CITY OF ALBUQUERQUE

Planning Department
Brennon Williams, Interim Director

Mayor Timothy M. Keller

August 28, 2019

Sheila Johnson, P.E.
WHPacific, Inc.
6501 Americas Parkway NE, Suite 400
Albuquerque, NM 87110

RE: **Cibola Loop New Library**
Cibola Loop & Ellison NW
Drainage Analysis Report
Engineer's Stamp Date: none (8/7/19)
Hydrology File: A13D011A

Dear Ms. Johnson:

PO Box 1293

Albuquerque

NM 87103

www.cabq.gov

Based on the submittal received on 8/13/19, Hydrology can recommend the following:

1. Prior to construction, an approved grading plan and drainage report will be required. The drainage report should take the selected option(s) from this report and fully develop it, per the DPM Ch 22. The grading plan should be developed concurrently and be integrated with the Drainage Report.

2. All supporting documentation needs to be included: experts from previous reports, hydrologic models, hydraulic models, calculations, etc… all need to be included in order to provide meaningful feedback.

3. Options 1a/b & 2 can be pursued without too much additional emphasis on downstream capacity, since they only need to show that runoff rate and volume will remain the same (this assumes these options won't be combined with some part of option 4). But the pond routing for the new pond configuration still needs to be provided.

4. Hydrology recommends replacing the vertical retaining walls in Option 2 with 1:1 shotcrete for a cost savings of about $200,000. This combined with some as yet unidentified part of Option 4 seems like the obvious choice. Pond optimization should absolutely be done at this stage as any capacity found in the Coors pond may greatly reduce the size requirement of the Ellison pond. The required pond volume may vary significantly from one option to the next as the "peak shaving" discharge relationship in the AHYMO model changes from one pond option to another, and all of the alternatives may vary significantly from the existing volume which is the only volume used for the cost analysis.

5. There should be some discussion of grading assumptions for this steep site. Deep ponds are possible assuming that the library site is filled to the elevation of the southwest corner (16'

above the southeast corner). Borrow should come from the north half of the lot where the future Senior Center will go. The grading design will affect the drainage design and should be considered early in the design process. For example, the open pond may not be visible from Ellison if it is elevated above Ellison. The library visibility may be increased by shifting the building to the east side of the site.

6. Grading considerations should enter into the decision making process in addition to the drainage considerations because they are related. A conceptual level grading plan should at least be put together for Options 1 & 2.

7. The volume of aggregate in Option 1A is correct in the cost estimate and the dimensions of the pond, but in the discussion on page 10 the aggregate volume should be 250% larger than the required pond volume, not 60% as stated in two places.

8. Options 3 & 4 must demonstrate adequate downstream capacity per § 14-5-2-12(G) of the Albuquerque Code of Ordinances. This includes but is not limited to street capacity analysis, storm drain analysis with HGL's calculated from the EGL, and pond routing.

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9. The concept that the Coors pond is oversized and can accommodate additional runoff really needs to be thoroughly researched and analyzed at this stage. Elimination/reduction of the Ellison pond should not be pursued until the additional capacity in the Coors pond is identified and accepted by Hydrology.

10. The cost of Option 3, (free discharge and increased pipe size) seems low; but this option really isn't feasible until significant capacity in the Coors pond can be proven.

11. With AHYMO S4, be sure to use NOAA Atlas 14 precipitation depths in conjunction with the NOAA Atlas 14 distribution. Include the location map and tables obtained from the NOAA website. Using the NOAA Atlas 2 Precipitation depths (Found in the DPM), with the NOAA Atlas 14 Distributions results in an over-prediction of peak runoff (Q_{100}). See AHYMO AppNote-01, and the Hydrology website for more information regarding this.

12. All AHYMO runs need to include the input and output files, not just the summary table.

13. Please provide an engineer's stamp with a signature and date on the report.

14. For Information. Hydrology and Transportation files are available online through the City's GIS Viewer 2.0: https://www.cabq.gov/gis/advanced-map-viewer. Turn on the *HydroTrans* layer: *Operational Layers* > *Albuquerque Layers* > *Sites* > *HydroTrans*. Select the desired polygon from the map and click *Link to Project Documents*.

15. Provide management onsite for the Stormwater Quality Volume (SWQV) in accordance with the new drainage ordinance, § 14-5-2-6 (H) enacted 10/2/18 (Council Bill C/S O-18-2). To calculate the required volume to be captured, multiply the impervious area (SF) by 0.34

inches for the 90th percentile storm. This can be designed/addressed with the grading plan, once the desired option is selected.

If you have any questions, please contact me at 924-3695 or dpeterson@cabq.gov.

Sincerely,

Dana Peterson, P.E.
Senior Engineer, Planning Dept.
Development Review Services

PO Box 1293

Albuquerque

NM 87103

www.cabq.gov

CIBOLA LOOP DRAINAGE ANALYSIS AND FEASIBILITY REPORT – PHASE 1

95% Review Submittal

CITY OF ALBUQUERQUE PROJECT 6526.00

Prepared for

City of Albuquerque, New Mexico

Prepared by

WHPacific
AN NV5 COMPANY

6501 Americas Parkway Northeast, Suite 400
Albuquerque, New Mexico 87110

August 7, 2019

CIBOLA LOOP DRAINAGE ANALYSIS AND FEASIBILITY REPORT – PHASE 1

I, Sheila K. Johnson, Registered New Mexico Professional Engineer No. 19758, hereby certify that the material contained in this document was prepared by me, or directly under my supervision, and is true and correct to the best of my knowledge and belief

_____ _____

Sheila K. Johnson, P.E. Date
N.M.P.E. License No. 19758

WHPacific
AN NV5 COMPANY

TABLE OF CONTENTS

Recommended Options

Option 1a Underground Onsite Ponding – with Aggregate
Option 1b Underground Onsite Ponding – with Storage Chambers
Option 2 Surface Onsite Ponding
Option 3 Free Discharge to Coors Bypass Pond

Appendix

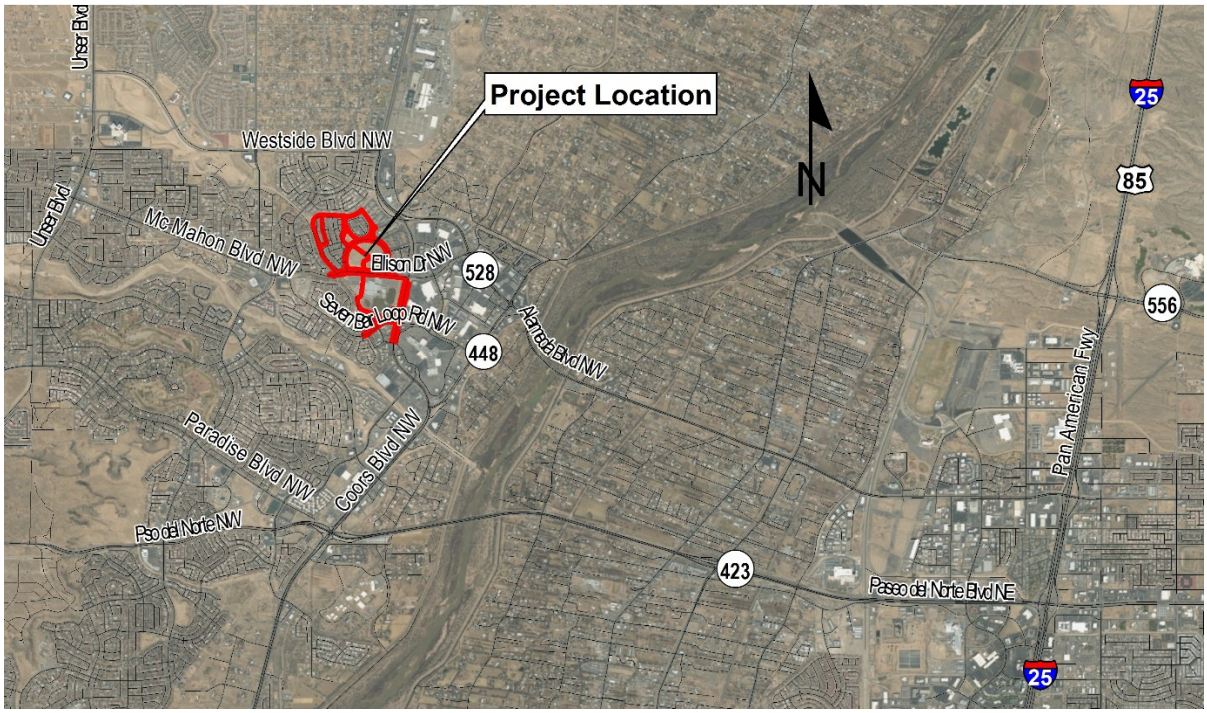
Comprehensive Options and Discussion List
AHYMO Summary Printout

1. INTRODUCTION AND PURPOSE

1.1 INTRODUCTION

Cibola Loop NW is a semi-circular roadway in northwest Albuquerque enclosing mostly undeveloped land. One developed tract is the Albuquerque Police Department' Westside Substation located in the southeast corner of the property. The City of Albuquerque (City) owns properties within the loop (Tract A-1 and A-2). The City wants to develop part of Tract A-1 as a library with adjacent parking and the remaining part of Tract 1 and Tract A-2 as a Multigenerational Center. An excerpt from the plat is shown on Figure 1. This report pertains to the development of the library. A significant portion of Tract A-1 is encumbered by a drainage pond (Cibola Loop Pond) that prevents construction of the library. The purpose of this feasibility study is to conceptually develop options to remove, relocate, or reduce the pond size to aid the City in making the decision regarding development at this location. Subsequent reports will be required for development and design.

A Location Map is shown below.



LOCATION MAP

Currently Cibola Loop Pond is constructed adjacent to Ellison Drive, NW. The library planners want the library to be constructed near the Ellison Drive frontage to provide maximum visibility and impact, placing it in direct conflict with the existing pond.

This project lies within Special Assessment District (SAD) 223. The surrounding infrastructure was constructed by SAD 223, generally in the late 1990s and early 2000s. Layout of the existing system and surrounding area is shown on Figure 2. The SAD 223 Master Drainage Plan established the drainage constraints for development in the area stating that peak flow rates in part were based on "Fully developed conditions within SAD 223 with approximately 50% on site ponding" and overall flow rates

were listed on the schematic drawings included in the Master Drainage Plan. All of the individual tracts within Cibola Loop, when developed, will need to comply with SAD 223. Subsequent studies will be required to determine the specifics and details of each Tract's developed conditions.

