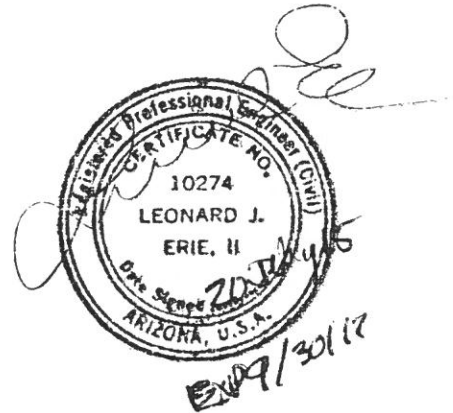


Venture Out RV Resort
Final Drainage Report
5001 E Main Street
Mesa, AZ

Prepared for:
Hess-Rountree, Inc.
Consulting Engineers & Land Surveyors
9831 S 51st Street, Suite C110
Phoenix, AZ 85044

For submittal to:
Venture Out RV Association

Prepared by:
Erie & Associates, Inc.
3120 N 24th Street
Phoenix, AZ 85016



EA #2169.01

July 14, 2015



Erie & Associates, Inc.
CONSULTING ENGINEERS

3120 N. 24th St. / Phoenix, Arizona 85016 / (602) 954-6399

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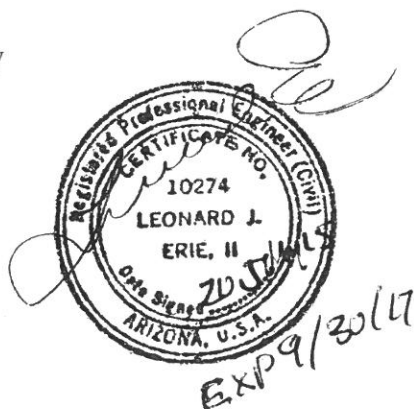
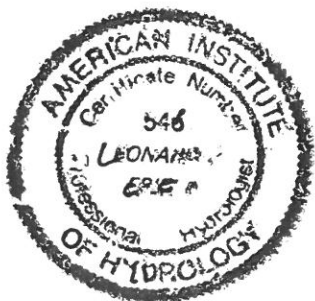
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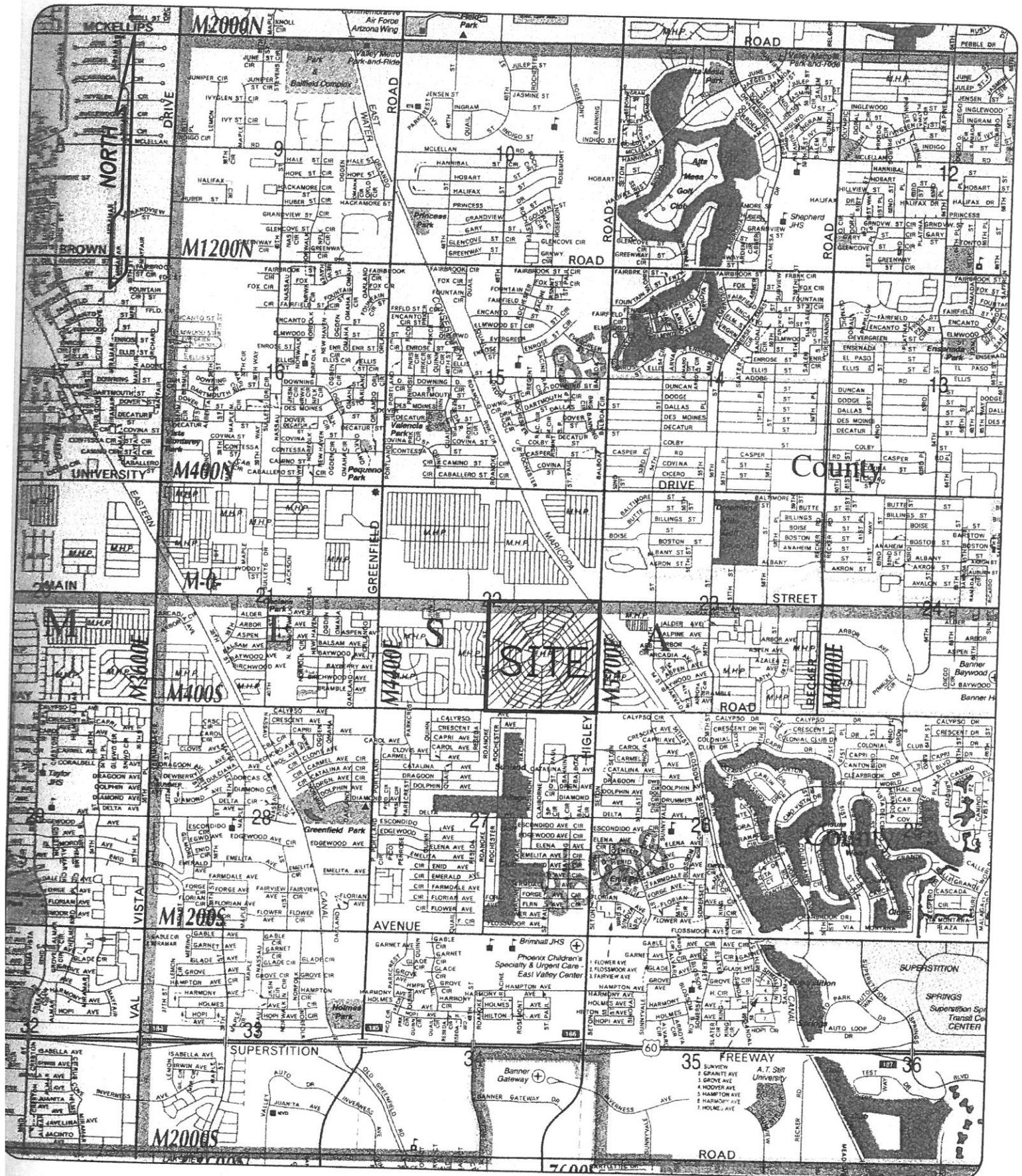
3.0 Location/Description

