

DRAINAGE REPORT FOR OXBOW BLUFF SUBDIVISION (TRACT F)

G-11/D14D

BOHANNAN HUSTON

Courtyard One

7500 JEFFERSON NE

Albuquerque

NEW MEXICO 87109

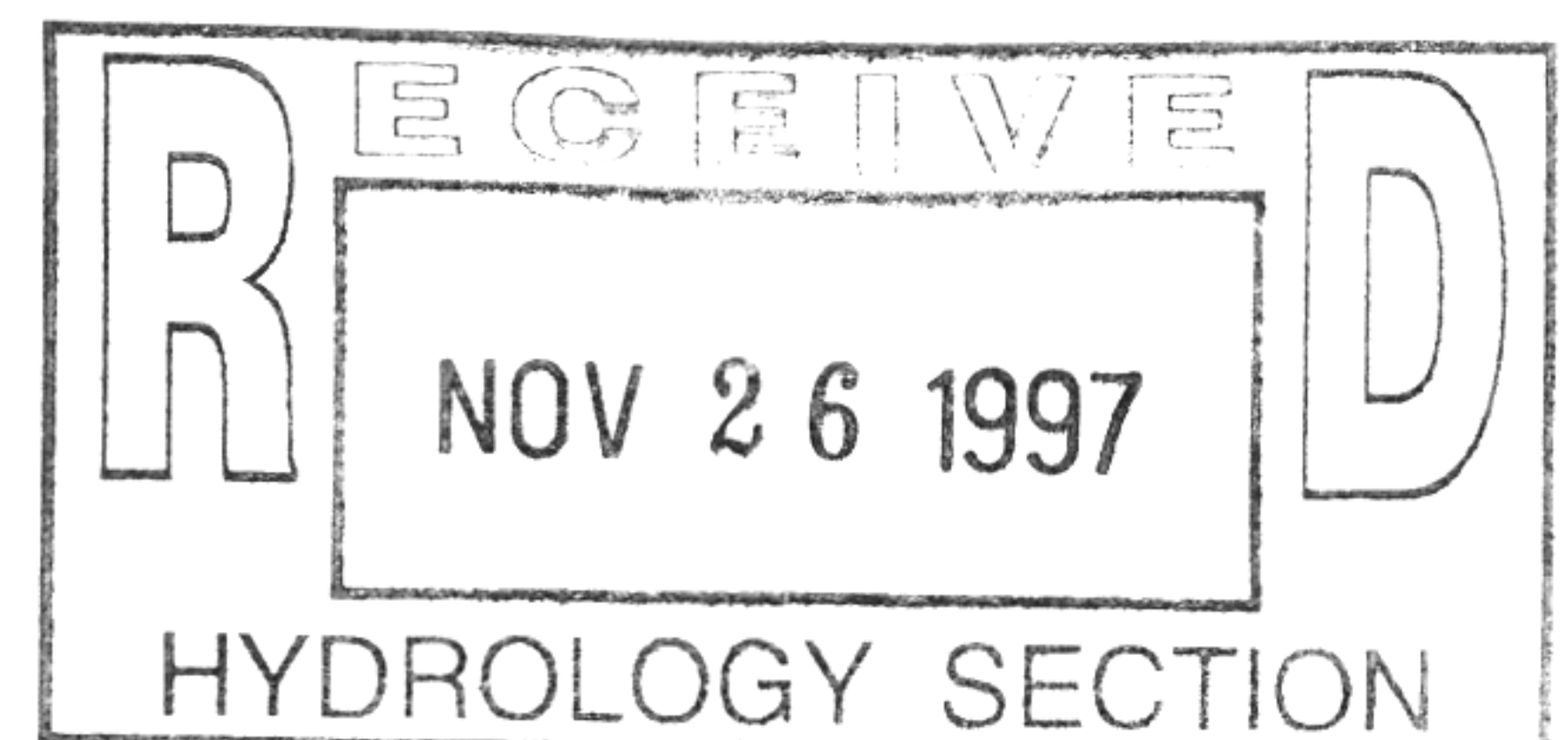
voice 505.823.1000

fax 505.821.0892

NOVEMBER 26, 1997

PREPARED FOR:

**ALTURA WEST LTD
414 SILVER AVENUE SW
SUITE 1100
ALBUQUERQUE, NEW MEXICO 87103**



DRAINAGE INFORMATION SHEET

PROJECT TITLE: Oxbow Bluff Subdivision ZONE ATLAS/DRNG. FILE # G11-D14#D
 DRB #: 97-237 EPC #: Z-96-99 WORK ORDER #: _____
 LEGAL DESCRIPTION: Section 2 and projected Section 2, T10N, R2E, N.M.P.M. and Section 35, T11N, R2E, N.M.P.M.
(Tract F Oxbow)
 CITY ADDRESS: _____

ENGINEERING FIRM: BOHANNAN-HUSTON INC.

ADDRESS: 7500 JEFFERSON NE, ALB. NM 87109

OWNER: Altura West Ltd.

ADDRESS: 414 Silver SW, Suite 1100, Alb. NM 87103

ARCHITECT: _____

ADDRESS: _____

SURVEYOR: _____

ADDRESS: _____

CONTRACTOR: _____

ADDRESS: _____

CONTACT: Kevin Patton

PHONE: (505) 823-1000

CONTACT: Tom Keleher

PHONE: 346-4646

CONTACT: _____

PHONE: _____

CONTACT: _____

PHONE: _____

CONTACT: _____

PHONE: _____

TYPE OF SUBMITTAL:

- ☒ DRAINAGE REPORT
- ☐ DRAINAGE PLAN
- ☒ FINAL GRADING & DRAINAGE PLAN
- ☐ GRADING PLAN
- ☐ EROSION CONTROL PLAN
- ☐ ENGINEER'S CERTIFICATION
- ☐ OTHER

PRE-DESIGN MEETING:

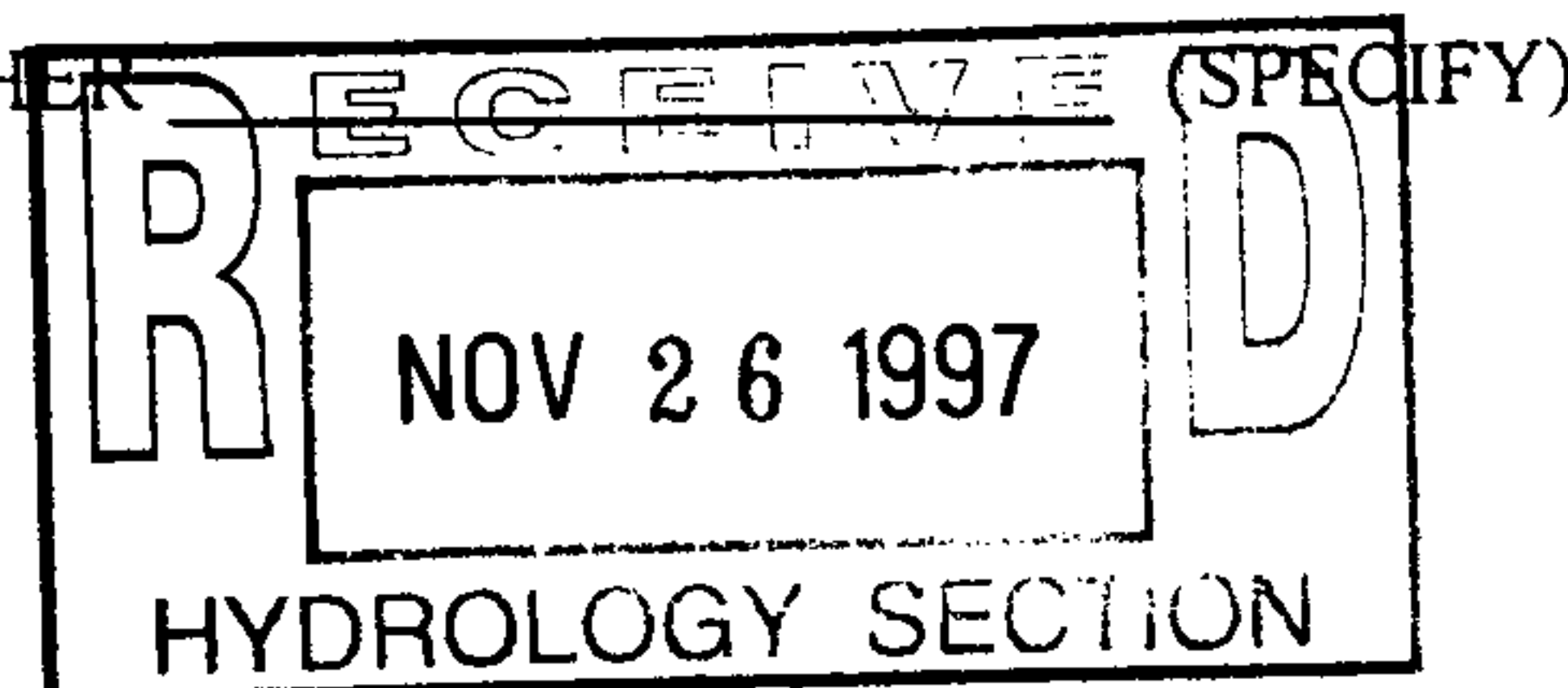
- ☐ YES
- ☐ NO
- ☐ COPY PROVIDED

DATE SUBMITTED: 11/26/97

BY: Kevin Patton

CHECK TYPE OF APPROVAL SOUGHT:

- ☐ SKETCH PLAT APPROVAL
- ☒ PRELIMINARY PLAT APPROVAL
- ☐ S. DEV. PLAN FOR SUB'D. APPROVAL
- ☐ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
- ☐ SECTOR PLAN APPROVAL
- ☒ FINAL PLAT APPROVAL
- ☐ FOUNDATION PERMIT APPROVAL
- ☐ BUILDING PERMIT APPROVAL
- ☐ CERTIFICATE OF OCCUPANCY APPROVAL
- ☒ GRADING PERMIT APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☐ S.A.D. DRAINAGE REPORT
- ☐ DRAINAGE REQUIREMENTS
- ☐ OTHER _____ (SPECIFY)





BOHANNAN HUSTON

Courtyard One

7500 JEFFERSON NE

Albuquerque

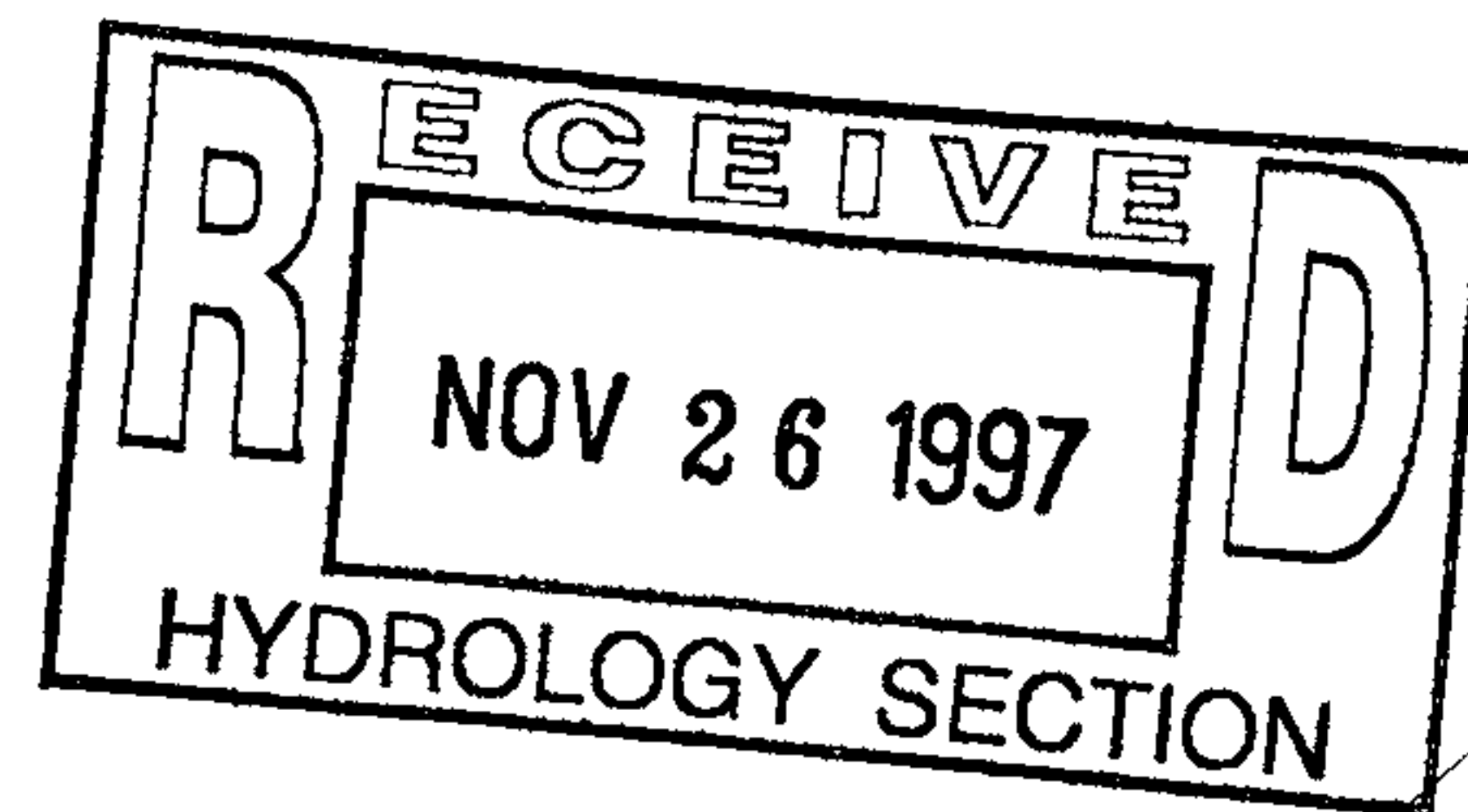
NEW MEXICO 87109

voice 505.823.1000

fax 505.821.0892

November 26, 1997

Lisa Ann Manwill, P.E.
City of Albuquerque
Hydrology Division/PWD
P.O. Box 1293
Albuquerque, NM 87102



Re: Drainage Plan for Oxbow Bluff Subdivision for Preliminary Plat, Final Plat, and Grading and Drainage Approval (COA Drainage File No. ~~G11-D14A~~)

G11/D14D

Dear Lisa:

The purpose of this letter is to respond to your comments and request final approval of the enclosed Drainage Report. Below I have addressed the comments from your letter dated November 18, 1997, and received November 20, 1997.

1. The enclosed site specific drainage report for the Oxbow Bluff Subdivision now refers to the approved Master Drainage Report, dated October 1997 instead of July 1997.
2. The Master Drainage Report (MDR) was first submitted to the City on July 29, 1996. The MDR was again resubmitted to the City to address phasing revisions on July 25, 1997. It was then again resubmitted on October 23, 1997 to address the final comments provided by the City. The enclosed report for the site specific drainage was submitted on October 17, 1997. Thus there is a significant difference in time from the master report's first submittal and the site specific submittal. The paragraph on page 1 points out the minor differences in the master plan verse the site specific plan. The site specific plan has the ability to clearly define the basins with the approved subdivision layout which the master report did not have.
3. The desilting pond within Basin M of this report drains to a storm drain pipe outlet as mentioned in the report. The report has removed any reference to retention ponds; and no developed flows will be retained with this grading plan.
4. Cross lot drainage easements will be required. There is a note on the preliminary plat which reflects this. There is an existing note in the report which reflects this as well.
5. a) Your letter stated that theoretically, the entire building envelope could be consumed by a structure, thus the entire building envelope should be considered "type D" land treatment (or impervious). I would add that this is true for any proposed or existing developed lot within the City. Theoretically an entire lot within the City (with minor exceptions) could be consumed by an impervious area. It would be very difficult to determine whether or not a future lot owner would install a pool or change their landscaping to reflect a new landscaping ordinance. Table A-5 in Section 22.2 of the COA DPM provides a guide in determining impervious land treatment types given the number of units per acre. Tract F is 1.79 du/ac. Table A-5, mentioned above, would suggest an impervious area of 24.4%. The enclosed drainage report has assumed a building envelope which is approximately 70% impervious and 30% non-impervious ("type B"). I believe good engineering reasoning has been made in assuming the land treatment types submitted with the last report.

Ms. Lisa Ann Manwill, P.E.

November 26, 1997

Page 2

5. b) You also suggested that the building envelope took up 75% to 90% of the lot. Our calculations of the worse case of building envelope size to lot size ratio is on lot 19. The building envelope on lot 19 is 57% of the lot area. Far less than 75% to 90%. Altura West Ltd. Co. is in the process of creating restrictive covenants which will establish criteria for the individual lots grading and drainage plan. I am enclosing a copy of a letter recently sent to Fred Aguirre concerning individual lot grading and drainage plan.
6. There are two conditions in which the street is in a sump condition and not considered a cul-de-sac. One at the intersection of Oxbow Drive and Mourning Dove Place and the other on Silvery Minnow Place. Due to the nature of this development and to meet the other City roadway requirements these sump conditions are necessary. Both of these streets have been designed so that the subdivision layout will conform to natural grades without mass grading. The inlet on Oxbow Drive is provided in the sump condition to redirect nuisance flows and the storm water flows will flow down the subdivision entrance street (Mourning Dove Place) and eventually into the storm drain system. The inlet on Silvery Minnow Place has been designed to collect two times the 100-year storm and deliver flows to the storm drain system. The 2% cross-sloped road and a valley gutter will help direct flows into the inlet. These sump conditions are very similar to the ones used in High Desert.
7. Basins "M" and "Q" are slightly detained in the pond within Basin M. The size of the pond is dictated by the weir of the pipe outlet and the pipe size. The underground system is designed for the developed flows from Basin "M". Please refer to the master plan for conformation of future upstream developed flows.
- Basins "O", "P" and "Q" are developed. The enclosed report has removed the word assumed. The basins are existing and reflect the land treatment types calculated.
9. The restrictive covenants will require that the lot owner tie to the existing ground elevation at the building envelope. The existing terrain outside of the building envelopes will remain the same except for the construction of the driveways, public roadways and the conveyance of storm water safety away from each home. Each lot requires a grading and drainage plan, stamped and certified by a New Mexico licensed Professional Engineer, to Altura West Ltd. Co. Please refer to the enclosed letter to Fred Aguirre from Thomas Keleher. Therefore, it is very difficult to provide a finish floor elevation. The report contains a grading plan which provides roadway grades, tie back limits to natural grades as well as storm drain rim and invert elevations.

I have revised the enclosed Drainage Report to reflect the above responses to your comments. Upon your receipt of the revised report I am requesting final approval for preliminary plat, final plat and grading permit. If you have any questions or require additional information please give me a call 823-1000.

Sincerely,
Bohannon Huston

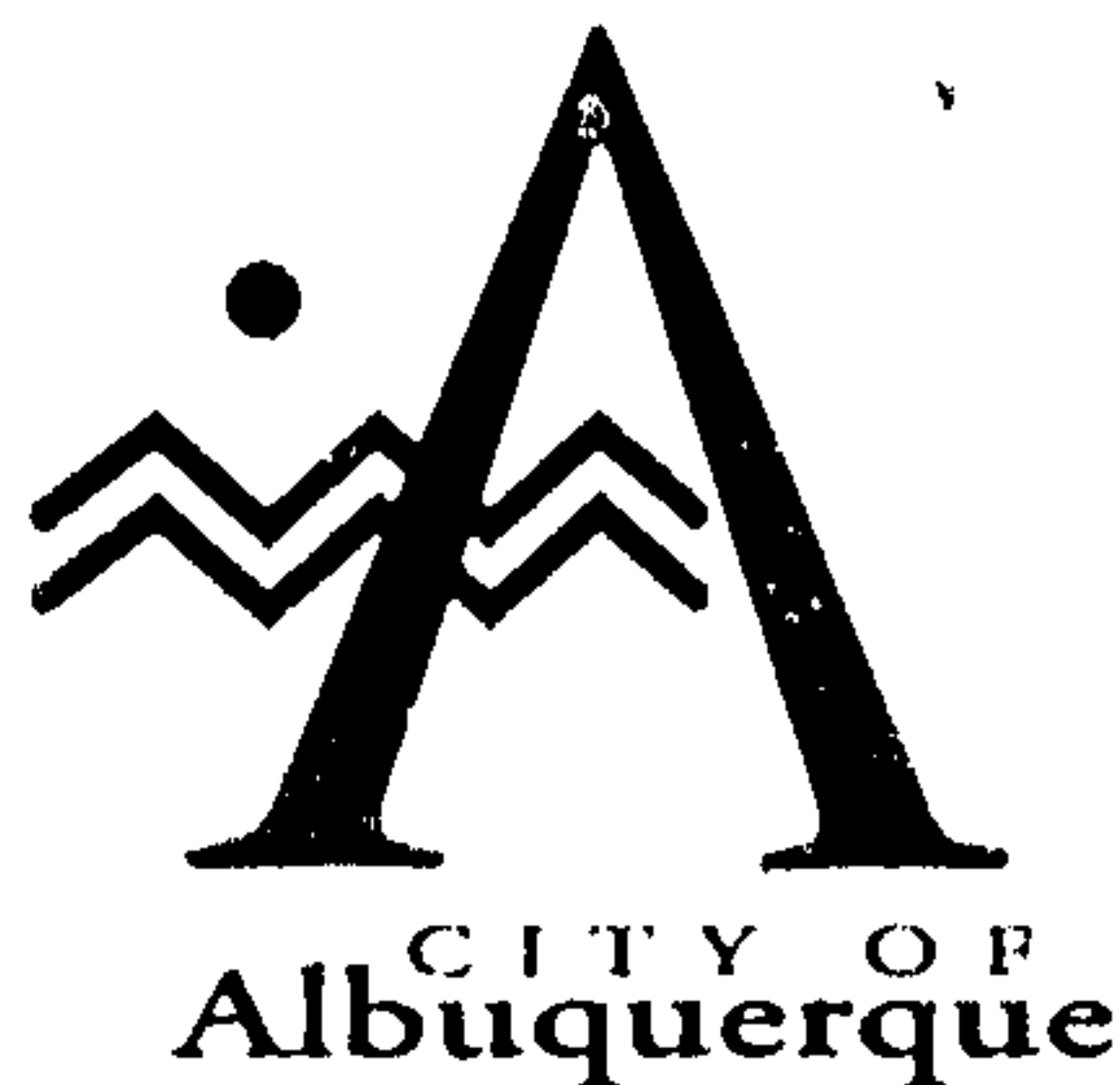
For 
Kevin Patton, P.E.
Project Manager
Community Development and Planning Group

KP/hjh

Enclosure

cc: Tom Keleher, Altura West

upsize pipe
in Mourning
Dove Place
to next inlet
to the sewer
or add overflow
basement. (Public
assessmant previously
maintained)



November 18, 1997

Martin J. Chávez, Mayor

Kevin Patton, P.E.
Bohannon-Huston, Inc
7500 Jefferson Blvd. NE
Albuquerque, NM 87109

611-D14D

**RE: OXBOW BLUFF SUBDIVISION (~~G11-D14A~~). DRAINAGE REPORT SUBMITTAL
FOR PRELIMINARY PLAT, FINAL PLAT, AND GRADING PERMIT
APPROVALS. ENGINEER'S STAMP DATED 10-17-97 Prelim**

Dear Mr. Patton:

Based on the information provided on your October 17, 1997 submittal, City Hydrology has the following comments:

1. On page 1, paragraph 4, refer to the approved master plan dated October 1997.
2. Considering that the master plan and this submittal came in at the same time, there is no reason why this submittal should be different from the master plan (last paragraph on page 1).
3. How do the desilting ponds drain? Developed flow cannot be retained.
4. Cross lot drainage easements will be required.
5. Theoretically, the entire building envelope could be consumed by a structure. The entire building envelope should be considered type "D" land treatment or impervious. The building envelope takes up 75% to 90% of each lot. Because 75% to 90% land treatment type "D" is not feasible, I suggest you come up with an allowable discharge per acre or a maximum pad size. I am concerned that by assuming such low values for impervious area, the storm drain will be substantially undersized.
6. A sump condition in the street is generally not allowed. The only time a sump is permitted is when it occurs at the end of a cul-de-sac.

Good for You, Albuquerque!

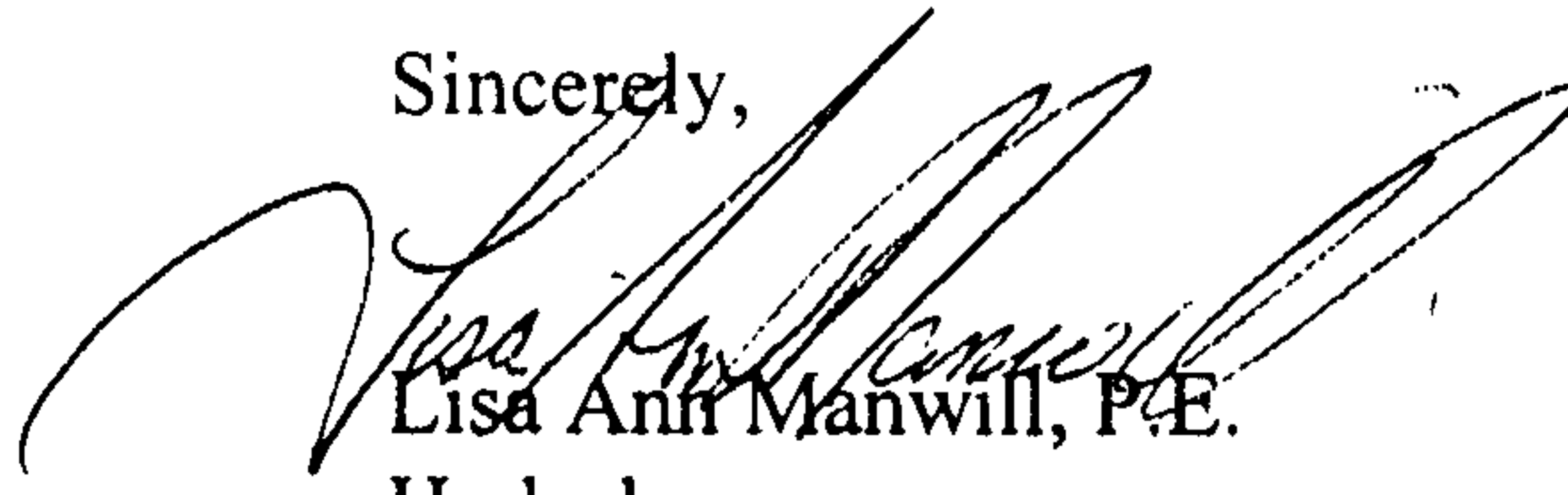


Kevin Patton
November 18, 1997
Letter Continued

7. I assume the flow from Basins "M" and "Q" are detained prior to entering a underground system. The underground system should be designed for developed flows in Basin "M."
8. Are Basins "O," "P," and "Q" developed? If so, there is no need to assume land treatment types, they should be known. If these basins are not developed, justify your use of such low impervious areas.
9. Show some proposed grades (finish grade, finish floor, invert, rim, and street grades).

If I can be of further assistance, please feel free to contact me at 924-3984.

Sincerely,



Lisa Ann Manwill, P.E.
Hydrology

c: Andrew Garcia
File

**DRAINAGE REPORT
FOR
OXBOW BLUFF SUBDIVISION
(TRACT F)**

NOVEMBER 26, 1997

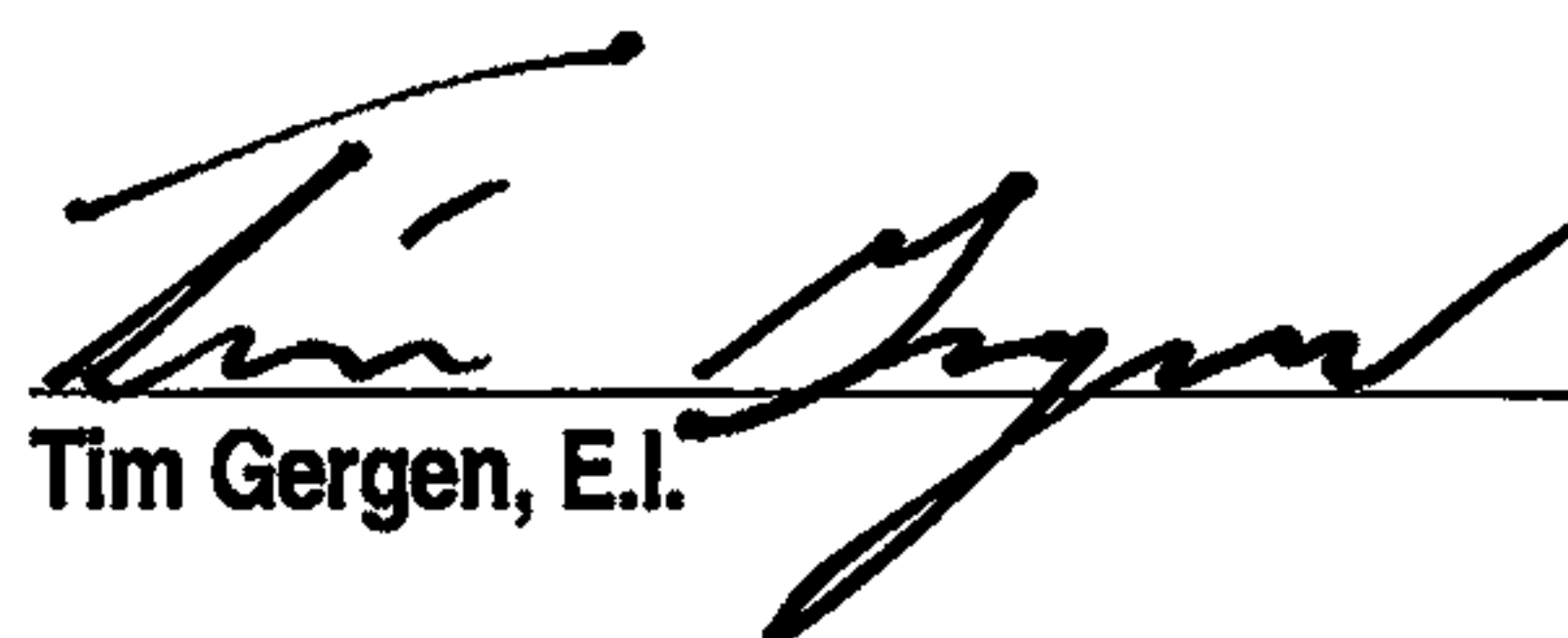
PREPARED BY:

**BOHANNAN HUSTON
COURTYARD I, 7500 JEFFERSON STREET N.E.
ALBUQUERQUE, NM 87109**

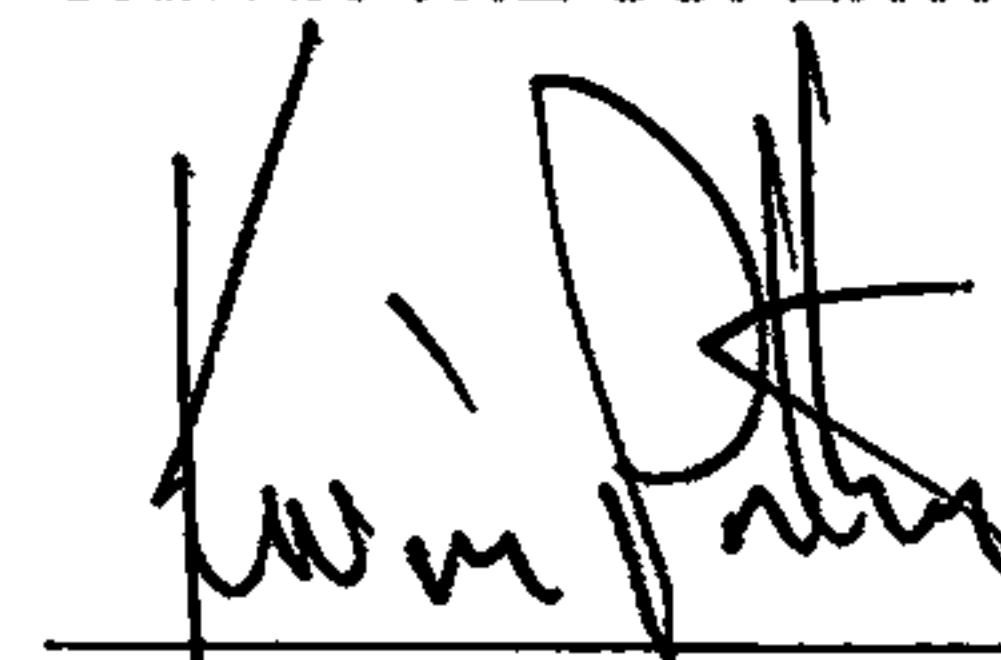
PREPARED FOR:

**Altura West Ltd.
414 Silver Avenue SW
Suite 1100
Albuquerque, NM 87103**

PREPARED BY:


Tim Gergen, E.I. 11/26/97
Date

UNDER THE SUPERVISION OF:


Kevin Patton, P.E. 11/26/97
Date

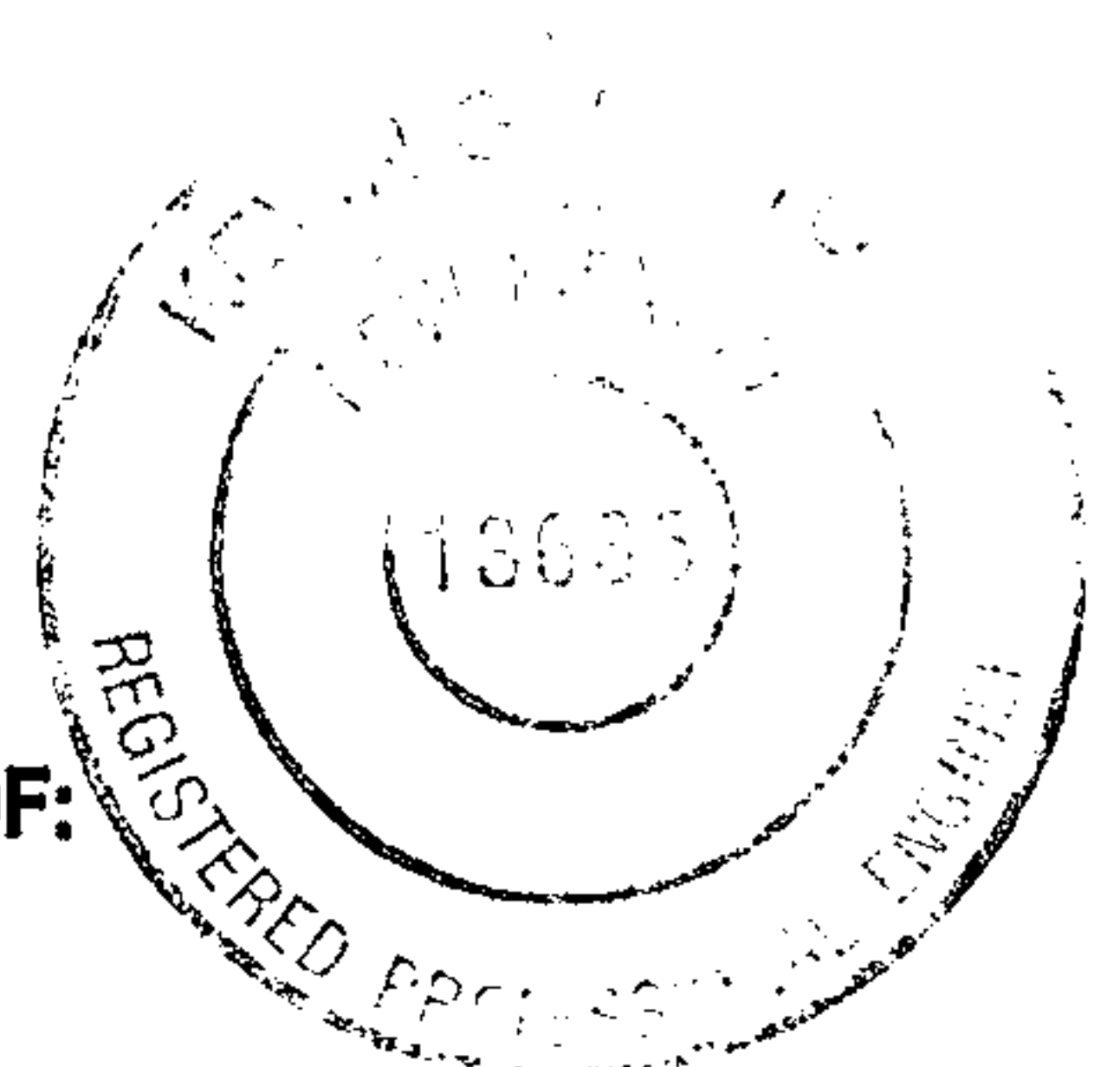


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APPENDIX G: BASINS
APPENDIX H: WETLANDS DETERMINATION BY MARRON & ASSOCIATES
APPENDIX I: STORM DRAIN CAPACITIES

EXHIBITS

- EXHIBIT 1: BULK LAND PLAT
- EXHIBIT 2: EXISTING DRAINAGE BASINS MAP
- EXHIBIT 3: PROPOSED DRAINAGE BASINS MAP
- EXHIBIT 4: GRADING AND DRAINAGE PLAN

I. PURPOSE

The purpose of this report is to present historic and proposed drainage conditions for the area pertaining to this site, and to obtain work order, preliminary and final plat approvals.

II. METHODOLOGIES

Site conditions will be analyzed for a 10-year and 100-year, 6-hour storm event in accordance with the City of Albuquerque Drainage Ordinance and the Development Process Manual (DPM) Volume 2, Design Criteria, Section 22.2, Hydrology, for the City of Albuquerque, January 1993.

The site, as described in the 'Site Location and Characteristics' section below, is approximately 40.82 acres. Therefore, Part A of the DPM, Section 22.2, which provides a simplified procedure for projects with sub-basins smaller than 40 acres was used.

This report will reference the Master Drainage Plan for Altura West and Archdiocese of Santa Fe Properties dated October, 1997 (hereafter referred to as the Master Plan), which was prepared for Altura West LTD. and Archdiocese of Santa Fe and approved by the City of Albuquerque. That report was prepared to support future drainage plans submitted for the development of individual land parcels within Altura West Development, and to provide design guidance for the installation of major drainage infrastructure to be constructed in advance of, or simultaneously with individual parcel development. In addition, it provides fully developed flow rates for basins within the Altura West and Archdiocese of Santa Fe Properties.

This report differs slightly from the Master Plan by sub-dividing Existing Drainage Conditions Basins C, D, F through J (Tract F) in the proposed Oxbow Bluff Subdivision into Sub-Basins A through L. Also, Basins 3 through 7, 13 and K that border the western most portion of the subdivision have been altered. All of these new Basins have been reconfigured with different

flows using new percent land treatments. Please refer to the proposed conditions section of this report for more information regarding the relocation of basin boundaries and the new flows developed within Tract F and the surrounding basins.

In order to more clearly convey information about the site, and existing conditions on and near the site, photographs have been included within Appendix A of this report. A Photo Orientation Map, showing the location and direction from which each photo was taken, has also been included in Appendix A.

III. SITE LOCATION AND CHARACTERISTICS

Please refer to the proposed Bulk Land Plat enclosed with this report and the A.G.I.S. vicinity map pages F-11 and G-11.

The Site, Oxbow Bluff Subdivision, Tract F Altura West Development, is located between and borders the Rio Grande to the east and the St. Pius High School and St. Joseph's Place to the west. The 40.82 acre site proposes to be developed into 63 lots of single family dwelling units. The main road, Oxbow Drive, is oriented north/south along the western most portion of the site and will provide access to the subdivision from Coors Boulevard and St. Joseph's Place.

Vegetation on the site consists primarily of Mesa Dropseed, Indian Ricegrass, Blace Gramma and Sand Sagebrush. The soil at the site has been given the SCS soil classification of BKD (Bluepoint-Kokan association, hilly) and MWA (Madurez-wink Association, gently sloping). The BKD soils are in the hydrologic soil Group A, which have the highest rate of rainfall absorption. The MWA soils are in the hydrologic soil Group B, which also absorb more water than typical. You may refer to the enclosed photos which will provide an overall view of the site vegetation.

IV. EXISTING HYDRAULIC AND HYDROLOGIC CONDITIONS

The existing drainage basins and patterns are shown graphically on the Existing Drainage Conditions Map located in the plates section of this report.

The existing site consists of six on-site drainage basins, labeled Basins C, D and F through J. The runoff from the on-site basins is approximately 75.4 cfs in the 100-year, 6-hour storm event which currently sheet flows unimpededly to the Rio Grande just east of the site. The relatively high velocities due to the existing terrain has created an erosion condition along the bluff. Large cuts in the bank are evident at these locations.

The off-site basins, labeled 03 through 07, all sheet flow onto the site and generate approximately 11.66 cfs in the 100-year, 6-hour storm event.

Off-site Basin 01 generates 29.89 cfs in the 100-year, 6-hour storm event and is collected by a culvert that exits onto Basin D on our site (see enclosed photos). Off-site Basin 02 generates 6.22 cfs in the 100-year, 6-hour storm event and is collected by a culvert that exits onto Basin C on our site. Although, by site inspection, the culvert is clogged and shows no noticeable swale unlike the culvert that drains Basin 01 onto Basin D. Therefore, it is concluded that all of the flow from Basin 02 sheet flows onto our site (see enclosed photos).

For additional information regarding the existing drainage conditions, please refer to the approved Master Plan (October, 1997).

V. PROPOSED HYDRAULIC AND HYDROLOGIC CONDITIONS

For Additional assistance throughout this section, please refer to the Grading and Drainage Plan or the Proposed Conditions Map enclosed with the plates section of this report.

The site proposes to preserve the natural terrain as much as possible. Altura West Ltd. Will create restrictive covenants which will establish criteria for the individual lots grading and drainage plan. For the purposes of this plan, the building envelopes were assumed to be 70% impervious and 30% non-impervious (Type B). The site contains 63 lots that will consist of cross-lot drainage that will be protected by easements shown on the final plat. Lot/property owners are required, by covenant agreements, to build within the building envelope and to utilize drainage concepts that will not produce concentrated flows outside their envelopes. No building will be permitted outside the building envelopes. All developed flows, including roofs, will not be allowed to discharge freely onto the existing terrain. Lot/property owners need to discharge all developed flows onto their driveways or discharge to the street, via an underground storm pipe system.

Each lot must provide a separate grading and drainage plan stamped by a N.M.P.E. which must conform to the covenants and guidelines developed for this subdivision. The developer will establish a review committee to insure compliance to these covenants. The developer will provide the city with a comprehensive drainage and grading certification of the proposed 63 lots after full build out.

A. On-Site Basins

The proposed site is broken into twelve (12) basins. The runoff from Basins B, C, D, F, and L, approximately 49.04 cfs in the 100-year, 6-hour storm event, sheet flows in a west to east direction. The existing conditions are currently discharging a runoff equal to 75.40 cfs, in the 100-year, 6-hour storm event., at the same location mentioned above. The proposed conditions reduce the existing runoff by 35% (from 75.40 cfs to 49.04 cfs), thus reducing the erosion problem mentioned earlier. In conjunction with the above mentioned basins, the runoff from Basins A, E, and, G through K, approximately 57.15 cfs in the 100-year, 6-hour storm event, is collected in a storm drain system and transported in an underground storm drain to the southeast boundary of the site into a energy dissipater outfall before entering the Rio Grande.

Basin B (1.41ac, $Q_{100}=4.45\text{cfs}$) is located in the far southeast corner of the Oxbow Bluff Subdivision. Basin B consists of three (3) lots, 50 through 52, and is assumed to be developed with 48% impervious and 52% natural areas. Run-off sheet flows from this basin with cross-lot drainage to the Rio Grande.

Basin C (2.86ac, $Q_{100}=8.48\text{cfs}$) is adjacent and to the north of Basin B. Basin C consists of five (5) lots, 45 through 49, and is assumed to be developed with 40% impervious and 60% natural areas. Run-off sheet flows from this basin with cross-lot drainage to the Rio Grande.

Basin D (2.91ac, $Q_{100}=8.43\text{cfs}$) is on the eastern edge of the Oxbow Bluff Subdivision and is adjacent to the northern edge of Basin C. Basin D consists of five (5) lots, 40 through 44, and is assumed to be developed with 37% impervious and 63% natural areas. Run-off from this basin sheet flows with cross-lot drainage to the Rio Grande.

Basin F (3.48ac, $Q_{100}=10.24\text{cfs}$) consists of seven (7) lots, 33 through 39, and is assumed to be developed with 39% impervious and 61% natural areas. It is located on the eastern edge of the site and adjacent to Basin D. Run-off from Basin F sheet flows with cross-lot drainage to the Rio Grande.

— Basin L (5.79ac, $Q_{100}=17.44\text{cfs}$) is located on the northern and northeastern edge of our site which consists of twelve (12) lots, 11 through 15 and 26 through 32, and half of lot 25. It is assumed to be developed with 42% impervious and 58% natural areas. Run-off from Basin L sheet flows with cross-lot drainage to the Rio Grande.

Basin A (3.08ac, $Q_{100}=8.99\text{cfs}$) consists of five (5) lots, 53 through 57, and is assumed to be developed with 38% impervious and 62% natural areas. It is located in the southwest corner of the Oxbow Bluff Subdivision. Basin A drains down Snow Goose Court to a double grate Type 'A' inlet with wings on both sides in a sump condition (Inlet 12). The inlet accepts 2x the 100-year, 6-hour runoff. The inlet directs the storm water to

an underground storm drain which continues east to the energy dissipater outfall. There is a 40' public drainage easement that exists on Basin A, between lots 56 and 57, which will allow an underground storm drain to transport off-site flows west of Basin A.

Basin E (4.54ac, $Q_{100}=13.46\text{cfs}$) consists of six (6) lots, 58 through 63, and is assumed to be developed with 40% impervious and 60% natural areas. Basin E is located to the south and east of the proposed Mourning Dove Place and sheet flows directly onto that street. Basin E is sub-divided into two smaller Sub-Basins E1 and E2 to simplify the flow direction.

Basin E1 (1.53ac, $Q_{100}=4.54\text{cfs}$) accepts an additional residual flow of 3.20 cfs from Inlet 1 and 3.22 cfs from Inlet 3. The flows are directed into two (2) single grate Type 'A' inlets (Inlet 2 and Inlet 4) at the entrance of the Oxbow Bluff Subdivision on Mourning Dove Place and into one (1) double grate Type 'A' inlet (Inlet 5) at the intersection of Basin E1 and E2 on Mourning Dove Place. These inlets accept 9.90 cfs and allow 1.06 cfs to continue down the street. The inlets direct the storm water to an underground storm drain which continues south and east to the energy dissipater outfall.

Basin E2 (3.01ac, $Q_{100}=8.93\text{cfs}$) accepts the residual flow of 1.06 cfs from Inlet 5 and directs the flow down Cinnamon Teal Court into a double grate Type 'A' inlet with wings on both sides in a sump condition (Inlet 11). The inlet accepts 2x the 100-year, 6-hour runoff and delivers the storm water to an underground storm drain which outfalls at the energy dissipater.

Basin G (2.24ac, $Q_{100}=7.17\text{cfs}$) consists of three (3) lots, 22 through 24, and one-third of lot 21. Basin G is assumed to be developed with 50% impervious and 50% natural areas. Basin G, also, accepts a residual flow of 1.06 cfs from Inlet 5 and directs the flow down Sand Piper Court into a double grate Type 'A' inlet with wings on both sides in a sump condition (Inlet 8). The inlet accepts 2x the 100-year, 6-hour runoff and delivers the storm water to the underground storm drain mentioned above.

Basin H (1.75ac, $Q_{100}=5.52\text{cfs}$) consists of two (2) lots, 19 and 20, and two-thirds of lot 21. Basin H is assumed to be developed with 48% impervious and 52% natural areas. Basin H drains down Gray Hawk Court into a single grate Type 'A' inlet with wings on both sides in a sump condition (Inlet 9). The inlet accepts 2x the 100-year, 6-hour runoff and delivers the storm water to the underground storm drain.

Basin I (3.85ac, $Q_{100}=11.87\text{cfs}$) is located on the western edge and adjacent to the entrance of the Oxbow Bluff Subdivision. Basin I consists of seven (7) lots, 1 through 7, and is assumed to be developed with 45% impervious and 55% natural areas. Basin I drains to Silvery Minnow Place, where the street delivers the flow to a double grate Type 'A' inlet with wings on both sides in a sump condition (Inlet 6). The 2% cross-sloped road and a valley gutter will help direct flows into the inlet. The inlet accepts 2x the 100-year, 6-hour runoff and delivers the storm water to the underground storm drain. Basin I and Inlet 6, also, accepts an additional residual flow of 0.62 cfs from Inlets 2 and 4.

Basin J (1.56ac, $Q_{100}=4.92\text{cfs}$) consists of three (3) lots, 8 through 10, and is assumed to be developed with 48% impervious and 52% natural areas. It is located in the northwest corner of our site. Basin J drains down Silvery Minnow Place to the Silvery Minnow cul-de-sac and into a single grate Type 'A' inlet with wings on both sides in a sump condition (Inlet 7). The inlet accepts 2x the 100-year, 6-hour runoff and delivers the storm water to the underground storm drain.

Basin K (1.68ac, $Q_{100}=5.22\text{cfs}$) consists of three (3) lots, 16 through 18, and half of lot 25. It is assumed to be developed with 46% impervious and 54% natural areas. Basin K drains down Waterwillow Place to the Waterwillow cul-de-sac and into a single grate Type 'A' inlet with wings on both sides in a sump condition (Inlet 10). The inlet accepts 2x the 100-year, 6-hour runoff and delivers the storm water to an underground storm drain.

B. Off-Site Basins

All off-site flows mentioned in this report will continue to be accepted, collected and discharged by the proposed storm sewer in the Oxbow Bluff Subdivision as indicated by the Master Plan. As mentioned earlier, the off-site work proposes to preserve the natural terrain as much as possible.

For additional assistance throughout this section, please refer to the Grading and Drainage Plan or the Proposed Conditions Map enclosed with the plates section of this report.

Basin M (13.10ac, $Q_{100}=27.82\text{cfs}$) is located to the southwest of our site and is assumed to have mostly undisturbed vegetation with steep slopes and no impervious areas. Basin M drains easterly to a temporary pond constructed on the most eastern edge of the boundary that borders our site. Temporary swales constructed with the temporary pond will direct all of the flow into the pond. The flows from Basin M will be detained slightly before entering the storm drain system. The pond size is dictated by the weir of the pipe outlet and the pipe size. The storm pipe that daylights to the temporary pond will catch and deliver the flows, via the 40' drainage easement through Basin A, to the underground storm drain system mentioned earlier. The temporary pond and storm drain is designed to capture all of the flow from Basin M and all attributing flows. The storm drain, also, is designed to accommodate developed flows from Basin M and all developed attributing flows. No flow will enter the Oxbow Bluff Subdivision from Basin M.

Basin N (4.08ac, $Q_{100}=9.40\text{cfs}$) is located to the west of our site and to the south of the entrance to the site. It has 31% impervious and 69% natural areas. Basin N drains to the proposed Oxbow Drive and is directed into a double grate Type 'A' inlet (Inlet 1) just to the south of the entrance to our site. The inlet accepts 6.20 cfs and allows a residual flow of 3.20 cfs to continue down Mourning Dove Place in our subdivision. Inlet 1 directs storm water to the underground storm drain system in the Oxbow Bluff Subdivision.

Basin O (4.11ac, $Q_{100}=9.12\text{cfs}$) is located just north of the entrance to the site and Basin N. It has 29% impervious and 71% natural areas. Basin O drains to the proposed Oxbow Drive and is directed into a double grate Type 'A' inlet (Inlet 3) just to the north of the entrance to our site. The inlet accepts 5.90 cfs and allows a residual flow of 3.22 cfs to continue down Mourning Dove Place in our subdivision. Inlet 3 directs storm water to the underground storm drain system in the Oxbow Bluff Subdivision.

Basin P (2.88ac, $Q_{100}=5.88\text{cfs}$) is located on the northwestern edge of our site. It has 23% impervious and 77% natural areas. Basin P drains to the proposed Oxbow Drive and is directed into a double grate Type 'A' inlet with wings on both sides in a sump condition (Inlet 13). The inlet accepts 2x the 100-year, 6-hour runoff and directs the flow to the underground storm drain system.

Basin Q (1.12ac, $Q_{100}=3.31\text{cfs}$) is located on the southern boundary of Basin M. It has 25% impervious and 75% natural areas. Basin Q sheet flows directly on to Basin M where the temporary swales and pond catch the flows. The flows are detained slightly and then directed into the storm drain as mentioned earlier.

Basin 01 (8.77ac, $Q_{100}=29.89\text{cfs}$) is located on the St. Pius High School property just west of Basins O and P. Basin 01 flows will be collected at a storm pipe outlet at the eastern edge of the St. Pius High Property and connected to the underground storm drain system in the Oxbow Bluff Subdivision, in accordance with the Master Plan.

Basin 02 (1.83ac, $Q_{100}=6.22\text{cfs}$) is, also, located on the St. Pius High School property just west of Basin P. Basin 02 will be allowed to sheet flow onto Basin P and be collected by Inlet 13. As mentioned above, this inlet will accept 2x the 100-year, 6-hour runoff and will direct the flow to the underground storm drain system in the Oxbow Bluff Subdivision.

VI. 404 PERMIT/WETLANDS DETERMINATION

Bohannon Huston received a letter from the Army Corps of Engineers in regards to a 404 Permit. This letter states that a 404 Permit is not required. A Wetlands Determination was performed by Marron & Associates Inc. which determined that the outfall would not be discharging to a wetlands area. A copy of the Army Corps of Engineers letter and the Wetland Determination have been included in this report.

VII. EROSION CONTROL

A standard New Mexico State Highway and Transportation Department silt fence will be installed along the bluff and around the downstream side of the outfall construction. This will protect Tract G and the river from the construction activities above allowing materials to be transported down below.

The silt fence is shown on the grading plan and will be shown on the work order set of construction plans due to the construction of sanitary and storm sewer along the bluff. Notes will be placed on the plans to require the contractor to protect the areas below.

VIII. ENERGY DISSIPATER

The energy dissipater discussed in this report is a Bureau of Reclamation Basin VI which requires no tail water for successful performance. The dimensions, for a given discharge, for the energy dissipater is presented in the Appendix.

For more information, please refer to the U.S. Department of the Interior, Bureau of Reclamation, *"Hydraulic Design of Stilling Basins and Energy Dissipaters."*

IX. FUTURE CONDITIONS

The temporary pond and swales in Basin M, mentioned above, will be removed and replaced with a storm drain system that will accept, collect and discharge the flows from the upstream basins noted in the approved Master Plan proposed conditions map ($Q_{100}=93.5$ cfs). This storm drain system will be further detailed with future development of off-site tracts.

X. CONCLUSION

This report has provided hydrologic and hydraulic considerations of the proposed development of Altura West Tract F, the Oxbow Bluff Subdivision. This information provides adequate supporting documentation and guidance for approval of this report and to guide future development and phasing of the properties previously mentioned. It is recommended that this plan be approved as requested.

11-11-11

APPENDICES

APPENDIX A: STREET CAPACITIES

APPENDIX B: INLET CAPACITIES

APPENDIX C: PHOTO ORIENTATION MAP AND PHOTOS

APPENDIX D: ENERGY DISSIPATER

APPENDIX E: STREET HYDRAULICS

APPENDIX F: LETTER FROM ARMY CORPS OF ENGINEERS

APPENDIX G: BASINS

APPENDIX H: WETLANDS DETERMINATION BY MARRON & ASSOCIATES

APPENDIX I: STORM DRAIN CAPACITIES

APPENDIX A
STREET CAPACITIES

SUMMARY OF THE ROADWAY CAPACITY ANALYSIS FOR OXBOW BLUFF SUBDIVISION - TRACT F

OXBOW DRIVE - Drainage Basins N, O & P

Max Q (cfs)=24.40

Roadway Grade (%)	Q(100 YR) in roadway (cfs)	Depth of water in roadway (ft)	Velocity of storm water in roadway (ft/s)	$V^2/2 \cdot g$ (ft)	EGL (ft)	ROW Elevation (ft)	COMMENTS
5.00	9.40	0.34	5.11	0.41	0.75	1.00	OK
4.46	9.12	0.35	4.85	0.37	0.72	1.00	OK
0.75	12.10	0.50	2.70	0.11	0.61	1.00	OK

NOTE:

There is a 2% cross-slope along this roadway.

MOURNING DOVE PLACE - Drainage Basins A & E

Max Q (cfs)=28.88

Roadway Grade (%)	Q(100 YR) in roadway (cfs)	Depth of water in roadway (ft)	Velocity of storm water in roadway (ft/s)	$V^2/2 \cdot g$ (ft)	EGL (ft)	ROW Elevation (ft)	COMMENTS
4.00	6.42	0.17	2.04	0.06	0.23	1.00	OK
8.00a	3.20	0.23	4.77	0.35	0.58	1.00	OK
8.00b	3.22	0.23	4.78	0.35	0.58	1.00	OK
8.00c	5.16	0.27	5.31	0.44	0.70	1.00	OK
1.00	2.27	0.28	2.00	0.06	0.34	1.00	OK
3.04	3.75	0.28	3.38	0.18	0.46	1.00	OK
3.04	3.24	0.27	3.27	0.17	0.44	1.00	OK
2.00	2.00	0.25	2.50	0.10	0.35	1.00	OK
5.83	1.35	0.19	3.48	0.19	0.38	1.00	OK
1.25	4.72	0.34	2.56	0.10	0.44	1.00	OK

NOTE:

There is a 2% cross-slope along this roadway.

8.00a is the right side entrance to Oxbow Subdivision on Mourning Dove Place

8.00b is the left side entrance to Oxbow Subdivision on Mourning Dove Place

8.00c is the most downstream point on the 8% grade of Mourning Dove Place

SILVERY MINNOW PLACE - Drainage Basins I & J

Max Q (cfs)=17.41

Roadway Grade (%)	Q(100 YR) in roadway (cfs)	Depth of water in roadway (ft)	Velocity of storm water in roadway (ft/s)	$V^2/2 \cdot g$ (ft)	EGL (ft)	ROW Elevation (ft)	COMMENTS
4.59	2.55	0.23	3.61	0.20	0.43	1.00	OK
5.78	9.94	0.34	5.48	0.47	0.81	1.00	OK
0.75	8.15	0.44	2.46	0.09	0.53	1.00	OK
3.23	1.93	0.23	2.96	0.14	0.37	1.00	OK
0.75	3.03	0.32	1.89	0.06	0.38	1.00	OK
4.70	4.92	0.28	4.30	0.29	0.57	1.00	OK

NOTE:

There is a 2% cross-slope along this roadway.

WATERWILLOW PLACE - Drainage Basins G, H & K

Max Q (cfs)=18.66

Roadway Grade (%)	Q(100 YR) in roadway (cfs)	Depth of water in roadway (ft)	Velocity of storm water in roadway (ft/s)	$V^2/2 \cdot g$ (ft)	EGL (ft)	ROW Elevation (ft)	COMMENTS
4.00	1.59	0.21	3.11	0.15	0.36	1.00	OK
5.30	3.61	0.26	4.17	0.27	0.53	1.00	OK
4.00	3.36	0.26	3.69	0.21	0.47	1.00	OK
1.33	1.68	0.25	2.09	0.07	0.32	1.00	OK
4.40	0.67	0.15	2.74	0.12	0.27	1.00	OK
1.50	1.41	0.23	2.04	0.06	0.29	1.00	OK
2.50	1.84	0.23	2.65	0.11	0.34	1.00	OK
1.67	2.96	0.28	2.57	0.10	0.38	1.00	OK
4.50	5.22	0.29	4.29	0.29	0.58	1.00	OK

NOTE:

There is a 2% cross-slope along this roadway.

CINNAMON TEAL COURT - Drainage Basin E

Max Q (cfs)=10.16

Roadway Grade (%)	Q(100 YR) in roadway (cfs)	Depth of water in roadway (ft)	Velocity of storm water in roadway (ft/s)	$V^2/2 \cdot g$ (ft)	EGL (ft)	ROW Elevation (ft)	COMMENTS
4.00	9.03	0.21	3.53	0.19	0.40	1.00	OK
6.97	9.99	0.20	4.46	0.31	0.51	1.00	OK

SNOW GOOSE COURT - Drainage Basin A

Max Q (cfs)=8.99

Roadway Grade (%)	Q(100 YR) in roadway (cfs)	Depth of water in roadway (ft)	Velocity of storm water in roadway (ft/s)	$V^2/2 \cdot g$ (ft)	EGL (ft)	ROW Elevation (ft)	COMMENTS
4.00	7.97	0.21	3.38	0.18	0.39	1.00	OK
5.30	8.99	0.21	3.87	0.23	0.44	1.00	OK

GRAY HAWK COURT - Drainage Basin H

Max Q (cfs)=5.52

Roadway Grade (%)	Q(100 YR) in roadway (cfs)	Depth of water in roadway (ft)	Velocity of storm water in roadway (ft/s)	$V^2/2 \cdot g$ (ft)	EGL (ft)	ROW Elevation (ft)	COMMENTS
7.25	4.78	0.17	3.12	0.15	0.32	1.00	OK
4.38	5.52	0.19	2.98	0.14	0.33	1.00	OK

SAND PIPER COURT - Drainage Basin G

Max Q (cfs)=7.17

Roadway Grade (%)	Q(100 YR) in roadway (cfs)	Depth of water in roadway (ft)	Velocity of storm water in roadway (ft/s)	$V^2/2 \cdot g$ (ft)	EGL (ft)	ROW Elevation (ft)	COMMENTS
4.00	7.47	0.20	3.31	0.17	0.37	1.00	OK
7.64	8.23	0.19	4.19	0.27	0.46	1.00	OK

Oxbowr.out

ALTURA WEST DEVELOPMENT - OXBOW DRIVE

MANNING'S N = .0170

SLOPE = .0500

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	44.00	98.45	7	52.00	99.32
2	19.83	99.60	5	46.00	98.33			
3	20.00	98.93	6	46.17	98.99			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.38	0.05	0.0	0.0	0.9	1.6	0.85
98.43	0.10	0.1	0.2	1.8	2.6	1.69
98.48	0.15	0.2	0.6	3.7	2.9	3.54
98.53	0.20	0.4	1.5	6.2	3.4	6.05
98.58	0.25	0.8	3.2	8.8	4.0	8.56
98.63	0.30	1.3	6.0	11.3	4.6	11.08
98.68	0.35	1.9	10.0	13.9	5.2	13.59
98.73	0.40	2.7	15.5	16.4	5.8	16.10
98.78	0.45	3.5	22.5	19.0	6.4	18.62
98.83	0.50	4.5	31.2	21.5	6.9	21.13
98.88	0.55	5.6	41.9	24.1	7.4	23.64
98.93	0.60	6.9	54.6	26.6	7.9	26.15
98.98	0.65	8.2	72.8	26.7	8.9	26.18
99.03	0.70	9.5	91.7	27.5	9.6	26.90
99.08	0.75	10.9	112.2	28.4	10.3	27.80
99.13	0.80	12.3	134.5	29.4	10.9	28.69
99.18	0.85	13.8	158.8	30.3	11.5	29.59
99.23	0.90	15.3	184.9	31.2	12.1	30.49
99.28	0.95	16.8	213.0	32.2	12.7	31.38
99.32	0.99	18.1	236.8	32.9	13.1	32.10

Oxbow2r.out
ALTURA WEST DEVELOPMENT - OXBOW DRIVE

MANNING'S N = .0170 SLOPE = .0446

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	44.00	98.45	7	52.00	99.32
2	19.83	99.60	5	46.00	98.33			
3	20.00	98.93	6	46.17	98.99			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.38	0.05	0.0	0.0	0.9	1.5	0.85
98.43	0.10	0.1	0.2	1.8	2.4	1.69
98.48	0.15	0.2	0.6	3.7	2.7	3.54
98.53	0.20	0.4	1.4	6.2	3.2	6.05
98.58	0.25	0.8	3.1	8.8	3.8	8.56
98.63	0.30	1.3	5.7	11.3	4.4	11.08
98.68	0.35	1.9	9.5	13.9	4.9	13.59
98.73	0.40	2.7	14.6	16.4	5.5	16.10
98.78	0.45	3.5	21.2	19.0	6.0	18.62
98.83	0.50	4.5	29.5	21.5	6.5	21.13
98.88	0.55	5.6	39.6	24.1	7.0	23.64
98.93	0.60	6.9	51.6	26.6	7.5	26.15
98.98	0.65	8.2	68.7	26.7	8.4	26.18
99.03	0.70	9.5	86.6	27.5	9.1	26.90
99.08	0.75	10.9	105.9	28.4	9.7	27.80
99.13	0.80	12.3	127.0	29.4	10.3	28.69
99.18	0.85	13.8	149.9	30.3	10.9	29.59
99.23	0.90	15.3	174.6	31.2	11.4	30.49
99.28	0.95	16.8	201.1	32.2	12.0	31.38
99.32	0.99	18.1	223.5	32.9	12.4	32.10

Oxbow3r.out
ALTURA WEST DEVELOPMENT - OXBOW DRIVE

MANNING'S N = .0170 SLOPE = .0075

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	44.00	98.45	7	52.00	99.32
2	19.83	99.60	5	46.00	98.33			
3	20.00	98.93	6	46.17	98.99			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.38	0.05	0.0	0.0	0.9	0.6	0.85
98.43	0.10	0.1	0.1	1.8	1.0	1.69
98.48	0.15	0.2	0.2	3.7	1.1	3.54
98.53	0.20	0.4	0.6	6.2	1.3	6.05
98.58	0.25	0.8	1.3	8.8	1.5	8.56
98.63	0.30	1.3	2.3	11.3	1.8	11.08
98.68	0.35	1.9	3.9	13.9	2.0	13.59
98.73	0.40	2.7	6.0	16.4	2.3	16.10
98.78	0.45	3.5	8.7	19.0	2.5	18.62
98.83	0.50	4.5	12.1	21.5	2.7	21.13
98.88	0.55	5.6	16.2	24.1	2.9	23.64
98.93	0.60	6.9	21.2	26.6	3.1	26.15
98.98	0.65	8.2	28.2	26.7	3.4	26.18
99.03	0.70	9.5	35.5	27.5	3.7	26.90
99.08	0.75	10.9	43.4	28.4	4.0	27.80
99.13	0.80	12.3	52.1	29.4	4.2	28.69
99.18	0.85	13.8	61.5	30.3	4.5	29.59
99.23	0.90	15.3	71.6	31.2	4.7	30.49
99.28	0.95	16.8	82.5	32.2	4.9	31.38
99.32	0.99	18.1	91.7	32.9	5.1	32.10

Mdr.out
ALTURA WEST DEVELOPMENT - MOURNING DOVE PLACE

MANNING'S N = .0170 SLOPE = .0400

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	11.00	99.13	7	73.17	99.67
2	8.83	99.67	5	71.00	99.13	8	82.00	100.00
3	9.00	99.00	6	73.00	99.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
99.05	0.05	0.0	0.1	1.6	1.4	1.56
99.10	0.10	0.2	0.4	3.3	2.3	3.13
99.15	0.15	1.5	2.3	64.3	1.5	64.08
99.20	0.20	4.8	14.6	64.4	3.1	64.10
99.25	0.25	8.0	34.5	64.5	4.3	64.13
99.30	0.30	11.2	60.5	64.6	5.4	64.15
99.35	0.35	14.4	92.1	64.7	6.4	64.18
99.40	0.40	17.6	128.8	64.8	7.3	64.20
99.45	0.45	20.8	170.1	64.9	8.2	64.23
99.50	0.50	24.0	215.9	65.0	9.0	64.25
99.55	0.55	27.2	265.9	65.1	9.8	64.28
99.60	0.60	30.4	320.0	65.2	10.5	64.30
99.65	0.65	33.6	377.9	65.3	11.2	64.33
99.70	0.70	36.9	433.2	67.0	11.7	65.95
99.75	0.75	40.3	488.1	69.7	12.1	68.62
99.80	0.80	43.8	546.9	72.4	12.5	71.30
99.85	0.85	47.4	609.7	75.0	12.9	73.97
99.90	0.90	51.1	676.6	77.7	13.2	76.65
99.95	0.95	55.0	747.7	80.4	13.6	79.32
100.00	1.00	59.1	823.0	83.1	13.9	82.00

Md2r.out
ALTURA WEST DEVELOPMENT - MOURNING DOVE PLACE

MANNING'S N = .0170 SLOPE = .0800

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	2.0	0.85
98.50	0.10	0.1	0.3	1.8	3.3	1.69
98.55	0.15	0.2	0.7	3.7	3.6	3.54
98.60	0.20	0.4	1.9	6.2	4.3	6.05
98.65	0.25	0.8	4.1	8.8	5.1	8.56
98.70	0.30	1.3	7.6	11.3	5.8	11.08
98.75	0.35	1.9	12.7	13.9	6.6	13.59
98.80	0.40	2.7	19.6	16.4	7.3	16.10
98.85	0.45	3.5	28.4	19.0	8.1	18.62
98.90	0.50	4.5	39.5	21.5	8.7	21.13
98.95	0.55	5.6	53.0	24.1	9.4	23.64
99.00	0.60	6.9	69.1	26.6	10.0	26.15
99.05	0.65	8.2	92.1	26.7	11.2	26.18
99.10	0.70	9.5	115.1	27.9	12.1	27.27
99.15	0.75	10.9	140.0	29.3	12.8	28.62
99.20	0.80	12.4	167.4	30.6	13.5	29.97
99.25	0.85	13.9	197.4	32.0	14.2	31.32
99.30	0.90	15.5	230.1	33.4	14.8	32.67
99.35	0.95	17.2	265.4	34.8	15.4	34.02
99.39	0.99	18.6	295.7	35.9	15.9	35.10

tot. 1.37 ac
 Va: D: 23335 sf .54 AC 39%
 B: .83 ac 61%
 Q = 5.26

tot 0.98 AC
 Vb: D: 18076 sf .41 AC 42%
 B .57 AC 58%
 Q = 3.82

Md2ra.out

* ALTURA WEST DEVELOPMENT - MOURNING DOVE PLACE

MANNING'S N = .0170

SLOPE = .0800

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	28.00	98.62	7	35.00	99.27
2	8.83	99.67	5	30.00	98.50			
3	9.00	99.00	6	30.17	99.17			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.55	0.05	0.0	0.0	0.9	2.0	0.85
98.60	0.10	0.1	0.3	1.8	3.3	1.69
98.65	0.15	0.2	0.7	3.7	3.6	3.54
98.70	0.20	0.4	1.9	6.2	4.3	6.05
98.75	0.25	0.8	4.1	8.8	5.1	8.56
98.80	0.30	1.3	7.6	11.3	5.8	11.08
98.85	0.35	1.9	12.7	13.9	6.6	13.59
98.90	0.40	2.7	19.5	16.4	7.3	16.10
98.95	0.45	3.5	28.4	19.0	8.1	18.61
99.00	0.50	4.5	39.5	21.5	8.7	21.13
99.05	0.55	5.6	55.9	21.6	10.0	21.15
99.10	0.60	6.6	74.4	21.7	11.2	21.18
99.15	0.65	7.7	95.0	21.8	12.3	21.20
99.20	0.70	8.8	113.0	23.4	12.9	22.67
99.25	0.75	10.0	130.8	25.8	13.1	25.10
99.27	0.77	10.5	138.6	26.8	13.2	26.07

Md2rb.out

ALTURA WEST DEVELOPMENT - MOURNING DOVE PLACE

MANNING'S N = .0170

SLOPE = .0800

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	7.00	99.36	7	26.17	99.57
2	4.83	99.90	5	24.00	99.02	8	35.00	99.90
3	5.00	99.23	6	26.00	98.90			

WSEL	DEPTH	FLOW	FLOW	WETTED	FLOW	TOP
(FT)	INC	AREA	RATE	PER	VEL	WID
		(SQ FT)	(CFS)	(FT)	(FPS)	
98.95	0.05	0.0	0.0	0.9	2.0	0.85
99.00	0.10	0.1	0.3	1.8	3.3	1.69
99.05	0.15	0.2	0.7	3.7	3.6	3.54
99.10	0.20	0.4	1.9	6.2	4.3	6.05
99.15	0.25	0.8	4.1	8.8	5.1	8.56
99.20	0.30	1.3	7.6	11.3	5.8	11.08
99.25	0.35	1.9	12.5	14.2	6.5	13.90
99.30	0.40	2.7	19.1	17.6	7.1	17.20
99.35	0.45	3.6	28.0	20.9	7.7	20.49
99.40	0.50	4.7	41.8	21.7	8.9	21.17
99.45	0.55	5.8	58.5	21.8	10.2	21.20
99.50	0.60	6.8	77.4	21.9	11.4	21.22
99.55	0.65	7.9	98.2	22.0	12.5	21.25
99.60	0.70	9.0	118.4	22.9	13.2	22.07
99.65	0.75	10.1	138.9	24.3	13.8	23.42
99.70	0.80	11.3	161.5	25.7	14.3	24.77
99.75	0.85	12.6	186.3	27.1	14.8	26.12
99.80	0.90	13.9	213.3	28.4	15.3	27.47
99.85	0.95	15.3	242.7	29.8	15.8	28.82
99.90	1.00	16.8	274.4	31.2	16.3	30.17

Md3r.out

ALTURA WEST DEVELOPMENT - MOURNING DOVE PLACE

MANNING'S N = .0170

SLOPE = .0100

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	0.7	0.85
98.50	0.10	0.1	0.1	1.8	1.2	1.69
98.55	0.15	0.2	0.3	3.7	1.3	3.54
98.60	0.20	0.4	0.7	6.2	1.5	6.05
98.65	0.25	0.8	1.4	8.8	1.8	8.56
98.70	0.30	1.3	2.7	11.3	2.1	11.08
98.75	0.35	1.9	4.5	13.9	2.3	13.59
98.80	0.40	2.7	6.9	16.4	2.6	16.10
98.85	0.45	3.5	10.1	19.0	2.8	18.62
98.90	0.50	4.5	14.0	21.5	3.1	21.13
98.95	0.55	5.6	18.7	24.1	3.3	23.64
99.00	0.60	6.9	24.4	26.6	3.5	26.15
99.05	0.65	8.2	32.6	26.7	4.0	26.18
99.10	0.70	9.5	40.7	27.9	4.3	27.27
99.15	0.75	10.9	49.5	29.3	4.5	28.62
99.20	0.80	12.4	59.2	30.6	4.8	29.97
99.25	0.85	13.9	69.8	32.0	5.0	31.32
99.30	0.90	15.5	81.3	33.4	5.2	32.67
99.35	0.95	17.2	93.8	34.8	5.5	34.02
99.39	0.99	18.6	104.5	35.9	5.6	35.10

Md4r.out

ALTURA WEST DEVELOPMENT - MOURNING DOVE PLACE

MANNING'S N = .0170

SLOPE = .0304

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.3	0.85
98.50	0.10	0.1	0.2	1.8	2.0	1.69
98.55	0.15	0.2	0.5	3.7	2.2	3.54
98.60	0.20	0.4	1.2	6.2	2.6	6.05
98.65	0.25	0.8	2.5	8.8	3.1	8.56
98.70	0.30	1.3	4.7	11.3	3.6	11.08
98.75	0.35	1.9	7.8	13.9	4.1	13.59
98.80	0.40	2.7	12.1	16.4	4.5	16.10
98.85	0.45	3.5	17.5	19.0	5.0	18.62
98.90	0.50	4.5	24.4	21.5	5.4	21.13
98.95	0.55	5.6	32.7	24.1	5.8	23.64
99.00	0.60	6.9	42.6	26.6	6.2	26.15
99.05	0.65	8.2	56.8	26.7	6.9	26.18
99.10	0.70	9.5	71.0	27.9	7.5	27.27
99.15	0.75	10.9	86.4	29.3	7.9	28.62
99.20	0.80	12.4	103.3	30.6	8.3	29.97
99.25	0.85	13.9	121.8	32.0	8.7	31.32
99.30	0.90	15.5	141.9	33.4	9.1	32.67
99.35	0.95	17.2	163.7	34.8	9.5	34.02
99.39	0.99	18.6	182.4	35.9	9.8	35.10

Md5r.out

ALTURA WEST DEVELOPMENT - MOURNING DOVE PLACE

MANNING'S N = .0170

SLOPE = .0304

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.3	0.85
98.50	0.10	0.1	0.2	1.8	2.0	1.69
98.55	0.15	0.2	0.5	3.7	2.2	3.54
98.60	0.20	0.4	1.2	6.2	2.6	6.05
98.65	0.25	0.8	2.5	8.8	3.1	8.56
98.70	0.30	1.3	4.7	11.3	3.6	11.08
98.75	0.35	1.9	7.8	13.9	4.1	13.59
98.80	0.40	2.7	12.1	16.4	4.5	16.10
98.85	0.45	3.5	17.5	19.0	5.0	18.62
98.90	0.50	4.5	24.4	21.5	5.4	21.13
98.95	0.55	5.6	32.7	24.1	5.8	23.64
99.00	0.60	6.9	42.6	26.6	6.2	26.15
99.05	0.65	8.2	56.8	26.7	6.9	26.18
99.10	0.70	9.5	71.0	27.9	7.5	27.27
99.15	0.75	10.9	86.4	29.3	7.9	28.62
99.20	0.80	12.4	103.3	30.6	8.3	29.97
99.25	0.85	13.9	121.8	32.0	8.7	31.32
99.30	0.90	15.5	141.9	33.4	9.1	32.67
99.35	0.95	17.2	163.7	34.8	9.5	34.02
99.39	0.99	18.6	182.3	35.9	9.8	35.10

Md6r.out

• ALTURA WEST DEVELOPMENT - MOURNING DOVE PLACE

MANNING'S N = .0170

SLOPE = .0200

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.0	0.85
98.50	0.10	0.1	0.1	1.8	1.6	1.69
98.55	0.15	0.2	0.4	3.7	1.8	3.54
98.60	0.20	0.4	0.9	6.2	2.1	6.05
98.65	0.25	0.8	2.0	8.8	2.5	8.56
98.70	0.30	1.3	3.8	11.3	2.9	11.08
98.75	0.35	1.9	6.3	13.9	3.3	13.59
98.80	0.40	2.7	9.8	16.4	3.7	16.10
98.85	0.45	3.5	14.2	19.0	4.0	18.62
98.90	0.50	4.5	19.8	21.5	4.4	21.13
98.95	0.55	5.6	26.5	24.1	4.7	23.64
99.00	0.60	6.9	34.6	26.6	5.0	26.15
99.05	0.65	8.2	46.1	26.7	5.6	26.18
99.10	0.70	9.5	57.6	27.9	6.0	27.27
99.15	0.75	10.9	70.0	29.3	6.4	28.62
99.20	0.80	12.4	83.7	30.6	6.8	29.97
99.25	0.85	13.9	98.7	32.0	7.1	31.32
99.30	0.90	15.5	115.0	33.4	7.4	32.67
99.35	0.95	17.2	132.7	34.8	7.7	34.02
99.39	0.99	18.6	147.8	35.9	8.0	35.10

Md7r.out

ALTURA WEST DEVELOPMENT - MOURNING DOVE PLACE

MANNING'S N = .0170

SLOPE = .0583

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.7	0.85
98.50	0.10	0.1	0.2	1.8	2.8	1.69
98.55	0.15	0.2	0.6	3.7	3.1	3.54
98.60	0.20	0.4	1.6	6.2	3.6	6.05
98.65	0.25	0.8	3.5	8.8	4.3	8.56
98.70	0.30	1.3	6.5	11.3	5.0	11.08
98.75	0.35	1.9	10.8	13.9	5.6	13.59
98.80	0.40	2.7	16.7	16.4	6.3	16.10
98.85	0.45	3.5	24.3	19.0	6.9	18.62
98.90	0.50	4.5	33.7	21.5	7.5	21.13
98.95	0.55	5.6	45.3	24.1	8.0	23.64
99.00	0.60	6.9	59.0	26.6	8.6	26.15
99.05	0.65	8.2	78.7	26.7	9.6	26.18
99.10	0.70	9.5	98.3	27.9	10.3	27.27
99.15	0.75	10.9	119.6	29.3	10.9	28.62
99.20	0.80	12.4	143.0	30.6	11.5	29.97
99.25	0.85	13.9	168.6	32.0	12.1	31.32
99.30	0.90	15.5	196.4	33.4	12.7	32.67
99.35	0.95	17.2	226.6	34.8	13.2	34.02
99.39	0.99	18.6	252.5	35.9	13.6	35.10

Md8r.out

ALTURA WEST DEVELOPMENT - MOURNING DOVE PLACE

MANNING'S N = .0170

SLOPE = .0125

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL	DEPTH	FLOW	FLOW	WETTED	FLOW	TOP
(FT)	INC	AREA	RATE	PER	VEL	WID
		(SQ FT)	(CFS)	(FT)	(FPS)	
98.45	0.05	0.0	0.0	0.9	0.8	0.85
98.50	0.10	0.1	0.1	1.8	1.3	1.69
98.55	0.15	0.2	0.3	3.7	1.4	3.54
98.60	0.20	0.4	0.8	6.2	1.7	6.05
98.65	0.25	0.8	1.6	8.8	2.0	8.56
98.70	0.30	1.3	3.0	11.3	2.3	11.08
98.75	0.35	1.9	5.0	13.9	2.6	13.59
98.80	0.40	2.7	7.7	16.4	2.9	16.10
98.85	0.45	3.5	11.3	19.0	3.2	18.62
98.90	0.50	4.5	15.6	21.5	3.5	21.13
98.95	0.55	5.6	21.0	24.1	3.7	23.64
99.00	0.60	6.9	27.4	26.6	4.0	26.15
99.05	0.65	8.2	36.5	26.7	4.5	26.18
99.10	0.70	9.5	45.6	27.9	4.8	27.27
99.15	0.75	10.9	55.4	29.3	5.1	28.62
99.20	0.80	12.4	66.3	30.6	5.4	29.97
99.25	0.85	13.9	78.2	32.0	5.6	31.32
99.30	0.90	15.5	91.1	33.4	5.9	32.67
99.35	0.95	17.2	105.1	34.8	6.1	34.02
99.39	0.99	18.6	117.1	35.9	6.3	35.10

Smr.out

ALTURA WEST DEVELOPMENT - SILVERY MINNOW PLACE

MANNING'S N = .0170

SLOPE = .0459

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.6	0.85
98.50	0.10	0.1	0.2	1.8	2.5	1.69
98.55	0.15	0.2	0.6	3.7	2.7	3.54
98.60	0.20	0.4	1.4	6.2	3.2	6.05
98.65	0.25	0.8	3.1	8.8	3.8	8.56
98.70	0.30	1.3	5.8	11.3	4.4	11.08
98.75	0.35	1.9	9.6	13.9	5.0	13.59
98.80	0.40	2.7	14.8	16.4	5.6	16.10
98.85	0.45	3.5	21.5	19.0	6.1	18.62
98.90	0.50	4.5	29.9	21.5	6.6	21.13
98.95	0.55	5.6	40.2	24.1	7.1	23.64
99.00	0.60	6.9	52.4	26.6	7.6	26.15
99.05	0.65	8.2	69.8	26.7	8.5	26.18
99.10	0.70	9.5	87.2	27.9	9.2	27.27
99.15	0.75	10.9	106.1	29.3	9.7	28.62
99.20	0.80	12.4	126.9	30.6	10.2	29.97
99.25	0.85	13.9	149.6	32.0	10.7	31.32
99.30	0.90	15.5	174.3	33.4	11.2	32.67
99.35	0.95	17.2	201.1	34.8	11.7	34.02
99.39	0.99	18.6	224.0	35.9	12.1	35.10

Sm2r.out

ALTURA WEST DEVELOPMENT - SILVERY MINNOW PLACE

MANNING'S N = .0170

SLOPE = .0578

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.7	0.85
98.50	0.10	0.1	0.2	1.8	2.8	1.69
98.55	0.15	0.2	0.6	3.7	3.1	3.54
98.60	0.20	0.4	1.6	6.2	3.6	6.05
98.65	0.25	0.8	3.5	8.8	4.3	8.56
98.70	0.30	1.3	6.5	11.3	5.0	11.08
98.75	0.35	1.9	10.8	13.9	5.6	13.59
98.80	0.40	2.7	16.6	16.4	6.2	16.10
98.85	0.45	3.5	24.2	19.0	6.8	18.62
98.90	0.50	4.5	33.6	21.5	7.4	21.13
98.95	0.55	5.6	45.1	24.1	8.0	23.64
99.00	0.60	6.9	58.7	26.6	8.5	26.15
99.05	0.65	8.2	78.3	26.7	9.6	26.18
99.10	0.70	9.5	97.9	27.9	10.3	27.27
99.15	0.75	10.9	119.0	29.3	10.9	28.62
99.20	0.80	12.4	142.3	30.6	11.5	29.97
99.25	0.85	13.9	167.8	32.0	12.1	31.32
99.30	0.90	15.5	195.5	33.4	12.6	32.67
99.35	0.95	17.2	225.5	34.8	13.1	34.02
99.39	0.99	18.6	251.3	35.9	13.5	35.10

Sm3r.out

* ALTURA WEST DEVELOPMENT - SILVERY MINNOW PLACE

MANNING'S N = .0170

SLOPE = .0075

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	0.6	0.85
98.50	0.10	0.1	0.1	1.8	1.0	1.69
98.55	0.15	0.2	0.2	3.7	1.1	3.54
98.60	0.20	0.4	0.6	6.2	1.3	6.05
98.65	0.25	0.8	1.3	8.8	1.5	8.56
98.70	0.30	1.3	2.3	11.3	1.8	11.08
98.75	0.35	1.9	3.9	13.9	2.0	13.59
98.80	0.40	2.7	6.0	16.4	2.3	16.10
98.85	0.45	3.5	8.7	19.0	2.5	18.62
98.90	0.50	4.5	12.1	21.5	2.7	21.13
98.95	0.55	5.6	16.2	24.1	2.9	23.64
99.00	0.60	6.9	21.2	26.6	3.1	26.15
99.05	0.65	8.2	28.2	26.7	3.4	26.18
99.10	0.70	9.5	35.3	27.9	3.7	27.27
99.15	0.75	10.9	42.9	29.3	3.9	28.62
99.20	0.80	12.4	51.3	30.6	4.1	29.97
99.25	0.85	13.9	60.5	32.0	4.3	31.32
99.30	0.90	15.5	70.5	33.4	4.5	32.67
99.35	0.95	17.2	81.3	34.8	4.7	34.02
99.39	0.99	18.6	90.6	35.9	4.9	35.10

Sm4r.out

ALTURA WEST DEVELOPMENT - SILVERY MINNOW PLACE

MANNING'S N = .0170

SLOPE = .0322

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.3	0.85
98.50	0.10	0.1	0.2	1.8	2.1	1.69
98.55	0.15	0.2	0.5	3.7	2.3	3.54
98.60	0.20	0.4	1.2	6.2	2.7	6.05
98.65	0.25	0.8	2.6	8.8	3.2	8.56
98.70	0.30	1.3	4.8	11.3	3.7	11.08
98.75	0.35	1.9	8.1	13.9	4.2	13.59
98.80	0.40	2.7	12.4	16.4	4.7	16.10
98.85	0.45	3.5	18.0	19.0	5.1	18.62
98.90	0.50	4.5	25.1	21.5	5.5	21.13
98.95	0.55	5.6	33.7	24.1	6.0	23.64
99.00	0.60	6.9	43.9	26.6	6.4	26.15
99.05	0.65	8.2	58.5	26.7	7.1	26.18
99.10	0.70	9.5	73.1	27.9	7.7	27.27
99.15	0.75	10.9	88.9	29.3	8.1	28.62
99.20	0.80	12.4	106.3	30.6	8.6	29.97
99.25	0.85	13.9	125.3	32.0	9.0	31.32
99.30	0.90	15.5	146.1	33.4	9.4	32.67
99.35	0.95	17.2	168.5	34.8	9.8	34.02
99.39	0.99	18.6	187.7	35.9	10.1	35.10

Sm5r.out

ALTURA WEST DEVELOPMENT - SILVERY MINNOW PLACE

MANNING'S N = .0170

SLOPE = .0075

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	0.6	0.85
98.50	0.10	0.1	0.1	1.8	1.0	1.69
98.55	0.15	0.2	0.2	3.7	1.1	3.54
98.60	0.20	0.4	0.6	6.2	1.3	6.05
98.65	0.25	0.8	1.3	8.8	1.5	8.56
98.70	0.30	1.3	2.3	11.3	1.8	11.08
98.75	0.35	1.9	3.9	13.9	2.0	13.59
98.80	0.40	2.7	6.0	16.4	2.3	16.10
98.85	0.45	3.5	8.7	19.0	2.5	18.62
98.90	0.50	4.5	12.1	21.5	2.7	21.13
98.95	0.55	5.6	16.2	24.1	2.9	23.64
99.00	0.60	6.9	21.2	26.6	3.1	26.15
99.05	0.65	8.2	28.2	26.7	3.4	26.18
99.10	0.70	9.5	35.3	27.9	3.7	27.27
99.15	0.75	10.9	42.9	29.3	3.9	28.62
99.20	0.80	12.4	51.3	30.6	4.1	29.97
99.25	0.85	13.9	60.4	32.0	4.3	31.32
99.30	0.90	15.5	70.4	33.4	4.5	32.67
99.35	0.95	17.2	81.3	34.8	4.7	34.02
99.39	0.99	18.6	90.5	35.9	4.9	35.10

Sm6r.out
ALTURA WEST DEVELOPMENT - SILVERY MINNOW PLACE

MANNING'S N = .0170 SLOPE = .0470

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.6	0.85
98.50	0.10	0.1	0.2	1.8	2.5	1.69
98.55	0.15	0.2	0.6	3.7	2.8	3.54
98.60	0.20	0.4	1.5	6.2	3.3	6.05
98.65	0.25	0.8	3.1	8.8	3.9	8.56
98.70	0.30	1.3	5.8	11.3	4.5	11.08
98.75	0.35	1.9	9.7	13.9	5.1	13.59
98.80	0.40	2.7	15.0	16.4	5.6	16.10
98.85	0.45	3.5	21.8	19.0	6.2	18.62
98.90	0.50	4.5	30.3	21.5	6.7	21.13
98.95	0.55	5.6	40.6	24.1	7.2	23.64
99.00	0.60	6.9	53.0	26.6	7.7	26.15
99.05	0.65	8.2	70.6	26.7	8.6	26.18
99.10	0.70	9.5	88.3	27.9	9.3	27.27
99.15	0.75	10.9	107.3	29.3	9.8	28.62
99.20	0.80	12.4	128.3	30.6	10.4	29.97
99.25	0.85	13.9	151.3	32.0	10.9	31.32
99.30	0.90	15.5	176.3	33.4	11.4	32.67
99.35	0.95	17.2	203.4	34.8	11.8	34.02
99.39	0.99	18.6	226.6	35.9	12.2	35.10

Willowr.out
ALTURA WEST DEVELOPMENT - WATERWILLOW PLACE

MANNING'S N = .0170 SLOPE = .0400

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.4	0.85
98.50	0.10	0.1	0.2	1.8	2.3	1.69
98.55	0.15	0.2	0.5	3.7	2.6	3.54
98.60	0.20	0.4	1.3	6.2	3.0	6.05
98.65	0.25	0.8	2.9	8.8	3.6	8.56
98.70	0.30	1.3	5.4	11.3	4.1	11.08
98.75	0.35	1.9	9.0	13.9	4.7	13.59
98.80	0.40	2.7	13.8	16.4	5.2	16.10
98.85	0.45	3.5	20.1	19.0	5.7	18.62
98.90	0.50	4.5	27.9	21.5	6.2	21.13
98.95	0.55	5.6	37.5	24.1	6.6	23.64
99.00	0.60	6.9	48.9	26.6	7.1	26.15
99.05	0.65	8.2	65.1	26.7	7.9	26.18
99.10	0.70	9.5	81.4	27.9	8.5	27.27
99.15	0.75	10.9	99.0	29.3	9.1	28.62
99.20	0.80	12.4	118.4	30.6	9.6	29.97
99.25	0.85	13.9	139.6	32.0	10.0	31.32
99.30	0.90	15.5	162.7	33.4	10.5	32.67
99.35	0.95	17.2	187.7	34.8	10.9	34.02
99.39	0.99	18.6	209.1	35.9	11.3	35.10

Willow2r.out

* ALTURA WEST DEVELOPMENT - WATERWILLOW PLACE

MANNING'S N = .0170

SLOPE = .0530

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.7	0.85
98.50	0.10	0.1	0.2	1.8	2.6	1.69
98.55	0.15	0.2	0.6	3.7	3.0	3.54
98.60	0.20	0.4	1.5	6.2	3.5	6.05
98.65	0.25	0.8	3.3	8.8	4.1	8.56
98.70	0.30	1.3	6.2	11.3	4.8	11.08
98.75	0.35	1.9	10.3	13.9	5.4	13.59
98.80	0.40	2.7	15.9	16.4	6.0	16.10
98.85	0.45	3.5	23.1	19.0	6.6	18.62
98.90	0.50	4.5	32.2	21.5	7.1	21.13
98.95	0.55	5.6	43.2	24.1	7.7	23.64
99.00	0.60	6.9	56.3	26.6	8.2	26.15
99.05	0.65	8.2	75.0	26.7	9.2	26.18
99.10	0.70	9.5	93.8	27.9	9.8	27.27
99.15	0.75	10.9	114.0	29.3	10.4	28.62
99.20	0.80	12.4	136.3	30.6	11.0	29.97
99.25	0.85	13.9	160.8	32.0	11.5	31.32
99.30	0.90	15.5	187.3	33.4	12.1	32.67
99.35	0.95	17.2	216.1	34.8	12.6	34.02
99.39	0.99	18.6	240.7	35.9	13.0	35.10

Willow3r.out
ALTURA WEST DEVELOPMENT - WATERWILLOW PLACE

MANNING'S N = .0170 SLOPE = .0400

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.4	0.85
98.50	0.10	0.1	0.2	1.8	2.3	1.69
98.55	0.15	0.2	0.5	3.7	2.6	3.54
98.60	0.20	0.4	1.3	6.2	3.0	6.05
98.65	0.25	0.8	2.9	8.8	3.6	8.56
98.70	0.30	1.3	5.4	11.3	4.1	11.08
98.75	0.35	1.9	9.0	13.9	4.7	13.59
98.80	0.40	2.7	13.8	16.4	5.2	16.10
98.85	0.45	3.5	20.1	19.0	5.7	18.62
98.90	0.50	4.5	27.9	21.5	6.2	21.13
98.95	0.55	5.6	37.5	24.1	6.6	23.64
99.00	0.60	6.9	48.9	26.6	7.1	26.15
99.05	0.65	8.2	65.1	26.7	7.9	26.18
99.10	0.70	9.5	81.4	27.9	8.5	27.27
99.15	0.75	10.9	99.0	29.3	9.1	28.62
99.20	0.80	12.4	118.4	30.6	9.6	29.97
99.25	0.85	13.9	139.6	32.0	10.0	31.32
99.30	0.90	15.5	162.7	33.4	10.5	32.67
99.35	0.95	17.2	187.7	34.8	10.9	34.02
99.39	0.99	18.6	209.1	35.9	11.3	35.10

Willow4r.out
ALTURA WEST DEVELOPMENT - WATERWILLOW PLACE

MANNING'S N = .0170 SLOPE = .0133

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	0.8	0.85
98.50	0.10	0.1	0.1	1.8	1.3	1.69
98.55	0.15	0.2	0.3	3.7	1.5	3.54
98.60	0.20	0.4	0.8	6.2	1.7	6.05
98.65	0.25	0.8	1.7	8.8	2.1	8.56
98.70	0.30	1.3	3.1	11.3	2.4	11.08
98.75	0.35	1.9	5.2	13.9	2.7	13.59
98.80	0.40	2.7	8.0	16.4	3.0	16.10
98.85	0.45	3.5	11.6	19.0	3.3	18.62
98.90	0.50	4.5	16.1	21.5	3.6	21.13
98.95	0.55	5.6	21.6	24.1	3.8	23.64
99.00	0.60	6.9	28.2	26.6	4.1	26.15
99.05	0.65	8.2	37.6	26.7	4.6	26.18
99.10	0.70	9.5	47.0	27.9	4.9	27.27
99.15	0.75	10.9	57.2	29.3	5.2	28.62
99.20	0.80	12.4	68.3	30.6	5.5	29.97
99.25	0.85	13.9	80.6	32.0	5.8	31.32
99.30	0.90	15.5	93.9	33.4	6.1	32.67
99.35	0.95	17.2	108.3	34.8	6.3	34.02
99.39	0.99	18.6	120.7	35.9	6.5	35.10

Willow5r.out
ALTURA WEST DEVELOPMENT - WATERWILLOW PLACE

MANNING'S N = .0170 SLOPE = .0440

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.5	0.85
98.50	0.10	0.1	0.2	1.8	2.4	1.69
98.55	0.15	0.2	0.6	3.7	2.7	3.54
98.60	0.20	0.4	1.4	6.2	3.2	6.05
98.65	0.25	0.8	3.0	8.8	3.8	8.56
98.70	0.30	1.3	5.6	11.3	4.3	11.08
98.75	0.35	1.9	9.4	13.9	4.9	13.59
98.80	0.40	2.7	14.5	16.4	5.4	16.10
98.85	0.45	3.5	21.1	19.0	6.0	18.62
98.90	0.50	4.5	29.3	21.5	6.5	21.13
98.95	0.55	5.6	39.3	24.1	7.0	23.64
99.00	0.60	6.9	51.3	26.6	7.4	26.15
99.05	0.65	8.2	68.3	26.7	8.3	26.18
99.10	0.70	9.5	85.4	27.9	9.0	27.27
99.15	0.75	10.9	103.8	29.3	9.5	28.62
99.20	0.80	12.4	124.2	30.6	10.0	29.97
99.25	0.85	13.9	146.4	32.0	10.5	31.32
99.30	0.90	15.5	170.6	33.4	11.0	32.67
99.35	0.95	17.2	196.8	34.8	11.5	34.02
99.39	0.99	18.6	219.3	35.9	11.8	35.10

Willow6r.out
ALTURA WEST DEVELOPMENT - WATERWILLOW PLACE

MANNING'S N = .0170 SLOPE = .0150

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	0.9	0.85
98.50	0.10	0.1	0.1	1.8	1.4	1.69
98.55	0.15	0.2	0.3	3.7	1.6	3.54
98.60	0.20	0.4	0.8	6.2	1.8	6.05
98.65	0.25	0.8	1.8	8.8	2.2	8.56
98.70	0.30	1.3	3.3	11.3	2.5	11.08
98.75	0.35	1.9	5.5	13.9	2.9	13.59
98.80	0.40	2.7	8.5	16.4	3.2	16.10
98.85	0.45	3.5	12.3	19.0	3.5	18.62
98.90	0.50	4.5	17.1	21.5	3.8	21.13
98.95	0.55	5.6	23.0	24.1	4.1	23.64
99.00	0.60	6.9	29.9	26.6	4.3	26.15
99.05	0.65	8.2	39.9	26.7	4.9	26.18
99.10	0.70	9.5	49.9	27.9	5.2	27.27
99.15	0.75	10.9	60.6	29.3	5.6	28.62
99.20	0.80	12.4	72.5	30.6	5.9	29.97
99.25	0.85	13.9	85.5	32.0	6.1	31.32
99.30	0.90	15.5	99.6	33.4	6.4	32.67
99.35	0.95	17.2	114.9	34.8	6.7	34.02
99.39	0.99	18.6	128.0	35.9	6.9	35.10

