# Appendix A

# Model Parameters

| Subbasin Parameters | | | Loss Model Parameters | | | | Unit Hydrograph Parameters | |
|---|---|---|---|---|---|---|---|---|
| Basin ID | Area | | Existing Conditions | Existing Cond. Impervious | DEVEX Conditions | DEVEX Cond. Impervious | Time of concentration | Lag [a] |
| | (ac) | ($mi^2$) | (CN) | (%) | (CN) | (%) | (h) | (min) |
| BA_A_101 | 133 | 0.208 | 75 | 4.7 | 81 | 16.2 | 0.31 | 11 |
| BA_A_102 | 49 | 0.077 | 75 | 9.4 | 81 | 17.6 | 0.34 | 12 |
| BA_A_103 | 53 | 0.083 | 78 | 16.1 | 82 | 21.3 | 0.30 | 11 |
| BA_A_104 | 78 | 0.122 | 75 | 0.9 | 82 | 13.0 | 0.33 | 12 |
| BA_A_105 | 166 | 0.259 | 75 | 0.1 | 80 | 7.7 | 0.60 | 22 |
| BA_A_106 | 123 | 0.192 | 75 | 0.2 | 79 | 5.8 | 0.40 | 14 |
| BA_A_107 | 381 | 0.595 | 75 | 0.0 | 80 | 7.6 | 0.92 | 33 |
| BA_A_108 | 227 | 0.354 | 75 | 0.6 | 81 | 15.3 | 0.51 | 18 |
| BA_A_109 | 215 | 0.335 | 76 | 1.3 | 82 | 35.5 | 0.44 | 16 |
| BA_A_110 | 535 | 0.836 | 76 | 1.6 | 82 | 20.7 | 0.98 | 35 |
| BA_A_111 | 474 | 0.741 | 76 | 2.2 | 78 | 5.5 | 0.86 | 31 |
| BA_A_112 | 234 | 0.365 | 77 | 6.0 | 80 | 17.2 | 0.73 | 26 |
| BA_A_113 | 54 | 0.084 | 78 | 15.9 | 79 | 16.5 | 0.20 | 7 |
| BA_B_101 | 49 | 0.076 | 78 | 4.4 | 79 | 7.3 | 0.91 | 33 |
| BA_B_102 | 115 | 0.180 | 78 | 3.8 | 78 | 4.7 | 0.70 | 25 |
| BA_B_103 | 165 | 0.257 | 78 | 6.8 | 80 | 8.8 | 0.54 | 20 |
| BA_B_104 | 20 | 0.031 | 81 | 17.0 | 81 | 22.3 | 0.13 | 5 |
| BA_B_105 | 72 | 0.112 | 78 | 41.5 | 84 | 68.3 | 0.16 | 6 |
| BA_B_106 | 69 | 0.108 | 84 | 27.4 | 84 | 27.4 | 0.50 | 18 |
| BA_B_107 | 152 | 0.237 | 82 | 24.9 | 83 | 27.5 | 0.76 | 27 |
| BA_C_101 | 169 | 0.263 | 78 | 12.5 | 86 | 79.7 | 0.50 | 18 |
| BA_C_102 | 282 | 0.441 | 79 | 19.0 | 86 | 69.1 | 0.77 | 28 |
| BA_D_101 | 469 | 0.733 | 75 | 0.7 | 81 | 8.7 | 0.77 | 28 |
| BA_D_102 | 272 | 0.425 | 76 | 0.8 | 82 | 16.2 | 0.69 | 25 |
| BA_D_103 | 182 | 0.285 | 76 | 3.2 | 83 | 44.8 | 0.87 | 31 |
| BA_D_201 | 98 | 0.153 | 74 | 0.0 | 85 | 82.3 | 0.58 | 21 |
| BA_E_101 | 848 | 1.325 | 75 | 0.2 | 81 | 8.3 | 0.94 | 34 |
| BA_F_101 | 606 | 0.946 | 75 | 0.0 | 81 | 14.9 | 1.06 | 38 |
| BA_F_102A | 133 | 0.208 | 79 | 4.0 | 85 | 40.6 | 0.84 | 30 |
| BA_F_102B | 49 | 0.076 | 85 | 27.3 | 85 | 33.2 | 0.48 | 17 |
| BA_F_103 | 42 | 0.066 | 80 | 6.4 | 81 | 15.6 | 0.31 | 11 |
| BA_F_104 | 55 | 0.086 | 77 | 5.2 | 79 | 13.0 | 0.40 | 14 |
| BA_F_201 | 42 | 0.066 | 83 | 38.0 | 84 | 41.8 | 0.24 | 9 |
| BA_G_101 | 150 | 0.234 | 76 | 2.1 | 84 | 18.1 | 0.55 | 20 |
| BA_H_101 | 166 | 0.259 | 75 | 2.5 | 85 | 51.3 | 0.90 | 32 |
| BA_H_102 [b] | 114 | 0.179 | 76 | 2.3 | 84 | 49.4 | 0.75 | 27 |
| BA_H_103 | 166 | 0.259 | 85 | 8.5 | 86 | 13.4 | 0.39 | 14 |
| BA_H_104 | 164 | 0.256 | 77 | 4.8 | 80 | 15.6 | 0.36 | 13 |
| BA_H_105 | 95 | 0.148 | 76 | 2.6 | 79 | 5.3 | 0.37 | 13 |
| BA_H_201 | 56 | 0.088 | 79 | 21.3 | 79 | 26.8 | 0.34 | 12 |
| BA_H_202 | 20 | 0.032 | 79 | 8.6 | 85 | 31.4 | 0.41 | 15 |
| BA_H_203 | 73 | 0.115 | 78 | 6.3 | 84 | 47.2 | 0.93 | 34 |
| BA_H_301 | 58 | 0.091 | 79 | 9.6 | 81 | 27.2 | 0.68 | 25 |

| Subbasin Parameters | | | Loss Model Parameters | | | | Unit Hydrograph Parameters | |
|---|---|---|---|---|---|---|---|---|
| Basin ID | Area | | Existing Conditions | Existing Cond. Impervious | DEVEX Conditions | DEVEX Cond. Impervious | Time of concentration | Lag [a] |
| | (ac) | ($mi^2$) | (CN) | (%) | (CN) | (%) | (h) | (min) |
| BA_I_101 | 68 | 0.106 | 75 | 1.0 | 78 | 21.7 | 0.18 | 7 |
| BA_I_102 | 8 | 0.012 | 75 | 0.2 | 81 | 7.7 | 0.16 | 6 |
| BA_I_103 | 39 | 0.061 | 76 | 1.4 | 80 | 7.4 | 0.28 | 10 |
| BA_I_104 | 39 | 0.061 | 76 | 1.5 | 80 | 7.8 | 0.25 | 9 |
| BA_I_105 | 15 | 0.024 | 76 | 1.6 | 79 | 6.2 | 0.19 | 7 |
| BA_I_106 | 28 | 0.044 | 76 | 1.9 | 81 | 8.3 | 0.22 | 8 |
| BA_I_107 | 51 | 0.080 | 84 | 29.7 | 84 | 29.7 | 0.24 | 9 |
| BA_I_201 | 60 | 0.094 | 75 | 0.5 | 79 | 5.5 | 0.22 | 8 |
| BA_I_202 | 9 | 0.014 | 78 | 3.0 | 81 | 6.3 | 0.15 | 6 |
| BA_I_301 | 24 | 0.038 | 78 | 2.3 | 80 | 5.5 | 0.31 | 11 |
| BA_I_401 | 36 | 0.057 | 78 | 3.0 | 80 | 7.1 | 0.19 | 7 |
| BA_I_501 | 38 | 0.060 | 77 | 2.5 | 81 | 7.7 | 0.32 | 11 |
| BA_I_601 | 29 | 0.046 | 78 | 8.1 | 81 | 11.6 | 0.32 | 12 |

[a] Lag = 0.6 * $T_c$

[b] Ultimate conditons for subbasion BA_H_102 includes a proposed diversion to the Venada Arroyo; modified parameters are:

| Subbasin Parameters | | | Loss Model Parameters | | | | Unit Hydrograph Parameters | |
|---|---|---|---|---|---|---|---|---|
| Basin ID | Area | | Existing Conditions | Existing Cond. Impervious | DEVEX Conditions | DEVEX Cond. Impervious | Time of concentration | Lag [a] |
| | (ac) | ($mi^2$) | (CN) | (%) | (CN) | (%) | (h) | (min) |
| BA_H_102 | 60 | 0.094 | n/a | n/a | 85 | 61.2 | 0.50 | 18 |

| Routing Reach ID | Length | Slope | Manning's n | | | Shape | Index Flow (Existing) | Index Flow (DEVEX) | Diam. | Width | Side Slope |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (ft) | (ft/ft) | Main | Left | Right | | (cfs) | (cfs) | (ft) | (ft) | (xH : 1V) |
| BA_A_101_R1 | 681 | 0.037 | 0.025 | | | Trapezoid | 42 | 52 | | 10 | 2 |
| BA_A_103_R1 | 1910 | 0.018 | 0.025 | 0.035 | 0.035 | Eight Point | 80 | 103 | | | |
| BA_A_104_R1 | 4313 | 0.017 | 0.025 | 0.035 | 0.035 | Eight Point | 121 | 178 | | | |
| BA_A_105_R1 | 8157 | 0.019 | 0.025 | 0.035 | 0.035 | Eight Point | 191 | 281 | | | |
| BA_A_106_R1 | 2110 | 0.017 | 0.025 | 0.035 | 0.035 | Eight Point | 214 | 332 | | | |
| BA_A_106_R2 | 4522 | 0.014 | 0.025 | 0.035 | 0.035 | Eight Point | 479 | 736 | | | |
| BA_A_107_R1 | 3500 | 0.013 | 0.025 | 0.035 | 0.035 | Eight Point | 834 | 1327 | | | |
| BA_A_108_R1 | 5050 | 0.013 | 0.025 | 0.035 | 0.035 | Eight Point | 891 | 1418 | | | |
| BA_A_109_R1 | 6524 | 0.016 | 0.025 | 0.035 | 0.035 | Eight Point | 931 | 1487 | | | |
| BA_A_110_R1 | 2790 | 0.015 | 0.025 | 0.035 | 0.035 | Eight Point | 1032 | 1673 | | | |
| BA_A_110_R2 | 5280 | 0.016 | 0.025 | 0.035 | 0.035 | Eight Point | 1245 | 2075 | | | |
| BA_A_111_R1 | 2557 | 0.017 | 0.025 | 0.035 | 0.035 | Eight Point | 1464 | 2523 | | | |
| BA_A_112_R1 | 1527 | 0.016 | 0.025 | | | Trapezoid | 1492 | 2581 | | 70 | 3 |
| BA_A_112_R2 | 1184 | 0.016 | 0.025 | | | Trapezoid | 1514 | 2624 | | 70 | 3 |
| BA_B_101_R1 | 4070 | 0.023 | 0.030 | | | Trapezoid | 40 | 40 | | 10 | 6 |
| BA_B_102_R1 | 1240 | 0.023 | 0.030 | | | Trapezoid | 67 | 68 | | 10 | 6 |
| BA_B_102_R2 | 1498 | 0.014 | 0.013 | | | Circle | 67 | 68 | 5.0 | | |
| BA_B_104_R1 | 1036 | 0.020 | 0.025 | | | Trapezoid | 152 | 164 | | 15 | 3 |
| BA_B_105_R1 | 945 | 0.019 | 0.025 | | | Trapezoid | 173 | 201 | | 15 | 3 |
| BA_B_106_R1 | 3003 | 0.013 | 0.025 | | | Trapezoid | 225 | 244 | | 30 | 3 |
| BA_C_101_R1 | 4052 | 0.016 | 0.035 | | | Rectangle | 58 | 126 | | 40 | |
| BA_C_101_R2 | 1914 | 0.021 | 0.025 | | | Rectangle | 40 | 52 | | 15 | |
| BA_D_101_R1 | 2354 | 0.019 | 0.025 | | | Trapezoid | 169 | 260 | | 15 | 3 |
| BA_D_102_R1 | 2416 | 0.014 | 0.025 | | | Trapezoid | 180 | 250 | | 20 | 6 |
| BA_D_102_R2 | 2690 | 0.015 | 0.025 | 0.035 | 0.035 | Eight Point | 198 | 301 | | | |
| BA_D_201_R1 | 1801 | 0.024 | 0.035 | | | Rectangle | 40 | 131 | | 25 | |
| BA_E_101_R1 | 391 | 0.019 | 0.020 | | | Rectangle | 267 | 410 | | 40 | |
| BA_F_101_R1 | 1792 | 0.015 | 0.013 | | | Trapezoid | 175 | 296 | | 10 | 2 |
| BA_F_101_R2 | 1173 | 0.021 | 0.020 | | | Trapezoid | 175 | 296 | | 15 | 6 |
| BA_F_102_R1 | 2098 | 0.015 | 0.025 | | | Trapezoid | 262 | 430 | | 15 | 6 |
| BA_F_103_R1 | 3769 | 0.021 | 0.025 | | | Trapezoid | 268 | 439 | | 20 | 6 |
| BA_F_104_R1 | 1467 | 0.019 | 0.025 | | | Trapezoid | 277 | 451 | | 20 | 6 |
| BA_G_101_R1 | 2650 | 0.022 | 0.030 | | | Trapezoid | 74 | 132 | | 10 | 4 |
| BA_H_102_R1 | 3344 | 0.024 | 0.020 | | | Trapezoid | 92 | 216 | | 15 | 3 |
| BA_H_103_R1 | 2687 | 0.019 | 0.025 | 0.035 | 0.035 | Eight Point | 326 | 512 | | | |
| BA_H_104_R1 | 1960 | 0.017 | 0.025 | 0.035 | 0.035 | Eight Point | 411 | 611 | | | |
| BA_H_105_R1 | 1800 | 0.017 | 0.025 | | | Rectangle | 451 | 661 | | 60 | |
| BA_H_202_R1 | 1337 | 0.017 | 0.035 | | | Rectangle | 96 | 123 | | 60 | |
| BA_H_202_R2 | 3175 | 0.022 | 0.017 | | | Rectangle | 96 | 123 | | 30 | |
| BA_H_301_R1 | 1484 | 0.025 | 0.030 | | | Trapezoid | 40 | 40 | | 10 | 6 |
| BA_I_101_R1 | 1001 | 0.028 | 0.030 | | | Trapezoid | 69 | 103 | | 10 | 4 |
| BA_I_102_R1 | 650 | 0.018 | 0.025 | | | Trapezoid | 127 | 180 | | 20 | 3 |
| BA_I_103_R1 | 775 | 0.020 | 0.025 | | | Trapezoid | 154 | 218 | | 25 | 3 |
| BA_I_104_R1 | 885 | 0.020 | 0.025 | | | Trapezoid | 213 | 293 | | 25 | 3 |

| Routing Reach ID | Length | Slope | Manning's n | | | Shape | Index Flow (Existing) | Index Flow (DEVEX) | Diam. | Width | Side Slope |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (ft) | (ft/ft) | Main | Left | Right | | (cfs) | (cfs) | (ft) | (ft) | (xH : 1V) |
| BA_I_105_R1 | 2141 | 0.017 | 0.025 | | | Trapezoid | 252 | 344 | | 30 | 3 |
| BA_I_106_R1 | 1273 | 0.023 | 0.020 | | | Trapezoid | 294 | 398 | | 15 | 3 |
| BA_I_201_R1 | 682 | 0.029 | 0.030 | | | Trapezoid | 44 | 59 | | 15 | 4 |

# Appendix B

# Ponds

| *Hydro ID* | *Source* | **Compiled by** | *Date* | *Drainage area ($mi^2$)* | *Emergency spillway (ft)* [a] | *$V_{EmSp}$ (ac-ft)* | *Top of embankment (ft)* [a] | *$V_{TOP}$ (ac-ft)* | *Existing peak depth (ft)* [a] | *DEVEX peak depth (ft)* [a] | *Note* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Campus_Dam | Design Memorandum for the Upper SLO Dam | Smith Engineering Company | Sep-13 | 1.16 | 13.0 | 33.3 | 15.0 | 41.8 | 7.5 | 10.7 | |
| BA_A_101_Pond | 2018 LiDAR & field investigation | SSCAFCA | Oct-21 | 0.21 | 7.0 | 5.2 | 10.0 | 10.6 | 5.0 | 6.9 | |
| BA_A_102_Pond | 2018 LiDAR & field investigation | SSCAFCA | Oct-21 | 0.29 | 7.0 | 4.9 | 10.0 | 8.9 | 5.2 | 6.3 | Emergency spillway not armored |
| BA_B_103_Pond | 2018 LiDAR & field investigation | SSCAFCA | Oct-21 | 0.51 | | | 7.0 | 3.9 | 7.4 | 7.4 | No emergency spillway, pond spills across Monterrey Rd |
| BA_C_101_Pond | 2018 LiDAR & record drawings | Huitt-Zollars Inc. | Dec-09 | 0.26 | | | 8.0 | 14.1 | 4.4 | 7.7 | No emergency spillway |
| BA_F_102B_Pond | Drainage Report for Cleveland Heights Unit 15 Subdivision | Bohannan Huston | May-18 | 0.08 | | | 7.5 | 3.5 | 6.0 | 6.2 | |
| BA_F_201_Pond | 2018 LiDAR & construction drawings | SSCAFCA | Oct-21 | 0.07 | | | 9.0 | 12.1 | 4.7 | 4.8 | No emergency spillway |
| BA_H_201_Pond | 2018 LiDAR & construction drawings | SSCAFCA | Oct-21 | 0.09 | | | 3.0 | 1.2 | 3.3 | 3.3 | No emergency spillway, pond spills onto road ROW and then through culvert under Paseo del Volcan |
| BA_H_301_Pond | 2018 LiDAR & construction drawings | SSCAFCA | Oct-21 | 0.09 | | | 4.0 | 1.5 | 3.3 | 4.1 | No emergency spillway |

[a] Depth vaule relative to pond invert

No concern
Low concern
High Concern

Smith Engineering Company 4/18/2018

1-7-15
Final Grading Plan

TABLE 1
Upper SLO Dam / Pond
Elevation - Volume - Discharge Data and Computations

Option Description - SEE CONSTRUCTION PLANS for Grading Plan, Principal and Emergency Spillway Details

grey box means must input data

| Contour Elevation NAVD 1988 | Depth | Contour Area (grading plan of 10-29-14) | Incremental Volume | Incremental Volume | Cumulative Volume | (A) 1st Row of Reverse Incline Ports Discharge | (A) 2nd Row of Reverse Incline Ports Discharge | (A) 3rd Row of Reverse Incline Ports Discharge | (A) Principal Spillway Grate Discharge | Principal Spillway Outfall Box Culvert Discharge | Total Principal Spillway / Outfall Pipe Discharge | Emergency Spillway Discharge | Total Discharge Rating Curve | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Principal Spillway Orifice Diameter (inches) | | | | 8 | 8 | 8 | | 5' R X 8' S | | | | |
| | | Number of Orifices | | | | 15 | 18 | 15 | | 1 | | | | |
| (ft) | | (sq ft) | (cu ft) | (ac-ft) | (ac-ft) | (cfs) | (cfs) | (cfs) | (cfs) | (cfs) | (cfs) | (cfs) | (cfs) | |
| (d) | | | | | | (a) | (a) | (a) | (b) | ( c ) | ( e ) | (b) | | |
| 5584.00 | 0 | 0 | 0 | 0.0000 | 0.0000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Pond bottom and principal spillway structure invert |
| 5585.00 | 1 | 36,247 | 18,124 | 0.4161 | 0.4161 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | Highest Invert 1st row of reverse incline ports |
| 5586.00 | 2 | 68,826 | 52,537 | 1.2061 | 1.6221 | 25 | 0 | 0 | 0 | 51 | 25 | 0 | 25 | Highest Invert 2nd row of reverse incline ports |
| 5587.00 | 3 | 87,336 | 78,081 | 1.7925 | 3.4146 | 35 | 30 | 0 | 0 | 94 | 65 | 0 | 65 | Highest Invert 3rd row of reverse incline ports |
| 5588.00 | 4 | 97,950 | 92,643 | 2.1268 | 5.5414 | 43 | 42 | 25 | 0 | 144 | 110 | 0 | 110 | |
| 5589.00 | 5 | 105,478 | 101,714 | 2.3350 | 7.8764 | 50 | 52 | 35 | 0 | 202 | 136 | 0 | 136 | Top of principal spillway grate |
| 5590.00 | 6 | 113,243 | 109,361 | 2.5106 | 10.3870 | 55 | 59 | 43 | 144 | 265 | 265 | 0 | 265 | |
| 5591.00 | 7 | 121,245 | 117,244 | 2.6916 | 13.0786 | 61 | 67 | 50 | 407 | 334 | 334 | 0 | 334 | |
| 5592.00 | 8 | 129,529 | 125,387 | 2.8785 | 15.9571 | 66 | 73 | 55 | 748 | 386 | 386 | 0 | 386 | |
| 5593.00 | 9 | 138,009 | 133,769 | 3.0709 | 19.0280 | 70 | 79 | 61 | 1152 | 432 | 432 | 0 | 432 | |
| 5594.00 | 10 | 146,706 | 142,358 | 3.2681 | 22.2961 | 74 | 84 | 66 | 1610 | 474 | 474 | 0 | 474 | |
| 5595.00 | 11 | 155,633 | 151,170 | 3.4704 | 25.7664 | 78 | 89 | 70 | 2116 | 512 | 512 | 0 | 512 | |
| 5596.00 | 12.0 | 164,760 | 160,197 | 3.6776 | 29.4440 | 82 | 94 | 74 | 2667 | 548 | 548 | 0 | 548 | |
| 5597.00 | 13.0 | 174,110 | 169,435 | 3.8897 | 33.3337 | 86 | 99 | 78 | 3258 | 581 | 581 | 0 | 581 | Emergency Spillway Elevation |
| 5597.20 | 13.2 | 176,022 | 35,013 | 0.8038 | 34.1375 | 87 | 100 | 79 | 3381 | 587 | 587 | 41 | 628 | |
| 5597.40 | 13.4 | 177,934 | 35,396 | 0.8126 | 34.9501 | 87 | 100 | 80 | 3506 | 594 | 594 | 116 | 710 | |
| 5597.60 | 13.6 | 179,846 | 35,778 | 0.8213 | 35.7714 | 88 | 101 | 81 | 3632 | 600 | 600 | 213 | 813 | |
| 5597.80 | 13.8 | 181,758 | 36,160 | 0.8301 | 36.6016 | 89 | 102 | 81 | 3759 | 607 | 607 | 327 | 934 | |
| 5598.00 | 14.0 | 183,670 | 178,890 | 4.1067 | 37.4405 | 89 | 103 | 82 | 3888 | 613 | 613 | 458 | 1071 | |
| 5598.20 | 14.2 | 185,775 | 180,898 | 4.1529 | 38.2904 | 90 | 104 | 83 | 4018 | 619 | 619 | 602 | 1221 | |
| 5598.40 | 14.4 | 187,879 | 182,907 | 4.1990 | 39.1490 | 91 | 105 | 84 | 4150 | 625 | 625 | 758 | 1383 | |
| 5598.60 | 14.6 | 189,984 | 184,915 | 4.2451 | 40.0165 | 91 | 106 | 84 | 4283 | 631 | 631 | 926 | 1557 | |
| 5598.80 | 14.8 | 192,088 | 186,923 | 4.2912 | 40.8927 | 92 | 106 | 85 | 4418 | 637 | 637 | 1105 | 1742 | |
| 5599.00 | 15.0 | 194,193 | 188,932 | 4.3373 | 41.7777 | 93 | 107 | 86 | 4554 | 643 | 643 | 1294 | 1937 | Top of Dam |

VALUES ONLY TO PAST INTO HEC-HMS

| ELEV | CUM VOL | DISCHARGE |
|---|---|---|
| ft | ac-ft | cfs |
| 5584.00 | 0 | 0 |
| 5585.00 | 0.4161 | 0.1 |
| 5586.00 | 1.6221 | 25 |
| 5587.00 | 3.4146 | 65 |
| 5588.00 | 5.5414 | 110 |
| 5589.00 | 7.8764 | 136 |
| 5590.00 | 10.3870 | 265 |
| 5591.00 | 13.0786 | 334 |
| 5592.00 | 15.9571 | 386 |
| 5593.00 | 19.0280 | 432 |
| 5594.00 | 22.2961 | 474 |
| 5595.00 | 25.7664 | 512 |
| 5596.00 | 29.4440 | 548 |
| 5597.00 | 33.3337 | 581 |
| 5597.20 | 34.1375 | 628 |
| 5597.40 | 34.9501 | 710 |
| 5597.60 | 35.7714 | 813 |
| 5597.80 | 36.6016 | 934 |
| 5598.00 | 37.4405 | 1071 |
| 5598.20 | 38.2904 | 1221 |
| 5598.40 | 39.1490 | 1383 |
| 5598.60 | 40.0165 | 1557 |
| 5598.80 | 40.8927 | 1742 |
| 5599.00 | 41.7777 | 1937 |

( a ) Office equation and coefficient were obtained from Equation 4-10 and Table 4-3 from "Handbook of Hydraulics" Sixth Edition, by Brater & King, 1976.

$$Q = Ca\sqrt{2gh}$$ C = 0.590 g=32.2 ft/sec^2, a=area (sq ft) h=head (ft)

$$a = \pi D^2/4$$ (full area formula)

Principal Spill. Pipe radius r in feet = NA

( e ) The combined discharge of the reverse incline ports and the grate (A), will govern the discharge until the principal spillway outfall pipe becomes fully submerged. When the sum of (As) is greater than outfall pipe capacity then outfall pipe capacity governs the discharge

( b ) Emergency Spillway flows were computed based on the following data used in the weir equation
Q = CLH^ 1.5 C = discharge coeffient, L = spillway length perp. to flow (ft), H = head (ft)

( b ) Emergergency Spillway C = 2.6 L = 176 Emer. Spill. Elev.= 5597.0
( b ) Grate / Weir C = 3 L = 48 El. 12'x12' grate 5589

( b ) Weir equation and "C" coefficients were obtained from Equation 5-10 and Table 5-3 from "Handbook of Hydraulics" Sixth Edition, by Brater & King, 1976.

( d ) Data Source : Contours from Aerial / Contour map flown / prepared for the SLO Dam final design
( c ) Rating curve computed with Culvert Master - output included in Appendix

Emergency Spillway set at 5597.00, interpolate areas at 0.2 ft to 5599 to attain a better emergency spillway rating curve

| ELEV | AREA | Delta Area | AREAS |
|---|---|---|---|
| 5597.00 | 174,110 | | 174,110 |
| 5597.20 | | 1,912 | 176,022 |
| 5597.40 | | 1,912 | 177,934 |
| 5597.60 | | 1,912 | 179,846 |
| 5597.80 | | 1,912 | 181,758 |
| 5598.00 | 183,670 | 1,912 | 183,670 |
| 5598.20 | | 2,105 | 185,775 |
| 5598.40 | | 2,105 | 187,879 |
| 5598.60 | | 2,105 | 189,984 |
| 5598.80 | | 2,105 | 192,088 |
| 5599.00 | 194,193 | 2,105 | 194,193 |

Emergency Spillway set at 5597.00, interpolate Culvert Master Q's at 0.2 ft to compute culvert Q's to correspond to emergency spillway elevations

| ELEV | DISCHARGE | Delta Q | Q |
|---|---|---|---|
| 5597.00 | 581 | | 581 |
| 5597.20 | | 6 | 587 |
| 5597.40 | | 6 | 594 |
| 5597.60 | | 6 | 600 |
| 5597.80 | | 6 | 607 |
| 5598.00 | 613 | 6 | 613 |
| 5598.00 | 613 | | 613 |
| 5598.20 | | 6 | 619 |
| 5598.40 | | 6 | 625 |
| 5598.60 | | 6 | 631 |
| 5598.80 | | 6 | 637 |
| 5599.00 | 643 | 6 | 643 |

Q:\SSCAFCA_Project_Files\La_Barranca\BA_P0016\Engineering\Final_Rating_Data_Received_from_Smith_04182018\Table 1 1-7-15 SLO Dam el-stor-disSLO Pond 1-7-15 5x8

**Hydro ID:** **BA_A_101_Pond**

*Pond rating curve based on:*
*2018 LiDAR-derived digital elevation model*
*and field investigation*

| Parameters | |
|---|---|
| C | 3.0 |
| L (ft) | 50 |

| | | | Volume | | Principal spillway [2] | | Emergency spillway [3] | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Depth | Area [1] | Incremental | Cumulative | Head | Discharge | Head | Discharge | Discharge |
| | ft | ac | ac-ft | ac-ft | ft | cfs | ft | cfs | cfs |
| Pond bottom and principal spillway invert | 0 | 0.035 | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 |
| | 1 | 0.237 | 0.136 | 0.136 | 1 | 22 | 0 | 0 | 22 |
| | 2 | 0.457 | 0.347 | 0.484 | 2 | 40 | 0 | 0 | 40 |
| | 3 | 0.686 | 0.572 | 1.055 | 3 | 57 | 0 | 0 | 57 |
| | 4 | 0.868 | 0.777 | 1.832 | 4 | 71 | 0 | 0 | 71 |
| | 5 | 1.030 | 0.949 | 2.781 | 5 | 83 | 0 | 0 | 83 |
| | 6 | 1.201 | 1.115 | 3.896 | 6 | 94 | 0 | 0 | 94 |
| Emergency spillway invert | 7 | 1.431 | 1.316 | 5.212 | 7 | 104 | 0 | 0 | 104 |
| | 8 | 1.660 | 1.546 | 6.758 | 8 | 112 | 1 | 150 | 262 |
| | 9 | 1.901 | 1.781 | 8.538 | 9 | 120 | 2 | 424 | 544 |
| | 10 | 2.127 | 2.014 | 10.552 | 10 | 127 | 3 | 779 | 906 |

[1] based on 2018 LiDAR-derived digital elevation model

[2] RCP, diameter = 3.5 ft, inlet mitered to slope, length = 230 ft, slope = 0.017

[3] broad-crested weir

**Hydro ID:** **BA_A_102_Pond**

*Pond rating curve based on:*
*2018 LiDAR-derived digital elevation model*
*and field investigation*

| Parameters | |
|---|---|
| C | 3.0 |
| L (ft) | 30 |

| | | | Volume | | Principal spillway [2] | | Emergency spillway [3] | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Depth ft | Area [1] ac | Incremental ac-ft | Cumulative ac-ft | Head ft | Discharge cfs | Head ft | Discharge cfs | Discharge cfs |
| Pond bottom and principal spillway invert | 0.0 | 0.222 | 0.000 | 0.000 | | 0 | 0 | 0 | 0 |
| | 0.5 | 0.333 | 0.139 | 0.139 | | 0 | 0 | 0 | 0 |
| | 1.0 | 0.445 | 0.195 | 0.333 | | 0 | 0 | 0 | 0 |
| | 1.5 | 0.500 | 0.236 | 0.570 | | 0 | 0 | 0 | 0 |
| | 2.0 | 0.555 | 0.264 | 0.833 | | 16 | 0 | 0 | 16 |
| | 2.5 | 0.598 | 0.288 | 1.122 | | 23 | 0 | 0 | 23 |
| | 3.0 | 0.642 | 0.310 | 1.432 | | 40 | 0 | 0 | 40 |
| | 3.5 | 0.699 | 0.335 | 1.767 | | 52 | 0 | 0 | 52 |
| | 4.0 | 0.757 | 0.364 | 2.131 | | 71 | 0 | 0 | 71 |
| | 4.5 | 0.816 | 0.393 | 2.524 | | 85 | 0 | 0 | 85 |
| | 5.0 | 0.875 | 0.423 | 2.947 | | 96 | 0 | 0 | 96 |
| | 5.5 | 0.931 | 0.452 | 3.398 | | 107 | 0 | 0 | 107 |
| | 6.0 | 0.987 | 0.480 | 3.878 | | 117 | 0 | 0 | 117 |
| | 6.5 | 1.045 | 0.508 | 4.386 | | 126 | 0 | 0 | 126 |
| Dam top | 7.0 | 1.102 | 0.537 | 4.923 | | 133 | 0.0 | 0 | 133 |
| | 7.5 | 1.170 | 0.568 | 5.491 | | 140 | 0.5 | 32 | 172 |
| | 8.0 | 1.237 | 0.602 | 6.093 | | 147 | 1.0 | 90 | 237 |
| | 8.5 | 1.310 | 0.637 | 6.729 | | 152 | 1.5 | 165 | 318 |
| | 9.0 | 1.382 | 0.673 | 7.402 | | 158 | 2.0 | 255 | 413 |
| | 9.5 | 1.476 | 0.715 | 8.117 | | 164 | 2.5 | 356 | 520 |
| | 10.0 | 1.570 | 0.761 | 8.878 | | 170 | 3.0 | 468 | 638 |

[1] based on 2018 LiDAR-derived digital elevation model
[2] 1 x conrete ported riser outlet
[3] broad-crested weir

**Hydro ID:** **BA_B_103_Pond**

*Pond rating curve based on:*
*2018 LiDAR-derived digital elevation model*
*and field investigation*

| Parameters | |
|---|---|
| C | 3.0 |
| L (ft) | 150 |

| | Depth | Area [1] | Volume | | Principal spillway [2] | | Emergency spillway [3] | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | Incremental | Cumulative | Head | Discharge | Head | Discharge | Discharge |
| | ft | ac | ac-ft | ac-ft | ft | cfs | ft | cfs | cfs |
| | 0.0 | 0.136 | 0.000 | 0.000 | | 0 | 0 | 0 | 0 |
| | 0.5 | 0.189 | 0.081 | 0.081 | | 0 | 0 | 0 | 0 |
| Principal spillway invert | 1.0 | 0.242 | 0.108 | 0.189 | | 0 | 0 | 0 | 0 |
| Row 1 | 1.5 | 0.296 | 0.135 | 0.324 | | 0 | 0 | 0 | 0 |
| | 2.0 | 0.350 | 0.161 | 0.485 | | 7 | 0 | 0 | 7 |
| | 2.5 | 0.411 | 0.190 | 0.675 | | 9 | 0 | 0 | 9 |
| Row 2 | 3.0 | 0.471 | 0.220 | 0.896 | | 12 | 0 | 0 | 12 |
| | 3.5 | 0.554 | 0.256 | 1.152 | | 19 | 0 | 0 | 19 |
| | 4.0 | 0.636 | 0.297 | 1.449 | | 23 | 0 | 0 | 23 |
| Row 3 | 4.5 | 0.696 | 0.333 | 1.782 | | 26 | 0 | 0 | 26 |
| | 5.0 | 0.755 | 0.363 | 2.145 | | 35 | 0 | 0 | 35 |
| | 5.5 | 0.815 | 0.392 | 2.537 | | 40 | 0 | 0 | 40 |
| Top or riser | 6.0 | 0.874 | 0.422 | 2.960 | | 45 | 0 | 0 | 45 |
| | 6.5 | 0.939 | 0.453 | 3.413 | | 75 | 0 | 0 | 75 |
| Dam top | 7.0 | 1.004 | 0.486 | 3.899 | | 128 | 0.0 | 0 | 128 |
| | 7.5 | 1.082 | 0.522 | 4.420 | | 194 | 0.5 | 159 | 353 |
| | 8.0 | 1.160 | 0.561 | 4.981 | | 238 | 1.0 | 450 | 688 |
| | 8.5 | 1.242 | 0.601 | 5.582 | | 250 | 1.5 | 827 | 1076 |
| | 9.0 | 1.324 | 0.641 | 6.223 | | 260 | 2.0 | 1273 | 1533 |

[1] based on 2018 LiDAR-derived digital elevation model

[2] 2 x CMP standpipe

[3] broad-crested weir

**Hydro ID:** **BA_C_101_Pond**

*Pond rating curve based on:*
*2018 LiDAR-derived digital elevation model*
*and record drawings (City Center Infrastructure Improvements, Huitt-Zollars Inc. 12/21/2009)*

| Parameters | |
|---|---|
| C | 3.0 |
| L (ft) | 300 |

| | | | Volume | | Principal spillway [2] | | Emergency spillway [3] | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Depth ft | Area [1] ac | Incremental ac-ft | Cumulative ac-ft | Head ft | Discharge cfs | Head ft | Discharge cfs | Discharge cfs |
| Pond bottom and principal spillway invert | 0 | 1.219 | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 |
| | 1 | 1.387 | 1.303 | 1.303 | 1 | 6 | 0 | 0 | 6 |
| | 2 | 1.515 | 1.451 | 2.753 | 2 | 27 | 0 | 0 | 27 |
| | 3 | 1.639 | 1.577 | 4.330 | 3 | 59 | 0 | 0 | 59 |
| | 4 | 1.762 | 1.700 | 6.030 | 4 | 99 | 0 | 0 | 99 |
| | 5 | 1.884 | 1.823 | 7.853 | 5 | 143 | 0 | 0 | 143 |
| | 6 | 2.010 | 1.947 | 9.801 | 6 | 187 | 0 | 0 | 187 |
| | 7 | 2.141 | 2.075 | 11.876 | 7 | 228 | 0 | 0 | 228 |
| Dam top | 8 | 2.337 | 2.239 | 14.115 | 8 | 262 | 0 | 0 | 262 |
| | 9 | 2.677 | 2.507 | 16.622 | 9 | 285 | 1 | 900 | 1185 |

[1] based on 2018 LiDAR-derived digital elevation model
[2] RCP, diameter = 6 ft, inlet mitered to slope, length = 146 ft, slope = 0.023
[3] broad-crested weir

```
*S***************************************************************
*S ROUTE FLOWS THROUGH POND
*S***************************************************************
ROUTE RESERVOIR      ID=20 HYD=POND  INFLOW ID=10 CODE=5
                   OUTFLOW  STORAGE    DEPTH

                   0        0.0        5432.5
                   0.86     0.0954     5433.0
                   2.19     0.2704     5433.5
                   3.84     0.4557     5434.0
                   5.80     0.6517     5434.5
                   8.08     0.8583     5435.0
                   10.67    1.0758     5435.5
                   13.59    1.3043     5436.0
                   16.82    1.5440     5436.5
                   20.37    1.7949     5437.0
                   41.13    2.0572     5437.5
                   50.69    2.3310     5438.0
                   59.92    2.6164     5438.5
                   68.82    2.9135     5439.0
                   77.39    3.2224     5439.5
                   85.62    3.5432     5440.0
*
*
PRINT HYD          ID=20 CODE=10
*
FINISH
```

**Hydro ID:** Pond BA_F_102B_Pond
Source: Drainage report for Cleveland Hights Unit 15 subdivision,
BHI, 2018

**Hydro ID:** **BA_F_201_Pond**

*Pond rating curve based on:*
*2018 LiDAR-derived digital elevation model*
*and construction drawings (V. Sue Cleveland High School)*

| Parameters | |
|---|---|
| C | 3.0 |
| L (ft) | 150 |

| | | | Volume | | Principal spillway [2] | | Emergency spillway [3] | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Depth | Area [1] | Incremental | Cumulative | Head | Discharge | Head | Discharge | Discharge |
| | ft | ac | ac-ft | ac-ft | ft | cfs | ft | cfs | cfs |
| Pond bottom and principal spillway invert | 0.0 | 0.396 | 0.000 | 0.000 | | 0.0 | 0 | 0 | 0.0 |
| | 0.5 | 0.575 | 0.243 | 0.243 | | 0.9 | 0 | 0 | 0.9 |
| | 1.0 | 0.754 | 0.332 | 0.575 | | 1.6 | 0 | 0 | 1.6 |
| | 1.5 | 0.870 | 0.406 | 0.981 | | 3.3 | 0 | 0 | 3.3 |
| | 2.0 | 0.985 | 0.464 | 1.445 | | 3.8 | 0 | 0 | 3.8 |
| | 2.5 | 1.066 | 0.513 | 1.957 | | 4.3 | 0 | 0 | 4.3 |
| | 3.0 | 1.147 | 0.553 | 2.511 | | 4.7 | 0 | 0 | 4.7 |
| | 3.5 | 1.222 | 0.592 | 3.103 | | 5.0 | 0 | 0 | 5.0 |
| | 4.0 | 1.296 | 0.629 | 3.732 | | 5.4 | 0 | 0 | 5.4 |
| | 4.5 | 1.370 | 0.666 | 4.399 | | 5.7 | 0 | 0 | 5.7 |
| | 5.0 | 1.443 | 0.703 | 5.102 | | 6.0 | 0 | 0 | 6.0 |
| | 5.5 | 1.517 | 0.740 | 5.842 | | 6.3 | 0 | 0 | 6.3 |
| | 6.0 | 1.591 | 0.777 | 6.619 | | 6.6 | 0 | 0 | 6.6 |
| | 6.5 | 1.665 | 0.814 | 7.433 | | 6.9 | 0 | 0 | 6.9 |
| | 7.0 | 1.739 | 0.851 | 8.284 | | 7.1 | 0 | 0 | 7.1 |
| | 7.5 | 1.817 | 0.889 | 9.173 | | 7.4 | 0 | 0 | 7.4 |
| | 8.0 | 1.894 | 0.928 | 10.101 | | 7.6 | 0 | 0 | 7.6 |
| | 8.5 | 1.979 | 0.968 | 11.069 | | 7.9 | 0 | 0 | 7.9 |
| Dam top | 9.0 | 2.065 | 1.011 | 12.080 | | 8.1 | 0 | 0 | 8.1 |
| | 9.5 | 2.185 | 1.062 | 13.142 | | 8.3 | 0.5 | 159 | 167.4 |
| | 10.0 | 2.305 | 1.122 | 14.265 | | 8.5 | 1.0 | 450 | 458.5 |

[1] based on 2018 LiDAR-derived digital elevation model
[2] 1 x conrete ported riser outlet
[3] broad-crested weir

**Hydro ID:** **BA_H_201_Pond**

*Pond rating curve based on:*

*2018 LiDAR-derived digital elevation model*

*and construction drawings (V. Sue Cleveland High School)*

| Parameters | |
|---|---|
| C | 3.0 |
| L (ft) | 150 |

| | | | Volume | | Principal spillway [2] | | Emergency spillway [3] | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Depth | Area [1] | Incremental | Cumulative | Head | Discharge | Head | Discharge | Discharge |
| | ft | ac | ac-ft | ac-ft | ft | cfs | ft | cfs | cfs |
| Pond bottom and principal spillway invert | 0.0 | 0.070 | 0.000 | 0.000 | | 0.0 | 0 | 0 | 0.0 |
| | 0.5 | 0.194 | 0.066 | 0.066 | | 1.7 | 0 | 0 | 1.7 |
| | 1.0 | 0.318 | 0.128 | 0.194 | | 2.7 | 0 | 0 | 2.7 |
| | 1.5 | 0.415 | 0.183 | 0.377 | | 3.3 | 0 | 0 | 3.3 |
| | 2.0 | 0.513 | 0.232 | 0.609 | | 3.8 | 0 | 0 | 3.8 |
| | 2.5 | 0.597 | 0.277 | 0.887 | | 4.3 | 0 | 0 | 4.3 |
| Dam top | 3.0 | 0.681 | 0.319 | 1.206 | | 4.7 | 0 | 0 | 4.7 |
| | 3.5 | 0.762 | 0.361 | 1.567 | | 5.0 | 0.5 | 159 | 164.1 |
| | 4.0 | 0.844 | 0.402 | 1.968 | | 5.4 | 1.0 | 450 | 455.4 |

[1] based on 2018 LiDAR-derived digital elevation model

[2] 1 x conrete ported riser outlet

[3] broad-crested weir

**Hydro ID:** **BA_H_301_Pond**

*Pond rating curve based on:*
*2018 LiDAR-derived digital elevation model*
*and construction drawings (Progress Heights Phase 2 Improvement Plans)*

| Parameters | |
|---|---|
| C | 3.0 |
| L (ft) | 100 |

| | Depth | Area [1] | Volume: Incremental | Volume: Cumulative | Principal spillway [2]: Head | Principal spillway [2]: Discharge | Emergency spillway [3]: Head | Emergency spillway [3]: Discharge | Total Discharge |
|---|---|---|---|---|---|---|---|---|---|
| | ft | ac | ac-ft | ac-ft | ft | cfs | ft | cfs | cfs |
| Pond bottom and principal spillway invert | 0 | 0.195 | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 |
| | 1 | 0.315 | 0.255 | 0.255 | 1 | 9 | 0 | 0 | 9 |
| | 2 | 0.383 | 0.349 | 0.604 | 2 | 30 | 0 | 0 | 30 |
| | 3 | 0.440 | 0.411 | 1.015 | 3 | 46 | 0 | 0 | 46 |
| Dam top | 4 | 0.500 | 0.470 | 1.485 | 4 | 52 | 0 | 0 | 52 |
| | 5 | 0.578 | 0.539 | 2.025 | 5 | 60 | 1 | 300 | 360 |

[1] based on 2018 LiDAR-derived digital elevation model
[2] 2x CMP, diameter = 2.5 ft, length = 184 ft, slope = 0.022
[3] broad-crested weir

# Appendix C

# Design Storm Model Results

**Notes:**

(1) Model results reported in this table are for the 100-year design storm without a depth-area reduction factor.
**Please modify the storm area** in the HEC-HMS model for analyses with larger contributing areas.

