DRAINAGE STUDY
FOR
MONTEREY PARK SUBDIVISION

OCTOBER 14, 2002

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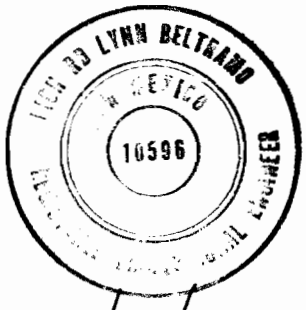

Prepared by:

Rick L. Beltramo, P.E. Date 10/21/02

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I. INTRODUCTION

This drainage study establishes a drainage management plan for the proposed development of the property legally described as Parcel C of the Fineland Development. Monterey Park is approximately 10.5 acres of residential (R-LT) zoned land to be re-subdivided as the "Monterey Park Subdivision". The subject property is located on Albuquerque's northwest mesa, east of Unser Blvd. and north of McMahon Blvd. (see vicinity map on the preliminary plat for location, **Plate 1**). Monterey Park is planned to consist of 65 single-family, residential dwellings.

This study provides hydrologic and hydraulic analysis and provides a drainage management plan as necessary to support the planned 65-unit development. More specifically, this report is submitted in conjunction with the preliminary plat application. Preliminary plat approval and grading plan approval is requested. Prior to final plat and building permit approvals of this project, the City of Albuquerque (COA) must approve final grading plans and work order construction plans.

II. METHODOLOGY

Existing and proposed site hydrological conditions were analyzed for the 100-year, 6-hour storm in accordance with the revised Section 22.2, Hydrology, of the Development Process Manual (DPM) for the City of Albuquerque, dated January 1993. Street capacities were analyzed using Manning's equation, consistent with the revised DPM Section 22.2. All data and calculations supporting this study are located in Appendix B. The new rational method hydrologic procedures identified within the revised DPM Section 22.2 are utilized to determine peak flow rates for design of the storm drainage improvements within the project. The 100-year, 6-hour storm is used as the design event. The results are included in Appendix A.

III. EXISTING CONDITIONS

A. Topography

Monterey Park is currently undeveloped land, sloping from southwest to northeast with grades ranging from approximately 2% to 4%. Soils consist of deep, well-drained loamy fine sands typical of the West Mesa. Vegetation is light and consists mostly of native grasses and sand sagebrush.

B. Existing Drainage Patterns

Monterey Park is located within the Black Arroyo Drainage Basin and will indirectly flow into the Black Arroyo. Adjacent properties and/or public roadways have been constructed which effectively intercept all of the potential off-site runoff. Flows from McMahon Blvd. will be obstructed by a water block placed at the entrance of Monterey Park Drive. The Stonebridge Subdivision, an adjacent property located on the east side of Monterey Park, slopes in an easterly direction away from the proposed site. Properties on the north and west side will be designed to flow away from the Monterey Park Subdivision.

The development of this subdivision is consistent with the intent of the drainage studies for the Tuscany and Stonebridge subdivisions. The existing Stonebridge subdivision is designed to accommodate a specified amount of runoff from Monterey Park and McMahon Blvd.

IV. LAND TREATMENTS

The minimum lot dimensions are 100' x 46'. The percent impervious was determined by measuring respective subareas of the subdivision. Calculations for determination of land treatment percentages are included in Appendix A and incorporated into the AHYMO analysis.

V. PROPOSED CONDITIONS

Monterey Park Subdivision is a proposed single-family, detached-unit residential development with 65 lots on 10.5 acres, producing a density of approximately 6.2 dwelling units per acre. Proposed street configurations are shown on the Preliminary Plat (See **Plate 1**).

A. Onsite Flows

The internal street system conveys flow north into Crooked Creek Avenue. A concrete rundown will connect flows from Monterey Bay Court to the north end of Monterey Pier Drive. This rundown is designed to safely convey flows without damaging or flooding the adjacent lots. A detailed analysis of the rundown is included in Appendix B.

All developed runoff generated by the Monterey Park Subdivision drains toward Crooked Creek Avenue located at the northeast corner of the site. Crooked Creek Avenue continues east into the Stonebridge Unit 2 Subdivision. The flow will be distributed into the internal street system and conveyed by the existing storm drain. A portion of the flow will contribute to an existing surge pond. The remainder will outfall indirectly to the Black Arroyo. Installation of a concrete rundown on Corundum Court is the only required infrastructure improvement to safely accommodate the addition of flows from Monterey Park Subdivision. A more detailed analysis is provided in Appendix C.