Willow7r.out

• ALTURA WEST DEVELOPMENT - WATERWILLOW PLACE

MANNING'S N = .0170

SLOPE = .0250

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.1	0.85
98.50	0.10	0.1	0.2	1.8	1.8	1.69
98.55	0.15	0.2	0.4	3.7	2.0	3.54
98.60	0.20	0.4	1.1	6.2	2.4	6.05
98.65	0.25	0.8	2.3	8.8	2.8	8.56
98.70	0.30	1.3	4.3	11.3	3.3	11.08
98.75	0.35	1.9	7.1	13.9	3.7	13.59
98.80	0.40	2.7	10.9	16.4	4.1	16.10
98.85	0.45	3.5	15.9	19.0	4.5	18.62
98.90	0.50	4.5	22.1	21.5	4.9	21.13
98.95	0.55	5.6	29.6	24.1	5.3	23.64
99.00	0.60	6.9	38.6	26.6	5.6	26.15
99.05	0.65	8.2	51.5	26.7	6.3	26.18
99.10	0.70	9.5	64.4	27.9	6.8	27.27
99.15	0.75	10.9	78.3	29.3	7.2	28.62
99.20	0.80	12.4	93.6	30.6	7.6	29.97
99.25	0.85	13.9	110.4	32.0	7.9	31.32
99.30	0.90	15.5	128.6	33.4	8.3	32.67
99.35	0.95	17.2	148.4	34.8	8.6	34.02
99.39	0.99	18.6	165.3	35.9	8.9	35.10

Willow8r.out
ALTURA WEST DEVELOPMENT - WATERWILLOW PLACE

MANNING'S N = .0170 SLOPE = .0167

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	0.9	0.85
98.50	0.10	0.1	0.1	1.8	1.5	1.69
98.55	0.15	0.2	0.3	3.7	1.7	3.54
98.60	0.20	0.4	0.9	6.2	1.9	6.05
98.65	0.25	0.8	1.9	8.8	2.3	8.56
98.70	0.30	1.3	3.5	11.3	2.7	11.08
98.75	0.35	1.9	5.8	13.9	3.0	13.59
98.80	0.40	2.7	8.9	16.4	3.4	16.10
98.85	0.45	3.5	13.0	19.0	3.7	18.62
98.90	0.50	4.5	18.0	21.5	4.0	21.13
98.95	0.55	5.6	24.2	24.1	4.3	23.64
99.00	0.60	6.9	31.5	26.6	4.6	26.15
99.05	0.65	8.2	42.0	26.7	5.1	26.18
99.10	0.70	9.5	52.6	27.9	5.5	27.27
99.15	0.75	10.9	63.9	29.3	5.9	28.62
99.20	0.80	12.4	76.4	30.6	6.2	29.97
99.25	0.85	13.9	90.1	32.0	6.5	31.32
99.30	0.90	15.5	105.0	33.4	6.8	32.67
99.35	0.95	17.2	121.1	34.8	7.0	34.02
99.39	0.99	18.6	135.0	35.9	7.3	35.10

Willow9r.out
ALTURA WEST DEVELOPMENT - WATERWILLOW PLACE

MANNING'S N = .0170 SLOPE = .0450

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	33.00	98.52	7	44.00	99.39
2	8.83	99.67	5	35.00	98.40			
3	9.00	99.00	6	35.17	99.06			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
98.45	0.05	0.0	0.0	0.9	1.5	0.85
98.50	0.10	0.1	0.2	1.8	2.4	1.69
98.55	0.15	0.2	0.6	3.7	2.7	3.54
98.60	0.20	0.4	1.4	6.2	3.2	6.05
98.65	0.25	0.8	3.1	8.8	3.8	8.56
98.70	0.30	1.3	5.7	11.3	4.4	11.08
98.75	0.35	1.9	9.5	13.9	5.0	13.59
98.80	0.40	2.7	14.7	16.4	5.5	16.10
98.85	0.45	3.5	21.3	19.0	6.0	18.62
98.90	0.50	4.5	29.6	21.5	6.6	21.13
98.95	0.55	5.6	39.8	24.1	7.0	23.64
99.00	0.60	6.9	51.8	26.6	7.5	26.15
99.05	0.65	8.2	69.1	26.7	8.4	26.18
99.10	0.70	9.5	86.4	27.9	9.1	27.27
99.15	0.75	10.9	105.0	29.3	9.6	28.62
99.20	0.80	12.4	125.6	30.6	10.1	29.97
99.25	0.85	13.9	148.1	32.0	10.6	31.32
99.30	0.90	15.5	172.5	33.4	11.1	32.67
99.35	0.95	17.2	199.0	34.8	11.6	34.02
99.39	0.99	18.6	221.7	35.9	11.9	35.10

Tealr.out

ALTURA WEST DEVELOPMENT - CINNAMON TEAL COURT

MANNING'S N = .0170

SLOPE = .0400

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	11.00	99.13	7	35.17	99.67
2	8.83	99.67	5	33.00	99.13	8	44.00	100.00
3	9.00	99.00	6	35.00	99.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
99.05	0.05	0.0	0.1	1.6	1.4	1.56
99.10	0.10	0.2	0.4	3.3	2.3	3.13
99.15	0.15	0.8	1.3	26.3	1.7	26.08
99.20	0.20	2.1	6.7	26.4	3.2	26.10
99.25	0.25	3.4	15.1	26.5	4.4	26.13
99.30	0.30	4.7	25.9	26.6	5.5	26.15
99.35	0.35	6.0	38.9	26.7	6.5	26.18
99.40	0.40	7.3	53.8	26.8	7.4	26.20
99.45	0.45	8.6	70.7	26.9	8.2	26.23
99.50	0.50	9.9	89.2	27.0	9.0	26.25
99.55	0.55	11.3	109.4	27.1	9.7	26.28
99.60	0.60	12.6	131.2	27.2	10.4	26.30
99.65	0.65	13.9	154.5	27.3	11.1	26.33
99.70	0.70	15.2	173.3	29.0	11.4	27.95
99.75	0.75	16.7	190.4	31.7	11.4	30.62
99.80	0.80	18.3	210.1	34.4	11.5	33.30
99.85	0.85	20.0	232.3	37.0	11.6	35.97
99.90	0.90	21.9	257.2	39.7	11.8	38.65
99.95	0.95	23.9	284.9	42.4	11.9	41.32
100.00	1.00	26.0	315.4	45.1	12.1	44.00

Teallr.out

ALTURA WEST DEVELOPMENT - CINNAMON TEAL COURT

MANNING'S N = .0170

SLOPE = .0697

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	11.00	99.13	7	35.17	99.67
2	8.83	99.67	5	33.00	99.13	8	44.00	100.00
3	9.00	99.00	6	35.00	99.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
99.05	0.05	0.0	0.1	1.6	1.9	1.56
99.10	0.10	0.2	0.5	3.3	3.0	3.13
99.15	0.15	0.8	1.7	26.3	2.2	26.08
99.20	0.20	2.1	8.9	26.4	4.3	26.10
99.25	0.25	3.4	19.9	26.5	5.9	26.13
99.30	0.30	4.7	34.2	26.6	7.3	26.15
99.35	0.35	6.0	51.3	26.7	8.5	26.18
99.40	0.40	7.3	71.0	26.8	9.7	26.20
99.45	0.45	8.6	93.2	26.9	10.8	26.23
99.50	0.50	9.9	117.7	27.0	11.8	26.25
99.55	0.55	11.3	144.4	27.1	12.8	26.28
99.60	0.60	12.6	173.2	27.2	13.8	26.30
99.65	0.65	13.9	203.9	27.3	14.7	26.33
99.70	0.70	15.2	228.7	29.0	15.0	27.95
99.75	0.75	16.7	251.2	31.7	15.1	30.62
99.80	0.80	18.3	277.2	34.4	15.2	33.30
99.85	0.85	20.0	306.6	37.0	15.3	35.97
99.90	0.90	21.9	339.5	39.7	15.5	38.65
99.95	0.95	23.9	376.0	42.4	15.7	41.32
100.00	1.00	26.0	416.2	45.1	16.0	44.00

Gooser.out

ALTURA WEST DEVELOPMENT - SNOW GOOSE COURT

MANNING'S N = .0170

SLOPE = .0400

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	11.00	99.13	7	35.17	99.67
2	8.83	99.67	5	33.00	99.13	8	44.00	100.00
3	9.00	99.00	6	35.00	99.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
99.05	0.05	0.0	0.1	1.6	1.4	1.56
99.10	0.10	0.2	0.4	3.3	2.3	3.13
99.15	0.15	0.8	1.3	26.3	1.7	26.08
99.20	0.20	2.1	6.7	26.4	3.2	26.10
99.25	0.25	3.4	15.1	26.5	4.4	26.13
99.30	0.30	4.7	25.9	26.6	5.5	26.15
99.35	0.35	6.0	38.9	26.7	6.5	26.18
99.40	0.40	7.3	53.8	26.8	7.4	26.20
99.45	0.45	8.6	70.7	26.9	8.2	26.23
99.50	0.50	9.9	89.2	27.0	9.0	26.25
99.55	0.55	11.3	109.4	27.1	9.7	26.28
99.60	0.60	12.6	131.2	27.2	10.4	26.30
99.65	0.65	13.9	154.5	27.3	11.1	26.33
99.70	0.70	15.2	173.3	29.0	11.4	27.95
99.75	0.75	16.7	190.4	31.7	11.4	30.62
99.80	0.80	18.3	210.1	34.4	11.5	33.30
99.85	0.85	20.0	232.3	37.0	11.6	35.97
99.90	0.90	21.9	257.2	39.7	11.8	38.65
99.95	0.95	23.9	284.9	42.4	11.9	41.32
100.00	1.00	26.0	315.4	45.1	12.1	44.00

Gooselr.out
ALTURA WEST DEVELOPMENT - SNOW GOOSE COURT

MANNING'S N = .0170 SLOPE = .0530

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	11.00	99.13	7	35.17	99.67
2	8.83	99.67	5	33.00	99.13	8	44.00	100.00
3	9.00	99.00	6	35.00	99.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
99.05	0.05	0.0	0.1	1.6	1.7	1.56
99.10	0.10	0.2	0.4	3.3	2.6	3.13
99.15	0.15	0.8	1.5	26.3	1.9	26.08
99.20	0.20	2.1	7.8	26.4	3.7	26.10
99.25	0.25	3.4	17.4	26.5	5.1	26.13
99.30	0.30	4.7	29.8	26.6	6.3	26.15
99.35	0.35	6.0	44.7	26.7	7.4	26.18
99.40	0.40	7.3	62.0	26.8	8.5	26.20
99.45	0.45	8.6	81.3	26.9	9.4	26.23
99.50	0.50	9.9	102.7	27.0	10.3	26.25
99.55	0.55	11.3	126.0	27.1	11.2	26.28
99.60	0.60	12.6	151.1	27.2	12.0	26.30
99.65	0.65	13.9	177.9	27.3	12.8	26.33
99.70	0.70	15.2	199.5	29.0	13.1	27.95
99.75	0.75	16.7	219.2	31.7	13.1	30.62
99.80	0.80	18.3	241.8	34.4	13.2	33.30
99.85	0.85	20.0	267.4	37.0	13.4	35.97
99.90	0.90	21.9	296.1	39.7	13.5	38.65
99.95	0.95	23.9	328.0	42.4	13.7	41.32
100.00	1.00	26.0	363.1	45.1	14.0	44.00

Hawkr.out
ALTURA WEST DEVELOPMENT - GRAY HAWK COURT

MANNING'S N = .0170 SLOPE = .0725

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	11.00	99.13	7	35.17	99.67
2	8.83	99.67	5	33.00	99.13	8	44.00	100.00
3	9.00	99.00	6	35.00	99.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
99.05	0.05	0.0	0.1	1.6	1.9	1.56
99.10	0.10	0.2	0.5	3.3	3.1	3.13
99.15	0.15	0.8	1.8	26.3	2.3	26.08
99.20	0.20	2.1	9.1	26.4	4.3	26.10
99.25	0.25	3.4	20.3	26.5	6.0	26.13
99.30	0.30	4.7	34.8	26.6	7.4	26.15
99.35	0.35	6.0	52.3	26.7	8.7	26.18
99.40	0.40	7.3	72.5	26.8	9.9	26.20
99.45	0.45	8.6	95.1	26.9	11.0	26.23
99.50	0.50	9.9	120.1	27.0	12.1	26.25
99.55	0.55	11.3	147.3	27.1	13.1	26.28
99.60	0.60	12.6	176.6	27.2	14.0	26.30
99.65	0.65	13.9	208.0	27.3	15.0	26.33
99.70	0.70	15.2	233.2	29.0	15.3	27.95
99.75	0.75	16.7	256.3	31.7	15.4	30.62
99.80	0.80	18.3	282.7	34.4	15.5	33.30
99.85	0.85	20.0	312.7	37.0	15.6	35.97
99.90	0.90	21.9	346.2	39.7	15.8	38.65
99.95	0.95	23.9	383.5	42.4	16.1	41.32
100.00	1.00	26.0	424.5	45.1	16.3	44.00

Hawk1r.out
ALTURA WEST DEVELOPMENT - GRAY HAWK COURT

MANNING'S N = .0170 SLOPE = .0437

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	11.00	99.13	7	35.17	99.67
2	8.83	99.67	5	33.00	99.13	8	44.00	100.00
3	9.00	99.00	6	35.00	99.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
99.05	0.05	0.0	0.1	1.6	1.5	1.56
99.10	0.10	0.2	0.4	3.3	2.4	3.13
99.15	0.15	0.8	1.4	26.3	1.8	26.08
99.20	0.20	2.1	7.0	26.4	3.4	26.10
99.25	0.25	3.4	15.8	26.5	4.6	26.13
99.30	0.30	4.7	27.1	26.6	5.8	26.15
99.35	0.35	6.0	40.6	26.7	6.8	26.18
99.40	0.40	7.3	56.3	26.8	7.7	26.20
99.45	0.45	8.6	73.9	26.9	8.6	26.23
99.50	0.50	9.9	93.3	27.0	9.4	26.25
99.55	0.55	11.3	114.5	27.1	10.2	26.28
99.60	0.60	12.6	137.2	27.2	10.9	26.30
99.65	0.65	13.9	161.6	27.3	11.6	26.33
99.70	0.70	15.2	181.2	29.0	11.9	27.95
99.75	0.75	16.7	199.1	31.7	11.9	30.62
99.80	0.80	18.3	219.7	34.4	12.0	33.30
99.85	0.85	20.0	243.0	37.0	12.1	35.97
99.90	0.90	21.9	269.0	39.7	12.3	38.65
99.95	0.95	23.9	298.0	42.4	12.5	41.32
100.00	1.00	26.0	329.9	45.1	12.7	44.00

Piperr.out
ALTURA WEST DEVELOPMENT - SAND PIPER COURT

MANNING'S N = .0170 SLOPE = .0400

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	11.00	99.13	7	35.17	99.67
2	8.83	99.67	5	33.00	99.13	8	44.00	100.00
3	9.00	99.00	6	35.00	99.00			

WSEL (FT)	DEPTH INC	FLOW AREA (SQ FT)	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOP WID
99.05	0.05	0.0	0.1	1.6	1.4	1.56
99.10	0.10	0.2	0.4	3.3	2.3	3.13
99.15	0.15	0.8	1.3	26.3	1.7	26.08
99.20	0.20	2.1	6.7	26.4	3.2	26.10
99.25	0.25	3.4	15.1	26.5	4.4	26.13
99.30	0.30	4.7	25.9	26.6	5.5	26.15
99.35	0.35	6.0	38.9	26.7	6.5	26.18
99.40	0.40	7.3	53.8	26.8	7.4	26.20
99.45	0.45	8.6	70.7	26.9	8.2	26.23
99.50	0.50	9.9	89.2	27.0	9.0	26.25
99.55	0.55	11.3	109.4	27.1	9.7	26.28
99.60	0.60	12.6	131.2	27.2	10.4	26.30
99.65	0.65	13.9	154.5	27.3	11.1	26.33
99.70	0.70	15.2	173.3	29.0	11.4	27.95
99.75	0.75	16.7	190.4	31.7	11.4	30.62
99.80	0.80	18.3	210.1	34.4	11.5	33.30
99.85	0.85	20.0	232.3	37.0	11.6	35.97
99.90	0.90	21.9	257.2	39.7	11.8	38.65
99.95	0.95	23.9	284.9	42.4	11.9	41.32
100.00	1.00	26.0	315.4	45.1	12.1	44.00

Piper1r.out

*ALTURA WEST DEVELOPMENT - SAND PIPER COURT

MANNING'S N = .0170

SLOPE = .0764

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	100.00	4	11.00	99.13	7	35.17	99.67
2	8.83	99.67	5	33.00	99.13	8	44.00	100.00
3	9.00	99.00	6	35.00	99.00			

WSEL	DEPTH	FLOW	FLOW	WETTED	FLOW	TOP
(FT)	INC	AREA	RATE	PER	VEL	WID
		(SQ FT)	(CFS)	(FT)	(FPS)	
99.05	0.05	0.0	0.1	1.6	2.0	1.56
99.10	0.10	0.2	0.5	3.3	3.2	3.13
99.15	0.15	0.8	1.8	26.3	2.3	26.08
99.20	0.20	2.1	9.3	26.4	4.5	26.10
99.25	0.25	3.4	20.8	26.5	6.1	26.13
99.30	0.30	4.7	35.8	26.6	7.6	26.15
99.35	0.35	6.0	53.7	26.7	8.9	26.18
99.40	0.40	7.3	74.4	26.8	10.2	26.20
99.45	0.45	8.6	97.6	26.9	11.3	26.23
99.50	0.50	9.9	123.3	27.0	12.4	26.25
99.55	0.55	11.3	151.2	27.1	13.4	26.28
99.60	0.60	12.6	181.4	27.2	14.4	26.30
99.65	0.65	13.9	213.5	27.3	15.4	26.33
99.70	0.70	15.2	239.5	29.0	15.7	27.95
99.75	0.75	16.7	263.1	31.7	15.8	30.62
99.80	0.80	18.3	290.3	34.4	15.9	33.30
99.85	0.85	20.0	321.0	37.0	16.0	35.97
99.90	0.90	21.9	355.5	39.7	16.2	38.65
99.95	0.95	23.9	393.7	42.4	16.5	41.32
100.00	1.00	26.0	435.9	45.1	16.8	44.00

APPENDIX B

INLET CAPACITIES

ULTIMATE DEVELOPED CONDITIONS FOR
INLETS IN OXBOW BLUFF SUBDIVISION - TRACT F
Oct-97

INLET	CONDITION	TYPE	CONTRIBUTING BASIN AND RESIDUAL INLET	FLOW TO INLET 100-YR (CFS)	STREET DEPTH (FT)	FLOW TO INLET 2X100-YR (CFS)	STREET DEPTH (FT)	GRATE CAP. AT ROW (CFS)	INLET CAP. AT ROW (CFS)
1	ON GRADE	'A' DOUBLE GRATE	BASIN N	9.40	0.342	NA	NA	6.20	NA
2	ON GRADE	'A' SINGLE GRATE	INLET 1	3.20	0.230	NA	NA	2.90	NA
3	ON GRADE	'A' DOUBLE GRATE	BASIN O	9.12	0.345	NA	NA	5.90	NA
4	ON GRADE	'A' SINGLE GRATE	INLET 3	3.22	0.230	NA	NA	2.90	NA
5	ON GRADE	'A' DOUBLE GRATE	BASIN E1, INLET 2, INLET 4	5.16	0.265	NA	NA	4.10	NA
6	SUMP	'A' DOUBLE GRATE & WINGS BOTH SIDES	BASIN I, INLET 2, INLET 4	12.49	0.391	24.98	0.621	NA	51.00
7	SUMP	'A' SINGLE GRATE & WINGS BOTH SIDES	BASIN J	4.92	0.237	9.84	0.378	NA	51.00
8	SUMP	'A' DOUBLE GRATE & WINGS BOTH SIDES	BASIN G, INLET 5	8.23	0.296	16.46	0.469	NA	51.00
9	SUMP	'A' SINGLE GRATE & WINGS BOTH SIDES	BASIN H	5.52	0.256	11.04	0.409	NA	51.00
10	SUMP	'A' SINGLE GRATE & WINGS BOTH SIDES	BASIN K	5.22	0.246	10.44	0.394	NA	51.00
11	SUMP	'A' DOUBLE GRATE & WINGS BOTH SIDES	BASIN E2, INLET 5	9.99	0.336	19.98	0.534	NA	51.00
12	SUMP	'A' DOUBLE GRATE & WINGS BOTH SIDES	BASIN A	8.99	0.313	17.98	0.499	NA	51.00
13	SUMP	'A' DOUBLE GRATE & WINGS BOTH SIDES	BASIN P	12.10	0.382	24.20	0.608	NA	51.00
14	SUMP	'D' SINGLE GRATE	BASIN N, BASIN O	NA	NA	NA	NA	NA	NA

NOTE:

Inlet 15 is only for nuisance flows coming from Oxbow Drive therefore the inlet was not included in the drainage basin calculations.

BASIN I
INLET 6

ANALYSIS OF AN INLET IN A SUMP CONDITION

INLET TYPE: Double Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: $Q = C \cdot L \cdot H^{1.5}$

Wing opening

C=3.0

L=2(4.0)=8.0

$Q = 3.0(8.0)H^{1.5} = 24.0 \cdot H^{1.5}$

Grate opening

C=3.0

L(double grate)=[2(2.96')+2(1.54')]=9.00'

$Q = 3.0(9.00)H^{1.5} = 27.00 \cdot H^{1.5}$

ORIFICE:

$Q = C \cdot A \cdot (2 \cdot G \cdot H)^{0.5}$

Grate opening

C=0.6

A(double grate)=8.19 sf

$Q = 4.914 \cdot (64.4 \cdot H)^{0.5}$

Wing opening

C=0.6

A=2(2.0)=4.0 sf

$Q = 2.4 \cdot (64.4 \cdot H)^{0.5}$

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.76	0.85	12.47	1.61	Weir controls on grate analysis
	0.20	0.20	2.15	2.41	17.64	4.56	
	0.30	0.30	3.94	4.44	21.60	8.38	
	0.40	0.40	6.07	6.83	24.94	12.90	Q ₁₀₀ =12.49 cfs from Basin I and Inlets 2 & 4
	0.50	0.50	8.49	9.55	27.88	18.03	
	0.60	0.60	11.15	12.55	30.55	23.70	
TOP OF CURB	0.70	0.70	14.06	15.81	32.99	29.87	Q _{2x100} =24.98 cfs from Basin I and Inlets 2 & 4
	0.80	0.80	17.17	19.32	35.27	36.49	
	0.90	0.90	20.49	23.05	37.41	43.54	
ROW LIMIT	1.00	1.00	24.00	27.00	39.43	51.00	

NOTE:

The total runoff intercepted by the inlet at the low point in Silvery Minnow Place is:

$Q_{total} = (\text{runoff of the wing opening}) + (\text{the lesser of the weir or orifice amount taken by the double grate}).$

THE 100 YR STORM EVENT = 12.49 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 24.98 CFS at the sump condition

An additional residual flow of 0.62 cfs is assumed from Inlets 2 & 4 on Mourning Dove Place in the 100 year and 200 year calculations.

BASIN J
INLET 7

ANALYSIS OF AN INLET IN A SUMP CONDITION

INLET TYPE: Single Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: $Q = C \cdot L \cdot H^{1.5}$

Wing opening

C= 3.0

L= 2(4.0)=8.0

$Q = 3.0(8.0')H^{1.5} = 24.0 \cdot H^{1.5}$

Grate opening

C=3.0

L(single grate)=[(2.96')+2(1.54')]=6.04'

$Q = 3.0(6.04)H^{1.5} = 18.12 \cdot H^{1.5}$

ORIFICE: $Q = C \cdot A \cdot (2 \cdot G \cdot H)^{0.5}$

Grate opening

C=0.6

A(single grate)=4.10 sf

$Q = 2.46 \cdot (64.4 \cdot H)^{0.5}$

Wing opening

C=0.6

A=2(2.0)=4.0 sf

$Q = 2.4 \cdot (64.4 \cdot H)^{0.5}$

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR SINGLE GRATE	Q (CFS) ORIFICE SINGLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.76	0.57	6.24	1.33	Weir controls on grate analysis
	0.20	0.20	2.15	1.62	8.83	3.77	
	0.30	0.30	3.94	2.98	10.81	6.92	$Q_{100} = 4.92$ cfs from Basin J
	0.40	0.40	6.07	4.58	12.49	10.66	$Q_{2 \times 100} = 9.84$ cfs from Basin J
	0.50	0.50	8.49	6.41	13.96	14.89	
	0.60	0.60	11.15	8.42	15.29	19.58	
TOP OF CURB	0.70	0.70	14.06	10.61	16.52	24.67	▼
	0.80	0.80	17.17	12.97	17.66	30.14	
	0.90	0.90	20.49	15.47	18.73	35.96	
ROW LIMIT	1.00	1.00	24.00	18.12	19.74	42.12	

NOTE: The total runoff intercepted by the inlet at the low point in the Silvery Minnow cul-de-sac is:

$Q_{total} = (\text{runoff of the wing opening}) + (\text{the lesser of the weir or orifice amount taken by the single grate}).$

THE 100 YR STORM EVENT = 4.92 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 9.84 CFS at the sump condition

BASIN G
INLET 8

ANALYSIS OF AN INLET IN A SUMP CONDITION

INLET TYPE: Double Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: $Q = C * L * H^{1.5}$

Wing opening

C= 3.0

L= 2(4.0)=8.0

$Q = 3.0(8.0)H^{1.5} = 24.0 * H^{1.5}$

Grate opening

C=3.0

L(double grate)=[2(2.96')+2(1.54')]=9.00'

$Q = 3.0(9.00)H^{1.5} = 27.00 * H^{1.5}$

ORIFICE: $Q = C * A * (2 * G * H)^{0.5}$

Grate opening

C=0.6

A(double grate)=8.19 sf

$Q = 4.914 * (64.4 * H)^{0.5}$

Wing opening

C=0.6

A=2(2.0)=4.0 sf

$Q = 2.4 * (64.4 * H)^{0.5}$

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.76	0.85	12.47	1.61	Weir controls on grate analysis
	0.20	0.20	2.15	2.41	17.64	4.56	
	0.30	0.30	3.94	4.44	21.60	8.38	$Q_{100} = 8.23$ cfs from Basin G and Inlet 5
	0.40	0.40	6.07	6.83	24.94	12.90	
	0.50	0.50	8.49	9.55	27.88	18.03	$Q_{2 \times 100} = 16.46$ cfs from Basin G and Inlet 5
	0.60	0.60	11.15	12.55	30.55	23.70	
TOP OF CURB	0.70	0.70	14.06	15.81	32.99	29.87	▼
	0.80	0.80	17.17	19.32	35.27	36.49	
	0.90	0.90	20.49	23.05	37.41	43.54	
ROW LIMIT	1.00	1.00	24.00	27.00	39.43	51.00	

NOTE:

The total runoff intercepted by the inlet at the low point in Sand Piper Court is:

$Q_{total} = (\text{runoff of the wing opening}) + (\text{the lesser of the weir or orifice amount taken by the double grate}).$

THE 100 YR STORM EVENT = 8.23 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 16.46 CFS at the sump condition

An additional residual flow of 1.06 cfs is assumed from Inlet 5 on Mourning Dove Place in the 100 year and 200 year calculations.

BASIN H
INLET 9

ANALYSIS OF AN INLET IN A SUMP CONDITION

INLET TYPE: Single Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: $Q = C \cdot L \cdot H^{1.5}$

Wing opening

C=3.0

L=2(4.0)=8.0

$Q = 3.0(8.0)H^{1.5} = 24.0 \cdot H^{1.5}$

Grate opening

C=3.0

L(single grate)=[(2.96')+2(1.54')]=6.04'

$Q = 3.0(6.04)H^{1.5} = 18.12 \cdot H^{1.5}$

ORIFICE: $Q = C \cdot A \cdot (2 \cdot G \cdot H)^{0.5}$

Grate opening

C=0.6

A(single grate)=4.10 sf

$Q = 2.46 \cdot (64.4 \cdot H)^{0.5}$

Wing opening

C=0.6

A=2(2.0)=4.0 sf

$Q = 2.4 \cdot (64.4 \cdot H)^{0.5}$

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR SINGLE GRATE	Q (CFS) ORIFICE SINGLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.76	0.57	6.24	1.33	Weir controls on grate analysis
	0.20	0.20	2.15	1.62	8.83	3.77	
	0.30	0.30	3.94	2.98	10.81	6.92	$Q_{100} = 5.52$ cfs from Basin H
	0.40	0.40	6.07	4.58	12.49	10.66	
	0.50	0.50	8.49	6.41	13.96	14.89	$Q_{2 \times 100} = 11.04$ cfs from Basin H
	0.60	0.60	11.15	8.42	15.29	19.58	
TOP OF CURB	0.70	0.70	14.06	10.61	16.52	24.67	▼
	0.80	0.80	17.17	12.97	17.66	30.14	
	0.90	0.90	20.49	15.47	18.73	35.96	
ROW LIMIT	1.00	1.00	24.00	18.12	19.74	42.12	

NOTE:

The total runoff intercepted by the inlet at the low point in Gray Hawk Court is:

$Q_{total} = (\text{runoff of the wing opening}) + (\text{the lesser of the weir or orifice amount taken by the single grate}).$

THE 100 YR STORM EVENT = 5.52 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 11.04 CFS at the sump condition

BASIN K
INLET 10

ANALYSIS OF AN INLET IN A SUMP CONDITION

INLET TYPE: Single Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: $Q = C \cdot L \cdot H^{1.5}$

Wing opening

C= 3.0

L= 2(4.0)=8.0

$Q = 3.0(8.0')H^{1.5} = 24.0 \cdot H^{1.5}$

Grate opening

C=3.0

L(single grate)=[(2.96')+2(1.54')]=6.04'

$Q = 3.0(6.04)H^{1.5} = 18.12 \cdot H^{1.5}$

ORIFICE: $Q = C \cdot A \cdot (2 \cdot G \cdot H)^{0.5}$

Grate opening

C=0.6

A(single grate)=4.10 sf

$Q = 2.46 \cdot (64.4 \cdot H)^{0.5}$

Wing opening

C=0.6

A=2(2.0)=4.0 sf

$Q = 2.4 \cdot (64.4 \cdot H)^{0.5}$

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR SINGLE GRATE	Q (CFS) ORIFICE SINGLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.76	0.57	6.24	1.33	Weir controls on grate analysis
	0.20	0.20	2.15	1.62	8.83	3.77	
	0.30	0.30	3.94	2.98	10.81	6.92	$Q_{100} = 5.22$ cfs from Basin K
	0.40	0.40	6.07	4.58	12.49	10.66	$Q_{2 \times 100} = 10.44$ cfs from Basin K
	0.50	0.50	8.49	6.41	13.96	14.89	
	0.60	0.60	11.15	8.42	15.29	19.58	
TOP OF CURB	0.70	0.70	14.06	10.61	16.52	24.67	▼
	0.80	0.80	17.17	12.97	17.66	30.14	
	0.90	0.90	20.49	15.47	18.73	35.96	
ROW LIMIT	1.00	1.00	24.00	18.12	19.74	42.12	

NOTE:

The total runoff intercepted by the inlet at the low point in Waterwillow cul-de-sac is:

$Q_{total} = (\text{runoff of the wing opening}) + (\text{the lesser of the weir or orifice amount taken by the single grate}).$

THE 100 YR STORM EVENT = 5.22 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 10.44 CFS at the sump condition

BASIN E2
INLET 11

ANALYSIS OF AN INLET IN A SUMP CONDITION

INLET TYPE: Double Gate Type "A" with curb opening wings on both sides on inlet.

WEIR: $Q = C * L * H^{1.5}$

Wing opening

C= 3.0

L= 2(4.0)=8.0

$Q = 3.0(8.0')H^{1.5} = 24.0 * H^{1.5}$

Grate opening

C=3.0

L(double grate)=[2(2.96')+2(1.54')]=9.00'

$Q = 3.0(9.00)H^{1.5} = 27.00 * H^{1.5}$

ORIFICE: $Q = C * A * (2 * G * H)^{0.5}$

Grate opening

C=0.6

A(double grate)=8.19 sf

$Q = 4.914 * (64.4 * H)^{0.5}$

Wing opening

C=0.6

A=2(2.0)=4.0 sf

$Q = 2.4 * (64.4 * H)^{0.5}$

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.76	0.85	12.47	1.61	Weir controls on grate analysis
	0.20	0.20	2.15	2.41	17.64	4.56	
	0.30	0.30	3.94	4.44	21.60	8.38	
	0.40	0.40	6.07	6.83	24.94	12.90	Q ₁₀₀ =9.99 cfs from Basin E2 and Inlet 5
	0.50	0.50	8.49	9.55	27.88	18.03	
	0.60	0.60	11.15	12.55	30.55	23.70	Q _{2x100} =19.98 cfs from Basin E2 and Inlet 5
TOP OF CURB	0.70	0.70	14.06	15.81	32.99	29.87	
	0.80	0.80	17.17	19.32	35.27	36.49	
	0.90	0.90	20.49	23.05	37.41	43.54	
ROW LIMIT	1.00	1.00	24.00	27.00	39.43	51.00	

NOTE:

The total runoff intercepted by the inlet at the low point in Cinnamon Teal Court is:

$Q_{total} = (\text{runoff of the wing opening}) + (\text{the lesser of the weir or orifice amount taken by the double grate}).$

THE 100 YR STORM EVENT = 9.99 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 19.98 CFS at the sump condition

An additional residual flow of 1.06 cfs is assumed from Inlet 5 on Mourning Dove Place in the 100 year and 200 year calculations.

Basin E was divided into two separate sub-basins(E1 & E2) where each sub-basin is directed into different inlets.

Basin E1 (Q=4.54 cfs) is directed into Inlet 5

Basin E2 (Q=8.93 cfs) is directed into Inlet 11

BASIN A
INLET 12

ANALYSIS OF AN INLET IN A SUMP CONDITION

INLET TYPE: Double Grate Type "A" with curb opening wings on both sides on inlet.

WEIR: $Q = C \cdot L \cdot H^{1.5}$

Wing opening

C= 3.0

L= 2(4.0)=8.0

$Q = 3.0(8.0')H^{1.5} = 24.0 \cdot H^{1.5}$

Grate opening

C=3.0

L(double grate)=[2(2.96')+2(1.54')]=9.00'

$Q = 3.0(9.00)H^{1.5} = 27.00 \cdot H^{1.5}$

ORIFICE: $Q = C \cdot A \cdot (2 \cdot G \cdot H)^{0.5}$

Grate opening

C=0.6

A(double grate)=8.19 sf

$Q = 4.914 \cdot (64.4 \cdot H)^{0.5}$

Wing opening

C=0.6

A=2(2.0)=4.0 sf

$Q = 2.4 \cdot (64.4 \cdot H)^{0.5}$

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.76	0.85	12.47	1.61	Weir controls on grate analysis
	0.20	0.20	2.15	2.41	17.64	4.56	
	0.30	0.30	3.94	4.44	21.60	8.38	
	0.40	0.40	6.07	6.83	24.94	12.90	Q ₁₀₀ =8.99 cfs from Basin A
	0.50	0.50	8.49	9.55	27.88	18.03	
	0.60	0.60	11.15	12.55	30.55	23.70	Q _{2x100} =17.98 cfs from Basin A
TOP OF CURB	0.70	0.70	14.06	15.81	32.99	29.87	▼
	0.80	0.80	17.17	19.32	35.27	36.49	
	0.90	0.90	20.49	23.05	37.41	43.54	
ROW LIMIT	1.00	1.00	24.00	27.00	39.43	51.00	

NOTE:

The total runoff intercepted by the inlet at the low point in Snow Goose Court is:

$Q_{total} = (\text{runoff of the wing opening}) + (\text{the lesser of the weir or orifice amount taken by the double grate}).$

THE 100 YR STORM EVENT = 8.99 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 17.98 CFS at the sump condition

BASIN P
INLET 13

ANALYSIS OF AN INLET IN A SUMP CONDITION

INLET TYPE: Double Gate Type "A" with curb opening wings on both sides on inlet.

WEIR: $Q=C*L*H^{1.5}$

Wing opening

C=3.0

L=2(4.0)=8.0

$Q=3.0(8.0)H^{1.5}=24.0*H^{1.5}$

Grate opening

C=3.0

L(double grate)=[2(2.96')+2(1.54')]=9.00'

$Q=3.0(9.00)H^{1.5}=27.00*H^{1.5}$

ORIFICE: $Q=C*A*(2*G*H)^{0.5}$

Grate opening

C=0.6

A(double grate)=8.19 sf

$Q=4.914*(64.4*H)^{0.5}$

Wing opening

C=0.6

A=2(2.0)=4.0 sf

$Q=2.4*(64.4*H)^{0.5}$

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.76	0.85	12.47	1.61	Weir controls on grate analysis
	0.20	0.20	2.15	2.41	17.64	4.56	
	0.30	0.30	3.94	4.44	21.60	8.38	
	0.40	0.40	6.07	6.83	24.94	12.90	Q ₁₀₀ =12.10 cfs from Basin P and Basin 02
	0.50	0.50	8.49	9.55	27.88	18.03	
	0.60	0.60	11.15	12.55	30.55	23.70	
TOP OF CURB	0.70	0.70	14.06	15.81	32.99	29.87	Q _{2X100} =24.20 cfs from Basin P and Basin 02
	0.80	0.80	17.17	19.32	35.27	36.49	
	0.90	0.90	20.49	23.05	37.41	43.54	
ROW LIMIT	1.00	1.00	24.00	27.00	39.43	51.00	

NOTE:

The total runoff intercepted by the inlet at the low point in Oxbow Drive is:

$Q_{total} = (\text{runoff of the wing opening}) + (\text{the lesser of the weir or orifice amount taken by the double grate}).$

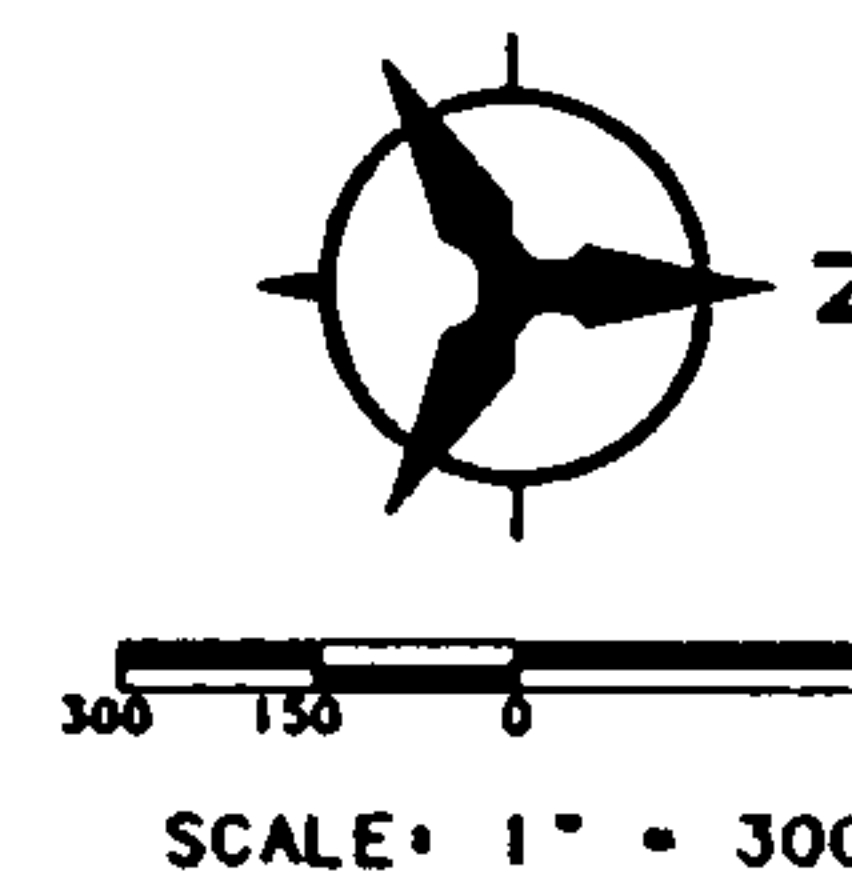
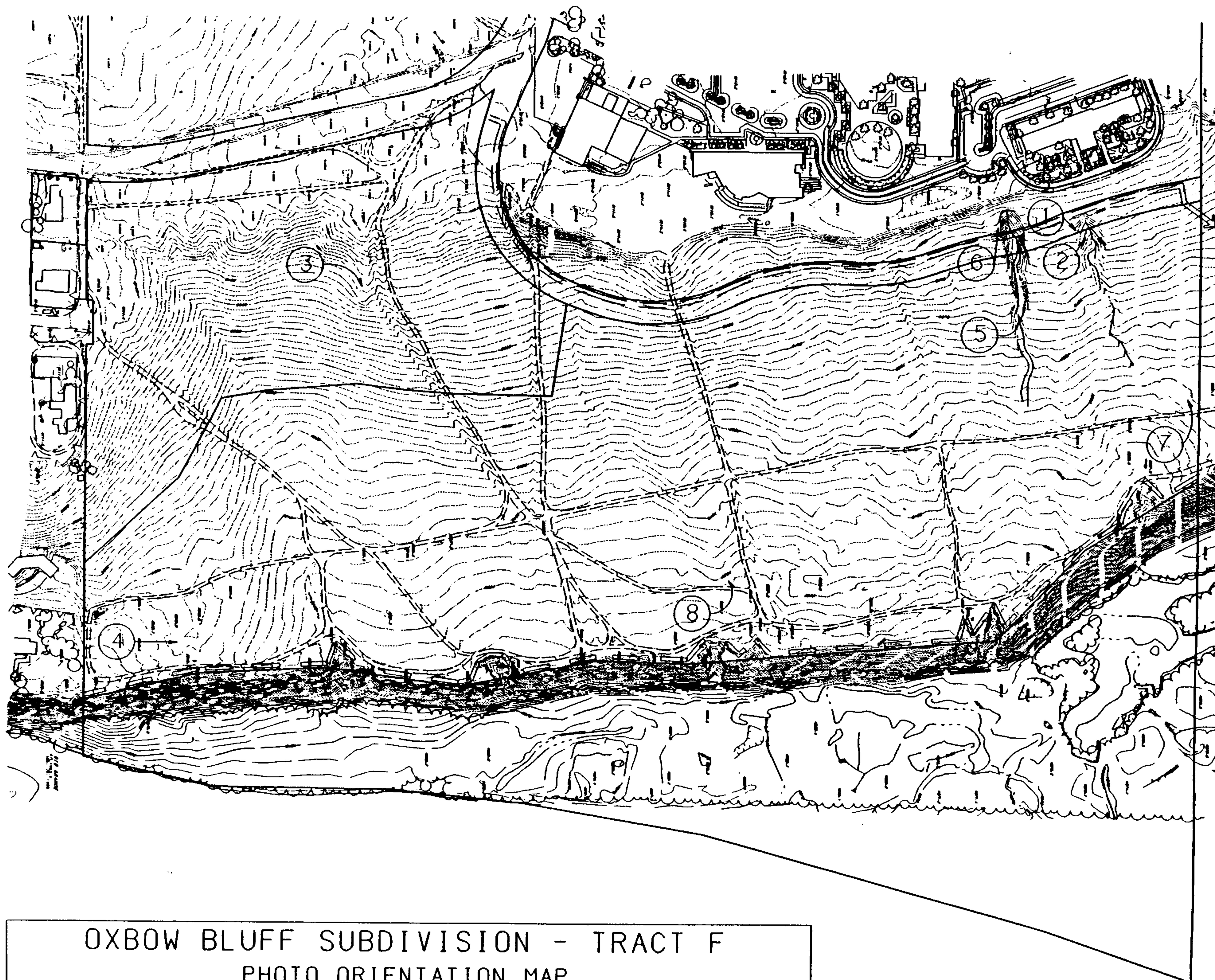
THE 100 YR STORM EVENT = 12.10 CFS at the sump condition

THE 2 x 100 YR STORM EVENT = 24.20 CFS at the sump condition

An additional sheet flow of 6.22 cfs is assumed from Basin 02 in the 100 year and 200 year calculations.

APPENDIX C

PHOTO ORIENTATION MAP AND PHOTOS



OXBOW BLUFF SUBDIVISION - TRACT F
PHOTO ORIENTATION MAP

APPENDIX D

ENERGY DISSIPATER

TABLE 11.—Stilling basin dimensions (Basin VI). Impact-type energy dissipator.

Suggested pipe size ¹		Max dis- charge Q	Feet and inches										Inches					
Dia in.	Area (sq ft)		W	H	L	a	b	c	d	e	f	g	t _w	t _r	t _s	t _p	K	Suggested riprap size
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19) ²
18	1.77	21	5-6	4-3	7-4	3-3	4-1	2-4	0-11	0-6	1-6	2-1	6	6½	6	6	3	4.0
24	3.14	38	6-9	5-3	9-0	3-11	5-1	2-10	1-2	0-6	2-0	2-6	6	6½	6	6	3	7.0
30	4.91	59	8-0	6-3	10-8	4-7	6-1	3-4	1-4	0-8	2-6	3-0	6	6½	7	7	3	8.5
36	7.07	85	9-3	7-3	12-4	5-3	7-1	3-10	1-7	0-8	3-0	3-6	7	7½	8	8	3	9.0
42	9.62	115	10-6	8-0	14-0	6-0	8-0	4-5	1-9	0-10	3-0	3-11	8	8½	9	8	4	9.5
48	12.57	151	11-9	9-0	15-8	6-9	8-11	4-11	2-0	0-10	3-0	4-5	9	9½	10	8	4	10.5
54	15.90	191	13-0	9-9	17-4	7-4	10-0	5-5	2-2	1-0	3-0	4-11	10	10½	10	8	4	12.0
60	19.63	236	14-3	10-9	19-0	8-0	11-0	5-11	2-5	1-0	3-0	5-4	11	11½	11	8	6	13.0
72	28.27	339	16-6	12-3	22-0	9-3	12-9	6-11	2-9	1-3	3-0	6-2	12	12½	12	8	6	14.0

¹ Suggested pipe will run full when velocity is 12 feet per second or half full when velocity is 24 feet per second. Size may be modified for other velocities by $Q = AV$, but relation between Q and basin dimensions shown must be maintained.

² For discharges less than 21 second-feet, obtain basin width from curve of Fig. 42. Other dimensions proportional to W ; $H = \frac{3W}{4}$, $L = \frac{4W}{3}$, $d = \frac{W}{6}$, etc.

³ Determination of riprap size explained in Sec. 40.

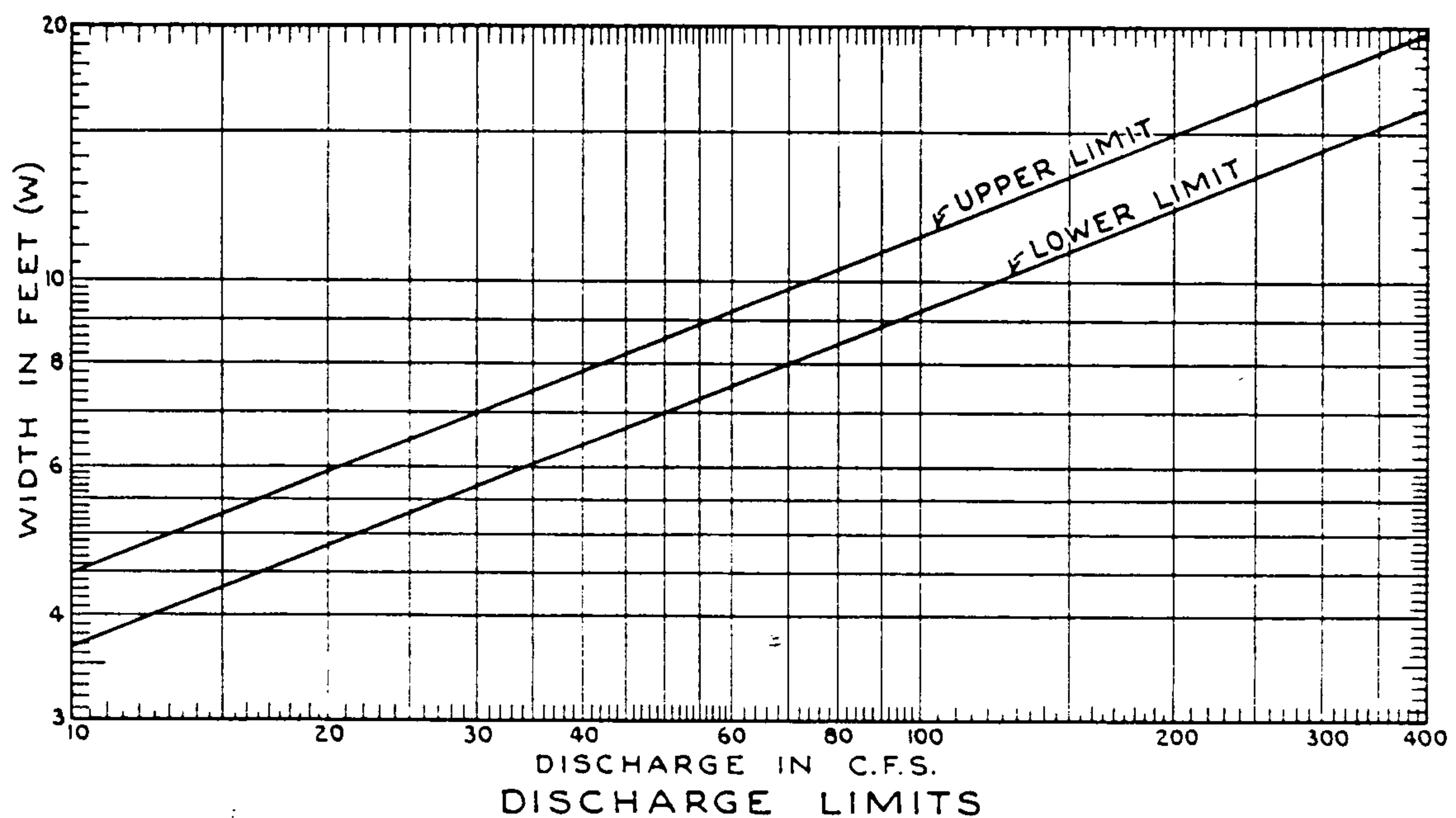
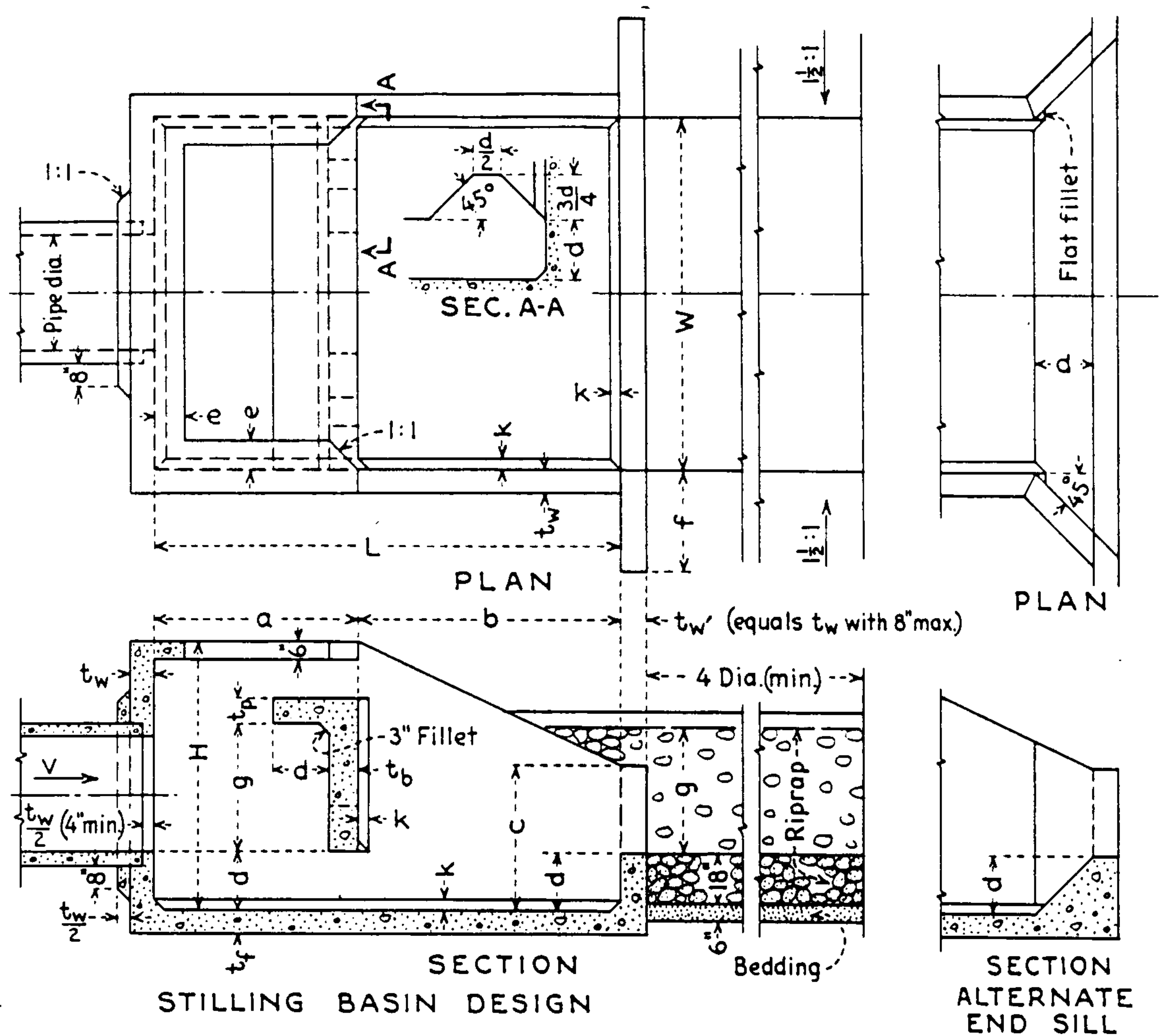
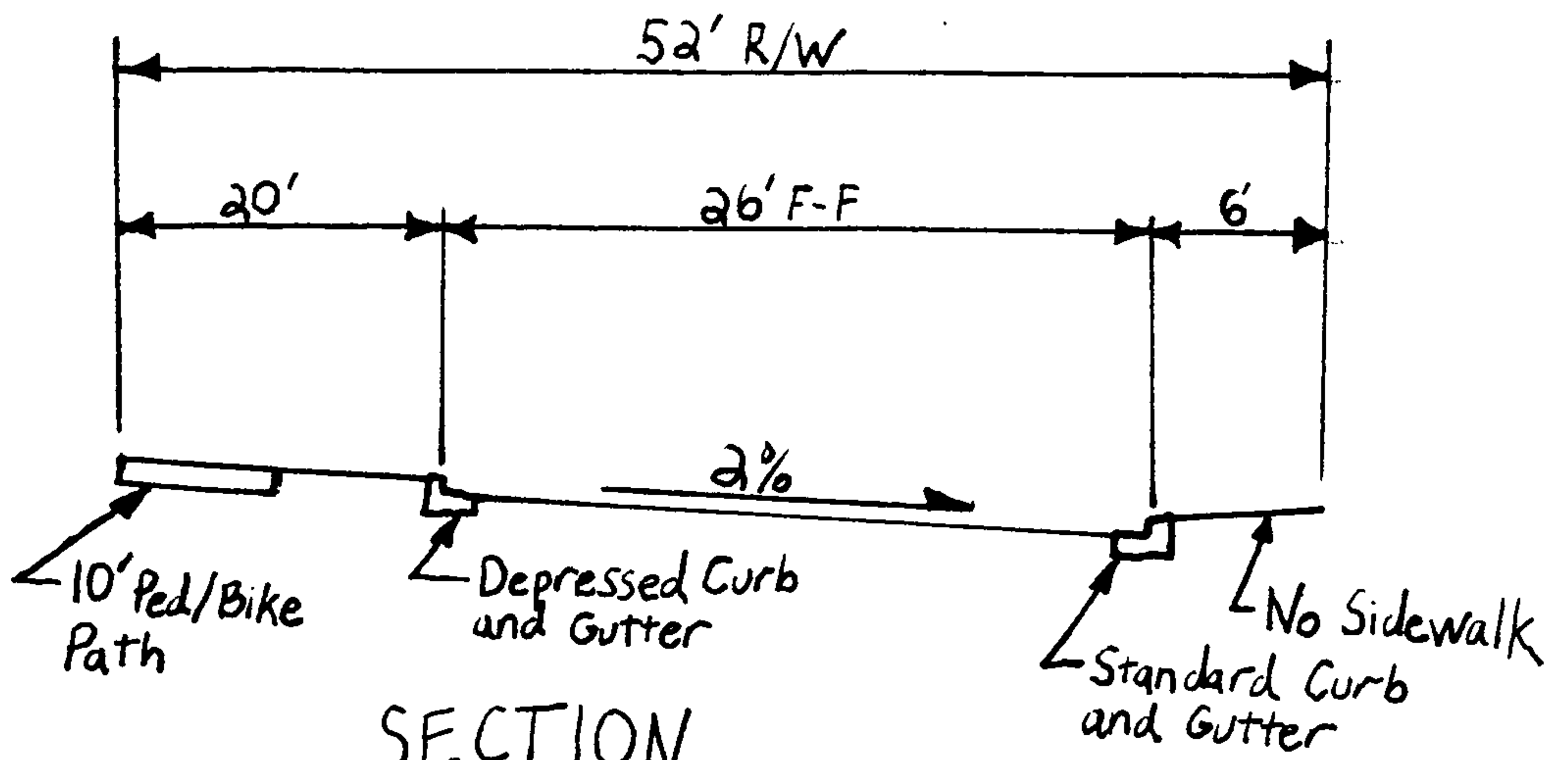


FIGURE 42.—Impact-type energy dissipator (Basin VI).

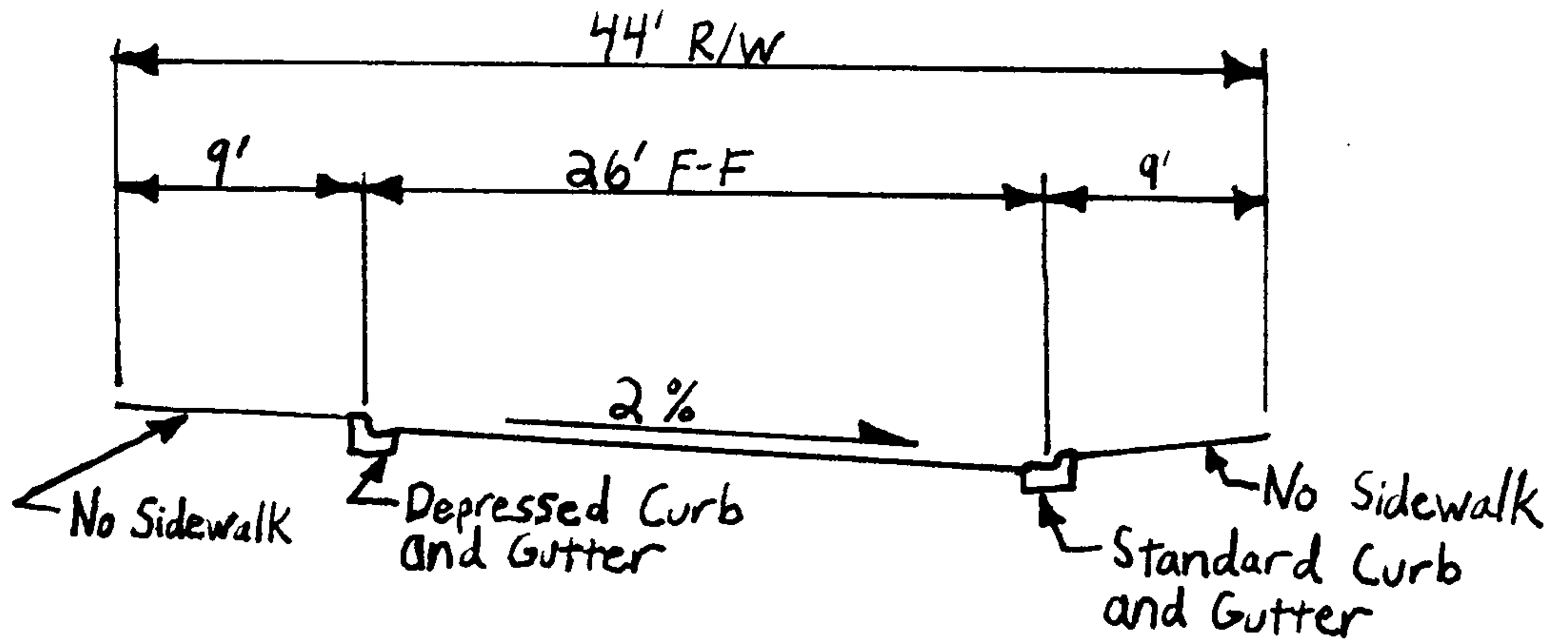
APPENDIX E

STREET HYDRAULICS



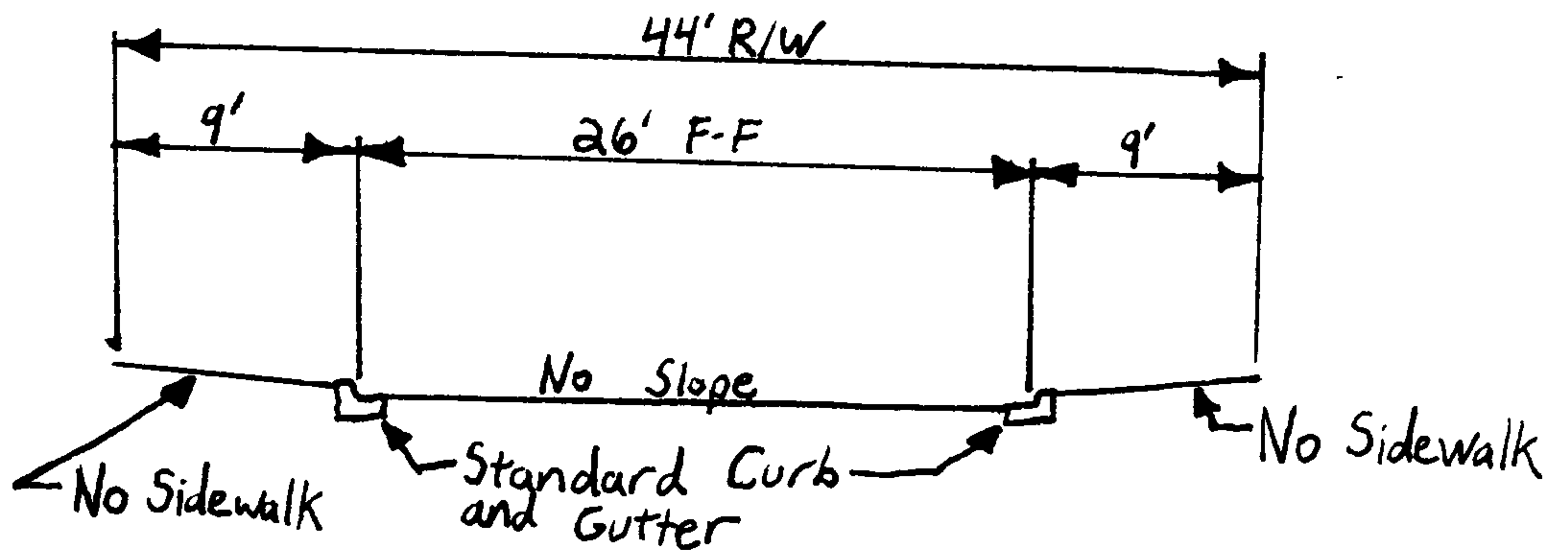
SECTION

NTS
OXBOW DRIVE



SECTION

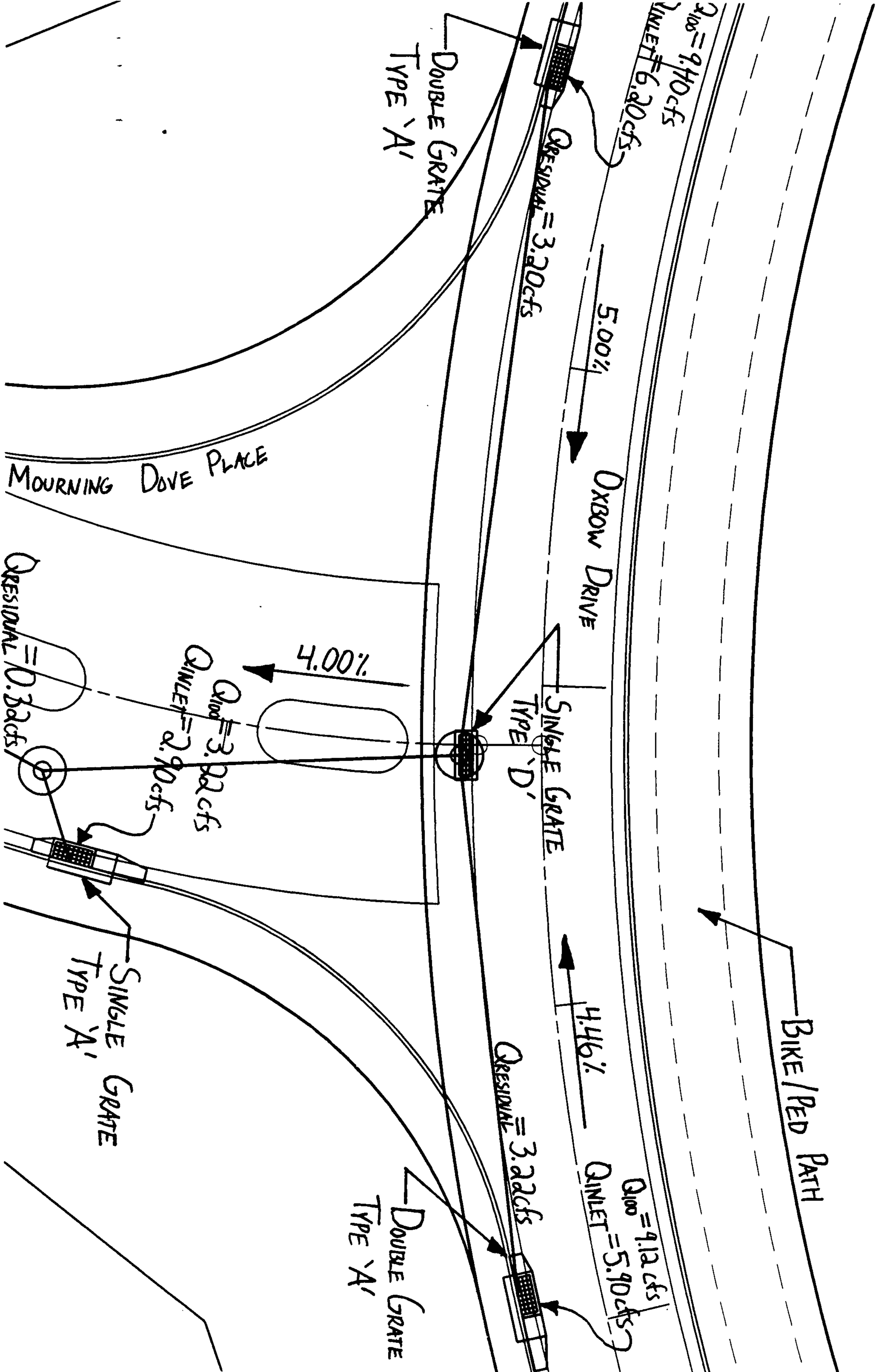
NTS
MOURNING DOVE PLACE
SILVERY MINNOW PLACE
WATER WILLOW PLACE



SECTION

NTS
SNOW GOOSE COURT
CINNAMON TEAL COURT
SAND PIPER COURT
GRAY HAWK COURT

NORTH
▽



4100' D.D.U.C.T.S

$Q_{INLET} = 2.90 \text{ cfs}$

$Q_{RESIDUAL} = 0.30 \text{ cfs}$

MOURNING DOVE PLACE

8.00%

SINGLE GRATE
TYPE 'A'

SILVERY MINNOW PLACE

4.59%

$Q_{INLET} = 12.49 \text{ cfs}$
 $Q_{RESIDUAL} = 24.98 \text{ cfs}$

$Q_{MAX} = 51.00 \text{ cfs}$

5.78%

NORTH

DOUBLE GRATE TYPE 'A'
w/ WINGS ON BOTH SIDES

NORTH

MOURNING DOVE PLACE

1.00%

$Q_{RESIDUAL} = 1.06 cfs$

$Q_{100} = 2.16 cfs$
 $Q_{INLET} = 4.10 cfs$

DOUBLE GRATE
TYPE 'A'

4.00%

WATERWILLOW PLACE

NORTH
↑

SILVERY MINNOW PLACE

4.70%

$Q_{100} = 4.92 \text{ cfs}$
 $Q_{2500} = 9.84 \text{ cfs}$
INLET CAPACITY @ ROW
 $Q_{CAP} = 51.00 \text{ cfs}$

SINGLE GRATE TYPE 'A'
w/ WINGS ON BOTH SIDES

25' PUBLIC
DRAINAGE & GAS
EASEMENT

SAND PIPER CT.

NORTH

7.64%

$Q_{400} = 8.23 \text{ cfs}$

$Q_{2400} = 16.46 \text{ cfs}$

INLET CAPACITY @ ROW

$Q_{CAP} = 51.00 \text{ cfs}$

DOUBLE GRATE TYPE 'A'
w/ WINGS ON BOTH SIDES

35' PUBLIC
DRAINAGE & SAS
EASEMENT

NORTH

GRAY HAWK CT.

4.38%

$Q_{100} = 5.52 \text{ cfs}$

$Q_{200} = 11.04 \text{ cfs}$

INLET CAPACITY @ ROW

$Q_{CAP} = 51.00 \text{ cfs}$

SINGLE GRATE TYPE 'A'
w/ WINGS ON BOTH SIDES

35' PUBLIC
DRAINAGE & SAS
EASEMENT

NORTH

WATERWILLOW PLACE

4.50%

SINGLE GRATE TYPE A
w/ WINGS ON BOTH SIDES

INLET CAPACITY @ ROW
 $Q_{100} = 5.22 \text{ cfs}$
 $Q_{24100} = 10.44 \text{ cfs}$
 $Q_{CAP} = 51.00 \text{ cfs}$

35' PUBLIC
DRAINAGE & SAS
EASEMENT

NORTH

AMON TEAL CT

AMON TEAL COURT

6.97%

$Q_{100} = 9.99 \text{ cfs}$

$Q_{2100} = 19.98 \text{ cfs}$

INLET CAPACITY @ ROW
 $Q_{CAP} = 51.00 \text{ cfs}$

DOUBLE GRATE TYPE 'A'
w/ WINGS ON BOTH SIDES

35' PUBLIC
DRAINAGE & SAS
EASEMENT

GOOSE CT.

NORTH

SNOW GOOSE COURT

5.30%

$Q_{100} = 8.99 \text{ cfs}$

$Q_{2 \times 100} = 17.98 \text{ cfs}$

INLET CAPACITY @ ROW

$Q_{CAP} = 51.00 \text{ cfs}$

DOUBLE GRATE TYPE 'A'
w/ WINGS ON BOTH SIDES

35' PUBLIC
DRAINAGE & SAS
EASEMENT

NORTH
▽

Bike/Ped Path

Oxbow Drive

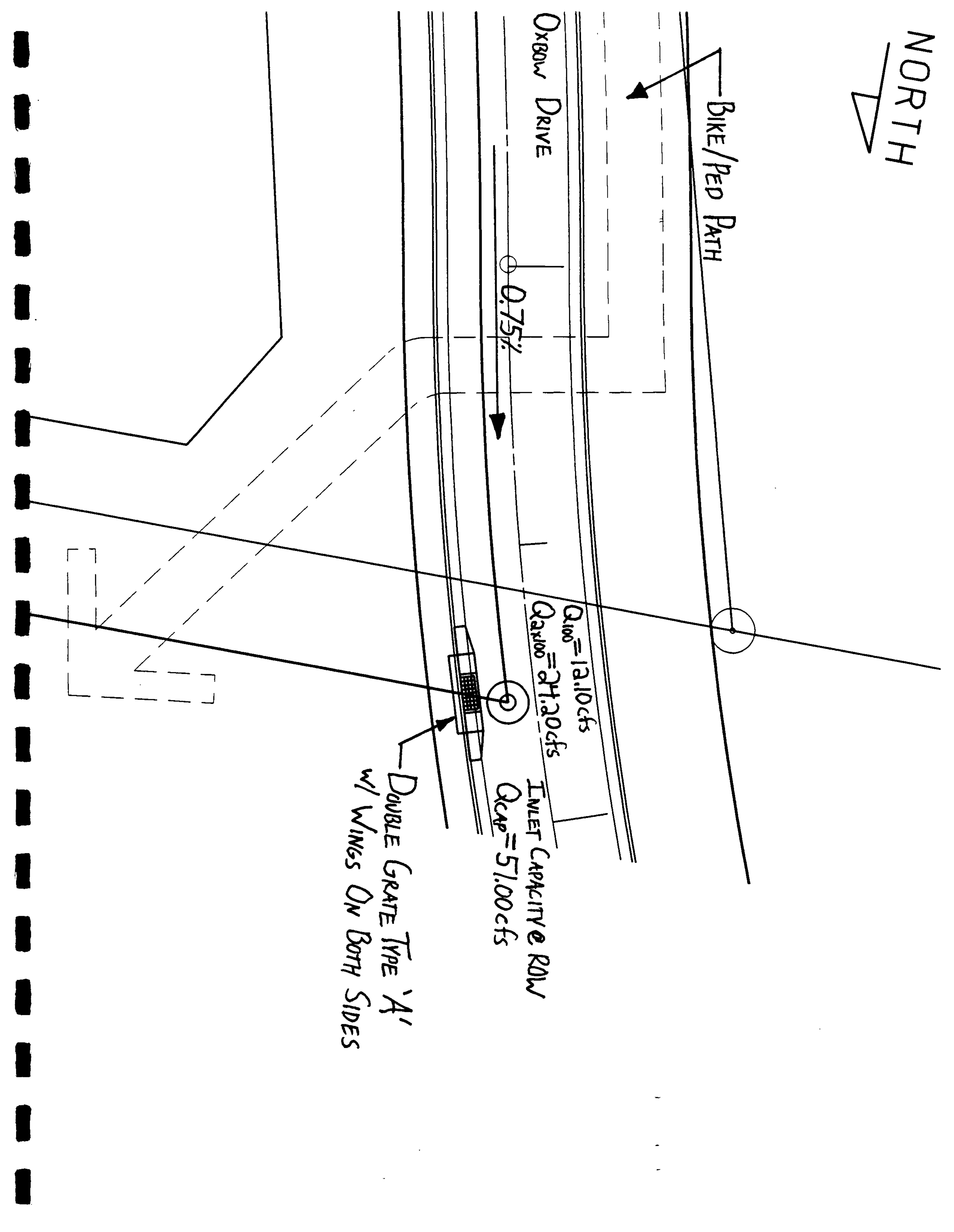
0.75%

$Q_{100} = 12.10 \text{ cfs}$

$Q_{250} = 24.20 \text{ cfs}$

INLET CAPACITY ROW
 $Q_{CAP} = 51.00 \text{ cfs}$

DOUBLE GRATE TYPE 'A'
w/ WINGS ON BOTH SIDES



APPENDIX F

LETTER FROM ARMY CORPS OF ENGINEERS



DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE, NEW MEXICO 87109-3435
FAX (505) 342-3498

REPLY TO
ATTENTION OF:

September 10, 1997

Operations Division
Regulatory Branch

Mr. Kevin Patton
Bohannon-Huston
Courtyard 1
7500 Jefferson Street, NE
Albuquerque, New Mexico 87109

Dear Mr. Patton:

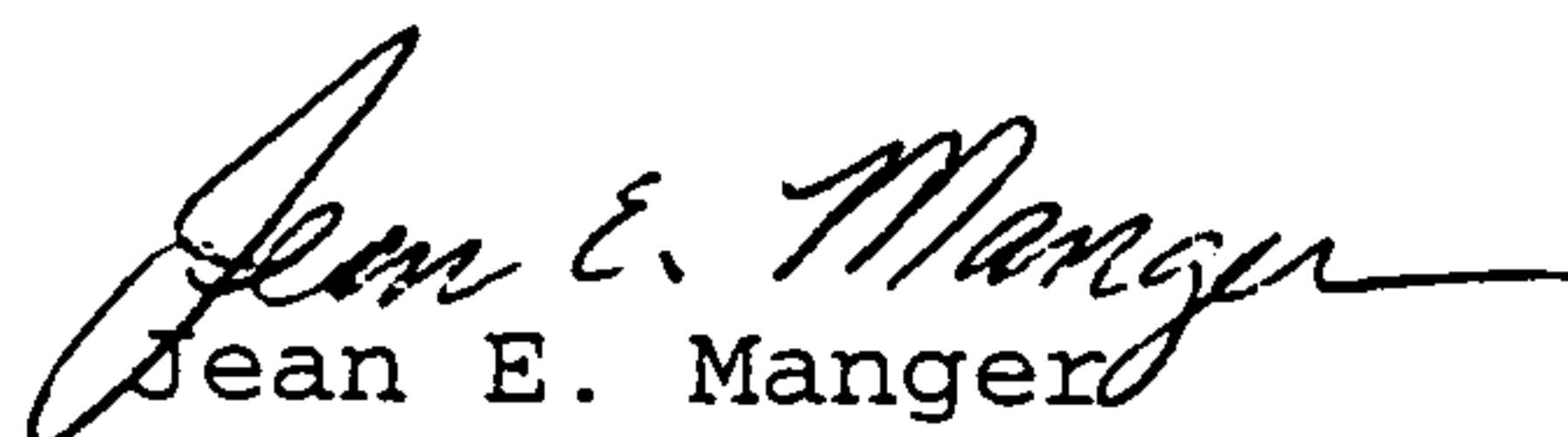
Reference is made to your September 10, 1997, letter regarding Altura West's proposed storm sewer outfall and Parcel F subdivision construction on lands adjacent to the Rio Grande in Albuquerque, Bernalillo County, New Mexico. (Action No. 1997-00323)

We have studied the project description, other records, and documents available to us. A field inspection was made on August 11, 1997. The storm sewer outfall will be constructed in an existing erosion rill and on a sediment fan entering the riparian bosque adjacent to the river. The rill and sediment fan are not waters of the United States. At other locations on the property, two erosion gullies have formed downstream of existing storm drain culverts east of St. Pius High School. These storm drains will be connected to the subdivision system and the gullies will be regraded for development. The gullies do not connect to waters of the United States and are not jurisdictional waters.

The project is not regulated under the provisions of Section 404 of the Clean Water Act and a Department of the Army permit will not be required. This determination was made because the project does not include any discharges of dredged or fill material into waters of the United States.

If you have any questions, please feel free to write or call me at (505) 342-3216.

Sincerely,


Jean E. Manger

Regulatory Project Manager

APPENDIX G

BASINS

ULTIMATE DEVELOPED CONDITIONS FOR
BASINS A-Q IN OXBOW BLUFF SUBDIVISION - TRACT F
Oct-97

OXBOW BASIN	AREA (ACRES)	% LAND TREATMENT*				PEAK DISCHARGE - (CFS/ACRE)*				REVISED Q(100-YR) DEVELOPED (CFS)	REVISED Q(2X100-YR) DEVELOPED (CFS)
		A	B	C	D	A	B	C	D		
A	3.08	0.00	62.00	0.00	38.00	1.29	2.03	2.87	4.37	8.99	17.98
B	1.41	0.00	52.00	0.00	48.00	1.29	2.03	2.87	4.37	4.45	NA
C	2.86	0.00	60.00	0.00	40.00	1.29	2.03	2.87	4.37	8.48	NA
D	2.91	0.00	63.00	0.00	37.00	1.29	2.03	2.87	4.37	8.43	NA
E	4.54	0.00	60.00	0.00	40.00	1.29	2.03	2.87	4.37	13.47	26.93
E1	1.53	0.00	60.00	0.00	40.00	1.29	2.03	2.87	4.37	4.54	9.08
E2	3.01	0.00	60.00	0.00	40.00	1.29	2.03	2.87	4.37	8.93	17.86
F	3.48	0.00	61.00	0.00	39.00	1.29	2.03	2.87	4.37	10.24	NA
G	2.24	0.00	50.00	0.00	50.00	1.29	2.03	2.87	4.37	7.17	14.34
H	1.75	0.00	52.00	0.00	48.00	1.29	2.03	2.87	4.37	5.52	11.04
I	3.85	0.00	55.00	0.00	45.00	1.29	2.03	2.87	4.37	11.87	23.74
J	1.56	0.00	52.00	0.00	48.00	1.29	2.03	2.87	4.37	4.92	9.84
K	1.68	0.00	54.00	0.00	46.00	1.29	2.03	2.87	4.37	5.22	10.44
L	5.79	0.00	58.00	0.00	42.00	1.29	2.03	2.87	4.37	17.44	NA
M	13.10	10.00	70.00	20.00	0.00	1.29	2.03	2.87	4.37	27.82	NA
N	4.08	61.00	8.00	0.00	31.00	1.29	2.03	2.87	4.37	9.40	NA
O	4.11	66.00	5.00	0.00	29.00	1.29	2.03	2.87	4.37	9.13	NA
P	2.88	71.00	6.00	0.00	23.00	1.29	2.03	2.87	4.37	5.88	11.77
Q	1.12	0.00	35.00	40.00	25.00	1.29	2.03	2.87	4.37	3.31	NA
TOTALS	60.44									161.73	

NOTES:

*Obtained from Section 22.2, Hydrology of the Development Process Manual, Volume 2, Design Criteria for the City of Albuquerque, January, 1993

Basins B, C, D, F & L all drain to the Rio Grande via direct sheet flow.

Basins A, E(1 & 2), G thru K, & M thru Q all drain to the Rio Grande via underground storm drain pipes that daylight into the Rio Grande.

APPENDIX H

WETLANDS DETERMINATION BY MARRON & ASSOCIATES

marron and associates, inc.

7809 fourth street nw
albuquerque, new mexico 87107-6526
tel: (505) 898-8848
fax: (505) 897-7847
e-mail marroninc@aol.com

August 15, 1997

Mr. Kevin Patton
Bohanan Houston, Inc.
7500 Jefferson NE
Albuquerque, NM 87109

Dear Mr. Patton:

On August 15, 1997, Marron and Associates, Inc., completed a wetland determination on a small piece of property located at the base of the escarpment on the west side of the Rio Grande, approximately 1/4 mile south of San Antonio Arroyo, and along the eastern edge of the Altura West Property (see Map 1). The study area is proposed for an outfall location which would discharge storm water from the adjacent mesa top. The study area is rectangular, approximately 40 x 60 feet in size, and is located at the existing outfall of a small drainage which conveys storm water flows down the slope of the escarpment. Over time the discharge of these flows has resulted in the creation of a sediment plume at the base of the escarpment. The thickness of the storm water-deposited sediments varies across the length of the plume. The sediments on the western end of the plume appear to be approximately 4.5 to 5 feet thick. The thickness of the deposit dwindles to the east until the plume grades into the existing floodplain in the Rio Grande Bosque approximately 40 feet west of the base of the escarpment.

Two study pits were installed in the soils of this sediment plume. The first pit (Site 1) was situated in the center of a small patch of coyote willows (*Salix exigua*) which were located along the southern end of the proposed construction area. The second pit (Site 2) was situated in the east-central portion of the study area, within the center of the channel formed by the runoff from the mesa top. Site 2 was located in the lowest spot of the study area where storm water runoff from the mesa appears to collect in a shallow pool-like area.

There was no sign of springs or groundwater discharge within the study area. Additionally, neither pit at Site 1 or 2 had saturated soils or water in the pits or gave any indication of a water table close to the surface. By comparing the height of the sediment plume where the pits were installed to the floor of the bosque and the current elevational level of the Rio Grande it was estimated that the water table was approximately 8 feet below the surface at Site 1, and 7 feet below the surface at Site 2. The hydrology of both Sites 1 and 2 appeared to be wholly related to surface water runoff. There were drainage channels and drift lines present near both of the sites, indicating that active surface hydrology is present.

Mr. Kevin Patton
August 15, 1997
Page 2

Vegetation within the study area is a mixture of upland, phreatophytic, and some wetland species. All of the annual species present on the site were upland in nature. The only shrubby species present on the site was coyote willow, which is an obligate wetland species. Rio Grande cottonwood, a facultative wetland species, was the dominant tree species present.

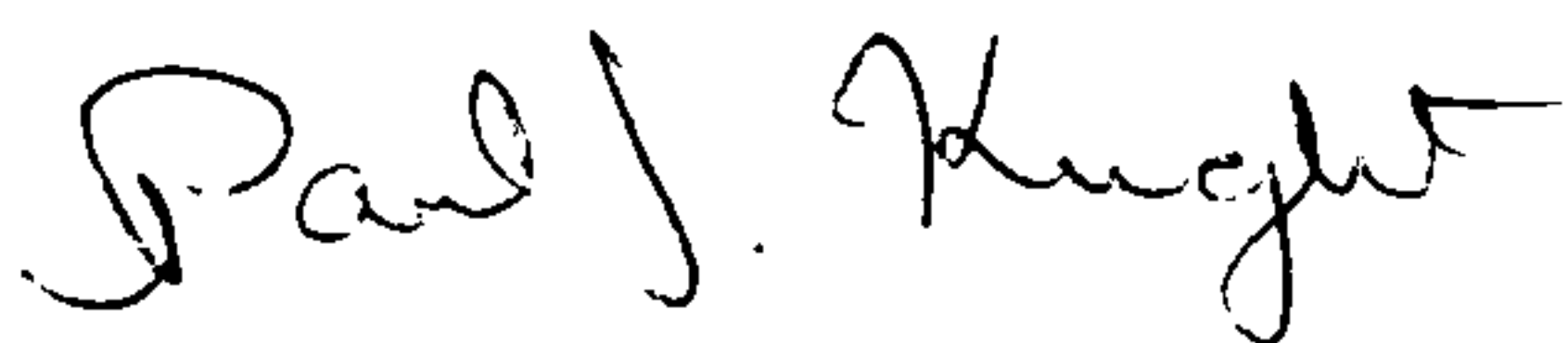
None of the soils within the study area (at Sites 1 and 2) gave any indication of hydric conditions or reduction. Aside from a pronounced clay lens at Site 1, all of the soils present within the study area were composed of coarse, well-drained sands and silty sands.

Our conclusion is that the Altura West property analyzed during this study does not qualify as a Jurisdictional Wetland. Although there are wetland species (such as coyote willow) present on the site, along with secondary hydrology indicators such as drift lines and drainage patterns, the site appears too dry to develop wetland soils and consistent stands of wetland vegetation. Our conclusion is that storm water runoff from the adjacent mesa is discharged into the sediment plume located within the study area. The generally coarse soils within this plume allow for quick infiltration of this water, and the soils within the plume are kept damp. Localized patches of wetland vegetation have developed on top of this sediment plume, fed by the storm waters collecting in the soil. The largest such patch of coyote willow within the study area was subtended by a 3.5-inch-thick clay layer located from 11.5 to 14 inches below the surface. It is possible that infiltrating storm water runoff collects on top of this clay lens and provides a slightly better water regime for the localized growth of wetland species such as coyote willow.

In order to facilitate the U. S. Army Corps of Engineers (COE) review of our findings, we have attached a map of the study area showing the location of the pits as well as the location and direction of photographs. We have also attached a selection of photographs from the site, as well as the COE Routine Wetland Determination forms for both Sites 1 and 2.

Thank you for utilizing Marron and Associates on this project. If you have any other questions or require additional materials, please contact me at 898-8848.

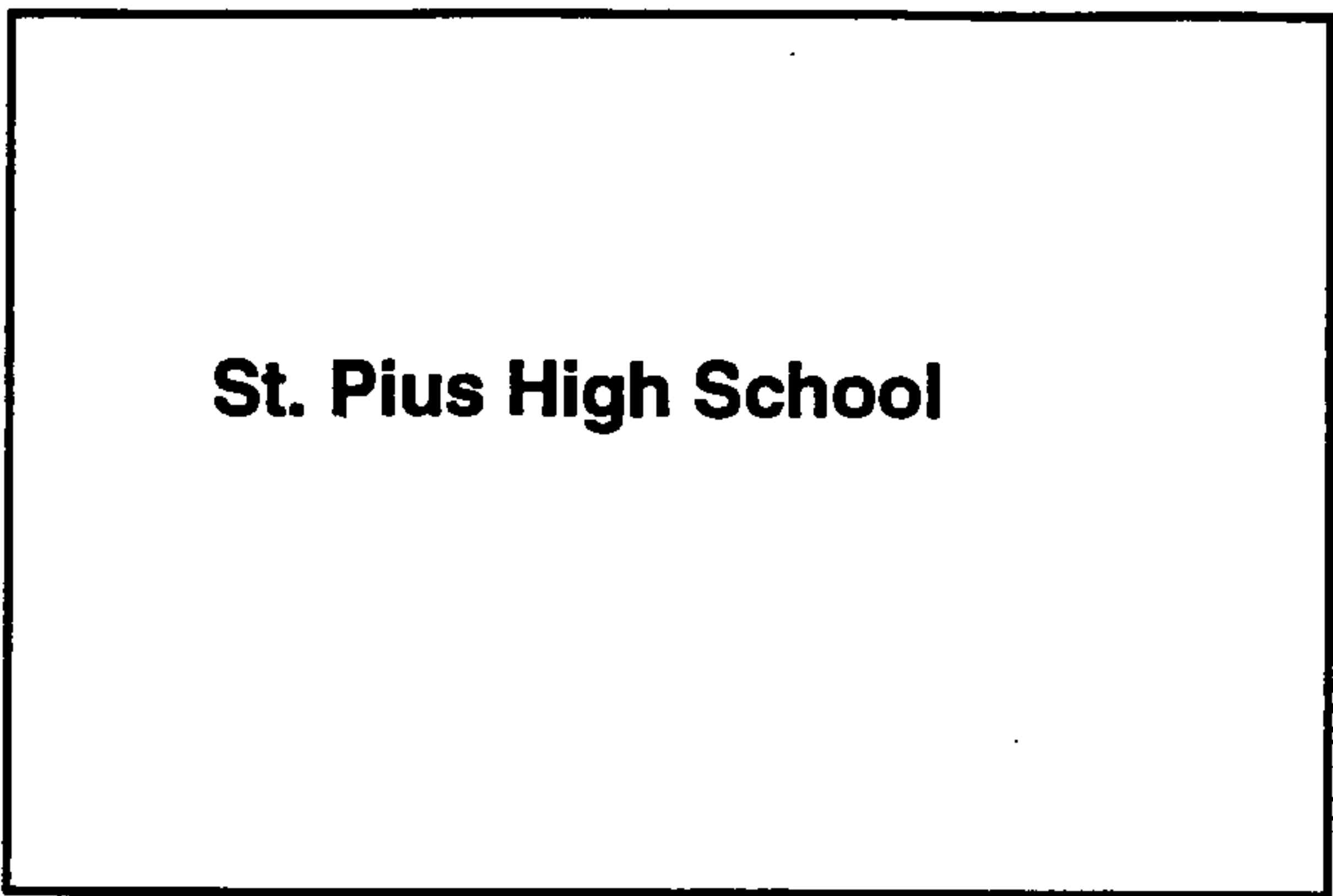
Sincerely,



Paul J. Knight

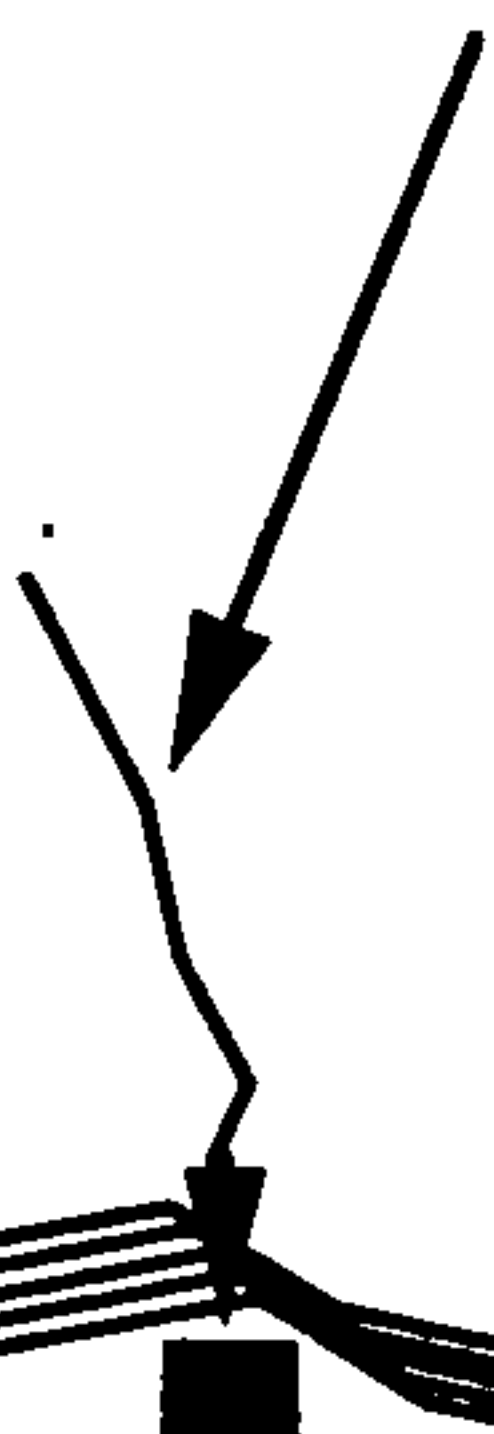


NM 528



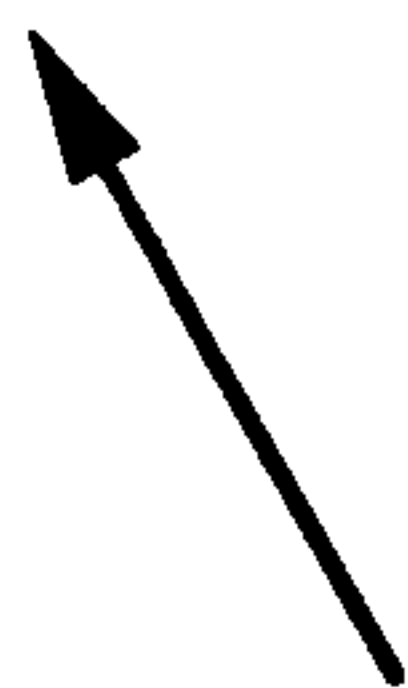
St. Pius High School

Small Drainage

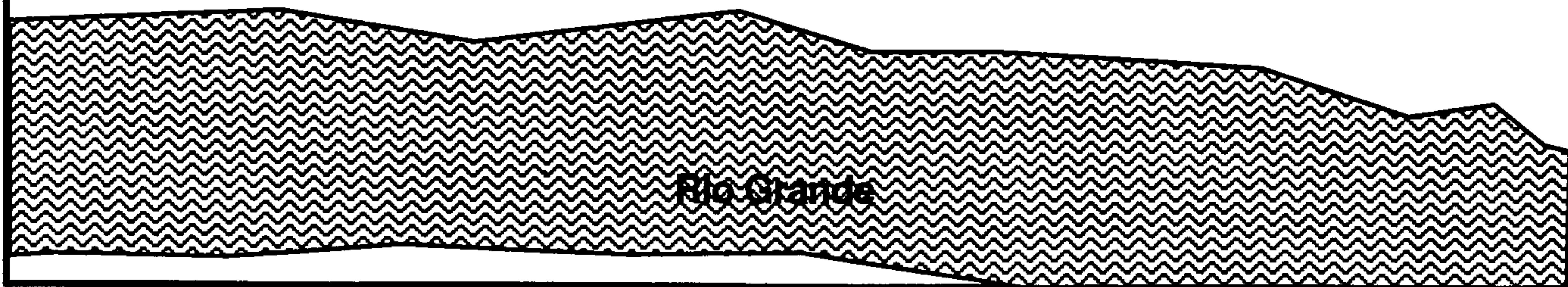


Escarpment

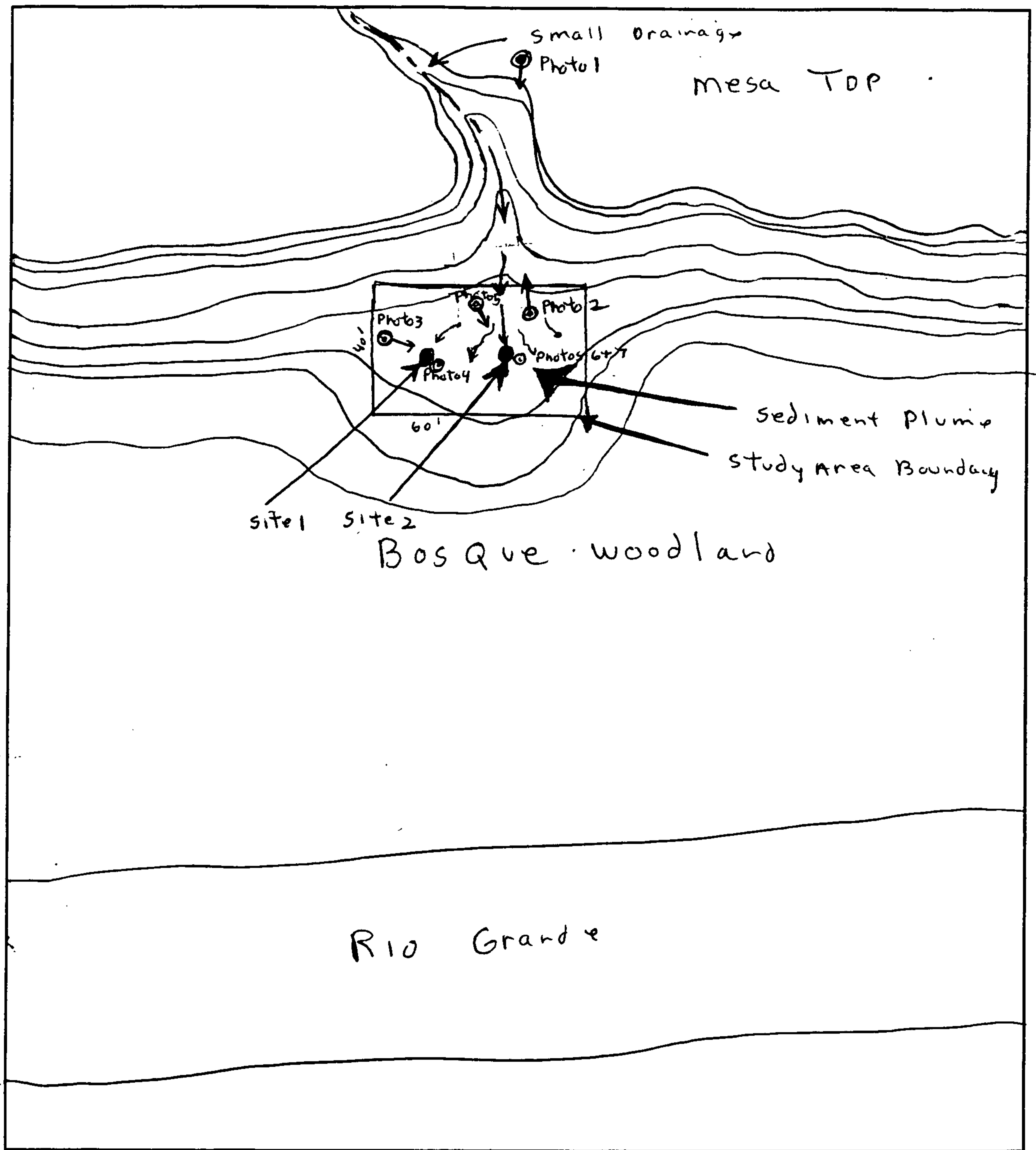
Altura West Wetland Study Site



Rio Grande



Location of the Altura West Study Area



Site Plan and Photo Locations at the Altura West Study Site

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: <u>Altura West / site 1</u> Applicant/Owner: _____ Investigator: <u>Paul J. Knight</u>	Date: <u>8/15/97</u> County: <u>Bernalillo</u> State: <u>New Mexico</u>
Do Normal Circumstances exist on the site? ☒ Yes ☐ No Is the site significantly disturbed (Atypical Situation)? ☐ Yes ☒ No Is the area a potential Problem Area? ☐ Yes ☒ No (If needed, explain on reverse.)	Community ID: _____ Transect ID: _____ Plot ID: _____

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. <u>Populus Fremontii</u>	<u>Tree</u>	<u>FACW/FACU</u>	9. _____	_____	_____
2. <u>Elaeagnus Angustifolia</u>	<u>Tree</u>	<u>FACW/FACU</u>	10. _____	_____	_____
3. <u>Salix exigua</u>	<u>Shrub</u>	<u>Obl/FACW</u>	11. _____	_____	_____
4. <u>Croton Texensis</u>	<u>Herb</u>	<u>UPL</u>	12. _____	_____	_____
5. _____	_____	_____	13. _____	_____	_____
6. _____	_____	_____	14. _____	_____	_____
7. _____	_____	_____	15. _____	_____	_____
8. _____	_____	_____	16. _____	_____	_____

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-): 75%

Remarks: Alought vegetation coverage at the site is poor the dominant species are primary FACW or OBL. It should be noted that none of the herbaceous species at the site are wetland indicators.