Many of the planning documents, drainage reports, and some construction record drawings have been located that cover these existing facilities, but no hydrology models or printouts of the model input/output have been found. All hydrologic modeling was produced for this study using current City methods.

Ellison Drive is a high traffic arterial roadway. It is important to the residents that construction of this project not impact roadway operation more than absolutely necessary. Cibola High School lies directly to the south of the proposed library site and is also a high traffic property, adverse to any construction impacts – shown on Figure 2.

The study analyzed the existing system capacity; conceptually investigated and documented a wide range of solution options; and, based on City preferences, recommended up to four options for further study. Three of the four recommended options include a rough order of magnitude cost estimate. Best available information is used for this study. Detailed field survey is not done at this stage.

2. EXISTING HYDROLOGY AND HYDRAULICS

2.1 PROJECT CRITERIA

Hydrologic and hydraulic analysis for the project met the current criteria for the City of Albuquerque as shown in the Development Process Manual (DPM). This is a conceptual, high level review of numerous options, so analysis of the options is done to determine feasibility and is not performed at a level of detail required for design.

Detention pond modeling is a component of this analysis so the 24-hour, 100-year storm event was evaluated. Flow rates and volumes and the Cibola Loop Pond were modeled in AHYMO. Storm drain modeling cannot be done in AHYMO, so the Ellison Drive storm drain and Coors Bypass regional pond was modeled using Autodesk Storm and Sanitary Analysis 2018 version 12.0.42.0 (SSA). This software was selected as it can provide storm drain analysis and pond routing. The hydrographs calculated in AHYMO were directly input into individual nodes along the storm drain. This included the Cibola Loop Pond outflow hydrograph and all basins draining to the Coors Bypass Pond.

2.2 DATUM

The reports and construction plans prepared in conjunction with SAD 223 use the National Geodetic Vertical Datum1929 (NGVD29). All record drawings used for this study were based on the NGVD29.

City LiDAR contour information was used to develop the pond storage data for Coors Bypass Pond and is based on the North American Vertical Datum 1988 (NAVD88). Since most of the elevations used are from the 1929 datum, all elevations including the LiDAR contour data for the Coors Bypass pond were converted to the 1929 datum. The conversion factor from 1988 to 1929 was calculated at -2.766 feet at the project site.

2.3 EXISTING CONDITIONS

Cibola Loop Pond functions as a surge pond. An 18-inch pipe conveys runoff from small storms to the storm drain with no detention. In larger storms the storm drain becomes surcharged, and the surcharged runoff drains into Cibola Loop Pond through a 36-inch pipe. This arrangement allows the small storms to drain quickly and the pond to store water only when the capacity of the storm drain is exceeded, allowing for a smaller pond and smaller storm drain pipes. Record information on the hydraulics of the existing surge pond were not found and it was modeled in this analysis.

The Drainage Basin Map for the project is shown in Figure 3 and the storm drain layout is shown on Figure 2. Cibola Loop pond drains Tres Placitas subdivision to the west (Basin 2), open space to the north (Basin 3), and part of the Cibola Loop roadway (Basin 4) via storm drain. Runoff from these basins combine in a 42-inch storm drain. The 48-inch storm drain connects to a manhole with an 18-inch storm drain outlet at the manhole invert. The record drawings show a 36-inch pipe constructed 3.66 feet above the manhole invert and connecting into Cibola Loop Pond. Once the 18-inch pipe exceeds capacity, and storm water raises to a depth greater than 3.66 feet runoff flows via the 36-inch pipe into the Cibola Loop Pond.

Some of the undeveloped land (Basin 5 and a small part of basin 9) drain overland, flowing directly into the pond. The remaining Basin 9 currently drains overland to the southeast and into Cibola Loop East roadway and is collected in the drop inlets. Basin 10 currently drains overland to Ellison Drive and is collected in the storm drain. As these basins are developed, future drainage plans will need to comply with SAD 223 and City drainage requirements.

Cibola Loop Pond is designed to store approximately 2.9 acre feet in the 100-year condition, with some additional freeboard to the embankment elevation. Currently the pond is nearly completely filled with sediment and is not functioning as designed. For this analysis, the design data from record drawings was used.

Keyed notes are shown within this text that correspond to Figure 2. The 18-inch outflow from Cibola Loop Pond (1) drains into a storm drain in Ellison Drive. The storm drain collects additional flow from Ellison itself and other development to the north (2) and outfalls into a regional detention pond (3) in the southwest quadrant Coors Bypass and Ellison Drive (Coors Bypass Pond).

The SAD 223 Drainage Master Plan states the Coors Bypass Pond stores 15.3 acre feet. A drainage plan specifically for the Coors Bypass Pond is not available, but the pond capacity was measured using the City 2-foot contour data at 25.28 acre feet to the top of the embankment. The pond's 24-inch outlet pipe is reduced to 13-inches by an orifice plate, restricting the outflow to approximately 11.6 cfs. Since the drainage report was not available, hydrology for basins draining to the pond and a pond routing were developed in this project, described below, to confirm the pond design and to determine if extra capacity is available. The storm drain layout on Figure 3 shows the storm drain layout beyond the Coors Bypass Pond to its outfall at Cabezon Channel. If the 11 cfs restrictor plate were removed this entire system would need to be analyzed. All of the options recommended in this study hold to the 11 cfs outflow from the pond.

The possibility of a clay soil layer lying under the project area exists and must be considered for future development. The police substation is constructed on the northwest corner of Cibola Loop East and

Ellison Drive. A Geotechnical evaluation was done at the substation site for the Albuquerque Police Department NW Area Command. The borings taken show clay was found on that site at 11 feet to 12 feet below the surface. It is unknown how far the clay extends. For this reason a geotechnical evaluation is recommended prior to any development on the site. All ponding options (surface or sub-surface) to replace Cibola Loop Pond considered in this study include an outlet for the pond. Infiltration at a proposed ponding area as a drainage mechanism is not considered or recommended.

BULK PLAT

TRACTS A-1, A-2, B-1 & C-1
CIBOLA LOOP SUBDIVISION

WITHIN
THE TOWN OF ALAMEDA GRANT
PROJECTED SECTION 6,
TOWNSHIP 11 NORTH, RANGE 3 EAST, N.M.P.M.
CITY OF ALBUQUERQUE
BERNALILLO COUNTY, NEW MEXICO
DECEMBER, 2016

EASEMENTS

① EXISTING 10' ABCWUA SANITARY SEWER EASEMENT (12-05-1974, BOOK MISC 345, PAGE 971)

② EXISTING 50' RADIUS TEMPORARY TURNING EASEMENT (11-08-1985, C28-161)

③ EXISTING 10' PUE (12-21-1989, C40-075)

④ EXISTING 10' PUE (02-21-1986, BOOK MISC 323A, PAGE 942)

⑤ EXISTING 12' UNDERGROUND QWEST EASEMENT (11-08-1985, C28-161)

⑥ EXISTING 10' PUE (04-29-2009, 2009C-066)

⑦ EXISTING C.O.A. PERMANENT DRAINAGE EASEMENT (05-05-1999, 1999060060)

⑧ EXISTING RECIPROCAL CROSS LOT ACCESS & DRAINAGE EASEMENT FOR THE JOINT USE AND BENEFIT OF AND TO BE MAINTAINED BY TRACTS A, B & C (04-29-2009, 2009C-066)

LUNA PARK STREET NW (71' R/W)

CUBA ROAD NW (60' R/W)

CIBOLA LOOP NW

MILL ROAD NW (60' R/W)

ELLISON DRIVE NW (156' R/W)

TRACT A-1 6.8934 AC

TRACT A-2 9.1422 AC

TRACT B-1 5.1785 AC

TRACT C-1 5.1214 AC

TRACT B-9E-2-A SEVEN-BAR RANCH (02-13-2008, 2008C-026)

40' WIDE PRIVATE ACCESS EASEMENT AND PRIVATE WATERLINE, SANITARY AND DRAINAGE EASEMENT GRANTED WITH THIS PLAT.

NON-TANGENT COMPOUND CURVE

NEW 40' WIDE PRIVATE RECIPROCAL CROSS LOT ACCESS EASEMENT AND PRIVATE WATERLINE, SANITARY AND DRAINAGE EASEMENT FOR THE JOINT USE AND BENEFIT OF AND TO BE MAINTAINED BY TRACTS A-1, A-2, B-1, & C-1 WITH THE FILING OF THIS PLAT.

DETAIL: 1" = 10'

DETAIL: 1" = 20'

DETAIL: 1" = 20'

DETAIL: 1" = 20'

100' 50' 0 100' 200'

SCALE: 1" = 100'

PROPERTY CORNERS

○ SET 1/2" REBAR WITH CAP OR PK WITH TAG "LS 7719" (TYP.)