(2) $Q_p$ and V values for ponds correspond to peak outflow and outflow volume, respectively. For detailed pond routing including peak inflow, peak storage and peak elevation values, please consult the HEC-HMS model.

| Existing Conditions | | | |
|---|---|---|---|
| HMS ID | Area ($mi^2$) | $Q_p$ (cfs) | V (ac-ft) |
| BA_A_101 | 0.208 | 184 | 11.8 |
| BA_A_101_Pond | 0.208 | 83 | 11.8 |
| BA_A_101_R1 | 0.208 | 83 | 11.8 |
| BA_A_102 | 0.077 | 71 | 4.8 |
| BA_A_102_Pond | 0.285 | 100 | 16.5 |
| BA_A_102_Pond_in | 0.285 | 140 | 16.5 |
| BA_A_103 | 0.083 | 104 | 6.3 |
| BA_A_103_J1 | 0.368 | 160 | 22.8 |
| BA_A_103_R1 | 0.368 | 160 | 22.7 |
| BA_A_104 | 0.122 | 94 | 6.3 |
| BA_A_104_J1 | 0.490 | 243 | 29.1 |
| BA_A_104_R1 | 0.490 | 244 | 29.0 |
| BA_A_105 | 0.259 | 139 | 13.3 |
| BA_A_105_J1 | 0.749 | 383 | 42.3 |
| BA_A_105_R1 | 0.749 | 378 | 42.1 |
| BA_A_106 | 0.192 | 135 | 9.9 |
| BA_A_106_J1 | 0.941 | 428 | 52.0 |
| BA_A_106_R1 | 0.941 | 428 | 51.9 |
| BA_A_106_R2 | 2.266 | 955 | 119.5 |
| BA_A_107 | 0.595 | 243 | 30.3 |
| BA_A_107_J1 | 2.266 | 957 | 119.8 |
| BA_A_107_J2 | 2.861 | 1171 | 149.8 |
| BA_A_107_J3 | 4.457 | 1668 | 233.4 |
| BA_A_107_R1 | 4.457 | 1665 | 232.9 |
| BA_A_108 | 0.354 | 215 | 18.2 |
| BA_A_108_J1 | 4.811 | 1727 | 251.1 |
| BA_A_108_J2 | 4.811 | 1782 | 259.0 |
| BA_A_108_R1 | 4.811 | 1778 | 258.2 |
| BA_A_109 | 0.335 | 240 | 18.6 |
| BA_A_109_J1 | 5.146 | 1817 | 276.7 |
| BA_A_109_J2 | 5.380 | 1863 | 289.9 |
| BA_A_109_R1 | 5.380 | 1861 | 289.1 |
| BA_A_110 | 0.836 | 361 | 46.0 |
| BA_A_110_J1 | 6.216 | 2065 | 335.1 |
| BA_A_110_R1 | 6.216 | 2065 | 334.7 |
| BA_A_110_R2 | 7.664 | 2491 | 418.7 |
| BA_A_111 | 0.741 | 343 | 40.3 |
| BA_A_111_J1 | 7.664 | 2491 | 419.9 |
| BA_A_111_J2 | 8.405 | 2631 | 459.0 |

| Existing Conditions | | | |
|---|---|---|---|
| HMS ID | Area | $Q_p$ | V |
| | (mi$^2$) | (cfs) | (ac-ft) |
| BA_A_111_J3 | 9.832 | 2929 | 553.2 |
| BA_A_111_R1 | 9.832 | 2928 | 552.7 |
| BA_A_112 | 0.365 | 220 | 22.5 |
| BA_A_112_J1 | 10.197 | 2986 | 575.2 |
| BA_A_112_R1 | 10.197 | 2985 | 574.8 |
| BA_A_112_R2 | 10.894 | 3030 | 617.2 |
| BA_A_113 | 0.084 | 129 | 6.3 |
| BA_A_113_J1 | 10.894 | 3031 | 617.4 |
| BA_A_113_J2 | 10.978 | 3034 | 623.5 |
| BA_A_113_J3 | 11.979 | 3239 | 701.4 |
| BA_B_101 | 0.076 | 40 | 4.7 |
| BA_B_101_R1 | 0.076 | 40 | 4.7 |
| BA_B_102 | 0.180 | 110 | 10.8 |
| BA_B_102_J1 | 0.256 | 133 | 15.5 |
| BA_B_102_R1 | 0.256 | 133 | 15.5 |
| BA_B_102_R2 | 0.256 | 133 | 15.5 |
| BA_B_103 | 0.257 | 192 | 16.4 |
| BA_B_103_J1 | 0.513 | 297 | 31.9 |
| BA_B_103_Pond | 0.513 | 294 | 31.8 |
| BA_B_104 | 0.031 | 62 | 2.6 |
| BA_B_104_J1 | 0.544 | 304 | 34.3 |
| BA_B_104_R1 | 0.544 | 304 | 34.3 |
| BA_B_105 | 0.112 | 248 | 11.4 |
| BA_B_105_J1 | 0.656 | 347 | 45.7 |
| BA_B_105_R1 | 0.656 | 347 | 45.7 |
| BA_B_106 | 0.108 | 140 | 10.6 |
| BA_B_106_J1 | 0.764 | 448 | 56.2 |
| BA_B_106_R1 | 0.764 | 448 | 56.2 |
| BA_B_107 | 0.237 | 220 | 21.8 |
| BA_B_107_J1 | 1.001 | 663 | 78.0 |
| BA_C_101 | 0.263 | 238 | 19.1 |
| BA_C_101_Pond | 0.263 | 115 | 18.4 |
| BA_C_101_R1 | 0.263 | 115 | 18.3 |
| BA_C_101_R2 | 0.000 | 67 | 7.9 |
| BA_C_102 | 0.441 | 341 | 35.5 |
| BA_C_102_Div | 0.704 | 344 | 46.0 |
| BA_C_102_J1 | 0.704 | 411 | 53.9 |
| BA_D_101 | 0.733 | 338 | 37.7 |
| BA_D_101_R1 | 0.733 | 338 | 37.7 |
| BA_D_102 | 0.425 | 228 | 23.3 |
| BA_D_102_R1 | 1.158 | 359 | 59.9 |
| BA_D_102_R2 | 1.311 | 397 | 67.2 |
| BA_D_103 | 0.285 | 140 | 16.4 |
| BA_D_103_J1 | 1.311 | 397 | 67.3 |

| Existing Conditions | | | |
|---|---|---|---|
| HMS ID | Area | $Q_p$ | V |
| | ($mi^2$) | (cfs) | (ac-ft) |
| BA_D_103_J2 | 1.596 | 498 | 83.6 |
| BA_D_201 | 0.153 | 78 | 7.4 |
| BA_D_201_R1 | 0.153 | 78 | 7.4 |
| BA_E_101 | 1.325 | 534 | 67.9 |
| BA_E_101_R1 | 1.325 | 534 | 67.9 |
| BA_F_101 | 0.946 | 351 | 48.2 |
| BA_F_101_R1 | 0.946 | 351 | 48.1 |
| BA_F_101_R2 | 1.022 | 403 | 55.7 |
| BA_F_102A | 0.208 | 125 | 13.8 |
| BA_F_102B | 0.076 | 105 | 7.7 |
| BA_F_102B_Pond | 0.076 | 60 | 7.6 |
| BA_F_102_J1 | 1.296 | 519 | 75.8 |
| BA_F_102_J2 | 1.022 | 403 | 55.7 |
| BA_F_102_R1 | 1.296 | 519 | 75.7 |
| BA_F_103 | 0.066 | 78 | 4.6 |
| BA_F_103_J1 | 1.362 | 532 | 80.3 |
| BA_F_103_R1 | 1.362 | 532 | 80.2 |
| BA_F_104 | 0.086 | 73 | 5.2 |
| BA_F_104_J1 | 1.448 | 549 | 85.3 |
| BA_F_104_R1 | 1.448 | 549 | 85.3 |
| BA_F_201 | 0.066 | 132 | 7.0 |
| BA_F_201_Pond | 0.066 | 6 | 6.4 |
| BA_G_101 | 0.234 | 149 | 13.2 |
| BA_G_101_R1 | 0.234 | 149 | 13.2 |
| BA_H_101 | 0.206 | 91 | 11.0 |
| BA_H_102 | 0.179 | 94 | 10.1 |
| BA_H_102_J1 | 0.385 | 183 | 21.2 |
| BA_H_102_R1 | 0.385 | 183 | 21.1 |
| BA_H_103 | 0.259 | 352 | 22.5 |
| BA_H_103_J1 | 1.023 | 652 | 70.5 |
| BA_H_103_R1 | 1.023 | 651 | 70.4 |
| BA_H_104 | 0.256 | 234 | 15.8 |
| BA_H_104_J1 | 1.279 | 822 | 86.2 |
| BA_H_104_R1 | 1.279 | 825 | 86.1 |
| BA_H_105 | 0.148 | 118 | 8.2 |
| BA_H_105_J1 | 1.427 | 906 | 94.3 |
| BA_H_105_R1 | 1.427 | 902 | 94.2 |
| BA_H_201 | 0.088 | 113 | 7.1 |
| BA_H_201_Pond | 0.088 | 107 | 7.0 |
| BA_H_202 | 0.085 | 85 | 6.0 |
| BA_H_202_J1 | 0.173 | 192 | 13.0 |
| BA_H_202_R1 | 0.173 | 191 | 13.0 |
| BA_H_202_R2 | 0.173 | 202 | 13.0 |
| BA_H_203 | 0.115 | 62 | 7.5 |

| Existing Conditions | | | |
|---|---|---|---|
| HMS ID | Area | $Q_p$ | V |
| | (mi$^2$) | (cfs) | (ac-ft) |
| BA_H_203_J1 | 0.379 | 262 | 26.8 |
| BA_H_301 | 0.091 | 65 | 6.3 |
| BA_H_301_Pond | 0.091 | 48 | 6.3 |
| BA_H_301_R1 | 0.091 | 48 | 6.3 |
| BA_I_101 | 0.106 | 105 | 5.4 |
| BA_I_101_J1 | 0.144 | 138 | 7.7 |
| BA_I_101_R1 | 0.144 | 138 | 7.7 |
| BA_I_102 | 0.012 | 13 | 0.6 |
| BA_I_102_J1 | 0.264 | 253 | 14.0 |
| BA_I_102_R1 | 0.264 | 253 | 14.0 |
| BA_I_103 | 0.061 | 56 | 3.4 |
| BA_I_103_J1 | 0.325 | 309 | 17.4 |
| BA_I_103_R1 | 0.325 | 309 | 17.4 |
| BA_I_104 | 0.061 | 59 | 3.3 |
| BA_I_104_J1 | 0.443 | 426 | 24.2 |
| BA_I_104_R1 | 0.443 | 426 | 24.2 |
| BA_I_105 | 0.024 | 26 | 1.3 |
| BA_I_105_J1 | 0.527 | 505 | 29.1 |
| BA_I_105_R1 | 0.527 | 504 | 29.0 |
| BA_I_106 | 0.044 | 45 | 2.4 |
| BA_I_106_J1 | 0.617 | 587 | 34.5 |
| BA_I_106_R1 | 0.617 | 587 | 34.5 |
| BA_I_107 | 0.080 | 154 | 8.0 |
| BA_I_107_J1 | 0.697 | 701 | 42.5 |
| BA_I_201 | 0.094 | 88 | 4.8 |
| BA_I_201_R1 | 0.094 | 88 | 4.8 |
| BA_I_202 | 0.014 | 19 | 0.8 |
| BA_I_202_J1 | 0.108 | 104 | 5.7 |
| BA_I_301 | 0.038 | 38 | 2.3 |
| BA_I_401 | 0.057 | 71 | 3.5 |
| BA_I_501 | 0.060 | 57 | 3.5 |
| BA_I_601 | 0.046 | 48 | 3.1 |
| Campus_Dam | 1.158 | 359 | 60.0 |
| Campus_Dam_in | 1.158 | 557 | 61.0 |
| Div_Montoyas | 0.704 | 344 | 46.0 |
| Rio_Grande | 11.979 | 3239 | 701.4 |

**Notes:**

(1) Model results reported in this table are for the 100-year design storm without a depth-area reduction factor.
**Please modify the storm area** in the HEC-HMS model for analyses with larger contributing areas.

(2) $Q_p$ and V values for ponds correspond to peak outflow and outflow volume, respectively. For detailed pond routing including peak inflow, peak storage and peak elevation values, please consult the HEC-HMS model.

| DEVEX Conditions | | | |
|---|---|---|---|
| HMS ID | Area | $Q_p$ | V |
| | ($mi^2$) | (cfs) | (ac-ft) |
| BA_A_101 | 0.208 | 286 | 16.8 |
| BA_A_101_Pond | 0.208 | 104 | 16.8 |
| BA_A_101_R1 | 0.208 | 104 | 16.8 |
| BA_A_102 | 0.077 | 103 | 6.3 |
| BA_A_102_Pond | 0.285 | 123 | 23.1 |
| BA_A_102_Pond_in | 0.285 | 188 | 23.1 |
| BA_A_103 | 0.083 | 125 | 7.3 |
| BA_A_103_J1 | 0.368 | 206 | 30.3 |
| BA_A_103_R1 | 0.368 | 206 | 30.3 |
| BA_A_104 | 0.122 | 162 | 9.9 |
| BA_A_104_J1 | 0.490 | 356 | 40.1 |
| BA_A_104_R1 | 0.490 | 355 | 40.0 |
| BA_A_105 | 0.259 | 207 | 18.3 |
| BA_A_105_J1 | 0.749 | 562 | 58.4 |
| BA_A_105_R1 | 0.749 | 602 | 58.1 |
| BA_A_106 | 0.192 | 187 | 12.8 |
| BA_A_106_J1 | 0.941 | 684 | 70.9 |
| BA_A_106_R1 | 0.941 | 670 | 70.9 |
| BA_A_106_R2 | 2.266 | 1477 | 166.3 |
| BA_A_107 | 0.595 | 359 | 41.6 |
| BA_A_107_J1 | 2.266 | 1489 | 166.6 |
| BA_A_107_J2 | 2.861 | 1811 | 207.8 |
| BA_A_107_J3 | 4.457 | 2654 | 348.9 |
| BA_A_107_R1 | 4.457 | 2641 | 348.3 |
| BA_A_108 | 0.354 | 372 | 28.8 |
| BA_A_108_J1 | 4.811 | 2750 | 377.1 |
| BA_A_108_J2 | 4.811 | 2837 | 390.2 |
| BA_A_108_R1 | 4.811 | 2820 | 389.3 |
| BA_A_109 | 0.335 | 471 | 33.8 |
| BA_A_109_J1 | 5.146 | 2892 | 423.1 |
| BA_A_109_J2 | 5.380 | 2975 | 444.2 |
| BA_A_109_R1 | 5.380 | 2967 | 443.4 |
| BA_A_110 | 0.836 | 619 | 73.0 |
| BA_A_110_J1 | 6.216 | 3347 | 516.4 |
| BA_A_110_R1 | 6.216 | 3344 | 516.0 |
| BA_A_110_R2 | 7.664 | 4145 | 638.6 |
| BA_A_111 | 0.741 | 399 | 45.3 |
| BA_A_111_J1 | 7.664 | 4147 | 639.5 |
| BA_A_111_J2 | 8.405 | 4389 | 683.9 |

| DEVEX Conditions | | | |
|---|---|---|---|
| HMS ID | Area | $Q_p$ | V |
| | (mi$^2$) | (cfs) | (ac-ft) |
| BA_A_111_J3 | 9.832 | 5040 | 819.6 |
| BA_A_111_R1 | 9.832 | 5038 | 819.0 |
| BA_A_112 | 0.365 | 289 | 28.4 |
| BA_A_112_J1 | 10.197 | 5156 | 847.5 |
| BA_A_112_R1 | 10.197 | 5154 | 847.2 |
| BA_A_112_R2 | 10.894 | 5242 | 898.7 |
| BA_A_113 | 0.084 | 135 | 6.5 |
| BA_A_113_J1 | 10.894 | 5243 | 898.9 |
| BA_A_113_J2 | 10.978 | 5251 | 905.2 |
| BA_A_113_J3 | 11.979 | 5573 | 989.5 |
| BA_B_101 | 0.076 | 42 | 5.0 |
| BA_B_101_R1 | 0.076 | 42 | 5.0 |
| BA_B_102 | 0.180 | 109 | 10.8 |
| BA_B_102_J1 | 0.256 | 136 | 15.7 |
| BA_B_102_R1 | 0.256 | 136 | 15.7 |
| BA_B_102_R2 | 0.256 | 136 | 15.7 |
| BA_B_103 | 0.257 | 215 | 18.0 |
| BA_B_103_J1 | 0.513 | 319 | 33.7 |
| BA_B_103_Pond | 0.513 | 317 | 33.6 |
| BA_B_104 | 0.031 | 64 | 2.7 |
| BA_B_104_J1 | 0.544 | 328 | 36.3 |
| BA_B_104_R1 | 0.544 | 328 | 36.2 |
| BA_B_105 | 0.112 | 331 | 14.8 |
| BA_B_105_J1 | 0.656 | 401 | 51.0 |
| BA_B_105_R1 | 0.656 | 401 | 51.0 |
| BA_B_106 | 0.108 | 140 | 10.6 |
| BA_B_106_J1 | 0.764 | 489 | 61.6 |
| BA_B_106_R1 | 0.764 | 488 | 61.5 |
| BA_B_107 | 0.237 | 232 | 22.8 |
| BA_B_107_J1 | 1.001 | 717 | 84.3 |
| BA_C_101 | 0.263 | 492 | 37.4 |
| BA_C_101_Pond | 0.263 | 252 | 36.6 |
| BA_C_101_R1 | 0.263 | 252 | 36.5 |
| BA_C_101_R2 | 0.000 | 104 | 13.1 |
| BA_C_102 | 0.441 | 594 | 59.2 |
| BA_C_102_Div | 0.704 | 708 | 82.6 |
| BA_C_102_J1 | 0.704 | 811 | 95.7 |
| BA_D_101 | 0.733 | 521 | 53.3 |
| BA_D_101_R1 | 0.733 | 521 | 53.3 |
| BA_D_102 | 0.425 | 380 | 35.8 |
| BA_D_102_R1 | 1.158 | 500 | 88.0 |
| BA_D_102_R2 | 1.311 | 602 | 109.8 |
| BA_D_103 | 0.285 | 291 | 31.3 |
| BA_D_103_J1 | 1.311 | 602 | 109.9 |

| DEVEX Conditions | | | |
|---|---|---|---|
| HMS ID | Area | $Q_p$ | V |
| | ($mi^2$) | (cfs) | (ac-ft) |
| BA_D_103_J2 | 1.596 | 868 | 141.1 |
| BA_D_201 | 0.153 | 263 | 21.9 |
| BA_D_201_R1 | 0.153 | 263 | 21.9 |
| BA_E_101 | 1.325 | 819 | 95.8 |
| BA_E_101_R1 | 1.325 | 819 | 95.8 |
| BA_F_101 | 0.946 | 593 | 74.8 |
| BA_F_101_R1 | 0.946 | 593 | 74.7 |
| BA_F_101_R2 | 1.022 | 651 | 82.6 |
| BA_F_102A | 0.208 | 221 | 23.1 |
| BA_F_102B | 0.076 | 110 | 8.0 |
| BA_F_102B_Pond | 0.076 | 63 | 7.9 |
| BA_F_102_J1 | 1.296 | 851 | 112.3 |
| BA_F_102_J2 | 1.022 | 651 | 82.6 |
| BA_F_102_R1 | 1.296 | 851 | 112.2 |
| BA_F_103 | 0.066 | 90 | 5.3 |
| BA_F_103_J1 | 1.362 | 868 | 117.5 |
| BA_F_103_R1 | 1.362 | 868 | 117.4 |
| BA_F_104 | 0.086 | 91 | 6.2 |
| BA_F_104_J1 | 1.448 | 891 | 123.6 |
| BA_F_104_R1 | 1.448 | 891 | 123.6 |
| BA_F_201 | 0.066 | 138 | 7.3 |
| BA_F_201_Pond | 0.066 | 6 | 6.7 |
| BA_G_101 | 0.234 | 263 | 21.2 |
| BA_G_101_R1 | 0.234 | 263 | 21.1 |
| BA_H_101 | 0.206 | 225 | 24.5 |
| BA_H_102 | 0.179 | 212 | 20.7 |
| BA_H_102_J1 | 0.385 | 433 | 45.3 |
| BA_H_102_R1 | 0.385 | 433 | 45.2 |
| BA_H_103 | 0.259 | 379 | 24.2 |
| BA_H_103_J1 | 1.023 | 1024 | 106.9 |
| BA_H_103_R1 | 1.023 | 1024 | 106.9 |
| BA_H_104 | 0.256 | 303 | 19.6 |
| BA_H_104_J1 | 1.279 | 1221 | 126.5 |
| BA_H_104_R1 | 1.279 | 1220 | 126.4 |
| BA_H_105 | 0.148 | 144 | 9.4 |
| BA_H_105_J1 | 1.427 | 1321 | 135.8 |
| BA_H_105_R1 | 1.427 | 1323 | 135.7 |
| BA_H_201 | 0.088 | 119 | 7.5 |
| BA_H_201_Pond | 0.088 | 115 | 7.4 |
| BA_H_202 | 0.085 | 131 | 8.8 |
| BA_H_202_J1 | 0.173 | 246 | 16.3 |
| BA_H_202_R1 | 0.173 | 246 | 16.3 |
| BA_H_202_R2 | 0.173 | 246 | 16.3 |
| BA_H_203 | 0.115 | 115 | 13.1 |

| DEVEX Conditions | | | |
|---|---|---|---|
| HMS ID | Area | $Q_p$ | V |
| | (mi$^2$) | (cfs) | (ac-ft) |
| BA_H_203_J1 | 0.379 | 372 | 37.5 |
| BA_H_301 | 0.091 | 86 | 8.2 |
| BA_H_301_Pond | 0.091 | 76 | 8.2 |
| BA_H_301_R1 | 0.091 | 76 | 8.1 |
| BA_I_101 | 0.106 | 170 | 8.3 |
| BA_I_101_J1 | 0.144 | 205 | 10.8 |
| BA_I_101_R1 | 0.144 | 205 | 10.8 |
| BA_I_102 | 0.012 | 20 | 0.9 |
| BA_I_102_J1 | 0.264 | 361 | 18.8 |
| BA_I_102_R1 | 0.264 | 360 | 18.8 |
| BA_I_103 | 0.061 | 75 | 4.2 |
| BA_I_103_J1 | 0.325 | 435 | 23.0 |
| BA_I_103_R1 | 0.325 | 435 | 23.0 |
| BA_I_104 | 0.061 | 79 | 4.2 |
| BA_I_104_J1 | 0.443 | 587 | 31.1 |
| BA_I_104_R1 | 0.443 | 586 | 31.1 |
| BA_I_105 | 0.024 | 33 | 1.6 |
| BA_I_105_J1 | 0.527 | 688 | 37.0 |
| BA_I_105_R1 | 0.527 | 687 | 37.0 |
| BA_I_106 | 0.044 | 64 | 3.2 |
| BA_I_106_J1 | 0.617 | 796 | 43.7 |
| BA_I_106_R1 | 0.617 | 795 | 43.7 |
| BA_I_107 | 0.080 | 154 | 8.0 |
| BA_I_107_J1 | 0.697 | 919 | 51.7 |
| BA_I_201 | 0.094 | 119 | 6.1 |
| BA_I_201_R1 | 0.094 | 119 | 6.1 |
| BA_I_202 | 0.014 | 23 | 1.0 |
| BA_I_202_J1 | 0.108 | 138 | 7.1 |
| BA_I_301 | 0.038 | 43 | 2.5 |
| BA_I_401 | 0.057 | 82 | 3.9 |
| BA_I_501 | 0.060 | 74 | 4.3 |
| BA_I_601 | 0.046 | 57 | 3.5 |
| Campus_Dam | 1.158 | 500 | 88.1 |
| Campus_Dam_in | 1.158 | 885 | 89.1 |
| Div_Montoyas | 0.704 | 708 | 82.6 |
| Rio_Grande | 11.979 | 5573 | 989.5 |

**Notes:**

(1) Model results reported in this table are for the 100-year design storm without a depth-area reduction factor.
**Please modify the storm area** in the HEC-HMS model for analyses with larger contributing areas.

(2) $Q_p$ and V values for ponds correspond to peak outflow and outflow volume, respectively. For detailed pond routing including peak inflow, peak storage and peak elevation values, please consult the HEC-HMS model.

| Ultimate Conditions | | | |
|---|---|---|---|
| HMS ID | Area ($mi^2$) | $Q_p$ (cfs) | V (ac-ft) |
| BA_A_101 | 0.208 | 286 | 16.8 |
| BA_A_101_Pond | 0.208 | 104 | 16.8 |
| BA_A_101_R1 | 0.208 | 104 | 16.8 |
| BA_A_102 | 0.077 | 103 | 6.3 |
| BA_A_102_Pond | 0.285 | 123 | 23.1 |
| BA_A_102_Pond_in | 0.285 | 188 | 23.1 |
| BA_A_103 | 0.083 | 125 | 7.3 |
| BA_A_103_J1 | 0.368 | 206 | 30.3 |
| BA_A_103_R1 | 0.368 | 206 | 30.3 |
| BA_A_104 | 0.122 | 162 | 9.9 |
| BA_A_104_J1 | 0.490 | 356 | 40.1 |
| BA_A_104_R1 | 0.490 | 355 | 40.0 |
| BA_A_105 | 0.259 | 207 | 18.3 |
| BA_A_105_J1 | 0.749 | 562 | 58.4 |
| BA_A_105_R1 | 0.749 | 602 | 58.1 |
| BA_A_106 | 0.192 | 187 | 12.8 |
| BA_A_106_J1 | 0.941 | 684 | 70.9 |
| BA_A_106_R1 | 0.941 | 670 | 70.9 |
| BA_A_106_R2 | 2.266 | 1477 | 166.3 |
| BA_A_107 | 0.595 | 359 | 41.6 |
| BA_A_107_J1 | 2.266 | 1489 | 166.6 |
| BA_A_107_J2 | 2.861 | 1811 | 207.8 |
| BA_A_107_J3 | 4.457 | 2654 | 348.9 |
| BA_A_107_R1 | 4.457 | 2641 | 348.3 |
| BA_A_108 | 0.354 | 372 | 28.8 |
| BA_A_108_J1 | 4.811 | 2750 | 377.1 |
| BA_A_108_J2 | 5.515 | 3351 | 472.8 |
| BA_A_108_R1 | 5.515 | 3335 | 471.7 |
| BA_A_109 | 0.335 | 471 | 33.8 |
| BA_A_109_J1 | 5.850 | 3411 | 505.5 |
| BA_A_109_J2 | 6.084 | 3497 | 526.7 |
| BA_A_109_R1 | 6.084 | 3487 | 525.7 |
| BA_A_110 | 0.836 | 619 | 73.0 |
| BA_A_110_J1 | 6.920 | 3986 | 598.7 |
| BA_A_110_R1 | 6.920 | 3986 | 598.2 |
| BA_A_110_R2 | 8.368 | 4842 | 720.8 |
| BA_A_111 | 0.741 | 399 | 45.3 |
| BA_A_111_J1 | 8.368 | 4841 | 721.8 |
| BA_A_111_J2 | 9.109 | 5099 | 766.1 |

| Ultimate Conditions | | | |
|---|---|---|---|
| HMS ID | Area | $Q_p$ | V |
| | ($mi^2$) | (cfs) | (ac-ft) |
| BA_A_111_J3 | 10.451 | 5709 | 893.0 |
| BA_A_111_R1 | 10.451 | 5706 | 892.4 |
| BA_A_112 | 0.365 | 289 | 28.4 |
| BA_A_112_J1 | 10.816 | 5828 | 920.8 |
| BA_A_112_R1 | 10.816 | 5826 | 920.6 |
| BA_A_112_R2 | 11.513 | 5920 | 971.9 |
| BA_A_113 | 0.084 | 135 | 6.5 |
| BA_A_113_J1 | 11.513 | 5919 | 972.2 |
| BA_A_113_J2 | 11.597 | 5929 | 978.4 |
| BA_A_113_J3 | 12.598 | 6271 | 1062.7 |
| BA_B_101 | 0.076 | 42 | 5.0 |
| BA_B_101_R1 | 0.076 | 42 | 5.0 |
| BA_B_102 | 0.180 | 109 | 10.8 |
| BA_B_102_J1 | 0.256 | 136 | 15.7 |
| BA_B_102_R1 | 0.256 | 136 | 15.7 |
| BA_B_102_R2 | 0.256 | 136 | 15.7 |
| BA_B_103 | 0.257 | 215 | 18.0 |
| BA_B_103_J1 | 0.513 | 319 | 33.7 |
| BA_B_103_Pond | 0.513 | 317 | 33.6 |
| BA_B_104 | 0.031 | 64 | 2.7 |
| BA_B_104_J1 | 0.544 | 328 | 36.3 |
| BA_B_104_R1 | 0.544 | 328 | 36.2 |
| BA_B_105 | 0.112 | 331 | 14.8 |
| BA_B_105_J1 | 0.656 | 401 | 51.0 |
| BA_B_105_R1 | 0.656 | 401 | 51.0 |
| BA_B_106 | 0.108 | 140 | 10.6 |
| BA_B_106_J1 | 0.764 | 489 | 61.6 |
| BA_B_106_R1 | 0.764 | 488 | 61.5 |
| BA_B_107 | 0.237 | 232 | 22.8 |
| BA_B_107_J1 | 1.001 | 717 | 84.3 |
| BA_C_101 | 0.263 | 492 | 37.4 |
| BA_C_101_Pond | 0.263 | 252 | 36.6 |
| BA_C_101_R1 | 0.263 | 252 | 36.5 |
| BA_C_101_R2 | 0.704 | 812 | 95.7 |
| BA_C_102 | 0.441 | 594 | 59.2 |
| BA_C_102_J1 | 0.704 | 811 | 95.7 |
| BA_D_101 | 0.733 | 521 | 53.3 |
| BA_D_101_R1 | 0.733 | 521 | 53.3 |
| BA_D_102 | 0.425 | 380 | 35.8 |
| BA_D_102_R1 | 1.158 | 500 | 88.0 |
| BA_D_102_R2 | 1.311 | 602 | 109.8 |
| BA_D_103 | 0.285 | 291 | 31.3 |
| BA_D_103_J1 | 1.311 | 602 | 109.9 |
| BA_D_103_J2 | 1.596 | 868 | 141.1 |

| Ultimate Conditions | | | |
|---|---|---|---|
| HMS ID | Area | $Q_p$ | V |
| | ($mi^2$) | (cfs) | (ac-ft) |
| BA_D_201 | 0.153 | 263 | 21.9 |
| BA_D_201_R1 | 0.153 | 263 | 21.9 |
| BA_E_101 | 1.325 | 819 | 95.8 |
| BA_E_101_R1 | 1.325 | 819 | 95.8 |
| BA_F_101 | 0.946 | 593 | 74.8 |
| BA_F_101_R1 | 0.946 | 593 | 74.7 |
| BA_F_101_R2 | 1.022 | 651 | 82.6 |
| BA_F_102A | 0.208 | 221 | 23.1 |
| BA_F_102B | 0.076 | 110 | 8.0 |
| BA_F_102B_Pond | 0.076 | 63 | 7.9 |
| BA_F_102_J1 | 1.296 | 851 | 112.3 |
| BA_F_102_J2 | 1.022 | 651 | 82.6 |
| BA_F_102_R1 | 1.296 | 851 | 112.2 |
| BA_F_103 | 0.066 | 90 | 5.3 |
| BA_F_103_J1 | 1.362 | 868 | 117.5 |
| BA_F_103_R1 | 1.362 | 868 | 117.4 |
| BA_F_104 | 0.086 | 91 | 6.2 |
| BA_F_104_J1 | 1.448 | 891 | 123.6 |
| BA_F_104_R1 | 1.448 | 891 | 123.6 |
| BA_F_201 | 0.066 | 138 | 7.3 |
| BA_F_201_Pond | 0.066 | 6 | 6.7 |
| BA_G_101 | 0.234 | 263 | 21.2 |
| BA_G_101_R1 | 0.234 | 263 | 21.1 |
| BA_H_101 | 0.206 | 225 | 24.5 |
| BA_H_102 | 0.094 | 157 | 11.9 |
| BA_H_102_J1 | 0.300 | 343 | 36.5 |
| BA_H_102_R1 | 0.300 | 343 | 36.5 |
| BA_H_103 | 0.259 | 379 | 24.2 |
| BA_H_103_J1 | 0.938 | 1000 | 98.2 |
| BA_H_103_R1 | 0.938 | 1000 | 98.1 |
| BA_H_104 | 0.256 | 303 | 19.6 |
| BA_H_104_J1 | 1.194 | 1214 | 117.7 |
| BA_H_104_R1 | 1.194 | 1219 | 117.6 |
| BA_H_105 | 0.148 | 144 | 9.4 |
| BA_H_105_J1 | 1.342 | 1321 | 127.0 |
| BA_H_105_R1 | 1.342 | 1321 | 127.0 |
| BA_H_201 | 0.088 | 119 | 7.5 |
| BA_H_201_Pond | 0.088 | 115 | 7.4 |
| BA_H_202 | 0.085 | 131 | 8.8 |
| BA_H_202_J1 | 0.173 | 246 | 16.3 |
| BA_H_202_R1 | 0.173 | 246 | 16.3 |
| BA_H_202_R2 | 0.173 | 246 | 16.3 |
| BA_H_203 | 0.115 | 115 | 13.1 |
| BA_H_203_J1 | 0.379 | 372 | 37.5 |

| Ultimate Conditions | | | |
|---|---|---|---|
| HMS ID | Area | $Q_p$ | V |
| | ($mi^2$) | (cfs) | (ac-ft) |
| BA_H_301 | 0.091 | 86 | 8.2 |
| BA_H_301_Pond | 0.091 | 76 | 8.2 |
| BA_H_301_R1 | 0.091 | 76 | 8.1 |
| BA_I_101 | 0.106 | 170 | 8.3 |
| BA_I_101_J1 | 0.144 | 205 | 10.8 |
| BA_I_101_R1 | 0.144 | 10 | 10.8 |
| BA_I_102 | 0.012 | 20 | 0.9 |
| BA_I_102_J1 | 0.264 | 58 | 18.8 |
| BA_I_102_R1 | 0.264 | 57 | 18.7 |
| BA_I_103 | 0.061 | 75 | 4.2 |
| BA_I_103_J1 | 0.325 | 130 | 23.0 |
| BA_I_103_R1 | 0.325 | 41 | 22.9 |
| BA_I_104 | 0.061 | 79 | 4.2 |
| BA_I_104_J1 | 0.443 | 179 | 31.1 |
| BA_I_104_R1 | 0.443 | 178 | 31.1 |
| BA_I_105 | 0.024 | 33 | 1.6 |
| BA_I_105_J1 | 0.467 | 209 | 32.6 |
| BA_I_105_J2 | 0.527 | 120 | 37.0 |
| BA_I_105_R1 | 0.527 | 120 | 36.9 |
| BA_I_106 | 0.044 | 64 | 3.2 |
| BA_I_106_J1 | 0.617 | 221 | 43.6 |
| BA_I_106_R1 | 0.617 | 221 | 43.6 |
| BA_I_107 | 0.080 | 154 | 8.0 |
| BA_I_107_J1 | 0.697 | 353 | 51.6 |
| BA_I_201 | 0.094 | 119 | 6.1 |
| BA_I_201_R1 | 0.094 | 16 | 6.1 |
| BA_I_202 | 0.014 | 23 | 1.0 |
| BA_I_202_J1 | 0.108 | 31 | 7.1 |
| BA_I_301 | 0.038 | 43 | 2.5 |
| BA_I_401 | 0.057 | 82 | 3.9 |
| BA_I_501 | 0.060 | 74 | 4.3 |
| BA_I_601 | 0.046 | 57 | 3.5 |
| Campus_Dam | 1.158 | 500 | 88.1 |
| Campus_Dam_in | 1.158 | 885 | 89.1 |
| Contreras_Pond | 0.144 | 10 | 10.8 |
| Honduras_Pond | 0.467 | 62 | 32.6 |
| LaPaz_Pond | 0.094 | 16 | 6.1 |
| Matamoros_Pond | 0.325 | 41 | 23.0 |
| Rio_Grande | 12.598 | 6271 | 1062.7 |

# Appendix D

# Lateral Erosion Envelopes

| Reach | EXISTING $Q_{100}$ [a] | Dominant Discharge $Q_d$ | Slope $S_0$ | Critical Slope $S_c$ | Maximum lateral erosion distance Δmax | Est. channel width $W_D$ |
|---|---|---|---|---|---|---|
| | (cfs) | (cfs) | (ft/ft) | (ft/ft) | (ft) | (ft) |
| BA_A_103_R1 | 148 | 30 | 0.018 | 0.024 | 47 | 19 |
| BA_A_104_R1 | 223 | 45 | 0.017 | 0.022 | 56 | 22 |
| BA_A_105_R1 | 346 | 69 | 0.019 | 0.021 | 64 | 25 |
| BA_A_106_R1 | 390 | 78 | 0.017 | 0.021 | 68 | 27 |
| BA_A_106_R2 | 875 | 175 | 0.014 | 0.019 | 95 | 38 |
| BA_A_107_R1 | 1,536 | 307 | 0.013 | 0.017 | 130 | 48 |
| BA_A_108_R1 | 1,645 | 329 | 0.013 | 0.017 | 135 | 49 |
| BA_A_109_R1 | 1,727 | 345 | 0.016 | 0.017 | 132 | 48 |
| BA_A_110_R1 | 1,921 | 384 | 0.015 | 0.017 | 142 | 50 |
| BA_A_110_R2 | 2,317 | 463 | 0.016 | 0.016 | 156 | 54 |
| BA_A_111_R1 | 2,722 | 544 | 0.017 | 0.016 | 168 | 57 |
| BA_D_101_R1 | 311 | 62 | 0.019 | 0.021 | 61 | 24 |
| BA_D_102_R1 | 340 | 68 | 0.014 | 0.021 | 67 | 27 |
| BA_D_102_R2 | 376 | 75 | 0.015 | 0.021 | 69 | 27 |
| BA_E_101 | 492 | 98 | 0.014 | 0.020 | 77 | 31 |
| BA_E_101_R1 | 492 | 98 | 0.019 | 0.020 | 73 | 29 |
| BA_F_102_R1 | 481 | 96 | 0.015 | 0.020 | 76 | 30 |
| BA_F_103_R1 | 494 | 99 | 0.021 | 0.020 | 72 | 29 |
| BA_F_104_R1 | 510 | 102 | 0.019 | 0.020 | 74 | 29 |
| BA_H_103_R1 | 605 | 121 | 0.019 | 0.020 | 79 | 31 |
| BA_H_104_R1 | 761 | 152 | 0.017 | 0.019 | 87 | 35 |
| BA_H_105_R1 | 831 | 166 | 0.017 | 0.019 | 91 | 36 |

[a] Existing conditons (2022) urbanization and drainage infrastructure; flow rates with depth-area reduction for a 10 $mi^2$ watershed

# Appendix E

## Structure Capacities

This Document contains capacity analyses of culvert crossings in the Barranca watershed at locations where flows are expected to reach or exceed 500 cfs during the 100-year storm event. Please note that this analysis was performed for planning purposes only to establish approximate maximum allowable flow rates at each location. Culvert dimensions were measured during field visits in the fall of 2021 and estimated in GIS using 2018 LiDAR-derived elevation data. Capacities were estimated using HY-8 software version 7.5. The analysis was based on the following assumptions:

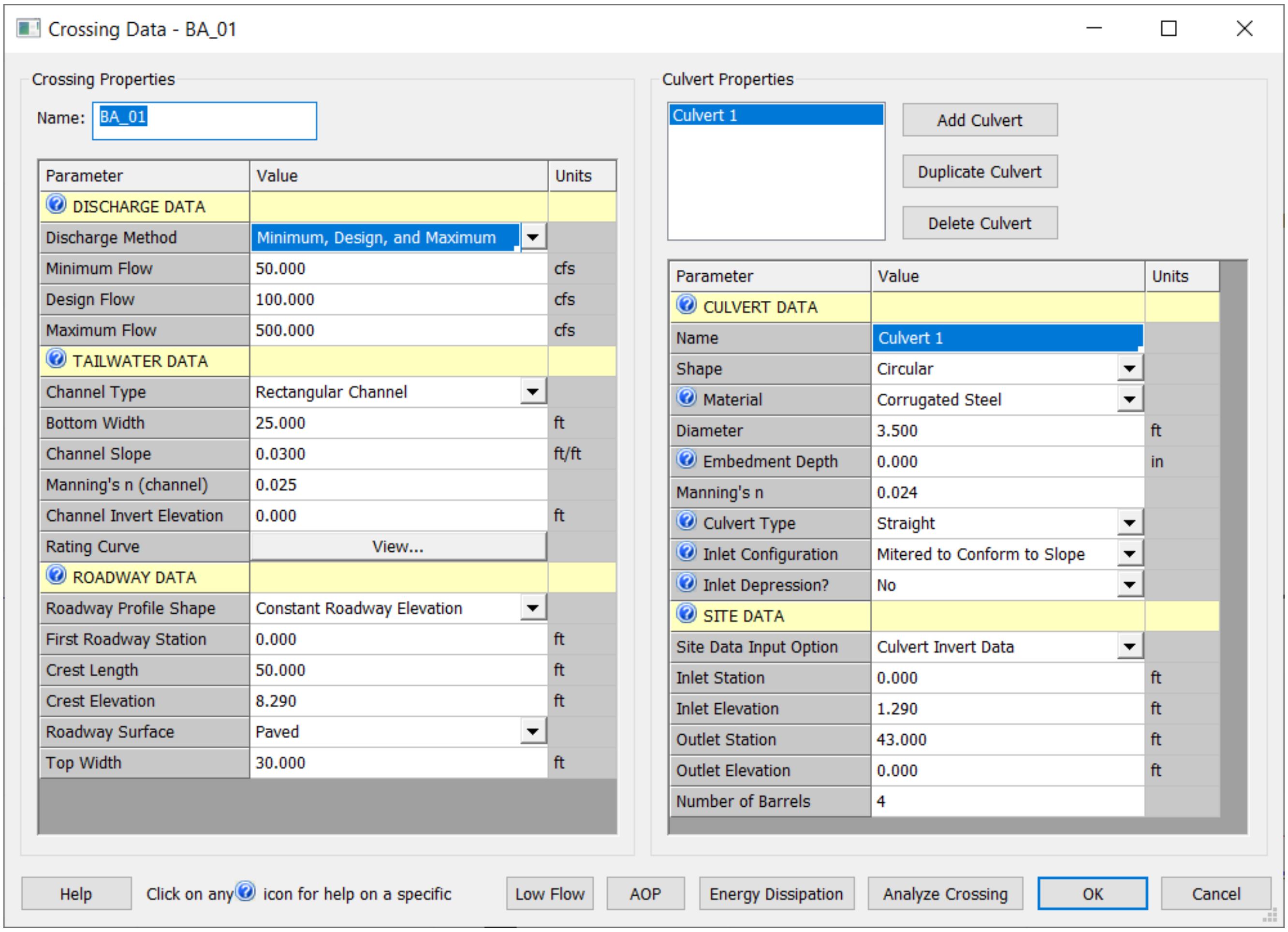
- Culverts are free of sediment and debris unless otherwise noted in the data tables; actual capacities may be less than those reported due to sediment accumulation, vegetation, and debris caught at culvert entrances.
- For simplicity, downstream channels were assumed to be trapezoidal with a bottom width and slope equal to that of the culvert crossing and a Manning’s value of 0.025.
- Overtopping of roadways was not modeled in HY-8. Maximum capacities correspond to maximum upstream water levels before flow starts overtopping the road or breaking out of the channel upstream of the crossing.

BA_01 (Barranca Arroyo & Unser Blvd.)

BA_01, upstream

BA_01, downstream

| Number of barrels | Diameter (in) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|
| 4 | 42 | CMP | Mitered to slope | 43 | 0.03 | 3.5 |




| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 2.88 | 50.00 | 50.00 | 0.00 | 1 |
| 3.55 | 95.00 | 95.00 | 0.00 | 1 |
| 3.61 | 100.00 | 100.00 | 0.00 | 1 |
| 4.65 | 185.00 | 185.00 | 0.00 | 1 |
| 5.29 | 230.00 | 230.00 | 0.00 | 1 |
| 6.07 | 275.00 | 275.00 | 0.00 | 1 |
| 7.00 | 320.00 | 320.00 | 0.00 | 1 |
| 8.06 | 365.00 | 365.00 | 0.00 | 1 |
| 8.59 | 410.00 | 385.59 | 24.33 | 6 |
| 8.83 | 455.00 | 394.78 | 60.14 | 5 |
| 9.03 | 500.00 | 402.39 | 97.38 | 4 |
| 8.29 | 374.06 | 374.06 | 0.00 | Overtopping |

BA_02 (Barranca Arroyo & Paseo del Volcan)

BA_02, upstream

BA_02, downstream

| Number of barrels | Height (ft) | Width (ft) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|---|
| 4 | 8 | 10 | CBC | Square edge, 30-75° wingwall | 115 | 0.026 | 3 |

Crossing Data - BA_02

Crossing Properties

Name: BA_02

| Parameter | Value | Units |
|---|---|---|
| DISCHARGE DATA | | |
| Discharge Method | Minimum, Design, and Maximum | |
| Minimum Flow | 100.000 | cfs |
| Design Flow | 500.000 | cfs |
| Maximum Flow | 2000.000 | cfs |
| TAILWATER DATA | | |
| Channel Type | Rectangular Channel | |
| Bottom Width | 50.000 | ft |
| Channel Slope | 0.0260 | ft/ft |
| Manning's n (channel) | 0.025 | |
| Channel Invert Elevation | 0.000 | ft |
| Rating Curve | View... | |
| ROADWAY DATA | | |
| Roadway Profile Shape | Constant Roadway Elevation | |
| First Roadway Station | 0.000 | ft |
| Crest Length | 50.000 | ft |
| Crest Elevation | 13.990 | ft |
| Roadway Surface | Paved | |
| Top Width | 30.000 | ft |

Culvert Properties

Culvert 1

Add Culvert | Duplicate Culvert | Delete Culvert

| Parameter | Value | Units |
|---|---|---|
| CULVERT DATA | | |
| Name | Culvert 1 | |
| Shape | Concrete Box | |
| Material | Concrete | |
| Span | 10.000 | ft |
| Rise | 8.000 | ft |
| Embedment Depth | 0.000 | in |
| Manning's n | 0.012 | |
| Culvert Type | Straight | |
| Inlet Configuration | Square Edge (30-75º flare) Wingwall | |
| Inlet Depression? | No | |
| SITE DATA | | |
| Site Data Input Option | Culvert Invert Data | |
| Inlet Station | 0.000 | ft |
| Inlet Elevation | 2.990 | ft |
| Outlet Station | 115.000 | ft |
| Outlet Elevation | 0.000 | ft |
| Number of Barrels | 4 | |

Help | Click on any icon for help on a specific | Low Flow | AOP | Energy Dissipation | Analyze Crossing | OK | Cancel

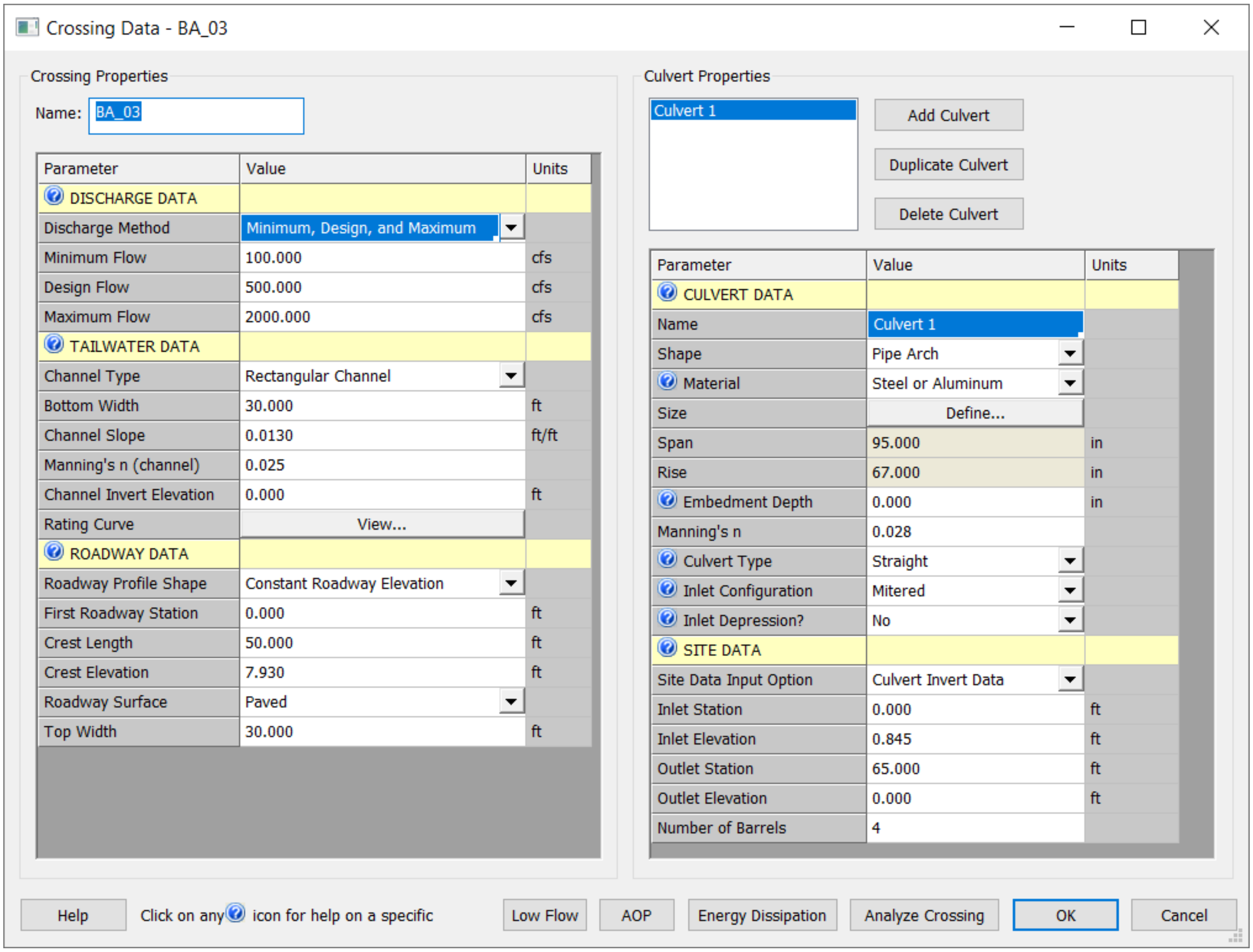
| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 3.86 | 100.00 | 100.00 | 0.00 | 1 |
| 4.76 | 290.00 | 290.00 | 0.00 | 1 |
| 5.46 | 480.00 | 480.00 | 0.00 | 1 |
| 5.53 | 500.00 | 500.00 | 0.00 | 1 |
| 6.63 | 860.00 | 860.00 | 0.00 | 1 |
| 7.16 | 1050.00 | 1050.00 | 0.00 | 1 |
| 7.68 | 1240.00 | 1240.00 | 0.00 | 1 |
| 8.16 | 1430.00 | 1430.00 | 0.00 | 1 |
| 8.62 | 1620.00 | 1620.00 | 0.00 | 1 |
| 9.06 | 1810.00 | 1810.00 | 0.00 | 1 |
| 9.49 | 2000.00 | 2000.00 | 0.00 | 1 |
| 13.99 | 3885.67 | 3885.67 | 0.00 | Overtopping |

BA_03 (Barranca Arroyo & Idalia Rd.)