The 150 acre Venture Out RV Resort (VORV) was developed in 1968 - 1969. The site is bounded by Broadway Road on the south, 48th Street on the west, Main Street on the north, and Higley Road on the east in the City of Mesa, Arizona. Lots are owned by individual owners with common areas owned by the Association. Drainage in the area is generally from the northeast to southwest. The offsite tributary is controlled by the Roosevelt Canal on the northeast. A 1.6 acre open space/basin area was constructed at the southwest corner of the site, the natural outfall of the site. See *Plate 1 – Location Map*.

Prior recent storms included an event on July 14, 2012, which produced a rainfall depth of 1.3 inches in one hour and ten minutes. On September 7, 2012, a larger storm produced a rainfall depth of 2.95 inches in one hour and thirty minutes. The design storm used is a 100-year, 6-hour storm with a rainfall depth of 2.50 inches.

The project has experienced repeated flooding over the years resulting from major rainfall events. This report presents an analysis of the existing conditions and the impacts of various alternatives for partial relief of the flooding.

Various storms have been analyzed to ensure that there are no negative downstream impacts. The 2-year, 10-year, 25-year, and 100-year, 6-hour duration storms are analyzed.



JOB NO. 2169.01
 DATE: 01/26/2015
 SCALE: 1"=3000'

ERIE AND ASSOCIATES, INC.
 320 N. 247 ST.
 PHOENIX, ARIZONA 85016
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VENTURE OUT RV
PLATE 1 - LOCATION MAP

4.0 Existing Drainage System

The site is laid out with a common area in the center and radial streets as “spokes” from the center. Radial roadways run around the center. A topo survey was prepared by Hess-Rountree for the site and that serves as a basis for the work. A HEC-1 analysis has been prepared to analyze runoff on the site.

The analysis is consistent with Maricopa County Design Manual Standards. The existing site has numerous flow splits on larger storms; and in addition, includes a number of interior basins that control all or a portion of the 100-year, 6-hour design storm. Flooding on the site can be broken down into three primary systems: 1) the outfall basin at the southwest corner; 2) the stormwater delivery system adjacent to the basin; and 3) the roadway/drainage system.

Each of the three components successively impacts the next upstream component’s drainage performance. This analysis looks at each component in order to isolate the flooding impacts; and potential results from alternates are presented in *Section 5.0*.

4.1 Existing Outfall Basin

The outfall basin at the southwest area is a six to eight foot deep area with a minor 12 inch bleedoff pipe near the top of the basin. Pondered water in the basin is drained primarily by drywells and pumping. The overflow outfall from the basin, which has a wall on the south and west, is through two courses of decorative blocks at the base of the wall. The analysis assumes that approximately 50% of the wall opening is blocked by debris.

The existing basin has a capacity of 7.68 ac-ft at the spillout of the basin (1317.8). The current 100-year, 2-hour standard for the basin would be approximately 23.4 ac-ft.

The HEC-1 analysis for the 100-year, 6-hour storm (*Appendix B*) at the existing basin resulted in a water surface of 1318.99 with a flow in of 311 cfs and a flow out of 288 cfs. The existing outlet

from the basin varies from 1317.8 to 1319.4. The interior road grades on Aero Road next to the basin vary from about 1319.0 to 1319.8. The existing condition flooding is shown on *Plate 2*.