HYDROLOGY

___ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ___ Aerial Photographs ___ Other _____ ___ No Recorded Data Available Field Observations: Depth of Surface Water: <u>None</u> (in.) Depth to Free Water in Pit: <u>None</u> (in.) Depth to Saturated Soil: <u>None in pit</u> (in.)	Wetland Hydrology Indicators: Primary Indicators: ___ Inundated ___ Saturated in Upper 12 Inches ___ Water Marks ☒ Drift Lines ___ Sediment Deposits ☒ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ___ Oxidized Root Channels in Upper 12 Inches ___ Water-Stained Leaves ___ Local Soil Survey Data ___ FAC-Neutral Test ___ Other (Explain in Remarks)
--	--

Remarks: The water table at the site is estimated to be 7' below the surface at the time of the study. The ordinary high water mark in the nearby Rio Grande suggests that ground water could rise by 2' during the spring runoff.

The site appears to rely solely on surface water runoff for hydrology.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: <u>Altura west / site 2</u> Applicant/Owner: _____ Investigator: <u>Paul J. Knight</u>	Date: <u>8/15/97</u> County: <u>Bernalillo</u> State: <u>New Mexico</u>
Do Normal Circumstances exist on the site? ☒ Yes ☐ No Is the site significantly disturbed (Atypical Situation)? ☐ Yes ☒ No Is the area a potential Problem Area? ☐ Yes ☒ No (If needed, explain on reverse.)	Community ID: _____ Transect ID: _____ Plot ID: _____

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. <u>Populus fremontii</u>	<u>Tree</u>	<u>FACW/FACW</u>	9. _____	_____	_____
2. <u>Glaucous Angustifolia</u>	<u>Tree</u>	<u>FACW-/FACW</u>	10. _____	_____	_____
3. <u>Maurandya wilsonii</u>	<u>Herb</u>	<u>OPL</u>	11. _____	_____	_____
4. _____	_____	_____	12. _____	_____	_____
5. _____	_____	_____	13. _____	_____	_____
6. _____	_____	_____	14. _____	_____	_____
7. _____	_____	_____	15. _____	_____	_____
8. _____	_____	_____	16. _____	_____	_____

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-): 66.6%

Remarks: There was very little herbaceous and no shrubby vegetation at the site. The site was shaded by an overstory of cottonwood and Russian olive trees

HYDROLOGY

☐ Recorded Data (Describe in Remarks): ☐ Stream, Lake, or Tide Gauge ☐ Aerial Photographs ☐ Other _____ ☐ No Recorded Data Available Field Observations: Depth of Surface Water: <u>None</u> (in.) Depth to Free Water in Pit: <u>None</u> (in.) Depth to Saturated Soil: <u>None</u> (in.)	Wetland Hydrology Indicators: Primary Indicators: ☐ Inundated ☐ Saturated in Upper 12 Inches ☐ Water Marks ☒ Drift Lines ☐ Sediment Deposits ☒ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ☐ Oxidized Root Channels in Upper 12 Inches ☐ Water-Stained Leaves ☐ Local Soil Survey Data ☐ FAC-Neutral Test ☐ Other (Explain in Remarks)
Remarks: <u>The site was situated in a low spot of a drainage where water collects. The site is located in a small drainage pattern and some small drift lines indicate that shallow water occasionally collects at the site. The water table at this site was estimated to be 8' below the surface at the time of this study.</u>	

APPENDIX I

STORM DRAIN CAPACITIES

STORM DRAIN ANALYSIS FOR
 OXBOW BLUFF SUBDIVISION - TRACT F
 Oct-97

PIPE LOCATION	SIZE/TYPE	LENGTH (ft)	SLOPE (%)	PROPOSED Q (100-YR, CFS)	PIPE CAPACITY (100-YR, CFS)
MH 1 TO MH 2	24" RCP	85.00	5.65	29.89	53.77
MH2 TO MH3	24" RCP	450.00	2.00	29.89	31.99
MH 3 TO MH 4	30" RCP	395.00	6.35	63.99	103.36
INLET 7 TO MH 4	18" RCP	190.00	5.48	4.92	24.59
MH 4 TO MH 5	30"RCP	123.61	3.89	68.91	80.90
MH 5 TO MH 6	36" RCP	384.46	3.47	68.91	124.25
INLET 10 TO MH 6	18" RCP	110.00	6.60	5.22	26.99
MH 6 TO MH 7	48" RCP	284.78	5.27	74.13	329.75
MH 7 TO MH 8	54" RCP	286.88	0.10	74.13	62.19
INLET 9 TO MH 8	18" RCP	130.00	14.50	5.52	40.00
MH 8 TO MH 9	60" RCP	427.53	0.10	79.65	82.36
INLET 8 TO MH 9	18" RCP	135.00	10.80	7.92	34.52
MH 9 TO MH 10	60" RCP	372.90	0.10	87.57	82.36
MH 10 TO MH 11	60" RCP	422.71	0.10	132.04	82.36
MH 12 TO MH 11	60" RCP	200.00	8.86	144.99	775.23
BASIN M TO MH 12	60" RCP	430.00	6.81	136.00	679.65
MH 13 TO MH 10	24" RCP	350.00	7.14	44.47	60.45
MH 14 TO TO MH 13	24" RCP	235.00	2.83	34.29	38.06
INLET 5 TO MH 14	18" RCP	15.00	15.60	3.90	41.49
MH 15 TO MH 14	24" RCP	200.00	4.69	30.39	48.99
MH 16 TO MH 15	24" RCP	70.00	8.00	17.90	63.99
INLET 2 TO MH 16	18" RCP	25.00	16.90	2.90	43.18
MH 17 TO MH 16	24" RCP	80.00	8.00	15.00	63.99
INLET 4 TO MH 17	18" RCP	15.00	25.60	2.90	53.15
MH 18 TO MH 17	24" RCP	55.00	4.65	12.10	48.78
INLET 1 TO MH 18	18" RCP	110.00	4.75	6.20	22.89
INLET 3 TO MH 18	18" RCP	70.00	6.73	5.90	27.25
INLET 6 TO MH 19	18" RCP	75.00	1.45	12.49	12.65
MH 19 TO MH 15	24" RCP	70.00	0.50	12.49	16.00
MH 11 TO DISSIPATOR	72" RCP	135.00	20.36	277.03	1910.96

NOTES:

All lengths and slopes are approximate.

EXHIBITS

- EXHIBIT 1: BULK LAND PLAT
- EXHIBIT 2: EXISTING DRAINAGE BASIN MAP
- EXHIBIT 3: PROPOSED DRAINAGE BASIN MAP
- EXHIBIT 4: GRADING AND DRAINAGE PLAN

EXHIBIT 1

BULK LAND PLAT

EXHIBIT 2

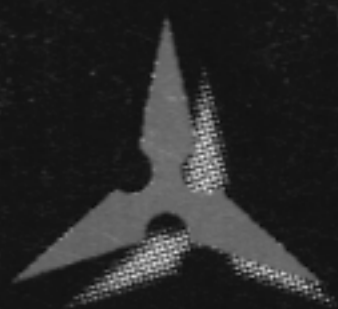
EXISTING DRAINAGE BASIN MAP

EXHIBIT 3

PROPOSED DRAINAGE BASIN MAP

EXHIBIT 4

GRADING AND DRAINAGE PLAN



Courtyard One

7500 JEFFERSON NE

Albuquerque

NEW MEXICO 87109

voice 505.823.1000

fax 505.821.0892

SPECIAL CASES.

OXFORD BLUFF (TRACT F) G11D014D <u>Lot #</u>						(FILE NAME)				
Lots 12, 13, 25-51 require water harvesting						All other drain to SD system and roads				
LOT	Dev'd?	Date	ENGR	doc	COA appr ltr?	LOT	Dev'd?	Date	Engr	document
12		⊙				1		⊙		
13	N	8-12-16	TERRA WEST	AS-BUILT	YES-RTH	2		⊙		
14						3		⊙		
25	COMBINED WITH LOT 14					4		⊙		
26	N					5		⊙		
27	N					6	N			
28	N					7		Jan-00	Weiss	As-built
29		Mar-01	Weiss	As-built		8		3-Oct	Clark	As-built
30		⊙				9		Feb-02	Bordenave	As-built
31		Dec-03	Arfman	As-built		10		⊙		
2015-32	NY	3-31-15	Soule	Plan	Yes-RTH	11		⊙		
33		Dec-02	Patton	Plan						
34	PART OF LOTS 33 AND 35					15		⊙		
35		Feb-10	Soule	Plan	Yes Curtis	16		Jan-04	Weiss	As-built
36		⊙				17		⊙		
37	N					18		⊙		
38		Feb-03	MacKenzie	As-built		19		⊙		
39	N					20	N			
40		⊙				21		3-Dec	Weiss	As-built
41		⊙				22		⊙		
42	N					23		⊙		
43	N					24		⊙		
44	N									
45		Jan-04	Read	As-built		52	N			
46		Nov-04	Patton	As-built		53	N			
47		Jul-13	Soule	Plan	Yes Shohab	54	N			
48	N					55	N			
49		Sep-02	Mortenser	As-built		56	N			
50		Nov-04	Patton	As-built		57		⊙		
51	N					58	N			
						59		⊙		
						60	N			
						61		Feb-02	Mortenser	As-built
						62	N			
						63	N			

Once BTH approves & sends an approval letter - we will also approve. RTH.

⊙ = developed but no AS-built or plan in file. unknown why.

→ Eng. Cert to be sent to BTH for approval. Once BTH letter received then approve for CO.

[illegible]

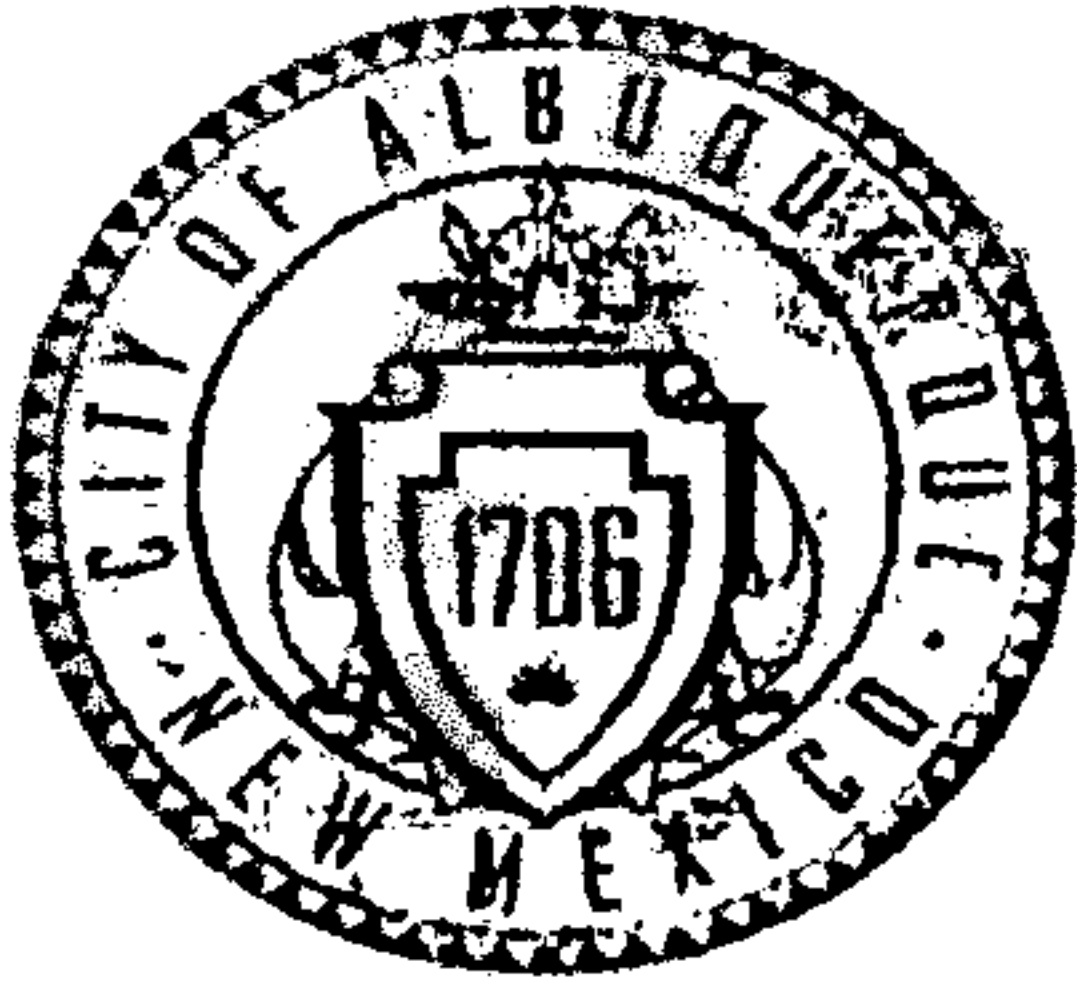
Put flag ^{hold} on

all these united

Approved by BTH. (Eng. Cert)

~~Both for B.P.~~

~~for~~ for! C.O.



City of Albuquerque

Planning Department

Development & Building Services Division

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV 02/2013)

Verbal
NO, need letter
approval
from BTH.

Project Title: Raskob Residence Building Permit #: _____ City Drainage #: G11D014D20
DRB#: _____ EPC#: _____ Work Order#: _____
Legal Description: LOT 30P1
City Address: 4101 Water Willow

Engineering Firm: RIO GRANDE ENGINEERING Contact: DAVID SOULE
Address: PO BOX 93924, ALBUQUERQUE, NM 87199
Phone#: 505.321.9099 Fax#: 505.872.0999 E-mail: DAVID@RIOGRANDEENGINEERING.COM

Owner: _____ Contact: _____
Address: _____
Phone#: _____ Fax#: _____ E-mail: _____

Architect: judson Cervinak Contact: _____
Address: _____
Phone#: _____ Fax#: _____ E-mail: _____

Surveyor: CONSTRUCTION SURVEY INCORPORATED Contact: JOHN GALLEGOS
Address: _____
Phone#: 917.8921 Fax#: _____ E-mail: _____

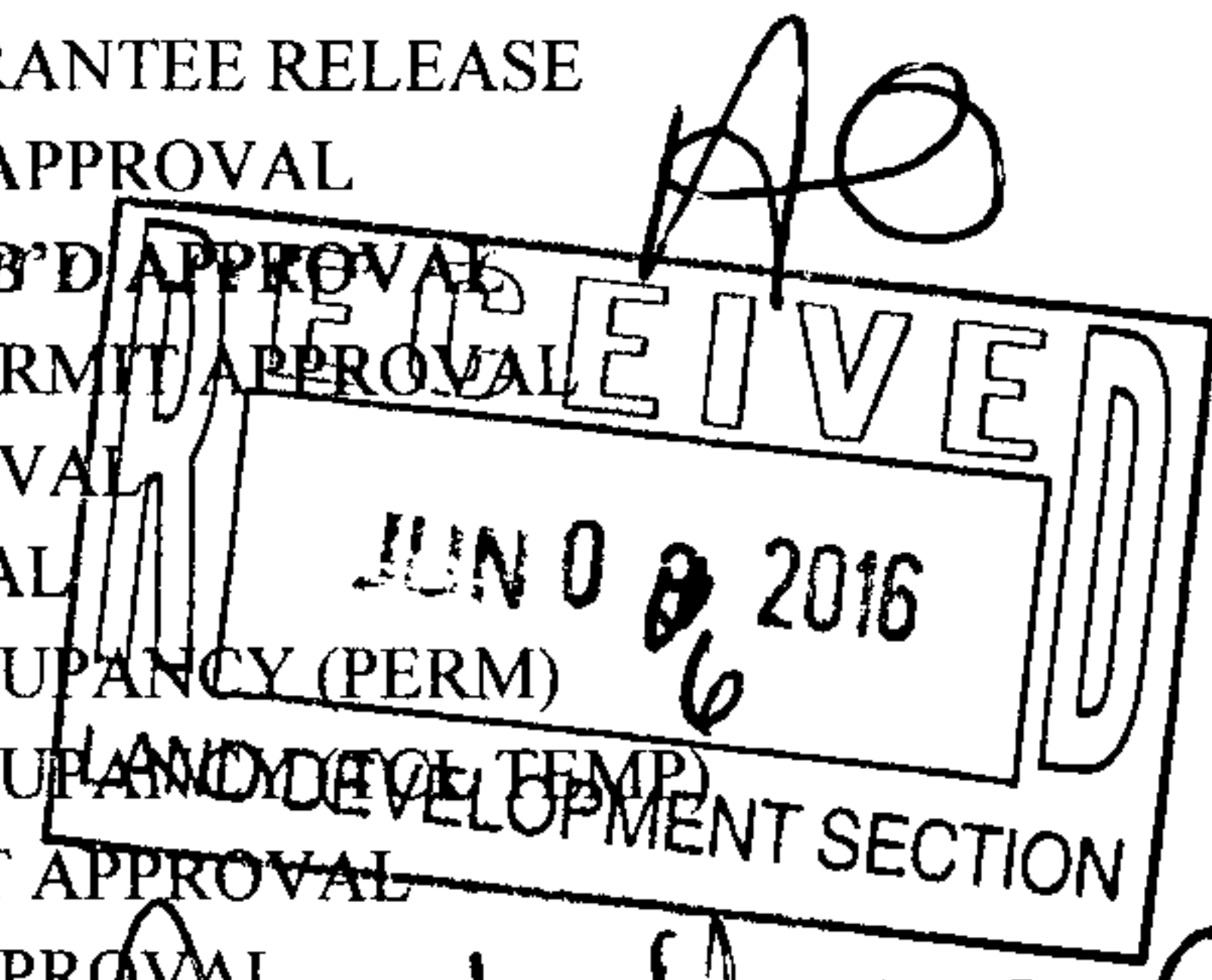
Contractor: _____ Contact: _____
Address: _____
Phone#: _____ Fax#: _____ E-mail: _____

TYPE OF SUBMITTAL:

- ☐ DRAINAGE REPORT
☒ DRAINAGE PLAN 1st SUBMITTAL
☐ DRAINAGE PLAN RESUBMITTAL
☐ CONCEPTUAL G & D PLAN
☐ GRADING PLAN
☐ EROSION & SEDIMENT CONTROL PLAN (ESC)
☐ ENGINEER'S CERT (HYDROLOGY)
☐ CLOMR/LOMR
☐ TRAFFIC CIRCULATION LAYOUT (TCL)
☐ ENGINEER'S CERT (TCL)
☐ ENGINEER'S CERT (DRB SITE PLAN)
☐ ENGINEER'S CERT (ESC)
☐ SO-19
☐ OTHER (SPECIFY) _____

CHECK TYPE OF APPROVAL/ACCEPTANCE SOUGHT:

- ☐ SIA/FINANCIAL GUARANTEE RELEASE
☐ PRELIMINARY PLAT APPROVAL
☐ S. DEV. PLAN FOR SUB'D APPROVAL
☐ S. DEV. FOR BLDG. PERMIT APPROVAL
☐ SECTOR PLAN APPROVAL
☐ FINAL PLAT APPROVAL
☐ CERTIFICATE OF OCCUPANCY (PERM)
☐ CERTIFICATE OF OCCUPANCY (TEMP)
☐ FOUNDATION PERMIT APPROVAL
☒ BUILDING PERMIT APPROVAL
☐ GRADING PERMIT APPROVAL
☐ PAVING PERMIT APPROVAL
☐ WORK ORDER APPROVAL
☐ GRADING CERTIFICATION
☐ SO-19 APPROVAL
☐ ESC PERMIT APPROVAL
☐ ESC CERT. ACCEPTANCE
☐ OTHER (SPECIFY) _____



WAS A PRE-DESIGN CONFERENCE ATTENDED: _____ Yes ☒ No _____ Copy Provided _____

DATE SUBMITTED: 6/3/16 By: _____

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature, location, and scope to the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following

1. **Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres
3. **Drainage Report:** Required for subdivision containing more than ten (10) lots or constituting five (5) acres or more
4. **Erosion and Sediment Control Plan:** Required for any new development and redevelopment site with 1-acre or more of land disturbing area, including project less than 1-acre than are part of a larger common plan of development

FILE G11D014D20

- ☐ SCAN letter
- ☐ MOVE eSubmittal to COMBINE folder
- ☐ DELETE eSubmittal from email
- ☐ RENAME letter (use naming convention)
- ☐ EMAIL letter
- ☐ COMBINE if approval (save as renamed letter)
- ☐ MOVE to electronic file (K: drive)
(~~delete~~ unneeded files in COMBINE folder)
- ☐ LOG & FILE paper folder (%D, discharge)

CITY OF ALBUQUERQUE



August 12, 2016

Yolanda Padilla-Moyer, PE
Bohannon-Huston
7500 Jefferson St NE Courtyard I
Albuquerque, NM 87109

**Re: Oxbow Bluff Lot 13
4118 Silvery Minnow
Request Permanent C.O. - Approved
Engineer's Stamp dated: ~~7-18-15~~ (G11D014D13)
Certification dated: 8-10-16 10-6-15**

Dear Ms. Padilla-Moyer,

Based on the Certification received 8/11/2016, the above referenced Certification is acceptable for the release of permanent Certificate of Occupancy by Hydrology.

PO Box 1293

If you have any questions, you can contact me at 924-3695 or Totten Elliott at 924-3982.

Albuquerque

Sincerely,

New Mexico 87103

Rita Harmon, P.E.
Senior Engineer, Planning Dept.
Development Review Services

www.cabq.gov

TE/~~AC~~ RH

C: email, Cordova, Camille C.; Miranda, Rachel; Sandoval, Darlene M.; Blocker, Lois

Bohannon Huston

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

August 12, 2016

Abiel Carrillo, P.E.
Senior Engineer
City of Albuquerque
PO Box 1293
Albuquerque NM 87103

RE: Grading and Drainage Certification for Lot 13 Oxbow Bluff Subdivision

Dear Abiel:

The purpose of this letter is to provide you with a copy of the individual grading and drainage certification for Lot 13 of Oxbow Bluff Subdivision

Per the letter agreement, dated December 16, 1997, from Tom Keleher with Altura West Ltd, Company (the developer of Oxbow Bluff Subdivision) to Fred Aguirre, City Hydrologist for the City of Albuquerque, the developer agreed to submit drainage certifications for those individual lots with the review and approval from Bohannon Huston Inc. Please note that the original letter indicated that the letters would be submitted to the city on an annual basis or the completion of every 15 houses whichever came first. Due to the number of lots being constructed or lack thereof, I am submitting as I receive final certification from the engineer of record to not lose track of which homes have been completed.

I have reviewed the above mentioned lot prepare by Mark Goodwin and Associates and concur that the lot is in substantial compliance with the approved grading and drainage plan as well as to the drainage report prepared by Bohannon Huston, Inc. dated December 11, 1997. Also, enclosed is a copy of the Engineer of record's certification of the latest Grading Plan stamp date 10-6-15 and 12-28-15 and certification date 08-10-16.

I would appreciate a letter from you indicating that you have received the certification and any comments you might have concerning the submittal. If you have any questions or require any additional information be feel free to contact me at 823-1000.

Sincerely,



Yolanda Padilla Moyer, P.E.
Senior Project Manager
Bohannon Huston, Inc

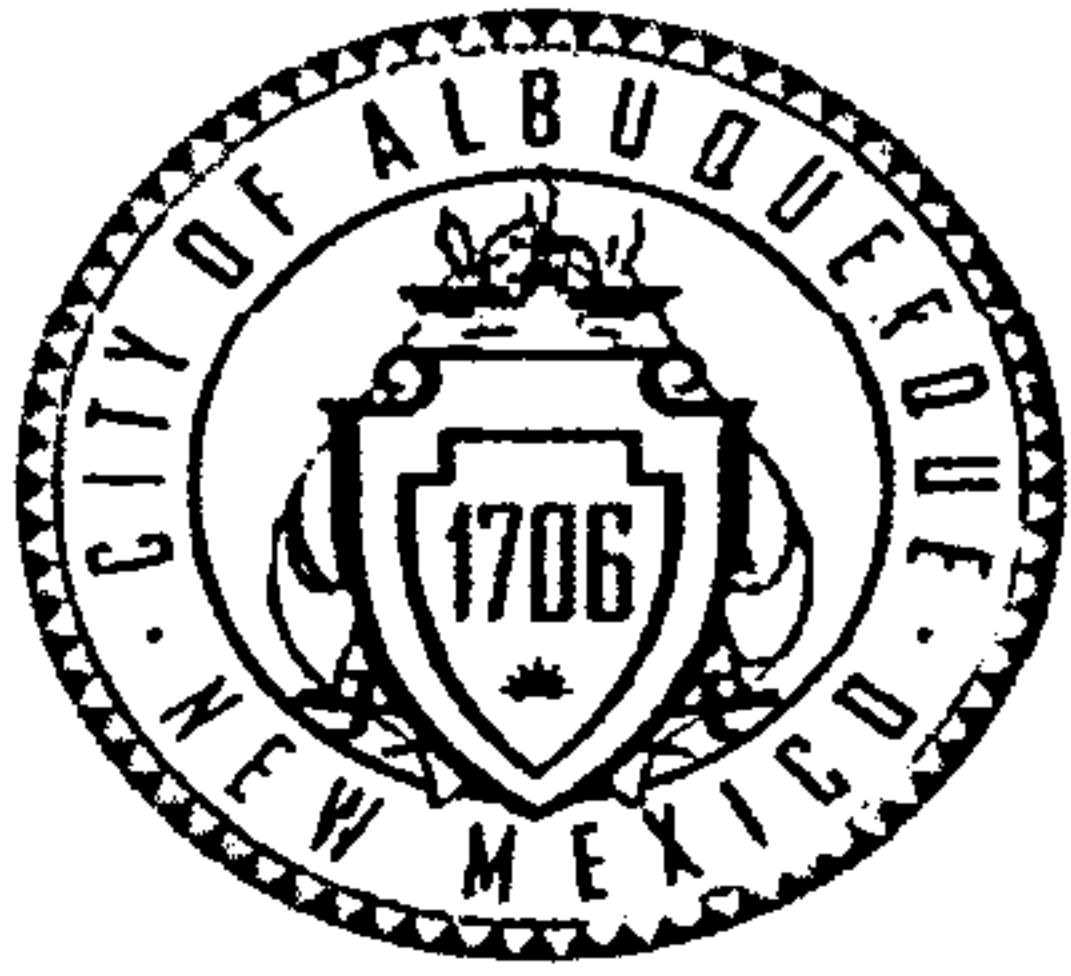
YP/cc
Enclosures

cc: Stephen Dixon, ACC Liaison

Engineering ▲

Spatial Data ▲

Advanced Technologies ▲



City of Albuquerque

Planning Department

Development & Building Services Division

DRAINAGE AND TRANSPORTATION INFORMATION SHEET (REV 09/2015)

Project Title: Oxbow Bluff Subdivision Lot 13

Building Permit #: 2015-93102

City Drainage #: G11D014D13

DRB#:

EPC#:

Work Order#:

Legal Description: Lot 13 Oxbow Bluff Subdivision, City of Albuquerque, Bernalillo County, NM

City Address: 4118 Slivery Minnow

Engineering Firm: Mark Goodwin & Associates

Contact: Kelly Klein

Address: PO Box 90606, Albuquerque, NM 87199

Phone#: 505-828-2200

Fax#:

E-mail: kelly@goodwinengineers.com

Owner: Raylee Homes

Contact: Bob Feeney

Address: PO Box 1443, Corrales, NM 87048

Phone#: 505-338-4708

Fax#:

E-mail: bfeeney@rayleehomes.com

Architect:

Contact:

Address:

Phone#:

Fax#:

E-mail:

Other Contact:

Contact:

Address:

Phone#:

Fax#:

E-mail:

Check all that Apply:

DEPARTMENT:

- ☒ HYDROLOGY/ DRAINAGE
☐ TRAFFIC/ TRANSPORTATION
☐ MS4/ EROSION & SEDIMENT CONTROL

TYPE OF SUBMITTAL:

- ☒ ENGINEER/ ARCHITECT CERTIFICATION

☐ CONCEPTUAL G & D PLAN
☐ GRADING PLAN
☐ DRAINAGE MASTER PLAN
☐ DRAINAGE REPORT
☐ CLOMR/LOMR

☐ TRAFFIC CIRCULATION LAYOUT (TCL)
☐ TRAFFIC IMPACT STUDY (TIS)
☐ EROSION & SEDIMENT CONTROL PLAN (ESC)

☐ OTHER (SPECIFY) _____

IS THIS A RESUBMITTAL?: ☐ Yes ☒ No

DATE SUBMITTED: 8/10/2016

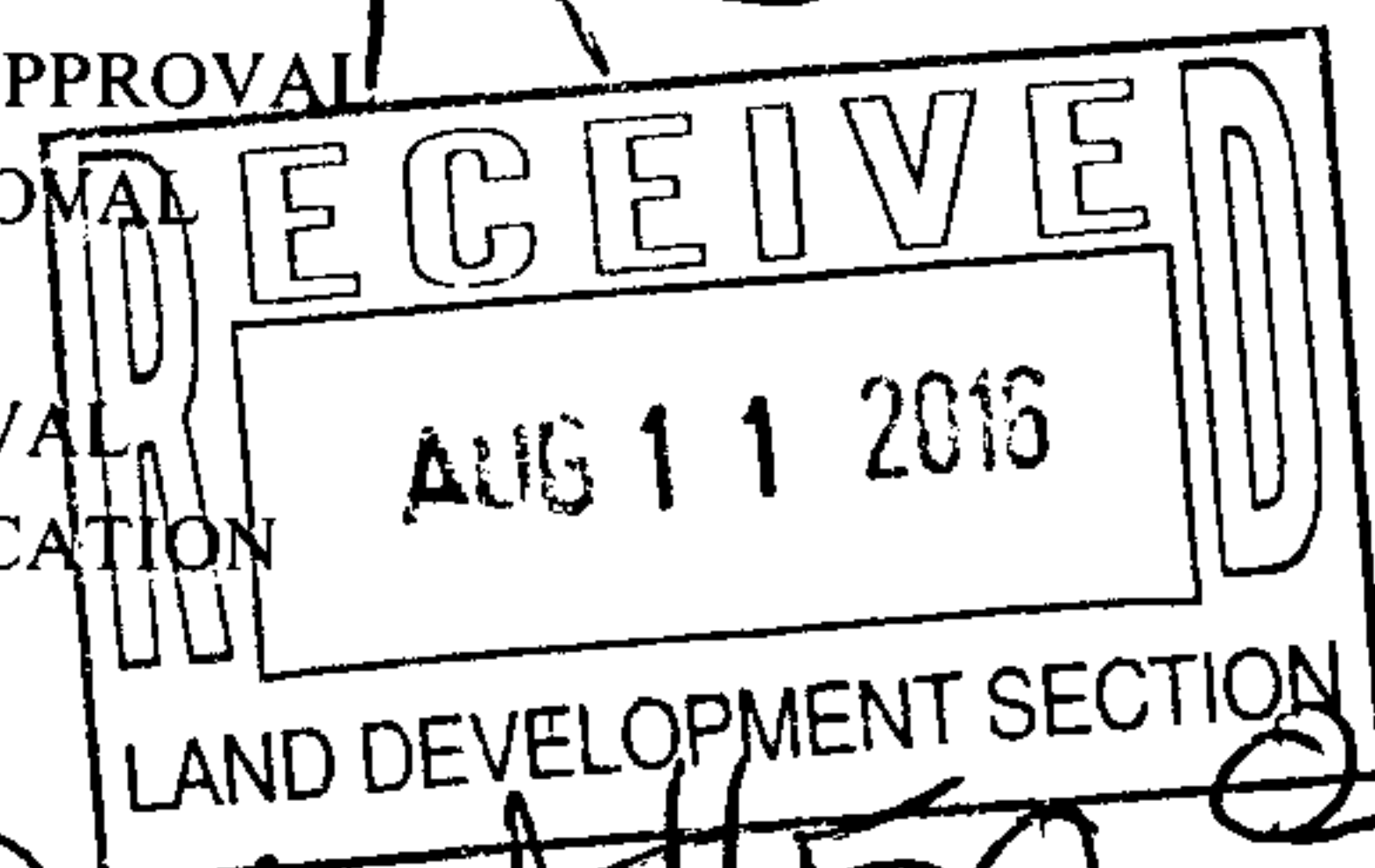
By: Kelly Klein

CHECK TYPE OF APPROVAL/ACCEPTANCE SOUGHT:

- ☐ BUILDING PERMIT APPROVAL
☒ CERTIFICATE OF OCCUPANCY

- ☐ PRELIMINARY PLAT APPROVAL
☐ SITE PLAN FOR SUB'D APPROVAL
☐ SITE PLAN FOR BLDG. PERMIT APPROVAL
☐ FINAL PLAT APPROVAL
☐ SIA/ RELEASE OF FINANCIAL GUARANTEE
☐ FOUNDATION PERMIT APPROVAL
☐ GRADING PERMIT APPROVAL
☐ SO-19 APPROVAL
☒ PAVING PERMIT APPROVAL
☒ GRADING/ PAD CERTIFICATION
☐ WORK ORDER APPROVAL
☐ CLOMR/LOMR

- ☐ PRE-DESIGN MEETING
☐ OTHER (SPECIFY) _____



COA STAFF: ELECTRONIC SUBMITTAL RECEIVED: _____

Kay Brashear

From: Kelly Klein
Sent: Wednesday, August 10, 2016 2:25 PM
To: plndrs@cabq.gov
Cc: Kay Brashear; Bob Feeney; Yolanda Padilla Moyer
Subject: 4118 Silvery Minnow - Lot 13 Oxbow Bluff Subdivision Building Permit #2015-93102
Attachments: A13016_Silvery Minnow G&D_Cert.pdf; DIS_Grading Certification 8_10_2016.pdf

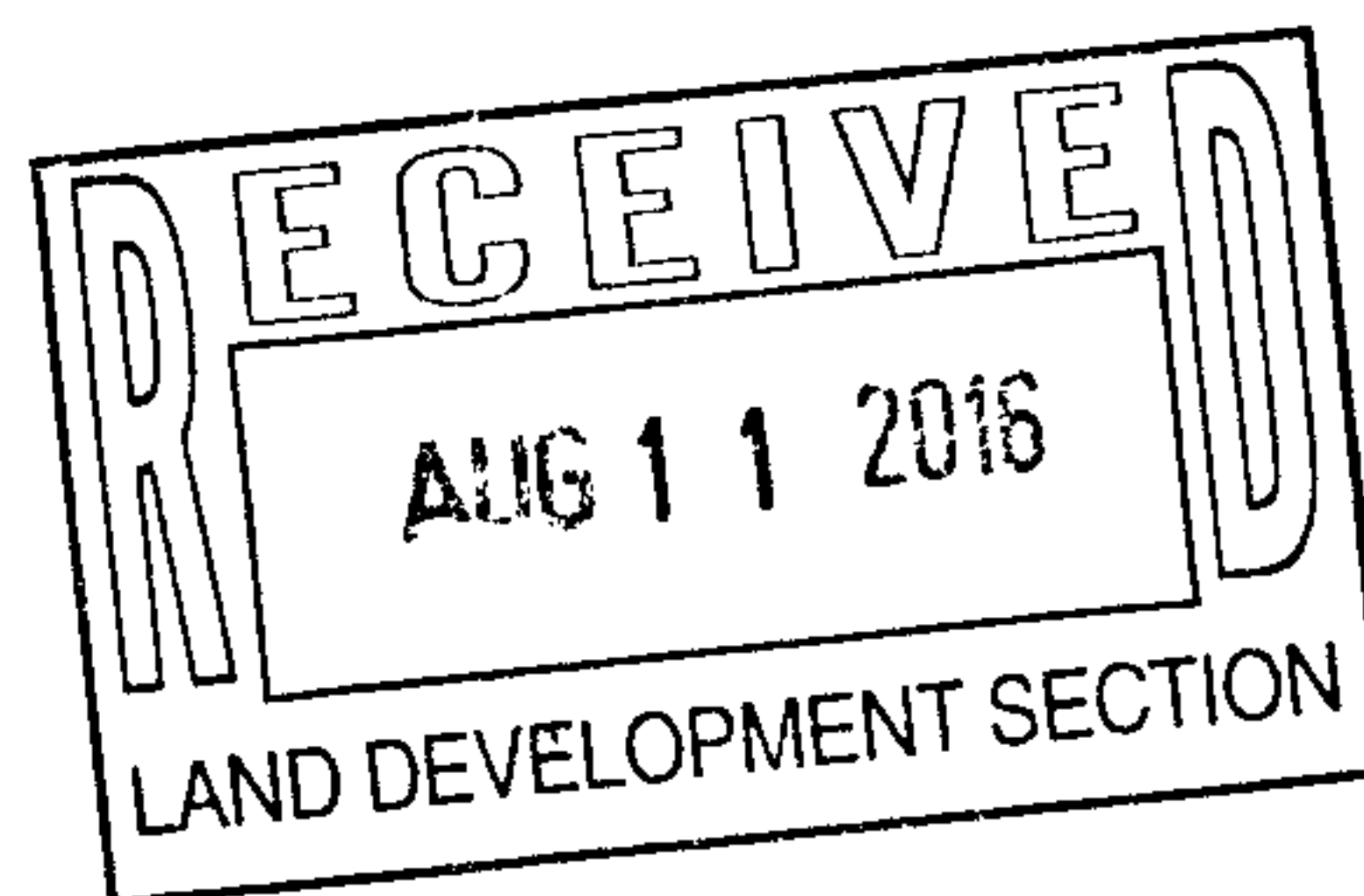
Please find the attached Engineer Certification for *Lot 13- Oxbow Bluff Subdivision Grading and Drainage Plan*. We will deliver hard copies tomorrow (8/11/2016).

Kelly Klein, EI

D. Mark Goodwin & Associates, P.A.

P: 505-828-2200 ext 104

F: 505-797-9539



(R) MOURNING DOVE

CITY OF ALBUQUERQUE



May 26, 2016

David Soule, PE
Rio Grande Engineering
1606 Central SE Suite 201
Albuquerque, NM 87106

**Re: Spuhler-Lasaster
5001 Grey Hawk Court
Requested for Permanent C. O. - Accepted
Engineers Stamp Date 3/31/15 (G11D014D32)
Certification dated: 5-3-16**

Dear Mr. Soule,

Based on the Certification received 5/24/2016, the site is acceptable for release of Certificate of Occupancy by Hydrology.

PO Box 1293

If you have any questions, you can contact me at 924-3695 or Totten Elliott at 924-3982.

Albuquerque

Sincerely,

New Mexico 87103

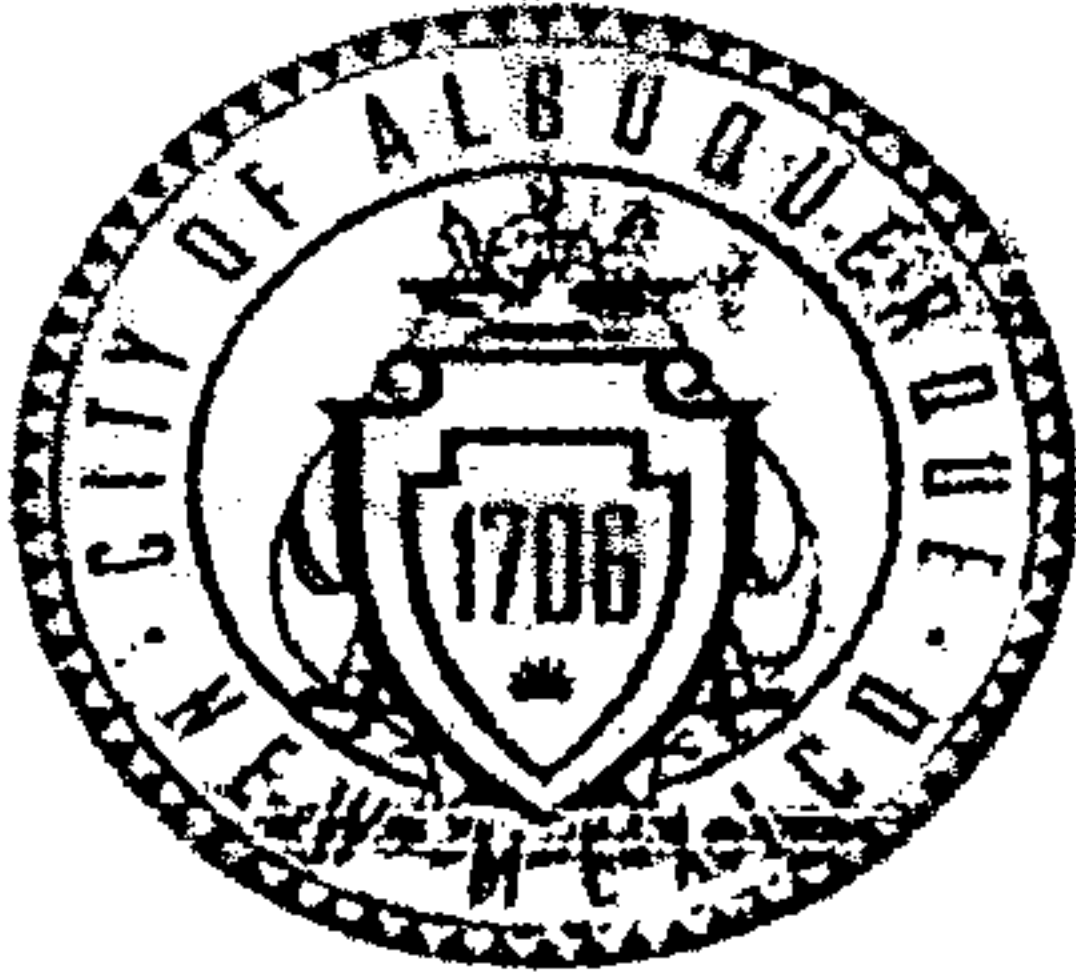
Rita Harmon, P.E.
Senior Engineer, Planning Dept.
Development Review Services

www.cabq.gov

TE/RH

C: email Cordova, Camille C.; Miranda, Rachel; Sandoval, Darlene M.; Blocker, Lois

Lot 32



City of Albuquerque

Planning Department

Development & Building Services Division

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV 02/2013)

9110014D32

Project Title: SPUHLER-LASASTER Building Permit #: _____ City Drainage #: E11-P814G

DRB#: _____ EPC#: _____ Work Order#: _____

Legal Description: LOT 32P1

City Address: 5001 GREY HAWK COURT #1948

Engineering Firm: RIO GRANDE ENGINEERING Contact: DAVID SOULE

Address: PO BOX 93924, ALBUQUERQUE, NM 87199

Phone#: 505.321.9099 Fax#: 505.872.0999 E-mail: DAVID@RIOGRANDEENGINEERING.COM

Owner: PANARAMA HOMES Contact: _____

Address: _____

Phone#: _____ Fax#: _____ E-mail: _____

Architect: MIKE GRAHSUIS Contact: _____

Address: _____

Phone#: _____ Fax#: _____ E-mail: _____

Surveyor: CONSTRUCTION SURVEY INCORPORATED Contact: JOHN GALLEGOS

Address: _____

Phone#: 917.8921 Fax#: _____ E-mail: _____

Contractor: _____ Contact: _____

Address: _____

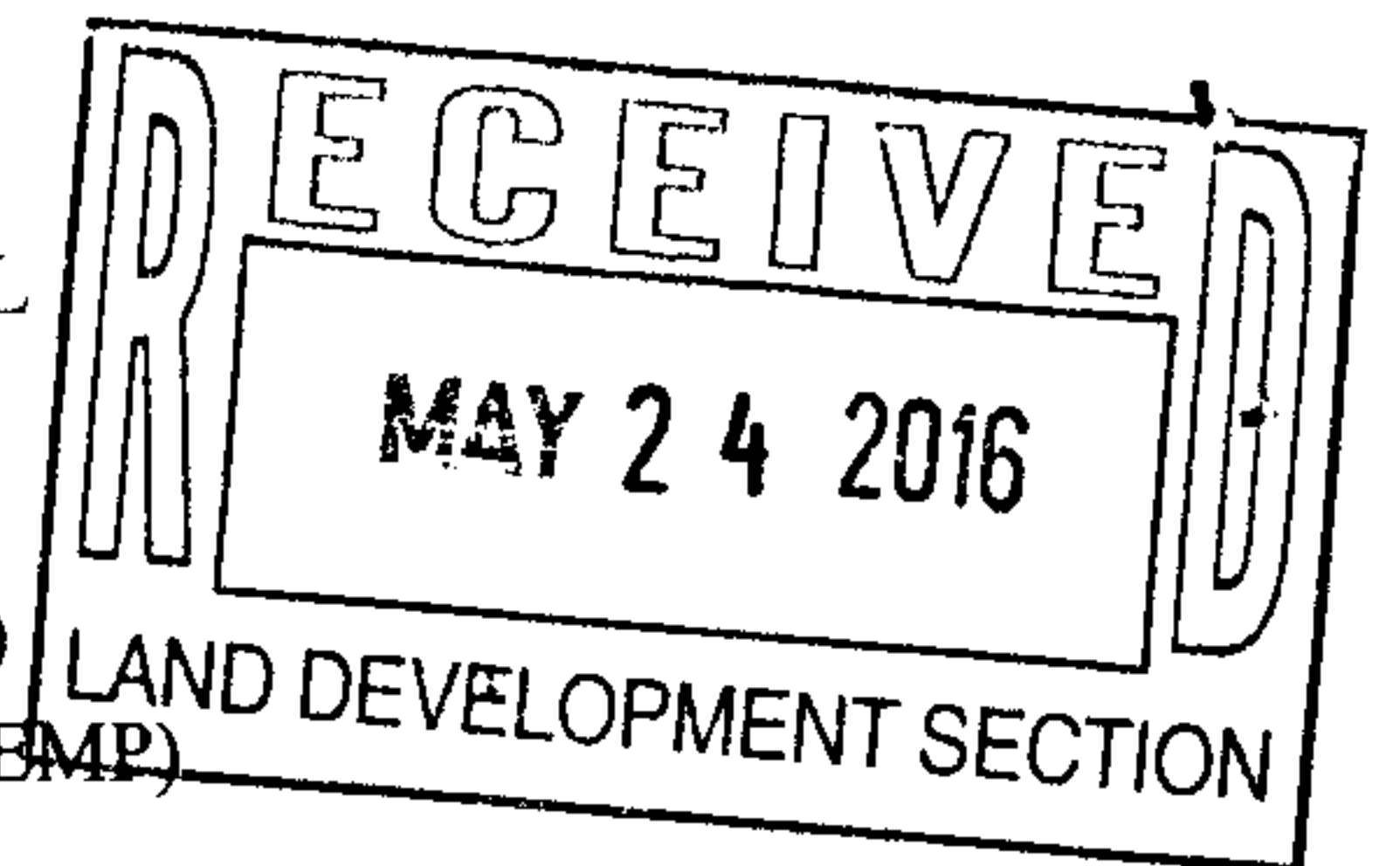
Phone#: _____ Fax#: _____ E-mail: _____

TYPE OF SUBMITTAL:

- ☐ DRAINAGE REPORT
☐ DRAINAGE PLAN 1st SUBMITTAL
☐ DRAINAGE PLAN RESUBMITTAL
☐ CONCEPTUAL G & D PLAN
☐ GRADING PLAN
☐ EROSION & SEDIMENT CONTROL PLAN (ESC)
☒ ENGINEER'S CERT (HYDROLOGY)
☐ CLOMR/LOMR
☐ TRAFFIC CIRCULATION LAYOUT (TCL)
☐ ENGINEER'S CERT (TCL)
☐ ENGINEER'S CERT (DRB SITE PLAN)
☐ ENGINEER'S CERT (ESC)
☐ SO-19
☐ OTHER (SPECIFY) _____

CHECK TYPE OF APPROVAL/ACCEPTANCE SOUGHT:

- ☐ SIA/FINANCIAL GUARANTEE RELEASE
☐ PRELIMINARY PLAT APPROVAL
☐ S. DEV. PLAN FOR SUB'D APPROVAL
☐ S. DEV. FOR BLDG. PERMIT APPROVAL
☐ SECTOR PLAN APPROVAL
☐ FINAL PLAT APPROVAL
☒ CERTIFICATE OF OCCUPANCY (PERM)
☐ CERTIFICATE OF OCCUPANCY (TCL TEMP)
☐ FOUNDATION PERMIT APPROVAL
☐ BUILDING PERMIT APPROVAL
☐ GRADING PERMIT APPROVAL
☐ PAVING PERMIT APPROVAL
☐ WORK ORDER APPROVAL
☐ GRADING CERTIFICATION
☐ SO-19 APPROVAL
☐ ESC PERMIT APPROVAL
☐ ESC CERT. ACCEPTANCE
☐ OTHER (SPECIFY) _____



WAS A PRE-DESIGN CONFERENCE ATTENDED: _____ Yes ☒ No _____ Copy Provided _____

DATE SUBMITTED: 5/23/16 By: _____

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature, location, and scope to the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres
3. **Drainage Report:** Required for subdivision containing more than ten (10) lots or constituting five (5) acres or more
4. **Erosion and Sediment Control Plan:** Required for any new development and redevelopment site with 1-acre or more of land disturbing area, including project less than 1-acre than are part of a larger common plan of development



Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

June 7, 2016

Abiel Carrillo, P.E.
Senior Engineer
City of Albuquerque
PO Box 1293
Albuquerque NM 87103

RE: Grading and Drainage Certification for Lot 32 Oxbow Bluff Subdivision

Dear Abiel:

The purpose of this letter is to provide you with a copy of the individual grading and drainage certification for Lot 32 of Oxbow Bluff Subdivision

Per the letter agreement, dated December 16, 1997, from Tom Keleher with Altura West Ltd, Company (the developer of Oxbow Bluff Subdivision) to Fred Aguirre, City Hydrologist for the City of Albuquerque, the developer agreed to submit drainage certifications for those individual lots with the review and approval from Bohannon Huston Inc. Please note that the original letter indicated that the letters would be submitted to the city on an annual basis or the completion of every 15 houses whichever came first. Due to the number of lots being constructed or lack thereof, I am submitting as I receive final certification from the engineer of record to not lose track of which homes have been completed.

I have reviewed the above mentioned lot prepare by David Soule of Rio Grande Engineering and concur that the lot is in substantial compliance with the approved grading and drainage plan as well as to the drainage report prepared by Bohannon Huston, Inc. dated December 11, 1997. Also, enclosed is a copy of the Engineer of record's certification of the latest Grading Plan stamp date 03-31-15 certification date 05-03-16.

I would appreciate a letter from you indicating that you have received the certification and any comments you might have concerning the submittal. If you have any questions or require any additional information be feel free to contact me at 823-1000.

Sincerely,

Yolanda Padilla Moyer, P.E.
Senior Project Manager
Bohannon Huston, Inc

YP/cc
Enclosures

cc: Stephen Dixon, ACC Liaison

Engineering ▲

Spatial Data ▲

Advanced Technologies ▲

- ② A ten foot (10') Public Utility Easement, and incidental purposes thereto, reserved along the front lot line of the subject premises, as shown on the recorded plat, recorded in Plat Book 98C, Page 32, records of Bernalillo County, New Mexico.
- ③ A one hundred foot (100') Public Storm Drain and Sanitary Sewer Easement, and incidental purposes thereto, reserved along the eastern lot line of the subject premises, as shown on the recorded plat, recorded in Plat Book 98C, Page 32, records of Bernalillo County, New Mexico.
- ④ A seventeen and one-half foot (17.5') Public Storm Drain and Sanitary Sewer Easement and Access and Landscape Easement, and incidental purposes thereto, reserved along the southern lot line of the subject premises, as shown on the recorded plat, recorded in Plat Book 98C, Page 32, records of Bernalillo County, New Mexico.
- ⑤ Conservation, Landscape and Utility Easement recorded February 18, 1989, in Book 8903, Page 1885, as Doc. No. 1889023047, records of Bernalillo County, New Mexico.
- ⑥ Landscape and Easement recorded February 18, 1989, in Book 8903, Page 1885, as Doc. No. 1889023048, records of Bernalillo County, New Mexico (Does Not Affect Property - Off Site).
- ⑦ Access and Landscape Easement recorded February 18, 1989, in Book 8903, Page 1887, as Doc. No. 1889023049, records of Bernalillo County, New Mexico.

EASEMENT LEGEND

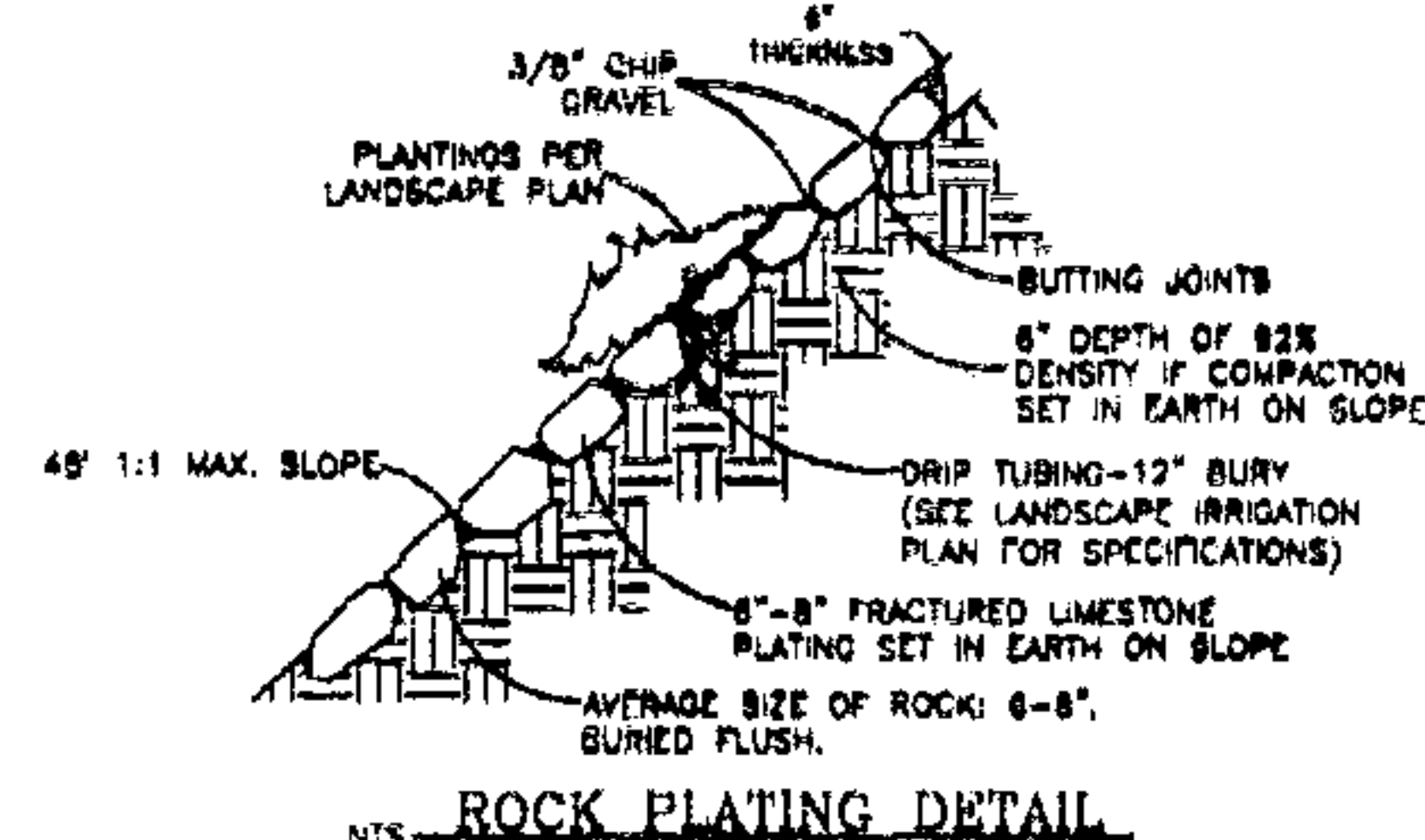
- ② 10' Easement for utility purposes of any kind and for any other purpose, as shown on the recorded plat, recorded in Plat Book 98C, Page 32, records of Bernalillo County, New Mexico.

KEYED INVERT DATA

- | | | | |
|---|---|---|---|
| ② Sanitary Sewer MH
Invert = 5038.80'
Invert = 5038.80' (N)
Invert = 5038.80' (E)
Invert = 5038.79' (W) | ③ Storm Drain MH
Top of Invert = 5038.81'
Invert = 5038.81' | ④ Storm Drain MH
Invert = 5014.30' (N)
Invert = 5012.00' (W)
Invert = 5012.10' (E) | ⑤ Storm Drain MH
Top of Invert = 5022.80'
Invert = 5022.80' |
| ⑥ Sanitary Sewer MH
Invert = 5027.40'
Invert = 5019.80' (N)
Invert = 5019.30' (W)
Invert = 5019.60' (E) | ⑦ Storm Drain MH
Top of Invert = 5022.80'
Invert = 5022.80' | ⑧ Sanitary Sewer MH
Invert = 5018.95'
Invert = 5018.95' (N)
Invert = 5018.78' (W) | |

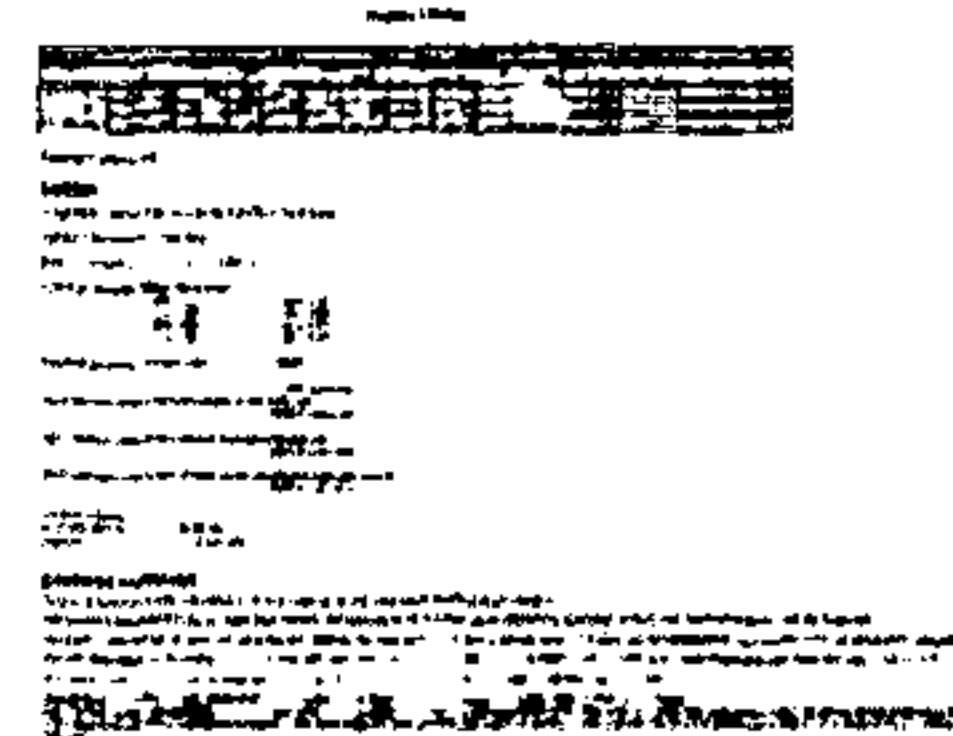
Vertical Datum is based on Albuquerque Control Survey Monument "B-011", elevation = 5116.009, as published.

INFORMATION PROVIDED BY SURVEX DATED 2011

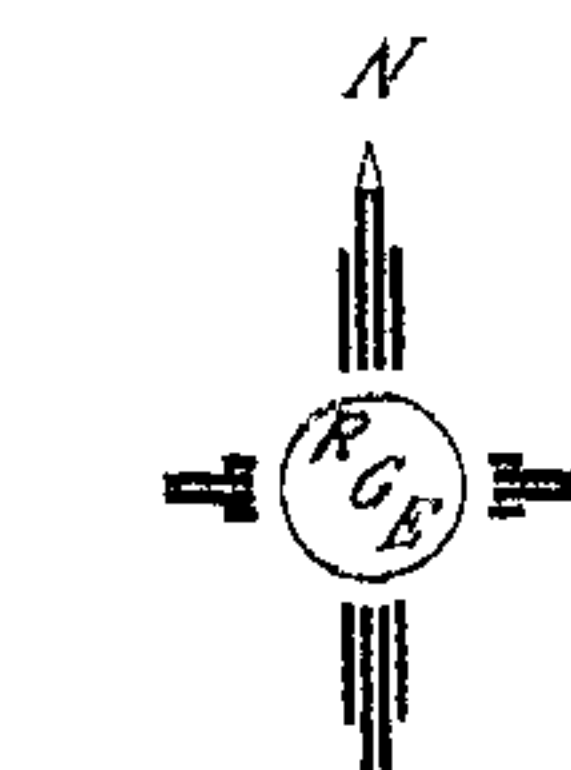
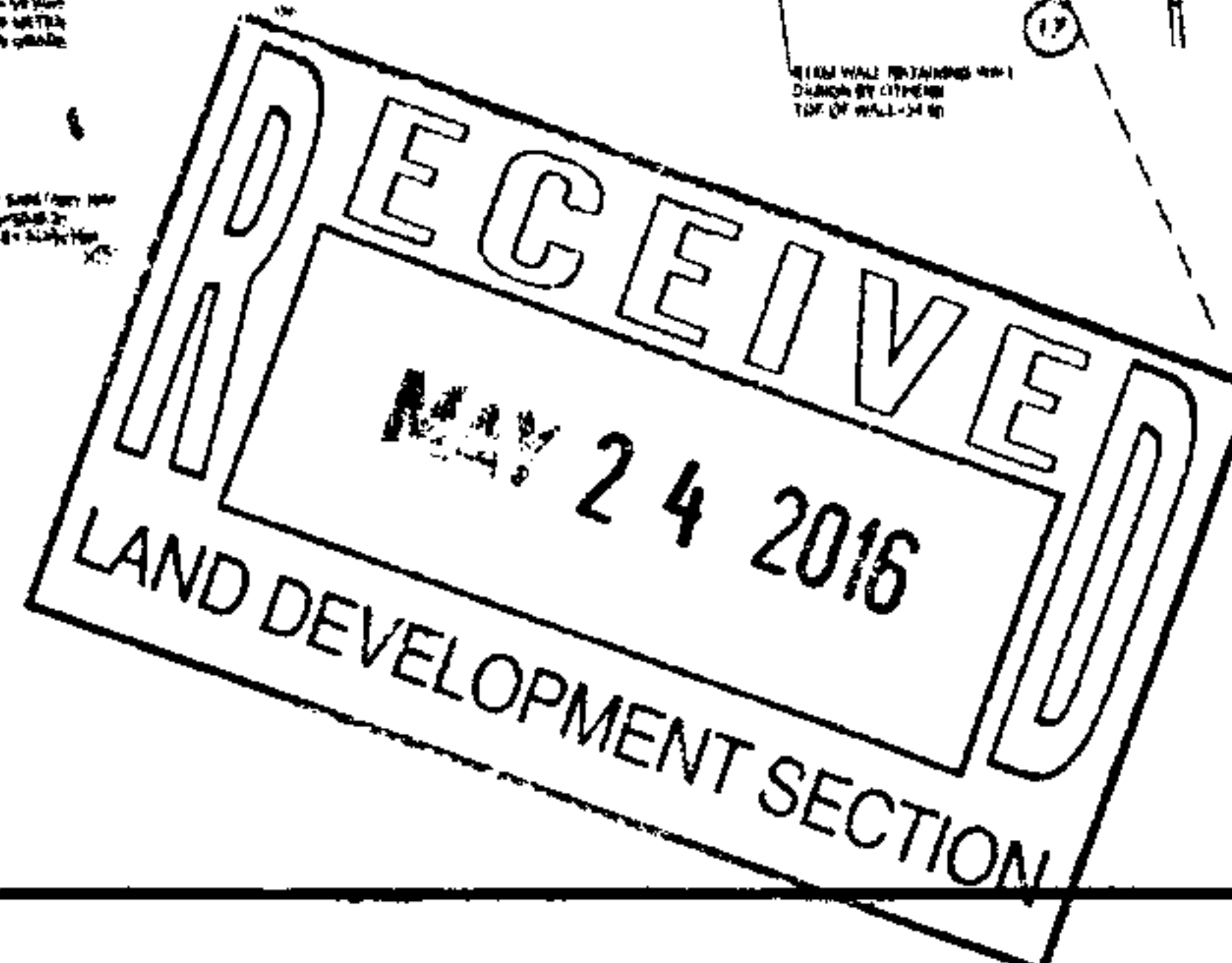


EROSION CONTROL NOTES:

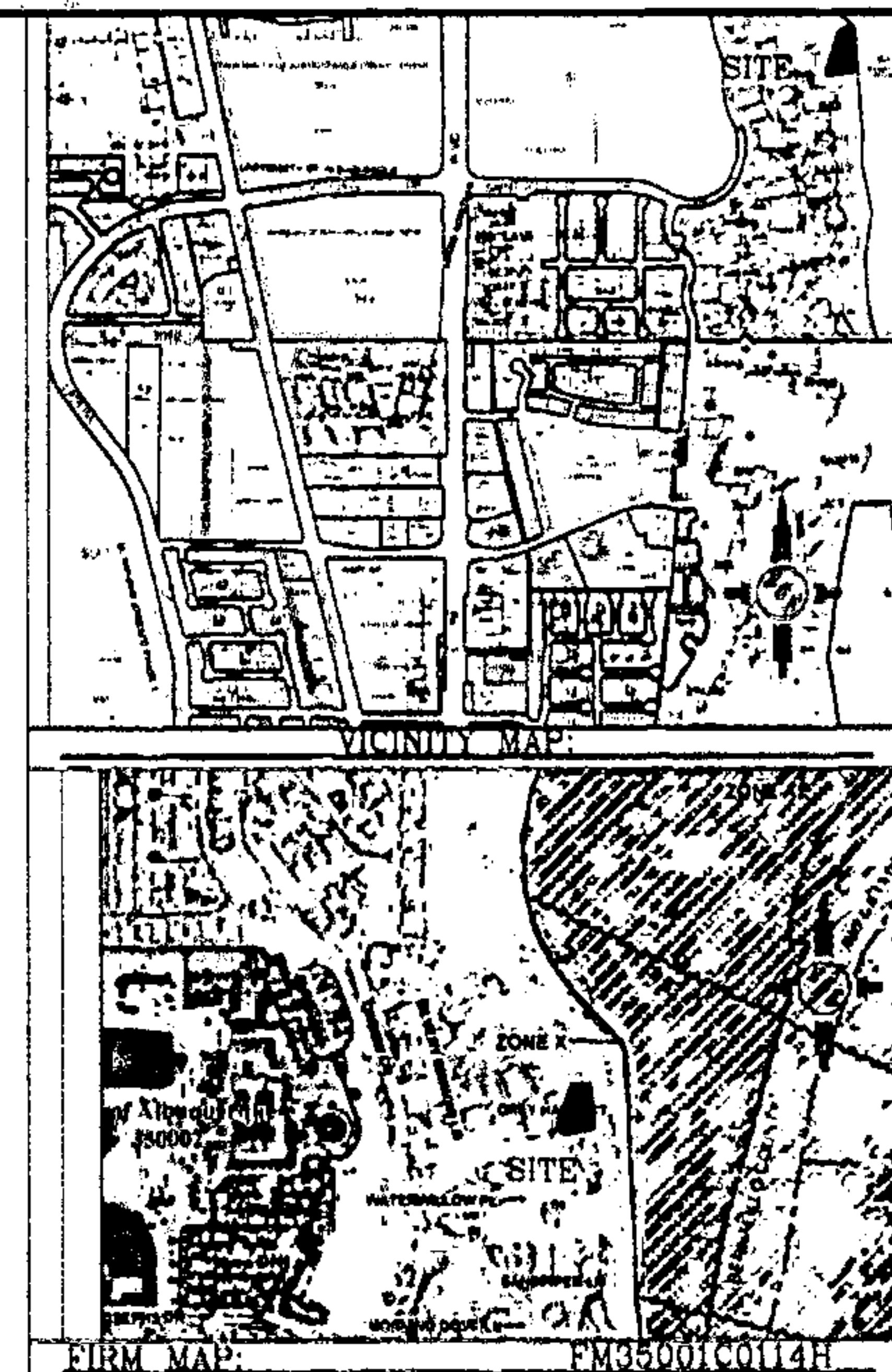
1. CONTRACTOR IS RESPONSIBLE FOR OBTAINING A TOPSOIL DISTURBANCE PERMIT PRIOR TO BEGINNING WORK.
2. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING RUN-OFF ON SITE DURING CONSTRUCTION.
3. CONTRACTOR IS RESPONSIBLE FOR CLEANING ALL SEDIMENT THAT GETS INTO EXISTING RIGHT-OF-WAY.
4. REPAIR OF DAMAGED FACILITIES AND CLEANUP OF SEDIMENT ACCUMULATIONS ON ADJACENT PROPERTIES AND IN PUBLIC FACILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR.
5. ALL EXPOSED EARTH SURFACES MUST BE PROTECTED FROM WIND AND WATER EROSION PRIOR TO FINAL (CITY) ACCEPTANCE OF ANY PROJECT.



LOT OF GREY HAWK COURT NW



GRAPHIC SCALE
SCALE: 1"=20'



LEGAL DESCRIPTION:

LOT 32-P1 OXBOW BLUFF SUBDIVISION

NOTES:

1. ALL SPOT ELEVATIONS REPRESENT FLOWLINE ELEVATION UNLESS OTHERWISE NOTED.
2. TOPOGRAPHIC SURVEY INFORMATION SHOWN ON THIS PLAN WAS OBTAINED FROM PANORAMA MOVIES, JOHN LOWE.
3. All roof drains shall have concrete splash pads and detritus baskets which extend from building.
4. ALL INLETS SHALL BE 12"X18" ALUMINUM DRAINAGE INLET WITH FLAT GRATES UNLESS OTHERWISE NOTED.

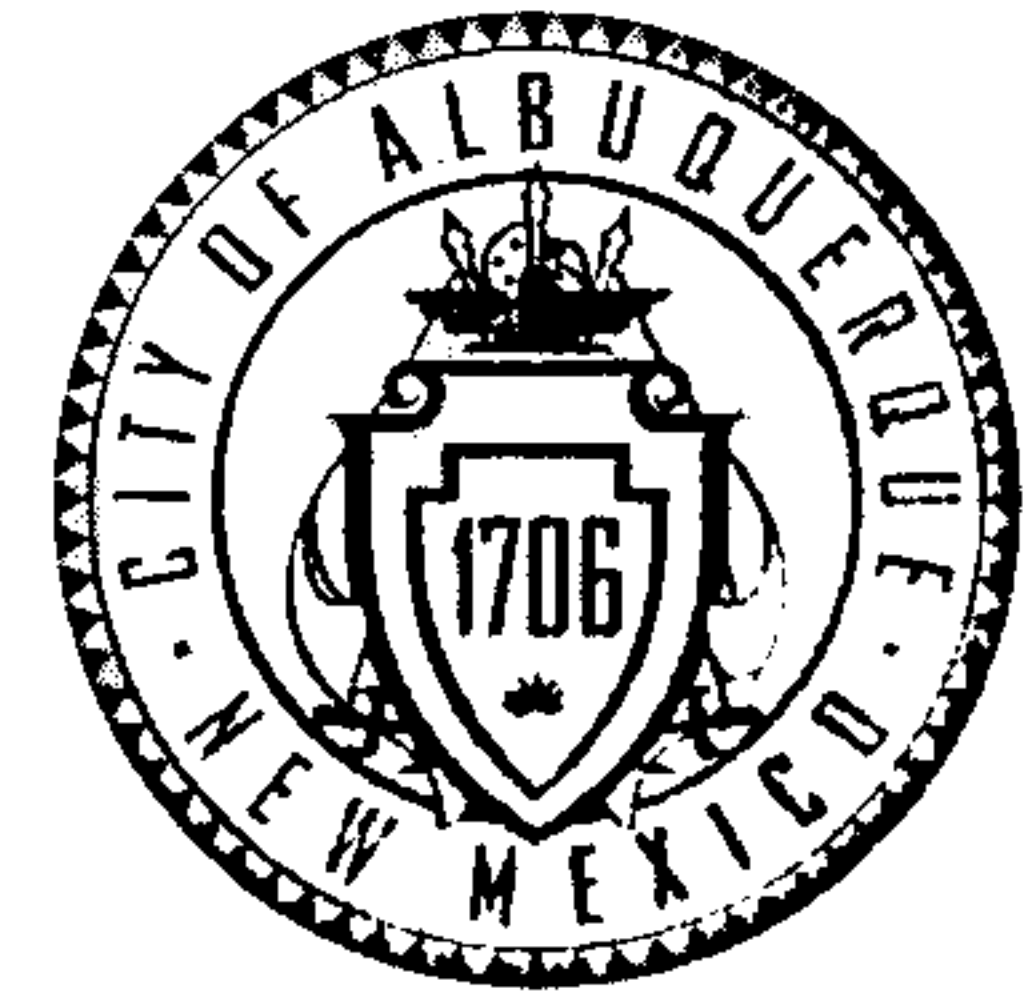
LEGEND

- | | |
|-----|---|
| --- | EXISTING CONTOUR |
| --- | EXISTING INDEX CONTOUR |
| --- | PROPOSED CONTOUR |
| --- | PROPOSED INDEX CONTOUR |
| --- | PROPOSED STEM RETAINING WALL |
| --- | SWALE-FLOWLINE |
| ● | PROJECT BENCHMARK |
| --- | ROCK PLATING SLOPES GREATER THAN 3:1, 1:1.5:1 MAX |
| --- | 12"X18" CONCRETE PAD RUNDOWN |
| --- | 2' COBBLE SWALE |

ENGINEER'S SEAL 3/31/15 DAVID SOULE P.E. #14522	LOT 32-P1 OXBOW BLUFF SUBDIVISION GRADING AND DRAINAGE PLAN <i>Rio Grande Engineering</i> 1800 CENTRAL AVENUE SE SUITE 201 ALBUQUERQUE, NM 87106 (505) 872-0999	DRAWN BY JGG DATE 03-31-2018
		SHEET # 1 OF 1 JOB #

CITY OF ALBUQUERQUE

PLANNING DEPARTMENT – Development Review Services



April 17, 2015

David Soule, P.E.
Rio Grande Engineering
P.O. Box 93924
Albuquerque, NM 87199

Richard J. Berry, Mayor

**RE: Lot 32 P1 - Oxbow Bluff (File: G11D014D32)
Grading and Drainage Plan, Engineer's Stamp Date 3-31-15**

Dear Mr. Soule:

Based upon the information provided in your submittal received 4-10-15, the above referenced submittal is approved for Building Permit.

Please note: Oxbow Bluff ACC has a contract with Bohannon-Houston to perform the reviews. Please submit the engineers certificate to BHI for their approval, which they should then submit to the Planning Department for our files.

If you have any questions, you can contact me at 924-3695.

PO Box 1293

Albuquerque

New Mexico 87103

Sincerely,

Rita Harmon, P.E.
Senior Engineer, Planning Dept.
Development Review Services

www.cabq.gov

Orig: Drainage file
c.pdf: via Email: Recipient, Monica Ortiz

.65 Ac - D
100% Retention

Lot 32



City of Albuquerque

Planning Department

Development & Building Services Division

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV 02/2013)

G11D014D32

Project Title: SPUHLER-LASASTER Building Permit #: _____ City Drainage #: ~~F4120143~~
DRB#: _____ EPC#: _____ Work Order#: _____
Legal Description: LOT 32P1
City Address: 5001 GREY HAWK COURT

Engineering Firm: RIO GRANDE ENGINEERING Contact: DAVID SOULE
Address: PO BOX 93924, ALBUQUERQUE, NM 87199
Phone#: 505.321.9099 Fax#: 505.872.0999 E-mail: DAVID@RIOGRANDEENGINEERING.COM

Owner: PANARAMA HOMES Contact: _____
Address: _____
Phone#: _____ Fax#: _____ E-mail: _____

Architect: MIKE GRAHSUIS Contact: _____
Address: _____
Phone#: _____ Fax#: _____ E-mail: _____

Surveyor: CONSTRUCTION SURVEY INCORPORATED Contact: JOHN GALLEGOS
Address: _____
Phone#: 917.8921 Fax#: _____ E-mail: _____

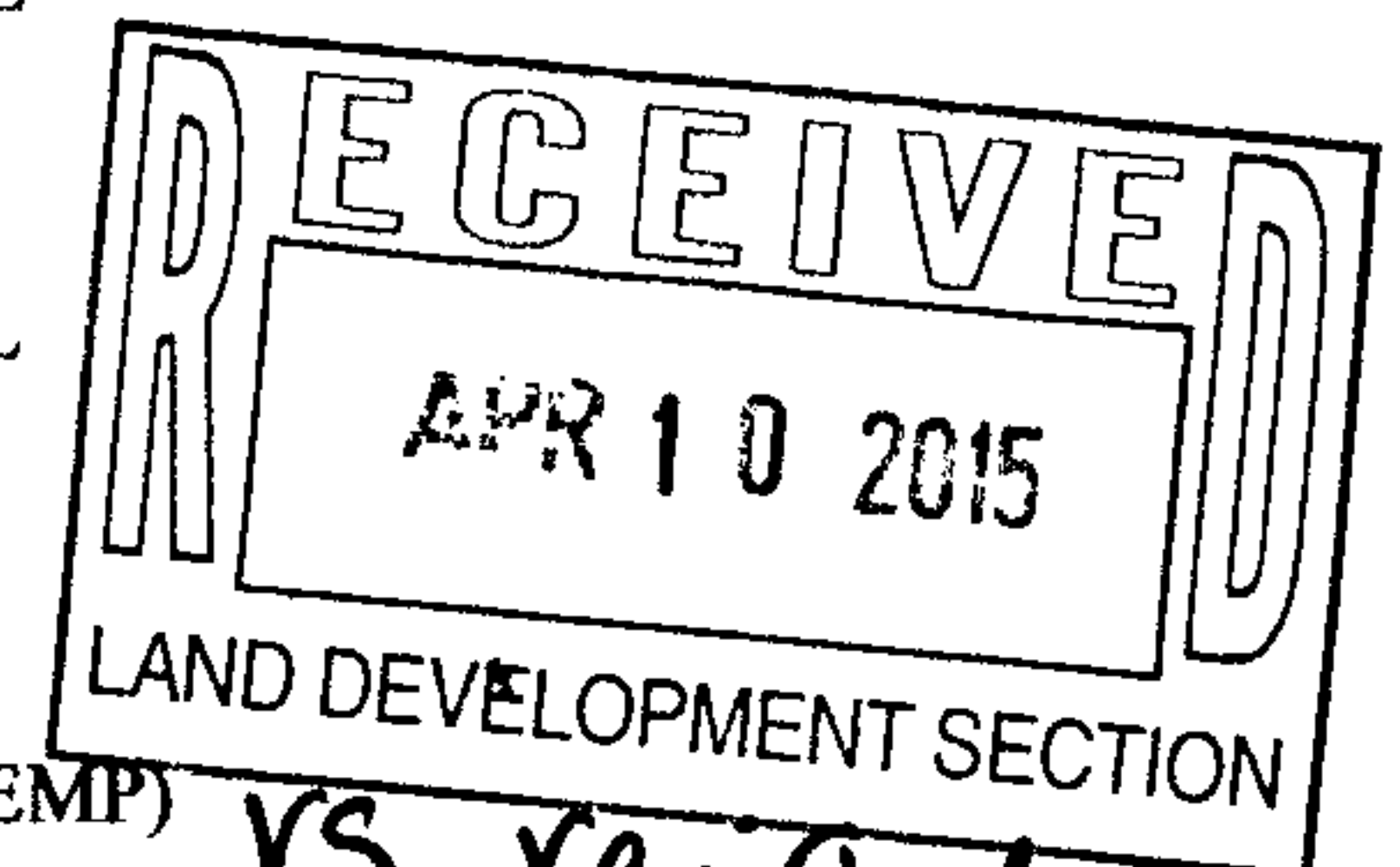
Contractor: _____ Contact: _____
Address: _____
Phone#: _____ Fax#: _____ E-mail: _____

TYPE OF SUBMITTAL:

- ☐ DRAINAGE REPORT
- ☐ DRAINAGE PLAN 1st SUBMITTAL
- ☒ DRAINAGE PLAN RESUBMITTAL
- ☐ CONCEPTUAL G & D PLAN
- ☐ GRADING PLAN
- ☐ EROSION & SEDIMENT CONTROL PLAN (ESC)
- ☐ ENGINEER'S CERT (HYDROLOGY)
- ☐ CLOMR/LOMR
- ☐ TRAFFIC CIRCULATION LAYOUT (TCL)
- ☐ ENGINEER'S CERT (TCL)
- ☐ ENGINEER'S CERT (DRB SITE PLAN)
- ☐ ENGINEER'S CERT (ESC)
- ☐ SO-19
- ☐ OTHER (SPECIFY) _____

CHECK TYPE OF APPROVAL/ACCEPTANCE SOUGHT:

- ☐ SIA/FINANCIAL GUARANTEE RELEASE
- ☐ PRELIMINARY PLAT APPROVAL
- ☐ S. DEV. PLAN FOR SUB'D APPROVAL
- ☐ S. DEV. FOR BLDG. PERMIT APPROVAL
- ☐ SECTOR PLAN APPROVAL
- ☐ FINAL PLAT APPROVAL
- ☐ CERTIFICATE OF OCCUPANCY (PERM)
- ☐ CERTIFICATE OF OCCUPANCY (TCL TEMP)
- ☐ FOUNDATION PERMIT APPROVAL
- ☒ BUILDING PERMIT APPROVAL
- ☐ GRADING PERMIT APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☐ WORK ORDER APPROVAL
- ☐ GRADING CERTIFICATION
- ☐ SO-19 APPROVAL
- ☐ ESC PERMIT APPROVAL
- ☐ ESC CERT. ACCEPTANCE
- ☐ OTHER (SPECIFY) _____



WAS A PRE-DESIGN CONFERENCE ATTENDED: _____ Yes ☒ No _____ Copy Provided _____

DATE SUBMITTED: 2/9/15 By: _____

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature, location, and scope to the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres
3. **Drainage Report:** Required for subdivision containing more than ten (10) lots or constituting five (5) acres or more
4. **Erosion and Sediment Control Plan:** Required for any new development and redevelopment site with 1-acre or more of land disturbing area, including project less than 1-acre than are part of a larger common plan of development



Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

April 8, 2015

Mr. Stephen Dixon
Oxbow Bluff ACC Liaison
2317 Royene Ave NE
Albuquerque, NM 87110

Re: Lot 32 – Oxbow Bluff; 3rd and Final Review for Lot Specific Grading and Drainage Plan

Dear Stephen:

Based on the revised grading and drainage plan for the above referenced Lot stamped dated 3/31/15 by Rio Grande Engineering, it appears that all the comments have been addressed and the site retains the total developed flow generated from this site.

There are a few minor comments, see attached markup, but none that reflect the actual approval of grading and drainage of the site. I would request these comments be addressed.

Please let me know if you have any comments or concerns.

Sincerely,

A handwritten signature in black ink that reads "Yolanda Padilla Moyer".

Yolanda Padilla Moyer, P.E.
Senior Project Manager
Community Development and Planning

YPM/cc

cc: Rita Harmon, COA (w/encl)
John Lowe, Panorama Homes
David Soule, Rio Grande Engineering

Engineering ▲

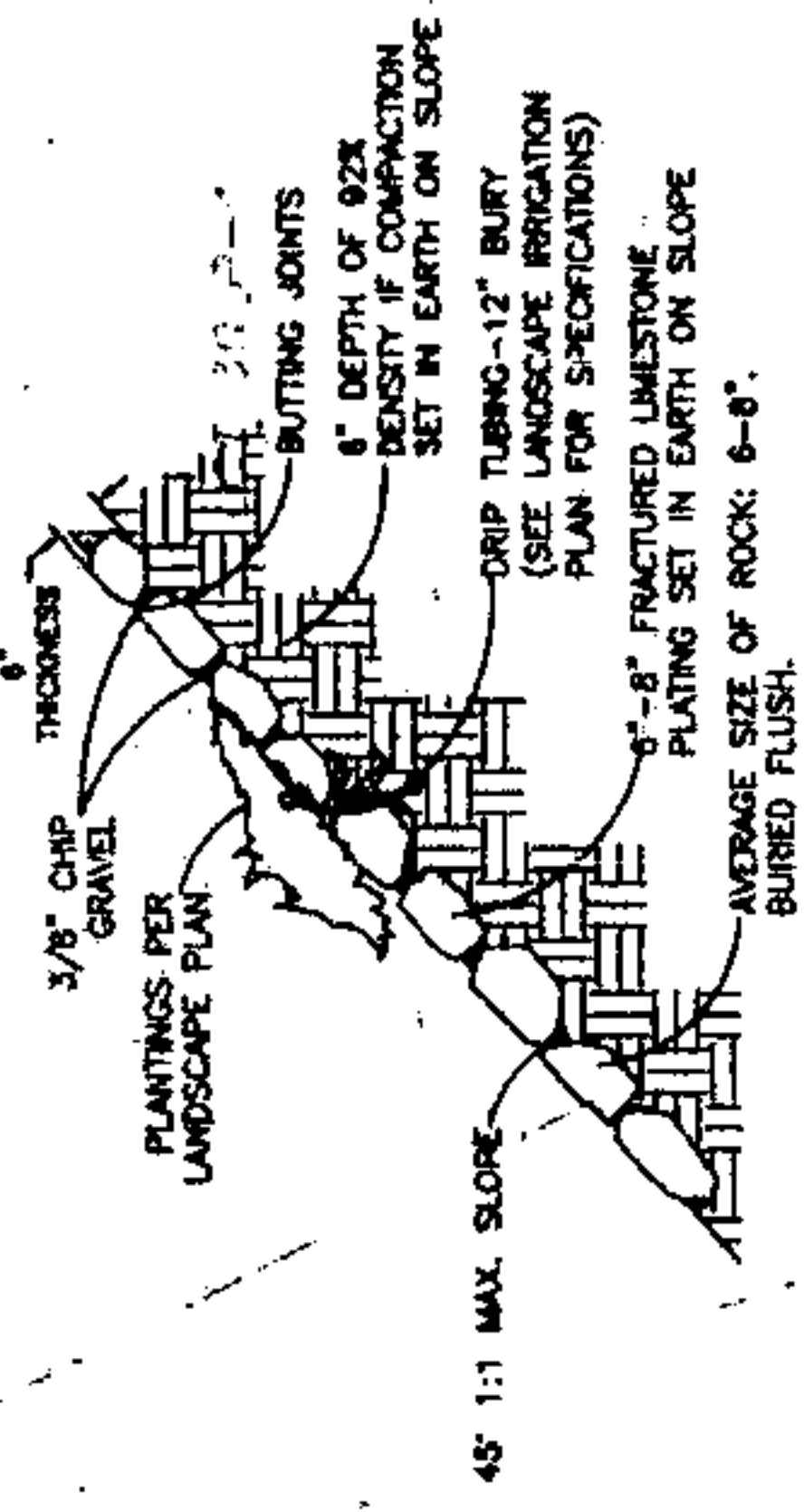
Spatial Data ▲

- ### EASEMENT LEGEND

- KEYED EVENT DATA**

- Vertical Datum is based on Albuquerque Control Survey Monument "B-G11", elevation = 5116.009, as published.

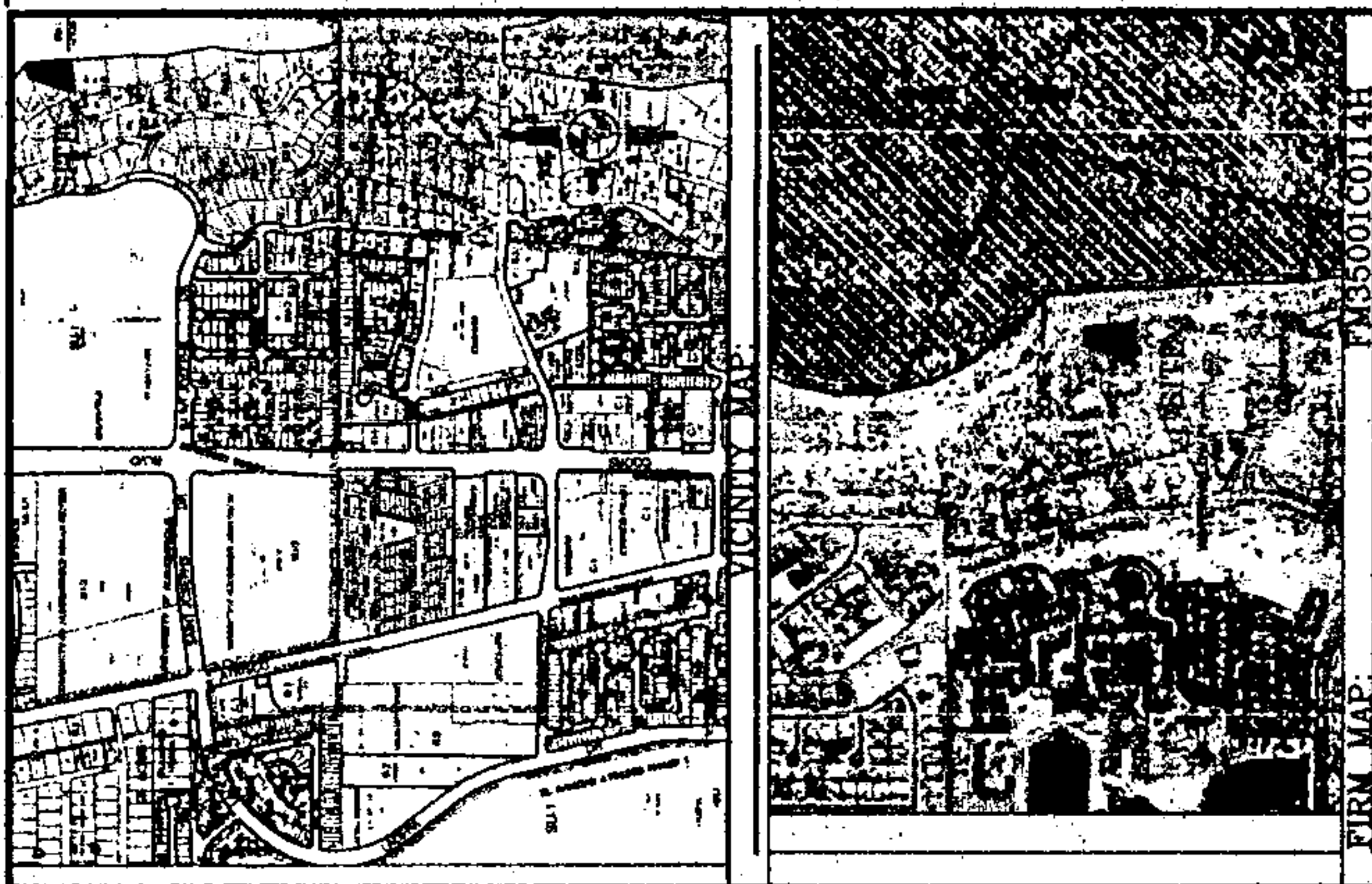
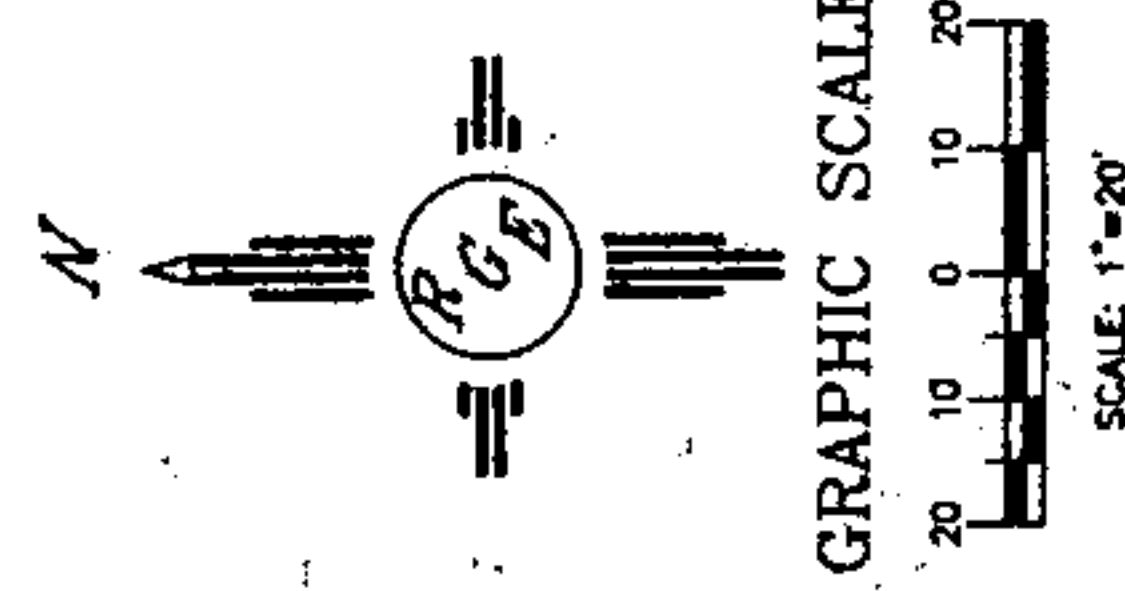
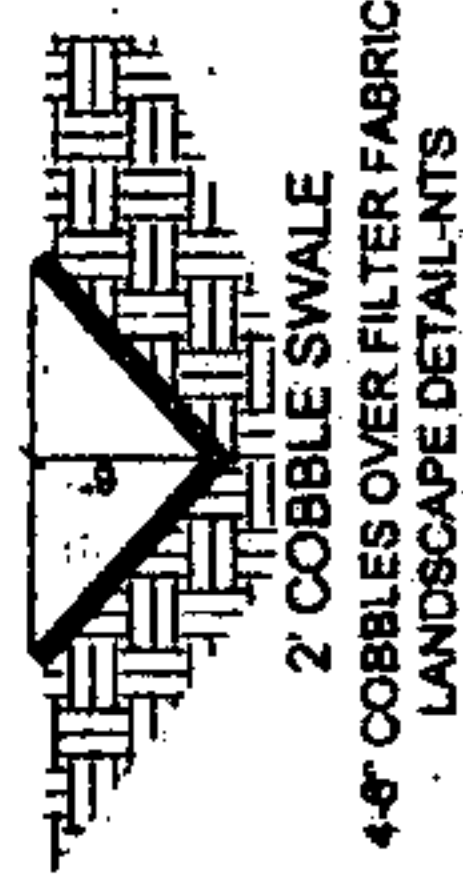
U-371, REVISED - 3/10/00, AS PERMITTED.
INFORMATION PROVIDED BY SURVEX DATED 2011



ROCK PLATING DETAIL

EROSION CONTROL NOTES:

1. CONTRACTOR IS RESPONSIBLE FOR OBTAINING A TOPSOIL DISTURBANCE PERMIT PRIOR TO BEGINNING WORK.
2. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING RUN-OFF ON SITE DURING CONSTRUCTION.
3. CONTRACTOR IS RESPONSIBLE FOR CLEANING ALL SEDIMENT THAT GETS INTO EXISTING RIGHT-OF-WAY.
4. REPAIR OF DAMAGED FACILITIES AND CLEANUP OF SEDIMENT REMAINS THE RESPONSIBILITY OF THE CONTRACTOR.
5. ALL EXPOSED EARTH SURFACES MUST BE PROTECTED FROM WIND AND WATER EROSION PRIOR TO FINAL (OTM) ACCEPTANCE OF ANY PROJECT.



LEGAL DESCRIPTION:

LOT 32-P1 OXBOW BLUFF SUBMISORNS 44TH MOBXO 14-25 107

NOTES

1. ALL SPOT ELEVATIONS REPRESENT FLOWING ELEVATION UNLESS OTHERWISE NOTED.
2. TOPOGRAPHIC SURVEY INFORMATION SHOWN ON THIS PLAN WAS OBTAINED FROM THE FOLLOWING SOURCES:
3. A. LAND RECORDS HAVE CONCRETE EPOCH POSTS AND DEFINED TOPOGRAPHIC STUDIES CARRY FROM BUILDING.
4. ALL WELLS SHALL BE NYLOPLAST INJUNE DRAINS 18" WITH FLAT GRATES UNLESS OTHERWISE NOTED.