BA_03, upstream

BA_03, downstream

| Number of barrels | Height (in) | Width (in) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|---|
| 4 | 67 | 95 | CMP | Mitered to slope | 65 | 0.013 | 1.5 |



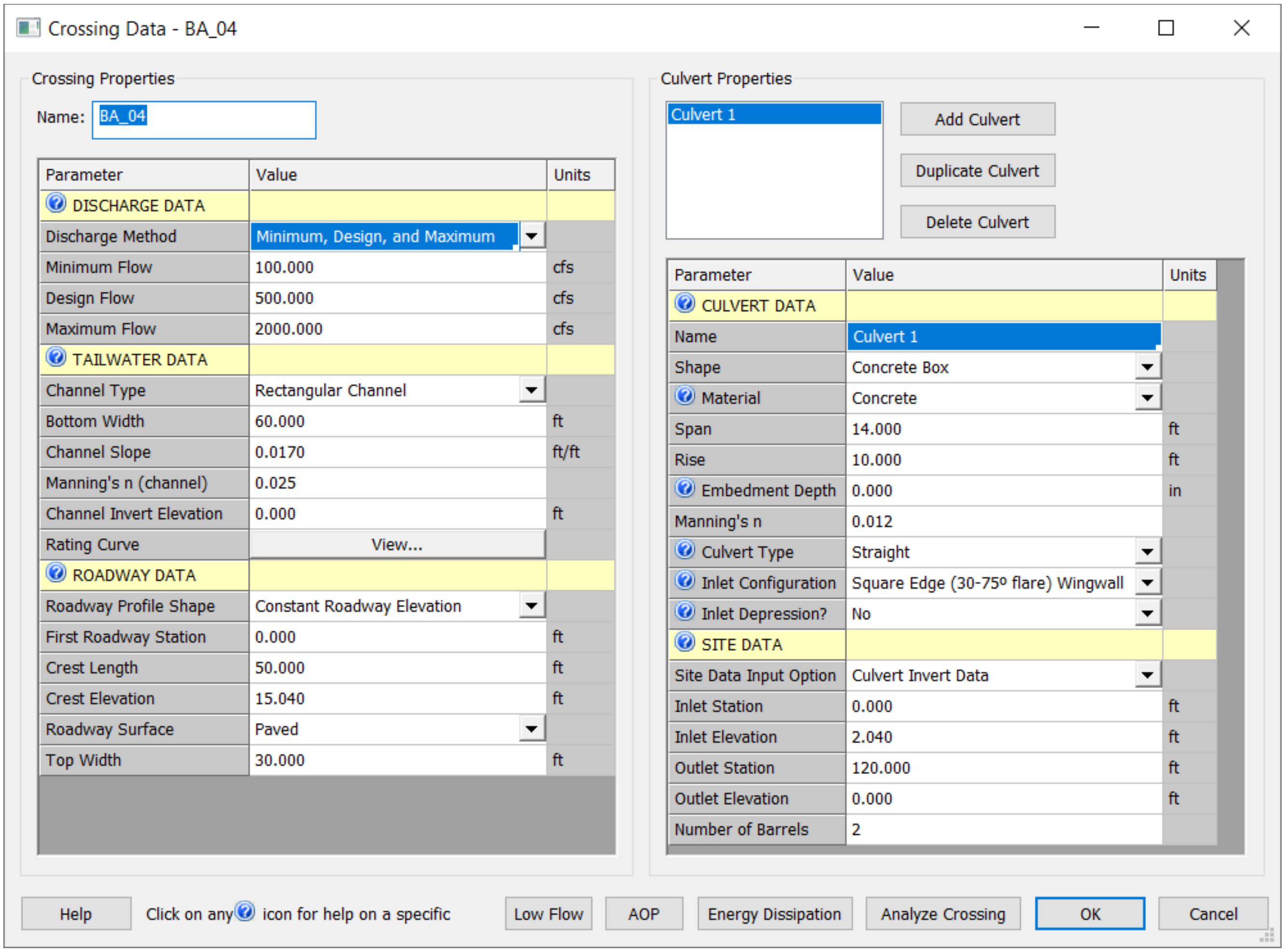

| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 2.34 | 100.00 | 100.00 | 0.00 | 1 |
| 3.55 | 290.00 | 290.00 | 0.00 | 1 |
| 4.42 | 480.00 | 480.00 | 0.00 | 1 |
| 4.50 | 500.00 | 500.00 | 0.00 | 1 |
| 6.52 | 860.00 | 860.00 | 0.00 | 1 |
| 7.29 | 1050.00 | 1050.00 | 0.00 | 1 |
| 8.09 | 1240.00 | 1230.89 | 9.10 | 4 |
| 8.70 | 1430.00 | 1327.07 | 102.89 | 4 |
| 9.21 | 1620.00 | 1399.32 | 220.66 | 4 |
| 9.67 | 1810.00 | 1461.21 | 348.36 | 3 |
| 10.09 | 2000.00 | 1516.83 | 482.81 | 3 |
| 7.93 | 1196.62 | 1196.62 | 0.00 | Overtopping |

BA_04 (Barranca Arroyo & NM 528)

BA_04, upstream

BA_04, downstream

| Number of barrels | Height (ft) | Width (ft) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|---|
| 2 | 10 | 14 | CBC | Square edge, 30-75° wingwall | 120 | 0.017 | 3 |




| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 3.15 | 100.00 | 100.00 | 0.00 | 1 |
| 4.30 | 290.00 | 290.00 | 0.00 | 1 |
| 5.20 | 480.00 | 480.00 | 0.00 | 1 |
| 5.29 | 500.00 | 500.00 | 0.00 | 1 |
| 6.70 | 860.00 | 860.00 | 0.00 | 1 |
| 7.38 | 1050.00 | 1050.00 | 0.00 | 1 |
| 8.03 | 1240.00 | 1240.00 | 0.00 | 1 |
| 8.64 | 1430.00 | 1430.00 | 0.00 | 1 |
| 9.22 | 1620.00 | 1620.00 | 0.00 | 1 |
| 9.78 | 1810.00 | 1810.00 | 0.00 | 1 |
| 10.33 | 2000.00 | 2000.00 | 0.00 | 1 |
| 15.04 | 3573.36 | 3573.36 | 0.00 | Overtopping |

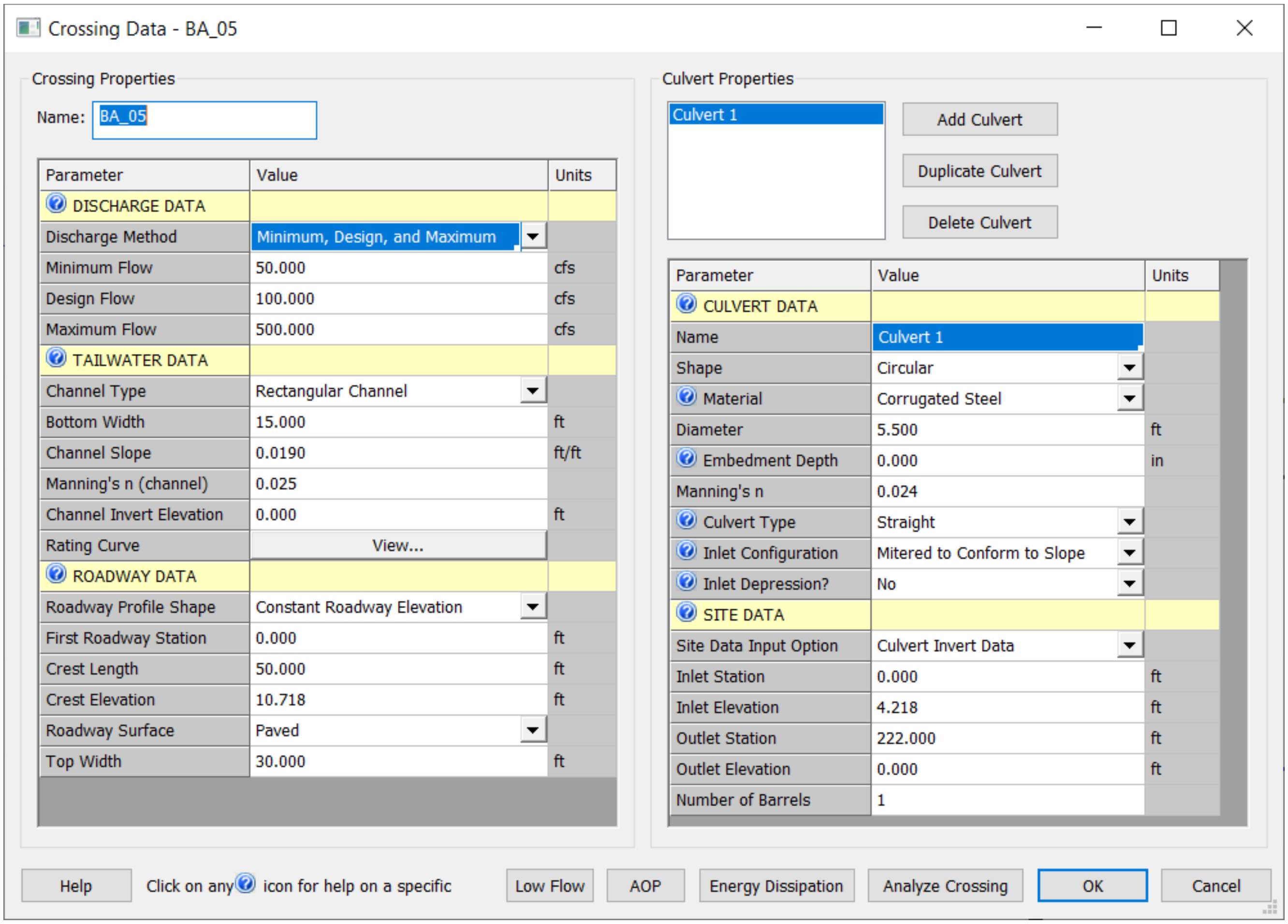
BA_05 (Tributary B & NM 528)

BA_05, upstream

BA_05, downstream

| Number of barrels | Diameter (in) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) * |
|---|---|---|---|---|---|---|
| 1 | 66 | CMP | Mitered to slope | 222 | 0.019 | 0.5 |

* Allowable headwater determined by low point in left bank



Crossing Data - BA_05

Crossing Properties

Name: BA_05

| Parameter | Value | Units |
|---|---|---|
| DISCHARGE DATA | | |
| Discharge Method | Minimum, Design, and Maximum | |
| Minimum Flow | 50.000 | cfs |
| Design Flow | 100.000 | cfs |
| Maximum Flow | 500.000 | cfs |
| TAILWATER DATA | | |
| Channel Type | Rectangular Channel | |
| Bottom Width | 15.000 | ft |
| Channel Slope | 0.0190 | ft/ft |
| Manning's n (channel) | 0.025 | |
| Channel Invert Elevation | 0.000 | ft |
| Rating Curve | View... | |
| ROADWAY DATA | | |
| Roadway Profile Shape | Constant Roadway Elevation | |
| First Roadway Station | 0.000 | ft |
| Crest Length | 50.000 | ft |
| Crest Elevation | 10.718 | ft |
| Roadway Surface | Paved | |
| Top Width | 30.000 | ft |

Culvert Properties

Culvert 1

Add Culvert

Duplicate Culvert

Delete Culvert

| Parameter | Value | Units |
|---|---|---|
| CULVERT DATA | | |
| Name | Culvert 1 | |
| Shape | Circular | |
| Material | Corrugated Steel | |
| Diameter | 5.500 | ft |
| Embedment Depth | 0.000 | in |
| Manning's n | 0.024 | |
| Culvert Type | Straight | |
| Inlet Configuration | Mitered to Conform to Slope | |
| Inlet Depression? | No | |
| SITE DATA | | |
| Site Data Input Option | Culvert Invert Data | |
| Inlet Station | 0.000 | ft |
| Inlet Elevation | 4.218 | ft |
| Outlet Station | 222.000 | ft |
| Outlet Elevation | 0.000 | ft |
| Number of Barrels | 1 | |

Help | Click on any icon for help on a specific | Low Flow | AOP | Energy Dissipation | Analyze Crossing | OK | Cancel

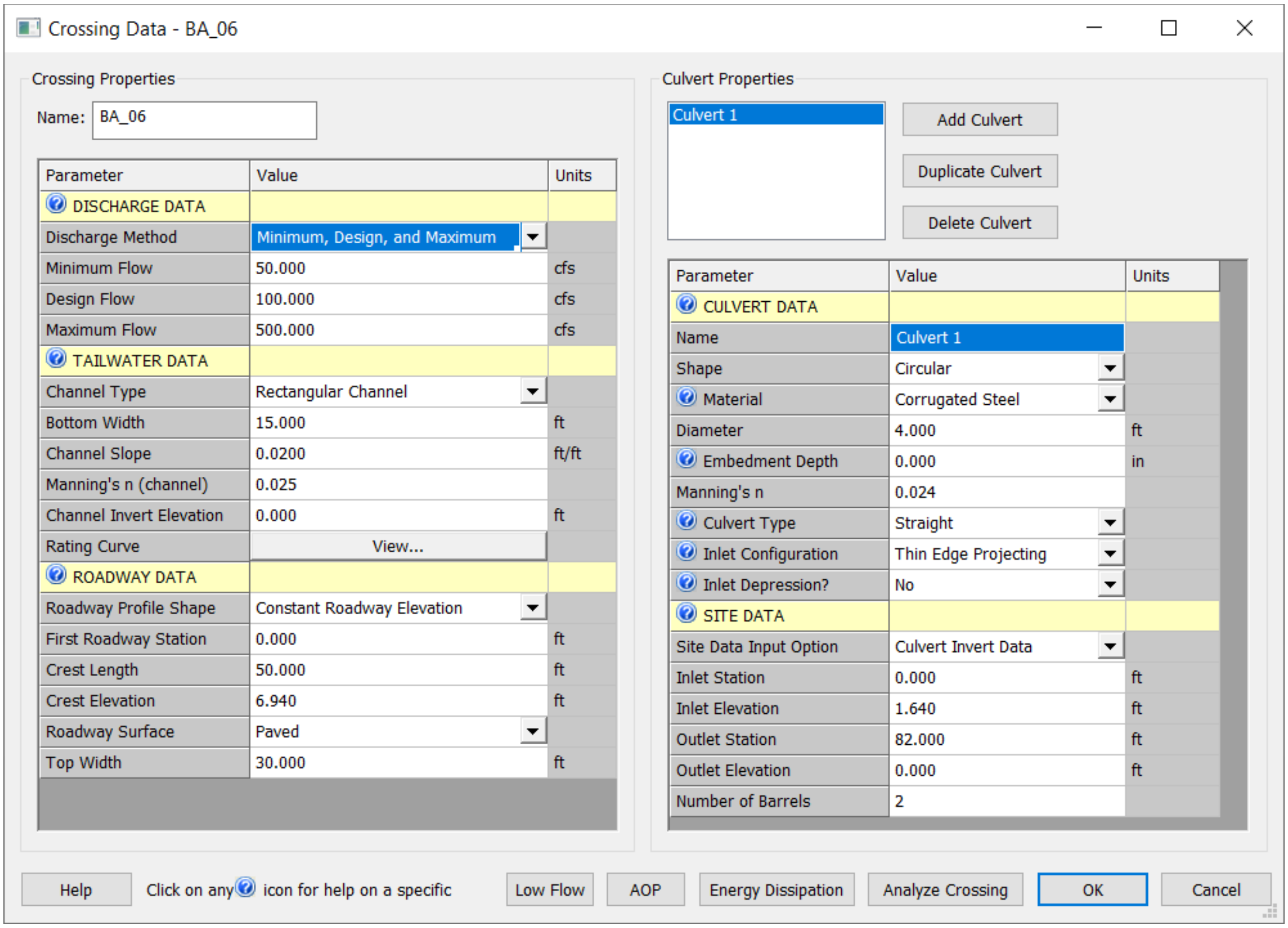
| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 7.05 | 50.00 | 50.00 | 0.00 | 1 |
| 8.26 | 95.00 | 95.00 | 0.00 | 1 |
| 8.38 | 100.00 | 100.00 | 0.00 | 1 |
| 10.69 | 185.00 | 185.00 | 0.00 | 1 |
| 11.08 | 230.00 | 196.58 | 33.37 | 6 |
| 11.33 | 275.00 | 203.26 | 71.67 | 5 |
| 11.53 | 320.00 | 208.79 | 111.01 | 4 |
| 11.72 | 365.00 | 213.66 | 151.21 | 4 |
| 11.89 | 410.00 | 218.05 | 191.85 | 4 |
| 12.05 | 455.00 | 222.07 | 232.85 | 4 |
| 12.20 | 500.00 | 225.84 | 274.12 | 4 |
| 10.72 | 185.89 | 185.89 | 0.00 | Overtopping |

BA_06 (Tributary B & Grande Vista Rd.)

BA_06, upstream

BA_06, downstream

| Number of barrels | Diameter (in) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|
| 2 | 48 | CMP | Headwall | 82 | 0.02 | 1.3 |



Crossing Data - BA_06

Crossing Properties

Name: BA_06

| Parameter | Value | Units |
|---|---|---|
| DISCHARGE DATA | | |
| Discharge Method | Minimum, Design, and Maximum | |
| Minimum Flow | 50.000 | cfs |
| Design Flow | 100.000 | cfs |
| Maximum Flow | 500.000 | cfs |
| TAILWATER DATA | | |
| Channel Type | Rectangular Channel | |
| Bottom Width | 15.000 | ft |
| Channel Slope | 0.0200 | ft/ft |
| Manning's n (channel) | 0.025 | |
| Channel Invert Elevation | 0.000 | ft |
| Rating Curve | View... | |
| ROADWAY DATA | | |
| Roadway Profile Shape | Constant Roadway Elevation | |
| First Roadway Station | 0.000 | ft |
| Crest Length | 50.000 | ft |
| Crest Elevation | 6.940 | ft |
| Roadway Surface | Paved | |
| Top Width | 30.000 | ft |

Culvert Properties

Culvert 1

Add Culvert / Duplicate Culvert / Delete Culvert

| Parameter | Value | Units |
|---|---|---|
| CULVERT DATA | | |
| Name | Culvert 1 | |
| Shape | Circular | |
| Material | Corrugated Steel | |
| Diameter | 4.000 | ft |
| Embedment Depth | 0.000 | in |
| Manning's n | 0.024 | |
| Culvert Type | Straight | |
| Inlet Configuration | Thin Edge Projecting | |
| Inlet Depression? | No | |
| SITE DATA | | |
| Site Data Input Option | Culvert Invert Data | |
| Inlet Station | 0.000 | ft |
| Inlet Elevation | 1.640 | ft |
| Outlet Station | 82.000 | ft |
| Outlet Elevation | 0.000 | ft |
| Number of Barrels | 2 | |

Help | Click on any icon for help on a specific | Low Flow | AOP | Energy Dissipation | Analyze Crossing | OK | Cancel

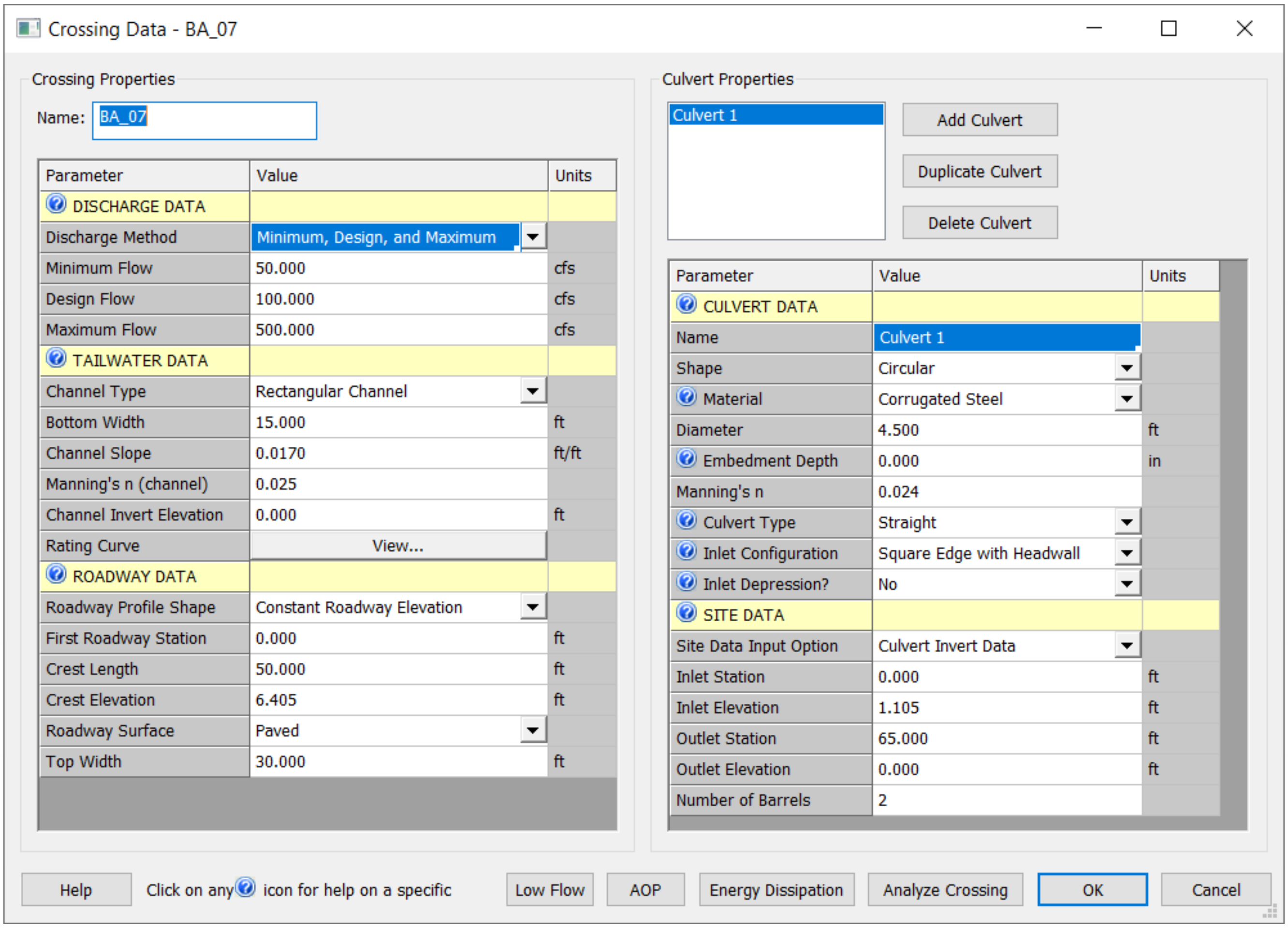
| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 3.82 | 50.00 | 50.00 | 0.00 | 1 |
| 4.86 | 95.00 | 95.00 | 0.00 | 1 |
| 4.97 | 100.00 | 100.00 | 0.00 | 1 |
| 7.02 | 185.00 | 181.76 | 3.07 | 8 |
| 7.34 | 230.00 | 192.26 | 37.57 | 5 |
| 7.57 | 275.00 | 199.51 | 75.43 | 5 |
| 7.77 | 320.00 | 205.56 | 114.26 | 4 |
| 7.95 | 365.00 | 210.91 | 153.97 | 4 |
| 8.12 | 410.00 | 215.73 | 194.18 | 4 |
| 8.28 | 455.00 | 220.14 | 234.79 | 4 |
| 8.43 | 500.00 | 224.27 | 275.69 | 4 |
| 6.94 | 179.16 | 179.16 | 0.00 | Overtopping |

BA_07 (Tributary B & Sandia Vista Rd.)

BA_07, upstream

BA_07, downstream

| Number of barrels | Diameter (in) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|
| 2 | 54 | CMP | Headwall | 65 | 0.017 | 0.8 |



Crossing Data - BA_07

Crossing Properties

Name: BA_07

| Parameter | Value | Units |
|---|---|---|
| DISCHARGE DATA | | |
| Discharge Method | Minimum, Design, and Maximum | |
| Minimum Flow | 50.000 | cfs |
| Design Flow | 100.000 | cfs |
| Maximum Flow | 500.000 | cfs |
| TAILWATER DATA | | |
| Channel Type | Rectangular Channel | |
| Bottom Width | 15.000 | ft |
| Channel Slope | 0.0170 | ft/ft |
| Manning's n (channel) | 0.025 | |
| Channel Invert Elevation | 0.000 | ft |
| Rating Curve | View... | |
| ROADWAY DATA | | |
| Roadway Profile Shape | Constant Roadway Elevation | |
| First Roadway Station | 0.000 | ft |
| Crest Length | 50.000 | ft |
| Crest Elevation | 6.405 | ft |
| Roadway Surface | Paved | |
| Top Width | 30.000 | ft |

Culvert Properties

Culvert 1

Add Culvert
Duplicate Culvert
Delete Culvert

| Parameter | Value | Units |
|---|---|---|
| CULVERT DATA | | |
| Name | Culvert 1 | |
| Shape | Circular | |
| Material | Corrugated Steel | |
| Diameter | 4.500 | ft |
| Embedment Depth | 0.000 | in |
| Manning's n | 0.024 | |
| Culvert Type | Straight | |
| Inlet Configuration | Square Edge with Headwall | |
| Inlet Depression? | No | |
| SITE DATA | | |
| Site Data Input Option | Culvert Invert Data | |
| Inlet Station | 0.000 | ft |
| Inlet Elevation | 1.105 | ft |
| Outlet Station | 65.000 | ft |
| Outlet Elevation | 0.000 | ft |
| Number of Barrels | 2 | |

Help | Click on any icon for help on a specific | Low Flow | AOP | Energy Dissipation | Analyze Crossing | OK | Cancel

| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 3.05 | 50.00 | 50.00 | 0.00 | 1 |
| 3.89 | 95.00 | 95.00 | 0.00 | 1 |
| 3.98 | 100.00 | 100.00 | 0.00 | 1 |
| 5.37 | 185.00 | 185.00 | 0.00 | 1 |
| 6.15 | 230.00 | 230.00 | 0.00 | 1 |
| 6.65 | 275.00 | 256.70 | 18.21 | 6 |
| 6.93 | 320.00 | 262.73 | 57.22 | 5 |
| 7.11 | 365.00 | 276.17 | 88.79 | 4 |
| 7.27 | 410.00 | 287.06 | 122.86 | 4 |
| 7.44 | 455.00 | 294.77 | 160.14 | 4 |
| 7.60 | 500.00 | 301.85 | 198.08 | 4 |
| 6.41 | 243.84 | 243.84 | 0.00 | Overtopping |

BA_08 (Tributary F & Paseo del Volcan)

BA_08, upstream

BA_08, downstream

| Number of barrels | Height (ft) | Width (ft) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) * |
|---|---|---|---|---|---|---|---|
| 4 | 6 | 8 | CBC | Square edge, 30-75° wingwall | 141 | 0.017 | 0 |

* Allowable headwater determined by low point in left bank

Crossing Data - BA_08

**Crossing Properties**

Name: BA_08

| Parameter | Value | Units |
|---|---|---|
| DISCHARGE DATA | | |
| Discharge Method | Minimum, Design, and Maximum | |
| Minimum Flow | 50.000 | cfs |
| Design Flow | 500.000 | cfs |
| Maximum Flow | 2000.000 | cfs |
| TAILWATER DATA | | |
| Channel Type | Rectangular Channel | |
| Bottom Width | 20.000 | ft |
| Channel Slope | 0.0170 | ft/ft |
| Manning's n (channel) | 0.025 | |
| Channel Invert Elevation | 0.000 | ft |
| Rating Curve | View... | |
| ROADWAY DATA | | |
| Roadway Profile Shape | Constant Roadway Elevation | |
| First Roadway Station | 0.000 | ft |
| Crest Length | 50.000 | ft |
| Crest Elevation | 8.397 | ft |
| Roadway Surface | Paved | |
| Top Width | 30.000 | ft |

**Culvert Properties**

Culvert 1

Add Culvert

Duplicate Culvert

Delete Culvert

| Parameter | Value | Units |
|---|---|---|
| CULVERT DATA | | |
| Name | Culvert 1 | |
| Shape | Concrete Box | |
| Material | Concrete | |
| Span | 8.000 | ft |
| Rise | 6.000 | ft |
| Embedment Depth | 0.000 | in |
| Manning's n | 0.012 | |
| Culvert Type | Straight | |
| Inlet Configuration | Square Edge (30-75º flare) Wingwall | |
| Inlet Depression? | No | |
| SITE DATA | | |
| Site Data Input Option | Culvert Invert Data | |
| Inlet Station | 0.000 | ft |
| Inlet Elevation | 2.397 | ft |
| Outlet Station | 141.000 | ft |
| Outlet Elevation | 0.000 | ft |
| Number of Barrels | 4 | |

Help | Click on any icon for help on a specific | Low Flow | AOP | Energy Dissipation | Analyze Crossing | OK | Cancel

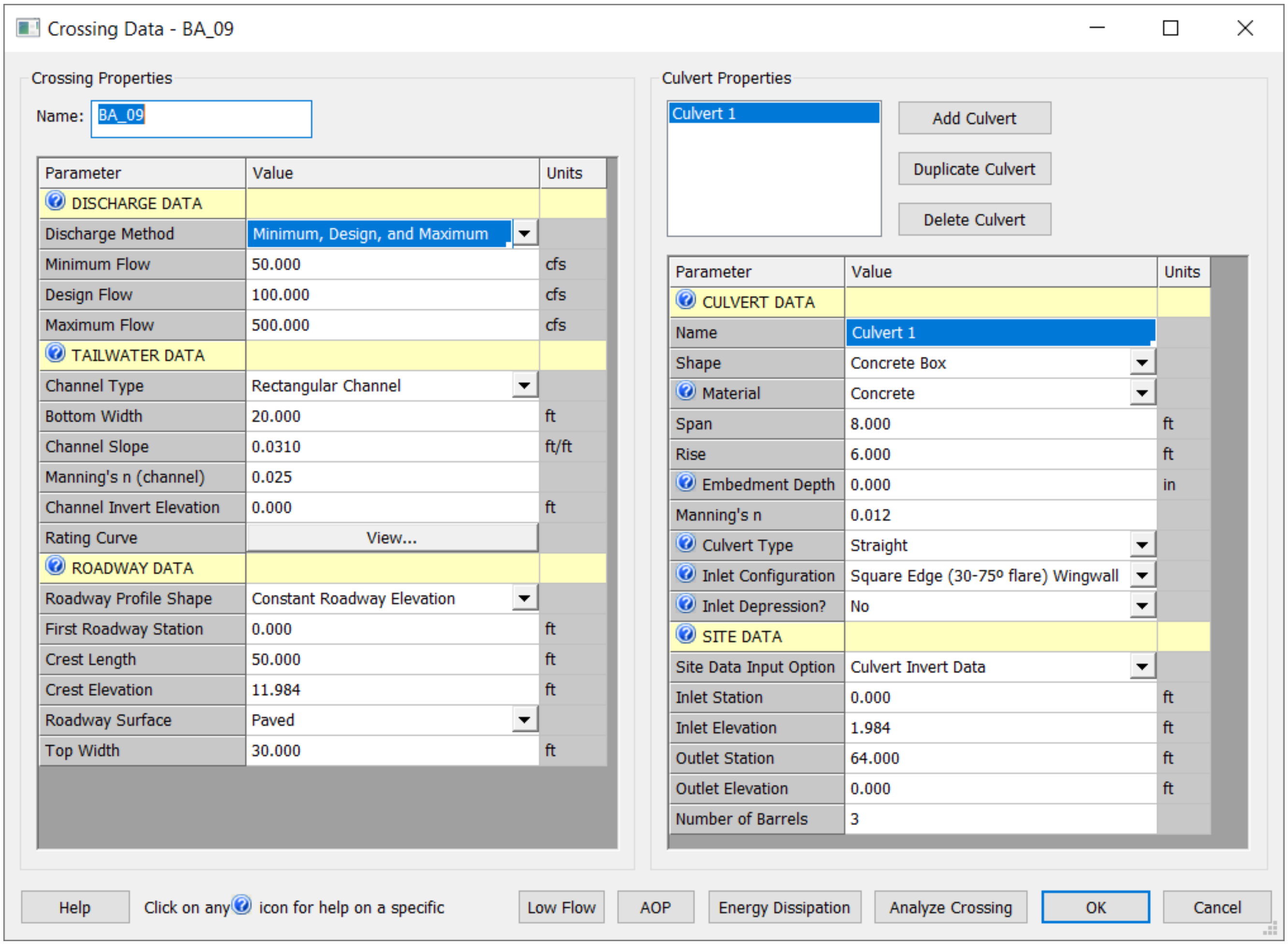
| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 3.04 | 50.00 | 50.00 | 0.00 | 1 |
| 4.24 | 245.00 | 245.00 | 0.00 | 1 |
| 5.13 | 440.00 | 440.00 | 0.00 | 1 |
| 5.37 | 500.00 | 500.00 | 0.00 | 1 |
| 6.60 | 830.00 | 830.00 | 0.00 | 1 |
| 7.25 | 1025.00 | 1025.00 | 0.00 | 1 |
| 7.87 | 1220.00 | 1220.00 | 0.00 | 1 |
| 8.49 | 1415.00 | 1410.69 | 3.98 | 4 |
| 8.94 | 1610.00 | 1548.72 | 61.22 | 4 |
| 9.34 | 1805.00 | 1665.00 | 139.55 | 3 |
| 9.72 | 2000.00 | 1769.74 | 229.97 | 3 |
| 8.40 | 1382.91 | 1382.91 | 0.00 | Overtopping |

BA_09 (Tributary F & Idalia Rd.)

BA_09, upstream

BA_09, downstream

| Number of barrels | Height (ft) | Width (ft) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|---|
| 3 | 6 | 8 | CBC | Square edge, 30-75° wingwall | 64 | 0.031 | 4 |



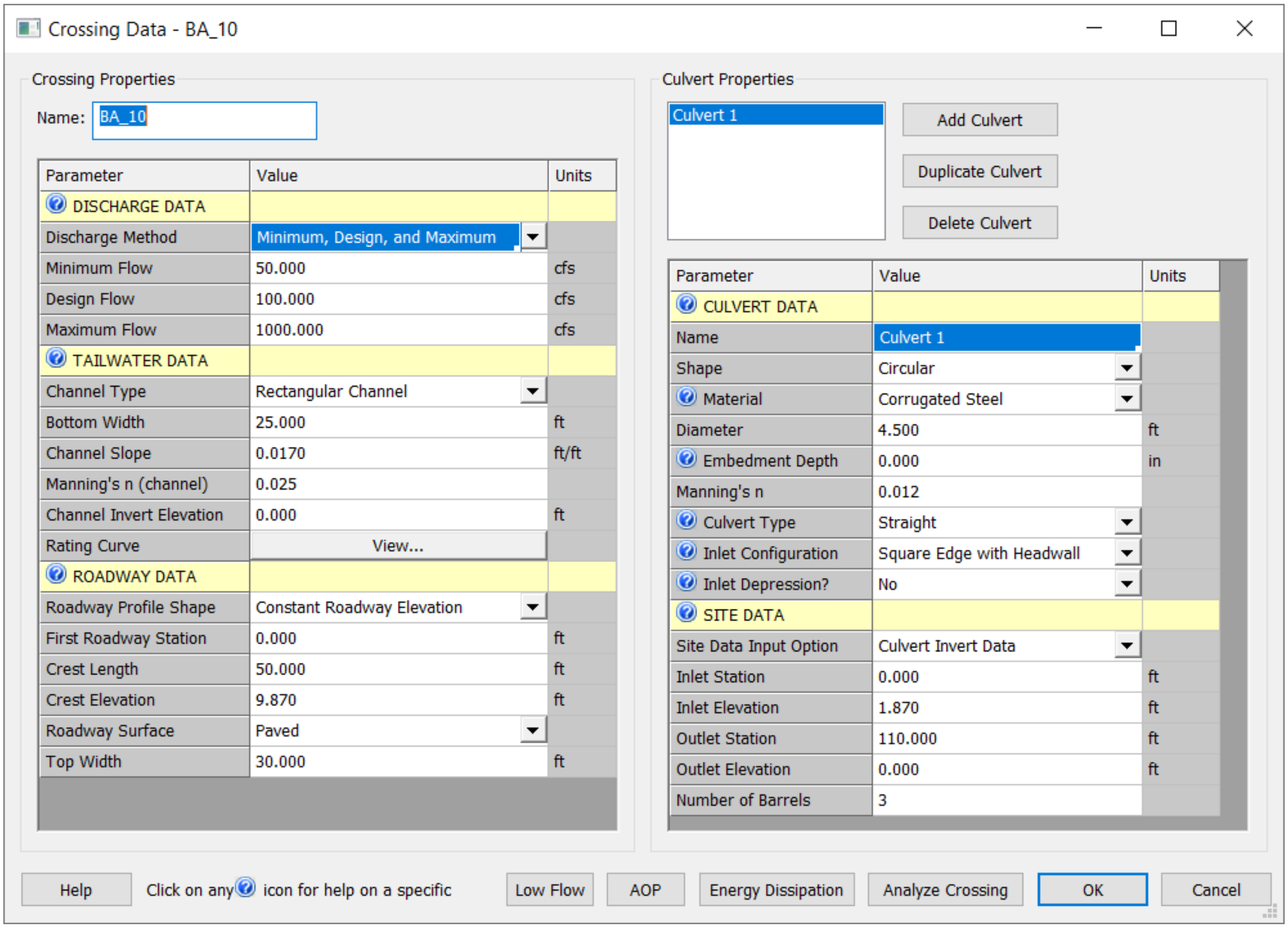

| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 2.75 | 50.00 | 50.00 | 0.00 | 1 |
| 3.16 | 95.00 | 95.00 | 0.00 | 1 |
| 3.20 | 100.00 | 100.00 | 0.00 | 1 |
| 3.81 | 185.00 | 185.00 | 0.00 | 1 |
| 4.10 | 230.00 | 230.00 | 0.00 | 1 |
| 4.37 | 275.00 | 275.00 | 0.00 | 1 |
| 4.62 | 320.00 | 320.00 | 0.00 | 1 |
| 4.86 | 365.00 | 365.00 | 0.00 | 1 |
| 5.10 | 410.00 | 410.00 | 0.00 | 1 |
| 5.34 | 455.00 | 455.00 | 0.00 | 1 |
| 5.57 | 500.00 | 500.00 | 0.00 | 1 |
| 11.98 | 1812.57 | 1812.57 | 0.00 | Overtopping |

BA_10 (Tributary H & Idalia Rd.)

BA_10, upstream

BA_10, downstream

| Number of barrels | Diameter (in) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|
| 3 | 54 | Ultraflow | Headwall | 110 | 0.017 | 3 |



Crossing Data - BA_10

Crossing Properties

Name: BA_10

| Parameter | Value | Units |
|---|---|---|
| DISCHARGE DATA | | |
| Discharge Method | Minimum, Design, and Maximum | |
| Minimum Flow | 50.000 | cfs |
| Design Flow | 100.000 | cfs |
| Maximum Flow | 1000.000 | cfs |
| TAILWATER DATA | | |
| Channel Type | Rectangular Channel | |
| Bottom Width | 25.000 | ft |
| Channel Slope | 0.0170 | ft/ft |
| Manning's n (channel) | 0.025 | |
| Channel Invert Elevation | 0.000 | ft |
| Rating Curve | View... | |
| ROADWAY DATA | | |
| Roadway Profile Shape | Constant Roadway Elevation | |
| First Roadway Station | 0.000 | ft |
| Crest Length | 50.000 | ft |
| Crest Elevation | 9.870 | ft |
| Roadway Surface | Paved | |
| Top Width | 30.000 | ft |

Culvert Properties

Culvert 1

Add Culvert

Duplicate Culvert

Delete Culvert

| Parameter | Value | Units |
|---|---|---|
| CULVERT DATA | | |
| Name | Culvert 1 | |
| Shape | Circular | |
| Material | Corrugated Steel | |
| Diameter | 4.500 | ft |
| Embedment Depth | 0.000 | in |
| Manning's n | 0.012 | |
| Culvert Type | Straight | |
| Inlet Configuration | Square Edge with Headwall | |
| Inlet Depression? | No | |
| SITE DATA | | |
| Site Data Input Option | Culvert Invert Data | |
| Inlet Station | 0.000 | ft |
| Inlet Elevation | 1.870 | ft |
| Outlet Station | 110.000 | ft |
| Outlet Elevation | 0.000 | ft |
| Number of Barrels | 3 | |

Help | Click on any icon for help on a specific | Low Flow | AOP | Energy Dissipation | Analyze Crossing | OK | Cancel

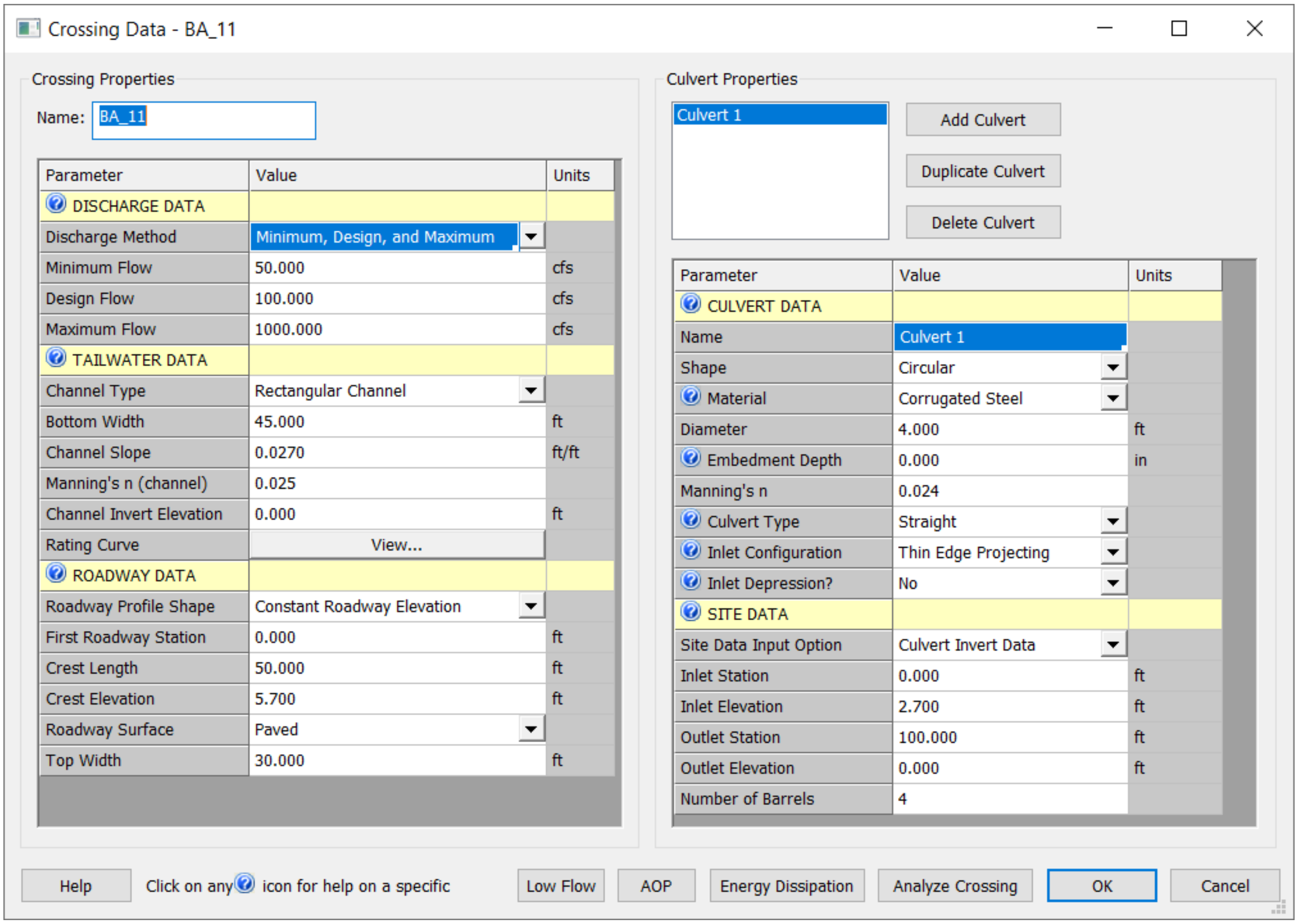
| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 3.44 | 50.00 | 50.00 | 0.00 | 1 |
| 4.14 | 100.00 | 100.00 | 0.00 | 1 |
| 5.73 | 240.00 | 240.00 | 0.00 | 1 |
| 6.79 | 335.00 | 335.00 | 0.00 | 1 |
| 8.03 | 430.00 | 430.00 | 0.00 | 1 |
| 9.54 | 525.00 | 525.00 | 0.00 | 1 |
| 10.35 | 620.00 | 569.53 | 50.37 | 4 |
| 10.75 | 715.00 | 589.97 | 124.87 | 4 |
| 11.09 | 810.00 | 606.75 | 203.16 | 4 |
| 11.39 | 905.00 | 621.37 | 283.57 | 4 |
| 11.67 | 1000.00 | 634.56 | 365.40 | 4 |
| 9.87 | 543.67 | 543.67 | 0.00 | Overtopping |

BA_11 (Tributary H & Iris Rd.)