B. Offsite Flows

There will be no offsite flows affecting the Monterey Park Subdivision. This is mostly due to the overall elevation of Monterey Park in comparison with surrounding properties. A water block placed at the proposed entrance of Monterey Park Drive will prevent runoff from McMahon Blvd. In addition, the site slopes from west to east, therefore, no runoff from the east is possible.

C. FEMA Floodplain

The property does not lie within a flood hazard zone, as designated on Panel 104 of 825 of the National Flood Insurance Program, Flood Insurance Rate Map published by FEMA for Bernalillo County, New Mexico (September 20, 1996). See the FEMA Floodplain exhibit provided at the end of the report text.

VI. CONCLUSION

This report provides a detailed study of the developed runoff and street capacities for the proposed Monterey Park Subdivision. Included is the preliminary plat, proposed conditions basin map, grading plan, infrastructure list, and all necessary hydrologic and hydraulic analyses. This drainage plan maintains the overall drainage pattern of the area as proposed in "Stonebridge Drainage Master Plan", and allows for safe management of storm runoff in permanent as well as interim conditions.

MONTEREY PARK SUBDIVISION

DETERMINATION OF LAND TREATMENT PERCENTAGES FOR RESIDENTIAL AREAS
(USED FOR BASINS A, B, AND C) Ref: Basin Map

(1) Lots
Minimum Lot Dimensions: 46'x100'
Total Lots = 65
Total Lot Area = 6.86 acres
Total Impervious Area = 3.94 acres
Percent A=0
Percent B=42.6
Percent C=0
Percent D=57.4

(2) Misc. Lot Areas
(Represents Extra Large Lots)
Total Area = 1.42 acres
Percent A=0
Percent B=100
Percent C=0
Percent D=0

(3) Right-of-Way
Total Area = 2.25 acres
Percent A=0
Percent B=10
Percent C=0
Percent D=90

Cumulative Percentages for Residential Areas
Total Area of Subdivision = 10.53 acres

$$\frac{6.86}{10.53}(57.4)+\frac{1.42}{10.53}(0)+\frac{2.25}{10.53}(90)\Rightarrow\Rightarrow Percent D=57$$

