Revision	Date

REFERENCE:

APPENDIX A.9

TABLE 503

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX HOUR DEPTH-AREA REDUCTION FACTORS

<u>Drainage Area (Square Miles)</u>	<u>Six-Hour Depth-Area Reduction Factor</u>
0.0	1.00
0.5	0.98
1.0	0.97
2.0	0.93
4.0	0.91
6.0	0.90
8.0	0.88
10.0	0.86
20.0	0.79
30.0	0.74
50.0	0.68
100.0	0.60
150.0	0.55
200.0	0.51
300.0	0.46
400.0	0.42
500.0	0.39

- NOTES: 1. A graphical representation of these factors is presented in Figure 514.
2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

APPENDIX A.10

<i>Revision</i>	<i>Date</i>

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 502

Appendix B - Hydrology

- B.1 - Drainage Basin Maps
 - B.1A - Major Basin Map
 - B.1B - Minor Basin Map
- B.2 - Time of Concentration
 - B.2A - Major Basin Standard Form 4
 - B.2B - Minor Basin Standard Form 4
- B.3 - Rainfall
 - B.3A - Major Basin Rainfall
 - B.3B - Minor Basin Rainfall
- B.4 - Curve Numbers
 - B.4A - Major Basin Curve Numbers
 - B.4B - Minor Basin Curve Numbers
- B.5 - Flow Splits
 - B.5A - Method - Dimensional Simplification of Manning's Equation
 - B.5B - Major Basin Flow Split Summary
 - B.5C - Minor Basin Flow Split Summary
 - B.5D - Half Street Capacity for Flow Splits Flowmaster Output
- B.6 - HEC-1 Output
 - B.6A - Major Basin 100-year HEC-1
 - B.6B - Major Basin 10-year HEC-1
 - B.6C - Minor Basin 100-year HEC-1
 - B.6D - Minor Basin 10-year HEC-1

- **B.1 - Drainage Basin Maps**

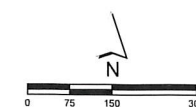


ULTIMATE CONDITION
SURFACE FLOW
SUMMARY

Legend

Proposed Storm Drain

SURFACE FLOW:
USING MINOR BASIN FLOWRATES



Scale: 1 inch = 150 feet

PARSONS
BRINCKERHOFF



ULTIMATE CONDITION
MAJOR BASIN MAP

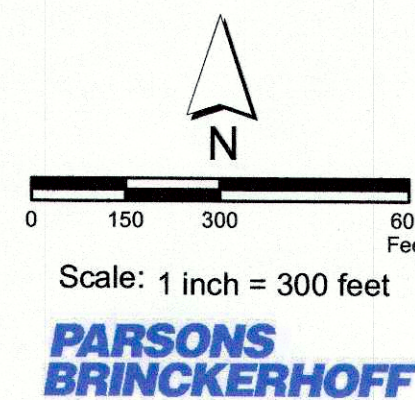
- Legend**
- Proposed Storm Drain
 - Flow Pattern
 - Major Basins
 - COMBINATION POINT
 - DIVERSION

MAJOR BASIN	10-YR FLOW	100-YR FLOW
BFN	10	32
BFS	11	35
CON	14	56
LN1M1	50	225
LN1M2	4	17
LN1M3	8	30
LN1M4	14	43
PARK*	15	48
WAS1	35	146
WAS2	10	30

COMBINATION POINT	10-YR FLOW	100-YR FLOW
CPBFN	10	32
CPBFS	116	498
CPCON	52	189
CPCON1	106	464
CPLNM1	55	268
CPLNM2	4	66
CPLNM3	57	284
CPLNM4	111	480
CPWAS2	41	102

DIVERSION	10-YR FLOW	100-YR FLOW
CPLNM2-E	0	29
CPLNM2-S	4	37
CPWAS2-E	0	2
CPWAS2-S	41	100
WAS1-E	35	97
WAS1-S	0	49
WAS2-E	35	80
WAS2-S	0	17

* See Section 3 of the report for a discussion on the Park flows



PARSONS
BRINCKERHOFF



ULTIMATE CONDITION
MAJOR BASIN MAP

Legend

- Proposed Storm Drain
- Flow Pattern
- Major Basins
- COMBINATION POINT
- DIVERSION

MAJOR BASIN	10-YR FLOW	100-YR FLOW
BFN	10	32
BFS	11	35
CON	14	56
LN1	50	225
LN2	4	17
LN3	8	30
LN4	14	43
PARK*	15	48
WAS1	35	146
WAS2	10	30

COMBINATION POINT	10-YR FLOW	100-YR FLOW
CPBFN	10	32
CPBFS	116	498
CPCON	52	189
CPCON1	106	464
CPLNM1	55	268
CPLNM2	4	66
CPLNM3	57	284
CPLNM4	111	480
CPWAS2	41	102

DIVERSION	10-YR FLOW	100-YR FLOW
CPLNM2-E	0	29
CPLNM2-S	4	37
CPWAS2-E	0	2
CPWAS2-S	41	100
WAS1-E	35	97
WAS1-S	0	49
WAS2-E	35	80
WAS2-S	0	17

* See Section 3 of the report for a discussion on the Park flows



Scale: 1 inch = 300 feet

PARSONS
BRINCKERHOFF

ANN RD

HAMMER LN

FISHER AVE

WASHBURN RD

ROSADA WAY

LA MADRE WAY

EL CAPITAN WAY

LONE MOUNTAIN RD

DURANGO DR

CIMARRON RD

VALADEZ ST

CONOUGH LN

MILLER LN

BUFFALO DR

TOMSIK ST

QUADREL

WAS1

WAS2

LN2

LN1

CON

BFN

BFS

LN3

LN4

PARK

CPLNM1

CPLNM3

CPCON1

CPLNM4

CPBFS

CPCON

WAS1-E

WAS2-E

CPWAS2

CPWAS2-E

CPBFN

CPLNM2

WAS1-S

WAS2-S

CPWAS2-S

CPBFS

CPLNM2-E

CPLNM2-S

CPLNM3

CPLNM4

GOWAN NORTH
BUFFALO BRANCH
LONE MTN. TO WASHBURN



ULTIMATE CONDITION
MINOR BASIN MAP

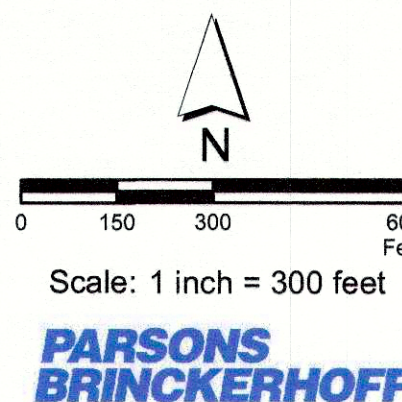
- Legend**
- Proposed Storm Drain
 - Flow Pattern
 - Minor Basins
 - COMBINATION POINT
 - DIVERSION

DIVERSION	10-YR FLOW	100-YR FLOW
CPCMLA-E	0	0
CPCMLA-S	14	91
CPCNRS-E	0	0
CPCNRS-S	50	190
CPLABF-E	8	28
CPLABF-S	0	0
CPLACO-E	0	5
CPLACO-S	52	200
CPRSBF-E	7	22
CPRSBF-S	0	0
CPTMRS-E	1	35
CPTMRS-S	3	40
CPWSCM-E	46	113
CPWSCM-S	0	17
CPWSCN-E	0	2
CPWSCN-S	46	116
CPWSTM-E	41	107
CPWSTM-S	0	58

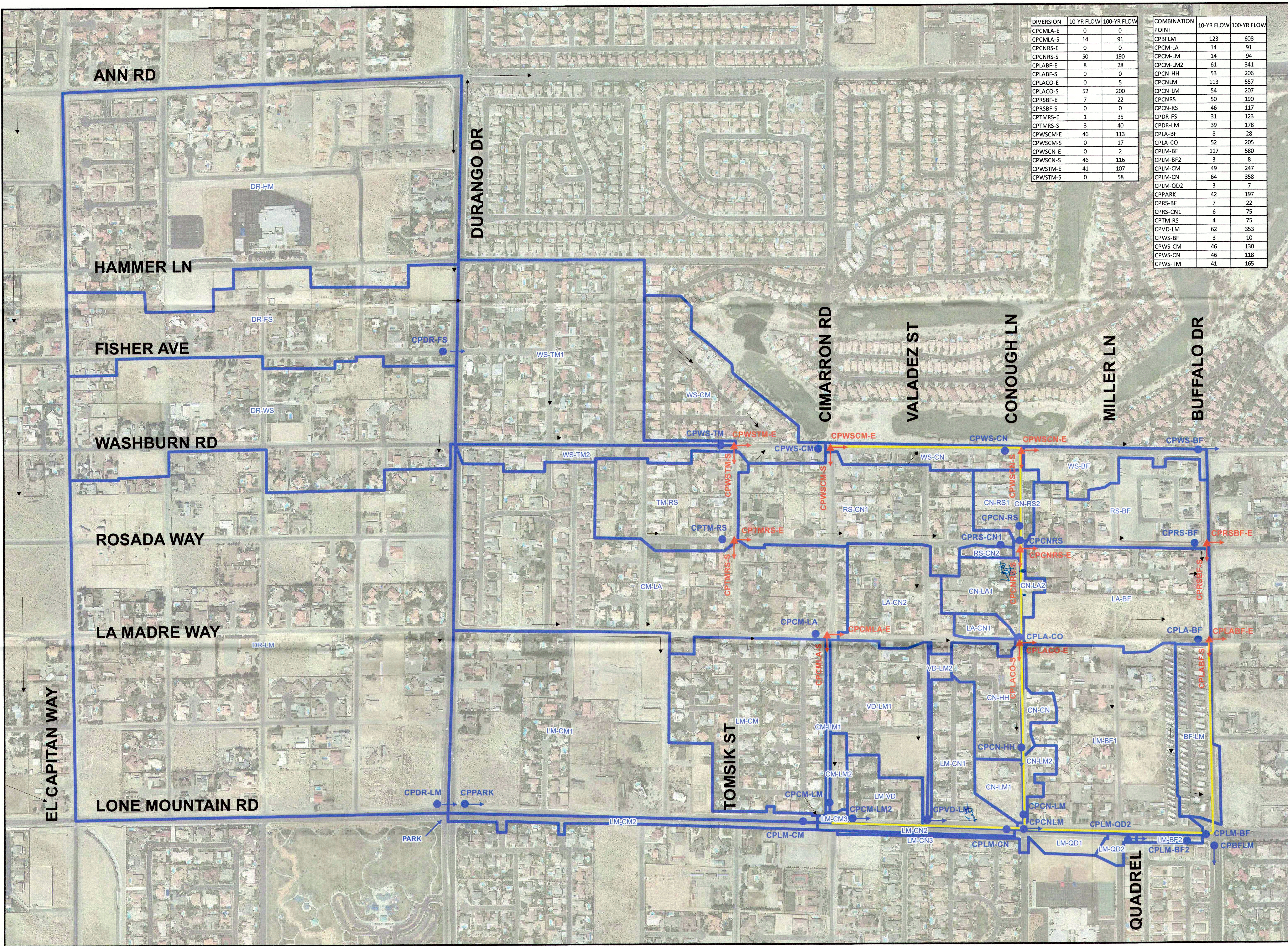
COMBINATION POINT	10-YR FLOW	100-YR FLOW
CPBFLM	123	608
CPCM-LA	14	91
CPCM-LM	14	94
CPCM-LM2	61	341
CPCN-HH	53	206
CPCNLM	113	557
CPCN-LM	54	207
CPCNRS	50	190
CPCN-RS	46	117
CPDR-FS	31	123
CPDR-LM	39	178
CPLA-BF	8	28
CPLA-CO	52	205
CPLM-BF	117	580
CPLM-BF2	3	8
CPLM-CM	49	247
CPLM-CN	64	358
CPLM-QD2	3	7
CPPARK	42	197
CPRS-BF	7	22
CPRS-CN1	6	75
CPTM-RS	4	75
CPVD-LM	62	353
CPWS-BF	3	10
CPWS-CM	46	130
CPWS-CN	46	118
CPWS-TM	41	165

MINOR BASIN	10-YR FLOW	100-YR FLOW
BF-LM	5	14
CM-LA	11	51
CM-LM1	1	2
CM-LM2	1	2
CN-CN	1	3
CN-HH	3	11
CN-LA1	1	6
CN-LA2	1	2
CN-LM1	1	5
CN-LM2	1	3
CN-RS1	1	4
CN-RS2	0	2
DR-FS	17	65
DR-HM	24	100
DR-LM	31	126
DR-W5	12	53
LA-BF	8	28
LA-CN1	1	2
LA-CN2	4	15
LM-BF1	14	44
LM-BF2	1	1
LM-CM	5	27
LM-CM1	11	46
LM-CM2	2	6
LM-CM3	0	1
LM-CN1	3	10
LM-CN2	1	3
LM-CN3	0	1
LM-QD1	2	5
LM-QD2	1	2
LM-VD	1	6
PARK*	15	48
RS-BF	7	22
RS-CN1	6	24
RS-CN2	0	1
TM-RS	4	17
VD-LM1	4	15
VD-LM2	1	2
WS-BF	3	10
WS-CM	10	28
WS-CN	2	8
WS-TM1	9	39
WS-TM2	2	7

* See Report Section 3 for a discussion on Park flow



PARSONS
BRINCKERHOFF



DIVERSION	10-YR FLOW	100-YR FLOW
CPCM-LA-E	0	0
CPCM-LA-S	14	91
CPCN-RS-E	0	0
CPCN-RS-S	50	190
CPLABF-E	8	28
CPLABF-S	0	0
CPLACO-E	0	5
CPLACO-S	52	200
CPRS-BF-E	7	22
CPRS-BF-S	0	0
CPTM-RS-E	1	35
CPTM-RS-S	3	40
CPWSCM-E	46	113
CPWSCM-S	0	17
CPWSCN-E	0	2
CPWSCN-S	46	116
CPWSTM-E	41	107
CPWSTM-S	0	58

COMBINATION POINT	10-YR FLOW	100-YR FLOW
CPBFLM	123	608
CPCM-LA	14	91
CPCM-LM2	14	94
CPCM-LM2	61	341
CPCN-HH	53	206
CPCN-LM	113	557
CPCN-LM	54	207
CPCN-RS	50	190
CPCN-RS	46	117
CPDR-FS	31	123
CPDR-LM	39	178
CPLA-BF	8	28
CPLA-CO	52	205
CPLM-BF	117	580
CPLM-BF2	3	8
CPLM-CM	49	247
CPLM-CN	64	358
CPLM-QD2	3	7
CPARK	42	197
CPRS-BF	7	22
CPRS-CN1	6	75
CPTM-RS	4	75
CPVD-LM	62	353
CPWS-BF	3	10
CPWS-CM	46	130
CPWS-CN	46	118
CPWS-TM	41	165

GOWAN NORTH
BUFFALO BRANCH
LONE MTN. TO WASHBURN



ULTIMATE CONDITION
MINOR BASIN MAP

Legend

- Proposed Storm Drain
- Flow Pattern
- Minor Basins
- COMBINATION POINT
- DIVERSION

MINOR BASIN	10-YR FLOW	100-YR FLOW
BF-LM	5	14
CM-LA	11	51
CM-LM1	1	2
CM-LM2	1	2
CN-CN	1	3
CN-HH	3	11
CN-LA1	1	6
CN-LA2	1	2
CN-LM1	1	5
CN-LM2	1	3
CN-RS1	1	4
CN-RS2	0	2
DR-FS	17	65
DR-HM	24	100
DR-LM	31	126
DR-WS	12	53
LA-BF	8	28
LA-CN1	1	2
LA-CN2	4	15
LM-BF1	14	44
LM-BF2	1	1
LM-CM	5	27
LM-CM1	11	46
LM-CM2	2	6
LM-CM3	0	1
LM-CN1	3	10
LM-CN2	1	3
LM-CN3	0	1
LM-QD1	2	5
LM-QD2	1	2
LM-VD	1	6
PARK*	15	48
RS-BF	7	22
RS-CN1	6	24
RS-CN2	0	1
TM-RS	4	17
VD-LM1	4	15
VD-LM2	1	2
WS-BF	3	10
WS-CM	10	28
WS-CN	2	8
WS-TM1	9	39
WS-TM2	2	7

* See Report Section 3 for a discussion on Park flow

Scale: 1 inch = 300 feet

PARSONS
BRINCKERHOFF

- **B.2 - Time of Concentration**



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

ULTIMATE CONDITION MODEL - MAJOR BASINS

TIME OF CONCENTRATION CALCULATION - CCRFCD STANDARD FORM 4

Project #: 31698
Made by: NSA
Date: 03/02/15
Checked by: JS
Date: 04/06/15

Sub-Basin Data						Initial/Overland Time (T _i)			Travel Time (T _t)					T _c Check (Urbanized Basins)				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Basin	U/NU	CN	K	Area (acres)	Area (sq mi)	Lo Initial Length (ft)	Slope (%)	T _i (min)	Travel Length (ft)	Slope (%)	V1 Velocity (fps)	V2 Velocity (fps)	T _t (min)	Total Length (ft)	Check T _c = (L/180)+10 (min)	T _c = T _i + T _t vs Check T _c (min)	Final T _c (min)	T lag =0.6T _c /60 (hours)
(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10a)	(10b)	(11)	(12)	(13)	(14a)	(14b)	(15)
WAS1	U	77	0.625	179.8	0.2810	40	1.00	5.40	7341	1.50	2.47	3.75	33.79	7381	51.01	39.20	39.20	0.392
WAS2	U	83	0.708	22.5	0.0351	147	1.00	8.56	3235	1.14	2.16	3.27	17.82	3382	28.79	26.38	26.38	0.264
LN1	U	76	0.618	348.1	0.5439	32	0.50	6.17	8789	1.27	2.28	3.45	43.72	8821	59.01	49.89	49.89	0.499
LN2	U	77	0.625	15.3	0.0239	345	0.50	19.97	1269	1.15	2.17	3.28	7.75	1614	18.97	18.97	18.97	0.190
LN3	U	78	0.633	29.2	0.0457	165	0.50	13.57	2744	0.50	1.43	2.16	23.12	2909	26.16	26.16	26.16	0.262
LN4	U	83	0.705	31.0	0.0485	90	0.50	8.48	2500	0.67	1.65	2.50	18.35	2590	24.39	24.39	24.39	0.244
CON	U	78	0.644	63.9	0.0998	160	0.50	13.06	4630	0.69	1.68	2.54	32.05	4790	36.61	36.61	36.61	0.366
BFN	U	83	0.702	20.5	0.0321	115	0.50	9.65	1330	0.83	1.84	2.79	9.49	1445	18.03	18.03	18.03	0.180
BFS	U	82	0.689	29.2	0.0456	220	0.50	13.80	3321	0.65	1.63	2.47	24.17	3541	29.67	29.67	29.67	0.297

Column

Equations Used

- 1 HEC-1 KK Card
- 2 U/NU Urban or Non-Urban condition of the basin
- 3 CN Composite Curve Number determined from typical land use and soil group shown on MPU H Maps and CCRFCD Table 602 and 602A
- 4 K HEC-1 LS Card
- 6 K = 0.0132CN-0.39 From CCRFCD, 1999- Equation 603 Use this equation since this project uses HEC-1 to calculate flows.
- 9 Area HEC-1 BA Card
- 9 T_i $T_i = 1.8(1.1-K)L_o^{0.5}/S^{0.3}$ From CCRFCD, 1999 - Equation 602
- 12 V1 $V1 = CS^{1/2}$ where C = 14.80 (for Non-Urbanized Areas) From page 606, paragraph 2 of the Design Manual
- 13 V2 $V2 = CS^{1/2}$ where C = 20.20 (for Urbanized Areas) S = Slope (ft/ft)
- 13 V2 $V2 = CS^{1/2}$ where C = 29.40 (for Non-Urbanized Areas) S = Slope (ft/ft)
- 13 V2 $V2 = CS^{1/2}$ where C = 30.60 (for Urbanized Areas) S = Slope (ft/ft)
- 14 T_t Length/(Velocity * 60) Condition 1 + Condition 2 (Length (ft); Velocity (fps))
- 14 T_t Since L_o is limited to 500ft max, per equation 602
- 14 T_t Condition 1: T_t for L ≤ 500ft, use V1
- 14 T_t Condition 2: T_t for L > 500ft, use V2 for L-500
- 16 T_c check T_c = (L/180)+10 From CCRFCD, 1999 - Equation 604 T_c check is for urbanized areas only
- 16 T_c L = L_o + Travel length
- 17 T_c If Check T_c ≤ T_i+T_t, use Check T_c
- 17 T_c If Check T_c > T_i+T_t, use T_i+T_t
- 18 Used T_c The minimum T_c recommended for non-urban watersheds is 10 minutes. (CCRFCD, 1999 - Page 605)
- 18 Used T_c The minimum T_c recommended for urbanized areas is 5 minutes. (CCRFCD, 1999 - Page 606)
- 19 HEC-1 UD Card Per Equation 612 of the Manual, Since basin areas for this project are less than 1 square mile Equation 613 not utilized.



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

ULTIMATE CONDITION MODEL - MINOR BASINS

TIME OF CONCENTRATION CALCULATION - CCRFCD STANDARD FORM 4

Project #: 31698
Made by: NSA
Date: 03/02/15
Checked by: JS
Date: 04/06/15

Sub-Basin Data						Initial/Overland Time (T _i)			Travel Time (T _t)						T _c Check (Urbanized Basins)				
1	2	3	4	5.0	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Basin	U/NU	CN	K	Area (acres)	Area (sq mi)	Lo Initial Length (ft)	Slope (%)	T _i (min)	Travel Length (ft)	Slope (%)	V1 Velocity (fps)	V2 Velocity (fps)	T _t (min)	Total Length (ft)	Check T _c = (L/180)+10 (min)	T _c = T _i + T _t vs Check T _c (min)	Final T _c (min)	T lag =0.6T _c /60 (hours)	
(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10a)	(10b)	(11)	(12)	(13)	(14a)	(14b)	(15)	
BF-LM	U	84	0.721	8.1	0.0126	20	0.50	3.84	1492	0.74	1.74	2.63	11.08	1512	18.40	14.91	14.91	0.149	
CM-LA	U	76	0.610	55.8	0.0872	20	0.50	4.96	3948	1.32	2.32	3.52	19.94	3968	32.04	24.89	24.89	0.249	
CM-LM1	U	85	0.738	0.9	0.0014	20	0.50	3.67	1250	0.48	1.40	2.12	11.85	1270	17.06	15.52	15.52	0.155	
CM-LM2	U	81	0.674	1.6	0.0025	94	0.50	9.34	570	0.44	1.34	2.03	6.79	664	13.69	13.69	13.69	0.137	
CN-CN	U	85	0.734	1.8	0.0028	20	0.50	3.70	800	0.38	1.25	1.89	9.34	820	14.56	13.04	13.04	0.130	
CN-HH	U	81	0.677	7.5	0.0117	168	0.50	12.41	1061	0.47	1.38	2.10	10.47	1229	16.83	16.83	16.83	0.168	
CN-LA1	U	76	0.613	5.3	0.0083	230	0.50	16.70	560	0.26	1.03	1.56	8.73	790	14.39	14.39	14.39	0.144	
CN-LA2	U	81	0.676	1.2	0.0018	30	0.50	5.26	685	0.29	1.09	1.65	9.53	715	13.97	13.97	13.97	0.140	
CN-LM1	U	81	0.681	2.9	0.0046	324	0.50	17.07	455	0.44	1.34	2.03	5.66	779	14.33	14.33	14.33	0.143	
CN-LM2	U	84	0.721	1.6	0.0026	80	0.50	7.67	645	0.54	1.48	2.25	6.69	725	14.03	14.03	14.03	0.140	
CN-RS1	U	77	0.624	3.6	0.0055	310	0.50	18.95	514	0.58	1.54	2.33	5.52	824	14.58	14.58	14.58	0.146	
CN-RS2	U	80	0.667	1.2	0.0018	131	0.50	11.21	514	0.58	1.54	2.33	5.52	645	13.58	13.58	13.58	0.136	
DR-FS	U	77	0.627	36.6	0.0572	17	0.50	4.41	3248	1.72	2.65	4.01	14.56	3265	28.14	18.97	18.97	0.190	
DR-HM	U	77	0.621	95.5	0.1492	36	1.00	5.18	4026	1.64	2.59	3.92	18.22	4062	32.57	23.40	23.40	0.234	
DR-LM	U	77	0.621	156.5	0.2445	320	0.50	19.38	5120	1.36	2.36	3.57	25.11	5440	40.22	40.22	40.22	0.402	
DR-WS	U	76	0.619	50.8	0.0794	20	0.50	4.86	3320	1.60	2.56	3.87	15.40	3340	28.56	20.27	20.27	0.203	
LA-BF	U	81	0.679	21.5	0.0335	234	0.50	14.56	2015	0.65	1.63	2.47	15.35	2249	22.49	22.49	22.49	0.225	
LA-CN1	U	78	0.642	1.5	0.0024	154	0.50	12.86	440	0.70	1.69	2.56	4.34	594	13.30	13.30	13.30	0.133	
LA-CN2	U	78	0.635	12.3	0.0193	20	0.50	4.70	1842	0.76	1.76	2.67	13.12	1862	20.34	17.82	17.82	0.178	
LM-BF1	U	83	0.707	31.6	0.0493	644	0.50	22.56	1942	0.72	1.71	2.60	14.12	2586	24.37	24.37	24.37	0.244	
LM-BF2	U	87	0.755	0.6	0.0010	38	0.50	4.82	475	1.05	2.07	3.14	3.82	513	12.85	8.64	8.64	0.086	
LM-CM	U	75	0.601	28.8	0.0450	114	0.50	12.06	1967	1.02	2.04	3.09	12.00	2081	21.56	21.56	21.56	0.216	
LM-CM1	U	77	0.621	53.4	0.0834	200	0.50	15.34	3872	1.16	2.18	3.30	20.88	4072	32.62	32.62	32.62	0.326	
LM-CM2	U	86	0.745	3.3	0.0052	20	0.50	3.60	2673	1.31	2.31	3.50	13.95	2693	24.96	17.54	17.54	0.175	
LM-CM3	U	85	0.731	0.4	0.0006	10	0.50	2.64	216	0.93	1.95	2.95	1.85	226	11.26	4.49	5.00	0.050	
LM-CN1	U	78	0.639	8.7	0.0136	26	0.50	5.32	1497	0.40	1.28	1.94	15.11	1523	18.46	18.46	18.46	0.185	
LM-CN2	U	87	0.758	1.7	0.0027	20	0.50	3.46	1425	0.56	1.51	2.29	12.25	1445	18.03	15.70	15.70	0.157	
LM-CN3	U	78	0.640	0.6	0.0009	28	0.50	5.50	1280	0.46	1.37	2.08	12.35	1308	17.27	17.27	17.27	0.173	
LM-QD1	U	87	0.755	2.1	0.0033	10	0.50	2.47	706	0.85	1.86	2.82	5.69	716	13.98	8.16	8.16	0.082	
LM-QD2	U	87	0.765	0.9	0.0014	10	0.50	2.40	285	0.70	1.69	2.56	2.81	295	11.64	5.21	5.21	0.052	
LM-VD	U	77	0.620	5.1	0.0080	435	0.50	22.65	548	0.64	1.62	2.45	5.48	983	15.46	15.46	15.46	0.155	
RS-BF	U	82	0.694	15.3	0.0239	428	0.50	18.99	1264	0.80	1.81	2.74	9.26	1692	19.40	19.40	19.40	0.194	
RS-CN1	U	77	0.629	24.3	0.0380	168	0.50	13.81	2445	0.98	2.00	3.03	14.87	2613	24.52	24.52	24.52	0.245	
RS-CN2	U	76	0.617	0.7	0.0011	68	0.50	9.02	390	0.82	1.83	2.77	3.55	458	12.54	12.54	12.54	0.125	
TM-RS	U	77	0.625	15.3	0.0239	198	0.50	15.13	1489	1.00	2.02	3.06	9.51	1687	19.37	19.37	19.37	0.194	
VD-LM1	U	77	0.631	14.2	0.0222	20	0.50	4.74	1920	0.57	1.53	2.31	15.71	1940	20.78	20.45	20.45	0.205	
VD-LM2	U	81	0.683	1.3	0.0020	10	0.50	2.99	1264	0.51	1.44	2.19	11.60	1274	17.08	14.59	14.59	0.146	
WS-BF	U	85	0.733	5.8	0.0090	120	0.50	9.09	1323	0.84	1.85	2.80	9.39	1443	18.02	18.02	18.02	0.180	
WS-CM	U	84	0.719	18.4	0.0287	148	0.50	10.48	1833	1.36	2.36	3.57	9.76	1981	21.01	20.24	20.24	0.202	
WS-CN	U	81	0.677	5.1	0.0080	36	0.50	5.74	1430	1.05	2.07	3.14	8.97	1466	18.14	14.71	14.71	0.147	
WS-TM1	U	77	0.633	42.2	0.0659	124	0.50	11.77	3207	1.30	2.30	3.49	16.55	3331	28.51	28.32	28.32	0.283	
WS-TM2	U	78	0.634	5.5	0.0085	16	0.50	4.22	2092	1.48	2.46	3.72	10.52	2108	21.71	14.74	14.74	0.147	

- B.3 - Rainfall



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

MAJOR BASIN RAINFALL DEPTHS

Project #: 31698
 Made by: JS
 Date: 03/09/15
 Checked by: NSA
 Date: 03/09/15

BASIN	Total Basin Area	Rainfall Depth	Area	Percent of Basin	Fractional Rainfall Depth	Weighted Basin Rainfall Depth
	(ac)	(in)	(ac)	(%)	(in)	(in)
BFN	20.53	2.77	20.53	100	2.77	2.77
BFS	29.20	2.77	29.20	100	2.77	2.77
CON	63.89	2.77	63.89	100	2.77	2.77
LNM1	348.09	2.87	24.13	7	0.20	2.80
		2.83	76.45	22	0.62	
		2.77	172.70	50	1.38	
		2.80	74.80	21	0.60	
LNM2	15.30	2.77	15.30	100	2.77	2.77
LNM3	29.22	2.77	29.22	100	2.77	2.77
LNM4	31.02	2.77	31.02	100	2.77	2.77
WAS1	179.83	2.87	17.19	10	0.27	2.81
		2.83	10.54	6	0.17	
		2.77	70.72	39	1.09	
		2.80	47.01	26	0.73	
		2.85	34.36	19	0.54	
WAS2	22.48	2.77	22.48	100	2.77	2.77



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

Project #: 31698
 Made by: JS
 Date: 03/09/15
 Checked by: NSA
 Date: 03/09/15

MINOR BASIN RAINFALL DEPTHS

BASIN	Total Basin Area	Rainfall Depth	Area	Percent of Basin	Fractional Rainfall Depth	Weighted Basin Rainfall Depth
	(ac)	(in)	(ac)	(%)	(in)	(in)
BF-LM	8.06	8.06	100	2.77	2.77	2.77
CM-LA	55.83	55.82	100	2.77	2.77	2.77
CM-LM1	0.90	0.90	100	2.77	2.77	2.77
CM-LM2	1.57	1.57	100	2.77	2.77	2.77
CN-CN	1.77	1.77	100	2.77	2.77	2.77
CN-HH	7.50	7.50	100	2.77	2.77	2.77
CN-LA1	5.30	5.30	100	2.77	2.77	2.77
CN-LA2	1.17	1.17	100	2.77	2.77	2.77
CN-LM1	2.92	2.92	100	2.77	2.77	2.77
CN-LM2	1.64	1.64	100	2.77	2.77	2.77
CN-RS1	3.55	3.55	100	2.77	2.77	2.77
CN-RS2	1.15	1.15	100	2.77	2.77	2.77
DR-FS	36.60	4.90	13	2.87	0.39	2.81
		9.12	25	2.83	0.71	
		7.49	20	2.77	0.57	
		14.23	39	2.80	1.09	
		0.87	2	2.85	0.07	
DR-HM	95.49	12.29	13	2.87	0.37	2.82
		1.43	1	2.83	0.04	
		15.56	16	2.77	0.45	
		32.74	34	2.80	0.96	
		33.47	35	2.85	1.00	
DR-LM	156.50	18.17	12	2.87	0.33	2.82
		59.42	38	2.83	1.07	
		24.29	16	2.77	0.43	
		54.63	35	2.80	0.98	
DR-WS	50.83	5.97	12	2.87	0.34	2.82
		17.07	34	2.83	0.95	
		7.54	15	2.77	0.41	
		20.25	40	2.80	1.12	
LA-BF	21.46	21.46	100	2.77	2.77	2.77
LA-CN1	1.54	1.54	100	2.77	2.77	2.77
LA-CN2	12.33	12.33	100	2.77	2.77	2.77
LM-BF1	31.58	31.58	100	2.77	2.77	2.77
LM-BF2	0.64	0.64	100	2.77	2.77	2.77
LM-CM	28.80	28.80	100	2.77	2.77	2.77
LM-CM1	53.37	53.37	100	2.77	2.77	2.77
LM-CM2	3.33	3.33	100	2.77	2.77	2.77
LM-CM3	0.37	0.37	100	2.77	2.77	2.77
LM-CN1	8.72	8.72	100	2.77	2.77	2.77
LM-CN2	1.73	1.73	100	2.77	2.77	2.77
LM-CN3	0.61	0.61	100	2.77	2.77	2.77
LM-QD1	2.14	2.14	100	2.77	2.77	2.77
LM-QD2	0.90	0.90	100	2.77	2.77	2.77
LM-VD	5.10	5.10	100	2.77	2.77	2.77
RS-BF	15.29	15.29	100	2.77	2.77	2.77
RS-CN1	24.33	24.33	100	2.77	2.77	2.77
RS-CN2	0.72	0.72	100	2.77	2.77	2.77
TM-RS	15.30	15.30	100	2.77	2.77	2.77
VD-LM1	14.21	14.20	100	2.77	2.77	2.77
VD-LM2	1.31	1.31	100	2.77	2.77	2.77
WS-BF	5.75	5.75	100	2.77	2.77	2.77
WS-CM	18.38	18.38	100	2.77	2.77	2.77
WS-CN	5.14	5.14	100	2.77	2.77	2.77
WS-TM1	42.18	42.18	100	2.77	2.77	2.77
WS-TM2	5.46	5.46	100	2.77	2.77	2.77

- B.4 - Curve Numbers

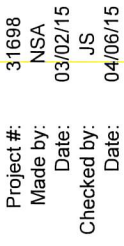


GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN
ULTIMATE CONDITION - MAJOR BASINS

Project #: 31698
Made by: NSA
Date: 03/02/15
Checked by: JS
Date: 04/06/15

CURVE NUMBER CALCULATIONS

Basin ID	Total Basin Area	Land Use 2				Land Use 4				Land Use 5				Land Use 6				Land Use 7				Land Use 12				Composite Curve Number
		Parks				Low Density Residential				Medium Density Residential				High Density Residential				Public Facility, Residential				Schools				
		A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	
	Acres	---	64	---	---	---	75	---	82	---	71	---	---	---	84	---	---	---	87	---	91	---	79	---	---	---
WAS1	179.8	---	0.0	---	---	---	138.5	---	0.0	---	---	1.5	---	---	0.1	---	---	---	23.8	---	0.0	---	16.0	---	---	77
WAS2	22.5	---	0.0	---	---	---	3.8	---	0.3	---	---	0.0	---	---	13.2	---	---	---	4.8	---	0.3	---	0.0	---	---	83
LNM1	348.1	---	0.0	---	---	---	286.3	---	0.0	---	---	16.5	---	---	0.0	---	---	---	45.3	---	0.0	---	0.0	---	---	76
LNM2	15.3	---	0.0	---	---	---	12.8	---	0.0	---	---	0.1	---	---	0.0	---	---	---	2.4	---	0.0	---	0.0	---	---	77
LNM3	29.2	---	0.0	---	---	---	22.7	---	1.5	---	---	0.0	---	---	0.0	---	---	---	4.4	---	0.6	---	0.0	---	---	78
LNM4	31.0	---	0.0	---	---	---	0.0	---	27.7	---	---	0.0	---	---	0.0	---	---	---	0.0	---	3.3	---	0.0	---	---	83
CON	63.9	---	0.0	---	---	---	42.9	---	10.1	---	---	0.0	---	---	0.0	---	---	---	8.7	---	2.2	---	0.0	---	---	78
BFN	20.5	---	0.0	---	---	---	2.5	---	14.0	---	---	0.0	---	---	0.0	---	---	---	0.6	---	3.4	---	0.0	---	---	83
BFS	29.2	---	0.0	---	---	---	5.5	---	20.1	---	---	0.0	---	---	0.0	---	---	---	0.2	---	3.3	---	0.0	---	---	82



CURVE NUMBER CALCULATIONS

Project #: 31698
Made by: NSA
Date: 03/02/15
Checked by: JS
Date: 04/06/15

- **B.5 - Flow Splits**

APPENDIX B.5A

METHOD - DIMENSIONAL SIMPLIFICATION OF MANNING'S EQUATION

Given Manning Equation

$$Q_T = \frac{1.49}{n} AR^{\frac{2}{3}} S^{\frac{1}{2}}$$

Where:

Q_T = Total Flow

n = Manning's n

A = flow area (sq-ft)

R = hydraulic radius (ft)

S = slope (ft/ft)

Assume Manning's n value is consistent between streets

$$Q_T \propto AR^{\frac{2}{3}} S^{\frac{1}{2}}$$

Given:

$$R = \frac{A}{P}$$

Where:

A = flow area (sq-ft)

P = wetted perimeter (ft)

Then:

$$Q_T \propto A \left(\frac{A}{P} \right)^{\frac{2}{3}} S^{\frac{1}{2}}$$

$$Q_T \propto \frac{A^{\frac{5}{3}}}{P^{\frac{2}{3}}} S^{\frac{1}{2}}$$

Area is W times depth y, Perimeter is W plus depth 2y

$$Q_T \propto \frac{(W \times y)^{\frac{5}{3}}}{(W + 2y)^{\frac{2}{3}}} S^{\frac{1}{2}}$$

Eliminate $2y$ in denominator because y is small with respect to W

$$Q_T \propto \frac{(W \times y)^{\frac{5}{3}}}{(W)^{\frac{2}{3}}} S^{\frac{1}{2}}$$

$$Q_T \propto \frac{W^{\frac{5}{3}} y^{\frac{5}{3}}}{W^{\frac{2}{3}}} S^{\frac{1}{2}}$$

$$Q_T \propto W y^{\frac{5}{3}} S^{\frac{1}{2}}$$

Eliminate y in equation because the relative difference in y between two streets is small as compared to the difference in W and S

$$Q_T \propto W S^{\frac{1}{2}}$$

By conservation of mass and energy:

$$Q_T = Q_S + Q_E$$

Or

$$Q_E = Q_T - Q_S$$

Where:

Q_S = Flow draining to south street

Q_E = Flow draining to east street

And:

$$\frac{Q_S}{Q_E} = \frac{W_S S_S^{1/2}}{W_E S_E^{1/2}}$$

Where:

W_S = Width of south street

S_S = Slope of south street

W_E = Width of east street

S_E = Slope of east street

Assume:

$$X = \frac{W_S S_S^{1/2}}{W_E S_E^{1/2}}$$

Substitute X for the ratio

$$\frac{Q_S}{Q_E} = X$$

Substitute for Q_E

$$\frac{Q_S}{(Q_T - Q_S)} = X$$

$$Q_S = (X)(Q_T - Q_S)$$

$$Q_S = Q_T(X) - Q_S(X)$$

$$Q_S + Q_S(X) = Q_T(X)$$

$$Q_S[1 + (X)] = Q_T(X)$$

$$Q_S = \frac{Q_T(X)}{[1 + (X)]}$$

With ratio X replaced back in:

$$Q_S = \frac{Q_T \left(\frac{W_S S_S^{1/2}}{W_E S_E^{1/2}} \right)}{\left[1 + \left(\frac{W_S S_S^{1/2}}{W_E S_E^{1/2}} \right) \right]}$$



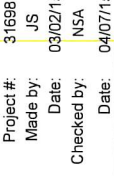
GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

MAJOR BASIN FLOW SPLITS

Project #: 31598
Made by: JS
Date: 03/02/15
Checked by: NSA
Date: 04/07/15

Diversion Name	Intersection	Intersection Geometry										10-Year										100-Year																																																																																																																																																																																																																																																																																																																																																																																																																																													
		Half Street		South Street				East Street				Q ₀ /Q _c		HEC-1		Q Entering Intersection				Split Flow				Q Exiting Intersection				HEC-1		Q Entering Intersection				Split Flow				Q Exiting Intersection																																																																																																																																																																																																																																																																																																																																																																																																																													
		Crown Street (E or S)	Capacity (cfs)	Width (ft)	Slope (ft/ft)	Width (ft)	Slope (ft/ft)	Width (ft)	Slope (ft/ft)	Ratio	Ratio	Cards	HEC-1	Q ₀	Q _c	HEC-1	Q	Bypass *	Total	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split	Above	Crown	South	East	Split	Split

- 1 KK card for diversion in HEC-1
 - 2 Intersection of interest
 - 3 Notes that a crown is present through the intersection and indicates the direction that the crown runs. IF N/A there is no crown.
 - 4 Normal depth capacity of half of the crowned street through the intersection. See flowmaster calculations in Appendix B.5D.
 - 5 Width of half of the street to the south (downstream) of the intersection
 - 6 Longitudinal slope of the street to the south (downstream) of the intersection
 - 7 Width of half of the street to the east (downstream) of the intersection
 - 8 Longitudinal slope of the street to the east (downstream) of the intersection
 - 9 Ratio for flow split based on street geometry. See Appendix B.5A for derivation.
 - 10 HEC-1 node directly contributing to intersection flow split
 - 11 10-year HEC-1 flow directly contributing to intersection
 - 12 10-year inlet bypass contributing to intersection
 - 13 10-year total flow contributing to intersection
 - 14 10-year flow that exceeds the half street capacity. This is the flow above crown to be split.
 - 15 10-year flow above the crown that will split to the south
 - 16 10-year flow above the crown that will split to the east
 - 17 Total 10-year flow that will exit the intersection to the south (any half street flow below crown + split flow above crown)
 - 18 Total 10-year flow that will exit the intersection to the east (any half street flow below crown + split flow above crown)
 - 19 100-year HEC-1 flow directly contributing to intersection
 - 20 100-year inlet bypass contributing to intersection
 - 21 100-year total flow contributing to intersection
 - 22 100-year flow that exceeds the half street capacity. This is the flow above crown to be split.
 - 23 100-year flow above the crown that will split to the south
 - 24 100-year flow above the crown that will split to the east
 - 25 Total 100-year flow that will exit the intersection to the south (any half street flow below crown + split flow above crown)
 - 26 Total 100-year flow that will exit the intersection to the east (any half street flow below crown + split flow above crown)
- * Inlet bypass flow is from the Drop Inlet Analysis - Ultimate Condition table, which uses the minor basin HEC-1 flows. This value is conservative.



MINOR BASIN FLOW SPLITS

1 KK card for diversion in HEC-1

3 Notes that a crown is pr

5 Width of half of the street to the south (downstream) of the intersection

7 Width of half of the street to the east (downstream) of the intersection

8 longitudinal slope of the street to the east (downstream) of the intersection

U HEC-1 node directly contributing to intersection flow split

2 10-year inlet bypass contributing to intersection

4 10-year flow that exceeds the half street capacity. This is the flow above crown to be split.

6 10-year flow above the crown that will split to the east

8 Total 10-year flow that will exit the intersection to the east (any half street flow below crown + split flow above crown)

On 100-year inlet bypass contributing to intersection

2. 100-year flow that exceeds the half-street capacity

100-year flow above the crown that will spill to the south

5 Total 100-year flow that will exit the intersection to the south (any half street flow below crown + split flow above crown)

* Surface flow splits at intersections account for bypass from upstream inlets

Worksheet for CPWSTM-E Washburn at Tomsik

Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.02500 ft/ft
Normal Depth 0.54 ft
Section Definitions

Station (ft)	Elevation (ft)
-0+26	2398.75
-0+25	2398.25
0+00	2398.79

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+26, 2398.75)	(-0+25, 2398.25)	0.013
(-0+25, 2398.25)	(0+00, 2398.79)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Discharge 41.91 ft³/s
Elevation Range 2398.25 to 2398.79 ft
Flow Area 6.89 ft²
Wetted Perimeter 25.96 ft
Hydraulic Radius 0.27 ft
Top Width 25.50 ft
Normal Depth 0.54 ft
Critical Depth 0.71 ft
Critical Slope 0.00508 ft/ft

Worksheet for CPWSTM-E Washburn at Tomsik

Results

Velocity	6.09	ft/s
Velocity Head	0.58	ft
Specific Energy	1.12	ft
Froude Number	2.06	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.54	ft
Critical Depth	0.71	ft
Channel Slope	0.02500	ft/ft
Critical Slope	0.00508	ft/ft

Cross Section for CPWSTM-E Washburn at Tomsik

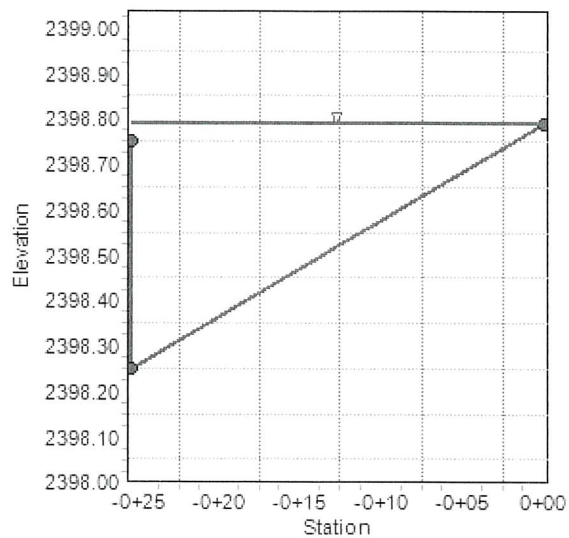
Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.02500 ft/ft
Normal Depth 0.54 ft
Discharge 41.91 ft³/s

Cross Section Image



Worksheet for CPWSCN-E Washburn at Conough

Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.00900 ft/ft
Normal Depth 0.19 ft
Section Definitions

Station (ft)	Elevation (ft)
-0+31	2376.98
-0+27	2375.53
-0+27	2375.03
-0+01	2375.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+31, 2376.98)	(-0+27, 2375.53)	0.030
(-0+27, 2375.53)	(-0+27, 2375.03)	0.013
(-0+27, 2375.03)	(-0+01, 2375.22)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Discharge	4.49 ft ³ /s
Elevation Range	2375.03 to 2376.98 ft
Flow Area	2.46 ft ²
Wetted Perimeter	26.01 ft
Hydraulic Radius	0.09 ft
Top Width	25.86 ft
Normal Depth	0.19 ft

Worksheet for CPWSCN-E Washburn at Conough

Results

Critical Depth	0.19	ft
Critical Slope	0.00814	ft/ft
Velocity	1.83	ft/s
Velocity Head	0.05	ft
Specific Energy	0.24	ft
Froude Number	1.05	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.19	ft
Critical Depth	0.19	ft
Channel Slope	0.00900	ft/ft
Critical Slope	0.00814	ft/ft

Cross Section for CPWSCN-E Washburn at Conough

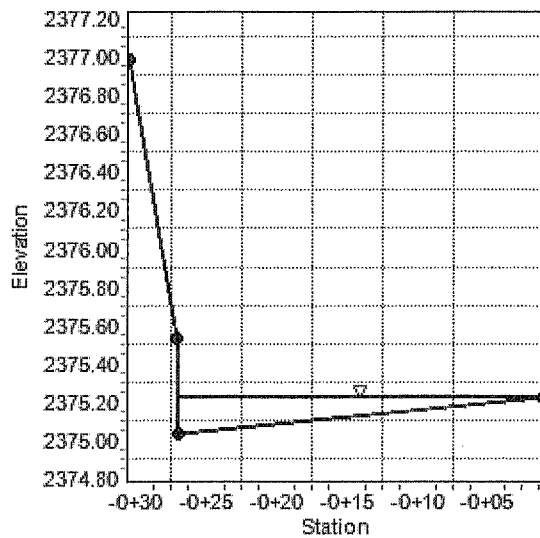
Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.00900 ft/ft
Normal Depth 0.19 ft
Discharge 4.49 ft³/s

Cross Section Image



Project Description

Input Data

Station (ft)

Elevation (ft)

Roughness Segment Definitions

Start Station

Ending Station

Roughness Coefficient

$(-0+75, 2395.51)$

(0+12, 2395.21)

0.016

Options

Current Roughness vweighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	17.99	ft³/s
Elevation Range	2394.79 to 2395.51 ft	
Flow Area	11.41	ft²
Wetted Perimeter	66.18	ft

Worksheet for CPTMRS-E Tomsik at Rosada

Results

Hydraulic Radius	0.17	ft
Top Width	66.17	ft
Normal Depth	0.42	ft
Critical Depth	0.36	ft
Critical Slope	0.00697	ft/ft
Velocity	1.58	ft/s
Velocity Head	0.04	ft
Specific Energy	0.46	ft
Froude Number	0.67	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.42	ft
Critical Depth	0.36	ft
Channel Slope	0.00300	ft/ft
Critical Slope	0.00697	ft/ft

Cross Section for CPTMRS-E Tomsik at Rosada

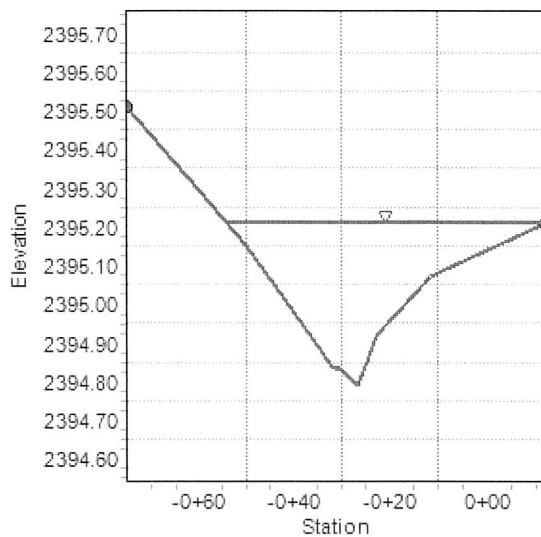
Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.00300 ft/ft
Normal Depth 0.42 ft
Discharge 17.99 ft³/s

Cross Section Image



Worksheet for CPCNRS-E Rosada at Conough

Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.00700 ft/ft
Normal Depth 0.34 ft
Section Definitions

Station (ft)	Elevation (ft)
-0+65	2373.10
-0+36	2373.08
-0+10	2373.06
-0+03	2373.02
0+03	2372.84
0+40	2372.76
0+75	2372.94

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+65, 2373.10)	(0+75, 2372.94)	0.016

Options

Current Roughness Weighted Pavlovskii's Method
Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Discharge 50.98 ft³/s
Elevation Range 2372.76 to 2373.10 ft
Flow Area 22.31 ft²
Wetted Perimeter 139.81 ft
Hydraulic Radius 0.16 ft
Top Width 139.65 ft

Worksheet for CPCNRS-E Rosada at Conough

Results

Normal Depth	0.34	ft
Critical Depth	0.34	ft
Critical Slope	0.00687	ft/ft
Velocity	2.29	ft/s
Velocity Head	0.08	ft
Specific Energy	0.42	ft
Froude Number	1.01	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.34	ft
Critical Depth	0.34	ft
Channel Slope	0.00700	ft/ft
Critical Slope	0.00687	ft/ft