These results are used to evaluate the impacts of various alternatives considered. They are described in *Section 5.0*.

4.2 Existing Delivery System Adjacent to the Basin

The existing delivery system includes a system of pipes and inlets, together with a spillway through an existing lot on the north side of the basin. The delivery system also includes a small open channel with pipes into the basin along the back of the lots just east of the basin.

Any improvement to the delivery system will assume some improvement to the basin in order to have a lower basin elevation to reduce backwater effects from the basin into the delivery system.

Improvements to the basin will result in a more effective delivery system. The existing delivery system, with the existing basin, resulted in a 100-year water surface of 1320.53, which is slightly more than one foot above the existing basin ponding elevation (1318.99). This would pond water to back past Navajo Drive.

Options for improving the delivery system include increasing the capacity of the north spillway and developing a new spillway for the south area by lowering the existing drive into the parking and buildings east of the basin.

The construction of these two inlet spillways will lower the ponding elevation from 1320.5 to 1319.61. The spillways are discussed in more detail in *Section 5.2.3*.

4.3 Existing Roadway/Drainage System

The existing roadways also function as drainage channels. Depths in the roadways in the southwest quarter of the site vary from 1.3 feet to 0.5 feet above whatever the ponded elevation

from the delivery system is. Lowering Grumman, Helio, and Fairchild four inches (the height of a "rolled curb") will further reduce flooding when combined with the other improvements to the basin and delivery system. The alternatives considered are described in more detail in *Section 5.2.3*.

5.0 Drainage Improvement Alternatives

A number of alternatives have been considered in the analysis, but are not recommended. Improving the existing drainage system would need to include either reduction of the peak runoff and/or an increase in the system capacity.

5.1 Alternatives Considered, But Not Recommended

- Install Porous Pavement in Streets: Porous pavement allows some or all of the rainfall to infiltrate through the pavement into the sub-grade. This works best on relatively level paved surfaces. The streets in Venture Out have existing utilities at 3± feet below the surface, so the depth of porous material is limited.

We ran out the numbers with porous pavement assuming the roads would be porous and take the rainfall. Because there is a relatively large ratio of tributary adjacent to the street (home sites) to the width of the road, the change in runoff was not very significant, 10 to 20 percent. The peak flow at the southwest outfall went from 311 cfs to 279 cfs to 245 cfs (along all the streets) depending on the amount of pervious pavement. Also, the cost for this alternative would be considerable, since the streets and 2± feet of the sub-grade would need to be removed on the whole park.

- Convert Open Space Areas to Basin/Open Spaces: We looked at areas, such as shuffleboard, putting greens, and court areas. We assumed they would be lowered 2 to 2.5 feet and then rebuilt. The five areas upstream (northeast) of Invincible and Ercoupe roads were assumed lowered and upstream tributaries routed through them.

The peak flow was reduced from 311 cfs to 284 cfs. Again, the reduction was not significant enough to justify the cost to implement the fix. In addition, we looked at expanding the existing basin into the shop areas. That option dropped flow out of the

basin from 242 cfs to 190 cfs. That option would require relocation and excavation of the area east of the basin.

5.2 Alternatives That Have Proven Effective

5.2.1 Proposed Outfall Basin: The existing basin spillout is at approximately elevation 1318.0. The existing basin ponding elevation with 311 cfs entering is 1318.99. Water would back up on Aero and adjacent lots. The spillout is 288 cfs into the right-of-way. The outlet elevation can be lowered from 1318.0 to 1317.5. Back of curb at the intersection is 1317.2.

The proposed condition has a larger basin volume of 8.19 ac-ft at 1317.5. It is proposed to lower the spillout to 1317.5 for an 80 foot long spillway. The existing 12 inch bleedoff pipe will remain in place.

The proposed basin keeps the existing basin footprint, but increases the volume by lowering the bottom 1.5 feet from 1311.0 to 1309.5. This will ensure the existing volume is not decreased, even though the spillway has been lowered from 1317.8 to 1317.5. The existing 12 inch stormdrain with an inlet elevation at 1314.2 will remain in place. The proposed basin will pond at an elevation of 1317.5; at which point, it will spill out of the basin along an 80 foot spillway. The 100-year, 6-hour storm event will result in a water surface of 1318.6 feet with an outflow of 269 cfs, compared to the existing water surface of 1319.0 feet and outflow of 288 cfs. The proposed basin modification results in a 0.4 foot drop in water surface and a 19 cfs decrease in outflow for the 100-year, 6-hour storm event. The peak outflows and water surfaces were also decreased for the 25-year, 10-year, and 2-year storms. See *Table 1 – Peak Flows/Water Surface Summary* for comparison of existing and developed conditions outflows and water surfaces for Basin 2. The HEC-1 analysis is included in *Appendix B*.