◓ FOUND 5/8" REBAR WITH CAP "LS 11599"

ALDRICH LAND SURVEYING
P.O. BOX 30701, ALBQ., N.M. 87190
505-884-1990

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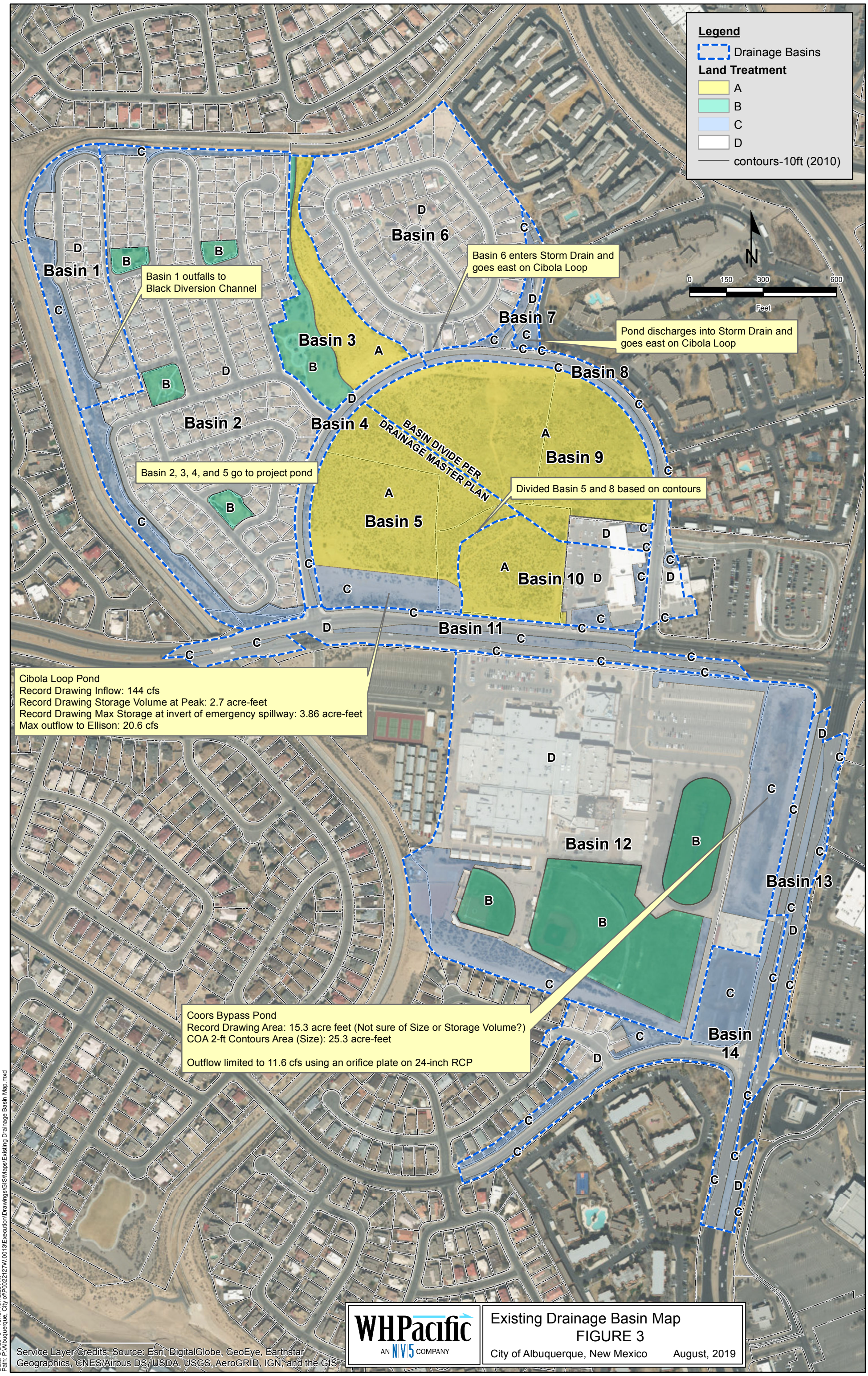
CIBOLA LOOP DRAINAGE ANALYSIS & FEASIBILITY STUDY
FIGURE 1 - Excerpt from CIBOLA LOOP SUBDIVISION PLAT

Existing Storm Drain Map
FIGURE 2
City of Albuquerque, New Mexico August, 2019

User: CTom WHPacific Inc. Date: 8/7/2019 Time: 1:00:48 PM Path: P:\Albuquerque, City of\P0022127W.0013\Execution\Drawings\GIS\Maps\Existing Storm Drain Map.mxd


Legend
Drainage Basins
Land Treatment
A
B
C
D
contours-10ft (2010)
N
0
150
300
600
Feet
Basin 1
Basin 2
Basin 3
Basin 4
Basin 5
Basin 6
Basin 7
Basin 8
Basin 9
Basin 10
Basin 11
Basin 12
Basin 13
Basin 14
Basin 1 outfalls to Black Diversion Channel
Basin 6 enters Storm Drain and goes east on Cibola Loop
Pond discharges into Storm Drain and goes east on Cibola Loop
Basin 2, 3, 4, and 5 go to project pond
BASIN DIVIDE PER DRAINAGE MASTER PLAN
Divided Basin 5 and 8 based on contours
Cibola Loop Pond
Record Drawing Inflow: 144 cfs
Record Drawing Storage Volume at Peak: 2.7 acre-feet
Record Drawing Max Storage at invert of emergency spillway: 3.86 acre-feet
Max outflow to Ellison: 20.6 cfs
Coors Bypass Pond
Record Drawing Area: 15.3 acre feet (Not sure of Size or Storage Volume?)
COA 2-ft Contours Area (Size): 25.3 acre-feet
Outflow limited to 11.6 cfs using an orifice plate on 24-inch RCP
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS
WHPacific
AN NV5 COMPANY
Existing Drainage Basin Map
FIGURE 3
City of Albuquerque, New Mexico
August, 2019
User: CTom WHPacific Inc.
Date: 8/5/2019 Time: 10:12:28 AM
Path: P:\Albuquerque, City of\P0022127W.0013\Execution\Drawings\GIS\Maps\Existing Drainage Basin Map.mxd

2.4 HYDROLOGY

Basins were delineated using drainage basin maps from the applicable drainage reports where they were available, combined with City 2-foot contour LiDAR data, and a site visit. The project lies in Precipitation Zone 1 (west of the Rio Grande). Land treatments A through D were based on DPM criteria and shown on the Drainage Basin Map. Time of Concentration for the all of the basins is 12 minutes or less, thus 12 minutes is used everywhere, and the Time to Peak in AHYMO is equal to 2/3 of the Time of Concentration or 0.1333 hours.

An AHYMO summary printout is shown in the Appendix. Table 1 summarizes the individual basin areas and flow rate developed as part of this study using current development conditions.

TABLE 1: DRAINAGE BASINS, AREAS, AND DISCHARGES

Basin Number	Area (Acres)	Area (Sq. Mi.)	Q_{100} (f^3/s)
1	Not used		
2	31.62	0.04941	124.77
3	4.86	0.00759	10.31
4	1.75	0.00273	6.54
5	10.55	0.01648	23.78
6	14.95	0.02336	57.72
7	1.07	0.00168	3.83
8	3.63	0.00567	14.07
9	12.96	0.02025	28.49
10	6.26	0.00978	17.88
11	6.43	0.01005	25.32
12	43.88	0.06856	155.68
13	4.20	0.00657	15.70
14	8.86	0.01385	32.86

2.5 HYDRAULIC ANALYSIS OF EXISTING SYSTEMS

Cibola Loop Pond Routing

Cibola Loop Pond storage and pipe inflow and outflow sizes were obtained from record drawing for Tres Placitas Subdivision (Reference #7). Existing LiDAR could not be used as the pond is nearly full of sediment which is reflected in the LiDAR contours. Pond data was input into AHYMO software and the pond routing indicated a maximum storage of 2.97 acre feet, a peak discharge of 18.0 cfs and a maximum water surface of 5079.1 feet. This corresponds well with the drainage report data (storage 2.7 AF, max outflow of 20.6 cfs).

AHYMO does not perform detailed storm drain modeling, so to model the storm drain in conjunction with the Coors Bypass Pond, SSA software was used as described above. Record drawings show the Ellison Drive storm drain, but the hydraulic design data was not available from the existing drainage report. Hydrographs were extracted from the AHYMO model and input to SSA. The elevations shown in the record drawings were used in SSA and the pipe lengths were obtained from City shapefiles.

Under existing conditions, the storm drain modeling results indicate two manholes along Cibola Loop will be surcharged in the 100-year condition.

The top of Coors Bypass Pond is approximately at elevation 5055 feet (from LiDAR contours converted to NGVD29) and the maximum water surface was modeled at 5051.9 feet.

The storm drain was based on Record Drawings *Design Plans for City of Albuquerque Ellison Drive*, Project Number 3727.90, by Bohannan Huston, 2/17/1997.

3. SELECTION OF OPTIONS

Once the hydrologic analysis was complete and the existing downstream storm drain and pond layout was determined from record drawings, several meetings were held to gain input on development options for the project site. The City wished to, at least conceptually, consider and document a wide range of options. To this end a brainstorming meeting was held within WHPacific, and also with the City Project Manager and City Hydrology Senior Engineer. These meetings resulted in numerous, and varied options which WHPacific reviewed. In some cases an option could be determined as non-feasible based on a review of documents or topography. A conceptual level of analysis and rough order cost estimating was done where appropriate.

A meeting was held on May 13, 2019 with the City project manager, the Library Director and WHPacific to determine which options were feasible and would fit with the Library plans for development. A comprehensive list of options, notes including pros and cons, and the decisions or discussion regarding each option is included in the Appendix.

Also discussed at the May 13 meeting, Tracts A-1 and A-2 will need to detain future on-site developed runoff on the developed site. The Cibola Loop Pond solution will need to address the interim condition however. For example if the library is constructed on Tract A-1, but Tract A-2 is still undeveloped, the runoff from the Tract A-2 that currently drains across Tract A-1 site will need to be addressed.

The result of this options discussion meeting was to recommend up to four options for more detailed analysis and rough order of magnitude cost estimation. The recommended options were revised at a later date due to a change in the City Project Management staff and additional input from City Hydrology. The recommended options are shown below in Section 4.

4. RECOMMENDATIONS AND ROUGH ORDER OF MAGNITUDE COST ESTIMATES

The following four options were selected for future study, shown in no particular order. Detailed descriptions of the options follow and a layout and rough order of magnitude cost estimates are included at the end of Section 5. Due to the potential for clay in the area, a geotechnical analysis is recommended for any option for proposed development.

TABLE 2: RECOMMENDED OPTIONS

Option	Description
1	Underground Onsite ponding – subsurface ponding with an outlet.
2	Surface Onsite Ponding – to replace the existing pond
3	Free discharge to the Coors Pond – by upsizing the existing storm drain
4	Increase flow to Coors Pond – using pipe and street conveyance

Option 1a or 1b: Underground Onsite ponding – subsurface ponding with an outlet.

This option consists of subsurface ponding: either an excavated ponding area filled with aggregate (40% void ratio) or underground storage chambers. See Option 1a and 1b layouts following this section. The parking lot pavement or landscape area will be constructed over either option. For this preliminary review, the proposed ponding area will replace the existing pond and have the same storage capacity. The storage could likely be optimized with future development conditions, but this analysis used the current design storage for comparison purposes.