BA_11, upstream

BA_11, downstream

| Number of barrels | Diameter (in) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|
| 4 | 48 | CMP | Projecting from fill | 100 | 0.027 | 0 (only 3 ft of depth allowed before flow breaks out to the east) |



Crossing Data - BA_11

Crossing Properties

Name: BA_11

| Parameter | Value | Units |
|---|---|---|
| DISCHARGE DATA | | |
| Discharge Method | Minimum, Design, and Maximum | |
| Minimum Flow | 50.000 | cfs |
| Design Flow | 100.000 | cfs |
| Maximum Flow | 1000.000 | cfs |
| TAILWATER DATA | | |
| Channel Type | Rectangular Channel | |
| Bottom Width | 45.000 | ft |
| Channel Slope | 0.0270 | ft/ft |
| Manning's n (channel) | 0.025 | |
| Channel Invert Elevation | 0.000 | ft |
| Rating Curve | View... | |
| ROADWAY DATA | | |
| Roadway Profile Shape | Constant Roadway Elevation | |
| First Roadway Station | 0.000 | ft |
| Crest Length | 50.000 | ft |
| Crest Elevation | 5.700 | ft |
| Roadway Surface | Paved | |
| Top Width | 30.000 | ft |

Culvert Properties

Culvert 1

Add Culvert

Duplicate Culvert

Delete Culvert

| Parameter | Value | Units |
|---|---|---|
| CULVERT DATA | | |
| Name | Culvert 1 | |
| Shape | Circular | |
| Material | Corrugated Steel | |
| Diameter | 4.000 | ft |
| Embedment Depth | 0.000 | in |
| Manning's n | 0.024 | |
| Culvert Type | Straight | |
| Inlet Configuration | Thin Edge Projecting | |
| Inlet Depression? | No | |
| SITE DATA | | |
| Site Data Input Option | Culvert Invert Data | |
| Inlet Station | 0.000 | ft |
| Inlet Elevation | 2.700 | ft |
| Outlet Station | 100.000 | ft |
| Outlet Elevation | 0.000 | ft |
| Number of Barrels | 4 | |

Help

Click on any icon for help on a specific

Low Flow

AOP

Energy Dissipation

Analyze Crossing

OK

Cancel

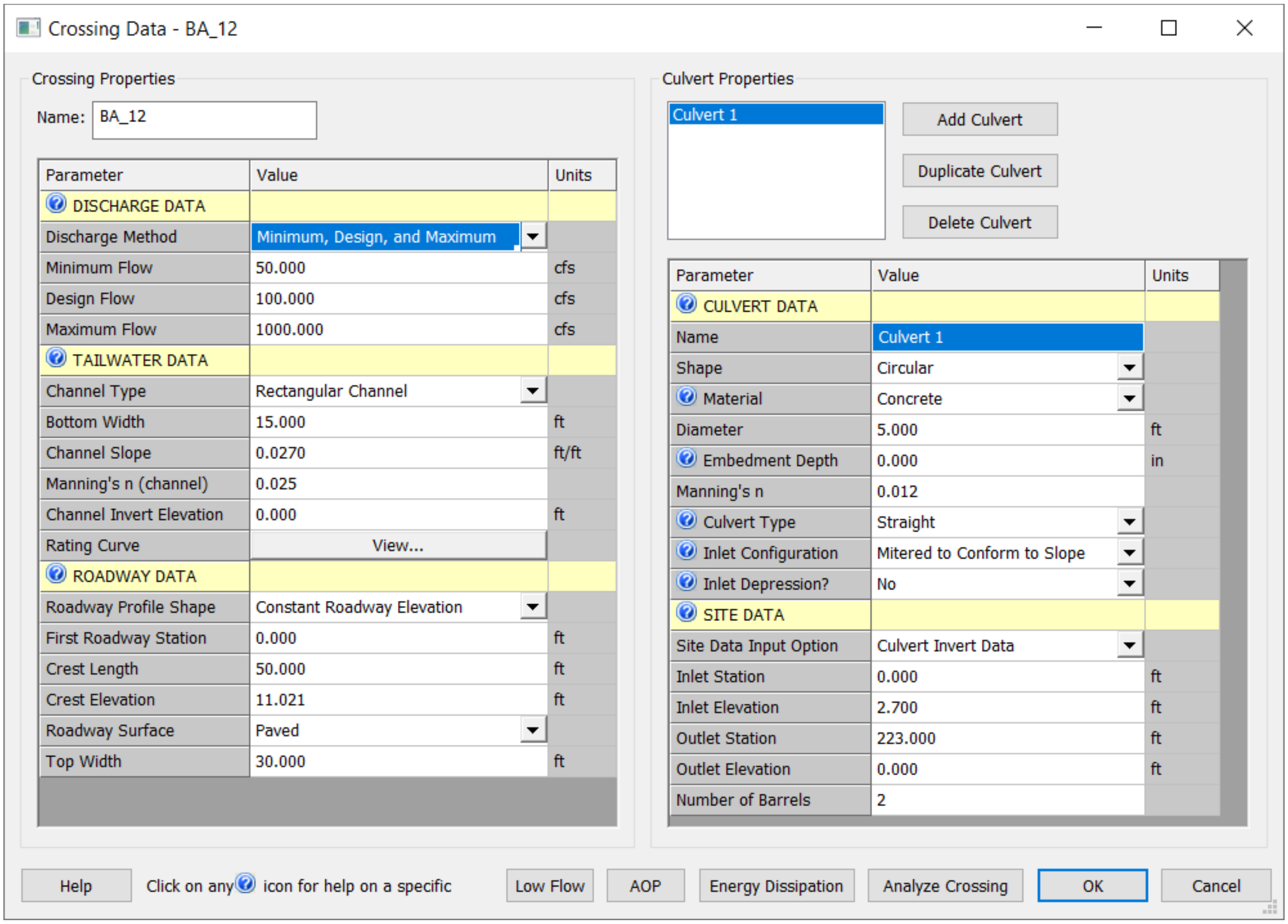
| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 4.19 | 50.00 | 50.00 | 0.00 | 1 |
| 4.87 | 100.00 | 100.00 | 0.00 | 1 |
| 6.08 | 240.00 | 205.23 | 34.69 | 6 |
| 6.44 | 335.00 | 237.76 | 97.09 | 4 |
| 6.76 | 430.00 | 264.83 | 165.10 | 4 |
| 7.05 | 525.00 | 288.42 | 236.54 | 4 |
| 7.31 | 620.00 | 309.42 | 310.55 | 4 |
| 7.56 | 715.00 | 328.44 | 386.18 | 3 |
| 7.81 | 810.00 | 345.86 | 463.80 | 3 |
| 8.04 | 905.00 | 361.92 | 542.79 | 3 |
| 8.26 | 1000.00 | 376.83 | 622.91 | 3 |
| 5.70 | 171.46 | 171.46 | 0.00 | Overtopping |

BA_12 (Tributary I & NM 528)

BA_12, upstream

BA_12, downstream

| Number of barrels | Diameter (in) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|
| 2 | 60 | CMP | Mitered to slope | 223 | 0.027 | 0 |




| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 4.69 | 50.00 | 50.00 | 0.00 | 1 |
| 5.61 | 100.00 | 100.00 | 0.00 | 1 |
| 7.66 | 240.00 | 240.00 | 0.00 | 1 |
| 9.45 | 335.00 | 335.00 | 0.00 | 1 |
| 11.29 | 430.00 | 409.16 | 20.80 | 6 |
| 11.77 | 525.00 | 426.47 | 98.31 | 4 |
| 12.14 | 620.00 | 439.50 | 180.38 | 4 |
| 12.47 | 715.00 | 450.59 | 264.33 | 4 |
| 12.77 | 810.00 | 460.49 | 349.46 | 4 |
| 13.04 | 905.00 | 469.54 | 435.42 | 4 |
| 13.30 | 1000.00 | 477.95 | 522.02 | 4 |
| 11.02 | 399.16 | 399.16 | 0.00 | Overtopping |

BA_13 (Tributary I & Riverside Dr.)

BA_13, upstream

BA_13, downstream

| Number of barrels | Diameter (in) | Material | Entrance | Length (ft) | Slope (ft/ft) | Allowable headwater (ft) |
|---|---|---|---|---|---|---|
| 1 | 66 | RCP | Headwall | 75 | 0.015 | 2.3 |

Crossing Data - BA_13

Crossing Properties

Name: BA_13

| Parameter | Value | Units |
|---|---|---|
| DISCHARGE DATA | | |
| Discharge Method | Minimum, Design, and Maximum | |
| Minimum Flow | 50.000 | cfs |
| Design Flow | 100.000 | cfs |
| Maximum Flow | 1000.000 | cfs |
| TAILWATER DATA | | |
| Channel Type | Rectangular Channel | |
| Bottom Width | 20.000 | ft |
| Channel Slope | 0.0150 | ft/ft |
| Manning's n (channel) | 0.025 | |
| Channel Invert Elevation | 0.000 | ft |
| Rating Curve | View... | |
| ROADWAY DATA | | |
| Roadway Profile Shape | Constant Roadway Elevation | |
| First Roadway Station | 0.000 | ft |
| Crest Length | 50.000 | ft |
| Crest Elevation | 8.925 | ft |
| Roadway Surface | Paved | |
| Top Width | 30.000 | ft |

Culvert Properties

Culvert 1

Add Culvert · Duplicate Culvert · Delete Culvert

| Parameter | Value | Units |
|---|---|---|
| CULVERT DATA | | |
| Name | Culvert 1 | |
| Shape | Circular | |
| Material | Concrete | |
| Diameter | 5.500 | ft |
| Embedment Depth | 0.000 | in |
| Manning's n | 0.012 | |
| Culvert Type | Straight | |
| Inlet Configuration | Square Edge with Headwall | |
| Inlet Depression? | No | |
| SITE DATA | | |
| Site Data Input Option | Culvert Invert Data | |
| Inlet Station | 0.000 | ft |
| Inlet Elevation | 1.125 | ft |
| Outlet Station | 75.000 | ft |
| Outlet Elevation | 0.000 | ft |
| Number of Barrels | 1 | |

Help · Click on any icon for help on a specific · Low Flow · AOP · Energy Dissipation · Analyze Crossing · OK · Cancel

| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 3.76 | 50.00 | 50.00 | 0.00 | 1 |
| 5.17 | 100.00 | 100.00 | 0.00 | 1 |
| 8.82 | 240.00 | 240.00 | 0.00 | 1 |
| 9.54 | 335.00 | 261.20 | 73.64 | 4 |
| 9.95 | 430.00 | 272.29 | 157.57 | 4 |
| 10.30 | 525.00 | 281.30 | 243.61 | 4 |
| 10.61 | 620.00 | 289.12 | 330.82 | 4 |
| 10.89 | 715.00 | 296.11 | 418.85 | 4 |
| 11.16 | 810.00 | 302.52 | 507.45 | 4 |
| 11.41 | 905.00 | 308.43 | 596.18 | 3 |
| 11.66 | 1000.00 | 313.98 | 685.67 | 3 |
| 8.93 | 243.29 | 243.29 | 0.00 | Overtopping |

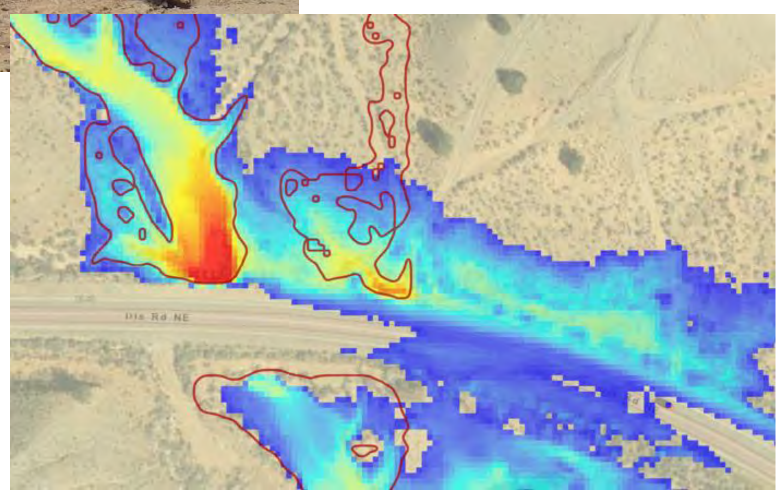
# Appendix F

# BLE Model Updates

# Southern Sandoval County Arroyo Flood Control Authority

## Barranca Watershed Base Level Engineering Model Updates

***Modeling and Results Summary Report***



1203 West Ella Drive
Corrales, NM 87048

DATE SUBMITTED: March 15, 2022

# TABLE OF CONTENTS

# 1.0 BACKGROUND

The Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA) has asked ESP Associates, Inc. to update previously developed 2D hydraulic models that were part of a FEMA Base Level Engineering (BLE) study. The BLE study was completed for SSCAFCA in conjunction with the University of New Mexico Earth Data Analysis Center. Updates to the BLE 2D HEC-RAS models include incorporating culverts at specific locations to assist in identifying additional areas of flooding and support prioritization of future projects. SSCAFCA is currently in the process of updating Watershed Management Plans throughout their jurisdictional area. As structures are identified that might have insufficient capacity, these were passed along for analysis. This report only presents structures within the Barranca Watershed.

## 1.1 PREVIOUS WORK

A BLE analysis was completed for the area within the jurisdictional boundary of SSCAFCA, located just north of Albuquerque, New Mexico in August, 2019. Hydrologic and hydraulic computations and analyses of the BLE study consisted of determining excess precipitation amounts and calculating Water Surface Elevations (WSELs) for the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events, as well as the 1-percent plus and minus events. 2018 lidar data was used as the terrain data supporting the analysis. The 2018 lidar data is a compilation of collections by the Natural Resources Conservation Service and the Mid-Region Council of Governments, each taking place in January of 2018. Hydrologic analyses were completed using HEC-HMS rainfall-runoff modeling to determine excess precipitation values for all flooding events in the project area. Two-dimensional (2D) hydraulic models were developed for the project area using HEC-RAS version 5.0.7. **Figure 1** provides an overview of the modeled areas and generally scoped streamlines (only results within the SSCAFCA jurisdictional bounds are considered as part of this BLE analysis). Results from this analysis were compared with the updated analysis of this study.

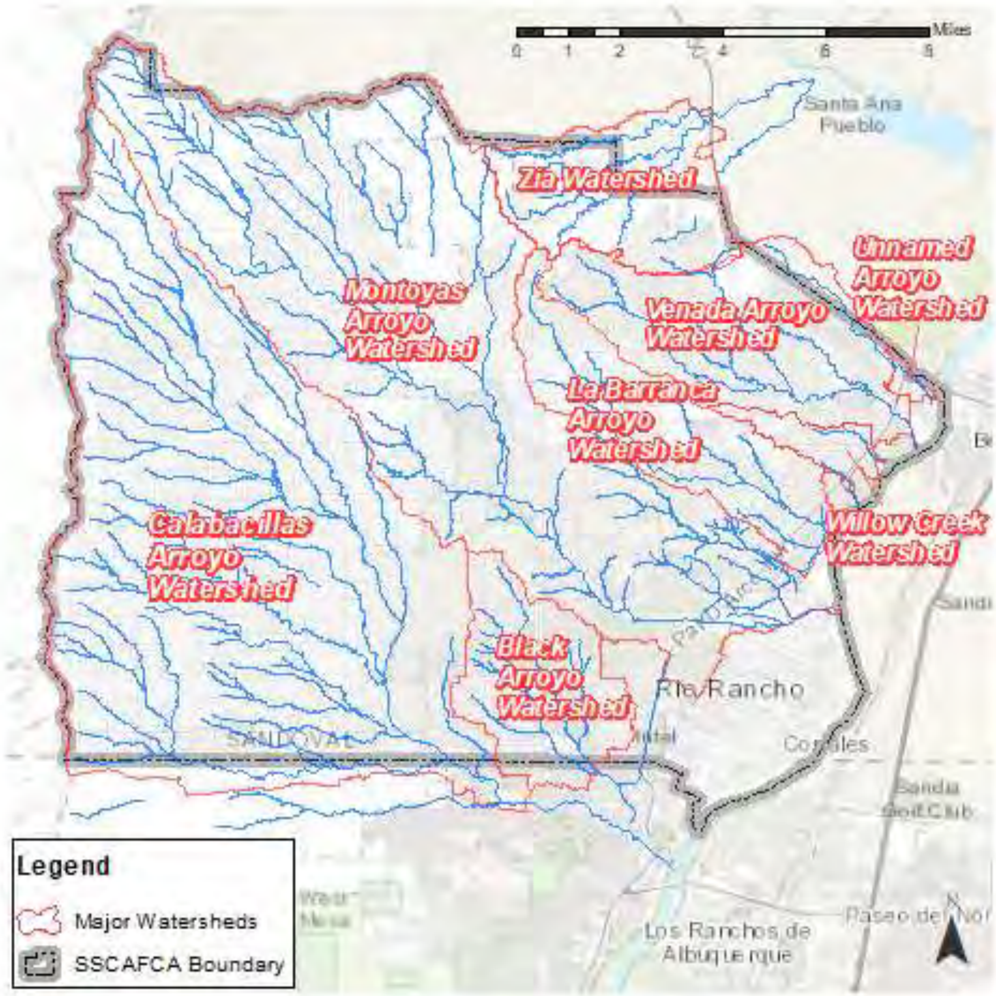



**Figure 1: Model Watershed Overview for BLE Analysis**

# 2.0 UPDATED ANALYSIS PROCEDURE

## 2.1 HYDROLOGY

Hydrologic data provided by SSCAFCA was used for the updated BLE analysis. For the March 15, 2022 submittal of the updated BLE analysis, all structures modeled are located inside the SSCAFCA Barranca Watershed. Existing conditions and developed conditions events were modeled to represent runoff rates of current land uses and proposed land uses, respectively. Flow rates provided by SSCAFCA come from the Barranca Watershed Master Plan effort being completed in 2022. It is understood that these flow rates are calculated in a detailed HEC-HMS model which incorporates items such as routing reaches and detention ponds. **Table 1** below summarizes the data received and used in the updated BLE modeling. Capacities reported from HY-8 modeling of the structures were also included in the data provided, and are contained in **Table 1**. Flow hydrograph boundary conditions were used to incorporate steady discharges through each individual hydraulic model.

**Table 1: Hydrologic Information Provided for Use in Updated BLE Analysis**

| Structure | Location | DA (sq mi) | Existing Q (cfs) | Developed Q (cfs) | Capacity (cfs) |
|---|---|---|---|---|---|
| **BA_01** | Barranca Arroyo & Unser Blvd | 1 | 383 | 562 | 370 |
| **BA_03** | Barranca Arroyo & Idalia Rd | 6 | 1,975 | 3,209 | 1,190 |
| **BA_04** | Barranca Arroyo & NM 528 | 10 | 2,776 | 4,859 | 3,570 |
| **BA_05** | Tributary B & NM 528 | 1 | 304 | 328 | 180 |
| **BA_06** | Tributary B & Sandia Vista Rd | 1 | 347 | 401 | 180 |
| **BA_07** | Tributary F & Paseo del Volcan | 1 | 448 | 489 | 240 |
| **BA_10** | Tributary H & Idalia Rd | 1 | 652 | 1,024 | 540 |
| **BA_11** | Tributary H & Iris Rd | 1 | 906 | 1,321 | 170 |
| **BA_12** | Tributary I & NM 528 | 1 | 587 | 796 | 400 |
| **BA_13** | Tributary I & Riverside Dr | 1 | 701 | 919 | 240 |

## 2.2 HYDRAULIC ANALYSIS

Modeling was completed using HEC-RAS version 6.1. Two plans were created within the modeling for each structure analyzed: the existing conditions storm event (RAS Plan “ExCond_Ex 1pct Annual Chance”) and the developed conditions storm event (RAS Plan “ExCond_Dev 1pct Annual Chance”). Hydrologic inputs for these models were taken directly from the flow table provided, as referenced in Section 2.1 of the report.

The modeling completed is primarily two-dimensional, with structures modeled in HEC-RAS as one-dimensional culverts within SA/2D Connections. The EDAC QL2 lidar (Jan. 2018 flight date) was used as the base terrain data for the updated BLE modeling. This raster dataset was created in New Mexico State Plane with vertical units in feet. All HEC-RAS models were thus developed in New Mexico Central State Plane with a vertical datum of NAVD88 in feet.

As part of this analysis, survey was taken at the structures. Dates of survey on the sealed plans range from December 30, 2021 to January 7, 2022. This survey data typically includes a few shots on the upstream and downstream face of the culverts and a few shots on the road surface just over the culverts. Survey data was provided as a GIS point shapefile and as a PDF document with survey information overlaying aerial imagery. Surveyed culvert inverts were used to set invert elevations and general locations within the hydraulic modeling. Detailed information about each structure is provided in the relevant memo within **Appendix A**. **Figure 2** below shows one of the documents provided.


**Figure 2: Survey PDF Provided for Barranca Structure 4**

At the onset of this analysis, various survey data incorporation was tested. A test was completed to compare the incorporation of all survey terrain shots (any headwall shots, any channel shots, and road surface) to the incorporation of only the road surface. No significant difference in reported water surfaces or flows were noted; therefore, due to the limited survey taken, it was decided that the 2018 lidar would be used with the exception of the road surface. The final terrain used in modeling is therefore a combined terrain dataset with surveyed elevations at the road surface where available, a small (3-foot buffer) burned invert elevation value at the surveyed culvert inverts to eliminate HEC-RAS automated errors, and 2018 lidar elsewhere.

Mesh size was initially set to a 50-foot by 50-foot grid covering the structure and a small area upstream and downstream of the structure. This mesh was then refined as necessary for the unique geometry present in and around the structure by using targeted cell size adjustments and breaklines. **Figure 3** below shows how breaklines adjust the cell faces within the computational mesh. Final mesh sizes for each structure are detailed in the relevant memos contained in **Appendix A**.

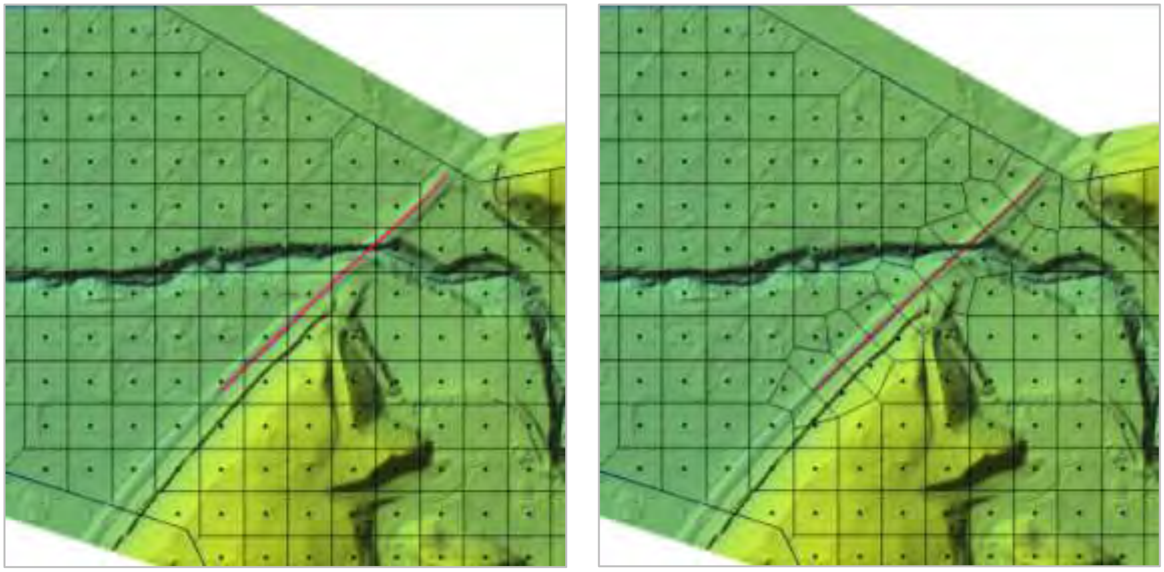


**Figure 3: Breakline Cell Adjustment in HEC-RAS**

Manning's n-values used for the culverts were incorporated based upon the culvert material type. These values are listed below in **Table 2**. Manning's n-values used in the 2D areas of the study were refined along primary flow paths to reflect the n-values recommended in the SSCAFCA Hydrology Manual. Areas beyond the primary flow path use a value derived from the National Land Cover Dataset, as used in the original 2019 BLE modeling. Values derived from the NLCD and the associated manning's n-value used are detailed in **Table 3**. In certain models within the Barranca watershed, overflow paths were present near structures. In these scenarios, the manning's value was raised to 10.0 at the location of the structure to allow storage of water but little conveyance, as would be anticipated in reality.

**Table 2: Manning's N-values Used in Refinement/Structure Areas**

| Channel Type | Manning's n value |
|---|---|
| Sand channel/arroyo | 0.025 |
| Troweled concrete | 0.013 |
| Streets (asphalt) | 0.017 |
| Reinforced concrete pipe | 0.013 |
| Reinforced concrete box | 0.015 |

**Table 3: Manning's N-value Summary for Base HEC-RAS Model Development**

| NLCD Land Cover Value | Description | Manning's n-value |
|---|---|---|
| 11 | Open Water | 0.02 |
| 21 | Developed, Open Space | 0.02 |
| 22 | Developed, Low Intensity | 0.04 |
| 23 | Developed, Medium Intensity | 0.06 |
| 24 | Developed, High Intensity | 0.08 |
| 31 | Barren Land | 0.025 |
| 41 | Deciduous Forest | 0.06 |
| 42 | Evergreen Forest | 0.06 |
| 52 | Shrub/Scrub | 0.035 |
| 71 | Herbaceous | 0.025 |
| 81 | Hay/Pasture | 0.025 |
| 82 | Cultivated Crops | 0.04 |
| 90 | Woody Wetlands | 0.10 |
| 95 | Emergent Herbaceous Wetlands | 0.035 |

A normal depth boundary condition was placed on the 2D modeling surface downstream of each structure area, such that any backwater effect along the primary flow path is anticipated to be resolved by the distance from the structure. For models containing multiple structures, the normal depth boundary was placed beneath the most downstream structure. Models were run until the outlets reported a discharge within 5% of the inlet flow. Modeling errors were resolved where possible; all modeling errors above 1-foot (following the first few time steps where calculation time steps are reduced) were eliminated from model runs.

## 3.0 MODELING RESULTS

During the model refinement process, automated mapping from the HEC-RAS tool RAS Mapper was used to ensure cell spacing and alignment was appropriate. For the final mapping, a manual process was used. The center point of each cell was exported from HEC-RAS with the associated maximum water surface elevation of the corresponding cell. Next, a triangulated terrain network was created from the cells which was then used to create a water surface elevation raster. To create a depth grid, the terrain (consisting of the surveyed road surface blended with the 2018 lidar data) was subtracted from the water surface elevation raster. This depth raster was reviewed and hand edits were made to eliminate disconnected areas of mapping to create the final reported mapping. **Appendix A** details the modeling results for each structure including a graphic depiction of the mapping and numeric values of reported structure flows and ponding. In support of this report, HEC-RAS models and depth grids for the Existing and Developed Conditions were provided.

# Appendix A
# Modeling Summary and Results
# Barranca Watershed

## Structure BA_01

| | |
|---|---|
| Structure Name: | BA_01 |
| Structure Location: | Barranca Arroyo and Unser Blvd NE crossing (Approximately 325' SW of Cayenne Rd and Unser Blvd NE intersection) |
| Watershed: | Barranca |
| Barrel Type: | Corrugated Metal Pipe |
| Number of Barrels: | 4 |
| Barrel Dimensions: | 42" |
| US Culvert Invert(s), E to W: | 5760.25', 5760.63',5760.70',5761.03' |
| DS Culvert Invert(s), E to W: | 5759.50', 5759.36', 5759.31', 5759.35' |
| US Top of Headwall: | Approximately 5766.59' |
| DS Top of Headwall: | Approximately 5766.36' |
| Road Crown Elev. At Culverts: | Approximately 5767.61 |
| Rail (Y/N): | Y |

BA_01, upstream

BA_01, downstream

**Figure 1: Structure BA_01, Photos Provided by SSCAFCA**

Structure BA_01 was modeled using survey data obtained by Wayjohn Surveying, Inc. on December 16, 2021. Approximately 39.2 acres were modeled in 2D using HEC-RAS 6.1. Cell sizes within the 2D modeled area range from 73.9 square feet to 5,666.5 square feet. The average cell size in the model was 748.6 square feet.

Flows were taken as reported in the December 2021 Barranca Watershed Management Plan and incorporated into a boundary at the upstream end of the hydraulic modeling using boundary condition lines with a uniform inflow for the model run duration. Peak flows are shown in the table below.

**Table 1: Flow Data Provided by SSCAFCA**

| Storm Event | Peak Flow (CFS) |
|---|---|
| Existing Conditions | 383 |
| Developed Conditions | 562 |
| Culvert Capacity | 370 |

The model was run until the summation of inflows was achieved at the downstream end of the model. The model was run for a duration of 2 hours to ensure no significant instabilities would occur.

The model results showed that the capacity of the culvert is not sufficient to convey the flow downstream in either the existing or developed conditions. Overtopping is expected on Unser Boulevard with depths of approximately 0.2 feet and 0.6 feet in existing and developed conditions, respectively. Graphic and tabular results are shown below.

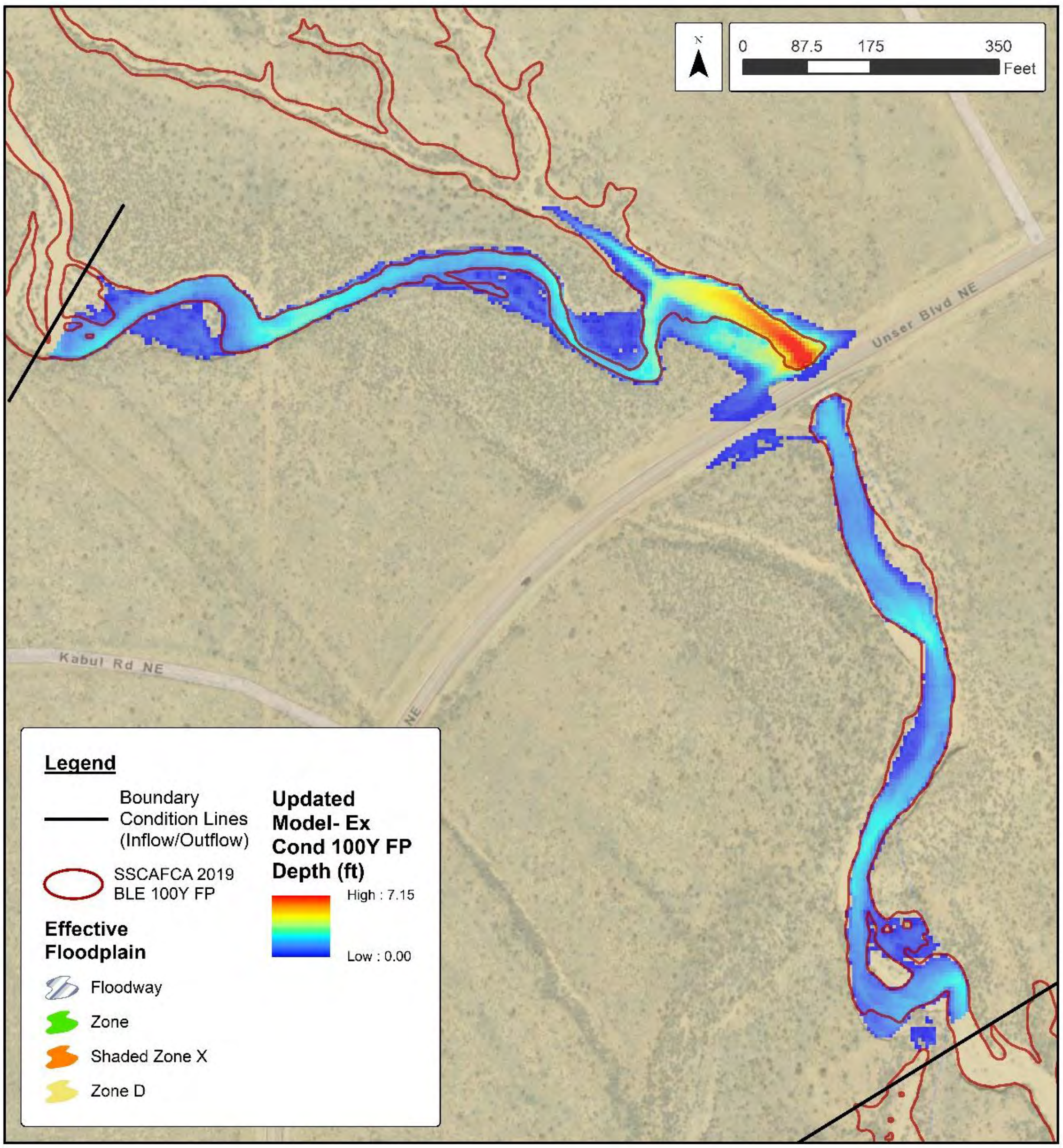



**Figure 2: Existing Conditions Compared with FEMA BLE Results – Full Model Extents**

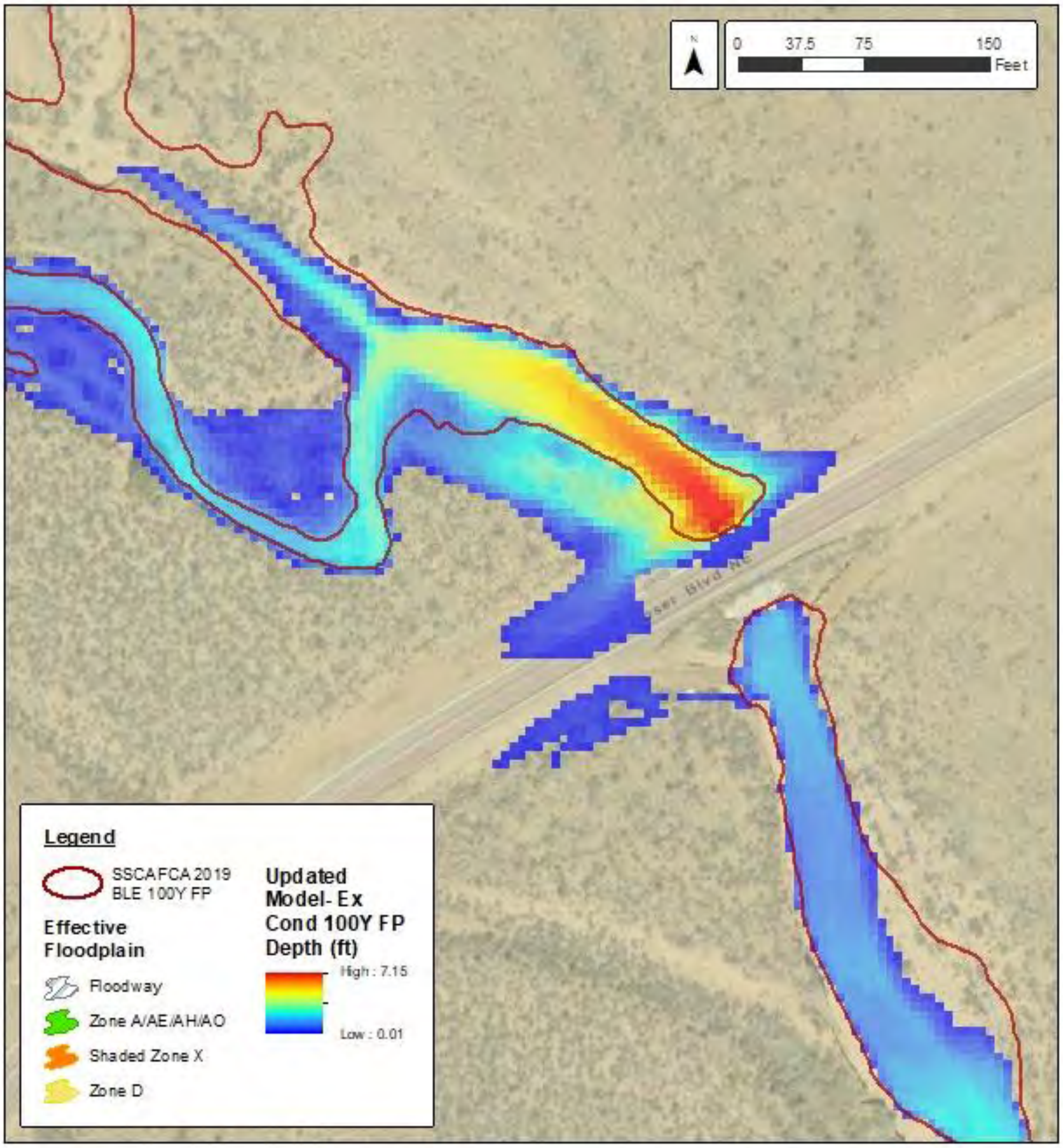



**Figure 3: Existing Conditions Compared with FEMA BLE Results**

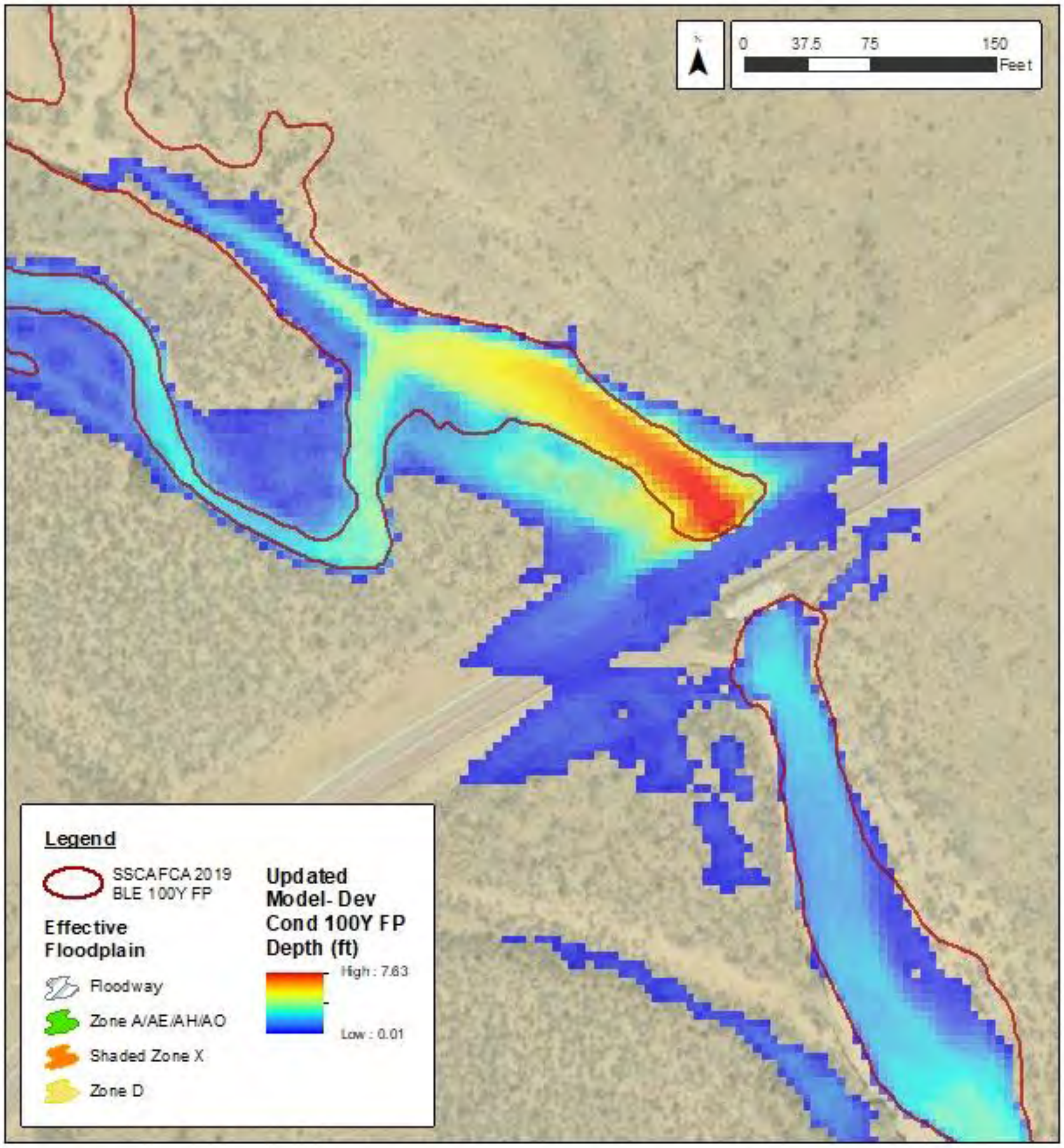



**Figure 4: Developed Conditions Compared with FEMA BLE Results**

**Table 2: Updated BLE Model Results Synopsis**

| US Crown of Culvert (ft) | Top of Road (ft) (approx.) | Conditions | Upstream WSEL (ft) | Downstream WSEL (ft) | Depth Over Rd Based on US WSEL (ft) | Modeled Flow at US Boundary (cfs) | Total Max Flow Through Culverts (cfs) | Flow Over Road (cfs) |
|---|---|---|---|---|---|---|---|---|
| 5763.75 to 5764.53 | 5767.6 | Existing | 5767.64 | 5760.29 | 0.04 | 383 | 371 | 13 |
| | | Developed | 5768.13 | 5760.26 | 0.5 | 562 | 391 | 170 |

Table 2 above details the relevant geometry of the structure compared with the modeling results. The upstream water surface elevation impacts the flow through the culverts, whether the culverts are submerged on the upstream end, and whether the road overtops in the modeled storm event. The 'Total Max Flow Through Culverts' reported in the table is the summation of flow reported in each culvert, and the 'Flow Over Road' reported in the table is the weir flow recorded in the modeling.

For BA_01, the culvert capacity reported in the Barranca WMP (December 2021) is 370 cfs. The modeling showed that the culverts were able to convey approximately 371 cfs in the Existing Rainfall event with submerged culvert inlets and some road overtopping. It also shows that the culverts are able to convey approximately 391 cfs in the Developed Rainfall event with submerged culvert inlets and road overtopping occurring. The differences in the WMP capacity and the modeled capacity is likely due to a combination of calculation methodology differences and more specific data.

Structure BA_01 restricted flow in both Existing and Developed Conditions, resulting in ponding occurring on the roadway. The detailed raster mapping shows that the deepest ponding occurs just west of the structure, with depths of approximately 0.2 and 0.6 feet occurring in existing and developed conditions, respectively.

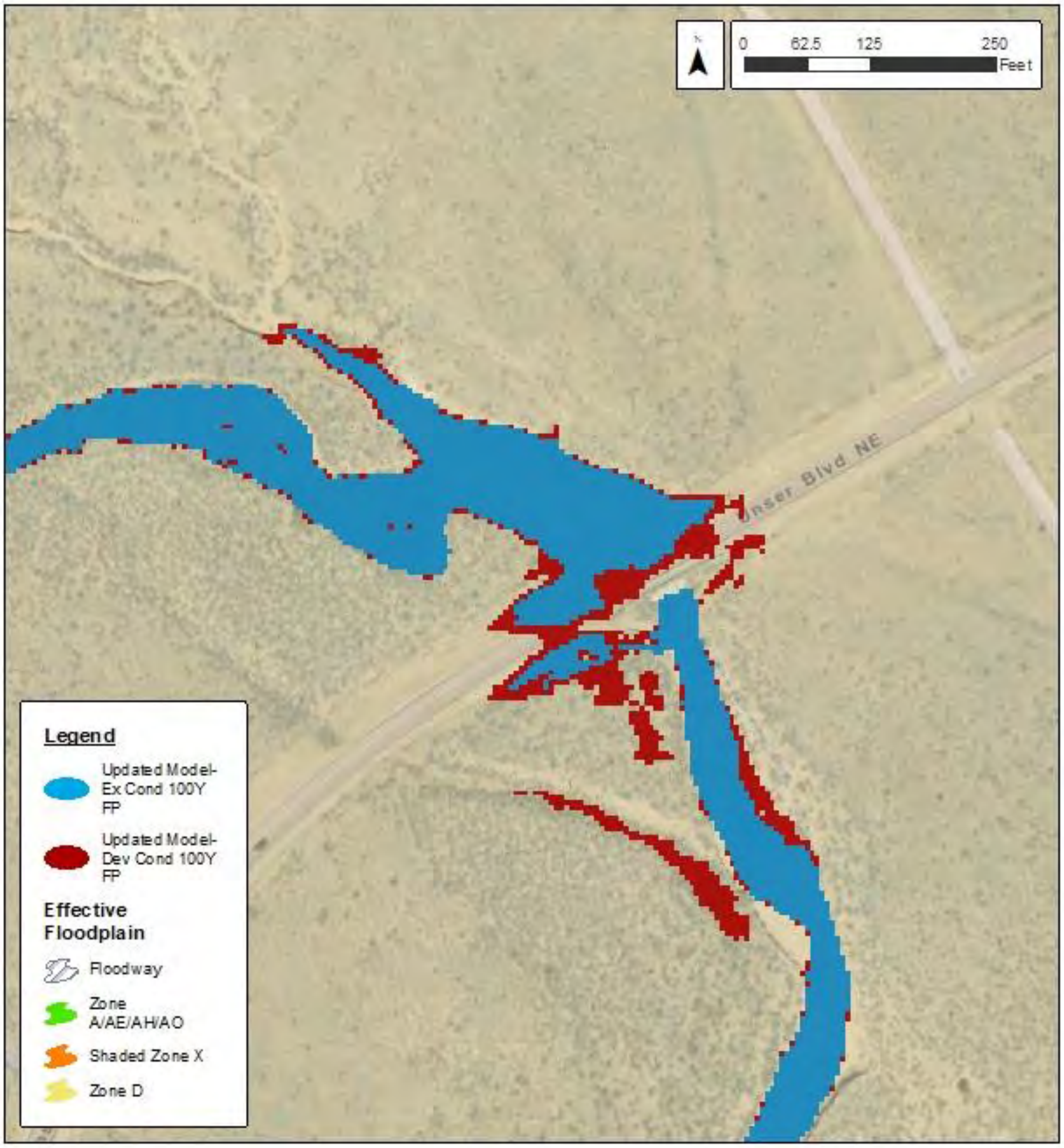



**Figure 5: Mapping Comparison of Existing and Developed Conditions**

# Structure BA_03

| | |
|---|---|
| Structure Name: | BA_03 |
| Structure Location: | Barranca Arroyo and Idalia Rd NE crossing (Approximately 200' west of Idalia Rd NE and Barranca Dr NE intersection) |
| Watershed: | Barranca |
| Barrel Type: | Corrugated Metal Pipe, Elliptical |
| Number of Barrels: | 4 |
| Barrel Dimensions: | 95’’ wide x 67’’ high |
| US Culvert Invert(s), NE to SW: | 5279.49’, 5279.58’, 5279.8’, 5279.90’ |
| DS Culvert Invert(s), NE to SW: | 5278.42’, 5278.23’, 5278.54’, 5278.82’ |
| US Top of Headwall: | Approximately 5287.5’ |
| DS Top of Headwall: | Approximately 5287.1’ |
| Road Surface Elev. At Culverts: | Curbs: NA<br>Road: Approximately 5288.1’<br>Median: NA |
| Rail (Y/N): | Y |

BA_03 (Barranca Arroyo & Idalia Rd.)

BA_03, upstream

BA_03, downstream

**Figure 1: Structure BA_03, photos provided by SSCAFA**

BA_03 was modeled using survey data obtained by Wayjohn Surveying, Inc. on December 16, 2021. Approximately 45.7 acres were modeled in 2D using HEC-RAS 6.1. Cell sizes within the 2D modeled area range from 126.4 square feet to 4,921 square feet. The average cell size in the model is 1,312.8 square feet.

Flow values were taken as reported in the December 2021 Barranca Watershed Management Plan and incorporated into a boundary at the upstream end of the hydraulic modeling using boundary condition lines with a uniform inflow for the model run duration. Assigned flow values at structure BA_03 are shown in the table below.

**Table 1: Flow Data Provided by SSCAFCA**

| Storm Event | Peak Flow (CFS) |
|---|---|
| Existing Conditions | 1,975 |
| Developed Conditions | 3,209 |
| Culvert Capacity | 1,190 |

The model was run until the summation of inflows was achieved at the downstream end of the model, and for a short time following to ensure no significant instabilities were occurring in the model. The run duration for each event was 2 hours.

The model results show that the capacity of the culverts is not sufficient to convey the flow downstream in both existing and developed conditions.