LEGEND

- EXISTING CONTOUR
EXISTING INDEX CONTOUR
PROPOSED CONTOUR
PROPOSED INDEX CONTOUR
PROPOSED STEM RETAINING WALL
SWALE - FLOWLINE
PROJECT BENCHMARK
ROCK PLANTING SLOPES GREATER THAN 3:1, 1.5:1 MAX
12"x18" CONCRETE PAD RUNDOWN
2" COBBLE SWALE

ENGINEER'S SEAL		LOT 32-P1 OXBOW BLUFF SUBDIVISION GRADING AND DRAINAGE PLAN	 <i>P.O. Grande</i> <i>Er Engineering</i> 1609 CENTRAL AVENUE SE ALBUQUERQUE, NM 87106 (505) 872-4800	DRAWN BY JDC	DATE 03-J7-2015
				SHEET # 1 OF 1	JOB #

April 9, 2015

Ms. Jeanne Wolfenbarger
Hydrology Department
Public Works Department
City of Albuquerque

**RE: Revised Grading Plan (F11-1D014G
Lot 32P1 Oxbow bluff
Albuquerque, New Mexico**

Dear Ms. Wolfenbarger:

The purpose of this letter is to accompany the enclosed revised grading plan. The plan has been revised to accommodate your written comments dated 3/30/15. The following is a summary of your comment and the narrative as to how we addressed

1. Show off site basins

We have included the exhibits that were in the initial submittal. We have an upland for the pond and for the storm drain

2. Show capacity of the storm drain.

We have added the exhibit that shows the contributing basin as well as the flow calculations. The pipe is larger than required due the desire to better maintain. The total flow contributing to the west reach is 1.21 cfs, the west reach storm drain conveys only nuisance flows and was added at BHI request to prohibit flow from leaving site at southwest. We have also included the grate capacities

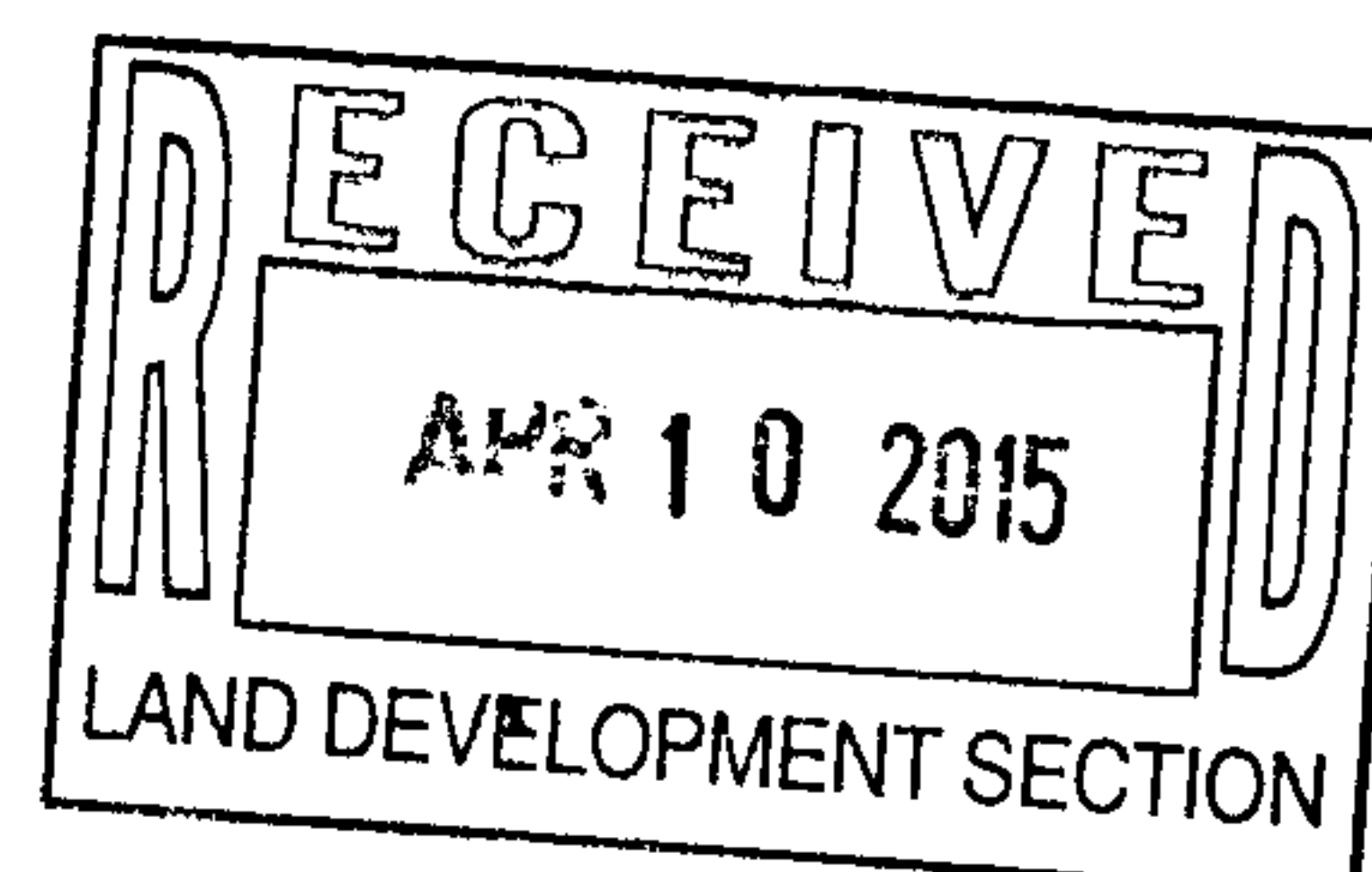
3. Show how flow gets to beehive inlet, show capacity of inlet, how flow gets to inlet thru wall.

We are retaining all of the developed flow from the usable portion of the lot. The wall we discussed is a wrought iron fence that allows flow to pass. We have pushed our pond overflow as far north as practical. The gravel path in the drainage easement is higher than the grate. We are not allowed to grade within the drainage easement and are discharging less than existing conditions. The area is maintained by the HOA and they have approved the plan .

4. The narrative discusses contributing flow of 4.09 cfs, discuss more.

We have included the drainage basin map. The upland flow is the only flow that leaves the site, the onsite flow is retained. The majority of basin L enters the storm drain inlet at the front of the lot. The overflow was design such that it has excess capacity and allows the flow to leave in a sheet flow manner

5. Provide BHI approval letter



**We have provided. The letter approved and had comments the revised plan
incorporates those comments**

Should you have any questions regarding this matter, please do not hesitate to call me.

Sincerely,



David Soule, PE
RIO GRANDE ENGINEERING
PO Box 93924
ALBUQUERQUE, NM 87199
321-9099

Weighted E Method

Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		100-Year, 6-hr.			10-day
			%	(acres)	%	(acres)	%	(acres)	%	(acres)	Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs	Volume (ac-ft)
Contributing	70647.00	1.622	60%	0.9731	0%	0.000	0%	0.000	40%	0.649	1.052	0.142	4.09	0.229
Existing*	18012.00	0.413	100%	0.4135	0%	0.000	0%	0.000	0%	0.000	0.440	0.015	0.53	0.015
PROPOSED*	18012.00	0.413	0%	0	10%	0.041	31%	0.128	59%	0.244	1.536	0.053	1.52	0.085

* area west of fence only

Equations:

Weighted E = $E_a \cdot A_a + E_b \cdot A_b + E_c \cdot A_c + E_d \cdot A_d$ / (Total Area)

Volume = Weighted D * Total Area

Flow = $Q_a \cdot A_a + Q_b \cdot A_b + Q_c \cdot A_c + Q_d \cdot A_d$

Where for 100-year, 6-hour storm(zone1)

Ea= 0.44	Qa= 1.29
Eb= 0.67	Qb= 2.03
Ec= 0.99	Qc= 2.87
Ed= 1.97	Qd= 4.37

First flush pond requirements (.34") x 10627

301 cubic feet

100% retention requirement of increase in flow from native

1645.4 cubic feet

100% retention requirement of entire developed flow on site

2305.8 cubic feet

100% retention requirement of entire contributing flow (onsite and upland)

8499.2 cubic feet

overflow capacity

$Q = 2.95 \cdot L \cdot H^{1.5} =$ 20.85 cfs
required 4.090 cfs

DRAINAGE NARRATIVE

THIS SITE IS LOCATED WITHIN BASIN L OF THE OXBOW BLUFF DRAINAGE MASTER PLAN G11/D14.

THE MASTER DRAINAGE PLAN ALLOWS FOR CROSS LOT DRAINAGE TO A COMMON STORM DRAIN RUNNING ALONG THE EAST PROPERTY LINE OF THIS LOT

THE LAND TREATMENT OF THIS LOT GENERATES LESS FLOW THAN ALLOWED, YET A WATER QUALITY POND HAS BEEN ADDED TO ACCOUNT FOR THE REQUIRED VOLUME

THE UPLAND FLOW IS ALLOWED TO ENTER THE SITE AND DUE TO FLOW PATH ENTERS OUR FIRST FLUSH POND. THE POND PROVIDES A 20' WIDE X 6" HIGH OVERFLOW

THE OVERFLOW CAPACITY OF 20.85 IS SIGNIFICANTLY GREATER THAN THE CONTRIBUTING FLOW RATE OF 4.09 CFS.

THIS SITE CONFORMS TO THE OXBOW BLUFF MASTER PLAN AND THE CITY OF ALBUQUERQUE FIRST FLUSH ORDINANCE

DUE TO THE HOME OWNER REGULATIONS THE SITE IS REQUIRED TO POND THE DEVELOPED FLOW. THIS SITE RETAINS THE 2306 CUBIC FEET OF DEVELOPED STORMWATER THAT WILL OCCUR WITH THE DEVELOPMENT. THE SITE AND UPLAND BASINS ARE PART OF BASIN L, AND ENTER THE STORM DRAIN LOCATED AT THE NORTH EAST CORNER OF THE LOT.

David Soule

From: Wolfenbarger, Jeanne [jwolfenbarger@cabq.gov]
Sent: Tuesday, March 31, 2015 7:52 AM
To: 'David Soule'
Subject: RE: G11D014D32 - 5001 Grey Hawk Court NW

See updated comments below. Thanks!

Jeanne

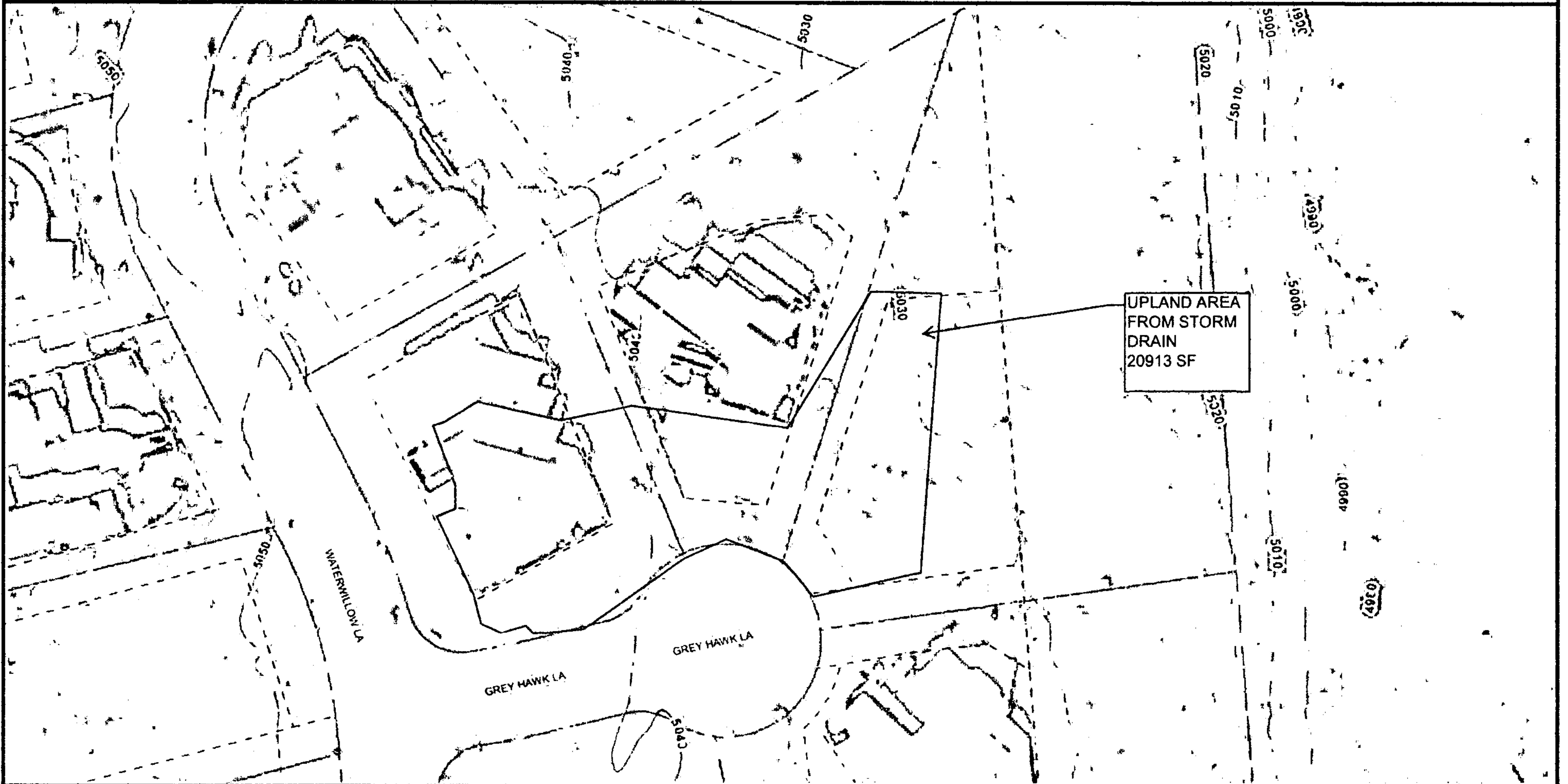
From: Wolfenbarger, Jeanne
Sent: Monday, March 30, 2015 5:11 PM
To: David Soule
Subject: G11D014D32 - 5001 Grey Hawk Court NW

David, as discussed on the phone earlier, we still need the following comments below addressed prior to you obtaining approval for a Building Permit. (For this submittal, I will mark down a verbal "no", wait for the updated plan you said you were preparing, and have it routed to me for a quicker response for the next review.)

- 1) Show the extent of limits of the off-site basin area that is contributing to the on-site pond area, and include contours.
- 2) For each of the proposed on-site pipe runs, show capacity calculations. Label the flow that each pipe run is conveying.
- 3) Because this site is part of Basin L in the Oxbow Bluff Subdivision, indicate this in the "Drainage Narrative" on the plan. If the site is draining to the beehive inlet, call out the beehive grate and the grate elevation of the beehive grate. Show how the site is draining to this beehive inlet. (You mentioned you would be moving the overflow area to direct the flow to the beehive inlet better, but you mentioned that you could not provide a channel on the opposite side of the wall. If there is a wall east of the overflow area, show how drainage gets to this beehive inlet. Will there be an opening in the wall, and how wide/high will it be?) Also, call out cobble size for the overflow and height of overflow area. Judging from the contours, it looks like not all of the flow from the overflow area will be directed to the beehive inlet without creating a channel. Could you explain this? Also, include capacity calculations for the beehive grate, and show existing downstream pipe from beehive grate.
- 4) In the "Drainage Narrative", also talk about the number of lots that contribute to the off-site flow that is entering the site and contributing to the 4.09 cfs. With the amount of flow entering the pond, shouldn't the "required flow" be larger than 4.09 cfs? Shouldn't it include both the on-site and off-site flows? Discuss whether this off-site flow area is contained within "Basin L" from the Oxbow Bluff Subdivision. Discuss that the flow is being conveyed from the storm drain to the river.
- 5) When providing the necessary acceptance letter from Bohannon-Huston, Inc., please include the flow that is being accepted into the beehive inlet from the on-site pond. (If there is updated information from B-H that supports your report from the 1997 report, provide excerpts. From what you are saying, there was a lot of information that Bohannon-Huston had updated from the 1997 report.)

Jeanne

4/9/2015



1/14/15

This information is for reference only.
Bernalillo County assumes no liability for errors associated
with the use of these data. Users are solely responsible for
confirming data accuracy when necessary. For current
information visit www.bernao.gov/its-program.

Notes



0 51.12 102.2 Feet

Weighted E Method

Basin	Area (sq)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		100-Year, 6-hr.		10-day
			%	(acres)	%	(acres)	%	(acres)	%	(acres)	Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs
STORMDRAIN CONTRIB	20913.00	0.480	60%	0.2881	0%	0.000	0%	0.000	40%	0.192	1.052	0.042	1.21

Equations:

Weighted E = $E_a \cdot A_a + E_b \cdot A_b + E_c \cdot A_c + E_d \cdot A_d$ / (Total Area)

Volume = Weighted D * Total Area

Flow = $Q_a \cdot A_a + Q_b \cdot A_b + Q_c \cdot A_c + Q_d \cdot A_d$

Where for 100-year, 6-hour storm(zone1)

$E_a = 0.44$

$E_b = 0.67$

$E_c = 0.99$

$E_d = 1.97$

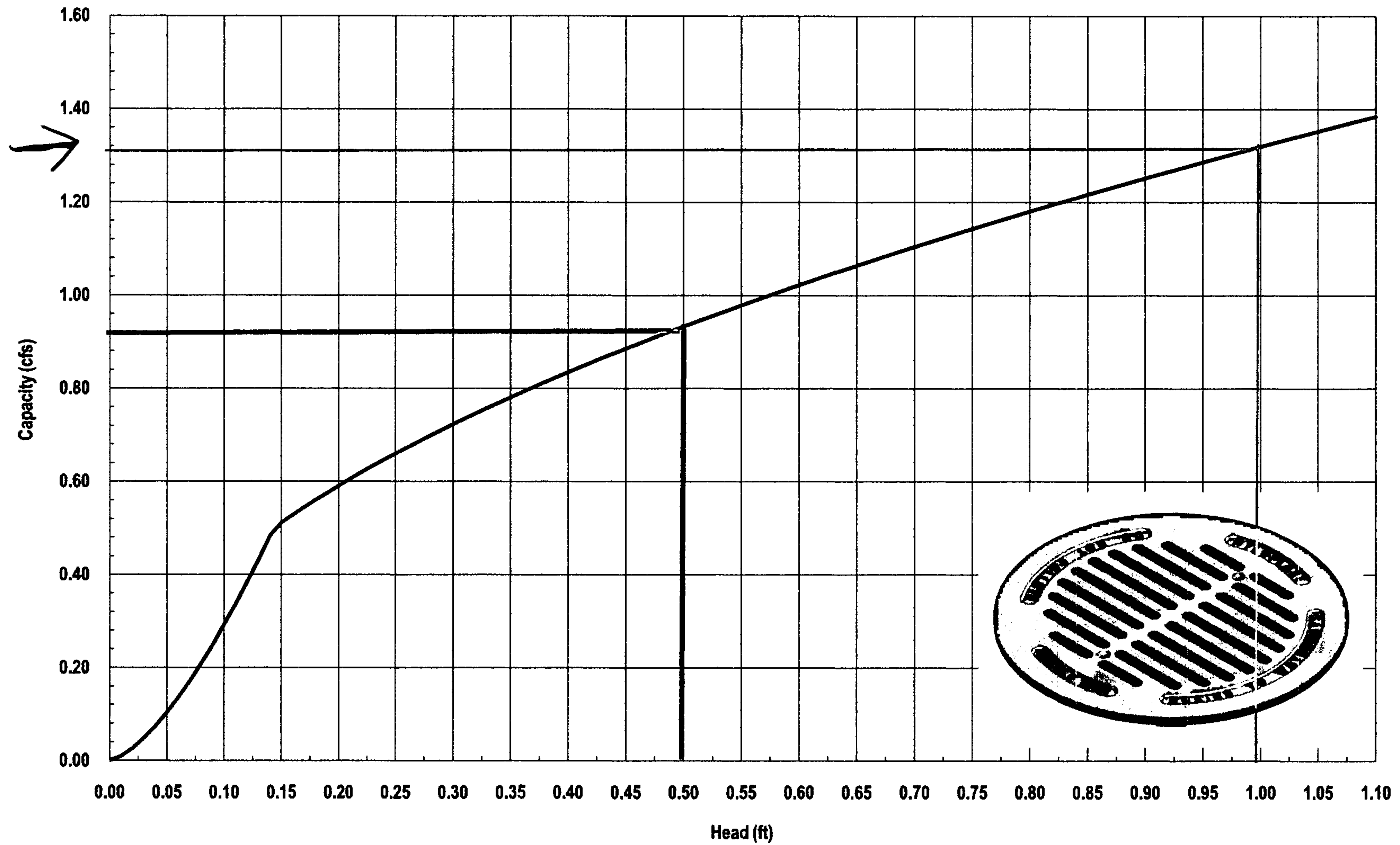
$Q_a = 1.29$

$Q_b = 2.03$

$Q_c = 2.87$

$Q_d = 4.37$

Nyloplast 12" Drop In Grate Inlet Capacity Chart



3130 Verona Avenue • Buford, GA 30518
 (866) 888-8479 / (770) 932-2443 • Fax: (770) 932-2490
 © Nyloplast Inlet Capacity Charts June 2012

Pipe Capacity

Pipe	D	Slope	Area	R	Q Provided	Q Required	Velocity
	(in)	(%)	(ft^2)		(cfs)	(cfs)	(ft/s)
POND OUTFALL	12	1	0.79	0.25	3.57	1.21	1.54

Manning's Equation:

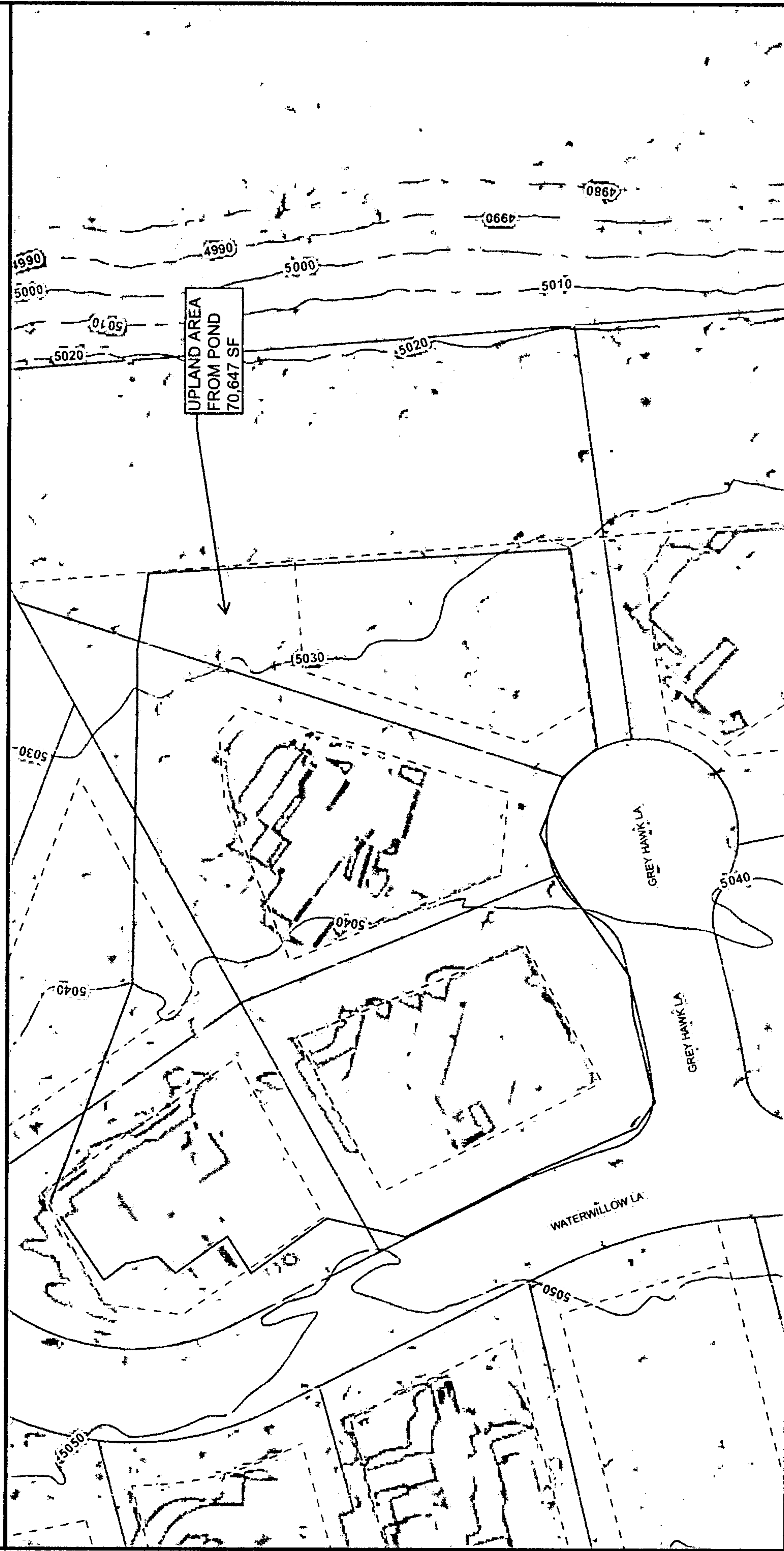
$Q = 1.49/n * A * R^{(2/3)} * S^{(1/2)}$

A = Area

R = D/4

S = Slope

n = 0.013



Notes

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with the use of these data. Users are solely responsible for
confirming data accuracy when necessary. For current
information visit www.bemco.gov/jis-program.

1/14/15



INVEST **IN**

SECRET

SECRET

APR 26 1957

SECRET

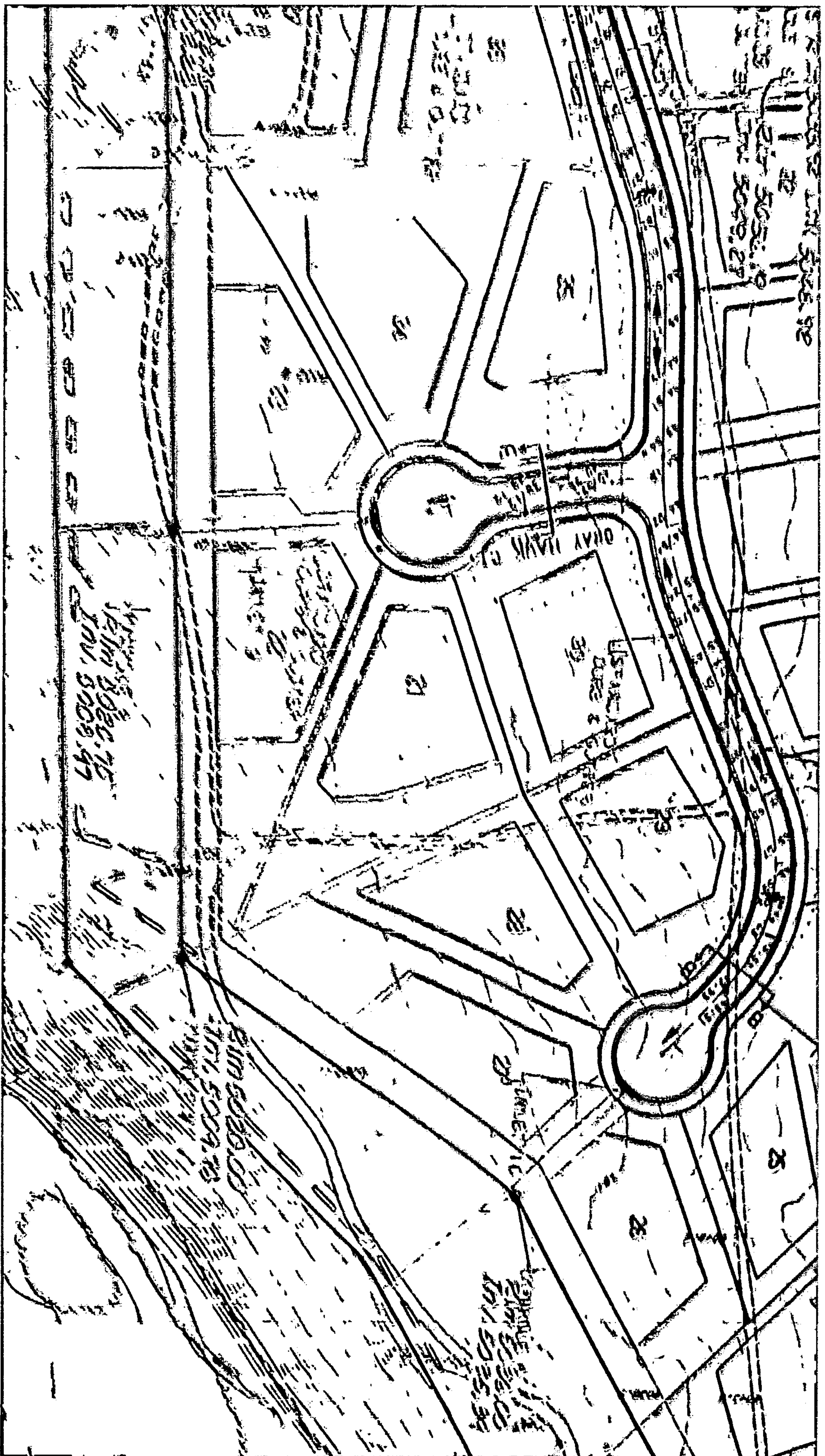
ALTRA WEST LTD

414 SEVER AVENUE SW

SITE 1100

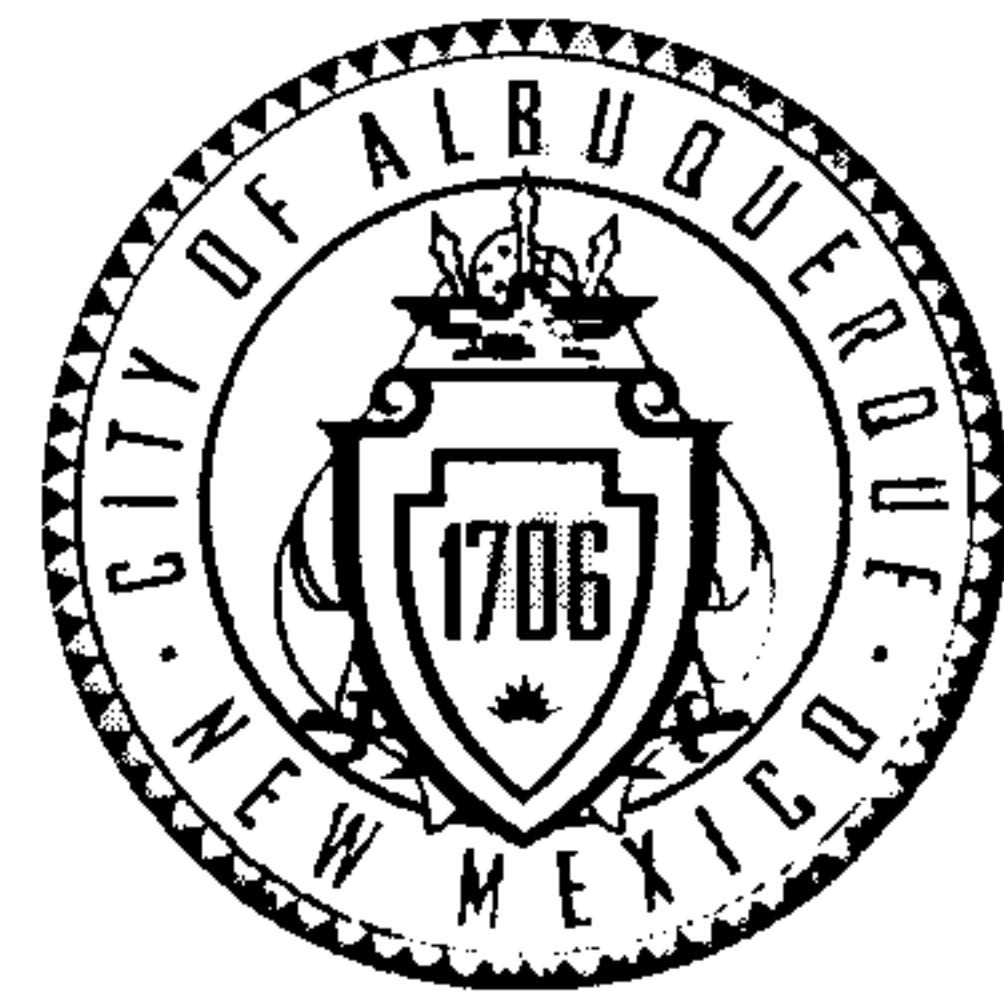
ALBUQUERQUE, NEW MEXICO 87103

1000



CITY OF ALBUQUERQUE

PLANNING DEPARTMENT – Development Review Services



February 5, 2015

David Soule, P.E.
Rio Grande Engineering
P.O. Box 93924
Albuquerque, NM 87199

Richard J. Berry, Mayor

**RE: Lot 32 P1 - Oxbow Bluff (File: G11D014D32)
Grading and Drainage Plan, Engineer's Stamp Date 1-15-15**

Dear Mr. Soule:

Based upon the information provided in your submittal received 1-15-15, the above referenced submittal cannot be approved for Building Permit until the following comments are addressed:

1. The Drainage is per the Oxbow Bluff Subdivision (Tract F) Drainage Report (Nov. 26, 1997) File G11D014D, Basin L.
2. Per the Master Drainage Report all proposed Grading and Drainage plans need to be reviewed and approved through the subdivision's architectural review committee prior to Hydrology approval being issued. Oxbow Bluff ACC has a contract with Bohannon-Houston to perform the reviews. Please submit the approval letter from BHI.

PO Box 1293

Albuquerque

If you have any questions, you can contact me at 924-3695.

New Mexico 87103

www.cabq.gov

Sincerely,

Rita Harmon, P.E.

Senior Engineer, Planning Dept.
Development Review Services

Orig: Drainage file
c.pdf: via Email: Recipient



City of Albuquerque

Planning Department

Development & Building Services Division

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV 02/2013)

611 D0146

Project Title: SPUHLER-LASASTER Building Permit #: _____ City Drainage #: 611 D0146
DRB#: _____ EPC#: _____ Work Order#: _____
Legal Description: LOT 32P1
City Address: 5001 GREY HAWK COURT

Engineering Firm: RIO GRANDE ENGINEERING Contact: DAVID SOULE
Address: PO BOX 93924, ALBUQUERQUE, NM 87199
Phone#: 505.321.9099 Fax#: 505.872.0999 E-mail: DAVID@RIOGRANDEENGINEERING.COM

Owner: PANARAMA HOMES Contact: _____
Address: _____
Phone#: _____ Fax#: _____ E-mail: _____

Architect: MIKE GRAHSUIS Contact: _____
Address: _____
Phone#: _____ Fax#: _____ E-mail: _____

Surveyor: CONSTRUCTION SURVEY INCORPORATED Contact: JOHN GALLEGOS
Address: _____
Phone#: 917.8921 Fax#: _____ E-mail: _____

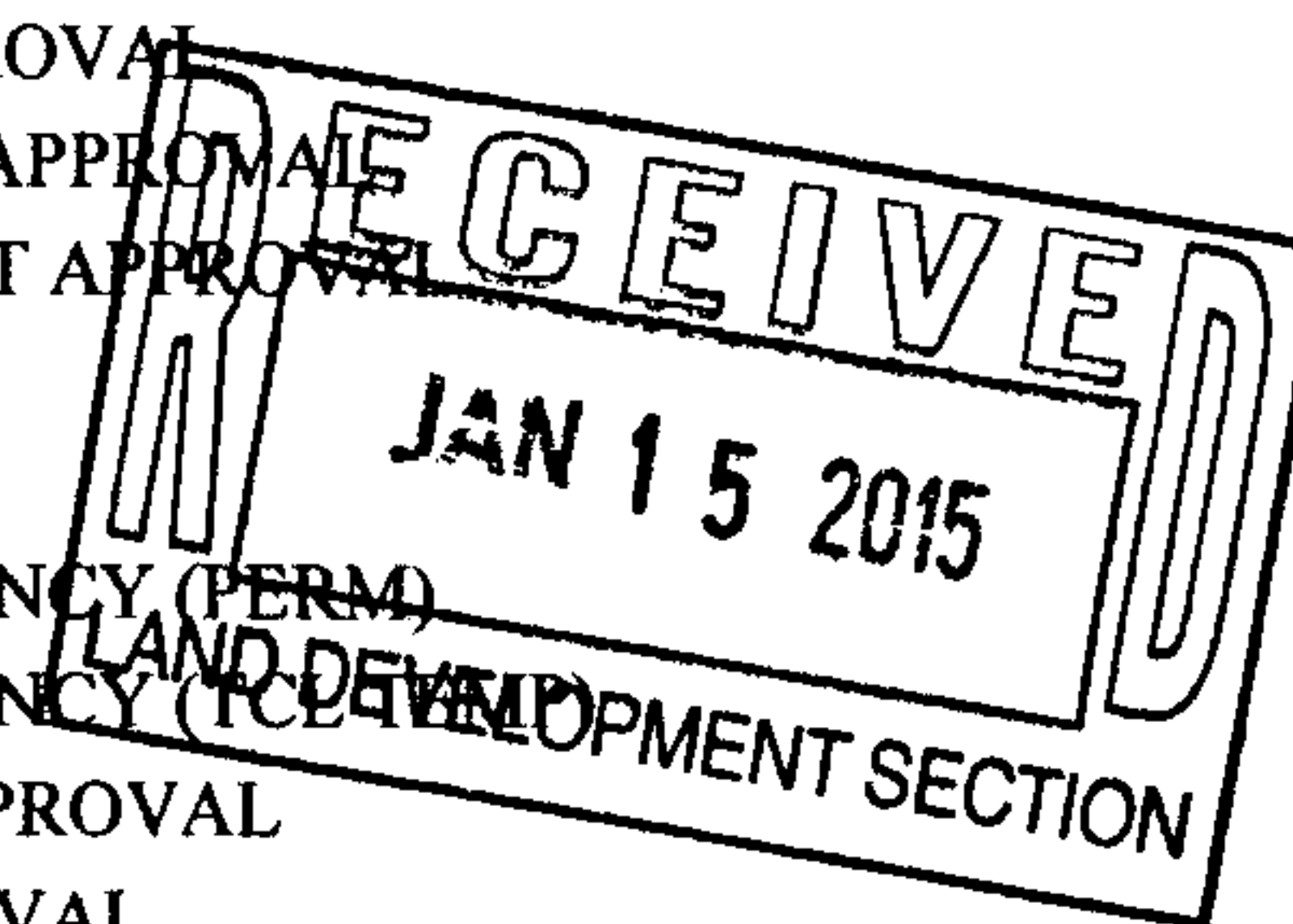
Contractor: _____ Contact: _____
Address: _____
Phone#: _____ Fax#: _____ E-mail: _____

TYPE OF SUBMITTAL:

- ☐ DRAINAGE REPORT
- ☐ DRAINAGE PLAN 1st SUBMITTAL
- ☒ DRAINAGE PLAN RESUBMITTAL
- ☐ CONCEPTUAL G & D PLAN
- ☐ GRADING PLAN
- ☐ EROSION & SEDIMENT CONTROL PLAN (ESC)
- ☐ ENGINEER'S CERT (HYDROLOGY)
- ☐ CLOMR/LOMR
- ☐ TRAFFIC CIRCULATION LAYOUT (TCL)
- ☐ ENGINEER'S CERT (TCL)
- ☐ ENGINEER'S CERT (DRB SITE PLAN)
- ☐ ENGINEER'S CERT (ESC)
- ☐ SO-19
- ☐ OTHER (SPECIFY) _____

CHECK TYPE OF APPROVAL/ACCEPTANCE SOUGHT:

- ☐ SIA/FINANCIAL GUARANTEE RELEASE
- ☐ PRELIMINARY PLAT APPROVAL
- ☐ S. DEV. PLAN FOR SUB'D APPROVAL
- ☐ S. DEV. FOR BLDG. PERMIT APPROVAL
- ☐ SECTOR PLAN APPROVAL
- ☐ FINAL PLAT APPROVAL
- ☐ CERTIFICATE OF OCCUPANCY (PERM)
- ☐ CERTIFICATE OF OCCUPANCY (TCL DEVELOPMENT)
- ☐ FOUNDATION PERMIT APPROVAL
- ☒ BUILDING PERMIT APPROVAL
- ☐ GRADING PERMIT APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☐ WORK ORDER APPROVAL
- ☐ GRADING CERTIFICATION
- ☐ SO-19 APPROVAL
- ☐ ESC PERMIT APPROVAL
- ☐ ESC CERT. ACCEPTANCE
- ☐ OTHER (SPECIFY) _____



WAS A PRE-DESIGN CONFERENCE ATTENDED: _____ Yes ☒ No _____ Copy Provided _____

DATE SUBMITTED: 1/14/15 By: _____

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature, location, and scope to the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres
3. **Drainage Report:** Required for subdivision containing more than ten (10) lots or constituting five (5) acres or more
4. **Erosion and Sediment Control Plan:** Required for any new development and redevelopment site with 1-acre or more of land disturbing area, including project less than 1-acre than are part of a larger common plan of development

January 14, 2015

Ms. Rita Harmon
Senior Engineer
Hydrology Department
Public Works Department
City of Albuquerque

**RE: Revised Grading Plan (F11-1D014G
Lot 32P1 Oxbow bluff
Albuquerque, New Mexico**

Dear Ms. Harmon:

The purpose of this letter is to accompany the enclosed revised grading plan. The plan has been revised to accommodate your written comments dated 12/30/14. The following is a summary of your comment and the narrative as to how we addressed

1. Show Mwse, overflow and contours on pond

We have added the overflow and contours. Since the pond is a water quality pond only the water surface elevation will be the spillway. The entire contributing basin generate a peak of 4.1 cfs, the spill way has a capacity for 20.8 cfs. We have shown the entire lot that shows the existing inlet outfall

2. Provide drainage narrative.

We have added the narrative the plan — 10

3. Provide benchmark

We have added the benchmark.

4. Show property liners.

We have shown property line .

5. Don't show architectural features

We have removed

6. Provide relevant information from the master drainage plan

The narrative includes the reference to the Oxbow master drainage plan(G11D14). This site is located within basin F and allowed to discharge based upon 58%A and 42%D..

7. Show roof drains and flow directions

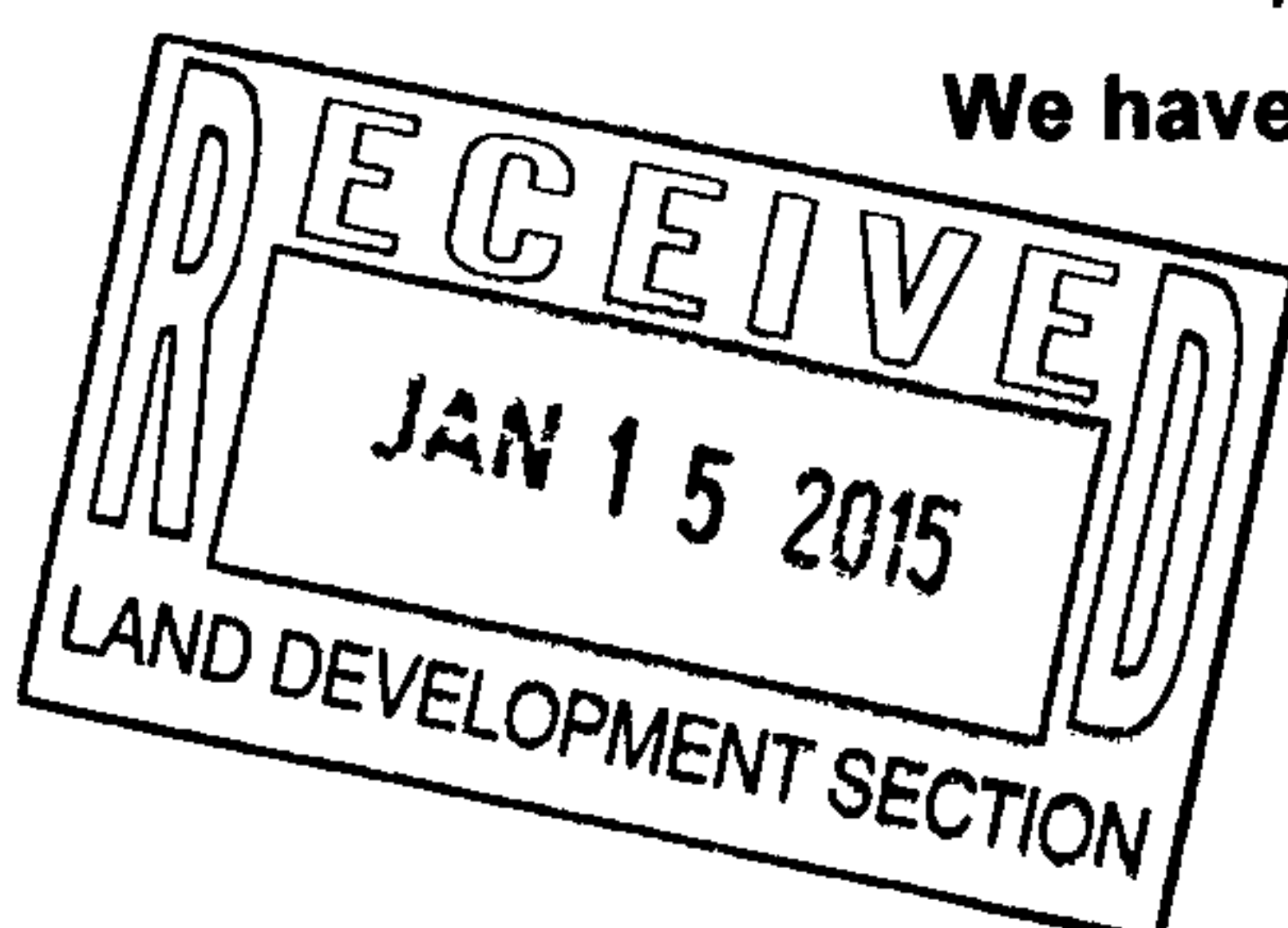
We have added

8. How is offsite handled

We have included a basin map for the contributing area. The city AGIS map with 2' contours was utilized but the website will not allow print outs. So the County GIS was used to show. The flow is allowed onto the site and drains through the first flush pond, the overflow has capacity for entire upland flow to safely pass.

9. Were is public drainage easement

We have shown entire property including referenced easement.



Ms. Janet Stephens
June 6, 2000
Page 2

10. Where is oxbow main outfall?

We have shown the inlet we are draining to on the plan set

11. Show flow arrows and contours

We have added the contours for the plan

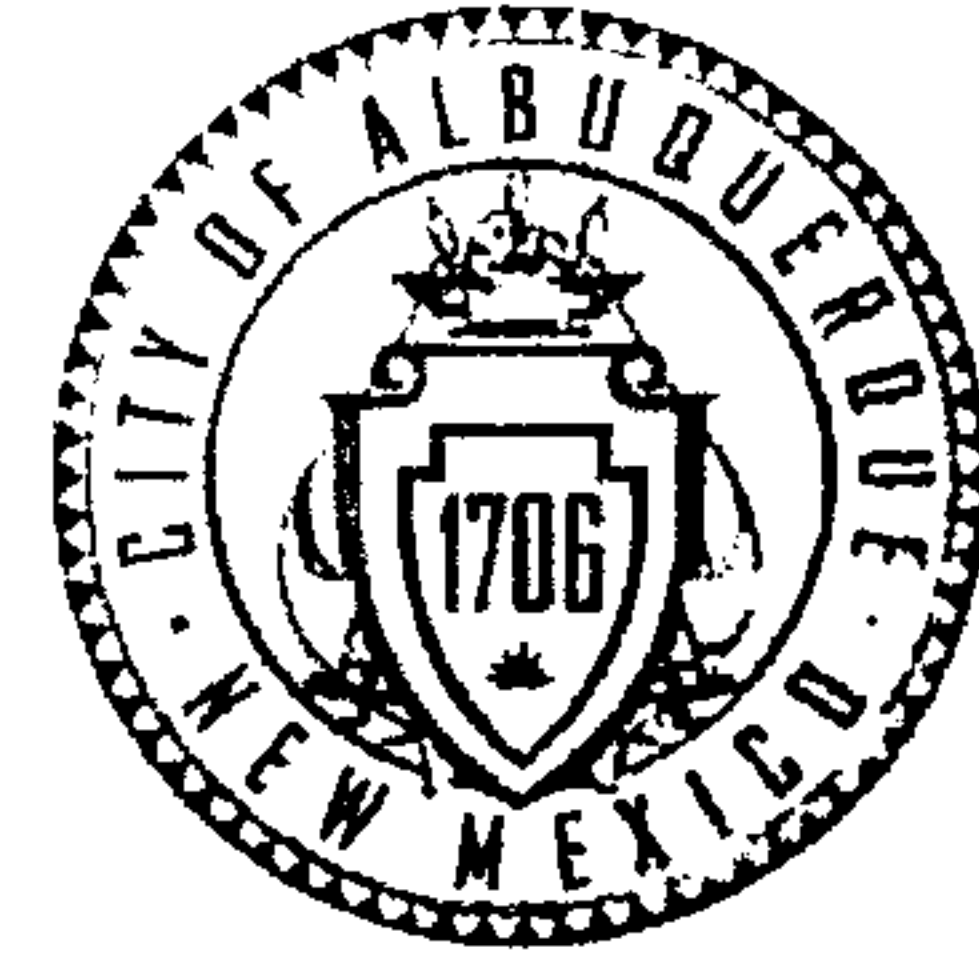
Should you have any questions regarding this matter, please do not hesitate to call me.

Sincerely,

David Soule, PE
RIO GRANDE ENGINEERING
PO Box 93924
ALBUQUERQUE, NM 87199
321-9099

CITY OF ALBUQUERQUE

PLANNING DEPARTMENT – Development Review Services



December 30, 2014

David Soule, P.E.
Rio Grande Engineering
P.O. Box 93924
Albuquerque, NM 87199

Richard J. Berry, Mayor

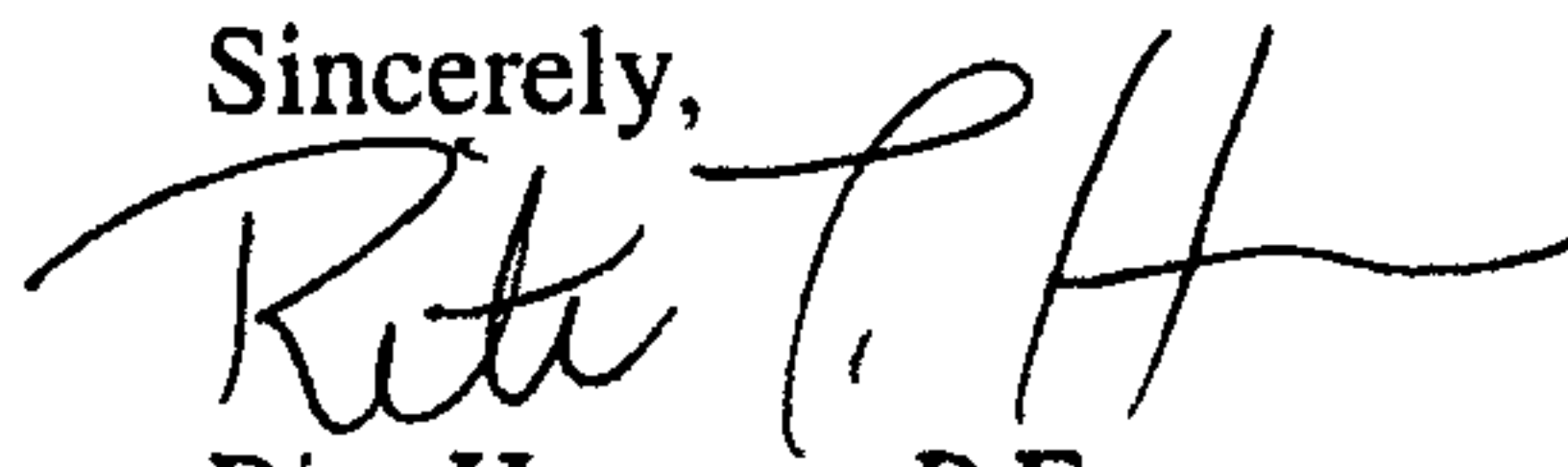
**RE: Lot 32 P1 - Oxbow Bluff (File: G11D014G)
Grading and Drainage Plan, Engineer's Stamp Date 12-1-14**

Dear Mr. Soule:

Based upon the information provided in your submittal received 12-5-14, the above referenced submittal cannot be approved for Building Permit until the following comments are addressed:

1. Show WSEL and emergency overflow locations on Pond. Show contour elevations. Where and how does pond discharge to?
2. Provide a narrative.
3. Provide a benchmark
4. Show Property boundaries.
5. Architectural features need not be shown, just the building footprint and retaining walls.
6. Provide relevant information from Master Drainage plan
7. Show roof drains - the discharge locations, and direction of discharge.
8. How is offsite flow handled?
9. Where is public Drainage easement that this site drains to?
10. Where is the oxbow main outfall?
11. Show flow arrows, proposed contours.

If you have any questions, you can contact me at 924-3695.

Sincerely,

Rita Harmon, P.E.
Senior Engineer, Planning Dept.
Development Review Services

Orig: Drainage file
c.pdf: via Email: Recipient

Weighted E Method

Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		100-Year, 6-hr.		10-day
			%	(acres)	%	(acres)	%	(acres)	%	(acres)	Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs
Contributing	70647.00	1.622	60%	0.9731	0%	0.000	0%	0.000	40%	0.649	1.052	0.142	4.09
Existing	47863.00	1.099	100%	1.0988	0%	0.000	0%	0.000	0%	0.000	0.440	0.040	1.42
PROPOSED	47863.00	1.099	34%	0.3736	20%	0.220	26%	0.286	21%	0.231	0.955	0.087	2.76
ALLOWED	47863.00	1.099	58%	0.6373	0%	0.000	0%	0.000	42%	0.461	1.083	0.099	2.84

Equations:

Weighted E = $E_a \cdot A_a + E_b \cdot A_b + E_c \cdot A_c + E_d \cdot A_d$ / (Total Area)

Volume = Weighted D * Total Area

Flow = $Q_a \cdot A_a + Q_b \cdot A_b + Q_c \cdot A_c + Q_d \cdot A_d$

Where for 100-year, 6-hour storm(zone1)

Ea= 0.44	Qa= 1.29
Eb= 0.67	Qb= 2.03
Ec= 0.99	Qc= 2.87
Ed= 1.97	Qd= 4.37

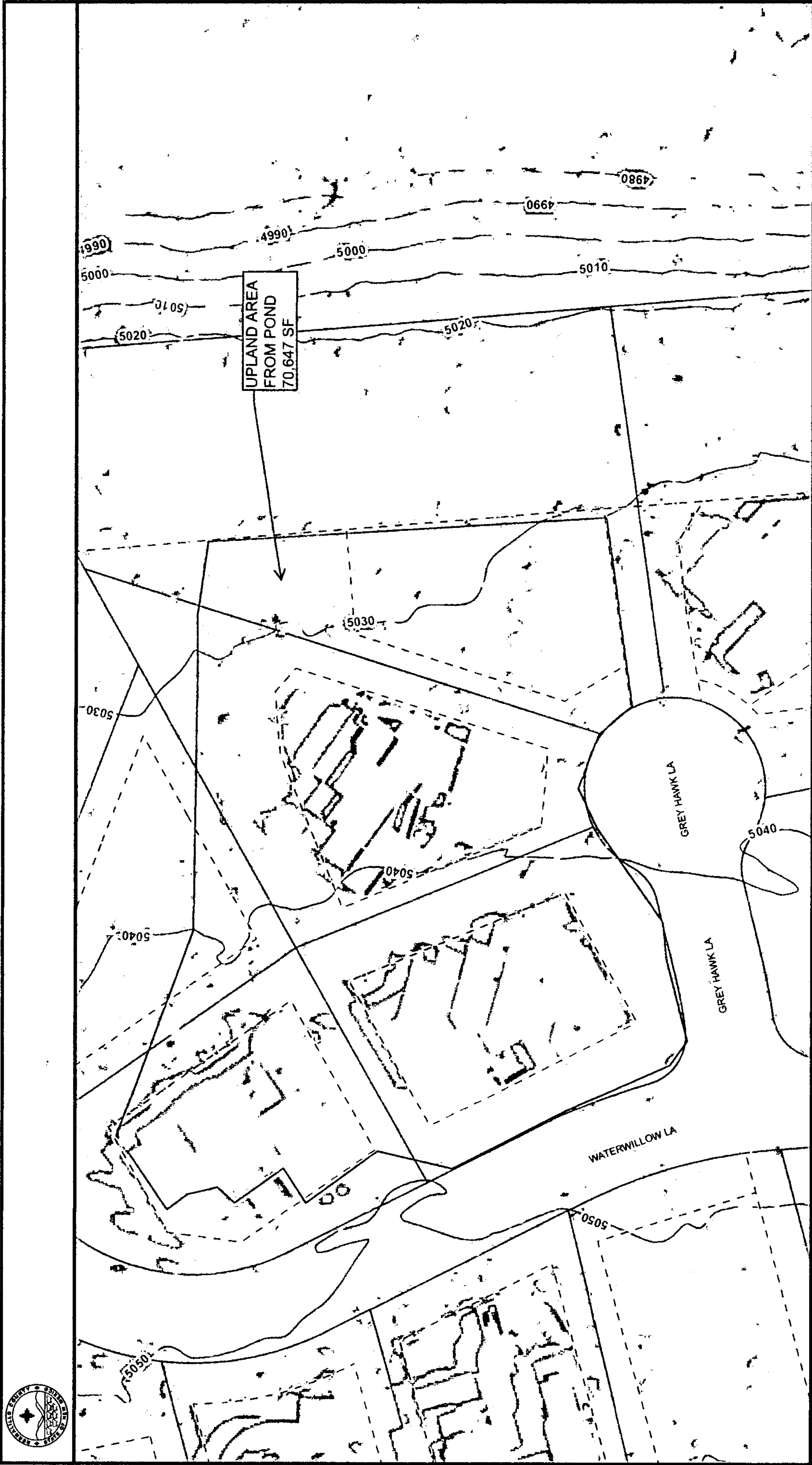
First flush pond requirements (.34") x 10051

285 cubic feet

overflow capacity

$Q=2.95 \cdot L \cdot H^{1.5}$ 20.85 cfs
required 4.090 cfs

Site located in master drainage plan for oxbow bluff(Basin F). The site has less discharge than allowed. So ponding not required for flood control. Water quality ponding is required. Discharge leaves site in two locations. Once the flow leaves the site it travels within the public drainage easment until it enter the oxbow main out fall via bee hive grate inlet shown on plan

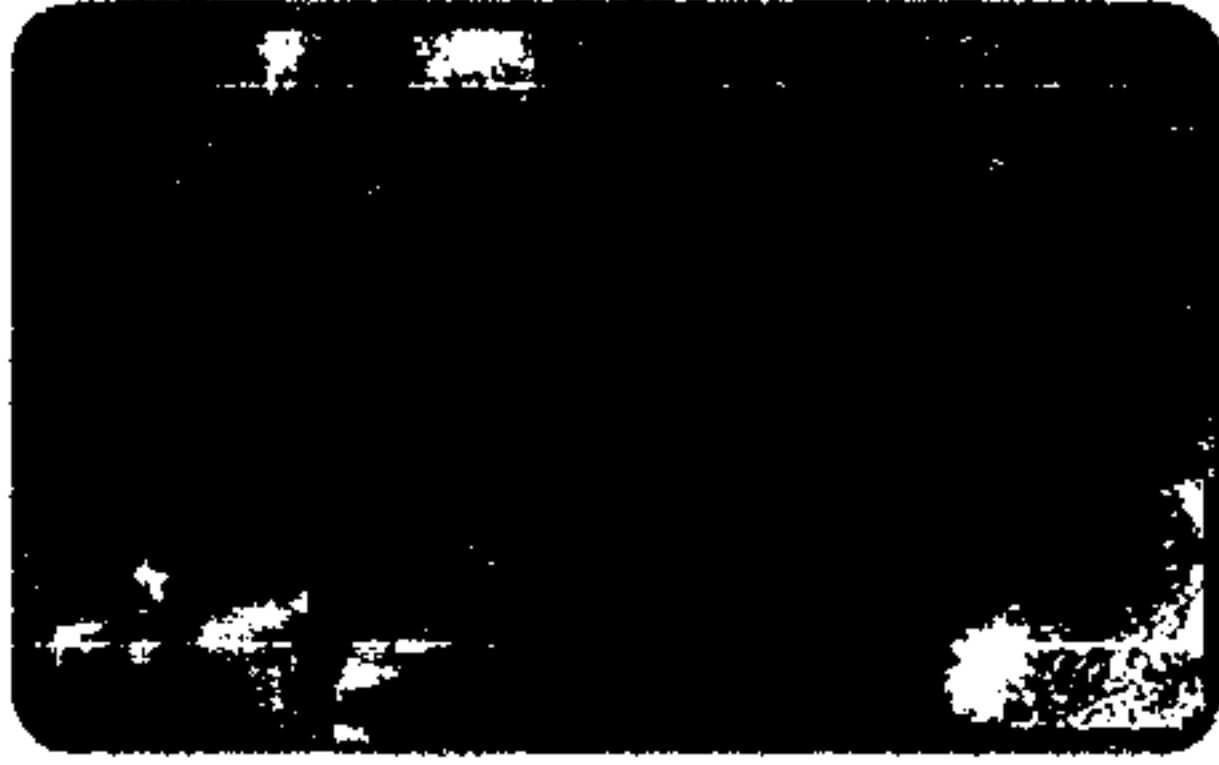


Notes

This information is for reference only. Bernalillo County assumes no liability for errors associated with the use of these data. Users are solely responsible for confirming data accuracy when necessary. For current information visit www.bermco.gov/jis-program.

1/14/15





Home Owners Association
C/O HOAMCO
P.O. Box 67590
Albuquerque, NM 87193
Phone: 505-888-4479
Emergency: 855-210-0353
Fax: 505-888-4483

March 4, 2015

RE: Spuhler, Lasater ACC Submittal Lot 32

To Whom It May Concern:

After review of initial plans and submittal of request information for clarification, the ACC has agreed the House Plans titled Lasater Spuhler, sheets 01 through 10, dated 11/26/2014, reference #14081 by YCD Designs and the Lot 32-P1 Grading and Drainage Plan sheet 1 of 1 by Rio Grande Engineering dated 03-04-2015 are in substantial compliance with the specifications and design guidelines as set from by the Oxbow Bluff HOA.

This approved does not supersede/grant approve to any missed conditions that might arise during construction. The project will be inspected on a regular basis by the HOA Liaison, Stephen Dixon for adherence to the design guidelines. Any deviations must be corrected before additional construction can proceed.

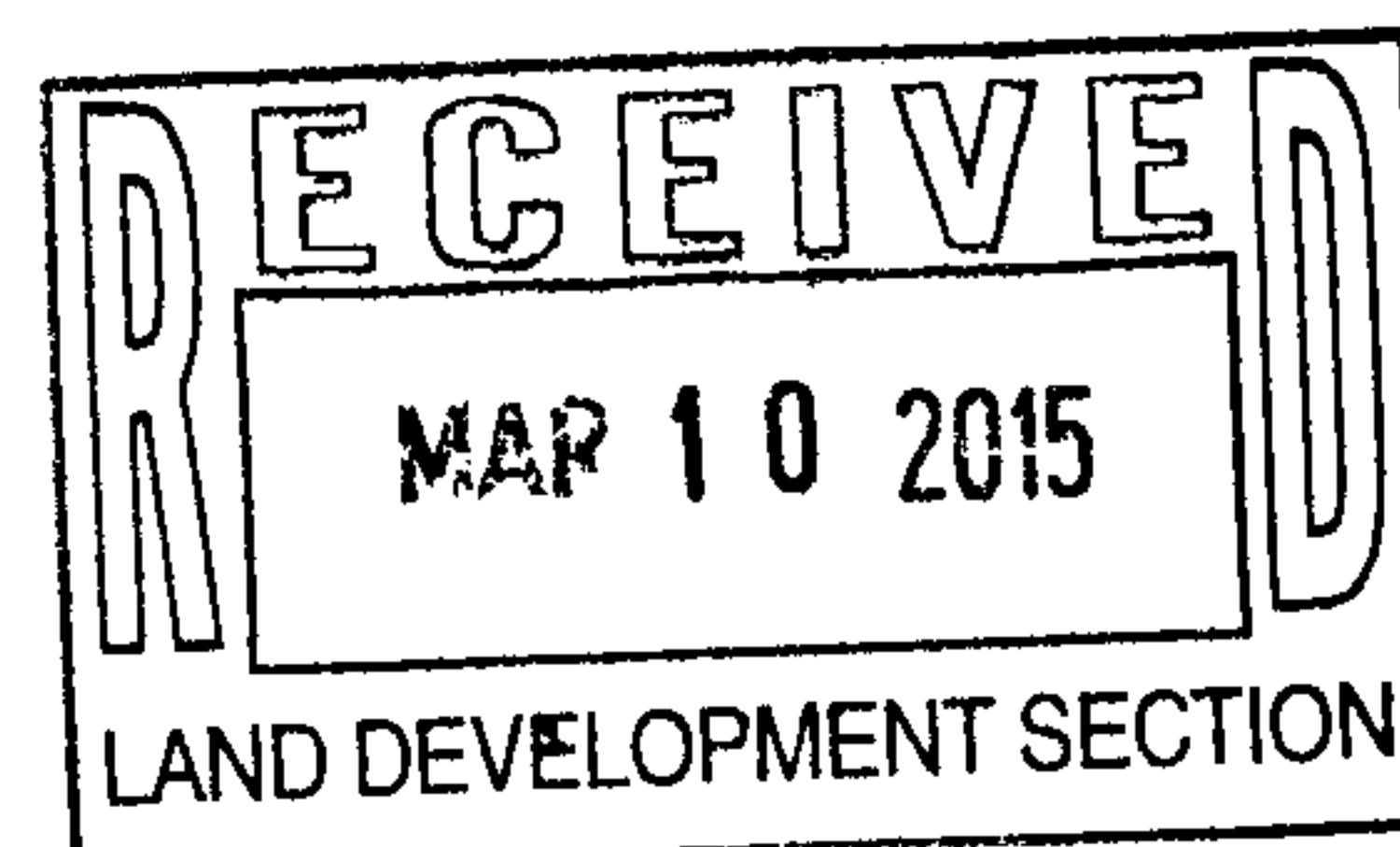
The ACC grants permission to proceed with the necessary permitting required by the City of Albuquerque and/or the County of Bernalillo. We look forward to the addition of your beautiful home in our community.

Sincerely Yours,

Brian Jones

President of the HOA
And ACC member

CC: Stephen Dixon
ACC Liasion



February 9, 2015

Ms. Rita Harmon
Senior Engineer
Hydrology Department
Public Works Department
City of Albuquerque

**RE: Revised Grading Plan (F11-1D014G)
Lot 32P1 Oxbow bluff
Albuquerque, New Mexico**

Dear Ms. Harmon:

The purpose of this letter is to accompany the enclosed revised grading plan. The plan has been revised to accommodate your written comments dated 2/5/154. The following is a summary of your comment and the narrative as to how we addressed

1. Correct drainage basin

The site is in basin L rather than F. The land treatment assumptions for both basins are the same. I have included excerpts of the report.

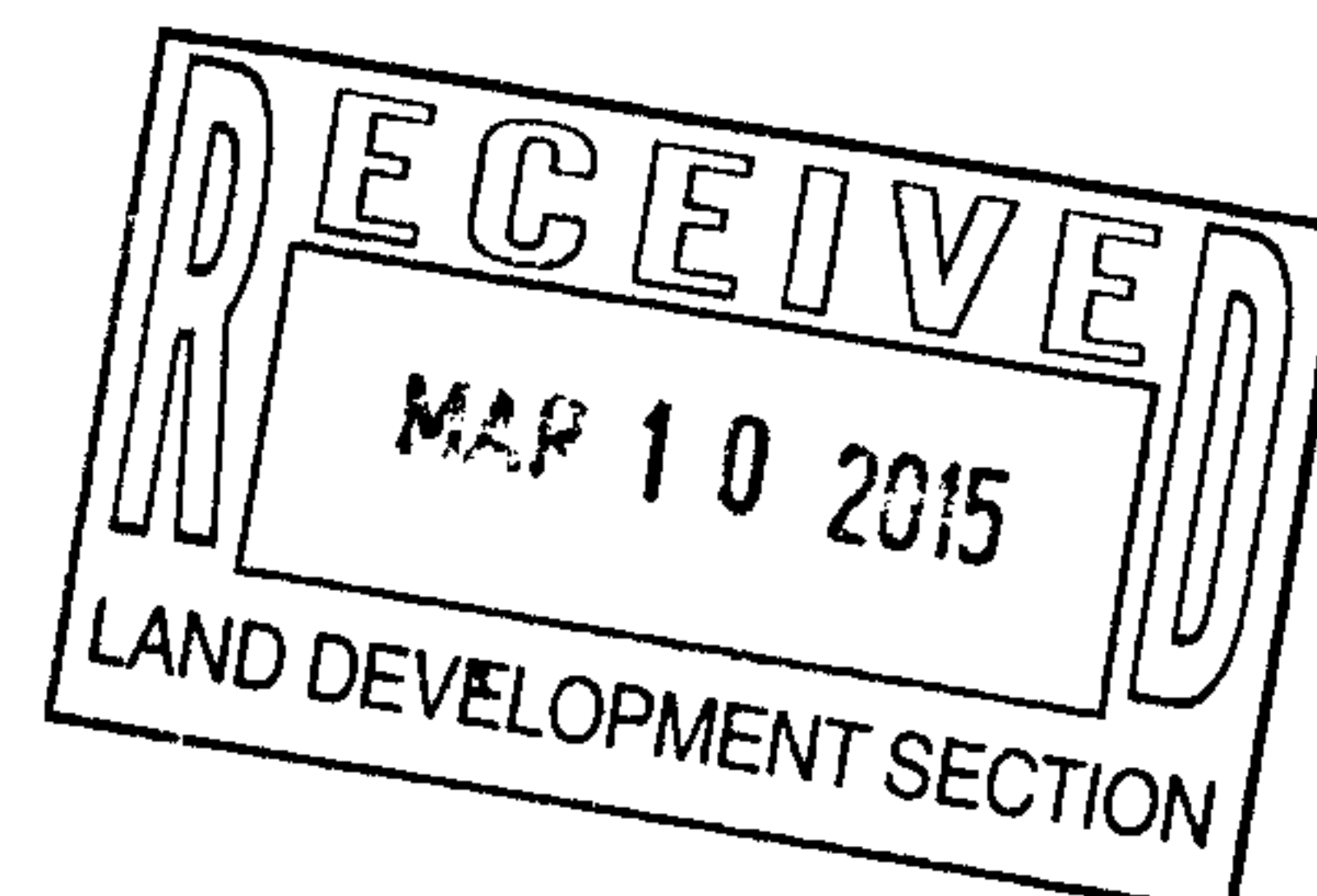
2. Provide ACC approval letter.

We have enclosed the approval letter.

Should you have any questions regarding this matter, please do not hesitate to call me.

Sincerely,

David Soule, PE
RIO GRANDE ENGINEERING
PO Box 93924
ALBUQUERQUE, NM 87199
321-9099



CITY OF ALBUQUERQUE

PLANNING DEPARTMENT – Development Review Services



December 30, 2014

David Soule, P.E.
Rio Grande Engineering
P.O. Box 93924
Albuquerque, NM 87199

Richard J. Berry, Mayor

**RE: Lot 32 P1 - Oxbow Bluff (File: G11D014G)
Grading and Drainage Plan, Engineer's Stamp Date 12-1-14**

Dear Mr. Soule:

Based upon the information provided in your submittal received 12-5-14, the above referenced submittal cannot be approved for Building Permit until the following comments are addressed:

1. Show WSEL and emergency overflow locations on Pond. Show contour elevations. Where and how does pond discharge to?
2. Provide a narrative.
3. Provide a benchmark
4. Show Property boundaries.
5. Architectural features need not be shown, just the building footprint and retaining walls.
6. Provide relevant information from Master Drainage plan
7. Show roof drains - the discharge locations, and direction of discharge.
8. How is offsite flow handled?
9. Where is public Drainage easement that this site drains to?
10. Where is the oxbow main outfall?
11. Show flow arrows, proposed contours.

PO Box 1293

Albuquerque

New Mexico 87103

www.cabq.gov

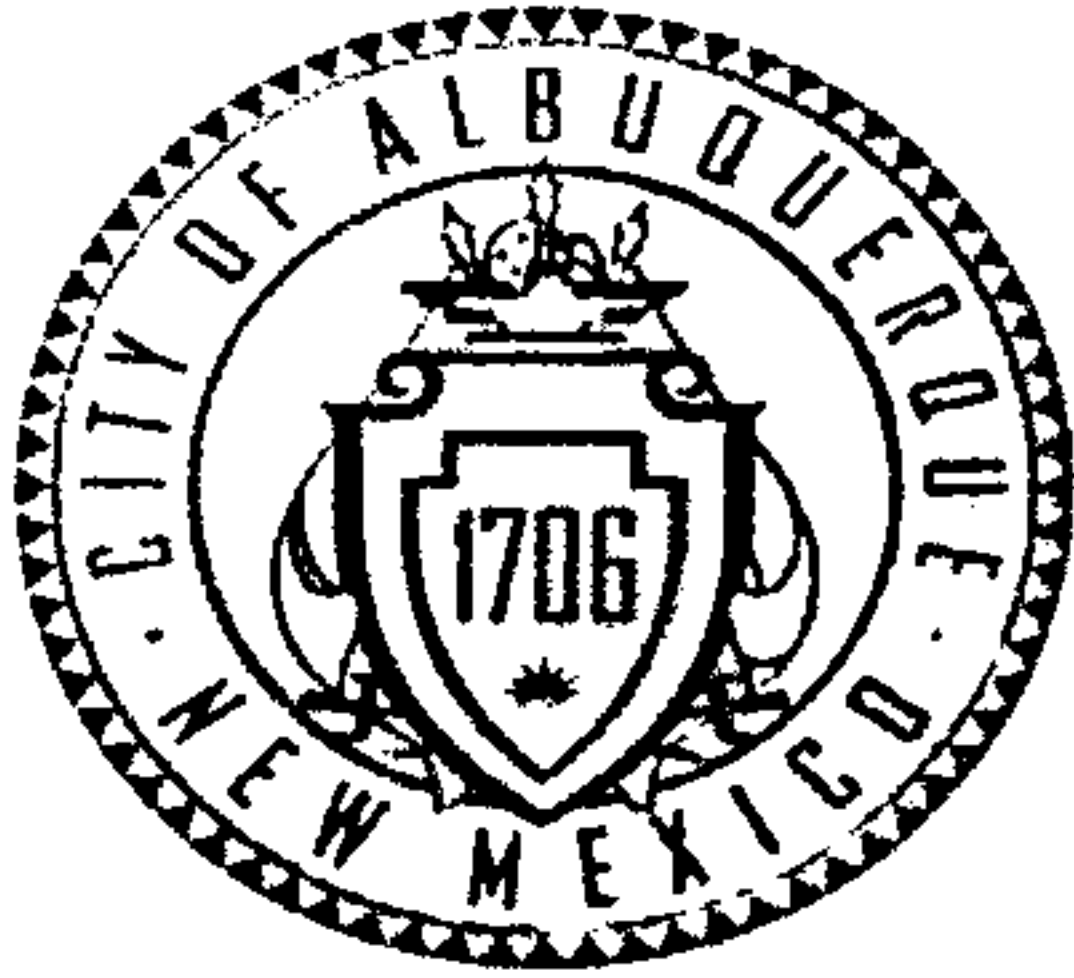
If you have any questions, you can contact me at 924-3695.

Sincerely,

Rita Harmon, P.E.

Senior Engineer, Planning Dept.
Development Review Services

Orig: Drainage file
c.pdf: via Email: Recipient



City of Albuquerque

Planning Department

Development & Building Services Division

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV 02/2013)

Project Title: SPUHLER-LASASTER Building Permit #: _____ City Drainage #: G11 D014G

DRB#: _____ EPC#: _____ Work Order#: _____

Legal Description: LOT 32P1 Ox Bow Bluffs

City Address: 5001 GREY HAWK COURT

Engineering Firm: RIO GRANDE ENGINEERING Contact: DAVID SOULE

Address: PO BOX 93924, ALBUQUERQUE, NM 87199

Phone#: 505.321.9099 Fax#: 505.872.0999 E-mail: DAVID@RIOGRANDEENGINEERING.COM

Owner: PANARAMA HOMES Contact: _____

Address: _____

Phone#: _____ Fax#: _____ E-mail: _____

Architect: MIKE GRAHSUIS Contact: _____

Address: _____

Phone#: _____ Fax#: _____ E-mail: _____

Surveyor: CONSTRUCTION SURVEY INCORPORATED Contact: JOHN GALLEGOS

Address: _____

Phone#: 917.8921 Fax#: _____ E-mail: _____

Contractor: _____ Contact: _____

Address: _____

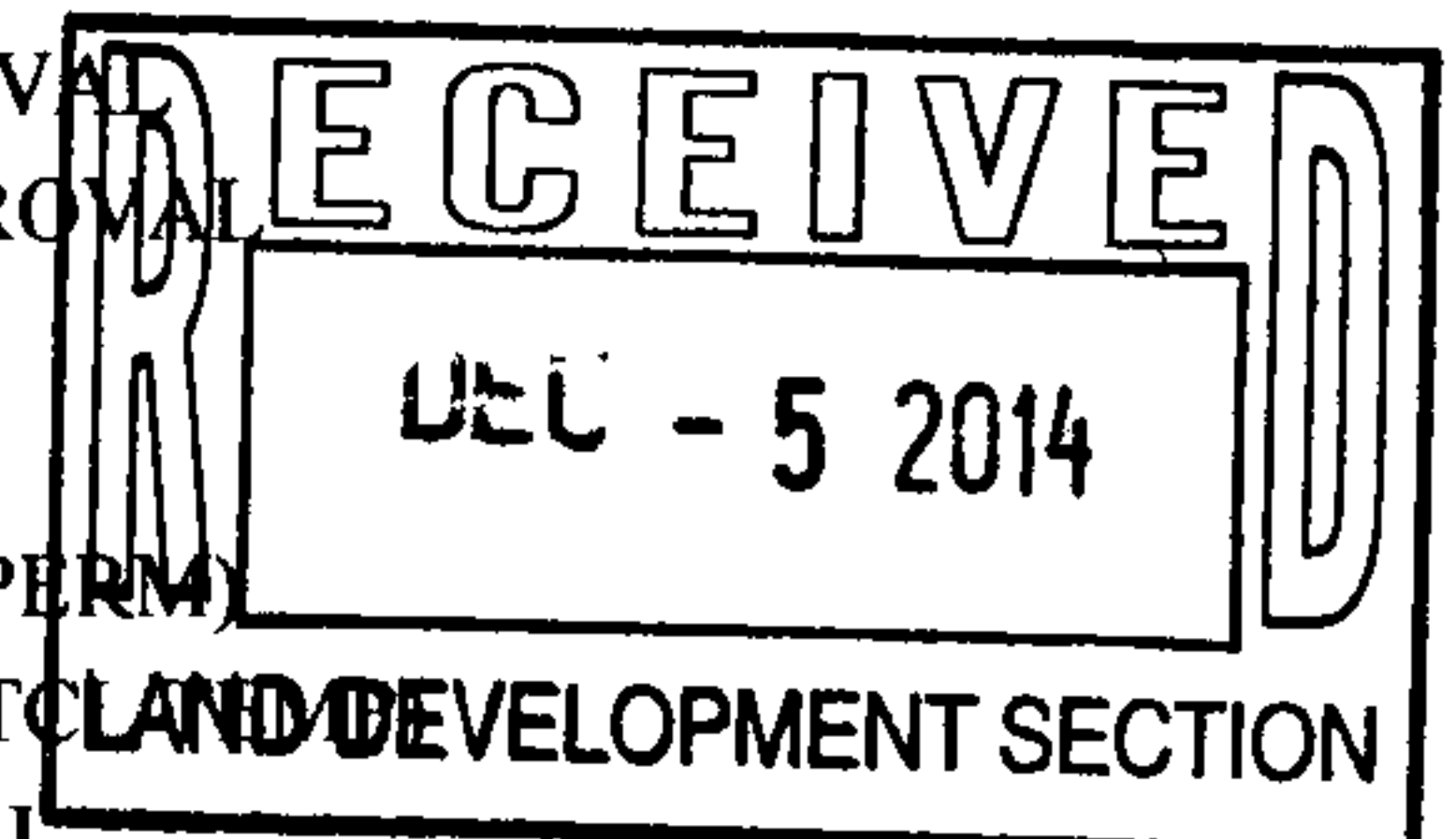
Phone#: _____ Fax#: _____ E-mail: _____

TYPE OF SUBMITTAL:

- ☐ DRAINAGE REPORT
- ☒ DRAINAGE PLAN 1st SUBMITTAL
- ☐ DRAINAGE PLAN RESUBMITTAL
- ☐ CONCEPTUAL G & D PLAN
- ☐ GRADING PLAN
- ☐ EROSION & SEDIMENT CONTROL PLAN (ESC)
- ☐ ENGINEER'S CERT (HYDROLOGY)
- ☐ CLOMR/LOMR
- ☐ TRAFFIC CIRCULATION LAYOUT (TCL)
- ☐ ENGINEER'S CERT (TCL)
- ☐ ENGINEER'S CERT (DRB SITE PLAN)
- ☐ ENGINEER'S CERT (ESC)
- ☐ SO-19
- ☐ OTHER (SPECIFY) _____

CHECK TYPE OF APPROVAL/ACCEPTANCE SOUGHT:

- ☐ SIA/FINANCIAL GUARANTEE RELEASE
- ☐ PRELIMINARY PLAT APPROVAL
- ☐ S. DEV. PLAN FOR SUB'D APPROVAL
- ☐ S. DEV. FOR BLDG. PERMIT APPROVAL
- ☐ SECTOR PLAN APPROVAL
- ☐ FINAL PLAT APPROVAL
- ☐ CERTIFICATE OF OCCUPANCY (PERM)
- ☐ CERTIFICATE OF OCCUPANCY (TCL)
- ☐ FOUNDATION PERMIT APPROVAL
- ☒ BUILDING PERMIT APPROVAL
- ☐ GRADING PERMIT APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☐ WORK ORDER APPROVAL
- ☐ GRADING CERTIFICATION
- ☐ SO-19 APPROVAL
- ☐ ESC PERMIT APPROVAL
- ☐ ESC CERT. ACCEPTANCE
- ☐ OTHER (SPECIFY) _____



WAS A PRE-DESIGN CONFERENCE ATTENDED: _____ Yes ☒ No _____ Copy Provided _____

DATE SUBMITTED: 12/1/14 By: _____

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature, location, and scope to the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres
3. **Drainage Report:** Required for subdivision containing more than ten (10) lots or constituting five (5) acres or more
4. **Erosion and Sediment Control Plan:** Required for any new development and redevelopment site with 1-acre or more of land disturbing area, including project less than 1-acre than are part of a larger common plan of development

Weighted E Method

										100-Year, 6-hr.			10-day	
Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs	Volume (ac-ft)
			%	(acres)	%	(acres)	%	(acres)	%	(acres)				
Existing	47863.00	1.099	100%	1.0988	0%	0.000	0%	0.000	0%	0.000	0.440	0.040	1.42	0.040
PROPOSED	47863.00	1.099	34%	0.3736	20%	0.220	26%	0.286	21%	0.231	0.955	0.087	2.76	0.118
ALLOWED	47863.00	1.099	60%	0.6593	0%	0.000	0%	0.000	40%	0.440	1.052	0.096	2.77	0.155

Equations:

Weighted E = $E_a \cdot A_a + E_b \cdot A_b + E_c \cdot A_c + E_d \cdot A_d$ / (Total Area)

Volume = Weighted D * Total Area

Flow = $Q_a \cdot A_a + Q_b \cdot A_b + Q_c \cdot A_c + Q_d \cdot A_d$

Where for 100-year, 6-hour storm(zone1)

Ea= 0.44	Qa= 1.29
Eb= 0.67	Qb= 2.03
Ec= 0.99	Qc= 2.87
Ed= 1.97	Qd= 4.37

water quality pond requirements (.34") x 10051 ✓

285 cubic feet ✓

Site located in master drainage plan for oxbow bluff. The site has less discharge than allowed. So ponding not required for flood control. Water quality ponding is required. Discharge leaves site in two locations. Once the flow leaves the site it travels within the public drainage easment until it enter the oxbow main out fall via bee hive grate inlet 800' north of site

December 5, 2014

Ms. Rita Harmon
Hydrology Department
Public Works Department
City of Albuquerque

**RE: Grading Plan
Lot 32 P1- OXBOW BLUFF
5001 GREY HAWK
Albuquerque, New Mexico**

Dear Ms. Harmon:

The purpose of this letter is to accompany the enclosed grading plan for 5001 Grey Hawk. The site is in a master drainage plan that anticipated 40% impervious. Our land treatments are slightly under the assumed developed conditions, therefore the only ponding required is for the first flush requirement. As shown the inlets, pipes and ponds have been designed to conform to city of Albuquerque standards.

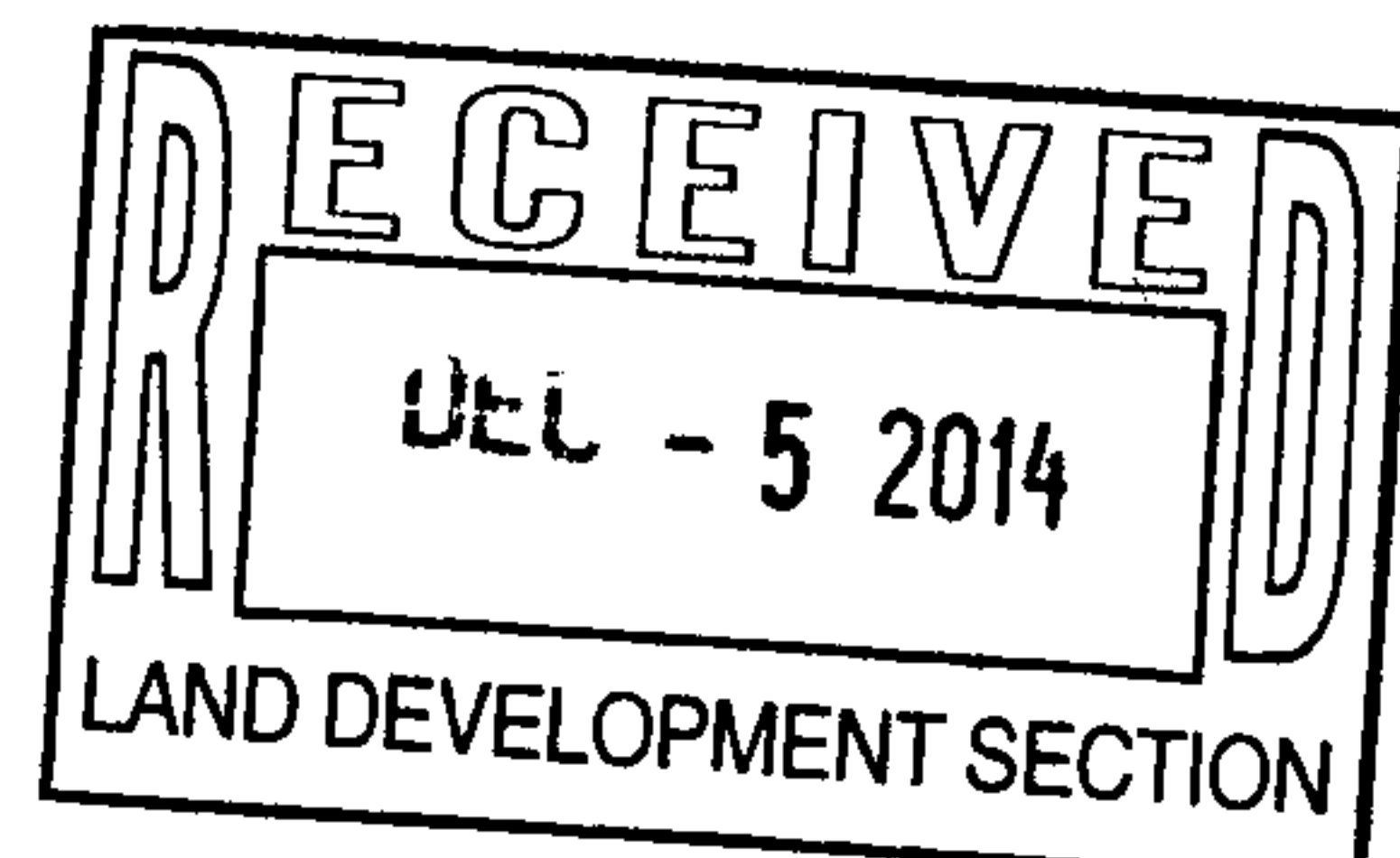
Should you have any questions regarding this matter, please do not hesitate to call me.

Sincerely,



David Soule, PE
RIO GRANDE ENGINEERING
PO Box 93924
ALBUQUERQUE, NM 87199
321-9099

Enclosures



Pipe Capacity

Pipe	D	Slope	Area	R	Q Provided	Q Required	Velocity
	(in)	(%)	(ft^2)		(cfs)	(cfs)	(ft/s)
POND OUTFALL	18	0.5	1.77	0.375	7.45	3.00	1.70

Manning's Equation:

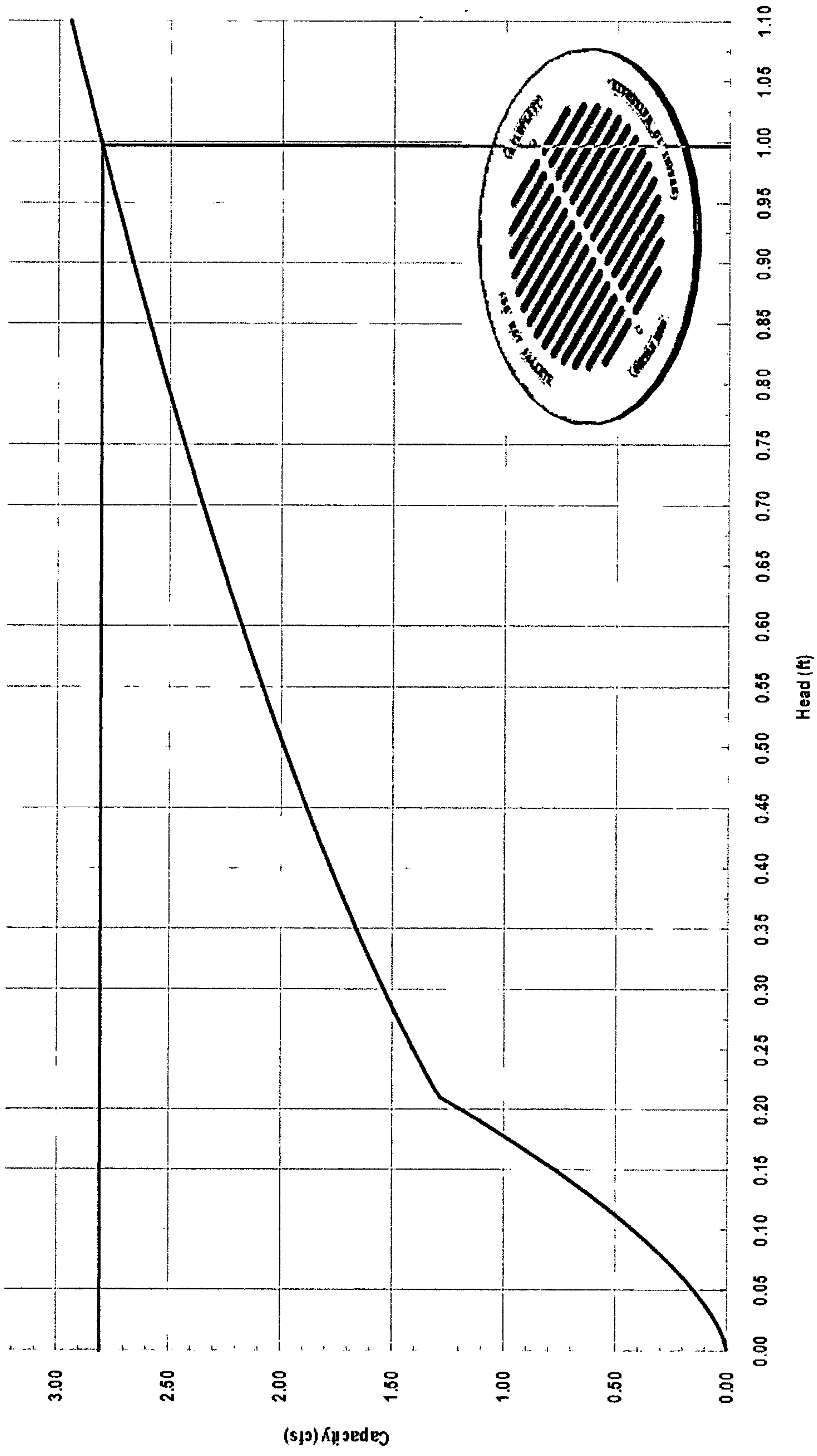
$Q = 1.49/n * A * R^{(2/3)} * S^{(1/2)}$

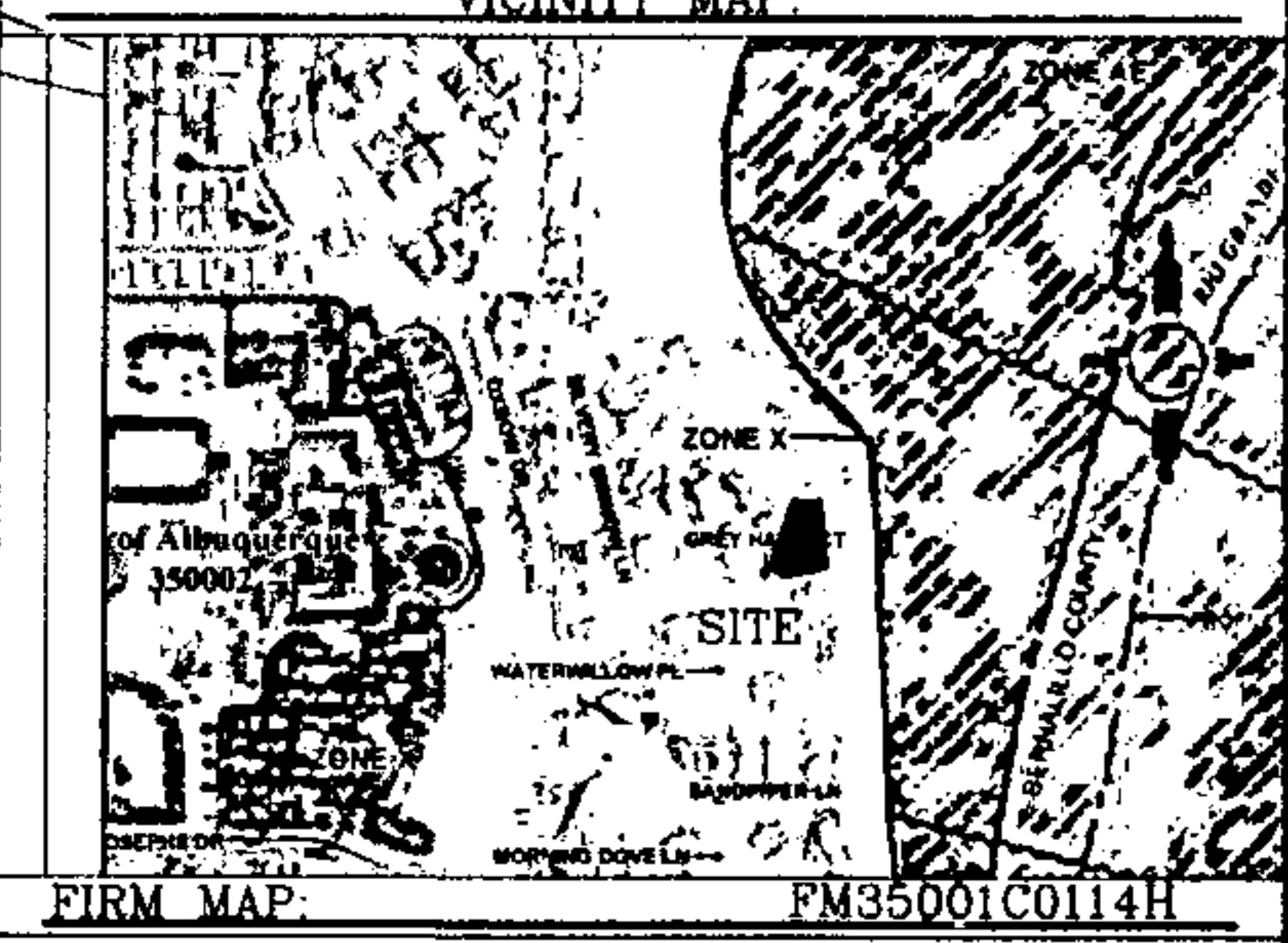
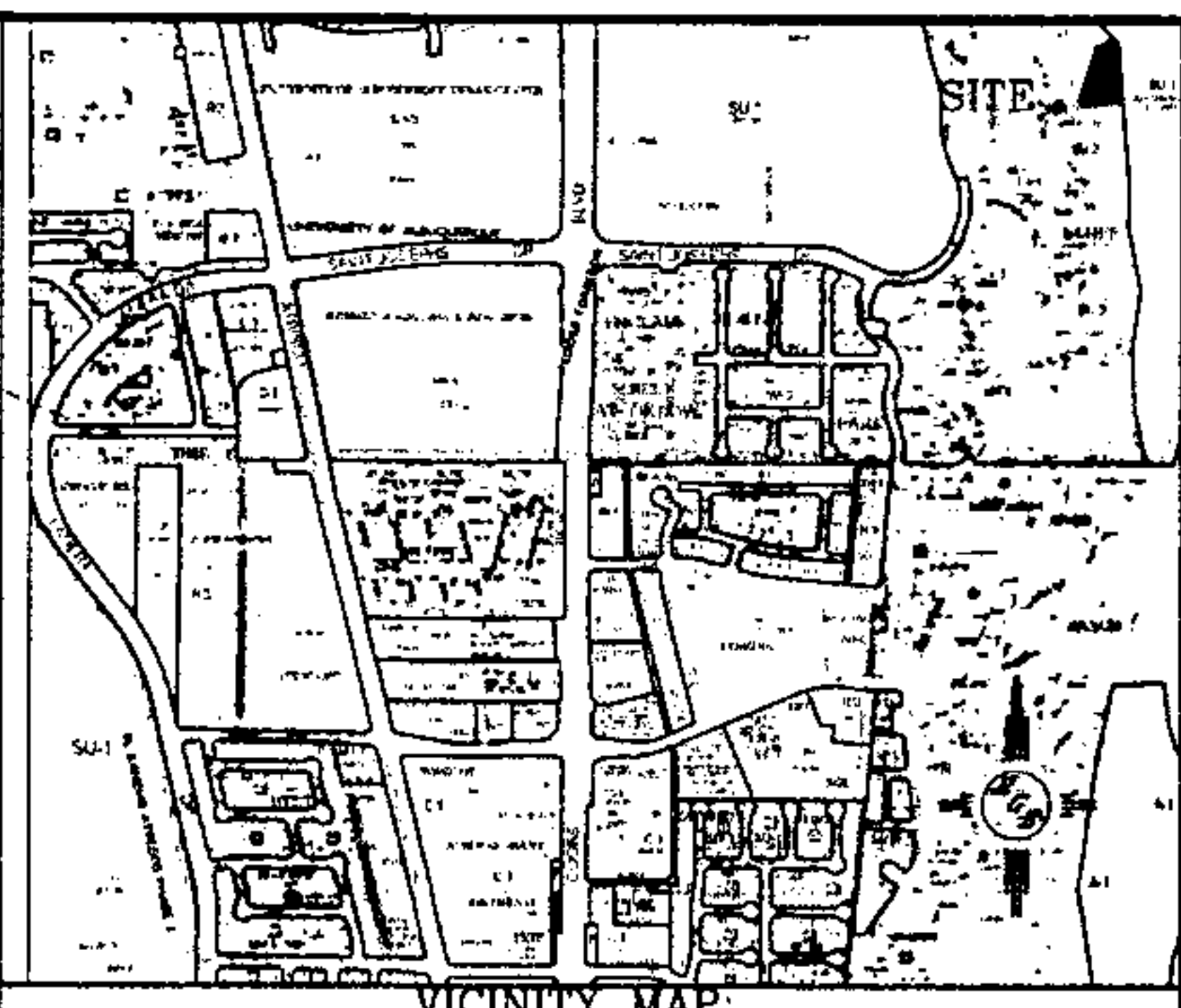
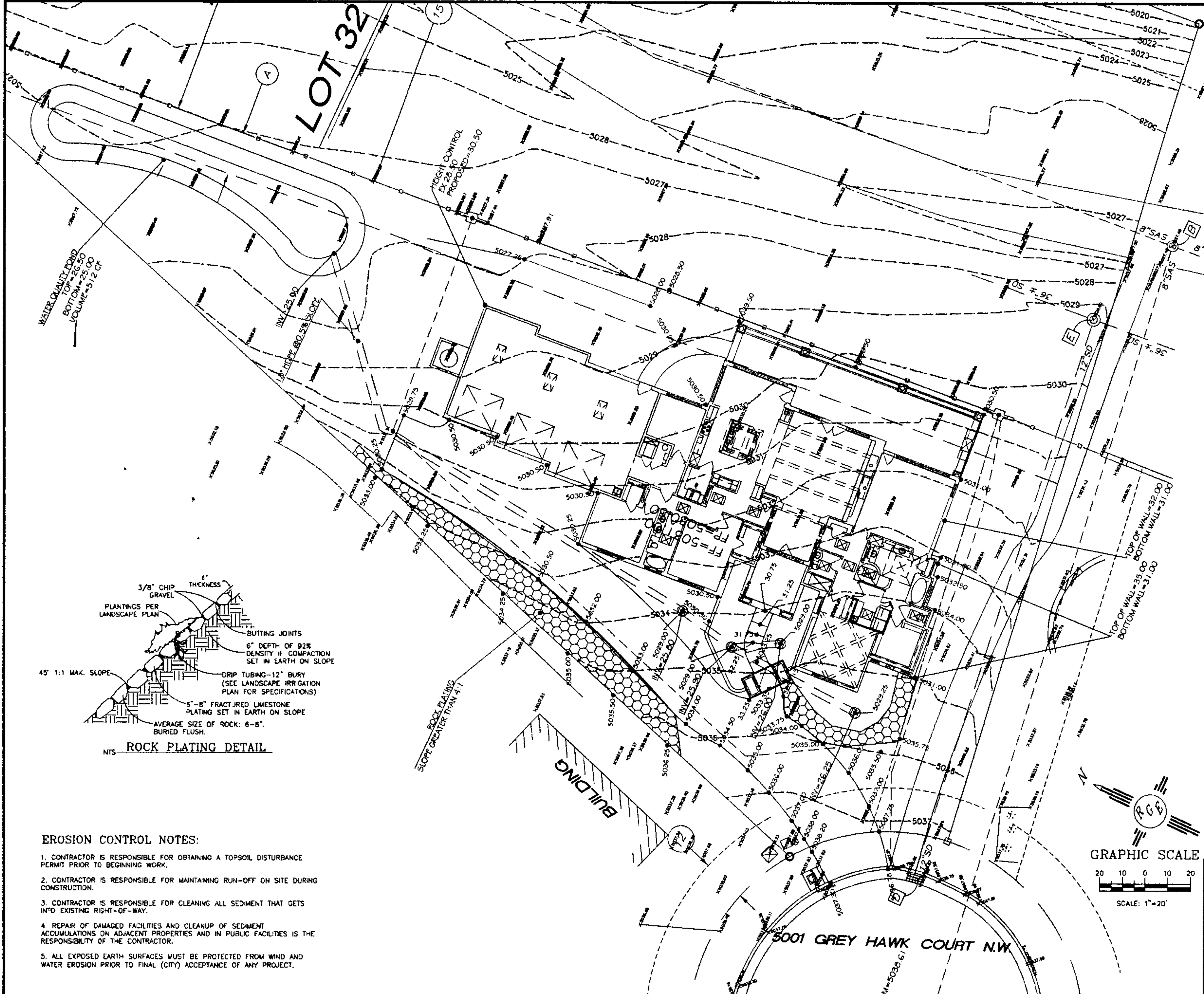
A = Area

R = D/4

S = Slope

n = 0.013

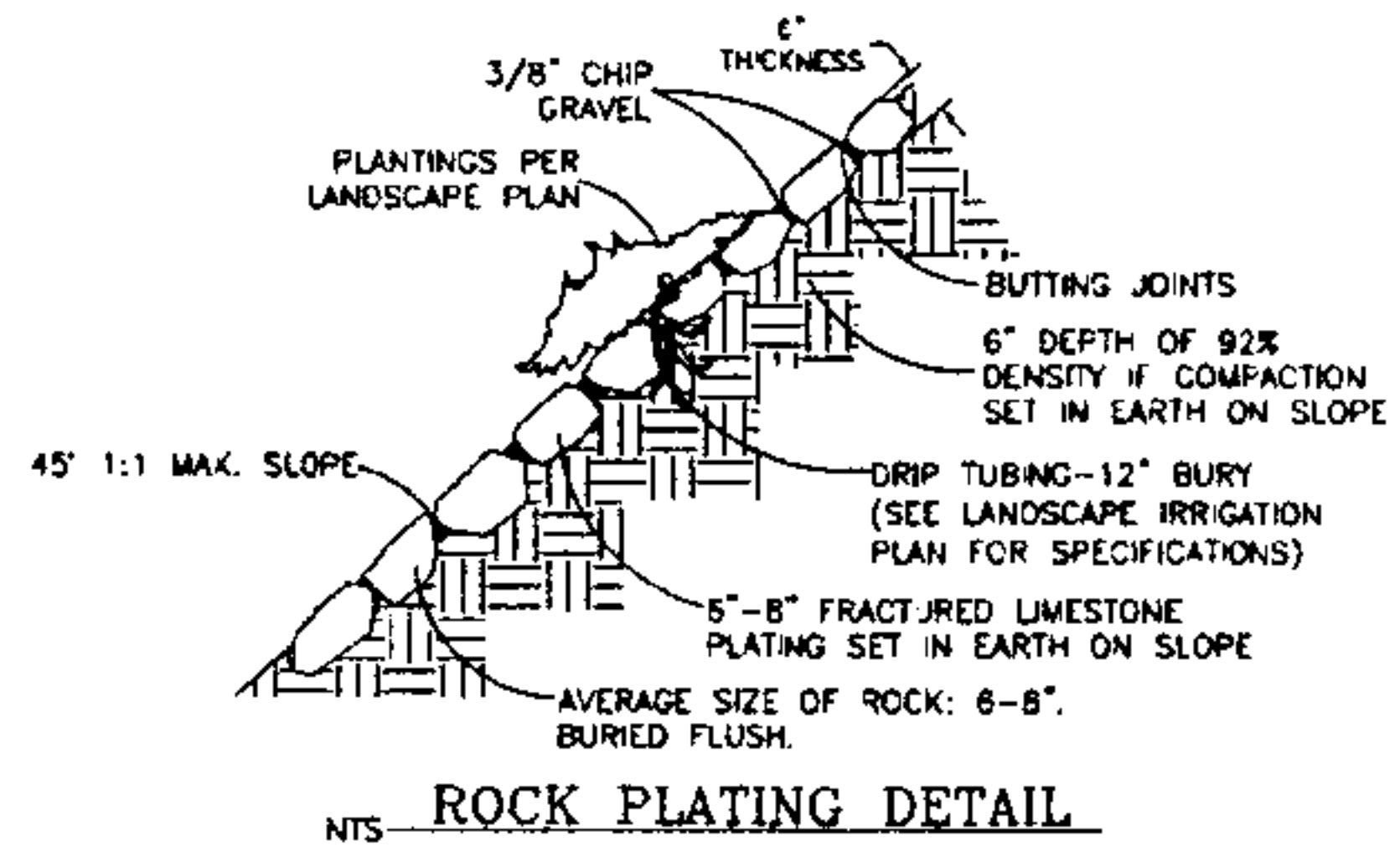




LEGAL DESCRIPTION:
LOT 32-P1 OXBOW BLUFF SUBDIVISION

NOTES:
1. ALL SPOT ELEVATIONS REPRESENT FLOWLINE ELEVATION UNLESS OTHERWISE NOTED.
2. TOPOGRAPHIC SURVEY INFORMATION SHOWN ON THIS PLAN WAS OBTAINED FROM PANORAMA HOMES, JOHN LOWE.
3. ALL INLETS SHALL BE NYLOPLAST INLINE DRAINS 18" WITH PLAT GRATES.