The ponding area is not intended to infiltrate due to the potential of a clay in the area. Any subsurface pond must have an outlet to the existing storm drain.

Option 1a: The recommended aggregate would need a 40% void ratio, as is typical for construction aggregate. The 40% void ratio results in the excavation being 60% larger than the required storage. The excavation would be lined with filter cloth, or depending on the geotechnical analysis, may need to be lined with an impermeable lining to prevent infiltration into the soil. The excavation would then be covered with filter cloth and topped with a minimum of 2-feet of compacted fill, and asphalt parking lot pavement. The aggregate cost is based on a quote received from City Hydrology, adjusted for inflation. Sediment is a major concern for these types of ponds and a sediment pond would be required on the north side at the boundary with undeveloped area. The sediment pond may be removed once Tract A-2 is developed. A sediment trap is also recommended at any point runoff is entering the pond.

A primary benefit of this option is that development would not be impacted by the pond and the same function as currently designed could be achieved. Only smaller on-site ponding for the library runoff would be visible on the site.

The sediment pond on the north side would need regular maintenance; most likely it would need to be cleaned out after every storm event. It would also be a catch-all for debris and weeds. Maintenance of the aggregate filled ponding area would pose problems in accessing.

The aggregate option for excavation would need to be a minimum of 60% larger than the required storage and adjusted on the site to fit the volume. Some settling of the parking pavement over the pond may occur if there are any construction defects.

Option 1b: Storage chambers would function in much the same way as the aggregate filled pond, but the footprint may be different and the depth shallower. The storage chamber option is more costly for the chambers, but the excavation is not as deep and they have access points to allow for maintenance. Sediment is also an issue for storage chambers and a sediment trap would be required at the north

boundary to capture runoff from the undeveloped land. The chambers are designed to carry traffic loading.

Pavement would be part of any library construction so is not included in the conceptual level estimate.

Option 2 Surface Onsite Ponding to replace the existing pond

A surface pond with enough capacity to contain the existing pond volume and fit along the south side of the site would need to have vertical sides and need to be on the order of 10-15 feet deep (shown at 11 feet deep for this study). At this depth the outfall can drain to the existing storm drain. The retaining walls for the pond sides must meet the City zoning regulations stating that vertical sides must be terraced with maximum six foot high walls separated by four foot benches. It would need to be completely fenced and include an entrance and ramp for maintenance.

A surface pond straightforward for design and construction and is more easily accessible for maintenance.

Surface ponds readily collect sediment and debris so regular maintenance would be needed. The pond would need to be constructed on the south side of the site at the low area, placing it directly in front of the proposed library building. The pond would be excavated below the surface, but the fencing would be visible and the opening would gather debris, trash, and weeds. Generally surface ponds are unsightly. This option would be constructed along the Ellison Drive frontage, potentially impacting the library's architectural impact desired by the planners. Safety is of concern; the pond would be fenced, but children or others may still find a way inside and the concrete lined vertical drop is hazardous. Th

Option 3 - Free discharge to the Coors Pond

The Coors Bypass Regional Detention pond has extra capacity and based on this analysis of existing conditions, it has capacity for the entire volume of roughly 5.7 acre feet. The difference in volume from Options 1 and 2 is due to pond attenuation of the surge pond. Options 1 and 2, as in the existing condition, are still functioning as surge ponds with an 18-inch pipe conveying the low flow directly to the storm drain.

Option 3 upsized the storm drain to convey the entire runoff from the 100-year storm event to the Coors Bypass Pond and eliminating the pond on the library site. The library site would need to detain their development site runoff to the limits required in the SAD 223 Master Drainage Report and the City Development requirements.

The storm drain would convey the runoff from Basin 2, Basin 3, Basin 4, and collect the SAD 223 allowed runoff from Basin 8 and the street flow in Ellison Drive. Runoff from the storm drain in Cibola Loop East would be collected as it currently is. This analysis results indicate the storm drain would need to be upsized to 54-inch pipe throughout most of the entire length. The water surface elevation of the Coors Bypass pond increased to 5052.3 feet, and the top pond embankment elevation is approximately 5055. The storm drain and pond routing model indicates the Coors Bypass pond would have capacity.

The obvious benefit of this option is the elimination of the Cibola Loop Pond, however construction of this large storm drain parallel and within Ellison Drive would be expensive and have significant impacts to the area. Ellison Drive is a high traffic, busy roadway and any lane shutdowns may cause major traffic slow-downs, especially during rush hours. Cibola High School is directly to the south of the Cibola Loop

property and is also a high traffic volume site when school is in session. A new inlet structure would need to be constructed to the Coors Bypass pond to replace the existing 42-inch pond inlet with the larger 54-inch structure. Several modifications to this option could be made, such as constructing a parallel pipe within the right of way but out of the roadway. The existing line would remain in service, allowing the proposed pipe to be smaller. The proposed storm drain would have to cross Ellison Drive at some point, and bore and jack could be used for this. For the rough order of magnitude cost, upsizing the storm drain to convey the entire flow and constructing it in the same location was used.

Option 4 - Increase flow to Coors Pond – using pipe and street conveyance

Option 4 involves using the street conveyance capacity of Ellison Drive to drain as much runoff as the DPM allows or possibly a lessor flow rate based on the amount that can reasonably be drained to the street. Diverting runoff that would have drained to the Cibola Loop Pond to Ellison Drive will reduce the Cibola Loop pond size. Suggestions from City Hydrology to increase street capacity included adding a bike lane, paved ditch parallel to the roadway or using the existing asphalt paved sidewalk/trail adjacent to Ellison Drive and adding a curb behind it (as has been done elsewhere in the City).

If a parallel ditch on the north side of Ellison were used, a culvert pipe would be needed to convey the runoff across Ellison to enter Coors Bypass Pond. Increased runoff within Ellison Drive would require additional drop inlets near Coors Bypass Pond to collect this flow and direct it to the pond. The system hydraulics would need to be reanalyzed, possibly requiring the storm drain and inlet to the pond to be upsized or a parallel system constructed.

Ellison Drive already has an existing 6-foot bike lane. The street including the bike lane is approximately 32 feet wide. The street section has a standard curb and gutter on the outside lane, a 12-foot wide asphalt sidewalk, and 2% cross slope to a median curb. The street capacity, per 100-year DPM criteria using this geometry, is 40cfs (0.81 feet deep). Any development option would also need to meet the 10-year street criteria for flow velocity and the requirement to keep one 12-foot lane clear.

Two options are available to increase street runoff to Ellison Drive. One alternative would increase the pond outflow: directing a portion of the runoff to a pipe and a portion to the surface conveyance. The existing 20 cfs outflow (now 100% within pipe) may be increased by approximately 20 to 40 cfs draining to the surface conveyance. A structure would be needed to facilitate this outflow. Using both pipe and street conveyance would allow a reduced pond size at the Cibola Loop site.

Alternatively surface flow that is currently draining to the pond or storm drain could be diverted to surface street flow where it is reasonable to do so. Basin 4 and Basin 11 would be reasonable to include as street flow – resulting in approximately 31 cfs draining into Ellison Drive at the 100-year storm. To drain Basin 4 to Ellison would require removing storm drain inlets in Cibola Loop West and would result in 0.73 feet depth of flow in Ellison.

Ellison is a high traffic, busy roadway with high pedestrian traffic from the school (and potentially more pedestrian traffic if the library is constructed). Allowing runoff to flow this deep in Ellison Drive could be a safety concern and would negatively impact drivers. At locations where significant runoff drains from one street into another (such as Cibola Loop West into Ellison Drive) turbulence occurs until the water has fully changed direction. If the full 31 cfs were released to Ellison, the resulting water depth in addition to the turbulence caused at the 90° turn could be a safety hazard.

No exhibit or rough order of magnitude cost was developed for this option as there are so many variables. If the City wants to consider one or a combination of these alternatives in Phase 2, WHPacific will analyze them using the City's preferred surface conveyance or option for adding flow to Ellison Drive in conjunction with a smaller pond on Tract A-1. The intent would be to optimize surface flow versus pipe flow versus size of Cibola Loop Pond.

5. CONCLUSION

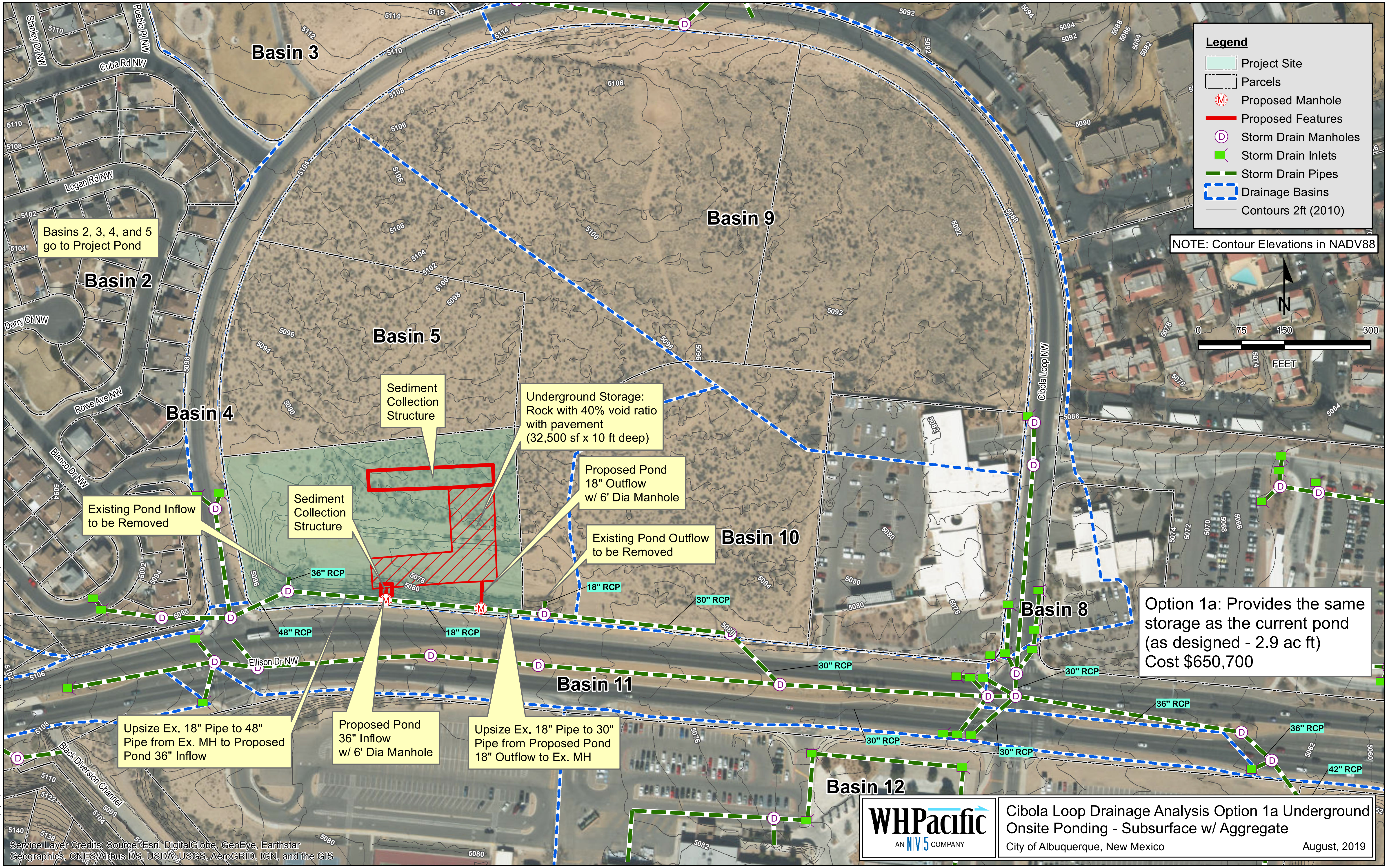
After consideration of the options, including review, discussion, analysis of existing conditions, and conceptual analysis for mitigating the existing Cibola Loop Pond, four feasible options have been selected by the City for consideration by the Library Director and planners. Schematic layouts of options 1a, 1b, 2 and 3 are shown on the following pages and the Rough Order of Magnitude costs follow the Option sketches.