Table 1 – Peak Flows/Water Surface Summary

Storm Event	Existing Conditions		Developed Conditions	
	Q (out)	Water Surface	Q (out)	Water Surface
100-year, 6-hour	288 cfs	1318.99	269 cfs	1318.60
25-year, 6-hour	158 cfs	1318.59	155 cfs	1318.24
10-year, 6-hour	98 cfs	1318.28	81 cfs	1318.00
2-year, 6-hour	6 cfs	1317.28	5 cfs	1316.63

5.2.2 Improved Drainage from Aero into the Basin: If ponding from the basin into the areas adjacent to the park is eliminated by *Option 5.2.1*, the delivery system into the basin would cause a backup into the lots along Aero and Navajo. The drain on the north is through/under an existing deck on a residence. We looked at lowering the spillway and eliminating or raising the deck, so that the water approaching the 15± foot wide spillway would drop into the spillway and not be backed up by it.

On the south, the existing drive into the shops area from Aero can be lowered with similar results as that proposed for the north spillway. Water coming to Grumman and Aero would be directed north to the lowered drive/spillway by reconstruction of a portion of Aero. The drive area from the access drive to the park would also need to be lowered approximately 12 to 18 inches.

5.2.3 Lower Flooded Streets Approaching the Basin: With the basin ponding elevation lowered and the spillways into the basin improved (*Options 5.2.1 and 5.2.2*), the flooding left would be from water running down Invincible, Helio, Grumman, and Fairchild. The depth of flooding in the streets varies from 0.5 feet on the upstream at Boeing Circle to 1.3 feet on Aero at Grumman. A portion of Aero Road and Navajo Road will be modified to an inverted crown section with the edges dropped four inches (the height of a “rolled curb”) and with a five percent slope down to the center to a six foot valley gutter. The proposed inverted crown section will start at Helio Road and run south along Navajo Road approximately 210 feet until reaching the proposed spillway emptying to the north side of Basin 2. Aero Road will be modified to an inverted crown section starting at

Grumman Road and running northwest approximately 190 feet until reaching the proposed spillway/driveway that empties near the center east side of the basin. *Plate 3* shows an approximation of that condition. This would directly result in a four inch lowering of the resulting water surfaces on the roads approaching the new basin spillways and Aero Road improvements. Some areas would continue to be flooded on extreme flood events unless on lot improvements were raised.

5.3 Evaluation of Other Flooding Areas

Most of the roads in the northeast half of the site are carrying flow in inverted crown drives. All the units and adjacent areas are constructed differently. Most of the drives would be flooded to some extent, but the adjacent units would be mostly dry if there was a minimum of 0.5 feet difference between the low point of the drive and onsite grade. Flows exceeding 0.5± feet are shown on *Plate 2*.

Broadway Road Flows – Flows in Broadway Road were reviewed. It was found that flows from the east would turn south at Higley. The existing intersection pitches back east from just west of the intersection. The remainder of the road flows west with water that overflows the center line draining south at existing drives. The south entrance on Broadway at Fairchild will spill out into Broadway. Of the 92 cfs coming into the Fairchild/Navajo intersection, approximately 7 cfs would flow out into Broadway. The basin spills into Broadway at 48th Street. This outflow is far in excess of the existing 24 inch pipe capacity (16 cfs). That would continue to be the case. Downstream flooding would be slightly reduced, due to decreases in the outflows. See *Table 1*.

48th Street Flows – 48th Street on the west side of the site drains south. The private development on the northwest corner has retention basins that, when full, will spill to 48th Street. Flows exceeding the street capacity will currently flow west through drives into the properties to the west.

A number of areas were analyzed and found to be acceptable. By area they were:

Northeast Triangle Area – The area on the northeast side of the park (SA-22) was analyzed. The mostly paved area drains to an existing retention basin at the south. This basin (Det-3) could outfall to a channel along Higley Road through a wall opening. The basin would pond to elevation 1340.02 on a 100-year, 6-hour storm. This would backup for about 200 feet into the parking lot, but does not appear to flood the building. Approximately 16 cfs comes in and 1 cfs would leave the site. It is recommended that an outfall be provided to Higley for extreme storm events. See *Plate 2* for ponding limits.

Southeast Triangle Area – The area on the southeast at the Higley/Broadway intersection is also mostly paved. This area drains to a small retention basin on the west. This basin drains out through a fence opening to Broadway Road. The ponding elevation is 1329.04, which is below the nearby units. See *Plate 3* for ponding limits.