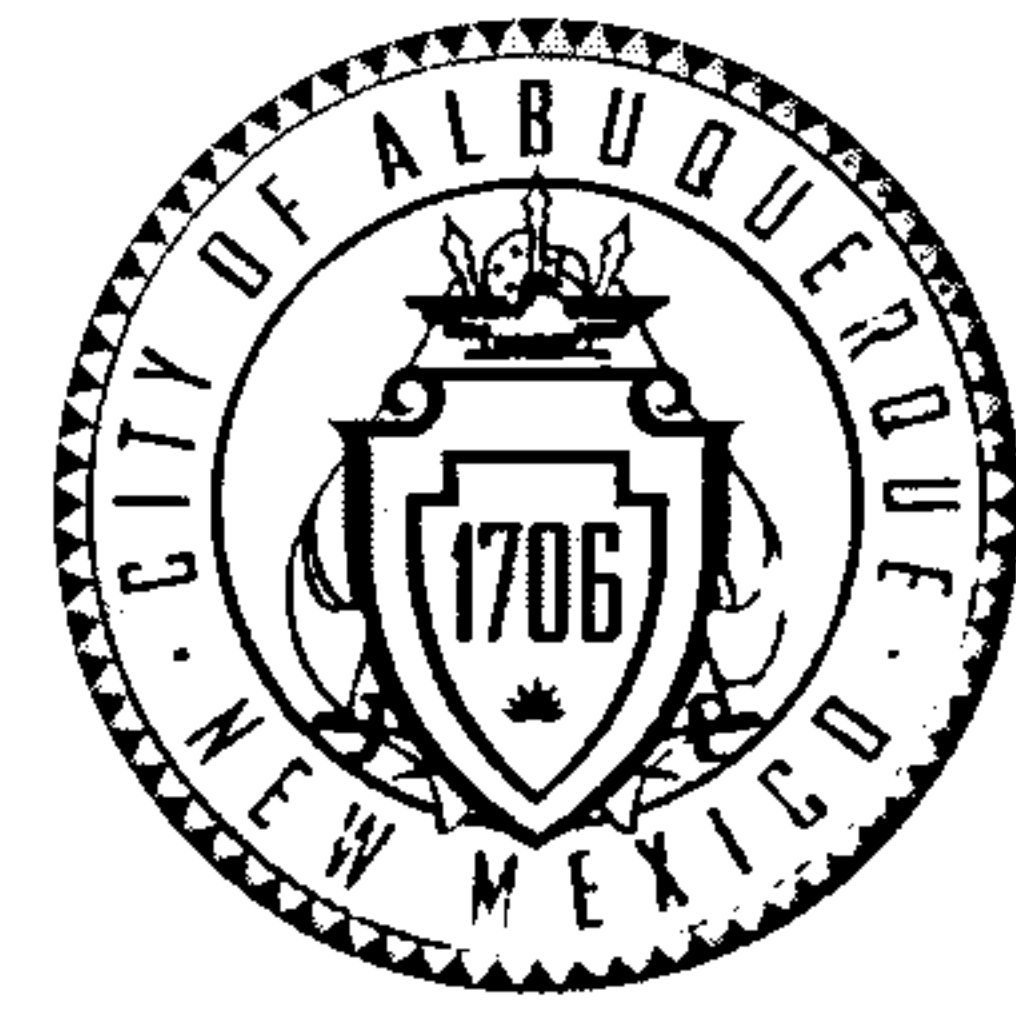
LEGEND	
---	EXISTING CONTOUR
---	EXISTING INDEX CONTOUR
---	PROPOSED CONTOUR
---	PROPOSED INDEX CONTOUR
---	PROPOSED STEM RETAINING WALL
---	SWALE-FLOWLINE
●	PROJECT BENCHMARK



- EROSION CONTROL NOTES:**
- CONTRACTOR IS RESPONSIBLE FOR OBTAINING A TOPSOIL DISTURBANCE PERMIT PRIOR TO BEGINNING WORK.
 - CONTRACTOR IS RESPONSIBLE FOR MAINTAINING RUN-OFF ON SITE DURING CONSTRUCTION.
 - CONTRACTOR IS RESPONSIBLE FOR CLEANING ALL SEDIMENT THAT GETS INTO EXISTING RIGHT-OF-WAY.
 - REPAIR OF DAMAGED FACILITIES AND CLEANUP OF SEDIMENT ACCUMULATIONS ON ADJACENT PROPERTIES AND IN PUBLIC FACILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR.
 - ALL EXPOSED EARTH SURFACES MUST BE PROTECTED FROM WIND AND WATER EROSION PRIOR TO FINAL (CITY) ACCEPTANCE OF ANY PROJECT.

ENGINEER'S SEAL DAVID SOULE NEW MEXICO 14522 12/1/14 DAVID SOULE P.E. #14522	LOT 32-P1 OXBOW BLUFF SUBDIVISION	DRAWN BY JDC DATE 08-04-2014
	GRADING AND DRAINAGE PLAN	SHEET # 1 OF 1 JOB #

CITY OF ALBUQUERQUE



July 12, 2013

David Soule, P.E.
Rio Grande Engineering
P.O. Box 93924
Albuquerque, NM 87199

**Re: 5000 Snow Goose Court, Grading and Drainage Plan
Engineer's Stamp Dated 04-02-2013 (G-11/D014D)**

Dear Mr. Soule,

Based upon the information provided in your submittal dated 07-11-2013, the above referenced Grading and Drainage Plan is approved for Building Permit with the stipulations set forth in the ARC Letter submitted by Bohannon-Huston on April 8, 2013. These stipulations are stated as follows and will need to be included in the as-built certification:

- The northern pond needs to be increased to retain 935 CF instead of the 770 CF the plan currently reflects.
- No disturbance shall encroach onto adjacent lots. In order to minimize that the adjacent lot is not disturbed in any manner, grading shall not occur within a minimum of 24" from the property line.

PO Box 1293

Albuquerque

Please attach a copy of this approved plan to the construction sets when submitting for a building permit. If the approved plan is not attached to the construction set, Hydrology will reject the construction set for building permit.

New Mexico 87103

Prior to Certificate of Occupancy release, Engineer Certification per the DPM checklist will be required. If you have any questions, you can contact me at 924-3695.

www.cabq.gov

Sincerely,

Shahab Blazar, P.E.

Senior Engineer, Planning Dept.
Development and Building Services

C: email

LOT 47

April 8, 2013

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

Mr. Richard Schalk
Oxbow Bluff ACC Liaison
1606 Old Town Road NW
Albuquerque, NM 87104

RE: LOT 47 – OXBOW BLUFF; 2ND REVIEW OF THE LOT SPECIFIC GRADING AND DRAINAGE

Dear Richard:

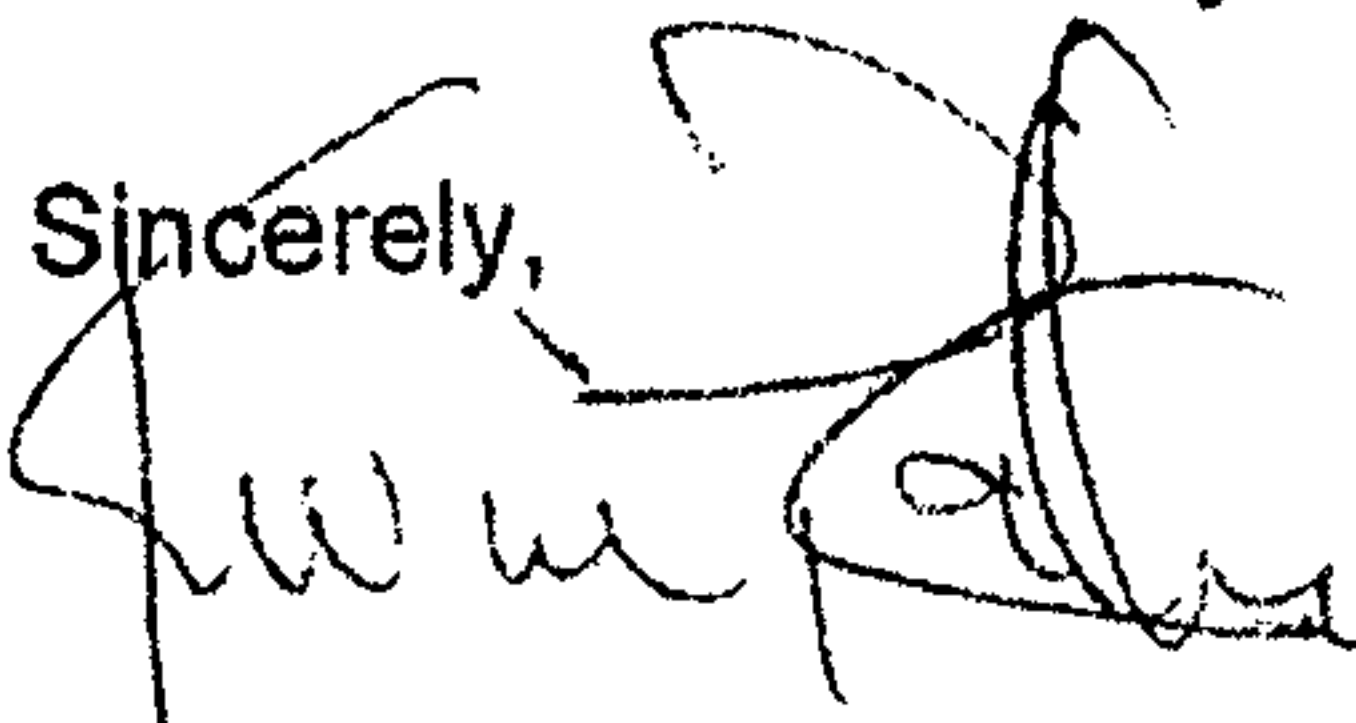
Per your request, we have reviewed the 2nd submittal of the referenced grading and drainage plan and have the following comments concerning our review. The above referenced Grading and Drainage Plan (G&D Plan) within the Oxbow Bluff Community; was prepared by David Soule, dated 4-2-2013 with accompanying letter and supplemental calculations on April 2, 2013.

In order to move the project forward we are requiring the following correction be made during construction and that the certified grading and drainage plan reflect these changes prior to our acceptance:

- As stated in the hydrology calculation, the proposed volume is 0.075 ac-ft and the existing volume is 0.032 ac-ft. As stated in the Oxbow Bluff Design Guidelines, "The retention ponds shall be of sufficient size and capacity to capture all developed flow generated by a 6 hour 100 year storm event." With that stated, 0.043 ac-ft (1873 CF) of storage is required for Lot 47. The southern pond will only receive 938 CF from the upstream basins within the 100 year 6 hr event, thus any allowable volume beyond that provides no benefit; therefore the northern pond needs to be increased to retain 935 CF instead of the 770 CF you currently reflect. Your certified plan must reflect the 935 CF.
- No disturbance shall encroach onto adjacent lots. It appears that tie slopes along Lot 48 tie at the property line. In order to minimize that the adjacent lot is not disturbed in any manner, grading shall not occur within a minimum of 24" from the property line. This will help ensure that no grading occurs on adjacent lots.

Please let me know if you have any questions or comments concerning our review.

Sincerely,


Kevin G. Patton, P.E.
Senior Vice President
Community Development & Planning

BCP/sls
Enclosure

cc: Brian C. Patterson, BHI

Engineering ▲

Spatial Data ▲

Advanced Technologies ▲

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 01/28/2003rd)

PROJECT TITLE: 5000 Snow Goose Court
DRB #: _____ EPC #: _____

ZONE MAP/DRG. FILE #: G11-d014D
WORK ORDER #: _____

LEGAL DESCRIPTION: LOT # 47
Bluffs, Oxbow Bluff
CITY ADDRESS: 5000 Snow Goose Court

ENGINEERING FIRM: Rio Grande Engineering
ADDRESS: PO BOX 67305
CITY, STATE: Alb

CONTACT: David Soule, PE
PHONE: (505)321-9099
ZIP CODE: 87193

OWNER: Wike/ Calcott
ADDRESS: _____
CITY, STATE: Albuquerque, NM

CONTACT: _____
PHONE: _____
ZIP CODE: 87106

ARCHITECT: Richard Shalk
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

SURVEYOR: Geo survco
ADDRESS: _____
CITY, STATE: _____

CONTACT: David Vigil/ John Gallegs
PHONE: 975-4567
ZIP CODE: _____

CONTRACTOR: _____
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:

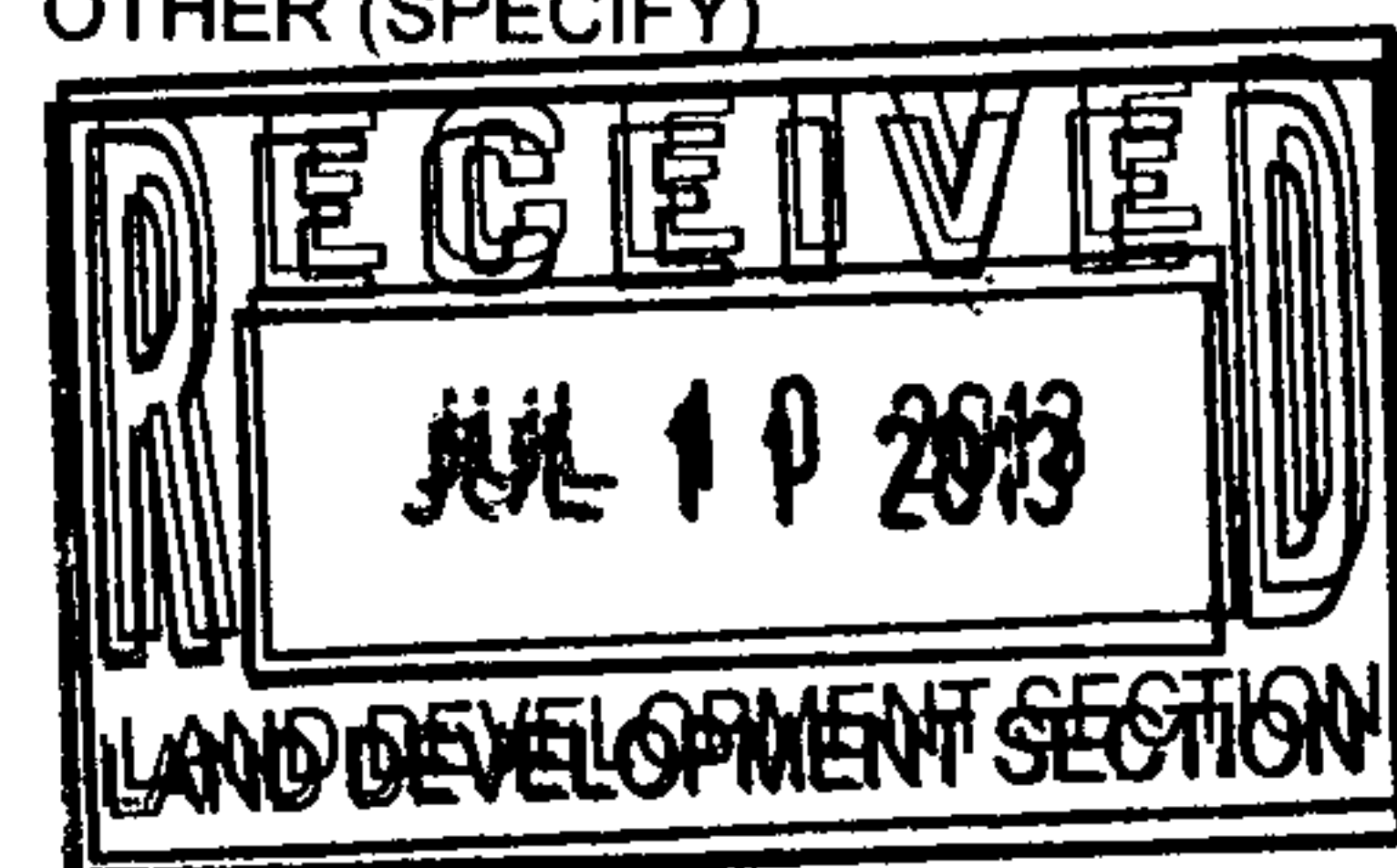
CHECK TYPE OF APPROVAL SOUGHT:

- ☐ DRAINAGE REPORT
☐ DRAINAGE PLAN 1st SUBMITTAL, *REQUIRES TCL or equal*
☒ DRAINAGE PLAN RESUBMITTAL
☐ CONCEPTUAL GRADING & DRAINAGE PLAN
☐ GRADING PLAN
☐ EROSION CONTROL PLAN
☐ ENGINEER'S CERTIFICATION (HYDROLOGY)
☐ CLOMR/LOMR
☐ TRAFFIC CIRCULATION LAYOUT (TCL)
☐ ENGINEERS CERTIFICATION (TCL)
☐ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
☐ OTHER

- ☐ SIA / FINANACIAL GUARANTEE RELEASE
☐ PRELIMINARY PLAT APPROVAL
☐ S. DEV. PLAN FOR SUB'D. APPROVAL
☐ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
☐ SECTOR PLAN APPROVAL
☐ FINAL PLAT APPROVAL
☐ FOUNDATION PERMIT APPROVAL
☒ BUILDING PERMIT APPROVAL
☐ CERTIFICATE OF OCCUPANCY (PERM.)
☐ CERTIFICATE OF OCCUPANCY (TEMP.)
☐ GRADING PERMIT APPROVAL
☐ PAVING PERMIT APPROVAL
☐ WORK ORDER APPROVAL
☐ OTHER (SPECIFY)

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ☐ YES
☐ NO
☐ COPY PROVIDED



DATE SUBMITTED: 7/11/13. BY: David Soule

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal.

The particular nature, location and scope of the proposed development defines the degree of drainage detail.

One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plans:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres.
3. **Drainage Report:** Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

CITY OF ALBUQUERQUE



February 1, 2013

David Soule, P.E.
Rio Grande Engineering
P.O. Box 93924
Albuquerque, NM 87199

**Re: 5000 Snow Goose Court, Grading and Drainage Plan
Engineer's Stamp Dated 01-10-13 (G-11/D014D)**

Dear Mr. Soule,

Based upon the information provided in your submittal received 01-14-2013, the above referenced plan cannot be approved for Building Permit until the following comments are addressed:

- The proposed drainage concept will need to be reviewed and approved through the subdivision's architectural review committee prior to Hydrology approval being issued.
- All developed flows must be either fully retained or discharged through the drive pad to Snow Goose Court per the subdivision's DMP.
- None of the basins on the site will be accepted as being of Treatment A. Land Treatment Type B will be the minimum treatment type allowed for the flow calculations on this site.
- It appears that flows from Basins B1 & B2 along with a portion of Basin B should be redirected to the southern ponding area and that this pond should be enlarged.

PO Box 1293

Albuquerque

NM 87103

If you have any questions, you can contact me at 924-3695.

Sincerely,

Shahab Biazar, P.E.
Senior Engineer, Planning Dept.
Development and Building Services

www.cabq.gov

C: email

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 01/28/2003rd)

PROJECT TITLE: 5000 Snow Goose Court
DRB #: _____ EPC #: _____

ZONE MAP/DRG. FILE #: G11-d014D
WORK ORDER #: _____

LEGAL DESCRIPTION: Lot 35, Oxbow Bluff
CITY ADDRESS: 5008 Greyhawk Court

ENGINEERING FIRM: Rio Grande Engineering
ADDRESS: PO BOX 67305
CITY, STATE: Alb

CONTACT: David Soule, PE
PHONE: (505)321-9099
ZIP CODE: 87193

OWNER: Wike/ Calcott
ADDRESS: _____
CITY, STATE: Albuquerque , NM

CONTACT: _____
PHONE: _____
ZIP CODE: 87106

ARCHITECT: Richard Shalk
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

SURVEYOR: Geo survco
ADDRESS: _____
CITY, STATE: _____

CONTACT: David Vigil/ John Gallegs
PHONE: 975-4567
ZIP CODE: _____

CONTRACTOR: _____
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:

CHECK TYPE OF APPROVAL SOUGHT:

- ☐ DRAINAGE REPORT
☐ DRAINAGE PLAN 1st SUBMITTAL, *REQUIRES TCL or equal*
☒ DRAINAGE PLAN RESUBMITTAL
☐ CONCEPTUAL GRADING & DRAINAGE PLAN
☐ GRADING PLAN
☐ EROSION CONTROL PLAN
☐ ENGINEER'S CERTIFICATION (HYDROLOGY)
☐ CLOMR/LOMR
☐ TRAFFIC CIRCULATION LAYOUT (TCL)
☐ ENGINEERS CERTIFICATION (TCL)
☐ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
☐ OTHER

- ☐ SIA / FINANACIAL GUARANTEE RELEASE
☐ PRELIMINARY PLAT APPROVAL
☐ S. DEV. PLAN FOR SUB'D. APPROVAL
☐ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
☐ SECTOR PLAN APPROVAL
☐ FINAL PLAT APPROVAL
☐ FOUNDATION PERMIT APPROVAL
☒ BUILDING PERMIT APPROVAL
☐ CERTIFICATE OF OCCUPANCY (PERM.)
☐ CERTIFICATE OF OCCUPANCY (TEMP.)
☐ GRADING PERMIT APPROVAL
☐ PAVING PERMIT APPROVAL
☐ WORK ORDER APPROVAL
☐ OTHER (SPECIFY)

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ☐ YES
☐ NO
☐ COPY PROVIDED

RECEIVED
JAN 14 2013

DATE SUBMITTED: 1/9/2013 BY: David Soule

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal.

The particular nature, location and scope of the proposed development defines the degree of drainage detail.

One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plans:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres.
3. **Drainage Report:** Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

January 10, 2013

Mr. Shahab Biazar, PE
Senior Engineer
Planning Department
City of Albuquerque

Mr. Kevin Patton, PE
Bohannon Huston
7500 Jefferson NE
Albuquerque, NM 87109

**RE: Grading and Drainage Plan
5000 Snow Goose Ct
Lot 47, Oxbow Bluff Subdivision**

Dear Gentleman:

The purpose of this letter is to accompany the enclosed grading plan for 5000 Snow Goose Ct NW. The proposed development is the construction of a single family residential home on lot 35 of the Oxbow Bluff Subdivision. This particular lot is governed by the master drainage plan for the Oxbow Bluffs subdivisions dated November 1997 (G11/D14). This lot is located within Drainage basin C and is allowed to free discharge as sheet flow to the east (assuming 40% impervious and 60% undisturbed). The site allows for cross-lot drainage. As shown on the attached work sheet, the Weighted E method was utilized to determine the 100-year, 6-hour developed storm discharge. As proposed, this site is predicted to discharge 1.48 cfs which is less than the 1.51 cfs allowed. The enclosed plan has been revised to address city hydrology comments dated 1/4/2013

Should you have any questions regarding this submittal, please do not hesitate to call me.

Sincerely,

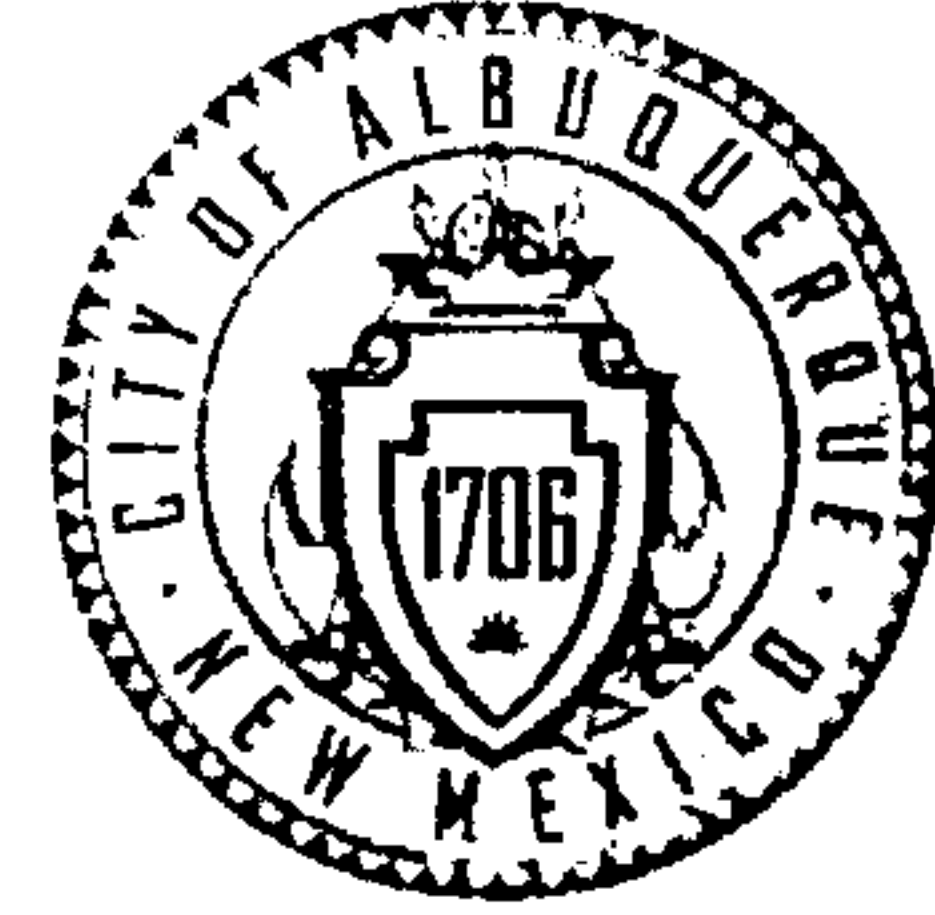


David Soule, PE
Rio Grande Engineering of NM
PO box 93924
Albuquerque nm 87199

Enclosures
cc: file

RECEIVED
JAN 14 2013

CITY OF ALBUQUERQUE



January 4, 2012

David Soule, P.E.
Rio Grande Engineering
P.O. Box 93924
Albuquerque, NM 87199

Re: 5000 Snow Goose Court, Grading and Drainage Plan
Engineer's Stamp Dated 12-21-12 (G-11/D014D)

Dear Mr. Soule,

Based upon the information provided in your submittal received 12-21-2012, the above referenced plan cannot be approved for Building Permit until the following comments are addressed:

- The proposed drainage concept will need to be reviewed and approved through the subdivision's architectural review committee prior to Hydrology approval being issued. *Pending*
- According to the Oxbow DMP the lot lies in Basin C and not Basin B as suggested in the introduction letter submitted with this grading plan; this will affect the assumption that has been made of a developed condition of 42% impervious and 58% undisturbed land treatment. *mod. file*
- Developed land treatment can be no less than a "Type B" for the purposes of calculating runoff and pond volumes in the report. The drainage report will need to be revised to reflect an increase in 100 yr./10 day retention pond volumes. *mod. file*
- Delineate on the plan between existing and proposed contours; a difference between contours is not clearly illustrated. *Clar. file*
- The line type symbol for the property line should be included in the legend. *add*
- It appears that a fence is located along the boundary of the western drainage easement; please indicate this as such on the drainage plan. *Clar. file*

PO Box 1293

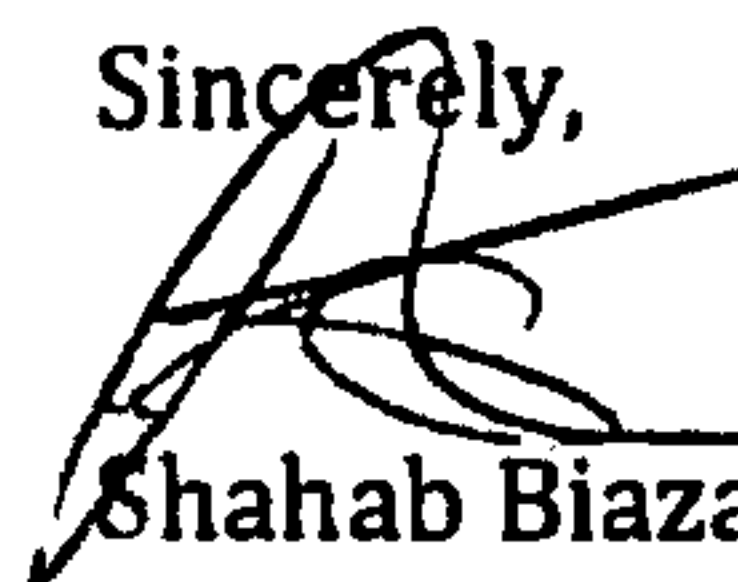
Albuquerque

NM 87103

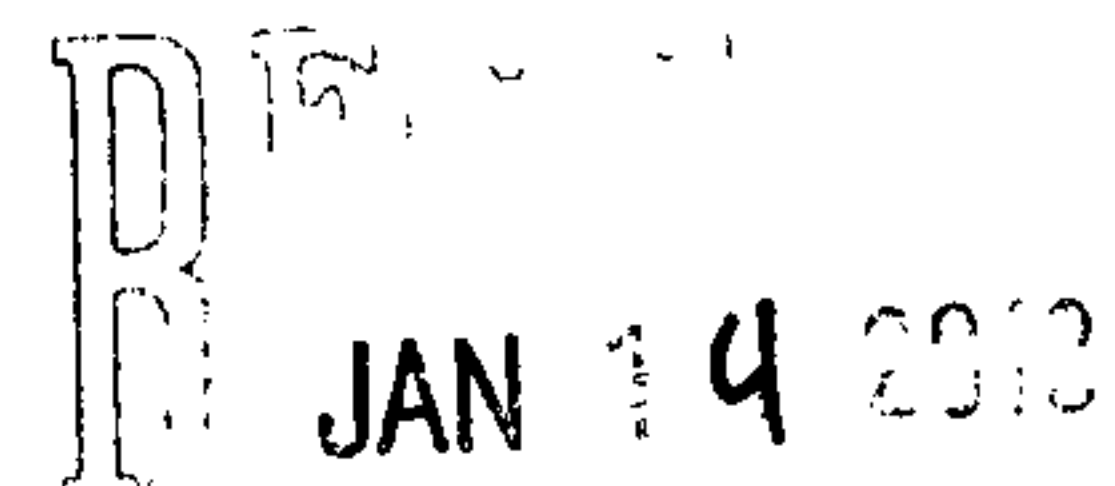
www.cabq.gov

If you have any questions, you can contact me at 924-3695.

Sincerely,


Shahab Biazar, P.E.
Senior Engineer, Planning Dept.
Development and Building Services

C: email



Albuquerque - Making History 1706-2006

SNOW GOOSE COURT

ACS CONTROL STATION
8-G11
N 1502236.625
E 1505431.887
Z 5516.009
NAD 83/NAVD 88
G-G= 0.999680082
DELTA-ALPHA= -00°15'35.17"
NEW MEXICO STATE PLANE
CENTRAL ZONE

L=39.64'
R=46.00'
Δ=50°27'56"
B=3 36°30'31" W
C=38.37'

END 14"
HDPE CULVERT
FL=5034.90

LOT 46

BUILD RETENTION POND
4:1 SLOPE MAX
TOP=5034.00
BOTTOM=5032.00
REQUIRED VOLUME=700 CU. FT.
PROPOSED VOLUME @ 5033.50=739 CU. FT.

10' EMERGENCY OVERFLOW
SEE DETAIL THIS SHEET
FL=5033.50

BUILD 6" COBBLE CHECK DAM
SEE DETAIL THIS SHEET

EX 50' PUBLIC
STORM & SAS
EASEMENT

BUILD 6" COBBLE CHECK DAM
SEE DETAIL THIS SHEET

10' OVERFLOW
SEE DETAIL THIS SHEET
FL=5039.50
W/6" COBBLES TO
EXFENCE LINE

BUILD RETENTION POND
4:1 SLOPE MAX.
TOP=5040.00
BOTTOM=5038.00
REQUIRED VOLUME=200 CU. FT.
PROPOSED VOLUME @ 5039.50=1225 CU. FT.

ENST

S 02°50'30" E 163.64'

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JAN 14 2013



Weighted E Method

Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		100-Year, 6-hr.		10-day
			%	(acres)	%	(acres)	%	(acres)	%	(acres)	Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs
Existing	38140.00	0.876	100%	0.8756	0%	0.000	0%	0.000	0%	0.000	0.440	0.032	1.13
EASE	8422.00	0.193	60%	0.116	20%	0.039	20%	0.039	0%	0.000	0.222	0.004	0.13
SITE A	7120.00	0.163	50%	0.0817	50%	0.082	0%	0.000	0%	0.000	0.555	0.008	0.27
ROOFA1	3700.00	0.085	0%	0	0%	0.000	0%	0.000	100%	0.085	1.970	0.014	0.37
SITE B	16318.00	0.375	0%	0	23%	0.086	38%	0.142	39%	0.146	1.299	0.041	1.22
ROOFB1	1300.00	0.030	0%	0	0%	0.000	0%	0.000	100%	0.030	1.970	0.005	0.13
ROOF B2	1280.00	0.029	0%	0	0%	0.000	0%	0.000	100%	0.029	1.970	0.005	0.13
PROPOSED	38140.00	0.88	28%	0.1977	24%	0.20656	21%	0.18102	33%	0.2903		0.075	2.252
ALLOWED	38140.00	0.876	60%	0.5253	0%	0.000	0%	0.000	40%	0.350	1.052	0.077	1.51

Equations:

Weighted E = $E_a \cdot A_a + E_b \cdot A_b + E_c \cdot A_c + E_d \cdot A_d$ / (Total Area)

Volume = Weighted D * Total Area

Flow = $Q_a \cdot A_a + Q_b \cdot A_b + Q_c \cdot A_c + Q_d \cdot A_d$

Where for 100-year, 6-hour storm(zone1)

Ea= 0.44	Qa= 1.29
Eb= 0.67	Qb= 2.03
Ec= 0.99	Qc= 2.87
Ed= 1.97	Qd= 4.37

drains to south pond

basin a+a1 0.64 cfs 1430.05 cf 100-year, 10-day

drains to north pond

basin b+b1+b2 1.48 cfs 3381.97 cf 100-year, 10-day
basin b1+b2 767.55 cf 100-year, 10-day

site discharge summary

existing	1.129 cfs
allowed	1.508
proposed	1.479

s inlet 1.35 (basin b+b1)

Pond a retains flow for bains A and A1. Pond b Retains flow equivalent to roof b2

Site located in master drainage plan for oxbow bluff. Site gradign plan retains portions of the site and allows remaining flow to discharge. The dischage leaves site in two locations. Once the flow leaves the site it travels within the public drainage easment until it enter the oxbow main out fall via bee hive grate inlet 800' north of site

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Pipe Capacity

Pipe	D	Slope	Area	R	Q Provided	Q Required	Velocity
	(in)	(%)	(ft^2)		(cfs)	(cfs)	(ft/s)
12HDPE	12	1	0.79	0.25	3.87	1.10	1.40

Manning's Equation:

$$Q = 1.49/n * A * R^{(2/3)} * S^{(1/2)}$$

A = Area

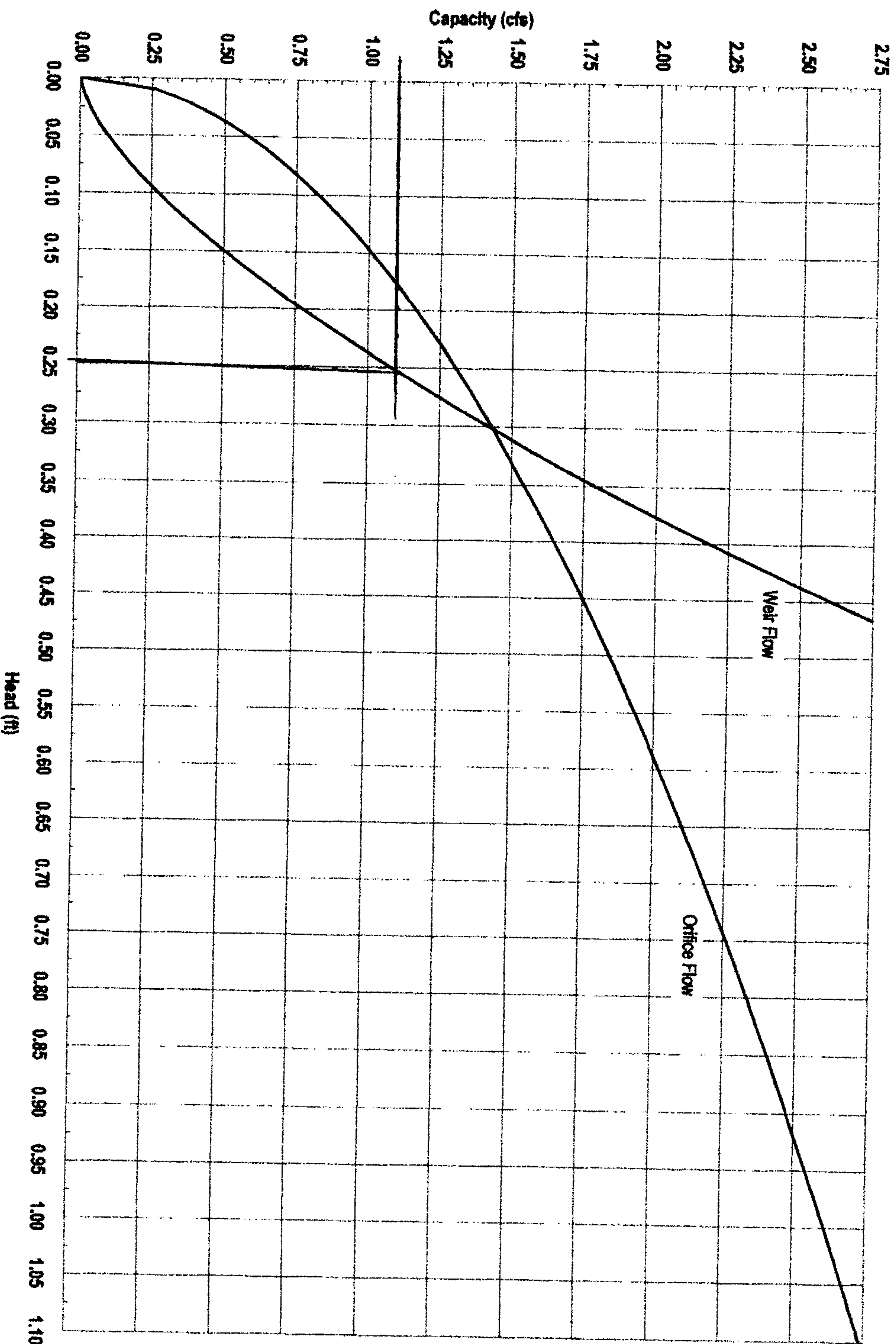
R = D/4

S = Slope

n = 0.012

RECEIVED
JAN 14 2013

Nyloplast 12" Dome Grate Inlet Capacity Chart



Grate = 36.9
 $M_{s1} = 37.15$

B
 JAN 14 2013

CITY OF ALBUQUERQUE



January 4, 2012

David Soule, P.E.
Rio Grande Engineering
P.O. Box 93924
Albuquerque, NM 87199

**Re: 5000 Snow Goose Court, Grading and Drainage Plan
Engineer's Stamp Dated 12-21-12 (G-11/D014D)**

Dear Mr. Soule,

Based upon the information provided in your submittal received 12-21-2012, the above referenced plan cannot be approved for Building Permit until the following comments are addressed:

- The proposed drainage concept will need to be reviewed and approved through the subdivision's architectural review committee prior to Hydrology approval being issued.
- According to the Oxbow DMP the lot lies in Basin C and not Basin B as suggested in the introduction letter submitted with this grading plan; this will affect the assumption that has been made of a developed condition of 42% impervious and 58% undisturbed land treatment.
- Developed land treatment can be no less than a "Type B" for the purposes of calculating runoff and pond volumes in the report. The drainage report will need to be revised to reflect an increase in 100 yr./10 day retention pond volumes.
- Delineate on the plan between existing and proposed contours; a difference between contours is not clearly illustrated.
- The line type symbol for the property line should be included in the legend.
- It appears that a fence is located along the boundary of the western drainage easement; please indicate this as such on the drainage plan.

PO Box 1293

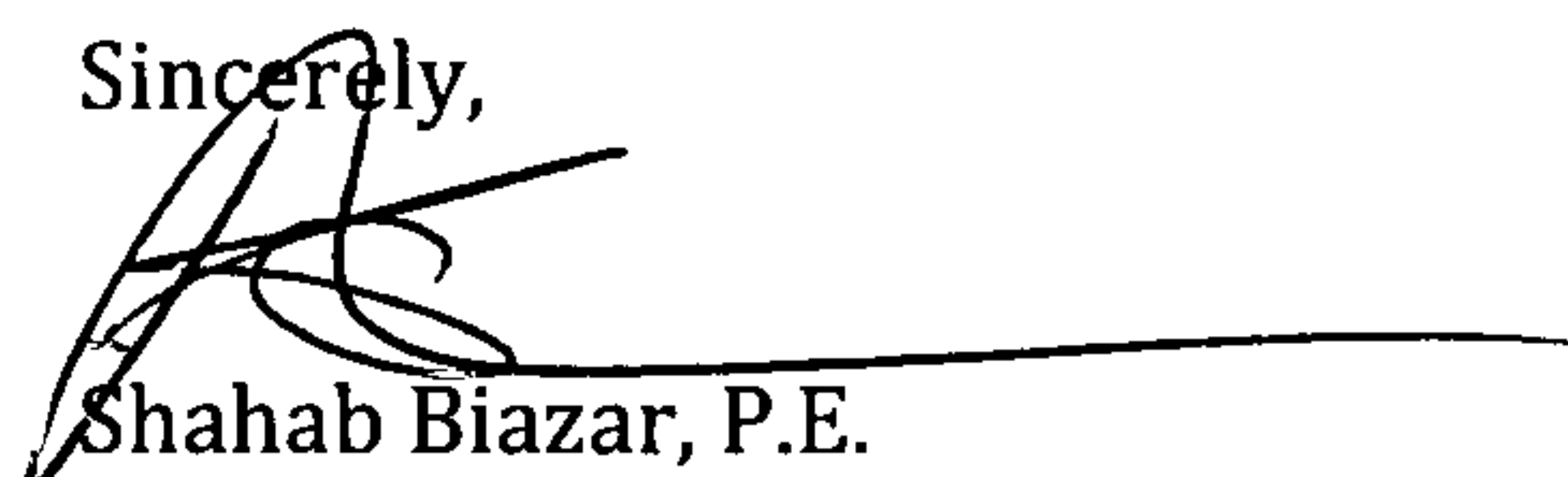
Albuquerque

NM 87103

www.cabq.gov

If you have any questions, you can contact me at 924-3695.

Sincerely,


Shahab Biazar, P.E.
Senior Engineer, Planning Dept.
Development and Building Services

C: email

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 01/28/2003rd)

PROJECT TITLE: 5000 Snow Goose Court
DRB #: _____ EPC #: _____

ZONE MAP/DRG. FILE #: G11/ D04D
WORK ORDER #: _____

LEGAL DESCRIPTION: Lot 47, Oxbow Bluff
CITY ADDRESS: 5000 Snow Goose Court

ENGINEERING FIRM: Rio Grande Engineering
ADDRESS: PO BOX 93924
CITY, STATE: Alb

CONTACT: David Soule, PE
PHONE: (505)321-9099
ZIP CODE: 87199

OWNER: Richard Shaulk
ADDRESS: _____
CITY, STATE: Albuquerque, NM

CONTACT: _____
PHONE: _____
ZIP CODE: 87106

ARCHITECT: _____
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

SURVEYOR: Geo survco
ADDRESS: _____
CITY, STATE: _____

CONTACT: David Vigil/ John Gallegs
PHONE: 917-8921
ZIP CODE: _____

CONTRACTOR: _____
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:

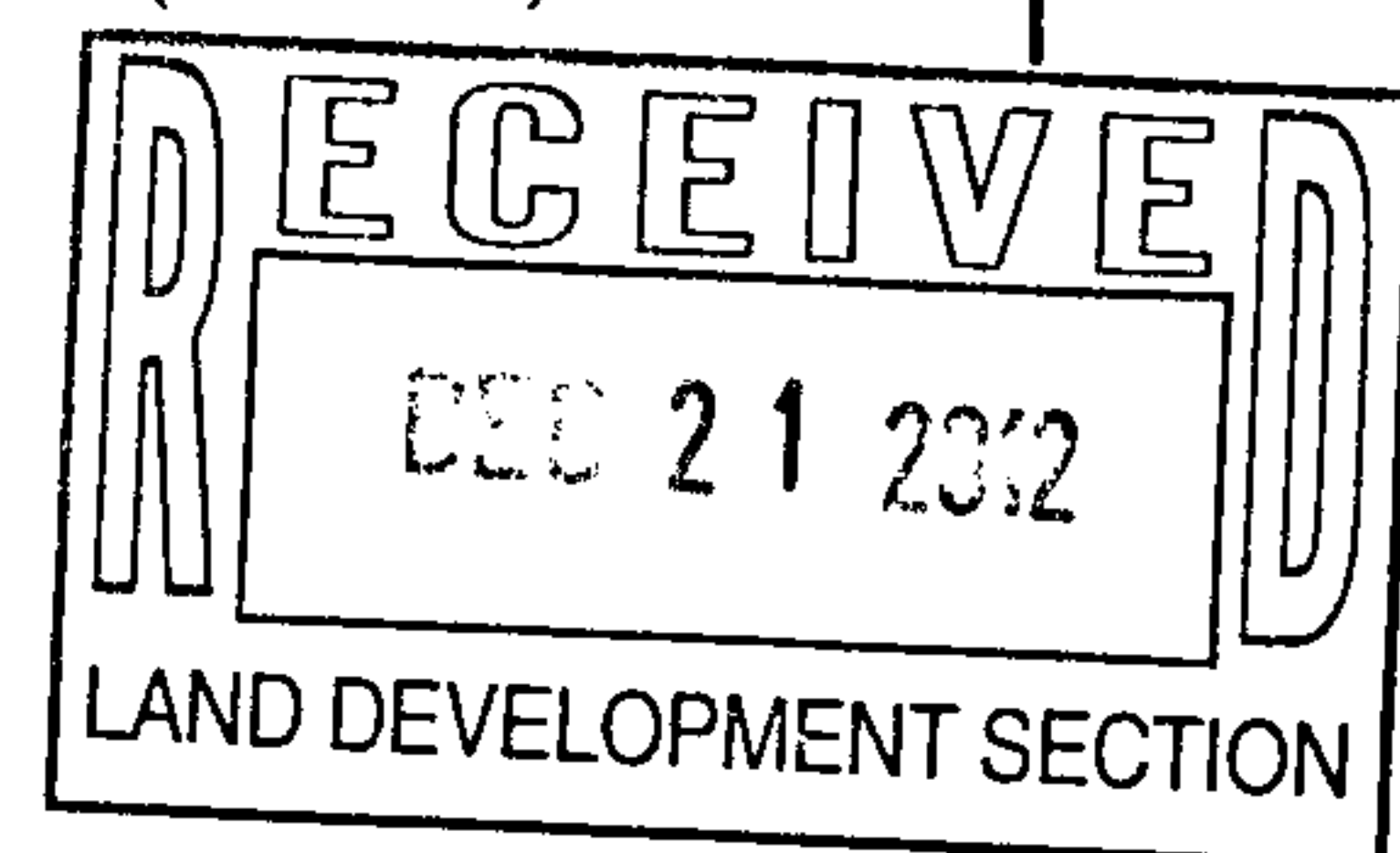
CHECK TYPE OF APPROVAL SOUGHT:

- ☐ DRAINAGE REPORT
☐ DRAINAGE PLAN 1st SUBMITTAL, *REQUIRES TCL or equal*
☐ DRAINAGE PLAN RESUBMITTAL
☐ CONCEPTUAL GRADING & DRAINAGE PLAN
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☐ ENGINEER'S CERTIFICATION (HYDROLOGY)
☐ CLOMR/LOMR
☐ TRAFFIC CIRCULATION LAYOUT (TCL)
☐ ENGINEERS CERTIFICATION (TCL)
☐ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
☐ OTHER

- ☐ SIA / FINANACIAL GUARANTEE RELEASE
☐ PRELIMINARY PLAT APPROVAL
☐ S. DEV. PLAN FOR SUB'D. APPROVAL
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☐ CERTIFICATE OF OCCUPANCY (TEMP.)
☐ GRADING PERMIT APPROVAL
☐ PAVING PERMIT APPROVAL
☐ WORK ORDER APPROVAL
☐ OTHER (SPECIFY)

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ☐ YES
☐ NO
☐ COPY PROVIDED



DATE SUBMITTED: 12/20/2012 BY: David Soule

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal.

The particular nature, location and scope of the proposed development defines the degree of drainage detail.

One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plans:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres.
3. **Drainage Report:** Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

November 23, 2010

Brad Bingham, P.E.
Senior Engineer
City of Albuquerque
PO Box 1293
Albuquerque NM 87103

RE: Grading and Drainage Certification for Lot 35A Oxbow Bluff Subdivision

Dear Brad:

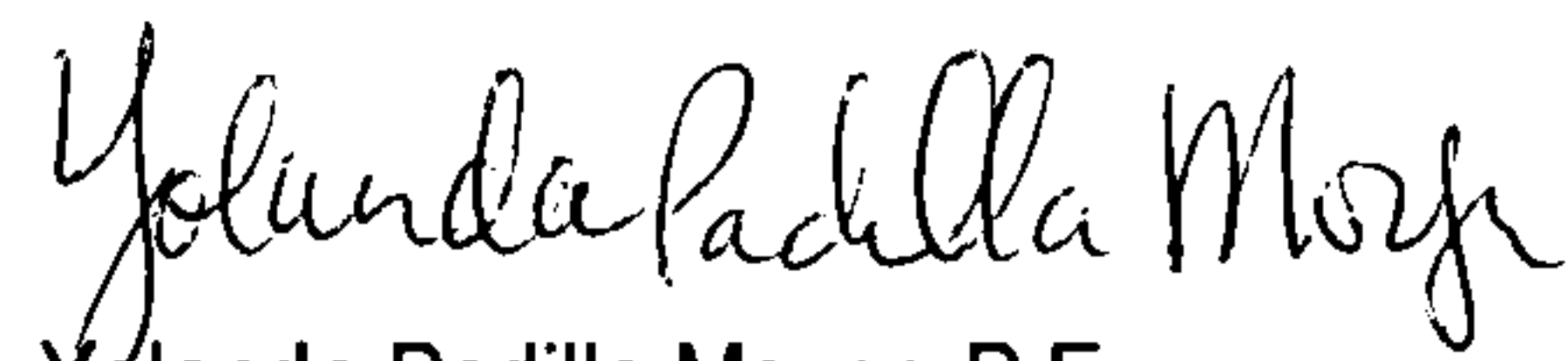
The purpose of this letter is to provide you with a copy of the individual grading and drainage certification for Lot 35A of Oxbow Bluff Subdivision

Per the letter agreement, dated December 16, 1997, from Tom Keleher with Altura West Ltd, Company (the developer of Oxbow Bluff Subdivision) to Fred Aguirre, City Hydrologist for the City of Albuquerque, the developer agreed to submit drainage certifications for those individual lots with the review and approval from Bohannon Huston Inc. Please note that the original letter indicated that the letters would be submitted to the city on an annual basis or the completion of every 15 houses whichever came first. Due to the number of lots being constructed or lack thereof, I am submitting as I receive final certification from the engineer of record to no lose track of which homes have been completed.

I have reviewed the above mentioned lot prepare by David Soule of Rio Grande Engineering and concur that the lot is in substantial compliance with the approved grading and drainage plan as well as to the drainage report prepared by Bohannon Huston, Inc. dated December 11, 1997. Also, enclosed is a copy of the Engineer of record's certification as well as a copy of the latest Grading Plan stamp date 1-28-2010.

I would appreciate a letter from you indicating that you have received the certification and any comments you might have concerning the submittal. If you have any questions or require any additional information be feel free to contact me at 823-1000.

Sincerely,



Yolanda Padilla Moyer, P.E.
Senior Project Manager
Bohannon Huston, Inc

YP/cc
Enclosures

cc: Kevin Patton, BHI
Doug Guinn, ACC Liaison

RIO GRANDE ENGINEERING OF NEW MEXICO, LLC

November 9, 2010

Ms. Kathryn Guinn, Chair
Oxbow Residential Homeowners Association
4006 Silvery Minnow NW
Albuquerque NM 87120

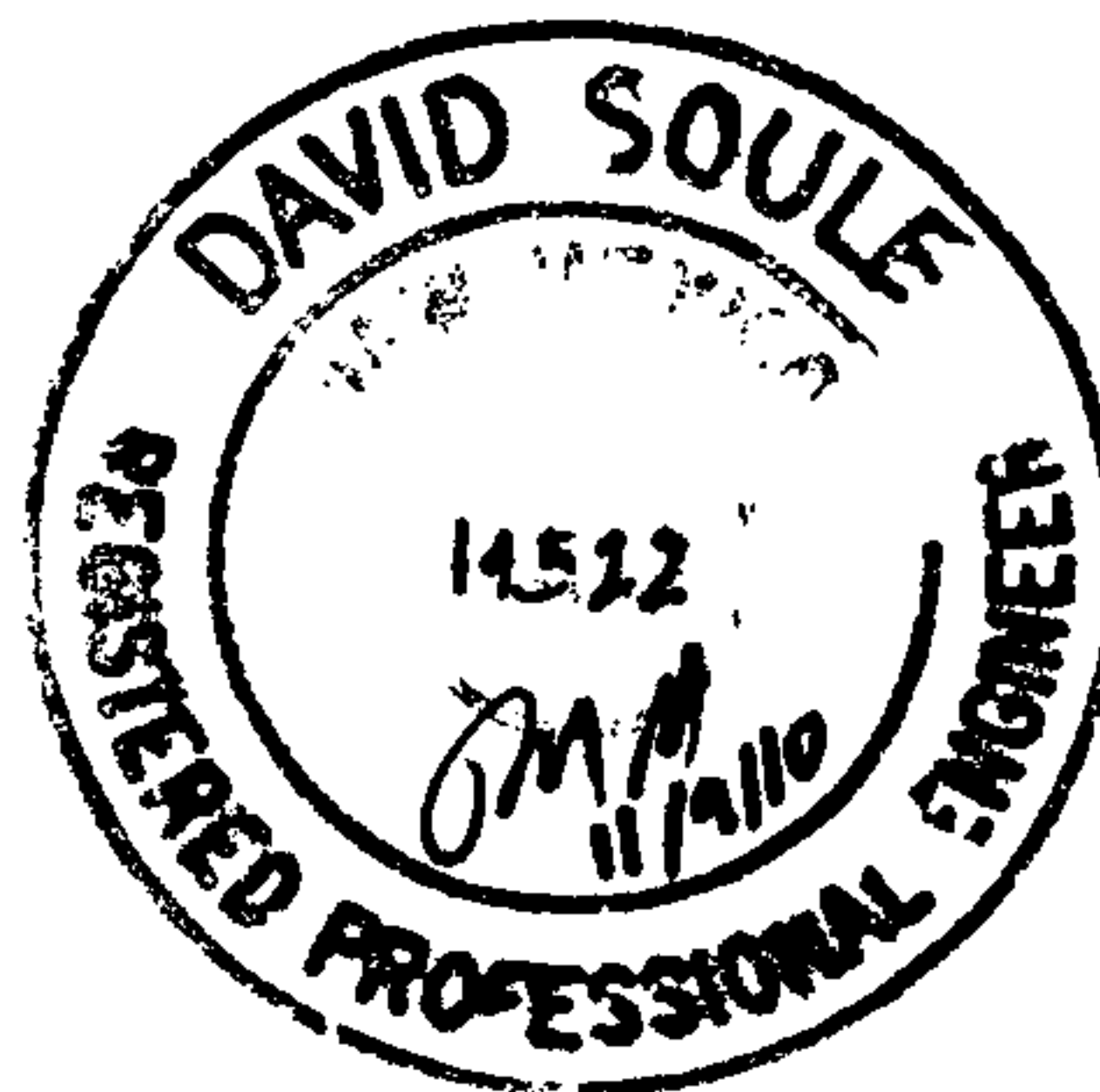
**RE: Engineers Certification for Grading
Lot 35A, Oxbow Bluff**

Dear Ms. Guinn:

The purpose of this letter is to certify that the grading of Lot 35A, Oxbow Bluff was completed and is in substantial compliance to the approved grading Plan. I have personally visited the site and reviewed the as-built survey obtained by my office.

Should you have any questions regarding this certification, please do not hesitate to contact me.

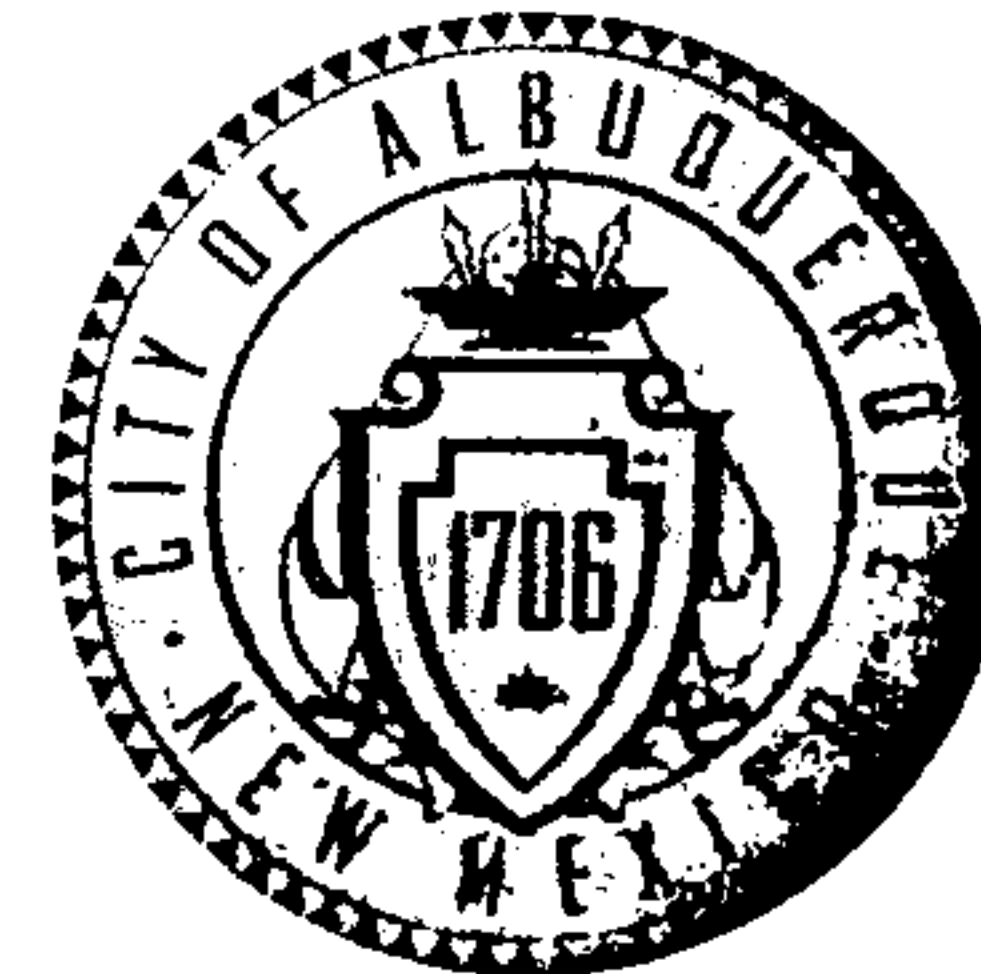
Sincerely,



David Soule, PE
Rio Grande Engineering
PO Box 67305
Albuquerque, NM 87193
505-321-9099

Enclosures

CITY OF ALBUQUERQUE



February 3, 2010

David Soule, P.E.
Rio Grande Engineering
P.O. Box 67305
Rio Rancho, NM 87193

Re: **Lot 35A Oxbow Bluff, 5008 Grey Hawk Ct NW, Grading and Drainage Plan**
Engineer's Stamp date 1-28-10 (G11/D014D)

Dear Mr. Soule,

Based upon the information provided in your submittal received 2-2-10, the above referenced plan is approved for Building Permit. Please attach a copy of this approved plan to the construction sets prior to sign-off by Hydrology.

Prior to Certificate of Occupancy release, Engineer Certification per the DPM checklist will be required.

Sincerely,

Curtis A. Cherne, P.E.
Senior Engineer, Planning Dept.
Development and Building Services

C: file

PO Box 1293

Albuquerque

NM 87103

www.cabq.gov

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 01/28/2003rd)

PROJECT TITLE: 5008 Greyhawk Court
DRB #: _____ EPC #: _____

ZONE MAP/DRG. FILE #: G11/D014D
WORK ORDER #: _____

LEGAL DESCRIPTION: Lot 35, Oxbow Bluff
CITY ADDRESS: 5008 Greyhawk Court

ENGINEERING FIRM: Rio Grande Engineering
ADDRESS: PO BOX 67305
CITY, STATE: Alb

CONTACT: David Soule, PE
PHONE: (505)321-9099
ZIP CODE: 87193

OWNER: Sunn Homes
ADDRESS: _____
CITY, STATE: Albuquerque, NM

CONTACT: _____
PHONE: _____
ZIP CODE: 87106

ARCHITECT: _____
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

SURVEYOR: Geo survco
ADDRESS: _____
CITY, STATE: _____

CONTACT: David Vigil/ John Gallegs
PHONE: 975-4567
ZIP CODE: _____

CONTRACTOR: _____
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:

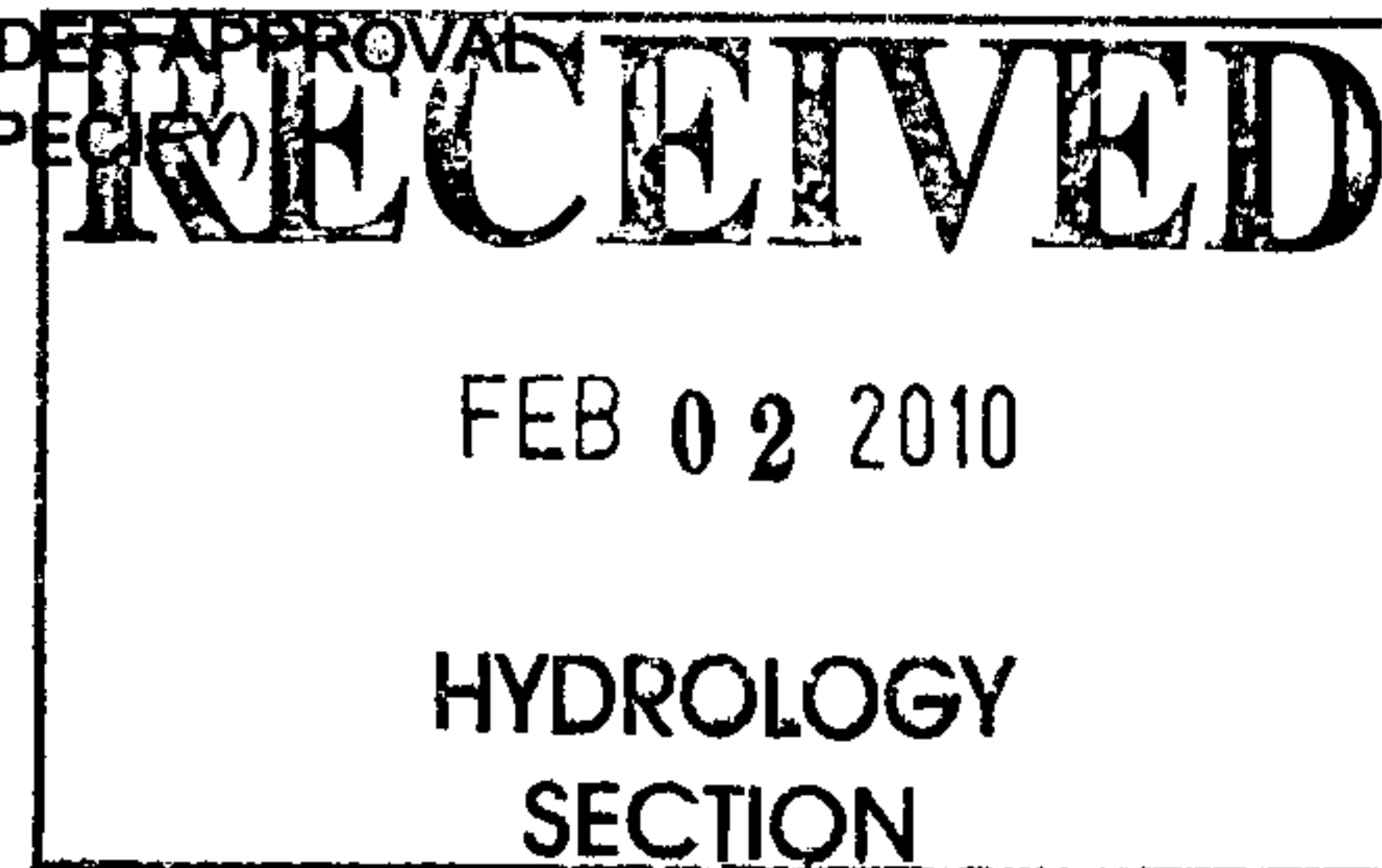
CHECK TYPE OF APPROVAL SOUGHT:

____ DRAINAGE REPORT
____ DRAINAGE PLAN 1st SUBMITTAL, **REQUIRES TCL or equal**
☒ DRAINAGE PLAN RESUBMITTAL
____ CONCEPTUAL GRADING & DRAINAGE PLAN
☒ GRADING PLAN
____ EROSION CONTROL PLAN
____ ENGINEER'S CERTIFICATION (HYDROLOGY)
____ CLOMR/LOMR
____ TRAFFIC CIRCULATION LAYOUT (TCL)
____ ENGINEERS CERTIFICATION (TCL)
____ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
____ OTHER

____ SIA / FINANACIAL GUARANTEE RELEASE
____ PRELIMINARY PLAT APPROVAL
____ S. DEV. PLAN FOR SUB'D. APPROVAL
____ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
____ SECTOR PLAN APPROVAL
____ FINAL PLAT APPROVAL
____ FOUNDATION PERMIT APPROVAL
☒ BUILDING PERMIT APPROVAL
____ CERTIFICATE OF OCCUPANCY (PERM.)
____ CERTIFICATE OF OCCUPANCY (TEMP.)
____ GRADING PERMIT APPROVAL
____ PAVING PERMIT APPROVAL
____ WORK ORDER APPROVAL
____ OTHER (SPECIFY) _____

WAS A PRE-DESIGN CONFERENCE ATTENDED:

____ YES
____ NO
____ COPY PROVIDED



DATE SUBMITTED: 10/30/2009 BY: David Soule

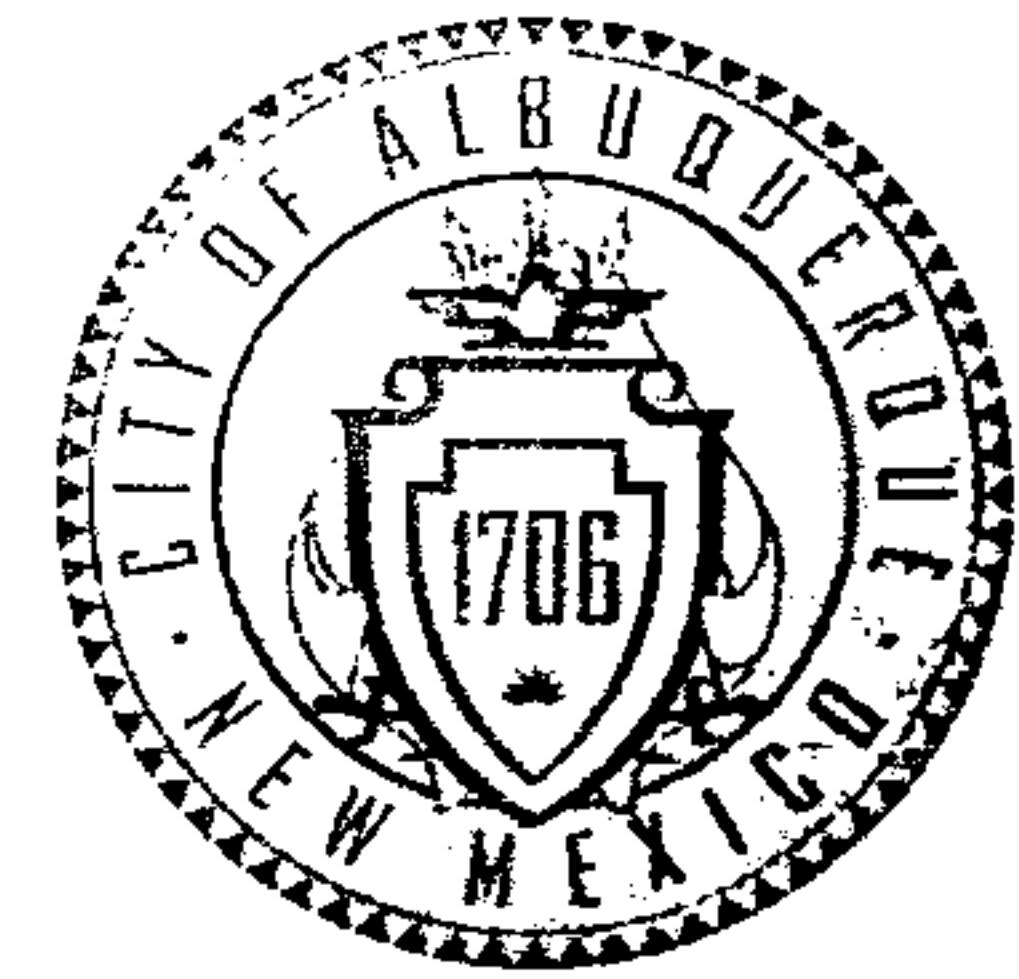
Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal.

The particular nature, location and scope of the proposed development defines the degree of drainage detail.

One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plans:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
2. **Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres.
3. **Drainage Report:** Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

CITY OF ALBUQUERQUE



October 6, 2009

David Soule, P.E.
Rio Grande Engineering
P.O. Box 67305
Rio Rancho, NM 87193

**Re: Lot 35A Oxbow Bluff, 5008 Grey Hawk Ct NW, Grading and Drainage Plan
Engineer's Stamp date 9-18-09 (G11/D014D)**

Dear Mr. Soule,

Based upon the information provided in your submittal received 9-24-09, the above referenced plan cannot be approved for Building Permit until the following comments are addressed:

PO Box 1293

Albuquerque

NM 87103

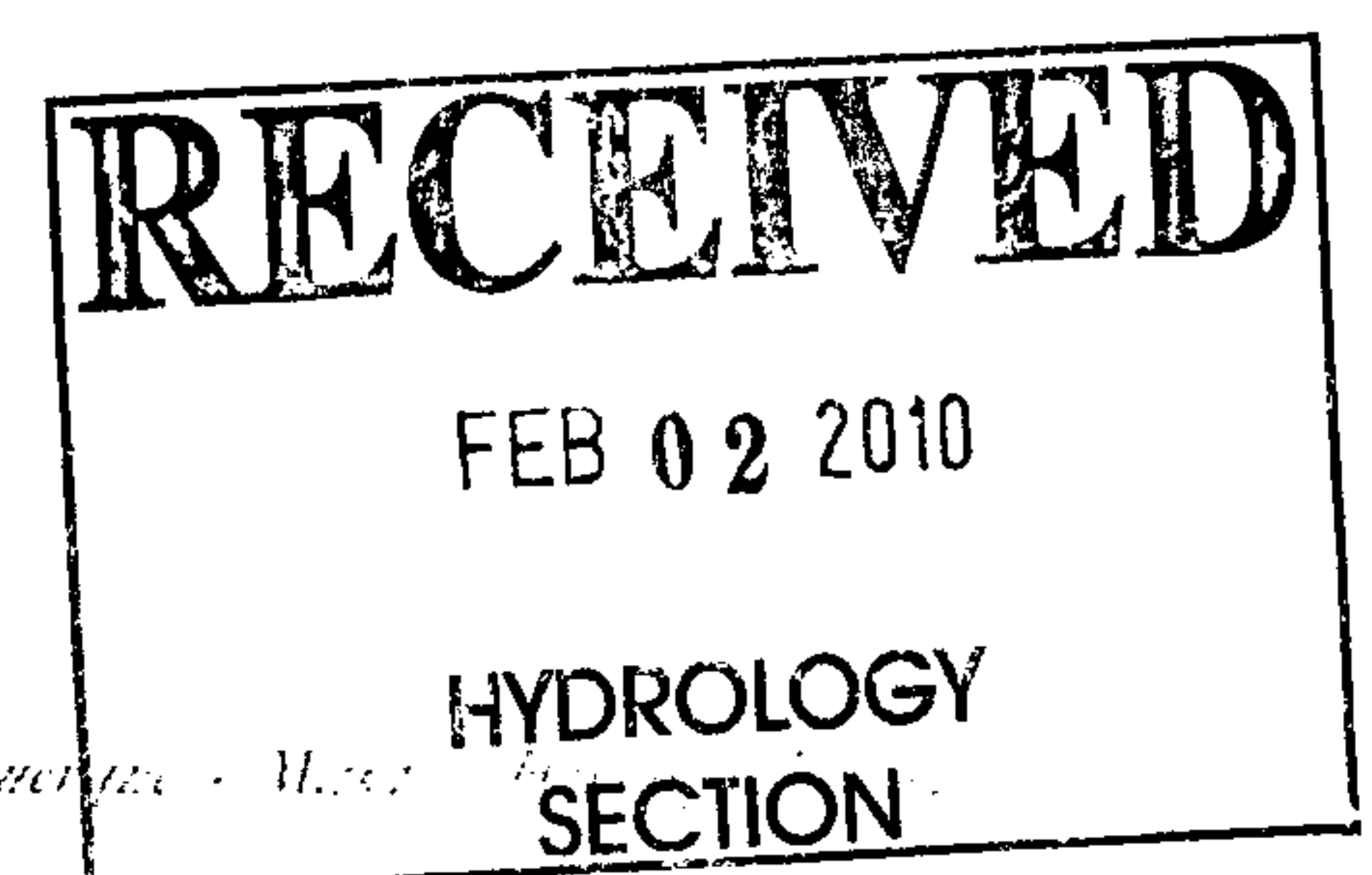
www.cabq.gov

- Provide a copy of the plan approved by the HOA's Engineer with the approval letter.
- It appears that a plan acceptable to the HOA's Engineer will be acceptable to Hydrology.

Sincerely,

Curtis A. Cherne, P.E.
Senior Engineer, Planning Dept.
Development and Building Services

C: file



Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

February 1, 2010

Ms. Kathryn Guinn, Chair
Oxbow Residential Homeowners Association
4006 Silvery Minnow NW
Albuquerque, NM 87120

Re: Lot 35A - Oxbow Bluff; Review of the Lot Specific Grading and Drainage

Dear Kathryn:

The purpose of this letter is to inform you that the grading and drainage plan for the above referenced lot within Oxbow Bluff prepared by Rio Grande Engineering Stamp date January 28, 2010 received by Bohannon Huston on February 1, 2010 has been revised in accordance with our previous comment and is acceptable to us. However I would like to point out a typo on the north pond note. The note indicates the pond top to be 5039.35 and the pond bottom to be 5039.85 however the elevations on the pond show the pond top to be 5039.85 and the bottom to be 5037.35. It appears that the elevations are correct and I would ask the note be corrected to reflect as such.

Please let me know if you have any comments or concerns.

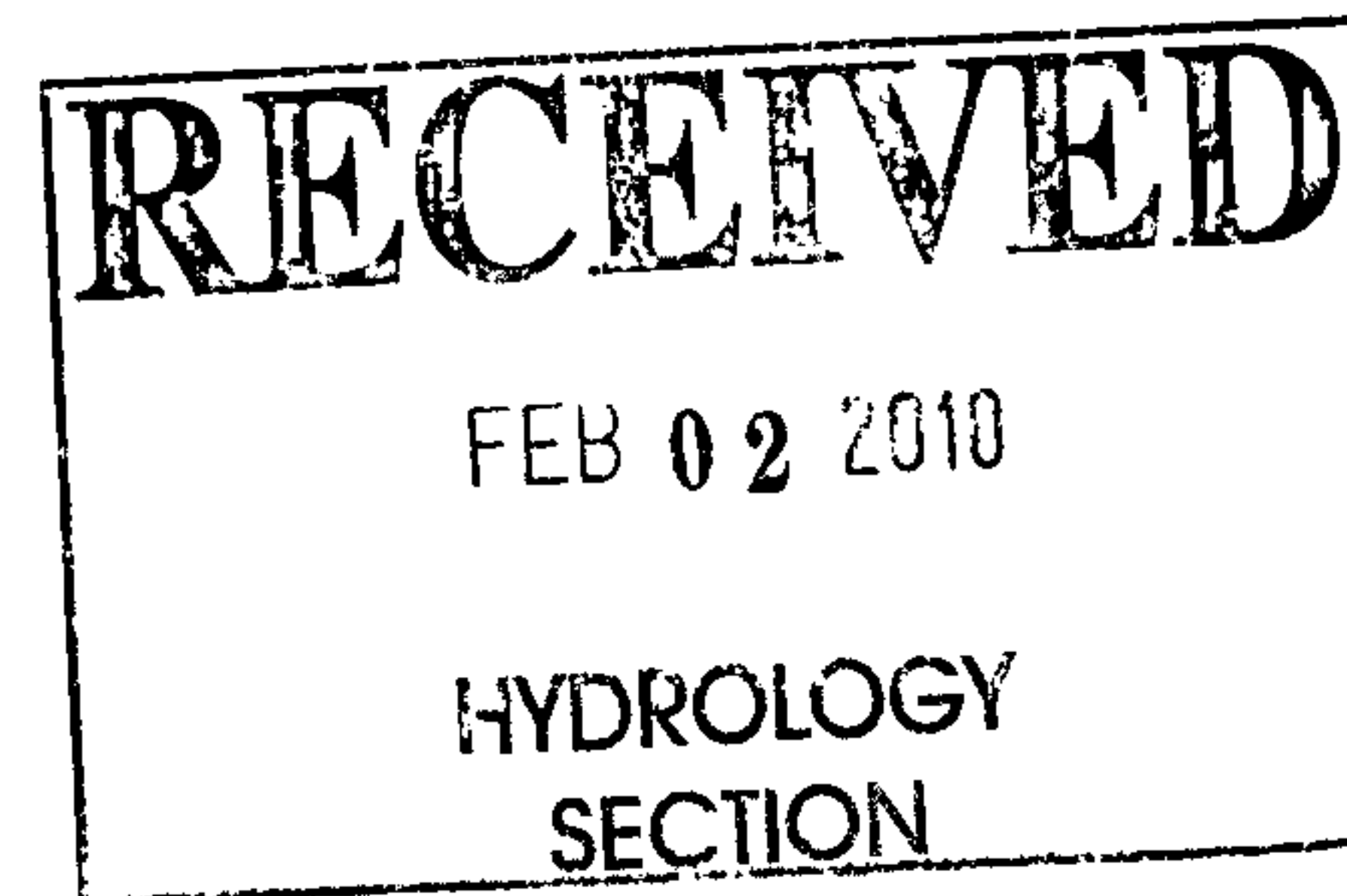
Sincerely,



Yolanda Padilla Moyer, P.E.
Senior Project Manager
Community Development and Planning

YPM/cc

cc: Kevin Patton, BHI
Brad Bingham, COA (w/encl)
Doug Guinn, ACC Liaison
David Soule, Rio Grande Engineering



ENGINEERING *

SPATIAL DATA *

ADVANCED TECHNOLOGIES *



Rio Grande
Engineering

Land Development and Civil Engineering Services

January 28, 2010

Ms Yolanda Padilla Moyer, PE
Senior Project Manager
Community Development and Planning
Bohannon-Huston, Inc
7500 Jefferson St. NE
Albuquerque

**RE: Revised Grading and Drainage Plan
Lot 35A, Oxbow Bluff**

Dear Ms. Padilla Moyer:

Please find the attached revised grading plan. I have revised the plan to comply with your comments. These comments were not provided to me but I received them from the builder. The following is a list of your comments and a summary as to how we addressed them.

1. Per the ACC requirements site must pond 100-year, 6-hour storm event.

The previous grading plans as submitted meet the city requirements as well as conforming to the BHI prepared master drainage study. The ACC requirement does not comply with either but since this is the 5th revision I have created the ponding that will hold the 100-year, 6-hour event. I have added a 10% bulking factor.

2. It is acceptable to not have 8" cap, this was not a comment by BHI.

This was a previous comment by BHI that is why it was added.

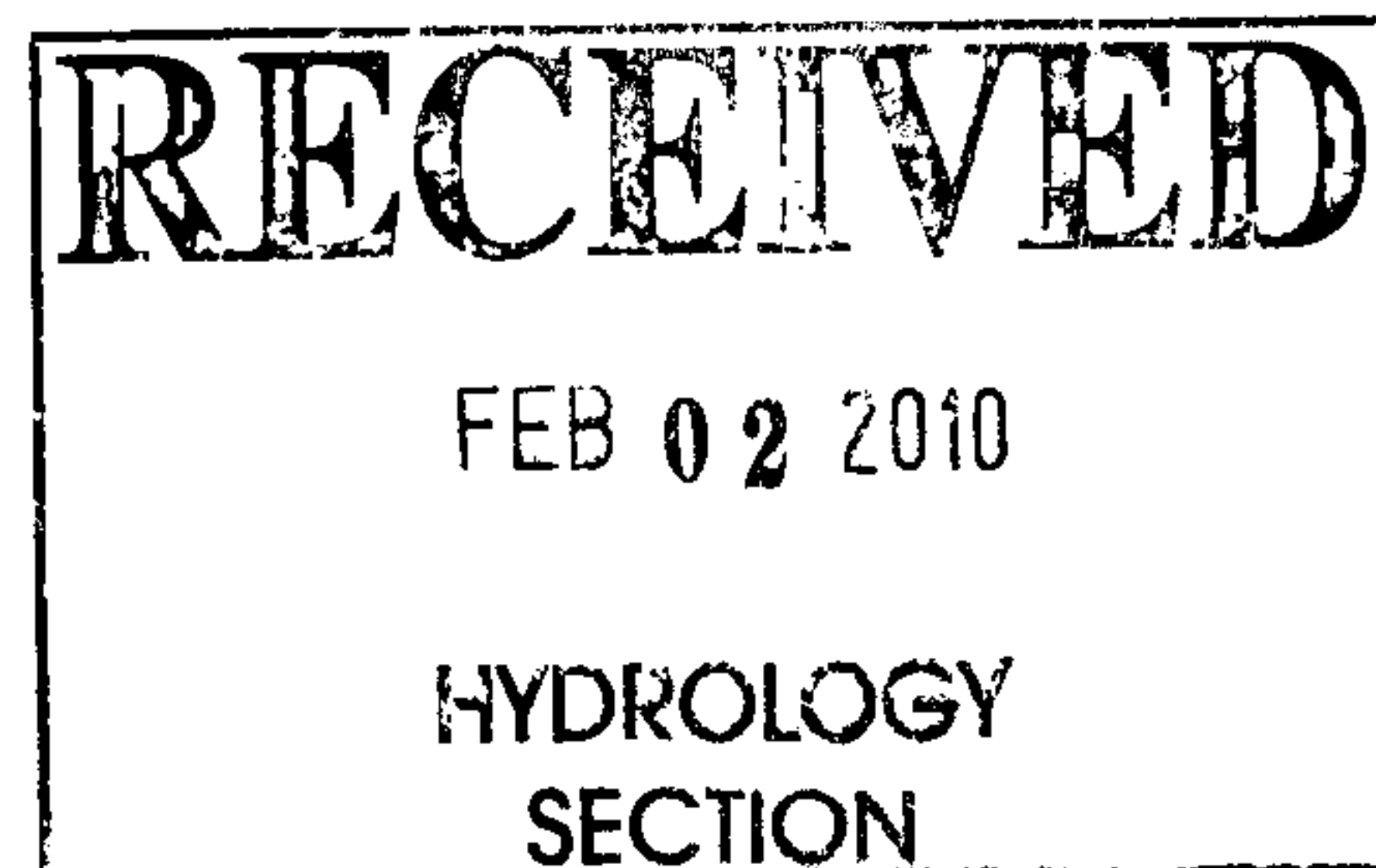
This process has been extremely frustrating. I hope this plan is acceptable. Should you have any questions regarding this submittal, please do not hesitate to email me.

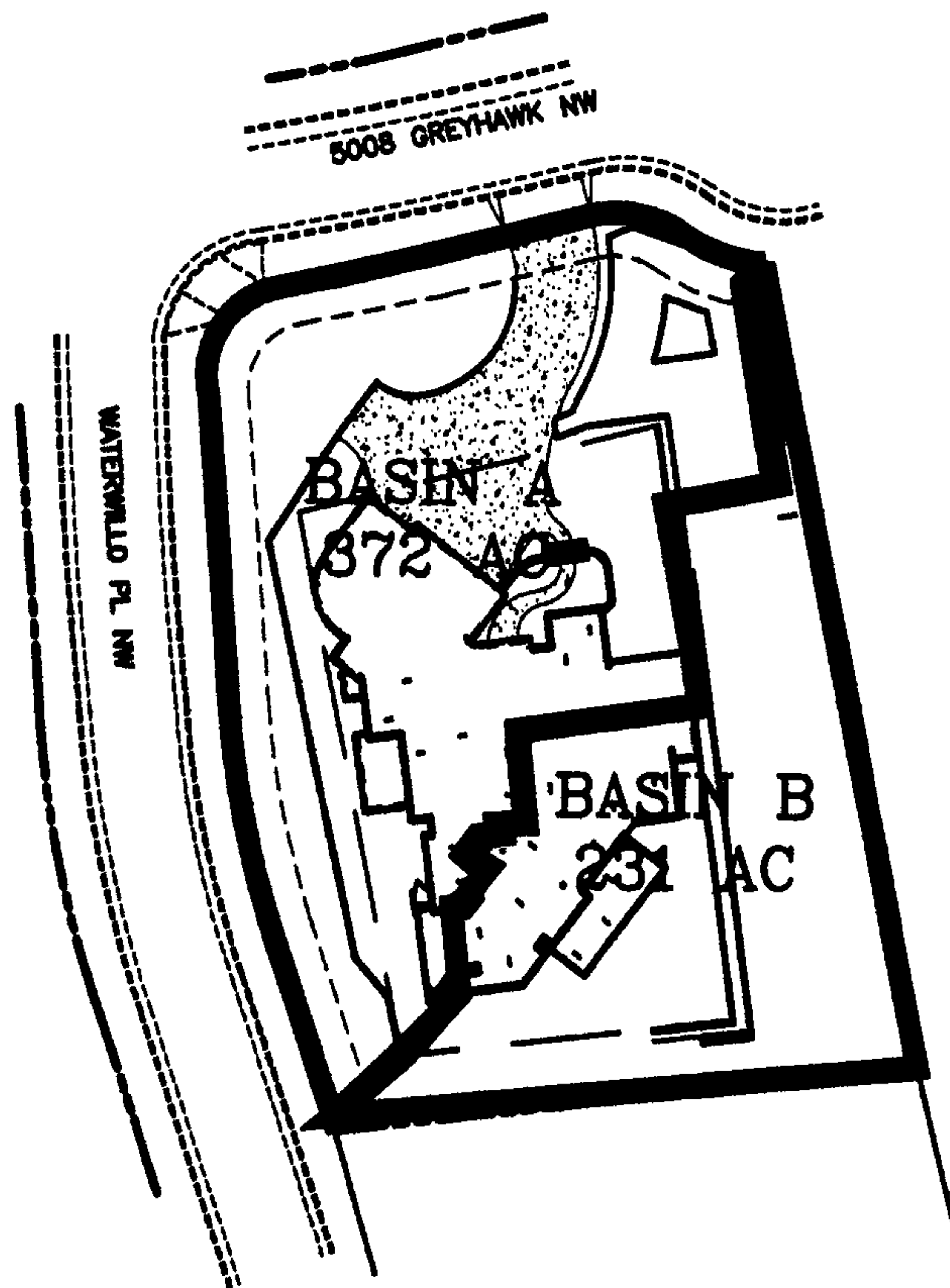
Sincerely,

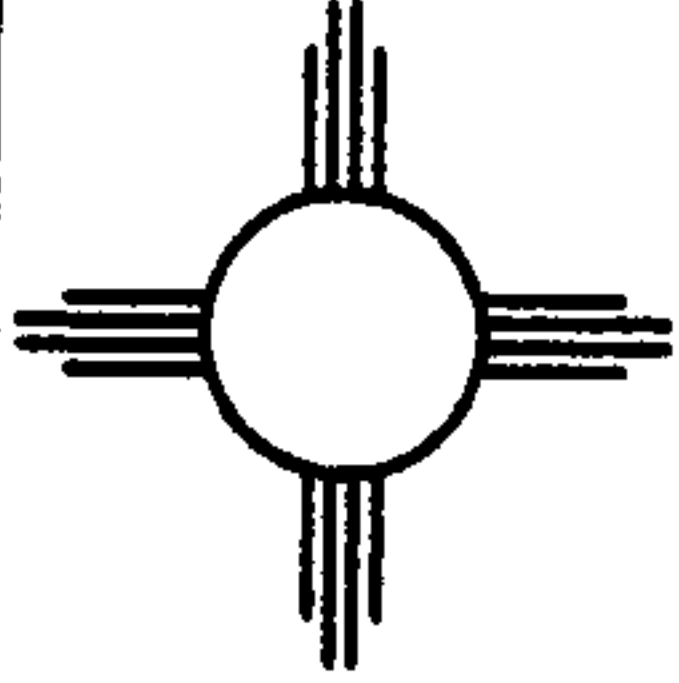
David Soule, PE
Rio Grande Engineering
PO Box 67305
Albuquerque, New Mexico 87193
505-321-9099
david@riograndeengineering.com

Enclosures
cc: file

JN: 2955





ENGINEER'S SEAL	LOT 35A OXBOW	DRAWN BY WCHJ
		DATE 1-27-10
	BASIN MAP	2001-LOT35A-0-10-00
		SHEET # —
DAVID SOULE P.E. #14322	 <i>Rio Grande Engineering</i> 1808 CENTRAL AVENUE SUITE 301 ALBUQUERQUE, NM 87108 (505) 872-0800	JOB # 2931

RECEIVED

FEB 02 2010

HYDROLOGY
SECTION

Weighted E Method

Existing Basins

Basin	Area (sf)	Area (acres)									100-Year			10-day
			Treatment A		Treatment B		Treatment C		Treatment D		Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs	Volume (ac-ft)
			%	(acres)	%	(acres)	%	(acres)	%	(acres)				
ONSITE	19688.00	0.452	100%	0.4519743	0%	0.000	0%	0	0%	0.000	0.440	0.017	0.58	0.017

Proposed Developed Basins

											100-Year, 6-hr.			10-day
Basin	Area (sf)	Area (acres)	Treatment A		Treatment B		Treatment C		Treatment D		Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs	Volume (ac-ft)
			%	(acres)	%	(acres)	%	(acres)	%	(acres)				
ALLOWED	19688.00	0.611	0%	0	61%	0.373	0%	0	39%	0.238	1.177	0.060	1.80	0.092
BASIN A	16204.32	0.372	0%	0	32%	0.119	22%	0.08184	46%	0.171	1.338	0.041	1.22	0.064
BASIN B	10062.36	0.231	0%	0	50%	0.116	18%	0.04158	32%	0.074	1.144	0.022	0.68	0.032
DISCHARGE COMP				0		-0.254		0.082		-0.067		-0.018	-0.575	-0.027

Equations:

Weighted E = $E_a \cdot A_a + E_b \cdot A_b + E_c \cdot A_c + E_d \cdot A_d$ / (Total Area)

Volume = Weighted D * Total Area

$$\text{Flow} = Q_a \cdot A_a + Q_b \cdot A_b + Q_c \cdot A_c + Q_d \cdot A_d$$

Where for 100-year, 6-hour storm

Ea= 0.44

Qa= 1.29

Eb= 0.67

Qb= 2.03

Ec= 0.99

Qc= 2.87

Ed= 1.97

Qd= 4.37

SITE SHALL RETAIN THE 100-YEAR, 6-HOUR STORM WATER VOLUME OF

0.041 ac-ft
0.022

1988.1 cubic feet (including 10% bulking)
1054.8

basin a
basin b

David Soule

From: bill chreist [sunquality@comcast.net]
Sent: Tuesday, January 26, 2010 12:47 PM
To: David Soule
Subject: Fwd: Oxbow BLuff Lot 35A

David, the person at the ACC is back in town and sent me the following e-mail about Yolanda from BHI. Have you had this response sent to you? Let me know what can be done about it. Thanks,
Bill Chreist

Begin forwarded message:

From: jguinn50@comcast.net
Date: January 26, 2010 12:40:59 PM MST
To: Bill Chreist <sunquality@comcast.net>
Cc: terry hennigan <hennigan@juno.com>, Van Gilbert <VGilbert@vhgarchitect.com>, bunny <laconiglia@comcast.net>
Subject: Fwd: Oxbow BLuff Lot 35A

Bill:

I received this e mail from Yolanda regarding communication between your Civil Engineer and BHI. I do not understand the background completely, so I must ask the obvious question-" Did you provide all information (Guidelines and Amendments) to your engineer for his use, before you asked him to design your civil work? Amendment #8 states "Ponding is required on all lots in the Oxbow Bluff Subdivision. Retention ponds shall be of sufficient size and capacity to capture all developed flows generated by a six hour 100 year storm event....."