6. REFERENCES

1. City of Albuquerque, Development Process Manual, October 2008.
2. U.S. Department of Agriculture, Natural Resources Conservation Service, Digital General Soil Map of U.S., 2006.
3. City of Albuquerque, 2-foot contour data, http://www.cabq.gov/gis/geographic-information-systems-data.
4. Precipitation-Frequency Atlas of the Western United States, NOAA Atlas 14, Volume 1, Version 4, Semiarid Southwestern United States, January 2006.
5. AutoDesk Storm and Sanitary Analysis 2018, version 12.0.42.0, March 01, 2017, 14:33:52.
6. Bentley CulvertMaster, Version 3.3.
7. Bentley Flowmaster V8i (SELECT series 1).
8. National Soil Information Database, http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm, Natural Resources Conservation Services, United States Department of Agriculture, accessed January 2015.
9. Chavez Grieves Consulting Engineers, Inc., Investigative Report on Distress and Remediation, Albuquerque Police Department, Northwest Area Command Headquarters, October 24, 2018

Record Drawings

10. *Public Improvements Plans for Tres Placitas Subdivision, Albuquerque, NM*, by Isaacson & Arfman PA, November 4, 2004.
11. *Design Plans for City of Albuquerque Ellison Drive*, Project Number 3727.90, by Bohannan Huston, 2/17/1997.


Basin 3
Basin 9
Basin 2
Basin 5
Basin 4
Basin 10
Basin 8
Basin 11
Basin 12
Basins 2, 3, 4, and 5 go to Project Pond
Sediment Collection Structure
Underground Storage: Rock with 40% void ratio with pavement (32,500 sf x 10 ft deep)
Proposed Pond 18" Outflow w/ 6' Dia Manhole
Existing Pond Inflow to be Removed
Sediment Collection Structure
Existing Pond Outflow to be Removed
Upsize Ex. 18" Pipe to 48" Pipe from Ex. MH to Proposed Pond 36" Inflow
Proposed Pond 36" Inflow w/ 6' Dia Manhole
Upsize Ex. 18" Pipe to 30" Pipe from Proposed Pond 18" Outflow to Ex. MH
36" RCP
18" RCP
30" RCP
48" RCP
36" RCP
42" RCP
Cuba Rd NW
Logan Rd NW
Derry Ct NW
Rowe Ave NW
Blanco Dr NW
Stanley Dr NW
Pueblo Pl NW
Ellison Dr NW
Cibola Loop NW
Black Diversion Channel
Legend
Project Site
Parcels
Proposed Manhole
Proposed Features
Storm Drain Manholes
Storm Drain Inlets
Storm Drain Pipes
Drainage Basins
Contours 2ft (2010)
NOTE: Contour Elevations in NADV88
N
0 75 150 300
FEET
Option 1a: Provides the same storage as the current pond (as designed - 2.9 ac ft) Cost $650,700
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS
WHPacific AN NV5 COMPANY
Cibola Loop Drainage Analysis Option 1a Underground Onsite Ponding - Subsurface w/ Aggregate
City of Albuquerque, New Mexico
August, 2019

CIBOLA LOOP DRAINAGE ANALYSIS AND FEASIBILITY REPORT - PHASE I
CITY OF ALBUQUERQUE PROJECT 6526.00
ROUGH ORDER OF MAGNITUDE COST ESTIMATE
8/7/2019

			Option 1a Cost Estimate		
ITEM NO.	**ITEM DESCRIPTION**	**UNIT**	**QUANTITY**	**UNIT COST**	**COST**
1	Survey	%		1.00	$4,531.00
2	Construction Mobilization, compl.	%		4.26	$19,300.00
3	Construction Demobilization, compl.	%		0.50	$2,265.00
4	Construction Traffic Control & Barricading, compl.	%		4.00	$18,122.00
5	Flood Protection, compl.	%		2.00	$9,061.00
6	Fill, construction, incl. excavation, placement & compaction of unclassified material, over 2 ft. deep, cip.	CY	903	$13.00	$11,739.00
7	Filter Cloth, cip.	SF	20,298	$0.06	$1,167.14
8	Trenching, Backfilling, & Compaction, for 18" to 36" sewer pipe, up to 8' in depth, pipe not incl., compl.	LF	231	$27.00	$6,237.00
9	Trenching, Backfilling, & Compaction, for 42" to 60" sewer pipe, up to 8' in depth, pipe not incl., compl.	LF	175	$29.00	$5,075.00
10	Backfill Material, Select, incl. compaction, cip.	CY	3,015	$13.00	$39,195.00
11	18" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	50	$41.00	$2,050.00
12	30" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	110	$67.00	$7,370.00
13	36" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	30	$83.00	$2,490.00
14	48" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	175	$148.00	$25,900.00
15	Drainline Removal, 10" to 18", excl. trenching, compl.	LF	310	$21.00	$6,510.00
16	Drainline Removal, 21" to 48", excl. trenching, compl.	LF	16	$19.00	$304.00
17	Manhole, 6' dia., Type "C" or "E", less than 6' deep, cip. SD2101	EA	2	$5,256.00	$10,512.00
18	7/8" Concrete Aggregate	CY	7,518	$40.50	$304,501.55
19	Sediment Collection Structure	LS	1	$30,000.00	$30,000.00

Construction Subtotal	$506,330
NMGRT (7.3125%)	$37,039
Construction Contingecy (20%)	$101,266
Geotechnical Services	$6,000
Total	**$650,700**

Basin 3

Basin 9

Basins 2, 3, 4, and 5 go to Project Pond

Basin 2

Basin 5

Basin 4

Sediment Collection System

Underground Storage Chambers: (36,500 sf)

Sediment Collection System

Existing Pond Inflow to be Removed

Proposed Pond 36" Inflow w/ 6' Dia Manhole

Proposed Pond 18" Outflow w/ 6' Dia Manhole

Existing Pond Outflow to be Removed

Basin 10

Basin 8

Basin 11

Basin 12

36" RCP

18" RCP

48" RCP

30" RCP

42" RCP

Upsize Ex. 18" Pipe to 48" Pipe from Ex. MH to Proposed Pond 36" Inflow

Upsize Ex. 18" Pipe to 30" Pipe from Proposed Pond 18" Outflow to Ex. MH

Option 1b: Provides the same storage as the current pond (as designed - 2.9 ac ft)
Cost $1,251,000

Legend

- Project Site
- Parcels
- Proposed Manhole
- Storm Drain Manholes
- Storm Drain Inlets
- Storm Drain Pipes
- Drainage Basins
- Contours 2ft (2010)

NOTE: Contour Elevations in NADV88

N

0 75 150 300

FEET

Stanley Dr NW
Pueblo Pl NW
Cuba Rd NW
Logan Rd NW
Derry Ct NW
Rowe Ave NW
Blanco Dr NW
Ellison Dr NW
Cibola Loop NW
Black Diversion Channel

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS

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WHPacific
AN NV5 COMPANY

Cibola Loop Drainage Analysis Option 1b Underground Onsite Ponding - Subsurface w/ Storage Chambers

City of Albuquerque, New Mexico — August, 2019

CIBOLA LOOP DRAINAGE ANALYSIS AND FEASIBILITY REPORT - PHASE I
CITY OF ALBUQUERQUE PROJECT 6526.00
ROUGH ORDER OF MAGNITUDE COST ESTIMATE
8/7/2019

			Option 1b Cost Estimate		
ITEM NO.	**ITEM DESCRIPTION**	**UNIT**	**QUANTITY**	**UNIT COST**	**COST**
1	Survey	%		1.00	$8,746.00
2	Construction Mobilization, compl.	%		4.26	$37,259.00
3	Construction Demobilization, compl.	%		0.50	$4,373.00
4	Construction Traffic Control & Barricading, compl.	%		4.00	$34,985.00
5	Flood Protection, compl.	%		2.00	$17,493.00
6	Trenching, Backfilling, & Compaction, for 18" to 36" sewer pipe, up to 8' in depth, pipe not incl., compl.	LF	246	$27.00	$6,642.00
7	Trenching, Backfilling, & Compaction, for 42" to 60" sewer pipe, up to 8' in depth, pipe not incl., compl.	LF	260	$29.00	$7,540.00
8	18" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	40	$41.00	$1,640.00
9	30" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	115	$67.00	$7,705.00
10	36" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	50	$83.00	$4,150.00
11	48" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	260	$148.00	$38,480.00
12	Drainline Removal, 10" to 18", excl. trenching, compl.	LF	400	$21.00	$8,400.00
13	Drainline Removal, 21" to 48", excl. trenching, compl.	LF	16	$19.00	$304.00
14	Manhole, 6' dia., Type "C" or "E", less than 6' deep, cip. SD2101	EA	2	$5,256.00	$10,512.00
15	ADS Stormceptor Chambers	CF	126,542	$6.00	$759,252.00
16	Sediment Collection Structure	LS	1	$30,000.00	$30,000.00