Cross Section for CPCNRS-E Rosada at Conough

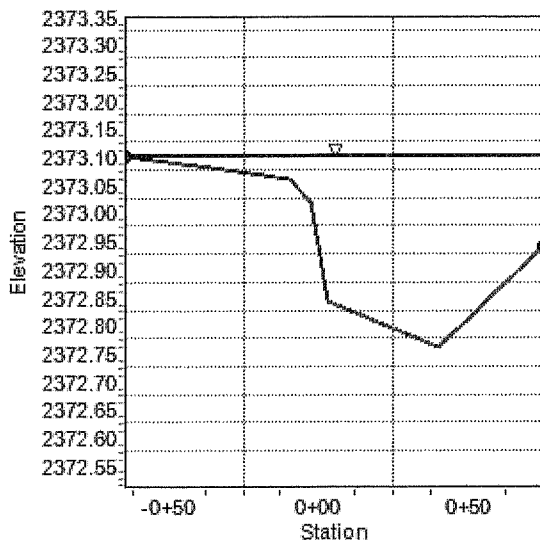
Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.00700 ft/ft
Normal Depth 0.34 ft
Discharge 50.98 ft³/s

Cross Section Image



Worksheet for CPRSBF-S Rosada at Buffalo

Results

Velocity Head	0.14	ft
Specific Energy	0.63	ft
Froude Number	1.08	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.49	ft
Critical Depth	0.50	ft
Channel Slope	0.00700	ft/ft
Critical Slope	0.00588	ft/ft

Cross Section for CPRSBF-S Rosada at Buffalo

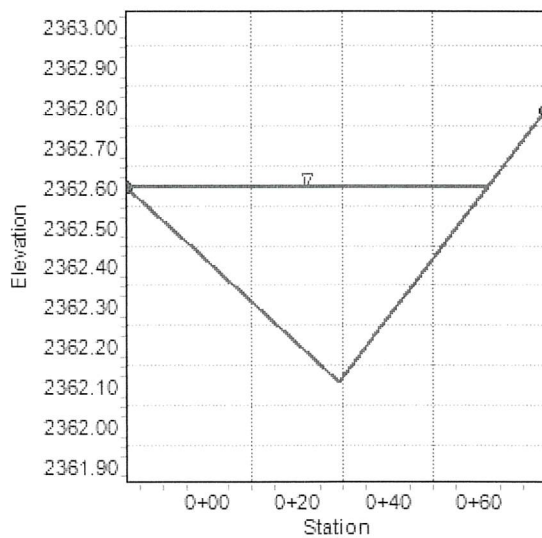
Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.00700 ft/ft
Normal Depth 0.49 ft
Discharge 59.32 ft³/s

Cross Section Image



Worksheet for CPCMLA-E Cimarron at La Madre

Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.01300 ft/ft
Normal Depth 0.88 ft
Section Definitions

Station (ft)	Elevation (ft)
-0+97	2380.40
-0+67	2380.00
-0+41	2379.56
-0+37	2379.54
-0+36	2379.52
-0+36	2379.53
-0+34	2379.61
-0+07	2380.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+97, 2380.40)	(-0+07, 2380.40)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Discharge 233.55 ft³/s
Elevation Range 2379.52 to 2380.40 ft
Flow Area 38.72 ft²
Wetted Perimeter 90.03 ft
Hydraulic Radius 0.43 ft

Worksheet for CPCMLA-E Cimarron at La Madre

Results

Top Width	90.00	ft
Normal Depth	0.88	ft
Critical Depth	1.04	ft
Critical Slope	0.00446	ft/ft
Velocity	6.03	ft/s
Velocity Head	0.57	ft
Specific Energy	1.45	ft
Froude Number	1.62	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.88	ft
Critical Depth	1.04	ft
Channel Slope	0.01300	ft/ft
Critical Slope	0.00446	ft/ft

Project Description

Manning Formula

Discharge

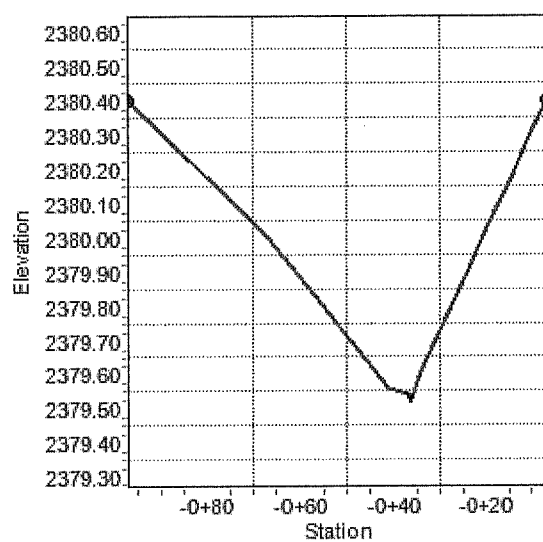
Input Data

0.01300 ft/ft

0.88 ft

233.55 ft³/s

Cross Section Image



Worksheet for CPLABF-E Buffalo at La Madre

Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.00770 ft/ft
Normal Depth 0.89 ft
Section Definitions

Station (ft)	Elevation (ft)
-0+02	2359.47
-0+24	2359.02
-0+27	2358.74
-0+30	2358.58
-0+47	2359.39
-0+51	2360.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+02, 2359.47)	(-0+24, 2359.02)	0.030
(-0+24, 2359.02)	(-0+51, 2360.00)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Discharge 50.22 ft³/s
Elevation Range 2358.58 to 2360.00 ft
Flow Area 17.42 ft²
Wetted Perimeter 45.57 ft
Hydraulic Radius 0.38 ft
Top Width 45.52 ft

Worksheet for CPLABF-E Buffalo at La Madre

Results

Normal Depth	0.89	ft
Critical Depth	0.83	ft
Critical Slope	0.01172	ft/ft
Velocity	2.88	ft/s
Velocity Head	0.13	ft
Specific Energy	1.02	ft
Froude Number	0.82	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.89	ft
Critical Depth	0.83	ft
Channel Slope	0.00770	ft/ft
Critical Slope	0.01172	ft/ft

Project Description

Manning Formula

Discharge

50.22 ft³/s

Worksheet for CPWSCM-E Washburn at Cimarron

Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.00850 ft/ft
Normal Depth 0.45 ft
Section Definitions

Station (ft)	Elevation (ft)
-0+25	2390.72
-0+24	2390.22
-0+22	2390.27
-0+11	2390.52
0+10	2390.67

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+25, 2390.72)	(-0+22, 2390.27)	0.013
(-0+22, 2390.27)	(0+10, 2390.67)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Discharge 14.56 ft³/s
Elevation Range 2390.22 to 2390.72 ft
Flow Area 5.65 ft²
Wetted Perimeter 35.01 ft
Hydraulic Radius 0.16 ft
Top Width 34.90 ft
Normal Depth 0.45 ft

Worksheet for CPWSCM-E Washburn at Cimarron

Results

Critical Depth	0.46	ft
Critical Slope	0.00650	ft/ft
Velocity	2.58	ft/s
Velocity Head	0.10	ft
Specific Energy	0.55	ft
Froude Number	1.13	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.45	ft
Critical Depth	0.46	ft
Channel Slope	0.00850	ft/ft
Critical Slope	0.00650	ft/ft

Cross Section for CPWSCM-E Washburn at Cimarron

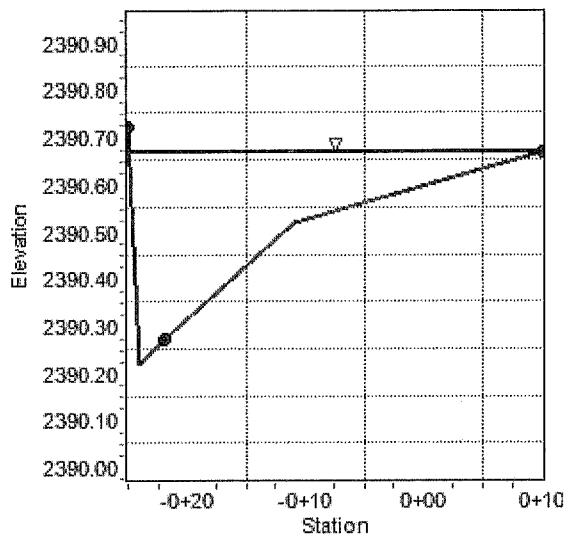
Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.00850 ft/ft
Normal Depth 0.45 ft
Discharge 14.56 ft³/s

Cross Section Image



- B.6 - HEC-1 Output


```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JAN 1997
* VERSION 4.1
*
* RUN DATE 13APR15 TIME 14:06:49
*
*****

```

```

*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*
*****

```

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X X XXXXXXX XXXXX X
X X X X X XX
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X X X X X
X X X X X
X X XXXXXXX XXXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*DIAGRAM

*** FREE ***

```

1 ID GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN
2 ID 30% ALTERNATIVE ANALYSIS STUDY
3 ID ULTIMATE CONDITION - 100-YR MAJOR BASIN
4 ID 4/13/2015
5 ID
6 ID DESIGN STORM = 100-YEAR 6-HR STORM
7 ID STORM DISTRIBUTION = SDN #3
8 ID
9 ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
10 ID
11 ID AREA DARF
12 ID SQ. MI.
13 ID 0-0.5 0.99
14 ID 0.5-1 0.975
15 ID
16 ID JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
17 ID
18 IT 5 0 0 300
19 IO 5 0 0
20 IN 5 0 0
21 JR PREC 0.99 0.975
*

```

```

22 KK WAS1
23 BA 0.2810
24 PB 2.81
25 PC 0 0.02 0.057 0.07 0.087 0.108 0.124 0.13 0.13 0.13
26 PC 0.13 0.13 0.13 0.133 0.14 0.142 0.148 0.158 0.172 0.181
27 PC 0.19 0.197 0.199 0.2 0.201 0.204 0.214 0.229 0.241 0.249
28 PC 0.251 0.256 0.27 0.278 0.281 0.283 0.295 0.322 0.352 0.409
29 PC 0.499 0.59 0.71 0.744 0.781 0.812 0.819 0.835 0.851 0.856
30 PC 0.86 0.868 0.876 0.888 0.91 0.926 0.937 0.95 0.97 0.976
31 PC 0.982 0.985 0.987 0.989 0.99 0.993 0.993 0.994 0.995 0.998
32 PC 0.998 0.999 1
33 LS 0 77.0
34 UD 0.392
*

```

```

35 KK WAS1-E
36 KM DIVERT FLOW AT TOMSIK AND WASHBURN (49 CFS SOUTH, 97 CFS EAST)
37 DT WAS1-S

```



```

38      DI      0      100      200      300
39      DQ      49      49      49      49
      *

40      KK  WAS2-E
41      KM  DIVERT FLOW AT WASHBURN AND CIMARRON
42      KM  INLET BYPASS IS 58.90 CFS. FLOW SPLIT IS 17 CFS SOUTH
43      KM  REMAINDER TRAVELS EAST IN SYSTEM OR ON SURFACE
44      DT  WAS2-S
45      DI      0      100      200      300
46      DQ      17      17      17      17
      *

```

1

HEC-1 INPUT

PAGE 2

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

47      KK  RWAS2E
48      KM  ROUTE WAS2-E TO INTERSECTION OF WASHBURN AND CONOUGH
49      RD  1400  0.0083  0.016      0  TRAP      60      0
      *

50      KK  WAS2
51      BA  0.0351
52      PB  2.77
53      LS      0      83.0
54      UD  0.264
      *

55      KK  CPWAS2
56      KM  COMBINE WAS2 AND RWAS2E
57      HC      2
      *

58      KKCPWAS2-E
59      KM  DIVERT FLOW AT WASHBURN AND CONOUGH (100% SOUTH, 0% EAST)
60      KM  TOTAL FLOW AT CPWAS2-E IS 102 CFS. INLET BYPASS IS 2 CFS TO THE EAST,
61      KM  THEREFORE DIVERSION SOUTH IS 100 CFS
62      DTCPWAS2-S
63      DI      0      100      200      300
64      DQ      100      100      100      100
      *

65      KKRCPWAS2E
66      KM  ROUTE CPWAS2-E TO INTERSECTION OF WASHBURN AND BUFFALO
67      RD  1300  0.0083  0.016      0  TRAP      60      0
      *

68      KK  BEN
69      BA  0.0321
70      PB  2.77
71      LS      0      83.0
72      UD  0.180
      *

73      KK  CPBFN
74      KM  COMBINE CPBFN AND RCPWAS3E AT INTERSECTION OF WASHBURN AND BUFFALO
75      HC      2
      *

76      KK  WAS1-S
77      KM  RETRIEVE WAS1-S AT INTERSECTION OF TOMSIK AND WASHBURN
78      DR  WAS1-S
      *

79      KK  RWAS1-S
80      KM  ROUTE WAS1-S TO INTERSECTION OF ROSADA AND TOMSIK
81      RD  660  0.0039  0.016      0  TRAP      60      0
      *

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1

HEC-1 INPUT

PAGE 3

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

82      KK  LNM2
83      BA  0.0239
84      PB  2.77
85      LS      0      77.0
86      UD  0.190
      *

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```

87      KK  CPLNM2
88      KM  COMBINE LNM2 AND RWAS1-S AT INTERSECTION OF ROSADA AND TOMSIK
89      HC      2
      *

90      KKRCPLNM2-S
91      KM  DIVERT FLOW AT TOMSIK AND ROSADA (37 CFS SOUTH, 29 CFS EAST)
92      DTCPLNM2-E
93      DI      0      100      200      300
94      DQ      29      29      29      29
      *

95      KKRCPLNM2S
96      KM  ROUTE CPLNMW-S TO INTERSECTION OF CIMARRON AND LONE MOUNTAIN
97      RD  2700  0.0078  0.016      0      TRAP      80      0
      *

98      KK  LNM1
99      BA  0.5439
100     PB  2.80
101     LS      0      76.0
102     UD  0.499
      *

103     KK  PARK
104     KM  48 CFS FROM MOUNTAIN CREST PARK AT SW CORNER OF DURANGO AND LONE MOUNTAIN
105     KM  CONTRIBUTES TO ONSITE FLOWS. A DUMMY OFFSITE BASIN AREA IS CREATED FOR MODEL.
106     KM  SEE REPORT FOR DISCUSSION ON PARK FLOWS
107     BA  0.0480
108     PB  2.80
109     LS      0      80.0
110     UD  0.100
      *

111     KK  CPLNM1
112     KM  COMBINE PARK, LNM1, AND RCPLNM2S
113     HC      3
      *

114     KK  RCPLNM1
115     KM  ROUTE CPLNM1 TO JUST WEST OF INTERSECTION OF CONOUGH AND LONE MOUNTAIN
116     RD  1340  0.0058  0.016      0      TRAP      100      0
      *

117     KK  LNM3
118     BA  0.0457
119     PB  2.77
120     LS      0      78.0
121     UD  0.262
      *

122     KK  CPLNM3
123     KM  COMBINE LNM3 AND RCPLNM1
124     HC      2
      *

125     KK  CON
126     BA  0.0998
127     PB  2.77
128     LS      0      78.0
129     UD  0.366
      *

130     KKRCPLNM2-E
131     KM  RETREIVE CPLNM2-E AT INTERSECTION OF ROSADA AND TOMSIK
132     DRCPLNM2-E
      *

133     KKRCPLNM2E
134     KM  ROUTE RCPLNM2E TO INTERSECTION OF LONE MOUNTAIN AND CONOUGH
135     RD  4120  0.0070  0.016      0      TRAP      60      0
      *

136     KK  WAS2-S
137     KM  RETRIEVE CPWAS2-S AT INTERSECTION OF WASHBURN AND CIMARRON
138     DR  WAS2-S
      *

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1

HEC-1 INPUT

PAGE 4

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

139 KK RWAS2S
 140 KM ROUTE WAS2-S TO INTERSECTION OF LONE MOUNTAIN AND CONOUGH
 141 RD 4100 0.0070 0.016 0 TRAP 60 0
 *
 142 KKCPWAS2-S
 143 KM RETRIEVE CPWAS2-S AT INTERSECTION OF WASHBURN AND CONOUGH
 144 DRCPWAS2-S
 *
 145 KKRCPWAS2S
 146 KM ROUTE CPWAS2-S TO INTERSECTION OF LONE MOUNTAIN AND CONOUGH
 147 RD 2700 0.0035 0.016 0 TRAP 60 0
 *

HEC-1 INPUT

PAGE 5

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

148 KK CPCON
 149 KM COMBINE RWAS2S, RCPWAS2S, RCPLNM2E AND CON
 150 HC 4
 *
 151 KK CPCON1
 152 KM COMBINE CPCON AND CPLNM3. FLOW ON CONOUGH COMBINES WITH FLOW ON
 153 KM LONE MOUNTAIN AT INTERSECTION OF LONE MOUNTAIN AND CONOUGH.
 154 HC 2
 *
 155 KK RCPCON1
 156 KM ROUTE CPCON1 TO JUST WEST OF INTERSECTION OF LONE MOUNTAIN AND BUFFALO
 157 RD 1310 0.0100 0.016 0 TRAP 100 0
 *
 158 KK LNM4
 159 BA 0.0485
 160 PB 2.77
 161 LS 0 83.0
 162 UD 0.244
 *
 163 KK CPLNM4
 164 KM COMBINE LNM4 AND RCPCON1
 165 HC 2
 *
 166 KK RCPLNM4
 167 KM ROUTE CPLNM4 TO INTERSECTION OF LONE MOUNTAIN AND BUFFALO
 168 RD 100 0.0100 0.016 0 TRAP 100 0
 *
 169 KK BFS
 170 BA 0.0456
 171 PB 2.77
 172 LS 0 82.0
 173 UD 0.297
 *
 174 KK CPBFS
 175 KM COMBINE BFS AND RCPLNM4
 176 HC 2
 *
 177 ZZ

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
 LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
 NO. (.) CONNECTOR (<----) RETURN OF DIVERTED OR PUMPED FLOW
 22 WAS1
 .
 37 .-----> WAS1-S
 35 WAS1-E
 .
 44 .-----> WAS2-S
 40 WAS2-E


```

      V
      V
47    RWAS2E
      .
50    .      WAS2
      .
55    CPWAS2.....
      .
62    .----->CPWAS2-S
58    CPWAS2-E
      V
      V
65    RCPWAS2E
      .
      .
68    .      BFN
      .
73    CPBFN.....
      .
78    .      .<----- WAS1-S
76    .      WAS1-S
      .      V
      .      V
79    .      RWAS1-S
      .
82    .      .      LNM2
      .
87    .      CPLNM2.....
      .
92    .      .----->CPLNM2-E
90    .      CPLNM2-S
      .      V
      .      V
95    .      RCPLNM2S
      .
98    .      .      LNM1
      .
103   .      .      .      PARK
      .
111   .      CPLNM1.....
      .      V
      .      V
114   .      RCPLNM1
      .
117   .      .      LNM3
      .
122   .      CPLNM3.....
      .
125   .      .      CON
      .
132   .      .      .      .<-----CPLNM2-E
130   .      .      .      CPLNM2-E
      .      V
      .      V
133   .      .      .      RCPLNM2E
      .
138   .      .      .      .<----- WAS2-S
136   .      .      .      WAS2-S
      .      V
      .      V
139   .      .      .      RWAS2S
      .
144   .      .      .      .<-----CPWAS2-S
142   .      .      .      CPWAS2-S

```



```

      .      .      .      .      .      .      V
      .      .      .      .      .      .      V
145    .      .      .      .      .      .      RCPWAS2S
      .      .      .      .      .      .      .
148    .      .      .      .      .      .      .
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151    .      .      .      .      .      .      .
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163    .      .      .      .      .      .      .
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166    .      .      .      .      .      .      .
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169    .      .      .      .      .      .      .
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174    .      .      .      .      .      .      .

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JAN 1997
* VERSION 4.1
* RUN DATE 13APR15 TIME 14:06:49
*
*****

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```

*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*
*****

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GOWAN NORTH BUFFALO BRANCH -- LONE MOUNTAIN TO WASHBURN
 30% ALTERNATIVE ANALYSIS STUDY
 ULTIMATE CONDITION - 100-YR MAJOR BASIN
 4/13/2015

DESIGN STORM = 100-YEAR 6-HR STORM
 STORM DISTRIBUTION = SDN #3

JR CARDS CONTAIN DARF'S BASED ON THE FOLLOWING VALUES:

AREA	DARF
SQ. MI.	
0-0.5	0.99
0.5-1	0.975

JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)

```

19 IO      OUTPUT CONTROL VARIABLES
          IPRNT      5  PRINT CONTROL
          IPLOT      0  PLOT CONTROL
          QSCAL      0.  HYDROGRAPH PLOT SCALE

IT        HYDROGRAPH TIME DATA
          NMIN      5  MINUTES IN COMPUTATION INTERVAL
          IDATE      1  0  STARTING DATE
          ITIME      0000  STARTING TIME
          NQ        300  NUMBER OF HYDROGRAPH ORDINATES
          NDDATE      2  0  ENDING DATE
          NDTIME      0055  ENDING TIME
          ICENT      19  CENTURY MARK

          COMPUTATION INTERVAL      .08 HOURS
          TOTAL TIME BASE      24.92 HOURS

```

ENGLISH UNITS
 DRAINAGE AREA SQUARE MILES
 PRECIPITATION DEPTH INCHES

LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-Feet
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .99 .98

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION	
					RATIO 1 .99	RATIO 2 .98
HYDROGRAPH AT						
+	WAS1	.28	1	FLOW	146.	142.
				TIME	3.83	3.83
DIVERSION TO						
+	WAS1-S	.28	1	FLOW	49.	49.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	WAS1-E	.28	1	FLOW	97.	93.
				TIME	3.83	3.83
DIVERSION TO						
+	WAS2-S	.28	1	FLOW	17.	17.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	WAS2-E	.28	1	FLOW	80.	76.
				TIME	3.83	3.83
ROUTED TO						
+	RWAS2E	.28	1	FLOW	80.	76.
				TIME	3.92	3.92
HYDROGRAPH AT						
+	WAS2	.04	1	FLOW	30.	29.
				TIME	3.67	3.67
2 COMBINED AT						
+	CPWAS2	.32	1	FLOW	102.	97.
				TIME	3.92	3.92
DIVERSION TO						
+	CPWAS2-S	.32	1	FLOW	100.	97.
				TIME	3.92	3.92
HYDROGRAPH AT						
+	CPWAS2-E	.32	1	FLOW	2.	0.
				TIME	3.92	.00
ROUTED TO						
+	RCPWAS2E	.32	1	FLOW	1.	0.
				TIME	4.33	.00
HYDROGRAPH AT						
+	BFN	.03	1	FLOW	32.	31.
				TIME	3.58	3.58
2 COMBINED AT						
+	CPBFN	.35	1	FLOW	32.	31.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	WAS1-S	.00	1	FLOW	49.	49.
				TIME	3.50	3.50
ROUTED TO						
+	RWAS1-S	.00	1	FLOW	50.	50.

				TIME	3.58	3.58
HYDROGRAPH AT						
+	LNM2	.02	1	FLOW	17.	16.
				TIME	3.67	3.67
2 COMBINED AT						
+	CPLNM2	.02	1	FLOW	66.	66.
				TIME	3.58	3.58
DIVERSION TO						
+	CPLNM2-E	.02	1	FLOW	29.	29.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	CPLNM2-S	.02	1	FLOW	37.	37.
				TIME	3.58	3.58
ROUTED TO						
+	RCPLNM2S	.02	1	FLOW	36.	36.
				TIME	3.83	3.83
HYDROGRAPH AT						
+	LNM1	.54	1	FLOW	232.	225.
				TIME	4.00	4.00
HYDROGRAPH AT						
+	PARK	.05	1	FLOW	48.	46.
				TIME	3.50	3.50
3 COMBINED AT						
+	CPLNM1	.62	1	FLOW	276.	268.
				TIME	4.00	4.00
ROUTED TO						
+	RCPLNM1	.62	1	FLOW	274.	266.
				TIME	4.00	4.00
HYDROGRAPH AT						
+	LNM3	.05	1	FLOW	30.	29.
				TIME	3.75	3.75
2 COMBINED AT						
+	CPLNM3	.66	1	FLOW	292.	284.
				TIME	4.00	4.00
HYDROGRAPH AT						
+	CON	.10	1	FLOW	56.	54.
				TIME	3.83	3.83
HYDROGRAPH AT						
+	CPLNM2-E	.00	1	FLOW	29.	29.
				TIME	3.50	3.50
ROUTED TO						
+	RCPLNM2E	.00	1	FLOW	35.	36.
				TIME	3.83	3.83
HYDROGRAPH AT						
+	WAS2-S	.00	1	FLOW	17.	17.
				TIME	3.58	3.58
ROUTED TO						
+	RWAS2S	.00	1	FLOW	17.	18.
				TIME	4.17	4.08
HYDROGRAPH AT						
+	CPWAS2-S	.00	1	FLOW	100.	97.
				TIME	3.92	3.92
ROUTED TO						
+	RCPWAS2S	.00	1	FLOW	112.	105.
				TIME	4.00	4.00
4 COMBINED AT						
+	CPCON	.10	1	FLOW	189.	182.
				TIME	4.00	4.08
2 COMBINED AT						
+	CPCON1	.76	1	FLOW	480.	464.
				TIME	4.00	4.00


```

ROUTED TO
+          RCPCON1      .76    1  FLOW      475.    463.
                                TIME      4.08    4.08

HYDROGRAPH AT
+          LNM4         .05    1  FLOW      43.     42.
                                TIME      3.67    3.67

  2 COMBINED AT
+          CPLNM4       .81    1  FLOW      493.    480.
                                TIME      4.08    4.08

ROUTED TO
+          RCPLNM4      .81    1  FLOW      492.    480.
                                TIME      4.08    4.08

HYDROGRAPH AT
+          BFS          .05    1  FLOW      35.     34.
                                TIME      3.75    3.75

  2 COMBINED AT
+          CPBFS        .86    1  FLOW      512.    498.
                                TIME      4.08    4.08
1

```

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	DT (MIN)	INTERPOLATED TO COMPUTATION INTERVAL		VOLUME (IN)
							PEAK (CFS)	TIME TO PEAK (MIN)	
FOR PLAN = 1 RATIO= .00									
RWAS2E	MANE	1.00	80.34	234.00	.22	5.00	80.23	235.00	.21
CONTINUITY SUMMARY (AC-FT) - INFLOW= .3219E+01 EXCESS= .0000E+00 OUTFLOW= .3226E+01 BASIN STORAGE= .3196E-02 PERCENT ERROR= -.3									
FOR PLAN = 1 RATIO= .00									
RWAS2E	MANE	1.00	75.73	235.00	.20	5.00	75.73	235.00	.20
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2979E+01 EXCESS= .0000E+00 OUTFLOW= .2987E+01 BASIN STORAGE= .3608E-02 PERCENT ERROR= -.4									
FOR PLAN = 1 RATIO= .00									
RCPWAS2E	MANE	.25	1.39	256.00	.00	5.00	.66	260.00	.00
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1211E-01 EXCESS= .0000E+00 OUTFLOW= .1395E-01 BASIN STORAGE= .2935E-02 PERCENT ERROR= -39.5									
FOR PLAN = 1 RATIO= .00									
RCPWAS2E	MANE	5.00	.00	.00	.00	5.00	.00	260.00	.00
FOR PLAN = 1 RATIO= .00									
RWAS1-S	MANE	3.28	50.36	216.73	-1.00	5.00	49.78	215.00	-1.00
FOR PLAN = 1 RATIO= .00									
RWAS1-S	MANE	3.28	50.45	216.73	-1.00	5.00	49.86	215.00	-1.00
FOR PLAN = 1 RATIO= .00									
RCPLNM2S	MANE	.50	46.70	225.50	3.17	5.00	36.27	230.00	3.11
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4012E+01 EXCESS= .0000E+00 OUTFLOW= .4038E+01 BASIN STORAGE= .7987E-02 PERCENT ERROR= -.8									
FOR PLAN = 1 RATIO= .00									
RCPLNM2S	MANE	.50	48.64	226.00	3.11	5.00	35.64	230.00	3.02

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3936E+01 EXCESS= .0000E+00 OUTFLOW= .3962E+01 BASIN STORAGE= .7484E-02 PERCENT ERROR= -.8

FOR PLAN = 1 RATIO= .00
RCPLNM1 MANE 3.64 274.92 243.67 .97 5.00 273.56 240.00 .97

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3182E+02 EXCESS= .0000E+00 OUTFLOW= .3183E+02 BASIN STORAGE= .4639E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPLNM1 MANE 3.68 266.36 242.89 .94 5.00 266.28 240.00 .94

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3083E+02 EXCESS= .0000E+00 OUTFLOW= .3084E+02 BASIN STORAGE= .3863E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPLNM2E MANE 4.25 36.40 229.50 -1.00 5.00 35.19 230.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPLNM2E MANE 4.25 37.54 229.50 -1.00 5.00 36.23 230.00 -1.00

FOR PLAN = 1 RATIO= .00
RWAS2S MANE .50 21.34 241.50 -1.00 5.00 17.00 250.00 -1.00

FOR PLAN = 1 RATIO= .00
RWAS2S MANE .50 22.10 242.00 -1.00 5.00 17.55 245.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPWAS2S MANE 5.00 111.64 240.00 -1.00 5.00 111.64 240.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPWAS2S MANE 5.00 104.85 240.00 -1.00 5.00 104.85 240.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPCON1 MANE 2.42 478.09 244.32 1.29 5.00 474.82 245.00 1.29

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5248E+02 EXCESS= .0000E+00 OUTFLOW= .5249E+02 BASIN STORAGE= .3658E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPCON1 MANE 2.45 463.21 242.77 1.25 5.00 462.53 245.00 1.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5091E+02 EXCESS= .0000E+00 OUTFLOW= .5092E+02 BASIN STORAGE= .3263E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPLNM4 MANE .18 492.50 244.93 1.29 5.00 492.47 245.00 1.29

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5569E+02 EXCESS= .0000E+00 OUTFLOW= .5569E+02 BASIN STORAGE= .2448E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPLNM4 MANE .18 479.71 245.10 1.25 5.00 479.67 245.00 1.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5407E+02 EXCESS= .0000E+00 OUTFLOW= .5407E+02 BASIN STORAGE= .2459E-03 PERCENT ERROR= .0

*** NORMAL END OF HEC-1 ***


```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JAN 1997
* VERSION 4.1
*
* RUN DATE 27APR15 TIME 09:00:31
*
*****

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```

*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*
*****

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X X XXXXXXX XXXXX X
X X X X X XX
X X X X X
XXXXXXX XXXX X XXXXX X
X X X X X
X X X X X
X X XXXXXXX XXXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*DIAGRAM

*** FREE ***

```

1 ID GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN
2 ID 30% ALTERNATIVE ANALYSIS STUDY
3 ID ULTIMATE CONDITION - 10-YR MAJOR BASIN
4 ID 4/13/2015
5 ID
6 ID DESIGN STORM = 10-YEAR 6-HR STORM
7 ID STORM DISTRIBUTION = SDN #3
8 ID
9 ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
10 ID
11 ID AREA DARF
12 ID SQ. MI.
13 ID 0-0.5 0.99
14 ID 0.5-1 0.975
15 ID
16 ID JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
17 ID
18 IT 5 0 0 300
19 IO 5 0 0
20 IN 5 0 0
21 JR PREC 0.99 0.975

```

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22 KK WAS1
23 BA 0.2810
24 PB 1.60
25 PC 0 0.02 0.057 0.07 0.087 0.108 0.124 0.13 0.13 0.13
26 PC 0.13 0.13 0.13 0.133 0.14 0.142 0.148 0.158 0.172 0.181
27 PC 0.19 0.197 0.199 0.2 0.201 0.204 0.214 0.229 0.241 0.249
28 PC 0.251 0.256 0.27 0.278 0.281 0.283 0.295 0.322 0.352 0.409
29 PC 0.499 0.59 0.71 0.744 0.781 0.812 0.819 0.835 0.851 0.856
30 PC 0.86 0.868 0.876 0.888 0.91 0.926 0.937 0.95 0.97 0.976
31 PC 0.982 0.985 0.987 0.989 0.99 0.993 0.993 0.994 0.995 0.998
32 PC 0.998 0.999 1
33 LS 0 77.0
34 UD 0.392

```

```

35 KK WAS1-E
36 KM DIVERT FLOW AT TOMSIK AND WASHBURN (100% EAST, 0% SOUTH)
37 DT WAS1-S

```


38 DI 0 100 200 300
39 DQ 0 0 0 0
*

40 KK WAS2-E
41 KM DIVERT FLOW AT WASHBURN AND CIMARRON (0 CFS SOUTH)
42 DT WAS2-S
43 DI 0 100 200 300
44 DQ 0 0 0 0
*

1

HEC-1 INPUT

PAGE 2

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

45 KK RWAS2-E
46 KM ROUTE WAS2-E TO INTERSECTION OF WASHBURN AND CONOUGH
47 RD 1400 0.0083 0.016 0 TRAP 60 0
*

48 KK WAS2
49 BA 0.0351
50 PB 1.58
51 LS 0 83.0
52 UD 0.264
*

53 KK CPWAS2
54 KM COMBINE WAS2 AND RWAS2-E
55 HC 2
*

56 KKCPWAS2-E
57 KM DIVERT FLOW AT WASHBURN AND CONOUGH (100% SOUTH, 0% EAST)
58 DTCPWAS2-S
59 DI 0 100 200 300
60 DQ 0 100 200 300
*

61 KKRCPWAS2E
62 KM ROUTE CPWAS2-E TO INTERSECTION OF WASHBURN AND BUFFALO
63 RD 1130 0.0083 0.016 0 TRAP 60 0
*

64 KK BFN
65 BA 0.0321
66 PB 1.58
67 LS 0 83.0
68 UD 0.180
*

69 KK CPBFN
70 KM COMBINE CPBFN AND RCPWAS2E AT INTERSECTION OF WASHBURN AND BUFFALO
71 HC 2
*

72 KK WAS1-S
73 KM RETRIEVE WAS1-S AT INTERSECTION OF TOMSIK AND WASHBURN
74 DR WAS1-S
*

75 KK RWAS1-S
76 KM ROUTE WAS1-S TO INTERSECTION OF ROSADA AND TOMSIK
77 RD 660 0.0039 0.016 0 TRAP 60 0
*

1

HEC-1 INPUT

PAGE 3

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

78 KK LNM2
79 BA 0.0239
80 PB 1.58
81 LS 0 77.0
82 UD 0.190
*

83 KK CPLNM2
84 KM COMBINE LNM2 AND RWAS1-S AT INTERSECTION OF ROSADA AND TOMSIK
85 HC 2
*


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86      KKCPNM2-S
87      KM   DIVERT FLOW AT TOMSIK AND ROSADA (100% SOUTH, 0% EAST)
88      DTCPLNM2-E
89      DI      0      100      200      300
90      DQ      0      0      0      0
      *

91      KKRCPLNM2S
92      KM   ROUTE CPLNMW-S TO INTERSECTION OF CIMARRON AND LONE MOUNTAIN
93      RD  2700  0.0078  0.016      0      TRAP      80      0
      *

94      KK      LNM1
95      BA  0.5439
96      PB      1.60
97      LS      0      76.0
98      UD  0.499
      *

99      KK      PARK
100     KM   FLOW FROM MOUNTAIN CREST PARK AT SW CORNER OF DURANGO AND LONE MOUNTAIN
101     KM   CONTRIBUTES TO ONSITE FLOWS. A DUMMY OFFSITE BASIN AREA IS CREATED FOR MODEL.
102     KM   SEE REPORT FOR DISCUSSION ON PARK FLOWS
103     BA  0.048
104     PB      1.61
105     LS      0      80.0
106     UD  0.100
      *

107     KK   CPLNM1
108     KM   COMBINE PARK, LNM1, AND RCPLNM2S
109     HC      3
      *

110     KK   RCPLNM1
111     KM   ROUTE CPLNM1 TO JUST WEST OF INTERSECTION OF CONOUGH AND LONE MOUNTAIN
112     RD  1340  0.0058  0.016      0      TRAP      100      0
      *

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1

HEC-1 INPUT

PAGE 4

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

113     KK      LNM3
114     BA  0.0457
115     PB      1.58
116     LS      0      78.0
117     UD  0.262
      *

118     KK   CPLNM3
119     KM   COMBINE LNM3 AND RCPLNM1
120     HC      2
      *

121     KK      CON
122     BA  0.0998
123     PB      1.58
124     LS      0      78.0
125     UD  0.366
      *

126     KKCPNM2-E
127     KM   RETREIVE CPLNM2-E AT INTERSECTION OF ROSADA AND TOMSIK
128     DRCPLNM2-E
      *

129     KKRCPLNM2E
130     KM   ROUTE RCPLNM2E TO INTERSECTION OF LONE MOUNTAIN AND CONOUGH
131     RD  4120  0.0070  0.016      0      TRAP      60      0
      *

132     KK   WAS2-S
133     KM   RETRIEVE CPWAS2-S AT INTERSECTION OF WASHBURN AND CIMARRON
134     DR   WAS2-S
      *

135     KK   RWAS2S
136     KM   ROUTE WAS2-S TO INTERSECTION OF LONE MOUNTAIN AND CONOUGH
137     RD  4100  0.0070  0.016      0      TRAP      60      0

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*
138      KKCPWAS2-S
139      KM  RETRIEVE CPWAS2-S AT INTERSECTION OF WASHBURN AND CONOUGH
140      DRCPWAS2-S
*
141      KKRCPWAS2S
142      KM  ROUTE CPWAS2-S TO INTERSECTION OF LONE MOUNTAIN AND CONOUGH
143      RD   2700  0.0035  0.016      0      TRAP      60      0
*

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1

HEC-1 INPUT

PAGE 5

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

144      KK  CPCON
145      KM  COMBINE RWAS2S, RCPWAS2S, RCPLNM2E AND CON
146      HC   4
*
147      KK  CPCON1
148      KM  COMBINE CPCON AND CPLNM3. FLOW ON CONOUGH COMBINES WITH FLOW ON
149      KM  LONE MOUNTAIN AT INTERSECTION OF LONE MOUNTAIN AND CONOUGH.
150      HC   2
*
151      KK  RCPCON1
152      KM  ROUTE CPCON1 TO JUST WEST OF INTERSECTION OF LONE MOUNTAIN AND BUFFALO
153      RD   1310  0.0100  0.016      0      TRAP      100      0
*
154      KK  LNM4
155      BA  0.0485
156      PB  1.58
157      LS   0      83.0
158      UD  0.244
*
159      KK  CPLNM4
160      KM  COMBINE LNM4 AND RCPCON1
161      HC   2
*
162      KK  RCPLNM4
163      KM  ROUTE CPLNM4 TO INTERSECTION OF LONE MOUNTAIN AND BUFFALO
164      RD   100  0.0100  0.016      0      TRAP      100      0
*
165      KK  BFS
166      BA  0.0456
167      PB  1.58
168      LS   0      82.0
169      UD  0.297
*
170      KK  CPBFS
171      KM  COMBINE BFS AND RCPLNM4
172      HC   2
*
173      ZZ

```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```

INPUT
LINE  (V) ROUTING      (--->) DIVERSION OR PUMP FLOW
NO.    (.) CONNECTOR    (<---) RETURN OF DIVERTED OR PUMPED FLOW

22      WAS1
      .
      .
37      .-----> WAS1-S
35      WAS1-E
      .
      .
42      .-----> WAS2-S
40      WAS2-E
      V
      V
45      RWAS2-E
      .

```



```

48      .      WAS2
      .
      .
53      CPWAS2.....
      .
      .
58      .----->CPWAS2-S
56      CPWAS2-E
      V
      V
61      RCPWAS2E
      .
      .
64      .      BFN
      .
      .
69      CPBFN.....
      .
      .
74      .      .<----- WAS1-S
72      .      WAS1-S
      .      V
      .      V
75      .      RWAS1-S
      .
      .
78      .      .      LNM2
      .      .
      .      .
83      .      CPLNM2.....
      .
      .
88      .      .----->CPLNM2-E
86      .      CPLNM2-S
      .      V
      .      V
91      .      RCPLNM2S
      .
      .
94      .      .      LNM1
      .      .
      .      .
99      .      .      .      PARK
      .      .
      .      .
107     .      CPLNM1.....
      .      V
      .      V
110     .      RCPLNM1
      .
      .
113     .      .      LNM3
      .      .
      .      .
118     .      CPLNM3.....
      .
      .
121     .      .      CON
      .      .
      .      .
128     .      .      .<-----CPLNM2-E
126     .      .      CPLNM2-E
      .      V
      .      V
129     .      .      RCPLNM2E
      .      .
      .      .
134     .      .      .<----- WAS2-S
132     .      .      WAS2-S
      .      V
      .      V
135     .      .      RWAS2S
      .      .
      .      .
140     .      .      .<-----CPWAS2-S
138     .      .      CPWAS2-S
      .      V
      .      V
141     .      .      RCPWAS2S
      .      .
      .      .

```



```
( ***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
*****
*
*      U.S. ARMY CORPS OF ENGINEERS
*      HYDROLOGIC ENGINEERING CENTER
*      609 SECOND STREET
*      DAVIS, CALIFORNIA 95616
*      (916) 756-1104
*
*****
```

ENGLISH UNITS		
DRAINAGE AREA		SQUARE MILES
PRECIPITATION DEPTH		INCHES
LENGTH, ELEVATION		FEET
FLOW		CUBIC FEET PER SECOND
STORAGE VOLUME		ACRE-Feet
SURFACE AREA		ACRES

TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .99 .98

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
 TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 .99	RATIO 2 .98
HYDROGRAPH AT +	WAS1	.28	1 FLOW TIME	35. 3.92	34. 3.92
DIVERSION TO +	WAS1-S	.28	1 FLOW TIME	0. .00	0. .00
HYDROGRAPH AT +	WAS1-E	.28	1 FLOW TIME	35. 3.92	34. 3.92
DIVERSION TO +	WAS2-S	.28	1 FLOW TIME	0. .00	0. .00
HYDROGRAPH AT +	WAS2-E	.28	1 FLOW TIME	35. 3.92	34. 3.92
ROUTED TO +	RWAS2-E	.28	1 FLOW TIME	35. 4.00	33. 4.00
HYDROGRAPH AT +	WAS2	.04	1 FLOW TIME	10. 3.75	10. 3.75
2 COMBINED AT +	CPWAS2	.32	1 FLOW TIME	41. 4.00	39. 4.00
DIVERSION TO +	CPWAS2-S	.32	1 FLOW TIME	41. 4.00	39. 4.00
HYDROGRAPH AT +	CPWAS2-E	.32	1 FLOW TIME	0. .00	0. .00
ROUTED TO +	RCPWAS2E	.32	1 FLOW TIME	0. .00	0. .00
HYDROGRAPH AT +	BFN	.03	1 FLOW TIME	10. 3.67	10. 3.67
2 COMBINED AT +	CPBFN	.35	1 FLOW TIME	10. 3.67	10. 3.67
HYDROGRAPH AT +	WAS1-S	.00	1 FLOW TIME	0. .00	0. .00
ROUTED TO +	RWAS1-S	.00	1 FLOW TIME	0. .00	0. .00
HYDROGRAPH AT +	LMN2	.02	1 FLOW	4.	4.

				TIME	3.67	3.67
2 COMBINED AT						
+	CPLNM2	.02	1	FLOW	4.	4.
				TIME	3.67	3.67
DIVERSION TO						
+	CPLNM2-E	.02	1	FLOW	0.	0.
				TIME	.00	.00
HYDROGRAPH AT						
+	CPLNM2-S	.02	1	FLOW	4.	4.
				TIME	3.67	3.67
ROUTED TO						
+	RCPLNM2S	.02	1	FLOW	3.	4.
				TIME	4.17	4.17
HYDROGRAPH AT						
+	LNMI	.54	1	FLOW	52.	50.
				TIME	4.08	4.08
HYDROGRAPH AT						
+	PARK	.05	1	FLOW	15.	14.
				TIME	3.58	3.58
3 COMBINED AT						
+	CPLNM1	.62	1	FLOW	56.	55.
				TIME	4.08	4.17
ROUTED TO						
+	RCPLNM1	.62	1	FLOW	56.	53.
				TIME	4.17	4.25
HYDROGRAPH AT						
+	LNMI	.05	1	FLOW	8.	7.
				TIME	3.75	3.75
2 COMBINED AT						
+	CPLNM3	.66	1	FLOW	60.	57.
				TIME	4.17	4.17
HYDROGRAPH AT						
+	CON	.10	1	FLOW	14.	13.
				TIME	3.92	3.92
HYDROGRAPH AT						
+	CPLNM2-E	.00	1	FLOW	0.	0.
				TIME	.00	.00
ROUTED TO						
+	RCPLNM2E	.00	1	FLOW	0.	0.
				TIME	.00	.00
HYDROGRAPH AT						
+	WAS2-S	.00	1	FLOW	0.	0.
				TIME	.00	.00
ROUTED TO						
+	RWAS2S	.00	1	FLOW	0.	0.
				TIME	.00	.00
HYDROGRAPH AT						
+	CPWAS2-S	.00	1	FLOW	41.	39.
				TIME	4.00	4.00
ROUTED TO						
+	RCPWAS2S	.00	1	FLOW	41.	39.
				TIME	4.17	4.17
4 COMBINED AT						
+	CPCON	.10	1	FLOW	52.	49.
				TIME	4.08	4.08
2 COMBINED AT						
+	CPCON1	.76	1	FLOW	111.	106.
				TIME	4.08	4.08
ROUTED TO						
+	RCPCON1	.76	1	FLOW	110.	105.
				TIME	4.17	4.17

HYDROGRAPH AT
+ LNM4 .05 1 FLOW 14. 13.
TIME 3.67 3.75

2 COMBINED AT
+ CPLNM4 .81 1 FLOW 116. 110.
TIME 4.17 4.17

ROUTED TO
+ RCPLNM4 .81 1 FLOW 115. 110.
TIME 4.17 4.17

HYDROGRAPH AT
+ BFS .05 1 FLOW 11. 11.
TIME 3.75 3.75

2 COMBINED AT
+ CPBFS .86 1 FLOW 121. 116.
TIME 4.17 4.17

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	DT (MIN)	INTERPOLATED TO COMPUTATION INTERVAL		VOLUME (IN)
							PEAK (CFS)	TIME TO PEAK (MIN)	
FOR PLAN = 1	RATIO=	.00							
RWAS2-E	MANE	2.25	35.04	240.75	.25	5.00	34.94	240.00	.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3671E+01 EXCESS= .0000E+00 OUTFLOW= .3674E+01 BASIN STORAGE= .2932E-02 PERCENT ERROR= -.2

FOR PLAN = 1	RATIO=	.00							
RWAS2-E	MANE	2.25	33.36	240.75	.23	5.00	33.24	240.00	.23

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3516E+01 EXCESS= .0000E+00 OUTFLOW= .3520E+01 BASIN STORAGE= .3389E-02 PERCENT ERROR= -.2

FOR PLAN = 1	RATIO=	.00							
RCPWAS2E	MANE	.50	.00	445.00	.00	5.00	.00	445.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5131E-08 EXCESS= .0000E+00 OUTFLOW= .5131E-08 BASIN STORAGE= .3931E-05 PERCENT ERROR=*****

FOR PLAN = 1	RATIO=	.00							
RCPWAS2E	MANE	.50	.00	359.50	.00	5.00	.00	360.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1973E-07 EXCESS= .0000E+00 OUTFLOW= .1973E-07 BASIN STORAGE= .9031E-05 PERCENT ERROR=*****

FOR PLAN = 1	RATIO=	.00							
RWAS1-S	MANE	5.00	.00	.00	-1.00	5.00	.00	360.00	-1.00

FOR PLAN = 1	RATIO=	.00							
RWAS1-S	MANE	5.00	.00	.00	-1.00	5.00	.00	360.00	-1.00

FOR PLAN = 1	RATIO=	.00							
RCPLNM2S	MANE	1.50	5.87	249.00	.24	5.00	2.88	250.00	.22

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3013E+00 EXCESS= .0000E+00 OUTFLOW= .3121E+00 BASIN STORAGE= .6556E-02 PERCENT ERROR= -5.7

FOR PLAN = 1	RATIO=	.00							
RCPLNM2S	MANE	1.50	6.37	249.00	.23	5.00	4.44	250.00	.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2884E+00 EXCESS= .0000E+00 OUTFLOW= .2992E+00 BASIN STORAGE= .6884E-02 PERCENT ERROR= -6.1

FOR PLAN = 1 RATIO= .00
 RCPLNM1 MANE 3.25 56.12 250.25 .23 5.00 56.10 250.00 .23

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7537E+01 EXCESS= .0000E+00 OUTFLOW= .7543E+01 BASIN STORAGE= .3867E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
 RCPLNM1 MANE 3.50 53.59 252.00 .22 5.00 53.46 255.00 .22

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7251E+01 EXCESS= .0000E+00 OUTFLOW= .7258E+01 BASIN STORAGE= .4202E-02 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .00
 RCPLNM2E MANE 5.00 .00 .00 -1.00 5.00 .00 255.00 -1.00

FOR PLAN = 1 RATIO= .00
 RCPLNM2E MANE 5.00 .00 .00 -1.00 5.00 .00 255.00 -1.00

FOR PLAN = 1 RATIO= .00
 RWAS2S MANE 5.00 .00 .00 -1.00 5.00 .00 255.00 -1.00

FOR PLAN = 1 RATIO= .00
 RWAS2S MANE 5.00 .00 .00 -1.00 5.00 .00 255.00 -1.00

FOR PLAN = 1 RATIO= .00
 RCPWAS2S MANE 4.25 40.70 246.50 -1.00 5.00 40.58 250.00 -1.00

FOR PLAN = 1 RATIO= .00
 RCPWAS2S MANE 4.25 39.01 246.50 -1.00 5.00 38.67 250.00 -1.00

FOR PLAN = 1 RATIO= .00
 RCPCON1 MANE 4.35 110.28 247.69 .35 5.00 110.20 250.00 .35

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1403E+02 EXCESS= .0000E+00 OUTFLOW= .1405E+02 BASIN STORAGE= .3264E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
 RCPCON1 MANE 4.43 105.39 248.20 .33 5.00 105.22 250.00 .33

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1349E+02 EXCESS= .0000E+00 OUTFLOW= .1350E+02 BASIN STORAGE= .3933E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
 RCPLNM4 MANE .33 115.58 250.35 .35 5.00 115.28 250.00 .35

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1512E+02 EXCESS= .0000E+00 OUTFLOW= .1512E+02 BASIN STORAGE= .2439E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
 RCPLNM4 MANE .33 110.40 250.29 .34 5.00 110.03 250.00 .34

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1454E+02 EXCESS= .0000E+00 OUTFLOW= .1454E+02 BASIN STORAGE= .2466E-03 PERCENT ERROR= .0

*** NORMAL END OF HEC-1 ***


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1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JAN 1997
* VERSION 4.1
*
* RUN DATE 13APR15 TIME 13:57:35
*
*****

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*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*
*****

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X X XXXXXXX XXXXX X
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X X X X X
XXXXXX XXXX X XXXXX X
X X X X X
X X X X X
X X XXXXXXX XXXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*DIAGRAM

*** FREE ***

```

1 ID GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN
2 ID 30% ALTERNATIVE ANALYSIS STUDY
3 ID ULTIMATE CONDITION - 100-YR MINOR BASIN
4 ID 4/13/2015
5 ID
6 ID DESIGN STORM = 100-YEAR 6-HR STORM
7 ID STORM DISTRIBUTION = SDN #3
8 ID
9 ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
10 ID
11 ID AREA DARF
12 ID SQ. MI.
13 ID 0-0.5 0.99
14 ID 0.5-1 0.975
15 ID
16 ID JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
17 ID
18 IT 5 0 0 300
19 IO 5 0 0
20 IN 5 0 0
21 JR PREC 0.99 0.975

```

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22 KK DR-HM
23 BA 0.1492
24 PB 2.82
25 PC 0 0.02 0.057 0.07 0.087 0.108 0.124 0.13 0.13 0.13
26 PC 0.13 0.13 0.13 0.133 0.14 0.142 0.148 0.158 0.172 0.181
27 PC 0.19 0.197 0.199 0.2 0.201 0.204 0.214 0.229 0.241 0.249
28 PC 0.251 0.256 0.27 0.278 0.281 0.283 0.295 0.322 0.352 0.409
29 PC 0.499 0.59 0.71 0.744 0.781 0.812 0.819 0.835 0.851 0.856
30 PC 0.86 0.868 0.876 0.888 0.91 0.926 0.937 0.95 0.97 0.976
31 PC 0.982 0.985 0.987 0.989 0.99 0.993 0.993 0.994 0.995 0.998
32 PC 0.998 0.999 1
33 LS 0 77.0
34 UD 0.234