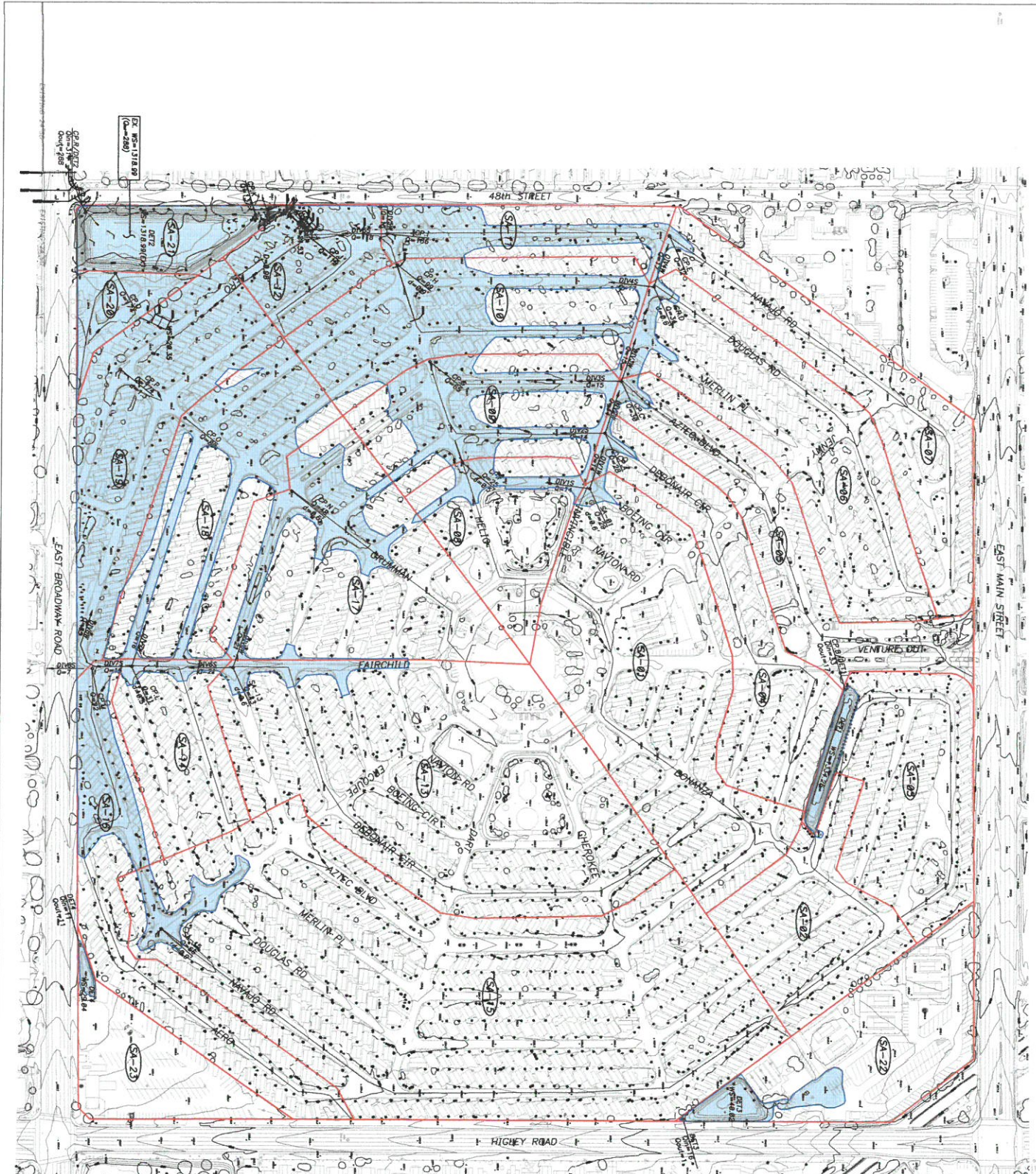
Merlin Place Basin – There is an existing linear retention basin (Det-1) in the 900 block of Merlin Place. That basin has a 1334.25 ponding elevation with a flow in of 33 cfs and a flow out of 17 cfs on the 100-year, 6-hour storm. That is shown on *Plate 2* and the ponding appears to be confined to the basin, with the existing outfall to the entrance road on the west side of the basin.

6.0 Conclusions

Lowering the existing outlet alone could prove effective.

Final analysis would be done with a future phase of the work on the recommended selection. That would include construction plans to turn into the City for construction permits. The work could possibly be ready to start the summer of 2016.