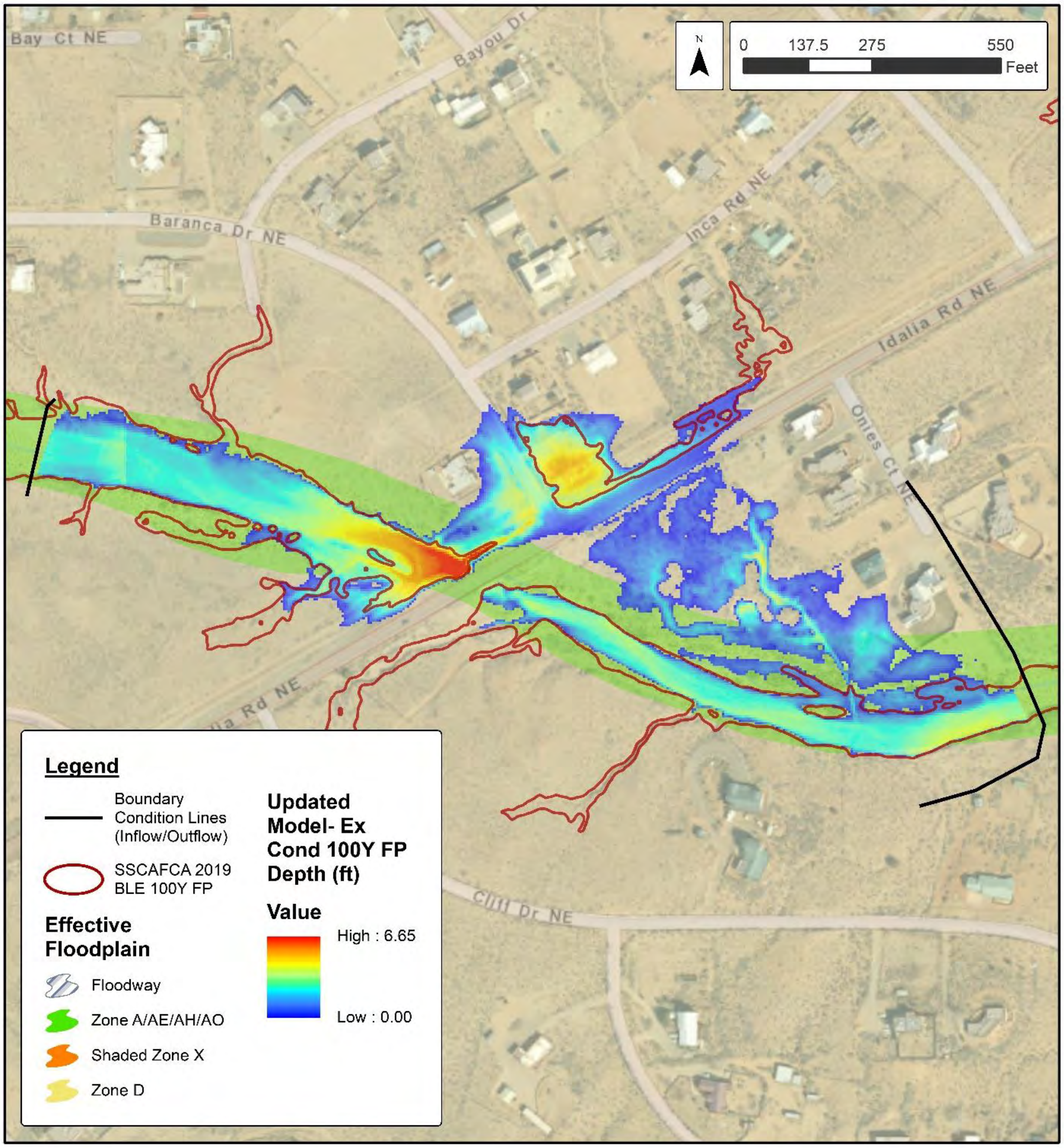



**Figure 2: Existing Conditions Compared with FEMA BLE Results – Full Model Extents**

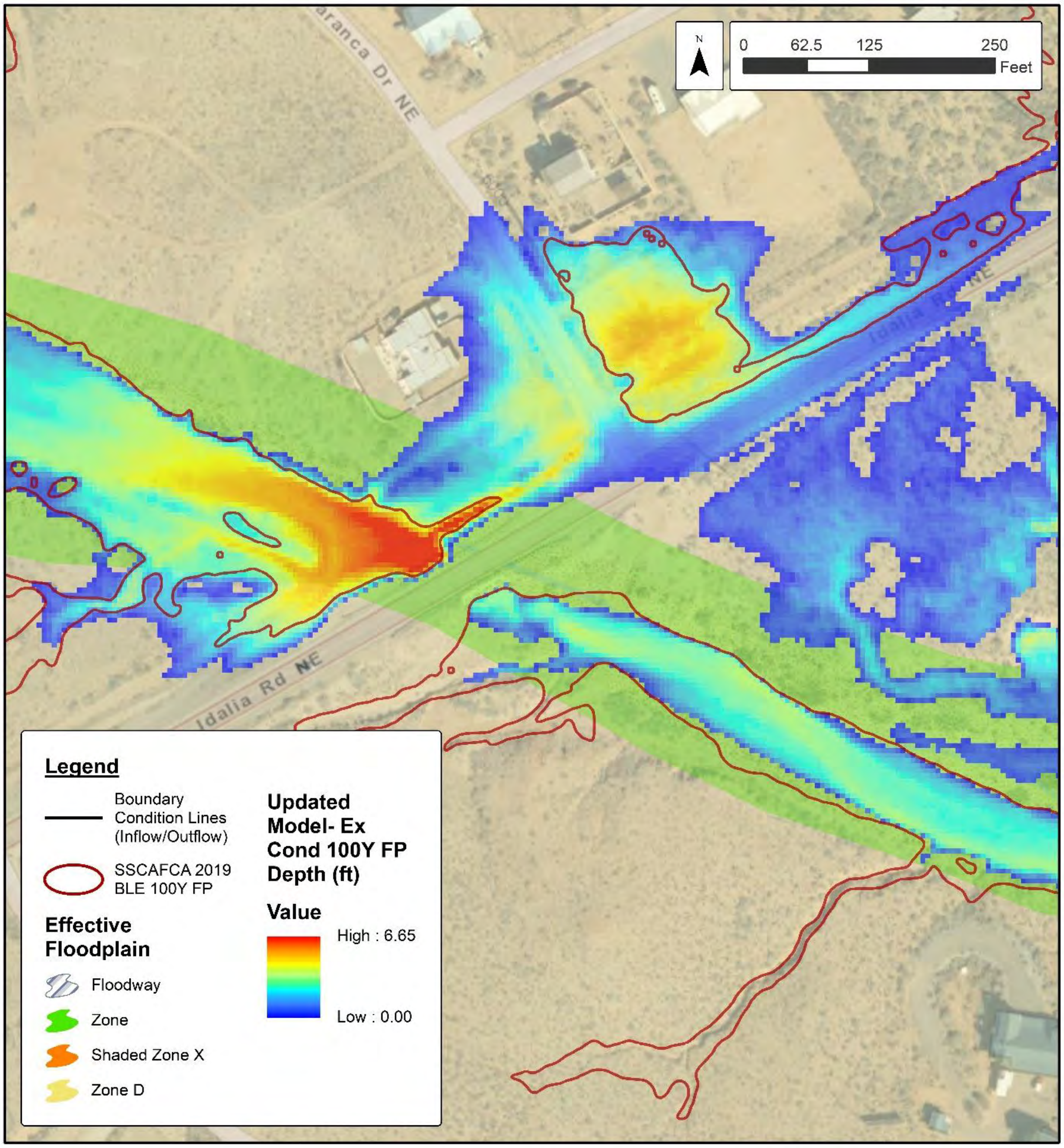



**Figure 3: Existing Conditions Compared with FEMA BLE Results**

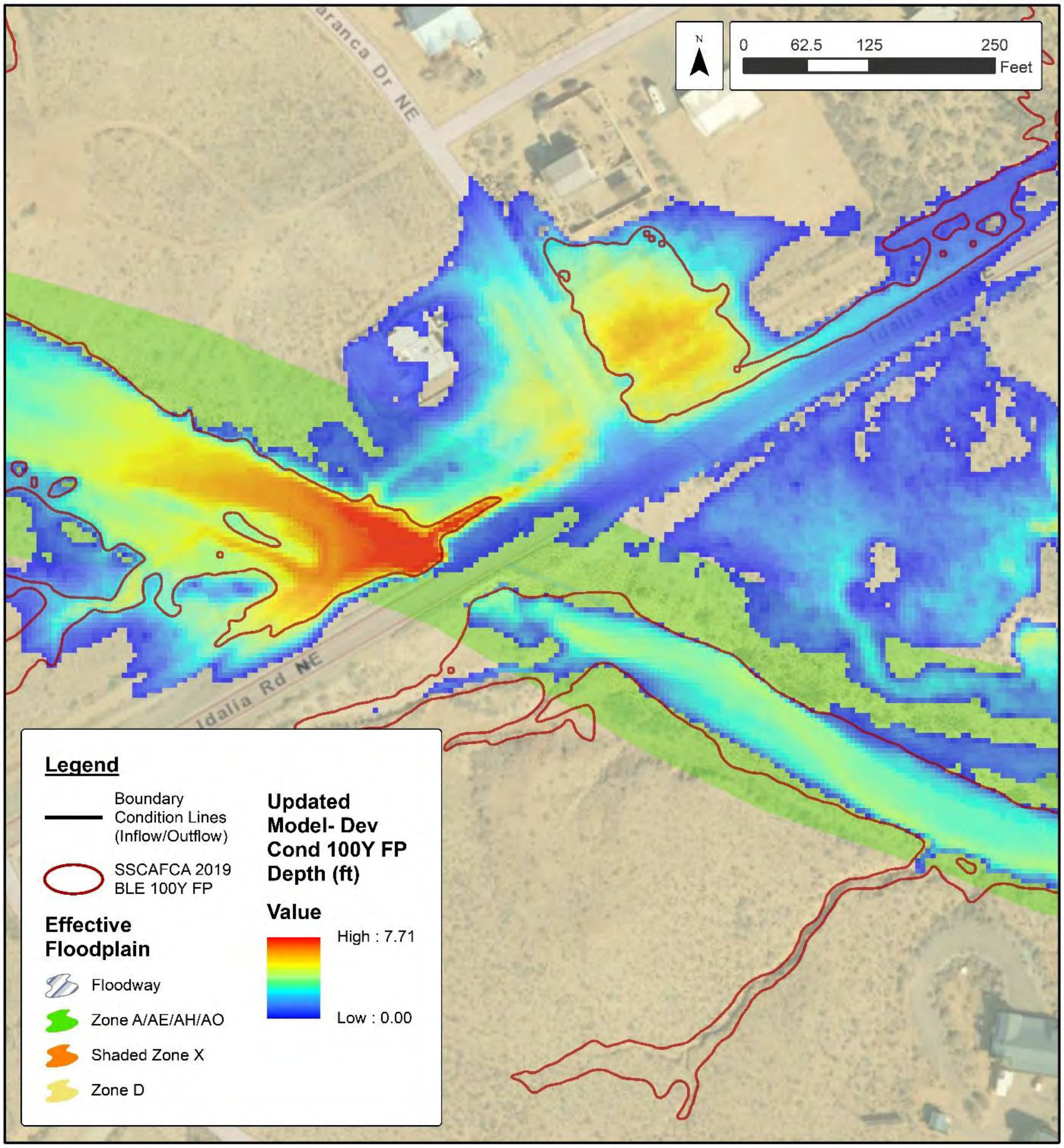



**Figure 4: Developed Conditions Compared with FEMA BLE Results**

**Table 2: Updated BLE Model Results Synopsis**

| US Crown of Culvert (ft) | Top of Road (ft) (approx.) | Conditions | Upstream WSEL (ft) | Downstream WSEL (ft) | Depth Over Rd Based on US WSEL (ft) | Modeled Flow at US Boundary (cfs) | Total Max Flow Through Culverts (cfs) | Flow Over Road (cfs) |
|---|---|---|---|---|---|---|---|---|
| 5285.1 | 5288.0 | Existing | 5286.79 | 5280.51 | - | 1,975 | 1,120 | 855 |
| | | Developed | 5287.91 | 5280.84 | - | 3,209 | 1,369 | 1,840 |

**The local low point of the road occurs east of the structure; therefore, maximum mapping of the analysis and the 'depth over road' based on the comparison of headwater water surface elevations and the top of road at structure may not match.*

Table 2 details the relevant geometry of the structure compared with the modeling results. The upstream water surface elevation impacts the flow through the culverts, whether the culverts are submerged on the upstream end, and whether the road overtops in the modeled storm event. The 'Total Max Flow Through Culverts' reported in the table is the summation of flow reported in each culvert, and the 'Flow Over Road' reported in the table is the weir flow recorded in the modeling.

For BA_03, the culvert capacity reported in the Barranca WMP (December 2021) is 1,190 cfs. The modeling showed that the culverts convey approximately 1,120 cfs in the existing conditions event with submerged culvert inlets and road overtopping occurring at a low point in the road to the east of the structure. It should be noted that the road centerline elevation just east of the structure is approximately 5284.5 feet, while the crown of the culverts range from approximately 5285 feet and 5285.5 feet.

The modeling shows that the culverts convey approximately 1,370 cfs in the developed conditions event with submerged culvert inlets and road overtopping occurring. The differences in the WMP capacity and the modeled capacity is likely due to a combination of calculation methodology differences and more specific data.

According to the computed water surface elevations and the approximate terrain elevations on Idalia Road, depths of approximately 1.0 and 1.7 feet occur in the existing conditions and developed conditions modeling, respectively. A sump occurs on Barranca Drive just north of the intersection with Idalia Road. According to the modeled depths and approximate road elevations, 2.8 feet of ponding is expected to occur in the existing flow condition, and 3.5 feet of ponding is expected to occur in the developed flow condition.

For each event, the primary location of ponding is east of the structure, where a sump exists in the terrain. Also of concern is the sump on Barranca Drive near the intersection with Idalia Road. A more significant sump exists along this road and is more expansive, including nearby residential parcels. Currently, the limited capacity of the culverts combined with the higher elevations along Idalia Road result in significant inundation of Barranca Drive and impacts to properties near the road intersection, including a home at the northwest corner of the intersection.

The inundation boundaries and impacted structures are shown in Figure 6. What appears to be a casita along the Onies Court cul-de-sac is also impacted during each flow condition as a result of overflow drainage paths off of Idalia Road.

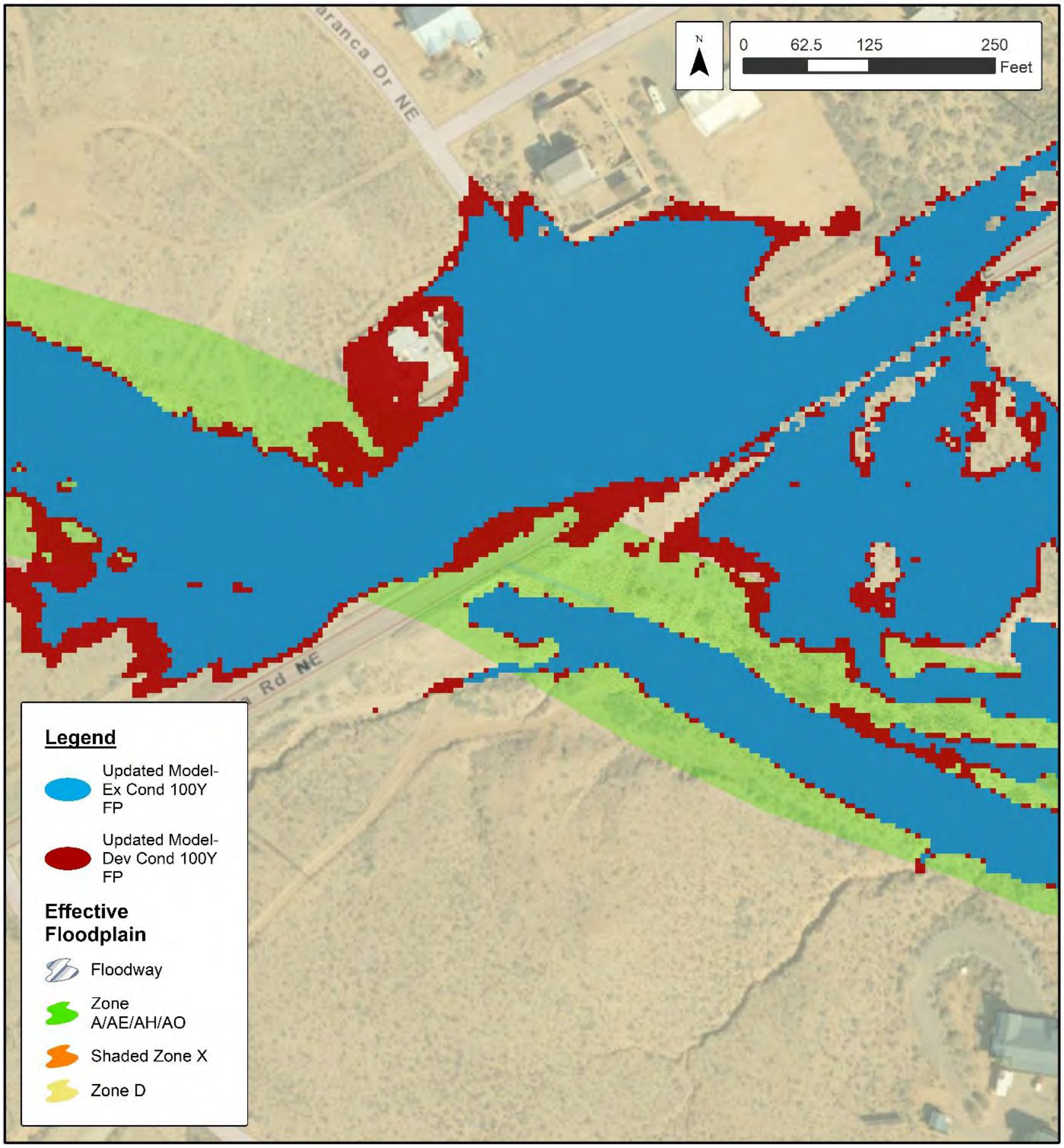



**Figure 5: Mapping Comparison of Existing and Developed Conditions**

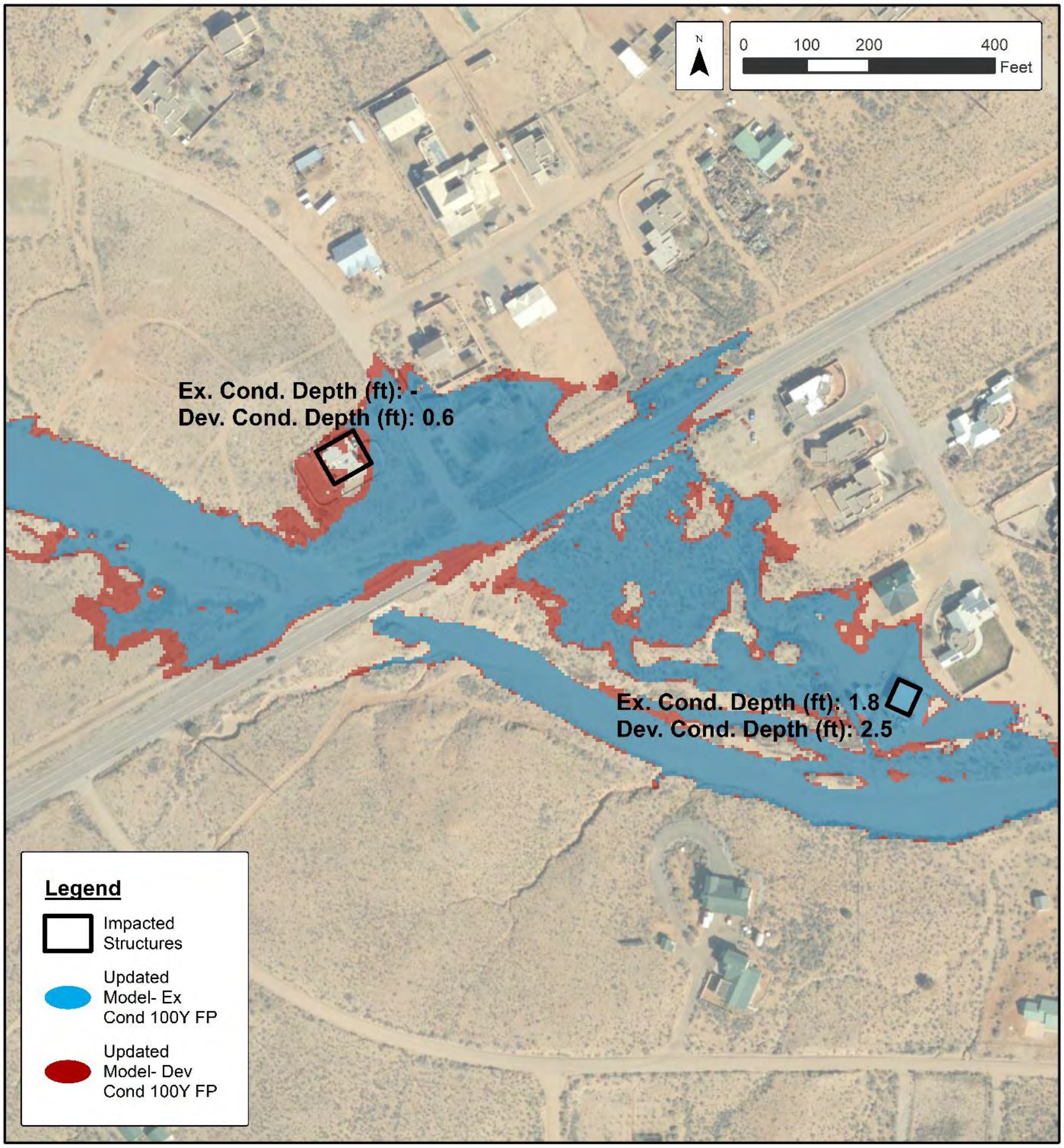



**Figure 6: Impacted Structures – Existing and Developed Conditions**

## Structure BA_04

| | |
|---|---|
| Structure Name: | BA_04 |
| Structure Location: | Barranca Arroyo and NM 528 (Approximately 700' southwest of intersection of NM 528 and Iris Rd) |
| Watershed: | Barranca |
| Barrel Type: | Reinforced Concrete Box |
| Number of Barrels: | 2 |
| Barrel Dimensions: | 14’ W x 10’ H |
| US Culvert Invert, NE to SW: | 5102.90’, 5102.80’ |
| DS Culvert Invert, NE to SW: | 5098.98’, 5099.05’ |
| US Top of Headwall: | Approximately 5115.4’ |
| DS Top of Headwall: | Approximately 5111.28’ |
| Road Surface Elev. At Culverts: | Road: Approximately 5119.8’<br>Median: Approximately 5120.4’ |
| Rail (Y/N): | Y |

BA_04 (Barranca Arroyo & NM 528)

BA_04, upstream

BA_04, downstream

**Figure 1: Structure BA_04, photos provided by SSCAFA**

Structures BA_04 (shown in Figure 1), BA_12, and BA_13 are in very close proximity with no tributaries joining in between (as shown in Figure 2) and have been modeled together. BA_04 (Barranca Arroyo and NM 528) is located approximately 1,900 feet southwest of structure BA_12, each along NM 528. Overflows from BA_04 and BA_12 combine along the northern edge of NM 528 and some of this combined flow travels down Riverside Drive before entering Tributary I at BA_13.

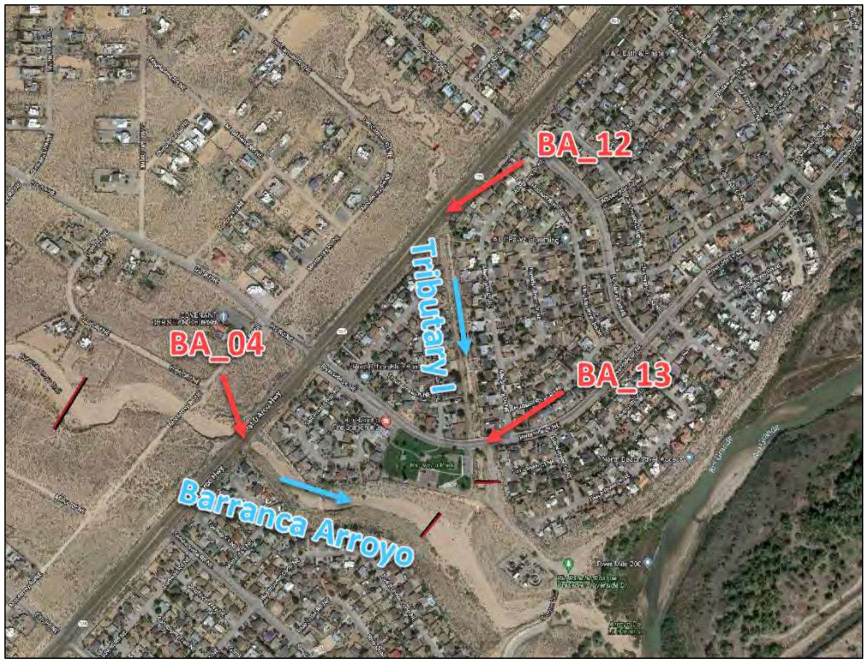



**Figure 2: Map showing the modeled structures**

BA_04 was modeled using survey data obtained by Wayjohn Surveying, Inc. on January 3, 2022. Approximately 88.3 acres were modeled in 2D using HEC-RAS 6.1. Cell sizes within the 2D modeled area range from 37.2 square feet to 6048.1 square feet. The average cell size in the model is 423.2 square feet.

Flow values were taken as reported in the December 2021 Baranca Watershed Management Plan (WMP) and incorporated into a boundary at the upstream end of the hydraulic modeling using boundary condition lines with a uniform inflow for the model run duration. Assigned flow values at structure BA_04 are shown in the table below.

**Table 1: Flow Data Provided by SSCAFCA**

| Storm Event | Peak Flow (CFS) |
|---|---|
| Existing Conditions | 2,776 |
| Developed Conditions | 4,859 |
| Culvert Capacity | 3,570 |

The model was run until the summation of inflows was achieved at the downstream end of the model. The model was run for a duration of 2 hours to ensure no significant instabilities would occur. The model results show that the capacity of the culverts is not sufficient to convey the flow downstream in the developed conditions.

Although no overtopping is expected on NM 528 at BA_04 for the exisiting conditions, overtopping from BA_12 is expected to overflow onto NM 528 and cause ponding between the two structures. The existing walls around residential and business properties, where flooding impacts are expected, are included in the model geometry as well as the barrier (approximately 5 feet tall) located along the eastbound lanes of NM 528. For the developed conditions flow, both BA_04 and BA_12 overtop directly onto NM 528.

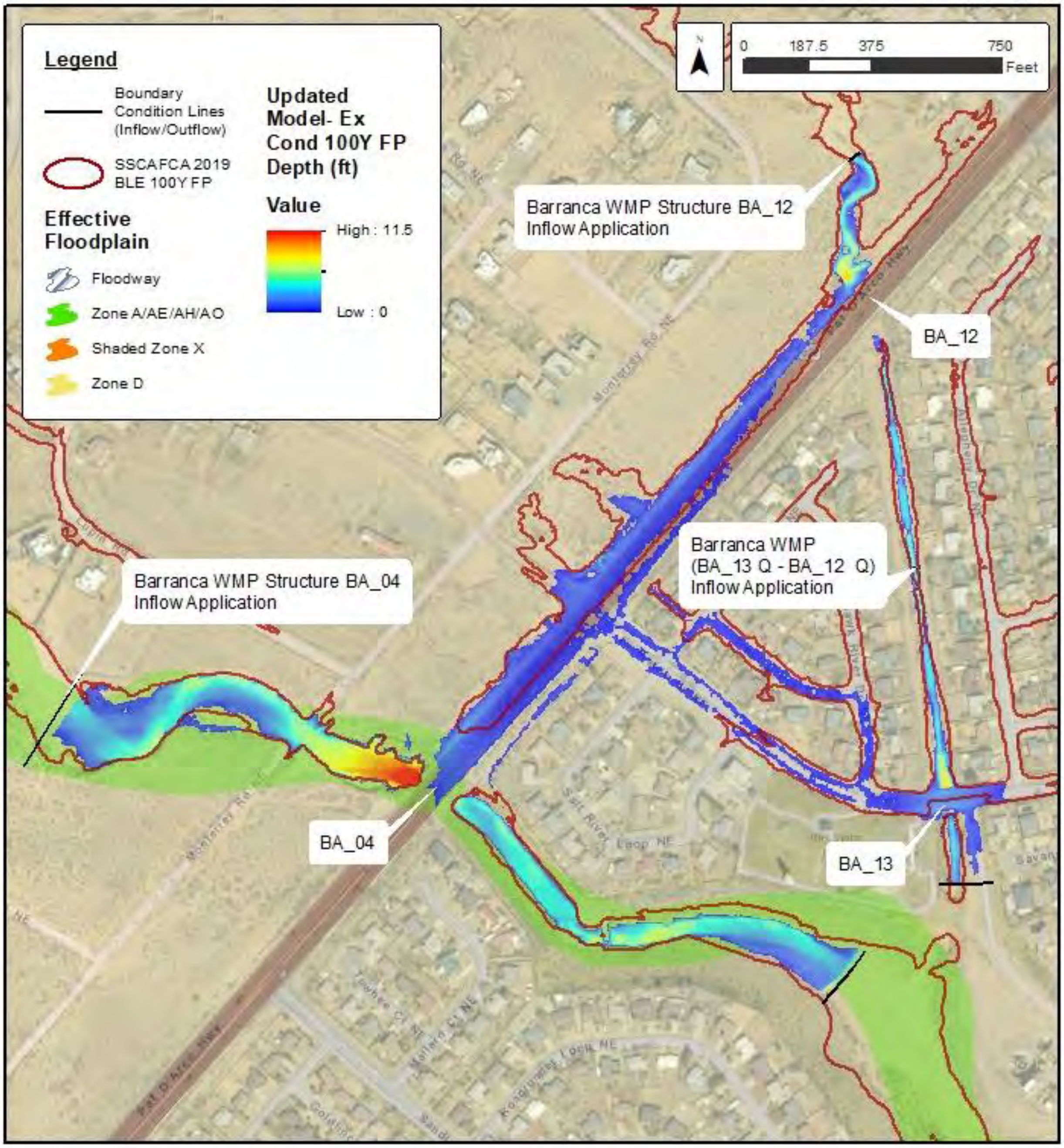



**Figure 3: Existing Conditions Compared with FEMA BLE Results – Full Model Extents**

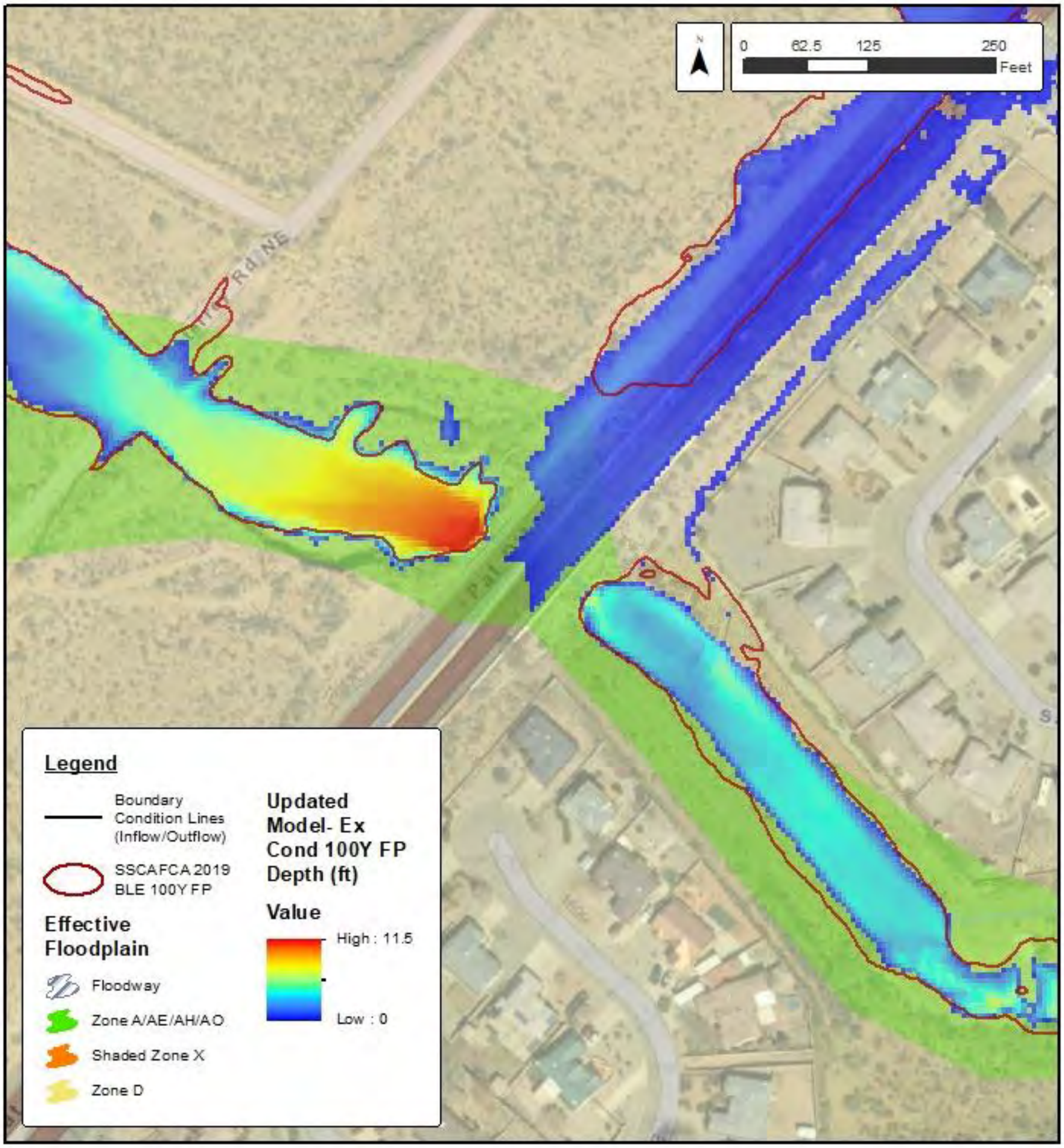



**Figure 4: Existing Conditions Compared with FEMA BLE Results**

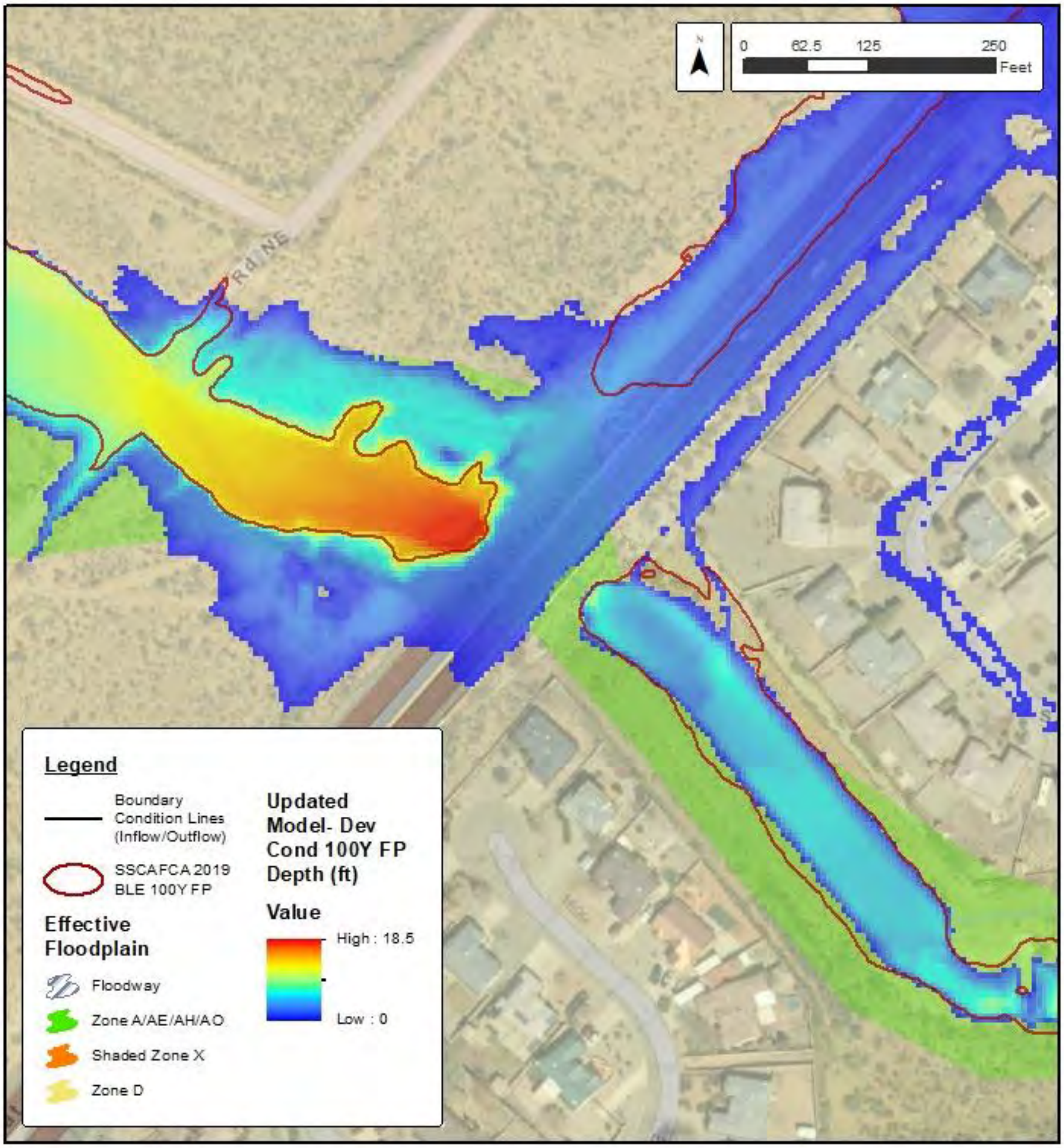



**Figure 5: Developed Conditions Compared with FEMA BLE Results**

**Table 2: Updated BLE Model Results Synopsis**

| US Crown of Culvert (ft) | Top of Road (ft) (approx.) | Conditions | Upstream WSEL (ft) | Downstream WSEL (ft) | Depth Over Rd Based on US WSEL (ft) | Modeled Flow at US Boundary (cfs) | Total Max Flow Through Culverts (cfs) | Flow Over Road (cfs) |
|---|---|---|---|---|---|---|---|---|
| 5,103.8 | 5,119.8 | Existing | 5,114.57 | 5,106.29 | - | 2,776 | 2,909 | -133 |
| | | Developed | 5,121.55 | 5,109.07 | 1.75 | 4,859 | 4,821 | 38 |

Table 2 details the relevant geometry of the structure compared with the modeling results. The upstream water surface elevation impacts the flow through the culverts, whether the culverts are submerged on the upstream end, and whether the road overtops in the modeled storm event. The 'Total Max Flow Through Culverts' reported in the table is the summation of flow reported in each culvert, and the 'Flow Over Road' reported in the table is the weir flow recorded in the modeling.

The elevation along NM 528 declines northeast to southwest direction up to Barranca Arroyo and BA_4 crossing; therefore, the flooding is not limited by the natural terrain along the road. The 2D connection lines, which are used to define the culverts in the model geometry, measure the flow passing through the 2D mesh. As a portion of the overflow crosses downstream of NM 528, the connection line defining the NM 528 road is bent toward the high ground upstream of NM 528 to measure the full flow past the structure. A similar approach was followed to measure full flow at the BA_13 right bank to include the flow draining from Riverside Drive.

For BA_04, the culvert capacity reported in the Baranca WMP (December 2021) is 3,570 cfs. Reviewing the model results over time shows that the existing conditions flooding along NM 528 comes from BA-12; therefore, the flooding depths on NM 528 are not attributed to BA_04. During developed conditions, the total flooding depth at NM 528 (above the culverts) is 1.75 feet (this depth includes flooding from BA_12) and the culverts are able to convey approximately 4,821 cfs (maximum flooding depth over NM 528 is approximately 3 feet). The differences in the WMP capacity and the modeled capacity are likely due to a combination of calculation methodology differences and more specific data. The inundation boundaries for existing and developed conditions are shown in Figure 6.

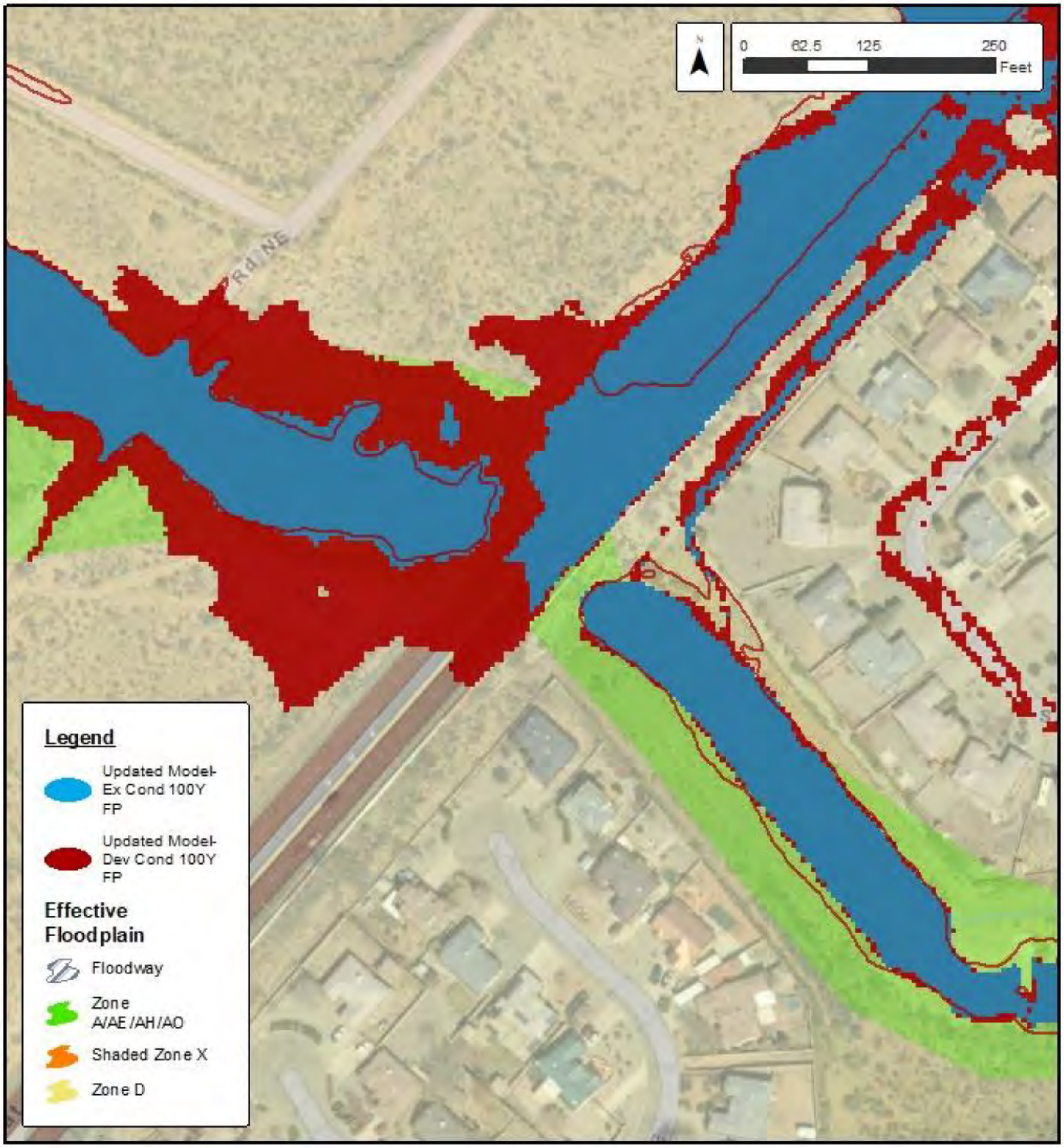



**Figure 6: Mapping Comparison of Existing and Developed Conditions**

## Structure BA_05

| | |
|---|---|
| Structure Name: | BA_05 |
| Structure Location: | Tributary B and NM 528 crossing (Approximately 400' southeast of Tributary B and Monterrey Rd NE) |
| Watershed: | Barranca |
| Barrel Type: | Corrugated Metal Pipe |
| Number of Barrels: | 1 |
| Barrel Dimensions: | 66’’ |
| US Culvert Invert: | 5128.30’ |
| DS Culvert Invert: | 5122.40’ |
| US Top of Headwall: | Approximately 5134.3’ |
| DS Top of Headwall: | Approximately 5128.6’ |
| Road Surface Elev. At Culverts: | Road: Approximately 5146.2’<br>Median: Approximately 5147.1’ |
| Rail (Y/N): | Y |

BA_05 (Tributary B & NM 528)

BA_05, upstream

BA_05, downstream

**Figure 1: Structure BA_05, photos provided by SSCAFA**

Structures BA_05 (shown in Figure 1), BA_06, and BA_07 are in very close proximity with no significant tributaries joining in between as shown in Figure 2. BA_06 (Grand Vista Road) is located around 1,220 feet downstream of BA_05, and BA_07 (Sandia Vista Road) is located around 1,050 feet downstream of BA_06. Due to the close proximity and potential for interaction, all three structures are combined in the same model geometry.


**Figure 2: Modeled Structures**

BA_05 was modeled using survey data obtained by Wayjohn Surveying, Inc. on January 06, 2022. Approximately 86 acres were modeled in 2D using HEC-RAS 6.1. Cell sizes within the 2D modeled area range from 35.6 square feet to 5,475.5 square feet. The average cell size in the model is 535 square feet.

Preliminary modeling resulted in ponding stacking up against the upstream boundary of the project area. To ensure the reported water surface elevations and ponding extent were not being impacted by the limited surface volume and flow conditions of the restricted grid, the 2D extents were expanded upstream of Monterrey Road. The inflow hydrograph was maintained between Monterrey Road and NM 528. The Barranca Watershed Master Plan HEC-HMS model was reviewed, and results in the HMS model indicate that the flow at the upstream face of Monterrey Road and the downstream face of Monterrey Road are approximately the same. It is understood that there are risers on the upstream side of Monterrey Road that likely restrict downstream flow. The hydraulic modeling shows a static elevation upstream of NM 528 in each event; therefore, it is not anticipated that the inclusion of the structure at Monterrey Road would yield different mapping, particularly with the steady state inflow condition used in this analysis.

Flow values were incorporated using a uniform inflow for the model run duration. Assigned flow values at structure BA_05, and the reported culvert capacity, are shown in the table below.

**Table 1: Flow Data Provided by SSCAFCA**

| Storm Event | Peak Flow (CFS) |
|---|---|
| Existing Conditions | 304 |
| Developed Conditions | 328 |
| Culvert Capacity | 180 |

The model was run until the summation of inflows was achieved at the downstream end of the model. The model was run for a duration of 16 hours to ensure no significant instabilities would occur. The 2D model results show that the culvert is able to convey flows downstream without road overtopping in both existing and developed conditions.

Although no overtopping occurs on NM 528, the structure does restrict flow, resulting in ponding upstream of NM 528 with impacts to homes along the left bank and depths of up to 2.8 feet on Monterrey Road. The retention structure at Monterrey Road was not included in the hydraulic modeling as the controlling factor for the area is the limited capacity of the 66 inch culvert at NM 528.