```

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35 KK RDR-HM
36 KM ROUTE DR-HM TO INTERSECTION OF FISHER AND DURANGO
37 RD 634 0.0110 0.016 0 TRAP 100 0

```


*
 38 KK DR-FS
 39 BA 0.0572
 40 PB 2.81
 41 LS 0 77.0
 42 UD 0.0190
 *

1 HEC-1 INPUT PAGE 2

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

43 KK CPDR-FS
 44 KM COMBINE DR-FS AND RDR-HM AT INTERSECTION OF FISHER AND DURANGO
 45 HC 2
 *

46 KKRCPDR-FS
 47 KM ROUTE CPDR-FS EAST THRU WS-TM1 TO INTERSECTION OF WASHBURN AND TOMSIK
 48 RD 2695 0.0156 0.016 0 TRAP 70 0
 *

49 KK WS-TM1
 50 BA 0.0659
 51 PB 2.77
 52 LS 0 77.0
 53 UD 0.283
 *

54 KK WS-TM2
 55 BA 0.0085
 56 PB 2.77
 57 LS 0 78.0
 58 UD 0.147
 *

59 KK CPWS-TM
 60 KM COMBINE WS-TM2, WS-TM1, AND RCPDR-FS
 61 KM AT INTERSECTION OF WASHBURN AND TOMSIK
 62 HC 3
 *

63 KKCPWSTM-E
 64 KM CPWSTM-E WILL HAVE A FLOW SPLIT EAST (CPWSTM-E) AND SOUTH (CPWSTM-S)
 65 KM FLOW SPLIT IS 58 CFS SOUTH
 66 KM CPWSTM-S TO BE RETRIEVED AT TM-RS
 67 DTCPWSTM-S
 68 DI 0 100 200 300
 69 DQ 58 58 58 58
 *

70 KKRCPWSTME
 71 KM ROUTE CPWSTM-E THRU WS-CM TO INTERSECTION OF WASHBURN AND CIMARRON
 72 RD 680 0.0152 0.016 0 TRAP 60 0
 *

73 KK WS-CM
 74 BA 0.0287
 75 PB 2.77
 76 LS 0 84.0
 77 UD 0.202
 *

1 HEC-1 INPUT PAGE 3

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

78 KK CPWS-CM
 79 KM COMBINE WS-CM AND RCPWSTME AT INTERSECTION OF WASHBURN AND CIMARRON
 80 HC 2
 *

81 KKCPWSCM-E
 82 KM CPWS-CM WILL HAVE A FLOW SPLIT EAST (CPWSCM-E) ON WASHBURN
 83 KM AND SOUTH (CPWSCM-S) ON CIMARRON
 84 KM FLOW SPLIT IS 17 CFS SOUTH
 85 KM CPWSCM-S TO BE RETRIEVED AT CPRS-CN1
 86 DTCPWSCM-S
 87 DI 0 100 200 300
 88 DQ 17 17 17 17


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      *
89      KKRCPWSCM-E
90      KM  ROUTE CPWSCM-E THRU WS-CN TO INTERSECTION OF WASHBURN AND CONOUGH
91      RD   1430  0.0105  0.016      0      TRAP      60      0
      *

92      KK  WS-CN
93      BA  0.0080
94      PB   2.77
95      LS    0      81.0
96      UD   0.147
      *

97      KK CPWS-CN
98      KM  COMBINE WS-CN AND RCPWS-CM AT INTERSECTION OF WASHBURN AND CONOUGH
99      HC    2
      *

100     KKCPWSCN-E
101     KM  CPWS-CN WILL HAVE FLOW GO EAST (CPWSCN-E) ON WASHBURN
102     KM  AND FLOW GO SOUTH (CPWSCN-S) ON CONOUGH VIA INLETS BETWEEN
103     KM  CONOUGH AND CIMARRON ON WASHBURN
104     KM  DIVERSION RATIO BASED ON INLET INTAKE CALCS
105     KM  INLET BYPASS IS 2 CFS, WHICH FLOWS EAST. TOTAL FLOW AT CPWS-CN IS 118 CFS
106     KM  REMAINDER OF FLOW TO SOUTH IS 116 CFS
107     DTCPWSCN-S
108     DI    0      100      200      300
109     DQ   116      116      116      116
      *

110     KKRCPWSCNE
111     KM  ROUTE CPWSCN-E THRU WS-BF TO INTERSECTION OF WASHBURN AND BUFFALO
112     RD   1322  0.0084  0.016      0      TRAP      60      0
      *

1      HEC-1 INPUT
      LINE  ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

113     KK  WS-BF
114     BA  0.0090
115     PB   2.77
116     LS    0      85.0
117     UD   0.180
      *

118     KK CPWS-BF
119     KM  COMBINE WS-BF AND RCPWSCNE AT INTERSECTION OF WASHBURN AND BUFFALO
120     KM  ALL FLOW AT INTERSECTION OF WASHBURN AND BUFFALO GOES EAST OFFSITE
121     HC    2
      *

122     KK  TM-RS
123     BA  0.0239
124     PB   2.77
125     LS    0      77.0
126     UD   0.194
      *

127     KKCPWSTM-S
128     KM  RETRIEVE FLOW DIVERSION CPWSTM-S FROM INTERSECTION OF WASHBURN AND TOMSIK
129     DRCPWSTM-S
      *

130     KKRCPWSTMS
131     KM  ROUTE CPWSTM-S THRU TM-RS TO INTERSECTION OF ROSADA AND TOMSIK
132     RD    620  0.0058  0.016      0      TRAP      60      0
      *

133     KK CPTM-RS
134     KM  COMBINE RCPWSTMS AND TM-RS AT INTERSECTION OF ROSADA AND TOMSIK
135     HC    2
      *

136     KKCPTMRS-E
137     KM  CPTM-RS WILL HAVE A FLOW SPLIT EAST (CPTMRS-E) AND SOUTH (CPTMRS-S)
138     KM  FLOW SPLIT IS 40 CFS SOUTH
139     KM  CPTMRS-S TO BE RETRIEVED AT CM-LA
140     DTCPTMRS-S
141     DI    0      100      200      300

```


142 DQ 40 40 40 40
*

143 KKRCPTMRSE
144 KM ROUTE CPTMRS-E THRU RS-CN1 TO INTERSECTION OF ROSADA AND CONOUGH
145 RD 1990 0.0106 0.016 0 TRAP 60 0
*

HEC-1 INPUT

PAGE 5

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

146 KK RS-CN1
147 BA 0.0380
148 PB 2.77
149 LS 0 77.0
150 UD 0.245
*

151 KK RS-CN2
152 PB 2.77
153 BA 0.0011
154 LS 0 76.0
155 UD 0.125
*

156 KKCPWSCM-S
157 KM RETRIEVE FLOW RIVERSON CPWSCM-S FROM INTERSECTION OF WASHBURN AND CIMARRON
158 DRCPWSCM-S
*

159 KKRCPWSCMS
160 KM ROUTE CPWSCM-S THRU RS-CN1 TO INTERSECTION OF ROSADA AND CONOUGH
161 RD 1300 0.0106 0.016 0 TRAP 60 0
*

162 KKCPRS-CN1
163 KM COMBINE RS-CN1, RS-CN2, RCPTMRSE AND RCPWSCMS JUST WEST OF INTERSECTION OF
164 KM ROSADA AND CONOUGH
165 HC 4
*

166 KK CN-RS1
167 BA 0.0055
168 PB 2.77
169 LS 0 77.0
170 UD 0.146
*

171 KK CN-RS2
172 BA 0.0018
173 PB 2.77
174 LS 0 80.0
175 UD 0.136
*

176 KKCPWSCN-S
177 KM RETRIEVE CPWSCN-S FROM INTERSECTION OF WASHBURN AND CONOUGH
178 DRCPWSCN-S
*

HEC-1 INPUT

PAGE 6

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

179 KKRCPWSCNS
180 KM ROUTE CPWSCN-S TO INTERSECTION OF ROSADA AND CONOUGH
181 RD 514 0.0058 0.016 0 TRAP 60 0
*

182 KK CPCN-RS
183 KM COMBINE CN-RS2, RCPWSCNS, AND CN-RS1
184 HC 3
*

185 KK CPCNRS
186 KM COMBINE CPCN-RS AND CPRS-CN1 AT INTERSECTION OF ROSADA AND CONOUGH
187 HC 2
*

188 KKPCNRS-E

189 KM CPCNRS WILL HAVE FLOW COLLECTED BY INLETS AND SPLIT
 190 KM EAST (CPCNRS-E) AND SOUTH (CPCNRS-S) AT INTERSECTION OF CONOUGH AND ROSADA
 191 KM RATIO BASED ON INLET INTAKE AND FLOW SPLIT CALCULATIONS
 192 KM 100% OF INLET BYPASS FLOWS EAST
 193 DTCPCNRS-S
 194 DI 0 100 200 300
 195 DQ 0 100 200 300
 *

196 KKRCPCNRSE
 197 KM ROUTE CPCNRS-E TO INTERSECTION OF ROSADA AND BUFFALO
 198 RD 1310 0.0072 0.016 0 TRAP 60 0
 *

199 KK RS-BF
 200 BA 0.0239
 201 PB 2.77
 202 LS 0 82.0
 203 UD 0.194
 *

204 KK CPRS-BF
 205 KM COMBINE RS-BF AND RCPCNRSE AT INTERSECTION OF ROSADA AND BUFFALO
 206 HC 2
 *

207 KKCPRSBF-S
 208 KM CPRS-BF WILL HAVE 100% FLOW GO EAST (CPRSBF-E) ON ROSADA
 209 KM AND 0% SOUTH (CPRSBF-S) ON BUFFALO
 210 DTCPRSBF-E
 211 DI 0 100 200 300
 212 DQ 0 100 200 300
 *

HEC-1 INPUT

PAGE 7

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

213 KK CM-LA
 214 BA 0.0872
 215 PB 2.77
 216 LS 0 76.0
 217 UD 0.249
 *

218 KKCPTRMS-S
 219 KM RETRIEVE FLOW DIVERSION CPTMRS-S FROM INTERSECTION OF ROSADA AND TOMSIK
 220 DRCPTRMS-S
 *

221 KKRCPTMRSS
 222 KM ROUTE CPTMRS-S THRU CM-LA TO INTERSECTION OF LA MADRE AND CIMARRON
 223 RD 1390 0.0108 0.016 0 TRAP 60 0
 *

224 KK CPCM-LA
 225 KM COMBINE RCPTMRSS AND CM-LA AT INTERSECTION OF LA MADRE AND CIMARRON
 226 HC 2
 *

227 KKCPCLMA-E
 228 KM CPCM-LA WILL HAVE 100% FLOW GO SOUTH (CPCMLA-S) ON CIMARRON
 229 KM AND 0% EAST (CPCMLA-E) ON LA MADRE
 230 DTCPCMLA-S
 231 DI 0 100 200 300
 232 DQ 0 100 200 300
 *

233 KKRCPCMLAE
 234 KM ROUTE CPCMLA-E THRU LA-CN2 TO INTERSECTION OF LA MADRE AND CONOUGH
 235 RD 1288 0.0066 0.016 0 TRAP 60 0
 *

236 KKPCNRS-S
 237 KM RETRIEVE FLOW DIVERSION CPCNRS-S FROM INTERSECTION OF ROSADA AND CONOUGH
 238 DRPCNRS-S
 *

239 KKRCPCNRSS
 240 KM ROUTE CPCNRS-S THRU CN-LA2 TO INTERSECTION OF LA MADRE AND CONOUGH
 241 RD 685 0.0026 0.016 0 TRAP 60 0

*
242 KK CN-LA1
243 BA 0.0083
244 PB 2.77
245 LS 0 76.0
246 UD 0.144
*

HEC-1 INPUT

PAGE 8

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

247 KK CN-LA2
248 BA 0.0018
249 PB 2.77
250 LS 0 81.0
251 UD 0.140
*

252 KK LA-CN1
253 BA 0.0024
254 PB 2.77
255 LS 0 78.0
256 UD 0.133
*

257 KK LA-CN2
258 BA 0.0193
259 PB 2.77
260 LS 0 78.0
261 UD 0.178
*

262 KK CPLA-CO
263 KM COMBINE LA-CN2, LA-CN1, CN-LA2, CN-LA1, RCPCLAE, AND RCPNRS
264 HC 6
*

265 KK CPLA-CO-E
266 KM CPLA-CO SPLITS EAST (CPLA-CO-E) AND SOUTH (CPLA-CO-S)
267 KM RATIO BASED ON INLET INTAKE AND FLOW SPLIT CALCULATIONS
268 KM INLET BYPASS IS 4 CFS. 2 CFS SPLIT TO EAST. TOTAL FLOW AT CPLA-CO IS 205 CFS,
269 KM REMAINDER FLOW TO SOUTH IS 203 CFS
270 DTCPCLA-CO-S
271 DI 0 100 200 300
272 DQ 203 203 203 203
*

273 KKRCPCLAOE
274 KM ROUTE CPLA-CO-E TO INTERSECTION OF LA MADRE AND BUFFALO
275 RD 1362 0.0077 0.016 0 TRAP 40 0
*

276 KK LA-BF
277 BA 0.0335
278 PB 2.77
279 LS 0 81.0
280 UD 0.225
*

281 KK CPLA-BF
282 KM COMBINE LA-BF, RCPLAOE AND CPRSBF-S
283 HC 3
*

HEC-1 INPUT

PAGE 9

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

284 KRCPLABF-E
285 KM CPLA-BF WILL HAVE 100% FLOW GO SOUTH (CPLABF-S) ON BUFFALO
286 KM AND 0% EAST (CPLABF-E) ON LA MADRE
287 DTCPLABF-S
288 DI 0 100 200 300
289 DQ 0 100 200 300
*

290 KK DR-WS
291 BA 0.0794
292 PB 2.82

293	LS	0	76.0
294	UD	0.203	
	*		
295	KK	RDR-WS	
296	KM	ROUTE DR-WS THRU DR-LM TO INTERSECTION OF LONE MOUNTAIN AND DURANGO	
297	RD	2668 0.0090 0.016 0 TRAP 100 0	
	*		
298	KK	DR-LM	
299	BA	0.2445	
300	PB	2.82	
301	LS	0	77.0
302	UD	0.402	
	*		
303	KK	CPDR-LM	
304	KM	COMBINE DR-LM AND RDR-WS AT INTERSECTION OF LONE MOUNTAIN AND DURANGO	
305	HC	2	
	*		
306	KK	PARK	
307	KM	48 CFS FROM MOUNTAIN CREST PARK AT SW CORNER OF DURANGO AND LONE MOUNTAIN	
308	KM	CONTRIBUTES TO ONSITE FLOWS. A DUMMY OFFSITE BASIN AREA IS CREATED FOR MODEL.	
309	KM	SEE REPORT FOR DISCUSSION ON PARK FLOW	
310	BA	0.0480	
311	PB	2.82	
312	LS	0	80.0
313	UD	0.100	
	*		
314	KK	CPPARK	
315	KM	COMBINE PARK AND CPDR-LM AT INTERSECTION OF LONE MOUNTAIN AND DURANGO	
316	HC	2	
	*		
317	KK	RCPPARK	
318	KM	ROUTE CPPARK TO INTERSECTION OF LONE MOUNTAIN AND CIMARRON	
319	RD	2674 0.0131 0.016 0 TRAP 100 0	
	*		

HEC-1 INPUT

1

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
320	KK LM-CM2
321	BA 0.0052
322	PB 2.77
323	LS 0 86.0
324	UD 0.175
	*
325	KK LM-CM1
326	BA 0.0834
327	PB 2.77
328	LS 0 77.0
329	UD 0.326
	*
330	KK CPLM-CM
331	KM COMBINE LM-CM1, LM-CM2 AND RCPPARK JUST WEST OF INTERSECTION OF
332	KM LONE MOUNTAIN CIMARRON
333	HC 3
	*
334	KK CM-LM1
335	BA 0.0014
336	PB 2.77
337	LS 0 85.0
338	UD 0.155
	*
339	KK CM-LM2
340	BA 0.0025
341	PB 2.77
342	LS 0 81.0
343	UD 0.137
	*
344	KKCPCMLA-S
345	KM RETRIEVE FLOW DIVERSION CPCMLA-S FROM INTERSECTION OF LA MADRE AND CIMARRON

346 DRCPCMLA-S
 *
 347 KKRCPCMLAS
 348 KM ROUTE CPCMLA-S THRU CM-LM1 TO INTERSECTION OF LONE MOUNTAIN AND CIMARRON
 349 RD 1250 0.0048 0.016 0 TRAP 80 0
 *
 350 KK CPCM-LM
 351 KM COMBINE RCPCMLAS, CM-LM2, AND CM-LM1 JUST NORTH OF INTERSECTION OF
 352 KM LONE MOUNTAIN AND CIMARRON
 353 HC 3
 *

1 HEC-1 INPUT PAGE 11

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

354 KK LM-CM
 355 BA 0.0450
 356 PB 2.77
 357 LS 0 75.0
 358 UD 0.216
 *

359 KK LM-CM3
 360 BA 0.0006
 361 PB 2.77
 362 LS 0 85.0
 363 UD 0.050
 *

364 KKPCPM-LM2
 365 KM COMBINE LM-CM3, LM-CM, CPCM-LM, AND CPLM-CM AT INTERSECTION OF
 366 KM LONE MOUNTAIN AND CIMARRON
 367 KM THIS IS TOTAL FLOW AT INTERSECTION
 368 HC 4
 *

369 KKRCPCMLM2
 370 KM ROUTE CPCM-LM2 TO INTERSECTION OF LONE MOUNTAIN AND VALADEZ
 371 RD 546 0.0055 0.016 0 TRAP 100 0
 *

372 KK LM-VD
 373 BA 0.0080
 374 PB 2.77
 375 LS 0 77.0
 376 UD 0.155
 *

377 KK VD-LM1
 378 BA 0.0222
 379 PB 2.77
 380 LS 0 77.0
 381 UD 0.205
 *

382 KK VD-LM2
 383 BA 0.0020
 384 PB 2.77
 385 LS 0 81.0
 386 UD 0.146
 *

387 KK CPVD-LM
 388 KM COMBINE VD-LM2, VD-LM1, LM-VD, AND RCPCMLM2
 389 KM AT INTERSECTION OF LONE MOUNTAIN AND VALADEZ
 390 HC 4
 *

1 HEC-1 INPUT PAGE 12

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

391 KKRCFVD-LM
 392 KM ROUTE CPVD-LM TO INTERSECTION OF LONE MOUNTAIN AND CONOUGH
 393 RD 726 0.0041 0.016 0 TRAP 100 0
 *

394 KK LM-CN1

395 BA 0.0136
396 PB 2.77
397 LS 0 78.0
398 UD 0.185
*

399 KK LM-CN2
400 BA 0.0027
401 PB 2.77
402 LS 0 87.0
403 UD 0.157
*

404 KK LM-CN3
405 BA 0.0009
406 PB 2.77
407 LS 0 78.0
408 UD 0.173
*

409 KK CPLM-CN
410 KM COMBINE LM-CN3, LM-CN2, LM-CN1, AND RCPVD-LM
411 KM JUST WEST OF LONE MOUNTAIN AND CONOUGH INTERSECTION
412 HC 4
*

413 KKCPLACO-S
414 KM RETRIEVE CPLACO-S FROM INTERSECTION OF LA MADRE AND CONOUGH
415 DRCPLACO-S
*

416 KKRCPACOS
417 KM ROUTE CPLACO-S TO JUST NORTH OF INTERSECTION OF LONE MOUNTAIN AND CONOUGH
418 RD 1330 0.0026 0.016 0 TRAP 60 0
*

419 KK CN-HH
420 BA 0.0117
421 PB 2.77
422 LS 0 81.0
423 UD 0.168
*

HEC-1 INPUT

PAGE 13

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

424 KK CN-CN
425 BA 0.0028
426 PB 2.77
427 LS 0 85.0
428 UD 0.130
*

429 KK CPCN-HH
430 KM COMBINE CN-CN, CN-HH AND RCPLACOS
431 HC 3
*

432 KKRCPCN-HH
433 KM ROUTE CPCN-HH TO JUST NORTH OF INTERSECTION LONE MOUNTAIN AND CONOUGH
434 RD 455 0.0044 0.016 0 TRAP 60 0
*

435 KK CN-LM1
436 BA 0.0046
437 PB 2.77
438 LS 0 81.0
439 UD 0.143
*

440 KK CN-LM2
441 BA 0.0026
442 PB 2.77
443 LS 0 84.0
444 UD 0.140
*

445 KK CPCN-LM
446 KM COMBINE CN-LM2, CN-LM1 AND RCPCN-HH
447 KM JUST NORTH OF INTERSECTION OF LONE MOUNTAIN AND CONOUGH

448 HC 3
 *
 449 KK CPCNLM
 450 KM COMBINE CPCN-LM AND CPLM-CN AT INTERSECTION OF LONE MOUNTAIN AND CONOUGH
 451 HC 2
 *
 452 KK RCPCNLM
 453 KM ROUTE CPCNLM TO JUST WEST OF INTERSECTION OF LONE MOUNTAIN AND BUFFALO
 454 RD 1298 0.0092 0.016 0 TRAP 100 0
 *
 455 KK LM-QD1
 456 BA 0.0033
 457 PB 2.77
 458 LS 0 87.0
 459 UD 0.082
 *

1 HEC-1 INPUT PAGE 14

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

460 KK RLM-QD1
 461 KM ROUTE LM-QD1 THRU LM-QD2
 462 RD 207 0.0096 0.016 0 TRAP 100 0
 *
 463 KK LM-QD2
 464 BA 0.0014
 465 PB 2.77
 466 LS 0 87.0
 467 UD 0.052
 *
 468 KKCPLM-QD2
 469 KM COMBINE LM-QD2 AND RLM-QD1
 470 HC 2
 *
 471 KKRCPLMQD2
 472 KM ROUTE CPLM-QD2 THRU LM-BF2
 473 RD 475 0.0105 0.016 0 TRAP 100 0
 *
 474 KK LM-BF2
 475 BA 0.0010
 476 PB 2.77
 477 LS 0 87.0
 478 UD 0.086
 *
 479 KKCPLM-BF2
 480 KM COMBINE LM-BF2 AND RCPLMQD2
 481 HC 2
 *
 482 KK LM-BF1
 483 BA 0.0493
 484 PB 2.77
 485 LS 0 83.0
 486 UD 0.244
 *
 487 KK CPLM-BF
 488 KM COMBINE LM-BF1, CPLM-BF2, AND RCPCNLM
 489 KM JUST WEST OF INTERSECTION OF LONE MOUNTAIN AND BUFFALO
 490 HC 3
 *

491 KKCPLABF-S
 492 KM RETRIEVE CPLABF-S FROM INTERSECTION OF LA MADRE AND BUFFALO
 493 DRCPLABF-S
 *

1 HEC-1 INPUT PAGE 15

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

494 KKRCPLABFS

495	KM	ROUTE CPLABF-S TO JUST NORTH OF INTERSECTION OF BUFFALO AND LONE MOUNTAIN					
496	RD	1279	0.0055	0.016	0	TRAP	100 0
	*						
497	KK	BF-LM					
498	BA	0.0126					
499	PB	2.77					
500	LS	0	84.0				
501	UD	0.149					
	*						
502	KK	CPBFLM					
503	KM	COMBINE BF-LM, CPLM-BF AND RCPLABFS JUST NORTH OF INTERSECTION OF					
504	KM	BUFFALO AND LONE MOUNTAIN					
505	HC	3					
	*						
506	ZZ						

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT			
LINE	(V) ROUTING	(--->)	DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---)	RETURN OF DIVERTED OR PUMPED FLOW
22	DR-HM		
	V		
	V		
35	RDR-HM		
	.		
	.		
38	DR-FS		
	.		
	.		
43	CPDR-FS.....		
	V		
	V		
46	RCPDR-FS		
	.		
	.		
49	WS-TM1		
	.		
	.		
54	WS-TM2		
	.		
	.		
59	CPWS-TM.....		
	.		
	.		
67	----->CPWSTM-S		
63	CPWSTM-E		
	V		
	V		
70	RCPWSTME		
	.		
	.		
73	WS-CM		
	.		
	.		
78	CPWS-CM.....		
	.		
	.		
86	----->CPWSCM-S		
81	CPWSCM-E		
	V		
	V		
89	RCPWSCM-		
	.		
	.		
92	WS-CN		
	.		
	.		
97	CPWS-CN.....		
	.		
	.		
107	----->CPWSCN-S		
100	CPWSCN-E		
	V		
	V		
110	RCPWSCNE		
	.		
	.		


```

113      .      WS-BF
118      .      CPWS-BF.....
122      .      TM-RS
129      .      .<-----CPWSTM-S
127      .      .CPWSTM-S
130      .      .V
133      .      .V
136      .      .RCPWSTMS
140      .      .CPTM-RS.....
143      .      .----->CPTMRS-S
146      .      .CPTMRS-E
151      .      .V
158      .      .V
159      .      .RCPTMRSE
162      .      .RS-CN1
166      .      .RS-CN2
171      .      .<-----CPWSCM-S
176      .      .CPWSCM-S
179      .      .V
182      .      .V
185      .      .RCPWSCMS
193      .      .CPRS-CN1.....
196      .      .CN-RS1
204      .      .CN-RS2
210      .      .<-----CPWSCN-S
213      .      .CPWSCN-S
216      .      .V
219      .      .V
222      .      .RCPWSCNS
225      .      .CPCN-RS.....
228      .      .CPCNRS.....
231      .      .----->CPCNRS-S
234      .      .CPCNRS-E
237      .      .V
240      .      .V
243      .      .RCPCNRSE
246      .      .RS-BF
249      .      .CPRS-BF.....
252      .      .----->CPRSBF-E
255      .      .CPRSBF-S
258      .      .CM-LA

```


330	.	.	.	.	.	CPLM-CM.....	.
334	.	.	.	.	.	CM-LM1	.
339	.	.	.	.	.	CM-LM2	.
346	.	.	.	.	.	.	.<-----CPCMLA-S
344	.	.	.	.	.	CPCMLA-S	.
	.	.	.	.	.	V	.
	.	.	.	.	.	V	.
347	.	.	.	.	.	RCPCMLAS	.
	.	.	.	.	.	.	.
350	.	.	.	.	.	CPCM-LM.....	.
354	.	.	.	.	.	LM-CM	.
359	.	.	.	.	.	LM-CM3	.
	.	.	.	.	.	.	.
364	.	.	.	.	.	CPCM-LM2.....	.
	.	.	.	.	.	V	.
	.	.	.	.	.	V	.
369	.	.	.	.	.	RCPCMLM2	.
	.	.	.	.	.	.	.
372	.	.	.	.	.	LM-VD	.
	.	.	.	.	.	.	.
377	.	.	.	.	.	VD-LM1	.
	.	.	.	.	.	.	.
382	.	.	.	.	.	VD-LM2	.
	.	.	.	.	.	.	.
387	.	.	.	.	.	CPVD-LM.....	.
	.	.	.	.	.	V	.
	.	.	.	.	.	V	.
391	.	.	.	.	.	RCFVD-LM	.
	.	.	.	.	.	.	.
394	.	.	.	.	.	LM-CN1	.
	.	.	.	.	.	.	.
399	.	.	.	.	.	LM-CN2	.
	.	.	.	.	.	.	.
404	.	.	.	.	.	LM-CN3	.
	.	.	.	.	.	.	.
409	.	.	.	.	.	CPLM-CN.....	.
	.	.	.	.	.	.	.
415	.	.	.	.	.	.	.<-----CPLACO-S
413	.	.	.	.	.	CPLACO-S	.
	.	.	.	.	.	V	.
	.	.	.	.	.	V	.
416	.	.	.	.	.	RCPLACOS	.
	.	.	.	.	.	.	.
419	.	.	.	.	.	CN-HH	.
	.	.	.	.	.	.	.
424	.	.	.	.	.	CN-CN	.
	.	.	.	.	.	.	.
429	.	.	.	.	.	CPCN-HH.....	.
	.	.	.	.	.	V	.
	.	.	.	.	.	V	.
432	.	.	.	.	.	RCPCN-HH	.
	.	.	.	.	.	.	.
435	.	.	.	.	.	CN-LM1	.

JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)

19 IO OUTPUT CONTROL VARIABLES
 IPRNT 5 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
 NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS
 DRAINAGE AREA SQUARE MILES
 PRECIPITATION DEPTH INCHES
 LENGTH, ELEVATION FEET
 FLOW CUBIC FEET PER SECOND
 STORAGE VOLUME ACRE-FEET
 SURFACE AREA ACRES
 TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .99 .98

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
 TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION	
					RATIO 1 .99	RATIO 2 .98
HYDROGRAPH AT						
+	DR-HM	.15	1	FLOW	100.	97.
				TIME	3.67	3.67
ROUTED TO						
+	RDR-HM	.15	1	FLOW	97.	95.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	DR-FS	.06	1	FLOW	65.	64.
				TIME	3.50	3.50
2 COMBINED AT						
+	CPDR-FS	.21	1	FLOW	123.	120.
				TIME	3.67	3.67
ROUTED TO						
+	RCPDR-FS	.21	1	FLOW	122.	118.
				TIME	3.67	3.67
HYDROGRAPH AT						
+	WS-TM1	.07	1	FLOW	39.	38.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	WS-TM2	.01	1	FLOW	7.	7.
				TIME	3.58	3.58
3 COMBINED AT						
+	CPWS-TM	.28	1	FLOW	165.	160.
				TIME	3.67	3.67
DIVERSION TO						
+	CPWSTM-S	.28	1	FLOW	58.	58.

				TIME	3.50	3.50
HYDROGRAPH AT						
+	CPWSTM-E	.28	1	FLOW	107.	102.
				TIME	3.67	3.67
ROUTED TO						
+	RCPWSTME	.28	1	FLOW	105.	100.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	WS-CM	.03	1	FLOW	28.	28.
				TIME	3.67	3.67
2 COMBINED AT						
+	CPWS-CM	.31	1	FLOW	130.	124.
				TIME	3.75	3.75
DIVERSION TO						
+	CPWSCM-S	.31	1	FLOW	17.	17.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	CPWSCM-E	.31	1	FLOW	113.	107.
				TIME	3.75	3.75
ROUTED TO						
+	RCPWSCM-	.31	1	FLOW	113.	107.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	WS-CN	.01	1	FLOW	8.	8.
				TIME	3.58	3.58
2 COMBINED AT						
+	CPWS-CN	.32	1	FLOW	118.	112.
				TIME	3.75	3.75
DIVERSION TO						
+	CPWSCN-S	.32	1	FLOW	116.	112.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	CPWSCN-E	.32	1	FLOW	2.	0.
				TIME	3.75	.00
ROUTED TO						
+	RCPWSCNE	.32	1	FLOW	1.	0.
				TIME	4.08	.00
HYDROGRAPH AT						
+	WS-BF	.01	1	FLOW	10.	10.
				TIME	3.58	3.58
2 COMBINED AT						
+	CPWS-BF	.33	1	FLOW	10.	10.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	TM-RS	.02	1	FLOW	17.	16.
				TIME	3.67	3.67
HYDROGRAPH AT						
+	CPWSTM-S	.00	1	FLOW	58.	58.
				TIME	3.50	3.50
ROUTED TO						
+	RCPWSTMS	.00	1	FLOW	59.	59.
				TIME	3.58	3.58
2 COMBINED AT						
+	CPTM-RS	.02	1	FLOW	75.	75.
				TIME	3.58	3.58
DIVERSION TO						
+	CPTMRS-S	.02	1	FLOW	40.	40.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	CPTMRS-E	.02	1	FLOW	35.	35.
				TIME	3.58	3.58

ROUTED TO						
+	RCPTMRSE	.02	1	FLOW TIME	34. 3.75	34. 3.75
HYDROGRAPH AT						
+	RS-CN1	.04	1	FLOW TIME	24. 3.67	23. 3.67
HYDROGRAPH AT						
+	RS-CN2	.00	1	FLOW TIME	1. 3.58	1. 3.58
HYDROGRAPH AT						
+	CPWSCM-S	.00	1	FLOW TIME	17. 3.50	17. 3.50
ROUTED TO						
+	RCPWSCMS	.00	1	FLOW TIME	17. 3.67	17. 3.67
4 COMBINED AT						
+	CPRS-CN1	.06	1	FLOW TIME	75. 3.75	74. 3.75
HYDROGRAPH AT						
+	CN-RS1	.01	1	FLOW TIME	4. 3.58	4. 3.58
HYDROGRAPH AT						
+	CN-RS2	.00	1	FLOW TIME	2. 3.58	2. 3.58
HYDROGRAPH AT						
+	CPWSCN-S	.00	1	FLOW TIME	116. 3.75	112. 3.75
ROUTED TO						
+	RCPWSCNS	.00	1	FLOW TIME	114. 3.83	109. 3.83
3 COMBINED AT						
+	CPCN-RS	.01	1	FLOW TIME	117. 3.83	112. 3.83
2 COMBINED AT						
+	CPCNRS	.07	1	FLOW TIME	190. 3.75	184. 3.75
DIVERSION TO						
+	CPCNRS-S	.07	1	FLOW TIME	190. 3.75	184. 3.75
HYDROGRAPH AT						
+	CPCNRS-E	.07	1	FLOW TIME	0. .00	0. .00
ROUTED TO						
+	RCPCNRSE	.07	1	FLOW TIME	0. .00	0. .00
HYDROGRAPH AT						
+	RS-BF	.02	1	FLOW TIME	22. 3.58	21. 3.67
2 COMBINED AT						
+	CPRS-BF	.09	1	FLOW TIME	22. 3.58	21. 3.67
DIVERSION TO						
+	CPRSBF-E	.09	1	FLOW TIME	22. 3.58	21. 3.67
HYDROGRAPH AT						
+	CPRSBF-S	.09	1	FLOW TIME	0. .00	0. .00
HYDROGRAPH AT						
+	CM-LA	.09	1	FLOW TIME	51. 3.67	50. 3.67

HYDROGRAPH AT						
+	CPTMRS-S	.00	1	FLOW TIME	40. 3.50	40. 3.50
ROUTED TO						
+	RCPTMRSS	.00	1	FLOW TIME	41. 3.58	40. 3.58
2 COMBINED AT						
+	CPCM-LA	.09	1	FLOW TIME	91. 3.75	89. 3.67
DIVERSION TO						
+	CPCMLA-S	.09	1	FLOW TIME	91. 3.75	89. 3.67
HYDROGRAPH AT						
+	CPCMLA-E	.09	1	FLOW TIME	0. .00	0. .00
ROUTED TO						
+	RCPCMLAE	.09	1	FLOW TIME	0. .00	0. .00
HYDROGRAPH AT						
+	CPCNRS-S	.00	1	FLOW TIME	190. 3.75	184. 3.75
ROUTED TO						
+	RCPCNRSS	.00	1	FLOW TIME	190. 3.83	183. 3.83
HYDROGRAPH AT						
+	CN-LA1	.01	1	FLOW TIME	6. 3.58	6. 3.58
HYDROGRAPH AT						
+	CN-LA2	.00	1	FLOW TIME	2. 3.58	2. 3.58
HYDROGRAPH AT						
+	LA-CN1	.00	1	FLOW TIME	2. 3.58	2. 3.58
HYDROGRAPH AT						
+	LA-CN2	.02	1	FLOW TIME	15. 3.58	14. 3.58
6 COMBINED AT						
+	CPLA-CO	.12	1	FLOW TIME	205. 3.83	198. 3.83
DIVERSION TO						
+	CPLACO-S	.12	1	FLOW TIME	203. 3.83	198. 3.83
HYDROGRAPH AT						
+	CPLACO-E	.12	1	FLOW TIME	2. 3.83	0. .00
ROUTED TO						
+	RCPLACOE	.12	1	FLOW TIME	1. 4.17	0. .00
HYDROGRAPH AT						
+	LA-BF	.03	1	FLOW TIME	28. 3.67	27. 3.67
3 COMBINED AT						
+	CPLA-BF	.25	1	FLOW TIME	28. 3.67	27. 3.67
DIVERSION TO						
+	CPLABF-S	.25	1	FLOW TIME	28. 3.67	27. 3.67
HYDROGRAPH AT						
+	CPLABF-E	.25	1	FLOW TIME	0. .00	0. .00
HYDROGRAPH AT						

+	DR-WS	.08	1	FLOW TIME	53. 3.67	51. 3.67
ROUTED TO						
+	RDR-WS	.08	1	FLOW TIME	52. 3.83	51. 3.83
HYDROGRAPH AT						
+	DR-LM	.24	1	FLOW TIME	126. 3.92	122. 3.92
2 COMBINED AT						
+	CPDR-LM	.32	1	FLOW TIME	178. 3.83	173. 3.83
HYDROGRAPH AT						
+	PARK	.05	1	FLOW TIME	48. 3.50	47. 3.50
2 COMBINED AT						
+	CPPARK	.37	1	FLOW TIME	197. 3.83	191. 3.83
ROUTED TO						
+	RCPPARK	.37	1	FLOW TIME	202. 3.92	197. 3.92
HYDROGRAPH AT						
+	LM-CM2	.01	1	FLOW TIME	6. 3.58	6. 3.58
HYDROGRAPH AT						
+	LM-CM1	.08	1	FLOW TIME	46. 3.75	45. 3.75
3 COMBINED AT						
+	CPLM-CM	.46	1	FLOW TIME	247. 3.92	240. 3.92
HYDROGRAPH AT						
+	CM-LM1	.00	1	FLOW TIME	2. 3.58	2. 3.58
HYDROGRAPH AT						
+	CM-LM2	.00	1	FLOW TIME	2. 3.58	2. 3.58
HYDROGRAPH AT						
+	CPCMLA-S	.00	1	FLOW TIME	91. 3.75	89. 3.67
ROUTED TO						
+	RCPCMLAS	.00	1	FLOW TIME	92. 3.75	90. 3.75
3 COMBINED AT						
+	CPCM-LM	.00	1	FLOW TIME	94. 3.75	93. 3.75
HYDROGRAPH AT						
+	LM-CM	.05	1	FLOW TIME	27. 3.67	26. 3.67
HYDROGRAPH AT						
+	LM-CM3	.00	1	FLOW TIME	1. 3.50	1. 3.50
4 COMBINED AT						
+	CPCM-LM2	.51	1	FLOW TIME	351. 3.83	341. 3.92
ROUTED TO						
+	RCPCM-LM2	.51	1	FLOW TIME	350. 3.92	341. 3.92
HYDROGRAPH AT						
+	LM-VD	.01	1	FLOW TIME	6. 3.58	6. 3.58
HYDROGRAPH AT						
+	VD-LM1	.02	1	FLOW	15.	15.

				TIME	3.67	3.67
HYDROGRAPH AT						
+	VD-LM2	.00	1	FLOW	2.	2.
				TIME	3.58	3.58
4 COMBINED AT						
+	CPVD-LM	.54	1	FLOW	362.	353.
				TIME	3.92	3.92
ROUTED TO						
+	RCPVD-LM	.54	1	FLOW	361.	351.
				TIME	3.92	3.92
HYDROGRAPH AT						
+	LM-CN1	.01	1	FLOW	10.	10.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	LM-CN2	.00	1	FLOW	3.	3.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	LM-CN3	.00	1	FLOW	1.	1.
				TIME	3.58	3.58
4 COMBINED AT						
+	CPLM-CN	.56	1	FLOW	368.	358.
				TIME	3.92	3.92
HYDROGRAPH AT						
+	CPLACO-S	.00	1	FLOW	203.	198.
				TIME	3.83	3.83
ROUTED TO						
+	RCPLACOS	.00	1	FLOW	196.	193.
				TIME	3.92	3.92
HYDROGRAPH AT						
+	CN-HH	.01	1	FLOW	11.	11.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	CN-CN	.00	1	FLOW	3.	3.
				TIME	3.58	3.58
3 COMBINED AT						
+	CPCN-HH	.01	1	FLOW	202.	199.
				TIME	3.83	3.92
ROUTED TO						
+	RCPCN-HH	.01	1	FLOW	202.	197.
				TIME	3.92	3.92
HYDROGRAPH AT						
+	CN-LM1	.00	1	FLOW	5.	4.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	CN-LM2	.00	1	FLOW	3.	3.
				TIME	3.58	3.58
3 COMBINED AT						
+	CPCN-LM	.02	1	FLOW	204.	200.
				TIME	3.92	3.92
2 COMBINED AT						
+	CPCNLM	.58	1	FLOW	573.	557.
				TIME	3.92	3.92
ROUTED TO						
+	RCPCNLM	.58	1	FLOW	567.	549.
				TIME	3.92	3.92
HYDROGRAPH AT						
+	LM-QD1	.00	1	FLOW	5.	5.
				TIME	3.50	3.50
ROUTED TO						
+	RLM-QD1	.00	1	FLOW	4.	4.
				TIME	3.58	3.58

HYDROGRAPH AT							
+	LM-QD2	.00	1	FLOW	2.	2.	
				TIME	3.50	3.50	
2 COMBINED AT							
+	CPLM-QD2	.00	1	FLOW	7.	7.	
				TIME	3.50	3.50	
ROUTED TO							
+	RCPLMQD2	.00	1	FLOW	6.	6.	
				TIME	3.58	3.58	
HYDROGRAPH AT							
+	LM-BF2	.00	1	FLOW	1.	1.	
				TIME	3.50	3.50	
2 COMBINED AT							
+	CPLM-BF2	.01	1	FLOW	8.	7.	
				TIME	3.58	3.58	
HYDROGRAPH AT							
+	LM-BF1	.05	1	FLOW	44.	42.	
				TIME	3.67	3.67	
3 COMBINED AT							
+	CPLM-BF	.64	1	FLOW	598.	580.	
				TIME	3.92	3.92	
HYDROGRAPH AT							
+	CPLABF-S	.00	1	FLOW	28.	27.	
				TIME	3.67	3.67	
ROUTED TO							
+	RCPLABFS	.00	1	FLOW	28.	26.	
				TIME	3.75	3.75	
HYDROGRAPH AT							
+	BF-LM	.01	1	FLOW	14.	14.	
				TIME	3.58	3.58	
3 COMBINED AT							
+	CPBFILM	.65	1	FLOW	627.	608.	
				TIME	3.92	3.92	

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	INTERPOLATED TO COMPUTATION INTERVAL		
							PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1	RATIO=	.00							
RDR-HM	MANE	2.13	99.72	223.52	.93	5.00	97.29	225.00	.93

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7396E+01 EXCESS= .0000E+00 OUTFLOW= .7397E+01 BASIN STORAGE= .1554E-02 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RDR-HM	MANE	2.16	96.45	222.05	.90	5.00	94.69	225.00	.90

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7172E+01 EXCESS= .0000E+00 OUTFLOW= .7173E+01 BASIN STORAGE= .1716E-02 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RCPDR-FS	MANE	4.00	123.66	228.00	.93	5.00	121.59	220.00	.93

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1020E+02 EXCESS= .0000E+00 OUTFLOW= .1022E+02 BASIN STORAGE= .6004E-02 PERCENT ERROR= -.2

FOR PLAN = 1	RATIO=	.00							
RCPDR-FS	MANE	4.00	120.31	228.00	.90	5.00	117.63	220.00	.90

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9895E+01 EXCESS= .0000E+00 OUTFLOW= .9909E+01 BASIN STORAGE= .5966E-02 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .00
RCPWSTME MANE .75 107.26 222.00 .29 5.00 105.01 225.00 .29

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4287E+01 EXCESS= .0000E+00 OUTFLOW= .4291E+01 BASIN STORAGE= .1226E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
RCPWSTME MANE .75 101.98 222.00 .27 5.00 99.99 225.00 .27

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4032E+01 EXCESS= .0000E+00 OUTFLOW= .4035E+01 BASIN STORAGE= .1568E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
RCPWSCM- MANE 1.00 113.67 224.00 .26 5.00 112.79 225.00 .26

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4282E+01 EXCESS= .0000E+00 OUTFLOW= .4292E+01 BASIN STORAGE= .3923E-02 PERCENT ERROR= -.3

FOR PLAN = 1 RATIO= .00
RCPWSCM- MANE 1.00 107.52 224.00 .24 5.00 106.91 225.00 .24

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4004E+01 EXCESS= .0000E+00 OUTFLOW= .4014E+01 BASIN STORAGE= .3141E-02 PERCENT ERROR= -.3

FOR PLAN = 1 RATIO= .00
RCPWSCNE MANE .25 1.67 244.75 .00 5.00 .84 245.00 .00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1426E-01 EXCESS= .0000E+00 OUTFLOW= .1632E-01 BASIN STORAGE= .3171E-02 PERCENT ERROR= -36.7

FOR PLAN = 1 RATIO= .00
RCPWSCNE MANE 5.00 .00 .00 .00 5.00 .00 245.00 .00

FOR PLAN = 1 RATIO= .00
RCPWSTMS MANE 2.56 59.08 215.03 -1.00 5.00 59.07 215.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPWSTMS MANE 2.56 59.12 215.03 -1.00 5.00 59.11 215.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPTRMRSE MANE .50 40.91 219.00 2.20 5.00 34.44 225.00 2.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2789E+01 EXCESS= .0000E+00 OUTFLOW= .2803E+01 BASIN STORAGE= .5120E-02 PERCENT ERROR= -.7

FOR PLAN = 1 RATIO= .00
RCPTRMRSE MANE .50 37.87 222.00 2.10 5.00 34.21 225.00 2.07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2662E+01 EXCESS= .0000E+00 OUTFLOW= .2675E+01 BASIN STORAGE= .4335E-02 PERCENT ERROR= -.7

FOR PLAN = 1 RATIO= .00
RCPWSCMS MANE 4.75 17.40 218.50 -1.00 5.00 17.20 220.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPWSCMS MANE 4.75 17.45 218.50 -1.00 5.00 17.24 220.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPWSCNS MANE 1.61 116.63 226.78 -1.00 5.00 114.16 230.00 -1.00

FOR PLAN = 1 RATIO= .00

RCPWSCNS	MANE	1.63	112.73	226.68	-1.00	5.00	109.03	230.00	-1.00
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FOR PLAN = 1 RATIO=		.00							
RCPCNRSE	MANE	.50	.00	359.50	.00	5.00	.00	360.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4106E-07 EXCESS= .0000E+00 OUTFLOW= .4106E-07 BASIN STORAGE= .1656E-04 PERCENT ERROR=*****

FOR PLAN = 1 RATIO=		.00							
RCPCNRSE	MANE	1.00	.00	462.00	.00	5.00	.00	460.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4105E-07 EXCESS= .0000E+00 OUTFLOW= .4105E-07 BASIN STORAGE= .1656E-04 PERCENT ERROR=*****

FOR PLAN = 1 RATIO=		.00							
RCPTMRSS	MANE	4.75	41.56	213.75	-1.00	5.00	40.95	215.00	-1.00

FOR PLAN = 1 RATIO=		.00							
RCPTMRSS	MANE	4.75	40.50	213.75	-1.00	5.00	40.33	215.00	-1.00

FOR PLAN = 1 RATIO=		.00							
RCPCMLAE	MANE	1.00	.00	464.00	.00	5.00	.00	465.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7240E-07 EXCESS= .0000E+00 OUTFLOW= .7240E-07 BASIN STORAGE= .1671E-04 PERCENT ERROR=*****

FOR PLAN = 1 RATIO=		.00							
RCPCMLAE	MANE	.50	.00	388.00	.00	5.00	.00	390.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1905E-06 EXCESS= .0000E+00 OUTFLOW= .1905E-06 BASIN STORAGE= .1671E-04 PERCENT ERROR=*****

FOR PLAN = 1 RATIO=		.00							
RCPCNRSS	MANE	2.24	190.13	228.08	-1.00	5.00	189.80	230.00	-1.00

FOR PLAN = 1 RATIO=		.00							
RCPCNRSS	MANE	2.27	184.70	228.88	-1.00	5.00	183.21	230.00	-1.00

FOR PLAN = 1 RATIO=		.00							
RCPLACOE	MANE	.25	1.39	249.00	.00	5.00	.85	250.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1190E-01 EXCESS= .0000E+00 OUTFLOW= .1337E-01 BASIN STORAGE= .2727E-02 PERCENT ERROR= -35.3

FOR PLAN = 1 RATIO=		.00							
RCPLACOE	MANE	5.00	.00	.00	.00	5.00	.00	250.00	.00

FOR PLAN = 1 RATIO=		.00							
RDR-WS	MANE	4.25	52.55	229.50	.88	5.00	52.23	230.00	.88

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3713E+01 EXCESS= .0000E+00 OUTFLOW= .3730E+01 BASIN STORAGE= .9093E-02 PERCENT ERROR= -.7

FOR PLAN = 1 RATIO=		.00							
RDR-WS	MANE	4.00	50.72	228.00	.85	5.00	50.70	230.00	.85

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3601E+01 EXCESS= .0000E+00 OUTFLOW= .3616E+01 BASIN STORAGE= .8999E-02 PERCENT ERROR= -.6

FOR PLAN = 1 RATIO=		.00							
RCPPARK	MANE	5.00	202.38	235.00	.94	5.00	202.38	235.00	.94

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1867E+02 EXCESS= .0000E+00 OUTFLOW= .1869E+02 BASIN STORAGE= .6278E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
RCPYPARK MANE 5.00 196.96 235.00 .91 5.00 196.96 235.00 .91

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1810E+02 EXCESS= .0000E+00 OUTFLOW= .1811E+02 BASIN STORAGE= .5985E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
RCPYMLAS MANE 5.00 91.58 225.00 -1.00 5.00 91.58 225.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPYMLAS MANE 5.00 90.41 225.00 -1.00 5.00 90.41 225.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPYMLM2 MANE 1.37 351.40 232.42 1.36 5.00 350.08 235.00 1.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3709E+02 EXCESS= .0000E+00 OUTFLOW= .3710E+02 BASIN STORAGE= .1568E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPYMLM2 MANE 1.38 341.05 235.07 1.33 5.00 341.04 235.00 1.33

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3613E+02 EXCESS= .0000E+00 OUTFLOW= .3613E+02 BASIN STORAGE= .1772E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPVD-LM MANE 1.96 362.32 233.37 1.34 5.00 361.35 235.00 1.34

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3868E+02 EXCESS= .0000E+00 OUTFLOW= .3868E+02 BASIN STORAGE= .2577E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPVD-LM MANE 1.98 351.95 233.85 1.30 5.00 351.11 235.00 1.30

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3767E+02 EXCESS= .0000E+00 OUTFLOW= .3767E+02 BASIN STORAGE= .2802E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPLACOS MANE 4.23 202.63 232.79 -1.00 5.00 196.04 235.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPLACOS MANE 4.28 193.23 235.24 -1.00 5.00 193.19 235.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPYCN-HH MANE 1.24 202.56 232.85 18.37 5.00 201.68 235.00 18.38

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1420E+02 EXCESS= .0000E+00 OUTFLOW= .1420E+02 BASIN STORAGE= .1205E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPYCN-HH MANE 1.25 197.57 235.66 17.66 5.00 197.07 235.00 17.68

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1366E+02 EXCESS= .0000E+00 OUTFLOW= .1366E+02 BASIN STORAGE= .1172E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPYCNLM MANE 2.29 567.29 235.96 1.75 5.00 566.97 235.00 1.75

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5430E+02 EXCESS= .0000E+00 OUTFLOW= .5431E+02 BASIN STORAGE= .3708E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00

RCPCNLM	MANE	2.32	550.85	236.18	1.70	5.00	549.38	235.00	1.70
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CONTINUITY SUMMARY (AC-FT) - INFLOW= .5270E+02 EXCESS= .0000E+00 OUTFLOW= .5271E+02 BASIN STORAGE= .3375E-02 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RLM-QD1	MANE	2.42	4.74	213.26	1.52	5.00	4.44	215.00	1.51