Note: ADS Stormceptor Chambers cost includes excavation, gravel, manifold and backfill

Construction Subtotal	$977,481
NMGRT (7.3125%)	$71,505
Construction Contingecy (20%)	$195,496
Geotechnical Services	$6,000
Total	**$1,250,500**

Basin 3

Basin 9

Basin 2

Basin 5

Basin 4

Basin 10

Basin 8

Basin 11

Basin 12

Basins 2, 3, 4, and 5
go to Project Pond

Surface Storage Pond:
19,200 sf x 11 ft deep

Existing Pond Inflow
and Existing Manhole
to be Removed

Proposed Pond
36" Inflow
w/ 6' Dia Manhole

Existing 18" Pipe
to be Removed

Proposed Pond
18" Outflow
w/ 6' Dia Manhole

Existing Pond Outflow
to be Removed

New 18" Pipe

36" RCP
18" RCP
48" RCP
30" RCP
42" RCP

Stanley Dr NW
Pueblo Pl NW
Cuba Rd NW
Logan Rd NW
Derry Ct NW
Rowe Ave NW
Bianco Dr NW
Ellison Dr NW
Cibola Loop NW
Black Diversion Channel

Legend

- Project Site
- Parcels
- Proposed Manhole
- Proposed Features
- Storm Drain Manholes
- Storm Drain Inlets
- Storm Drain Pipes
- Drainage Basins
- Contours 2ft (2010)

NOTE: Contour Elevations in NADV88

N

0 75 150 300

FEET

Option 2: Provides the same storage as the current pond (as designed - 2.9 ac ft)
Cost $667,900

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS

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WHPacific
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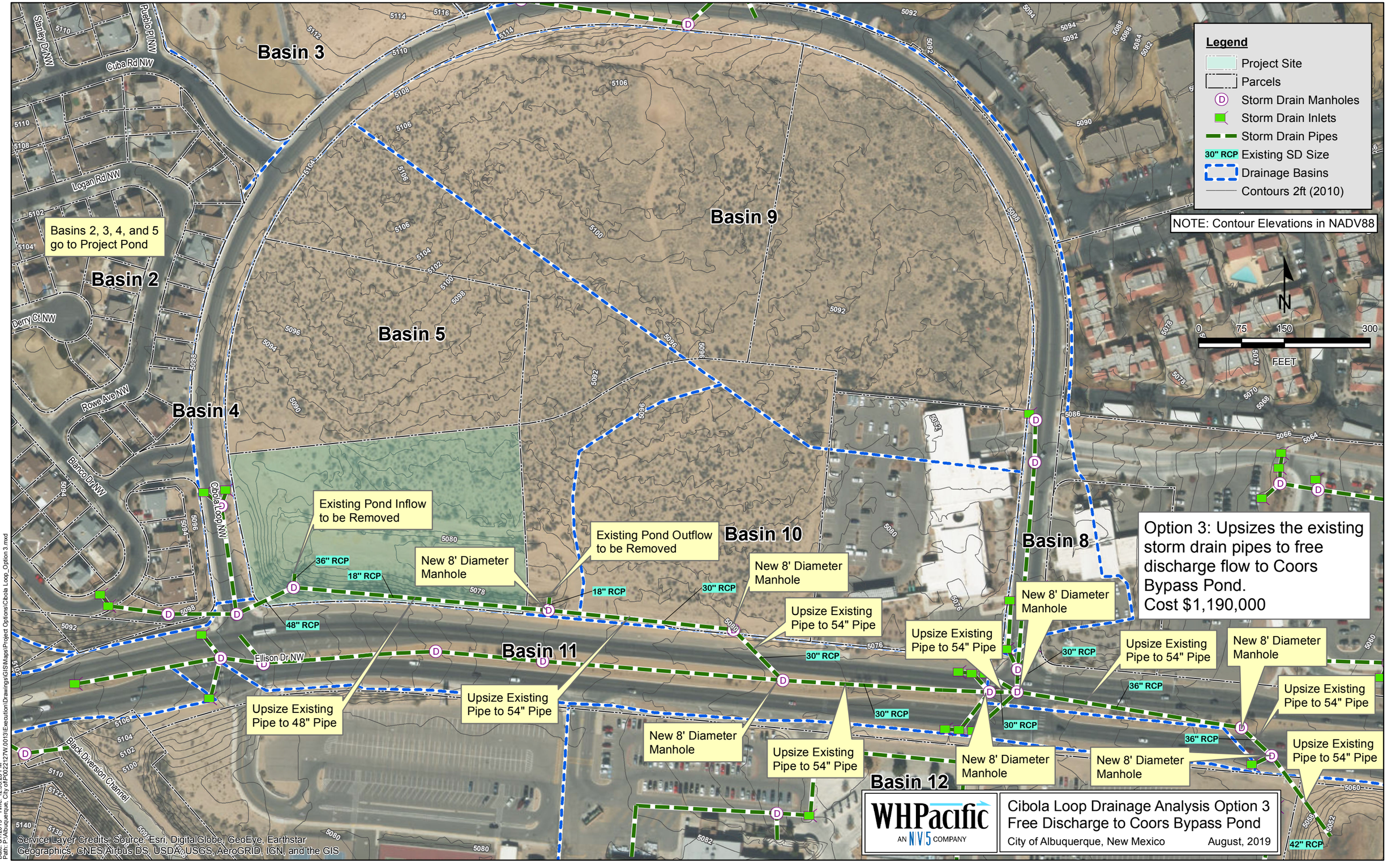
Cibola Loop Drainage Analysis
Option 2 Surface Onsite Ponding
City of Albuquerque, New Mexico August, 2019

CIBOLA LOOP DRAINAGE ANALYSIS AND FEASIBILITY REPORT - PHASE I
CITY OF ALBUQUERQUE PROJECT 6526.00
ROUGH ORDER OF MAGNITUDE COST ESTIMATE
8/7/2019

			Option 2 Cost Estimate		
ITEM NO.	**ITEM DESCRIPTION**	**UNIT**	**QUANTITY**	**UNIT COST**	**COST**
1	Survey	%		1.00	$4,648.00
2	Construction Mobilization, compl.	%		4.26	$19,799.00
3	Construction Demobilization, compl.	%		0.50	$2,324.00
4	Construction Traffic Control & Barricading, compl.	%		4.00	$18,591.00
5	Flood Protection, compl.	%		2.00	$9,295.00
6	Fill, construction, incl. excavation, placement & compaction of unclassified material, over 2 ft. deep, cip.	CY	1,367	$13.00	$17,777.26
7	Chain Link Fence, incl. posts & hardward, cip	SF	3,828	$4.60	$17,608.80
8	Gates for Chain Link Fence, incl. all attachments, hardware & anchor posts, cip.	SF	48	$7.50	$360.00
9	Structural, Reinforced PC Concrete, 4000 psi, incl. formwork, cip.	CY	481	$707.00	$340,067.00
10	Trenching, Backfilling, & Compaction, for 18" to 36" sewer pipe, up to 8' in depth, pipe not incl., compl.	LF	864	$27.00	$23,328.00
11	Trenching, Backfilling, & Compaction, for 42" to 60" sewer pipe, up to 8' in depth, pipe not incl., compl.	LF	40	$29.00	$1,160.00
12	Backfill Material, Select, incl. compaction, cip.	CY	1,863	$13.00	$24,217.56
13	18" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	430	$41.00	$17,630.00
14	36" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	20	$83.00	$1,660.00
15	Drainline Removal, 10" to 18", excl. trenching, compl.	LF	398	$21.00	$8,358.00
16	Drainline Removal, 21" to 48", excl. trenching, compl.	LF	56	$19.00	$1,064.00
17	Manhole, 6' dia., Type "C" or "E", less than 6' deep, cip. SD2101	EA	2	$5,256.00	$10,512.00
18	Existing Mahnole, Remove & Dispose, all depths, 4' to 6' dia., cip.	EA	1	$1,021.00	$1,021.00

Construction Subtotal	$519,421
NMGRT (7.3125%)	$37,997
Construction Contingecy (20%)	$103,884
Geotechnical Services	$6,000
Total	**$667,400**



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WHPacific
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Cibola Loop Drainage Analysis Option 3
Free Discharge to Coors Bypass Pond
City of Albuquerque, New Mexico August, 2019

CIBOLA LOOP DRAINAGE ANALYSIS AND FEASIBILITY REPORT - PHASE I
CITY OF ALBUQUERQUE PROJECT 6526.00
ROUGH ORDER OF MAGNITUDE COST ESTIMATE
8/7/2019