Percent A = 0
Percent B = 43
Percent C = 0.0
Percent D = 57

```
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*                    OUTUPUT FILE NAME:  MONTEREY.OUT
*                    PROJECT NUMBER:  030067
*                    COMMENTS:     100 YEAR-6 HOUR STORM
S
S ////////////////////////////////////////////////////////////////////////
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                     RAIN DAY=2.66 IN    DT=0.03333 HRS
**************************************************************************
**************************************************************************
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FINISH
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COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION

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S DATE: September 13, 2002
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S OUTUPUT FILE NAME: MONTEREY.OUT
S PROJECT NUMBER: 030067
S COMMENTS: 100 YEAR-6 HOUR STORM
*S
*S //

START										TIME= .00
RAINFALL TYPE= 1										RAIN6= 2.200
*S**********										
*S	BASIN A									
COMPUTE NM HYD	A	-	1	.00370	7.97	.278	1.40730	1.500	3.365	PER IMP= 57.00
*S**********										
*S	BASIN C									
COMPUTE NM HYD	C	-	2	.00714	15.36	.536	1.40730	1.500	3.362	PER IMP= 57.00
*S**********										
*S	ADD BASINS A AND C									
ADD HYD	A.C	1&	2 3	.01084	23.33	.814	1.40725	1.500	3.363	
*S**********										
*S	BASIN B									
COMPUTE NM HYD	B	-	4	.00562	12.10	.422	1.40730	1.500	3.363	PER IMP= 57.00
*S**********										
*S	ADD BASIN B WITH A AND C									
ADD HYD	TOTAL	4&	3 5	.01646	35.43	1.235	1.40725	1.500	3.363	
*S**********										
FINISH										

MONTEREY PARK SUBDIVISION
Internal Street Capacity Calculations
October 8, 2002

1. Monterey Cove Avenue

Basin A (See Basin Map)
S = 6.06%
Q = 6.1 cfs

Total flow from Basin A is 8.0 cfs. The contributing area from Monterey Cove Avenue west of Monterey Pier Drive is about 77% of the total Basin A area. Therefore, runoff from this area is 6.1 cfs.

At 6.06%, a road with mountable curb can handle 6.1 cfs. Therefore, no inlets are needed. Roll curb will be placed along the entire length of Monterey Cove Avenue. See PC stream output. Water flows into Monterey Pier Drive.

2. Monterey Bay Court

Basin B (See Basin Map)
S = 2.86%
Q = 4 cfs

Total flow from Basin B is 12.1 cfs. The contributing area from Monterey Bay Court at 2.86% slope is about 33% of the total Basin B area. Therefore, runoff from this area is 4 cfs. Roll curb will be placed along this portion of Monterey Bay Court.

3. Monterey Bay Court

Basin B (See Basin Map)
S = 6.08%
Q = 12.1 cfs