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2667E+00 EXCESS= .0000E+00 OUTFLOW= .2669E+00 BASIN STORAGE= .5146E-03 PERCENT ERROR= -.3

FOR PLAN = 1	RATIO=	.00							
RLM-QD1	MANE	2.45	4.70	212.75	1.48	5.00	4.39	215.00	1.48

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2607E+00 EXCESS= .0000E+00 OUTFLOW= .2608E+00 BASIN STORAGE= .6158E-03 PERCENT ERROR= -.3

FOR PLAN = 1	RATIO=	.00							
RCPLMQD2	MANE	4.76	6.46	214.36	1.52	5.00	6.40	215.00	1.52

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3804E+00 EXCESS= .0000E+00 OUTFLOW= .3812E+00 BASIN STORAGE= .1493E-02 PERCENT ERROR= -.6

FOR PLAN = 1	RATIO=	.00							
RCPLMQD2	MANE	4.75	6.18	213.75	1.48	5.00	6.14	215.00	1.48

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3713E+00 EXCESS= .0000E+00 OUTFLOW= .3720E+00 BASIN STORAGE= .1585E-02 PERCENT ERROR= -.6

FOR PLAN = 1	RATIO=	.00							
RCPLABFS	MANE	5.00	27.60	225.00	-1.00	5.00	27.60	225.00	-1.00

FOR PLAN = 1	RATIO=	.00							
RCPLABFS	MANE	4.75	26.58	228.00	-1.00	5.00	25.70	225.00	-1.00

*** NORMAL END OF HEC-1 ***


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1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JAN 1997
* VERSION 4.1
*
* RUN DATE 13APR15 TIME 13:55:25
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*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*DIAGRAM

*** FREE ***

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1 ID GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN
2 ID 30% ALTERNATIVE ANALYSIS STUDY
3 ID ULTIMATE CONDITION - 10-YR MINOR BASIN
4 ID 4/13/2015
5 ID
6 ID DESIGN STORM = 10-YEAR 6-HR STORM
7 ID STORM DISTRIBUTION = SDN #3
8 ID
9 ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
10 ID
11 ID AREA DARE
12 ID SQ. MI.
13 ID 0-0.5 0.99
14 ID 0.5-1 0.975
15 ID
16 ID JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
17 ID
18 IT 5 0 0 300
19 IO 5 0 0
20 IN 5 0 0
21 JR PREC 0.99 0.975
*

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22 KK DR-HM
23 BA 0.1492
24 PB 1.61
25 PC 0 0.02 0.057 0.07 0.087 0.108 0.124 0.13 0.13 0.13
26 PC 0.13 0.13 0.13 0.133 0.14 0.142 0.148 0.158 0.172 0.181
27 PC 0.19 0.197 0.199 0.2 0.201 0.204 0.214 0.229 0.241 0.249
28 PC 0.251 0.256 0.27 0.278 0.281 0.283 0.295 0.322 0.352 0.409
29 PC 0.499 0.59 0.71 0.744 0.781 0.812 0.819 0.835 0.851 0.856
30 PC 0.86 0.868 0.876 0.888 0.91 0.926 0.937 0.95 0.97 0.976
31 PC 0.982 0.985 0.987 0.989 0.99 0.993 0.993 0.994 0.995 0.998
32 PC 0.998 0.999 1
33 LS 0 77.0
34 UD 0.234
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35 KK RDR-HM
36 KM ROUTE DR-HM TO INTERSECTION OF FISHER AND DURANGO
37 RD 634 0.0110 0.016 0 TRAP 100 0

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*
38 KK DR-FS
39 BA 0.0572
40 PB 1.61
41 LS 0 77.0
42 UD 0.0190
*

HEC-1 INPUT

PAGE 2

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

43 KK CPDR-FS
44 KM COMBINE DR-FS AND RDR-HM AT INTERSECTION OF FISHER AND DURANGO
45 HC 2
*

46 KKRCPDR-FS
47 KM ROUTE CPDR-FS EAST THRU WS-TM1 TO INTERSECTION OF WASHBURN AND TOMSIK
48 RD 2695 0.0156 0.016 0 TRAP 70 0
*

49 KK WS-TM1
50 BA 0.0659
51 PB 1.58
52 LS 0 77.0
53 UD 0.283
*

54 KK WS-TM2
55 BA 0.0085
56 PB 1.58
57 LS 0 78.0
58 UD 0.147
*

59 KK CPWS-TM
60 KM COMBINE WS-TM2, WS-TM1, AND RCPDR-FS
61 KM AT INTERSECTION OF WASHBURN AND TOMSIK
62 HC 3
*

63 KKCPWSTM-E
64 KM CPWSTM-E WILL HAVE A FLOW SPLIT EAST (CPWSTM-E) AND SOUTH (CPWSTM-S)
65 KM FLOW SPLIT IS 0 CFS SOUTH
66 KM CPWSTM-S TO BE RETRIEVED AT TM-RS
67 DTCPWSTM-S
68 DI 0 100 200 300
69 DQ 0 0 0 0
*

70 KKRCPWSTME
71 KM ROUTE CPWSTM-E THRU WS-CM TO INTERSECTION OF WASHBURN AND CIMARRON
72 RD 680 0.0152 0.016 0 TRAP 60 0
*

73 KK WS-CM
74 BA 0.0287
75 PB 1.58
76 LS 0 84.0
77 UD 0.202
*

HEC-1 INPUT

PAGE 3

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

78 KK CPWS-CM
79 KM COMBINE WS-CM AND RCPWSTME AT INTERSECTION OF WASHBURN AND CIMARRON
80 HC 2
*

81 KKCPWSCM-E
82 KM CPWS-CM WILL HAVE A FLOW SPLIT EAST (CPWSCM-E) ON WASHBURN
83 KM AND SOUTH (CPWSCM-S) ON CIMARRON
84 KM FLOW SPLIT IS 0 CFS SOUTH
85 KM CPWSCM-S TO BE RETRIEVED AT CPRS-CN1
86 DTCPWSCM-S
87 DI 0 100 200 300
88 DQ 0 0 0 0


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*
89      KKRCPWSCM-E
90      KM  ROUTE CPWSCM-E THRU WS-CN TO INTERSECTION OF WASHBURN AND CONOUGH
91      RD   1430 0.0105 0.016      0      TRAP      60      0
*

92      KK  WS-CN
93      BA  0.0080
94      PB   1.58
95      LS   0      81.0
96      UD  0.147
*

97      KK CPWS-CN
98      KM  COMBINE WS-CN AND RCPWS-CM AT INTERSECTION OF WASHBURN AND CONOUGH
99      HC    2
*

100     KKCPWSCN-E
101     KM  CPWS-CN WILL HAVE FLOW GO EAST (CPWSCN-E) ON WASHBURN
102     KM  AND FLOW GO SOUTH (CPWSCN-S) ON CONOUGH VIA INLETS BETWEEN
103     KM  CONOUGH AND CIMARRON ON WASHBURN
104     KM  DIVERSION RATIO BASED ON INLET INTAKE CALCS
105     KM  INLET BYPASS IS 0 CFS. 100% OF FLOW GOES SOUTH
106     DTCPWSCN-S
107     DI      0      100      200      300
108     DQ      0      100      200      300
*

109     KKRCPWSCNE
110     KM  ROUTE CPWSCN-E THRU WS-BF TO INTERSECTION OF WASHBURN AND BUFFALO
111     RD   1322 0.0084 0.016      0      TRAP      60      0
*

112     KK  WS-BF
113     BA  0.0090
114     PB   1.58
115     LS   0      85.0
116     UD  0.180
*

117     KK CPWS-BF
118     KM  COMBINE WS-BF AND RCPWSCNE AT INTERSECTION OF WASHBURN AND BUFFALO
119     KM  ALL FLOW AT INTERSECTION OF WASHBURN AND BUFFALO GOES EAST OFFSITE
120     HC    2
*

121     KK  TM-RS
122     BA  0.0239
123     PB   1.58
124     LS   0      77.0
125     UD  0.194
*

126     KKCPWSTM-S
127     KM  RETRIEVE FLOW DIVERSION CPWSTM-S FROM INTERSECTION OF WASHBURN AND TOMSIK
128     DRCPWSTM-S
*

129     KKRCPWSTMS
130     KM  ROUTE CPWSTM-S THRU TM-RS TO INTERSECTION OF ROSADA AND TOMSIK
131     RD   620 0.0058 0.016      0      TRAP      60      0
*

132     KK CPTM-RS
133     KM  COMBINE RCPWSTMS AND TM-RS AT INTERSECTION OF ROSADA AND TOMSIK
134     HC    2
*

135     KKCPTMRS-E
136     KM  CPTM-RS WILL HAVE A FLOW SPLIT EAST (CPTMRS-E) AND SOUTH (CPTMRS-S)
137     KM  FLOW SPLIT IS 34% EAST AND 66% SOUTH
138     KM  CPTMRS-S TO BE RETRIEVED AT CM-LA
139     DTCPTMRS-S
140     DI      0      100      200      300
141     DQ      0      66      132      198

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*
 142 KKRCPTMRSE
 143 KM ROUTE CPTMRS-E THRU RS-CN1 TO INTERSECTION OF ROSADA AND CONOUGH
 144 RD 1990 0.0106 0.016 0 TRAP 60 0
 *

145 KK RS-CN1
 146 BA 0.0380
 147 PB 1.58
 148 LS 0 77.0
 149 UD 0.245
 *

1

HEC-1 INPUT

PAGE 5

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

150 KK RS-CN2
 151 PB 1.58
 152 BA 0.0011
 153 LS 0 76.0
 154 UD 0.125
 *

155 KKCPWSCM-S
 156 KM RETRIEVE FLOW RIVERION CPWSCM-S FROM INTERSECTION OF WASHBURN AND CIMARRON
 157 DRCPWSCM-S
 *

158 KKRCPWSCMS
 159 KM ROUTE CPWSCM-S THRU RS-CN1 TO INTERSECTION OF ROSADA AND CONOUGH
 160 RD 1300 0.0106 0.016 0 TRAP 60 0
 *

161 KKCPRS-CN1
 162 KM COMBINE RS-CN1, RS-CN2, RCPTMRSE AND RCPWSCMS JUST WEST OF INTERSECTION OF
 163 KM ROSADA AND CONOUGH
 164 HC 4
 *

165 KK CN-RS1
 166 BA 0.0055
 167 PB 1.58
 168 LS 0 77.0
 169 UD 0.146
 *

170 KKCPWSCN-S
 171 KM RETRIEVE CPWSCN-S FROM INTERSECTION OF WASHBURN AND CONOUGH
 172 DRCPWSCN-S
 *

173 KKRCPWSCNS
 174 KM ROUTE CPWSCN-S TO INTERSECTION OF ROSADA AND CONOUGH
 175 RD 514 0.0058 0.016 0 TRAP 60 0
 *

176 KK CN-RS2
 177 BA 0.0018
 178 PB 1.58
 179 LS 0 80.0
 180 UD 0.136
 *

181 KK CPCN-RS
 182 KM COMBINE CN-RS2, RCPWSCNS, AND CN-RS1
 183 HC 3
 *

1

HEC-1 INPUT

PAGE 6

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

184 KK CPCNRS
 185 KM COMBINE CPCN-RS AND CPRS-CN1 AT INTERSECTION OF ROSADA AND CONOUGH
 186 HC 2
 *

187 KKPCPNRS-E
 188 KM CPCNRS WILL HAVE FLOW COLLECTED BY INLETS AND SPLIT

189 KM EAST (CPCNRS-E) AND SOUTH (CPCNRS-S) AT INTERSECTION OF CONOUGH AND ROSADA
 190 KM RATIO BASED ON INLET INTAKE AND FLOW SPLIT CALCULATIONS
 191 DTCPCNRS-S
 192 DI 0 100 200 300
 193 DQ 0 100 200 300
 *

194 KKRCPCNRSE
 195 KM ROUTE CPCNRS-E TO INTERSECTION OF ROSADA AND BUFFALO
 196 RD 1310 0.0072 0.016 0 TRAP 60 0
 *

197 KK RS-BF
 198 BA 0.0239
 199 PB 1.58
 200 LS 0 82.0
 201 UD 0.194
 *

202 KK CPRS-BF
 203 KM COMBINE RS-BF AND RCPCNRSE AT INTERSECTION OF ROSADA AND BUFFALO
 204 HC 2
 *

205 KKCPRSBF-S
 206 KM CPRS-BF WILL HAVE 100% FLOW GO EAST (CPRSBF-E) ON ROSADA
 207 KM AND 0% SOUTH (CPRSBF-S) ON BUFFALO
 208 DTCPRSBF-E
 209 DI 0 100 200 300
 210 DQ 0 100 200 300
 *

211 KK CM-LA
 212 BA 0.0872
 213 PB 1.58
 214 LS 0 76.0
 215 UD 0.249
 *

216 KKCPMTMRS-S
 217 KM RETRIEVE FLOW DIVERSION CPTMRS-S FROM INTERSECTION OF ROSADA AND TOMSIK
 218 DRCPTMRS-S
 *

HEC-1 INPUT

PAGE 7

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

219 KKRCPTMRSS
 220 KM ROUTE CPTMRS-S THRU CM-LA TO INTERSECTION OF LA MADRE AND CIMARRON
 221 RD 1390 0.0108 0.016 0 TRAP 60 0
 *

222 KK CPCM-LA
 223 KM COMBINE RCPTMRSS AND CM-LA AT INTERSECTION OF LA MADRE AND CIMARRON
 224 HC 2
 *

225 KKPCMLA-E
 226 KM CPCM-LA WILL HAVE 100% FLOW GO SOUTH (CPCMLA-S) ON CIMARRON
 227 KM AND 0% EAST (CPCMLA-E) ON LA MADRE
 228 DTCPCMLA-S
 229 DI 0 100 200 300
 230 DQ 0 100 200 300
 *

231 KKRCPCMLAE
 232 KM ROUTE CPCMLA-E THRU LA-CN2 TO INTERSECTION OF LA MADRE AND CONOUGH
 233 RD 1288 0.0066 0.016 0 TRAP 60 0
 *

234 KKPCNRS-S
 235 KM RETRIEVE FLOW DIVERSION CPCNRS-S FROM INTERSECTION OF ROSADA AND CONOUGH
 236 DRCPCNRS-S
 *

237 KKRCPCNRSS
 238 KM ROUTE CPCNRS-S THRU CN-LA2 TO INTERSECTION OF LA MADRE AND CONOUGH
 239 RD 685 0.0026 0.016 0 TRAP 60 0
 *

240 KK CN-LA1
241 BA 0.0083
242 PB 1.58
243 LS 0 76.0
244 UD 0.144
*

245 KK CN-LA2
246 BA 0.0018
247 PB 1.58
248 LS 0 81.0
249 UD 0.140
*

250 KK LA-CN1
251 BA 0.0024
252 PB 1.58
253 LS 0 78.0
254 UD 0.133
*

1

HEC-1 INPUT

PAGE 8

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

255 KK LA-CN2
256 BA 0.0193
257 PB 1.58
258 LS 0 78.0
259 UD 0.178
*

260 KK CPLA-CO
261 KM COMBINE LA-CN2, LA-CN1, CN-LA2, CN-LA1, RCPCLAE, AND RCPNRS
262 HC 6
*

263 KKCPLACO-E
264 KM CPLA-CO SPLITS EAST (CPLACO-E) AND SOUTH (CPLACO-S)
265 KM RATIO BASED ON INLET INTAKE AND FLOW SPLIT CALCULATIONS
266 KM 100% INLET INTAKE TO SOUTH
267 DTCPLACO-S
268 DI 0 100 200 300
269 DQ 0 100 200 300
*

270 KKRCPPLACOE
271 KM ROUTE CPLACO-E TO INTERSECTION OF LA MADRE AND BUFFALO
272 RD 1362 0.0077 0.016 0 TRAP 40 0
*

273 KK LA-BF
274 BA 0.0335
275 PB 1.58
276 LS 0 81.0
277 UD 0.225
*

278 KK CPLA-BF
279 KM COMBINE LA-BF, RCPLACOE AND CPRSBF-S
280 HC 3
*

281 KKCPLABF-E
282 KM CPLA-BF WILL HAVE 100% FLOW GO SOUTH (CPLABF-S) ON BUFFALO
283 KM AND 0% EAST (CPLABF-E) ON LA MADRE
284 DTCPLABF-S
285 DI 0 100 200 300
286 DQ 0 100 200 300
*

287 KK DR-WS
288 BA 0.0794
289 PB 1.61
290 LS 0 76.0
291 UD 0.203
*

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HEC-1 INPUT

PAGE 9

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10


```

292      KK  RDR-WS
293      KM  ROUTE DR-WS THRU DR-LM TO INTERSECTION OF LONE MOUNTAIN AND DURANGO
294      RD  2668 0.0090 0.016 0 TRAP 100 0
      *

295      KK  DR-LM
296      BA  0.2445
297      PB  1.61
298      LS  0 77.0
299      UD  0.402
      *

300      KK  CPDR-LM
301      KM  COMBINE DR-LM AND RDR-WS AT INTERSECTION OF LONE MOUNTAIN AND DURANGO
302      HC  2
      *

303      KK  PARK
304      KM  FLOW FROM MOUNTAIN CREST PARK AT SW CORNER OF DURANGO AND LONE MOUNTAIN
305      KM  CONTRIBUTES TO ONSITE FLOWS. A DUMMY OFFSITE BASIN AREA IS CREATED FOR MODEL.
306      BA  0.0480
307      PB  1.61
308      LS  0 80.0
309      UD  0.100
      *

310      KK  CPPARK
311      KM  COMBINE PARK AND CPDR-LM AT INTERSECTION OF LONE MOUNTAIN AND DURANGO
312      HC  2
      *

313      KK  RCPPARK
314      KM  ROUTE CPPARK TO INTERSECTION OF LONE MOUNTAIN AND CIMARRON
315      RD  2674 0.0131 0.016 0 TRAP 100 0
      *

316      KK  LM-CM2
317      BA  0.0052
318      PB  1.58
319      LS  0 86.0
320      UD  0.175
      *

321      KK  LM-CM1
322      BA  0.0834
323      PB  1.58
324      LS  0 77.0
325      UD  0.326
      *

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1

HEC-1 INPUT

PAGE 10

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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

326      KK  CPLM-CM
327      KM  COMBINE LM-CM1, LM-CM2 AND RCPPARK JUST WEST OF INTERSECTION OF
328      KM  LONE MOUNTAIN CIMARRON
329      HC  3
      *

330      KK  CM-LM1
331      BA  0.0014
332      PB  1.58
333      LS  0 85.0
334      UD  0.155
      *

335      KK  CM-LM2
336      BA  0.0025
337      PB  1.58
338      LS  0 81.0
339      UD  0.137
      *

340      KK  CPCMLA-S
341      KM  RETRIEVE FLOW DIVERSION CPCMLA-S FROM INTERSECTION OF LA MADRE AND CIMARRON
342      DRPCMLA-S
      *

343      KK  RCPCLAS

```


344 KM ROUTE CPCMLA-S THRU CM-LM1 TO INTERSECTION OF LONE MOUNTAIN AND CIMARRON
345 RD 1250 0.0048 0.016 0 TRAP 80 0
*

346 KK CPCM-LM
347 KM COMBINE RCPCMLAS, CM-LM2, AND CM-LM1 JUST NORTH OF INTERSECTION OF
348 KM LONE MOUNTAIN AND CIMARRON
349 HC 3
*

350 KK LM-CM
351 BA 0.0450
352 PB 1.58
353 LS 0 75.0
354 UD 0.216
*

355 KK LM-CM3
356 BA 0.0006
357 PB 1.58
358 LS 0 85.0
359 UD 0.050
*

HEC-1 INPUT

PAGE 11

1
LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

360 KKRCPCM-LM2
361 KM COMBINE LM-CM3, LM-CM, CPCM-LM, AND CPLM-CM AT INTERSECTION OF
362 KM LONE MOUNTAIN AND CIMARRON
363 KM THIS IS TOTAL FLOW AT INTERSECTION
364 HC 4
*

365 KKRCPCMLM2
366 KM ROUTE CPCM-LM2 TO INTERSECTION OF LONE MOUNTAIN AND VALADEZ
367 RD 546 0.0055 0.016 0 TRAP 100 0
*

368 KK LM-VD
369 BA 0.0080
370 PB 1.58
371 LS 0 77.0
372 UD 0.155
*

373 KK VD-LM1
374 BA 0.0222
375 PB 1.58
376 LS 0 77.0
377 UD 0.205
*

378 KK VD-LM2
379 BA 0.0020
380 PB 1.58
381 LS 0 81.0
382 UD 0.146
*

383 KK CPVD-LM
384 KM COMBINE VD-LM2, VD-LM1, LM-VD, AND RCPCMLM2
385 KM AT INTERSECTION OF LONE MOUNTAIN AND VALADEZ
386 HC 4
*

387 KKRCPVD-LM
388 KM ROUTE CPVD-LM TO INTERSECTION OF LONE MOUNTAIN AND CONOUGH
389 RD 726 0.0041 0.016 0 TRAP 100 0
*

390 KK LM-CN1
391 BA 0.0136
392 PB 1.58
393 LS 0 78.0
394 UD 0.185
*

HEC-1 INPUT

PAGE 12

1
LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

446 KM COMBINE CPCN-LM AND CPLM-CN AT INTERSECTION OF LONE MOUNTAIN AND CONOUGH
 447 HC 2
 *

448 KK RCPCLM
 449 KM ROUTE CPCNLM TO JUST WEST OF INTERSECTION OF LONE MOUNTAIN AND BUFFALO
 450 RD 1298 0.0092 0.016 0 TRAP 100 0
 *

451 KK LM-QD1
 452 BA 0.0033
 453 PB 1.58
 454 LS 0 87.0
 455 UD 0.082
 *

456 KK RLM-QD1
 457 KM ROUTE LM-QD1 THRU LM-QD2
 458 RD 207 0.0096 0.016 0 TRAP 100 0
 *

459 KK LM-QD2
 460 BA 0.0014
 461 PB 1.58
 462 LS 0 87.0
 463 UD 0.052
 *

HEC-1 INPUT

PAGE 14

1
 LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

464 KKCPLM-QD2
 465 KM COMBINE LM-QD2 AND RLM-QD1
 466 HC 2
 *

467 KKRCPLMQD2
 468 KM ROUTE CPLM-QD2 THRU LM-BF2
 469 RD 475 0.0105 0.016 0 TRAP 100 0
 *

470 KK LM-BF2
 471 BA 0.0010
 472 PB 1.58
 473 LS 0 87.0
 474 UD 0.086
 *

475 KKCPLM-BF2
 476 KM COMBINE LM-BF2 AND RCPLMQD2
 477 HC 2
 *

478 KK LM-BF1
 479 BA 0.0493
 480 PB 1.58
 481 LS 0 83.0
 482 UD 0.244
 *

483 KK CPLM-BF
 484 KM COMBINE LM-BF1, CPLM-BF2, AND RCPCLM
 485 KM JUST WEST OF INTERSECTION OF LONE MOUNTAIN AND BUFFALO
 486 HC 3
 *

487 KKCPLABF-S
 488 KM RETRIEVE CPLABF-S FROM INTERSECTION OF LA MADRE AND BUFFALO
 489 DRCPLABF-S
 *

490 KKRCPLABFS
 491 KM ROUTE CPLABF-S TO JUST NORTH OF INTERSECTION OF BUFFALO AND LONE MOUNTAIN
 492 RD 1279 0.0055 0.016 0 TRAP 100 0
 *

493 KK BF-LM
 494 BA 0.0126
 495 PB 1.58
 496 LS 0 84.0

497 UD 0.149
*

1 HEC-1 INPUT PAGE 15

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

498 KK CPBFLM
499 KM COMBINE BF-LM, CPLM-BF AND RCPLABFS JUST NORTH OF INTERSECTION OF
500 KM BUFFALO AND LONE MOUNTAIN
501 HC 3
*
502 ZZ

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

22 DR-HM
V
V
35 RDR-HM
.
.
38 . DR-FS
.
.
43 CPDR-FS.....
V
V
46 RCPDR-FS
.
.
49 . WS-TM1
.
.
54 . WS-TM2
.
.
59 CPWS-TM.....
.
67 .----->CPWSTM-S
63 CPWSTM-E
V
V
70 RCPWSTME
.
.
73 . WS-CM
.
.
78 CPWS-CM.....
.
86 .----->CPWSCM-S
81 CPWSCM-E
V
V
89 RCPWSCM-
.
.
92 . WS-CN
.
.
97 CPWS-CN.....
.
106 .----->CPWSCN-S
100 CPWSCN-E
V
V
109 RCPWSCNE
.
.
112 . WS-BF
.
.
117 CPWS-BF.....

121	.	TM-RS	.	.	.
128	.	.	.	.	.
126	.	.	CPWSTM-S	.	.<-----CPWSTM-S
	.	.	V	.	.
	.	.	V	.	.
129	.	.	RCPWSTMS	.	.
	.	.	.	.	.
132	.	CPTM-RS		.	.
	.	.	.	.	.
139	.	.	----->CPTMRS-S	.	.
135	.	CPTMRS-E	.	.	.
	.	V	.	.	.
	.	V	.	.	.
142	.	RCPTMRSE	.	.	.
	.	.	.	.	.
145	.	.	RS-CN1	.	.
	.	.	.	.	.
150	.	.	.	RS-CN2	.
	.	.	.	.	.
157	.	.	.	.	.
155	.	.	.	.	.<-----CPWSCM-S
	.	.	.	V	.
	.	.	.	V	.
158	.	.	.	RCPWSCMS	.
	.	.	.	.	.
161	.	CPRS-CN1		.	.
	.	.	.	.	.
165	.	.	CN-RS1	.	.
	.	.	.	.	.
172	.	.	.	.	.
170	.	.	.	CPWSCN-S	.<-----CPWSCN-S
	.	.	.	V	.
	.	.	.	V	.
173	.	.	.	RCPWSCNS	.
	.	.	.	.	.
176	.	.	.	.	CN-RS2
	.	.	.	.	.
181	.	.	CPCN-RS		.
	.	.	.	.	.
184	.	CPCNRS		.	.
	.	.	.	.	.
191	.	.	----->CPCNRS-S	.	.
187	.	CPCNRS-E	.	.	.
	.	V	.	.	.
	.	V	.	.	.
194	.	RCPCNRSE	.	.	.
	.	.	.	.	.
197	.	.	RS-BF	.	.
	.	.	.	.	.
202	.	CPRS-BF		.	.
	.	.	.	.	.
208	.	.	----->CPRSBF-E	.	.
205	.	CPRSBF-S	.	.	.
	.	.	.	.	.
211	.	.	CM-LA	.	.
	.	.	.	.	.
218	.	.	.	.	.
216	.	.	.	CPTMRS-S	.<-----CPTMRS-S
	.	.	.	V	.
	.	.	.	V	.

219	.	.	.	RCPTMRSS					
	.	.	.	.					
222	.	.	.	CPCM-LA.....					
	.	.	.	.					
228	.	.	.	.	----->CPCMLA-S				
225	.	.	.	CPCMLA-E					
	.	.	.	V					
	.	.	.	V					
231	.	.	.	RCPCMLAE					
	.	.	.	.					
236	.	.	.	.	.	<-----CPCNRS-S			
234	.	.	.	CPCNRS-S					
	.	.	.	V					
	.	.	.	V					
237	.	.	.	RCPCNRSS					
	.	.	.	.					
240	.	.	.	.		CN-LA1			
	.	.	.	.		.			
245	.	.	.	.		.	CN-LA2		
	.	.	.	.		.	.		
250	.	.	.	.		.	.	LA-CN1	
	.	.	.	.		.	.	.	
255	.	.	.	.		.	.	.	LA-CN2
	.	.	.	.		.	.	.	.
260	.	.	.	CPLA-CO.....					
	.	.	.	.					
267	.	.	.	.	----->CPLACO-S				
263	.	.	.	CPLACO-E					
	.	.	.	V					
	.	.	.	V					
270	.	.	.	RCPLACOE					
	.	.	.	.					
273	.	.	.	.	LA-BF				
	.	.	.	.	.				
278	.	.	.	CPLA-BF.....					
	.	.	.	.					
284	.	.	.	.	----->CPLABF-S				
281	.	.	.	CPLABF-E					
	.	.	.	.					
287	.	.	.	DR-WS					
	.	.	.	V					
	.	.	.	V					
292	.	.	.	RDR-WS					
	.	.	.	.					
295	.	.	.	.		DR-LM			
	.	.	.	.		.			
300	.	.	.	CPDR-LM.....					
	.	.	.	.					
303	.	.	.	.	PARK				
	.	.	.	.	.				
310	.	.	.	CPARK.....					
	.	.	.	V					
	.	.	.	V					
313	.	.	.	RCPPARK					
	.	.	.	.					
316	.	.	.	.	LM-CM2				
	.	.	.	.	.				
321	.	.	.	.	.	LM-CM1			
	.	.	.	.	.	.			
326	.	.	.	CPLM-CM.....					
	.	.	.	.					

330	.	.	.	CM-LM1	.	.
335	.	.	.	.	CM-LM2	.
342	.	.	.	.	.	.<-----CPCMLA-S
340	.	.	.	.	CPCMLA-S	.
	.	.	.	.	V	.
	.	.	.	.	V	.
343	.	.	.	.	RCPCMLAS	.
	.	.	.	.	.	.
346	.	.	.	CPCM-LM	.	.
	.	.	.	.	.	.
350	.	.	.	.	LM-CM	.
	.	.	.	.	.	.
355	.	.	.	.	.	LM-CM3
	.	.	.	.	.	.
360	.	.	.	CPCM-LM2	.	.
	.	.	.	V	.	.
	.	.	.	V	.	.
365	.	.	.	RCPCMLM2	.	.
	.	.	.	.	.	.
368	.	.	.	LM-VD	.	.
	.	.	.	.	.	.
373	.	.	.	.	VD-LM1	.
	.	.	.	.	.	.
378	.	.	.	.	.	VD-LM2
	.	.	.	.	.	.
383	.	.	.	CPVD-LM	.	.
	.	.	.	V	.	.
	.	.	.	V	.	.
387	.	.	.	RCFVD-LM	.	.
	.	.	.	.	.	.
390	.	.	.	LM-CN1	.	.
	.	.	.	.	.	.
395	.	.	.	.	LM-CN2	.
	.	.	.	.	.	.
400	.	.	.	.	.	LM-CN3
	.	.	.	.	.	.
405	.	.	.	CPLM-CN	.	.
	.	.	.	.	.	.
411	.	.	.	.	.	.<-----CPLACO-S
409	.	.	.	CPLACO-S	.	.
	.	.	.	V	.	.
	.	.	.	V	.	.
412	.	.	.	RCPLACOS	.	.
	.	.	.	.	.	.
415	.	.	.	.	CN-HH	.
	.	.	.	.	.	.
420	.	.	.	.	.	CN-CN
	.	.	.	.	.	.
425	.	.	.	CPCN-HH	.	.
	.	.	.	V	.	.
	.	.	.	V	.	.
428	.	.	.	RCPCN-HH	.	.
	.	.	.	.	.	.
431	.	.	.	.	CN-LM1	.
	.	.	.	.	.	.
436	.	.	.	.	.	CN-LM2
	.	.	.	.	.	.

19 IO OUTPUT CONTROL VARIABLES
 IPRNT 5 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
 NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK

 COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS
 DRAINAGE AREA SQUARE MILES
 PRECIPITATION DEPTH INCHES
 LENGTH, ELEVATION FEET
 FLOW CUBIC FEET PER SECOND
 STORAGE VOLUME ACRE-FEET
 SURFACE AREA ACRES
 TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .99 .98

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
 TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION	
					RATIO 1 .99	RATIO 2 .98
HYDROGRAPH AT						
+	DR-HM	.15	1	FLOW	24.	23.
				TIME	3.75	3.75
ROUTED TO						
+	RDR-HM	.15	1	FLOW	24.	23.
				TIME	3.75	3.83
HYDROGRAPH AT						
+	DR-FS	.06	1	FLOW	17.	17.
				TIME	3.50	3.50
2 COMBINED AT						
+	CPDR-FS	.21	1	FLOW	31.	30.
				TIME	3.75	3.75
ROUTED TO						
+	RCPDR-FS	.21	1	FLOW	30.	29.
				TIME	3.83	3.92
HYDROGRAPH AT						
+	WS-TM1	.07	1	FLOW	9.	9.
				TIME	3.83	3.83
HYDROGRAPH AT						
+	WS-TM2	.01	1	FLOW	2.	2.
				TIME	3.58	3.58
3 COMBINED AT						
+	CPWS-TM	.28	1	FLOW	41.	38.
				TIME	3.83	3.83
DIVERSION TO						
+	CPWSTM-S	.28	1	FLOW	0.	0.
				TIME	.00	.00
HYDROGRAPH AT						
+	CPWSTM-E	.28	1	FLOW	41.	38.

				TIME	3.83	3.83
ROUTED TO						
+	RCPWSTME	.28	1	FLOW	40.	38.
				TIME	3.92	3.92
HYDROGRAPH AT						
+	WS-CM	.03	1	FLOW	10.	10.
				TIME	3.67	3.67
2 COMBINED AT						
+	CPWS-CM	.31	1	FLOW	46.	44.
				TIME	3.92	3.92
DIVERSION TO						
+	CPWSCM-S	.31	1	FLOW	0.	0.
				TIME	.00	.00
HYDROGRAPH AT						
+	CPWSCM-E	.31	1	FLOW	46.	44.
				TIME	3.92	3.92
ROUTED TO						
+	RCPWSCM-	.31	1	FLOW	45.	42.
				TIME	3.92	4.00
HYDROGRAPH AT						
+	WS-CN	.01	1	FLOW	2.	2.
				TIME	3.58	3.58
2 COMBINED AT						
+	CPWS-CN	.32	1	FLOW	46.	43.
				TIME	3.92	4.00
DIVERSION TO						
+	CPWSCN-S	.32	1	FLOW	46.	43.
				TIME	3.92	4.00
HYDROGRAPH AT						
+	CPWSCN-E	.32	1	FLOW	0.	0.
				TIME	.00	.00
ROUTED TO						
+	RCPWSCNE	.32	1	FLOW	0.	0.
				TIME	.00	.00
HYDROGRAPH AT						
+	WS-BF	.01	1	FLOW	3.	3.
				TIME	3.58	3.58
2 COMBINED AT						
+	CPWS-BF	.33	1	FLOW	3.	3.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	TM-RS	.02	1	FLOW	4.	4.
				TIME	3.67	3.67
HYDROGRAPH AT						
+	CPWSTM-S	.00	1	FLOW	0.	0.
				TIME	.00	.00
ROUTED TO						
+	RCPWSTMS	.00	1	FLOW	0.	0.
				TIME	.00	.00
2 COMBINED AT						
+	CPTM-RS	.02	1	FLOW	4.	4.
				TIME	3.67	3.67
DIVERSION TO						
+	CPTMRS-S	.02	1	FLOW	3.	2.
				TIME	3.67	3.67
HYDROGRAPH AT						
+	CPTMRS-E	.02	1	FLOW	1.	1.
				TIME	3.67	3.67
ROUTED TO						
+	RCPTMRSE	.02	1	FLOW	2.	1.
				TIME	4.17	4.17

HYDROGRAPH AT	RS-CN1	.04	1	FLOW	6.	5.
+				TIME	3.75	3.75
HYDROGRAPH AT	RS-CN2	.00	1	FLOW	0.	0.
+				TIME	3.58	3.58
HYDROGRAPH AT	CPWSCM-S	.00	1	FLOW	0.	0.
+				TIME	.00	.00
ROUTED TO	RCPWSCMS	.00	1	FLOW	0.	0.
+				TIME	.00	.00
4 COMBINED AT	CPRS-CN1	.06	1	FLOW	6.	6.
+				TIME	3.75	3.75
HYDROGRAPH AT	CN-RS1	.01	1	FLOW	1.	1.
+				TIME	3.58	3.58
HYDROGRAPH AT	CPWSCN-S	.00	1	FLOW	46.	43.
+				TIME	3.92	4.00
ROUTED TO	RCPWSCNS	.00	1	FLOW	46.	43.
+				TIME	4.00	4.00
HYDROGRAPH AT	CN-RS2	.00	1	FLOW	0.	0.
+				TIME	3.58	3.58
3 COMBINED AT	CPCN-RS	.01	1	FLOW	46.	43.
+				TIME	4.00	4.00
2 COMBINED AT	CPCNRS	.07	1	FLOW	50.	47.
+				TIME	4.00	4.00
DIVERSION TO	CPCNRS-S	.07	1	FLOW	50.	47.
+				TIME	4.00	4.00
HYDROGRAPH AT	CPCNRS-E	.07	1	FLOW	0.	0.
+				TIME	.00	.00
ROUTED TO	RCPCNRSE	.07	1	FLOW	0.	0.
+				TIME	.00	.00
HYDROGRAPH AT	RS-BF	.02	1	FLOW	7.	7.
+				TIME	3.67	3.67
2 COMBINED AT	CPRS-BF	.09	1	FLOW	7.	7.
+				TIME	3.67	3.67
DIVERSION TO	CPRSBE-E	.09	1	FLOW	7.	7.
+				TIME	3.67	3.67
HYDROGRAPH AT	CPRSBE-S	.09	1	FLOW	0.	0.
+				TIME	.00	.00
HYDROGRAPH AT	CM-LA	.09	1	FLOW	11.	11.
+				TIME	3.75	3.75
HYDROGRAPH AT	CPTMRS-S	.00	1	FLOW	3.	2.
+				TIME	3.67	3.67

ROUTED TO						
+	RCPTMRSS	.00	1	FLOW TIME	3. 3.83	3. 3.92
2 COMBINED AT						
+	CPCM-LA	.09	1	FLOW TIME	14. 3.83	13. 3.83
DIVERSION TO						
+	CPCMLA-S	.09	1	FLOW TIME	14. 3.83	13. 3.83
HYDROGRAPH AT						
+	CPCMLA-E	.09	1	FLOW TIME	0. .00	0. .00
ROUTED TO						
+	RCPCMLAE	.09	1	FLOW TIME	0. .00	0. .00
HYDROGRAPH AT						
+	CPCNRS-S	.00	1	FLOW TIME	50. 4.00	47. 4.00
ROUTED TO						
+	RCPCNRSS	.00	1	FLOW TIME	49. 4.08	46. 4.08
HYDROGRAPH AT						
+	CN-LA1	.01	1	FLOW TIME	1. 3.58	1. 3.58
HYDROGRAPH AT						
+	CN-LA2	.00	1	FLOW TIME	1. 3.58	1. 3.58
HYDROGRAPH AT						
+	LA-CN1	.00	1	FLOW TIME	1. 3.58	0. 3.58
HYDROGRAPH AT						
+	LA-CN2	.02	1	FLOW TIME	4. 3.67	4. 3.67
6 COMBINED AT						
+	CPLA-CO	.12	1	FLOW TIME	52. 4.08	48. 4.08
DIVERSION TO						
+	CPLACO-S	.12	1	FLOW TIME	52. 4.08	48. 4.08
HYDROGRAPH AT						
+	CPLACO-E	.12	1	FLOW TIME	0. .00	0. .00
ROUTED TO						
+	RCPLACOE	.12	1	FLOW TIME	0. .00	0. .00
HYDROGRAPH AT						
+	LA-BF	.03	1	FLOW TIME	8. 3.67	8. 3.67
3 COMBINED AT						
+	CPLA-BF	.25	1	FLOW TIME	8. 3.67	8. 3.67
DIVERSION TO						
+	CPLABF-S	.25	1	FLOW TIME	8. 3.67	8. 3.67
HYDROGRAPH AT						
+	CPLABF-E	.25	1	FLOW TIME	0. .00	0. .00
HYDROGRAPH AT						
+	DR-WS	.08	1	FLOW TIME	12. 3.67	11. 3.75
ROUTED TO						

+	RDR-WS	.08	1	FLOW TIME	11. 4.17	10. 4.00
+	HYDROGRAPH AT DR-LM	.24	1	FLOW TIME	31. 3.92	29. 3.92
+	2 COMBINED AT CPDR-LM	.32	1	FLOW TIME	39. 4.08	39. 4.00
+	HYDROGRAPH AT PARK	.05	1	FLOW TIME	15. 3.58	14. 3.58
+	2 COMBINED AT CPPARK	.37	1	FLOW TIME	42. 4.08	43. 4.00
+	ROUTED TO RCPPARK	.37	1	FLOW TIME	42. 4.17	42. 4.17
+	HYDROGRAPH AT LM-CM2	.01	1	FLOW TIME	2. 3.58	2. 3.58
+	HYDROGRAPH AT LM-CM1	.08	1	FLOW TIME	11. 3.83	10. 3.83
+	3 COMBINED AT CPLM-CM	.46	1	FLOW TIME	49. 4.17	49. 4.17
+	HYDROGRAPH AT CM-LM1	.00	1	FLOW TIME	1. 3.58	1. 3.58
+	HYDROGRAPH AT CM-LM2	.00	1	FLOW TIME	1. 3.58	1. 3.58
+	HYDROGRAPH AT CPCMLA-S	.00	1	FLOW TIME	14. 3.83	13. 3.83
+	ROUTED TO RCPCMLAS	.00	1	FLOW TIME	14. 4.00	13. 4.00
+	3 COMBINED AT CPCM-LM	.00	1	FLOW TIME	14. 4.00	13. 4.00
+	HYDROGRAPH AT LM-CM	.05	1	FLOW TIME	5. 3.75	5. 3.75
+	HYDROGRAPH AT LM-CM3	.00	1	FLOW TIME	0. 3.50	0. 3.50
+	4 COMBINED AT CPCM-LM2	.51	1	FLOW TIME	64. 4.00	61. 4.17
+	ROUTED TO RCPCMLM2	.51	1	FLOW TIME	63. 4.08	60. 4.17
+	HYDROGRAPH AT LM-VD	.01	1	FLOW TIME	1. 3.67	1. 3.67
+	HYDROGRAPH AT VD-LM1	.02	1	FLOW TIME	4. 3.67	3. 3.67
+	HYDROGRAPH AT VD-LM2	.00	1	FLOW	1.	1.

				TIME	3.58	3.58
4 COMBINED AT						
+	CPVD-LM	.54	1	FLOW TIME	66. 4.00	62. 4.00
ROUTED TO						
+	RCPVD-LM	.54	1	FLOW TIME	66. 4.08	63. 4.08
HYDROGRAPH AT						
+	LM-CN1	.01	1	FLOW TIME	3. 3.67	2. 3.67
HYDROGRAPH AT						
+	LM-CN2	.00	1	FLOW TIME	1. 3.58	1. 3.58
HYDROGRAPH AT						
+	LM-CN3	.00	1	FLOW TIME	0. 3.67	0. 3.67
4 COMBINED AT						
+	CPLM-CN	.56	1	FLOW TIME	68. 4.08	64. 4.08
HYDROGRAPH AT						
+	CPLACO-S	.00	1	FLOW TIME	52. 4.08	48. 4.08
ROUTED TO						
+	RCPLACOS	.00	1	FLOW TIME	52. 4.17	49. 4.17
HYDROGRAPH AT						
+	CN-HH	.01	1	FLOW TIME	3. 3.58	3. 3.58
HYDROGRAPH AT						
+	CN-CN	.00	1	FLOW TIME	1. 3.58	1. 3.58
3 COMBINED AT						
+	CPCN-HH	.01	1	FLOW TIME	53. 4.17	50. 4.17
ROUTED TO						
+	RCPCN-HH	.01	1	FLOW TIME	53. 4.17	49. 4.17
HYDROGRAPH AT						
+	CN-LM1	.00	1	FLOW TIME	1. 3.58	1. 3.58
HYDROGRAPH AT						
+	CN-LM2	.00	1	FLOW TIME	1. 3.58	1. 3.58
3 COMBINED AT						
+	CPCN-LM	.02	1	FLOW TIME	54. 4.17	50. 4.17
2 COMBINED AT						
+	CPCNLM	.58	1	FLOW TIME	120. 4.17	113. 4.17
ROUTED TO						
+	RCPCNLM	.58	1	FLOW TIME	118. 4.17	113. 4.25
HYDROGRAPH AT						
+	LM-QD1	.00	1	FLOW TIME	2. 3.50	2. 3.50
ROUTED TO						
+	RLM-QD1	.00	1	FLOW TIME	2. 3.58	2. 3.58
HYDROGRAPH AT						
+	LM-QD2	.00	1	FLOW TIME	1. 3.50	1. 3.50

2 COMBINED AT							
+	CPLM-QD2	.00	1	FLOW	3.	2.	
				TIME	3.50	3.50	
ROUTED TO							
+	RCPLMQD2	.00	1	FLOW	3.	2.	
				TIME	3.67	3.67	
HYDROGRAPH AT							
+	LM-BF2	.00	1	FLOW	1.	1.	
				TIME	3.50	3.50	
2 COMBINED AT							
+	CPLM-BF2	.01	1	FLOW	3.	3.	
				TIME	3.67	3.67	
HYDROGRAPH AT							
+	LM-BF1	.05	1	FLOW	14.	14.	
				TIME	3.67	3.75	
3 COMBINED AT							
+	CPLM-BF	.64	1	FLOW	124.	117.	
				TIME	4.17	4.25	
HYDROGRAPH AT							
+	CPLABF-S	.00	1	FLOW	8.	8.	
				TIME	3.67	3.67	
ROUTED TO							
+	RCPLABFS	.00	1	FLOW	8.	8.	
				TIME	3.92	3.92	
HYDROGRAPH AT							
+	BF-LM	.01	1	FLOW	5.	5.	
				TIME	3.58	3.58	
3 COMBINED AT							
+	CPBFLM	.65	1	FLOW	131.	123.	
				TIME	4.17	4.17	

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL			
						DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1	RATIO=	.00							
RDR-HM	MANE	1.75	24.05	229.25	.25	5.00	23.80	225.00	.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1983E+01 EXCESS= .0000E+00 OUTFLOW= .1985E+01 BASIN STORAGE= .1545E-02 PERCENT ERROR= -.1

FOR PLAN = 1	RATIO=	.00							
RDR-HM	MANE	1.75	22.93	229.25	.24	5.00	22.66	230.00	.24

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1900E+01 EXCESS= .0000E+00 OUTFLOW= .1901E+01 BASIN STORAGE= .1518E-02 PERCENT ERROR= -.2

FOR PLAN = 1	RATIO=	.00							
RCPDR-FS	MANE	2.00	30.43	234.00	.25	5.00	30.43	230.00	.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2745E+01 EXCESS= .0000E+00 OUTFLOW= .2755E+01 BASIN STORAGE= .6121E-02 PERCENT ERROR= -.6

FOR PLAN = 1	RATIO=	.00							
RCPDR-FS	MANE	2.00	29.13	232.00	.24	5.00	28.71	235.00	.24

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2631E+01 EXCESS= .0000E+00 OUTFLOW= .2641E+01 BASIN STORAGE= .6041E-02 PERCENT ERROR= -.6

FOR PLAN = 1	RATIO=	.00							
RCPWSTME	MANE	2.42	40.70	234.58	.25	5.00	40.36	235.00	.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3724E+01 EXCESS= .0000E+00 OUTFLOW= .3726E+01 BASIN STORAGE= .1326E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
RCPWSTME MANE 2.49 38.26 233.87 .24 5.00 37.88 235.00 .24

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3543E+01 EXCESS= .0000E+00 OUTFLOW= .3545E+01 BASIN STORAGE= .1224E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
RCPWSCM- MANE 4.75 45.60 237.50 .27 5.00 44.64 235.00 .27

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4411E+01 EXCESS= .0000E+00 OUTFLOW= .4417E+01 BASIN STORAGE= .3351E-02 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .00
RCPWSCM- MANE 4.75 43.05 237.50 .26 5.00 42.17 240.00 .26

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4212E+01 EXCESS= .0000E+00 OUTFLOW= .4218E+01 BASIN STORAGE= .3376E-02 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .00
RCPWSCNE MANE .75 .00 404.25 .00 5.00 .00 405.00 .00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1337E-07 EXCESS= .0000E+00 OUTFLOW= .1337E-07 BASIN STORAGE= .1053E-04 PERCENT ERROR=*****

FOR PLAN = 1 RATIO= .00
RCPWSCNE MANE .50 .00 357.00 .00 5.00 .00 355.00 .00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2958E-07 EXCESS= .0000E+00 OUTFLOW= .2958E-07 BASIN STORAGE= .1053E-04 PERCENT ERROR=*****

FOR PLAN = 1 RATIO= .00
RCPWSTMS MANE 5.00 .00 .00 -1.00 5.00 .00 355.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPWSTMS MANE 5.00 .00 .00 -1.00 5.00 .00 355.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPTRMRSE MANE 1.50 2.37 246.00 .08 5.00 1.53 250.00 .09

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1024E+00 EXCESS= .0000E+00 OUTFLOW= .1056E+00 BASIN STORAGE= .3896E-02 PERCENT ERROR= -6.9

FOR PLAN = 1 RATIO= .00
RCPTRMRSE MANE 1.50 1.85 246.00 .08 5.00 .93 250.00 .08

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9807E-01 EXCESS= .0000E+00 OUTFLOW= .1012E+00 BASIN STORAGE= .4368E-02 PERCENT ERROR= -7.7

FOR PLAN = 1 RATIO= .00
RCPWSCMS MANE 5.00 .00 .00 -1.00 5.00 .00 250.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPWSCMS MANE 5.00 .00 .00 -1.00 5.00 .00 250.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPWSCNS MANE 2.34 45.73 238.20 -1.00 5.00 45.54 240.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPWSCNS MANE 2.39 42.98 239.29 -1.00 5.00 42.82 240.00 -1.00

FOR PLAN = 1	RATIO=	.00							
RCPCNRSE	MANE	.50	.00	482.50	.00	5.00	.00	485.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5346E-08 EXCESS= .0000E+00 OUTFLOW= .5346E-08 BASIN STORAGE= .3138E-05 PERCENT ERROR=*****

FOR PLAN = 1	RATIO=	.00							
RCPCNRSE	MANE	.25	.00	429.75	.00	5.00	.00	430.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2950E-08 EXCESS= .0000E+00 OUTFLOW= .2950E-08 BASIN STORAGE= .3138E-05 PERCENT ERROR=*****

FOR PLAN = 1	RATIO=	.00							
RCPTMRSS	MANE	1.50	3.30	234.00	-1.00	5.00	3.06	230.00	-1.00

FOR PLAN = 1	RATIO=	.00							
RCPTMRSS	MANE	1.50	3.34	231.00	-1.00	5.00	2.72	235.00	-1.00

FOR PLAN = 1	RATIO=	.00							
RCPCMLAE	MANE	.25	.00	364.75	.00	5.00	.00	365.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2925E-08 EXCESS= .0000E+00 OUTFLOW= .2925E-08 BASIN STORAGE= .3166E-05 PERCENT ERROR=*****

FOR PLAN = 1	RATIO=	.00							
RCPCMLAE	MANE	.25	.00	299.75	.00	5.00	.00	300.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3284E-08 EXCESS= .0000E+00 OUTFLOW= .3284E-08 BASIN STORAGE= .4799E-05 PERCENT ERROR=*****

FOR PLAN = 1	RATIO=	.00							
RCPCNRSS	MANE	3.82	49.91	244.16	-1.00	5.00	49.47	245.00	-1.00

FOR PLAN = 1	RATIO=	.00							
RCPCNRSS	MANE	3.91	46.62	242.26	-1.00	5.00	46.13	245.00	-1.00

FOR PLAN = 1	RATIO=	.00							
RCPLACOE	MANE	.75	.00	389.25	.00	5.00	.00	390.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2969E-07 EXCESS= .0000E+00 OUTFLOW= .2969E-07 BASIN STORAGE= .1435E-04 PERCENT ERROR=*****

FOR PLAN = 1	RATIO=	.00							
RCPLACOE	MANE	.25	.00	324.75	.00	5.00	.00	325.00	.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2022E-07 EXCESS= .0000E+00 OUTFLOW= .2022E-07 BASIN STORAGE= .9466E-05 PERCENT ERROR=*****