Lowering the water surfaces in the outfall basin at the southwest corner from 1,318.99 to 1,318.6 will improve the performance of all the existing onsite stormdrains. The current analysis does not include the capacity of the 48 inch pipes. The condition, alignment, and capacity of the pipes can be evaluated with the next phase to determine if further flooding reductions are possible with new or improved inlets.



LEGEND

EXISTING PONDING

SUB-AREA

INDICATES POSSIBLE FLOODING ON 100-YR, 5-PM STORM

NOTE: ANNUAL STREET FLOODING NOT SHOWN

DATE: 07/25/24
 SCALE: 1"=30'
 DRAWN: JLM
 CHECKED: JLM
 SHEET NO. 1

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VENTURE OUT RV
 EXISTING CONDITIONS

PLATE 2

- PHASE I (IMPROVEMENTS)**
- BASIN BOTTOM LOWERED TO EL=1309.5
 - 80' WALL OPENING AT EL=1312.5
 - CONSTRUCTED ALONG SOUTH WEST CORNER OF BASIN
 - EXISTING 12" BASIN STORM DRAIN OUTLET TO REMAIN INV=1314.2
- PHASE II (IMPROVEMENTS)**
- CONSTRUCT SPILLWAYS TO NORTH AND EAST SIDES OF THE BASIN
 - LOWER THE PORTION OF AERO FROM THE EAST SIDE SPILLWAY TO GRILLMAN
 - LOWER THE PORTION OF NAYVUO FROM THE NORTH SIDE SPILLWAY TO HELD