Based on this statement in the Eighth Amendment, I must request that you provide your reasons why you do not think you should make the north pond large enough to meet the required guideline.

Once you have submitted your request for variance I will forward to the ACC for their comments.

I have not received the letter referenced in Yolanda's e mail.

Doug Guinn

----- Forwarded Message -----

From: "Yolanda Padilla Moyer" <ypadilla@bhinc.com>

2/1/2010

To: jguinn50@comcast.net
Cc: "Kevin Patton" <Kpatton@bhinc.com>
Sent: Monday, January 25, 2010 5:54:07 PM GMT -07:00 US/Canada Mountain
Subject: Oxbow BLuff Lot 35A

Hi Doug,

Per David Soule's revised plan/letter dated January 4, 2010, he has noted that he is going to free discharge the northern pond into the street (cul-de-sac) thus not containing the 100-year 6-hours storm event per the Oxbow Drainage Covenant where the lots drain toward the Bluff. This is something the Board can allow if it chooses, however if this is allowed it is recommended that erosion protection be placed from the point of overflow of the pond to the back of curb. This will help direct the flow to the roadway as well as prevent the flow from running along the back of curb and possibly undermine the curb.

As for 8" cap block, this was never a comment from BHI; but with the elimination of it, the drainage will no longer pond at the wall but free flow over it.

2/1/2010

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

September 22, 2009

Ms. Kathryn Guinn, Chair
Oxbow Residential Homeowners Association
4006 Silvery Minnow NW
Albuquerque, NM 87120

Re: Lot 35A – Oxbow Bluff; Review of the Lot Specific Grading and Drainage

Dear Kathryn:

The current agreement with the City of Albuquerque requires that each grading and drainage plan prepared for each individual lot be reviewed by the HOA's licensed engineer (preferably the engineer of record for the approved master drainage study). The agreement also requires that the HOA's engineer review the submitted certifications and submit them to the city along with their concurrence.

We have the following concerns or comments concerning our review of the referenced Grading and Drainage Plan within the Oxbow Bluff Community; said plan was prepared by David Soule; engineers stamped dated 9-18-2009.

- It appears that the survey information and elevation provided are in datum NAD83/88. All previous surveys and plans are done in NAD 27/29. Reviewers need to be aware of the datum change.
- Lot 35A is located in Basin F not Basin L as stated in the letter, so all references and calculations need to be revised to reflect Basin F
- In the proposed basin table it is indicated there is 36% of Land Treatment Type "A". Type "A" is reserved for undisturbed land with a slope from 0% to 10%. If the area has been disturbed and within the same slope range it shall be Land Treatment Type "B" and if it is disturbed with a slope greater than 10% it is Type "C". Land Treatment Types shall be revised to comply with Section 22.2 of the COA DPM. In the Proposed Developed Basins Table, the "Allowed" runoff indicates 58% Type "A", this should be in Type "B" as indicated in the master drainage plan.
- All roof drains and splash pads need to be shown, as well as swales from splash pads to primary swales.
- It appears there is significant grading outside the building envelope. Per the guidelines, there should be minimum grading outside the building envelope. Retaining walls may be necessary to take up grade to reduce disturbance. It is our recommendation that the plan be revised to reduce the impact outside the envelope.
- There appears to be a retaining wall on the west property line. There is a 10' PUE inside the lot adjacent to the right of way. It maybe be necessary to relocate wall on easement line as not to encumber the PUE.
- The swale on western side of home must continue east to safely convey flow to pond.
- Specify pond treatment.

ENGINEERING 

SPATIAL DATA 

ADVANCED TECHNOLOGIES 

△
Ms. Kathryn Guinn, Chair
Oxbow Residential Homeowners Association
September 22, 2009
Page 2

- It appears that the ponds capacity is right at the required level. BHI recommends adding a bulking factor of 10% to account for sediment as is typically required by public agencies. It has been our experience that ponds are not being maintained on a consistent basis by the lot owner between storm events and thus the ponds don't function as designed.
- A swale needs to be installed from low point in driveway to a pond located at the northwest corner of lot. This is necessary for erosion and to prohibit the discharge of a concentrated flow to the adjacent lot.
- Wall elevations (top of wall and bottom of wall) need to be provided.

Due to the significant comments above, BHI anticipates having to review the revised plan/submittal and may have additional comments. Please let me know if you have any questions or comments concerning our review.

Sincerely,


Yolanda Padilla Moyer, P.E.
Senior Project Manager
Community Development and Planning

YPM/cc

cc: Kevin Patton, BHI
Brad Bingham, COA (w/encl)
Doug Guinn, ACC Liaison
David Soule, Rio Grande Eng. w/encl

File
G11D44D

HIGH MESA Consulting Group

FORMERLY JEFF MORTENSEN AND ASSOCIATES, INC.

2004.094.1

November 20, 2007

Ms. Kathryn Guinn, President
Oxbow Bluff Homeowners Association
4319 Summer Hill Lane NW
Albuquerque, NM 87120

Re: Drainage Analysis for The Eastern Portion of The Oxbow Bluff Subdivision

Dear Kathryn:

We have reviewed the above referenced report dated October 01, 2007 and hand delivered to out office on or about October 03, 2007. In general, we find the report does not address the main issues communicated to the Developer back in January of this year. To reiterate, the primary goals and concerns are as follows:

1. Restrict the discharge of runoff over the Bluff to that which is generated east of the trail.
2. Control the developed runoff west of and including the trail by re-grading the trail and trail bar ditch.
3. Protection of the trail and Bluff
4. Minimize the maintenance responsibilities for the HOA.

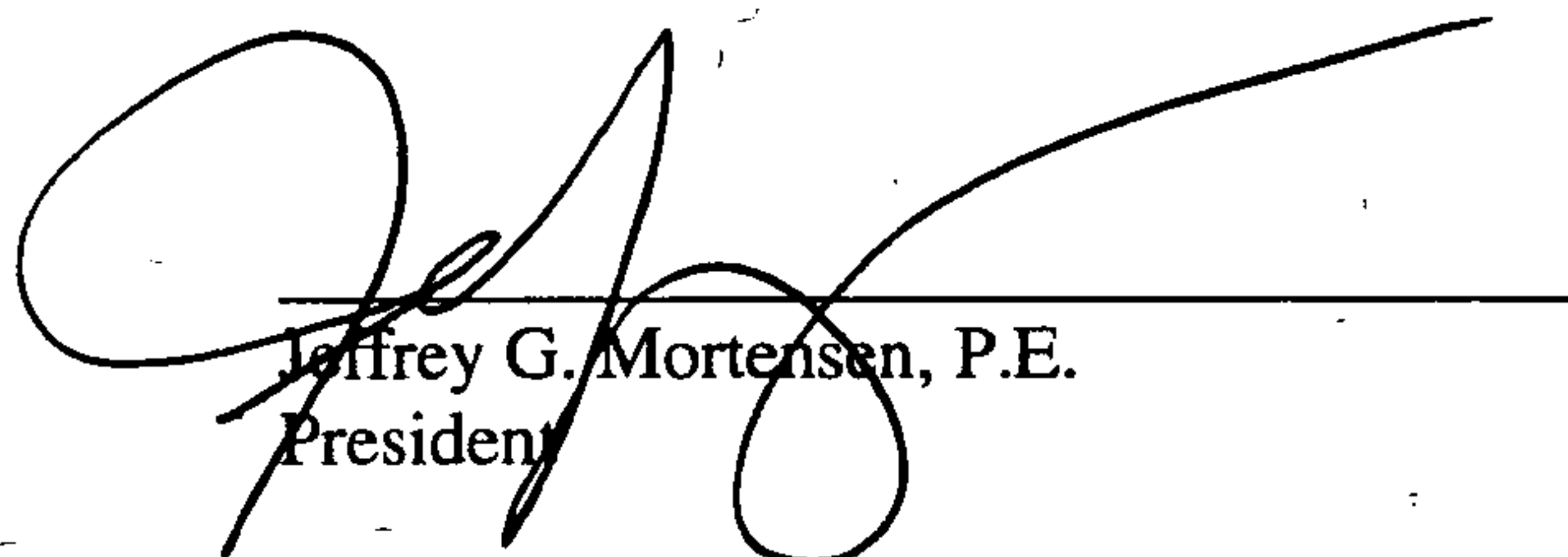
Attached is a copy of a more detailed recap of our expectations for the Report on behalf of the HOA. Attached thereto is a less detailed correspondence from the City Hydrologist, Mr. Brad Bingham, concurring with the re-grading of the trail and bar ditches. His opinion was based upon a field visit conducted January 30, 2007 with Mr. Charles Berry, Mr. Kevin Patton, Mr. Bingham and me all in attendance.

We maintain that the Report should address all items enumerated in our letter dated April 17, 2007 in order that the Developer reach a point whereby maintenance of the trail and associated open space be turned over to the HOA for future maintenance. It is our opinion that the October 01, 2007 does not completely address the concerns of Mr. Bingham and High Mesa Consulting Group. We therefore recommend a meeting with all concerned parties to regroup and get this effort back on track. In order to schedule such a meeting, all addressees should contact this office to arrange a date that works for all. We further suggest that the meeting be held in the offices of High Mesa Consulting Group.

Please review this information at your earliest convenience. If you or the HOA should have any questions or comments concerning this report, or if we can be of further service, please do not hesitate to call.

Sincerely,

HIGH MESA CONSULTING GROUP



Jeffrey G. Mortensen, P.E.
President

Principals: Jeffrey G. Mortensen, P.E. • Charles G. Cala, Jr., P.S. • Juan M. Cala
Joseph M. Solomon, Jr., P.S. • J. Graeme Means, P.E. • Richard C. White • Grady E. Barrens

THESE LETTERS

suggest there have
been problems w/ swale
along trail & capacity of
grates (see hire).

Unknown how Resolved.

~~File~~

12/5/2015

2004.094.1

November 20, 2007

Page 2

Enclosures

Xc: Brad Bingham
Kevin Patton
Tom Keleher

G11/D014D

 ENGINEERS & SURVEYORS	JEFF MORTENSEN & ASSOCIATES, INC.	P: 505.345.4250
	6010-B MIDWAY PARK BLVD. NE ALBUQUERQUE - NEW MEXICO 87109	F: 505.345.4254 ESTABLISHED 1977

2004.094.1

April 17, 2007

Mr. Bradley L. Bingham, P.E.
Principal Engineer, Planning Dept.
Development and Building Services Division
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Re: Oxbow Bluff Subdivision Open Space and Trail

Dear Brad:

We are in receipt of your letter dated April 06, 2007. To make sure the thrust of the letter is clear and so it shall serve as a Pre-design Recap for that portion of the Subdivision, we submit the following understandings:

1. A formal Drainage Submittal prepared by the Developer's Engineer s required to address the following –
 - a. Proposed grading of the Oxbow Bluff trail/open space area that abuts the top of the west bluff and city Open Space
 - b. Hydrologic calculations for upstream contributing areas including all routing and abstractions as allowed per the DPM
 - c. Hydraulic calculations to support capacities of the trail bar ditch, beehive inlets, beehive inlet ponds, and any other drainage features as appropriate
 - d. Identification of maintenance responsibilities of all components of the drainage facilities contained within the trail/open space area
2. Credit for individual on-lot ponding will be allowed per the approved Master Plan.
3. Whereas the approved Master Plan proposed sheetflow over the Bluff, the development of the trail/open space area has modified the method and character of that discharge from the subdivision over the Bluff. These changes will be supported and documented by the formal Drainage Submittal referenced above.
4. The formal Drainage Submittal shall be submitted to the City Engineer's Office for review and approval as well as the Oxbow Bluff Homeowners Association (HOA) for review and concurrence.
5. Upon approval of the formal Drainage Submittal for the proposed grading and/or improvements, the Developer shall initiate the work required to satisfy the requirements of the approved Plan.
6. Upon completion of the proposed grading and/or improvements, a Final Inspection shall be conducted to include the Developer, City Engineer's Office and the HOA.
7. Upon approval of the completed work including all punchlist items resulting from the above referenced Final Inspection, the Developer's Engineer shall prepare and submit an Engineer's Drainage Certification in accordance with DPM requirements.

PRINCIPALS	JEFFREY G. MORTENSEN, P.E.	JUAN M. CALA	CHARLES G. CALA, JR., P.S.
GRADY E. BARRENS	J. GRAEME MEANS, P.E.	RICHARD C. WHITE	JOSEPH M. SOLOMON, JR., P.S.

2004.094.1

April 17, 2007

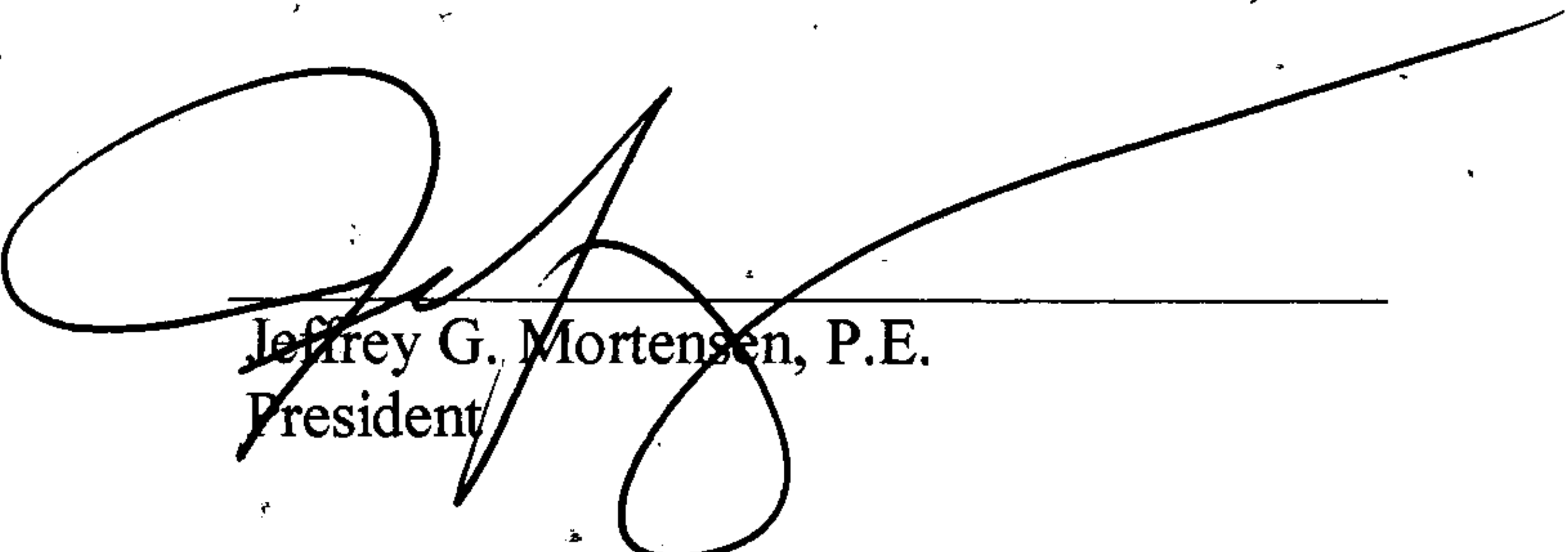
Page 2

8. The process outlined above shall serve as a means to identify and complete any required improvements to the trail/open space area. The goal being to reach a point that the private improvements can then be taken over for maintenance by the HOA and that the HOA understand those specific items that are their responsibility to maintain and those that are the responsibility of the City of Albuquerque.

Please review the above items of clarification. If there are any discrepancies noted or items with which you might disagree, please address those promptly in writing. If you should have any questions or comments regarding this proposed recap, or if we can provide more detail on any of the aspects touched upon, please do not hesitate to call.

Sincerely,

JEFF MORTENSEN & ASSOCIATES, INC.



Jeffrey G. Mortensen, P.E.
President

JGM:jgm.

Xc: Katherine Guinn
Kevin Patton

CITY OF ALBUQUERQUE

6/11/2014

File



April 6, 2007

Kevin Patton, PE
Bohannon Huston, Inc
7500 Jefferson NE
Albuquerque, NM 87109

Jeff Mortensen, PE
Jeff Mortensen & Associates, Inc
6010-B Midway Park Blvd. NE
Albuquerque, NM 87109

Re: Oxbow Bluff Subdivision Open Space

Dear Mr. Patton and Mr. Mortensen,

This letter is in response to the site visit we had on the trail of the Oxbow Bluff Subdivision HOA tract. I was asked to join you in determining what condition the open space is in for before being turned over to the HOA for maintenance. After a long time of consideration, I have come to the following conclusion. The condition of the tract is in relatively good shape with the following exceptions:

1. Some of the trail side-swales have silted in and thus some runoff is crossing the trail instead of being directed into the beehive grates installed on the manholes. Per Mr. Keleher's letter, he is willing to regrade the trail to cant it away from the river and make a better swale in the process. This I heartily concur with.
2. Per the calculations that were exchanged between you two (I have not seen them), the beehive grates and associated collection pond does not have capacity for the existing runoff but they do when all the lots are developed with the required ponding that the covenants require. I was asked to take this into consideration when I see the grading plan for the proposed improvements stated above. I will do this because the approved master plan did allow that the basin in question sheet flow over the bluff and with the improvement in place, the bluff should be much better off. So in the interim, the inlets will be somewhat inundated. Periodic inspection and maintenance is needed in any property and this open space amenity is no exception.

If you have any other questions, you can contact me at 924-3986.

Sincerely,

Bradley L. Bingham

Bradley L. Bingham, PE
Principal Engineer, Planning Dept.
Development and Building Services

C: file

ALTURA WEST LTD. CO.
P.O. DRAWER AA
ALBUQUERQUE, NM 87103

August 17, 2004

**VIA FACSIMILE 839-8544 and
E-MAIL**

Oxbow Bluff Homeowners Association
4060 St. Joseph's Place, NW
Albuquerque, NM 87120

Attention Charles Berry, President

Re: Oxbow Overlook - Possible Erosion Concerns

Dear Charles:

Although I do not believe that Altura West has any legal responsibility to make any modifications to the Oxbow Overlook to alleviate drainage concerns that you have pointed out, and although I do not believe there is a significant likelihood of any substantial erosion occurring on the Oxbow Overlook Bluff, Altura West is willing to perform a limited amount of work to address the situation you have described and which we have discussed.

In line with the foregoing and consistent with the conversations you and I had on the Bluff last Friday, Altura West will, at its expense, do the following:

1. The Oxbow Overlook Bluff Trail/Walking Path will be canted to the west from the southerly portion of Lot 47 to the middle of Lot 42 so that the majority of any rainfall on the trail/walking path will flow to the west.
2. I believe that the bar ditch on the west side of the trail/walking path is currently deep enough to maintain flow. If it needs to be slightly deeper at a couple of points, Altura West will have it deepened slightly.

Charles Berry, President
Oxbow Bluff Homeowners Association
Page 2 of 3
August 17, 2004

3. The existing hay bales and rebar will be removed from approximately the southerly property line of Lot 46 to a point marked by the large bush (approximately half way to the northerly property line of Lot 46); and those hay bales will be replaced by a dirt berm. The dirt berm will be compacted and seeded.
4. We will have the vertical hole that you and I noted (approximately 14 inches or so in diameter) filled.
5. The existing hay bales from approximately the southerly portion of Lot 41 to about the middle of Lot 41 (about 20 feet north of the sprinkler that you and I noted), will be removed; and those hay bales will be replaced by a dirt berm which will be compacted and seeded.
6. You and I walked up to the northerly end of the Subdivision. It doesn't appear to me that there are any areas of existing erosion and I think the likelihood of any significant erosion in the future is extremely small. I do not believe it would be worthwhile to spend money to address potential concerns when the risk of erosion is diminimus and the consequences if erosion does occur are minor. However, as I told you, if the Homeowners Association believes it wants to do something that I don't believe is necessary, and is willing to spend at least half of any estimated cost in addressing such concerns, then Jim Rogers and I will consider Altura West contributing something toward addressing the situation.
7. Finally, I mentioned to you that an important aspect of avoiding potential problems of erosion on the overlook bluff is to see to it that the bar ditch on the west side of the trail/walking path is dug out from time to time, i.e. that silt that blows into that bar ditch is removed. I believe this maintenance item is clearly the responsibility of the Oxbow Bluff Homeowners Association.

As we discussed, in performing the work described above, some of the existing vegetation will be slightly damaged. That is another reason we would not want to place any berms where it does not appear to be truly needed.

I understand that you will be meeting with other members of Oxbow Bluff Board of Directors. Altura West is prepared to pay to implement the work described in Items 1 through 7 at its cost. We do not have an estimate for this, but it will be done on a time and material basis. We do not want to have

Charles Berry, President
Oxbow Bluff Homeowners Association
Page 3 of 3
August 17, 2004

this work done unless it meets the approval of the Oxbow Bluff Homeowners Association. As noted, I do not believe there is a responsibility on Altura West's part to do anything, but in the spirit of goodwill and good relations, Altura West is prepared to do this if it meets with the Board's approval. I look forward to hearing from you at your earliest convenience.

Yours very truly,

ALTURA WEST LTD. CO.


Thomas F. Keleher

TFK/mb

P.S. Assuming the proposal meets with the Board's approval, please get me a key to the vehicular gates so that we can then get the equipment in to the areas where the work is to be done.

Thank you for your cooperation.

cc: Jim Rogers

kmc0879

LARRY READ & ASSOCIATES, Inc.*Civil Engineers*
Site • Drainage • Utility Design

January 22, 2004

ATTN: Ms. Jan Pierce
4407 Lomas Blvd. NE
Albuquerque, NM 87110RE: Carlisle Residence
Lot 45 Oxbow Bluffs Subdivision

On January 14, 2004 I made a site visit to check the drainage improvements as compared to the approved grading and drainage plan. At the time of the site visit the site construction, grading and drainage improvements, and landscaping were substantially complete.

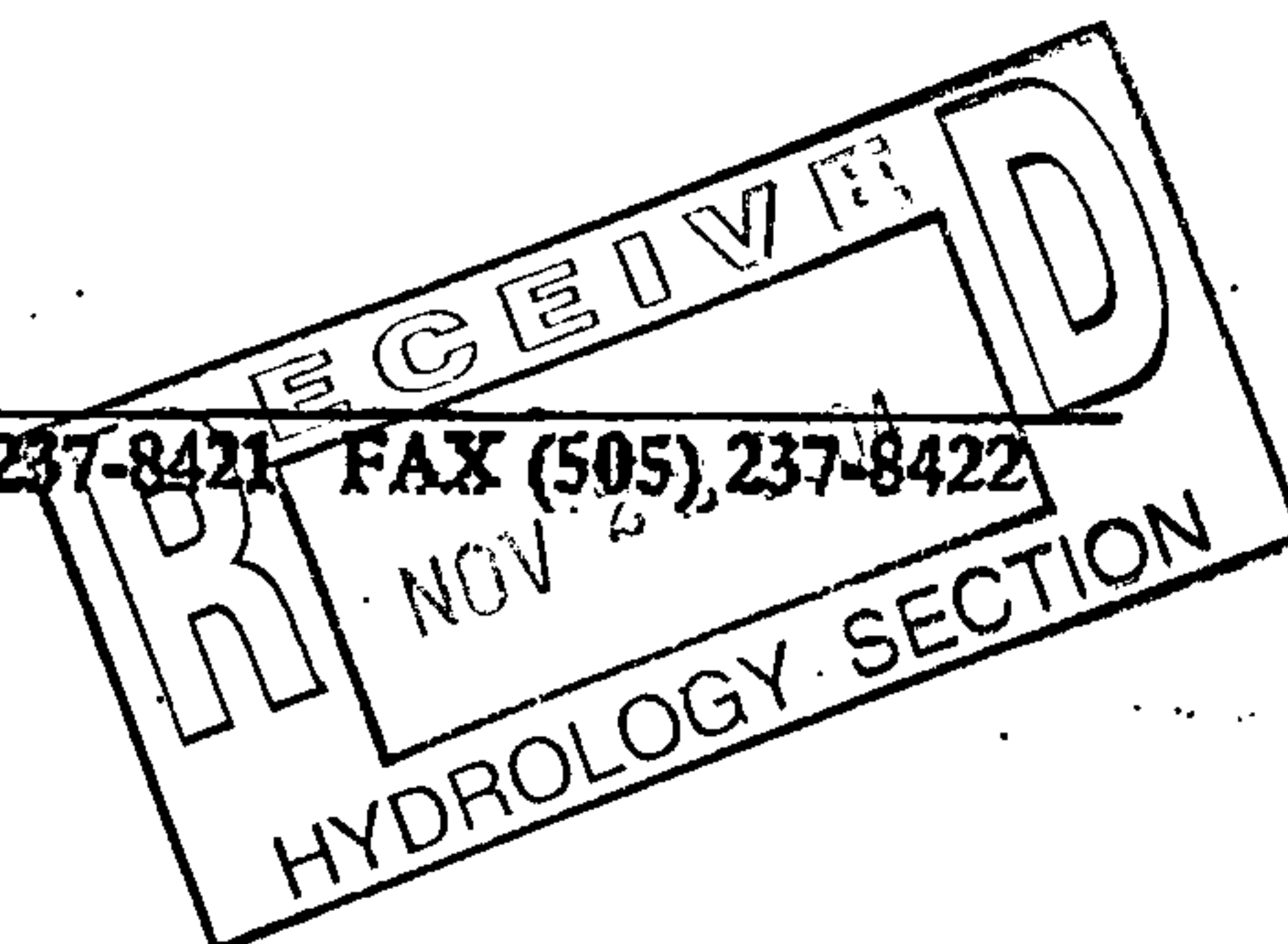
The only variance I observed between the completed grading and drainage construction and the approved plan was the addition of a small water harvesting pond in the southwest corner of the site near the intersection of Mourning Dove Place and Snow Goose Court. Since this pond is in addition to the designed ponding area, I believe it has a positive impact on the site.

Therefore, I am submitting this Engineer's Certification letter to show that the Site grading and drainage is substantially complete and in compliance with the approved grading and drainage plan as of the above date of the site visit.

If you have any questions or comments, please call me at 237-8421.

Sincerely,
LARRY READ & ASSOCIATES, Inc.

Larry D. Read, P.E.



LOT 45

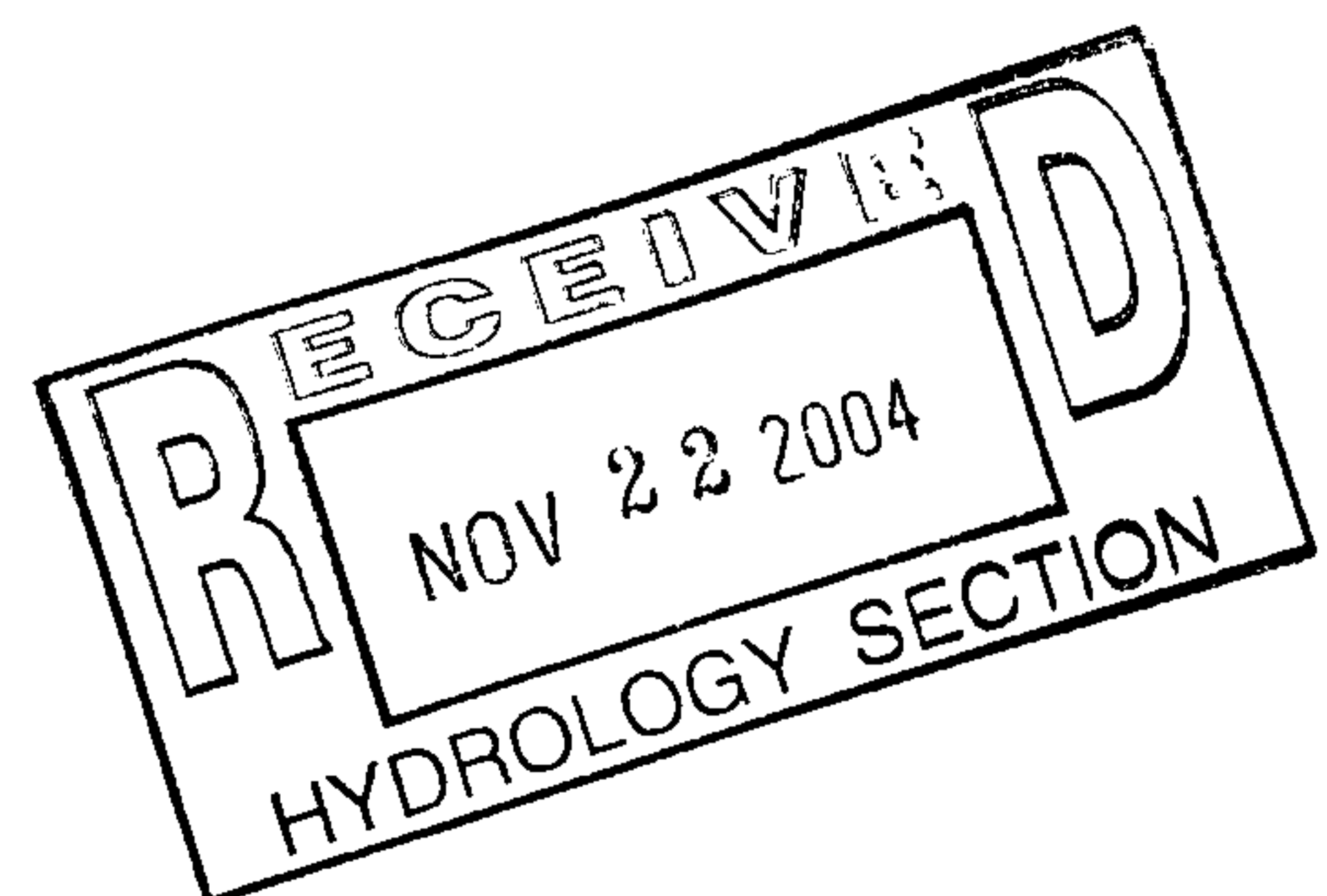
**OXBOW BLUFF SUBDIVISION
ARCHITECTURAL CONTROL COMMITTEE
Transmittal of Drainage Plans**

To: Kevin Patton
Bohannon Huston
From: Paula Dal Santo, ACC Liaison
CC: Tom Keleher
Date: March 1, 2004
2

Dear Kevin,
Please find enclosed the Engineer's Certification of Grading/Drainage Improvements and the Grading and Drainage plan for the following lot:
45

Sincerely,


Paula Dal Santo



FROM : JOHN LOWE

PHONE NO. : 505 856 0657

Aug. 22 2002 06:40AM P2

FROM : C.L. WEISS ENGINEERING

PHONE NO. : 505 266 3444

AUG. 21 2002 07:58AM P1



C.L. Weiss Engineering, Inc.
Post Office Box 97
Sundia Park, N.M. 87047

Phone / Fax (505) 281-1800
Alvarado Office (505) 266-3444

November 8, 2001

Mr. John Lowe
10420 Morning Star Dr. NE
Albuquerque, New Mexico 87111
PH: 856-7372 FAX: 856-1657

RE: ENGINEER'S CERTIFICATION FOR OXBOW BLUFF SUBDIVISION-LOT 29
DRAINAGE/GRADING PLAN-MCCARTY RESIDENCE

Dear Mr. Lowe,

Based on our final site inspection on November 7, 2001, the above-mentioned site is in substantial compliance with the approved Drainage / Grading plan.

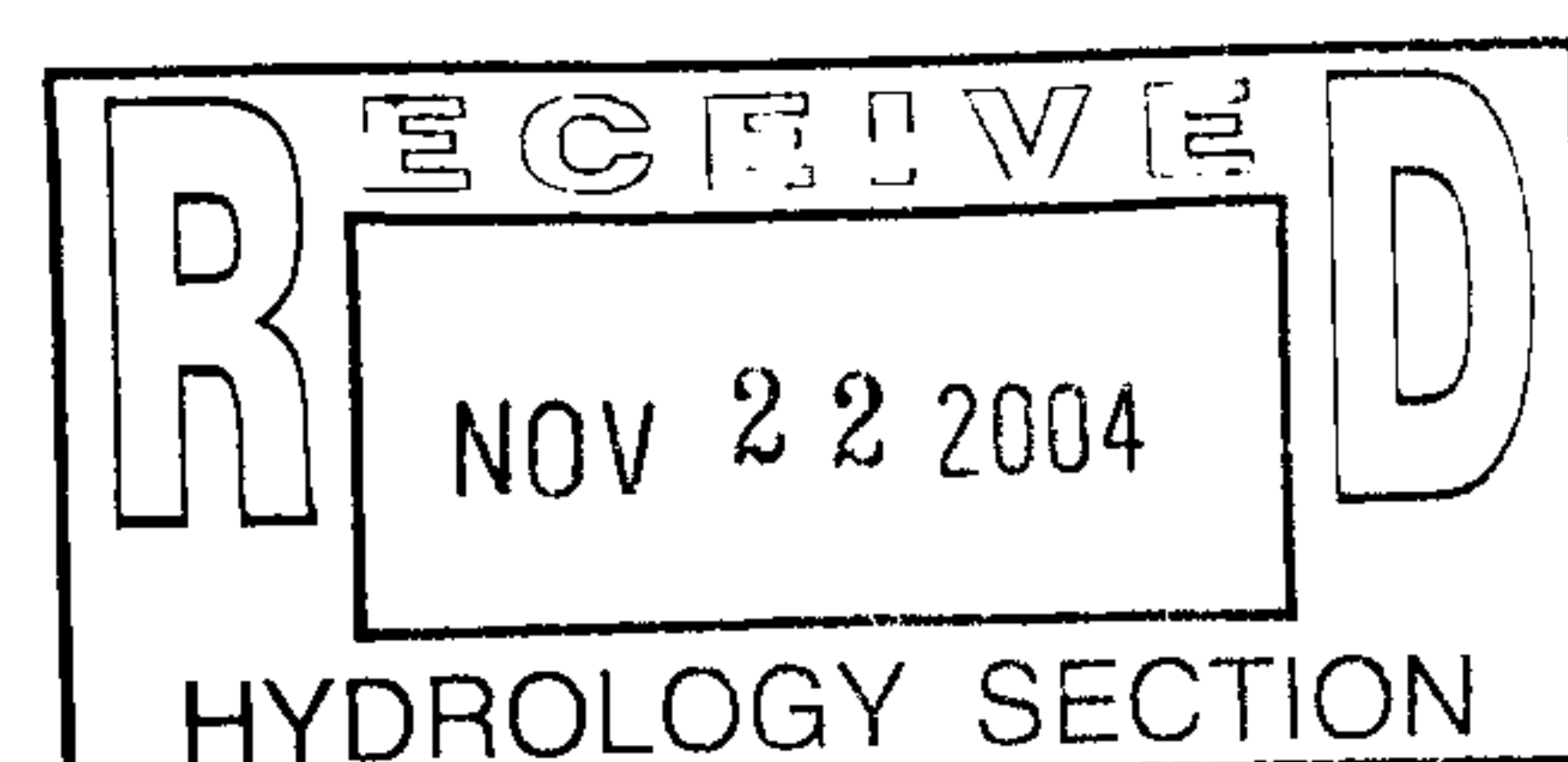
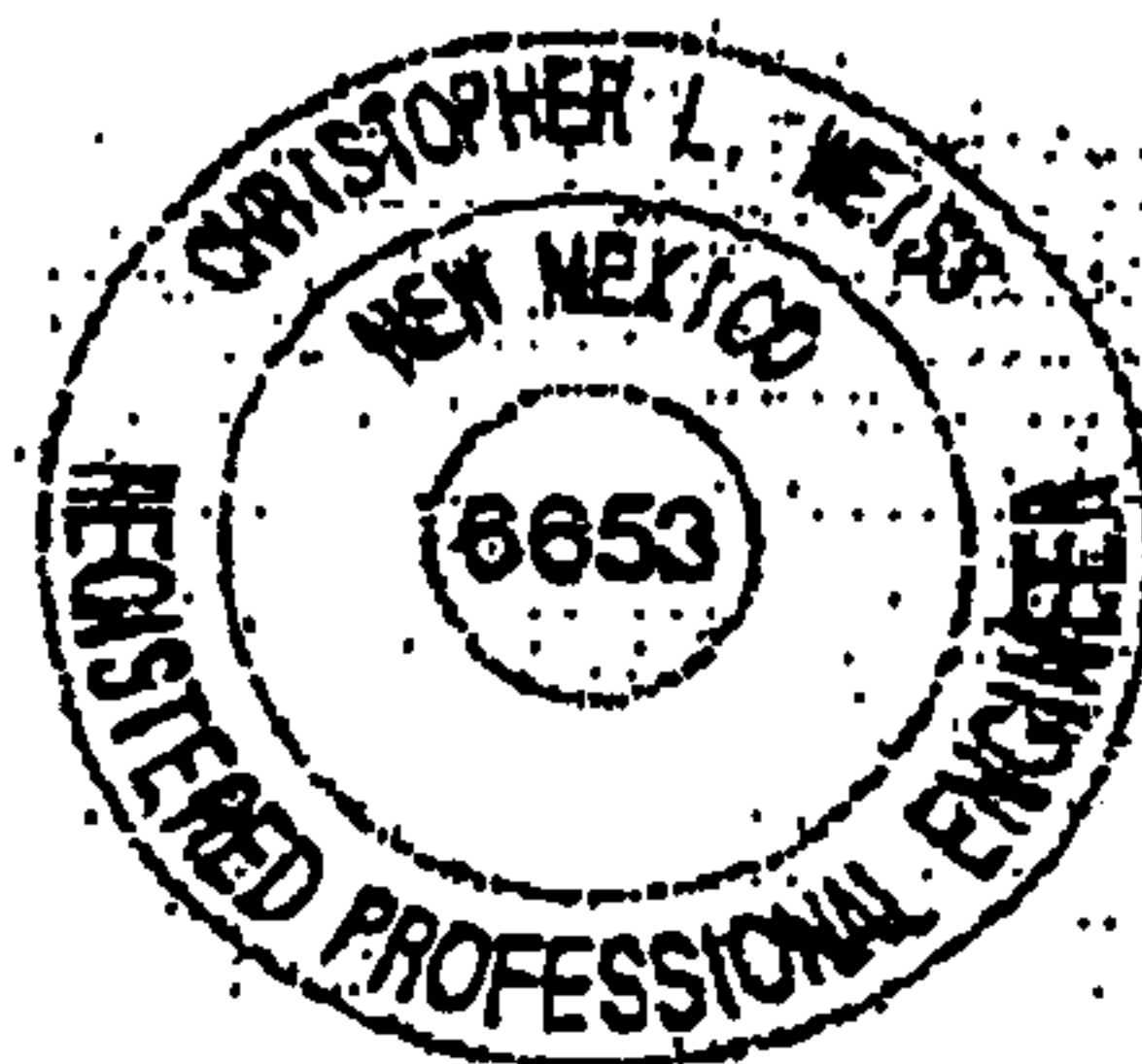
During inspection, we noted the following revisions to the approved plan: (see exhibit)

1. Entry paving reduced. Cobble swales installed at downspout locations to direct concentrated flow to main cobble swale. OK
2. Additional cobble swale on north side of walk. Pipes installed to pass flows to main cobble swale. OK
3. Rear courtyard storm drain inlet / pipe installed to deliver flows directly to ponding area. OK
4. Rear lot grading done - erosion protection fabric provided on slope. OK

Please don't hesitate to call me at 281-1800 with any questions or comments.

Sincerely,

Christopher L. Weiss, P.E.
C. L. Weiss, Engineering, Inc.



FROM : JOHN LOWE

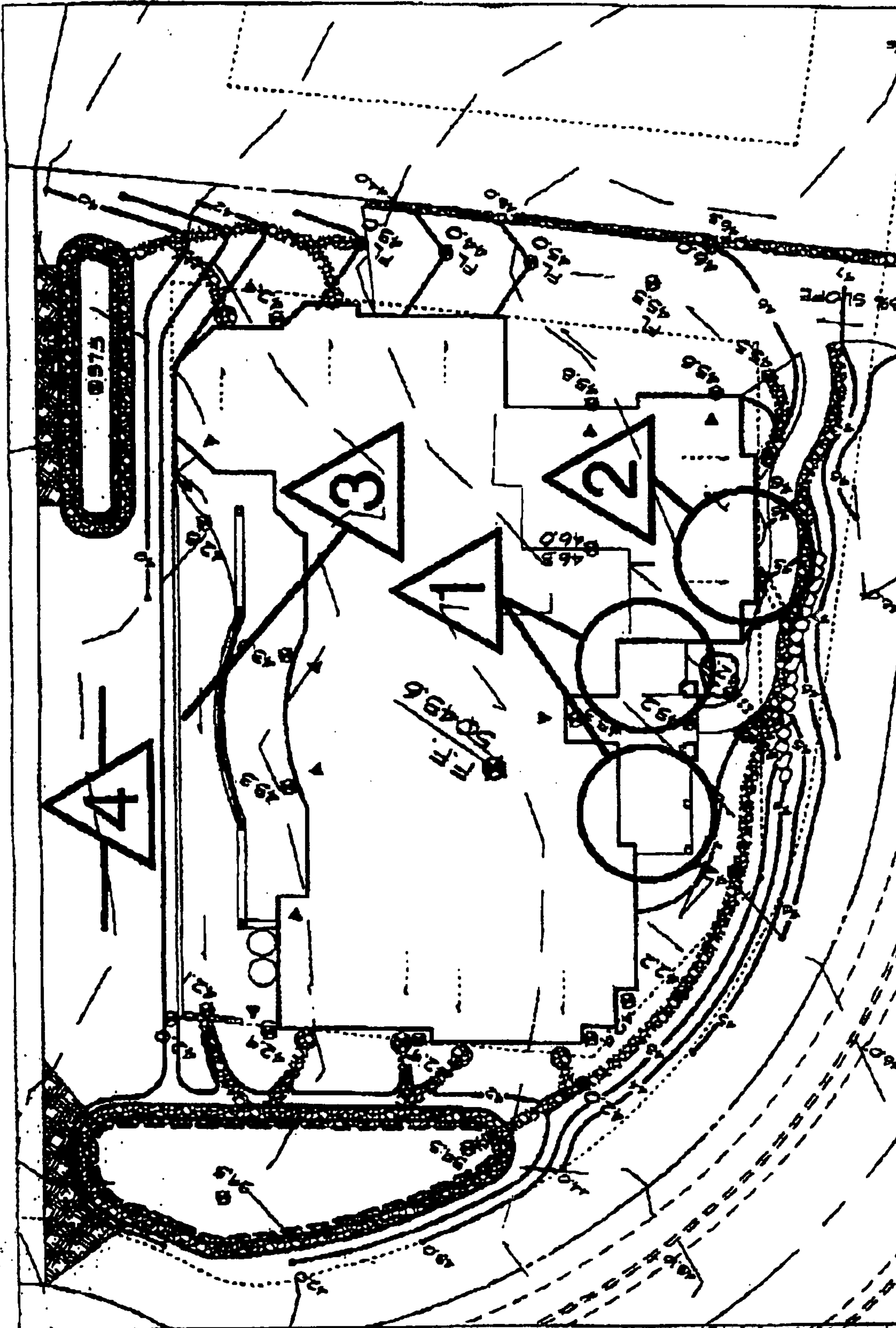
PHONE NO. : 505 856 0657

Aug. 22 2002 06:40AM P3

FROM : C.L. WEISS ENGINEERING

PHONE NO. : 505 266 3444

NOV. 08 2001 02:07PM P2



C.L. WEISS ENGINEERING, INC.

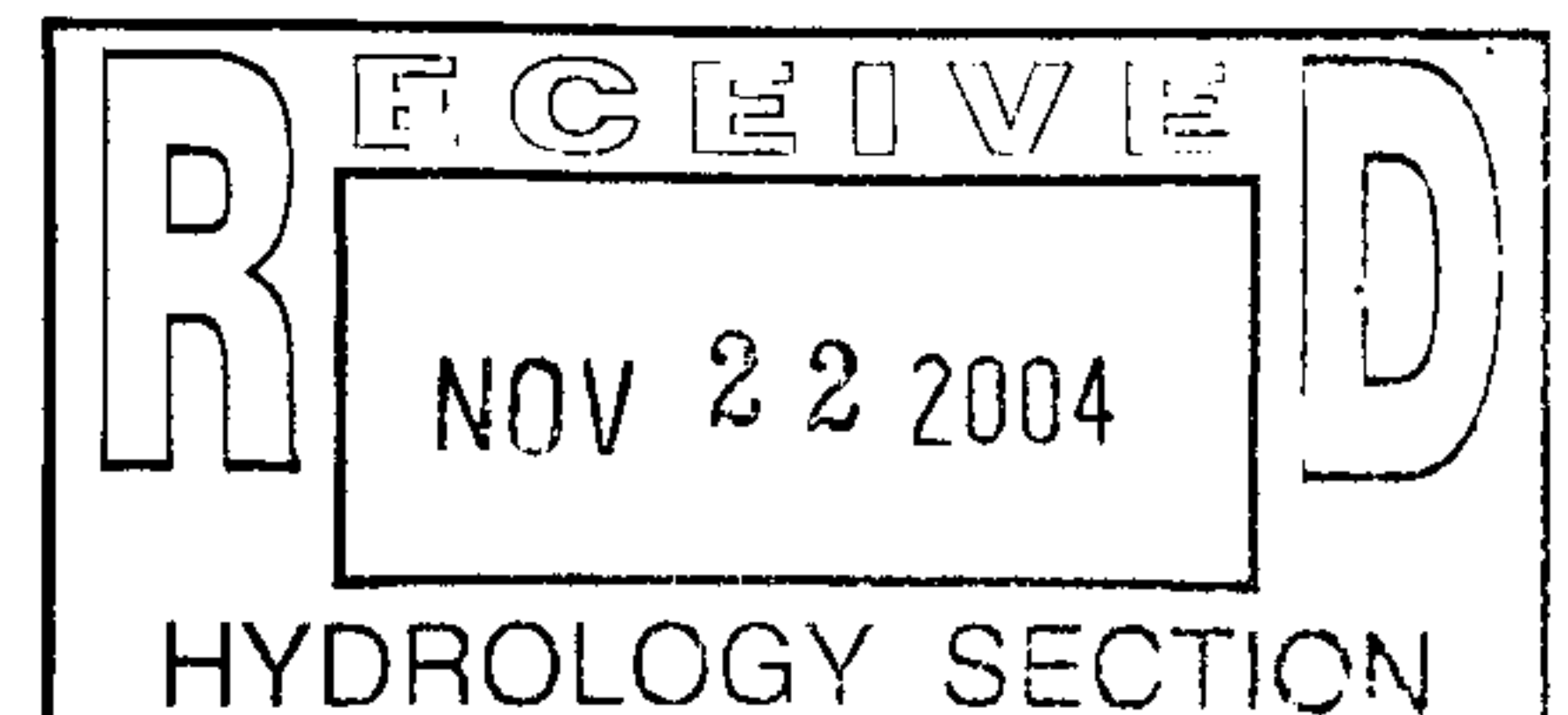
 PORT OFFICE: 1001 W. 10TH AVE., SUITE 100, DENVER, CO 80202
 TEL: 303.733.1111 FAX: 303.733.1112

DRAINAGE REVISIONS EXHIBIT

Nov. 8, 2001

Lot 24 - Oxbow Bluff - McCortly Residence

037 - McCortly.dwg 11/08/01 10:57:25





C.L. Weiss Engineering, Inc
Post Office Box 97
Sandia Park, N.M. 87047

Phone / Fax (505) 281-1800
Alvarado Office (505) 266-3444

December 22, 2000

Oxbow Bluff Architectural Control Committee

RE: LOT 7, OXBOW BLUFF SUBDIVISION – HOWARD RESIDENCE

To Whom It May Concern:

On Wednesday, December 20, 2000, my office conducted a site inspection of Lot 7, Oxbow Bluff Subdivision. The following items are areas of modifications from the approved drainage / grading plan, but do not affect drainage characteristics of the site – please refer to attached exhibit for additional information:

1. Cobble erosion protection on north side of drive not installed – not required based on site inspection. OKAY
2. Cobble swale constructed this area to carry flows east. OKAY
3. Additional site concrete.
4. All flows west of residence follow cobble swale south, then east to pond.
5. Screen wall constructed this area to hide cooler. Flows pass to cobble swale through turned block – owner to maintain.

The remainder of the site was constructed in accordance with the plan with the following exception:

- A. The as-built pond has no defined edge. Contractor / Owner shall line pond perimeter slope with cobbles for erosion protection. Owner's option to use Contech "Pyramat" (Contech Phone: 842-8282) with reseeded installed per manufacturer's recommendations for a more natural look (per Oxbow Bluff approval).

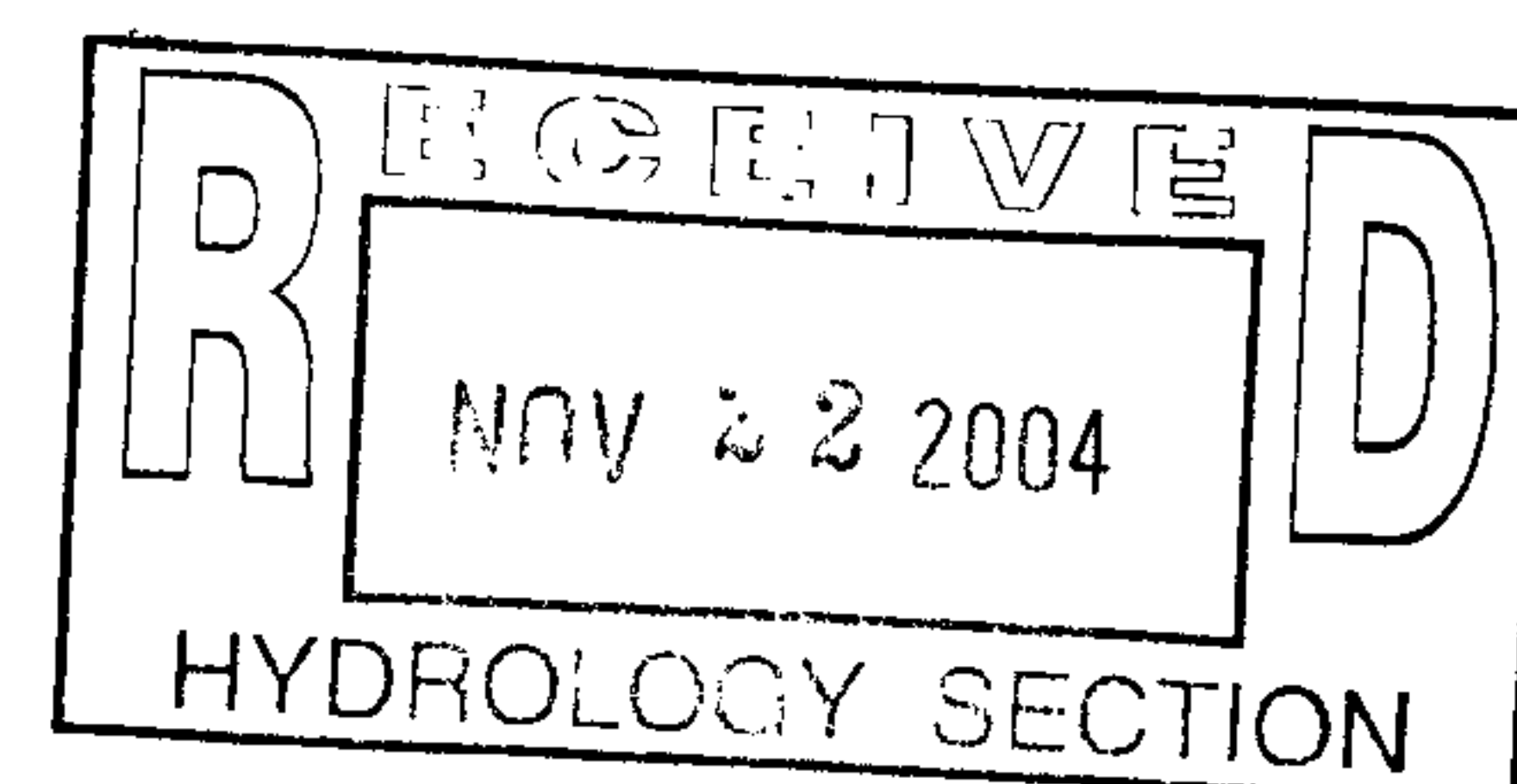
Please call me at 281-1800 if you have any questions.

I, Christopher L. Weiss, P.E. hereby certify that the as-built grades are in substantial compliance with the approved drainage / grading plan, with noted exceptions referenced above.

Christopher L. Weiss, P.E. (N.M.P.E. #6653)

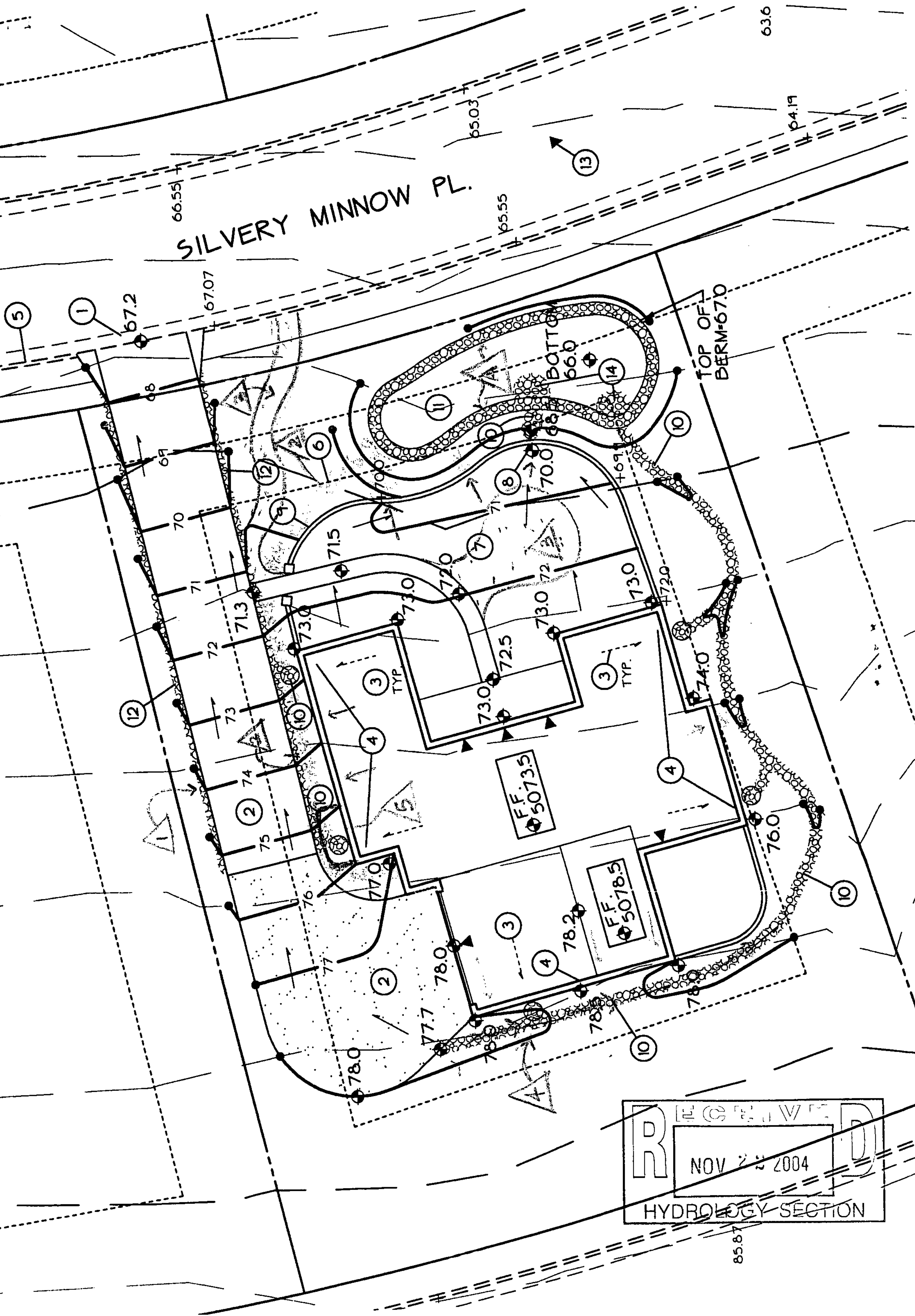
12-22-00

Date



LOT 8

SILVERY MINNOW PL.



Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

November 19, 2004

Brad Bingham, P.E.
Hydrology Division, PWD
City of Albuquerque
P O Box 1293
Albuquerque, NM 87103

Re: Grading and Drainage Certification for Oxbow Bluff Subdivision
Lots ~~5, 7, 8, 9, 16, 21, 29, 31, 32, 45, 46, 49, 50 & 61~~
(COA Hydrology File G11-D14D)

Dear Brad:

The purpose of this letter is to provide you with a copy of each of the individual grading and drainage certifications for the above referenced lots within the Oxbow Bluff Subdivision.

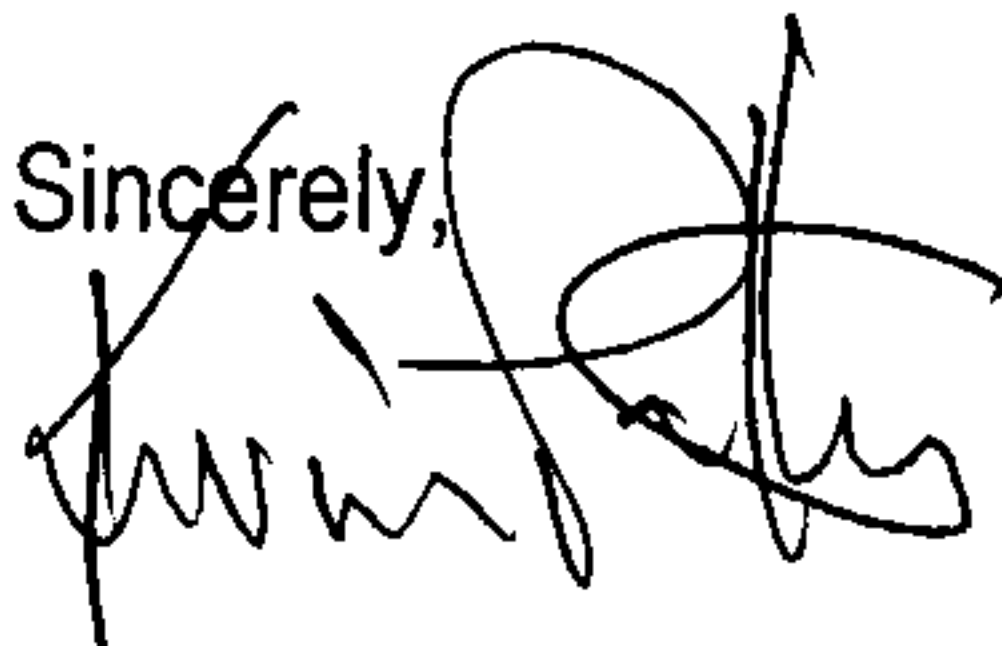
Per the letter agreement dated December 16, 1997 from Tom Keleher, Altura West Ltd Company (the developer of the Oxbow Bluff Subdivision) to Fred Aguirre, City Hydrologist for the City of Albuquerque, the developer agreed to submit drainage certifications for those individual lots with the review and approval from Bohannan Huston Inc. Please note that the original letter indicated that the certifications would be provided to the city on an annual basis or the completion of every 15 houses, whichever came first. I had spoken with Fred Aguirre in 1999 and requested that we be allowed to submit the individual drainage certifications upon the completion of every 15 homes (or so) instead of on an annual basis due to the fact that we had not received any certification within the first couple of years. In fact, the first certification received by us is dated December 22, 2000, and the second certification we received is dated November 2001. Fred agreed that we could submit the certifications once we received approximately 15 or so. I have enclosed a copy of the letter from Mr. Keleher.

I have reviewed each of the enclosed individual certifications prepared by a New Mexico Licensed Engineer and concur that they are in substantial compliance with the approved grading and drainage report prepared by Bohannan Huston Inc. dated December 11, 1997.

I would appreciate a letter from you indicating that you have received the certification(s) of the referenced lots and any comments you might have concerning our submittal.

If you have any questions or require additional information, please give me a call at 823-1000.

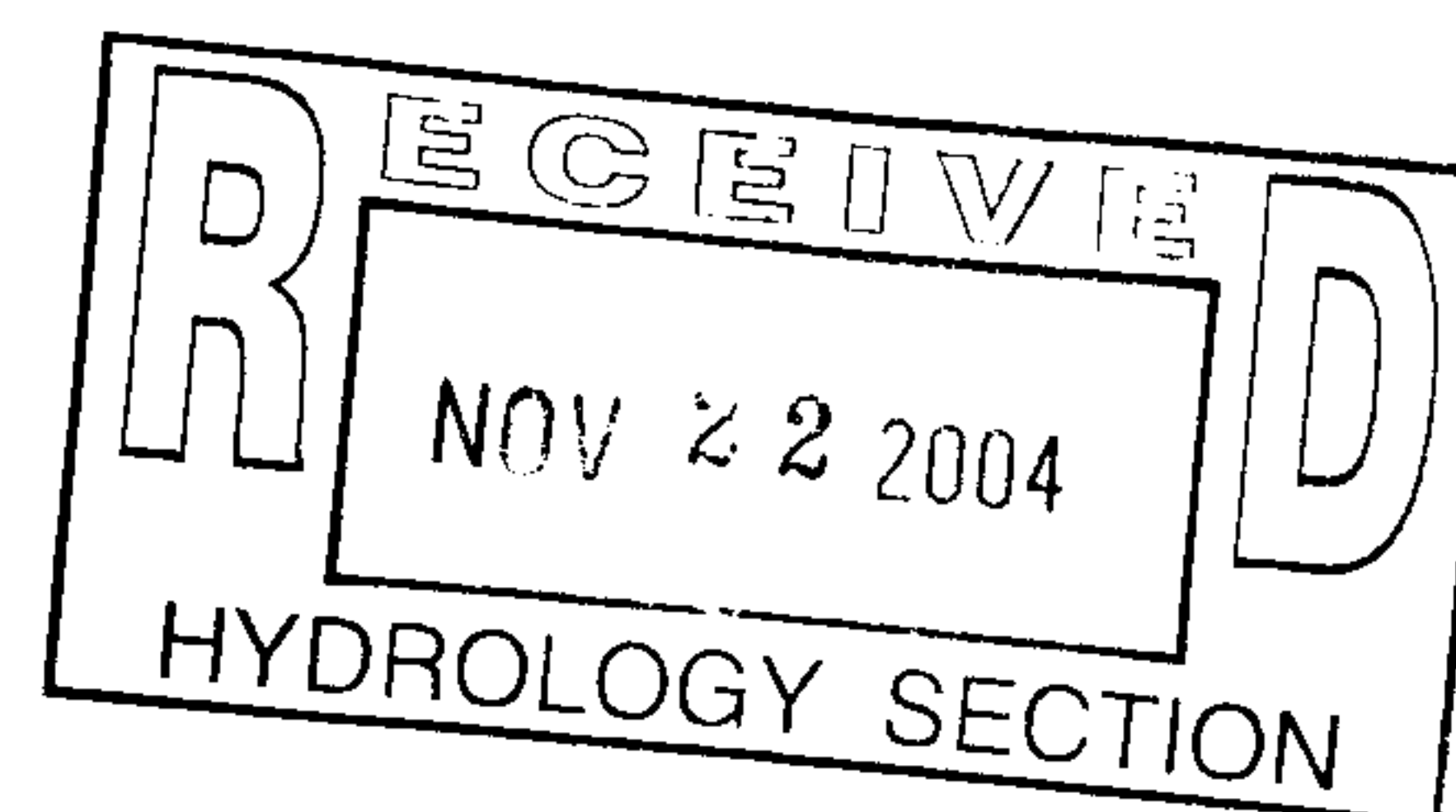
Sincerely,



Kevin G. Patton, P.E.
Vice President
Community Development and Planning

KGP/am
Enclosures

cc: Tom Keleher, Altura West Ltd Co (w/o encls)
Charles Berry, Oxbow Bluff Homeowners Assoc (w/o encls)



Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

CLIENT/COURIER TRANSMITTAL

To: Brad Bingham, P.E.
Drainage Section
Municipal Development Department
City of Albuquerque
600 Second Street NW - 2nd Floor West

Requested by: Kevin Patton - am

Date: November 22, 2004

Time Due: ☒ This A.M.
☐ This P.M.
☐ Rush _____
☐ By Tomorrow

Phone: 924-3986

Job No.: 00 217

Job Name: Oxbow Bluff Subdivision

DELIVERY VIA

☒ Courier ☐ Federal Express
☐ Mail ☐ UPS
☐ Other

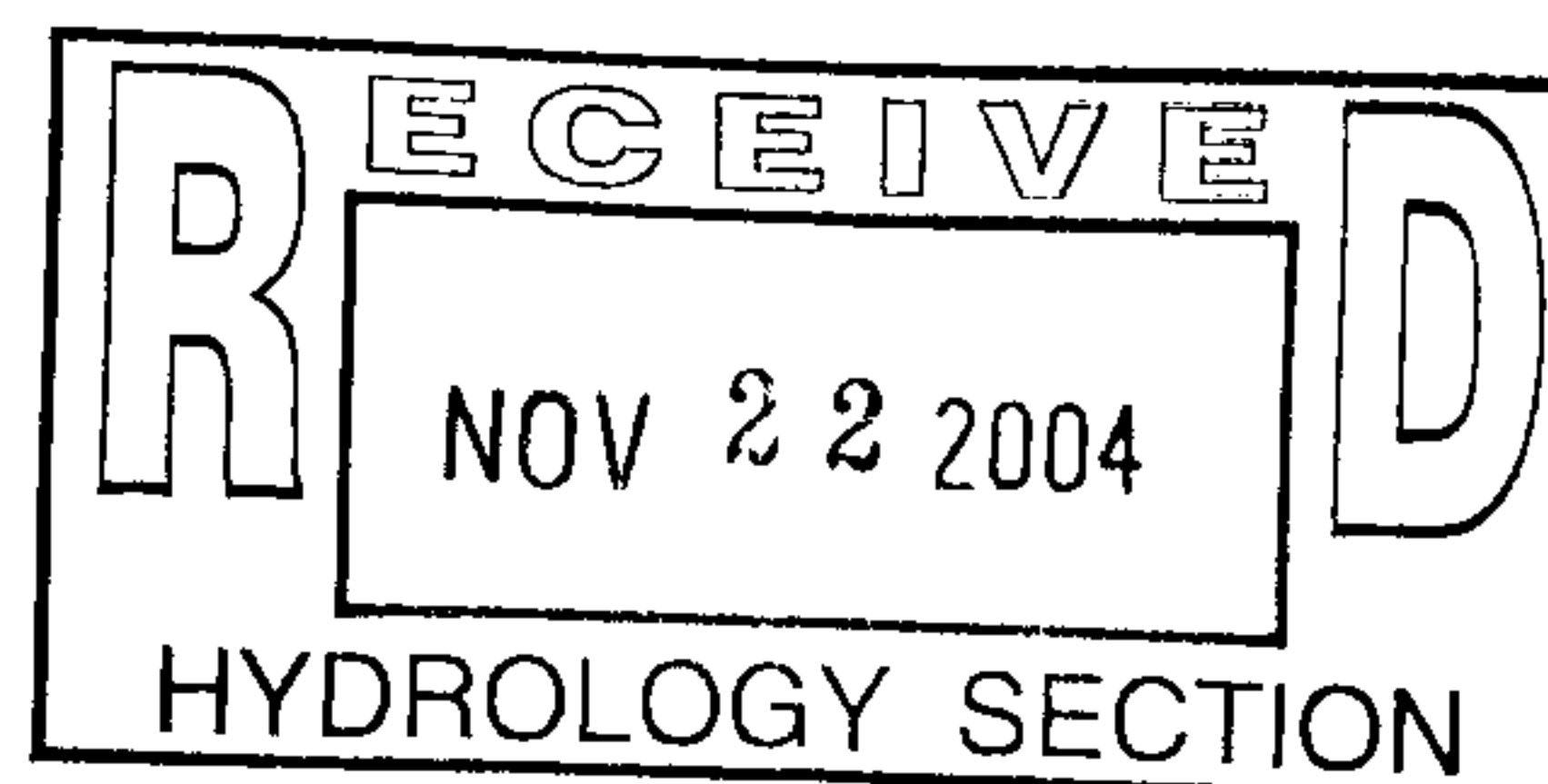
PICK UP

Item: _____

<u>ITEM NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
-----------------	-----------------	--------------------

1	1	Letter dated 11/19/04 re: Grading and Drainage Certification for Oxbow Bluff Subdivision Lots 5, 7, 8, 9, 16, 21, 29, 31, 38, 45, 46, 49, 50 & 61 (COA Hydrology File (G11-D14D)).
---	---	--

COMMENTS / INSTRUCTIONS



REC'D BY: _____ DATE: _____ TIME: _____

ENGINEERING ▲

SPATIAL DATA ▲

ADVANCED TECHNOLOGIES ▲

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 1/11/2002)

PROJECT TITLE: **OXBOW BLUFF SUBDIVISION**

ZONE MAP/DRG. FILE #: **F-11-Z (G11-D14D)**

DRB # **97-501**

EPC#: _____

WORK ORDER#: _____

LEGAL DESCRIPTION: **Oxbow Bluff Subdivision**

CITY ADDRESS: **OXBOW DRIVE NW**

ENGINEERING FIRM: **BOHANNAN HUSTON INC**

ADDRESS: **7500 JEFFERSON STREET NE**

CITY, STATE: **ALBUQUERQUE, NM**

CONTACT: _____

KEVIN PATTON

PHONE: _____

(505) 823-1000

ZIP CODE: _____

87109

OWNER: _____

ALTURA WEST LTD CO

ADDRESS: **PO DRAWER AA**

CITY, STATE: **ALBUQUERQUE, NM**

CONTACT: _____

TOM KELEHER

PHONE: _____

(505) 346-4646

ZIP CODE: _____

87103

ARCHITECT: _____

ADDRESS: _____

CITY, STATE: _____

CONTACT: _____

PHONE: _____

ZIP CODE: _____

SURVEYOR: _____

ADDRESS: _____

CITY, STATE: _____

CONTACT: _____

PHONE: _____

ZIP CODE: _____

CONTRACTOR: _____

ADDRESS: _____

CITY, STATE: _____

CONTACT: _____

PHONE: _____

ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:

- ☐ DRAINAGE REPORT
- ☐ DRAINAGE PLAN
- ☐ CONCEPTUAL GRADING & DRAINAGE PLAN
- ☐ GRADING PLAN
- ☐ EROSION CONTROL PLAN
- ☒ **ENGINEER'S CERTIFICATION (HYDROLOGY)**
- ☐ CLOMR/LOMR
- ☐ TRAFFIC CIRCULATION LAYOUT (TCL)
- ☐ ENGINEERS CERTIFICATION (TCL)
- ☐ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
- ☐ OTHER

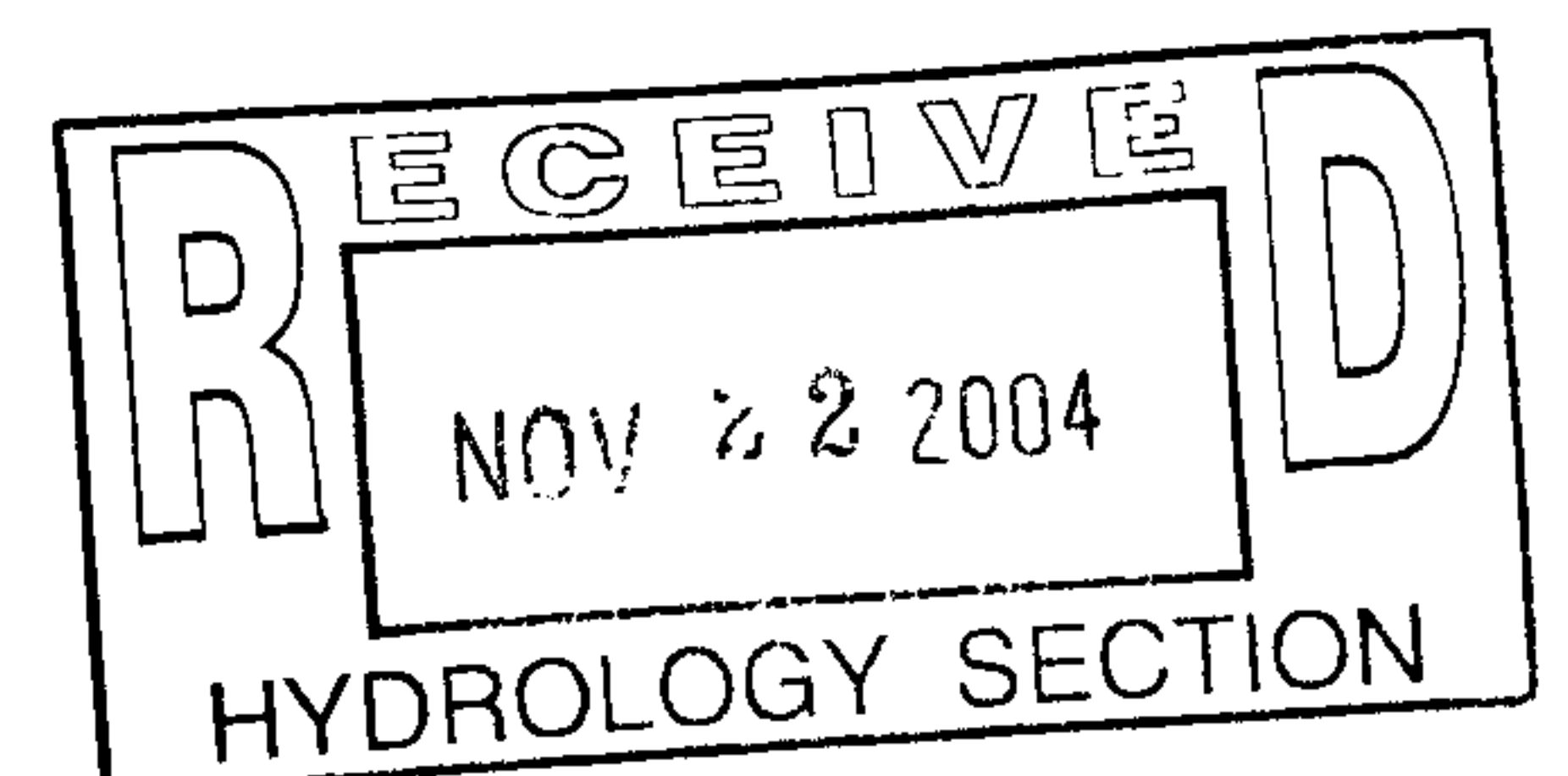
CHECK TYPE OF APPROVAL SOUGHT:

- ☐ SIA / FINANCIAL GUARANTEE RELEASE
- ☐ PRELIMINARY PLAT APPROVAL
- ☐ S. DEV. PLAN FOR SUB'D. APPROVAL
- ☐ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
- ☐ SECTOR PLAN APPROVAL
- ☐ FINAL PLAT APPROVAL
- ☐ FOUNDATION PERMIT APPROVAL
- ☐ BUILDING PERMIT APPROVAL
- ☐ CERTIFICATE OF OCCUPANCY (PERM.)
- ☐ CERTIFICATE OF OCCUPANCY (TEMP.)
- ☐ GRADING PERMIT APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☐ WORK ORDER APPROVAL
- ☒ **OTHER (SPECIFY) - Per agreement; FYI**

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ☐ YES
- ☐ NO
- ☐ COPY PROVIDED

DATE SUBMITTED: _____ BY: _____



Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature, location and scope of the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

- 1. Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
- 2. Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres.
- 3. Drainage Report:** Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

November 19, 2004

Ms. Paula Dal Santo, Liaison
Architectural Control Committee
Oxbow Bluff Subdivision
1200 Washington NE
Albuquerque, NM 87110

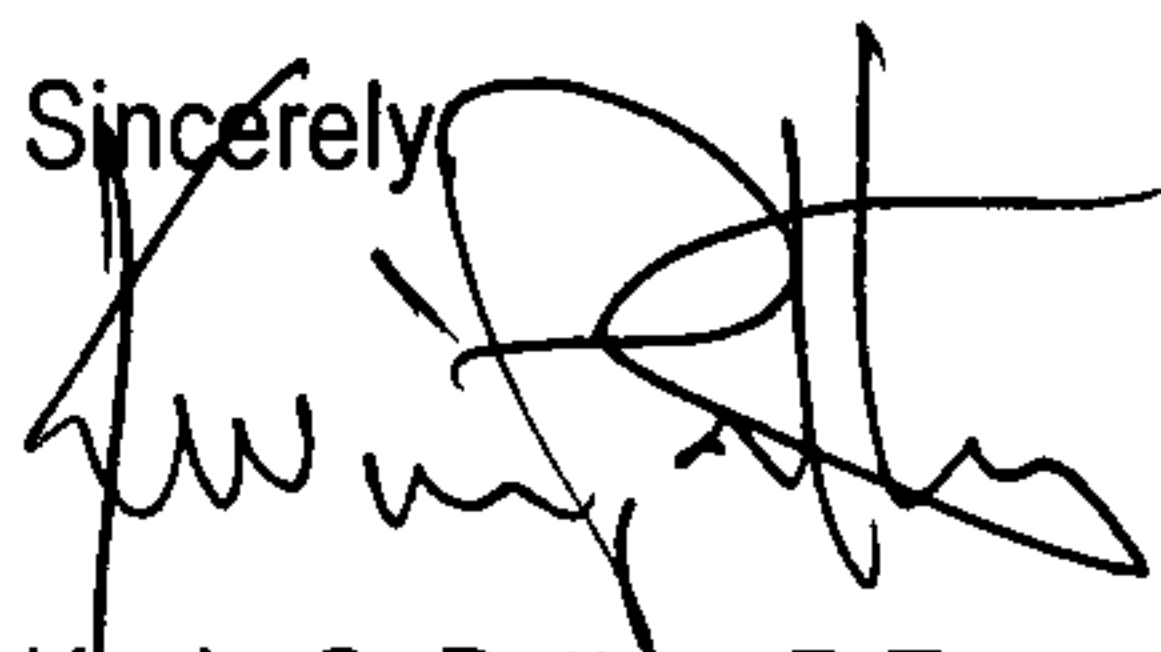
Re: Grading and Drainage Certification for Oxbow Bluff Subdivision
Lots 46 & 50

Dear Paula:

Enclosed are the grading and drainage certifications for the above referenced lots within the Oxbow Bluff Subdivision that were prepared by Bohannan Huston Inc. I have inspected the individual lots and believe that they are in substantial compliance with the approved grading and drainage plans prepared by me and the grading and drainage report approved by the City for the Oxbow Bluff Development dated, December 11, 1997.

If you have any questions or require additional information please give me a call at 823-1000.

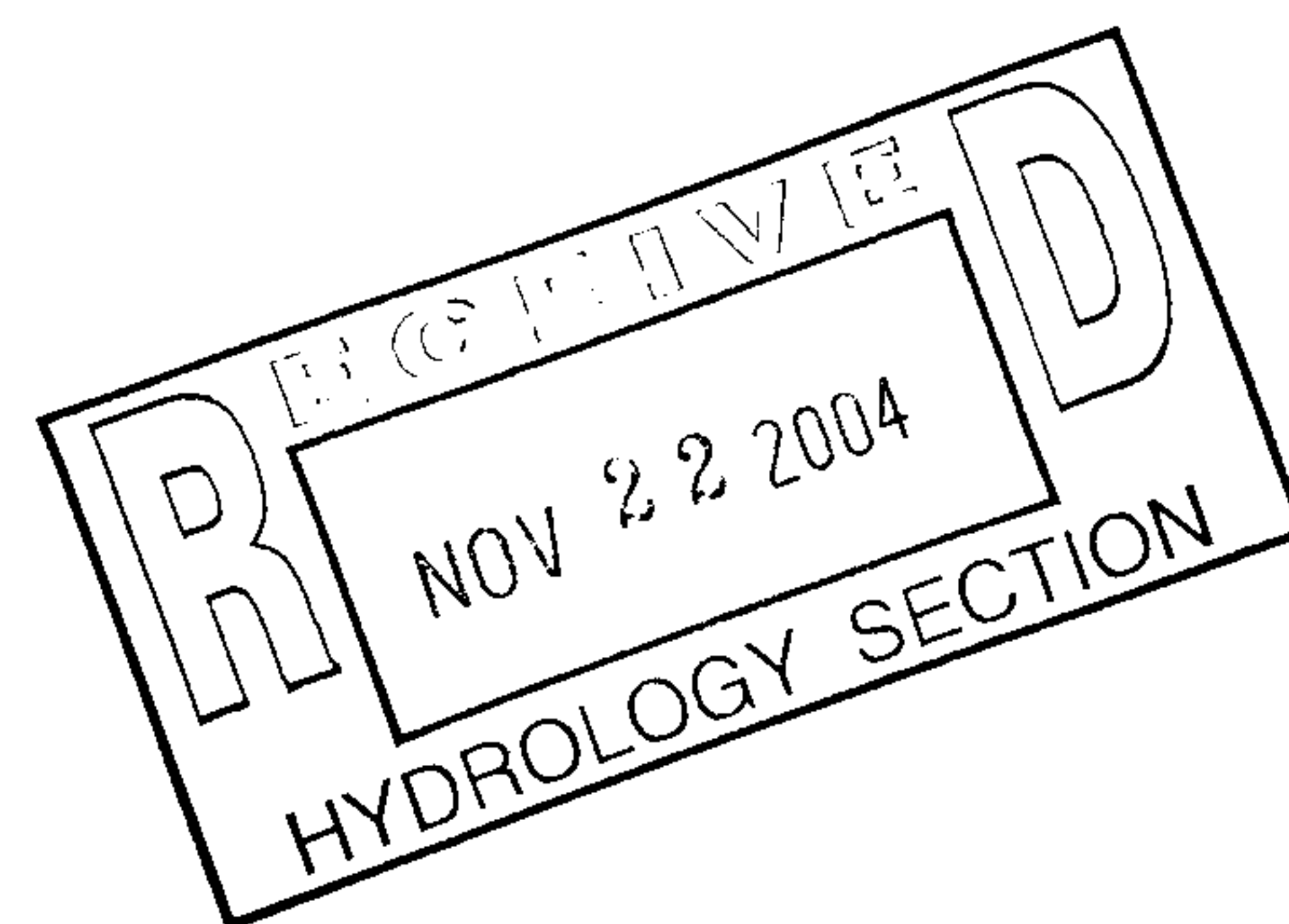
Sincerely,



Kevin G. Patton, P.E.
Vice President
Community Development and Planning

KP
Enclosures

cc: Tom Keleher. Altura West Ltd. Co (w/o encls)



Lot 16



C.L. Weiss Engineering, Inc
Post Office Box 97
Sandia Park, N.M. 87047

Phone / Fax (505) 281-1800
Alvarado Office (505) 266-3444

January 14, 2004

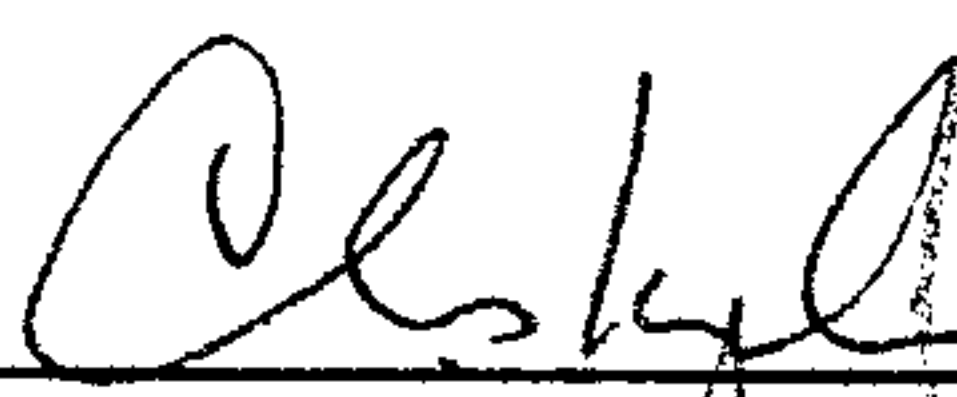
Ms. Jan Pierce
OxBow Architectural Control Committee
4613 Sunningdale NE
Albuquerque, NM 87110

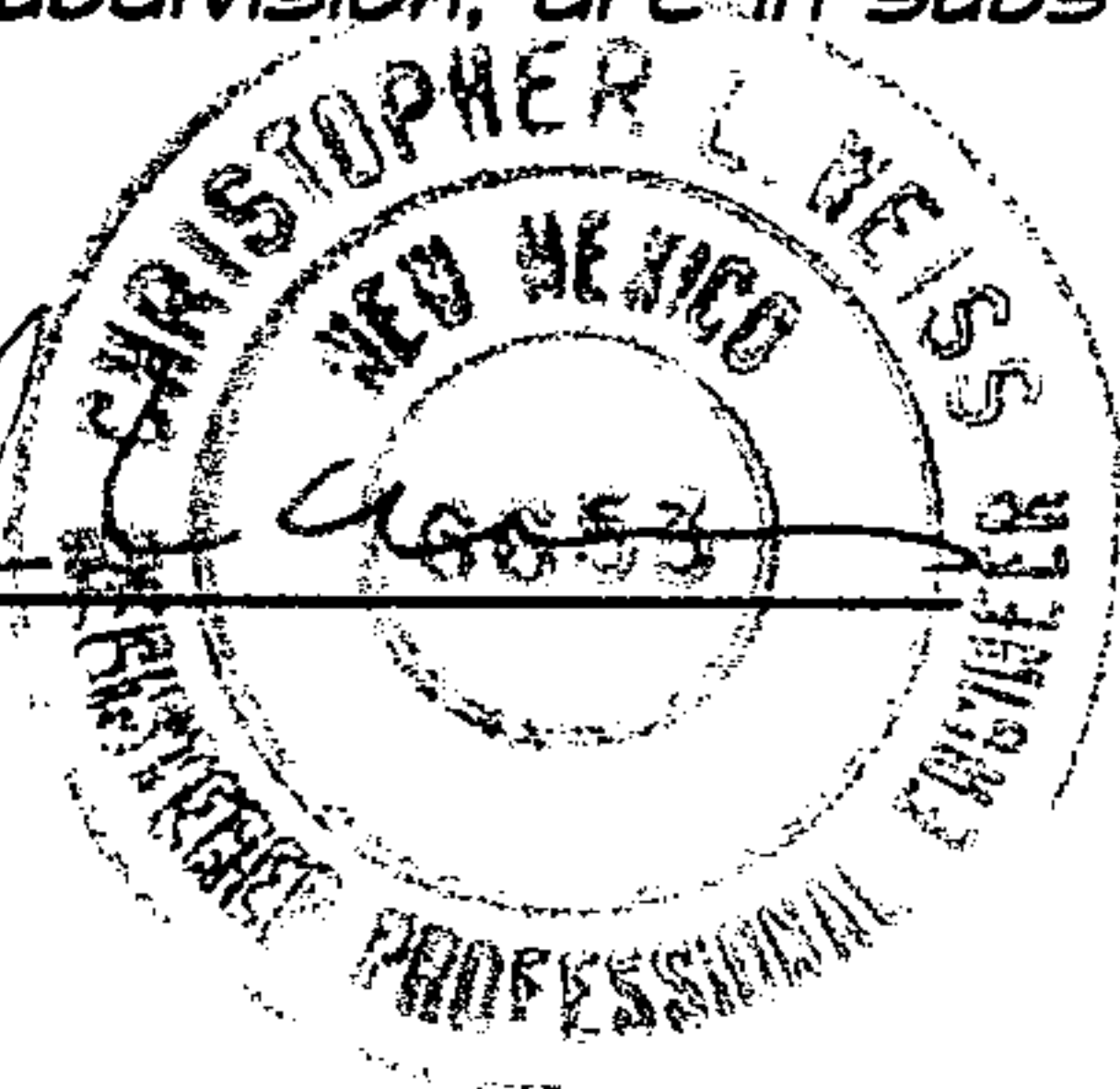
Re: Certification of Grading / Drainage, Lot 16 OxBow Subdivision

Dear Ms. Pierce:

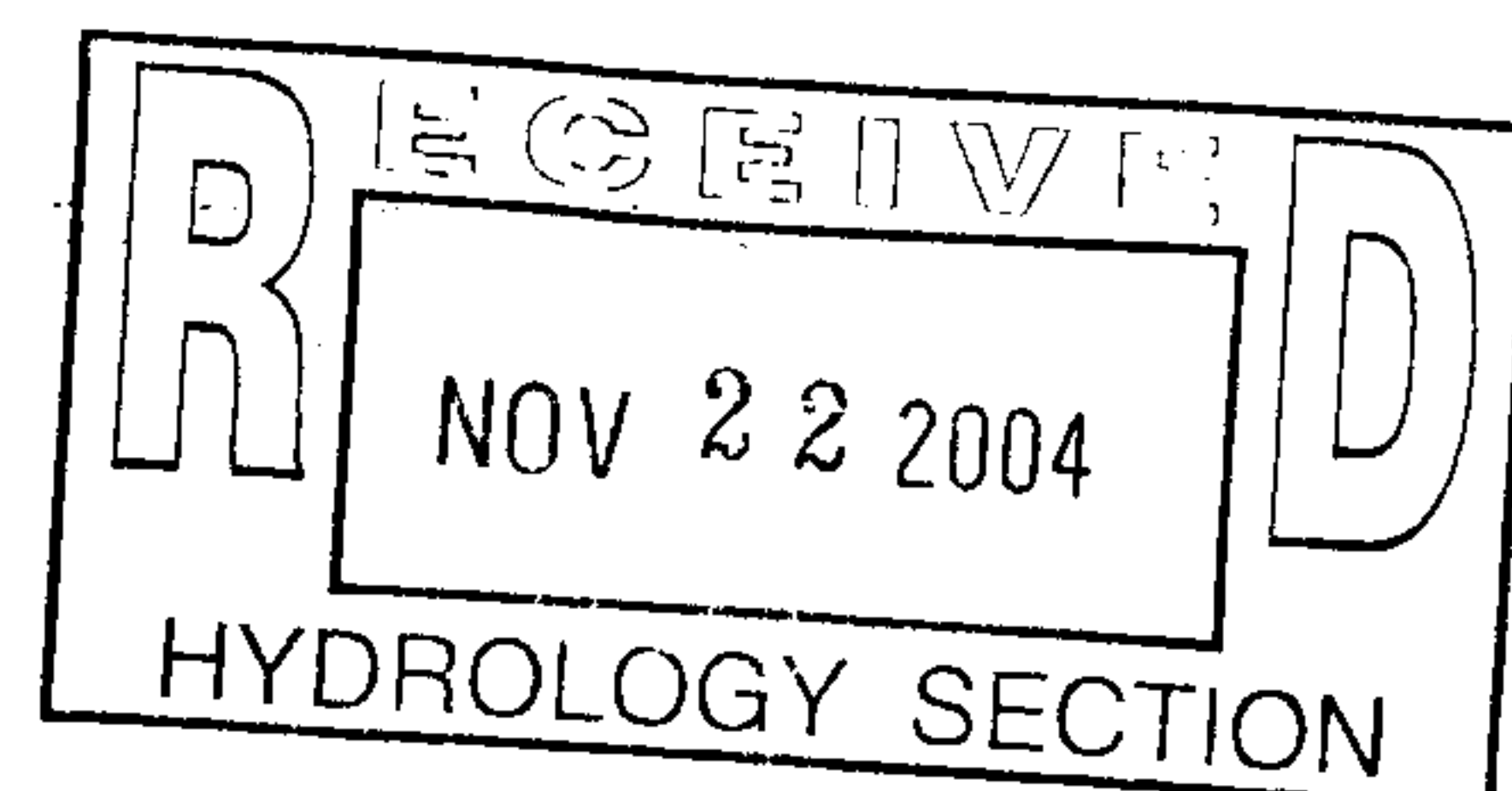
On Tuesday, January 13th, I inspected Lot 16 for compliance to the approved drainage / grading plan. All aspects of the completed drainage / grading improvements have been completed and follow the approved drainage / grading plan.

I, Christopher L. Weiss, P.E., do hereby certify that grading and drainage improvements for Lot 16, OxBow Subdivision, are in substantial compliance with the approved drainage / grading plan.