FOR PLAN = 1	RATIO=	.00							
RDR-WS	MANE	1.50	18.62	237.00	.23	5.00	10.70	250.00	.22

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9517E+00 EXCESS= .0000E+00 OUTFLOW= .9689E+00 BASIN STORAGE= .6921E-02 PERCENT ERROR= -2.5

FOR PLAN = 1	RATIO=	.00							
RDR-WS	MANE	1.75	17.85	238.00	.22	5.00	10.15	240.00	.21

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9099E+00 EXCESS= .0000E+00 OUTFLOW= .9283E+00 BASIN STORAGE= .7604E-02 PERCENT ERROR= -2.9

FOR PLAN = 1	RATIO=	.00							
RCPPARK	MANE	3.25	41.82	250.25	.25	5.00	41.62	250.00	.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5024E+01 EXCESS= .0000E+00 OUTFLOW= .5037E+01 BASIN STORAGE= .6206E-02 PERCENT ERROR= -.4

FOR PLAN = 1 RATIO= .00
RCPARK MANE 3.00 42.93 252.00 .24 5.00 41.50 250.00 .25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4823E+01 EXCESS= .0000E+00 OUTFLOW= .4835E+01 BASIN STORAGE= .6446E-02 PERCENT ERROR= -.4

FOR PLAN = 1 RATIO= .00
RCPCLAS MANE 2.25 13.73 240.75 -1.00 5.00 13.67 240.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPCLAS MANE 2.25 12.83 238.50 -1.00 5.00 12.73 240.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPCLM2 MANE 2.70 63.60 243.03 .29 5.00 63.19 245.00 .29

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7983E+01 EXCESS= .0000E+00 OUTFLOW= .7985E+01 BASIN STORAGE= .1651E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPCLM2 MANE 2.75 60.93 252.81 .28 5.00 60.22 250.00 .28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7674E+01 EXCESS= .0000E+00 OUTFLOW= .7676E+01 BASIN STORAGE= .1652E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPVD-LM MANE 3.87 66.21 244.08 .29 5.00 66.05 245.00 .29

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8403E+01 EXCESS= .0000E+00 OUTFLOW= .8407E+01 BASIN STORAGE= .2317E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
RCPVD-LM MANE 3.96 63.20 245.75 .28 5.00 62.65 245.00 .28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8072E+01 EXCESS= .0000E+00 OUTFLOW= .8076E+01 BASIN STORAGE= .3097E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00
RCPLACOS MANE 5.00 52.01 250.00 -1.00 5.00 52.01 250.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPLACOS MANE 5.00 48.80 250.00 -1.00 5.00 48.80 250.00 -1.00

FOR PLAN = 1 RATIO= .00
RCPCHH MANE 2.12 53.20 249.57 7.75 5.00 53.07 250.00 7.75

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5995E+01 EXCESS= .0000E+00 OUTFLOW= .5996E+01 BASIN STORAGE= .1197E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPCHH MANE 2.17 49.53 249.43 7.40 5.00 49.45 250.00 7.40

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5721E+01 EXCESS= .0000E+00 OUTFLOW= .5721E+01 BASIN STORAGE= .1180E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00
RCPCHM MANE 4.29 119.56 252.90 .48 5.00 118.08 250.00 .48

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1484E+02 EXCESS= .0000E+00 OUTFLOW= .1485E+02 BASIN STORAGE= .3564E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00

RCPCNLM	MANE	4.39	113.31	254.37	.46	5.00	112.70	255.00	.46
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CONTINUITY SUMMARY (AC-FT) - INFLOW= .1421E+02 EXCESS= .0000E+00 OUTFLOW= .1422E+02 BASIN STORAGE= .4092E-02 PERCENT ERROR= -.1

FOR PLAN = 1	RATIO=	.00							
RLM-QD1	MANE	3.52	1.88	214.56	.58	5.00	1.85	215.00	.58

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1021E+00 EXCESS= .0000E+00 OUTFLOW= .1022E+00 BASIN STORAGE= .5247E-03 PERCENT ERROR= -.6

FOR PLAN = 1	RATIO=	.00							
RLM-QD1	MANE	3.56	1.85	213.50	.56	5.00	1.80	215.00	.56

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9932E-01 EXCESS= .0000E+00 OUTFLOW= .9940E-01 BASIN STORAGE= .6442E-03 PERCENT ERROR= -.7

FOR PLAN = 1	RATIO=	.00							
RCPLMQD2	MANE	5.00	2.57	220.00	.58	5.00	2.57	220.00	.58

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1456E+00 EXCESS= .0000E+00 OUTFLOW= .1461E+00 BASIN STORAGE= .1304E-02 PERCENT ERROR= -1.2

FOR PLAN = 1	RATIO=	.00							
RCPLMQD2	MANE	5.00	2.50	220.00	.57	5.00	2.50	220.00	.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1413E+00 EXCESS= .0000E+00 OUTFLOW= .1418E+00 BASIN STORAGE= .1297E-02 PERCENT ERROR= -1.3

FOR PLAN = 1	RATIO=	.00							
RCPLABFS	MANE	2.00	8.60	232.00	-1.00	5.00	8.05	235.00	-1.00

FOR PLAN = 1	RATIO=	.00							
RCPLABFS	MANE	2.00	8.51	232.00	-1.00	5.00	7.71	235.00	-1.00

*** NORMAL END OF HEC-1 ***

Appendix C - Hydraulics

- C.1 - Mainline Hydraulics WSPG
 - C.1A - Capacity of Existing Tie-in Facility WSPG Output
 - C.1B - Lone Mountain System WSPG Output
 - C.1C - Conough System WSPG Output
 - C.1D - Buffalo System WSPG Output
- C.2 - Lateral Pipes Flowmaster Output
- C.3 - Drop Inlet Summary Table
- C.4 - Street Capacity
 - C.4A - 10-year Street Capacity Summary Table
 - C.4B - 100-year Street Capacity Summary Table
- C.5 Surface Flow Exhibit

- C.1 - Mainline Hydraulics WSPG

DATE: 1/21/2002

TIME: 5: 2

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CD	1	3	1	1.00	4.00	23.00	0.00	0.00	0.00
----	---	---	---	------	------	-------	------	------	------

cd	2	3	0	0.00	5.00	11.00	0.00	0.00	0.00
----	---	---	---	------	------	-------	------	------	------

CD	3	3	0	0.00	1.25	11.00	0.00	0.00	0.00
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WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

GOWAN NORTH BUFFALO BRANCH -- LONE MTN TO WASHBURN

HEADING LINE NO 2 IS -

PARSONS BRINCKERHOFF - PROJECT No. 31698A

HEADING LINE NO 3 IS -

FILE NAME: EX-MAX

F 0 5 1 5 P

PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	1 IS A SYSTEM OUTLET	*	*	*	
	U/S DATA	STATION	INVERT	SECT	W S ELEV

[illegible]

ELEMENT NO	3 IS A JUNCTION	*		*	*	*		*			*		*		*
	U/S DATA STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4			

[illegible]

ELEMENT NO	5	IS A SYSTEM HEADWORKS	*	*
	U/S DATA	STATION	INVERT	SECT
				W S ELEV

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

LICENSEE: PARSONS BRINCKERHOFF

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WATER SURFACE PROFILE LISTING

GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

PARSONS BRINCKERHOFF - PROJECT No. 31698A

FILE NAME: EX-MAX

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
100.00	2339.38	4.000	2343.380	664.0	7.59	0.894	2344.274	0.00	3.048	4.00	23.00	0.00	1	1.00
266.89	0.00250					.003548	0.95			3.621		0.00		
366.89	2340.05	4.279	2344.326	664.0	7.59	0.894	2345.220	0.00	3.048	4.00	23.00	0.00	1	1.00
HYDRAULIC JUMP												0.00		
366.89	2340.05	1.983	2342.030	664.0	15.22	3.596	2345.626	0.00	3.048	4.00	23.00	0.00	1	1.00
4.47	0.00250					.014489	0.06			3.621		0.00		
371.36	2340.06	1.964	2342.022	664.0	15.37	3.667	2345.689	0.00	3.048	4.00	23.00	0.00	1	1.00
20.66	0.00250					.015824	0.33			3.621		0.00		
392.02	2340.11	1.873	2341.983	664.0	16.12	4.034	2346.017	0.00	3.048	4.00	23.00	0.00	1	1.00
JUNCT STR	0.00240					.010651	0.13					0.00		
404.52	2340.14	4.293	2344.433	555.0	11.75	2.145	2346.578	0.00	4.293	5.00	11.00	0.00	0	0.00
9.18	0.00250					.004086	0.04			5.000		0.00		
413.70	2340.16	4.503	2344.666	555.0	11.21	1.950	2346.616	0.00	4.293	5.00	11.00	0.00	0	0.00
39.16	0.00250					.003587	0.14			5.000		0.00		
452.86	2340.26	4.722	2344.983	555.0	10.68	1.773	2346.756	0.00	4.293	5.00	11.00	0.00	0	0.00
106.73	0.00250					.003152	0.34			5.000		0.00		
559.59	2340.53	4.953	2345.481	555.0	10.19	1.611	2347.092	0.00	4.293	5.00	11.00	0.00	0	0.00
72.84	0.00250					.002933	0.21			5.000		0.00		
632.43	2340.71	5.000	2345.710	555.0	10.14	1.596	2347.306	0.00	4.293	5.00	11.00	0.00	0	0.00
1119.13	0.00250					.005117	5.73			5.000		0.00		
1751.56	2343.51	7.926	2351.436	555.0	10.14	1.596	2353.032	0.00	4.293	5.00	11.00	0.00	0	0.00

DATE: 1/ 1/2002

TIME: 1:37

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WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

HEADING LINE NO 2 IS -

PARSONS BRINCKERHOFF - PROJECT No. 31698A

HEADING LINE NO 3 IS -

FILE NAME: LM-MAIN

F 0 5 1 5 P

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WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	1	IS A	SYSTEM OUTLET	*	*	*										
			U/S DATA	STATION	INVERT	SECT	W S ELEV									
				100.00	2339.38	1	2343.38									
ELEMENT NO	2	IS A	REACH	*	*	*										
			U/S DATA	STATION	INVERT	SECT	N					RADIUS	ANGLE	ANG PT	MAN H	
				392.02	2340.11	1	0.015					0.00	0.00	0.00	0	
ELEMENT NO	3	IS A	JUNCTION	*	*	*	*	*								
			U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4	
				404.52	2340.14	2	3	0	0.015	109.0	0.0	2340.14	0.00	0.45	0.00	
ELEMENT NO	4	IS A	REACH	*	*	*										
			U/S DATA	STATION	INVERT	SECT	N					RADIUS	ANGLE	ANG PT	MAN H	
				1693.75	2343.39	2	0.015					0.00	0.00	0.00	0	
ELEMENT NO	5	IS A	JUNCTION	*	*	*	*	*								
			U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4	
				1703.75	2343.39	4	2	0	0.015	35.0	0.0	2343.39	0.00	0.45	0.00	
THE ABOVE ELEMENT CONTAINED AN				INVERT	ELEV	WHICH WAS NOT GREATER THAN THE				PREVIOUS	INVERT	ELEV	-WARNING			
THE ABOVE ELEMENT CONTAINED AN				INVERT	ELEV	WHICH WAS NOT GREATER THAN THE				PREVIOUS	INVERT	ELEV	-WARNING			
ELEMENT NO	6	IS A	REACH	*	*	*										
			U/S DATA	STATION	INVERT	SECT	N					RADIUS	ANGLE	ANG PT	MAN H	
				1804.23	2344.13	4	0.015					0.00	0.92	0.00	0	
ELEMENT NO	7	IS A	JUNCTION	*	*	*	*	*								
			U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4	
				1808.23	2344.17	4	8	8	0.015	0.1	0.1	2344.62	2344.62	0.45	0.05	
ELEMENT NO	8	IS A	REACH	*	*	*										
			U/S DATA	STATION	INVERT	SECT	N					RADIUS	ANGLE	ANG PT	MAN H	
				1821.22	2344.29	4	0.015					0.00	0.00	0.15	0	
ELEMENT NO	9	IS A	JUNCTION	*	*	*	*	*								
			U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4	
				1828.22	2344.34	4	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00	
F 0 5 1 5 P																
														PAGE NO	3	

F 0 5 1 5 P

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WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	10	IS A REACH	STATION	2208.25	INVERT	2346.50	SECT	4	N	0.015	RADIUS	0.00	ANGLE	0.00	ANG PT	0.00	MAN H	0								
ELEMENT NO	11	IS A JUNCTION	STATION	2215.25	INVERT	2346.54	SECT	4	LAT-1	0	LAT-2	0	N	0.015	Q3	0.0	Q4	0.0	INVERT-3	0.00	INVERT-4	0.00	PHI 3	0.00	PHI 4	0.00
ELEMENT NO	12	IS A REACH	STATION	2239.29	INVERT	2346.68	SECT	4	N	0.015	RADIUS	0.00	ANGLE	0.00	ANG PT	0.00	MAN H	0								
ELEMENT NO	13	IS A JUNCTION	STATION	2241.29	INVERT	2346.69	SECT	4	LAT-1	11	LAT-2	11	N	0.015	Q3	0.1	Q4	0.1	INVERT-3	2347.17	INVERT-4	2347.17	PHI 3	0.45	PHI 4	0.05
ELEMENT NO	14	IS A REACH	STATION	2429.91	INVERT	2347.77	SECT	4	N	0.015	RADIUS	0.00	ANGLE	0.00	ANG PT	0.00	MAN H	0								
ELEMENT NO	15	IS A JUNCTION	STATION	2431.91	INVERT	2347.78	SECT	4	LAT-1	11	LAT-2	0	N	0.015	Q3	0.1	Q4	0.0	INVERT-3	2348.67	INVERT-4	0.00	PHI 3	0.45	PHI 4	0.00
ELEMENT NO	16	IS A REACH	STATION	2501.04	INVERT	2348.17	SECT	4	N	0.015	RADIUS	0.00	ANGLE	0.00	ANG PT	0.00	MAN H	0								
ELEMENT NO	17	IS A JUNCTION	STATION	2502.54	INVERT	2348.18	SECT	4	LAT-1	12	LAT-2	0	N	0.015	Q3	0.1	Q4	0.0	INVERT-3	2349.18	INVERT-4	0.00	PHI 3	0.45	PHI 4	0.00
ELEMENT NO	18	IS A REACH	STATION	2737.41	INVERT	2349.51	SECT	4	N	0.015	RADIUS	0.00	ANGLE	0.00	ANG PT	0.00	MAN H	0								
ELEMENT NO	19	IS A JUNCTION	STATION	2744.41	INVERT	2349.55	SECT	4	LAT-1	0	LAT-2	0	N	0.015	Q3	0.0	Q4	0.0	INVERT-3	0.00	INVERT-4	0.00	PHI 3	0.00	PHI 4	0.00

F 0 5 1 5 P

PAGE NO 4

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	20	IS A REACH	STATION	3036.58	INVERT	2351.48	SECT	4	N	0.015	RADIUS	0.00	ANGLE	0.00	ANG PT	0.00	MAN H	0								
ELEMENT NO	21	IS A JUNCTION	STATION	3046.58	INVERT	2352.57	SECT	4	LAT-1	6	LAT-2	12	N	0.015	Q3	180.0	Q4	0.1	INVERT-3	2352.57	INVERT-4	2352.57	PHI 3	0.45	PHI 4	0.05
WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS																										
ELEMENT NO	22	IS A REACH	STATION	3176.35	INVERT	2353.70	SECT	5	N	0.015	RADIUS	0.00	ANGLE	0.00	ANG PT	0.00	MAN H	0								
ELEMENT NO	23	IS A JUNCTION	STATION	3177.85	INVERT	2353.72	SECT	5	LAT-1	12	LAT-2	0	N	0.015	Q3	0.1	Q4	0.0	INVERT-3	2354.83	INVERT-4	0.00	PHI 3	0.45	PHI 4	0.00
ELEMENT NO	24	IS A REACH	STATION	3338.74	INVERT	2355.12	SECT	5	N	0.015	RADIUS	0.00	ANGLE	0.00	ANG PT	0.00	MAN H	0								
ELEMENT NO	25	IS A JUNCTION	STATION	3344.74	INVERT	2355.18	SECT	5	LAT-1	0	LAT-2	0	N	0.015	Q3	0.0	Q4	0.0	INVERT-3	0.00	INVERT-4	0.00	PHI 3	0.00	PHI 4	0.00
ELEMENT NO	26	IS A REACH	STATION	3638.82	INVERT	2357.74	SECT	5	N	0.015	RADIUS	0.00	ANGLE	0.00	ANG PT	0.00	MAN H	0								
ELEMENT NO	27	IS A JUNCTION	STATION	3644.82	INVERT	2357.79	SECT	5	LAT-1	0	LAT-2	0	N	0.015	Q3	0.0	Q4	0.0	INVERT-3	0.00	INVERT-4	0.00	PHI 3	0.00	PHI 4	0.00
ELEMENT NO	28	IS A REACH	STATION	3702.61	INVERT	2358.30	SECT	5	N	0.015	RADIUS	0.00	ANGLE	0.00	ANG PT	0.00	MAN H	0								

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 29 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*
U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
	3704.11	2358.31	5	12	0	0.015	0.1	0.0	2359.31	0.00	0.45	0.00		
ELEMENT NO 30 IS A REACH	*	*	*											
U/S DATA	STATION	INVERT	SECT			N				RADIUS	ANGLE	ANG PT	MAN H	
	3770.67	2358.89	5			0.015				0.00	0.00	0.00	0	
ELEMENT NO 31 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*
U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
	3772.17	2358.91	5	12	0	0.015	0.1	0.0	2359.91	0.00	0.45	0.00		
ELEMENT NO 32 IS A REACH	*	*	*											
U/S DATA	STATION	INVERT	SECT			N				RADIUS	ANGLE	ANG PT	MAN H	
	3964.48	2360.59	5			0.015				0.00	0.00	0.00	0	
ELEMENT NO 33 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*
U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
	3970.48	2360.64	5	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00		
ELEMENT NO 34 IS A REACH	*	*	*											
U/S DATA	STATION	INVERT	SECT			N				RADIUS	ANGLE	ANG PT	MAN H	
	4290.41	2363.42	5			0.015				0.00	0.00	0.00	0	
ELEMENT NO 35 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*
U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
	4296.41	2364.53	5	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00		
WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS														
ELEMENT NO 36 IS A REACH	*	*	*											
U/S DATA	STATION	INVERT	SECT			N				RADIUS	ANGLE	ANG PT	MAN H	
	4386.73	2365.20	7			0.015				0.00	0.00	0.00	0	
ELEMENT NO 37 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*
U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
	4388.73	2365.22	7	11	0	0.015	0.1	0.0	2366.21	0.00	0.45	0.00		
F 0 5 1 5 P														
PAGE NO 6														

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 38 IS A REACH	*	*	*											
U/S DATA	STATION	INVERT	SECT			N				RADIUS	ANGLE	ANG PT	MAN H	
	4537.74	2366.33	7			0.015				0.00	0.00	0.00	0	
ELEMENT NO 39 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*
U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
	4540.74	2366.35	7	9	0	0.015	37.0	0.0	2366.35	0.00	0.90	0.00		
ELEMENT NO 40 IS A REACH	*	*	*											
U/S DATA	STATION	INVERT	SECT			N				RADIUS	ANGLE	ANG PT	MAN H	
	4553.95	2366.45	7			0.015				0.00	0.00	0.00	0	
ELEMENT NO 41 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*
U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
	4556.45	2366.47	7	10	0	0.015	0.1	0.0	2367.23	0.00	0.45	0.00		
ELEMENT NO 42 IS A REACH	*	*	*											
U/S DATA	STATION	INVERT	SECT			N				RADIUS	ANGLE	ANG PT	MAN H	
	4590.55	2366.72	7			0.015				0.00	0.00	0.00	0	
ELEMENT NO 43 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*
U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
	4596.55	2366.99	7	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.05		
WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS														
ELEMENT NO 44 IS A REACH	*	*	*											
U/S DATA	STATION	INVERT	SECT			N				RADIUS	ANGLE	ANG PT	MAN H	
	4636.50	2367.81	8			0.015				0.00	0.00	0.00	1	
ELEMENT NO 45 IS A SYSTEM HEADWORKS	*	*	*				*							
U/S DATA	STATION	INVERT	SECT						W S ELEV					
	4636.50	2367.81	8						0.00					

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: LM-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD. EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR	
100.00	2339.38	4.000	2343.380	609.2	6.66	0.689	2344.069	0.00	2.795	4.00	23.00	0.00	1	0.01
265.98	0.00250					.002691	0.72			3.276		0.00		
365.98	2340.05	4.051	2344.096	609.2	6.66	0.689	2344.785	0.00	2.795	4.00	23.00	0.00	1	0.01
HYDRAULIC JUMP													0.00	
365.98	2340.05	1.808	2341.853	609.2	14.66	3.336	2345.189	0.00	2.795	4.00	23.00	0.00	1	0.01
6.91	0.00250					.014641	0.10			3.276		0.00		
372.89	2340.06	1.781	2341.843	609.2	14.88	3.437	2345.280	0.00	2.795	4.00	23.00	0.00	1	0.01
19.13	0.00250					.016131	0.31			3.276		0.00		
392.02	2340.11	1.698	2341.808	609.2	15.60	3.780	2345.588	0.00	2.795	4.00	23.00	0.00	1	0.01
JUNCT STR	0.00240					.010785	0.13					0.00		
404.52	2340.14	4.006	2344.146	500.2	11.35	2.001	2346.147	0.00	4.006	5.00	11.00	0.00	0	0.00
9.12	0.00252					.004016	0.04			4.860		0.00		
413.64	2340.16	4.202	2344.365	500.2	10.82	1.819	2346.184	0.00	4.006	5.00	11.00	0.00	0	0.00
39.70	0.00252					.003522	0.14			4.860		0.00		
453.34	2340.26	4.407	2344.670	500.2	10.32	1.653	2346.323	0.00	4.006	5.00	11.00	0.00	0	0.00
113.71	0.00252					.003091	0.35			4.860		0.00		
567.05	2340.55	4.622	2345.172	500.2	9.84	1.503	2346.675	0.00	4.006	5.00	11.00	0.00	0	0.00
460.44	0.00252					.002714	1.25			4.860		0.00		
1027.49	2341.71	4.847	2346.558	500.2	9.38	1.367	2347.925	0.00	4.006	5.00	11.00	0.00	0	0.00
611.92	0.00252					.002530	1.55			4.860		0.00		
1639.41	2343.25	4.860	2348.114	500.2	9.36	1.359	2349.473	0.00	4.006	5.00	11.00	0.00	0	0.00
HYDRAULIC JUMP													0.00	

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WATER SURFACE PROFILE LISTING

GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

PARSONS BRINCKERHOFF - PROJECT No. 31698A

FILE NAME: LM-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZI	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH				
1639.41	2343.25	3.258	2346.512	500.2	13.96	3.025	2349.537	0.00	4.006	5.00	11.00	0.00	0	0.00
0.33	0.00252					.007652	0.00			4.860		0.00		
1639.74	2343.25	3.255	2346.509	500.2	13.97	3.031	2349.540	0.00	4.006	5.00	11.00	0.00	0	0.00
26.60	0.00252					.008219	0.22			4.860		0.00		
1666.34	2343.32	3.103	2346.424	500.2	14.65	3.334	2349.758	0.00	4.006	5.00	11.00	0.00	0	0.00
27.41	0.00252					.009416	0.26			4.860		0.00		
1693.75	2343.39	2.959	2346.349	500.2	15.37	3.667	2350.016	0.00	4.006	5.00	11.00	0.00	0	0.00
JUNCT STR	0.00000					.008667	0.09					0.00		
1703.75	2343.39	4.250	2347.640	465.2	13.68	2.907	2350.547	0.00	4.719	5.00	8.00	0.00	0	0.00
100.48	0.00737					.007103	0.71			4.230		0.00		
1804.23	2344.13	4.329	2348.459	465.2	13.43	2.802	2351.261	0.00	4.719	5.00	8.00	0.00	0	0.00
JUNCT STR	0.01000					.006868	0.03					0.00		
1808.23	2344.17	4.357	2348.527	465.0	13.34	2.764	2351.291	0.00	4.718	5.00	8.00	0.00	0	0.00
12.99	0.00924					.006446	0.08			3.884		0.00		
1821.22	2344.29	4.546	2348.836	465.0	12.79	2.538	2351.374	0.00	4.718	5.00	8.00	0.00	0	0.00
JUNCT STR	0.00714					.005886	0.04					0.00		
1828.22	2344.34	4.666	2349.006	465.0	12.46	2.410	2351.416	0.00	4.718	5.00	8.00	0.00	0	0.00
353.52	0.00568					.005685	2.01			4.666		0.00		
2181.74	2346.35	4.666	2351.015	465.0	12.46	2.410	2353.425	0.00	4.718	5.00	8.00	0.00	0	0.00
26.51	0.00568					.005737	0.15			4.666		0.00		
2208.25	2346.50	4.634	2351.134	465.0	12.54	2.443	2353.577	0.00	4.718	5.00	8.00	0.00	0	0.00
JUNCT STR	0.00571					.005807	0.04					0.00		

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT NO. 31698A
FILE NAME: LM-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
2215.25	2346.54	4.623	2351.163	465.0	12.57	2.455	2353.618	0.00	4.718	5.00	8.00	0.00	0	0.00
4.84	0.00582					.005824	0.03			4.623		0.00		
2220.09	2346.57	4.623	2351.191	465.0	12.57	2.455	2353.646	0.00	4.718	5.00	8.00	0.00	0	0.00
19.20	0.00582					.005673	0.11			4.623		0.00		
2239.29	2346.68	4.718	2351.398	465.0	12.32	2.357	2353.755	0.00	4.718	5.00	8.00	0.00	0	0.00
JUNCT STR	0.00500					.005345	0.01					0.00		
2241.29	2346.69	4.838	2351.528	464.8	12.01	2.239	2353.767	0.00	4.716	5.00	8.00	0.00	0	0.00
8.97	0.00573					.005345	0.05			4.652		0.00		
2250.26	2346.74	4.716	2351.457	464.8	12.32	2.357	2353.814	0.00	4.716	5.00	8.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
2250.26	2346.74	4.652	2351.393	464.8	12.49	2.422	2353.815	0.00	4.716	5.00	8.00	0.00	0	0.00
166.71	0.00573					.005725	0.95			4.652		0.00		
2416.97	2347.70	4.652	2352.348	464.8	12.49	2.422	2354.770	0.00	4.716	5.00	8.00	0.00	0	0.00
12.94	0.00573					.005625	0.07			4.652		0.00		
2429.91	2347.77	4.716	2352.486	464.8	12.32	2.357	2354.843	0.00	4.716	5.00	8.00	0.00	0	0.00
JUNCT STR	0.00500					.005386	0.01					0.00		
2431.91	2347.78	4.809	2352.589	464.7	12.08	2.266	2354.855	0.00	4.716	5.00	8.00	0.00	0	0.00
8.99	0.00564					.005385	0.05			4.677		0.00		
2440.90	2347.83	4.716	2352.547	464.7	12.32	2.356	2354.903	0.00	4.716	5.00	8.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
2440.90	2347.83	4.677	2352.508	464.7	12.42	2.395	2354.903	0.00	4.716	5.00	8.00	0.00	0	0.00
47.65	0.00564					.005643	0.27			4.677		0.00		

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WATER SURFACE PROFILE LISTING

GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

PARSONS BRINCKERHOFF - PROJECT No. 31698A

FILE NAME: LM-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
2488.55	2348.10	4.677	2352.777	464.7	12.42	2.395	2355.172	0.00	4.716	5.00	8.00	0.00	0	0.00
12.49	0.00564					.005617	0.07			4.677		0.00		
2501.04	2348.17	4.693	2352.863	464.7	12.38	2.379	2355.242	0.00	4.716	5.00	8.00	0.00	0	0.00
JUNCT STR	0.00667					.005627	0.01					0.00		
2502.54	2348.18	4.670	2352.850	464.6	12.44	2.401	2355.251	0.00	4.715	5.00	8.00	0.00	0	0.00
154.39	0.00566					.005663	0.87			4.670		0.00		
2656.93	2349.05	4.670	2353.724	464.6	12.44	2.401	2356.125	0.00	4.715	5.00	8.00	0.00	0	0.00
22.79	0.00566					.005699	0.13			4.670		0.00		
2679.72	2349.18	4.647	2353.830	464.6	12.50	2.425	2356.255	0.00	4.715	5.00	8.00	0.00	0	0.00
57.69	0.00566					.006118	0.35			4.670		0.00		
2737.41	2349.51	4.431	2353.941	464.6	13.11	2.668	2356.609	0.00	4.715	5.00	8.00	0.00	0	0.00
JUNCT STR	0.00571					.006552	0.05					0.00		
2744.41	2349.55	4.404	2353.954	464.6	13.19	2.700	2356.654	0.00	4.715	5.00	8.00	0.00	0	0.00
170.34	0.00661					.006605	1.13			4.404		0.00		
2914.75	2350.68	4.404	2355.079	464.6	13.19	2.700	2357.779	0.00	4.715	5.00	8.00	0.00	0	0.00
98.98	0.00661					.006432	0.64			4.404		0.00		
3013.73	2351.33	4.495	2355.824	464.6	12.92	2.592	2358.416	0.00	4.715	5.00	8.00	0.00	0	0.00
22.85	0.00661					.005891	0.13			4.404		0.00		
3036.58	2351.48	4.715	2356.195	464.6	12.32	2.356	2358.551	0.00	4.715	5.00	8.00	0.00	0	0.00
JUNCT STR	0.10900					.004243	0.04					0.00		
3046.58	2352.57	5.573	2358.143	284.5	8.19	1.041	2359.184	0.00	3.717	5.00	7.00	0.00	0	0.00
126.33	0.00871					.004169	0.53			3.141		0.00		

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WATER SURFACE PROFILE LISTING

GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

PARSONS BRINCKERHOFF - PROJECT No. 31698A

FILE NAME: LM-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD. EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
3172.91	2353.67	5.000	2358.670	284.5	8.19	1.041	2359.711	0.00	3.717	5.00	7.00	0.00	0	0.00
3.44	0.00871					.002625	0.01			3.141		0.00		
3176.35	2353.70	4.963	2358.663	284.5	8.19	1.041	2359.704	0.00	3.717	5.00	7.00	0.00	0	0.00
JUNCT STR	0.01333					.002635	0.00					0.00		
3177.85	2353.72	4.938	2358.658	284.4	8.23	1.051	2359.709	0.00	3.716	5.00	7.00	0.00	0	0.00
21.21	0.00870					.002824	0.06			3.141		0.00		
3199.06	2353.91	4.708	2358.613	284.4	8.63	1.156	2359.769	0.00	3.716	5.00	7.00	0.00	0	0.00
18.77	0.00870					.003192	0.06			3.141		0.00		
3217.83	2354.07	4.489	2358.557	284.4	9.05	1.272	2359.829	0.00	3.716	5.00	7.00	0.00	0	0.00
10.47	0.00870					.003521	0.04			3.141		0.00		
3228.30	2354.16	4.359	2358.518	284.4	9.32	1.349	2359.867	0.00	3.716	5.00	7.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
3228.30	2354.16	3.138	2357.297	284.4	12.95	2.603	2359.900	0.00	3.716	5.00	7.00	0.00	0	0.00
110.44	0.00870					.008761	0.97			3.141		0.00		
3338.74	2355.12	3.130	2358.250	284.4	12.98	2.617	2360.867	0.00	3.716	5.00	7.00	0.00	0	0.00
JUNCT STR	0.01000					.008749	0.05					0.00		
3344.74	2355.18	3.141	2358.321	284.4	12.93	2.598	2360.919	0.00	3.716	5.00	7.00	0.00	0	0.00
131.76	0.00870					.008706	1.15			3.141		0.00		
3476.50	2356.33	3.141	2359.468	284.4	12.93	2.598	2362.066	0.00	3.716	5.00	7.00	0.00	0	0.00
162.32	0.00870					.008715	1.41			3.141		0.00		
3638.82	2357.74	3.139	2360.879	284.4	12.94	2.602	2363.481	0.00	3.716	5.00	7.00	0.00	0	0.00
JUNCT STR	0.00833					.008736	0.05					0.00		

WATER SURFACE PROFILE LISTING

GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

PARSONS BRINCKERHOFF - PROJECT No. 31698A

FILE NAME: LM-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
3644.82	2357.79	3.135	2360.925	284.4	12.96	2.607	2363.532	0.00	3.716	5.00	7.00	0.00	0	0.00
57.79	0.00882					.008710	0.50			3.125		0.00		
3702.61	2358.30	3.145	2361.445	284.4	12.92	2.591	2364.036	0.00	3.716	5.00	7.00	0.00	0	0.00
JUNCT STR	0.00667					.008707	0.01					0.00		
3704.11	2358.31	3.135	2361.445	284.3	12.95	2.605	2364.050	0.00	3.715	5.00	7.00	0.00	0	0.00
66.56	0.00871					.008761	0.58			3.139		0.00		
3770.67	2358.89	3.130	2362.020	284.3	12.98	2.614	2364.634	0.00	3.715	5.00	7.00	0.00	0	0.00
JUNCT STR	0.01333					.008759	0.01					0.00		
3772.17	2358.91	3.135	2362.045	284.2	12.95	2.604	2364.649	0.00	3.714	5.00	7.00	0.00	0	0.00
16.69	0.00874					.008738	0.15			3.135		0.00		
3788.86	2359.06	3.135	2362.191	284.2	12.95	2.604	2364.795	0.00	3.714	5.00	7.00	0.00	0	0.00
175.62	0.00874					.008867	1.56			3.135		0.00		
3964.48	2360.59	3.102	2363.692	284.2	13.09	2.661	2366.353	0.00	3.714	5.00	7.00	0.00	0	0.00
JUNCT STR	0.00833					.009017	0.05					0.00		
3970.48	2360.64	3.096	2363.736	284.2	13.11	2.670	2366.406	0.00	3.714	5.00	7.00	0.00	0	0.00
122.15	0.00869					.009617	1.17			3.141		0.00		
4092.63	2361.70	2.962	2364.664	284.2	13.71	2.918	2367.582	0.00	3.714	5.00	7.00	0.00	0	0.00
69.49	0.00869					.010905	0.76			3.141		0.00		
4162.12	2362.30	2.824	2365.129	284.2	14.38	3.210	2368.339	0.00	3.714	5.00	7.00	0.00	0	0.00
50.75	0.00869					.012425	0.63			3.141		0.00		
4212.87	2362.75	2.692	2365.438	284.2	15.08	3.531	2368.969	0.00	3.714	5.00	7.00	0.00	0	0.00
41.58	0.00869					.014167	0.59			3.141		0.00		

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WATER SURFACE PROFILE LISTING

GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

PARSONS BRINCKERHOFF - PROJECT No. 31698A

FILE NAME: LM-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
4556.45	2366.47	4.508	2370.978	247.0	8.90	1.230	2372.208	0.00	3.382	4.00	7.00	0.00	0	0.00
34.10	0.00733					.005923	0.20		3.016			0.00		
4590.55	2366.72	4.460	2371.180	247.0	8.90	1.230	2372.410	0.00	3.382	4.00	7.00	0.00	0	0.00
JUNCT STR	0.04500					.005923	0.04					0.00		
4596.55	2366.99	4.225	2371.215	247.0	25.67	10.235	2381.450	0.00	3.484	3.50	0.00	0.00	0	0.00
39.95	0.02053					.080244	3.21		3.500			0.00		
4636.50	2367.81	7.123	2374.933	247.0	25.67	10.235	2385.168	0.00	3.484	3.50	0.00	0.00	0	0.00

DATE: 1/20/2002
TIME: 22:55

F0515P
WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

PAGE 1

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	3	1	0.01	4.00	23.00	0.00	0.00	0.00										
CD	2	3	0	0.00	5.00	11.00	0.00	0.00	0.00										
CD	3	3	0	0.00	1.25	11.00	0.00	0.00	0.00										
CD	4	3	0	0.00	6.00	7.00	0.00	0.00	0.00										
CD	5	3	0	0.00	5.00	7.00	0.00	0.00	0.00										
CD	6	3	0	0.00	5.00	5.00	0.00	0.00	0.00										
CD	7	3	0	0.00	4.00	7.00	0.00	0.00	0.00										
CD	8	4			3.50														
CD	9	4			3.00														
CD	10	4			2.50														
CD	11	4			2.00														
CD	12	4			1.50														
CD	13	4			4.00														

F 0 5 1 5 P

PAGE NO 3

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

HEADING LINE NO 2 IS -

PARSONS BRINCKERHOFF - PROJECT NO. 31698A

HEADING LINE NO 3 IS -

FILE NAME: CO-MAIN

F 0 5 1 5 P

PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	1 IS A SYSTEM OUTLET	*	*	*															
	U/S DATA	STATION	INVERT	SECT															
		100.00	2352.09	6															
ELEMENT NO	2 IS A REACH	*	*	*															
	U/S DATA	STATION	INVERT	SECT															
		145.68	2352.45	6															
ELEMENT NO	3 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4						
		147.18	2352.46	6	12	0	0.015	0.1	0.0	2353.45	0.00	0.45	0.00						
ELEMENT NO	4 IS A REACH	*	*	*															
	U/S DATA	STATION	INVERT	SECT															
		166.81	2352.62	6															
ELEMENT NO	5 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4						
		172.48	2352.66	6	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00						
ELEMENT NO	6 IS A REACH	*	*	*															
	U/S DATA	STATION	INVERT	SECT															
		179.26	2352.69	6															
ELEMENT NO	7 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4						
		180.76	2352.70	6	12	0	0.015	0.1	0.0	2353.70	0.00	0.45	0.00						
ELEMENT NO	8 IS A REACH	*	*	*															
	U/S DATA	STATION	INVERT	SECT															
		560.33	2354.62	6															
ELEMENT NO	9 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4						
		565.99	2354.65	6	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00						

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	10	IS A REACH	* U/S DATA	STATION 608.88	INVERT 2354.84	SECT 6	N 0.015			RADIUS 0.00		ANGLE 0.00	ANG PT 0.00	MAN H 0	
ELEMENT NO	11	IS A JUNCTION	* U/S DATA	STATION 610.38	INVERT 2354.85	SECT 6	LAT-1 12	LAT-2 0	N 0.015	Q3 0.1	Q4 0.0	INVERT-3 2355.85	INVERT-4 0.00	PHI 3 0.45	PHI 4 0.00
ELEMENT NO	12	IS A REACH	* U/S DATA	STATION 651.80	INVERT 2355.06	SECT 6	N 0.015			RADIUS 0.00		ANGLE 0.00	ANG PT 0.00	MAN H 0	
ELEMENT NO	13	IS A JUNCTION	* U/S DATA	STATION 653.30	INVERT 2355.07	SECT 6	LAT-1 12	LAT-2 0	N 0.015	Q3 0.1	Q4 0.0	INVERT-3 2356.07	INVERT-4 0.00	PHI 3 0.45	PHI 4 0.00
ELEMENT NO	14	IS A REACH	* U/S DATA	STATION 967.69	INVERT 2356.69	SECT 6	N 0.015			RADIUS 0.00		ANGLE 0.00	ANG PT 0.00	MAN H 0	
ELEMENT NO	15	IS A JUNCTION	* U/S DATA	STATION 973.15	INVERT 2356.71	SECT 6	LAT-1 0	LAT-2 0	N 0.015	Q3 0.0	Q4 0.0	INVERT-3 0.00	INVERT-4 0.00	PHI 3 0.00	PHI 4 0.00
ELEMENT NO	16	IS A REACH	* U/S DATA	STATION 1367.49	INVERT 2358.74	SECT 6	N 0.015			RADIUS 0.00		ANGLE 0.00	ANG PT 0.00	MAN H 0	
ELEMENT NO	17	IS A JUNCTION	* U/S DATA	STATION 1373.15	INVERT 2358.77	SECT 6	LAT-1 0	LAT-2 0	N 0.015	Q3 0.0	Q4 0.0	INVERT-3 0.00	INVERT-4 0.00	PHI 3 0.00	PHI 4 0.00
ELEMENT NO	18	IS A REACH	* U/S DATA	STATION 1437.14	INVERT 2359.12	SECT 6	N 0.015			RADIUS 0.00		ANGLE 0.00	ANG PT 0.00	MAN H 0	
ELEMENT NO	19	IS A JUNCTION	* U/S DATA	STATION 1438.64	INVERT 2359.13	SECT 6	LAT-1 12	LAT-2 0	N 0.015	Q3 0.1	Q4 0.0	INVERT-3 2360.12	INVERT-4 0.00	PHI 3 0.45	PHI 4 0.00

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	20	IS A REACH	U/S DATA	STATION 1511.18	INVERT 2359.51	SECT 6				N 0.015				RADIUS 0.00	ANGLE 0.00	ANG PT 0.00	MAN H 0
ELEMENT NO	21	IS A JUNCTION	U/S DATA	STATION 1512.68	INVERT 2359.52	SECT 6	LAT-1 12	LAT-2 0	N 0.015	Q3 0.1	Q4 0.0	INVERT-3 2360.52	INVERT-4 0.00	PHI 3 0.45	PHI 4 0.00		
ELEMENT NO	22	IS A REACH	U/S DATA	STATION 1746.40	INVERT 2360.78	SECT 6				N 0.015				RADIUS 0.00	ANGLE 0.00	ANG PT 0.00	MAN H 0
ELEMENT NO	23	IS A JUNCTION	U/S DATA	STATION 1752.06	INVERT 2360.81	SECT 6	LAT-1 0	LAT-2 0	N 0.015	Q3 0.0	Q4 0.0	INVERT-3 0.00	INVERT-4 0.00	PHI 3 0.00	PHI 4 0.00		
ELEMENT NO	24	IS A REACH	U/S DATA	STATION 1804.80	INVERT 2361.10	SECT 6				N 0.015				RADIUS 0.00	ANGLE 0.00	ANG PT 0.00	MAN H 0
ELEMENT NO	25	IS A JUNCTION	U/S DATA	STATION 1806.30	INVERT 2361.11	SECT 6	LAT-1 12	LAT-2 0	N 0.015	Q3 0.1	Q4 0.0	INVERT-3 2362.13	INVERT-4 0.00	PHI 3 0.45	PHI 4 0.00		
ELEMENT NO	26	IS A REACH	U/S DATA	STATION 2122.58	INVERT 2362.83	SECT 6				N 0.015				RADIUS 0.00	ANGLE 0.00	ANG PT 0.00	MAN H 0
ELEMENT NO	27	IS A JUNCTION	U/S DATA	STATION 2124.08	INVERT 2362.84	SECT 6	LAT-1 12	LAT-2 0	N 0.015	Q3 0.1	Q4 0.0	INVERT-3 2363.89	INVERT-4 0.00	PHI 3 0.45	PHI 4 0.00		
ELEMENT NO	28	IS A REACH		*	*	*											

	U/S DATA	STATION	INVERT	SECT	N				RADIUS	ANGLE	ANG PT	MAN H
		2148.23	2362.97	6	0.015				0.00	0.00	0.00	0
ELEMENT NO 29 IS A JUNCTION		*	*	*	*				*			
U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	2150.23	2362.99	6	11	11	0.015	0.1	0.1	2364.19	2363.94	0.45	0.45
				F 0 5 1 5 P								PAGE NO 5

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 30 IS A REACH	U/S DATA	STATION	INVERT	SECT	N				RADIUS	ANGLE	ANG PT	MAN H	
		2190.68	2363.19	6	0.015				0.00	0.00	0.00	0	
ELEMENT NO 31 IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		2192.18	2363.20	6	12	0	0.015	0.1	0.0	2364.21	0.00	0.45	0.00
ELEMENT NO 32 IS A REACH	U/S DATA	STATION	INVERT	SECT	N				RADIUS	ANGLE	ANG PT	MAN H	
		2197.49	2363.23	6	0.015				0.00	0.00	0.00	0	
ELEMENT NO 33 IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		2198.99	2363.24	6	12	0	0.015	8.7	0.0	2364.23	0.00	0.45	0.00
ELEMENT NO 34 IS A REACH	U/S DATA	STATION	INVERT	SECT	N				RADIUS	ANGLE	ANG PT	MAN H	
		2451.81	2364.54	6	0.015				0.00	0.00	0.00	0	
ELEMENT NO 35 IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		2457.48	2364.57	6	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00
ELEMENT NO 36 IS A REACH	U/S DATA	STATION	INVERT	SECT	N				RADIUS	ANGLE	ANG PT	MAN H	
		2851.65	2366.69	6	0.015				0.00	0.00	0.00	0	
ELEMENT NO 37 IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		2857.65	2366.72	6	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

ELEMENT NO 38 IS A REACH	U/S DATA	STATION	INVERT	SECT	N				RADIUS	ANGLE	ANG PT	MAN H
		2887.02	2367.95	13	0.015				0.00	0.00	0.00	0
				F 0 5 1 5 P								PAGE NO 6

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 39 IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		2888.52	2368.07	13	12	0	0.015	0.1	0.0	2368.07	0.00	0.90	0.00
ELEMENT NO 40 IS A REACH	U/S DATA	STATION	INVERT	SECT	N				RADIUS	ANGLE	ANG PT	MAN H	
		3224.85	2371.42	13	0.015				0.00	0.00	0.00	0	
ELEMENT NO 41 IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		3230.85	2371.71	13	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00
ELEMENT NO 42 IS A REACH	U/S DATA	STATION	INVERT	SECT	N				RADIUS	ANGLE	ANG PT	MAN H	
		3566.68	2375.04	13	0.015				0.00	0.00	0.00	0	
ELEMENT NO 43 IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		3569.18	2375.23	13	10	0	0.015	0.1	0.0	2375.23	0.00	0.90	0.00
ELEMENT NO 44 IS A REACH	U/S DATA	STATION	INVERT	SECT	N				RADIUS	ANGLE	ANG PT	MAN H	
		3899.89	2378.43	13	0.015				0.00	0.00	0.00	0	
ELEMENT NO 45 IS A JUNCTION	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
		3905.89	2378.87	13	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00
ELEMENT NO 46 IS A REACH	U/S DATA	STATION	INVERT	SECT	N				RADIUS	ANGLE	ANG PT	MAN H	
		4236.09	2383.64	13	0.015				0.00	0.00	0.00	0	

ELEMENT NO 47 IS A JUNCTION	*	*	*	*		*		*						
U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4		
	4239.59	2383.69	13	8	0	0.015	0.1	0.0	2383.69	0.00	0.90	0.00		
				F 0 5 1 5 P									PAGE NO	7

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 48 IS A SYSTEM HEADWORKS	*					*	
U/S DATA	STATION	INVERT	SECT				W S ELEV
	4239.59	2383.69	13				0.00

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

LICENSEE: PARSONS BRINCKERHOFF

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: CO-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
100.00	2352.09	6.050	2358.140	112.1	4.53	0.319	2358.459	0.00	2.500	5.00	5.00	0.00	0	0.00
45.68	0.00788					.001573	0.07		2.270			0.00		
145.68	2352.45	5.762	2358.212	112.1	4.53	0.319	2358.531	0.00	2.500	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00667					.001571	0.00					0.00		
147.18	2352.46	5.755	2358.215	112.0	4.53	0.318	2358.533	0.00	2.498	5.00	5.00	0.00	0	0.00
19.63	0.00815					.001570	0.03		2.241			0.00		
166.81	2352.62	5.626	2358.246	112.0	4.53	0.318	2358.564	0.00	2.498	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00705					.001570	0.01					0.00		
172.48	2352.66	5.595	2358.255	112.0	4.53	0.318	2358.573	0.00	2.498	5.00	5.00	0.00	0	0.00
6.78	0.00443					.001570	0.01		2.818			0.00		
179.26	2352.69	5.576	2358.266	112.0	4.53	0.318	2358.584	0.00	2.498	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00667					.001569	0.00					0.00		
180.76	2352.70	5.569	2358.269	111.9	4.52	0.317	2358.586	0.00	2.497	5.00	5.00	0.00	0	0.00
163.09	0.00506					.001568	0.26		2.677			0.00		
343.85	2353.53	5.000	2358.525	111.9	4.52	0.317	2358.842	0.00	2.497	5.00	5.00	0.00	0	0.00
50.88	0.00506					.001115	0.06		2.677			0.00		
394.73	2353.78	4.766	2358.548	111.9	4.70	0.342	2358.890	0.00	2.497	5.00	5.00	0.00	0	0.00
49.05	0.00506					.001234	0.06		2.677			0.00		
443.78	2354.03	4.545	2358.575	111.9	4.92	0.377	2358.952	0.00	2.497	5.00	5.00	0.00	0	0.00
47.38	0.00506					.001388	0.07		2.677			0.00		
491.16	2354.27	4.333	2358.603	111.9	5.17	0.414	2359.017	0.00	2.497	5.00	5.00	0.00	0	0.00
45.84	0.00506					.001563	0.07		2.677			0.00		

LICENSEE: PARSONS BRINCKERHOFF

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: CO-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.ELEV.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
537.00	2354.50	4.131	2358.633	111.9	5.42	0.456	2359.089	0.00	2.497	5.00	5.00	0.00	0	0.00
23.33	0.00506					.001709	0.04		2.677			0.00		
560.33	2354.62	4.030	2358.650	111.9	5.55	0.479	2359.129	0.00	2.497	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00530					.001777	0.01					0.00		
565.99	2354.65	4.004	2358.654	111.9	5.59	0.485	2359.139	0.00	2.497	5.00	5.00	0.00	0	0.00
42.89	0.00443					.001880	0.08		2.815			0.00		
608.88	2354.84	3.857	2358.697	111.9	5.80	0.523	2359.220	0.00	2.497	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00667					.001972	0.00					0.00		
610.38	2354.85	3.849	2358.699	111.8	5.81	0.524	2359.223	0.00	2.495	5.00	5.00	0.00	0	0.00
41.42	0.00507					.002098	0.09		2.672			0.00		
651.80	2355.06	3.676	2358.736	111.8	6.08	0.575	2359.311	0.00	2.495	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00667					.002223	0.00					0.00		
653.30	2355.07	3.669	2358.739	111.7	6.09	0.576	2359.315	0.00	2.494	5.00	5.00	0.00	0	0.00
40.66	0.00515					.002370	0.10		2.654			0.00		
693.96	2355.28	3.498	2358.778	111.7	6.39	0.633	2359.411	0.00	2.494	5.00	5.00	0.00	0	0.00
40.17	0.00515					.002677	0.11		2.654			0.00		
734.13	2355.49	3.335	2358.822	111.7	6.70	0.697	2359.519	0.00	2.494	5.00	5.00	0.00	0	0.00
40.22	0.00515					.003026	0.12		2.654			0.00		
774.35	2355.69	3.180	2358.874	111.7	7.03	0.766	2359.640	0.00	2.494	5.00	5.00	0.00	0	0.00
41.25	0.00515					.003423	0.14		2.654			0.00		
815.60	2355.91	3.032	2358.938	111.7	7.37	0.843	2359.781	0.00	2.494	5.00	5.00	0.00	0	0.00
44.46	0.00515					.003875	0.17		2.654			0.00		

LICENSEE: PARSONS BRINCKERHOFF

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WATER SURFACE PROFILE LISTING

GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

PARSONS BRINCKERHOFF - PROJECT No. 31698A

FILE NAME: CO-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
860.06	2356.14	2.891	2359.026	111.7	7.73	0.927	2359.953	0.00	2.494	5.00	5.00	0.00	0	0.00
54.83	0.00515					.004391	0.24		2.654			0.00		
914.89	2356.42	2.756	2359.174	111.7	8.10	1.020	2360.194	0.00	2.494	5.00	5.00	0.00	0	0.00
52.80	0.00515					.004836	0.26		2.654			0.00		
967.69	2356.69	2.684	2359.374	111.7	8.32	1.076	2360.450	0.00	2.494	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00366					.004929	0.03					0.00		
973.15	2356.71	2.716	2359.426	111.7	8.23	1.051	2360.477	0.00	2.494	5.00	5.00	0.00	0	0.00
81.90	0.00515					.005000	0.41		2.655			0.00		
1055.05	2357.13	2.655	2359.787	111.7	8.41	1.099	2360.886	0.00	2.494	5.00	5.00	0.00	0	0.00
312.44	0.00515					.005149	1.61		2.655			0.00		
1367.49	2358.74	2.655	2361.395	111.7	8.41	1.099	2362.494	0.00	2.494	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00530					.005162	0.03					0.00		
1373.15	2358.77	2.650	2361.420	111.7	8.43	1.103	2362.523	0.00	2.494	5.00	5.00	0.00	0	0.00
52.67	0.00547					.005322	0.28		2.595			0.00		
1425.82	2359.06	2.595	2361.653	111.7	8.61	1.151	2362.804	0.00	2.494	5.00	5.00	0.00	0	0.00
11.32	0.00547					.005470	0.06		2.595			0.00		
1437.14	2359.12	2.595	2361.715	111.7	8.61	1.151	2362.866	0.00	2.494	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00667					.005418	0.01					0.00		
1438.64	2359.13	2.613	2361.743	111.6	8.54	1.133	2362.876	0.00	2.492	5.00	5.00	0.00	0	0.00
53.06	0.00524					.005300	0.28		2.636			0.00		
1491.70	2359.41	2.636	2362.044	111.6	8.47	1.113	2363.157	0.00	2.492	5.00	5.00	0.00	0	0.00
19.48	0.00524					.005238	0.10		2.636			0.00		

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: CO-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR	
1511.18	2359.51	2.636	2362.146	111.6	8.47	1.113	2363.259	0.00	2.492	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00667					.005207	0.01					0.00		
1512.68	2359.52	2.647	2362.167	111.5	8.43	1.102	2363.269	0.00	2.491	5.00	5.00	0.00	0	0.00
55.13	0.00539					.005282	0.29			2.606		0.00		
1567.81	2359.82	2.606	2362.423	111.5	8.56	1.137	2363.560	0.00	2.491	5.00	5.00	0.00	0	0.00
178.59	0.00539					.005390	0.96			2.606		0.00		
1746.40	2360.78	2.606	2363.386	111.5	8.56	1.137	2364.523	0.00	2.491	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00530					.005382	0.03					0.00		
1752.06	2360.81	2.609	2363.419	111.5	8.55	1.134	2364.553	0.00	2.491	5.00	5.00	0.00	0	0.00
41.27	0.00550					.005435	0.22			2.587		0.00		
1793.33	2361.04	2.587	2363.624	111.5	8.62	1.154	2364.778	0.00	2.491	5.00	5.00	0.00	0	0.00
11.47	0.00550					.005496	0.06			2.587		0.00		
1804.80	2361.10	2.587	2363.687	111.5	8.62	1.154	2364.841	0.00	2.491	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00667					.005440	0.01					0.00		
1806.30	2361.11	2.606	2363.716	111.4	8.55	1.135	2364.851	0.00	2.489	5.00	5.00	0.00	0	0.00
41.92	0.00544					.005409	0.23			2.596		0.00		
1848.22	2361.34	2.596	2363.934	111.4	8.58	1.144	2365.078	0.00	2.489	5.00	5.00	0.00	0	0.00
274.36	0.00544					.005435	1.49			2.596		0.00		
2122.58	2362.83	2.596	2365.426	111.4	8.58	1.144	2366.570	0.00	2.489	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00667					.005386	0.01					0.00		
2124.08	2362.84	2.613	2365.453	111.3	8.52	1.127	2366.580	0.00	2.488	5.00	5.00	0.00	0	0.00
24.15	0.00538					.005350	0.13			2.604		0.00		

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: CO-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
2148.23	2362.97	2.607	2365.577	111.3	8.54	1.132	2366.709	0.00	2.488	5.00	5.00	0.00	0	0.00
JUNCT STR	0.01000					.005378	0.01					0.00		
2150.23	2362.99	2.599	2365.589	111.1	8.55	1.135	2366.724	0.00	2.485	5.00	5.00	0.00	0	0.00
40.45	0.00494					.005212	0.21			2.685		0.00		
2190.68	2363.19	2.668	2365.858	111.1	8.33	1.077	2366.935	0.00	2.485	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00667					.005010	0.01					0.00		
2192.18	2363.20	2.674	2365.874	111.0	8.30	1.070	2366.944	0.00	2.484	5.00	5.00	0.00	0	0.00
5.31	0.00565					.005031	0.03			2.552		0.00		
2197.49	2363.23	2.657	2365.887	111.0	8.35	1.084	2366.971	0.00	2.484	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00667					.003966	0.01					0.00		
2198.99	2363.24	3.108	2366.348	102.3	6.58	0.673	2367.021	0.00	2.352	5.00	5.00	0.00	0	0.00
36.93	0.00514					.003047	0.11			2.486		0.00		
2235.92	2363.43	2.963	2366.393	102.3	6.90	0.740	2367.133	0.00	2.352	5.00	5.00	0.00	0	0.00
37.78	0.00514					.003451	0.13			2.486		0.00		
2273.70	2363.62	2.825	2366.449	102.3	7.24	0.814	2367.263	0.00	2.352	5.00	5.00	0.00	0	0.00
40.68	0.00514					.003911	0.16			2.486		0.00		
2314.38	2363.83	2.694	2366.527	102.3	7.59	0.896	2367.423	0.00	2.352	5.00	5.00	0.00	0	0.00
50.73	0.00514					.004436	0.23			2.486		0.00		
2365.11	2364.09	2.569	2366.663	102.3	7.97	0.985	2367.648	0.00	2.352	5.00	5.00	0.00	0	0.00
75.56	0.00514					.004929	0.37			2.486		0.00		
2440.67	2364.48	2.486	2366.969	102.3	8.23	1.052	2368.021	0.00	2.352	5.00	5.00	0.00	0	0.00
11.14	0.00514					.005143	0.06			2.486		0.00		

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WATER SURFACE PROFILE LISTING
 GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
 PARSONS BRINCKERHOFF - PROJECT No. 31698A
 FILE NAME: CO-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR	
2451.81	2364.54	2.486	2367.026	102.3	8.23	1.052	2368.078	0.00	2.352	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00529					.005159	0.03					0.00		
2457.48	2364.57	2.481	2367.051	102.3	8.25	1.056	2368.107	0.00	2.352	5.00	5.00	0.00	0	0.00
45.27	0.00538					.005275	0.24			2.445		0.00		
2502.75	2364.81	2.445	2367.258	102.3	8.37	1.087	2368.345	0.00	2.352	5.00	5.00	0.00	0	0.00
345.63	0.00538					.005378	1.86			2.445		0.00		
2848.38	2366.67	2.445	2369.117	102.3	8.37	1.087	2370.204	0.00	2.352	5.00	5.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
2848.38	2366.67	2.236	2368.908	102.3	9.15	1.300	2370.208	0.00	2.352	5.00	5.00	0.00	0	0.00
3.27	0.00538					.006840	0.02			2.445		0.00		
2851.65	2366.69	2.236	2368.926	102.3	9.15	1.300	2370.226	0.00	2.352	5.00	5.00	0.00	0	0.00
JUNCT STR	0.00500					.007100	0.04					0.00		
2857.65	2366.72	2.176	2368.896	102.3	14.64	3.329	2372.225	0.00	3.064	4.00	0.00	0.00	0	0.00
6.56	0.04188					.019587	0.13			1.763		0.00		
2864.21	2366.99	2.232	2369.227	102.3	14.19	3.126	2372.353	0.00	3.064	4.00	0.00	0.00	0	0.00
8.11	0.04188					.017687	0.14			1.763		0.00		
2872.32	2367.33	2.320	2369.654	102.3	13.53	2.842	2372.496	0.00	3.064	4.00	0.00	0.00	0	0.00
6.26	0.04188					.015634	0.10			1.763		0.00		
2878.58	2367.60	2.414	2370.011	102.3	12.90	2.584	2372.595	0.00	3.064	4.00	0.00	0.00	0	0.00
4.81	0.04188					.013841	0.07			1.763		0.00		
2883.39	2367.80	2.514	2370.312	102.3	12.30	2.349	2372.661	0.00	3.064	4.00	0.00	0.00	0	0.00
3.63	0.04188					.012275	0.04			1.763		0.00		

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: CO-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH				
2887.02	2367.95	2.620	2370.570	102.3	11.73	2.135	2372.705	0.00	3.064	4.00	0.00	0.00	0	0.00
JUNCT STR	0.08000					.010756	0.02					0.00		
2888.52	2368.07	2.762	2370.832	102.2	11.04	1.893	2372.725	0.00	3.062	4.00	0.00	0.00	0	0.00
108.26	0.00996					.009968	1.08			2.762		0.00		
2996.78	2369.15	2.762	2371.910	102.2	11.04	1.893	2373.803	0.00	3.062	4.00	0.00	0.00	0	0.00
106.54	0.00996					.010188	1.09			2.762		0.00		
3103.32	2370.21	2.717	2372.927	102.2	11.24	1.962	2374.889	0.00	3.062	4.00	0.00	0.00	0	0.00
76.78	0.00996					.011057	0.85			2.762		0.00		
3180.10	2370.97	2.605	2373.579	102.2	11.79	2.159	2375.738	0.00	3.062	4.00	0.00	0.00	0	0.00
44.75	0.00996					.012450	0.56			2.762		0.00		
3224.85	2371.42	2.501	2373.921	102.2	12.37	2.374	2376.295	0.00	3.062	4.00	0.00	0.00	0	0.00
JUNCT STR	0.04833					.011557	0.07					0.00		
3230.85	2371.71	2.767	2374.477	102.2	11.02	1.886	2376.363	0.00	3.062	4.00	0.00	0.00	0	0.00
162.13	0.00992					.009920	1.61			2.767		0.00		
3392.98	2373.32	2.767	2376.085	102.2	11.02	1.886	2377.971	0.00	3.062	4.00	0.00	0.00	0	0.00
114.43	0.00992					.010364	1.19			2.767		0.00		
3507.41	2374.45	2.680	2377.132	102.2	11.42	2.024	2379.156	0.00	3.062	4.00	0.00	0.00	0	0.00
59.27	0.00992					.011487	0.68			2.767		0.00		
3566.68	2375.04	2.571	2377.611	102.2	11.97	2.226	2379.837	0.00	3.062	4.00	0.00	0.00	0	0.00
JUNCT STR	0.07600					.010922	0.03					0.00		
3569.18	2375.23	2.791	2378.021	102.1	10.90	1.846	2379.867	0.00	3.061	4.00	0.00	0.00	0	0.00
23.18	0.00968					.009677	0.22			2.791		0.00		

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: CO-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
3592.36	2375.45	2.791	2378.245	102.1	10.90	1.846	2380.091	0.00	3.061	4.00	0.00	0.00	0	0.00
100.95	0.00968					.009871	1.00			2.791		0.00		
3693.31	2376.43	2.749	2379.180	102.1	11.09	1.908	2381.088	0.00	3.061	4.00	0.00	0.00	0	0.00
75.92	0.00968					.010688	0.81			2.791		0.00		
3769.23	2377.17	2.635	2379.801	102.1	11.63	2.099	2381.900	0.00	3.061	4.00	0.00	0.00	0	0.00
43.80	0.00968					.012025	0.53			2.791		0.00		
3813.03	2377.59	2.528	2380.118	102.1	12.19	2.309	2382.427	0.00	3.061	4.00	0.00	0.00	0	0.00
33.72	0.00968					.013558	0.46			2.791		0.00		
3846.75	2377.92	2.428	2380.344	102.1	12.79	2.540	2382.884	0.00	3.061	4.00	0.00	0.00	0	0.00
28.21	0.00968					.015311	0.43			2.791		0.00		
3874.96	2378.19	2.333	2380.522	102.1	13.41	2.794	2383.316	0.00	3.061	4.00	0.00	0.00	0	0.00
24.93	0.00968					.017318	0.43			2.791		0.00		
3899.89	2378.43	2.244	2380.674	102.1	14.07	3.073	2383.747	0.00	3.061	4.00	0.00	0.00	0	0.00
JUNCT STR	0.07333					.016424	0.10					0.00		
3905.89	2378.87	2.424	2381.294	102.1	12.82	2.551	2383.845	0.00	3.061	4.00	0.00	0.00	0	0.00
16.82	0.01445					.014457	0.24			2.424		0.00		
3922.71	2379.11	2.424	2381.537	102.1	12.82	2.551	2384.088	0.00	3.061	4.00	0.00	0.00	0	0.00
170.26	0.01445					.014136	2.41			2.424		0.00		
4092.97	2381.57	2.460	2384.033	102.1	12.59	2.462	2386.495	0.00	3.061	4.00	0.00	0.00	0	0.00
86.18	0.01445					.013032	1.12			2.424		0.00		
4179.15	2382.82	2.562	2385.379	102.1	12.00	2.238	2387.617	0.00	3.061	4.00	0.00	0.00	0	0.00
32.79	0.01445					.011565	0.38			2.424		0.00		

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: CO-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
4211.94	2383.29	2.671	2385.962	102.1	11.45	2.034	2387.996	0.00	3.061	4.00	0.00	0.00	0	0.00
16.35	0.01445					.010287	0.17			2.424		0.00		
4228.29	2383.53	2.788	2386.315	102.1	10.91	1.850	2388.165	0.00	3.061	4.00	0.00	0.00	0	0.00
7.80	0.01445					.009178	0.07			2.424		0.00		
4236.09	2383.64	2.915	2386.555	102.1	10.41	1.681	2388.236	0.00	3.061	4.00	0.00	0.00	0	0.00
JUNCT STR	0.01429					.008193	0.03					0.00		
4239.59	2383.69	3.059	2386.749	102.0	9.89	1.519	2388.268	0.00	3.059	4.00	0.00	0.00	0	0.00

DATE: 1/20/2002
TIME: 23: 2

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WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

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CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	3	1	0.01	4.00	23.00	0.00	0.00	0.00										
CD	2	3	0	0.00	5.00	11.00	0.00	0.00	0.00										
CD	3	3	0	0.00	1.25	11.00	0.00	0.00	0.00										
CD	4	3	0	0.00	6.00	7.00	0.00	0.00	0.00										
CD	5	3	0	0.00	5.00	7.00	0.00	0.00	0.00										
CD	6	3	0	0.00	5.00	5.00	0.00	0.00	0.00										
CD	7	3	0	0.00	4.00	7.00	0.00	0.00	0.00										
CD	8	4			3.50														
CD	9	4			3.00														
CD	10	4			2.50														
CD	11	4			2.00														
CD	12	4			1.50														
CD	13	4			4.00														

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WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

HEADING LINE NO 2 IS -

PARSONS BRINCKERHOFF - PROJECT No. 31698A

HEADING LINE NO 3 IS -

FILE NAME: BU-MAIN

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WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	1 IS A SYSTEM OUTLET	*	*	*															
	U/S DATA	STATION	INVERT	SECT															
		100.00	2344.02	13															
ELEMENT NO	2 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4						
		107.66	2344.02	13	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00						
THE ABOVE ELEMENT	CONTAINED AN	INVERT ELEV	WHICH WAS NOT	GREATER THAN	THE PREVIOUS	INVERT ELEV	-WARNING												
THE ABOVE ELEMENT	CONTAINED AN	INVERT ELEV	WHICH WAS NOT	GREATER THAN	THE PREVIOUS	INVERT ELEV	-WARNING												
ELEMENT NO	3 IS A REACH	*	*	*															
	U/S DATA	STATION	INVERT	SECT			N					RADIUS	ANGLE	ANG PT	MAN H				
		399.90	2345.71	13			0.015					0.00	0.00	0.00	0				
ELEMENT NO	4 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4						
		407.57	2345.93	13	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00						
ELEMENT NO	5 IS A REACH	*	*	*															
	U/S DATA	STATION	INVERT	SECT			N					RADIUS	ANGLE	ANG PT	MAN H				
		702.98	2347.49	13			0.015					0.00	0.00	0.00	0				
ELEMENT NO	6 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4						
		704.48	2347.54	13	12	12	0.015	0.1	0.1	2348.04	2347.86	0.45	0.45						
ELEMENT NO	7 IS A REACH	*	*	*															
	U/S DATA	STATION	INVERT	SECT			N					RADIUS	ANGLE	ANG PT	MAN H				
		999.91	2349.09	13			0.015					0.00	0.00	0.00	0				
ELEMENT NO	8 IS A JUNCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4						
		1007.58	2349.30	13	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00						
ELEMENT NO	9 IS A REACH	*	*	*															
	U/S DATA	STATION	INVERT	SECT			N					RADIUS	ANGLE	ANG PT	MAN H				
		1201.22	2350.61	13			0.015					0.00	0.00	0.00	0				

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 10 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1208.88	2350.60	13	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

ELEMENT NO 11 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1234.92	2351.15	11	0.015	0.00	0.00	0.00	0

ELEMENT NO 12 IS A JUNCTION * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	1238.58	2351.40	11	0	0	0.015	0.0	0.0	0.00	0.00	0.00	0.00

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

ELEMENT NO 13 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1327.80	2352.89	12	0.015	0.00	0.00	0.00	0

ELEMENT NO 14 IS A SYSTEM HEADWORKS * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	1327.80	2352.89	12	0.00

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: BU-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
100.00	2344.02	4.440	2348.460	35.2	2.80	0.122	2348.582	0.00	1.766	4.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.000799	0.01					0.00		
107.66	2344.02	4.446	2348.466	35.2	2.80	0.122	2348.588	0.00	1.766	4.00	0.00	0.00	0	0.00
89.52	0.00578					.000794	0.07			1.690		0.00		
197.18	2344.54	4.000	2348.538	35.2	2.80	0.122	2348.660	0.00	1.766	4.00	0.00	0.00	0	0.00
70.99	0.00578					.000744	0.05			1.690		0.00		
268.17	2344.95	3.629	2348.577	35.2	2.94	0.134	2348.711	0.00	1.766	4.00	0.00	0.00	0	0.00
40.05	0.00578					.000723	0.03			1.690		0.00		
308.22	2345.18	3.413	2348.593	35.2	3.08	0.147	2348.740	0.00	1.766	4.00	0.00	0.00	0	0.00
32.45	0.00578					.000783	0.03			1.690		0.00		
340.67	2345.37	3.236	2348.604	35.2	3.23	0.162	2348.766	0.00	1.766	4.00	0.00	0.00	0	0.00
28.41	0.00578					.000862	0.02			1.690		0.00		
369.08	2345.53	3.080	2348.612	35.2	3.39	0.178	2348.790	0.00	1.766	4.00	0.00	0.00	0	0.00
25.31	0.00578					.000956	0.02			1.690		0.00		
394.39	2345.68	2.940	2348.618	35.2	3.55	0.196	2348.814	0.00	1.766	4.00	0.00	0.00	0	0.00
5.51	0.00578					.001021	0.01			1.690		0.00		
399.90	2345.71	2.910	2348.620	35.2	3.59	0.201	2348.821	0.00	1.766	4.00	0.00	0.00	0	0.00
JUNCT STR	0.02868					.001177	0.01					0.00		
407.57	2345.93	2.654	2348.584	35.2	3.98	0.246	2348.830	0.00	1.766	4.00	0.00	0.00	0	0.00
21.63	0.00528					.001402	0.03			1.732		0.00		
429.20	2346.04	2.545	2348.589	35.2	4.17	0.270	2348.859	0.00	1.766	4.00	0.00	0.00	0	0.00
19.99	0.00528					.001580	0.03			1.732		0.00		

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: BU-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
449.19	2346.15	2.444	2348.594	35.2	4.37	0.297	2348.891	0.00	1.766	4.00	0.00	0.00	0	0.00
18.95	0.00528					.001784	0.03			1.732		0.00		
468.14	2346.25	2.348	2348.598	35.2	4.59	0.327	2348.925	0.00	1.766	4.00	0.00	0.00	0	0.00
17.56	0.00528					.002017	0.04			1.732		0.00		
485.70	2346.34	2.258	2348.601	35.2	4.81	0.360	2348.961	0.00	1.766	4.00	0.00	0.00	0	0.00
16.69	0.00528					.002284	0.04			1.732		0.00		
502.39	2346.43	2.172	2348.603	35.2	5.05	0.396	2348.999	0.00	1.766	4.00	0.00	0.00	0	0.00

15.39	0.00528					.002589	0.04			1.732		0.00			
517.78	2346.51	2.091	2348.603	35.2	5.29	0.435	2349.038	0.00	1.766		4.00	0.00	0.00	0	0.00
14.29	0.00528					.002936	0.04			1.732		0.00			
532.07	2346.59	2.014	2348.601	35.2	5.55	0.479	2349.080	0.00	1.766		4.00	0.00	0.00	0	0.00
13.42	0.00528					.003334	0.04			1.732		0.00			
545.49	2346.66	1.940	2348.598	35.2	5.82	0.527	2349.125	0.00	1.766		4.00	0.00	0.00	0	0.00
12.28	0.00528					.003788	0.05			1.732		0.00			
557.77	2346.72	1.869	2348.592	35.2	6.11	0.579	2349.171	0.00	1.766		4.00	0.00	0.00	0	0.00
9.31	0.00528					.004306	0.04			1.732		0.00			
567.08	2346.77	1.802	2348.574	35.2	6.41	0.637	2349.211	0.00	1.766		4.00	0.00	0.00	0	0.00
0.41	0.00528					.004757	0.00			1.732		0.00			
567.49	2346.77	1.766	2348.540	35.2	6.58	0.672	2349.212	0.00	1.766		4.00	0.00	0.00	0	0.00
HYDRAULIC JUMP												0.00			
567.49	2346.77	1.732	2348.506	35.2	6.75	0.708	2349.214	0.00	1.766		4.00	0.00	0.00	0	0.00
94.76	0.00528					.005284	0.50			1.732		0.00			

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WATER SURFACE PROFILE LISTING
GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN
PARSONS BRINCKERHOFF - PROJECT No. 31698A
FILE NAME: BU-MAIN

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
662.25	2347.28	1.732	2349.007	35.2	6.75	0.708	2349.715	0.00	1.766	4.00	0.00	0.00	0	0.00
23.63	0.00528					.005589	0.13		1.732			0.00		
685.88	2347.40	1.680	2349.080	35.2	7.03	0.767	2349.847	0.00	1.766	4.00	0.00	0.00	0	0.00
17.10	0.00528					.006305	0.11		1.732			0.00		
702.98	2347.49	1.621	2349.111	35.2	7.37	0.843	2349.954	0.00	1.766	4.00	0.00	0.00	0	0.00
JUNCT STR	0.03333					.005980	0.01					0.00		
704.48	2347.54	1.730	2349.270	35.0	6.72	0.702	2349.972	0.00	1.760	4.00	0.00	0.00	0	0.00
205.98	0.00525					.005246	1.08		1.730			0.00		
910.46	2348.62	1.730	2350.351	35.0	6.72	0.702	2351.053	0.00	1.760	4.00	0.00	0.00	0	0.00
18.56	0.00525					.005399	0.10		1.730			0.00		
929.02	2348.72	1.703	2350.421	35.0	6.86	0.731	2351.152	0.00	1.760	4.00	0.00	0.00	0	0.00
17.67	0.00525					.005935	0.10		1.730			0.00		
946.69	2348.81	1.642	2350.453	35.0	7.20	0.805	2351.258	0.00	1.760	4.00	0.00	0.00	0	0.00
15.50	0.00525					.006759	0.10		1.730			0.00		
962.19	2348.89	1.585	2350.477	35.0	7.55	0.885	2351.362	0.00	1.760	4.00	0.00	0.00	0	0.00
13.24	0.00525					.007702	0.10		1.730			0.00		
975.43	2348.96	1.529	2350.491	35.0	7.92	0.974	2351.465	0.00	1.760	4.00	0.00	0.00	0	0.00
12.56	0.00525					.008779	0.11		1.730			0.00		
987.99	2349.03	1.476	2350.503	35.0	8.30	1.071	2351.574	0.00	1.760	4.00	0.00	0.00	0	0.00
11.92	0.00525					.010013	0.12		1.730			0.00		
999.91	2349.09	1.426	2350.516	35.0	8.71	1.178	2351.694	0.00	1.760	4.00	0.00	0.00	0	0.00
JUNCT STR	0.02738					.008723	0.07					0.00		

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GOWAN NORTH BUFFALO BRANCH - LONE MTN TO WASHBURN

PARSONS BRINCKERHOFF - PROJECT No. 31698A

FILE NAME: BU-MAIN

[illegible]

- C.2 - Lateral Pipes Flowmaster Output

Worksheet for LMP-1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.05560	ft/ft
Diameter	2.50	ft
Discharge	77.25	ft³/s

Results

Normal Depth	1.69	ft
Flow Area	3.53	ft²
Wetted Perimeter	4.83	ft
Hydraulic Radius	0.73	ft
Top Width	2.34	ft
Critical Depth	2.46	ft
Percent Full	67.6	%
Critical Slope	0.03205	ft/ft
Velocity	21.88	ft/s
Velocity Head	7.44	ft
Specific Energy	9.13	ft
Froude Number	3.14	
Maximum Discharge	104.03	ft³/s
Discharge Full	96.71	ft³/s
Slope Full	0.03547	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	67.58	%
Downstream Velocity	Infinity	ft/s

Worksheet for LMP-1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.69	ft
Critical Depth	2.46	ft
Channel Slope	0.05560	ft/ft
Critical Slope	0.03205	ft/ft

Worksheet for LMP-2

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.04400 ft/ft
Diameter 3.00 ft
Discharge 138.19 ft³/s

Results

Normal Depth 2.43 ft
Flow Area 6.12 ft²
Wetted Perimeter 6.71 ft
Hydraulic Radius 0.91 ft
Top Width 2.36 ft
Critical Depth 2.97 ft
Percent Full 80.9 %
Critical Slope 0.03957 ft/ft
Velocity 22.56 ft/s
Velocity Head 7.91 ft
Specific Energy 10.34 ft
Froude Number 2.47
Maximum Discharge 150.49 ft³/s
Discharge Full 139.90 ft³/s
Slope Full 0.04293 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 80.88 %
Downstream Velocity Infinity ft/s

Worksheet for LMP-2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.43	ft
Critical Depth	2.97	ft
Channel Slope	0.04400	ft/ft
Critical Slope	0.03957	ft/ft

Worksheet for LMP-3

Project Description

Friction Method Manning Formula

Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Diameter	5.00	ft
Discharge	176.62	ft³/s

Results

Normal Depth	3.93	ft
Flow Area	16.54	ft²
Wetted Perimeter	10.89	ft
Hydraulic Radius	1.52	ft
Top Width	4.11	ft
Critical Depth	3.81	ft
Percent Full	78.5	%
Critical Slope	0.00534	ft/ft
Velocity	10.68	ft/s
Velocity Head	1.77	ft
Specific Energy	5.70	ft
Froude Number	0.94	
Maximum Discharge	198.09	ft³/s
Discharge Full	184.15	ft³/s
Slope Full	0.00460	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	78.51	%
Downstream Velocity	Infinity	ft/s

Worksheet for LMP-3

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	3.93	ft
Critical Depth	3.81	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00534	ft/ft

Worksheet for LMP-5

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.00500 ft/ft
Diameter 2.50 ft
Discharge 19.93 ft³/s

Results

Normal Depth 1.52 ft
Flow Area 3.13 ft²
Wetted Perimeter 4.48 ft
Hydraulic Radius 0.70 ft
Top Width 2.44 ft
Critical Depth 1.52 ft
Percent Full 60.9 %
Critical Slope 0.00507 ft/ft
Velocity 6.37 ft/s
Velocity Head 0.63 ft
Specific Energy 2.15 ft
Froude Number 0.99
Maximum Discharge 31.20 ft³/s
Discharge Full 29.00 ft³/s
Slope Full 0.00236 ft/ft
Flow Type SubCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 60.90 %
Downstream Velocity Infinity ft/s

Worksheet for LMP-5

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.52	ft
Critical Depth	1.52	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00507	ft/ft

Worksheet for LMP-6

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.00610 ft/ft
Diameter 2.00 ft
Discharge 17.28 ft³/s

Results

Normal Depth 1.60 ft
Flow Area 2.70 ft²
Wetted Perimeter 4.43 ft
Hydraulic Radius 0.61 ft
Top Width 1.60 ft
Critical Depth 1.50 ft
Percent Full 80.0 %
Critical Slope 0.00703 ft/ft
Velocity 6.41 ft/s
Velocity Head 0.64 ft
Specific Energy 2.24 ft
Froude Number 0.87
Maximum Discharge 19.01 ft³/s
Discharge Full 17.67 ft³/s
Slope Full 0.00584 ft/ft
Flow Type SubCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 80.05 %
Downstream Velocity Infinity ft/s

Worksheet for LMP-6

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.60	ft
Critical Depth	1.50	ft
Channel Slope	0.00610	ft/ft
Critical Slope	0.00703	ft/ft

Worksheet for LMP-7

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013
Channel Slope	0.03780 ft/ft
Diameter	1.50 ft
Discharge	8.25 ft ³ /s

Results

Normal Depth	0.66 ft
Flow Area	0.75 ft ²
Wetted Perimeter	2.18 ft
Hydraulic Radius	0.35 ft
Top Width	1.49 ft
Critical Depth	1.11 ft
Percent Full	44.2 %
Critical Slope	0.00761 ft/ft
Velocity	10.94 ft/s
Velocity Head	1.86 ft
Specific Energy	2.52 ft
Froude Number	2.71
Maximum Discharge	21.97 ft ³ /s
Discharge Full	20.42 ft ³ /s
Slope Full	0.00617 ft/ft
Flow Type	SuperCritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	44.24 %
Downstream Velocity	Infinity ft/s

Worksheet for LMP-7

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.66	ft
Critical Depth	1.11	ft
Channel Slope	0.03780	ft/ft
Critical Slope	0.00761	ft/ft

Worksheet for LMP-8

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03990	ft/ft
Diameter	1.50	ft
Discharge	21.05	ft ³ /s

Results

Normal Depth	1.23	ft
Flow Area	1.56	ft ²
Wetted Perimeter	3.41	ft
Hydraulic Radius	0.46	ft
Top Width	1.15	ft
Critical Depth	1.47	ft
Percent Full	82.3	%
Critical Slope	0.03615	ft/ft
Velocity	13.53	ft/s
Velocity Head	2.85	ft
Specific Energy	4.08	ft
Froude Number	2.05	
Maximum Discharge	22.57	ft ³ /s
Discharge Full	20.98	ft ³ /s
Slope Full	0.04016	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	82.26	%
Downstream Velocity	Infinity	ft/s

Worksheet for LMP-8

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.23	ft
Critical Depth	1.47	ft
Channel Slope	0.03990	ft/ft
Critical Slope	0.03615	ft/ft

Worksheet for LMP-9

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.05740	ft/ft
Diameter	1.50	ft
Discharge	9.87	ft ³ /s

Results

Normal Depth	0.65	ft
Flow Area	0.74	ft ²
Wetted Perimeter	2.16	ft
Hydraulic Radius	0.34	ft
Top Width	1.49	ft
Critical Depth	1.21	ft
Percent Full	43.5	%
Critical Slope	0.00907	ft/ft
Velocity	13.37	ft/s
Velocity Head	2.78	ft
Specific Energy	3.43	ft
Froude Number	3.35	
Maximum Discharge	27.07	ft ³ /s
Discharge Full	25.17	ft ³ /s
Slope Full	0.00883	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	43.51	%
Downstream Velocity	Infinity	ft/s

Worksheet for LMP-9

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.65	ft
Critical Depth	1.21	ft
Channel Slope	0.05740	ft/ft
Critical Slope	0.00907	ft/ft

Worksheet for LMP-10

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.04460	ft/ft
Diameter	1.50	ft
Discharge	12.06	ft ³ /s

Results

Normal Depth	0.79	ft
Flow Area	0.94	ft ²
Wetted Perimeter	2.43	ft
Hydraulic Radius	0.39	ft
Top Width	1.50	ft
Critical Depth	1.32	ft
Percent Full	52.6	%
Critical Slope	0.01190	ft/ft
Velocity	12.82	ft/s
Velocity Head	2.55	ft
Specific Energy	3.34	ft
Froude Number	2.85	
Maximum Discharge	23.86	ft ³ /s
Discharge Full	22.18	ft ³ /s
Slope Full	0.01318	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	52.55	%
Downstream Velocity	Infinity	ft/s

Worksheet for LMP-10

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.79	ft
Critical Depth	1.32	ft
Channel Slope	0.04460	ft/ft
Critical Slope	0.01190	ft/ft

Worksheet for COP-1

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.05360	ft/ft
Diameter	1.50	ft
Discharge	2.41	ft ³ /s

Results

Normal Depth	0.32	ft
Flow Area	0.27	ft ²
Wetted Perimeter	1.44	ft
Hydraulic Radius	0.19	ft
Top Width	1.23	ft
Critical Depth	0.59	ft
Percent Full	21.3	%
Critical Slope	0.00501	ft/ft
Velocity	8.78	ft/s
Velocity Head	1.20	ft
Specific Energy	1.52	ft
Froude Number	3.27	
Maximum Discharge	26.16	ft ³ /s
Discharge Full	24.32	ft ³ /s
Slope Full	0.00053	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	21.26	%
Downstream Velocity	Infinity	ft/s

Worksheet for COP-1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.32	ft
Critical Depth	0.59	ft
Channel Slope	0.05360	ft/ft
Critical Slope	0.00501	ft/ft

Worksheet for RDI-1

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.05380 ft/ft
Diameter 1.50 ft
Discharge 23.58 ft³/s

Results

Normal Depth 1.19 ft
Flow Area 1.50 ft²
Wetted Perimeter 3.29 ft
Hydraulic Radius 0.46 ft
Top Width 1.22 ft
Critical Depth 1.48 ft
Percent Full 79.2 %
Critical Slope 0.04620 ft/ft
Velocity 15.71 ft/s
Velocity Head 3.83 ft
Specific Energy 5.02 ft
Froude Number 2.49
Maximum Discharge 26.21 ft³/s
Discharge Full 24.36 ft³/s
Slope Full 0.05040 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 79.21 %
Downstream Velocity Infinity ft/s

Worksheet for RDI-1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.19	ft
Critical Depth	1.48	ft
Channel Slope	0.05380	ft/ft
Critical Slope	0.04620	ft/ft

Worksheet for RDI-2

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.03060 ft/ft
Diameter 2.00 ft
Discharge 41.46 ft³/s

Results

Normal Depth 1.74 ft
Flow Area 2.90 ft²
Wetted Perimeter 4.81 ft
Hydraulic Radius 0.60 ft
Top Width 1.34 ft
Critical Depth 1.96 ft
Percent Full 87.1 %
Critical Slope 0.03002 ft/ft
Velocity 14.28 ft/s
Velocity Head 3.17 ft
Specific Energy 4.91 ft
Froude Number 1.71
Maximum Discharge 42.57 ft³/s
Discharge Full 39.57 ft³/s
Slope Full 0.03359 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 87.08 %
Downstream Velocity Infinity ft/s

Worksheet for RDI-2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.74	ft
Critical Depth	1.96	ft
Channel Slope	0.03060	ft/ft
Critical Slope	0.03002	ft/ft

Worksheet for RDI-3

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.07430 ft/ft
Diameter 1.50 ft
Discharge 2.39 ft³/s

Results

Normal Depth 0.29 ft
Flow Area 0.24 ft²
Wetted Perimeter 1.37 ft
Hydraulic Radius 0.18 ft
Top Width 1.19 ft
Critical Depth 0.59 ft
Percent Full 19.5 %
Critical Slope 0.00500 ft/ft
Velocity 9.83 ft/s
Velocity Head 1.50 ft
Specific Energy 1.79 ft
Froude Number 3.83
Maximum Discharge 30.80 ft³/s
Discharge Full 28.63 ft³/s
Slope Full 0.00052 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 19.53 %
Downstream Velocity Infinity ft/s

Worksheet for RDI-3

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.29	ft
Critical Depth	0.59	ft
Channel Slope	0.07430	ft/ft
Critical Slope	0.00500	ft/ft

Worksheet for COP-2

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.05120 ft/ft
Diameter 1.50 ft
Discharge 1.70 ft³/s

Results

Normal Depth 0.27 ft
Flow Area 0.22 ft²
Wetted Perimeter 1.32 ft
Hydraulic Radius 0.17 ft
Top Width 1.16 ft
Critical Depth 0.49 ft
Percent Full 18.1 %
Critical Slope 0.00490 ft/ft
Velocity 7.79 ft/s
Velocity Head 0.94 ft
Specific Energy 1.22 ft
Froude Number 3.16
Maximum Discharge 25.57 ft³/s
Discharge Full 23.77 ft³/s
Slope Full 0.00026 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 18.10 %
Downstream Velocity Infinity ft/s

Worksheet for COP-2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.27	ft
Critical Depth	0.49	ft
Channel Slope	0.05120	ft/ft
Critical Slope	0.00490	ft/ft

Worksheet for RDI-4

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.03990 ft/ft
Diameter 1.50 ft
Discharge 10.46 ft³/s

Results

Normal Depth 0.75 ft
Flow Area 0.88 ft²
Wetted Perimeter 2.35 ft
Hydraulic Radius 0.37 ft
Top Width 1.50 ft
Critical Depth 1.24 ft
Percent Full 49.9 %
Critical Slope 0.00972 ft/ft
Velocity 11.87 ft/s
Velocity Head 2.19 ft
Specific Energy 2.94 ft
Froude Number 2.73
Maximum Discharge 22.57 ft³/s
Discharge Full 20.98 ft³/s
Slope Full 0.00992 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 49.90 %
Downstream Velocity Infinity ft/s

Worksheet for RDI-4

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.75	ft
Critical Depth	1.24	ft
Channel Slope	0.03990	ft/ft
Critical Slope	0.00972	ft/ft

Worksheet for RDI-5

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01540	ft/ft
Diameter	2.00	ft
Discharge	25.65	ft³/s

Results

Normal Depth	1.50	ft
Flow Area	2.53	ft²
Wetted Perimeter	4.20	ft
Hydraulic Radius	0.60	ft
Top Width	1.73	ft
Critical Depth	1.78	ft
Percent Full	75.1	%
Critical Slope	0.01145	ft/ft
Velocity	10.13	ft/s
Velocity Head	1.59	ft
Specific Energy	3.10	ft
Froude Number	1.48	
Maximum Discharge	30.20	ft³/s
Discharge Full	28.07	ft³/s
Slope Full	0.01286	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	75.14	%
Downstream Velocity	Infinity	ft/s

Worksheet for RDI-5

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.78	ft
Channel Slope	0.01540	ft/ft
Critical Slope	0.01145	ft/ft

Worksheet for COP-3

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.08900 ft/ft
Diameter 1.50 ft
Discharge 1.64 ft³/s

Results

Normal Depth 0.23 ft
Flow Area 0.18 ft²
Wetted Perimeter 1.22 ft
Hydraulic Radius 0.14 ft
Top Width 1.09 ft
Critical Depth 0.48 ft
Percent Full 15.5 %
Critical Slope 0.00491 ft/ft
Velocity 9.37 ft/s
Velocity Head 1.36 ft
Specific Energy 1.60 ft
Froude Number 4.11
Maximum Discharge 33.71 ft³/s
Discharge Full 31.34 ft³/s
Slope Full 0.00024 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 15.55 %
Downstream Velocity Infinity ft/s

Worksheet for COP-3

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.23	ft
Critical Depth	0.48	ft
Channel Slope	0.08900	ft/ft
Critical Slope	0.00491	ft/ft

Worksheet for COP-4

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.07650	ft/ft
Diameter	1.50	ft
Discharge	3.28	ft ³ /s

Results

Normal Depth	0.34	ft
Flow Area	0.30	ft ²
Wetted Perimeter	1.49	ft
Hydraulic Radius	0.20	ft
Top Width	1.26	ft
Critical Depth	0.69	ft
Percent Full	22.7	%
Critical Slope	0.00521	ft/ft
Velocity	10.89	ft/s
Velocity Head	1.84	ft
Specific Energy	2.18	ft
Froude Number	3.92	
Maximum Discharge	31.25	ft ³ /s
Discharge Full	29.05	ft ³ /s
Slope Full	0.00098	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	22.69	%
Downstream Velocity	Infinity	ft/s

Worksheet for COP-4

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.34	ft
Critical Depth	0.69	ft
Channel Slope	0.07650	ft/ft
Critical Slope	0.00521	ft/ft

Worksheet for LAMP-1

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02100	ft/ft
Diameter	1.50	ft
Discharge	13.76	ft ³ /s

Results

Normal Depth	1.12	ft
Flow Area	1.41	ft ²
Wetted Perimeter	3.12	ft
Hydraulic Radius	0.45	ft
Top Width	1.31	ft
Critical Depth	1.37	ft
Percent Full	74.4	%
Critical Slope	0.01492	ft/ft
Velocity	9.75	ft/s
Velocity Head	1.48	ft
Specific Energy	2.60	ft
Froude Number	1.66	
Maximum Discharge	16.37	ft ³ /s
Discharge Full	15.22	ft ³ /s
Slope Full	0.01716	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	74.44	%
Downstream Velocity	Infinity	ft/s

Worksheet for LAMP-1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.12	ft
Critical Depth	1.37	ft
Channel Slope	0.02100	ft/ft
Critical Slope	0.01492	ft/ft

Worksheet for LAMP-3

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.03000 ft/ft
Diameter 1.50 ft
Discharge 1.53 ft³/s

Results

Normal Depth 0.29 ft
Flow Area 0.24 ft²
Wetted Perimeter 1.38 ft
Hydraulic Radius 0.18 ft
Top Width 1.19 ft
Critical Depth 0.46 ft
Percent Full 19.6 %
Critical Slope 0.00490 ft/ft
Velocity 6.26 ft/s
Velocity Head 0.61 ft
Specific Energy 0.90 ft
Froude Number 2.43
Maximum Discharge 19.57 ft³/s
Discharge Full 18.19 ft³/s
Slope Full 0.00021 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 19.60 %
Downstream Velocity Infinity ft/s

Worksheet for LAMP-3

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.29	ft
Critical Depth	0.46	ft
Channel Slope	0.03000	ft/ft
Critical Slope	0.00490	ft/ft

Worksheet for LAMP-2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02870	ft/ft
Diameter	1.50	ft
Discharge	16.46	ft ³ /s

Results

Normal Depth	1.14	ft
Flow Area	1.44	ft ²
Wetted Perimeter	3.17	ft
Hydraulic Radius	0.45	ft
Top Width	1.28	ft
Critical Depth	1.43	ft
Percent Full	75.9	%
Critical Slope	0.02132	ft/ft
Velocity	11.43	ft/s
Velocity Head	2.03	ft
Specific Energy	3.17	ft
Froude Number	1.90	
Maximum Discharge	19.14	ft ³ /s
Discharge Full	17.79	ft ³ /s
Slope Full	0.02456	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	75.94	%
Downstream Velocity	Infinity	ft/s

Worksheet for LAMP-2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.14	ft
Critical Depth	1.43	ft
Channel Slope	0.02870	ft/ft
Critical Slope	0.02132	ft/ft

Worksheet for COP-5

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.04990 ft/ft
Diameter 1.50 ft
Discharge 2.86 ft³/s

Results

Normal Depth 0.35 ft
Flow Area 0.32 ft²
Wetted Perimeter 1.52 ft
Hydraulic Radius 0.21 ft
Top Width 1.27 ft
Critical Depth 0.64 ft
Percent Full 23.6 %
Critical Slope 0.00510 ft/ft
Velocity 9.00 ft/s
Velocity Head 1.26 ft
Specific Energy 1.61 ft
Froude Number 3.18
Maximum Discharge 25.24 ft³/s
Discharge Full 23.46 ft³/s
Slope Full 0.00074 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 23.57 %
Downstream Velocity Infinity ft/s

Worksheet for COP-5

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.35	ft
Critical Depth	0.64	ft
Channel Slope	0.04990	ft/ft
Critical Slope	0.00510	ft/ft

Worksheet for COP-6

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.09070 ft/ft
Diameter 1.50 ft
Discharge 8.77 ft³/s

Results

Normal Depth 0.54 ft
Flow Area 0.57 ft²
Wetted Perimeter 1.93 ft
Hydraulic Radius 0.30 ft
Top Width 1.44 ft
Critical Depth 1.15 ft
Percent Full 36.0 %
Critical Slope 0.00803 ft/ft
Velocity 15.31 ft/s
Velocity Head 3.64 ft
Specific Energy 4.18 ft
Froude Number 4.28
Maximum Discharge 34.03 ft³/s
Discharge Full 31.63 ft³/s
Slope Full 0.00697 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 36.00 %
Downstream Velocity Infinity ft/s

Worksheet for COP-6

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.54	ft
Critical Depth	1.15	ft
Channel Slope	0.09070	ft/ft
Critical Slope	0.00803	ft/ft

Worksheet for COP-7

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.05280 ft/ft
Diameter 1.50 ft
Discharge 3.07 ft³/s

Results

Normal Depth 0.36 ft
Flow Area 0.33 ft²
Wetted Perimeter 1.54 ft
Hydraulic Radius 0.21 ft
Top Width 1.28 ft
Critical Depth 0.67 ft
Percent Full 24.1 %
Critical Slope 0.00515 ft/ft
Velocity 9.37 ft/s
Velocity Head 1.36 ft
Specific Energy 1.72 ft
Froude Number 3.27
Maximum Discharge 25.96 ft³/s
Discharge Full 24.14 ft³/s
Slope Full 0.00085 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 24.08 %
Downstream Velocity Infinity ft/s

Worksheet for COP-7

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.36	ft
Critical Depth	0.67	ft
Channel Slope	0.05280	ft/ft
Critical Slope	0.00515	ft/ft

Worksheet for COP-8

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.04390 ft/ft
Diameter 1.50 ft
Discharge 2.25 ft³/s

Results

Normal Depth 0.32 ft
Flow Area 0.28 ft²
Wetted Perimeter 1.45 ft
Hydraulic Radius 0.19 ft
Top Width 1.23 ft
Critical Depth 0.57 ft
Percent Full 21.6 %
Critical Slope 0.00499 ft/ft
Velocity 8.02 ft/s
Velocity Head 1.00 ft
Specific Energy 1.32 ft
Froude Number 2.96
Maximum Discharge 23.67 ft³/s
Discharge Full 22.01 ft³/s
Slope Full 0.00046 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 21.59 %
Downstream Velocity Infinity ft/s

Worksheet for COP-8

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.32	ft
Critical Depth	0.57	ft
Channel Slope	0.04390	ft/ft
Critical Slope	0.00499	ft/ft

Worksheet for WP-1

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.00970 ft/ft
Diameter 3.50 ft
Discharge 76.10 ft³/s

Results

Normal Depth 2.30 ft
Flow Area 6.70 ft²
Wetted Perimeter 6.62 ft
Hydraulic Radius 1.01 ft
Top Width 3.32 ft
Critical Depth 2.73 ft
Percent Full 65.7 %
Critical Slope 0.00631 ft/ft
Velocity 11.35 ft/s
Velocity Head 2.00 ft
Specific Energy 4.30 ft
Froude Number 1.41
Maximum Discharge 106.58 ft³/s
Discharge Full 99.08 ft³/s
Slope Full 0.00572 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 65.70 %
Downstream Velocity Infinity ft/s

Worksheet for WP-1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.30	ft
Critical Depth	2.73	ft
Channel Slope	0.00970	ft/ft
Critical Slope	0.00631	ft/ft

Worksheet for WP-2

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	2.50	ft
Discharge	37.89	ft ³ /s

Results

Normal Depth	1.90	ft
Flow Area	4.00	ft ²
Wetted Perimeter	5.29	ft
Hydraulic Radius	0.76	ft
Top Width	2.14	ft
Critical Depth	2.08	ft
Percent Full	75.9	%
Critical Slope	0.00831	ft/ft
Velocity	9.48	ft/s
Velocity Head	1.40	ft
Specific Energy	3.29	ft
Froude Number	1.22	
Maximum Discharge	44.12	ft ³ /s
Discharge Full	41.01	ft ³ /s
Slope Full	0.00853	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	75.85	%
Downstream Velocity	Infinity	ft/s

Worksheet for WP-2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.90	ft
Critical Depth	2.08	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00831	ft/ft

Worksheet for WP-3

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.01000 ft/ft
Diameter 1.50 ft
Discharge 10.35 ft³/s

Results

Normal Depth 1.21 ft
Flow Area 1.53 ft²
Wetted Perimeter 3.35 ft
Hydraulic Radius 0.46 ft
Top Width 1.18 ft
Critical Depth 1.24 ft
Percent Full 80.7 %
Critical Slope 0.00959 ft/ft
Velocity 6.78 ft/s
Velocity Head 0.71 ft
Specific Energy 1.92 ft
Froude Number 1.05
Maximum Discharge 11.30 ft³/s
Discharge Full 10.50 ft³/s
Slope Full 0.00971 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 80.67 %
Downstream Velocity Infinity ft/s

Worksheet for WP-3

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.21	ft
Critical Depth	1.24	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00959	ft/ft

Worksheet for BP-1

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01680	ft/ft
Diameter	1.50	ft
Discharge	13.13	ft ³ /s

Results

Normal Depth	1.18	ft
Flow Area	1.50	ft ²
Wetted Perimeter	3.28	ft
Hydraulic Radius	0.46	ft
Top Width	1.22	ft
Critical Depth	1.36	ft
Percent Full	78.9	%
Critical Slope	0.01371	ft/ft
Velocity	8.78	ft/s
Velocity Head	1.20	ft
Specific Energy	2.38	ft
Froude Number	1.40	
Maximum Discharge	14.65	ft ³ /s
Discharge Full	13.61	ft ³ /s
Slope Full	0.01563	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	78.93	%
Downstream Velocity	Infinity	ft/s

Worksheet for BP-1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.18	ft
Critical Depth	1.36	ft
Channel Slope	0.01680	ft/ft
Critical Slope	0.01371	ft/ft

Worksheet for BP-2

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.01490 ft/ft
Diameter 2.00 ft
Discharge 22.25 ft³/s

Results

Normal Depth 1.36 ft
Flow Area 2.28 ft²
Wetted Perimeter 3.88 ft
Hydraulic Radius 0.59 ft
Top Width 1.87 ft
Critical Depth 1.68 ft
Percent Full 68.0 %
Critical Slope 0.00925 ft/ft
Velocity 9.78 ft/s
Velocity Head 1.49 ft
Specific Energy 2.85 ft
Froude Number 1.56
Maximum Discharge 29.70 ft³/s
Discharge Full 27.61 ft³/s
Slope Full 0.00967 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description .
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 68.02 %
Downstream Velocity Infinity ft/s

Worksheet for BP-2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.36	ft
Critical Depth	1.68	ft
Channel Slope	0.01490	ft/ft
Critical Slope	0.00925	ft/ft

Worksheet for BP-3

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.04740 ft/ft
Diameter 1.50 ft
Discharge 3.33 ft³/s

Results

Normal Depth 0.39 ft
Flow Area 0.36 ft²
Wetted Perimeter 1.60 ft
Hydraulic Radius 0.23 ft
Top Width 1.31 ft
Critical Depth 0.70 ft
Percent Full 25.8 %
Critical Slope 0.00521 ft/ft
Velocity 9.23 ft/s
Velocity Head 1.32 ft
Specific Energy 1.71 ft
Froude Number 3.10
Maximum Discharge 24.60 ft³/s
Discharge Full 22.87 ft³/s
Slope Full 0.00101 ft/ft
Flow Type SuperCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 25.78 %
Downstream Velocity Infinity ft/s

Worksheet for BP-3

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.39	ft
Critical Depth	0.70	ft
Channel Slope	0.04740	ft/ft
Critical Slope	0.00521	ft/ft

Worksheet for BP-4

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 0.00490 ft/ft
Diameter 1.50 ft
Discharge 3.75 ft³/s