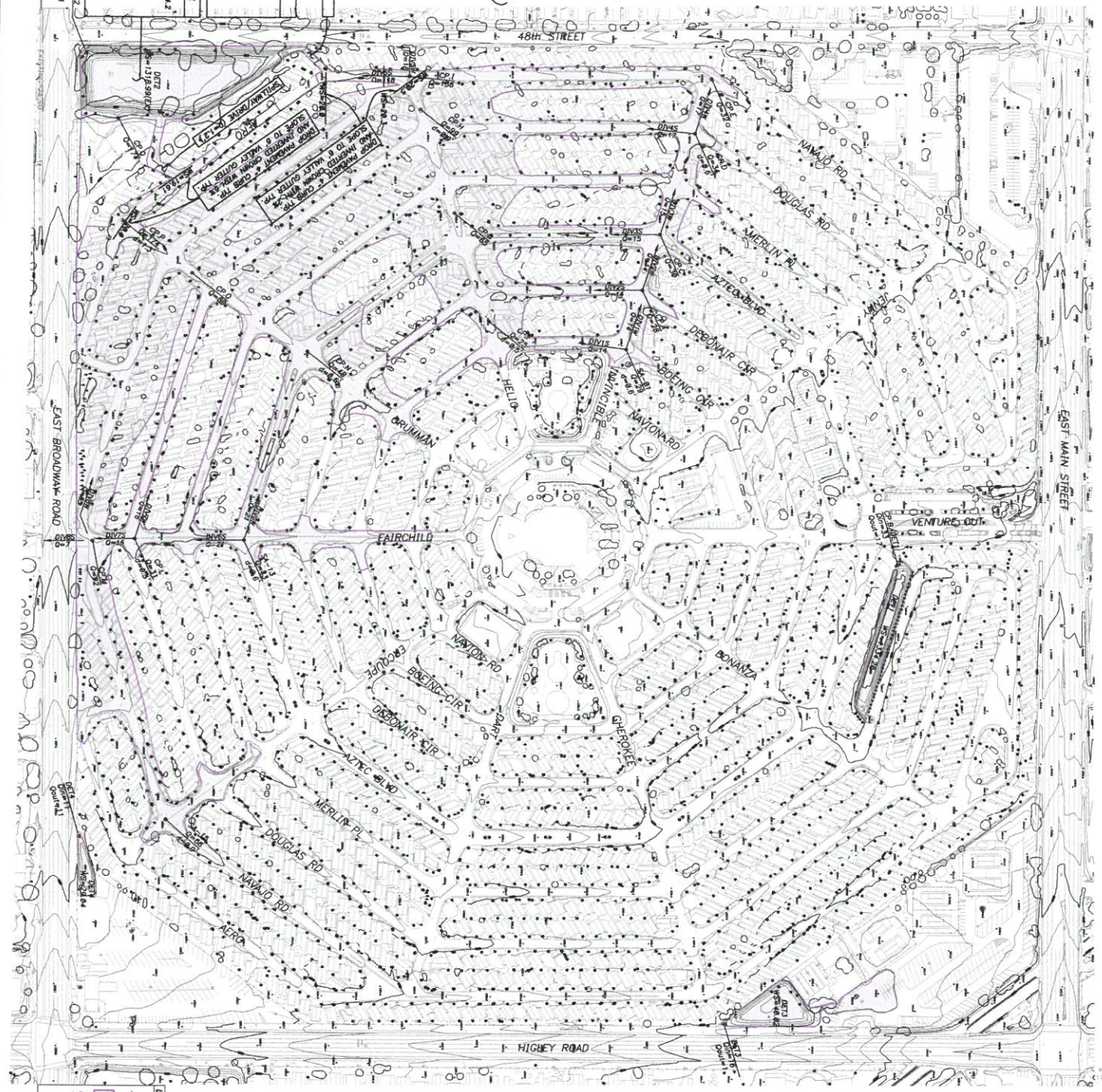
EXISTING CONDITIONS

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118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)

DEVELOPED CONDITIONS

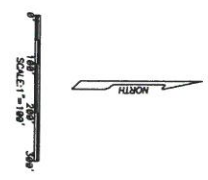
(LOWERED BASIN BOTTOM TO WITH A 0.5% SLOPE TO 142' WITH A 0.5% SLOPE TO 142')

118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
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118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)
118'-YARD, 6'-WIDE STORM	MS-11.8.8.9(10)=286(3)



LEGEND

- PROPOSED PONDING ELEVATION
- INDICATES POSSIBLE FLOODING ON 100-YR 2-HR STORM
- NOTE: ANNUAL STREET FLOODING NOT SHOWN



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VENTURE OUT RV
 PHASE II IMPROVEMENTS

PHASE I (IMPROVEMENTS)

- BASIN BOTTOM LOWERED TO E.L. 1389.5
- 80' WALL OPENING AT E.L. 1317.5
- CONSTRUCT SOUTH WEST CORNER OF BASIN
- EXISTING 12" BASIN STORM DRAIN OUTLET TO REMAIN INV=1314.2

PHASE II (IMPROVEMENTS)

- CONSTRUCT SPILLWAYS TO NORTH AND EAST SIDES OF THE BASIN
- LOWER THE PORTION OF ASPG FROM THE EAST SIDE SPILLWAY TO CRUMLAN
- LOWER THE PORTION OF NAWAU FROM THE NORTH SIDE SPILLWAY TO HELLO

PHASE III (IMPROVEMENTS)