NMPE #6653



01-14-04
Date



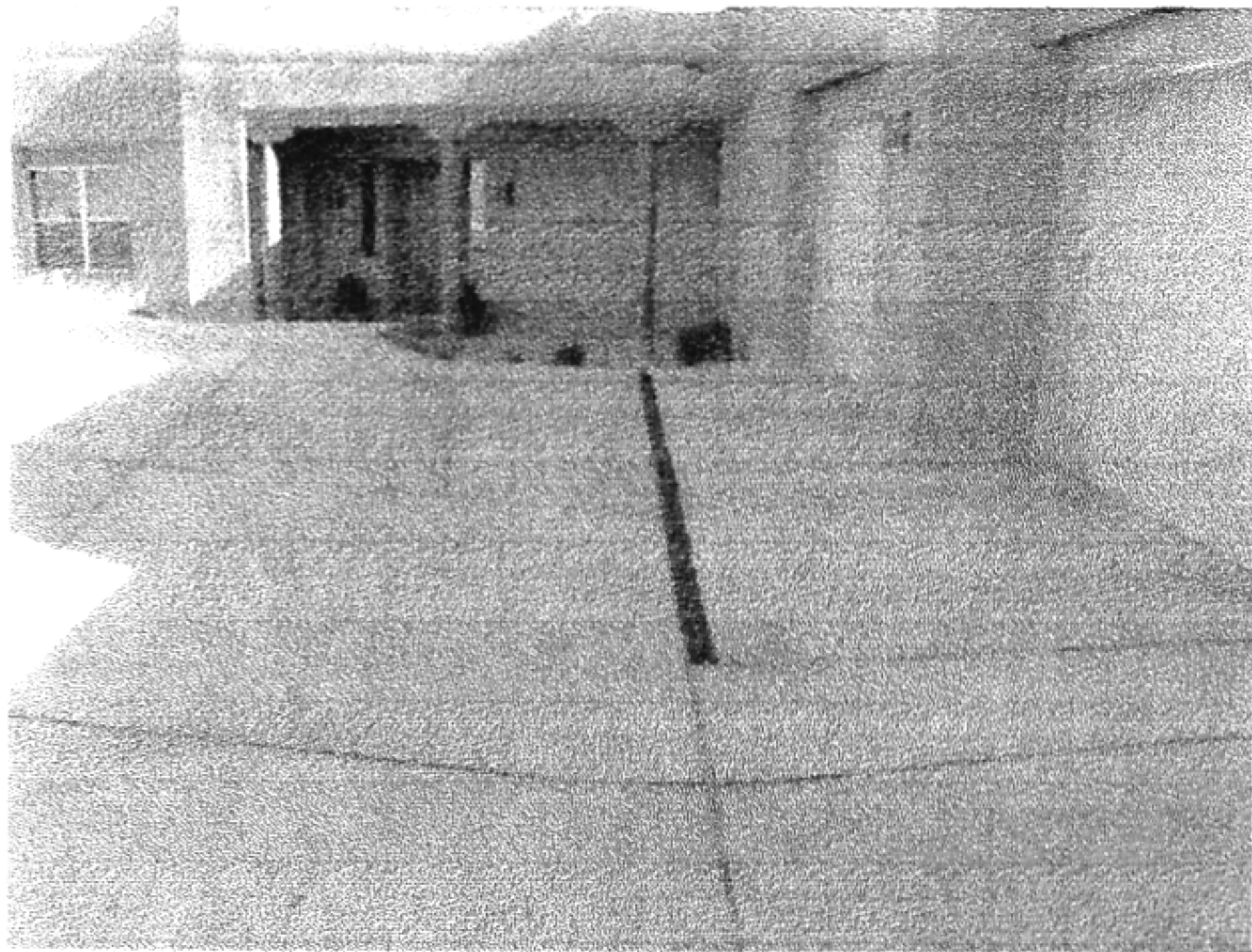
LOT 16



Driveway Entance



West Side looking South



Slotted Drain in Drive



Front Swale



North Swale



East Pond

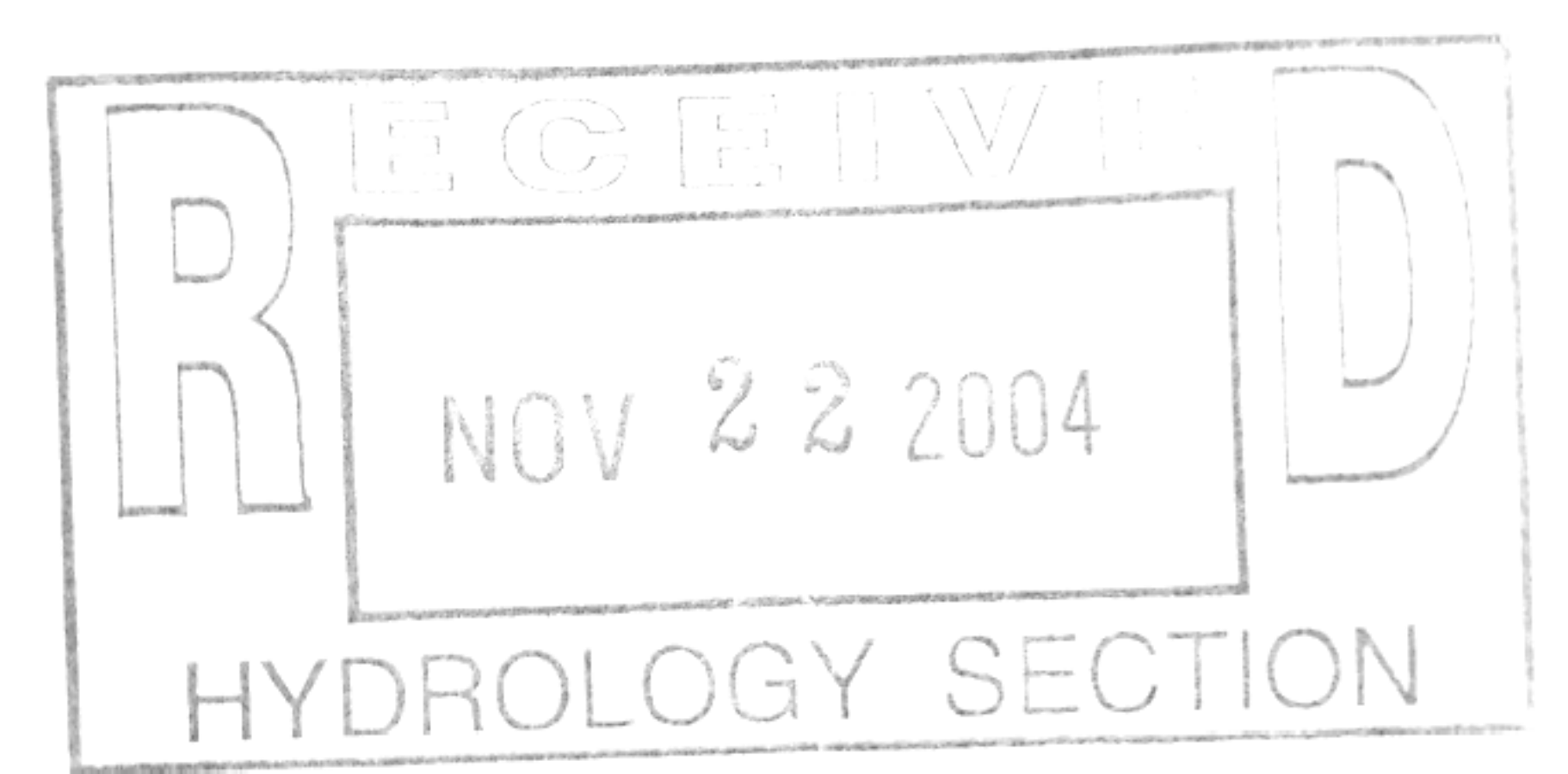


South Swale

Lot 16- Ox Bow



West Side





D. Mark Goodwin & Associates, P.A.
Consulting Engineers

P.O. BOX 90606, ALBUQUERQUE, NM 87199
(505) 828-2200 FAX 797-9539
e-mail: dmgs@swcp.com

February 28, 2003

Jann Pierce
Altura West Ltd., Inc.
4407 Lomas Blvd. NE
Albuquerque, NM 87107

Re: DiLorenzo Residence (Lot 38, Oxbow Bluff Subdivision)

Dear Ms. Pierce:

As a result of recent corrective measures performed by the contractor on the drainage improvements associates with the referenced residence, I am now able to certify that the grading and drainage plan improvements, as constructed, are in substantial compliance with the approved plan.

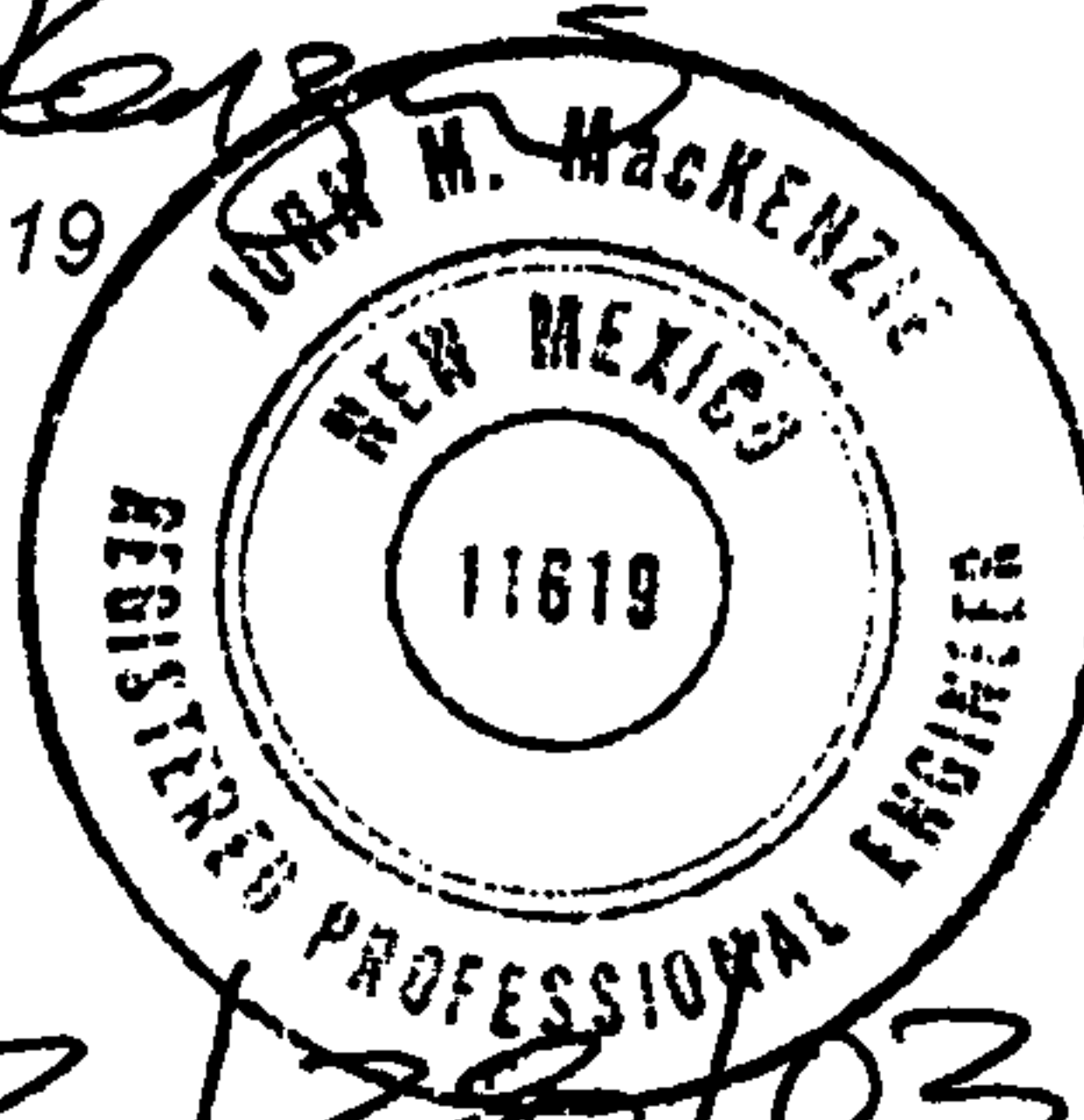
The owner of this property should be informed that the driveway drainage inlet and underground pipe around the north side of the house needs to be periodically cleaned-out so that site debris does not accumulate inside the system, which may impair its effectiveness or ultimately render it useless.

Please contact me if I can be of further assistance.

MARK GOODWIN & ASSOCIATES, PA

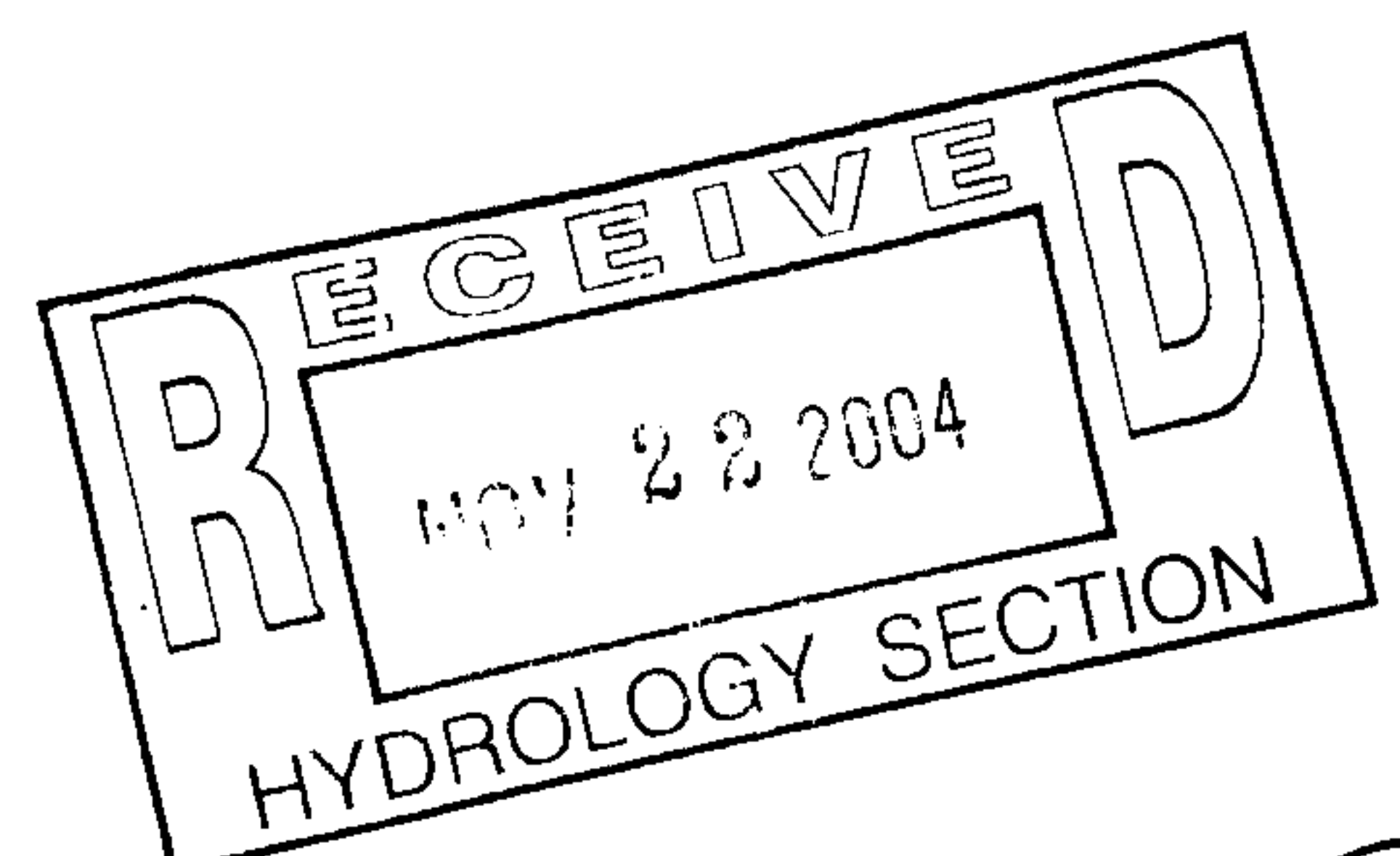
John M. MacKenzie
John M. MacKenzie, NMPE 11619
Vice President

JMM/bm



2/28/03

F:\dilorenz.res\certify2



LOT 38



ISAACSON & ARFMAN, P.A.

Consulting Engineering Associates

*Thomas O. Isaacson, PE & LS • Fred C. Arfman, PE
Scott M. McGee, PE*

LOT 31

December 12, 2003

Ms. Jann Pierce, ACC Liaison
Oxbow Bluff ACC
4407 Lomas Blvd. NE
Albuquerque, NM 87110

RE: Hennigan Residence
Lot 31, Oxbow Bluff

Dear Ms. Pierce:

Isaacson & Arfman, P.A. performed the final site observation of the grading and drainage improvements on December 9, 2003 and I, Fred C. Arfman, PE, No. 7322, do hereby certify that the site grading and drainage improvements are in place and constructed in substantial compliance with the plan dated March 10, 2003.

Minor changes in the location of roof drains had occurred during construction and the changes do not affect the drainage characteristics. Rock splash pads are located at each roof drain location. Additionally, a moss rock armoring was placed along the easterly slope on the outside of the privacy wall.

A copy of the Grading/Drainage Plan was "redlined" and found accompanying this submittal. Please contact our office if additional information is required to secure Oxbow ACC approval.

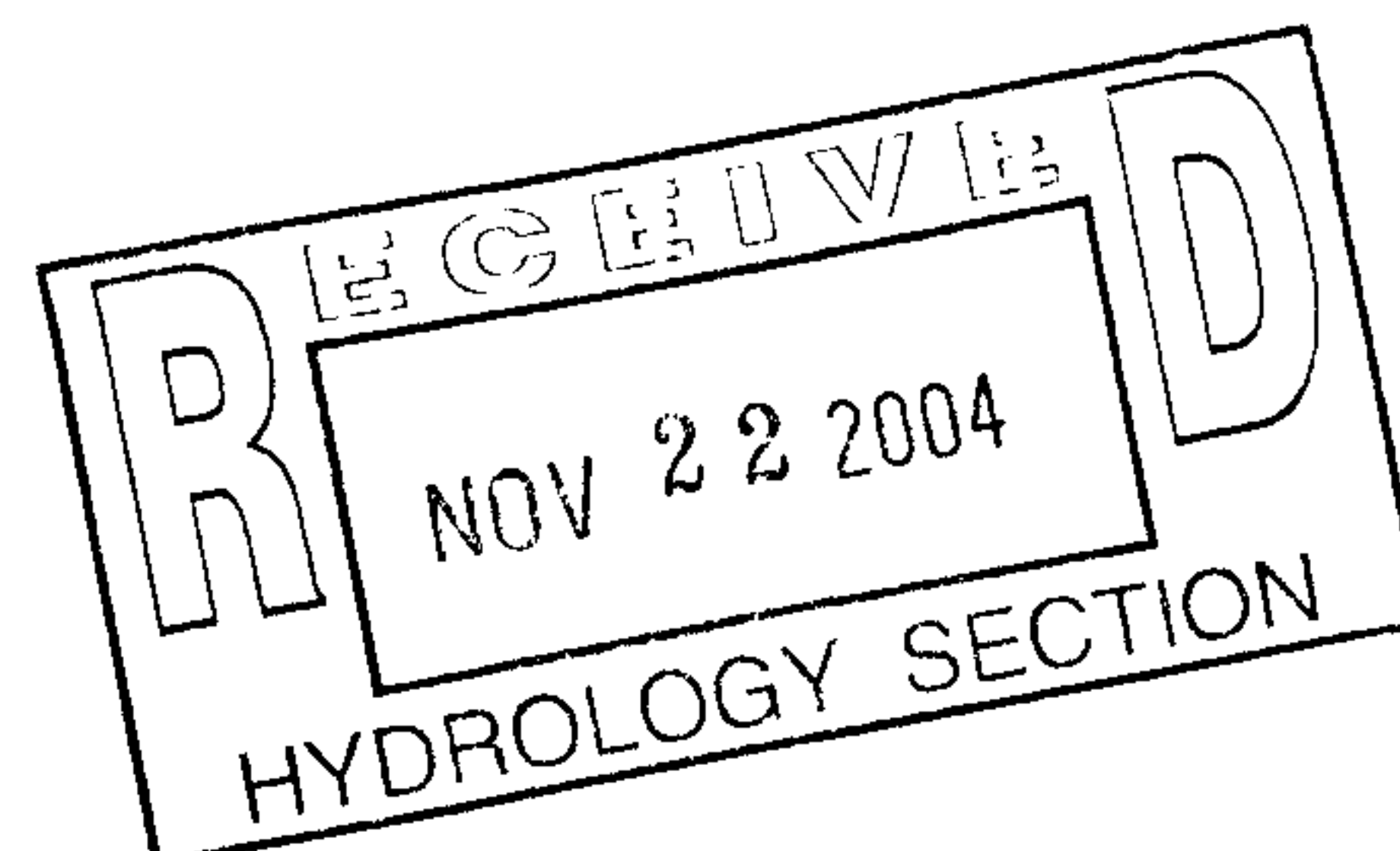
Very truly yours,

ISAACSON & ARFMAN, P.A.

Fred C. Arfman, PE

FCA/rtl

128 Monroe St. NE • Albuquerque, NM 87108 • (505) 268-8828 • FAX (505) 268-2632
M:\ACTIVE\RUTH\LETTERS\Dec-12-03 Pierce 1273.doc



LOT 31

JEFF MORTENSEN & ASSOCIATES, INC.
ENGINEERS & SURVEYORS

6010-8 MIDWAY

PARK BLVD. NE

ALBUQUERQUE

NEW MEXICO

8 7 1 0 9

P R I N C I P A L S

JEFFREY G. MORTENSEN, P.E.

CHARLES G. CALA, JR., P.S.

J U A N M . C A L A

TEL:505-345-4250

FAX:505-345-4254

jmainc@swcp.com



2001.012.2

September 10, 2002

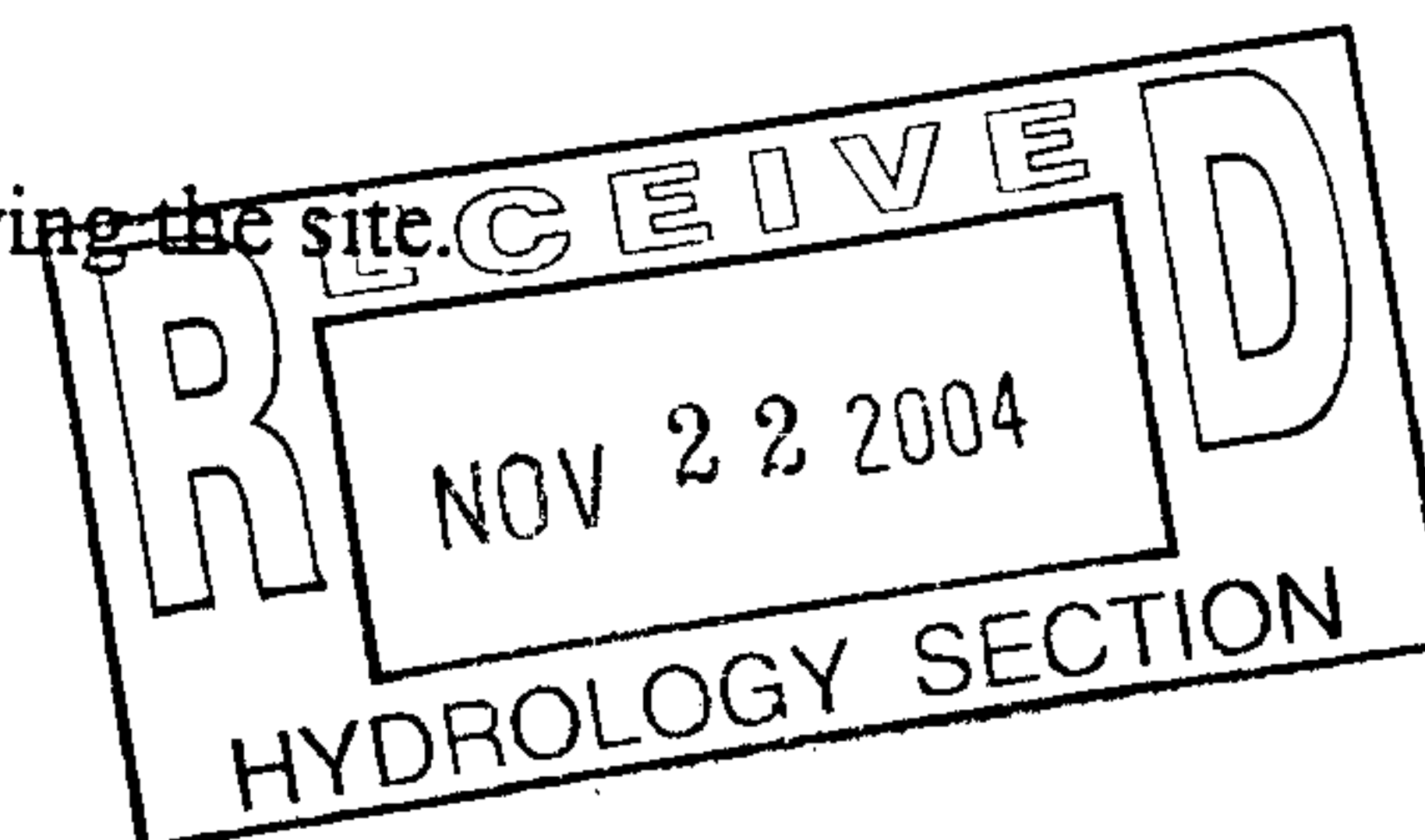
Mr. Chester French Stewart
3808 Mourning Dove Place NW
Albuquerque, NM 87120

Re: Stewart Residence
Lot 49, Oxbow Bluff Subdivision
3808 Mourning Dove Place NW

Dear Chet:

At the request of your Contractor, Mr. Steve Byrd, I visited the subject project site on the afternoon of September 05, 2002. The purpose for this visit was to visually observe the status and condition of the grading and drainage of the site. My observations are as follows:

1. The vegetation around the residence appears to be well established.
2. The water harvesting area specified for the southwest corner of the lot as delineated on the approved Plan is in place and visually conforms to the Plan.
3. The water harvesting area specified for the northeast corner of the lot as delineated on the approved Plan has been relocated to a location(s) outside the building envelope. In lieu of the singular pond, the Contractor has constructed four (4) ponds in series along the north side of the new residence lying parallel to and south of the north property line. It appears that if a pond should fill with water, it will overflow to the east cascading into the next lower pond. Although measurements were not made, the four ponds created visually appear to contain an equivalent volume of runoff to that of the single pond depicted on the approved Plan.
4. A garden wall was constructed at the rear of the residence that will effectively contain that runoff that falls within or drains into that area.
5. A small water harvesting area was created just upstream of the backyard garden wall area near the southeast corner of the residence. Flows collected by that feature are drained to the easternmost pond in series by a small diameter PVC drain line.
6. Although the configuration of the water harvesting areas has been there does not appear to be an adverse effect to the noted deviation.
7. There were no visual signs of erosion or excessive runoff leaving the site.



LOT 49

2001.012.2
September 10, 2002
Page 2

Based upon my visual observations, this lot has been graded and drained in substantial compliance with the intent and concepts set forth on the approved Grading and Drainage Plan last dated May 31, 2001. If you should have any questions or comments concerning this Final Letter of Certification, or any other aspect of this project, please do not hesitate to call. We sincerely hope that you are enjoying your new home; the view up the river is spectacular.

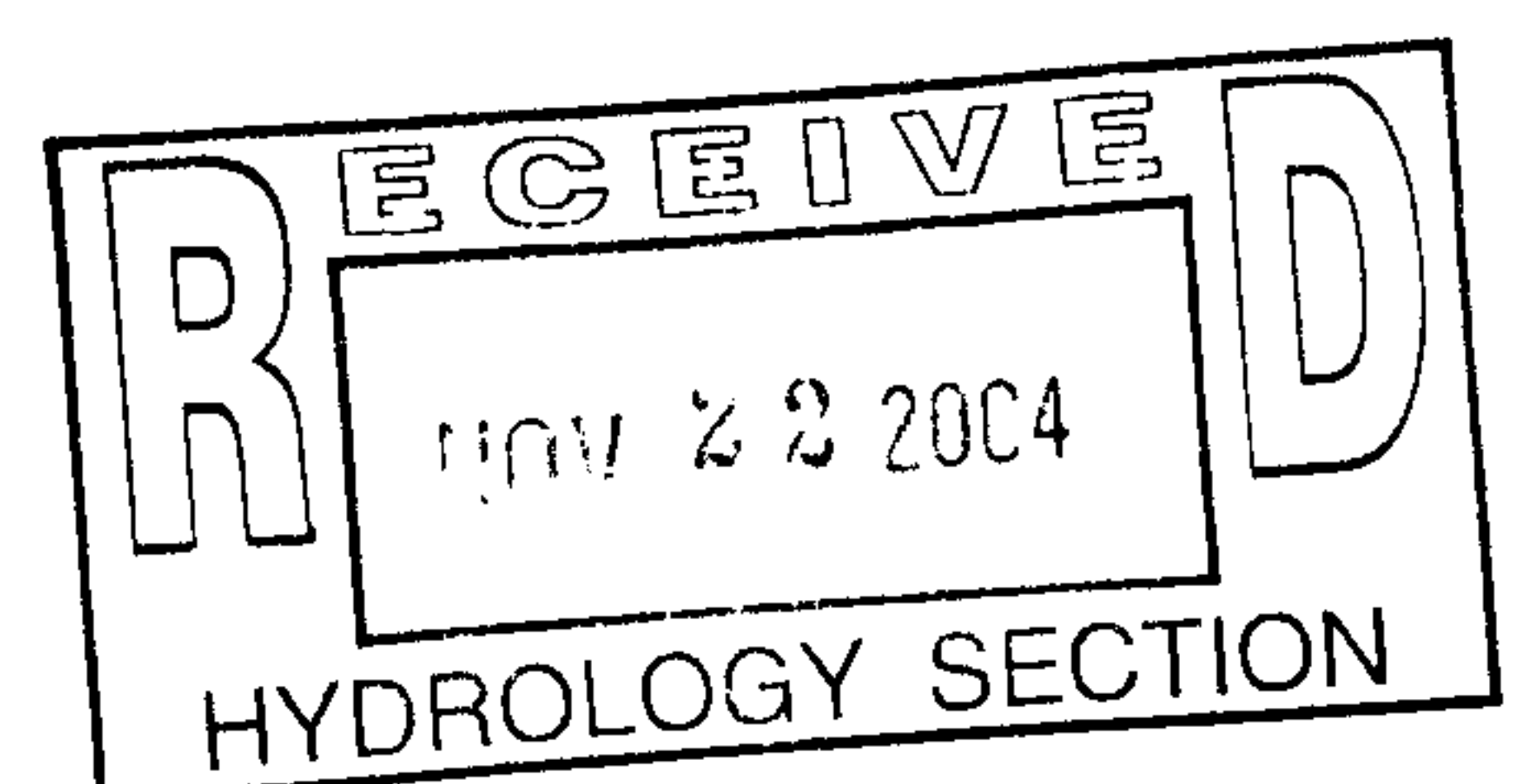


Xc: Oxbow Communities
Steve Byrd

Sincerely,

JEFF MORTENSEN & ASSOCIATES, INC.

Jeffrey G. Mortensen, P.E.
President





C.L. Weiss Engineering, Inc
Post Office Box 97
Sandia Park, N.M. 87047

Phone / Fax (505) 281-1800
Alvarado Office (505) 266-3444

December 18, 2003

Ms. Jan Pierce
OxBow Architectural Control Committee
4613 Sunningdale NE
Albuquerque, NM 87110

Re: Certification of Grading / Drainage, Lot 21 OxBow Subdivision

Dear Ms. Pierce:

On Wednesday, December 17th, I inspected Lot 21 for compliance to the approved drainage / grading plan. The following are areas which differ from the approved plan but will not adversely affect drainage patterns:

1. The driveway entrance was revised to allow low-slung vehicles access.
2. The driveway grades into the garage and configuration where changed from the original plan as well as the location of the slotted drain.
3. The two east ponds were combined into one pond. The outlet pipe was not installed but substantial erosion fabric covering the entire area should reduce the likelihood of an embankment breach should the pond overflow to the street.
4. Additional grade walls used in lieu of graded slopes on the west side of the building.

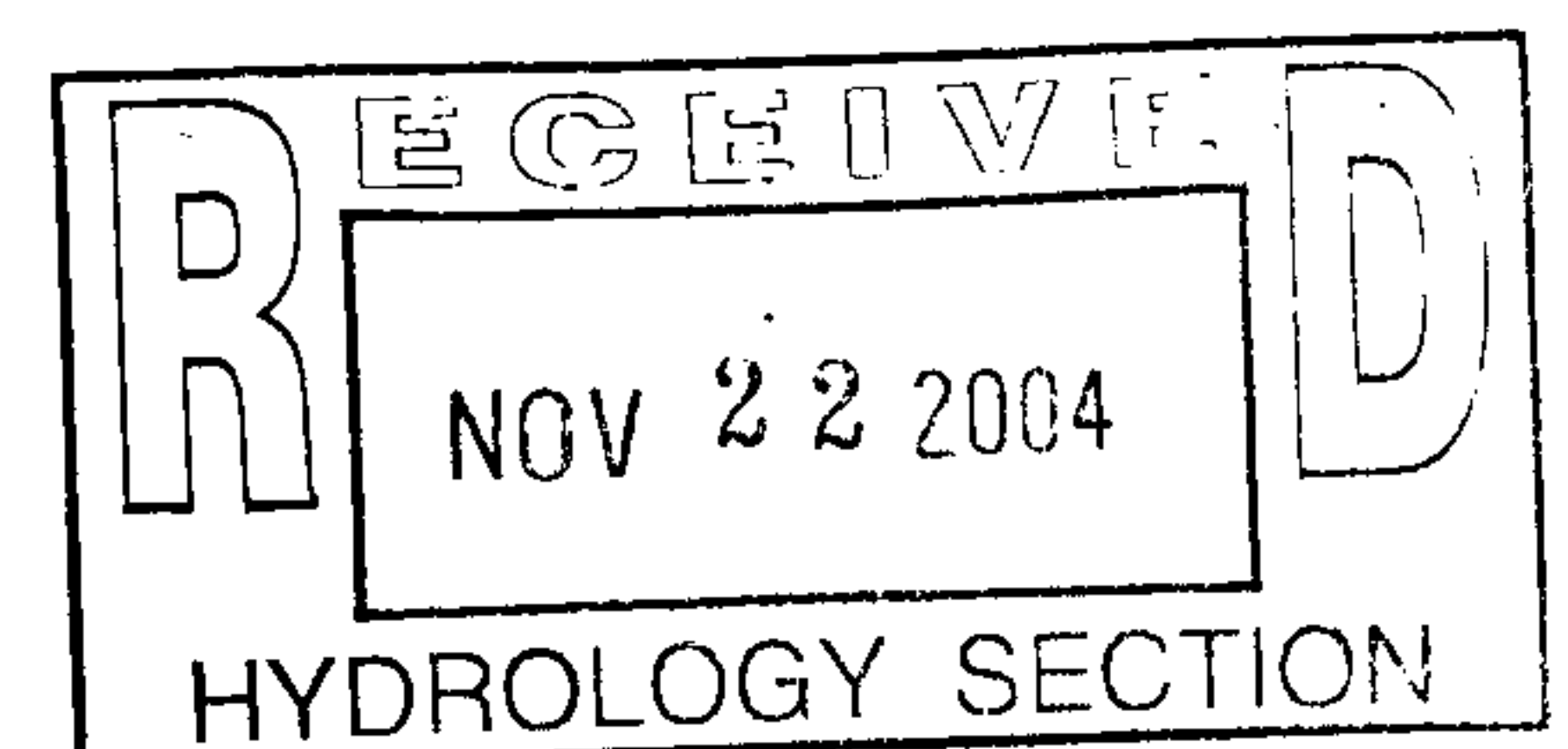
I, Christopher L. Weiss, P.E., do hereby certify that grading and drainage improvements for Lot 21, OxBow Subdivision, are in substantial compliance with the approved drainage / grading plan, with exceptions as noted above.

NMPE #6653

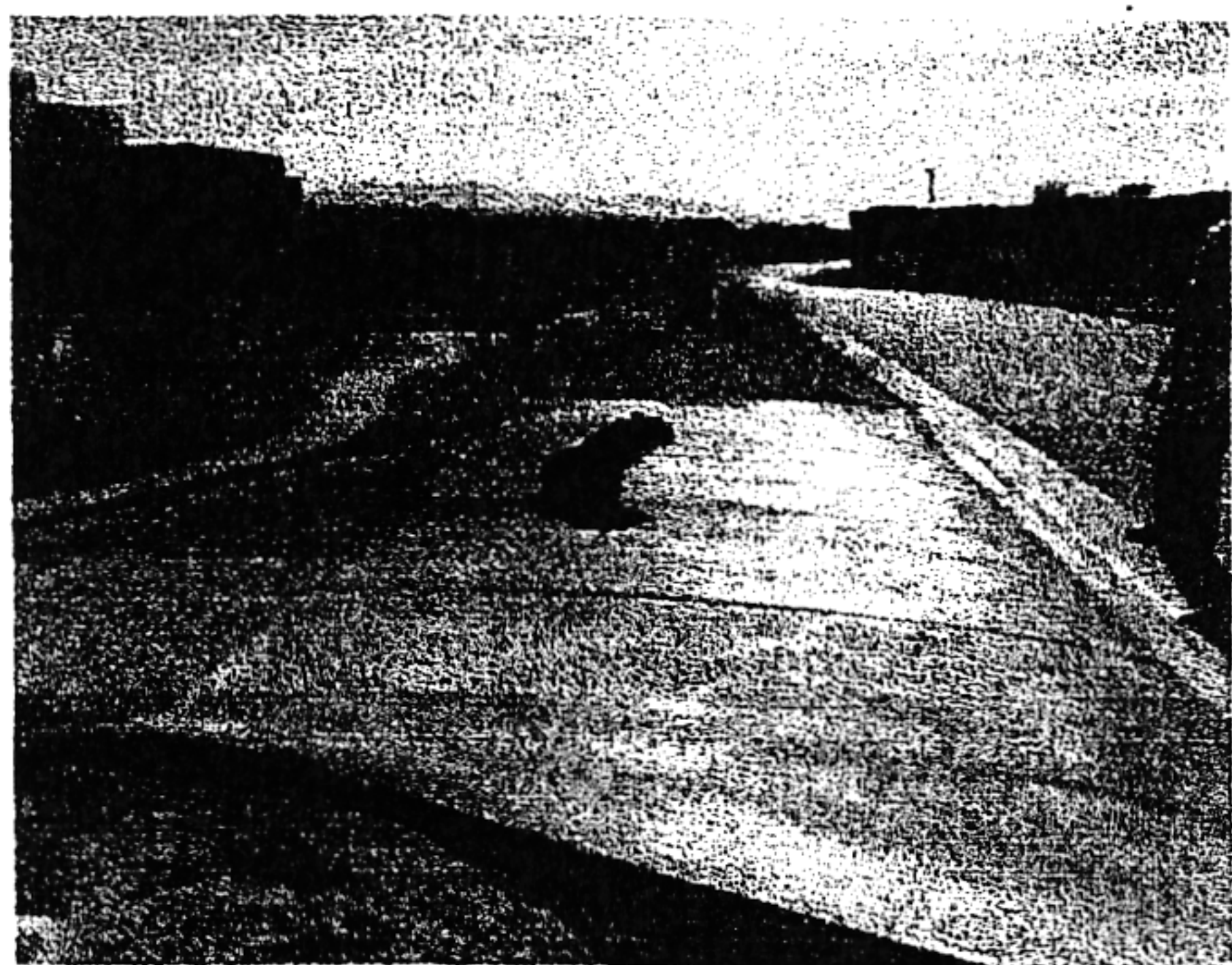


12-18-03

Date



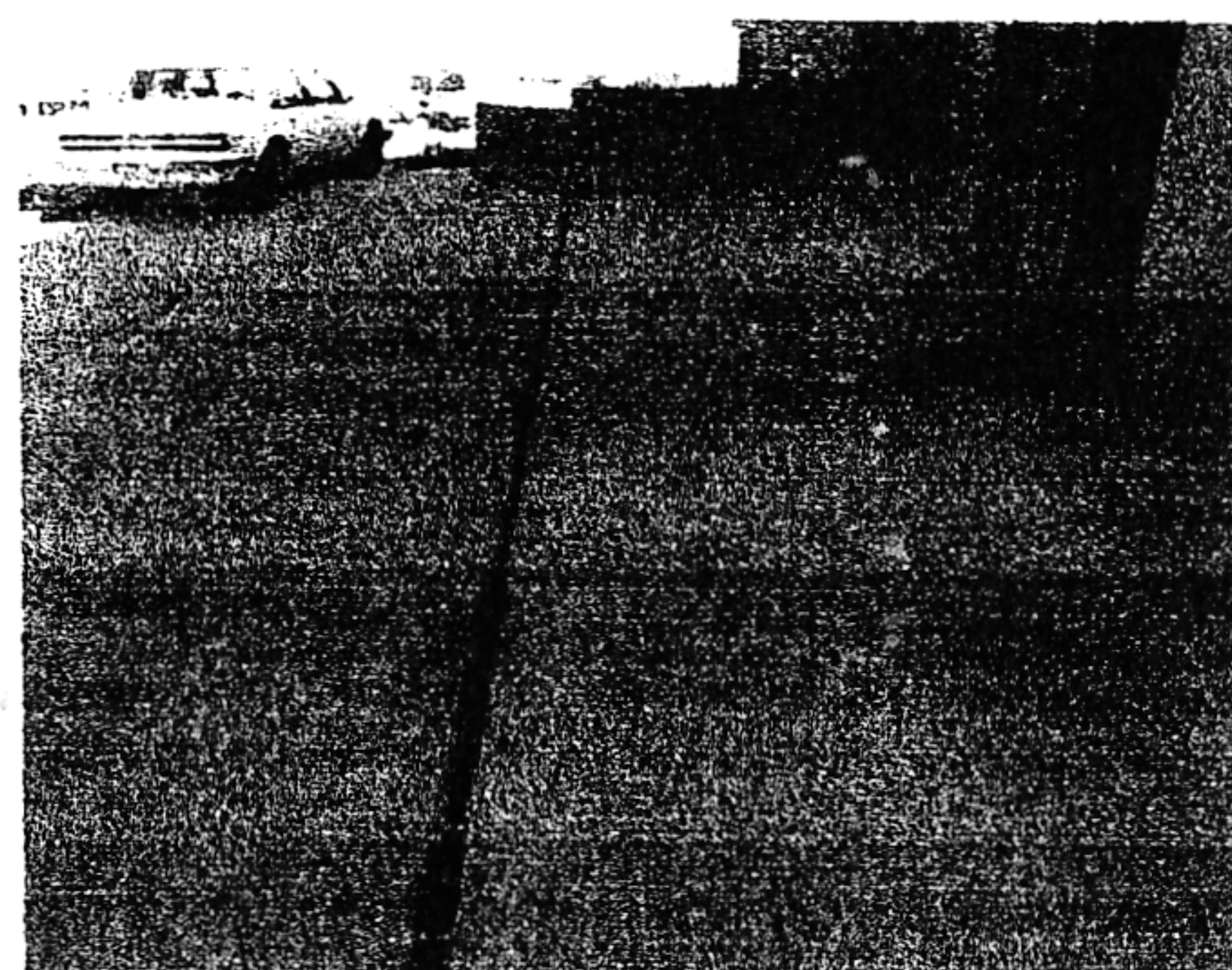
LOT 21



Driveway Entrance



West Side looking South



Slotted Drain in Drive



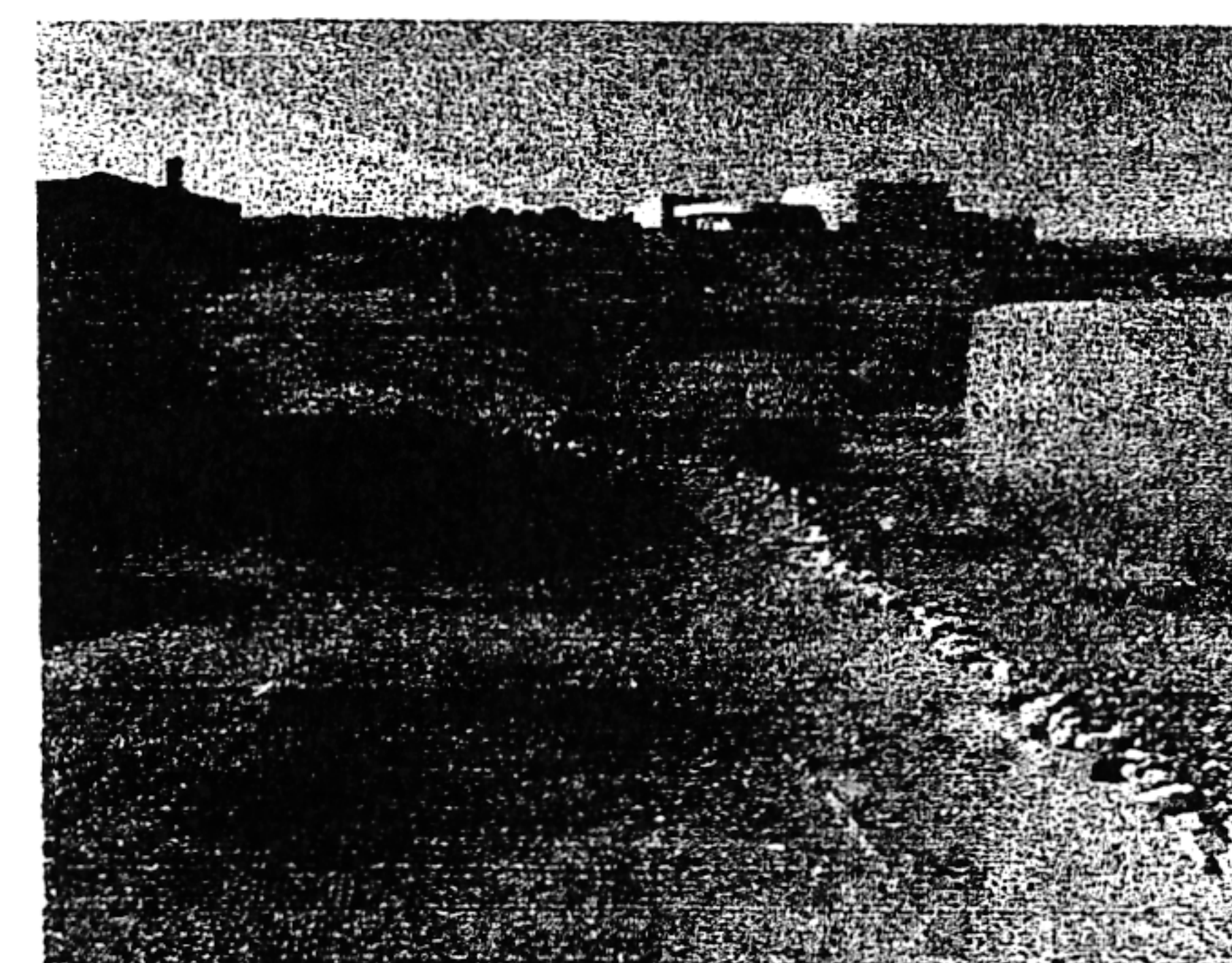
NE Swale



East Pond



South Side

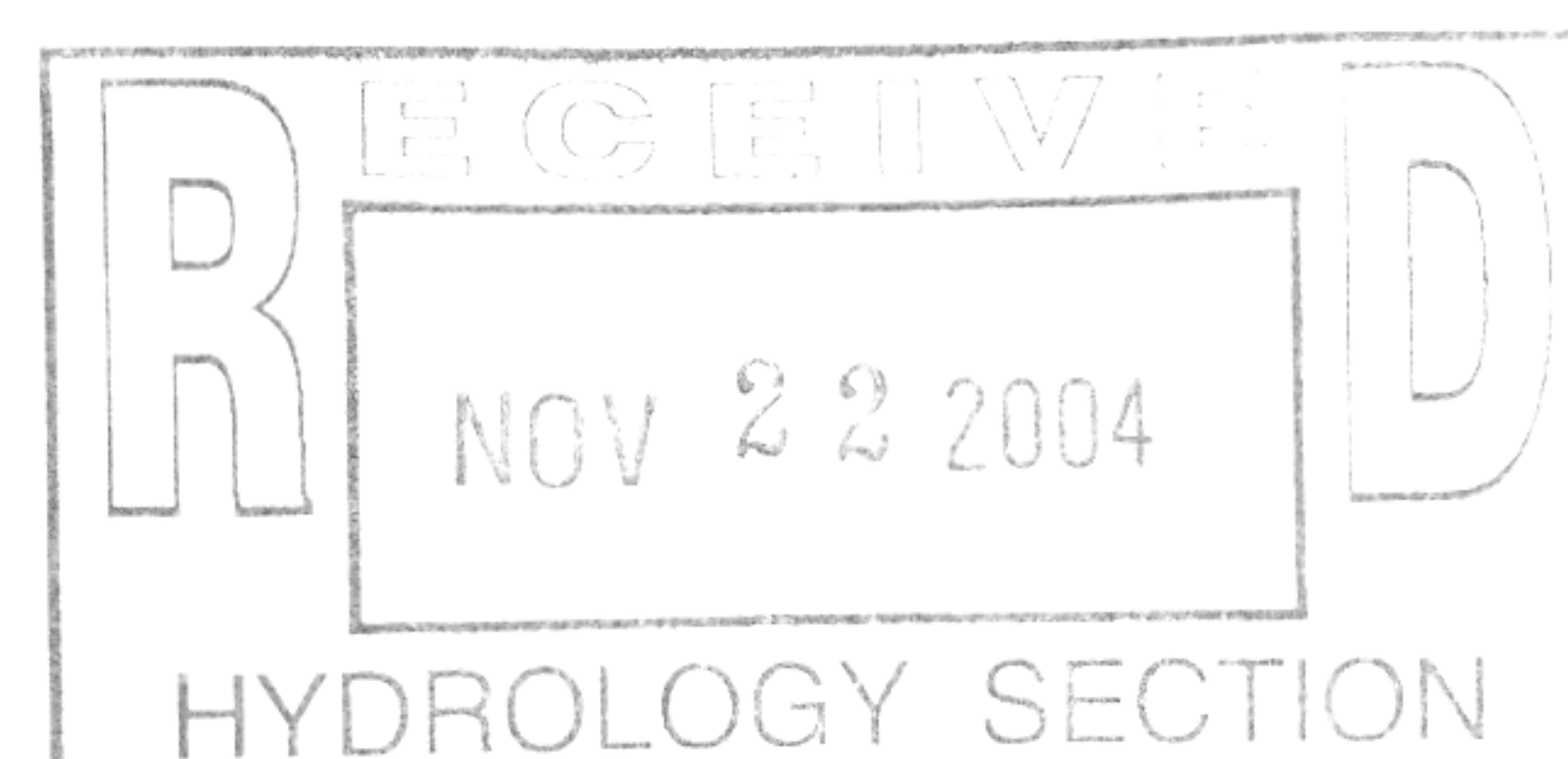


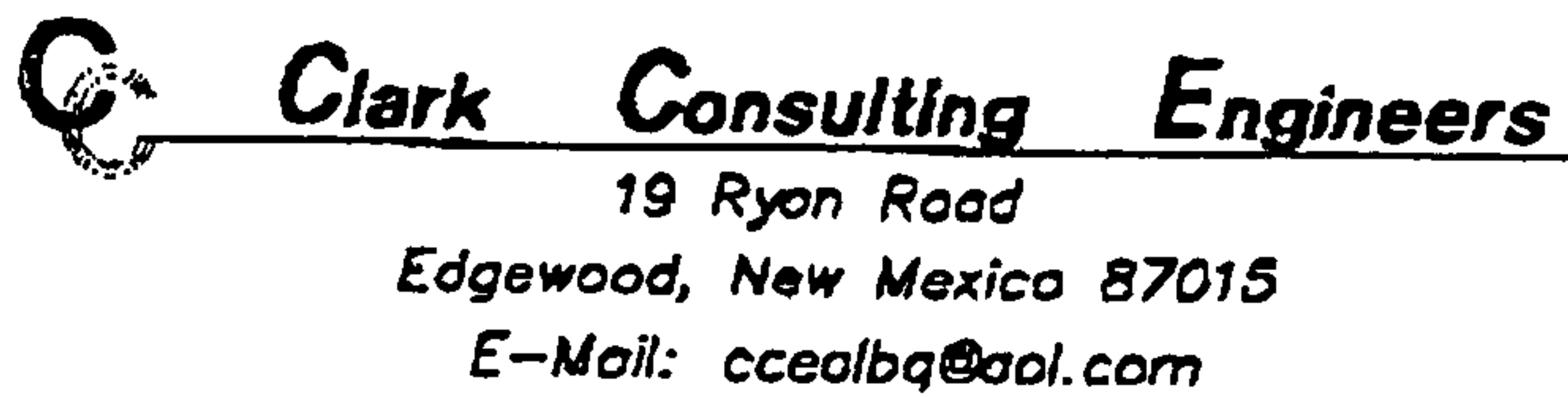
SW Pond



West Side

Lot 21 - Ox Bow





Tele: (505) 281-2444

Fax: (505) 281-2444

October 22, 2003

Oxbow Bluff Subdivision
c/o Kevin Patton, P.E.
Bohannon Huston, Inc.
7500 Jefferson St. NE
Albuquerque, NM 87109

RE: Engineer's Certification of Grading/Drainage Improvements, Lot 8, Oxbow Bluff
4105 Silvery Minnow Place - Ledbetter Residence

Dear Kevin:

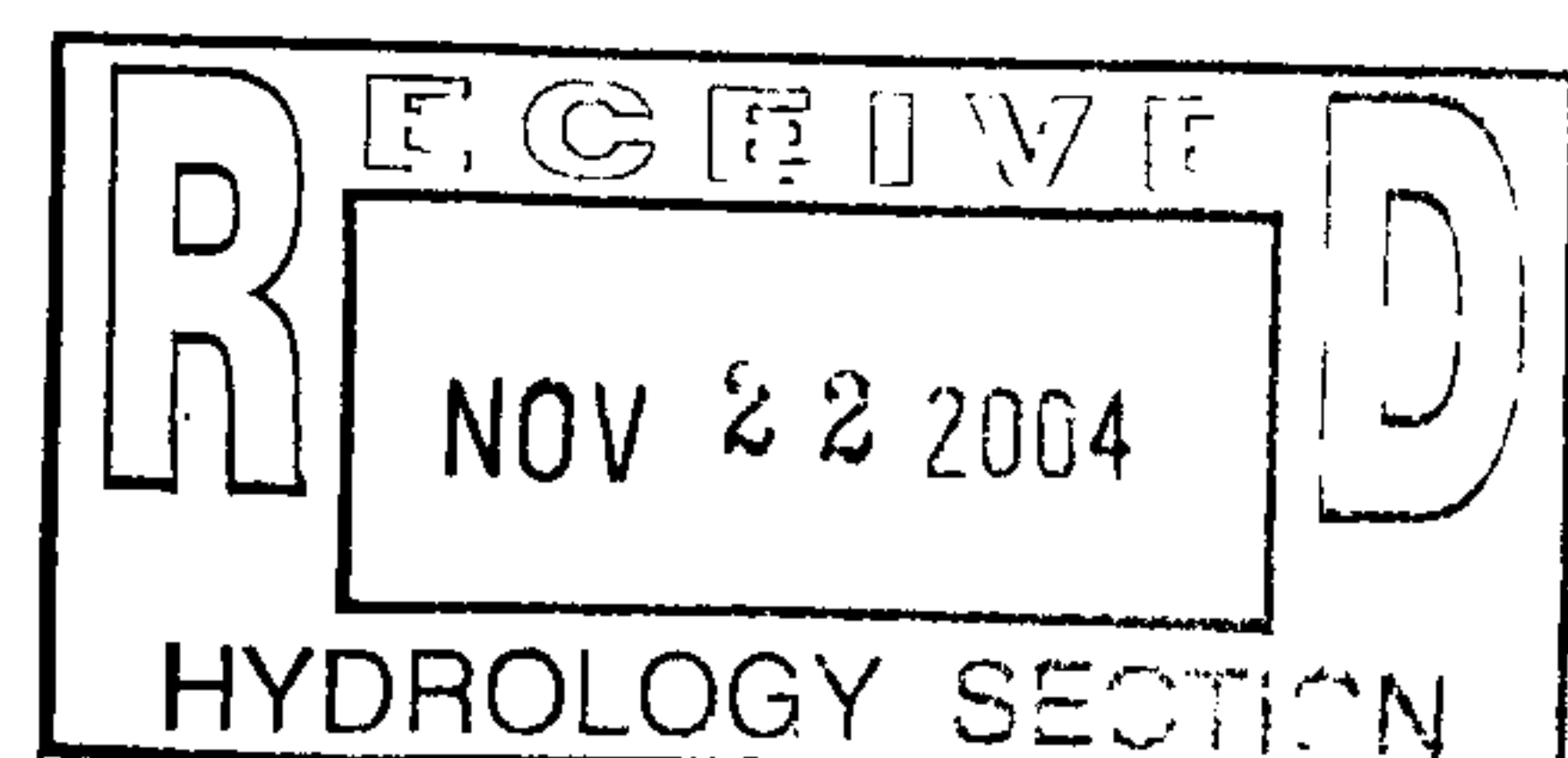
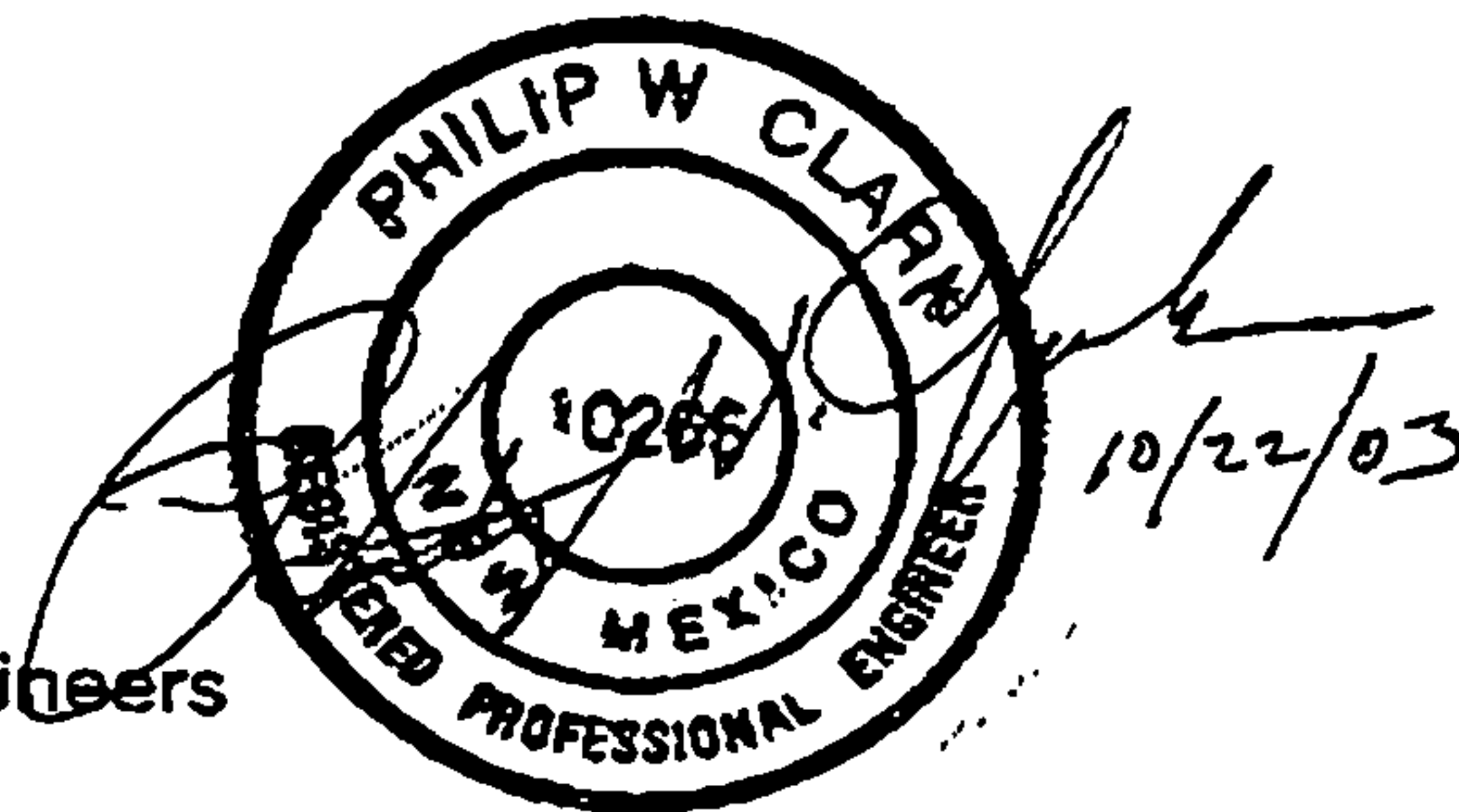
Please find the attached reduced copy of the as-built plan, and certification that the associated improvements were built in accordance with the approved plan, dated 1/02/03 with the following edifications noted:

1. The rock swale leading to the harvest pond was extended to the west an additional 9 feet.
2. Additional curvilinear patio area in the front courtyard was added, in addition to the sod and gravel areas shown.
3. Added triangular rock planter area at the entrance.
4. Extension of the rear retaining wall (2.5' high) to a point approximately opposite the NW corner of the residence.

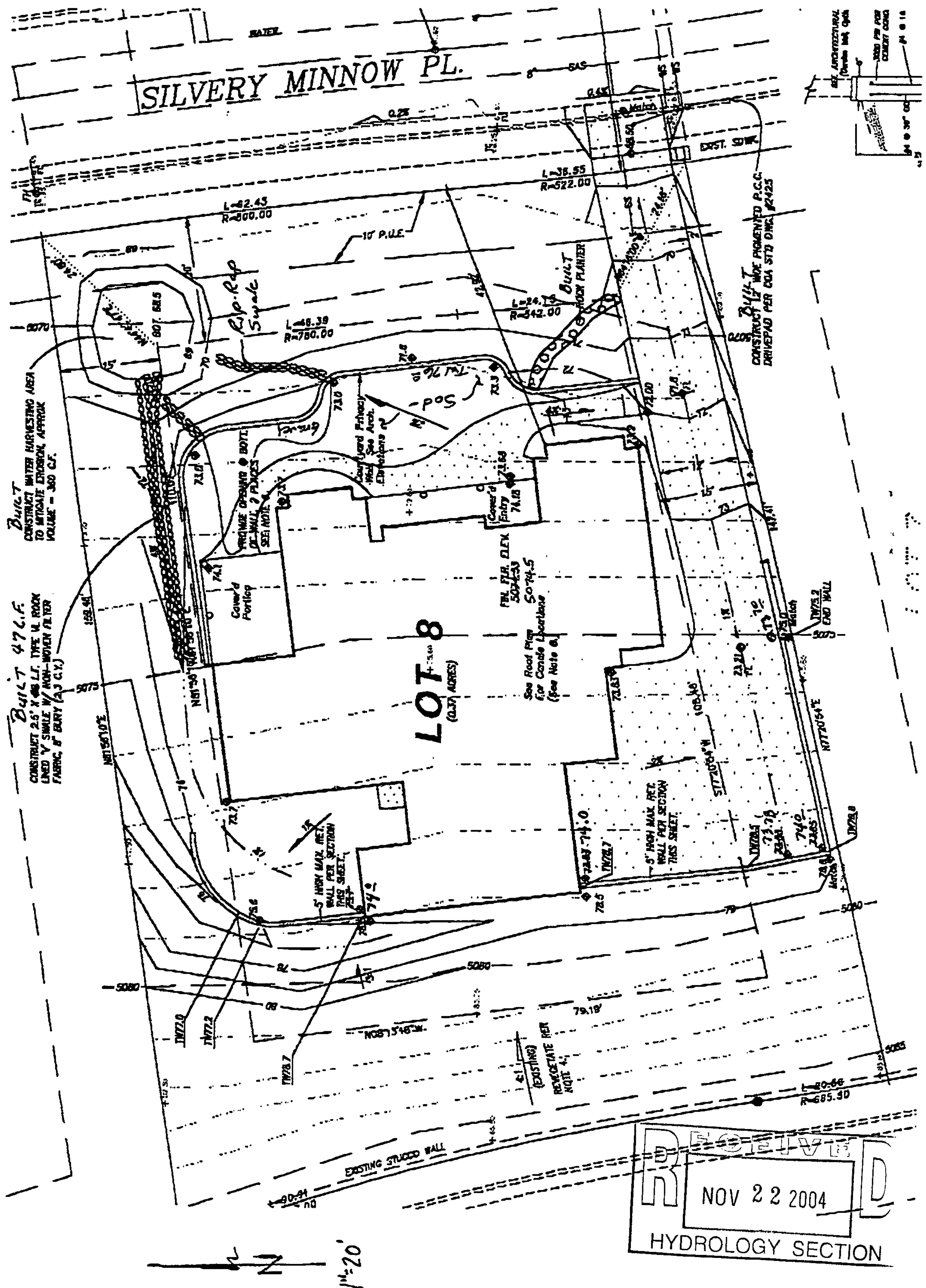
Thank you for processing this certification and should you have any questions, please give me a call.

Sincerely,

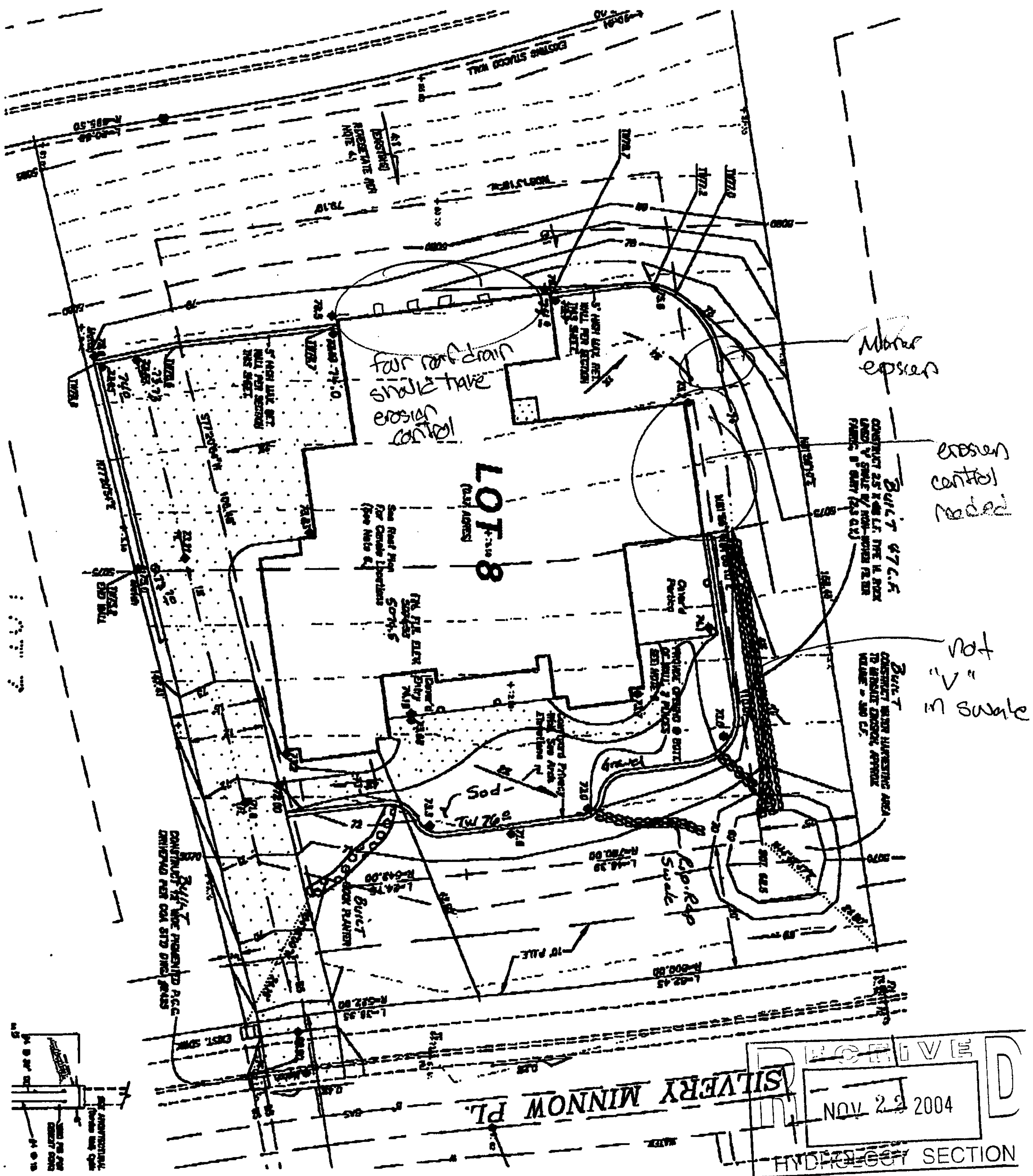
Philip W. Clark, P.E.
Clark Consulting Engineers



LOT 8



23



WILSON & COMPANY

2600 American Rd. SE, Suite 100
Rio Rancho, NM 87124
505-898-8021
505-898-8501 Fax

Albuquerque
Colorado Springs
Denver
El Paso
Fort Worth
Houston
Kansas City
Las Cruces
Lenexa
Los Angeles
Panama City, Fla.
Phoenix
Rio Rancho
Salina
San Bernardino
Wichita

24 October 2002

Altura West LTD, Inc.
4407 Lomas Blvd. NE
Albuquerque, NM 87110

Re: **Grading Certification – Lot 5 Oxbow Bluffs Subdivision**
WCEA File No.: X1218005

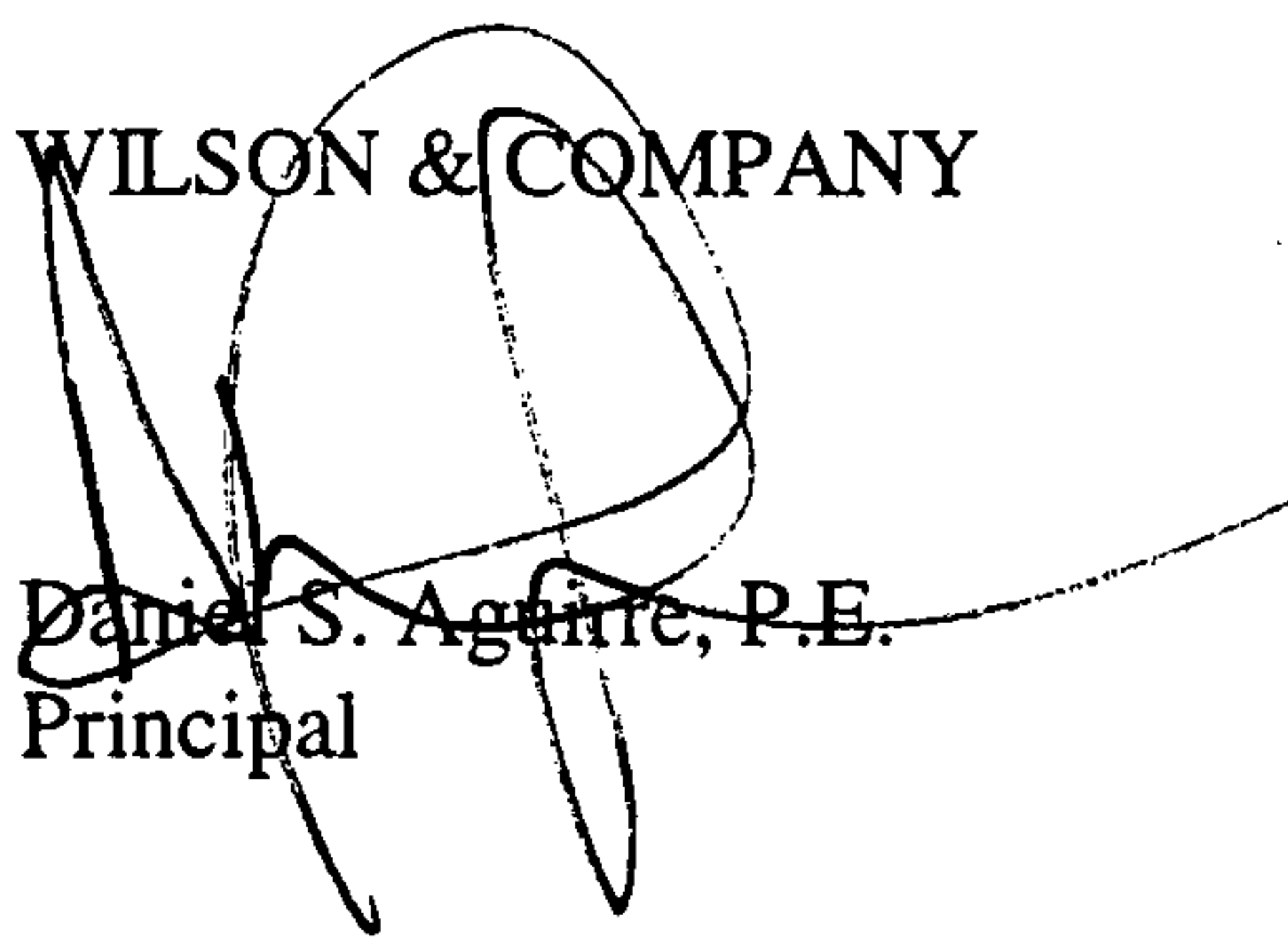
To Whom It May Concern::

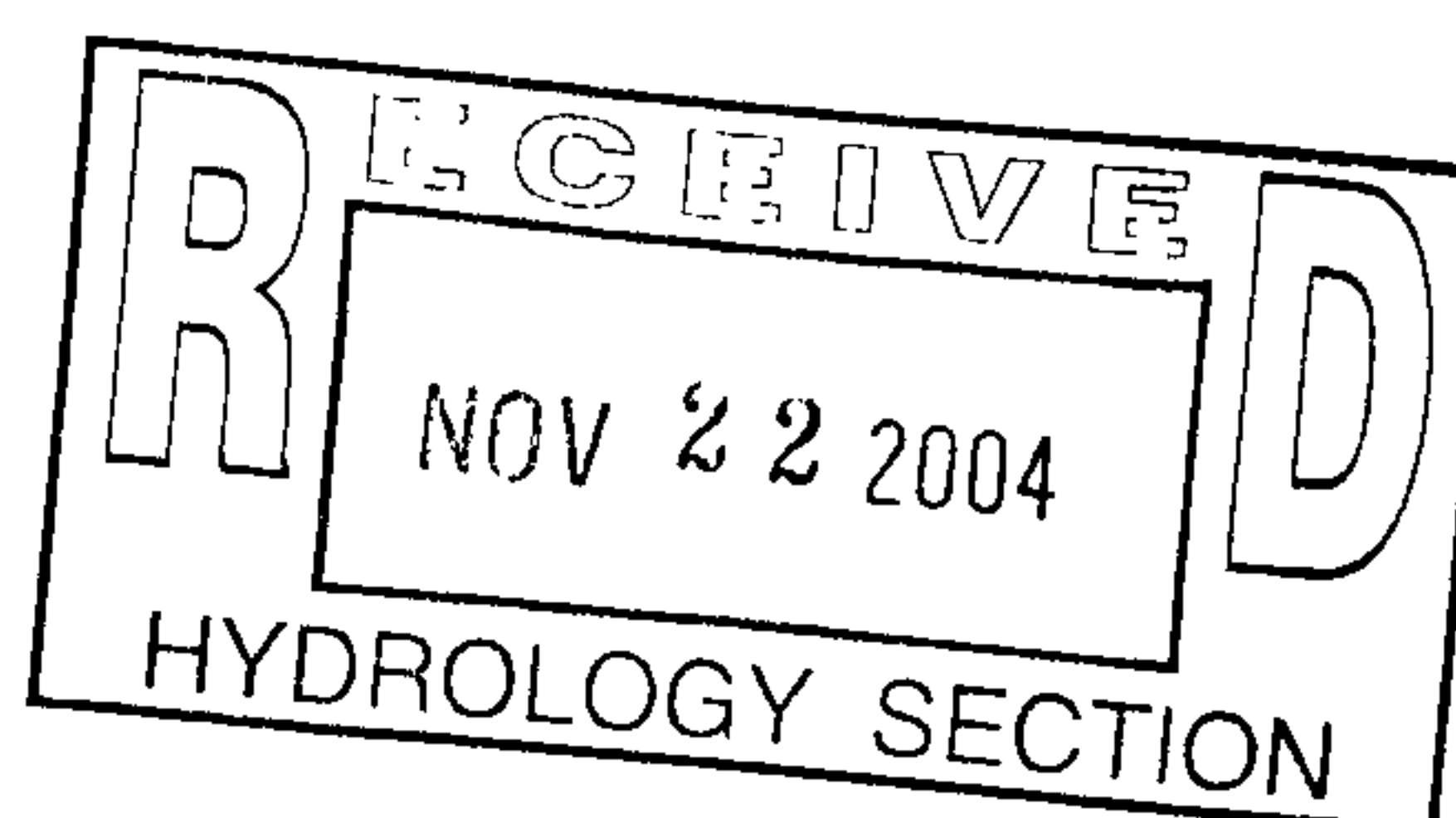
This letter is provided to certify that this lot has been graded and will drain in substantial compliance with and in accordance with the design intent of the approved plan dated 8-16-2000.

A signed and stamped certification has also been added to the plan.

If you have any questions or comments please don't hesitate to contact me.

WILSON & COMPANY


Daniel S. Aguirre, P.E.
Principal



Engineers & Architects
A PARTNERSHIP OF CORPORATIONS

LOT 5

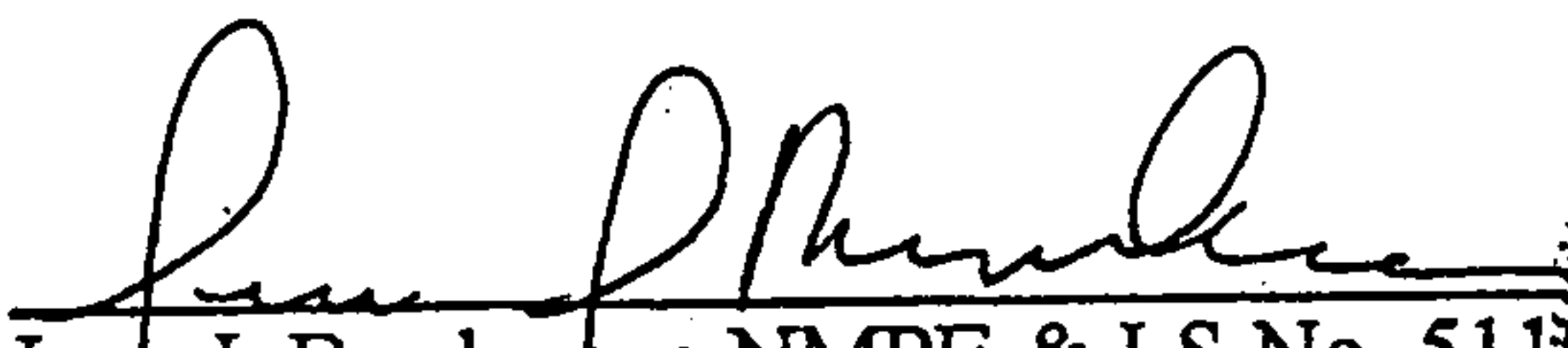


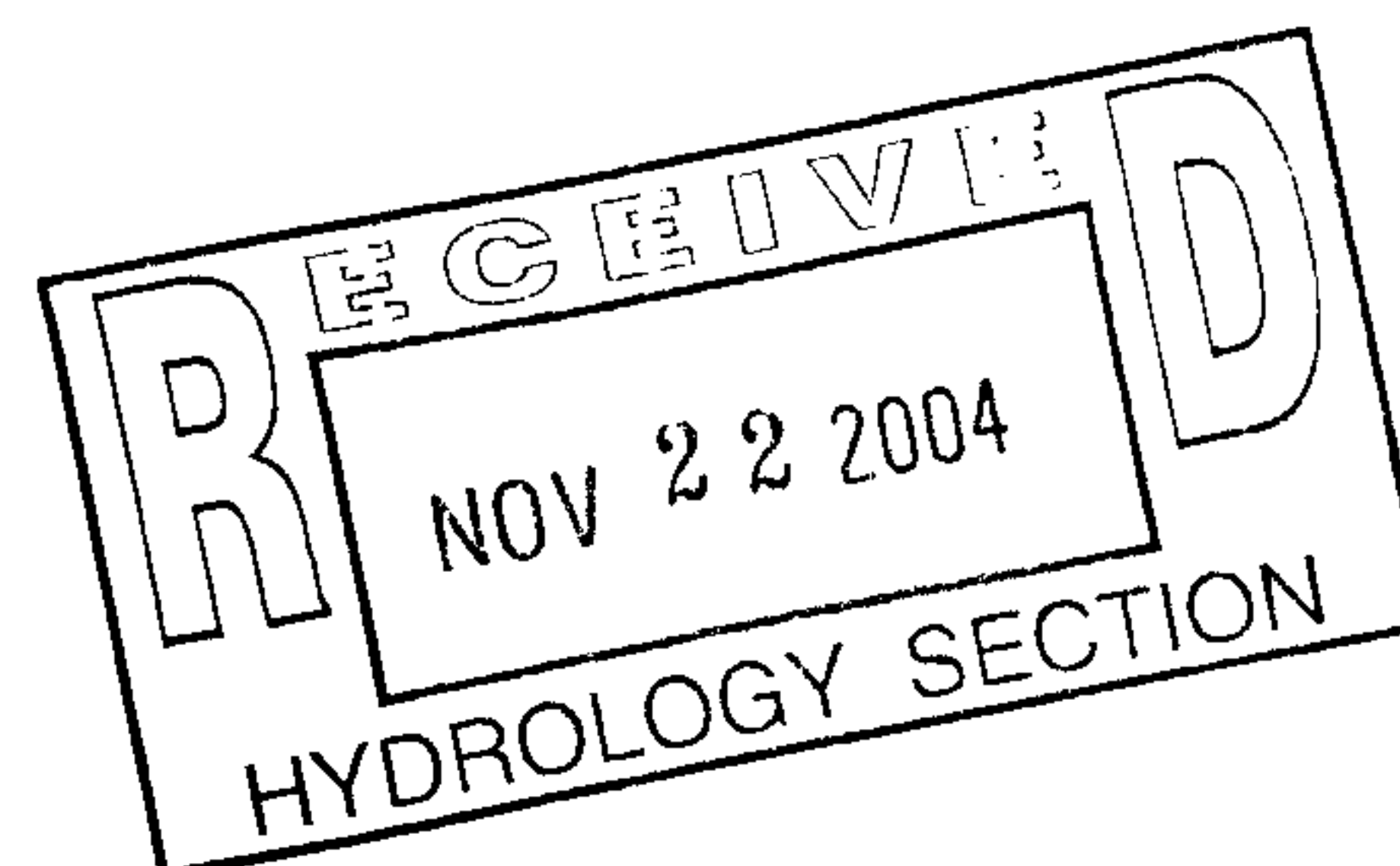
February 15, 2002

Altura West, Ltd. Co.
4060 St Joseph's Drive NW
Albuquerque, NM 87120

Attn: Jann Pierce
Re: Lot 9, Oxbow Bluff Subdivision

I, Jean J. Bordenave, a registered professional engineer in the State of New Mexico hereby certify that I prepared the Grading and Drainage plan for the subject lot and that I have made a site visit of the completed residential construction for the purpose of observing those items related to grading and drainage. As a result of the observation visit I hereby certify that the construction is in substantial conformance with the Grading and Drainage Plan prepared by me.


Jean J. Bordenave NMPE & LS No. 5110



JEFF MORTENSEN & ASSOCIATES, INC.
ENGINEERS & SURVEYORS

8010-B MIDWAY

PARK BLVD. NE

ALBUQUERQUE

NEW MEXICO

8 7 1 0 9

P R I N C I P A L S

JEFFREY G. MORTENSEN, P.E.

CHARLES G. CALA, JR., P.S.

J U A N M . C A L A

TEL:505-345-4250

FAX:505-345-4254

jmainc@swcp.com



990624

February 07, 2002

Ms. Mary Reed
3923 Mourning Dove Place NW
Albuquerque, NM 87120

Re: Reed-Brown Residence
Lot 61, Oxbow Bluff Subdivision
3923 Mourning Dove Place NW

Dear Mary:

At the request of your Contractor, Blueher Abodes LTD, I visited the subject project site on the afternoon of February 07, 2002. The purpose for this visit was to visually observe the status and condition of the grading and drainage of the site. My observations are as follows:

1. The vegetation around the residence appears to be reasonably well established.
2. The water harvesting area delineated on the approved Plan is in place.
3. Whereas the dry stream bed around the north end of the house was visually observed, the cobble check dams were either not in place, or not plainly visible. In either case, there does not appear to be an adverse effect to the apparent omission.
4. There were no visual signs of erosion or excessive runoff leaving the site.
5. Evidence of windblown sediment deposits at several locations on the site were observed. Routine maintenance will mitigate the effects of this natural phenomenon. In particular, removal of excess sediment from the water harvesting area in the front yard should occur on a routine basis to maintain volume and avoid "choking" the vegetation.

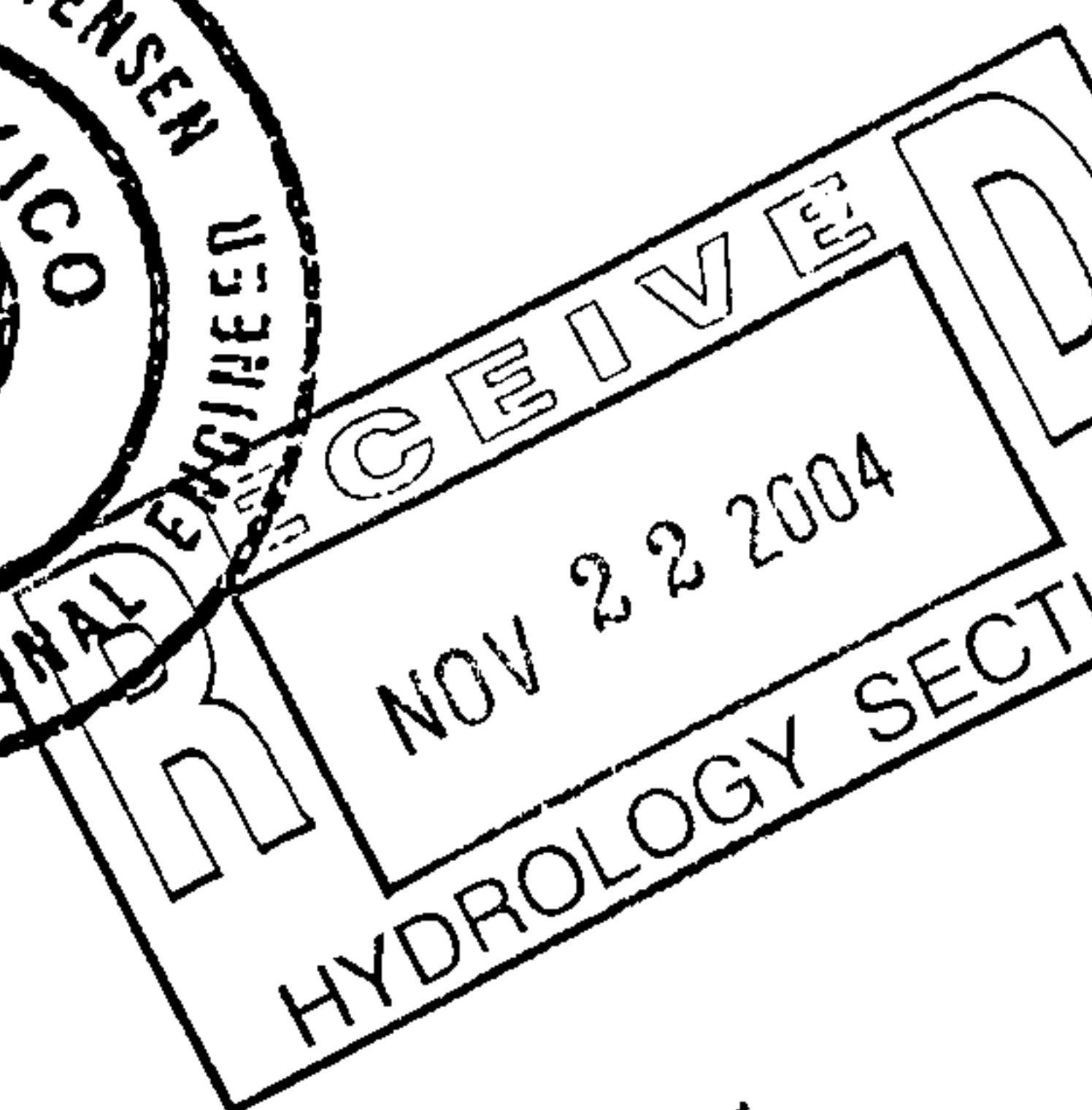
Based upon my visual observations, this lot has been graded and drained in substantial compliance with the intent and concepts set forth on the approved Grading and Drainage Plan last dated August 04, 2000. If you should have any questions or comments concerning this Final Letter of Certification, or any other aspect of this project, please do not hesitate to call.

Sincerely,

JEFF MORTENSEN & ASSOCIATES, INC.

Jeffrey G. Mortensen, P.E.
President

Xc: Oxbow Communities
Blueher Abodes LTD.



LOT 61



City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

February 22, 2002

Kevin Patton, PE
Bohannon Huston, Inc
7500 Jefferson NE
Albuquerque, NM 87109

Re: Lot 33 Oxbow Bluff Subdivision SO# 19 Permit
Engineer Stamp dated 2-18-02 (G11/D14D)

Dear Mr. Patton,

Based upon the information provided in your submittal dated 2-22-02, the above referenced plan is approved for SO#19 Permit. Please provide a copy of this plan to your contractor and advise him that an additional permit through the Excavation and Barricading Permit office is required.

If you have any questions, you can contact me at 924-3986.

Sincerely,

Bradley L. Bingham, PE
Sr. Engineer, PWD
Development and Building Services

C: file

LOT 33

DRAINAGE INFORMATION SHEET

14D
G-11/D

PROJECT TITLE: SO-19 for Lot 33 Oxbow Bluff ZONE MAP/DRG. FILE # G-11
DRB #: 97-237 EPC#: _____ WORK ORDER#: 584081

LEGAL DESCRIPTION: Lot 33 - P1 Oxbow Bluff
CITY ADDRESS: _____

ENGINEERING FIRM: BOHANNAN HUSTON, INC. CONTACT: KEVIN PATTON
ADDRESS: 7500 JEFFERSON NE. PHONE: (505) 823-1000
CITY, STATE: ALBUQUERQUE, NM 87109 ZIP CODE: _____

OWNER: John Clavin CONTACT: JOHN CALVIN
ADDRESS: 733 Chavez Road NW PHONE: (505) 344-5911
CITY, STATE: ALBUQUERQUE, NM 87109 ZIP CODE: _____

ARCHITECT: _____ CONTACT: _____
ADDRESS: _____ PHONE: _____
CITY, STATE: _____ ZIP CODE: _____

SURVEYOR: _____ CONTACT: _____
ADDRESS: _____ PHONE: _____
CITY, STATE: _____ ZIP CODE: _____

CONTRACTOR: _____ CONTACT: _____
ADDRESS: _____ PHONE: _____
CITY, STATE: _____ ZIP CODE: _____

TYPE OF SUBMITTAL:

- ☐ DRAINAGE REPORT
☐ DRAINAGE PLAN
☐ CONCEPTUAL GRADING & DRAINAGE PLAN
☒ GRADING PLAN
☐ EROSION CONTROL PLAN
☐ ENGINEER'S CERTIFICATION
☐ CLOMR/LOMR
☐ OTHER

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ☐ YES
☒ NO
☐ COPY PROVIDED

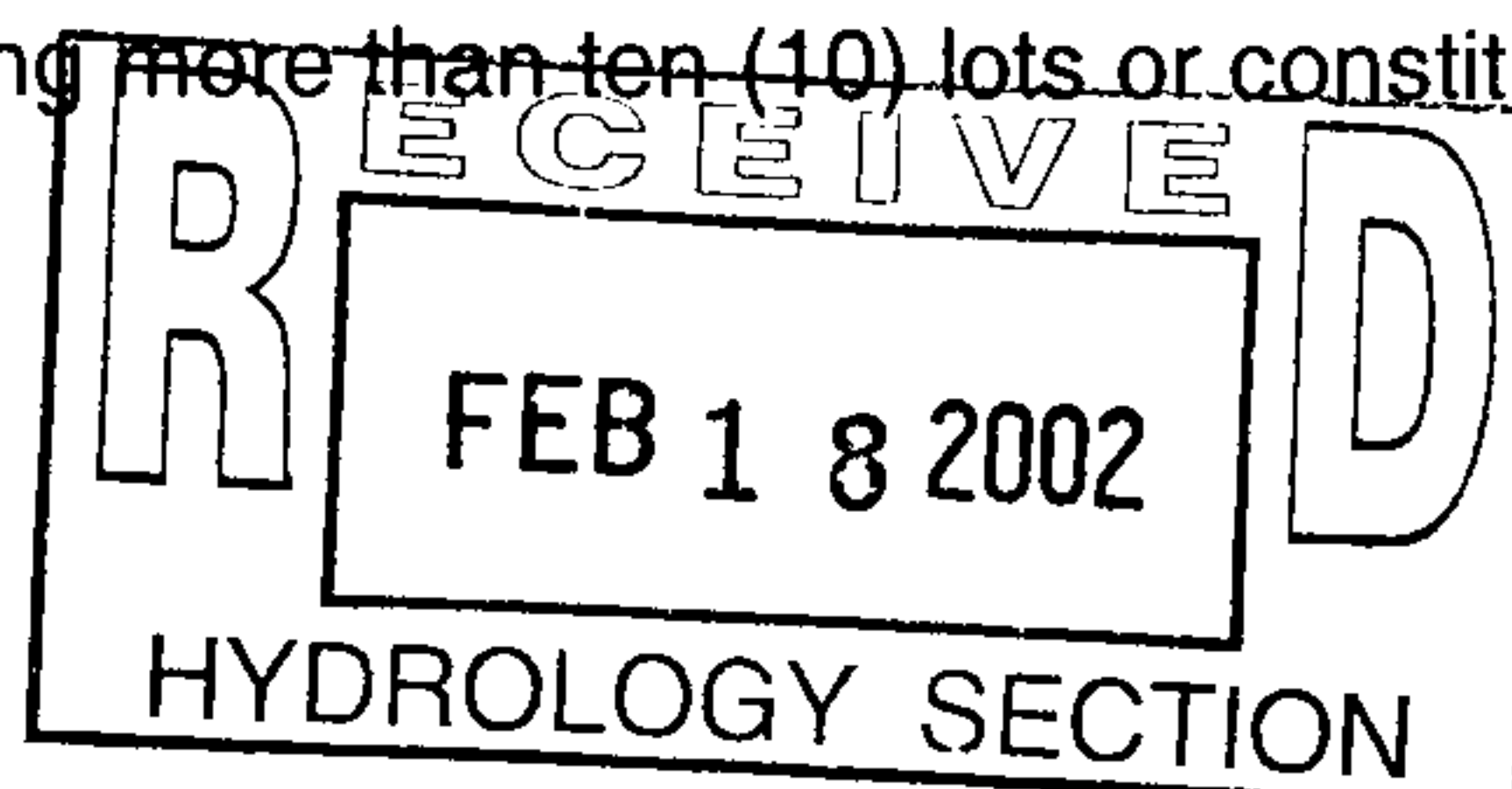
CHECK TYPE OF APPROVAL SOUGHT:

- ☐ SIA / FINANCIAL GUARANTEE RELEASE
☐ PRELIMINARY PLAT APPROVAL
☐ S. DEV. PLAN FOR SUB'D. APPROVAL
☐ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
☐ SECTOR PLAN APPROVAL
☐ FINAL PLAT APPROVAL
☐ FOUNDATION PERMIT APPROVAL
☐ BUILDING PERMIT APPROVAL
☐ CERTIFICATE OF OCCUPANCY APPROVAL
☐ GRADING PERMIT APPROVAL
☐ PAVING PERMIT APPROVAL
☐ WORK ORDER APPROVAL
☒ OTHER (SPECIFY) **SO-19**

DATE SUBMITTED: 2-18-02 BY: [Signature]

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature, location and scope of the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

- 1. Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
- 2. Drainage Plans:** Required for building permits, grading permits, paving permits and site plans less than five (5) acres.
- 3. Drainage Report:** Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.





City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

December 17, 1997

Kevin Patton, P.E.
Bohannon-Huston, Inc
7500 Jefferson Blvd. NE
Albuquerque, NM 87109

611-D14D

**RE: OXBOW BLUFF SUBDIVISION (~~CH-511A~~). DRAINAGE REPORT SUBMITTAL
FOR PRELIMINARY PLAT, FINAL PLAT, AND GRADING PERMIT
APPROVALS. ENGINEER'S STAMP DATED 12-11-97.**

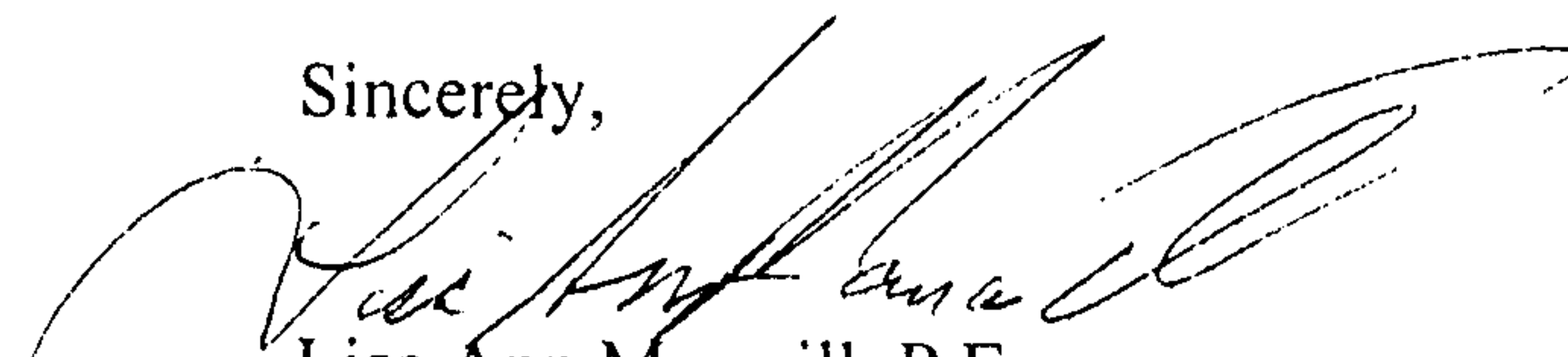
Dear Mr. Patton:

Based on the information provided on your November 26, 1997 submittal, the above referenced project is approved for Preliminary Plat, Final Plat, and Grading Permit. The following conditions are part of this approval:

1. Each lot will provide a grading and drainage plan, prepared and certified by a New Mexico Licensed Professional Engineer.
2. The total developed flow within each Basin in Oxbow Bluff will not exceed the assumed design flows set forth in the approved Drainage Report.

Please note that other conditions may be applicable between the City and the Developer. It is my understanding that Altura West Ltd. and the City are in drafting a "Letter of Agreement" regarding this project. If I can be of further assistance, please feel free to contact me at 924-3984.

Sincerely,



Lisa Ann Manwill, P.E.
Hydrology

c: Andrew Garcia

File

RECEIVED BHI DEC 17 1997

FILE 97 142 A 04 240

ALTURA WEST LTD. CO.
P.O. DRAWER AA
ALBUQUERQUE, NM 87103

December 16, 1997By Facsimile and Hand Delivery

Fred Aguirre, P.E.
City Hydrologist
City of Albuquerque
Hydrology Division/PWD
P.O. Box 1293
Albuquerque, NM 87103

Post-it® Fax Note	7671	Date	1/15/98	# of pages	2
To	USA MAILWALK	From	K. PATTON		
Co./Dept.	COA PWD	Co.	BOHANNAN-HUSTON		
Phone #	924 3984	Phone #	823-1000		
Fax #	924-3869	Fax #	798-7960		

RE: Oxbow Bluff Subdivision, Grading and Drainage Certification
(City Drainage File No. ~~G-11/D-14~~)

G-11/D14D

Dear Fred:

Please consider this letter confirmation of our intention concerning the referenced project and the on-going grading and drainage certification required to serve this subdivision. As you are aware, the development of new subdivisions within the City has recently brought forth new and innovative techniques to minimize the impact to the environment around us.

I understand the City now embraces developments that do not require a site to be mass graded, but instead, they maintain the existing terrain by providing building envelopes and roadways which are constructed to conform to the site's topography. At the same time, we recognize the development must provide adequate protection from storm water and its effects.

Altura West Ltd. Co. will create and record restrictive covenants which will establish criteria that must be met in order to build in Oxbow Bluff Subdivision. Prior to final plat approval, we will provide a copy of the restrictive covenants to the City of Albuquerque, Hydrology Division, so that you will be able to review the provisions relating to drainage certification and the procedural mechanism for enforcement of drainage certification. The covenants will require specific standards to be met for conveying developed flows. All of the lots within Oxbow Bluff (except for Lots 12, 13, 14 and 25 through 51) will be required to convey all developed flows, stormwater, or nuisance flows to the public roadway while protecting the existing soil from erosion. Lots 12, 13, 14 and 25 through 51 will be developed with small water harvesting ponds, for erosion protection, that may overflow to the river in larger storm events.

December 16, 1997

Page 2

Altura West Ltd. Co. will see to it that the following measures will be taken to satisfy the requirement of the subdivision drainage certification:

- Each lot will provide a grading and drainage plan, prepared and certified by a New Mexico Licensed Professional Engineer, to Altura West Ltd. Co.
- Altura West Ltd. Co. will see to it that as houses are planned and constructed within Oxbow Bluff, the total developed flow within each Basin in Oxbow Bluff will not exceed the design flow set forth in the approved Drainage Report.
- The grading and drainage plan provided to Altura West Ltd. Co. for each lot must be approved by Bohannon Huston, Inc.
- An updated grading and drainage certification, certified by Bohannon Huston shall be submitted to the City of Albuquerque Public Works Department, Hydrology Division, on an annual basis or upon the completion of every 15 houses within Oxbow Bluff, whichever comes first.

If you have any questions or require any additional information, please give me a call at 346-4646. We appreciate your cooperation.