			Option 3 Cost Estimate		
ITEM NO.	**ITEM DESCRIPTION**	**UNIT**	**QUANTITY**	**UNIT COST**	**COST**
1	Survey	%		1.00	$7,276.00
2	Construction Mobilization, compl.	%		4.26	$30,995.00
3	Construction Demobilization, compl.	%		0.50	$3,638.00
4	Construction Traffic Control & Barricading, compl.	%		20.00	$145,518.00
5	Flood Protection, compl.	%		2.00	$14,552.00
6	Sidewalk, 4" thick, Portland Cement Concrete, incl. subgrade compaction, cip. SD 2430	SY	35	$46.00	$1,610.00
7	Curb & Gutter, Standard, Portland Cement Concrete, incl. subgrade preparation, cip. SD 2415	LF	100	$21.00	$2,100.00
8	Curb & Gutter, Median, Portland Cement Concrete, cip. SD 2408	LF	450	$16.00	$7,200.00
9	Arterial Pavement, Existing, Remove & Replace, incl. 2" extra asphalt thickness, with machine laydown, & with	SY	2,050	$71.00	$145,550.00
10	Trenching, Backfilling, & Compaction, for 18" to 36" sewer pipe, up to 8' in depth, pipe not incl., compl.	LF	47	$27.00	$1,269.00
11	Trenching, Backfilling, & Compaction, for 42" to 60" sewer pipe, up to 8' in depth, pipe not incl., compl.	LF	1,951	$29.00	$56,579.00
12	48" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	447	$148.00	$66,156.00
13	54" Reinforced Concrete Pipe, Class III, furnish & place in open trench, cip.	LF	1,504	$218.00	$327,872.00
14	Drainline Removal, 10" to 18", excl. trenching, compl.	LF	470	$21.00	$9,870.00
15	Drainline Removal, 21" to 48", excl. trenching, compl.	LF	1,610	$19.00	$30,590.00
16	Manhole, 8' dia., Type "C" or "E", 6' to 10' deep, cip. SD2101	EA	7	$10,235.00	$71,645.00
17	Existing Mahnole, Remove & Dispose, all depths, 4' to 6' dia., cip.	EA	7	$1,021.00	$7,147.00

Construction Subtotal	$929,567
NMGRT (7.3125%)	$68,000
Construction Contingecy (20%)	$185,913
Geotechnical Services	$6,000
Total	**$1,189,500**

APPENDIX

City of Albuquerque 6526.00 - CIBOLA LOOP DRAINAGE ANALYSIS AND FEASIBILITY REPORT

Project Team Meeting 13 May 2019

Cibola Loop Pond Options List and Comments

The following list represents solution ideas on altering the Cibola Loop Surge Pond at the northeast corner of Cibola Loop (West) NW and Ellison Road NW to allow for construction of a new Library on the pond site. This list includes the potential solution ideas captured in early scoping discussions with the City, a coordination meeting also with the City, and an internal WHPacific brainstorming meeting, held on April 16, 2019.

Some of the ideas may not feasible due to physical limitations or cost and are noted as such. It is City Hydrology's intent to capture all (or nearly all) of the possibilities for a stormwater solution in this area. Hopefully any questions or ideas arising in the future regarding stormwater solutions for the pond/library site will be on this list and addressed. Four of the most feasible ideas, as determined by the City, will be studied in greater depth. This purpose of this preliminary study and meeting is to aid the City in determining which solutions are worthy of further study.

A Site / Drainage Basin Map is attached. Site or project constraints:

Sediment Under current conditions, sediment is a major occurrence. At Cibola Loop pond, the outflow is completely buried and the current available contour data indicate the ponding area is much reduced due to sediment. Basins 5, 7, and 8, within Cibola Loop Road, are undeveloped. Basin 5 drains directly to the pond via overland flow. Basins 7 and 8 drain southeast out of the project area. An area northwest of Cibola Loop (Basin 3) is also undeveloped, with somewhat more than half the site in a natural state and the remaining as a landscaped park. Runoff from this site drains into Cibola Loop roadway, to the storm drain system. The sediment load coming from basin 5 should greatly diminish if the entire site becomes developed.

Underlying Clay Soil There is an existing clay layer around the police substation – A Geotechnical evaluation was done at the substation site for the Albuquerque Police Department NW Area Command. The borings taken show clay was found on that site at 11 feet to 12 feet below the surface. It is unknown how far the clay extends.

Hydrology and Hydraulic Modeling There are no hydrology or hydraulic models available. Hydrology was done using AHYMO and in some cases the summary output is printed in the reports. More often a limited summary table has been included in the reports. Hydrology using current methodology (also AHYMO – but different version) will need to be done for any areas draining to ponds or storm drain we want to revise. Hydraulic analysis will be needed for any storm drains or ponds – although at this phase it will be limited.

Existing Regional Pond appears to have extra capacity. Currently as noted in SAD 223 drainage master plan, the pond storage is 15.3 Acre Feet. The full pond capacity as measured from current City 2 foot contour data is 25.2 acre feet. Revised hydrology would need to be done for all the areas contributing to the pond, but it seems to have some extra capacity.

No.	Solution Concept	Advantages / Notes	Cons	Meeting Discussion
1	Construct an underground storage area excavated and filled with coarse aggregate, then directly pave over the aggregate for the parking lot. The coarse aggregate typically gives 40% void space and the excavation would be sized to have the same storage as is currently provided. The storage area may be able to infiltrate, but it is expected the underground storage would still be designed as a peak shaving pond (surge pond) and an outlet would be needed. The City quoted an expected cost of approximately $3.25 per cubic foot for the rock.	-Rock to provide a 40% void ratio is needed – use cost for rip rap -Possibly the runoff from the library site could be surface ponded on site. - A Geotechnical Investigation would be needed	-There is concern that the parking lot paving over the pond gravel would not be very stable and would crack and move. - Sediment would need to be addressed. -Storage area needs to be 60% larger than required storage, for rock volume.	Due to the possibility of instability and the large storage area required (volume for water and volume for rock), this option is not being considered. Additionally the cost of $3.25 per cubic foot could not be verified.
2a	Underground storage using open bottom pipe system allowing infiltration into the soil. The existing storm drain could direct runoff into the underground storage. Sediment is major concern for underground systems.	-The volume of runoff would require a lot of infiltrator pipes -This option would need geotechnical investigation. -Rough budgeting cost is approx. $5 to $5.25 per cubic foot of storage.	Would need somewhere to collect sediment prior to runoff getting to the pond, or drain upper basin 5 via surface flow and surface ponding.	The underground storage seems a viable option – but infiltration is not being considered at this phase.
2b	Underground storage as above but with an outlet to the storm drain	-Same as above – this may be feasible if the geotechnical report shows clay in the area and infiltration is not reasonable.	- This will need to be shallower than the infiltration option and will thus be larger in area.	This option is being considered in combination with other options that reduce the underground storage required.
3a	Surface pond elsewhere on the library site. Would still need geotechnical analysis. Possibly smaller storm could be stored in landscaped pond areas with up to design storm in parking lot.	-This pond would still be a surge (peak shaving) pond for full surface storage.	To be equivalent to the existing pond, the site would need to contain 2.9 AF from offsite and Basin 5 runoff.	Surface ponding to contain the entire volume of runoff is not feasible.

			-this amount of storage would be too deep for parking lot ponding – if surface ponding was wanted for the entire area, a dedicated pond would be required.	
3b	Surface pond for library site only runoff – direct overland flow from the rest of the tract (Basin 5) around the site. Use underground or other option for runoff from Basins 2, 3, and 4.		Where would sediment go that is directed around the site?	This option is being considered in combination with upstream reduction of runoff.
4	Purchase of adjacent land	Minimal pipe reworking and similar facility. It would need to contain additional runoff from adjacent sites and sediment would remain an issue.	Based on conversations the City has had with the landowner, they are not willing to sell.	Not feasible.
5	Bring all runoff from basins 2,3, and 4 directly to regional pond adjacent to Cibola High School. There seems to be extra storage but this would need to be modeled in more detail. Storm drain in Ellison Drive would need to be upsized. Hold regional pond outflow to the same restriction of 11 cfs. Per drainage reports – runoff to pond is 15.5 AF. Our evaluation of pond storage using current 2-foot contours is 25 AF.	Would convey storm water with no ponding – except library on site and the remaining Basin 5 runoff would still need to be ponded.	Basins 2, 3 and 4 would have free discharge to the regional pond. Other developments are required to pond on site. These developments are required by SAD 223 to pond on site too. The parcels within Cibola Loop will need to continue to pond as required by SAD 223. -cost up upsizing the storm drain in Ellison Drive to 48 to 54-inch pipe	It is thought that the cost of larger pipes and the work in Ellison Drive will be too great but it should be examined and priced.

6	Drain part of the runoff stored in the pond to Black Diversion Channel. City hydrology felt this was not feasible due to elevations.	This would reduce flow to Ellison / Cibola Loop intersection.	The outlet would need to be too far downstream in the channel to make this feasible. The outlet would need to be in excess of 1500 feet south of Ellison Drive.	Installation of new storm drain pipe to the Regional Pond would be approximately 1800 feet in a very busy road. Construction of a pipe line to Black Arroyo may be this long or longer, but would likely be within the ditch right of way. So it may be less expensive than building in Ellison. Also it is an obvious answer that is raised when only looking at a plan view. Even if it is not feasible, with this analysis the City can respond that we have looked at it.
7	Remove restrictor plate on Regional Pond if additional volume is needed and cannot be found by other means. Re-evaluate the downstream hydrology to the system too. This will most likely determine a lessor flow rate, meaning more capacity available in the storm drain, meaning more flow can be released thru the restrictor plate. Revising inflow hydrology may be beneficial for this option.	The downstream storm drain and channel would need to be reanalyzed. AMAFCA states the downstream pipe (Ellison SD) is at capacity. (Anecdotal).	This would require much downstream hydrologic and hydraulic modeling and in anecdotal evidence is correct, the capacity is unlikely to be there.	Not feasible at this time.
8	Re-evaluate hydrology for as-built conditions. Often design reports prepared for the storm drain used conservative assumptions regarding land treatment and ultimate development conditions. Actual hydrology may prove to contribute less runoff with refined land treatments and	This might prove to be beneficial and is a good idea for any areas to ponds or storm drain we are evaluating. We have done this for the area upstream of the Cibola Loop pond and will for any areas we are impacting.	This would become important if we were looking at the entire downstream system.	This is being done for any basin hydrology calculations are required (any basin we impact in this study).