At 6.08%, a road with standard curb can handle 17 cfs. Therefore, no inlets are needed. However, standard curb will need to be placed at lot 8. See PC stream output. Water will flow north into a concrete rundown located at the end of the cul-de-sac.

4. Monterey Pier Drive

Basin C (See Basin Map)
S = 2.15%
Q = 23.4 cfs

At 2.15%, a road with standard curb can handle 33 cfs. Therefore, no inlets are needed. Standard curb will be placed along the entire length of Monterey Pier Drive. See PC stream output. Water will flow east into Crooked Creek Avenue.

5. Crooked Creek Avenue

Basin C (See Basin Map)
S = 1.88%
Q = 35.5 cfs

At 1.88%, a road with standard curb can handle 36 cfs. Therefore, no inlets are needed. See PC stream output. Water will flow east into the Stonebridge Subdivision.

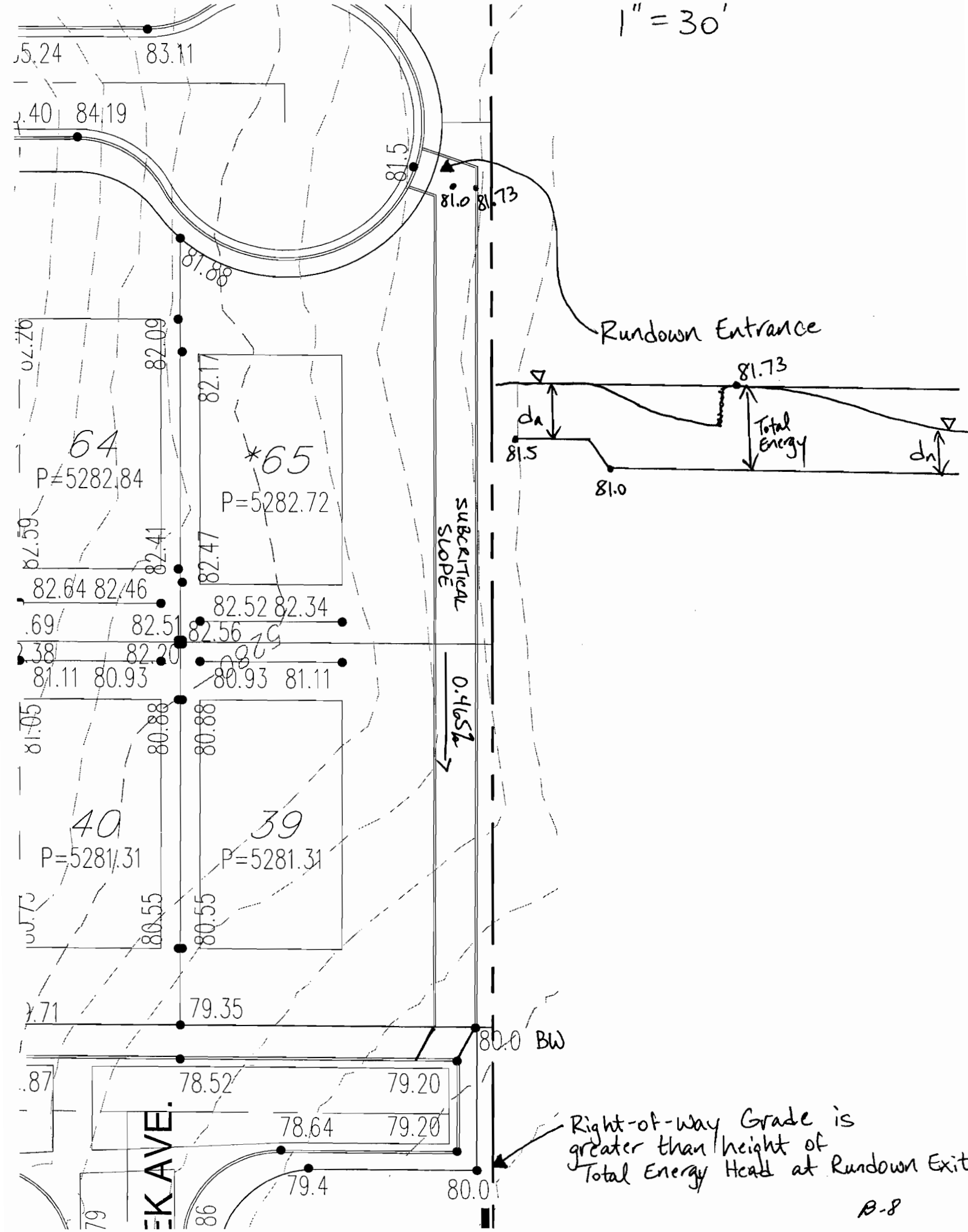
MONTEREY PARK SUBDIVISION
Analysis of Rundown

A concrete rundown connects flows from the cul-de-sac of Monterey Bay Court to the north end of Monterey Pier Drive. (Please refer to the diagram on the following page). The entrance of the rundown will coincide with the low point of the cul-de-sac and exist as a sump inlet. From the AHYMO analysis, the total flow from the Monterey Bay Court basin is 12.1 cfs. Using the broad-crested weir equation:

$$Q = CLH^{3/2}$$

where C=2.7, L=10 ft, and H=0.67 ft; the rundown inlet can accommodate 14.8 cfs. At this point, the normal depth and total energy head is calculated. (Please refer to the PC Stream Output). A hydraulic jump is anticipated to occur at this point due to the rapid change in slopes. To fully contain the flow, the bottom of the channel will drop down 0.5 feet and the height of the wall will then be 0.73 ft. This height is slightly greater than the total energy head and does allow for a few inches of freeboard.

The rundown channel will continue east at a subcritical slope of 0.465%. The channel discharges directly into Monterey Pier Drive. To ensure that this discharge does not flood or damage any property, the right-of-way grade across the street is higher than the total energy head at the rundown exit.


1" = 30'
83.11
84.19
81.5
81.0
81.73
87.88
Rundown Entrance
81.73
da
Total Energy
dn
81.5
81.0
82.09
82.11
64
P=5282.84
*65
P=5282.72
82.41
82.47
82.64 82.46
82.52 82.34
82.51
82.56
82.20
81.11 80.93
80.93 81.11
SUBCRITICAL SLOPE
0.46%
80.88
80.88
40
P=5281.31
39
P=5281.31
80.55
80.55
79.35
80.0 BW
78.52
79.20
78.64
79.20
EK AVE.
79.4
80.0
Right-of-way Grade is greater than height of Total Energy Head at Rundown Exit

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MONTEREY SUBDIVISION
Street Hydraulic Analysis through Stonebridge Subdivision

1. Crooked Creek Avenue and Stonebrook Place