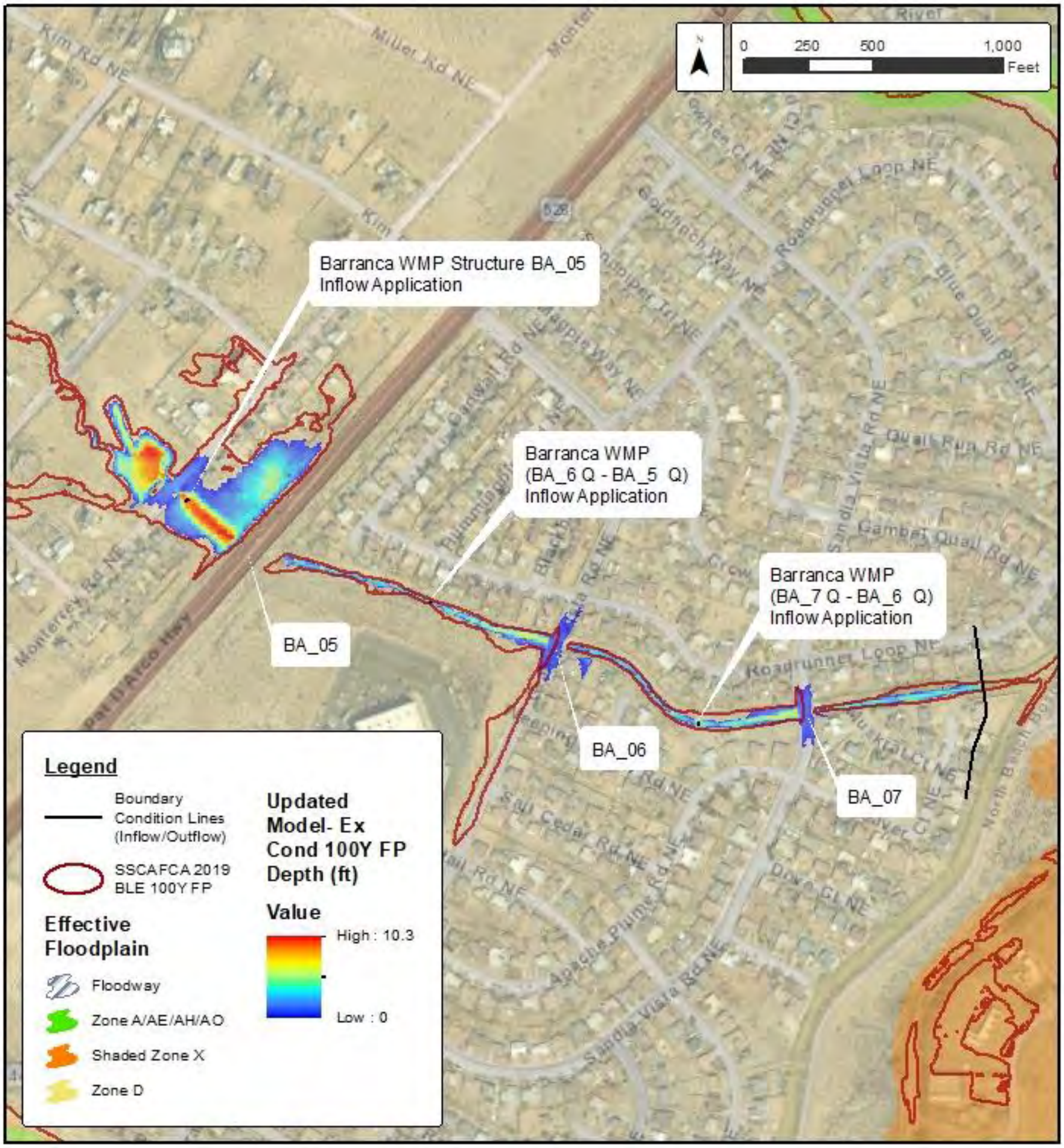



**Figure 3: Existing Conditions Compared with FEMA BLE Results – Full Model Extents**

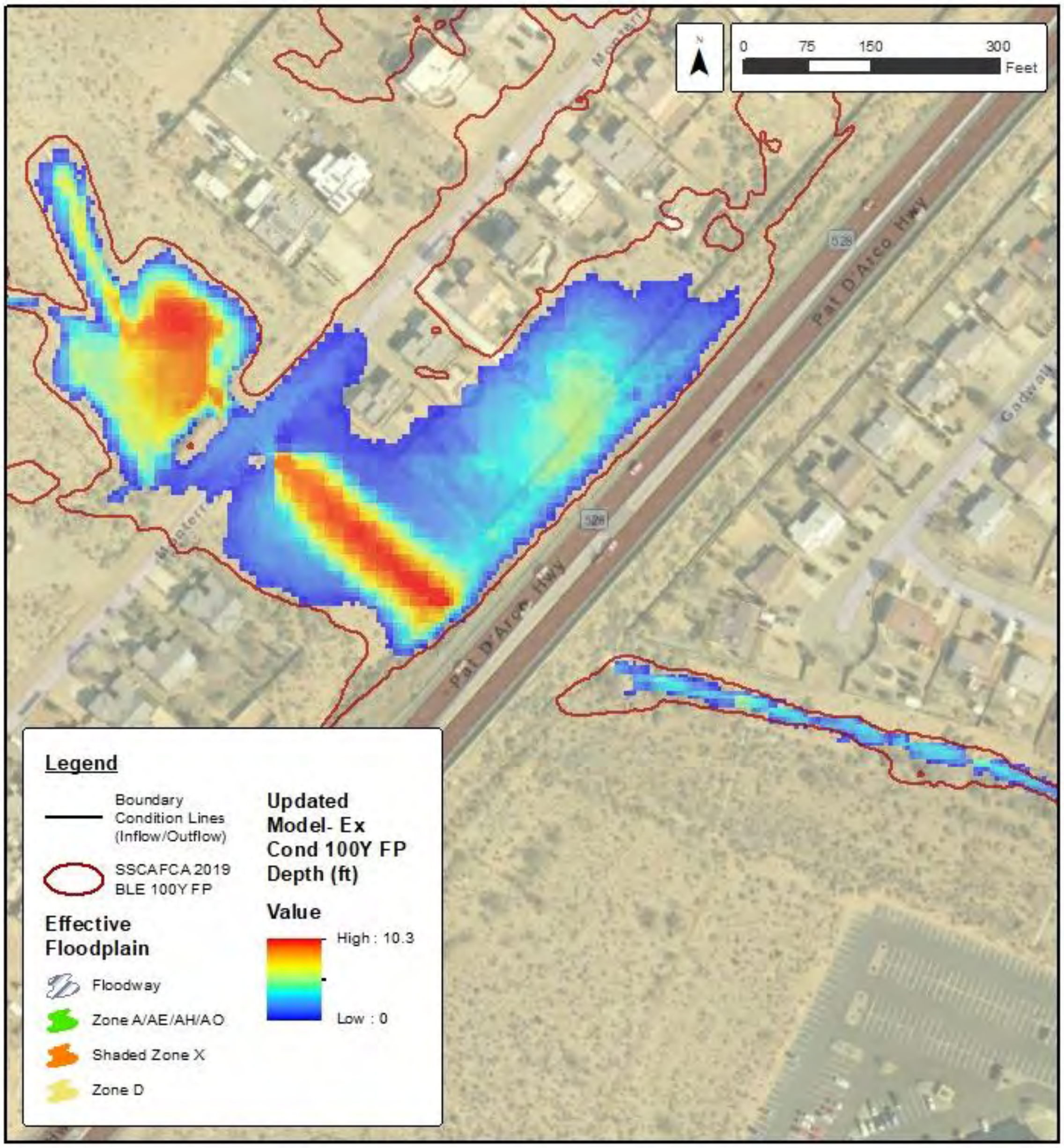



**Figure 4: Existing Conditions Compared with FEMA BLE Results**

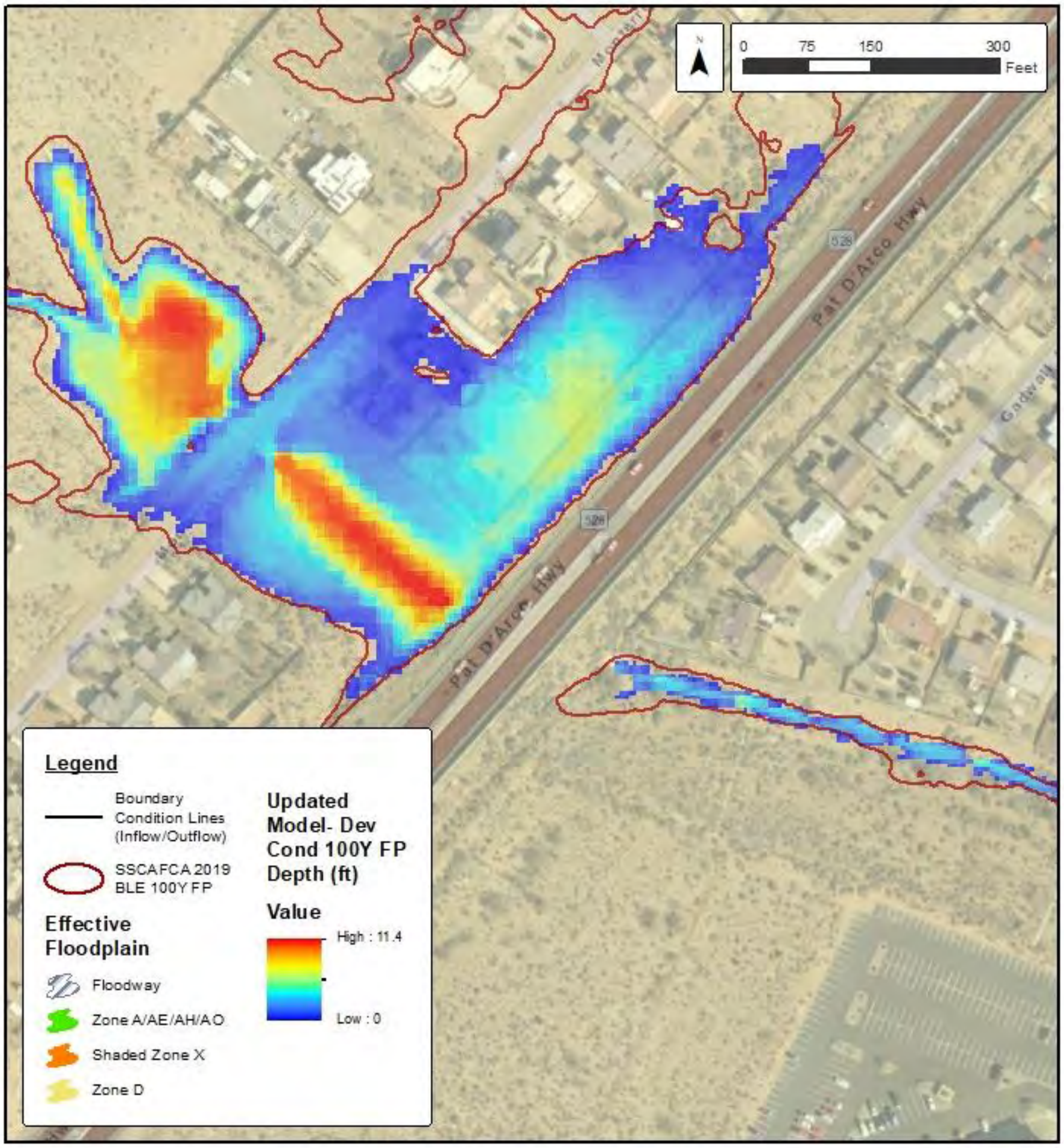



**Figure 5: Developed Conditions Compared with FEMA BLE Results**

**Table 2: Updated BLE Model Results Synopsis**

| US Crown of Culvert (ft) | Top of Road (ft) (approx.) | Conditions | Upstream WSEL (ft) | Downstream WSEL (ft) | Depth Over Rd Based on US WSEL (ft) | Modeled Flow at US Boundary (cfs) | Total Max Flow Through Culverts (cfs) | Flow Over Road (cfs) |
|---|---|---|---|---|---|---|---|---|
| 5133.8 | 5146.2 | Existing | 5140.11 | 5126.84 | - | 304 | 304 | - |
| | | Developed | 5141.32 | 5126.94 | - | 328 | 327 | - |

Table 2 details the relevant geometry of the structure compared with the modeling results. The upstream water surface elevation impacts the flow through the culverts, whether the culverts are submerged on the upstream end, and whether the road overtops in the modeled storm event. The 'Total Max Flow Through Culverts' reported in the table is the summation of flow reported in each culvert, and the 'Flow Over Road' reported in the table is the weir flow recorded in the modeling.

For BA_05, the culvert capacity reported in the Barranca WMP (December 2021) is 180 cfs. The modeling showed that the culverts are able to convey 304 cfs and 327 cfs in the existing and developed conditions with submerged culvert inlets and no overtopping over NM 528. The differences in the WMP capacity and the modeled capacity is likely due to a combination of calculation methodology differences and more specific data.

Although no overtopping of NM 528 is expected, the results indicate flooding on the left overbank upstream of the structure due to the limited capacity of the single pipe. Two properties between NM 528 and Monterrey Road are expected to experience flooding in developed conditions, with ponding on private property during existing conditions but not reaching the structure. The inundation boundaries in Figure 6 and impacted structures, in Figure 7, are shown below.  Approximately 1.6 feet and 2.8 feet of ponding are shown to occur along Monterrey Road during existing and developed conditions, repectively.  Results may be impacted by the nature of the assessment: a steady inflow for the duration of the model rather than an inflow hydrograph mimicking a storm event where the pond would be anticipated to store volume in an incremental fashion.

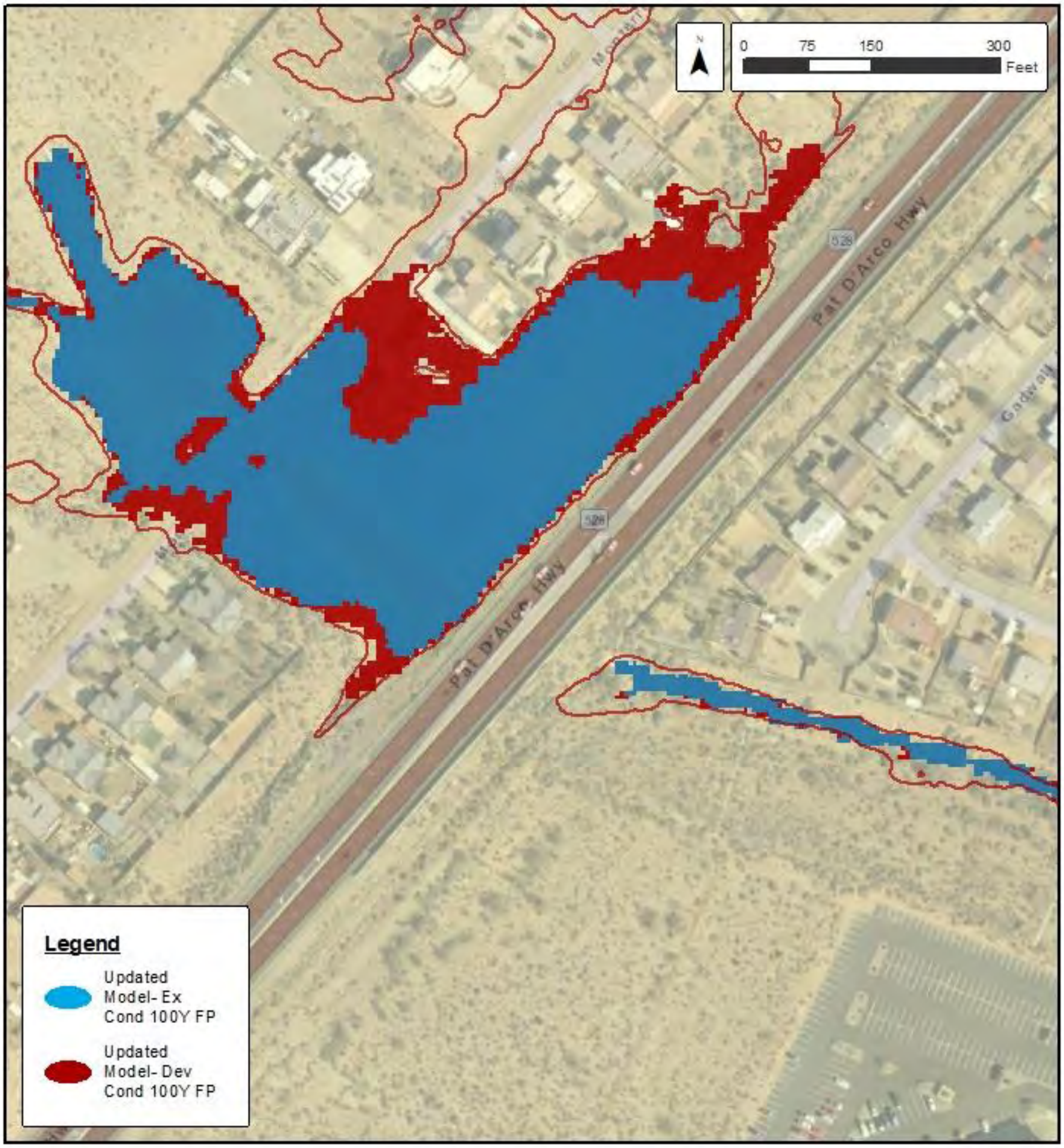



**Figure 6: Mapping Comparison of Existing and Developed Conditions**

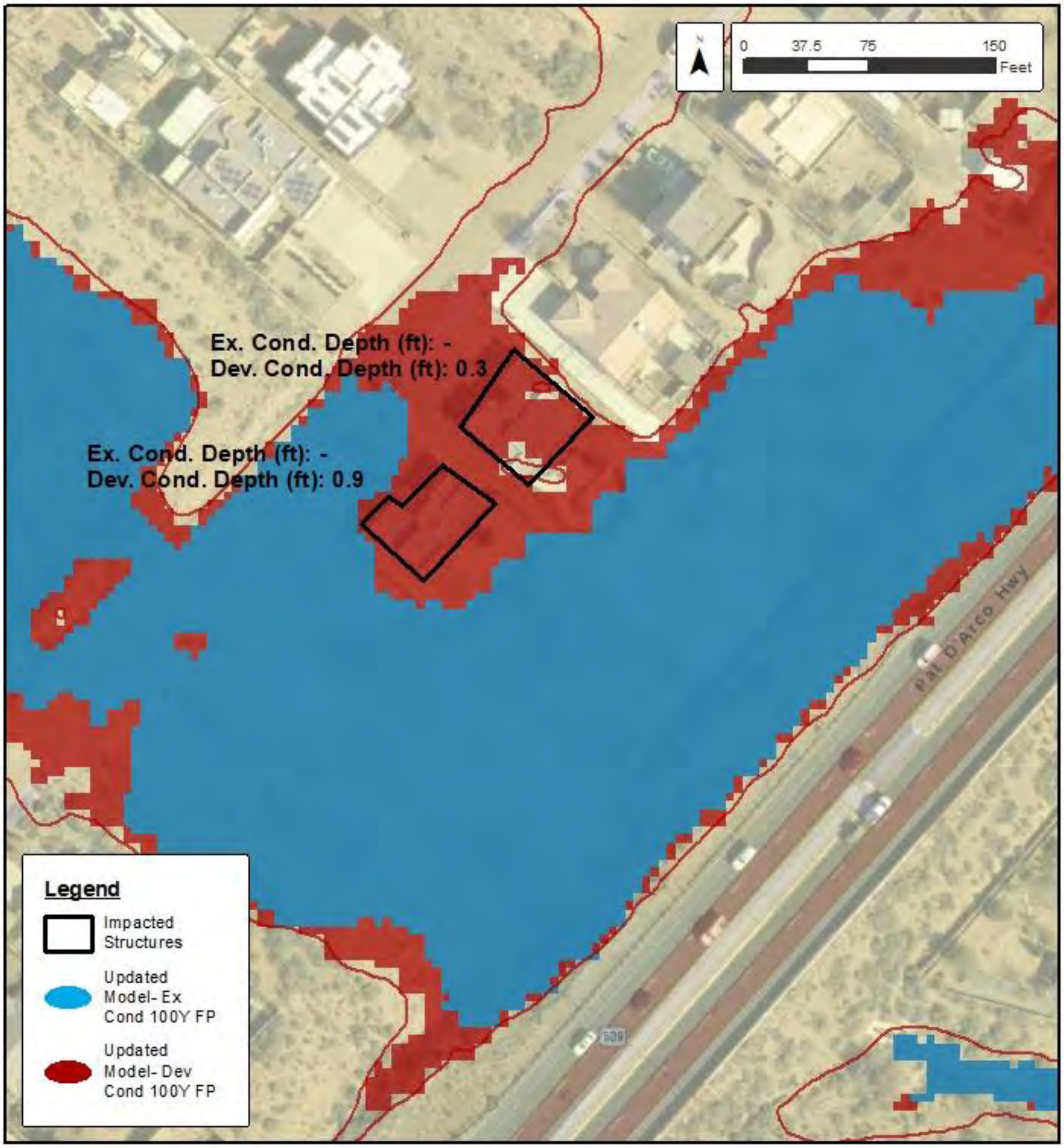



**Figure 7: Impacted Structures – Existing and Developed Conditions**

## Structure BA_06

| | |
|---|---|
| Structure Name: | BA_06 |
| Structure Location: | Tributary B and Grande Vista Rd crossing (Approximately 190' south west of Grande Vista Rd and Roadrunner Loop NE) |
| Watershed: | Barranca |
| Barrel Type: | Corrugated Metal Pipe |
| Number of Barrels: | 2 |
| Barrel Dimensions: | 48'' |
| US Culvert Inverts N to S: | 5098.09', 5098.21' |
| DS Culvert Inverts N to S: | 5096.80', 5096.84' |
| US Top of Headwall: | Approximately 5103.57' |
| DS Top of Headwall: | Approximately 5103.5' |
| Road Surface Elev. At Culverts: | Curbs: Approximately 5105.6'<br>Road: Approximately 5105.42' |
| Rail (Y/N): | Y |

BA_06 (Tributary B & Grande Vista Rd.)

BA_06, upstream

BA_06, downstream

**Figure 1: Structure BA_06, photos provided by SSCAFA**

Structures BA_06 (shown in Figure 1), BA_05, and BA_07 are in very close proximity with no significant tributaries joining in between as shown in Figure 2. BA_06 (Grand Vista Road) is located around 1,220 feet downstream of BA_05, and BA_07 (Sandia Vista Road) is located around 1,050 feet downstream of BA_06. Due to the close proximity and potential for interaction, all three structures are combined in the same model geometry.


**Figure 2: Modeled Structures**

BA_06 was modeled using survey data obtained by Wayjohn Surveying, Inc. on January 06, 2022. Approximately 86 acres were modeled in 2D using HEC-RAS 6.1. Cell sizes within the 2D modeled area range from 35.6 square feet to 5,475.5 square feet. The average cell size in the model is 535 square feet.

Flow values were taken as reported in the December 2021 Barranca Watershed Management Plan (WMP). Because this model includes multiple structures, staggered inflows were added in the model. To match the inflow provided in the WMP, 43 cfs and 73 cfs were input into the model between structure BA_05 and BA_06 for the existing conditions and developed conditions plans, respectively.

Total flow values at structure BA_06, and the reported culvert capacity, are shown in the table below.

**Table 1: Flow Data Provided by SSCAFCA**

| Storm Event | Peak Flow (CFS) |
|---|---|
| Existing Conditions | 347 |
| Developed Conditions | 401 |

| | |
|---|---|
| Culvert Capacity | 180 |

The model was run until the summation of inflows was achieved at the downstream end of the model. The model was run for a duration of 16 hours to ensure no significant instabilities would occur. The model results show that the capacity of the culverts is not sufficient to convey the flow downstream in either existing or developed conditions. Overtopping is expected on Grande Vista Road with depths of 1.0 feet and 1.2 feet in existing and developed conditions, respectively.

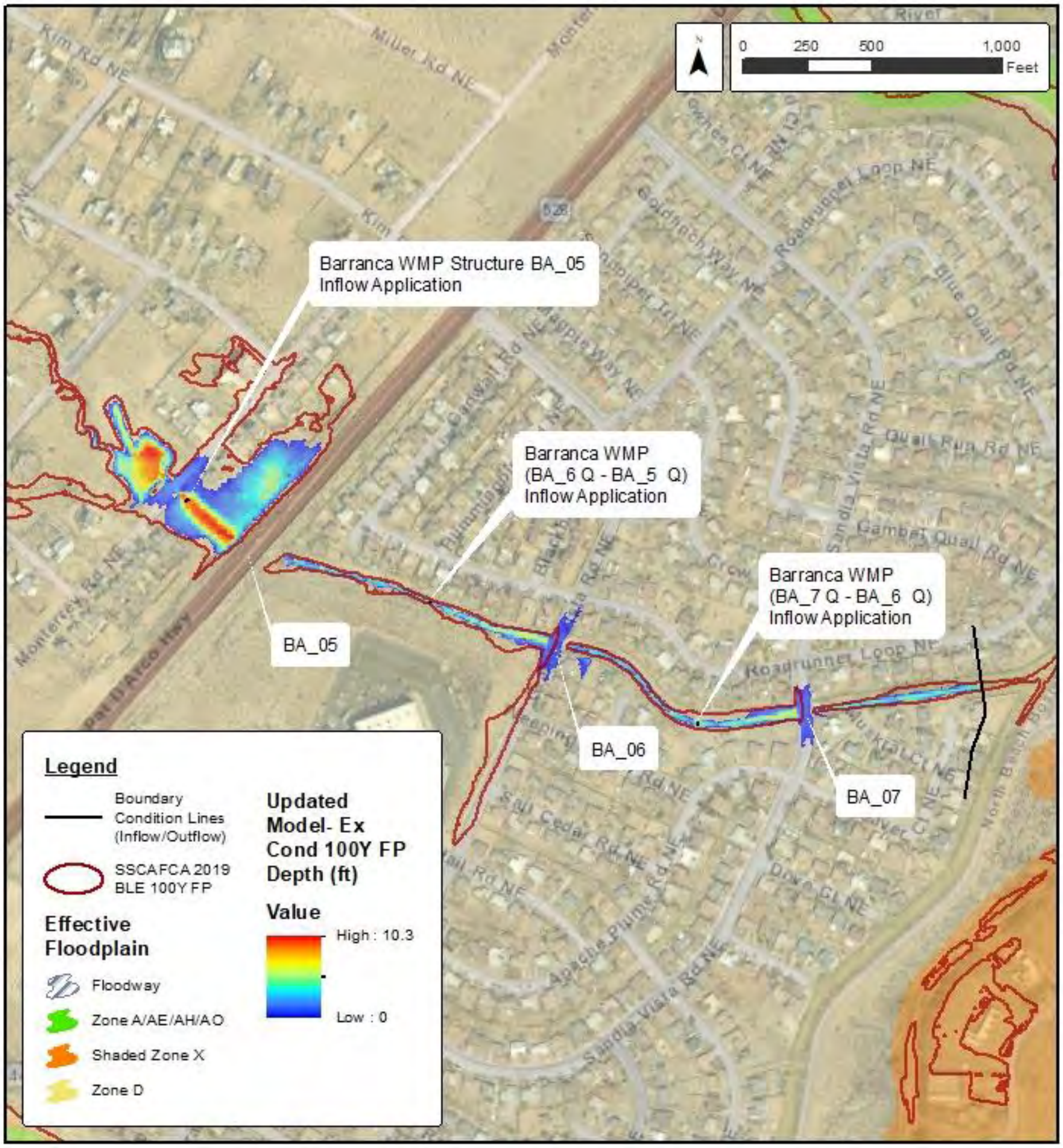


**Figure 3: Existing Conditions Compared with FEMA BLE Results – Full Model Extents**

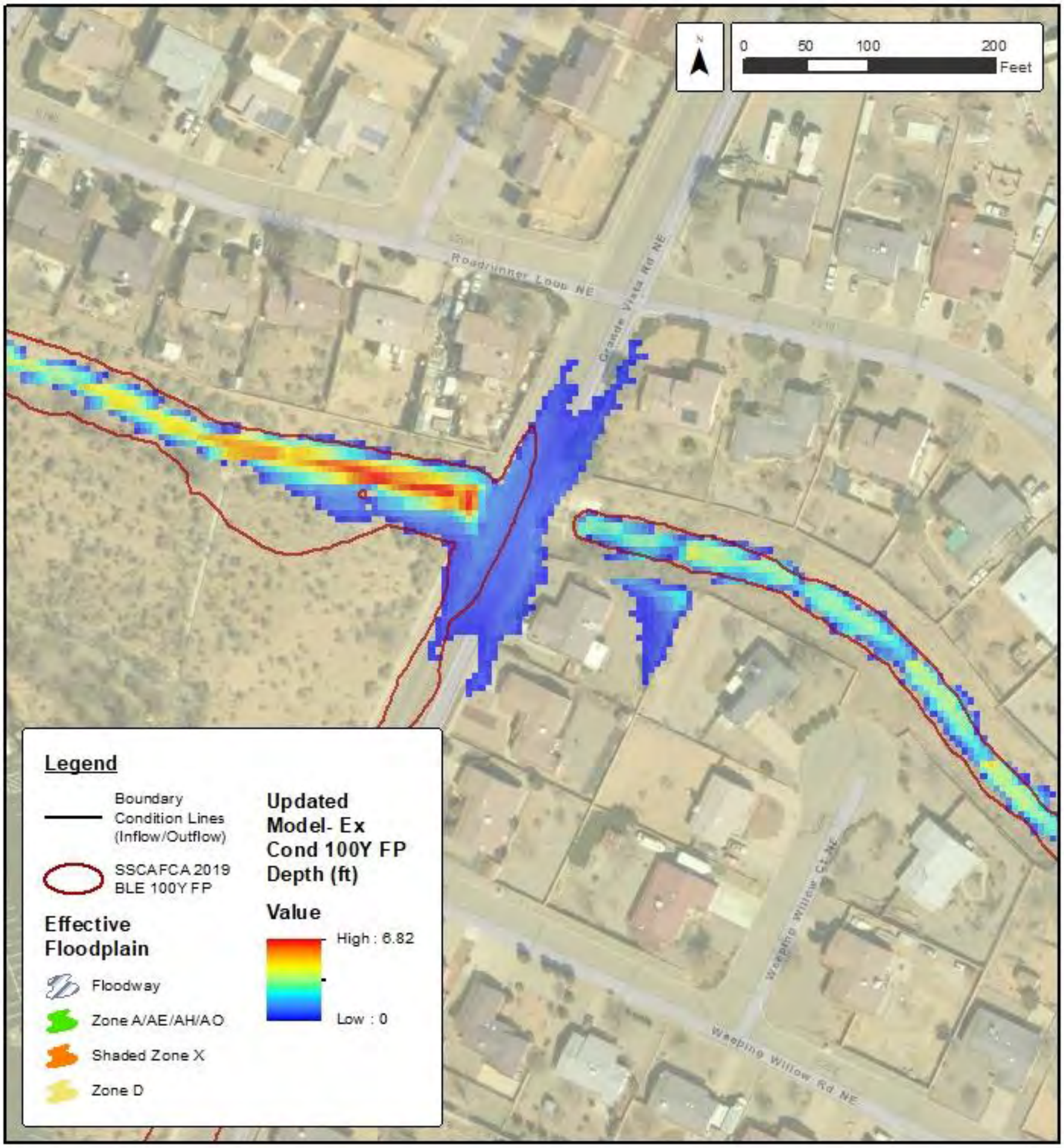



**Figure 4: Existing Conditions Compared with FEMA BLE Results**

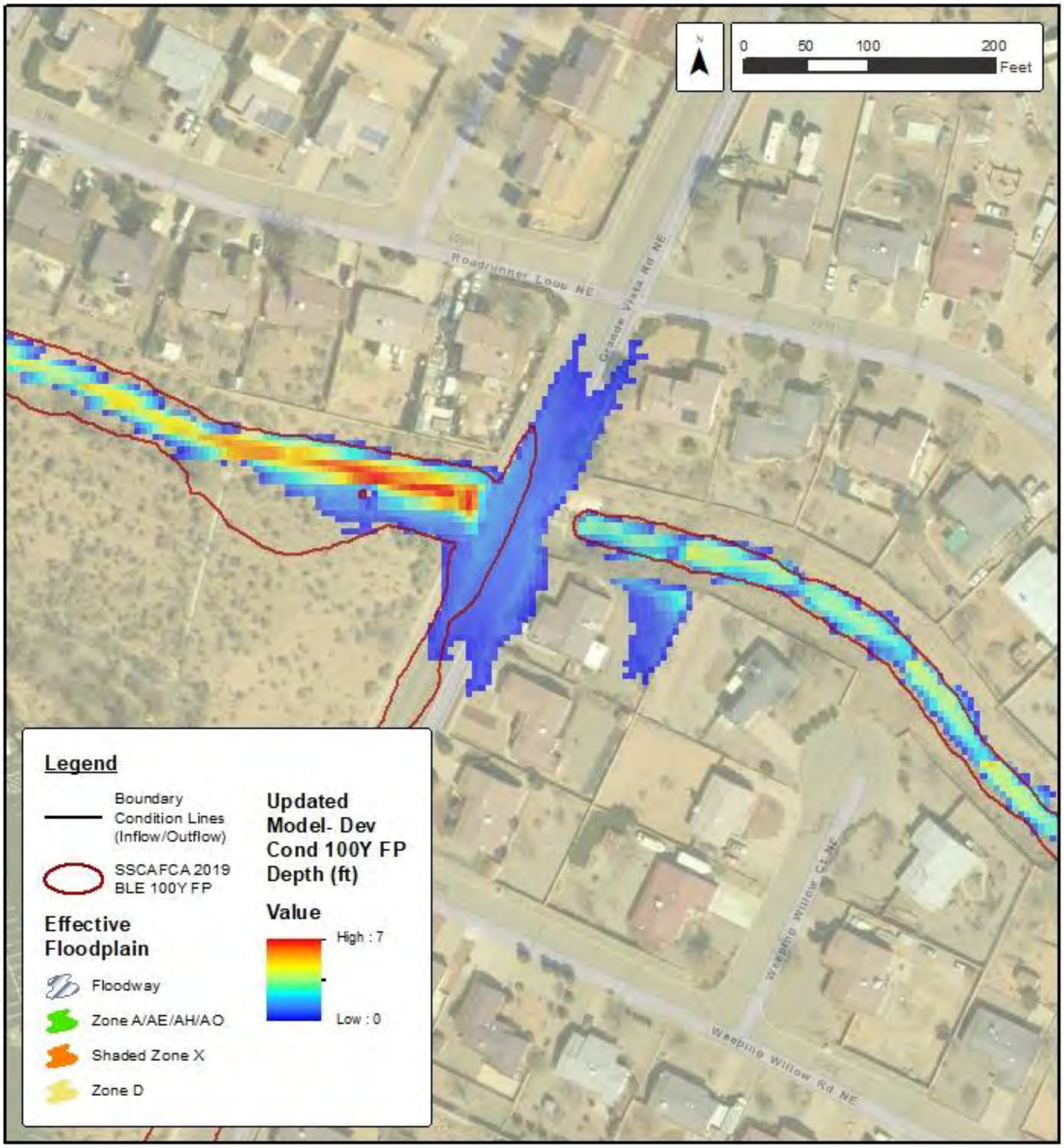



**Figure 5: Developed Conditions Compared with FEMA BLE Results**

**Table 2: Updated BLE Model Results Synopsis**

| US Crown of Culvert (ft) | Top of Road (ft) (approx.) | Conditions | Upstream WSEL (ft) | Downstream WSEL (ft) | Depth Over Rd Based on US WSEL (ft) | Modeled Flow at US Boundary (cfs) | Total Max Flow Through Culverts (cfs) | Flow Over Road (cfs) |
|---|---|---|---|---|---|---|---|---|
| 5102.09 | 5105.4 | Existing | 5106.12 | 5099.76 | 0.7 | 347 | 272 | 75 |
| | | Developed | 5106.32 | 5100.3 | 0.9 | 401 | 276 | 124 |

Table 2 details the relevant geometry of the structure compared with the modeling results. The upstream water surface elevation impacts the flow through the culverts, whether the culverts are submerged on the upstream end, and whether the road overtops in the modeled storm event. The 'Total Max Flow Through Culverts' reported in the table is the summation of flow reported in each culvert, and the 'Flow Over Road' reported in the table is the weir flow recorded in the modeling.

For BA_06, the capacity reported in the Barranca WMP (December 2021) is 180 cfs. The modeling indicates that the culverts are able to convey 272 cfs in the existing flow conditions, with overtopping of approximately 75 cfs over Grande Vista Road. The developed flow conditions modeling shows that the culverts are able to convey approximately 276 cfs with approximately 124 cfs flowing over Grande Vista Road. The differences in the WMP capacity and the modeled capacity is likely due to a combination of calculation methodology differences and more specific data.

Overtopping is expected on Grande Vista Road with maximum depths of 1.0 feet and 1.2 feet occurring in the detailed mapping in existing and developed conditions, respectively. The existing walls around residential and business properties, where flooding impacts are expected, are included in the model geometry, and buildings are represented with a high n-value to reflect ineffective flow within residential buildings. The assumption with regards to these structures are that they are watertight and no vents exist for water to escape. The modeling reported that ponding resulting from the overtopping of Grande Vista Road is entering the yard of the home located on the southern bank, just downstream of the structure. The runoff is then trapped by the walls, resulting in maximum ponding depths at the northeast property corner of approximately 2 and 2.5 feet in existing and developed conditions, respectively. The inundation boundaries are shown in Figure 6.

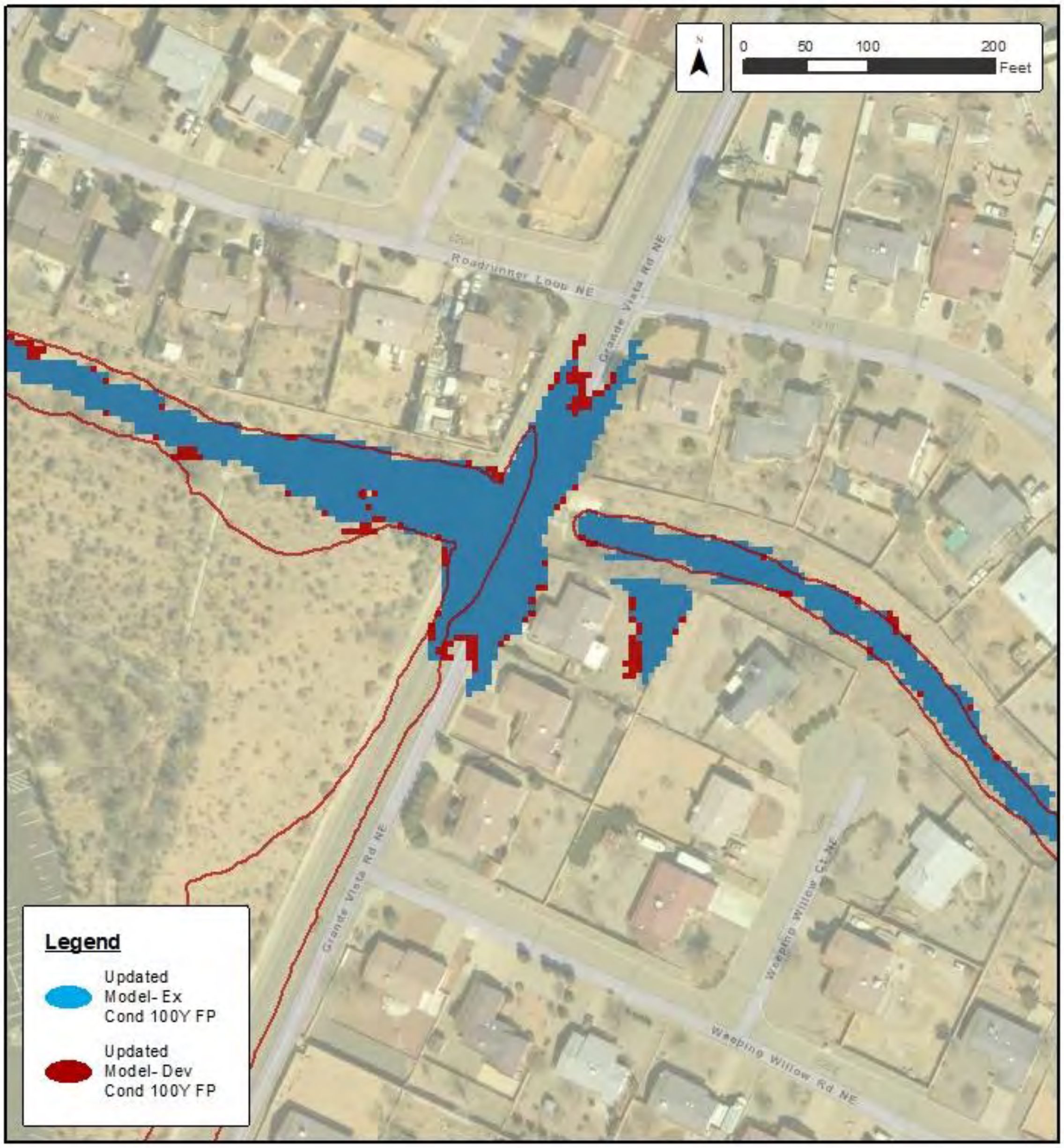



**Figure 6: Mapping Comparison of Existing and Developed Conditions**

## Structure BA_07

| | |
|---|---|
| Structure Name: | BA_07 |
| Structure Location: | Tributary B and Sandia Vista Rd crossing (Approximately 190' south of Sandia Vista Rd and Roadrunner Loop NE) |
| Watershed: | Barranca |
| Barrel Type: | Corrugated Metal Pipe |
| Number of Barrels: | 2 |
| Barrel Dimensions: | 54'' |
| US Culvert Inverts, N to S: | 5076.10', 5075.79' |
| DS Culvert Inverts, N to S: | 5075.27', 5075.26' |
| US Top of Headwall: | Approximately 5081.42' |
| DS Top of Headwall: | Approximately 5081.97' |
| Road Surface Elev. At Culverts: | Curbs: Approximately 5082.8'<br>Road: Approximately 5082.70' |
| Rail (Y/N): | Y |

BA_07 (Tributary B & Sandia Vista Rd.)

BA_07, upstream

BA_07, downstream

**Figure 1: Structure BA_07, photos provided by SSCAFA**

Structures BA_07 (shown in Figure 1), BA_05, and BA_06 are in very close proximity with no significant tributaries joining in between as shown in Figure 2. BA_06 (Grand Vista Road) is located around 1,220 feet downstream of BA_05, and BA_07 (Sandia Vista Road) is located around 1,050 feet downstream of BA_06. Due to the close proximity and potential for interaction, all three structures are combined in the same model geometry.


**Figure 2: Modeled Structures**

BA_07 was modeled using survey data obtained by Wayjohn Surveying, Inc. on January 06, 2022. Approximately 86 acres were modeled in 2D using HEC-RAS 6.1. Cell sizes within the 2D modeled area range from 35.6 square feet to 5,475.5 square feet. The average cell size in the model is 535 square feet.

Flow values were taken as reported in the December 2021 Barranca Watershed Management Plan (WMP). Because this model includes multiple structures, staggered inflows were added in the model. To match the inflow provided in the WMP, 101 cfs and 88 cfs were input into the model between structure BA_06 and BA_07 for the existing and developed conditions, respectively.

Total flow values at structure BA_07, and the reported culvert capacity, are shown in the table below.

**Table 1: Flow Data Provided by SSCAFCA**

| Storm Event | Peak Flow (CFS) |
|---|---|
| Existing Conditions | 448 |
| Developed Conditions | 489 |

| | |
|---|---|
| Culvert Capacity | 240 |

The model was run until the summation of inflows was achieved at the downstream end of the model. The model was run for a duration of 16 hours to ensure no significant instabilities would occur. The model results show that the capacity of the culverts is not sufficient to convey the flow downstream in either existing or developed conditions. Overtopping is expected on Sandia Vista Road with depths of 1 foot and 1.1 feet, in existing and developed conditions, respectively.