	development conditions, thus reducing flow to the storm drains or ponds.			
9	Condemn adjacent property to the east and move the pond. The land rises to the north and the elevations would not work to move the pond to the north.	This would allow the pond to be moved as noted in Option 4. Minimal pipe reworking and similar facility. It would need to contain additional runoff from adjacent sites and sediment would remain an issue.	Probably not received well by Owner and may be some legal issues. Condemning adjacent property is legal but requires that City pay fair market value for that property.	Not feasible.
10	Divert some of the storm water from the upper region in Basin 2 to a proposed pond on the open space in Basin 3. Based on basin elevations possibly 2 acre feet or a bit more could be diverted. This would reduce the flow getting to the Cibola Loop Pond.	Only a portion of the contributing area (Basin 2) would be able to drain to a new pond on the open space area – but it would allow the downstream system to use a smaller pond in conjunction with one of the underground storage options or option 12.	This would require storm drain construction within the existing subdivision for the diversion and construction of a pond on the open space area in addition to the infrastructure revisions at the library site.	This option is being considered in conjunction with other options as noted.
11	Divert what we can of the upper portion of Basin 2 to the Black Diversion thus reducing the flow draining to the Cibola Loop Pond. Use the existing rundown location into the Black Diversion Channel.	Diverting upper watershed basin(s) runoff to Black Diversion which would require new drainage infrastructure and coordination with AMAFCA.	The amount of diversion is limited due to elevations – possibly 1 acre foot or less. This would likely require storm drain. The alternate would be to regrade an existing road in a developed subdivision which does not seem feasible.	Not being considered.
12	Increase flow to regional pond by upsizing the project pond outlet to the capacity of the 30-inch (or 36-inch) pipe downstream of the pond – thus	Full flow capacity of the 30-inch is 41 cfs. Storage requirement would be approx. 2.3 AF		This option is being considered in conjunction with other options as noted.

	reducing the storage required in the project pond.	Full flow capacity of the 36-inch is 93 cfs. Storage requirement would be approx. 0.7 AF This would minimize replacement of existing pipes, but new storage is still required.		
13	Combine items 10 or 11 with 12. Divert some upstream Basin 2 runoff and increase outflow of storage facility to capacity of 30 or 36-inch pipe	By reducing the flow to the Cibola Loop Pond the storage requirement drops	Increasing outflow to 30-inch capacity would reuire upsizing of pipe with the right of way. Increasing outflow to 36-inch capacity would require upsizing some pipes in Ellison	increasing outflow to 30-inch capacity.
14	Pick up inlets at Cibola Loop West and divert all of this runoff to a completely separate storm drain to drain into Regional Pond from Basins 2, 3, and 5 – or a portion of the runoff in excess of 18-inch capacity. Possibly run this line on the south side of Ellison. Keep the 18-inch – with no pond (except on site library runoff)	This puts the new construction in right of way so arterial pavement removal and replacement is not needed.	Coordination with the high school would be required.	This option is not being considered due to the work required in Ellison Drive. Some of the other options seemed more feasible.
15	Possibly drain to Cottonwood Mall storm drain system.	Reduce ponding needs.	Diverting stormwater to another watershed is not usually a good solution. New infrastructure would be required and it would need to extend relatively far. We have drainage report for Mall Storm Drain but this is not feasible.	Not feasible.

16	Eliminate project pond and Drain runoff from Basins 2, 3, and 4 across Ellison Drive directly to Cibola HS and add underground storage in High School parking lot. Infiltration or outlet to regional pond.	Construction of storm drain adjacent to the roadway pavement has less roadway disturbance.	Maintenance on high school property may be an issue Geotechnical investigation needed. Coordination and agreement with high school.	Not being considered – coordination with Cibola High School would be difficult and maintenance would need access the high school property.
17	Could library be constructed elsewhere in the Cibola Loop area?	Area ponding on the library site would not be required.	City wants to have the library prominent and visible. Placing it back farther away from Ellison Drive will make it less visible.	Not feasible.
18	Build Ponds on both library and adjacent tract to east. Purchase an easement for adjacent tract ponds. This could solve drainage for both parcels – although the adjacent tract would have a pond where it currently does not. Similar to Option #8 but purchase of easement is much cheaper than land purchase.	This would provide a similar facility to what exists and would collect runoff from adjacent property in addition to Cibola Loop Pond.	It seems unlikely that the owner would agree to an easement. If they don't want to sell, they must want to develop the site or have some plans for the site and it seems unlikely they would want to add a pond, which would restrict development. It may be worth asking.	Not feasible.

AHYMO PROGRAM SUMMARY TABLE (AHYMO-S4) - Ver. S4.02a, Rel: 02a RUN DATE (MON/DAY/YR) =08/05/2019

INPUT FILE = e, City of\P0022127W.0013\Execution\Design\Calculations\AHYMO\CIBOLAPOND.DAT USER NO.= AHYMO-S4TempUser05901704

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	PAGE = 1 NOTATION
*S CIBOLA LOOP DRAINAGE ANALYSIS AND FEASIBILITY REPORT										
*S BASINS TO CIBOLA LOOP POND BASED CURRENT CONTOUR MAPPING AND ON PREVIOUS REPO										
*S USE OVERALL BASINS - NOT DETAIL SMALL BASINS TO INDIVIDUAL SD INLETS										
*S 100 YEAR 24 HOUR STORM EVENT CURRENT CONDITIONS										
START										TIME= 0.00
LOCATION	ALBUQUERQUE									
RAINFALL TYPE= 2 NOAA 14										RAIN24= 2.620
SEDIMENT BULK										PK BF = 1.00
COMPUTE NM HYD	BASIN2	-	2	0.04941	124.77	5.443	2.06534	1.530	3.946	PER IMP= 79.85
SEDIMENT BULK										PK BF = 1.10
COMPUTE NM HYD	BASIN3	-	3	0.00759	10.31	0.302	0.74633	1.540	2.122	PER IMP= 0.00
SEDIMENT BULK										PK BF = 1.00
COMPUTE NM HYD	BASIN4	-	4	0.00273	6.54	0.260	1.78625	1.530	3.745	PER IMP= 57.14
ADD HYD	3AND4	3& 4	20	0.01032	16.81	0.562	1.02139	1.540	2.546	
*S POND INFLOW VIA STORM DRAIN										
ADD HYD	2AND20	2&20	21	0.05973	141.57	6.005	1.88497	1.530	3.703	
SEDIMENT BULK										PK BF = 1.20
COMPUTE NM HYD	BASIN5E	-	5	0.01648	23.78	0.703	0.79978	1.540	2.255	PER IMP= 0.00
*S DIVIDE FLOW INTO 36INCH OUTLET PIPE AND 18INCH RCP STORM DRAIN PIPE										
DIVIDE HYD	18.00	21	1	0.02890	23.76	2.906	1.88497	1.530	1.285	
	36.00	and	2	0.03083	117.81	3.099	1.88497	1.530	5.971	
ADD HYD	2AND5	2& 5	22	0.04731	141.46	3.802	1.50694	1.530	4.672	
ROUTE RESERVOIR	100POND	22	50	0.04731	18.02	3.802	1.50694	1.910	0.595	AC-FT= 2.973
ADD HYD	1AND50	1&50	32	0.07621	35.53	6.708	1.65028	1.600	0.728	
SEDIMENT BULK										PK BF = 1.10
COMPUTE NM HYD	BASIN10	-	10	0.00978	17.88	0.685	1.31371	1.530	2.857	PER IMP= 31.84
SEDIMENT BULK										PK BF = 1.00
COMPUTE NM HYD	BASIN11	-	11	0.01005	25.32	1.070	1.99549	1.530	3.936	PER IMP= 72.67
ADD HYD	10AND11	10&11	23	0.01983	43.20	1.755	1.65921	1.530	3.404	
ADD HYD	23AND32	23&32	24	0.09604	77.35	8.462	1.65212	1.540	1.258	
*S END Adding Basin 2,3,4,5,10,11,project pond Hydrographs										
*S Start Adding Basin 6,7,8,9 Hydrographs										
SEDIMENT BULK										PK BF = 1.00
COMPUTE NM HYD	BASIN6	-	6	0.02336	57.72	2.526	2.02715	1.530	3.861	PER IMP= 78.60
SEDIMENT BULK										PK BF = 1.00
COMPUTE NM HYD	BASIN7	-	7	0.00168	3.83	0.142	1.59020	1.530	3.566	PER IMP= 42.59
ADD HYD	6AND7	6& 7	25	0.02504	61.56	2.668	1.99781	1.530	3.841	
*SUBDIVISION POND NORTH OF CIBOLA LOOP										
ROUTE RESERVOIR	300POND	25	52	0.02504	11.35	2.668	1.99781	1.940	0.708	AC-FT= 1.314
SEDIMENT BULK										PK BF = 1.00
COMPUTE NM HYD	BASIN8	-	8	0.00567	14.07	0.584	1.93196	1.530	3.878	PER IMP= 67.96
SEDIMENT BULK										PK BF = 1.20
COMPUTE NM HYD	BASIN9	-	9	0.02025	28.49	0.922	0.85337	1.540	2.198	PER IMP= 5.95
ADD HYD	8AND9	8& 9	26	0.02592	42.47	1.506	1.08929	1.540	2.560	
ADD HYD	26AND52	26&52	27	0.05096	51.94	4.174	1.53570	1.540	1.593	
*S End Adding Basin 6,7,8,9 Hydrographs										
*S Start Adding Basin 12,13,14 Hydrographs										
SEDIMENT BULK										PK BF = 1.00
COMPUTE NM HYD	BASIN12	-	12	0.06856	155.68	6.248	1.70862	1.530	3.548	PER IMP= 55.53

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	PAGE = 2 NOTATION
SEDIMENT BULK										PK BF = 1.00
COMPUTE NM HYD	BASIN13	-	13	0.00657	15.70	0.624	1.78123	1.530	3.735	PER IMP= 56.77
ADD HYD	12AND13	12&13	28	0.07513	171.38	6.872	1.71496	1.530	3.564	
SEDIMENT BULK										PK BF = 1.00
COMPUTE NM HYD	BASIN14	-	14	0.01385	32.86	1.296	1.75389	1.530	3.707	PER IMP= 54.74
ADD HYD	14AND28	14&28	29	0.08898	204.24	8.167	1.72101	1.530	3.586	
*S End Adding Basin 12,13,14 Hydrographs										
*S Start Adding Basins for Northwest Inflow Pipe of Regional Pond										
ADD HYD	24AND27	24&27	30	0.14700	129.29	12.636	1.61176	1.540	1.374	
*S End Adding Basins for Northwest Inflow Pipe of Regional Pond										

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*S Start Adding Basins for South&East Inflow Pipe of Regional Pond
ADD HYD              29AND30 29&30  31       0.23598       333.05      20.803      1.65296    1.530    2.205
ROUTE RESERVOIR      200POND   31   51       0.23598        11.13      20.617      1.63811    4.370    0.074 AC-FT=   14.720
FINISH
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