Yours very truly,

ALTURA WEST LTD. CO.



Thomas F. Keleher, President

TFK/js

cc: James Topmiller, Bohannon Huston
Kevin Patton, Bohannon Huston
James W. Rogers, Jr.

FINAL DRAFT

6/10/96

OXBOW BIOLOGICAL MANAGEMENT PLAN

with

Draft Inspection & Maintenance Plan for San Antonio Arroyo Outfall



Prepared for:

**Parks & General Services Department
OPEN SPACE DIVISION**

Prepared by:

**Parks & General Services Department
DESIGN & DEVELOPMENT DIVISION**

EXECUTIVE SUMMARY

The Oxbow at the San Antonio Arroyo supports a large complex of marshes, unique in the Albuquerque metropolitan area. The Oxbow marshes are located on the west side of the Rio Grande, east of the Saint Pius X High School Campus, approximately 1.5 miles north of the Interstate 40 bridge. The marshes occupy an abandoned meander scar, or oxbow, of the Rio Grande formed by a series of flood events in the mid twentieth century. The present wetlands were not established until the 1960's. Although relatively new, the Oxbow marshes are representative of a habitat type which was abundant along the Rio Grande prior to modern river management practices. As such they are a window on the river's past and are essential habitat for species which have long thrived in wetland habitats of the Rio Grande.

Due to the rarity of marsh habitat locally, and the high value of such habitat to a variety of wildlife species, the Oxbow marshes have been identified as resources suitable for protection and conservation in several City plans. This document provides a framework of management policies and measures for protecting, restoring and maintaining the biological richness of the marshes.

The Oxbow marshes are currently privately owned. Implementation of the plan will require acquisition of land or easement rights to land within the Oxbow, to the bluff above the Oxbow and to a buffer zone above the bluff. The City Open Space Advisory Board has recommended that negotiations for acquisition of land or easements be initiated.

The City's assumption of management responsibilities is also contingent upon the completion of the Albuquerque Metropolitan Arroyo Flood Control Authority improvements to the San Antonio Arroyo, which are scheduled for 1996 construction.

Current threats to the viability of the Oxbow marshes include sedimentation, water stagnation and human disturbance. The Oxbow Biological Management Plan proposes to limit sedimentation through implementation of erosion control measures both on- and off-site. The AMAFCA upgrades to the San Antonio Arroyo should also considerably reduce sedimentation of the Oxbow marshes. A variety of drainage control measures and practices are recommended to enhance the biological diversity of the marshes and rejuvenate stagnant areas. Human impacts on the marshes are addressed through access management recommendations aimed at facilitating interpretive education and passive recreation, while limiting access to the marshes to management and research activities.

Development of lands west of the Oxbow may occur soon. (Altura West Ltd. has amended the University of Albuquerque Sector Development Plan as a first step toward development of the Keleher lands and Archdiocese has engaged a consultant to study feasibility of developing their undeveloped lands). This will provide an opportunity to address some of the current access and drainage concerns.

Creation of an advisory committee which would include members with expertise pertinent to the management of the Oxbow as a marsh habitat is recommended to provide ongoing refinement of the management program. The management plan establishes a general philosophy of using the least invasive methods that prove to be effective, but more invasive management procedures may be warranted in the early

stages to improve habitat. Also, new advances in knowledge and technology and specific conditions in the Oxbow may warrant changes in approach. For this reason, the advisory committee will play an important role in the ongoing management of the San Antonio Oxbow by reviewing management options and recommending modifications in strategy, as needed.

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1. INTRODUCTION

1.1 Background

An oxbow, or oxbow lake, is defined as “a long, broad, crescent-shaped lake formed when a stream abandons a meander and takes a new course” (Press and Siever, 1978). Generally, the term oxbow can connote any meander channel cut off from the main stem by stream relocation. The Oxbow at San Antonio Arroyo (the Oxbow), a natural meander scar of the Rio Grande, is located on the west side of the main channel, north of the Interstate 40 Bridge, directly across from the Rio Grande Nature Center, extending south from the mouth of the San Antonio Arroyo and Lower Corrales Riverside Drain outlet (see Figures 1 and 2).

A series of natural and human caused events over the last 50 years (see Section 1.4) led to the development of approximately 40 acres of wetlands in the Oxbow. These wetlands constitute the only large block of contiguous marshland in the Albuquerque reach of the Rio Grande. Although marshes and other wetlands have often been regarded as nuisance areas or wastelands, their high biological productivity, flood attenuation properties, and ability to remove some pollutants from water have gained increasing notice in recent years, leading to wetland conservation initiatives by various public and private entities. This plan identifies administrative and management actions which the City of Albuquerque Parks and General Services Department, Open Space Division intends to implement to conserve and enhance the natural resources value of the Oxbow and its wetlands.

1.2 Land Ownership Status

Figure 2 depicts the approximate boundaries of current land ownership in and around the Oxbow. The northern boundary of the management area is the north berm of outfall area, the eastern limit is the Rio Grande Channel, the southern limit is near the southern edge of the Keleher Family Trust lands, and the western limit would be determined by the limit of land acquisition above the bluff.

The land to be acquired for implementation of this plan includes lands of the Sierra Club Foundation, Albuquerque Public Schools and the Keleher Family Trust. The Albuquerque Public Schools tract would be acquired in its entirety. Only that portion of the Keleher Family Trust lands including the Oxbow marshes, the bluff above the Oxbow and some buffer zone above the bluff (ideally at least 100 feet westward from the top of bluff, actual extent to be determined through negotiations with the trust) would be acquired. The Sierra Club Foundation proposes to transfer title of its lands to the City when the Oxbow Biological Management Plan is adopted.

The lands of the Sierra Club Foundation and Graham which lie between the south and north berms of the San Antonio Arroyo outfall will be managed for drainage

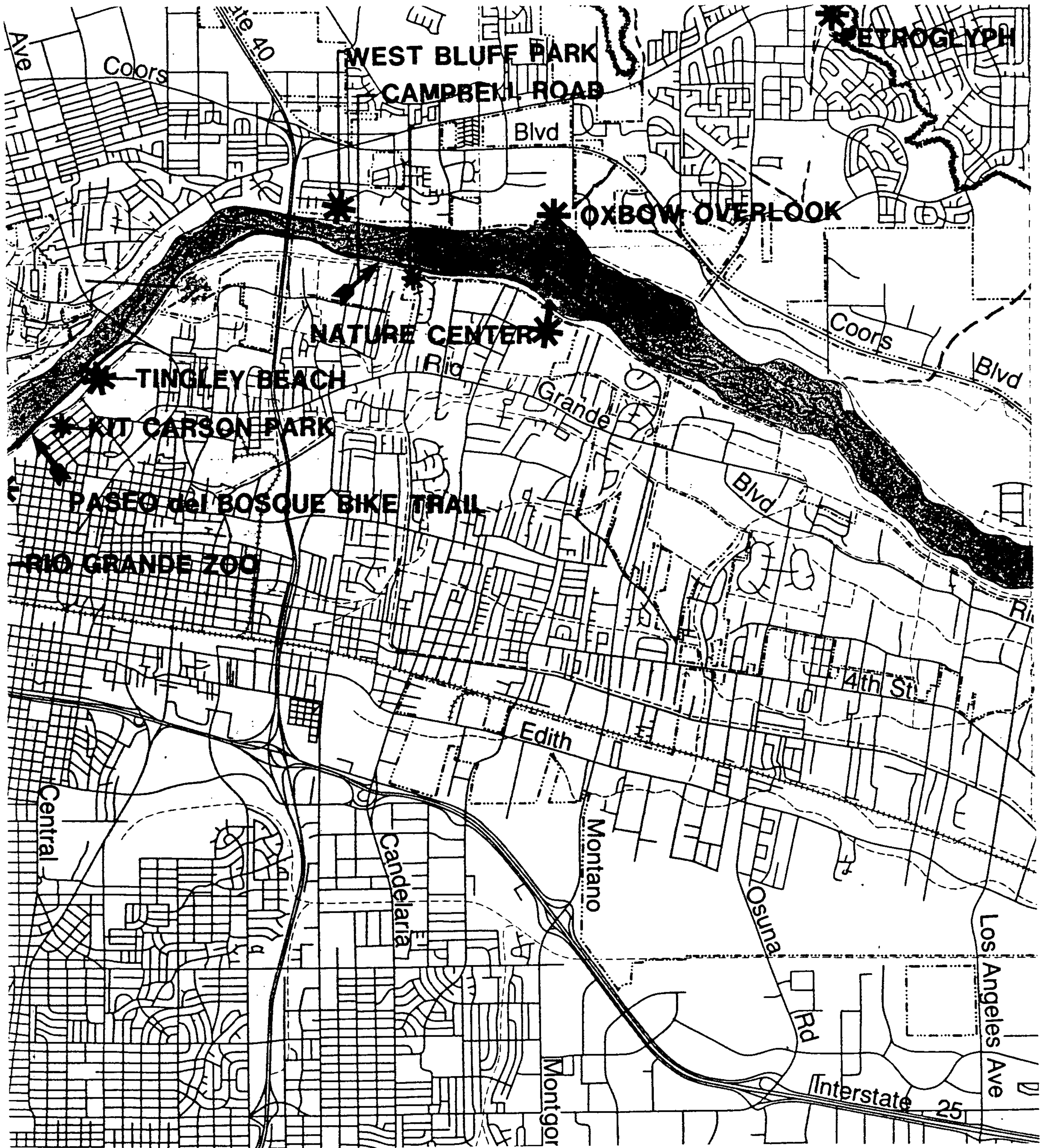


Figure 1. Location Map

Oxbow Area Land Ownership

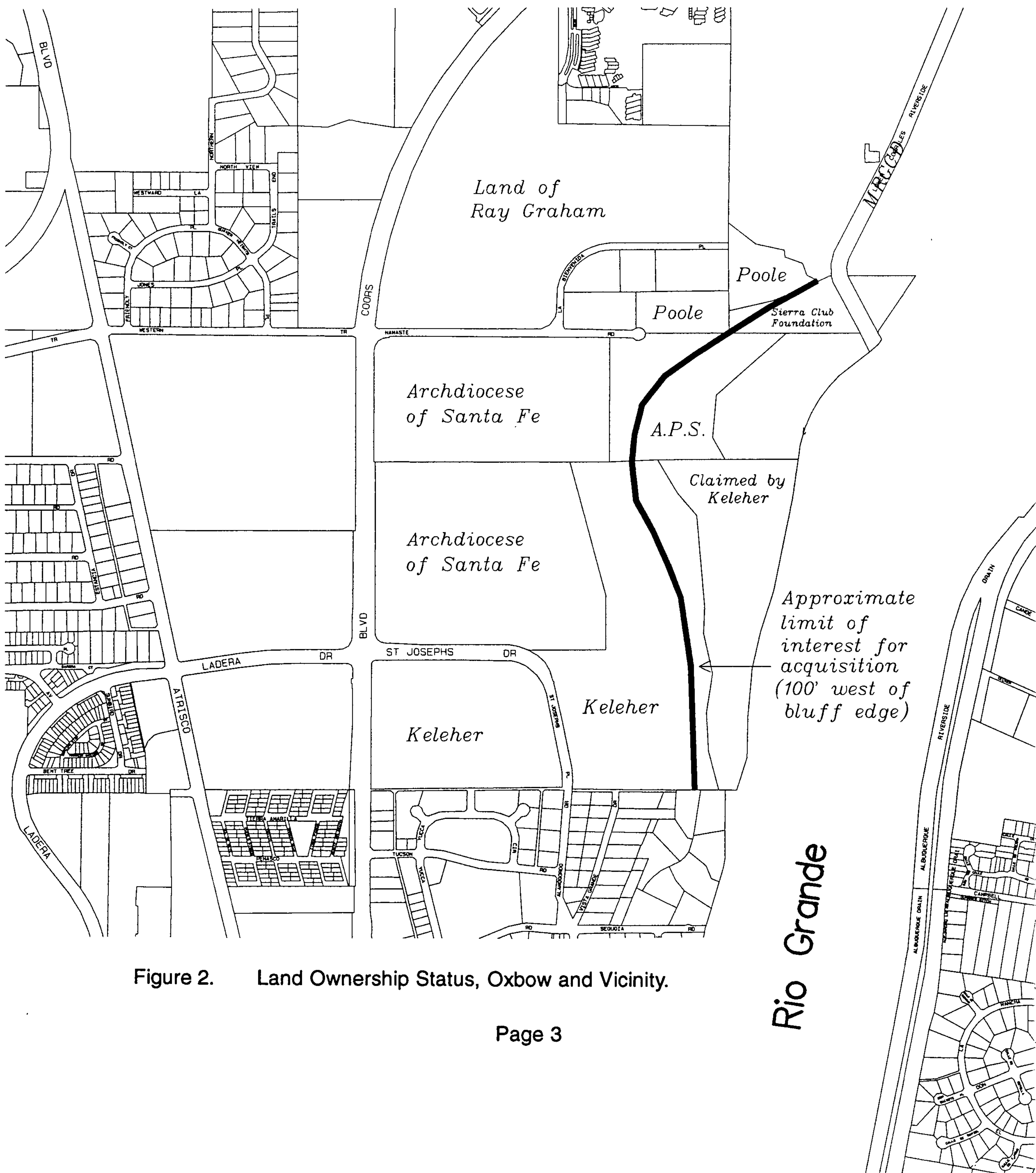


Figure 2. Land Ownership Status, Oxbow and Vicinity.

under a joint maintenance agreement between The Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), the Middle Rio Grande Conservancy District (MRGCD) and the City of Albuquerque Parks and General Services Department, Open Space Division. The drainage measures proposed (see Appendix C) will likely result in creation and maintenance of wetlands in the area between the berms. It is proposed that the area between the berms be managed as a "Special Management Area" with stormwater management as the primary purpose.

1.3 Regional Historical Context

An understanding of the local and regional importance of a 40 acre wetland such as the Oxbow marsh requires a brief review of changes which have occurred in the Middle Rio Grande due to human activity. Historically, the Rio Grande meandered through its broad floodplain, migrating laterally in response to periodic flooding and sand bar development. Actively meandering river systems in broad floodplains are generally characterized by numerous oxbows and other abandoned channel scars of varying age. Although individual circumstances greatly alter this process, an oxbow typically develops through time from an aquatic system (lake or pond) to a terrestrial system (bottomland forest) as decaying plant matter and eroded bank sediments gradually fill in the old channel scar. An intermediate stage in this process is the development of flood-water fed marshes within the oxbows. Over time such marshes typically grade through successional stages including wet meadows, upland meadows and shrublands, although fluvial processes can maintain marsh conditions indefinitely under some conditions. An uncontrolled river flowing through a broad floodplain is thus normally bordered by a diverse mosaic of ponds, wetlands, meadows and bottomland forests of varying ages created by channel relocation (Mitsch and Gosselink, 1986). Although detailed descriptions of the Rio Grande prior to agricultural development are few, they do indicate that the middle reach of the Rio was bordered by well developed dense forests of cottonwood and willows, interspersed liberally with marshlands rich in waterfowl (Horgan, 1954).

The natural condition of the Rio Grande has, however, been profoundly changed by tree harvest, channelization, irrigation and flood control works. By the middle of the eighteenth century, large areas of the Rio Grande Valley were used in irrigated agriculture. By the mid-nineteenth century, nearly all of the cottonwood bosque within 20 miles of Albuquerque had been cut for lumber and fuel. In the early twentieth century, poor return of irrigation water in conjunction with siltation of the river due to increased erosion from heavily grazed uplands, resulted in water logging of many areas in the middle Rio Grande Valley (DuMars et al., 1993). In 1925, MRGCD was established to effect drainage of waterlogged lands adjacent to the Rio Grande and construct localized flood control works. In addition to these changes in the middle reach of the Rio Grande, large scale projects were changing flooding patterns over the length of the river. Irrigation supply dams proliferated in the early twentieth century, including Elephant Butte Dam in 1916.

After major flooding of the middle Rio Grande valley in 1941, the U.S. Army Corps of Engineers and Bureau of Reclamation conducted intensive studies of flooding and prepared the Rio Grande Comprehensive Plan, which proposed a series of flood control dams on the Rio Grande and its tributaries above the middle valley. The Comprehensive Plan was implemented by the Federal Flood Control Act of 1948, with the Corps of Engineers responsible for constructing flood control reservoirs and rehabilitating levees constructed by MRGCD, while the Bureau of Reclamation was responsible for clearing the defined floodway and installing jetty jacks to stabilize the river banks. By the late 1950's, flooding on the middle reach of the Rio Grande had been virtually eliminated outside of a defined floodway within the levee system.

This history of channelization, drainage and flood control has significantly reduced wetland acreage along the middle reaches of the Rio Grande. Estimates published in the *Middle Rio Grande Ecosystem: Bosque Biological Management Plan* (Crawford et al., 1993) show a reduction of wetland area from 52,000 acres in 1918 to 3,700 acres in 1993. The figure of 3,700 acres includes the surface area of drains constructed by the MRGCD. Actual wetland acreage is likely considerably less. The marshes at the Oxbow, although of recent creation, are thus representative of past conditions.

Flood control works have also greatly reduced cottonwood regeneration, which requires regular spring flooding. The remaining Rio Grande Bosque in the vicinity of Albuquerque is thus composed primarily of mature cottonwood, established during the last period of regular flooding, with few cottonwood in the understory. Exotic species, notably the Russian olive, salt cedar and Siberian elm, have thrived in the bosque understory.

In summary, the character of the middle Rio Grande Valley has changed considerably since European colonization of the area. Flood control and channel stabilization have been imposed upon a formerly highly variable river system subject to seasonal flooding and considerable lateral migration. The result is an even-aged bosque with little regeneration, very limited wetlands and large-scale invasion of exotic species -- all in an area which previously supported a mosaic of varied age bosque and extensive marshes. The importance of the marshes at the Oxbow is thus increased by their local rarity.

1.4 Creation and Development of the San Antonio Oxbow

The Oxbow, although representative of earlier marsh systems, is of recent genesis. The following history of the Oxbow's development is summarized largely from ECoPlan, 1992. Prior to 1935, most of the current Oxbow area was high ground contiguous to the sandy uplands which characterize much of the developed area east of the West Mesa escarpment. Between 1935 and 1954, various flood events and channel relocations occurred in the Middle Rio Grande. The resulting bank cutting created roughly the current valley configuration at the location of the Oxbow. The Rio Grande channel occupied the western edge of the floodplain, adjacent to the current Oxbow bluff. Aerial photographs taken during this period show the development of a

sand bar between the meander channel and the former channel to the east. By 1954, willows and sapling cottonwood were well established on the sand bar.

During the period of 1954 to 1959, two major engineering projects important to the eventual formation of the Oxbow marshes were completed. Foremost, the Rio Grande was artificially channelized along its eastern bank. This was undertaken in response to concerns that additional bank cutting at the location of the present Oxbow might undermine the University of Albuquerque campus (now St. Pius X High School). Diversion and channelization of the Rio Grande at this reach was accomplished by blocking the head of the meander channel with an earthen dike and stabilizing the sandbar with jetty jacks. The other important project during this time was extension of the Lower Corrales Riverside Drain southward to the mouth of the San Antonio Arroyo, at which point it turns southeast to an outfall on the Rio Grande. Where the Corrales Drain turns southeast, its northern side berm effectively forms the northern limit of the Oxbow.

Between 1959 and 1964, beaver constructed a dam across the outlet of the Corrales Drain. Water that had backed up behind the dam breached the southern berm of the Corrales Drain and spilled over into the Oxbow area. The old meander scar area thus became inundated. As additional beaver dams were built in the Oxbow, marshes became established. By the end of the 1960's, wetlands had developed throughout most of the Oxbow and numerous beaver dams had appeared. Water flowed generally southward through the Oxbow channel, over a series of beaver dams, to drain back into the river at the south end of the channel.

In 1976, MRGCD initiated repairs in response to operational and access problems in the lowest portions of the Corrales Drain. In preparation for the repairs, a temporary diversion channel was constructed upstream in order to dry out the work area. This effectively cut off flows into the Oxbow marshes. With their primary water source removed, the marshes drained quickly, resulting in mortality to fish and other aquatic organisms. The Sierra Club rallied public support for maintaining flows to the Oxbow, and initiated emergency measures to support marsh hydrology, including pumping water into the Oxbow, using volunteer labor to operate and haul fuel to City owned pumps. In the summer of 1976, MRGCD entered into an informal agreement to provide adequate water to the Oxbow marshes.

With a steady water supply, the Oxbow wetlands continued to develop throughout the late 1970's and 1980's. As beaver proliferated, their on-going dam building raised water levels in the marshes, resulting in small areas of open water and inundation of previously dry areas within the Oxbow and its eastern margin (former sand bar). Both inundation and cutting by beaver began to reduce cottonwood stocks in the vicinity of the Oxbow during this period. Cottonwood branches are used by beaver in both dam and lodge construction, while cottonwood twigs and inner bark are a preferred beaver food. Although in normal circumstances beaver tend to use young shoots and seedlings as food sources, the absence of cottonwood regeneration in the bosque has left the tops of mature cottonwood trees as a primary beaver food source.

Throughout the 1980's, deposition of sediments in the Oxbow marsh by the San Antonio Arroyo became an increasing problem. The San Antonio originally drained

only a small area including the site of the present Santa Fe Village neighborhood and adjacent mesa areas to the west. In the late 1970's and early 1980's, however, AMAFCA diverted drainage from the Mariposa/Boca Negra and Ladera Arroyos into the San Antonio Arroyo in order to make use of its direct discharge to the Rio Grande. This increased the volume and duration of flows in the San Antonio Arroyo, leading to greater erosion and sedimentation. In 1979, AMAFCA initiated an erosion control project for the arroyo, using gabion drop structures and ungrouted rip rap. Erosion control measures were built on the middle reach of the arroyo (west of Coors), and planned for the lower reach (east of Coors). Construction of erosion controls on the lower reach was prevented, however, by landowner objections. By the late 1980's, erosion in the lower San Antonio was exacerbated by greatly increased impervious surface area throughout the middle portions of its drainage area.

During the summer of 1990, the sediment fan deposited at the end of the San Antonio Arroyo almost blocked the Corrales Riverside Drain outlet, greatly reducing water supply to the Oxbow. Since that time the sediments have come close to blocking the drain on other occasions, most recently in July, 1995. Flow into the Oxbow has been maintained largely through the efforts of Sierra Club volunteers excavating trenches through the accumulated sediments. Although water levels observed in the Oxbow during 1995 are higher than those reported in 1991, continued growth of the sediment fan at the end of the San Antonio Arroyo would threaten the long-term viability of the Oxbow marshes. In his 1992 study of the Oxbow Area, Ed Swenson identified sedimentation as the greatest stress upon the Oxbow ecosystem.

1.5 Policy Framework

Several City of Albuquerque plans address the resources of the Oxbow. A brief summary of applicable policies and plans follows:

- The *Albuquerque/Bernalillo County Comprehensive Plan*, revised in 1988, includes the Oxbow area within lands identified appropriate for Major Public Open Space status.

- The *Rio Grande Valley State Park Management Plan*, developed in 1987 by the City of Albuquerque and State of New Mexico, specifically identifies the Oxbow as a Special Protection Area and Nature Preserve. The Oxbow is the only area in the Rio Grande State Park identified as a Nature Preserve, a category of land recommended for restricted access to preserve sensitive vegetation and habitats. The Oxbow and the Rio Grande Nature Center are the only areas designated as Special Protection Areas, to be highly controlled for preservation of their unique character (RGVSP Management Plan, 1987).

- Three policies of the *Coors Corridor Plan*, an area plan adopted by the City of Albuquerque in 1984, address the Oxbow and its surroundings. Issue 2, Policy 3, Oxbow Marsh states:

The Oxbow Marsh and the bluff which overlooks it shall be protected and preserved through designation of this area as a wildlife refuge with limited access for scientific and education purposes. A minimum 100-

foot-wide setback along the top of the bluff shall be obtained through purchase, public easement or open space dedication, or through transfer of development rights. Alternative outfalls for development runoff shall be developed to prohibit flows directly into the Oxbow area. It is a unique feature of the bosque and Rio Grande floodplain whose fragile environment must be protected.

Issue 2, Policy 4, Floodplain states:

All development in the corridor area shall comply with all adopted drainage policies, including restrictions on development in the 100-year-floodplain. Cluster development on land above the flood level shall be encouraged and the floodplain shall be utilized as open space area.

Virtually all of the Oxbow Marsh is within the 100 year floodplain.

Finally, maps identifying recommended land uses appended to Issue 3, Land Use and Intensity of Development, Policy 3, Recommended Land Use, code the "Oxbow Marshlands" for park or open space use (Coors Corridor Plan, 1984).

1.6 Planning Process

Active planning for management of the Oxbow Marsh has been ongoing for several years, although no comprehensive management plan has yet been implemented. In 1990 the City Parks and General Services Department contracted with Ed Swenson for production of an Oxbow Management Plan. The resulting draft management plan, submitted in 1992, recommended three management scenarios with varying levels of wetland manipulation. This plan was never implemented, but formed the basis for the current plan.

Also in 1992, ECoPlan published *An Evaluation of the Biological Impacts of San Antonio Arroyo Upon the Oxbow*, under contract to AMAFCA. This report explores the inter-relationship of the Oxbow and conditions in San Antonio Arroyo and includes a detailed analysis of the natural and human caused processes which led to creation of the Oxbow Marsh. Sediment deposition at the end of the San Antonio Arroyo is identified in this report as a major threat to the integrity of the Oxbow.

On December 2, 1994 the City of Albuquerque, Parks and General Services Department held an informational meeting for all parties with a property or management interest in the Oxbow. This meeting initiated the current effort to establish a plan for management of the Oxbow. In attendance were Richard Barish, Sierra Club; Tony Barron, Parks and General Services Department, Open Space Division; Larry Blair, AMAFCA; Bill Burleigh, US Bureau of Reclamation; Bill DeBuys, Conservation Fund; Ross Coleman, HYDRA; Carol Schneider Dumont, Parks and General Services Department, Design and Development; Ray Graham, Owenwest Corporation; Jay Hart, Parks and General Services Department, Open Space Division; John Kelly, AMAFCA; John Pittenger, New Mexico Department of Game and Fish; Matt Schmader, Parks and General Services Department, Open Space Division; John Slown, Parks and General Services Department, Design and Development; Ed Swenson; and Leonard Utter, MRGCD. Participants were queried regarding their

concerns on management of the Oxbow. The issues so identified were addressed in the preliminary draft of the Oxbow Biological Management Plan. The preliminary plan was then provided to the meeting attendees and owners of land in or adjacent to the Oxbow for review and comment. Comments on the preliminary draft have been incorporated in this draft of the plan.

Land acquisition issues related to implementation of the Oxbow Biological Management plan have been addressed in several public meetings of the City of Albuquerque Open Space Advisory Board, and all potentially affected landowners, private and institutional, have been notified.

2.0 EXISTING CONDITIONS

2.1 Water Regime

Water levels in the Oxbow marsh have varied during the last few years. Ed Swenson reported depressed water levels during the summer of 1991, due to blockage of the inlet channel to the Oxbow from the Corrales Drain. As is discussed above in Section 1.4, such blockage by sediment derived from the San Antonio Arroyo has been a recurring problem in the Oxbow. Volunteers associated with the Sierra Club have cleared the channel several times during the 1990's, and water levels observed by Albuquerque Parks and General Services Department staff during the fall of 1994 and winter of 1995 were higher than those documented by Ed Swenson in 1991.

Water levels have been locally raised by beaver activity in the northern sections of the Oxbow. As this can contribute to flooding of private property north of the Oxbow, the dams have also periodically been breached to allow drainage.

2.2 Sediments\Erosion

2.2.1 San Antonio Arroyo

As discussed in Section 1.4, deposition of sediments at the mouth of the San Antonio Arroyo is a continuing problem. These sediments seriously restrict flow into the Oxbow marsh from the Corrales Riverside Drain, and physically displace previous marsh areas. The situation regarding sedimentation at the arroyo mouth should be changed considerably, however, by the San Antonio Arroyo project planned by AMAFCA. This project will include soil-cement stabilization of the lower San Antonio Arroyo channel, construction of a detention pond on land donated by Susie Poole for sediment removal during high flow events, a box structure to convey arroyo flows across the Corrales Drain and a new bosque outlet which includes structural provisions for directing flows into the Oxbow during storms of 10 year intensity or greater. The degree of water and sediment control afforded by the San Antonio Arroyo project is essential to the success of this biological management plan.

2.2.2 Other

Runoff from sandy uplands to the west has created significant gully erosion in the bluff above the Oxbow at several locations. Some of these gullies have eroded sufficiently to have created alluvial fans in the Oxbow marsh visible in aerial photographs (Figure 3). Such fans displace marsh habitat by raising the ground surface above the water level. As new bare soil areas between the marsh and the steep bluff, they also provide habitat available for plant colonization. Ed Swenson reports that fans below the gully have served as valuable nurseries for cottonwood establishment (1995). Field investigation of the fans during the early spring of 1995 revealed considerable variation in plant community composition among alluvial fans. The largest fan in the Oxbow system, that at the outfall of the San Antonio Arroyo, supports a dense, nearly pure stand of willows ranging between five and eight feet tall. A smaller fan to the south of the Arroyo outfall exhibited past colonization by cottonwood; trees ranging from approximately 4 inches in diameter at breast height (dbh) to approximately 12 inches dbh were present. The only sapling or seedling size trees represented, however, were salt cedar and Russian olive, suggesting that cottonwood regeneration at this site ceased at some point. This situation is representative of a trend in the Oxbow whereby mature cottonwoods which succumb to beaver damage or other stresses are replaced by the exotic species such as Russian olive and salt cedar. Other fans supported mixed communities including mature cottonwood (with beaver damage) and mixed age Russian olive and salt cedar with smaller numbers of willow and Siberian elm. A large fan near the southern end of the Oxbow narrows supported a virtually monotypic stand of salt cedar. Several gullies in the bluff are eroding at too great a rate to allow establishment of stabilizing vegetation. Unless erosion control measures are implemented, the gullies will likely continue eroding, exacerbating present sedimentation problems.

2.3 Vegetational Communities

The Oxbow area supports four vegetational communities: a shallow marsh community dominated by cattail with some hard-stem bulrush in and adjacent to the old river channel; remnant bosque with mature cottonwood trees, black willow and an understory of coyote willow, Russian olive and salt cedar located on the old sand bar east of the channel; a nearly monotypic stand of coyote willow located on new alluvium of the San Antonio Arroyo alluvial fan; and a nearly pure stand of salt cedar on one of the alluvial fans below a gully eroded through the bluff. In several areas dead plants show evidence of changing water regimes in the marsh. Drowned cottonwood and willows in areas currently supporting cattail reflect flooding caused by beaver dams.



Figure 3. Sediment plumes into the Oxbow from bluff edge.

2.4 Resident Wildlife

The wetland habitats of the Oxbow provide rich habitat for a variety of waterfowl, wading shorebirds, insectivorous song birds, semi-aquatic mammals, amphibians and fish species. Marsh vegetation provides food and cover for many wildlife species, the shallow water and abundance of plants provide escape cover for small fish and spawning habitat for larger fish species. Cattail, abundant in the Oxbow, is important in providing cover for waterfowl, marsh birds and shorebirds during nesting and migration (Crawford et al., 1993). Non-avian species including muskrat, beaver and mule deer also utilize marsh vegetation for cover and food.

Although no detailed wildlife inventories of the Oxbow are available, it is apparent that habitats in the Oxbow are being used by a variety of wildlife. During two brief winter site visits in 1995, City of Albuquerque staff identified, either directly or by sign, coot, pied-billed grebe, wood duck, mallard, herring gull, Canada goose, green-winged teal, northern harrier, red-winged blackbird, bank swallow, beaver, raccoon and coyote. The presence of bank swallow is of special note, as Albuquerque is near the southern limit of this species' nesting range. Numerous bank swallow nests are established in the cut bank of the Oxbow bluff. Colonies of bank swallows excavate 2 to 3-foot long nesting tunnels in exposed banks, preferably near open water. This species exhibits site tenacity, the trend of a colony returning to the same nest site for several years. Site tenacity increases population survival, apparently through group familiarity with area resources (Ehrlich et al., 1988). As arroyos within Albuquerque are hardlined and otherwise altered, a favored nesting habitat of bank swallow has been displaced and the value of areas such as the Oxbow has increased.

David Johnson, Planner for the New Mexico Parks and Recreation Department, has stated that virtually all of the diverse bird species which visit the Nature Center likely spend a portion of their lives in the Oxbow marsh. Over 100 species were banded at the Nature Center by Rio Grande Bird Research, Inc. during a 14 year period (see Appendix A). It is interesting to note that the list includes eastern United States species such as Virginia and chestnut-sided warblers, rarely sighted in New Mexico. The presence of such locally uncommon species reflects the high habitat value of the Rio Grande bosque to migrating birds. The Oxbow area is of additional value due to limited human presence and the rich wetland habitats present (Cox, 1995). A checklist of mammals currently or historically present in the New Mexico reach of the Rio Grande, and keyed as to current distribution, is attached as Appendix B. More than 50 mammalian species are confirmed or believed to occur in the vicinity of the Rio Grande Nature Center.

3. MANAGEMENT GOAL, POLICIES AND DISCUSSION

The Goal of Oxbow Marsh management is maintenance and enhancement of the native wildlife habitat value, biological diversity, biological productivity and natural aesthetic beauty of the Oxbow and its surroundings.

3.1 Policy 1: Develop and Maintain an Oxbow Ecological Database.

Discussion:

An ongoing database of environmental conditions in the Oxbow marsh and surroundings should be developed to facilitate management of the marsh. The parameters monitored for this database shall be pertinent to the Oxbow and its surroundings and are subject to change per review by the Oxbow Advisory Committee. Such a database would initially include periodic measurements of water level and temperature in the marsh, records of all regularly scheduled or emergency maintenance of the San Antonio Arroyo outfall, the results of all biological surveys conducted in the Oxbow area and detailed records of any drainage, maintenance or repair operations conducted within the Oxbow Marsh. Over time this database will provide a record of the marsh community's response to natural and human caused events, allowing greater accuracy in predicting the effects of proposed management measures.

3.2 Policy 2: Integrate Oxbow Management with Other Bosque Management Programs and Plans.

Discussion:

City Open Space Division management of the Oxbow should be consistent with other biological management programs for the Rio Grande Bosque, specifically the *Middle Rio Grande Ecosystem: Bosque Biological Management Plan* (1993) and the *Bosque Action Plan* (1993).

3.3 Policy 3: Establish Oxbow Advisory Committee.

Discussion:

To ensure that the *Oxbow Biological Management Plan* is implemented effectively and that advances in ecological management are incorporated in the plan, an advisory committee should be formed. This committee would include representatives of agencies actively involved in Rio Grande bosque management (e.g., US Fish and Wildlife Service, Bureau of Reclamation, university researchers actively involved in studies of bosque ecology). The qualifications for a committee member should include a working knowledge and expertise pertinent to the management of the Oxbow as a marsh habitat. The committee will meet annually,

or more frequently if required, to review the state of the Oxbow marshes and make management recommendations. These recommendations will be implemented by staff unless deemed inappropriate by the Open Space Division Superintendent. The City of Albuquerque Parks and General Services Department will prepare a summary report of existing conditions, current database and management practices for each meeting of the Advisory Committee. Every five years the Advisory Committee and Parks & General Services Department staff would review and update the management strategies of the *Oxbow Biological Management Plan*.

3.4 Policy 4: Secure a Reliable Water Source and Provide Flow Control Measures.

Discussion:

An initial goal is to provide an assured water source sufficient to establish a water regime which includes complete through flow from the Corrales Drain to the south end of the Oxbow. While normal flows from the lower Corrales Riverside Drain have provided sufficient water in the past, the City of Albuquerque Open Space Division should develop contingency plans to provide supplemental water in support of marsh hydrology in the event of temporary disruption of flows from the Corrales Drain. Seasonal drawdowns and surge flows should be used to manage marsh vegetation and allow periodic aeration of the substrate or temporary flooding of higher areas.

3.5 Policy 5: Restrict Access to the Marsh and Adjacent Buffer Zone.

Discussion:

There are three primary reasons for restricting access to the area: wildlife habitat protection, erosion control and prevention of hazards to human users.

The rarity of marsh habitats on the middle reach of the Rio Grande increases the importance of restricted human access to Oxbow wildlife. The mix of marsh, open water and riparian forest habitats at the Oxbow provides a rich nesting, resting and feeding resource for water fowl, wading shorebirds and song birds. Many of these species are very sensitive to noise or other disturbance during these critical periods of activity.

Sensitive birds will leave feeding or resting grounds if humans are nearby. In the past, when suitable habitat was more abundant along the Rio Grande, disruption of feeding or resting was only an inconvenience to bird populations, which might be able to relocate. Given the present lack of marshes in the region, however, birds and other wildlife inhibited by human presence would likely not be able to locate alternative feeding or resting sites. Nesting provides a more restrictive case, in that once eggs have been laid, the pair is committed to one nest. If human activity is great enough, a nesting pair will be forced to leave, possibly resulting in lost fledglings.

Standing dead trees surrounded by water, such as the cottonwood inundated

by beaver flooding at the Oxbow, are a preferred nesting habitat of the great blue heron. This species is extremely averse to human activity while nesting. The presence of a single person within 200 feet of great blue heron nests can cause parents to vacate the nest until the person has left the area. When young or eggs are in the nest, the absence of a parent greatly increases the likelihood of predation by snakes, raccoons, or birds.

Unrestricted access to the bluff above the oxbow has the potential to increase erosion through both vegetation trampling and soil displacement. Existing gullies provide attractive pedestrian routes through the bluff. Foot traffic in these currently eroding areas is particularly problematic, and must be prevented if stabilization of the gullies is to succeed.

It has also been the experience of the Albuquerque Open Space Division that unrestricted access to undeveloped lands proximate to urban areas typically results in trash dumping, leading to unsightly conditions and habitat degradation.

Finally, unrestricted access to the Oxbow and bluff presents hazards. Areas at the bluff top include unstable steep slopes subject to slumping and sliding. Such hazard areas tend to provide dramatic overlooks of the Oxbow, and are thus attractive hazards.

3.6 Policy 6: Identify and Implement Appropriate Measures to Increase Wildlife Habitat Value.

Discussion:

Although the wildlife habitat value of the Oxbow marsh and adjacent areas is comparatively high in the current condition, additional habitat enhancement/protection is feasible and appropriate. Marsh management to increase plant diversity, create additional open water areas and flush out stagnant water would greatly increase the value of the entire marsh to waterfowl, shore birds and semiaquatic mammals. Other habitat enhancement measures employed would include those designed to provide additional resources, (e.g., installing duck nesting boxes on existing jetty jacks) as well as measures designed to preserve existing fragile habitats, such as the bank swallow nests on the bluff face. Ongoing management and study of the area should allow identification of additional areas for habitat improvement. Planting specific wildlife food and cover plant species may be appropriate with additional experience.

3.7 Policy 7: Foster Environmental Research and Education Consistent with City of Albuquerque Open Space Policies.

Discussion:

The Oxbow marshes and bosque have research value as managed ecosystems in a largely urban setting. Through coordination with the University of New Mexico, state and federal resource agencies and other institutions, suitable research opportunities may be identified. Although school field trips within the Oxbow marsh

would be inconsistent with the wildlife habitat goals of this plan, an interpretive trail with wildlife blinds set back from the bluff could be useful for environmental education. Interpretive signage could be used to identify the various wildlife habitat, water control and other marsh management measures in place.

3.8 Policy 8: Provide Opportunities for Low-impact Passive Recreation Consistent with City of Albuquerque Open Space Policy.

Discussion:

Although direct public access should be restricted from the Oxbow and a buffer zone setback established from the bluff top, high quality recreational opportunities could remain. The area above the bluff provides dramatic views of the Bosque, the Rio Grande, the city and the Sandia Mountains beyond, as well as excellent bird and nature watching opportunities. Although proximate to the congestion of the Coors Road corridor, the Oxbow and its environs are a peaceful window on the natural world. As such, an interpretive trail could be expected to be used for passive recreation.

3.9 Policy 9: Assess the impact of exotic vegetation on the Oxbow, and implement control measures as necessary and appropriate.

Discussion:

Currently salt cedar, Russian olive and Siberian elm occur in the Oxbow at levels lower than those of the infestations which occur in some areas of the Rio Grande bosque. Controlling the spread of these species into areas currently supporting native vegetation is consistent with the goal of this plan. During management of the area, the feasibility of exotic plant reduction and its overall impact on the Oxbow area will be assessed. Techniques used for eradication will be determined by weighing potential disruption against resulting benefits.

4. MANAGEMENT CONSTRAINTS

4.1 Land Ownership

Only a small portion of the land within and surrounding the Oxbow is currently under the control of the City of Albuquerque. Drainage from, and activities upon, land owned by private interests or other institutions directly affect the Oxbow. Section 5.6.1 below makes recommendations for off-site erosion control. Section 5.8 below discusses mechanisms for developing management programs with the owners of adjacent land.

4.2 Water Supply

Wildlife habitat maintenance in the Oxbow is dependent on provision of adequate water. The availability of sufficient water is not assured. Other than very infrequent over-bank flooding of the Rio Grande (none has been documented since the establishment of the Oxbow marshes in the early 1960's), the only source of flow into the Oxbow marsh is the lower Corrales Riverside Drain, operated by MRGCD. While the lower Corrales Riverside Drain has consistently provided sufficient flows into the Oxbow during normal operations, repairs and other interruptions of normal operations may potentially disrupt water deliveries.

4.3 Siltation Control

Recurrent siltation at the outlet of the San Antonio Arroyo following major storms is a perennial problem in management of the Oxbow marshes. In the recent past this problem has been addressed by manual labor of Sierra Club volunteers and Open Space Staff who have excavated ditches through the sediment fan to allow drainage and flow into the Oxbow. With each major storm event, however, the sediment fan at the San Antonio Arroyo outfall enlarges. In the absence of sediment management, the fan could eventually grow to an unmanageable size. Construction of the proposed upgrades to the San Antonio Arroyo by AMAFCA, although independent of this plan, is thus an integral component of the long-term success of this management plan.

5. MANAGEMENT STRATEGIES

This section sets forth the specific actions that will be undertaken to implement the goals and policies set forth in Section 3. The biological management strategies are subject to amendment prior to implementation after review by the Oxbow Advisory Committee. After implementation, the management strategies may be amended as necessary to accomplish the goals and policies of this plan. Implementation is subject to final review by the Open Space Division Superintendent.

This section will be revised every five years by the committee and the Open Space Division to reflect any changes in management strategies based on experience and new knowledge regarding processes of marsh management techniques.

5.1 Baseline and On-going Data Gathering

As only limited baseline biological data are available for the Oxbow, the plan should include a research component. The City Open Space Division should coordinate research with State and Federal agencies, the University of New Mexico and /or Rio Grande Bird Research, Inc. to maximize the scope of investigation possible. At a minimum, surveys of vegetation, avian, mammalian, herptile and fish populations using the Oxbow should be conducted, with permanent study plots

established to allow ongoing studies of population changes with management. Coordination of these surveys with the comprehensive monitoring of environmental ecological systems described in the *Bosque Action Plan* (adopted 1993) would be appropriate. In addition to its annual review function, the Oxbow Advisory Committee would conduct an assessment of the management strategies of the *Oxbow Biological Management Plan* every five years in order to correct any deficiencies and address advances in biological science.

5.2 Access Control

5.2.1 Within the Oxbow Marsh

Since current access to the Oxbow marsh is mostly provided via the gullies through the bluff, control of access to the buffer zone above the bluff should address access to the Oxbow marsh. Access from private property to the bosque below the bluff will be discouraged through the installation of multiple strand smooth wire high-tensile strength fence (similar to that used to fence other City Open Space areas) along the north and south boundaries of the Oxbow area, posted with City of Albuquerque Open Space signs identifying the area as a Wildlife Preserve. The signs will be visually prominent, explain that public entry to the area is prohibited and display a telephone number for use in reporting violations. Regular patrols by Open Space Rangers will check for evidence of unauthorized entry to the Oxbow marsh.

5.2.2 Within Buffer Zone Above Bluff

Public access will be prohibited from some portion of a buffer zone extending at least 100 feet (size dependent upon land availability), upslope and west of the bluff top. A sufficient no-entry zone within the buffer zone will be identified in order to protect the trail and the bluff from further erosion and will be separated from the accessible portion of the buffer zone by fencing and signage as described above. The exterior perimeter of the buffer zone will also be fenced and signed as Major Public Open Space to prohibit vehicular access other than at one approved visitor parking area.

The narrow accessible area above the bluff will be developed to foster public passive recreation and environmental education. The northern bluff is conceptualized as a parking lot and wildlife viewpoint. At the southern end of the bluff, another viewing point may be established with connections to a trail running further west of the bluff. These concepts have been discussed with the current property owners, but there are no final plans at this point in time.

Figure 4 depicts a conceptual plan for a trail and wildlife blinds. Wildlife viewing blinds might be similar in size and construction to the one at the Elena Gallegos wildlife pond (Figure 5). The blinds would have an open back for ventilation, with viewing ports in the front wall (facing the marshes), some provision for shade and built-in benches for wildlife viewing. Blinds of this design allow wildlife watching with minimal intrusion on, or interruption of, wildlife activity.

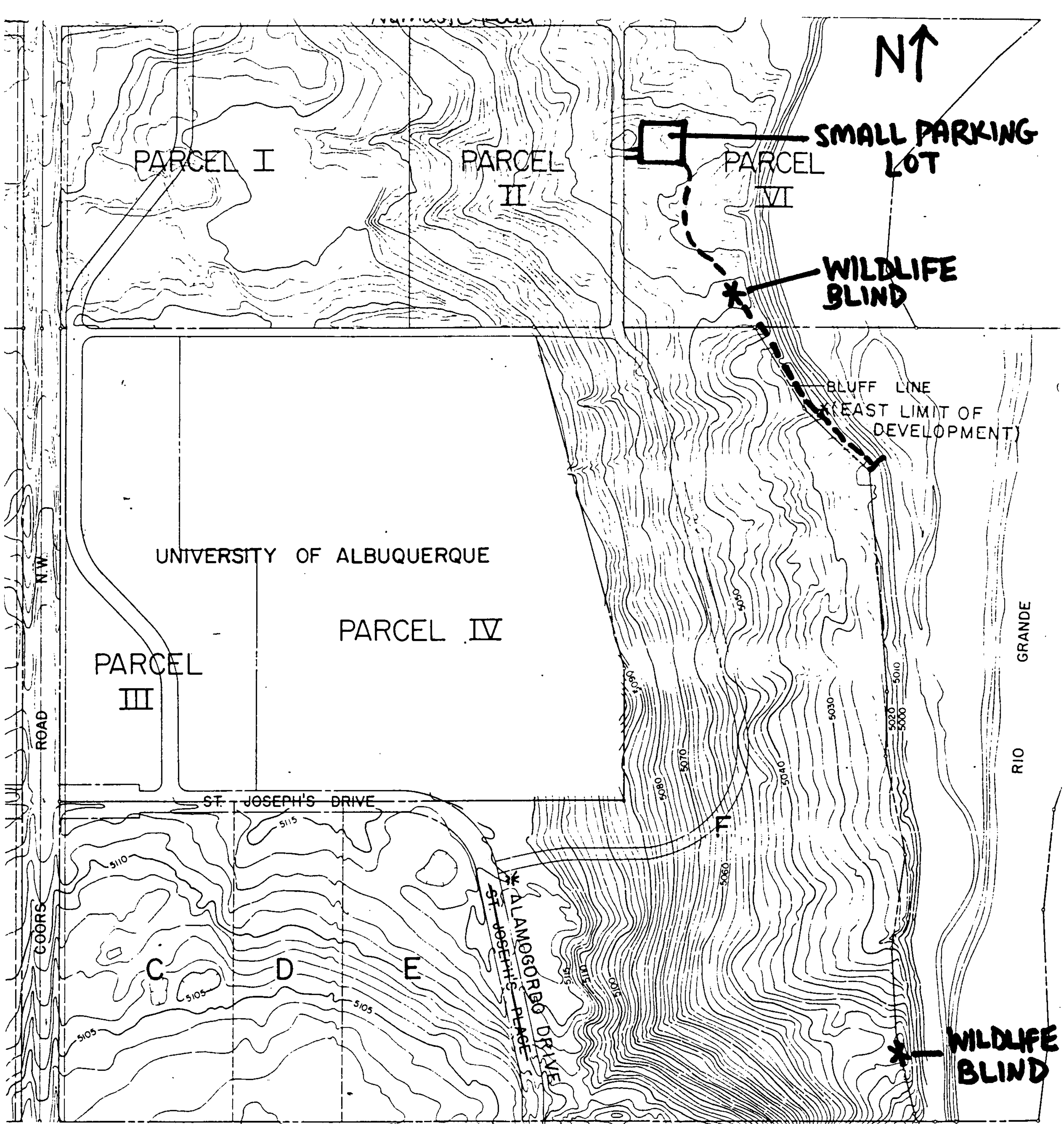


Figure 4. Conceptual plan of facility development for bluff top.



Figure 5. Wildlife blind at Elena Gallegos

A northern blind, overlooking the broadest area of the Oxbow, could provide a variety of views on the marsh ecosystem, and could afford rich and varied bird watching opportunities. Interpretive materials developed for this viewing blind could include information on the ongoing marsh management practices, the life history of the beaver and examples of wildlife species which use the marsh. Fixed "gun-sight" viewing pipes could be installed to direct the visitor to various points of interest.

A southern blind would also provide views of the marsh, but could focus more upon longer views of the surrounding landscape. From this location there are dramatic views northerly along the Rio Grande to the Jemez and Sangre de Cristo Mountains, as well as excellent views across the Albuquerque basin to the Sandia and Manzano Mountains. Interpretive materials developed for this blind might include descriptions of the relationship between the mountains and the river, in terms of drainage, climate, wildlife habitat and cultural use.

The combination of views and interpretive materials could also be well suited to use for organized environmental education programs, both for school-age children and adults. Design and construction of these blinds would be subject to City Ordinance and agency review.

5.3 Water Management

Since the creation of the Oxbow marshes, normal operation of the lower Corrales Riverside Drain has consistently provided sufficient in-flow to support the Oxbow marshes. Operation of the drain should continue to adequately support marsh hydrology. If flows are disrupted for any reason and the marshes become water stressed, the city will provide emergency waters to supplement the lower Corrales Riverside Drain until normal conditions are restored.

Given sufficient in-flow to the Oxbow marsh, drainage management to control water levels in the marsh and flooding upstream is the paramount concern. Water control in wetlands has the potential to profoundly affect vegetational composition, substrate oxygen levels, and overall patterns of ecological succession. Cycles of drawdown and flooding in the Oxbow are desirable to flush out accumulated sediments and aerate stagnant water. This stimulates biological production at the levels of plankton and of larger aquatic invertebrates, the basis of the marsh food chain. Appropriate use of limited drawdowns and flooding can also favor greater diversity of wetland plant species. For inland wetlands, Payne has recommended flooding at five year intervals to flush out accumulated nutrients and restore oxygen levels (1992).

The proposed water regime for the Oxbow marshes is thus a series of partial drawdowns followed by reflooding. Water management should be phased in gradually, accompanied by monitoring for adverse effects. Drawdowns would be scheduled to occur in the winter or early spring to avoid placing habitat stress on wildlife populations which require wetland habitats. Rather than running the risk of drawing down water throughout the entire marsh, a spatial mosaic of water levels is proposed, with drawdown staggered throughout the marsh. High flow volumes are

desirable in each portion of the marsh every five years, for flushing.

Some periodic high flows are anticipated due to the design of the proposed San Antonio Arroyo bosque outfall. Improvements to the south berm of the outfall will include spillways designed to discharge directly to the Oxbow in the event of a 10-year or greater intensity storm. Runoff from natural events should thus provide infrequent surging flows through the Oxbow marshes. More frequent high flows, however, will likely be needed to provide the water management regime desired. As is discussed below, episodic high flows can likely be achieved within portions of the marsh through manipulation of beaver dams.

Existing beaver dams segment the marsh into discrete pools within the marsh. Such dams are anticipated to remain a factor in drainage of the Oxbow. Controlling drainage in beaver impoundments by removing or breaching dams is a labor-intensive process, as beaver will quickly repair damage to dams. In cases of beaver blocking artificial spillways and culverts, daily inspection and maintenance has been recommended (Payne, 1992).

Given the difficulty of keeping a channel clear of beaver dams, installing drainage management devices in existing beaver dams is the preferred water management strategy. Early in the implementation of this plan, staff will conduct a detailed field inspection of existing beaver dams in the Oxbow marsh to identify appropriate locations for through-dam drains. The type of device depicted in Figure 6 is appropriate for installation through beaver dams in the Oxbow marshes. The "T" fitting depicted at the outlet end of the structure is connected with a swivel joint. The outlet pipe height, and thus pool elevation, can be altered by rotating the fitting. Each drain should be installed to allow the drain elevation to fluctuate from approximately 1 foot above to 1.5 feet below the apparent normal pool elevation. This range of potential managed pool elevations for each dam will allow maximum flexibility in water management.

The type of drain suggested has the considerable advantage of using existing beaver dams, which are regularly repaired and maintained by the resident beaver population. Commercially manufactured drains on this design are available, and are designed for durability and ease of field installation. The drains themselves are of simple design with no moving parts; they require only moderate maintenance, allow controlled draw down of beaver impoundments, can be adjusted as necessary to change drainage regime, and are difficult for beaver to block. Drains of this design have been used in numerous beaver impoundments, and have proven viable for managing water levels without displacing beaver populations (Payne, 1992).

The key features of the proposed design are a screened inlet on the pond side of the dam, an adjustable height outlet, a drain/cleaning plug below the outlet to allow maximum draw-down and cleaning, and an anti-seep collar within the dam. In the Oxbow 10 inch diameter pipe should be large enough to allow sufficient drainage.

The outlet structure should include a riser of appropriate length to place the invert of the installed outlet pipe at the desired pond elevation, as well as a threaded plug installed at the end of the primary drain pipe to allow draw down and cleaning. When reinserting the plug during operations, the inlet should be covered to reduce

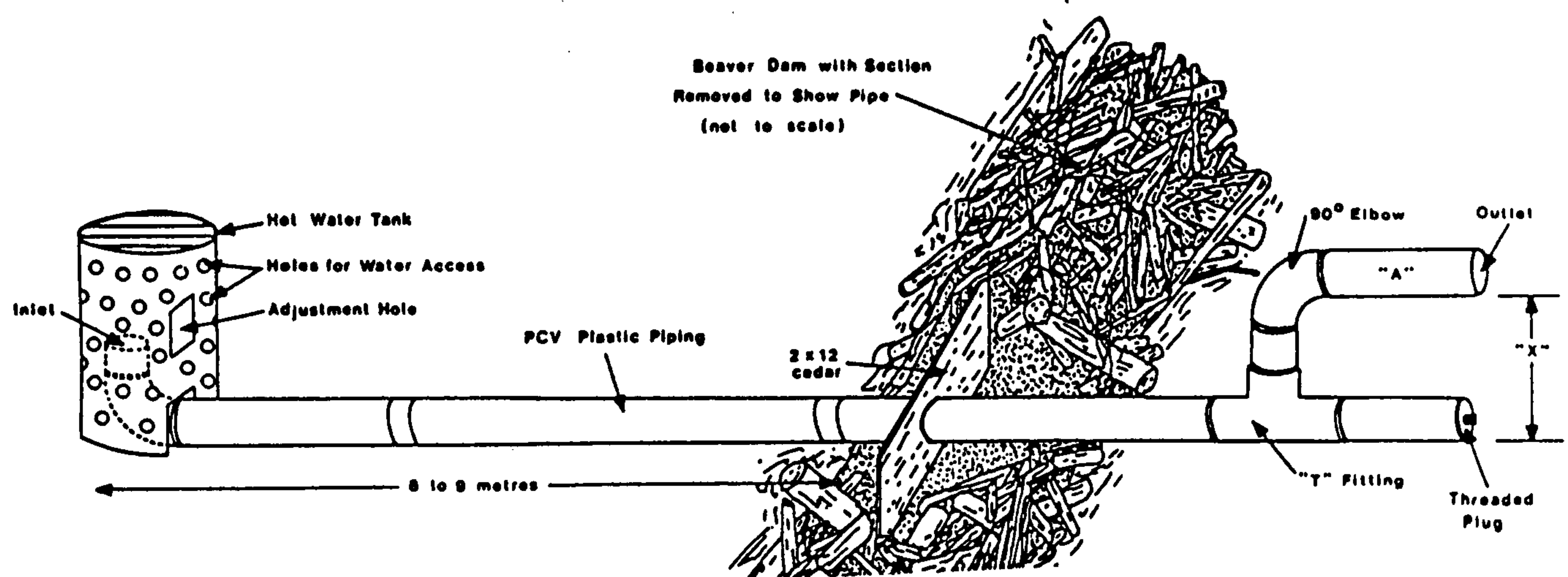


Figure 6. Typical beaver dam drain structure. Source: Payne 1992.

water pressure.

An anti-seep collar is necessary to provide stability of installation and reduce leakage immediately after installation. Beaver can be expected to address any leaks which persist on a longer term. The collar should be a rot resistant board (cedar or redwood are recommended, rather than pressure-treated lumber) at least eight feet long and wide enough to accommodate a hole the size of the drain pipe. The collar is installed in the dam and held in place by stakes driven into the ground, dam materials are then replaced around the collar and pipe. Installation of each drain should be planned to be accomplished in one field day, as beaver are nocturnal and will repair any damage to the dam during the first night after work begins. The drains should ideally be installed during a period of seasonal low flow in the Oxbow such as late September or October. Drains should be installed in the downstream dam first and proceed upstream to facilitate drainage during construction. To reduce the visual impact of the drains, the above water portions of the inlet and outlet structures should be painted a non-reflective neutral gray or tan color which will blend well with the surrounding marsh.

The water management program will also include provisions for the prevention of flooding upstream of the Oxbow. The Memorandum of Understanding Inspection & Maintenance Plan for San Antonio Arroyo Project, attached as Appendix C, establishes upstream flow criteria for clearing out beaver dams in the Oxbow or immediately above the Oxbow in the San Antonio Arroyo outfall. Open Space Division staff responsible for monitoring of the San Antonio Outfall will be responsible for water management activities in the Oxbow as well. Every effort will be made to identify developing drainage problems before the triggering criteria are met.

As with all aspects of this plan, water management strategies will be reviewed by the Oxbow Advisory Committee to assess their effectiveness and identify any necessary modifications.

5.4 Vegetation Management

5.4.1 Wetland Vegetation

The planned improvements to the San Antonio Arroyo and the water management described above should allow control of hydrology in the Oxbow marsh. Properly timed water level manipulation, in concert with planting and moderate levels of mechanical vegetation control, can foster changes in plant community composition. A 50-50 ratio of open water to emergent vegetation cover is considered ideal for water fowl habitat (Payne, 1992), and greater plant species diversity generally confers greater habitat richness and flexibility. The current condition in most of the marsh area is approximately 80 percent vegetative cover and a low diversity plant community dominated by cattail. Reduction in cattail stocks can thus benefit the overall community composition by increasing open water areas and by clearing potential growth habitat to allow establishment of other wetland species.

A commonly used method of cattail eradication for habitat improvement in

managed marshes is complete water drawdown during the winter, followed by burning the standing vegetation and deep plowing to remove cattail roots and underground stolons (Mitsch and Gosselink, 1986). This method, while effective in reducing cattail stocks, requires extreme disruption of the wetland habitat for several months and operation of heavy equipment within the wetland. Therefore, this option would be considered to be the least desirable option. Less invasive plant management strategies would be considered first. Payne (1992) suggests various lower-impact methods of cattail control. These methods include partial water level drawdowns in the winter and early spring, together with mowing cattail plants during mid-summer. Spring drawdowns of approximately 6 inches below normal pool depth create drought stress on cattail at the upper margins of the marsh, lower spring water favors establishment of willows and moist-soil herbs such as smart weeds and millet. The presence of some smart weeds in the Oxbow marsh suggest the presence of a seed bank in the soil which could proliferate, given appropriate conditions of exposed, saturated soils in early spring. Proliferation of either moist-soil herbs or willow in areas currently supporting cattail would add diversity to the marsh habitat. Hand-held equipment, such as rotary blades are suitable for mowing cattail in the marsh with minimal disturbance other than displacing wildlife during the actual cutting operation. Cattails should be cut within 1 - 2 inches of the soil surface to limit regrowth. While a single cut will not eradicate plants, cutting the same area for two or more seasons should considerably reduce cattail stocks. All mowing should be scheduled late in the summer after the nesting season.

Wetland plant management should be exercised in portions of the wetland as described above and assessed for its success. The Oxbow Advisory Committee may determine that changes in strategy are necessary if the main goals of increasing overall plant species diversity and open water interspersions are not being met. Additional strategies for increasing diversity and complexity in the marsh could include planting desired species, excavating to create small deep areas, prescription burning in limited areas, and others as management and research continue. Any new measures would be thoroughly investigated prior to implementation to ensure that a positive result would occur. In the case of management of the Oxbow Marsh, a "positive result" is defined as improvement of the habitat which outweighs the intrusiveness carried out to ensure that improvement.

5.4.2 Sandbar and Alluvial Fan Vegetation

Establishing cottonwood regeneration and willow thickets while reducing salt cedar and Russian olive stocks on the drier areas within the Oxbow is a desirable goal. There are numerous methods used to accomplish this; experimentation will yield the most effective method.

Managers at the Bosque del Apache Wildlife Refuge in San Antonio, New Mexico, have been successful in replacing salt cedar with natural cottonwood regeneration. Salt cedar is first eradicated by clear cut and deep blading (18 inches below the soil surface) to sever the sprouting root crown from the remainder of the root

system. Cottonwood regeneration on the cleared area is then fostered by controlled flooding during cottonwood seed dispersal. The flooding is timed to approximate natural, pre-flood control, conditions on the Rio Grande. This process has been very successful in replacing salt cedar with cottonwood seedlings at moderate cost (Taylor, 1995). Large scale use of this method in the Oxbow is likely not feasible, however, due to the difficulty of providing sufficient flood flows in the Albuquerque reach of the Rio Grande. A limited application of this technique would be suitable as demonstration projects in determining the best procedure, at the recommendation of the Oxbow Advisory Committee.

A labor-intensive, but effective, method of conversion of salt cedar stands to cottonwood and willow was recommended by Ed Swenson in his 1992 draft management plan for the Oxbow area. This plan calls for cutting individual trees and treating the stumps with a labeled herbicide, then pole planting cottonwood and willows. This method may prove to be the least desirable due to the use of herbicides. Reviewers on the preliminary draft of this plan have expressed opposition to the use of herbicides in the Oxbow.

While large scale conversion of areas currently supporting exotic species to cottonwood or willow stands may not be feasible in the context of this plan, some existing situations in the Oxbow marsh may foster cottonwood and willow establishment through careful water management. As stated above, spring drawdowns should favor spread of willows into the current marsh margins. Additionally, the old sandbar area in the eastern portion of the Oxbow is currently partially flooded by water backed up behind beaver dams. The installation of drains through these beaver dams should allow simulation of natural flooding of the sandbar. Water levels should be kept high enough to flood the sand bar during the spring seed dispersal period of cottonwood (while "the cotton is flying"), and then lowered throughout most of the remainder of the year. This flooding regime may foster cottonwood regeneration on the sandbar area. Managers at Bosque del Apache have demonstrated that where water regime favors their regeneration, cottonwood can out-compete Russian olive and salt cedar (Taylor, 1995). Currently, exotics are not present at excessive density and eradication methods may negatively impact the marsh.

The methods discussed above will be considered and pursued on an experimental basis to determine the procedure that yields the most "positive result." Vegetation management practices will be reviewed by the Oxbow Advisory Committee prior to implementation.

5.5 Wildlife Management

In recent years beaver have been considered nuisance wildlife where they occur in the Middle Rio Grande Bosque. This situation is unusual, as beaver are typically considered beneficial in terms of providing bank stabilization and enhancing fluvial habitat, despite their potential to cause nuisance flooding (Chapman and Feldhamer, 1990). The lack of cottonwood and willow regeneration in the bosque is largely the reason for beaver being considered a nuisance. Both are highly preferred

food species for beaver. Under normal conditions of regeneration, beaver harvest seedlings and saplings for food and construction material. In the absence of normal regeneration, however, beaver harvest large numbers of mature trees to consume young growth of the upper crown. Because maintaining healthy cottonwood stands is a major management concern for the Oxbow, various methods of beaver control have been recommended, including trapping/relocation and sterilization (Swenson, 1992). Given the large population of beavers in the vicinity of the Oxbow, trapping and relocation would be a unending process. Sterilizing individual beavers has more promise, as beavers are long lived, monogamous and highly territorial. This method is largely untested however, and may not prove effective.

The Rio Grande Nature Center (RGNC), directly across the river from the Oxbow, and the Open Space Division have both used a simple method to address beaver damage to mature and planted cottonwood. The RGNC and Open Space both protect trees by wrapping the trunk from ground level with poultry fencing or plastic encasement. These methods have provided sufficient protection of cottonwood and willow trees and pole plantings, and has the additional benefit of causing beaver to harvest unprotected species, including Russian olive (Johnson, 1995). A combination of beaver eradication and tree protection may prove most beneficial.

As with all aspects of this plan, the issue of beaver management will continue to be revisited and reexamined. As research continues, novel management techniques such as individual sterilization or use of artificial scent mounds to discourage establishment of new family groups may be demonstrated as effective additional measures. Methods may be employed on an experimental basis with review by the Oxbow Advisory Committee prior to implementation.

Other wildlife management measures are primarily related to enhancing the already high habitat value of the area. The water and vegetation management practices described above are inter-related with each other and with wildlife management. The overall primary goal of these measures is increasing the biological diversity, sustainability and productivity of the Oxbow Marshes. Successful implementation of these measures will lead to increased wildlife habitat quality; greater diversity and density of resident and migratory wildlife should follow.

Structural measures can benefit individual wildlife species. Nesting boxes for wood ducks and tree swallows can be placed in and around the marshes. These birds are cavity nesters, and have suffered from loss of natural nesting cavities in snags (standing dead trees). Nesting boxes can be directly attached to jetty jacks at 3 to 6 feet above the water surface. Terrestrial nest predators such as raccoons will have difficulty climbing the metal jacks. All cottonwood trees which have been killed by flooding should be left in place, as they will provide natural cavities and may attract great blue heron, which prefer standing dead trees for nesting due to the visibility provided from the nest in the absence of foliage. Stabilization of the Oxbow bluff, as described in Section 5.6.2, will preserve bank swallow nesting areas, allowing this species the benefit of a longer-term colony site.

If water management to foster willow regeneration at marsh edges is successful, favorable habitat for the federally endangered southwest willow flycatcher could be

created. Although no individuals have been identified within the Oxbow to date, the southwest willow flycatcher has been banded by Rio Grande Bird Research in the Neighboring Rio Grande Nature Center during the fall (Cox, 1995). While fall occurrence does not confirm breeding activity in the area, the Oxbow's combination of wetland habitat, willows near small pools and limited human use is favorable for reproduction of this species. The oxbow is also extremely valuable as stop-over habitat for additional migrating neotropical songbirds, such as the flycatcher.

5.6 Erosion Control

5.6.1 Off-site

Management of drainage flows on adjacent lands is an important component of reducing the current gully erosion at the edge of the Oxbow marsh and bluff. Large areas of impervious cover at St. Pius X High School currently discharge untreated drainage directly onto the sandy uplands above the bluff. During storm events this drainage has considerable energy and erosive potential. Directed expeditiously across the uplands via trails and minor arroyos, these flows arrive at the bluff with much erosive force remaining. Two general measures should be employed to reduce the effect of up-gradient drainage on the Oxbow and bluff.

First, storm water management on the St. Pius campus should be improved. This issue will be addressed when development of the Keleher lands between St. Pius and the bluff are developed. Some interim measures could be used to improve existing conditions. Closed curbing around all campus roadways would detain minor storm flows. Road and parking area runoff from more major storm events should be collected to one or more detention ponds from which it can be gradually released at a metered rate from one or more controlled outlets. The detention basin outlets would use ungrouted stone aprons in the receiving areas to dissipate flow. Roof runoff, which is typically much cleaner than road and parking area runoff, could be directed to infiltrating catch basins, removing volume from the runoff load and providing aquifer recharge (Dunne and Leopold, 1978).

Second, runoff flows should be slowed and dissipated to the greatest degree feasible. Where depressed/eroded trails or jeep roads convey flows, the installation of water bars can be effective in reducing erosion and dissipating flow energy. Water bars are low earthen berms placed across the trail at an oblique angle. They should be placed to divert flows out of the trail onto adjacent areas supporting vegetative cover. Where flows are conveyed in minor arroyos, installation of low (1.5 to 3 feet of vertical head) check dam grade control structures with stone lined spill ways will limit further erosion of the arroyo. These structures eventually fill with soil and can revegetate. The Open Space Division has been involved in studying the effectiveness of such structures, and initial results are promising (Resource Technology, Inc., 1995).

The above measures for storm water management and erosion control on the sandy uplands above the bluff are appropriate for the current levels of development. If currently vacant land in the vicinity of St. Pius X High School is developed, runoff volumes will increase and additional storm water management measures will be

required. Water management and erosion control above the Oxbow to the west is of critical concern.

5.6.2 On-site

Implementation of storm water and erosion control measures above the Oxbow and bluff should greatly ease erosion damage, but additional measures are necessary on site to address the existing erosion problems. Gullies in the bluff are extremely unstable in their current condition, and must be stabilized. Vegetative stabilization, in conjunction with access control, is the preferred method of stabilization where this would be effective. The importance of access control in vegetative soil stabilization must be stressed. The gullies present attractive access routes through the steep bluff to the Oxbow marshes. Even a moderate level of foot traffic through the gullies is extremely erosive due to the nature of the sandy soils and the steep slopes present. In the absence of disturbance, drought tolerant bunch grasses such as blue grama or side oats grama can be effective in reclaiming disturbed slopes. These grasses can be planted by seed or as turf plugs and should require little maintenance. They are an element of the area's native flora, and their seeds provide a source of forage for birds and small mammals. Only native grasses and shrubs will be used for vegetative stabilization (i.e., those occurring naturally in the immediate vicinity of the Oxbow).

Structural stabilization may be necessary to augment vegetative cover in the areas of greatest gully erosion. Stone filled gabions can be used to stabilize the gully heads, and as check dams along the gully channels where excessive down cutting is occurring.

In addition to stabilizing gullies, on-site measures can include final moderation of storm flows from adjacent areas. There will be sufficient space within the buffer zone acquired above the bluff to accommodate small detention ponds. These ponds will be used in conjunction with other, up-gradient storm water control measures to moderate flow intensity over the edge of the bluff. The space available within the buffer area is insufficient to provide detention of uncontrolled runoff from the St. Pius campus and adjacent uplands. Drainage controls in the area above the bluff are thus an integral component of any drainage plan for the bluff.

5.7 Maintenance

Although elements of this plan have been generally designed to minimize required maintenance, several components of the plan will require regular inspection, cleaning and occasional repair. The San Antonio Arroyo outfall is integral to the success of this biological management plan. The outfall and associated structures are more maintenance intensive than any portion of this plan, and will be maintained as described in Appendix C.

All fencing required for access restriction should be visually inspected monthly, and repaired as necessary. Loose high tensile fencing wire should be tightened and any bent or loose fence posts replaced or reset.

Beaver dam drains should be visually inspected monthly, and any damage repaired as necessary. During inspections, the inlet pipes should be checked to insure that water may enter freely. Scheduled maintenance is limited to semi-annual removal of drain plugs to clean out accumulated leaves and other debris.

All major channels should be inspected for sediment accumulations annually. Any excessive sediments should be removed to ensure free flow in the channel.

Bird nesting boxes should be cleaned annually, after the end of the nesting season, to prevent buildup of bacteria, fungi and lice. All nesting material should be properly disposed of and replaced with clean, untreated wood shavings. Structural erosion control measures should be inspected monthly during the first two years after construction, as well as after any storm of 10 year intensity or greater. Other maintenance issues will be addressed as they arise.

5.8 Land Ownership/Acquisition and/or Management Agreements

As is identified in Section 1.2, much of the Oxbow and the Bluff above the Oxbow are presently in private ownership (refer to Figure 2 for approximate property boundaries). In order to successfully implement this plan, the City of Albuquerque should acquire management control over the wetlands within the Oxbow itself, the bluff above the Oxbow and a buffer zone above the bluff. The specific lands of interest above the bluff include all of the Albuquerque Public Schools parcel and a buffer zone (minimum 100 feet wide) above the bluff on the Keleher Family Trust lands.

The City may acquire open space through purchase or easement; or may negotiate for management rights through joint-use/maintenance agreements with property owners. The Sierra Club Foundation, owner of some lands within the Oxbow, has expressed willingness to transfer title of the land to the City of Albuquerque, Open Space Division, contingent upon adoption of a suitable biological management plan, and subject to reversion clauses.

City staff have met with the property owners and have discussed various options that may be available to the City and property owners including joint-use agreements, conservation easements or transfer of development rights (TDR). The Open Space Advisory Board has placed the Oxbow and bluff lands in the first priority group of the Open Space Protection/Acquisition Priority List.

5.9 Fire Management

Reviewers have expressed concern about fire management in and around the Oxbow. There is little evidence that wildfires were common in the Rio Grande bosque before the mid twentieth century. Cottonwood are particularly susceptible to damage and mortality by fire and exposure to heat (Crawford et al., 1994). Establishment of high fire-risk species such as salt cedar and Russian olive and increased human use of the area have greatly increased the incidence and destructiveness of fires in the Bosque during the last several decades. In view of the recent history of damaging bosque fires, the *Rio Grande Valley State Park Fire Management Plan* was prepared

in 1992. Although the Oxbow area is not within the Rio Grande Valley State Park, the policies of the Fire Management Plan apply in general to the Rio Grande Bosque. While "let burn" policies for wildfires on many public lands have been adopted in recent years, the Rio Grande Valley State Park Fire Management Plan mandates fire prevention and suppression of any fires which do occur. The Oxbow marshes themselves have low potential for serious wildfire due to perennial inundation, but brush on the bluff and cottonwood/willow/ Russian Olive/salt cedar bosque adjacent to the Oxbow are prone to fire.

The Open Space Division is responsible for fire prevention within the Rio Grande Valley State Park and will assume responsibility for fire prevention in the Oxbow upon its acquisition. Fire prevention includes reducing the risk of human caused fires through public awareness and enforcement of fire, camping and access restrictions. Fire prevention also includes reducing the physical fire hazard through vegetation management. While fire prevention is not a primary goal of the Oxbow Biological Management Plan, the proposed increases in open water area and control of salt cedar and Russian olive spread should reduce the fire threat, as open water areas are effective fire-breaks and salt cedar--Russian Olive thickets burn readily (Rio Grande Valley State Park Fire Management Plan, 1992).

Responsibility for fire suppression in and around the Oxbow would be shared between the City of Albuquerque and Bernalillo County Fire Departments. The southern portion of the Oxbow (currently lands of Keleher and Albuquerque Public Schools) is within City of Albuquerque jurisdiction; the northern portion (currently lands of the Sierra Club Foundation and Poole) and adjacent lands to the north (lands of Graham) are within Bernalillo County jurisdiction. In practice, due to a mutual aid agreement between the fire departments, either fire department (or both departments) is likely to respond to a bosque fire. Typically any fire is attacked by the nearest available fire forces (Rio Grande State Park Fire Management Plan, 1992). The methods of treatment would be decided by the fire entities depending on the severity of the fire.

6. IMPLEMENTATION

Implementation of the Oxbow Biological Management Plan should proceed in three general phases. The first and crucial phase is purchase of land and/or acquisition of easement rights for City management of lands in and adjacent to the Oxbow. Concurrent with this, the AMAFCA improvements to the San Antonio Arroyo are scheduled for construction in the fall of 1996. The City's assumption of maintenance responsibilities is contingent upon acquiring lands and the completion of the AMAFCA improvements. The second phase is fencing, drainage management devices and erosion control measures. The second phase should be completed within two years of the completion of the first phase. The third phase is installation of any visitor use facilities (wildlife blinds, trails, and parking area). On-going operations include monitoring physical and biological conditions within the marsh, maintaining all

improvements, developing interpretive materials, reporting the results of management, and reviewing/updating portions of the plan.

The first phase of implementation, acquisition, is already underway. At its July, 1995 meeting, the Open Space Advisory Board recommended that the City Department of Financial Management, Real Property Division staff initiate purchase negotiations with owners of lands within the Oxbow and bluff areas, specifically the Keleher Family Trust and the Albuquerque Public Schools. When prices are established for purchasing land or acquiring easements, funding sources should be identified.

The second phase would then be undertaken by Open Space Division staff, Design and Development staff and consultants/contractors with review by the Oxbow Advisory Committee.

The long term monitoring, maintenance and management component would be implemented by Open Space Division staff. For consistency, one individual should coordinate all monitoring, maintenance and management activities, including those related to the San Antonio Bosque Outfall, as specified in the memorandum of Understanding between the City, AMAFCA and MRGCD. It is recommended that a new position, Riparian Management Specialist, be created within the Open Space Division to manage the Oxbow and other wetlands and riparian habitat in the Open Space system. This person would also prepare regular status reports to the Oxbow Advisory Committee, coordinate review of the overall effectiveness of the management plan and recommend necessary interim modifications to the plan. Every five years, full plan updates would be prepared, in cooperation with the Oxbow Advisory Committee.

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APPENDICES

APPENDIX A. Bird species captured at the Rio Grande Nature Center (1985-1994) by Wang Yong and Deborah Finch, USDA Forest Service.

<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>
<i>Accipitridae</i>	
Sharp-shinned hawk	<i>Accipiter striatus</i>
Cooper's hawk	<i>A. cooperii</i>
Northern harrier hawk	<i>Circus cyaneus</i>
<i>Falconidae</i>	
American kestrel	<i>Falco sparverius</i>
<i>Tyonidae</i>	
Wester screech-owl	<i>Otus kennicottii</i>
<i>Columbidae</i>	
Mourning dove	<i>Zenaida macroura</i>
<i>Cuculidae</i>	
Yellow-billed cuckoo	<i>Coccyzus americanus</i>
Greater roadrunner	<i>Geococcyx californiaus</i>
<i>Alcedinidae</i>	
Belted kingfisher	<i>Ceryle alcyon</i>
<i>Picidae</i>	
Downy woodpecker	<i>Picoides pubescens</i>
Ren-naped sapsucker	<i>Sphyrapicus varius</i>
Northern flicker	<i>Olaptres auratus</i>
<i>Tyrannidae</i>	
Olive-sided flycatcher	<i>Contopus borealis</i>
Western wood-pewee	<i>C. sordidulus</i>
Willow flycatcher	<i>Empidonax traillii</i>
Least flycatcher	<i>E. minimus</i>
Hammond's flycatcher	<i>E.hammondii</i>
Dusky flycatcher	<i>E. oberholseri</i>
Gray flycatcher	<i>E. wrightii</i>
Cordilleran flycatcher	<i>E. occidentalis</i>
Black phoebe	<i>Sayornis nigricans</i>
Say's phoebe	<i>S. saya</i>
Ash-throated flycatcher	<i>Myiarchus cinerascens</i>
Western kingbird	<i>Tyrannus verticalis</i>
Cassin's kingbird	<i>T. vociferans</i>

APPENDIX A. (cont'd)

COMMON NAME

SCIENTIFIC NAME

Hirundinidae

Barn swallow

Hirundo rustica

Corvidae

Scrub jay

Steller's jay

Aphelocoma coerulescens

Cyanocitta stelleri

Paridae

Mountain chickadee

Black-capped chickadee

Parus gambelli

P. atricapillus

Aegithalidae

Common bushtit

Psaltirparus minimus

Certhiidae

Brown creeper

Certhia americana

Sittidae

Red-breasted nuthatch

White-breasted nuthatch

Sitta canadensis

S. carolinensis

Troglodytidae

Bewick's wren

House wren

Marsh wren

Thryomanes bewickii

Troglodytes aedon

Cistothorus palustris

Muscicapidae

Ruby-crowned kinglet

Golden-crowned kinglet

Blue-gray gnatcatcher

Hermit thrush

American robin

Regulus calendula

R. satrapa

Polioptila caerulea

Catharus guttatus

Turdus migratorius

Mimidae

Gray catbird

Northern mockingbird

Crissal thrasher

Dumetella carolinensis

Mimus polyglottos

Toxostoma crissale

Laniidae

Northern shrike

Loggerhead shrike

Lanius excubitor

L. ludovicianus

APPENDIX A. (cont'd)

COMMON NAME

SCIENTIFIC NAME

Vireonidae

Solitary vireo

Vireo solitarius

Warbling vireo

V. gilvus

Red-eyed vireo

V. olivaceus

Emberizidae

Tennessee warbler

Vermivora pergrina

Orange-crowned warbler

V. celata

Virginia warbler

V. virginiae

Yellow warbler

Dendroica petechia

Yellow-rumped warbler

D. coronata

Townsend's warbler

D. townsendi

Black-and-white warbler

Mniotilta varia

Ovenbird

Seiurus aurocapillus

Northern waterthrush

S. noveboracensis

MacGillivray's warbler

Oporornis tolmiei

Common yellowthroat

Geothlypis trichas

Wilson's warbler

Wilsonia pusilla

Hooded warbler

W. citrina

Canada warbler

W. canadensis

American redstart

Setophaga ruticilla

Yellow-breasted chat

Icteria virens

Thraupinae

Summer tanager

Piranga rubra

Western tanager

P. ludoviciana

Scarlet tanager

P. olivacea

Cardinalinae

Pyrrhuloxia

Cardinalis sinuatus

Rose-breasted grosbeak

Pheucticus ludovicianus

Black-headed grosbeak

P. melanocephalus

Blue grosbeak

Guiraca caerulea

Lazuli bunting

Passerina amoena

Indigo bunting

P. cyanea

Painted bunting

P. ciris

Dickcissel

Spiza americana

Emberizinae

Green-tailed towhee

Pipilo chlorurus

Rufous-sided towhee

P. erythrophthalmus

Brown towhee

P. fuscus

American tree sparrow

Spizella arborea

APPENDIX A. (cont'd)

COMMON NAME

Emberizinae (cont'd)

Chipping sparrow
Clay-colored sparrow
Brewer's sparrow
Vesper sparrow
Lark sparrow
Lark bunting
Savannah sparrow
Grasshopper sparrow
Song sparrow
Lincoln's sparrow
Swamp sparrow
Fox sparrow
White-throated sparrow
Golden-crowned sparrow
Harris's sparrow
White-crowned sparrow
Dark-eyed junco

Icterinae

Red-winged blackbird
Rusty blackbird
Western meadowlark
Brown-headed cowbird
Orchard oriole
Northern oriole

Fringilidae

House finch
Pine siskin
Lesser goldfinch
American goldfinch

SCIENTIFIC NAME

Spizella passerina
S. pallida
S. breweri
Pooecetes gramineus
Chondestes grammacus
Calamospiza melanocorys
Passerculus sandwichensis
Ammodramus savannarum
Melospiza melodia
M. lincolnii
M. georgiana
Passerella illiaca
Zonotrichia albicollis
Z. atricapilla
Z. querula
Z. leucophrys
Junco hyemalis

Agelaius phoeniceus
Euphagus carolinus
Sturnella neglecta
Molothrus ater
Icterus spurius
I. galbula

Carpodacus mexicanus
Carduelis pinus
C. psaltria
C. tristis

APPENDIX B. Mammalian of the Rio Grande, New Mexico

D. J. HAFNER

NEW MEXICO MUSEUM OF NATURAL HISTORY

AUGUST, 1989

PROVISIONAL CHECKLIST:

MAMMALS OF THE RIO GRANDE, NEW MEXICO

KEY

<u>Distribution</u>	<u>Current status in Rio Grande</u>
* RGNC and vicinity today	I Introduced
N Northern Rio Grande	X Extinct
C Central Rio Grande	D Desert-grasslands along Rio
S Southern Rio Grande	R Rare or endangered
W Widespread throughout NM	M Migrants through/along Rio

Distribution/Status Codes
*NCSWIXDRM

Marsupials

Virginia Opossum (*Didelphis virginiana*) C I R

Insectivores

Desert Shrew (*Notiosorex crawfordi*) * CSW

Bats

Yuma Myotis (<i>Myotis yumanensis</i>)	*NCSW
Little Brown Myotis (<i>Myotis lucifugus</i>)	*NC W
Long-legged Myotis (<i>Myotis volans</i>)	* C W
California Myotis (<i>Myotis californicus</i>)	* CSW
Small-footed Myotis (<i>Myotis leibii</i>)	*NC W
Silver-haired Bat (<i>Lasionycteris noctivagans</i>)	*NC W
Western Pipistrelle (<i>Pipistrellus hesperus</i>)	*NCSW
Big Brown Bat (<i>Eptesicus fuscus</i>)	*NCSW
Red Bat (<i>Lasiurus borealis</i>)	S
Hoary Bat (<i>Lasiurus cinereus</i>)	*NCSW
Spotted Bat (<i>Euderma maculatum</i>)	*NCS
Townsend's Big-eared Bat (<i>Plecotus townsendi</i>)	*NC W
Pallid Bat (<i>Antrozous pallidus</i>)	*NCSW
Mexican Free-tailed Bat (<i>Tadarida brasiliensis</i>)	*NCSW
Big Free-tailed Bat (<i>Tadarida macrotis</i>)	*NC

Rabbits and Hares

Desert Cottontail (<i>Sylvilagus auduboni</i>)	*NCSW
Black-tailed Jack Rabbit (<i>Lepus californicus</i>)	*NCSW

Rodents

Spotted Ground Squirrel (<i>Spermophilus spilosoma</i>)	* CSW D
Rock Squirrel (<i>Spermophilus variegatus</i>)	*NCSW
Black-tailed Prairie Dog (<i>Cynomys ludovicianus</i>)	CS X
Gunnison's Prairie Dog (<i>Cynomys gunnisoni</i>)	*NC W D

Botta's Pocket Gopher (<i>Thomomys bottae</i>)	*NCSW
Desert Pocket Gopher (<i>Geomys arenarius</i>)	SW
Yellow-faced Pocket Gopher (<i>Pappogeomys castanops</i>)	C W X

Silky Pocket Mouse (<i>Perognathus flavus</i>)	*NCSW D
Plains Pocket Mouse (<i>Perognathus flavescens</i>)	*NCSW D
Hispid Pocket Mouse (<i>Chaetodipus hispidus</i>)	* C W D
Rock Pocket Mouse (<i>Chaetodipus intermedius</i>)	* CSW D
Desert Pocket Mouse (<i>Chaetodipus penicillatus</i>)	S D
Ord's Kangaroo Rat (<i>Dipodomys ordii</i>)	*NCSW D
Banner-tailed Kangaroo Rat (<i>Dipodomys spectabilis</i>)	* CSW D
Merriam's Kangaroo Rat (<i>Dipodomys merriami</i>)	* CSW D

Beaver (<i>Castor canadensis</i>)	*NCSW
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Plains Harvest Mouse (<i>Reithrodontomys montanus</i>)	C D
Western Harvest Mouse (<i>Reithrodontomys megalotis</i>)	*NCSW
Cactus Mouse (<i>Peromyscus eremicus</i>)	CSW D
Deer Mouse (<i>Peromyscus maniculatus</i>)	*NCSW
White-footed Mouse (<i>Peromyscus leucopus</i>)	*NCSW
Brush Mouse (<i>Peromyscus boylii</i>)	*NCSW
Pinyon Mouse (<i>Peromyscus truei</i>)	*NCSW
Northern Grasshopper Mouse (<i>Onychomys leucogaster</i>)	*NCSW D
Chihuahuan Grasshopper Mouse (<i>Onychomys arenicola</i>)	* CSW D
Hispid Cotton Rat (<i>Sigmodon hispidus</i>)	CSW
Tawny-bellied Cotton Rat (<i>Sigmodon fulviventer</i>)	* CS
Southern Plains Woodrat (<i>Neotoma micropus</i>)	NCSW D
White-throated Woodrat (<i>Neotoma albigula</i>)	*NCSW

Muskrat (<i>Ondatra zibethicus</i>)	*NCSW
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Black Rat (<i>Rattus rattus</i>)	S I
Norway Rat (<i>Rattus norvegicus</i>)	*NCS I
House Mouse (<i>Mus musculus</i>)	*NCSWI

Meadow Jumping Mouse (<i>Zapus hudsonius</i>)	*NC
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Porcupine (<i>Erethizon dorsatum</i>)	*NCSW
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Mammals of the Rio Grande, New Mexico: Provisional Checklist p. 3

Carnivores

Coyote (<i>Canis latrans</i>)	*NCSW		
Gray Wolf (<i>Canis lupus</i>)	NCSW	X	
Kit Fox (<i>Vulpes macrotis</i>)	*CSW	D	
Gray Fox (<i>Urocyon cinereoargenteus</i>)	*NCSW		
Black Bear (<i>Ursus americanus</i>)			RM
Raccoon (<i>Procyon lotor</i>)	*NCSW		
Long-tailed Weasel (<i>Mustela frenata</i>)	*NCSW		
Mink (<i>Mustela vison</i>)	NC		R
Badger (<i>Taxidea taxus</i>)	*NCSW		
Striped Skunk (<i>Mephitis mephitis</i>)	*NCSW		
Hog-nosed Skunk (<i>Conepatus mesoleucus</i>)	SW		
River Otter (<i>Lontra canadensis</i>)	N	X?	
Mountain Lion (<i>Felis concolor</i>)		SW	RM
Bobcat (<i>Lynx rufus</i>)	*NCSW		

Hooved Mammals

Elk (<i>Cervus elaphus</i>)	N		RM
Mule Deer (<i>Odocoileus hemionus</i>)	NCSW		
Pronghorn (<i>Antilocapra americana</i>)	CSW	D	
Burrow (<i>Equus asinus</i>)	C	IX	
Horse (<i>Equus caballus</i>)	NCSW	IX	M

APPENDIX C. Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING INSPECTION & MAINTENANCE PLAN FOR SAN ANTONIO ARROYO PROJECT

1. WHEREAS, the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) has designed the San Antonio Arroyo Project with input from the Middle Rio Grande Conservancy District (DISTRICT) and the City of Albuquerque (CITY); and
2. WHEREAS, an Agreement is pending between AMAFCA and the CITY, whereby CITY Public Works Department will share in the cost of the PROJECT and CITY Open Space will participate in certain aspects of the maintenance of the completed project; and
3. WHEREAS, at the DISTRICT's request, project features have been included in the PROJECT to enhance the function of the Lower Corrales Riverside Drain; and
4. WHEREAS, at the CITY Open Space request, PROJECT features have been included in the PROJECT to protect and enhance the Oxbow Marsh; and
5. WHEREAS, to insure the PROJECT functions as intended, regular inspection and maintenance of the PROJECT features will be required; and
6. WHEREAS, AMAFCA is charged with the responsibility to operate and maintain flood control systems, the DISTRICT is charged with the responsibility to operate and maintain irrigation systems, and CITY Open space is involved in planning for management of the Oxbow Marsh and outfall area; and
7. WHEREAS, each agency is willing and able to assume responsibility for inspection and maintenance of those PROJECT feature relevant to each agency's responsibility as designated herein at Attachments A and B.

NOW, THEREFORE THE PARTIES AGREE AS FOLLOWS:

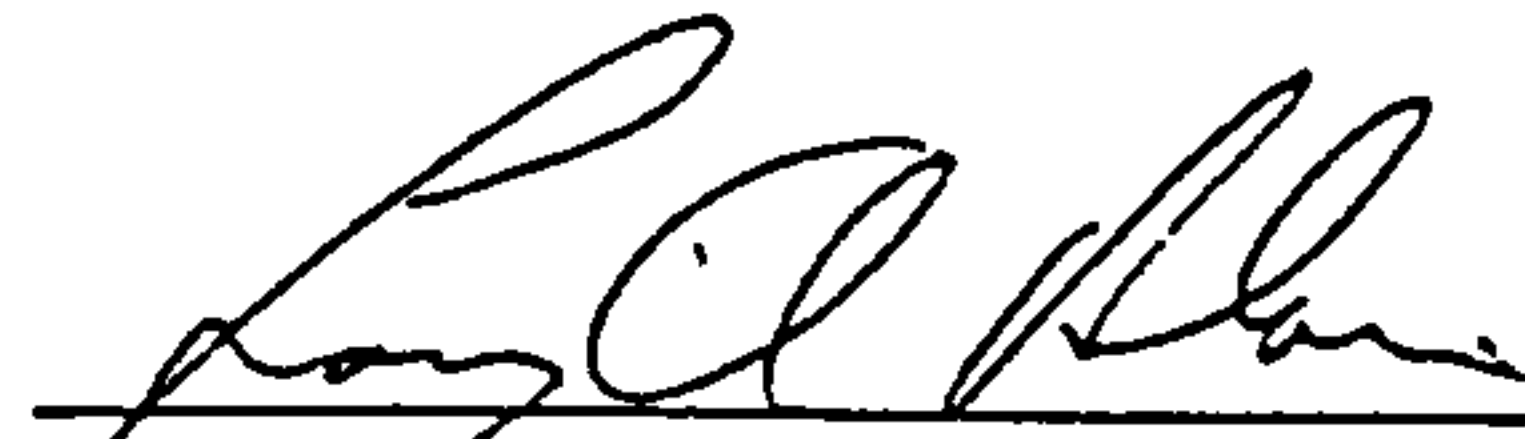
1. AMAFCA, the DISTRICT, and CITY Open space agree to inspect the project and to maintain the PROJECT features as described on Attachment A "Inspections" and Attachment B "Maintenance Responsibilities".
2. After two years of Inspection and Maintenance (following PROJECT completion), the parties will review this Memorandum of Understanding and its attachments for needed changes; however, changes will only be made if mutually agreed to, in writing, by all parties.
3. AMAFCA, the DISTRICT, and CITY Open Space hereby grant a license over the property owned or controlled by each to every other party as may be reasonably required to perform the Inspection, Operation, and Maintenance responsibilities as provided in this

Agreement.

4. Each party shall be solely responsible for any and all liability arising from personal injury including death(s) or damage to property arising from an act or failure to act of the respective party, its officials, agents, contractors and employees pursuant to this Agreement. Liabilities of each party shall be subject to the immunities and limitations of the Tort claims Act Section 41-4-1 et seq, NMSA, 1978 and any amendments thereto.

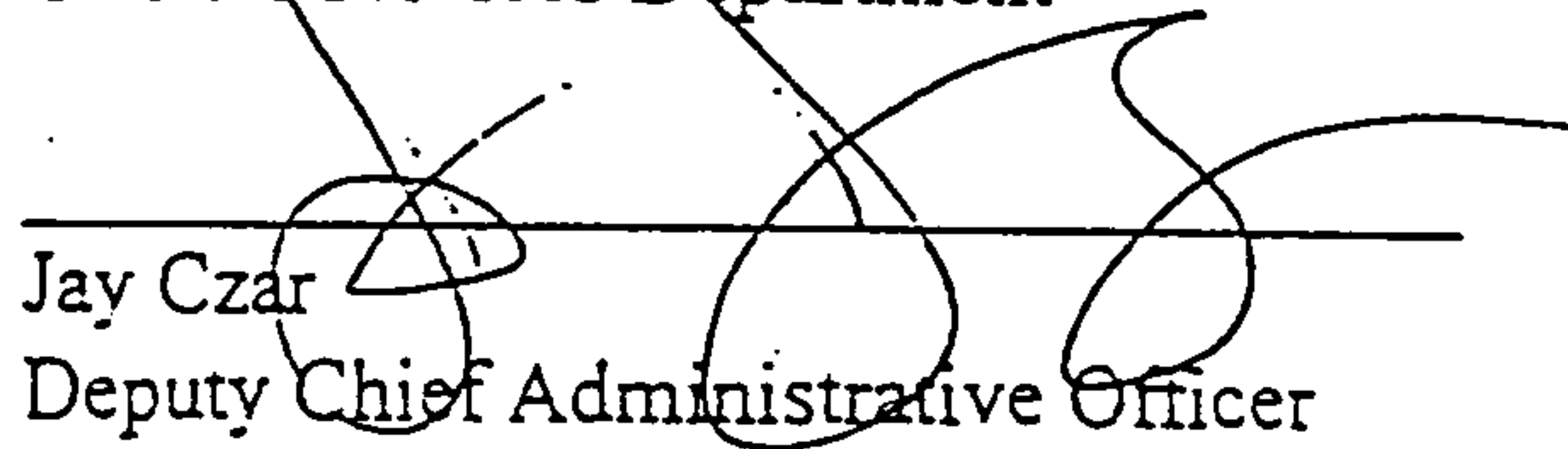
IN WITNESS WHEREOF, the parties have executed this Memorandum of Understanding this _____ day of _____, 199____.

Albuquerque Metropolitan Arroyo
Flood Control Authority



Larry A. Blair, P.E.
Executive Engineer

City of Albuquerque Parks and
General Services Department



Jay Czar
Deputy Chief Administrative Officer

Middle Rio Grande conservancy District

Subhas Shah
Chief Engineer

ATTACHMENT A INSPECTIONS

INSPECTIONS:

- Annual: By: AMAFCA
Timing: November
Inspection Scope:
Total Inspection of all project structures, including survey of berm elevations. Formal written report copied to MRGCD & City Open Space.
- Weekly: By: City Open Space
Timing: March 1 through October 30
Inspection Scope:
Beaver dams in Bosque Outfall or Oxbow that affect upstream water levels. Beaver plugging in any structure. Tumbleweeds in drain. Access control.
- As needed: By: District
Timing: March 1 through October 30
Inspection Scope:
Maintenance roads along Lower Corrales Riverside Drain from Montano Road CBC to Chute Structure. Functionality of triple 24-inch pipes.
- As needed: By: AMAFCA
Timing: After major storm events
Inspection Scope:
San Antonio Arroyo, Sediment Pond, Chute Structure and North and South Berms.

ATTACHMENT B MAINTENANCE RESPONSIBILITIES

AMAFCA

Function: Flood Control Structures

100% Responsibility Items:

San Antonio Arroyo Channel

Sediment Pond

Chute Structure

Structural Maintenance Only:

(Concrete repairs, gate repairs and/or replacement, fill in settled area on berms):

North and South Elevations

Will survey and fill in settlement on annual basis in winter.

Spillway

Gated Sluice Boxes

Annual cleaning only and operation check:

Triple 24-inch pipes ;and flap gates

After major storm events:

Assist District at triple 24-inch pipes if requested

DISTRICT

Function: Lower Corrales Riverside Drain

100% Responsibility Items:

Maintenance roads along Riverside Drain

Drain dredging

Triple 24-inch pipes

CITY OPEN SPACE Function: Wetland Management, Beaver Management and Vegetation Maintenance

Beaver Control:

Removal of dams that are affecting upstream water levels as follows:

In Bosque Outfall: Remove if water is flowing over spillway or if ends of triple 24-inch pipes flap gates are 50% submerged.

In Oxbow Area: Remove if drain is more than 50% diverted to triple 24-inch pipes.

Gated Sluice Boxes: Clean as required for water flow.

North and South Berms:

Maintain/control vegetation as needed. Maintain 4 x 4 access on top of berms.

Exhibit A - Sketch Map
 to
 Agreement for Channel Improvement
 San Antonio Arroyo, Coors to Rio Grande