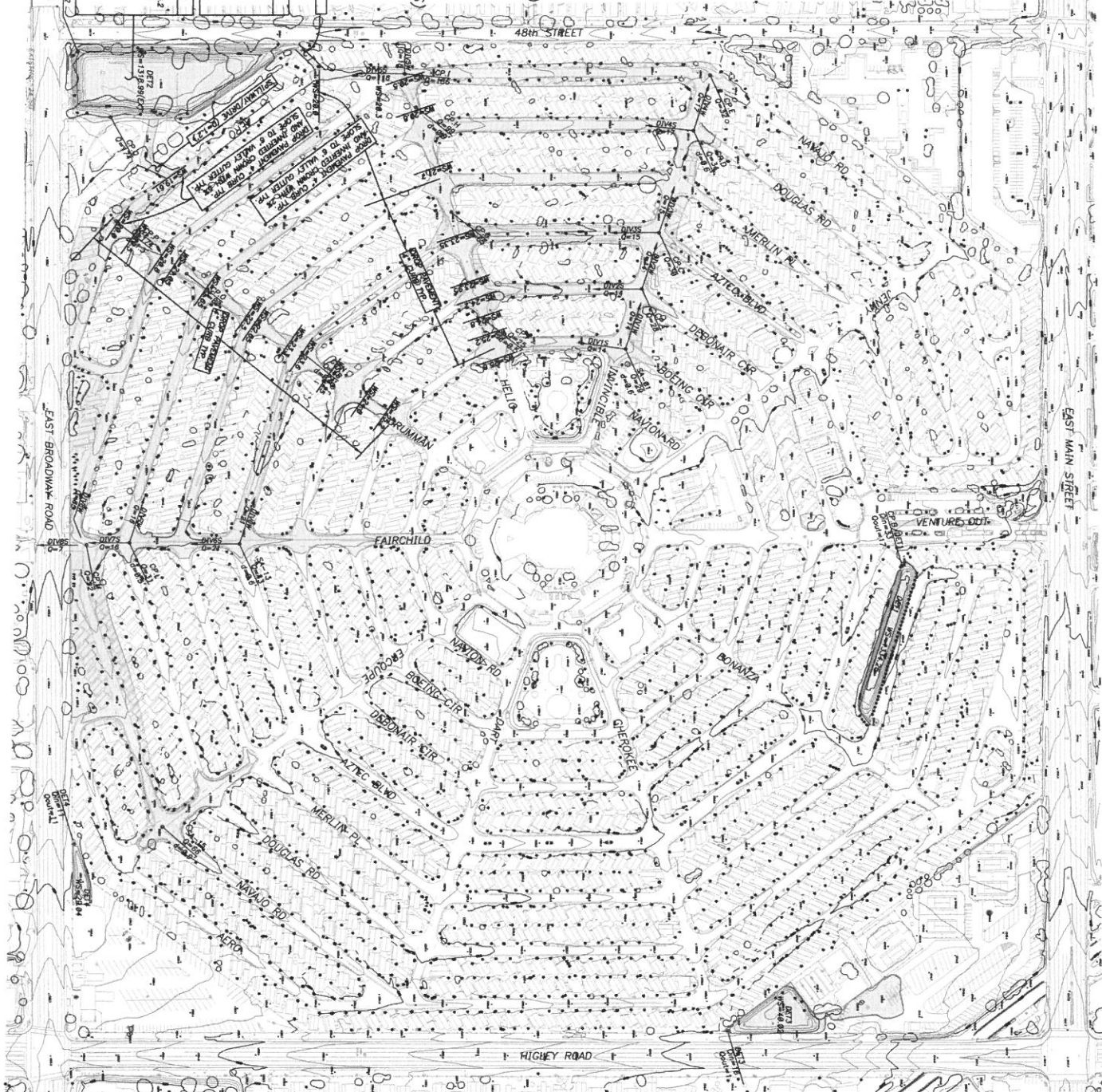
- LOWER HELLO AND CRUMLAN

EXISTING CONDITIONS

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45'-0" E.L. 1246.0	45'-0" E.L. 1246.0
43'-0" E.L. 1244.0	43'-0" E.L. 1244.0
41'-0" E.L. 1242.0	41'-0" E.L. 1242.0
39'-0" E.L. 1240.0	39'-0" E.L. 1240.0
37'-0" E.L. 1238.0	37'-0" E.L. 1238.0
35'-0" E.L. 1236.0	35'-0" E.L. 1236.0
33'-0" E.L. 1234.0	33'-0" E.L. 1234.0
31'-0" E.L. 1232.0	31'-0" E.L. 1232.0
29'-0" E.L. 1230.0	29'-0" E.L. 1230.0
27'-0" E.L. 1228.0	27'-0" E.L. 1228.0
25'-0" E.L. 1226.0	25'-0" E.L. 1226.0
23'-0" E.L. 1224.0	23'-0" E.L. 1224.0
21'-0" E.L. 1222.0	21'-0" E.L. 1222.0
19'-0" E.L. 1220.0	19'-0" E.L. 1220.0
17'-0" E.L. 1218.0	17'-0" E.L. 1218.0
15'-0" E.L. 1216.0	15'-0" E.L. 1216.0
13'-0" E.L. 1214.0	13'-0" E.L. 1214.0
11'-0" E.L. 1212.0	11'-0" E.L. 1212.0
9'-0" E.L. 1210.0	9'-0" E.L. 1210.0
7'-0" E.L. 1208.0	7'-0" E.L. 1208.0
5'-0" E.L. 1206.0	5'-0" E.L. 1206.0
3'-0" E.L. 1204.0	3'-0" E.L. 1204.0
1'-0" E.L. 1202.0	1'-0" E.L. 1202.0
0'-0" E.L. 1200.0	0'-0" E.L. 1200.0

DEVELOPED CONDITIONS

- LOWERED BASIN BOTTOM TO E.L. 1389.5 EX 12" OUTLET=1314.2
- 80' WALL OPENING AT E.L. 1317.5
- CONSTRUCT SOUTH WEST CORNER OF BASIN
- EXISTING 12" BASIN STORM DRAIN OUTLET TO REMAIN INV=1314.2
- CONSTRUCT SPILLWAYS TO NORTH AND EAST SIDES OF THE BASIN
- LOWER THE PORTION OF ASPG FROM THE EAST SIDE SPILLWAY TO CRUMLAN
- LOWER THE PORTION OF NAWAU FROM THE NORTH SIDE SPILLWAY TO HELLO
- LOWER HELLO AND CRUMLAN

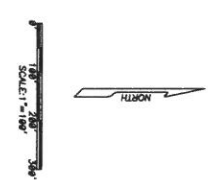


LEGEND

PROPOSED PONDING ELEVATION

INDICATES POSSIBLE FLOODING ON 100-YR. 5-HR STORM

NOTE: ANNUAL STREET FLOODING NOT SHOWN



**VENTURE OUT RV
PHASE III IMPROVEMENTS**

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710 N. 2nd St.
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