Results

Normal Depth 0.76 ft
Flow Area 0.90 ft²
Wetted Perimeter 2.37 ft
Hydraulic Radius 0.38 ft
Top Width 1.50 ft
Critical Depth 0.74 ft
Percent Full 50.6 %
Critical Slope 0.00534 ft/ft
Velocity 4.18 ft/s
Velocity Head 0.27 ft
Specific Energy 1.03 ft
Froude Number 0.95
Maximum Discharge 7.91 ft³/s
Discharge Full 7.35 ft³/s
Slope Full 0.00127 ft/ft
Flow Type SubCritical

GVF Input Data

Downstream Depth 0.00 ft
Length 0.00 ft
Number Of Steps 0

GVF Output Data

Upstream Depth 0.00 ft
Profile Description
Profile Headloss 0.00 ft
Average End Depth Over Rise 0.00 %
Normal Depth Over Rise 50.58 %
Downstream Velocity Infinity ft/s

Worksheet for BP-4

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.76	ft
Critical Depth	0.74	ft
Channel Slope	0.00490	ft/ft
Critical Slope	0.00534	ft/ft

- C.3 - Drop Inlet Summary Table

GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN
 DROP INLET ANALYSIS - ULTIMATE CONDITION

Drop Inlet ID	Drop Inlet Station/Offset	Sheet	Type	Grate Dimensions	Curb Opening Length (FT)	Slope			Flow Contributions					10-Year				100-Year					
						Longitudinal (%)	Cross (%)	Drainage Basins	Flowsplit	Upstream Drop Inlet	Basin Q (CFS)	Surface ¹ Flowsplit Q (CFS)	Upstream Bypass Q (CFS)	Total Q to Drop Inlet (CFS)	Intercept Q (CFS)	Bypass Q (CFS)	Basin Q (CFS)	Surface ¹ Flowsplit Q (CFS)	Upstream Bypass Q (CFS)	Total Q to Drop Inlet (CFS)	Intercept Q (CFS)	Bypass Q (CFS)	
WDI-1	"W" 9+57.23, 57' LT	SD-9	DM2	17.5	20	0.85	2.20	WS-CN	CPWSTM-E	N/A	10.0	9.7	0.0	51.0	31.3	9.7	28.0	107.0	0.0	135.0	76.1	58.9	
WDI-2	"W" 16+37.23, 55' LT	SD-10	DM2	17.5	20	0.80	2.50	WS-CN ²	CPWSTM-E	N/A	2.0	4.0	0.0	0.0	11.7	11.2	0.5	8.0	42.0	0.0	50.0	37.9	12.1
WDI-3	"W" 23+17.23, 26' LT	SD-11	DM2	17.5	20	0.60	0.70	N/A	N/A	WDI-2	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0	12.1	12.1	10.4	1.8
CDI-1	"CO" 30+97.21, 17' LT	SD-7	Type 2B	3x3	N/A	0.50	N/A	CH-RS1	N/A	N/A	1.0	0.0	0.0	1.0	1.0	0.0	4.0	0.0	0.0	4.0	2.4	1.6	
CDI-2	"CO" 31+07.15, 96' RT	SD-8	Type 2B	3x3	N/A	1.00	N/A	CH-RS2	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.3	
BDI-1	"R" 24+32.20, 29' RT	SD-7	Type 2B	3x3	N/A	0.60	N/A	RS-CN1	CPTMRSE-CPWSTM-S	N/A	6.0	0.0	0.0	6.0	5.5	0.5	24.0	52.0	0.0	76.0	23.6	52.4	
BDI-2	"R" 24+16.20, 60' RT	SD-7	Type 2B	3x3	N/A	0.60	N/A	Multiple	N/A	BDI-1	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0	49.0	49.0	17.9	31.1
BDI-5	"R" 22+98.18, 33' RT	SD-7	Type 2B	3x3	N/A	0.90	N/A	N/A	N/A	Multiple	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.0	34.0	15.2	18.9
BDI-4	"R" 22+87.18, 59' RT	SD-7	Type 2B	3x3	N/A	0.90	N/A	N/A	N/A	Multiple	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.9	18.9	10.5	8.4
BDI-3	"R" 24+15.24, 89' LT	SD-7	Type 2B	3x3	N/A	0.90	N/A	HAIR STREET	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	3.5	2.4	1.1	
CDI-3	"CO" 27+19.26, 90' RT	SD-7	Type 2B	3x3	N/A	0.80	N/A	CH-LA2 ³	N/A	N/A	1.0	0.0	0.0	1.0	1.0	0.0	2.0	0.0	0.0	2.0	1.6	0.4	
CDI-4	"CO" 24+15.24, 97' LT	SD-7	Type 2B	3x3	N/A	0.70	N/A	CH-LA1	N/A	N/A	1.0	0.0	0.0	1.0	1.0	0.0	6.0	0.0	0.0	6.0	3.3	2.7	
LMDI-1	"LM" 11+77.23, 12' LT	SD-7	DM2	17.5	20	0.90	2.40	LA-CN2	N/A	N/A	4.0	0.0	0.0	4.0	4.0	0.0	15.0	0.0	0.0	15.0	13.8	1.2	
LMDI-3	"LM" 10+45.15, 98' RT	SD-7	Type 2B	3x3	N/A	0.50	N/A	LA-CN1	N/A	N/A	1.0	0.0	0.0	1.0	1.0	0.0	2.0	0.0	0.0	2.0	1.5	0.5	
LMDI-2	"LM" 10+30.27, 43' LT	SD-7	Type 2B	3x3	N/A	0.70	N/A	N/A	N/A	LMDI-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	0.1	
CDI-5	"CO" 15+56.25, 36' RT	SD-6	Type 2B	3x3	N/A	0.60	N/A	CH-CN	CPLACO-S	N/A	1.0	0.0	0.0	1.0	1.0	0.0	3.0	0.0	0.0	3.0	2.9	2.1	
CDI-6	"CO" 15+10.24, 77' LT	SD-6	DM2	7.5	10	0.40	2.70	CH-HH	N/A	N/A	3.0	0.0	0.0	3.0	3.0	0.0	11.0	0.0	0.0	11.0	8.8	2.2	
CDI-7	"CO" 10+85.21, 15' LT	SD-5	Type 2B	3x3	N/A	1.00	N/A	CH-LM1	N/A	CODI-6	1.0	0.0	0.0	1.0	1.0	0.0	5.0	0.0	0.0	5.0	3.1	3.3	
CDI-8	"CO" 10+60.20, 61' RT	SD-5	Type 2B	3x3	N/A	1.10	N/A	CH-LM2	N/A	CODI-5	1.0	0.0	0.0	1.0	1.0	0.0	3.0	0.0	0.0	3.0	2.1	3.2	
LMDI-7	"LM" 17+14.91, 25' LT	SD-2	DM2	17.5	20	0.70	2.20	HAIR STREET	N/A	N/A	1.0	0.0	0.0	1.0	1.0	0.0	12.0	0.0	0.0	12.0	8.3	3.8	
LMDI-8	"LM" 17+79.44, 76' LT	SD-2	DM2	7.5	10	1.40	3.80	LM-VD, LM-CN3	N/A	Multiple	1.0	0.0	0.0	4.0	5.0	4.6	0.4	7.0	0.0	34.8	41.8	21.1	
LMDI-9	"LM" 23+01.30, 73' LT	SD-3	Type 2B	3x3	N/A	1.10	N/A	LM-CN1	N/A	LMDI-8	3.0	0.0	0.0	0.4	3.4	2.4	1.0	10.0	0.0	20.8	30.8	9.9	
EX Inlet XX	"LM" 24+50.00, 00' RT	SD-3	DM2	N/A	5	0.90	3.20	LM-CN2	N/A	LMDI-6	1.0	0.0	0.0	0.0	1.0	1.0	0.1	3.0	0.0	10.3	13.3	4.3	
LMDI-10	"LM" 29+73.33, 29' LT	SD-3	Type 2B	3x3	N/A	0.90	N/A	N/A	N/A	Multiple	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	26.2	12.1	
EX Inlet XX	"LM" 30+00.00, 00' RT	SD-3	DM2	17.5	20	1.70	1.80	LM-OD1	N/A	EX Inlet XX	2.0	0.0	0.1	2.1	2.1	2.1	0.0	5.0	0.0	9.0	14.0	8.5	
EX Inlet XX	"LM" 32+00.00, 00' RT	SD-4	DM2	15.0	15	1.30	1.80	LM-OD2	N/A	EX Inlet XX	1.0	0.0	0.0	1.0	1.0	1.0	0.0	2.0	0.0	5.5	7.5	6.7	
EX Inlet XX	"LM" 36+00.00, 00' LT	SD-4	DM2	17.5	20	1.10	1.70	LM-BF1	N/A	LMDI-10	14.0	0.0	0.0	0.0	14.0	12.6	1.4	44.0	0.0	11.5	55.5	36.9	
EX Inlet XX	"LM" 36+00.00, 00' RT	SD-4	DM2	17.5	20	1.80	1.90	LM-BF2	N/A	EX Inlet XX	1.0	0.0	0.0	1.0	1.0	1.0	0.0	1.0	0.0	0.8	1.8	1.8	
EX Inlet XX	"LM" 37+00.00, 00' LT	SD-4	DM2	17.5	20	0.40	1.30	N/A	N/A	EX Inlet XX	0.0	0.0	1.4	1.4	1.4	1.4	0.0	0.0	0.0	18.7	18.7	10.5	
EX Inlet XX	"LM" 37+00.00, 00' RT	SD-4	DM2	17.5	20	1.80	2.00	N/A	N/A	EX Inlet XX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
LMDI-11	"LM" 7+71.43, 89' LT	SD-1	DM2	17.5	20	1.30	2.00	HAIR STREET	N/A	N/A	39.3	0.0	0.0	0.0	39.3	27.8	11.5	169.0	0.0	0.0	169.0	77.3	
LMDI-2	"LM" 8+18.43, 86' LT	SD-1	DM2	17.5	20	1.30	2.00	HAIR STREET	N/A	LMDI-1	0.0	0.0	11.5	11.5	10.5	1.0	118.9	0.0	0.0	118.9	60.9	57.9	
LMDI-3	"LM" 8+64.43, 82' LT	SD-1	DM2	17.5	20	1.30	2.00	HAIR STREET	N/A	LMDI-2	0.0	0.0	0.0	1.0	1.0	1.0	0.0	61.4	0.0	0.0	61.4	38.4	
LMDI-5	"LM" 9+23.37, 53' RT	SD-1	Type 2B	3x3	N/A	0.80	N/A	HAIR STREET	N/A	N/A	9.7	0.0	0.0	0.0	9.7	7.3	2.4	47.5	0.0	0.0	47.5	19.9	
LMDI-6	"LM" 10+97.44, 64' RT	SD-1	DM2	7.5	10	0.70	3.70	N/A	N/A	LMDI-5	0.0	0.0	0.0	2.4	2.4	2.4	0.0	0.0	0.0	27.6	27.6	17.3	
CDI-1	"CI" 11+11.33, 16' LT	SD-1	DM2	17.5	20	0.47	2.00	HAIR STREET	N/A	N/A	14.0	0.0	0.0	0.0	14.0	9.6	4.4	50.3	0.0	0.0	50.3	39.4	
CDI-2	"CI" 10+77.33, 45' LT	SD-1	DM2	17.5	20	0.47	2.00	HAIR STREET	N/A	CDI-1	0.0	0.0	0.0	4.4	4.4	4.4	0.0	32.2	0.0	0.0	32.2	27.2	
EX-CDI-1	"CI" 11+00.00, 00' LT	SD-1	DM2	5.0	5	0.47	2.00	HAIR STREET	N/A	CDI-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0	7.2	4.1	
CDI-3	"CI" 10+80.33, 18' RT	SD-1	Type 2B	3x3	N/A	0.30	2.00	HAIR STREET	N/A	N/A	1.0	0.0	0.0	0.0	1.0	1.0	0.0	8.5	0.0	0.0	8.5	5.3	
BDI-1	"B" 23+43.34, 20' LT	SD-13	Type 2B	3x3	N/A	0.60	N/A	LA-BF	CPLACO-E	N/A	8.0	0.0	0.0	0.0	8.0	5.7	2.3	28.0	0.0	0.0	30.0	13.1	
BDI-2	"B" 22+51.33, 49' LT	SD-13	Type 2B	3x3	N/A	0.60	N/A	N/A	N/A	BDI-1	0.0	0.0	0.0	2.3	2.3	2.3	0.0	0.0	0.0	16.9	16.9	9.1	
BDI-3	"B" 17+59.32, 00' LT	SD-13	Type 2B	3x3	N/A	0.40	N/A	HAIR STREET	N/A	BDI-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	3.3	
BDI-4	"B" 17+58.36, 07' RT	SD-13	Type 2B	3x3	N/A	0.40	N/A	HAIR STREET	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	3.8	
EX Inlet XX	"B" 10+75.00, 00' LT	SD-12	DM2	3.0	3	0.30	0.10	NUISANCE	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
EX Inlet XX	"B" 10+75.00, 00' RT	SD-12	DM2	3.0	3	0.10	1.60	BF-LM	N/A	N/A	5.0	0.0	0.0	0.0	5.0	2.6	2.4	14.0	0.0	0.6	14.6	4.7	

Notes:
 1. Contribution from upstream surface flowsplit. See Minor Basin Flowsplits - Ultimate Table
 2. Assumed Minor sub-basin WS-CN fully contributes to catch basin WDI-2 to be conservative
 3. Assumed Minor sub-basin CH-LA2 fully contributes to catch basin CDI-3 to be conservative

- C.4 - Street Capacity



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN
STREET CAPACITY 10-YEAR - ULTIMATE CONDITION

Project #: 31698
Made by: JMS
Date: 03/02/15
NSA
Date: 04/07/15

Cross Section	US/DS ¹	Drop Inlet ID	Sheet	Upstream of Intersection w/ 80' ROW (Yes / No)	ROW Width (FT)	Max Allowable Inundated Width W _{max} (FT)	Max Allowable Depth D _{max} (FT)	Max Allowable Intersection Depth D _{max} (FT)	Flow ² Q ₉₀ (CFS)	Width W ₉₀ (FT)	Depth D ₉₀ (FT)	Velocity V ₉₀ (FT)	W ₉₀ < W _{max} (Met/Not Met)	D ₉₀ < D _{max} (Met / Not Met)	D ₉₀ X V ₉₀ (Met / Not Met)	D ₉₀ X V ₉₀ < 6 (Met / Not Met)	Intersection D ₉₀ < D _{max} (Met / Not Met)
"W" 9+67 N	US	WDI-1	SD-9	No	60	N/A	1.00	N/A	41.00	35.00	0.56	3.89	Met	Met	2.18	Met	N/A
"W" 9+67 N	DS	WDI-1	SD-9	No	60	N/A	1.00	N/A	9.67	27.38	0.40	2.42	Met	Met	0.97	Met	N/A
"W" 16+37 N	US	WDI-2	SD-10	No	60	N/A	1.00	N/A	11.67	33.94	0.47	2.84	Met	Met	1.10	Met	N/A
"W" 16+37 N	DS	WDI-2	SD-10	No	60	N/A	1.00	N/A	0.52	4.24	0.15	1.63	Met	Met	0.24	Met	N/A
"W" 23+17 N	US	WDI-3	SD-11	No	60	N/A	1.00	N/A	0.52	12.33	0.08	0.94	Met	Met	0.08	Met	N/A
"W" 23+17 N	DS	WDI-3	SD-11	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CO" 30+97 W	US	CODI-1	SD-7	No	60	N/A	1.00	N/A	1.00	16.71	0.19	0.88	Met	Met	0.17	Met	N/A
"CO" 30+97 W	DS	CODI-1	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CO" 31+07 E	US	CODI-2	SD-8	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CO" 31+07 E	DS	CODI-2	SD-8	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"R" 24+32 N	US	RDI-1	SD-7	No	60	N/A	1.00	N/A	6.00	27.26	0.24	1.81	Met	Met	0.43	Met	N/A
"R" 24+32 N	DS	RDI-1	SD-7	No	60	N/A	1.00	N/A	0.46	9.61	0.07	0.66	Met	Met	0.05	Met	N/A
"R" 24+36 N	US	RDI-2	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"R" 24+36 N	DS	RDI-2	SD-7	No	60	N/A	1.00	N/A	0.04	9.12	0.02	0.29	Met	Met	0.01	Met	N/A
"R" 22+98 N	US	RDI-5	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"R" 22+98 N	DS	RDI-5	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"R" 22+87 N	US	RDI-4	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"R" 22+87 N	DS	RDI-4	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"R" 24+15 S	US	RDI-3	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"R" 24+15 S	DS	RDI-3	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CO" 27+19 E	US	CODI-3	SD-7	No	60	N/A	1.00	N/A	1.00	13.74	0.13	1.09	Met	Met	0.14	Met	N/A
"CO" 27+19 E	DS	CODI-3	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CO" 24+15 W	US	CODI-4	SD-7	No	30	N/A	1.00	N/A	1.00	13.80	0.15	0.95	Met	Met	0.14	Met	N/A
"CO" 24+15 W	DS	CODI-4	SD-7	No	30	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"LAM" 11+77 S	US	LAMD-1	SD-7	No	60	N/A	1.00	N/A	4.00	22.81	0.19	1.84	Met	Met	0.35	Met	N/A
"LAM" 11+77 S	DS	LAMD-1	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"LAM" 10+45 N	US	LAMD-3	SD-7	No	60	N/A	1.00	N/A	1.00	8.65	0.20	0.89	Met	Met	0.18	Met	N/A
"LAM" 10+45 N	DS	LAMD-3	SD-7	No	60	N/A	1.00	N/A	0.04	2.55	0.08	0.40	Met	Met	0.03	Met	N/A
"LAM" 10+30 S	US	LAMD-2	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"LAM" 10+30 S	DS	LAMD-2	SD-7	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CO" 15+56 E	US	CODI-5	SD-6	No	60	N/A	1.00	N/A	1.00	10.11	0.22	0.89	Met	Met	0.20	Met	N/A
"CO" 15+56 E	DS	CODI-5	SD-6	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CO" 15+10 W	US	CODI-6	SD-6	No	74	N/A	1.00	N/A	3.00	8.66	0.32	2.14	Met	Met	0.68	Met	N/A
"CO" 15+10 W	DS	CODI-6	SD-6	No	74	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CO" 10+85 W	US	CODI-7	SD-5	No	60	N/A	1.00	N/A	1.00	7.35	0.23	1.18	Met	Met	0.27	Met	N/A
"CO" 10+85 W	DS	CODI-7	SD-5	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CO" 10+60 E	US	CODI-8	SD-5	No	60	N/A	1.00	N/A	1.00	7.12	0.23	1.23	Met	Met	0.28	Met	N/A
"CO" 10+60 E	DS	CODI-8	SD-5	No	60	N/A	1.00	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CO" 10+60 E	US	LMDI-1	SD-1	No	100	41.00	N/A	N/A	39.27	30.05	0.93	4.09	Met	Met	3.80	Met	N/A
"CO" 10+60 E	DS	LMDI-1	SD-1	No	100	41.00	N/A	N/A	11.50	10.07	0.53	4.30	Met	Met	2.28	Met	N/A
"LM" 8+18 N	US	LMDI-2	SD-1	No	100	41.00	N/A	N/A	0.98	4.00	0.21	2.32	Met	Met	0.49	Met	N/A
"LM" 8+18 N	DS	LMDI-2	SD-1	No	100	41.00	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"LM" 9+23 S	US	LMDI-3	SD-1	Yes	100	16.00	N/A	N/A	9.73	17.11	0.51	2.30	Not Met	Met	0.00	Met	Met
"LM" 9+23 S	DS	LMDI-3	SD-1	Yes	100	16.00	N/A	N/A	3.25	11.09	0.34	1.73	Met	Met	0.59	Met	N/A
"CI" 11+11 W	US	CIDI-1	SD-1	No	80	15.20	N/A	N/A	14.00	16.68	0.60	2.81	Not Met	Met	1.69	Met	N/A
"CI" 11+11 W	DS	CIDI-1	SD-1	No	80	15.20	N/A	N/A	4.43	10.83	0.39	2.11	Met	Met	0.82	Met	N/A
"CI" 10+77 W	US	CIDI-2	SD-1	No	80	15.20	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"CI" 10+77 W	DS	CIDI-2	SD-1	No	80	15.20	N/A	N/A	1.00	22.23	0.12	0.69	Not Met	Met	0.08	Met	N/A
"CI" 10+80 E	US	CIDI-3	SD-1	Yes	80	13.80	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	Met
"CI" 10+80 E	DS	CIDI-3	SD-1	Yes	80	13.80	N/A	N/A	2.39	8.38	0.28	2.06	Met	Met	0.58	Met	N/A
"LM" 10+97 S	US	LMDI-6	SD-1	No	100	31.90	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"LM" 10+97 S	DS	LMDI-6	SD-1	No	100	31.90	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met	N/A
"LM" 17+79 N	US	LMDI-8	SD-2	No	100	25.80	N/A	N/A	5.00	8.93	0.34	3.31	Met	Met	1.13	Met	N/A
"LM" 17+79 N	DS	LMDI-8	SD-2	No	100	27.80	N/A	N/A	0.41	3.30	0.14	1.81	Met	Met	0.25	Met	N/A
"LM" 23+01 N	US	LMDI-9	SD-3	No	100	18.00	N/A	N/A	3.41	10.47	0.41	1.49	Met	Met	0.61	Met	N/A



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN
STREET CAPACITY 10-YEAR - ULTIMATE CONDITION

Project #: 31698
Made by: JMS
Date: 03/02/15
NSA
Date: 04/07/15

Date: _____																	
Cross Section	US/DS ¹	Drop Inlet ID	Sheet	Upstream of Intersection w/ 80' ROW (Yes / No)	ROW Width (FT)	Max Allowable Inundated Width W _{Max}	Max Allowable Depth D _{Max}	Max Allowable Intersection Depth D _{Intersect}	Dry Lane and D X V < 6							Intersection D _{req} < D _{max} (Met / Not Met)	
									Flow ² Q ₁₀ (CFS)	Width W ₁₀₀ (FT)	Depth D ₁₀₀ (FT)	Velocity V ₁₀₀ (FT)	W ₁₀₀ < W _{Max} (Met/Not Met)	D ₁₀₀ < D _{Max} (Met/Not Met)	D ₁₀₀ X V ₁₀₀		D ₁₀₀ X V ₁₀₀ < 6 (Met / Not Met)
"LM" 23+01 N	DS	LMDI-9	SD-3	Yes	100	17.60	N/A	N/A	0.5	0.97	8.40	0.23	0.99	Met	Met	0.23	Met
"LM" 24+50 S	US	Ex Inlet XX	SD-3	No	100	25.50	N/A	N/A	N/A	1.05	5.85	0.20	1.63	Met	Met	0.36	N/A
"LM" 24+50 S	DS	Ex Inlet XX	SD-3	Yes	100	25.70	N/A	N/A	0.5	0.06	2.21	0.07	0.81	Met	Met	0.06	Met
"LM" 17+14 N	US	LMDI-7	SD-2	No	60	N/A	1.0	N/A	N/A	1.00	6.81	0.21	1.72	Met	Met	0.36	N/A
"LM" 17+14 N	DS	LMDI-7	SD-2	Yes	60	N/A	1.0	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	Met
"LM" 29+73 N	US	LMDI-10	SD-3	No	100	15.90	N/A	N/A	N/A	0.97	13.46	0.18	0.82	Met	Met	0.15	N/A
"LM" 29+73 N	DS	LMDI-10	SD-3	Yes	100	15.00	N/A	N/A	0.5	0.00	0.00	0.00	0.00	Met	Met	0.00	Met
"LM" 30+00 S	US	Ex Inlet XX	SD-3	No	100	24.50	N/A	N/A	N/A	2.06	14.55	0.18	1.56	Met	Met	0.28	N/A
"LM" 30+00 S	DS	Ex Inlet XX	SD-3	Yes	100	24.60	N/A	N/A	0.5	0.00	0.00	0.00	0.00	Met	Met	0.00	Met
"LM" 32+00 S	US	Ex Inlet XX	SD-4	No	100	24.00	N/A	N/A	N/A	1.00	7.19	0.18	1.55	Met	Met	0.28	N/A
"LM" 32+00 S	DS	Ex Inlet XX	SD-4	No	100	24.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	N/A
"LM" 36+00 N	US	Ex Inlet XX	SD-4	No	100	23.50	N/A	N/A	N/A	14.00	26.95	0.40	2.63	Not Met	Met	1.05	N/A
"LM" 36+00 N	DS	Ex Inlet XX	SD-4	No	100	23.50	N/A	N/A	N/A	1.44	10.12	0.18	1.56	Met	Met	0.28	N/A
"LM" 36+00 S	US	Ex Inlet XX	SD-4	No	100	24.70	N/A	N/A	N/A	1.00	7.85	0.17	1.50	Met	Met	0.26	N/A
"LM" 36+00 S	DS	Ex Inlet XX	SD-4	No	100	24.60	N/A	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	N/A
"LM" 37+00 N	US	Ex Inlet XX	SD-4	No	100	23.70	N/A	N/A	N/A	1.44	11.94	0.16	1.47	Met	Met	0.24	N/A
"LM" 37+00 N	DS	Ex Inlet XX	SD-4	Yes	100	24.10	N/A	N/A	0.5	0.00	0.00	0.00	0.00	Met	Met	0.00	Met
"LM" 37+00 S	US	Ex Inlet XX	SD-4	No	100	24.80	N/A	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.00	N/A
"LM" 37+00 S	DS	Ex Inlet XX	SD-4	Yes	100	24.50	N/A	N/A	0.5	0.00	0.00	0.00	0.00	Met	Met	0.00	Met
"B" 23+43 W	US	BDI-1	SD-13	No	100	21.00	N/A	N/A	N/A	8.00	18.73	0.58	1.67	Met	Met	0.97	N/A
"B" 23+43 W	DS	BDI-1	SD-13	No	100	21.50	N/A	N/A	N/A	2.33	10.25	0.37	1.24	Met	Met	0.46	N/A
"B" 22+51 W	US	BDI-2	SD-13	No	100	21.00	N/A	N/A	N/A	2.33	10.25	0.37	1.24	Met	Met	0.5	N/A
"B" 22+51 W	DS	BDI-2	SD-13	No	100	21.50	N/A	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.0	N/A
"B" 17+18 W	US	BDI-3	SD-13	No	100	21.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.0	N/A
"B" 17+18 W	DS	BDI-3	SD-13	No	100	7.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.0	N/A
"B" 17+58 E	US	BDI-4	SD-13	No	100	31.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.0	N/A
"B" 17+58 E	DS	BDI-4	SD-13	Yes	100	38.00	N/A	N/A	0.5	0.00	0.00	0.00	0.00	Met	Met	0.0	Met
"B" 10+75 W	US	Ex Inlet XX	SD-12	No	100	24.50	N/A	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.0	N/A
"B" 10+75 W	DS	Ex Inlet XX	SD-12	No	100	24.70	N/A	N/A	N/A	0.00	0.00	0.00	0.00	Met	Met	0.0	N/A
"B" 10+75 E	US	Ex Inlet XX	SD-12	No	100	25.50	N/A	N/A	N/A	5.00	25.62	0.39	0.99	Not Met	Met	0.4	N/A
"B" 10+75 E	DS	Ex Inlet XX	SD-12	Yes	100	25.60	N/A	N/A	0.5	2.42	19.51	0.30	0.20	Met	Met	0.1	Met

1 US= Upstream of drop inlet, DS= Downstream of drop inlet

2 See Drop Inlet Analysis - Ultimate Condition table for flow



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

STREET CAPACITY 100-YEAR - ULTIMATE CONDITION

Project #: 31698
 Made by: JMS
 Date: 03/02/15
 Checked by: NSA
 Date: 04/07/15

Cross Section	US/DS ¹	Drop Inlet ID	Sheet	Upstream of Intersection (Yes / No)	D X V < 8 & D _{Q100} < 2					Intersection D _{Q100} < 1 (Met / Not Met)
					Flow ² Q ₁₀₀ (CFS)	Depth D _{Q100} (FT)	Velocity V _{Q100} (FT)	D _{Q100} x V _{Q100} (Met / Not Met)	D _{Q100} < 2 (Met / Not Met)	
"W" 9+67 N	US	WDI-1	SD-9	No	135.00	0.88	6.23	5.48	Met	N/A
"W" 9+67 N	DS	WDI-1	SD-9	No	58.90	0.67	4.49	3.01	Met	N/A
"W" 16+37 N	US	WDI-2	SD-10	No	50.00	0.68	4.18	2.84	Met	N/A
"W" 16+37 N	DS	WDI-2	SD-10	No	12.11	0.64	1.89	1.21	Met	N/A
"W" 23+17 N	US	WDI-3	SD-11	No	12.11	0.30	2.54	0.76	Met	N/A
"W" 23+17 N	DS	WDI-3	SD-11	No	1.76	0.14	1.33	0.19	Met	N/A
"CO" 30+97 W	US	CODI-1	SD-7	No	4.00	0.29	1.48	0.43	Met	N/A
"CO" 30+97 W	DS	CODI-1	SD-7	Yes	1.59	0.13	1.20	0.16	Met	Met
"CO" 31+07 E	US	CODI-2	SD-8	No	2.00	0.14	1.51	0.21	Met	N/A
"CO" 31+07 E	DS	CODI-2	SD-8	Yes	0.30	0.07	0.82	0.06	Met	Met
"R" 24+32 N	US	RDI-1	SD-7	No	76.00	0.82	2.96	2.43	Met	N/A
"R" 24+32 N	DS	RDI-1	SD-7	Yes	52.42	0.56	3.80	2.13	Met	Met
"R" 24+16 N	US	RDI-2	SD-7	No	48.96	0.70	2.90	2.03	Met	N/A
"R" 24+16 N	DS	RDI-2	SD-7	Yes	31.08	0.60	2.43	1.46	Met	Met
"R" 22+98 N	US	RDI-5	SD-7	No	34.04	0.62	2.52	1.56	Met	N/A
"R" 22+98 N	DS	RDI-5	SD-7	No	18.85	0.49	2.28	1.12	Met	N/A
"R" 22+87 N	US	RDI-4	SD-7	No	8.39	0.38	1.90	0.72	Met	N/A
"R" 24+15 S	US	RDI-3	SD-7	No	3.46	0.45	1.49	0.67	Met	N/A
"R" 24+15 S	DS	RDI-3	SD-7	Yes	1.49	0.32	1.18	0.38	Met	Met
"CO" 27+19 E	US	CODI-3	SD-7	No	2.00	0.17	1.29	0.22	Met	N/A
"CO" 27+19 E	DS	CODI-3	SD-7	Yes	0.36	0.09	0.81	0.07	Met	Met
"CO" 24+15 W	US	CODI-4	SD-7	No	6.00	0.28	1.63	0.46	Met	N/A
"CO" 24+15 W	DS	CODI-4	SD-7	Yes	2.72	0.24	1.26	0.30	Met	Met
"LaM" 11+77 S	US	LAMDI-1	SD-7	No	15.00	0.31	2.53	0.78	Met	N/A
"LaM" 11+77 S	DS	LAMDI-1	SD-7	No	1.24	0.14	1.49	0.21	Met	N/A
"LaM" 10+45 N	US	LAMDI-3	SD-7	No	2.00	0.28	1.07	0.30	Met	N/A
"LaM" 10+45 N	DS	LAMDI-3	SD-7	Yes	0.47	0.20	0.76	0.15	Met	Met
"LaM" 10+30 S	US	LAMDI-2	SD-7	No	1.24	0.18	1.53	0.28	Met	N/A
"LaM" 10+30 S	DS	LAMDI-2	SD-7	Yes	0.07	0.06	0.73	0.04	Met	Met



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

Project #: 31698
 Made by: JMS
 Date: 03/02/15
 Checked by: NSA
 Date: 04/07/15

STREET CAPACITY 100-YEAR - ULTIMATE CONDITION

Cross Section	US/DS ¹	Drop Inlet ID	Sheet	Upstream of Intersection (Yes / No)	D X V < 8 & D _{Q100} < 2						Intersection D _{Q100} < 1 (Met / Not Met)
					Flow ² Q ₁₀₀ (CFS)	Depth D _{Q100} (FT)	Velocity V _{Q100} (FT)	D _{Q100} x V _{Q100}	D _{Q100} x V _{Q100} < 8 (Met / Not Met)	D _{Q100} < 2 (Met / Not Met)	
"CO" 15+56 E	US	CODI-5	SD-6	No	5.00	0.40	1.11	0.44	Met	Met	N/A
"CO" 15+56 E	DS	CODI-5	SD-6	Yes	2.14	0.26	0.94	0.24	Met	Met	Met
"CO" 15+10 W	US	CODI-6	SD-6	No	11.00	0.55	2.87	1.58	Met	Met	N/A
"CO" 15+10 W	DS	CODI-6	SD-6	No	2.23	0.30	2.01	0.60	Met	Met	N/A
"CO" 10+85 W	US	CODI-7	SD-5	No	7.23	0.48	1.92	0.92	Met	Met	N/A
"CO" 10+85 W	DS	CODI-7	SD-5	Yes	1.93	0.20	1.26	0.25	Met	Met	Met
"CO" 10+60 E	US	CODI-8	SD-5	No	5.14	0.41	1.83	0.75	Met	Met	N/A
"CO" 10+60 E	DS	CODI-8	SD-5	Yes	0.75	0.16	1.24	0.20	Met	Met	Met
"LM" 7+71 N	US	LMDI-1	SD-1	No	169.03	1.41	5.29	7.46	Met	Met	N/A
"LM" 8+18 N	US	LMDI-2	SD-1	No	118.86	1.31	4.60	6.03	Met	Met	N/A
"LM" 8+64 N	US	LMDI-3	SD-1	No	61.35	1.08	4.24	4.58	Met	Met	N/A
"LM" 8+64 N	DS	LMDI-3	SD-1	Yes	22.92	0.69	5.11	3.53	Met	Met	Met
"LM" 9+23 S	US	LMDI-5	SD-1	No	47.49	0.87	3.45	3.00	Met	Met	N/A
"LM" 9+23 S	DS	LMDI-5	SD-1	Yes	27.56	0.72	3.11	2.24	Met	Met	Met
"CI" 11+11 W	US	CIDI-1	SD-1	No	50.34	0.94	4.34	4.08	Met	Met	N/A
"CI" 10+77 W	US	CIDI-2	SD-1	No	32.15	0.80	3.65	2.92	Met	Met	N/A
"CI" 10+80 E	US	CIDI-3	SD-1	No	8.45	0.28	1.33	0.37	Met	Met	N/A
"CI" 10+80 E	DS	CIDI-3	SD-1	Yes	3.17	0.21	0.85	0.18	Met	Met	Met
"LM" 10+97 S	US	LMDI-6	SD-1	No	27.56	0.69	3.56	2.46	Met	Met	N/A
"LM" 10+97 S	DS	LMDI-6	SD-1	No	10.28	0.49	3.02	1.48	Met	Met	N/A
"LM" 17+79 N	US	LMDI-8	SD-2	No	41.84	0.75	5.64	4.23	Met	Met	N/A
"LM" 17+79 N	DS	LMDI-8	SD-2	No	20.79	0.60	4.84	2.90	Met	Met	N/A
"LM" 23+01 N	US	LMDI-9	SD-3	No	30.79	0.68	5.08	3.45	Met	Met	N/A
"LM" 23+01 N	DS	LMDI-9	SD-3	Yes	20.92	0.79	2.36	1.86	Met	Met	Met
"LM" 24+50 S	US	Ex Inlet XX	SD-3	No	13.28	0.51	3.08	1.57	Met	Met	N/A
"LM" 24+50 S	DS	Ex Inlet XX	SD-3	Yes	8.99	0.53	3.10	1.64	Met	Met	Met
"LM" 17+14 N	US	LMDI-7	SD-2	No	12.00	0.51	2.77	1.41	Met	Met	N/A
"LM" 17+14 N	DS	LMDI-7	SD-2	Yes	3.75	0.30	2.16	0.65	Met	Met	Met
"LM" 29+73 N	US	LMDI-10	SD-3	No	23.60	0.55	2.35	1.29	Met	Met	N/A



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

Project #: 31698
 Made by: JMS
 Date: 03/02/15
 Checked by: NSA
 Date: 04/07/15

STREET CAPACITY 100-YEAR - ULTIMATE CONDITION

Cross Section	US/DS ¹	Drop Inlet ID	Sheet	Upstream of Intersection (Yes / No)	D X V < 8 & D _{Q100} < 2						Intersection D _{Q100} < 1 (Met / Not Met)
					Flow ² Q ₁₀₀ (CFS)	Depth D _{Q100} (FT)	Velocity V _{Q100} (FT)	D _{Q100} x V _{Q100} (Met / Not Met)	D _{Q100} x V _{Q100} < 8 (Met / Not Met)	D _{Q100} < 2 (Met / Not Met)	
"LM" 29+73 N	DS	LMDI-10	SD-3	Yes	11.54	0.53	1.93	1.02	Met	Met	Met
"LM" 30+00 S	US	Ex Inlet XX	SD-3	No	13.99	0.37	2.52	0.93	Met	Met	N/A
"LM" 30+00 S	DS	Ex Inlet XX	SD-3	Yes	5.52	0.31	2.22	0.69	Met	Met	Met
"LM" 32+00 S	US	Ex Inlet XX	SD-4	No	7.52	0.38	2.57	0.98	Met	Met	N/A
"LM" 32+00 S	DS	Ex Inlet XX	SD-4	No	0.79	0.16	1.42	0.23	Met	Met	N/A
"LM" 36+00 N	US	Ex Inlet XX	SD-4	No	55.54	0.65	3.99	2.59	Met	Met	N/A
"LM" 36+00 N	DS	Ex Inlet XX	SD-4	No	18.65	0.47	2.98	1.40	Met	Met	N/A
"LM" 36+00 S	US	Ex Inlet XX	SD-4	No	1.79	0.21	1.73	0.36	Met	Met	N/A
"LM" 36+00 S	DS	Ex Inlet XX	SD-4	No	0.00	0.00	0.00	0.00	Met	Met	N/A
"LM" 37+00 N	US	Ex Inlet XX	SD-4	No	18.65	0.43	2.78	1.20	Met	Met	N/A
"LM" 37+00 N	DS	Ex Inlet XX	SD-4	Yes	8.17	0.29	2.15	0.62	Met	Met	Met
"LM" 37+00 S	US	Ex Inlet XX	SD-4	No	0.00	0.00	0.00	0.00	Met	Met	N/A
"LM" 37+00 S	DS	Ex Inlet XX	SD-4	Yes	0.00	0.00	0.00	0.00	Met	Met	Met
"B" 23+43 W	US	BDI-1	SD-13	No	30	0.87	2.37	2.06	Met	Met	N/A
"B" 23+43 W	DS	BDI-1	SD-13	No	16.87	0.73	2.02	1.47	Met	Met	N/A
"B" 22+51 W	US	BDI-2	SD-13	No	16.87	0.73	2.02	1.47	Met	Met	N/A
"B" 22+51 W	DS	BDI-2	SD-13	No	7.75	0.76	0.85	0.65	Met	Met	N/A
"B" 17+59 W	US	BDI-3	SD-13	No	3.88	0.14	0.80	0.11	Met	Met	N/A
"B" 17+59 W	DS	BDI-3	SD-13	No	0.55	0.05	0.39	0.02	Met	Met	N/A
"B" 17+58 E	US	BDI-4	SD-13	No	3.87	0.23	2.08	0.48	Met	Met	N/A
"B" 17+58 E	DS	BDI-4	SD-13	Yes	0.13	0.06	0.84	0.05	Met	Met	Met
"B" 10+75 W	US	Ex Inlet XX	SD-12	No	0.00	0.00	0.00	0.00	Met	Met	N/A
"B" 10+75 W	DS	Ex Inlet XX	SD-12	No	0.00	0.00	0.00	0.00	Met	Met	N/A
"B" 10+75 E	US	Ex Inlet XX	SD-12	No	14.00	0.60	1.17	0.70	Met	Met	N/A
"B" 10+75 E	DS	Ex Inlet XX	SD-12	Yes	9.28	0.50	1.15	0.58	Met	Met	Met

1 US= Upstream of drop inlet, DS=Downstream of drop inlet

2 See Drop Inlet Analysis - Ultimate Condition table for flow

-
- C.5 Surface Flow Exhibit

Appendix D – Considerations

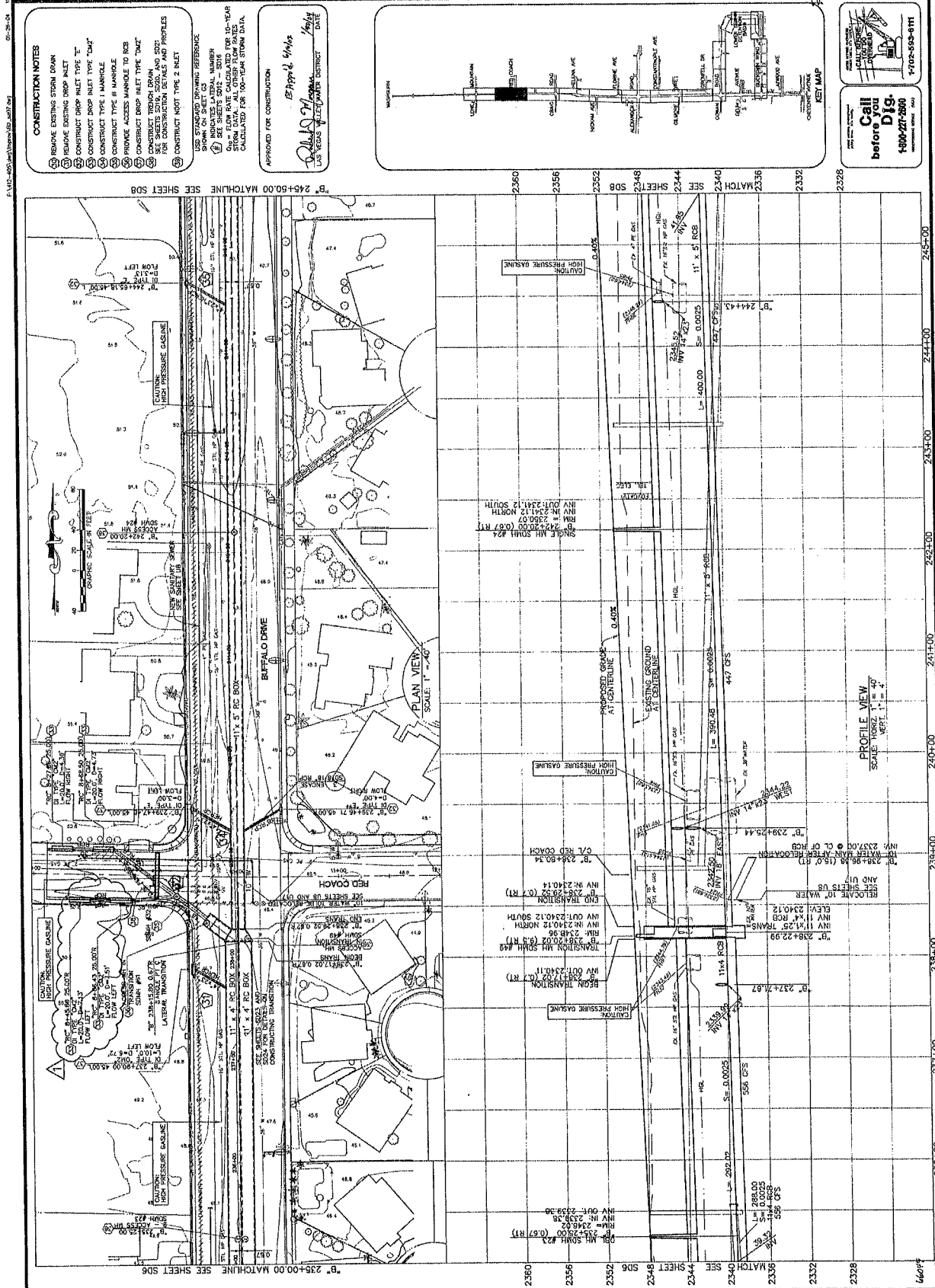
- D.1 - As-Builts
- D.2 - Possible Utility Conflicts
- D.3 - Right of Way Summary
- D.4 - Permit Matrix
- D.5 - Record of Survey
- D.6 - Citizen Complaint for Bubbler System
- D.7 - Meeting Minutes
- D.8 - Comment Responses

-
- D.1 - As-Built

10-23-04 10:31:43

P:\111-400\111-400-00\111-400-00.dwg

PROJECT NO. 111-400		SHEET 2332	
CHECKED BY: J. WALLACE		DESIGNED BY: J. WALLACE	
DATE: 7/27/03		DATE: 7/27/03	
TITLE: BUFFALO DRIVE STORM DRAIN			
PROJECT: CHEYENNE TO LONE MOUNTAIN			
G.C. WALLACE, INC. (202) 328-3278			
400 EAST STEWART AVE. #200 WASHINGTON, DC 20001			
DEPARTMENT OF PUBLIC WORKS			
CONSTRUCTION NOTES			
1. REMOVE EXISTING STORM DRAIN			
2. RECONSTRUCT EXISTING STORM DRAIN			
3. CONSTRUCT DROP INLET TYPE "C"			
4. CONSTRUCT DROP INLET TYPE "D"			
5. CONSTRUCT TYPE "I" MANHOLE			
6. PROVIDE ACCESS MANHOLE TO RCB			
7. CONSTRUCT DROP INLET TYPE "D"			
8. CONSTRUCT STORM DRAIN AND SLOPE			
9. FOR CONSTRUCTION DETAILS AND PROFILES			
10. CONSTRUCT NOT TYPE 2 INLET			
11. INDICATED LATERAL NUMBER			
12. ALL FLOW RATES CALCULATED FOR 10-YEAR			
13. STORM DATA. ALL OTHER FLOW RATES			
14. CALCULATED FOR 10-YEAR STORM DATA			
APPROVED FOR CONSTRUCTION			
DATE: 10/23/04			
BY: J. WALLACE			
FOR: WASHINGTON DISTRICT			



CONV PROJ # 111.400

CONSTRUCTION NOTES

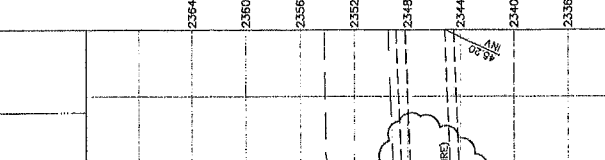
- 1) REMOVE EXISTING STORM DRAIN
- 2) REMOVE EXISTING DROP INLET
- 3) CONSTRUCT DROP INLET TYPE "C"
- 4) CONSTRUCT DROP INLET TYPE "D"
- 5) CONSTRUCT TYPE I MANHOLE
- 6) CONSTRUCT TYPE II MANHOLE
- 7) PROVIDE ACCESS MANHOLE TO R/O
- 8) CONSTRUCT DROP INLET TYPE "D"
- 9) CONSTRUCT TYPE I MANHOLE
- 10) SEE SHEETS R/W, S&W, S&D, AND S&T FOR CONSTRUCTION DETAILS AND PROFILES
- 11) CONSTRUCT ROOT TYPE 2 INLET

SEE ATTACHED DRAWING REFERENCE
SECTION ON SHEET C

STORM DRAIN FACILITIES
OF 2005 CONTRACT 54

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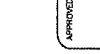
Edwin M. Meyer
LAS VEGAS VALLEY WATER DISTRICT
DATE: 12/16/87

[illegible]

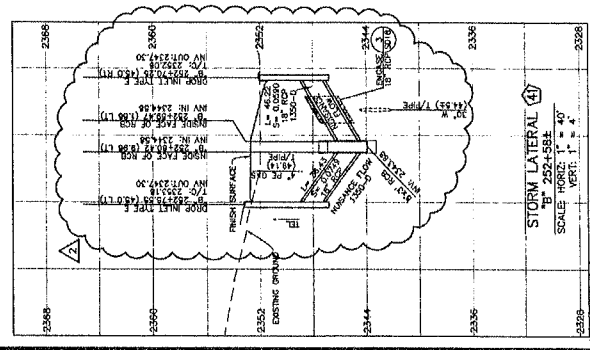
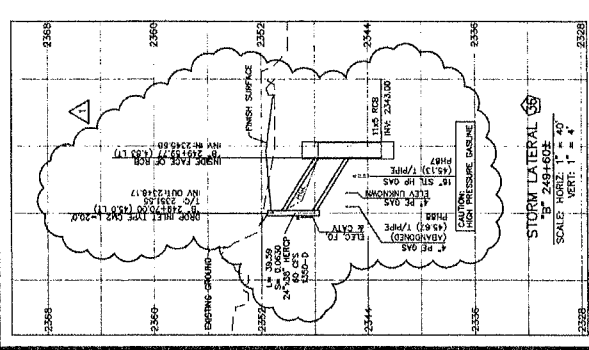
	SURFACE	7
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TESTING GROUNDED

100



Q. Q. Q.
LAS VEGAS



100

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- D.2 - Possible Utility Conflicts



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

POSSIBLE UTILITY CONFLICTS

Project #: 31698
Made by: NM
Date: 04/07/15
Checked by: JS
Date: 04/08/15

Station	Location	SD System	Utility	Horizontal Clearance	Vertical Clearance	Comments
Conough						
CO 37+22.03	Conough @ Washburn	COMH-1 to COMH-2	4" Gas	-	unk	
CO 37+17.69	Conough @ Washburn	COMH-1 to COMH-2	14" Water	-	unk	
CO 31+07.13	Conough @ Rosada	CODI-2	8" Water	5.5'	-	
CO 30+33.05	Conough @ Rosada	COMH-3 to COMH-4	2" Gas	4.5'	unk	
CO 27+13.97	Conough s/o Rosada	CODI-3	8" Water	5.8'	unk	
CO 26+65.03	Conough s/o Rosada	COMH-3 to COMH-4	2" Gas	-	unk	
CO 24+08.62	Conough n/o La Madre	CODI-4	2" Gas	-	unk	
CO 23+91.28	Conough n/o La Madre	COMH-4 to COMH-5	10" Water	-	unk	
CO 22+74.41	Conough s/o La Madre	COMH-4 to COMH-5	2" Gas	-	unk	
CO 15+53.98	Conough n/o Lone Mountain	CODI-5	2" Gas	3.5'	unk	
CO 15+52.50	Conough n/o Lone Mountain	CODI-5	8" Water	8'	unk	
CO 10+59.61	Conough @ Lone Mountain	CODI-8	8" Water	3.8'	-	
CO 10+52.25	Conough @ Lone Mountain	COMH-8 to LMMH-6	2" Gas	-	unk	
CO 10+47.07	Conough @ Lone Mountain	COMH-8 to LMMH-6	8" Water	-	unk	
CO 10+27.83	Conough @ Lone Mountain	COMH-8 to LMMH-6	16" Water	-	unk	
Rosada						
R 23+11.43	Rosada @ Conough	RDI-5 to COMH-3	Water Lateral	3.5'	-	SD system does not meet horizontal clearance from system connecting to fire hydrant
R 24+15.48	Rosada @ Conough	RDI-3	2" Gas	3'	-	
La Madre						
LaM 10+44.73	La Madre @ Conough	LAMDI-3 to LAMDI-2	10" Water	4.5'	-	
LaM 10+17.23	La Madre @ Conough	LAMDI-2	2" Gas	-	unk	
Lone Mountain						
LM 7+70.80 to LM 8+64.47	Lone Mountain w/o Cimarron	LMDI-1 to LMDI-3	12" Water	3.5'	-	Does not meet horizontal clearance requirements.
LM 8+70.04	Lone Mountain w/o Cimarron	LMDI-3 to LMMH-1	12" Water	3.5'	Est 0	12" W line crossing will likely need relocation, does not meet horizontal or vertical clearance requirements.
LM 9+27.39	Lone Mountain w/o Cimarron	LMDI-5	16" Gas	4.5'	Est 5"	
LM 9+63.92	Lone Mountain @ Cimarron	CIDI-2	12" Water	-	Est 0	12" W will likely need relocation due to vertical location
LM 9+78.26	Lone Mountain @ Cimarron	LMMH-1 to LMMH-2	42" Water	-	Est 10"	SD system goes above water crossing and will require concrete encasement
LM 10+00	Lone Mountain @ Cimarron	LMMH-1 to LMMH-2	Monument	0'	0'	Monument well will need to be relocated
LM 10+25.16	Lone Mountain @ Cimarron	LMMH-1 to LMMH-2	10" Water	-	Est 0	10" W will likely require relocation due to vertical location
LM 11+02.80	Lone Mountain e/o Cimarron	LMDI-6	16" Gas	-	Est 1"	
LM 23+69.17	Lone Mountain @ Conough	LMMH-5 to LMMH-6	8" Water	-	unk	
LM 23+94.56	Lone Mountain @ Conough	LMMH-5 to LMMH-6	2" Gas	-	unk	
LM 29+80.79	Lone Mountain w/o Miller	LMDI-10	16" Water	6'	unk	
LM 30+82.53	Lone Mountain @ Miller	LMMH-8 to LMMH-9	8" SS	4.5'	unk	
LM 37+34.08	Lone Mountain @ Buffalo	LMMH-10 to Ex RCB	4" Gas	-	unk	
LM 37+51.06	Lone Mountain @ Buffalo	LMMH-10 to Ex RCB	8" Water	-	unk	Water contains an 18" Steel Casing
Cimarron						
CI 11+00.20	Cimarron n/o Lone Mountain	CIDI-1 to CIDI-2	Water blow off valve	0'	-	Blow off valve will need relocation north of SD system
CI 10+91.37	Cimarron n/o Lone Mountain	CIDI-1 to CIDI-2	Water Valve	0'	-	Valve will need relocation north of SD system
CI 10+79.75	Cimarron n/o Lone Mountain	CIDI-3 to CIDI-2	10" Water	5.5'	Est 14"	Will likely need concrete encasement around SD
Buffalo						
B 22+35.72	Buffalo s/o La Madre	BDI-2 to BMH-1	4" Gas	-	unk	
B 21+30.21	Buffalo s/o La Madre	BMH-1 to BMH-2	1" Gas	-	unk	
B 17+50.01	Buffalo @ Verde Way	BMH-2 to BMH-3	1" Gas	-	unk	
B 17+43.53	Buffalo @ Verde Way	BDI-4 to BMH-3	30" W	-	unk	
B 17+33.36	Buffalo @ Verde Way	BDI-4 to BMH-3	8" SS	-	unk	

- D.3 - Right of Way Summary



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

ROW Summary

Project #: 31698
Made by: BB
Date: 4/22/2015
Checked by: JS
Date: 4/27/2015

Authorization to Enter Property (AEP) Possibly Required	Associated Storm Drain Facility
125-33-410-002	LMDI-1/LMDI-2/LMDI-3
125-33-410-003	CIDI-1/CIDI-2
125-33-805-006	CIDI-3
138-04-511-011	LMDI-6
125-33-302-017	LMDI-7/LMDI-8
125-33-803-016	CODI-8
125-33-802-006	CODI-7
125-33-810-004	CODI-6
125-33-810-025	CODI-5
125-33-502-002	LAMD-1/LAMD-3
125-33-706-014	CODI-4
125-33-707-008	CODI-3
125-33-706-006	RDI-3
125-33-702-016	RDI-1/RDI-2/CODI-1
125-33-703-005	RDI-5/RDI-4
125-33-210-033	WDI-1
125-34-110-001	WDI-2/WDI-3

- D.4 - Permit Matrix



GOWAN NORTH BUFFALO BRANCH - LONE MOUNTAIN TO WASHBURN

Permit Summary Matrix

30% Design Submittal

Project #: 31698
 Made by: BB
 Date: 4/24/2015
 Checked by: JS
 Date: 4/27/2015

Permit Type	Issuing Agency	Regulated Activity	Phase
Clark County Offsite Improvements Permit	Clark County Department of Public Works	All offsite work and improvements within Clark County ROW	Design/Construction
City of Las Vegas Excavation Permit	City of Las Vegas Department of Public Works	Underground construction within City of Las Vegas ROW	Construction
City of Las Vegas Soils Report Submittal	City of Las Vegas Department of Public Works	Soils associated with construction activity within City of Las Vegas ROW	Construction
City of Las Vegas Consturction Permit	City of Las Vegas Department of Public Works	All offsite work and improvements within City of Las Vegas ROW	Construction
City of Las Vegas Grading Permit	City of Las Vegas Department of Building and Safety	On-site grading activities	Construction
City of Las Vegas Temporary Stock Pile Permit	City of Las Vegas Department of Building and Safety	Temporary stock piling of earth materials on private or BLM parcels not covered by grading permit	Construction
City of Las Vegas Traffic Plan	City of Las Vegas Construction Services	Traffic control plan associated with construction impacting City of Las Vegas ROW	Construction
Dust Control Permit	Clark County Department of Air Quality Management	Regulated activity in accordance with DAQM, dust control permit required for grading and other land disturbance activities	Construction
NPDES General Storm Water Permit for Contruction	NDEP Bureau of Water Pollution Control	Activity that disturbs 1 acre or more and discharges storm water runoff from the consturction site into a minicipal separate storm water sewer system	Construction
CCRFCD Section 8 Resource Screening Analysis	Clark County Regional Flood Control District	Environmental screening required for each new regional facility to ensure full compliance with environmental regulatory requirements	Design/Construction

- D.5 - Record of Survey

SURVEYOR'S CERTIFICATE

2. THE LANDS SURVEYED LIE WITHIN SECTION 33 OF TOWNSHIP 19 SOUTH, RANGE 60 EAST, N.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA.