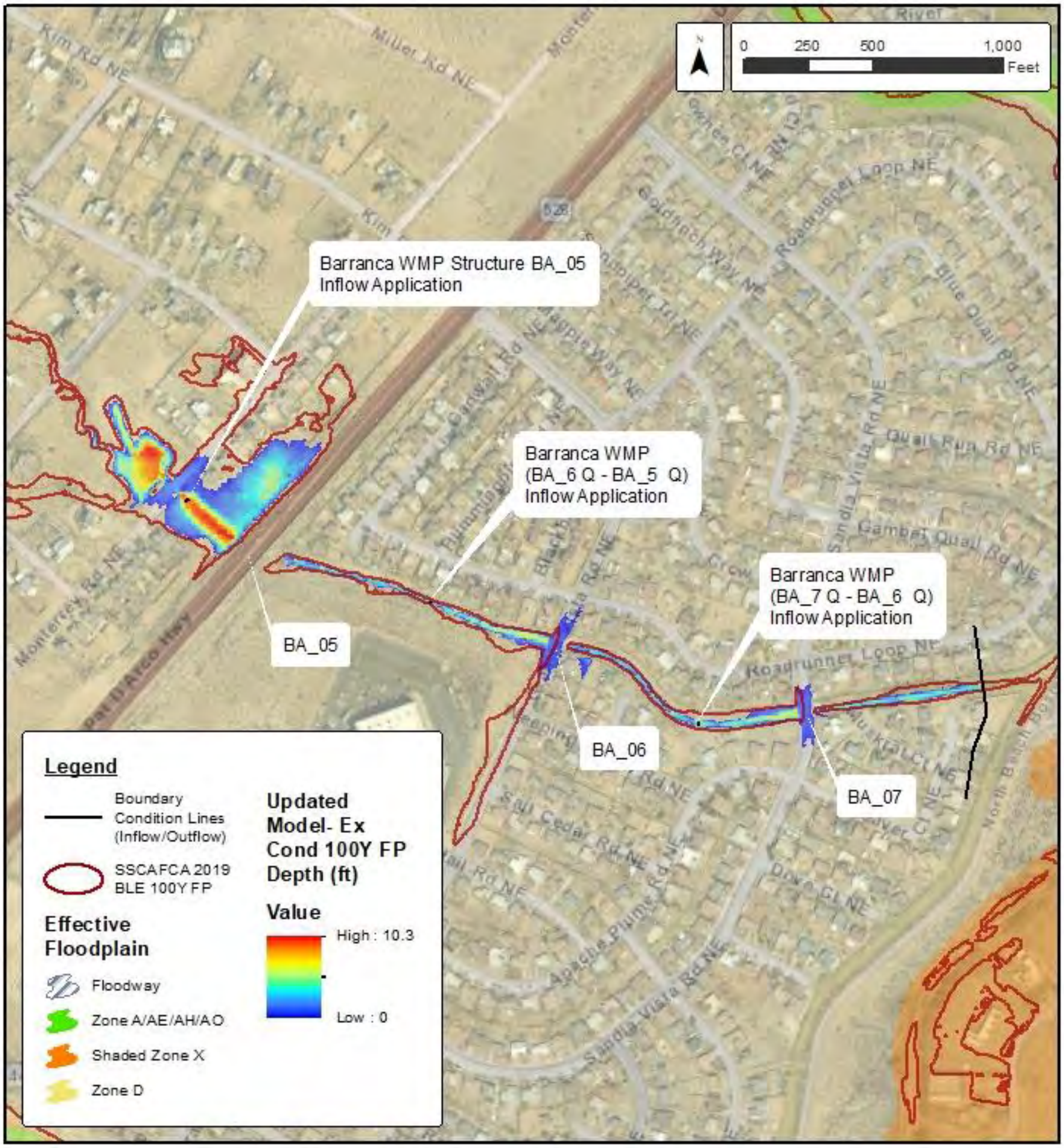



**Figure 3: Existing Conditions Compared with FEMA BLE Results – Full Model Extents**

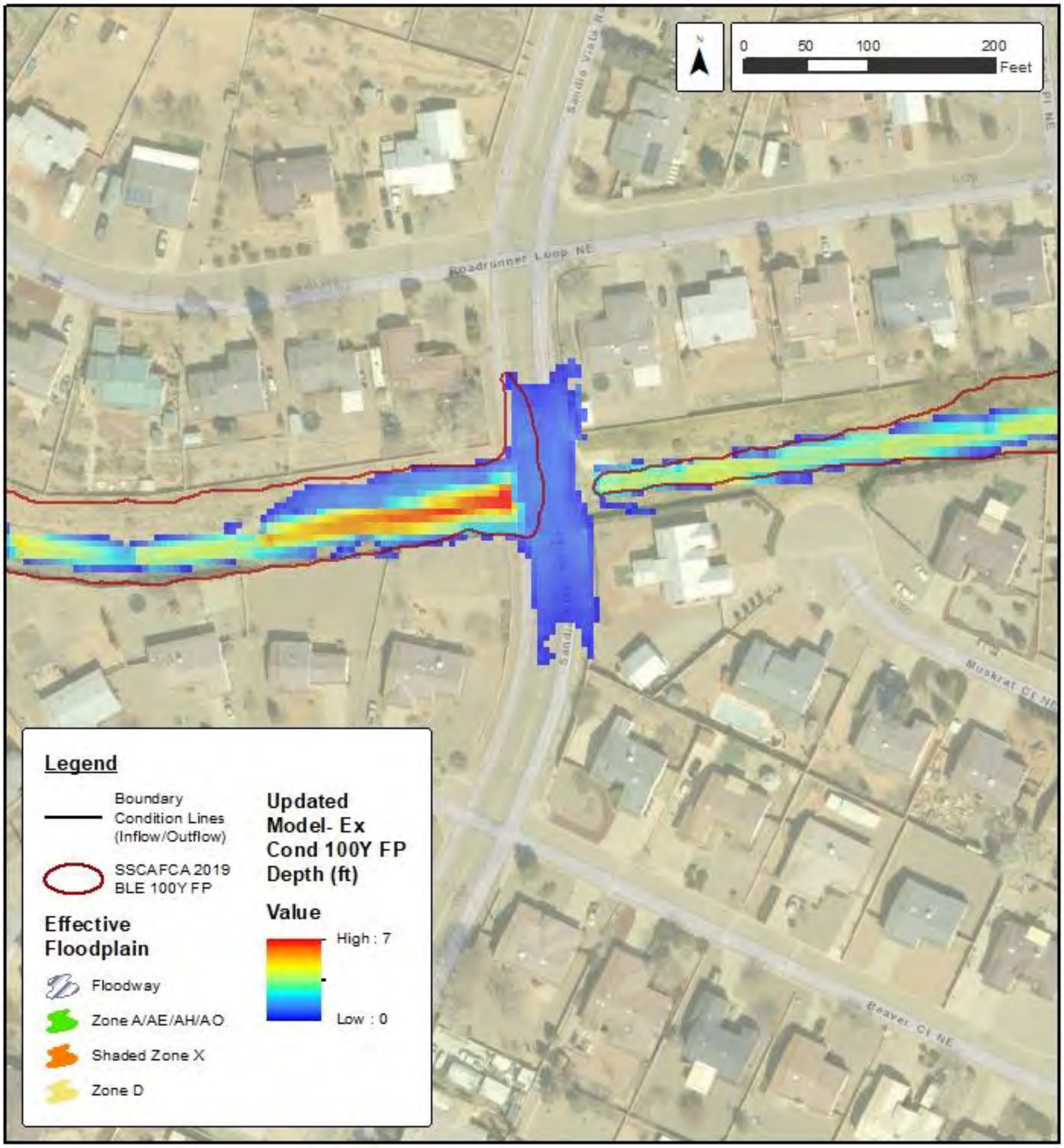



**Figure 4: Existing Conditions Compared with FEMA BLE Results**

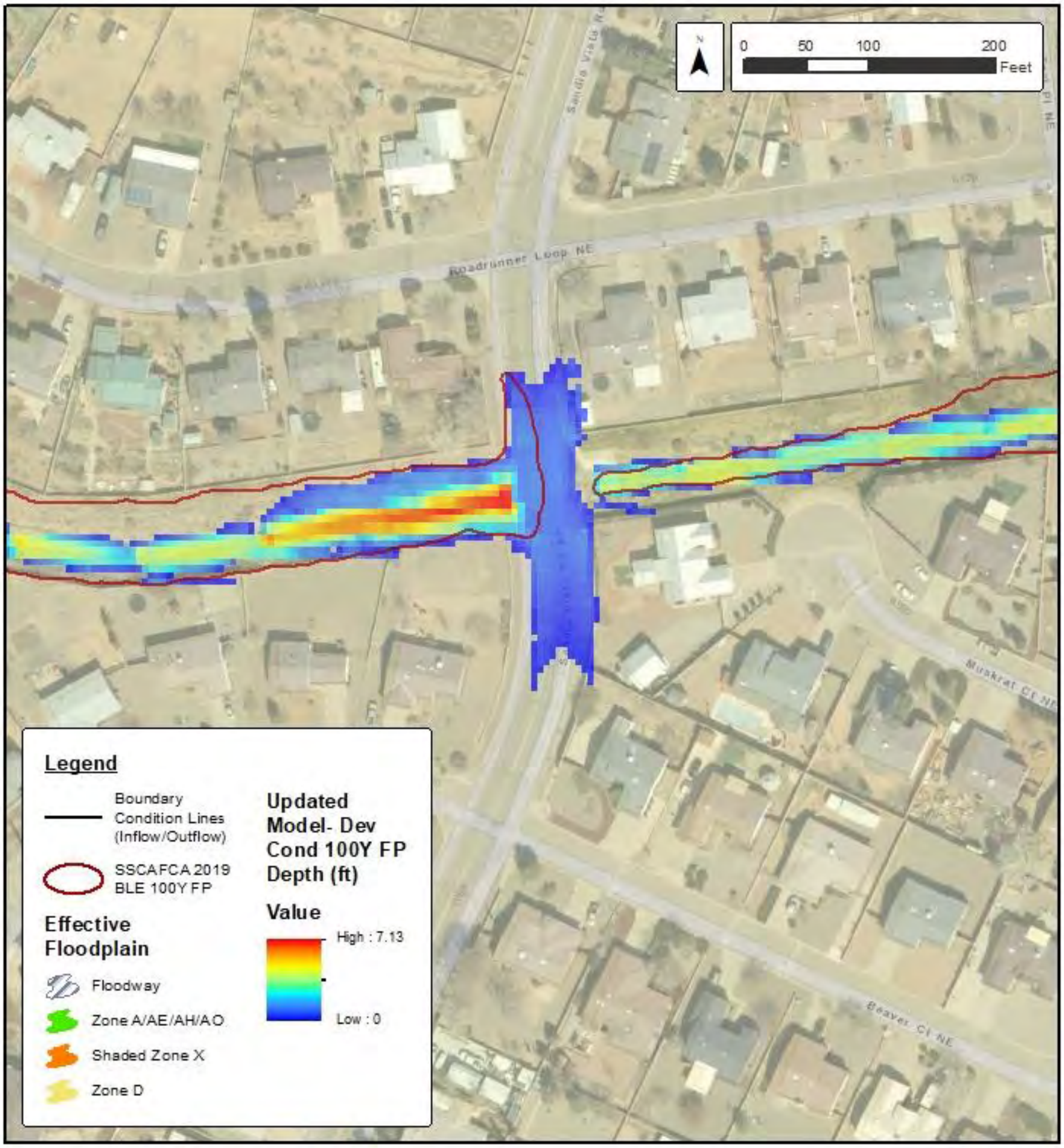



**Figure 5: Developed Conditions Compared with FEMA BLE Results**

**Table 2: Updated BLE Model Results Synopsis**

| US Crown of Culvert (ft) | Top of Road (ft) (approx.) | Conditions | Upstream WSEL (ft) | Downstream WSEL (ft) | Depth Over Rd Based on US WSEL (ft) | Modeled Flow at US Boundary (cfs) | Total Max Flow Through Culverts (cfs) | Flow Over Road (cfs) |
|---|---|---|---|---|---|---|---|---|
| 5080.29 | 5082.7 | Existing | 5083.54 | 5078.60 | 0.8 | 448 | 319 | 128 |
| | | Developed | 5083.68 | 5079.76 | 1.0 | 489 | 320 | 168 |

Table 2 details the relevant geometry of the structure compared with the modeling results. The upstream water surface elevation impacts the flow through the culverts, whether the culverts are submerged on the upstream end, and whether the road overtops in the modeled storm event. The 'Total Max Flow Through Culverts' reported in the table is the summation of flow reported in each culvert, and the 'Flow Over Road' reported in the table is the weir flow recorded in the modeling.

For BA_07, the culvert capacity reported in the Barranca WMP (December 2021) is 240 cfs. The modeling indicates that the culverts are able to convey approximately 320 cfs in existing conditions and proposed conditions with overtopping of Sandia Vista Road occurring in each event. The differences in the WMP capacity and the modeled capacity is likely due to a combination of calculation methodology differences and more specific data.

Overtopping is expected on Sandia Vista Road with maximum depths of 1.0 feet and 1.1 feet in existing and developed conditions, respectively. Fences were modeled as 4 foot tall walls in the hydraulic model with the assumption that no vents or gaps exist to allow water to flow through. In this location, overflow of the structure results in ponding depths along the roadway that is contained in the street by the modeled walls/residential fences. The inundation boundaries are shown in Figure 6.

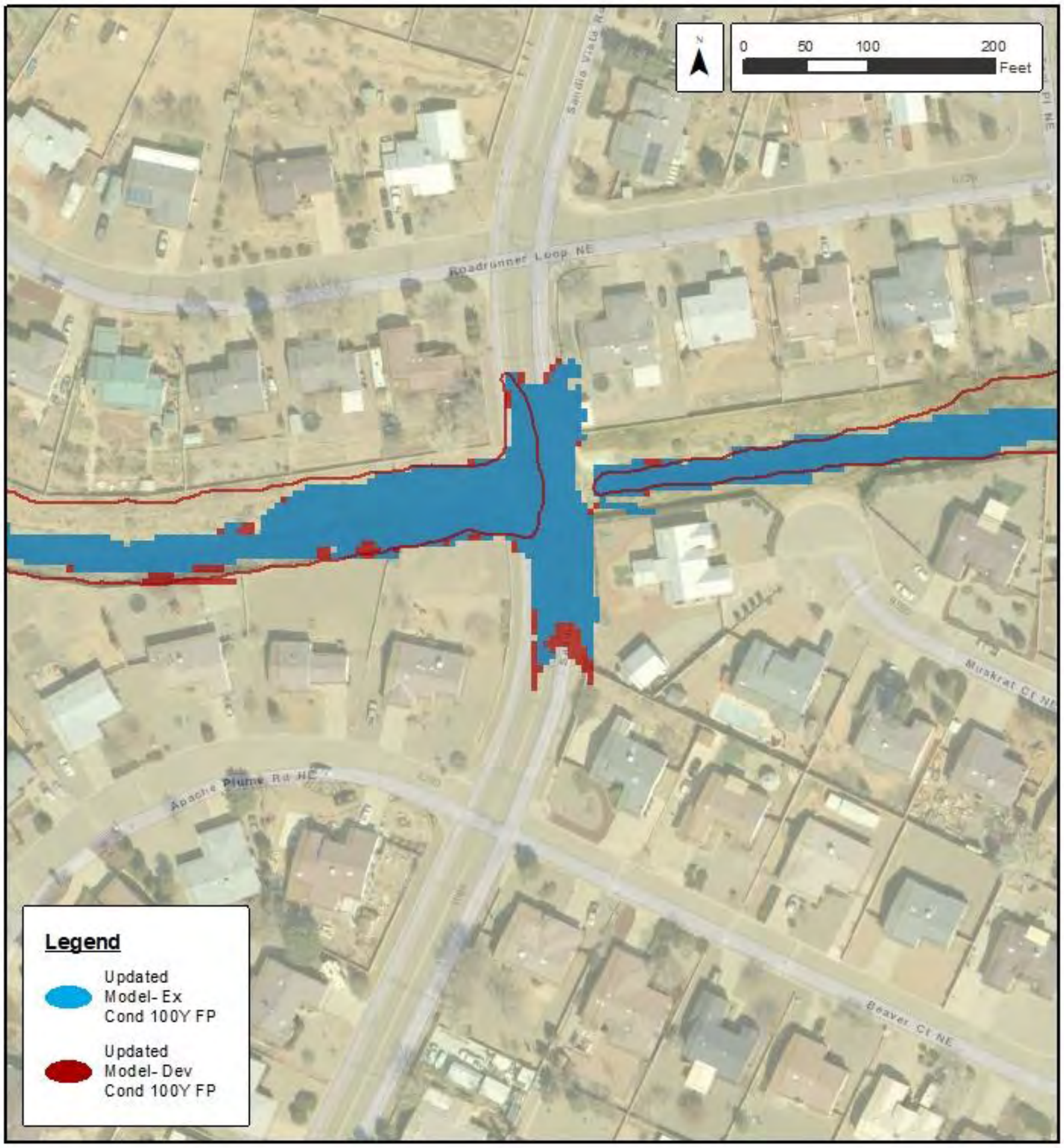



**Figure 6: Mapping Comparison of Existing and Developed Conditions**

## Structure BA 10

| | |
|---|---|
| Structure Name: | BA_10 |
| Structure Location: | Tributary H & Idalia Rd. (Approximately 400' east of intersection of Iris Rd. NE and Idalia Rd. NE) |
| Watershed: | Barranca |
| Barrel Type: | Ultra Flo (Contech Brand, lined CMP) |
| Number of Barrels: | 3 |
| Barrel Dimensions: | 54” |
| US Culvert Inverts, E to W: | 5284.17’, 5284.37’, 5284.35’ |
| DS Culvert Inverts, E to W: | 5276.77’, 5276.72’, 5276.97’ |
| US Top of Headwall: | Approximately 5293.91’ |
| DS Top of Headwall: | Approximately 5282.86’ |
| Road Crown Elev. At Culverts: | Curbs: Approximately 5293.3’<br>Road: Approximately 5292.7’<br>Median: Approximately 5293.5’ |
| Rail (Y/N): | Y |

BA_10 (Tributary H & Idalia Rd.)

BA_10, upstream

BA_10, downstream

**Figure 1: Structure BA_10, photos provided by SSCAFCA**

Structure BA_10 at Tributary H & Idalia Road was modeled using survey data obtained by Wayjohn Surverying Inc. on December 16, 2021. Approximately 24.3 acres were modeled in 2D using HEC-RAS 6.1. Cell sizes within the 2D modeled area range from 62.9 square feet to 7,827.2 square feet. The average cell size in the model was 406.1 square feet.

Flows were taken as reported in the December 2021 Barranca Watershed Management Plan and incorporated into a boundary at the upstream end of the hydraulic modeling using boundary condition lines with a uniform inflow for the model run duration. Peak flows are shown in the table below.

**Table 1: Flow Data Provided by SSCAFCA**

| Storm Event | Peak Flow (CFS) |
|---|---|
| Existing Conditions | 652 |
| Developed Conditions | 1,024 |
| Culvert Capacity | 540 |

The model was run until the summation of inflows was achieved at the downstream end of the model. This occurred quickly in the model, and a duration of one hour was selected to ensure no significant instabilities would occur.

The model results showed that the capacity of the culverts are not sufficient to convey the flow downstream in either the existing or developed conditions. Overtopping is expected on Idalia Road with depths approximately 1 foot and 1.6 foot, in existing and developed conditions respectively. Graphic and tabular results are shown below.

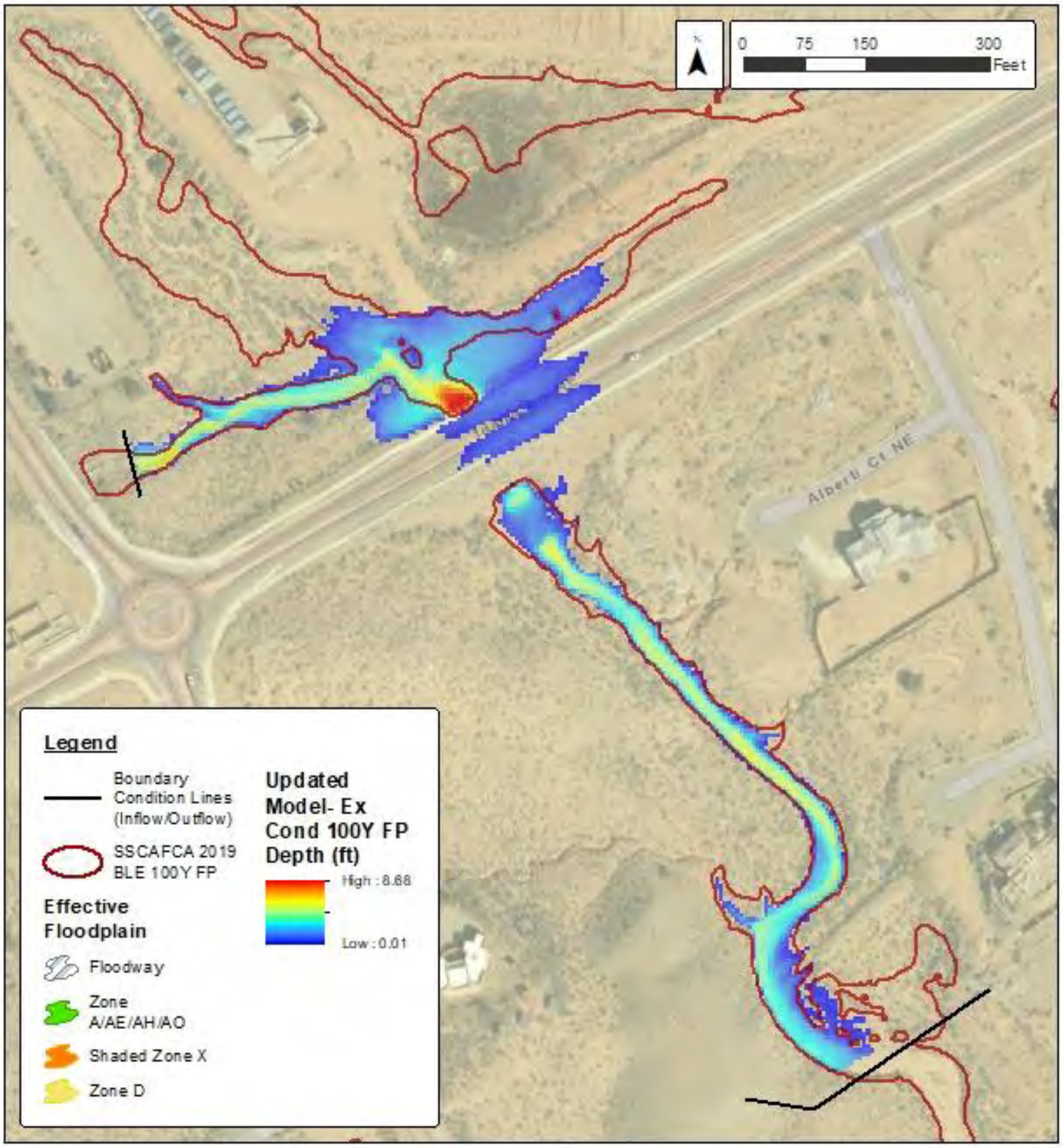



**Figure 2: Existing Conditions Compared with FEMA BLE Results – Full Model Extents**

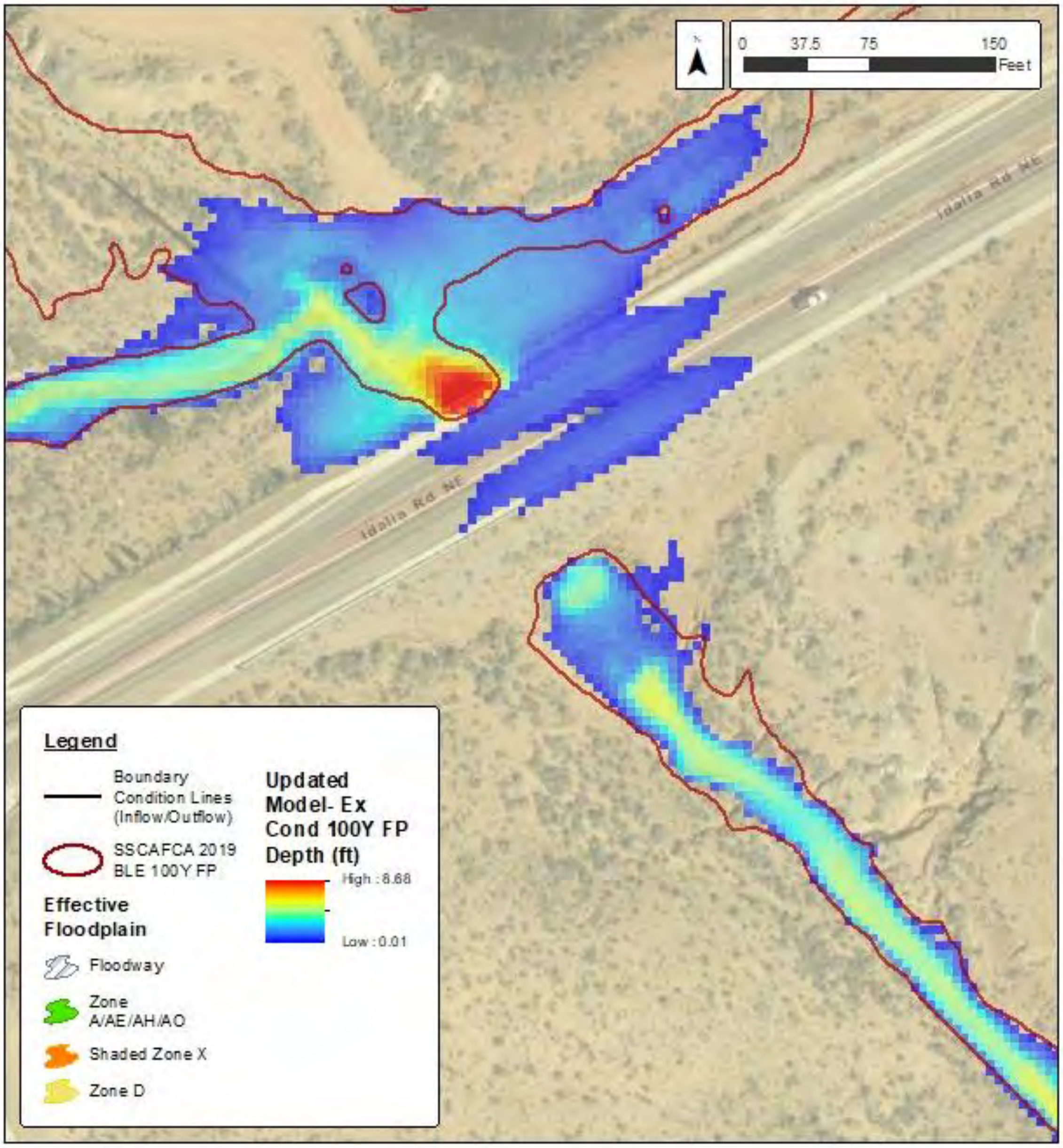



**Figure 3: Existing Conditions Compared with FEMA BLE Results**

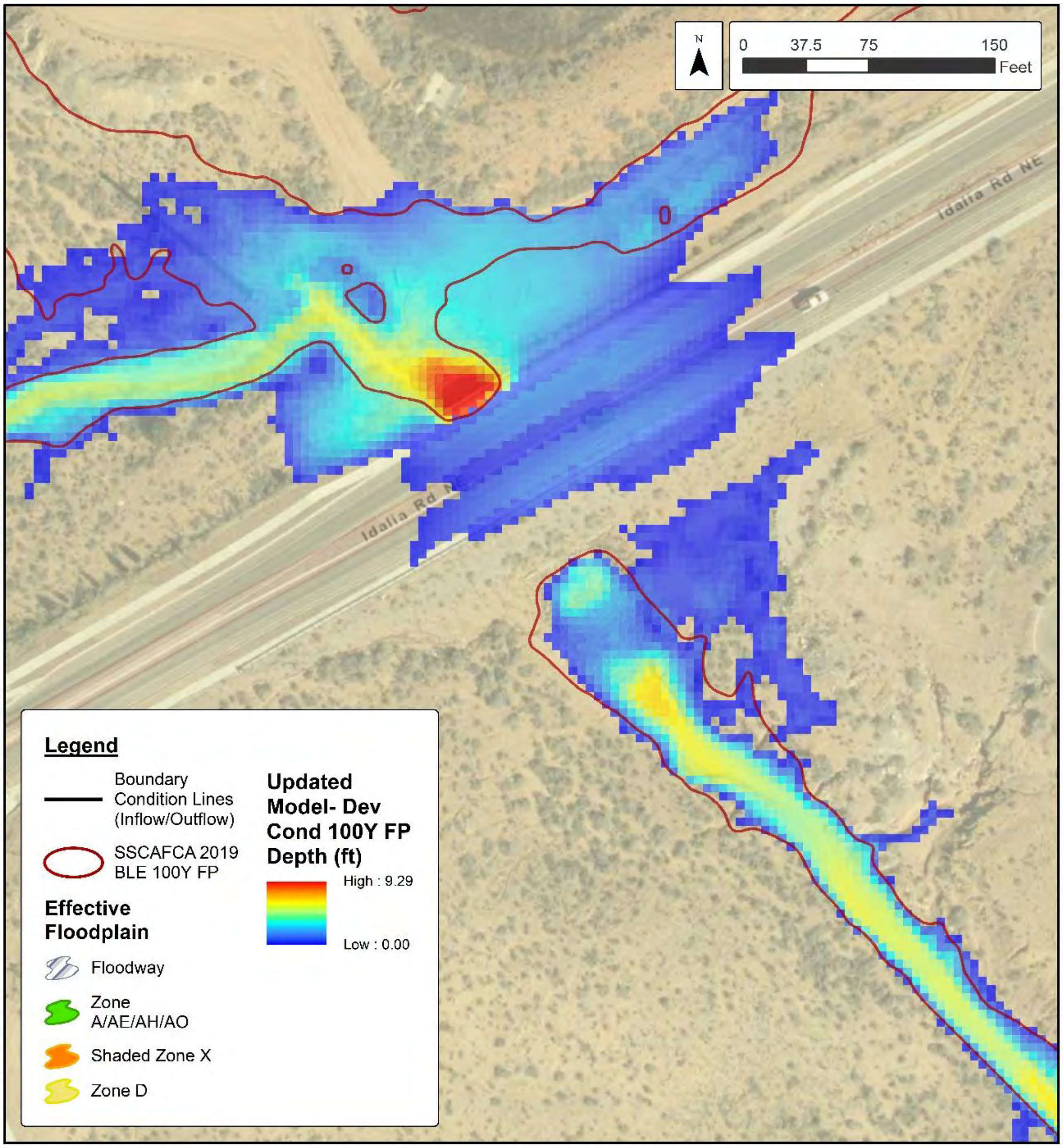



**Figure 4: Developed Conditions Compared with FEMA BLE Results**

**Table 2: Updated BLE Model Results Synopsis**

| US Crown of Culvert | Top of Road | Conditions | Upstream WSEL (ft) | Downstream WSEL (ft) | Depth over Rd Based on US WSEL (ft) | Modeled Flow at US Boundary (cfs) | Total Max Flow Through Culverts (cfs) | Flow Over Road (cfs) |
|---|---|---|---|---|---|---|---|---|
| 5,288.67 | 5,292.7 *Headwall at 5,293.9 | Existing | 5293.50 | 5278.75 | 0.8 | 652 | 610 | 42 |
| | | Developed | 5294.17 | 5278.71 | 1.5 | 1024 | 640 | 384 |

Table 2 above details the relevant geometry of the structure compared with the modeling results. The upstream water surface elevation impacts the flow through the culverts, whether the culverts are submerged on the upstream end, and whether the road overtops in the modeled storm event. The 'Total Max Flow Through Culverts' reported in the table is the summation of flow reported in each culvert, and the 'Flow Over Road' reported in the table is the weir flow recorded in the modeling.

For BA_10, the culvert capacity reported in the Barranca WMP (Dec 2021) is 540 cfs. The modeling showed that the culverts were able to convey approximately 610 cfs in the Existing Rainfall event with submerged culvert inlets and road overtopping. It also shows that the culverts are able to convey approximately 640 cfs in the Developed Rainfall event with submerged culvert inlets and road overtopping occurring. The differences in the WMP capacity and the modeled capacity is likely due to a combination of calculation methodology differences and more specific data.

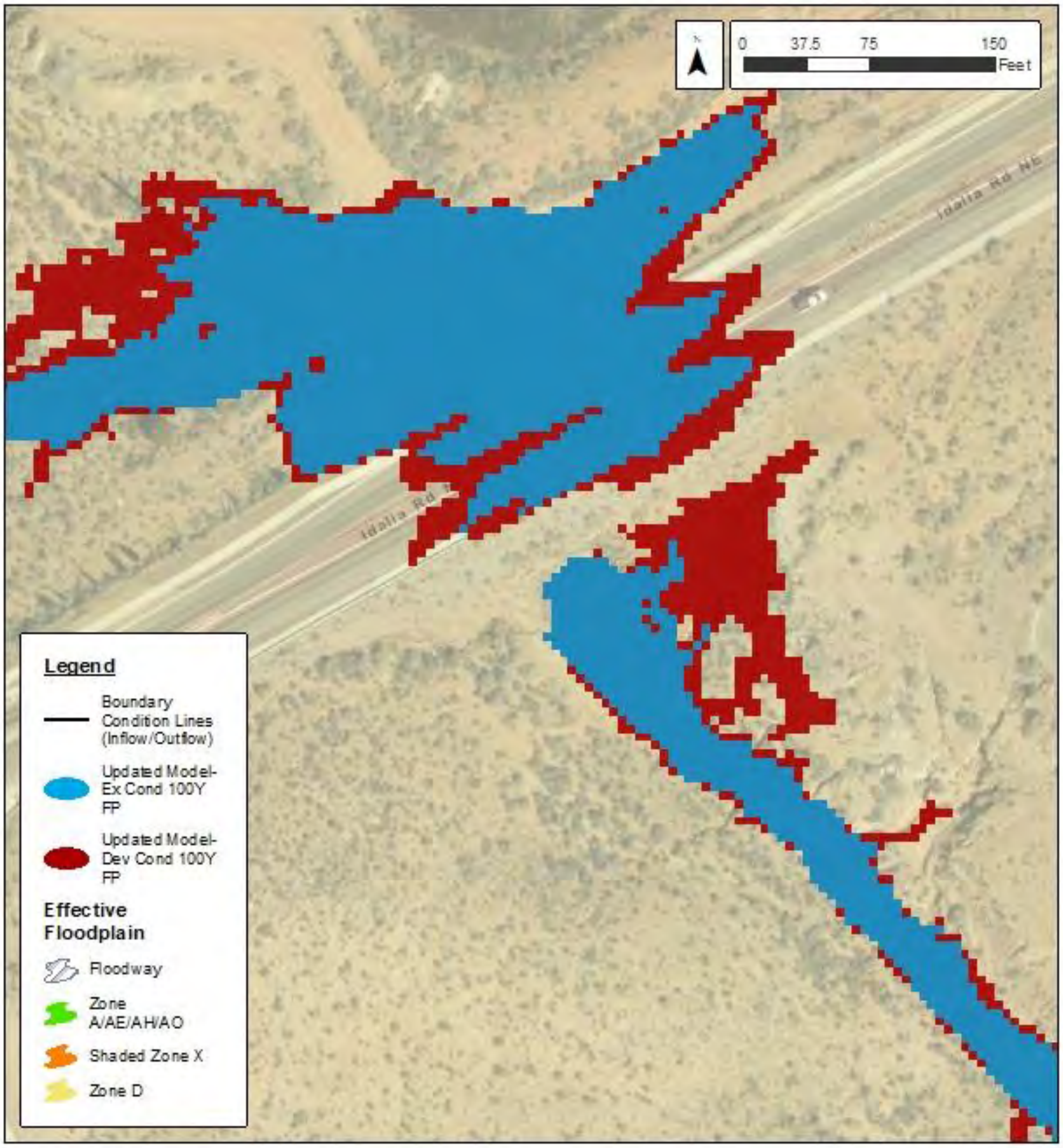



**Figure 5: Mapping Comparison of Existing and Developed Conditions**

# Structure BA_11

| | |
|---|---|
| Structure Name: | BA_11 |
| Structure Location: | Tributary H & Iris Rd |
| Watershed: | Barranca |
| Barrel Type: | CMP |
| Number of Barrels: | 4 |
| Barrel Dimensions: | 48'' |
| US Culvert Invert(s), E to W | 5222.16', 5222.06', 5222.52', 5222.39' |
| DS Culvert Invert(s), E to W | 5219.99', 5219.93', 5220.17', 5220.16' |
| US Top of Headwall: | NA – No headwall |
| DS Top of Headwall: | NA – No headwall |
| Road Crown Elev. At Culverts: | 5230.11' |
| Rail (Y/N): | Y - Fencing |

BA_11, upstream

BA_11, downstream

**Figure 1: Structure 11 photos provided by SSCAFCA**

The structure at Tributary H & Iris Road was modeled using survey data obtained by Wayjohn Surveying, Inc on December 11, 2021. 46.6 acres were modeled in 2D using HEC-RAS 6.1. Cell sizes within the 2D modeled area range from 21.1 square feet to 5,260.9 square feet. The average cell size in the model was 589.8 square feet.

Flow values were taken as reported in the December 2021 Barranca Watershed Management Plan incorporated into a boundary at the upstream end of the hydraulic modeling using boundary condition lines with a uniform inflow for the model run duration. Peak flows are shown in the table below.

**Table 1: Flow Data Provided by SSCAFCA**

| Storm Event | Peak Flow (CFS) |
|---|---|
| Existing Conditions | 906 |
| Developed Conditions | 1,321 |
| Culvert Capacity | 170 |

The model was run until the summation of inflows was achieved at the downstream end of the model. This occurred quickly in the model, and a duration of 1 hour was selected to ensure no significant instabilities would occur.

Overtopping was reported on Iris Road for both Existing and Developed flow conditions. The low point of Iris Road is not directly at the Tributary H crossing but is located just to the east. It is at this location that road overtopping and ponding was reported by the modeling. Graphic and tabular results are shown below.

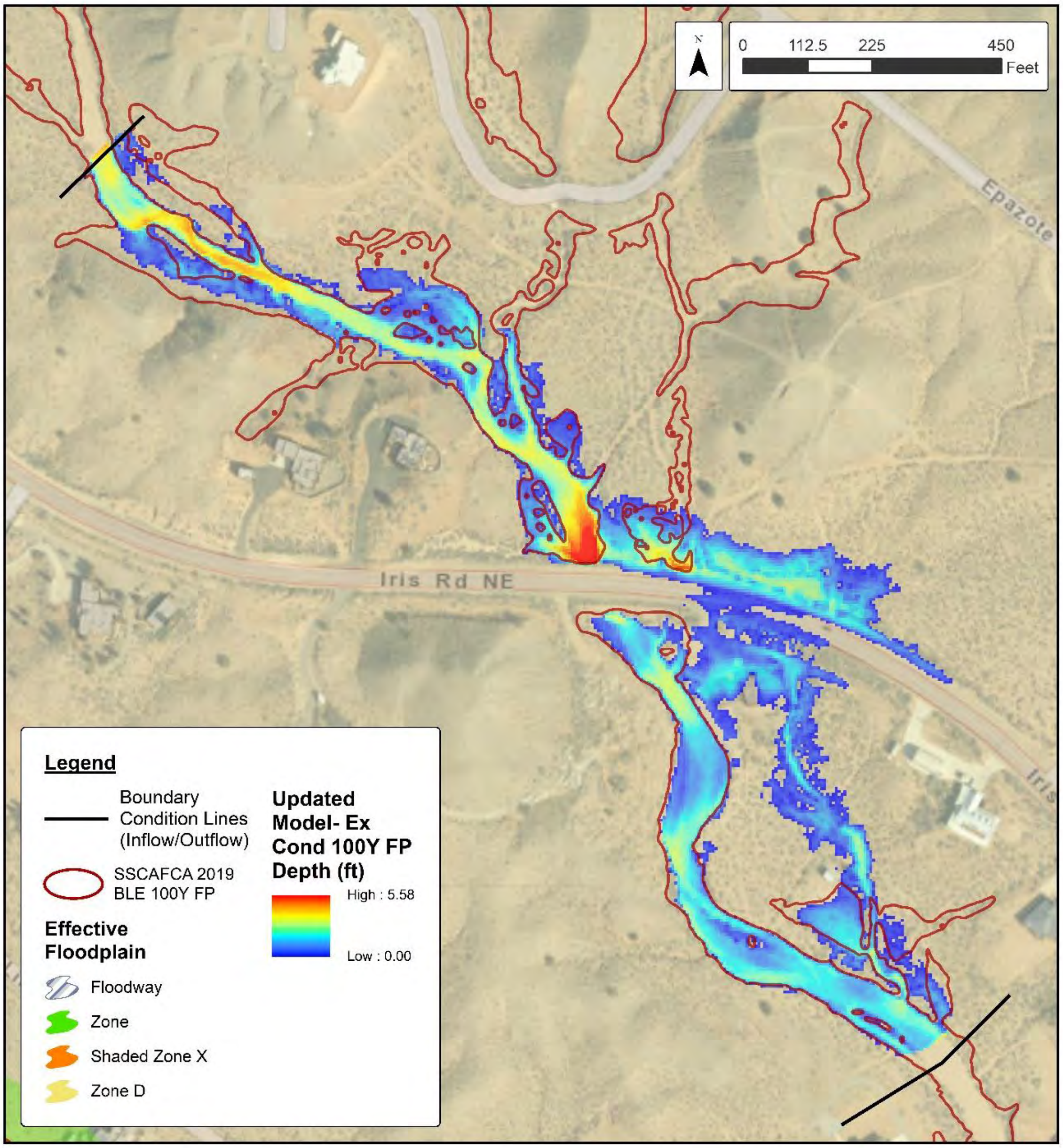



**Figure 2: Existing Conditions Compared with FEMA BLE Results – Full Model Extents**

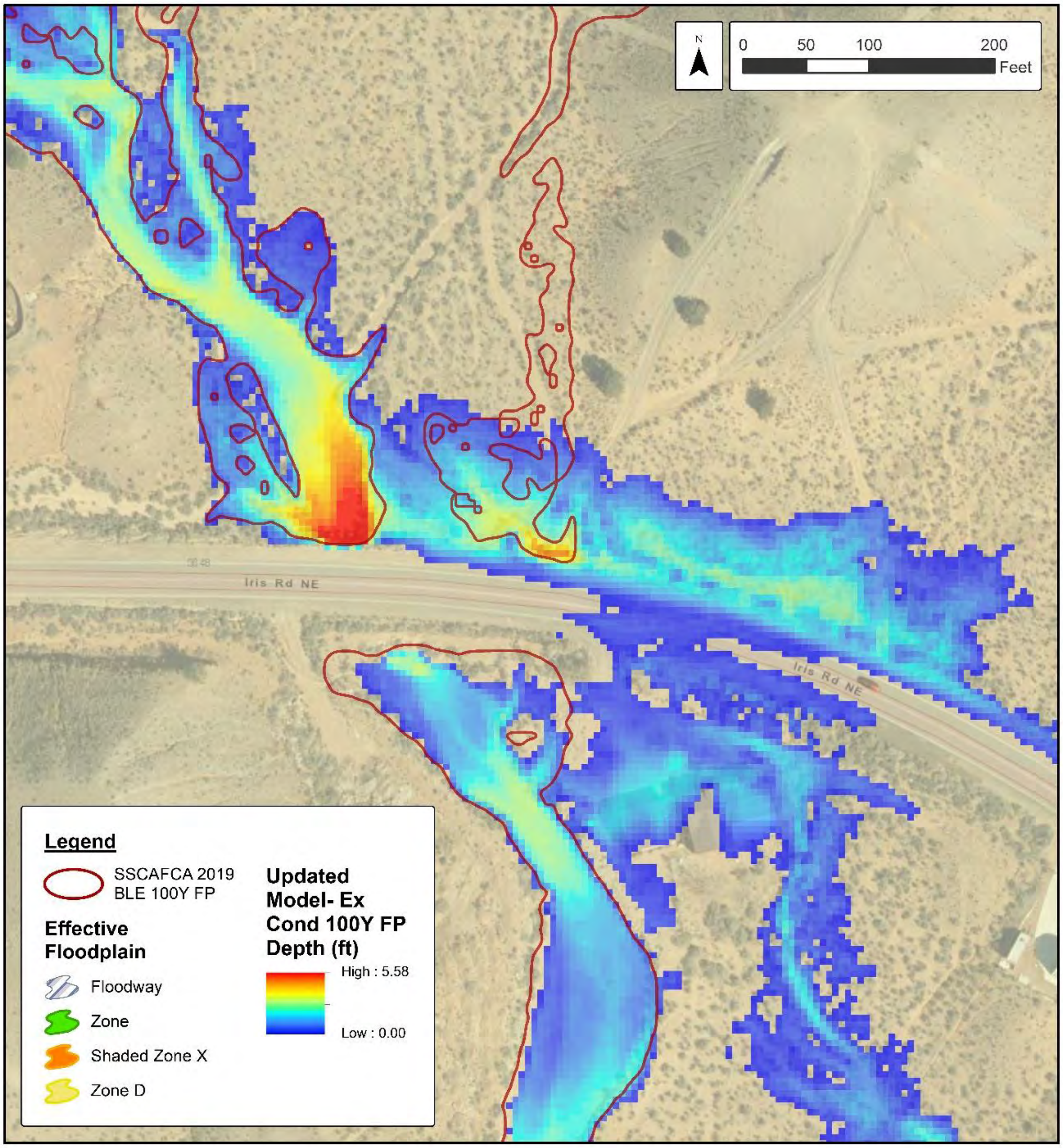



**Figure 3: Existing Conditions Compared with FEMA BLE Results**

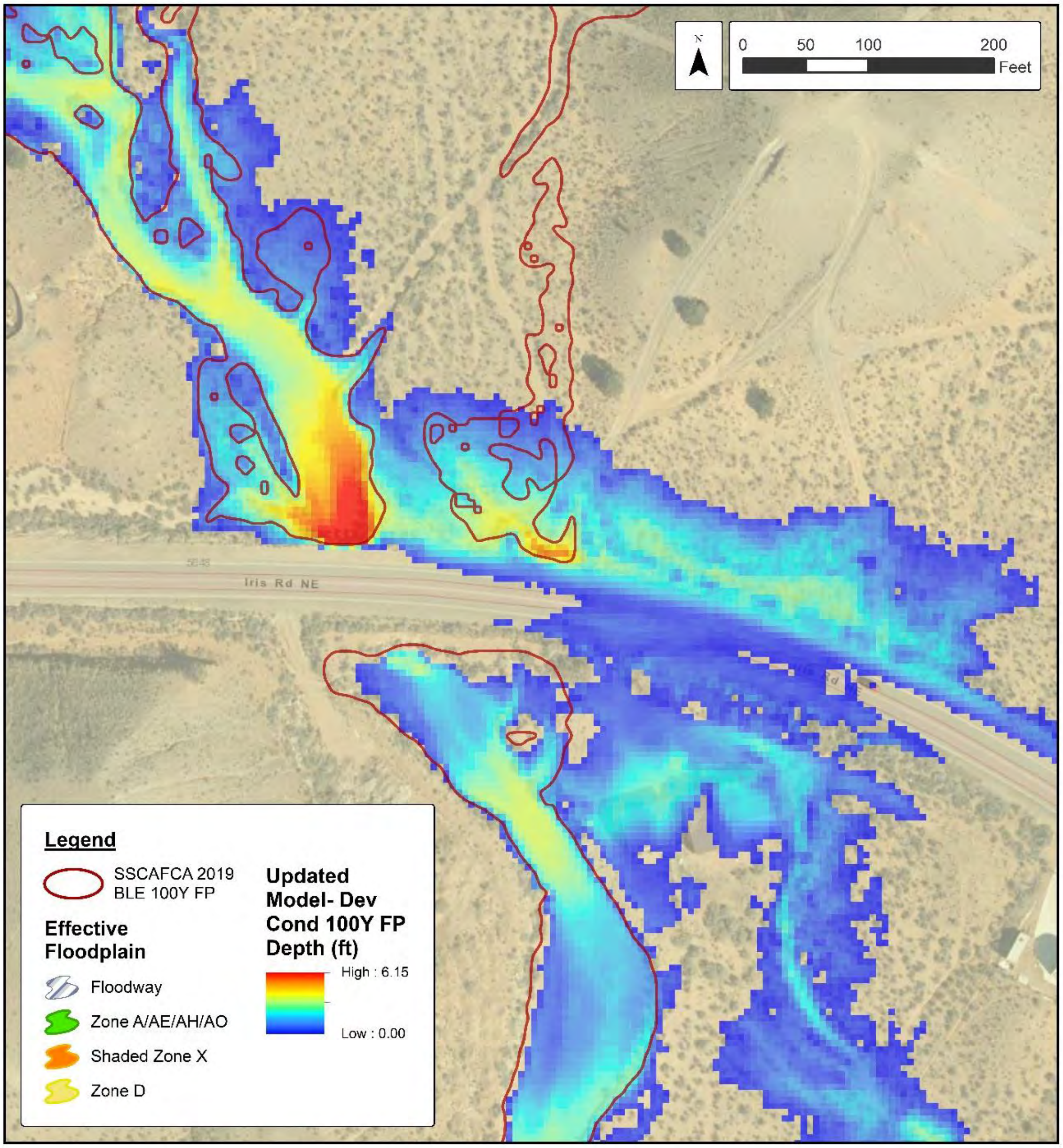



**Figure 4: Developed Conditions Compared with FEMA BLE Results**

**Table 2: Updated BLE Model Results Synopsis**

| US Crown of Culvert (ft) | Top of Road (ft) | Conditions | Upstream WSEL (ft) | Downstream WSEL (ft) | Depth over Rd Based on US WSEL (ft) | Modeled Flow at US Boundary (cfs) | Total Max Flow Through Culverts (cfs) | Flow Over Road (cfs) |
|---|---|---|---|---|---|---|---|---|
| 5226.06 | 5230.1 | Existing | 5228.52 | 5221.70 | - | 906 | 422 | 484 |
| | | Developed | 5229.08 | 5221.82 | - | 1321 | 457 | 864 |

**While the road elevation at the structure is approximately 5230 feet, the approximate elevation of the road just east of the structure is 5226.2 feet. This leads to a discrepancy between ponding reported directly at the structure and the overall ponding on Iris Road shown in the raster mapping.*

Table 2 above details the relevant geometry of the structure compared with the modeling results. The upstream water surface elevation impacts the flow through the culverts, whether the culverts are submerged on the upstream end, and whether the road overtops in the modeled storm event. The 'Total Max Flow Through Culverts' reported in the table is the summation of flow reported in each culvert, and the 'Flow Over Road' reported in the table is the weir flow recorded in the modeling.

For BA_11, the culvert capacity reported in the Barranca WMP (December 2021) is 170 cfs. The modeling showed that the culverts were able to convey approximately 422 cfs in the Existing Rainfall event with submerged culvert inlets and no road overtopping directly above the structure. It also shows that the culverts are able to convey approximately 457 cfs in the Developed Rainfall event with submerged culvert inlets and no road overtopping occurring directly above the structure. The differences in the WMP capacity and the modeled capacity is likely due to a combination of calculation methodology differences and more specific data.

Based on the detailed water surface raster mapping and the approximate terrain elevations on Iris Road, depths of approximately 0.4 and 0.6 feet occur in the existing conditions and developed conditions modeling, respectively. For each event, the primary location of ponding is just east of the structure, where a sump exists in the terrain. No ponding is located directly at the structure, as indicated in Table 2.