At this intersection, a total of 35.5 cfs is flowing from the Monterey Subdivision. Stonebrook Place has a slope of 4% through the intersection in a northward direction. (See Stonebrook Place and Crooked Creek Paving Sheets). Crooked Creek continues an eastern slope at 3.9%, however, the east side of the street is approximately 0.4 feet higher than the west side of the intersection. In addition, there is a valley gutter on the west end of Crooked Creek to direct flows north on Stonebrook Place. After using the broad-crested weir equation and considering momentum of the flow from the Monterey Subdivision, it was determined that 30 percent of the flow will continue east to Crooked Creek and 70 percent will turn north on to Stonebrook. Therefore, approximately 11 cfs will continue east on Crooked Creek.

Crooked Creek Avenue has been previously designed to accommodate 17.6 cfs from internal flows and 10 cfs from offsite flows. (See Crooked Creek Utility Sheet). Therefore, the portion of flow from the Monterey Subdivision will be nearly contained by inlets into the existing storm drain. Any excess flows will safely continue east into a surge pond at the end of the road.

2. Feather Rock Place and Stonebrook Place

At this intersection, 24.5 cfs has continued from the Monterey Subdivision. (See Feather Rock Place Paving Sheet). After analyzing the street grades and geometry of this intersection, it was determined that 50 percent of the flow will turn east onto Feather Rock and 50 percent will continue north on Stonebrook. Therefore, approximately 12.2 cfs is added to previously designed flows in Feather Rock which will be carried into the surge pond. However, the existing storm drain can only accommodate an additional 5 cfs from offsite flows. (See Feather Rock Place Utility Sheet). Therefore, a rundown will be installed at the end of this cul-de-sac to carry the remaining 7.2 cfs. This rundown will connect to Corundum Court and contribute flows into the Black Arroyo. (See Corundum Court Paving Sheet).

3. Stonebrook Place

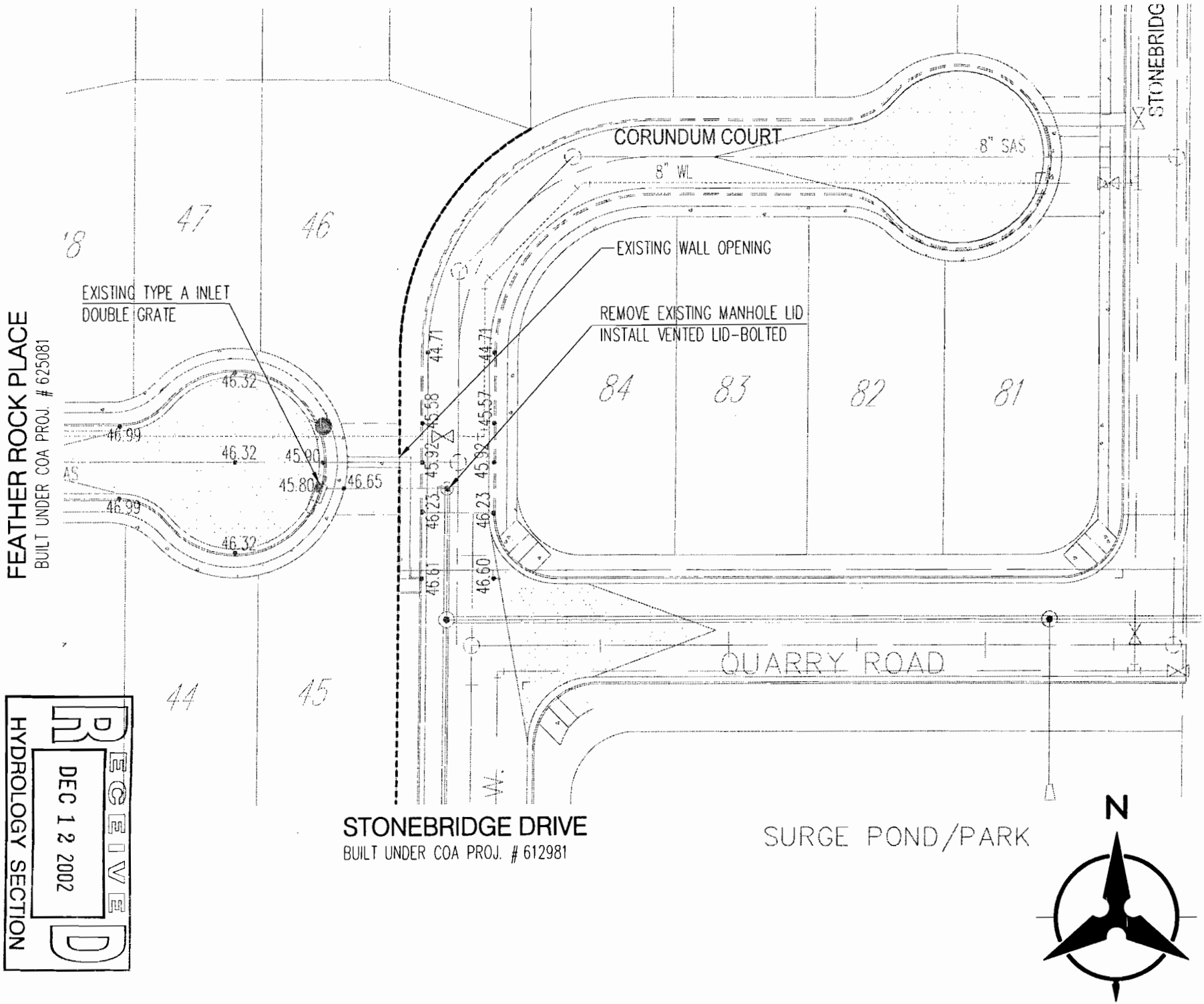
Approximately 12.3 cfs of flow from the Monterey Subdivision will continue north on Stonebrook Place. This amount will be distributed onto Stream Stone Avenue, River Ridge Avenue, and Ridge Rock Avenue. These streets will easily carry such an insignificant amount of runoff, therefore, no further analysis or infrastructure improvements are required.

MONTEREY PARK SUBDIVISION
Hydraulic Analysis through Stonebridge Unit 2 Subdivision
December 2, 2002