3. THIS MAP COMPLIES WITH THE APPLICABLE STATE STATUTES AND ANY LOCAL ORDINANCES IN EFFECT ON THE DATE THAT THE SURVEY WAS COMPLETED ON MARCH 12, 2015.

4. THE MONUMENTS DEPICTED ON THE PLAT ARE OF THE CHARACTER TO OCCUPY THE POSITIONS INDICATED AND ARE SUFFICIENT TO DEFINE THE BOUNDARIES.

REFERENCES

- RECORD OF SURVEY FILE 101. PAGE 47

FOUND MONUMENT AS NOTED

REFERENCE MONUMENT
BRASS CAP
ALUMINUM CAP
MEASURED VALUE
CENTERLINE
RIGHT OF WAY LINE
SECTION LINE

WORLD NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS AND LAS VEGAS HIGH ELEVATION ZONES, NORTH AMERICAN DATUM OF 1983, SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN, THE REFERENCE FRAME BEING NAD 83 (2011).
 APRIL 2010

DATUM/REFERENCE FRAME: NAD83 (2011) EPOCH 2010.0

MAPPING PROJECTION PARAMETERS

```

SYSTEM: NEVADA COORDINATE RE
ZONE: LAS VEGAS ZONE
PROJECTION TYPE: TRANSVERSE MERCATOR
PROJ. DATUM: NAD83
LONGITUDE OF CENTRAL MERIDIAN: 116.000000°N
LATITUDE OF CENTRAL MERIDIAN: 39.151500°N
SCALE FACT AT CENTRAL MERIDIAN: 1.0001 (EXACT)
FALSE EASTING: 328.084.3333 SFT (1000)
FALSE NORTHING: 656.105.6667 SFT (2000)
LINEAR UNIT: US SURVEY FOOT (SFT)

```

COUNTY RECORDER'S NOTE
ANY SUBSEQUENT CHANGES TO THIS MAP
BY REFERENCE TO THE COUNTY RECORDER'S

FOR SECTION 33

FOR GOWAN NORTH BUFFALO
BRANCH STORM DRAIN PROJECT

5800 S. Eastern Avenue, Suite 200
Las Vegas, Nevada 89119
(702) 369-9358 Fax (702) 368-5
www.slrlifevegas.com

Stanley Consultants INC.

SHEET 1 OF 3

COUNTY RECORDER'S NOTE
ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX. N.P.S. 278 5695

FALSE NORTHING: 656,166.6667 SF
FALSE EASTING: 328,083.3333 SF
SCALE FACTOR AT CENTRAL MERIDIAN: 1.0001 (EXACT)

NOTES

- 1) BEARINGS AND DISTANCES SHOWN ON THIS SHEET ARE MEASURED VALUES BETWEEN FOUND MONUMENT LOCATIONS AND AN ADJUT BREAKDOWN WAS USED TO DETERMINE THE RECORD INFORMATION AS SHOWN ON SUBSEQUENT SHEETS.
- 2) ALL THE DISTANCES SHOWN FROM REFERENCE POINTS ARE "AS SHOWN".

CV V CBIN NC H49974

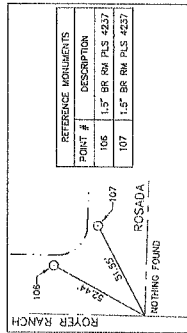
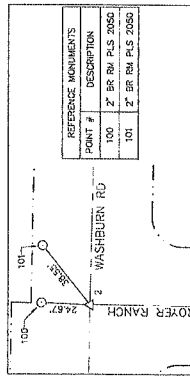
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Stanley Consultants, Inc.
Date 4/6/15 At 10:13
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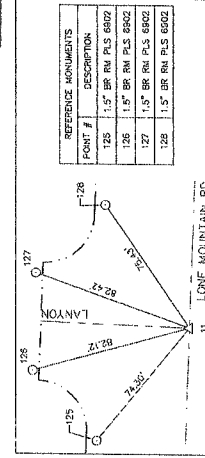
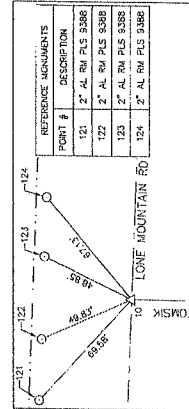
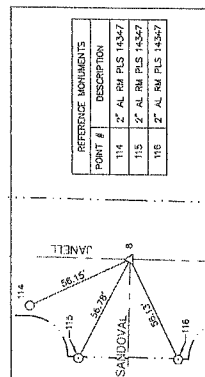
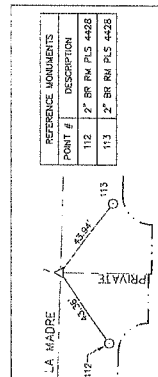
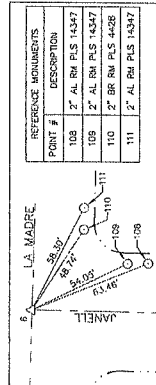
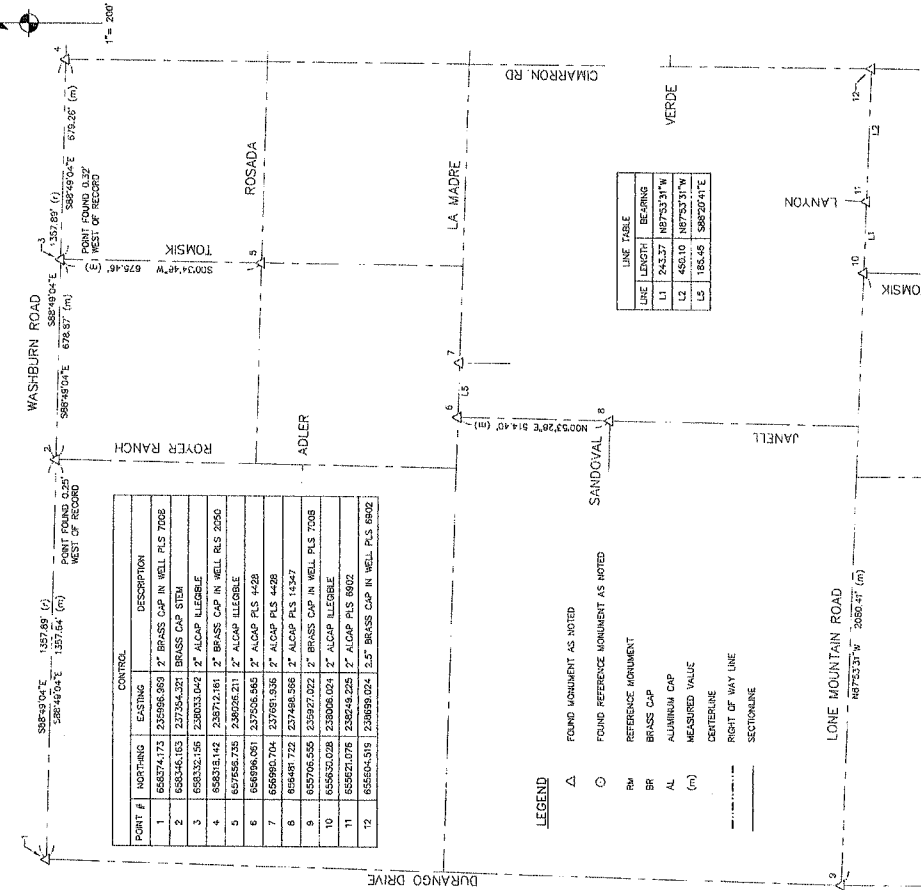
Official Records Book 2015 0406
Clark County, Nevada Records
Debbie Conway, Recorder
424.00 Deputy CWC

RECORD OF SURVEY

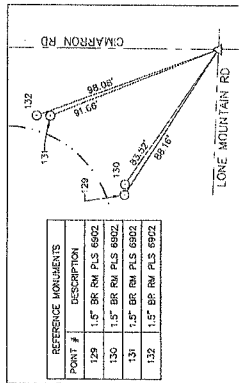
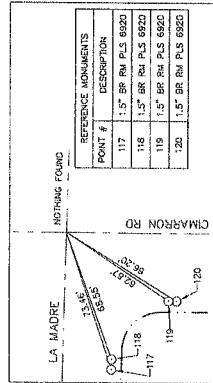
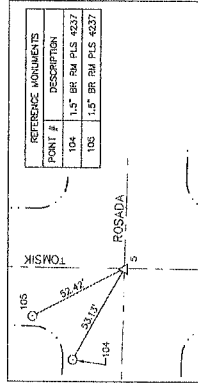
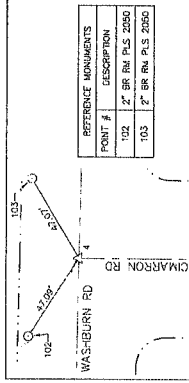
FOR GOWAN NORTH BUFFALO BRANCH STORM DRAIN PROJECT



POINT #	HOTSPOT	EASTING	NORTHING	CONTROL	DESCRIPTION
1	608374.73	235966.98	271	BRASS CAP IN WELL PLS 7008	
2	609346.163	237554.38	272	BRASS CAP IN WELL PLS 7008	
3	609332.25	238003.042	273	BRASS CAP STEM	
4	609332.25	238003.042	274	ALCOAP ALLEGRE	
5	609318.142	238572.161	275	BRASS CAP IN WELL PLS 2050	
6	607758.735	240026.211	276	ALCOAP ALLEGRE	
7	608989.961	237505.458	277	ALCOAP PLS 428	
8	608941.722	237494.398	278	ALCOAP PLS 428	
9	609706.505	233927.022	279	BRASS CAP IN WELL PLS 7008	
10	609636.028	238006.024	280	ALCOAP ALLEGRE	
11	609521.076	238424.225	281	ALCOAP PLS 6802	
12	605554.919	238698.024	282	BRASS CAP IN WELL PLS 6802	



LINE TABLE		
LINE	LENGTH	BEARING
L1	243.37	N87°53'31"W
L2	450.10	N87°53'31"W
L3	185.45	S88°20'41"E



NOTE
ALL THE DISTANCES SHOWN FROM REFERENCE
MONUMENTS ARE "AS STAMPED"

ENCE,

SHEET 2 OF 3



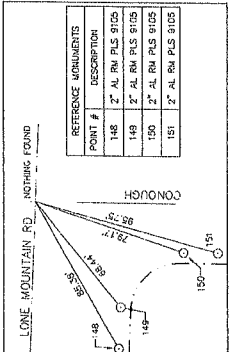
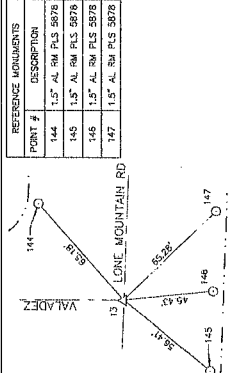
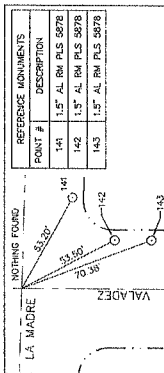
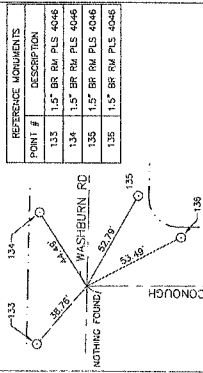
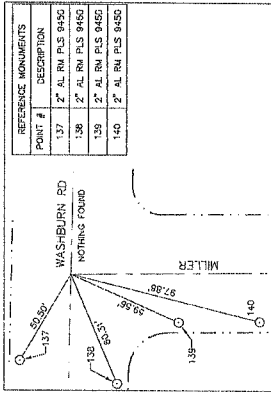
5200 S. Eastern Avenue, Suite 200
Las Vegas, Nevada 89119
(702) 369-9396 Fax (702) 369-9753
www.slipferry.com

Stanley Consultants INC.

195-0013

RECORD OF SURVEY

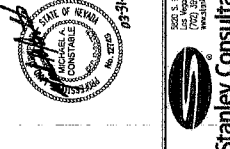
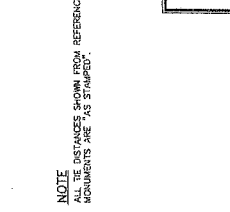
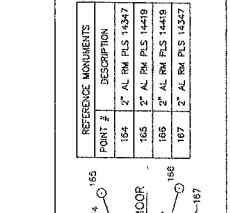
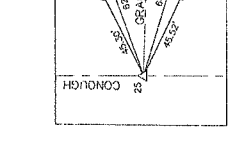
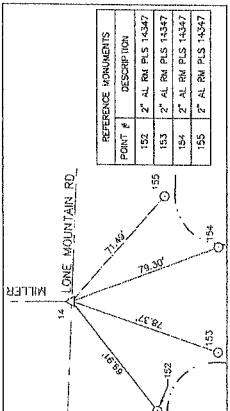
FOR GOWAN NORTH BUFFALO BRANCH STORM DRAIN PROJECT
SECTION 33 OF TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA



POINT #	NORTHING	EASTING	DESCRIPTION
13	655079.087	238392.102	2' AL RM PLS 5878
14	65527.797	240772.602	1.5' AL RM PLS 14347
15	65500.897	241472.095	3' BR RM PLS 15382
16	65502.008	24073.407	1.5' AL RM PLS 14347
17	65502.653	24077.550	2' AL RM PLS 14347
18	65502.086	24073.877	2' AL RM PLS 14347
19	65502.721	24449.633	2' AL RM PLS 14347
20	65502.724	24072.591	2' AL RM PLS 14347
21	65502.353	24075.886	2' AL RM PLS 14347
22	65502.747	24092.721	2' AL RM PLS 14347
23	65502.652	24143.440	2' AL RM PLS 14347
24	65502.817	24445.545	2' AL RM PLS 14347
25	65502.512	24072.580	1.5' AL RM PLS 14347
26	65502.754	24081.722	1.5' AL RM PLS 14347
27	65502.545	24083.545	1.5' AL RM PLS 14347

LEGEND

- FOUND MONUMENT AS NOTED
- FOUND REFERENCE MONUMENT AS NOTED
- RM BRASS CAP
- AL ALUMINUM CAP
- MEASURED VALUE
- CENTERLINE
- RIGHT OF WAY LINE
- SECTIONLINE



NOTE: ALL DISTANCES SHOWN FROM REFERENCE MONUMENTS ARE AS STAMPED.

Stanley Consultants INC.
195-0013

SHEET 3 OF 3

-
- D.6 - Citizen Complaint for Bubbler System

Schick, Jessica

From: Hsu, Eric SC.
Sent: Monday, October 20, 2014 9:27 AM
To: Schick, Jessica; Appuglise, Nicholas
Subject: FW: RFCD - Citizen Contact Tracking System

From: Oh-Sang Kwon [mailto:okwon@LasVegasNevada.GOV]
Sent: Monday, October 20, 2014 9:05 AM
To: Michael Sturdivant; Todd L. Myers; Peter Jackson
Cc: Marrs, James A.; Hsu, Eric SC.
Subject: FW: RFCD - Citizen Contact Tracking System

Mike,

Received complaint from a citizen. Maybe we could address this with the Buffalo Storm Drain Project.

Thanks,

Oh-Sang Kwon, P.E.
City of Las Vegas
Engineering Project Manager
Flood Control Section
333 N. Rancho Drive
Las Vegas, NV 89106

Phone: (702) 229-1815
Cell: (702) 379-9491
Fax: (702) 382-8551
TTY: (702) 386-9108

From: Kelsey Hand [mailto:KHand@regionalflood.org]
Sent: Friday, October 17, 2014 8:19 AM
To: Jerry Walker; Peter Jackson; Oh-Sang Kwon
Subject: RFCD - Citizen Contact Tracking System

This e-mail is being sent from the Regional Flood Control District's Citizen Contact Tracking System. This system is used by RFCD staff to record flood- or stormwater-related incidents that occur in Clark County. You are being sent this information because you may be able to provide assistance for this incident, information about which is outlined below:

Date/Time Reported: 10/15/14 15:51
Problem: Clogged storm drain
Location: At or near CIMARRON and LA MADRE (Lat: 36.25179, Long: -115.26974)
Comment: HOA: Aviana Association, clogged drain, will there be cleaning or a new drain installed. Waters continually back up to the properties. Contact: Kim Sand @ 702.880.4632

If you are not the correct person to assist with this issue please pass this along to the appropriate person or department. If you have any questions about this system or the incident mentioned above, please contact us at 702-685-0000 or via return e-mail.

Thank you for your kind assistance.

RFCD Citizen Contact Tracking System

- D.7 - Meeting Minutes

Project: Gowan North Buffalo Branch – Lone Mountain to Washburn
Purpose: Kickoff Meeting
Date: Wednesday August 20, 2014
Time: 2:00 PM

Location: City of Las Vegas
DSC 9th Floor Granite Conference Room

Attendance: Mike Sturdivant, City of Las Vegas
Jeremy Leavitt, City of Las Vegas
Tim Parks, City of Las Vegas
Bill Snyder, City of Las Vegas (ROW)
Oh-Sang Kwon, City of Las Vegas
Sherri McMahon, City of Las Vegas (Environmental)
Mike Kinney, City of Las Vegas (Survey)
Todd Myers, Regional Flood Control District
James Marrs, PB
Nicholas Appuglise, PB
Jessica Schick, PB
Eric Hsu, PB

DISCUSSION ITEMS

This kickoff meeting was held to introduce PB's design team to City of Las Vegas (CLV) staff involved on the project. The meeting also was held to give a project overview, a status update for what has been completed at this time, what is expected to be completed for the 15% alternative analysis submittal, to go over the projected schedule for future submittal deadlines, and to discuss any questions any attendees may have regarding the project.

Three 24" x 36" exhibits were presented at the meeting which showed the project area. One exhibit showed the existing and proposed Las Vegas Valley Flood Control Master Plan Update (MPU) facilities and their respective basins. Another exhibit showed the topography of the area based on survey and aerial footage received by PB's sub-consultant. The third exhibit showed which areas within the project study limits are within CLV and which are in Clark County, along with the three conceptual alignments for the alternative analysis.

Hydrology

The GC Wallace Drainage Study, which will be referenced for the Buffalo Drive Design, was completed in 1999. In 2008 the MPU updated land use values throughout the valley. The current 2014 MPU land uses will be utilized for this design, which means the HEC-1 analysis and hydrology design from the GC

Wallace study will need to be updated accordingly. This update creates higher peak flow to be collected by the Buffalo Drive storm drain as well as the Gowan Detention Basin south of the project area.

Jessica asked Todd if Regional Flood Control CLV and County boundaries would be a factor in the selection of the alignment of the proposed storm drain facility. Todd said this is not a major factor in selecting the storm drain alignment.

Jessica mentioned having storm drain laterals on Conough Lane and/or Cimarron Road would allow for better protection of the houses along those corridors.

Todd mentioned that Buffalo Drive will not be upgraded with curb and gutter unless major residential development is completed. The County will not likely fund a “complete streets” design of Buffalo Drive.

Jessica mentioned that the project area has a very flat north to south slope and the east to west slope is steeper, as seen on the aerial survey exhibit. Placing the storm drain on Buffalo Drive, the north-south MPU alignment, may result in design issues meeting minimum cover requirements and/or may require a larger facility. Alternatives to the MPU alignment are being considered that will utilize the steeper east-west slope within the project area and potentially provide more protection to properties to the west of Buffalo Drive. Jessica also mentioned that a larger facility may create issues at the connection to the existing MPU facility in the intersection of Buffalo Drive and Lone Mountain Road. It may be favorable to choose a storm drain alignment that does not use Buffalo Drive. These are some of the considerations that will go into selecting the alignment.

The MPU facility on Buffalo Drive, including all portions south of Lone Mountain Road that drain to the Gowan Detention Basin, are sized based on ultimate conditions of the area. There is a proposed MPU facility on El Capitan Way that will collect offsite flow and transfer it south, away from the Buffalo Drive storm drain facility. It was asked if the Buffalo Drive facility is expected to have the capacity to carry the interim condition flows, where the El Capitan MPU facility is not in place. Todd said that the Buffalo Drive facility should have the capacity to carry the ultimate conditions flows, not the interim condition flows. The Buffalo Drive system should be analyzed for the impacts to it during interim condition, however, and if there is the possibility to place extra inlets within the project alignment to maximize the flow intake into the system, that should be considered.

Utility

Tim mentioned there may be the need to have a city/county special improvement district (SID) being placed on the properties in the area due to improvements made in the area being paid for by the city/county. This will be something discussed at a later date.

Tim said there is a proposed sewer line that is planned to be placed on Lone Mountain Road, west of Buffalo Drive, which is not planned to be constructed until after the construction of the Buffalo Drive storm drain. PB will consider the sewer line's proposed location, size, and depth in the alternative

analysis of storm drain alignment alternatives on Lone Mountain Road. There was discussion that one of the benefits of placing the storm drain alignment along Lone Mountain Road is that both the proposed sanitary sewer line and storm drain line could be trenched simultaneously to save on construction costs. However, the timing of these projects is not likely to coincide.

Inlets

Todd and Mike said the NDOT Type 2B inlet is the preferred inlet to be used in a rural setting, as it has an opening small enough to keep from being a hazard to a person walking nearby, yet collects enough storm water to be efficient. Jeremy said the type 2A inlet is hazardous to pedestrians. Other inlets types are open for discussion.

Todd mentioned it would be more efficient to place proposed inlets at existing curb and gutter locations, if the design warrants. This would minimize inlets from being placed in graded swales, which pose a threat to pedestrians and equestrians in the area.

Oh-Sang mentioned that there are area inlet drains on Rainbow Boulevard, between Grand Teton Drive and Elkhorn Road, which are proving to be ineffective due to dirt and debris clogging them during storm events. It was mentioned that PB will make a site visit to inspect these inlets to analyze possibly how to better utilize this type of inlets for the Buffalo Drive project or how possibly selecting different inlets to use on this project would be beneficial.

Storm Drain

Currently there is an 8' x 3' reinforced concrete box (RCB) at the intersection of Buffalo Drive and Lone Mountain Road that connects to the existing 11' x 5' RCB in Buffalo Drive. The 8' x 3' RCB will most likely need to be resized to accommodate the Buffalo Drive storm drain MPU facility. This RCB is believed to have been made this size due to a utility conflict present when it was constructed, as well as there being minimum vertical clearance between the RCB and finish grade.

Jessica mentioned a Master Plan Amendment (MPA) would be needed if an alignment other than Buffalo Drive is selected in the alternative analysis report. Preparation of the MPA would be covered in additional services.

Todd mentioned the best way to determine the best alternative alignment is to have a group meeting between CLV and PB and to go over PB's findings and recommendations of the alternatives to make a qualitative decision. Tim added that CLV has created a matrix on a previous project on where specific items and factors were rated on a 1 to 10 scale, which was an effective tool in deciding alternative designs. Tim said he would send Mike a copy of the matrix.

Todd mentioned he would like to see PB's suggestion on a best alternative and that if that alternative is more costly than the others, it still will be considered because the main goal of this project is to collect

as much storm water as efficiently as possible. He said a quantity analysis will not factor in heavily on deciding the best alternative. The goal is to provide the most effective and efficient design.

Right of Way

Jessica mentioned that some homeowners in the area have made improvements in public right-of-way (ROW), including paved driveways with small culverts underneath, to allow storm water to flow past their property, mail boxes and other aesthetic improvements. She asked how this would affect hydrology design and ROW concerns. Oh-Sang said that if any property is disturbed during construction CLV will replace in kind. Todd added that for hydrology analysis if any property improvements affect the flow of water in the street, that will be reviewed as needed.

At this point in time, additional ROW or easements are not anticipated.

Miscellaneous

Todd mentioned that the County does not allow rip rap within ROW.

Additional survey and geotechnical data will be obtained from PB's sub consultants once a preferred alignment is selected.

PB's survey sub consultant will need to submit electronic copies of their survey to City of Las Vegas for them to include in their database.

Groundwater is not expected on this project, but if there is, a National Pollution Discharge Elimination System (NPDES) permit may be required.

Action Items

Tim Parks is to be contacted regarding electronic files for sanitary sewer lines that will be sent to PB to include with utility information. He will also provide PB with the approximate size, depth, and horizontal location of the proposed sewer line going in on Lone Mountain Road, west of Buffalo Drive.

A meeting with CLV is planned for September 17 to have an open discussion regarding the alternative analysis and which design alternative will be selected for moving forward with the design.

Next Meeting

2:00 PM Wednesday September 17, 2014

At City of Las Vegas

Project: Gowan North Buffalo Branch – Lone Mountain to Washburn
Purpose: Alternative Analysis Progress Meeting
Date: Wednesday September 17, 2014
Time: 2:00 PM
Location: City of Las Vegas
DSC 9th Floor Gravel Conference Room
Attendance: Mike Sturdivant, City of Las Vegas
Tim Parks, City of Las Vegas
Oh-Sang Kwon, City of Las Vegas
Peter Jackson, City of Las Vegas
James Marrs, PB
Nicholas Appuglise, PB
Jessica Schick, PB

DISCUSSION ITEMS

This meeting was held to discuss the alternative analysis on the Gowan North Buffalo Branch that will be presented in a report for the 15% alternative analysis submittal. The main focus was to discuss the existing drainage patterns, the alternative designs, and to take general questions about the information presented.

Five 24" x 36" exhibits were presented at the meeting which showed the project area. One exhibit showed the Las Vegas Valley Flood Control Master Plan Update (MPU) facilities and their respective MPU basins. The second exhibit showed the topography of the area based on survey and aerial footage received by PB's sub-consultant, as well as showing the drainage basins being revised based on PB study of the contours and street layout in the area. The third exhibit showed the first alternative of having the proposed storm drain facility being located on Buffalo Drive as the MPU suggests. The fourth exhibit showed the second alternative of having the proposed storm drain facility being located along Lone Mountain Road and Cimarron Road. The fifth exhibit showed the third alternative of having the proposed storm drain facility being located along Lone Mountain Road and Conough Lane.

Hydrology

Jessica discussed why the MPU drainage basins have been modified based on PB's preliminary analysis of the area contributing to the proposed storm drain facility. Due to existing valley gutters being present in certain intersections, as well as looking more closely at contours and roadway layout in the area, most the flow goes to Lone Mountain Road and not to Buffalo Drive as the MPU suggests. There was discussion on how the flow on Washburn Road will continue east past Buffalo Drive if not collected at Buffalo Drive and this flow should be considered as to its impact to future and existing systems.

Gowan North Buffalo Branch – Lone Mountain to Washburn

Peter stated that past experience with the larger storm events causes flow to overtop at the Washburn Road and Durango Drive intersection, and continue east past Durango Drive, while leaving sediment on the west side of Durango Drive. Mike noted that in ultimate condition there will be an MPU facility along Durango Drive, between Lone Mountain Road and Ann Road, which will reduce the amount of flow reaching this intersection. As a part of Alternatives Analysis Report, PB will analyze flow volumes and paths based on the MPU basin areas (ultimate condition).

Jessica mentioned flow split calculations will need to be done at certain intersections to accurately analyze how much flow goes east or south. Oh-Sang stated that for the Alternative Analysis Report that half-street capacity calculations will suffice in determining flow splits at intersections. He also stated if a drainage basin needs to be split into smaller basins, rather than updating the HEC-1 models, it would be acceptable to use a ratio of the basin's Q to determine flows at the intersections.

Jessica stated that at this point in the analysis, locating the MPU facility on Lone Mountain Road would be the best alternative. It would allow for inlets to be placed in existing curb and gutter sections and at a frequency to allow for by-pass flow collection. She mentioned that the system should be extended to the Washburn Road and Cimarron Road intersection to collect flows coming from the neighborhood to the northwest. This Lone Mountain Road-Cimarron Road system would allow for flows to be collected sooner, which keeps higher flows from accumulating at other locations in the project site, allows less sediment to transfer, reduces flow velocity, and protects more homes to the east.

Jessica said the GC Wallace Drainage Study for the Improvements for Buffalo Drive showed that more flow was directed to Lone Mountain Road than Buffalo Drive, which is dissimilar to what the MPU basin map suggest. This further supports the alternative of having a facility on Lone Mountain Road.

Peter stated having a facility on Conough Lane would allow for a higher Q value to be collected in the proposed design as opposed to having one on Cimarron Road. Analysis of the Conough Lane alignment is included as one of the alternatives to be analyzed.

Oh-Sang stated a Master Plan Amendment (MPA) will be required if the proposed MPU facility is not on Buffalo Drive as the 2008 MPU shows, and this will need to be supported with hydraulic calculations and data. This will need to be submitted prior to the 90% submittal for approval.

Hydraulics

Nick presented two exhibits showing the profiles of the Lone Mountain Road, Cimarron Road, Conough Lane, and Buffalo Drive proposed storm drain systems. These exhibits showed the amount of cover, slope, size, and maximum flow each system could ideally convey. Nick mentioned the limiting factor on these systems was connecting to the existing storm drain invert at the Buffalo Drive and Lone Mountain Road intersection, as well as the existing slope of the roadways, which limits the slope of the proposed storm drains.

Gowan North Buffalo Branch – Lone Mountain to Washburn

Peter stated as-builts of the existing storm drain system along Lone Mountain Road between Buffalo Drive and Cimarron Road should be requested from the City of Las Vegas or Clark County. This will allow consideration of what system is currently in the road and its impact to the proposed design.

Jessica mentioned the bubbler system located at the north side of the Cimarron Road and Lone Mountain Road intersection. Peter said this system could potentially be removed if the proposed storm drain was placed on Lone Mountain Road up to Cimarron Road. This would allow for a more desirable system than the bubbler.

Peter stated that the main purpose of the storm drain system is to maximize the total collection of flow, to meet the MPU's requirements.

Peter stated the existing corridors will most likely remain rural with side ditches if currently present and will not likely be improved by the County. This means that their capacity will be less than that those with curb, gutter and sidewalk.

Jessica mentioned one of the benefits to the Cimarron Road alignment are the existing curb and gutter.

Peter mentioned that anywhere a proposed facility is put into place, the dry-lane criteria from the Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual needs to be met.

Utility

Tim stated that there is a proposed sanitary sewer line to be placed on Lone Mountain Road at a future date past the expected construction of this project. He said that this must be a consideration in the alternative analysis. A 10 foot wide section, clear of utilities and storm drain improvements in the roadway will be sufficient for construction of the sewer line.

Report

Peter said the Alternative Analysis Report should present the storm drain alternative alignments, designation of which portions are considered MPU facility and which are considered laterals off the MPU facility, and their associated cost. The report should provide a matrix showing each alternative, how much flow is collected, how much is bypassed, the flow split calculations where necessary, and any other data regarding the alternative so as to allow the City of Las Vegas to accurately determine which alternative is best. The best alternative for the MPU system may include facilities on Buffalo Drive and Lone Mountain Road, with laterals at multiple locations.

Peter and Oh-Sang agree inlet efficiency calculations will not be required for the Alternative Analysis Report, but flow splits, using half street capacity calculations, and hydraulics will be completed as appropriate.

Next Meeting

2:00 PM Wednesday October 8, 2014

At City of Las Vegas

Submittal for the 15% Alternative Analysis Report scheduled for October 20.

Project: Gowan North Buffalo Branch – Lone Mountain to Washburn
Purpose: Progress Meeting: Alternative Analysis
Date: Tuesday October 21, 2014
Time: 3:30 PM
Location: City of Las Vegas
DSC 9th Floor Gravel Conference Room
Attendance: Mike Sturdivant, City of Las Vegas
Oh-Sang Kwon, City of Las Vegas
Peter Jackson, City of Las Vegas
Todd Myers, Regional Flood Control District
James Marrs, PB
Nicholas Appuglise, PB
Jessica Schick, PB

DISCUSSION ITEMS

This meeting was held to discuss the alternative analysis for the Gowan North Buffalo Branch MPU facility that will be presented in a report for the 15% alternative analysis submittal. The main focus was to discuss the preferred alternative of the three alternatives that are to be presented in the report.

Jessica provided an update of the flow patterns within the project watershed. An updated basin exhibit was presented showing subbasins and flow splits. It is essential to collect flow on Washburn Road, which currently continues east on Washburn Road, across Buffalo Drive and out of the MPU watershed boundary.

Jessica discussed how there is flow from outside of the MPU watershed boundary that contributes to the project watershed via a 4' x 2' reinforced concrete box (RCB) located at the southwest corner of Durango Drive and Lone Mountain Road. This RCB collects water from Mountain Crest Park. The as-built obtained shows 48 cfs being collected by the 4' x 2' RCB for the 100-year event. This flow will be considered when designing the proposed storm drain facility.

Jessica presented the city with a handout of photos that were taken in the field during a recent storm event. These photos illustrate some of the flooding concerns within the project limits. The main areas of concern and issues discussed are:

- There is a bubbler system located on the north side of Lone Mountain Road at the intersection of Lone Mountain Road and Cimarron Road, which causes major flooding at the intersection. A citizen's complaint was submitted to RFCD pertaining flooding in this area.

- The street capacity on Lone Mountain Road is limited on the north side of the street, causing dry lane criteria to be of concern. Most of the water in larger storm events weirs over to the south side of street.
- Ponding at the intersection of La Madre Way and Conough Lane is a recurring problem during minor storm events. A storm drain facility on Conough Lane would alleviate flooding at this intersection and could be extended north to collect flows on Washburn Road.
- Dry lane is of potential concern on Lone Mountain Road between Cimarron Road and Durango Drive. It was mentioned that if the proposed MPU facility is placed on Lone Mountain Road, it could be extended in the future to capture flow between Cimarron Road and Durango Drive to meet dry lane criteria. This would also provide for connectivity of the existing and future storm drain facilities within Lone Mountain Road and Durango Drive.

Jessica also presented a summary of the existing drainage facilities within the project limits. There are two key items. First, the existing MPU facility on Buffalo Road, south of Lone Mountain Road has the capacity to convey the 470 cfs generated within the project watershed. Second, the existing drop inlets on Lone Mountain Road just west of Buffalo Road are sized to collect most of the 100-year flows on Lone Mountain Road. However, they do not address the dry lane criteria on Lone Mountain Road west of the inlets or the flooding issues along Lone Mountain Road or Conough Lane.

Jessica presented a handout containing preliminary construction cost estimates for the three alternatives under consideration. She also stated that these estimates were only for the MPU facility trunkline and the cost does not include other factors contributing to project costs such as inlets, lateral systems, transition structures, removals, utility relocation, etc. Oh Sang stated that the cost estimates would need to be prepared using the Regional construction cost estimating tool for the Master Plan Amendment.

After the presentation and discussion of the existing flow patterns and other factors within the basin limits, alternatives under consideration were briefly discussed and the Conough Lane alignment was recommended to be the alternative selected to move forward to design. The Conough Lane alignment begins at Buffalo Drive and extends west on Lone Mountain Road to Conough Lane. At Conough Lane the alignment turn north and continues on to Washburn Road. Quarter mile lateral extensions would be placed on Lone Mountain Road from Conough Lane to Cimarron Road, and on Washburn Road from Conough Lane up to Cimarron Road or as needed. All meeting attendees concurred with the recommendation in that it addressed the issues present in the watershed and would collect flows equal to the capacity of the existing downstream MPU facility.

Todd noted that a Master Plan Amendment or Master Plan Change would be needed for the Conough Lane alternative.

James said it would be beneficial to send out a geotechnical crew to the field to begin the soil study after this meeting, so that PB could have the data back to include in the 30% design submittal. Mike

agreed that this was acceptable with the high confidence level of the selection of the proposed MPU alignment, based on the discussion at this meeting.

Todd said the MPU storm drain facility could be designed based on the flows calculated within HEC-1 for the large scale drainage basins. These large scale basins have longer lag times and the flows closely match what is found in the 2013 MPU. These large scale basins can be broken down to evaluate the drainage pattern by using an area ratio. Todd suggested that the only need to subdivide the basins into smaller sizes and run hydrology calculations with shorter time of concentrations would be for sizing drop inlets. This would allow for a more conservative design, accounting for capture of higher peak flow rates at inlets.

Follow-Up

Oh-Sang will send PB a cost estimator tool to estimate the cost of the proposed facility.

The 15% Alternative Analysis Report will be submitted to City of Las Vegas within the next 2 to 3 weeks.

Project: Gowan North Buffalo Branch – Lone Mountain to Washburn
Purpose: Progress Meeting: 30% Submittal
Date: Wednesday April 8, 2015
Time: 2:30 PM
Location: City of Las Vegas
DSC 9th Floor Gravel Conference Room
Attendance: Mike Sturdivant, City of Las Vegas
Peter Jackson, City of Las Vegas
Tim Parks, City of Las Vegas
Todd Myers, Regional Flood Control District
James Marrs, PB
Nicholas Appuglise, PB
Jessica Schick, PB

DISCUSSION ITEMS

Jessica opened the meeting by discussing that the final geotechnical report has been completed, utility information has been collected, and survey data has been received from the sub-consultant.

Jessica provided an update on the hydrology and hydraulic design of the project, which included inlet calculations, trunkline hydraulics, and lateral hydraulics. Two basin map exhibits were presented to illustrate the major basin watershed areas and the minor basin watershed areas. Also presented were the most current set of plan and profile sheets of the storm drain system.

Todd says in locations where curvilinear pipe is to be used for the main storm drain trunkline, beveled pipe should be used in lieu of pulled joints.

Tim discussed how the future sanitary sewer line that will be constructed in Lone Mountain Road will go under the proposed Gowan North Buffalo Branch storm drain system at the intersection of Lone Mountain Road and Buffalo Drive. The sanitary sewer system will run deep and it will be jack and bored through the intersection. Tim says he is more concerned with the neighborhood sewer tie-in locations to the proposed sanitary sewer system than it having a conflict with the proposed storm drain system.

Jessica discussed several concerns with utility conflicts along the project and presented a matrix showing potential utility conflicts. At the corner of Lone Mountain Road and Cimarron Road, there is particular concern with an existing 42-inch water line. James mentioned a meeting with Las Vegas Valley Water District to discuss concerns with water utilities at this intersection would be beneficial.

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Peter says it may be better to get potholes of utilities at this intersection prior to others since there are several critical concerns in this area. He said this should be done prior to the 70% submittal and the remaining potholes can be completed at the 70% submittal. However, Mike feels multiple mobilizations for the pothole crew could be expensive. A follow-up on this item is needed.

Peter mentioned it may be best for storm drain laterals connecting into the storm drain system, at the intersection of Lone Mountain Road and Cimarron Road, to not be constructed in the spandrel of the curb returns so as to avoid telephone and power utilities.

Jessica mentioned removing the dual horizontal elliptical storm drain pipe, that cross underneath Cimarron Road and connect to the beehive inlet at the northeast corner of the Lone Mountain Road and Cimarron Road intersection. Peter agreed these pipes will not adequately serve the purpose of the proposed system and a new lateral should be constructed.

Peter confirmed Jessica's comment regarding using a Manning's coefficient of 0.015 for the design of the storm drain. This is a conservative value and would account for the high probability of soil debris being located within the storm drain system based on the type of inlets being used throughout the project and the amount of undeveloped area within the project limits.

Jessica mentioned additional survey may be needed west of the Lone Mountain Road and Cimarron Road intersection due to three curb inlets being proposed at the northwest corner. This would allow for the design to confirm that the placement of these inlets is constructible. Mike agreed this would be a good idea.

Jessica mentioned that the location of a proposed inlet at the northwest corner of Lone Mountain Road and Miller Lane is near a "safe route to school sidewalk". Peter says that this asphalt path must stay in place and replaced if it is damaged during construction.

The 30% design report and plans was discussed to be submitted the first week of May.

- D.8 - Comment Responses

Project:	Gowan North Buffalo Branch – Lone Mountain to Washburn
Submittal:	DRAFT 15% Alternative Alignment Study (LAS24H13)
Comments From:	City of Las Vegas
Comments Received:	Tuesday January 27, 2015
Responses By:	Jessica Schick, CFM
Responses Sent:	Wednesday February 25, 2015

1. Flood Control has reviewed the alternatives and concurs with the Alignment B – Conough Lane alternative as being the most effective drainage solution. Based upon the recommended Alternative, this project will require a Master Plan Amendment (MPA) for the proposed MPU facilities. The MPA needs to be approved prior to the 90% submittal.

Agreed. An MPA will be performed as an additional service.

2. The provided HEC-1 analysis will require further refinement as the design process moves forward to reflect the identified flow splits. A detailed review of the revised HEC-1 analysis will be performed with the next submittal.

Agreed.

The following general comments are informational and will assist with the design process as it moves forward.

3. Provide Flood Control with CCRFCD's acceptance of the Environmental Screening for this project by the 70% submittal.

Noted.

4. Provide a draft WSPG analysis of the recommended system with the 50% submittal based upon the selected storm drain design.

Draft hydraulic calculations will be provided with the 30%submittal.

5. Flow split calculations need to be provided for the identified flow split locations per the HCDDM criteria. Provide additional flow split calculations based upon HEC-1 routing and physical roadway conditions to verify inlet and system parameters.

During the 30% design a more detailed HEC-1 will be developed with diversions and routing to account for the flow splits. Supporting flowsplit calculations will be provided with each submittal.

6. Provide details for the proposed inlet types. Limit the length of the drop inlets to a maximum 20-foot increments. Provide a minimum spacing of twenty feet between inlets.

Noted.

7. Provide detailed grading around the area drop inlets with the 70% submittal that includes; concrete collars, roadway safety markers and grading swales.

Noted.

8. Provide the HGN and Q100 on all profiles with the 70% submittal

Noted.

9. Show the RCB angle points and/or curved segments by station location and angle/degree change. Include the radius information and discuss how the curved sections are to be completed using curved forms or multiple angled segments. This needs to be explained within the Specifications. Thus information is needed to allow for the use of precast RCB's as well as cast in place construction.

Noted.

10. Provide details for the RCB construction. System design needs to determine the construction options of pre-cast or cast-in-place improvements. Verify that the Specifications and schedule accommodate the construction methods proposed.

Noted.

11. Provide access manholes along the RCB at 400-foot spacing to include manholes near the junction structures for maintenance considerations. Consider using manhole openings that are cast with the RCB's to reduce costs.

Noted.

12. Provide inlet calculations as necessary to support the system design

Noted.

13. Provide the lateral and inlet design information to include water and/or sewer relocations with the 70% submittal. Provide the clearance between storm drain and the water & sewer lines. Provide encasement requirements and details.

Noted.

14. The existing and proposed utility crossings of the storm drain must be shown on the storm drain plan and profile sheets and on the lateral profiles by the 70% submittal. Indicate the type of pipe material for water and sewer lines. ACP water lines will require special consideration and handling and must be addressed in the specifications.

Noted.

15. Clearly identify the required utility relocations and which relocations are incidental to and part of the storm drain work.

Noted.

16. Provide separate plan and profiles for any relocated sewer and/or water lines.

Noted.

17. Provide detail sheets showing typical details needed for the construction, connection and any special transition structure details. Structural details, if required, must be submitted by the 90% submittal.

Noted.

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18. Add a note for all storm drain drop inlets that references the newly adopted USDCCA Drawing No. 421 (Stormwater Quality Management Stamp and Sign Detail). Include the UDDCCA Drawing No. 421 (Stormwater Quality Management Stamp and Sign Detail) note to the concrete collar detail for the NDOT Type 2B inlets.

Noted.

19. Provide pothole data with the 70% submittal. The pothole information should identify the bottom limits of conduit bank crossings and show the limits of concrete encasement where applicable.

Noted.

20. Provide an updated detailed cost estimate with each submittal for review. Reduce the contingency to 10% by the 7% submittal. The cost estimate must be refined prior to the 90% submittal and request for construction funding to assure that the requested and allocated storm drain funds are sufficient for construction.

Noted.

21. The final design report shall include an electronic copy of the entire report with the input and output files for they hydraulics and hydrology.

Noted.

Project:	Gowan North Buffalo Branch – Lone Mountain to Washburn
Submittal:	DRAFT 15% Alternative Alignment Study (LAS24H13)
Comments From:	CCRFCD
Comments Received:	Wednesday February 11, 2015
Responses By:	Jessica Schick, CFM
Responses Sent:	Wednesday February 25, 2015

General

1. District has reviewed and concurs that “Alignment B – Conough” is the most effective facility alignment, as recommended in the Report.
Noted
2. Please prepare a Master Plan Amendment (MPA) for the proposed alignment to be presented to the District Technical Advisory Committee, Citizens Advisory Committee, and Board for approval/adoption prior to 90% submittal.
Agreed
3. Complete a facility-specific environmental analysis (Section 8) in accordance with Chapter 8 of District’s *Supplemental Programmatic Environmental Impact Statement, Clark County Regional Flood Control District, 2002 Master Plan Update, September 2004*. Submit analysis to District for review prior to funding request for construction.
PB will complete a facility specific preliminary screening according to the procedures outlined in Chapter 8 of the District’s SEIS.
4. Please address the following with the 30% submittal:

Report

5. Section 2.6: The report states that the existing Lone Mountain Road System connects to GOBU 0136. How does the 60-inch RCP drain under existing conditions? Does it outlet to surface flow or connect to GOBU 0085? Likewise, the report states that the existing 8’ x 3’ RCB in Buffalo Drive “...continues south on Buffalo Drive.” Where does this system discharge? A separate figure just showing local storm drains relevant to the project would be helpful.
Section 2.6 will be revised and a figure showing existing local facilities will be provided with the 30% submittal.
6. Section 7: The Report focuses on several weighting factors to determine the most efficient alternative. These factors include Capture Efficiency (highest weight), street spread criteria, local drainage issues...etc. The Capture Efficiency factor focuses on drop inlet efficiency. After

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reviewing the hydrology, and split flow analysis it becomes more apparent that the flow patterns should be the main consideration in the decision. The 2013 panning level hydrologic analysis does not consider the flow splits. The detailed analysis presented in this report determines that the majority of flow impacting the Buffalo and Lone Mountain intersection is conveyed from the west in Lone Mountain. Therefore, the strongest basis for amending the mainline alignment is the actual flow patterns determined in the detailed hydrologic analyses. Consider revising the Capture Efficiency factor write up to emphasize the flow patterns...it's easier to capture the flow if we put the system where the flow is.

Agreed. The Capture Efficiency write up will be revised with the final submittal of the 15% Alternative Alignment Study to better highlight the strongest deciding facture, which is the flow pattern.

Hydrology

7. Provide a refined HEC-1 analysis that includes the smaller localized sub-basins to be utilized for flow splits and drop inlet/lateral sizing. The larger regional analysis presented in the report should be used to size mainline.

Agreed.

8. Format the HEC-1 output so columns line up and can be easily read.

Agreed.

Appendix E – CD

- E.1 - Drop Inlet Flowmaster Output
- E.2 - Street Capacity Flowmaster Output