The proposed Monterey Park Subdivision will contribute storm runoff into the existing Stonebridge Subdivision and will distribute the flow into the internal street system. As discussed in the drainage study for Monterey Park, an approximate flow rate of 12 cfs will be added to Feather Rock Place. The existing storm drain system in this street is currently at the allowable limit for containing the 100-year design storm. To safely convey the addition of flows from Monterey Park, an improvement is proposed to an existing manhole cover. (Please refer to Feather Rock Plan Sheet) The following storm drain analysis will demonstrate the effectiveness of this improvement.

At the east end of Feather Rock Place, there is an existing sump inlet with a connector pipe into a manhole in Corundum Court. (See attached exhibit of storm drain profile.) The existing hydraulic grade line starts just below the top of curb from Feather Rock Place and ends at the manhole rim elevation in Corundum Court. The new hydraulic grade line can be calculated with two methods. First, the hydraulic grade line is assumed to be constant at the manhole rim elevation of 5245.87. Using a nomograph for connector pipes, the head loss in a 36" concrete pipe with 42 cfs is 0.85'. Therefore, the elevation of the hydraulic grade line at the inlet is 5246.72. The new hydraulic grade line can also be calculated at the inlet using a rating curve. A double grate type A inlet with a flow rate of 42 cfs will add 0.93' of head to the grate elevation of 5245.80. Therefore, the elevation of the hydraulic grade line at the inlet is 5246.73.

The right-of-way elevation at the lowest point of the Feather Rock cul-de-sac is 5246.65. The new hydraulic grade line of the 100-year design storm will exceed the right-of-way by .08'. The recommended solution is to install a vented lid to the existing manhole in Corundum Court. Flows contained within the storm drain will drain into the surge pond at the corner of Stonebridge Drive and Quarry Road. If the flow exceeds the storm drain capacity, it will discharge through the vented lid and surface drain via street flow north into Corundum Court. Should a storm event greater than the capacity of this system occurs in Feather Rock Place, the area between lots 45 and 46 will function as an emergency overflow weir and storm water will flow through the existing wall opening and drain to Corundum Court. In conclusion, the amount of runoff from the Monterey Park Subdivision into Feather Rock Place is insignificant and does not warrant additional infrastructure improvements.


CORUNDUM COURT
8" SAS
8" WL
STONEBRIDG
EXISTING WALL OPENING
EXISTING TYPE A INLET
DOUBLE GRATE
REMOVE EXISTING MANHOLE LID
INSTALL VENTED LID-BOLTED
FEATHER ROCK PLACE
BUILT UNDER COA PROJ. # 625081
QUARRY ROAD
STONEBRIDGE DRIVE
BUILT UNDER COA PROJ. # 612981
SURGE POND/PARK
N
RECEIVED
DEC 12 2002
HYDROLOGY SECTION

Bohannan ▲ Huston INC.

PROJECT NAME STORM DRAIN PROFILE SHEET OF
PROJECT NO. BY DATE
SUBJECT CH'D DATE

ENGINEERING ▲
SPATIAL DATA ▲
ADVANCED TECHNOLOGIES ▲