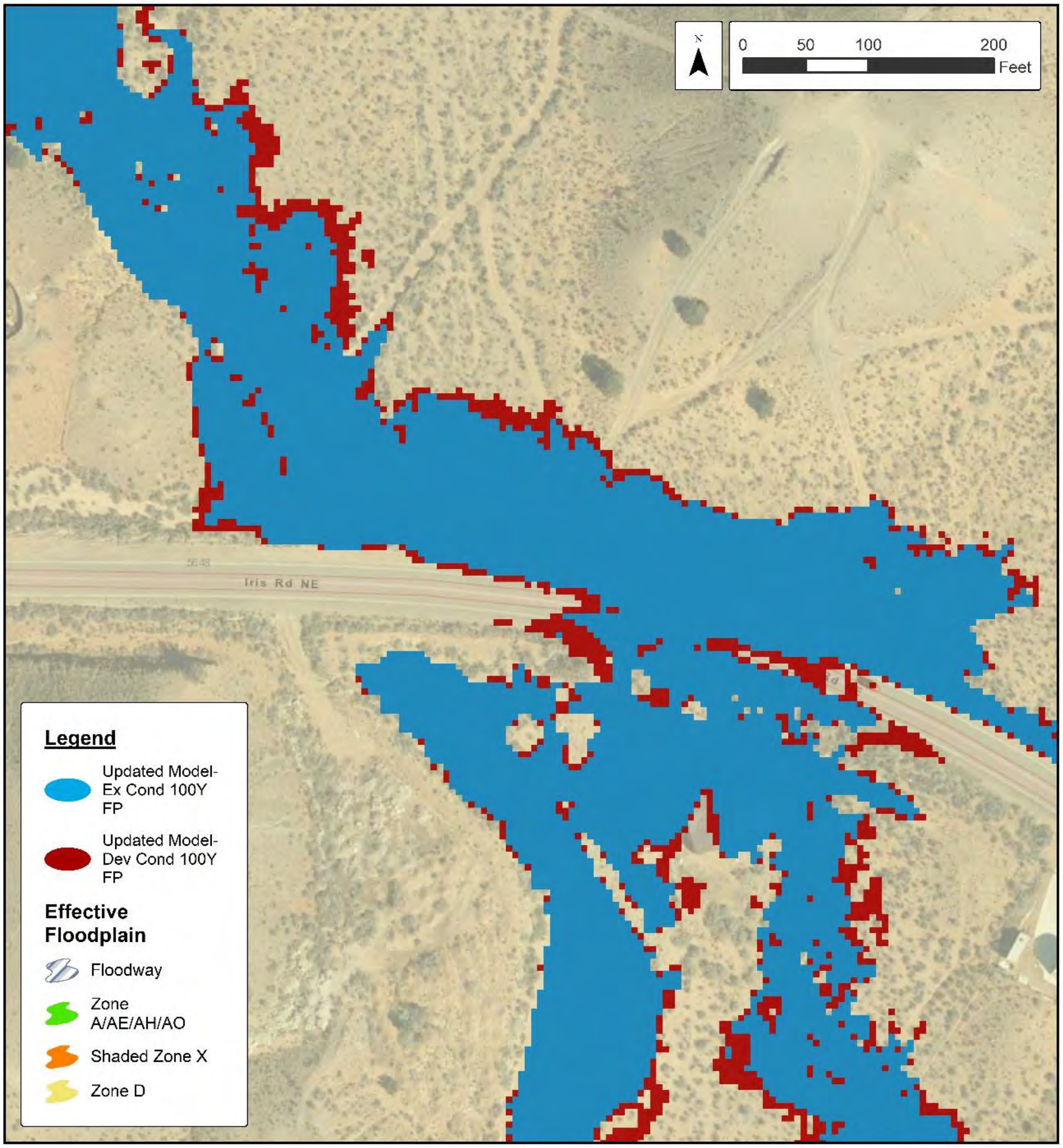



**Figure 5: Mapping Comparison of Existing and Developed Conditions**

# Structure BA_12

| | |
|---|---|
| Structure Name: | BA_12 |
| Structure Location: | Tributary I and NM 528 crossing (Approximately 720' south west of NM 528 and Honduras Rd corossing) |
| Watershed: | Barranca |
| Barrel Type: | Corrugated Metal Pipe |
| Number of Barrels: | 2 |
| Barrel Dimensions: | 60'' |
| US Culvert Invert | 5122.48', 5122.44' |
| DS Culvert Invert | 5118.22', 5118.33' |
| US Top of Headwall: | Approximately 5128.37' |
| DS Top of Headwall: | Approximately 5124.50' |
| Road Surface Elev. At Culverts: | Road: Approximately 5131.22'<br>Median: Approximately 5131.54' |
| Rail (Y/N): | Y |

BA_12 (Tributary I & NM 528)

BA_12, upstream

BA_12, downstream

**Figure 1: Structure BA_12, photos provided by SSCAFA**

Structures BA_12 (shown in Figure 1), BA_04, and BA_13 are in very close proximity with no significant tributaries joining in between (as shown in Figure 2) and have been modeled together. BA_13 (Riverside Dr NE crossing) is located approximately 1,380 feet downstream of BA_12. BA_04 (Barranca Arroyo and NM 528) is located approximately 1,900 feet southwest along the same highway as BA_12, and they have overlapping impacts.

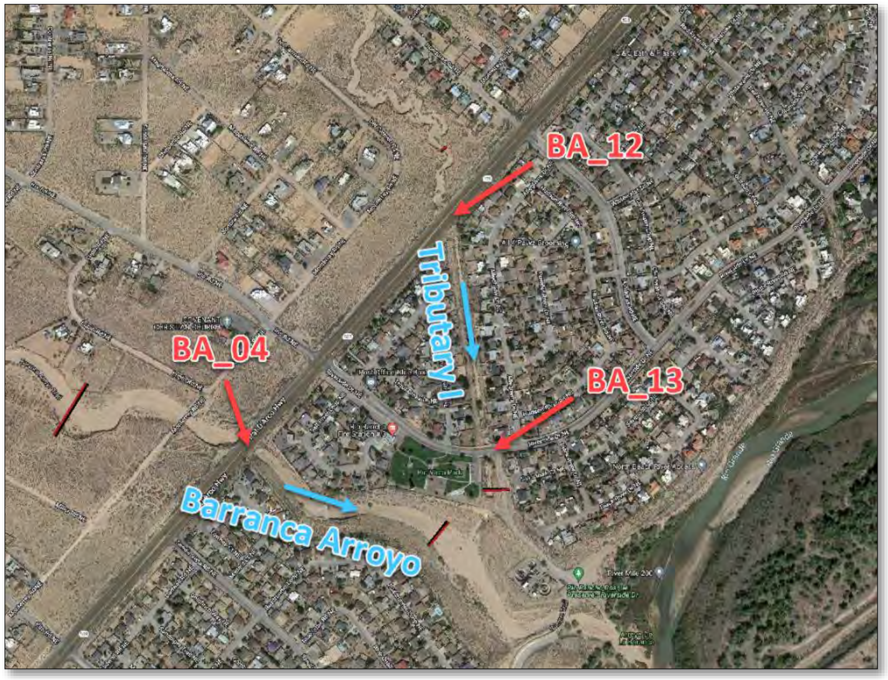



**Figure 2: Map showing the modeled structures**

BA_12 was modeled using survey data obtained by Wayjohn Surveying, Inc. on January 3, 2022. Approximately 88.3 acres were modeled in 2D using HEC-RAS 6.1. Cell sizes within the 2D modeled area range from 37.2 square feet to 6048.1 square feet. The average cell size in the model is 423.2 square feet.

Flow values were taken as reported in the December 2021 Baranca Watershed Management Plan (WMP) and incorporated into a boundary at the upstream end of the hydraulic modeling using boundary condition lines with a uniform inflow for the model run duration. Assigned flow values at structure BA_12 are shown in the table below.

**Table 1: Flow Data Provided by SSCAFCA**

| Storm Event | Peak Flow (CFS) |
| --- | --- |
| Existing Conditions | 587 |
| Developed Conditions | 796 |
| Culvert Capacity | 400 |

The model was run until the summation of inflows was achieved at the downstream end of the model. The model was run for a duration of 2 hours to ensure no significant instabilities would occur. The model results show that the capacity of the culverts is not sufficient to convey the flow downstream in either existing or developed conditions.

Although no overtopping is expected on NM 528 at BA_12, the excess flows start overtopping along NM 528 between the Riverside Drive intersection and BA_12 crossings. The floodwaters are expected to inundate part of NM 528 and flow downstream through Riverside Drive towards BA_13 while part of the flow is expected to drain into Barranca Arroyo at BA_4. Approximately 144 cfs and 221 cfs are shown to drain to Baranca Arroyo for existing and developed conditions, respectively. Approximately 34 cfs and 152 cfs are shown to drain to Tributary I at BA_13 from Riverside Drive for existing and developed conditions, respectively. The existing walls around residential and business properties, where flooding impacts are expected, are included in the model geometry as well as the barrier (approximately 5 feet tall) located along the downstream edge of NM 528.

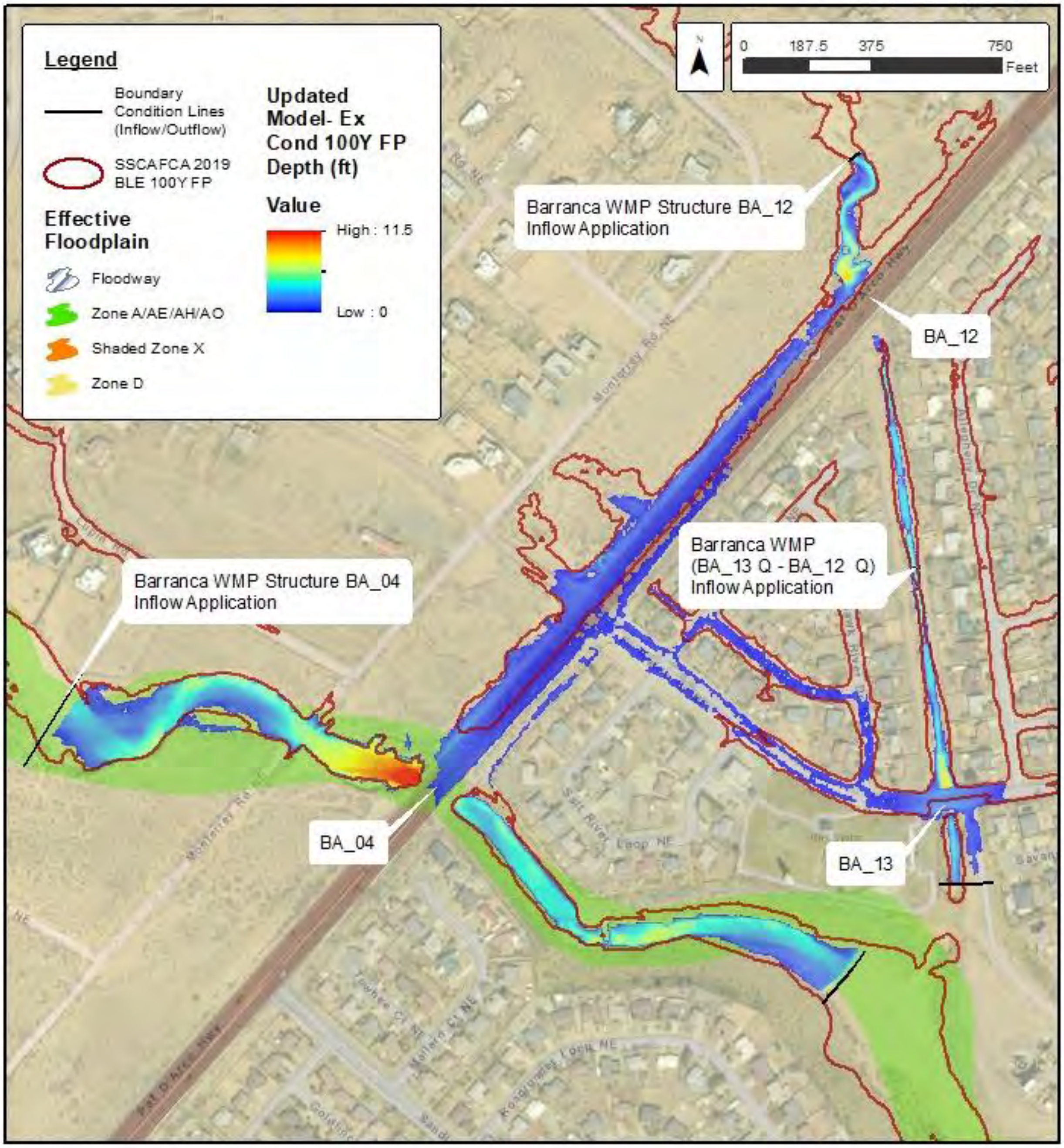



**Figure 3: Existing Conditions Compared with FEMA BLE Results – Full Model Extents**

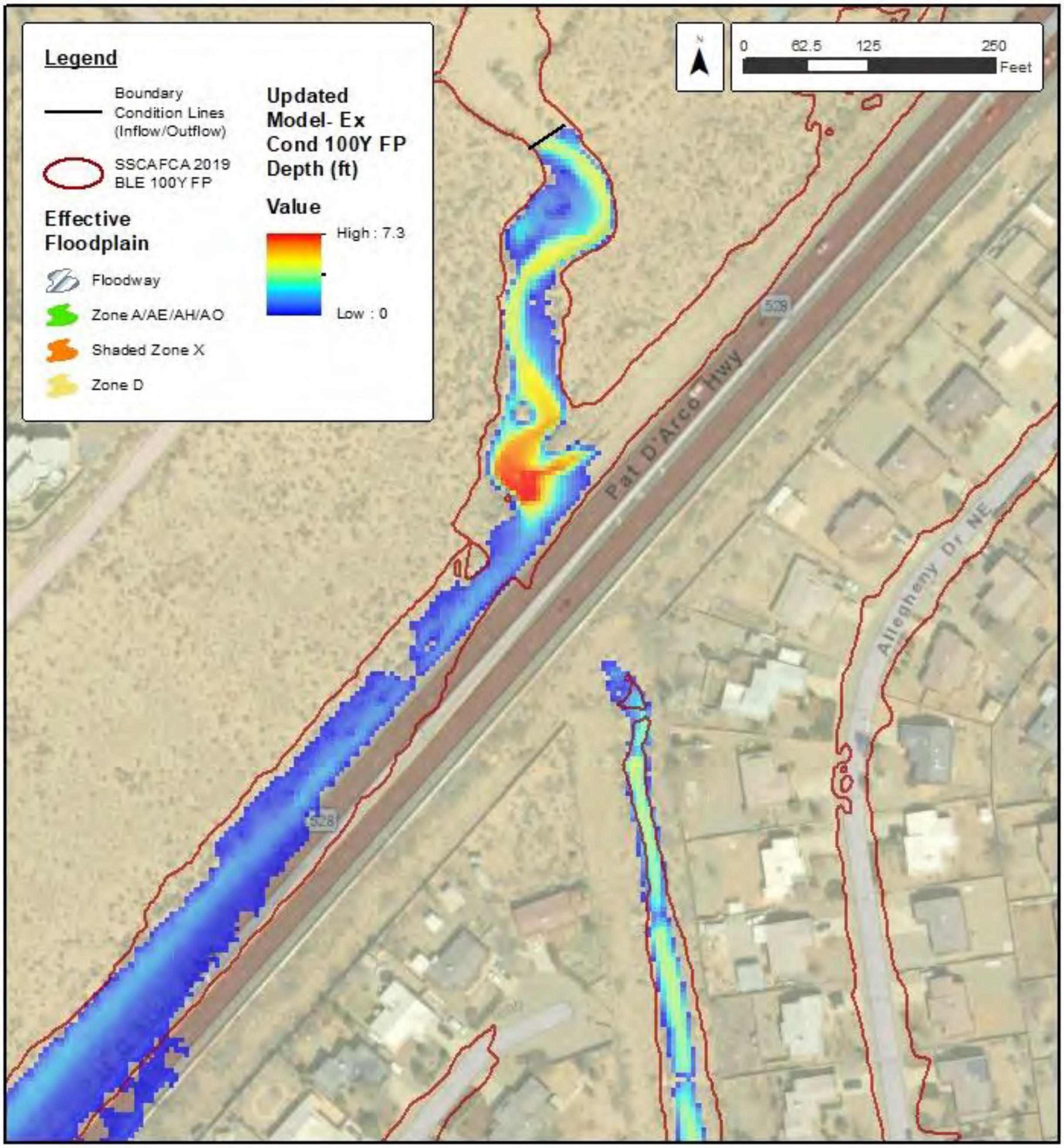



**Figure 4: Existing Conditions Compared with FEMA BLE Results**

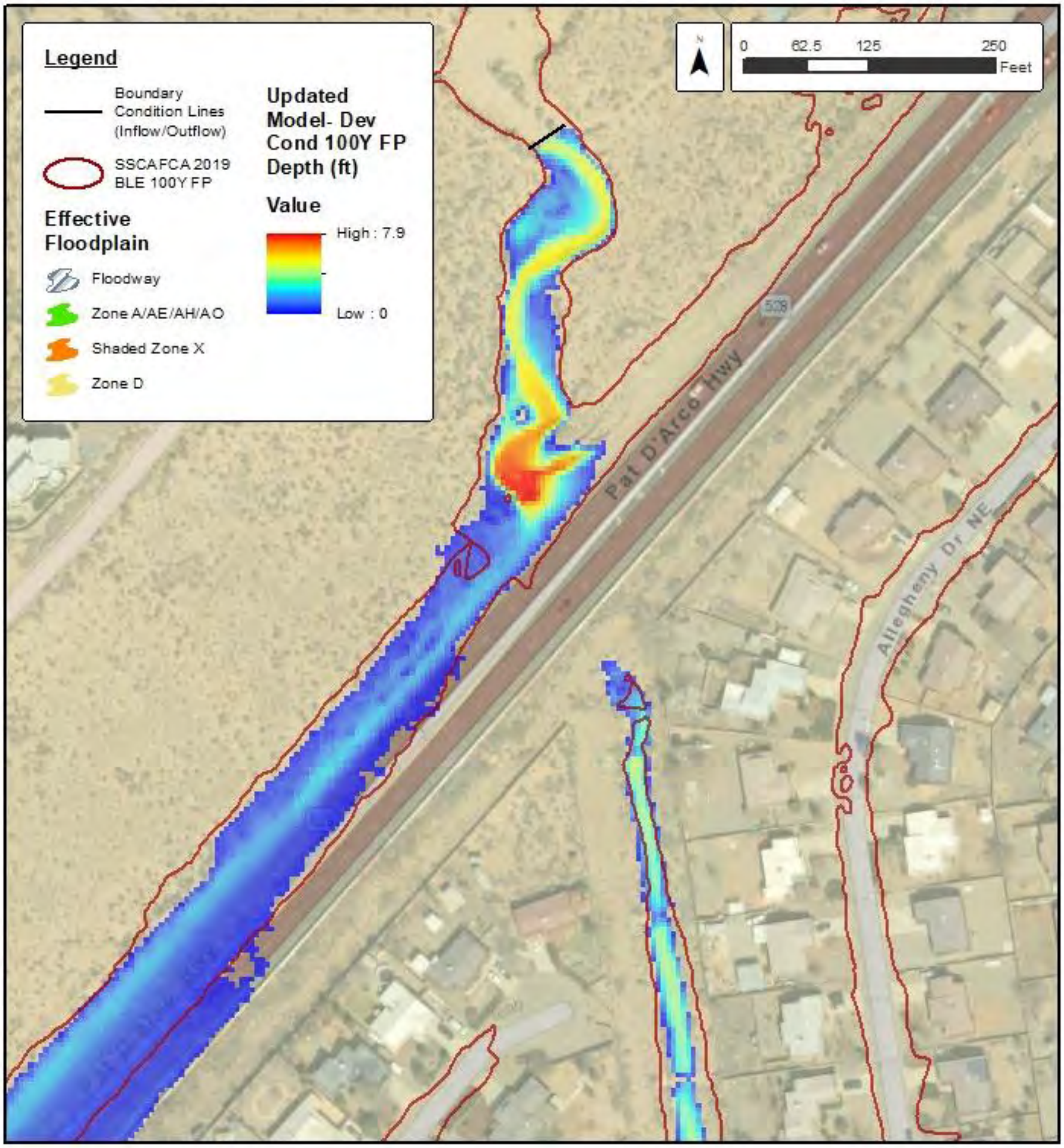



Figure 5: Developed Conditions Compared with FEMA BLE Results

**Table 2: Updated BLE Model Results Synopsis**

| US Crown of Culvert (ft) | Top of Road (ft) (approx.) | Conditions | Upstream WSEL (ft) | Downstream WSEL (ft) | Depth Over Rd Based on US WSEL (ft) | Modeled Flow at US Boundary (cfs) | Total Max Flow Through Culverts (cfs) | Flow Over Road (cfs) |
|---|---|---|---|---|---|---|---|---|
| 5127.48 | 5132.44 | Existing | 5131.48 | 5124.49 | - | 587 | 411 | 176 |
| | | Developed | 5132.03 | 5124.55 | - | 796 | 426 | 370 |

**The local low point of the road occurs southwest of the structure; therefore, maximum mapping of the analysis and the 'depth over road' based on the comparison of headwater water surface elevations and the top of road at the structure may not match.*

Table 2 details the relevant geometry of the structure compared with the modeling results. The upstream water surface elevation impacts the flow through the culverts, whether the culverts are submerged on the upstream end, and whether the road overtops in the modeled storm event. The 'Total Max Flow Through Culverts' reported in the table is the summation of flow reported in each culvert, and the 'Flow Over Road' reported in the table is the weir flow recorded in the modeling.

The elevation along NM 528 declines northeast to southwest direction up to Barranca Arroyo and BA_4 crossing; therefore, the flooding is not limited by the natural terrain along the road. The 2D connection lines, which are used to define the culverts in the model geometry, measure the flow passing through the 2D mesh. As a portion of the overflow crosses downstream of NM 528, the connection line defining the NM 528 road is bent toward the high ground upstream of NM 528 to measure the full flow past the structure. A similar approach is followed to measure full flow at the BA_13 right bank to include the flow draining from Riverside Drive.

For BA_12, the culvert capacity reported in the Baranca WMP (December 2021) is 400 cfs. The model results show that the culverts are able to convey approximately 381 cfs before NM 528 starts to overtop. The road over the culverts will not be submerged, and the maximum depth of flooding over NM 528 occurs at structure BA_04. The structure capacity up to the crown of culvert (5127.48') is expected to be approximately 211 cfs. The differences in the WMP capacity and the modeled capacity are likely due to a combination of calculation methodology differences and more specific data. The inundation boundaries for existing and developed conditions are shown in Figure 6.

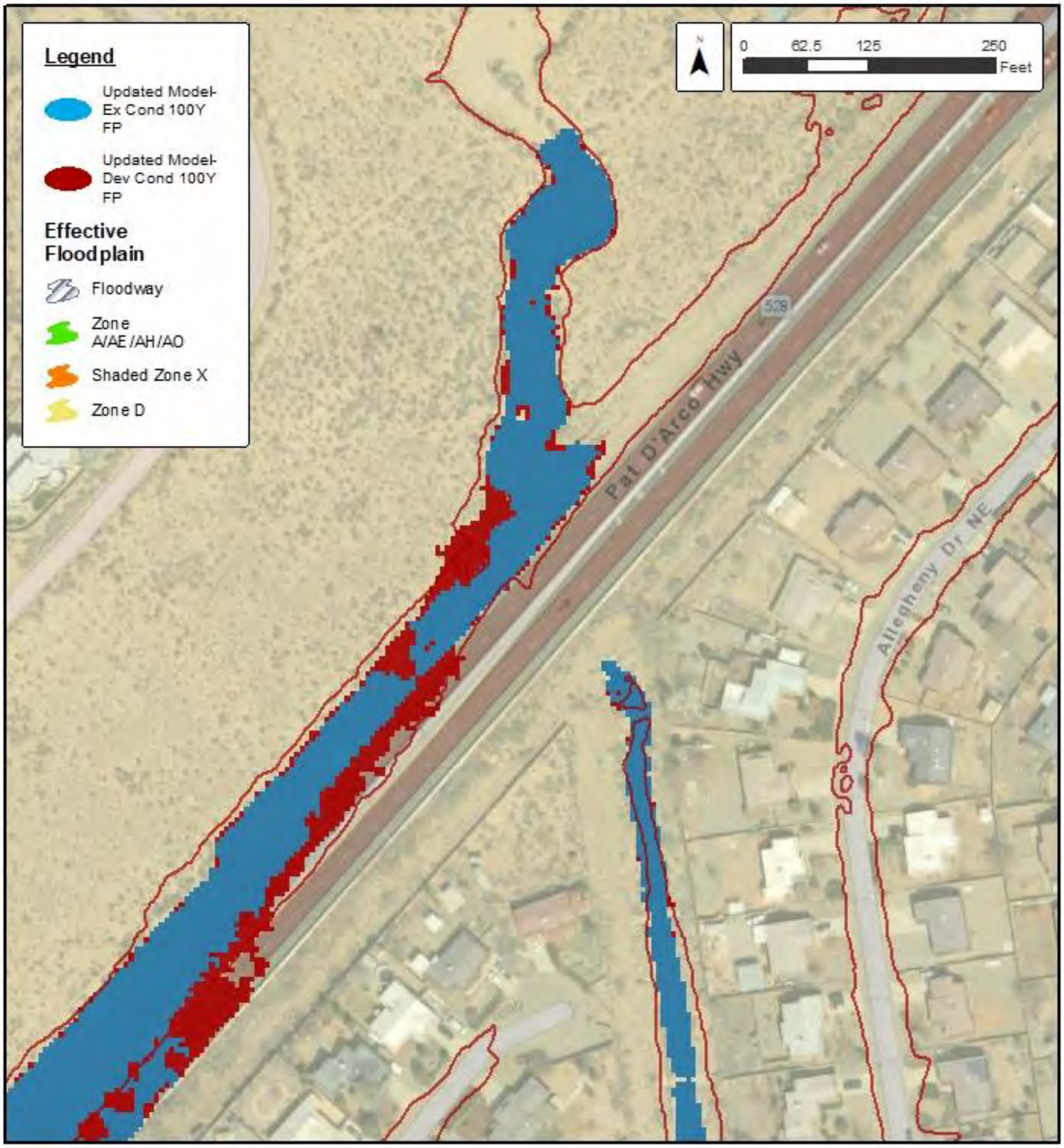



**Figure 6: Mapping Comparison of Existing and Developed Conditions**

## Structure BA_13

| | |
|---|---|
| Structure Name: | BA_13 |
| Structure Location: | Tributary I and Riverside Dr (Approximately 10' west of Riverside Dr and Allegheny Dr corossing) |
| Watershed: | Barranca |
| Barrel Type: | Reinforced Concrete Pipe |
| Number of Barrels: | 1 |
| Barrel Dimensions: | 66'' |
| US Culvert Invert | 5085.71' |
| DS Culvert Invert | 5084.97' |
| US Top of Headwall: | Approximately 5093.58' |
| DS Top of Headwall: | Approximately 5093.85' |
| Road Surface Elev. At Culverts: | Road: Approximately 5093.15'<br>Median: Approximately 5093.63' |
| Rail (Y/N): | Y |

BA_13 (Tributary I & Riverside Dr.)

BA_13, upstream

BA_13, downstream

**Figure 1: Structure BA_13, photos provided by SSCAFA**

Structures BA_13 (shown in Figure 1), BA_04, and BA_12 are in very close proximity with no significant tributaries joining in between (as shown in Figure 2) and have been modeled together. BA_13 (Riverside Dr NE crossing) is located around 1,380 feet downstream of BA_12 (NM 528 crossing). BA_04 (Barranca Arroyo and NM 528) is located approximately 1,900 feet southwest along the same highway as BA_12, and they have overlapping impacts.

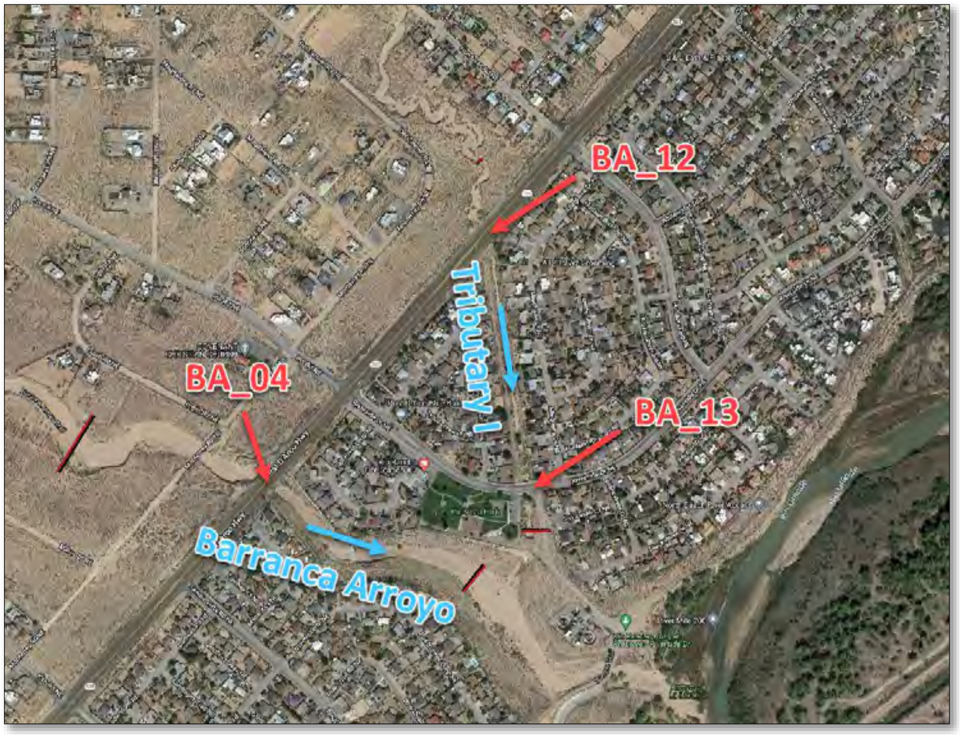



**Figure 2: Map showing the modeled structures**

BA_13 was modeled using survey data obtained by Wayjohn Surveying, Inc. on January 3, 2022. Approximately 88.3 acres were modeled in 2D using HEC-RAS 6.1. Cell sizes within the 2D modeled area range from 37.2 square feet to 6048.1 square feet. The average cell size in the model is 423.2 square feet.

Flow values were taken as reported in the December 2021 Baranca Watershed Management Plan (WMP). An inflow was added between BA_12 and BA_13 that adds 114 cfs and 123 cfs to the defined inflow values of BA_12 (587 cfs, 796 cfs) for existing and developed conditions, respectively, in order to meet BA_13 flow values. Assigned flow values at structure BA_13 are shown in the table below.

**Table 1: Flow Data Provided by SSCAFCA**

| Storm Event | Peak Flow (CFS) |
|---|---|
| Existing Conditions | 701 |
| Developed Conditions | 919 |
| Culvert Capacity | 240 |

The model was run until the summation of inflows was achieved at the downstream end of the model. The model was run for a duration of 2 hours to ensure no significant instabilities would occur. The model results show that the capacity of the culvert is not sufficient to convey the flow downstream in either existing or developed conditions.

Overtopping of Riverside Drive is expected for both existing and developed conditions at BA_13 crossing. Overtopping is due to insufficient culvert capacity and overtopped flooding on NM 528 that is expected to drain along Riverside Drive back to Tributary I.

Approximately 34 cfs and 152 cfs are shown to drain to Tributary I at BA_13 from Riverside Drive for existing and developed conditions, respectively. The existing walls around residential and business properties, where flooding impacts are expected, are included in the model geometry as well as the barrier (approximately 5 feet tall) located along the downstream edge of NM 528.

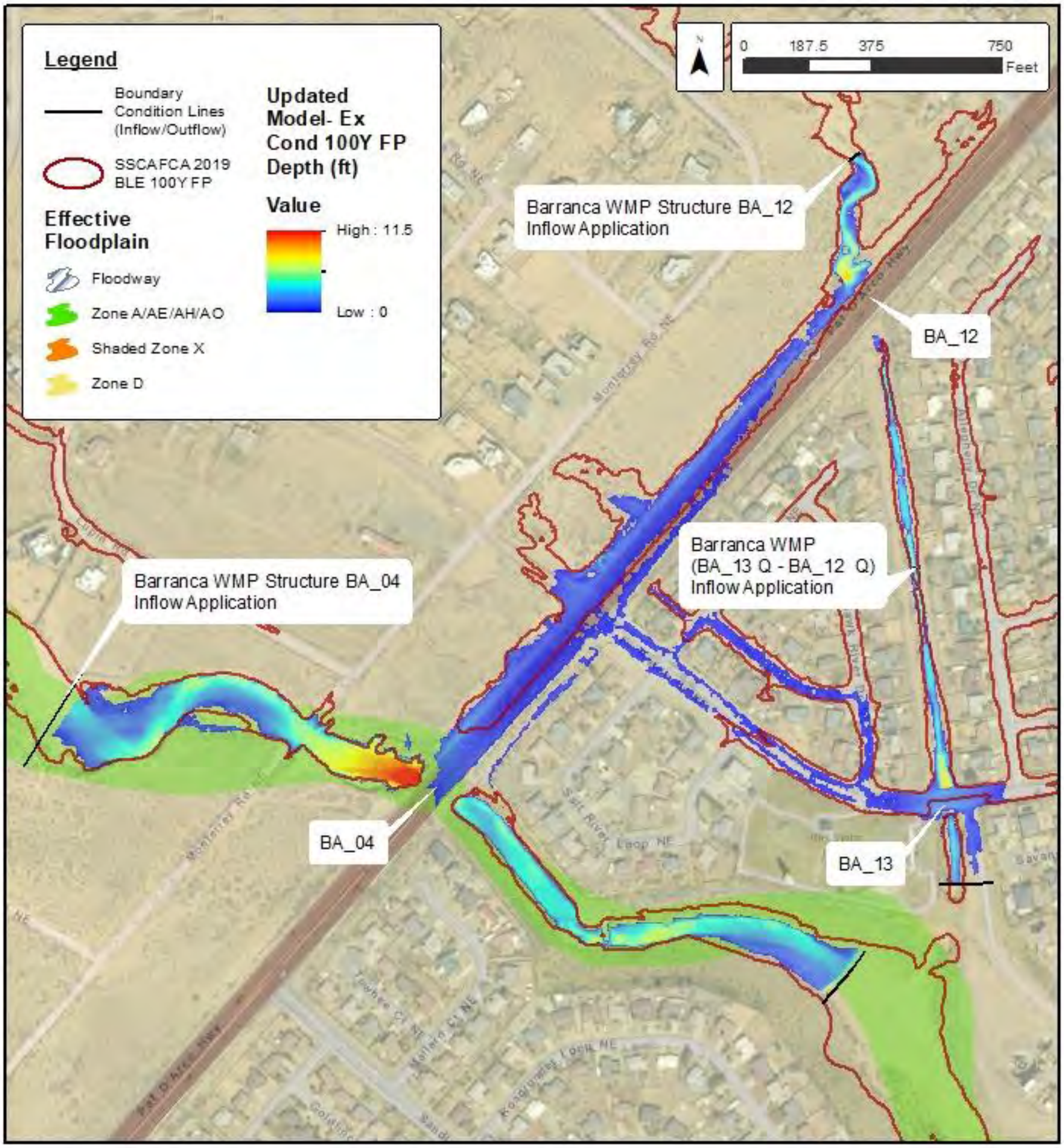



**Figure 3: Existing Conditions Compared with FEMA BLE Results – Full Model Extents**

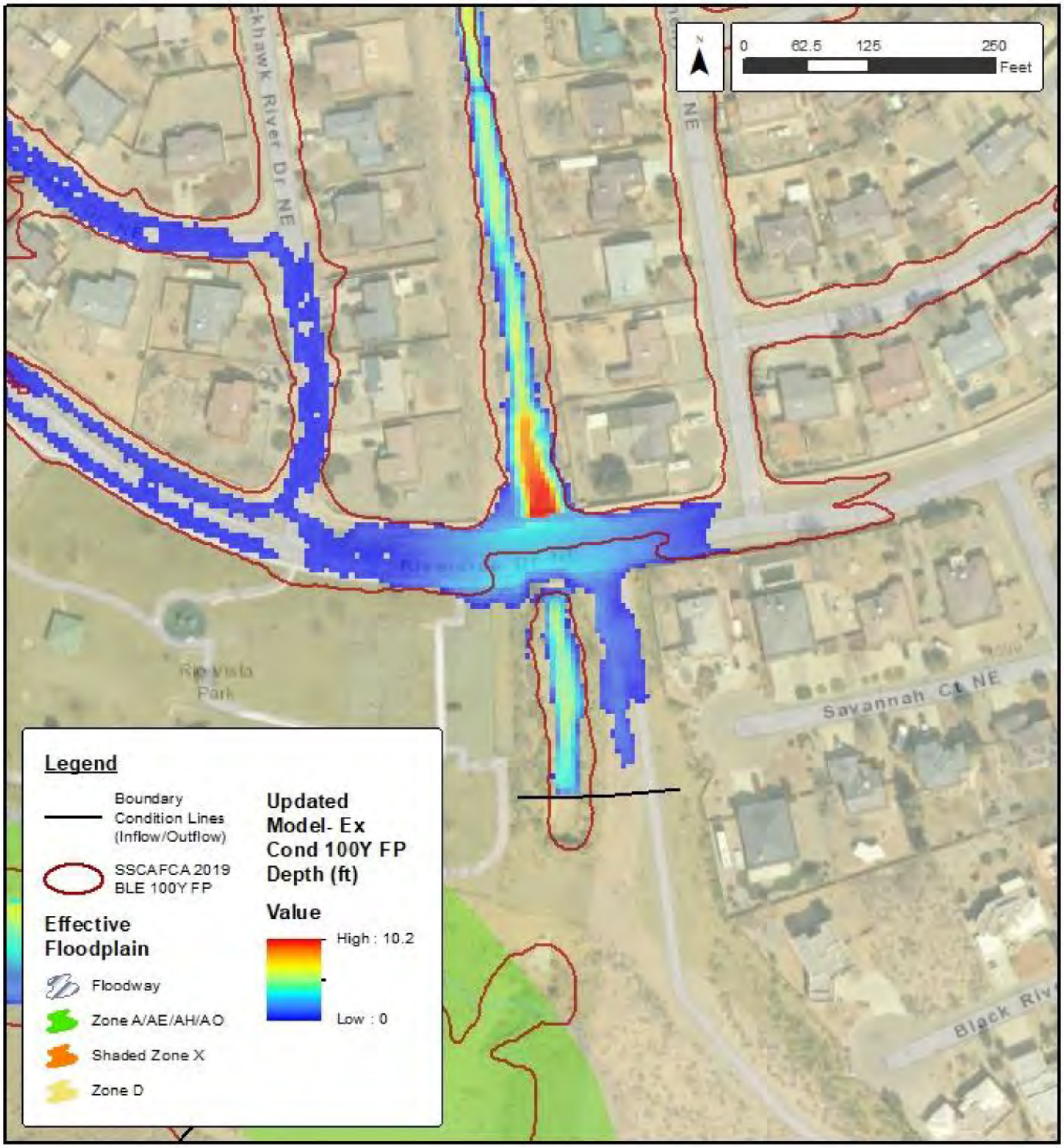



**Figure 4: Existing Conditions Compared with FEMA BLE Results**

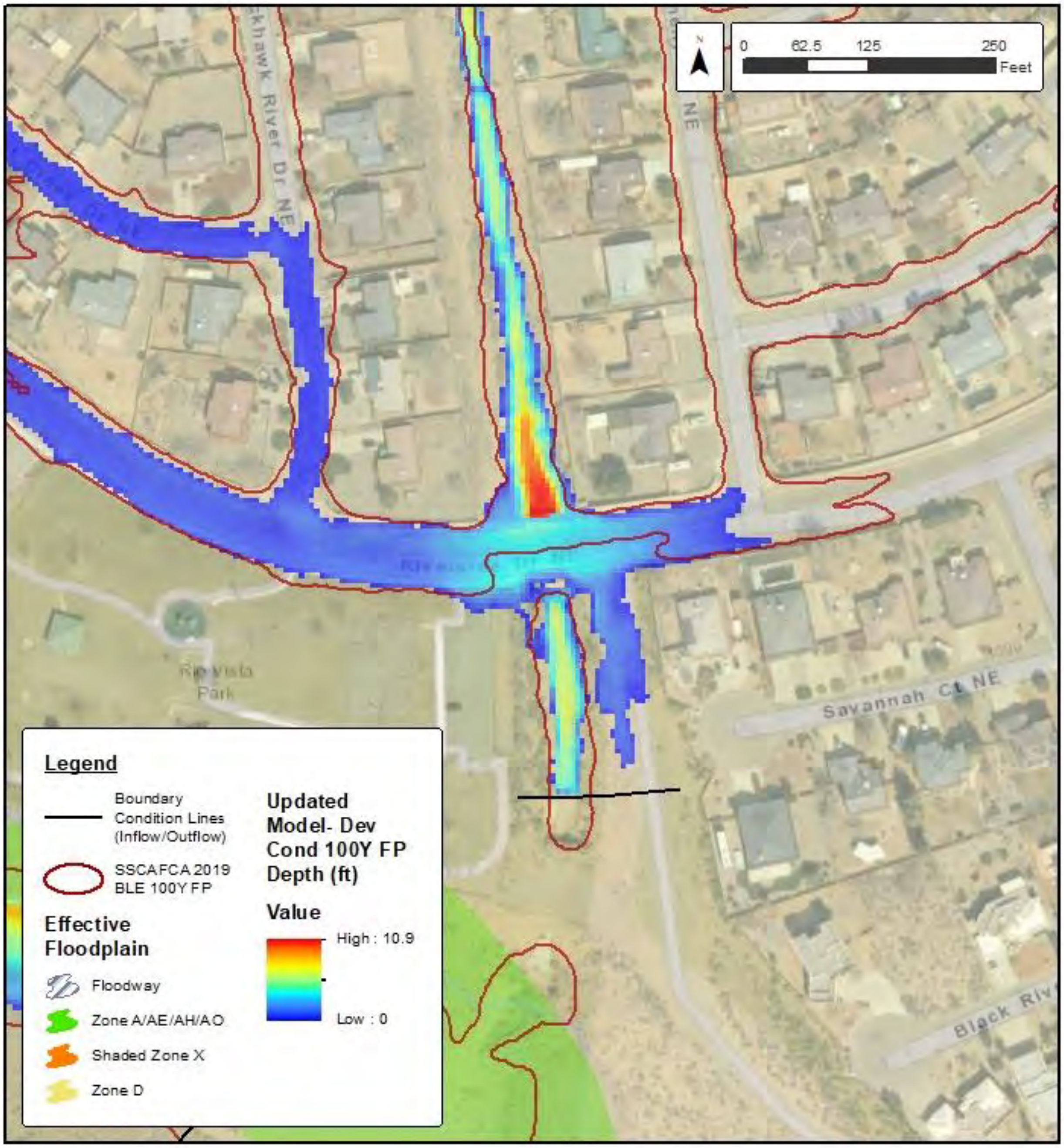



**Figure 5: Developed Conditions Compared with FEMA BLE Results**

**Table 2: Updated BLE Model Results Synopsis**

| US Crown of Culvert (ft) | Top of Road (ft) (approx.) | Conditions | Upstream WSEL (ft) | Downstream WSEL (ft) | Depth Over Rd Based on US WSEL (ft) | Modeled Flow at US Boundary (cfs) | Total Max Flow Through Culverts (cfs) | Flow Over Road (cfs) |
|---|---|---|---|---|---|---|---|---|
| 5,091.21 | 5,093.15 | Existing | 5,095.15 | 5,090.58 | 2.00 | 559 | 323 | 236 |
| | | Developed | 5,095.58 | 5,090.97 | 2.43 | 813 | 335 | 478 |

**Modeled flow at US boundary reflects the total flow at the structure. This is lower than the flows intended at this location because a significant portion of the flows at BA_12 are diverted down Riverside Drive and do not pass through this structure.*

Table 2 details the relevant geometry of the structure compared with the modeling results. The upstream water surface elevation impacts the flow through the culverts, whether the culverts are submerged on the upstream end, and whether the road overtops in the modeled storm event. The ‘Total Max Flow Through Culverts’ reported in the table is the summation of flow reported in each culvert, and the ‘Flow Over Road’ reported in the table is the weir flow recorded in the modeling.

The elevation along NM 528 declines northeast to southwest direction up to Barranca Arroyo and BA_4 crossing; therefore, the flooding is not limited by natural terrain along the road. The 2D connection lines, which is used to define the culverts in the model geometry, measure the flow passing through the 2D mesh. As a portion of the overflow is flowing through NM 528, the connection line defining the NM 528 road is bent toward the high ground upstream of NM 528 to measure full inflow introduced at the upstream boundary. A similar approach is followed to measure full flow at BA_13 right bank to include the flow draining from Riverside Dr.

For BA_13, the culvert capacity reported in the Baranca WMP (December 2021) is 240 cfs. The model results show that the culverts are able to convey approximately 248 cfs before the overtopping over Riverside Dr begins. For the existing conditions, the culvert is expected to convey 323 cfs, and the culvert is expected to convey 335 cfs in the developed conditions. The differences in the WMP capacity and the modeled capacity are likely due to a combination of calculation methodology differences and more specific data. The inundation boundaries for existing and developed conditions are shown in Figure 6.

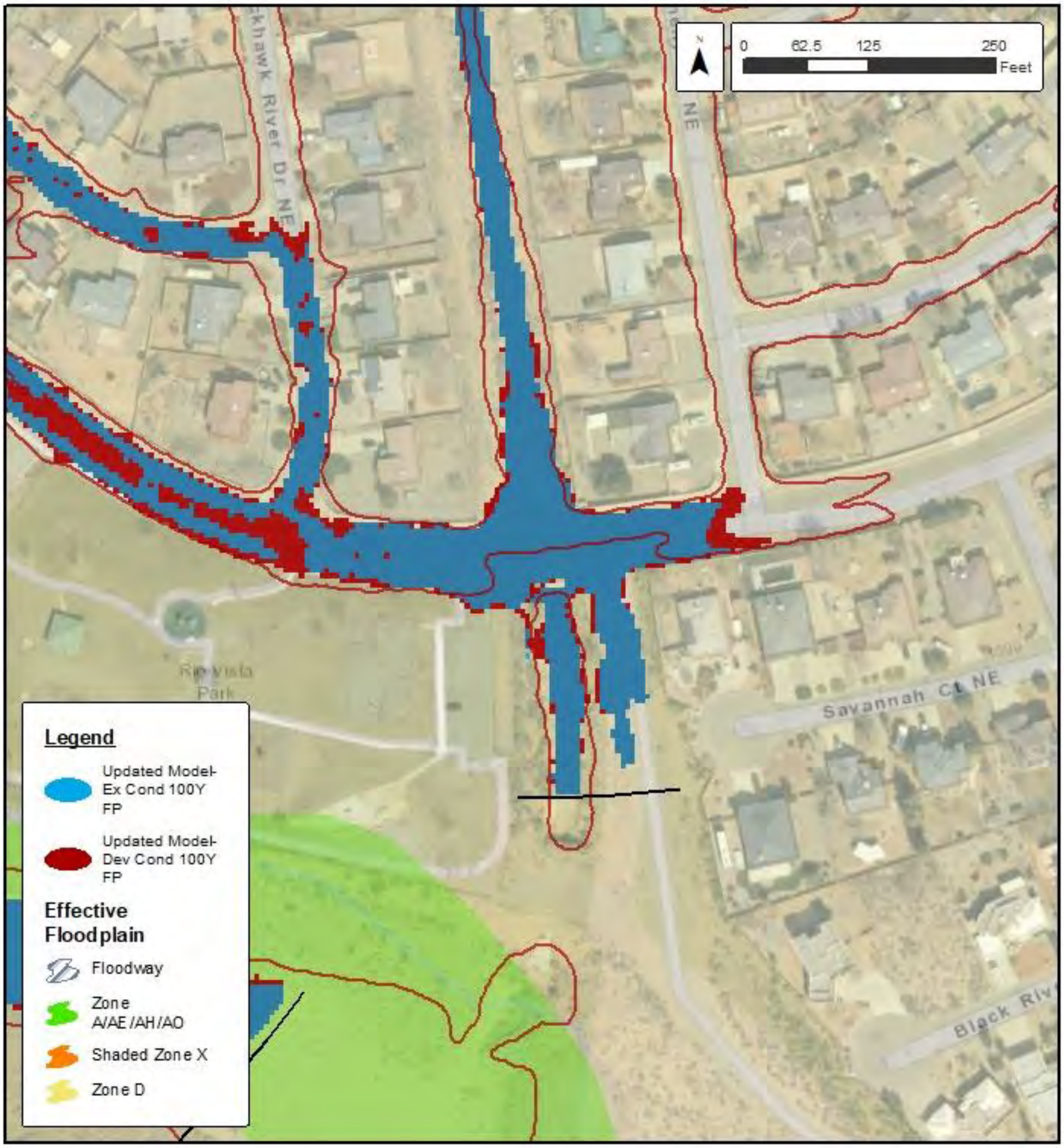



**Figure 6: Mapping Comparison of Existing and Developed Conditions**

# Appendix G

# Review

Appendix G contains a summary of comments resulting from external review (ESP Associates Inc.) and agency review (SSCAFCA, City of Rio Rancho) of the Arroyo de la Barranca Watershed Park Management Plan, along with a description of how individual comments were addressed. Following a presentation to the SSCAFCA Board of Directors on 7/14/2022, the draft document was posted on SSCAFCA's website for a three-week public comment period (7/14-8/4/2022). No public comments were received.

*External review, ESP Associates Inc.*

| No | Page | Review Comment | SSCAFCA Response |
|---|---|---|---|
| 1 | Cover | Bookmarks in the report are not working (just a reminder for when compiling final report). | In order to convert all figures embedded in the report correctly, the pdf version of the report had to be created using the "print to pdf" method; unfortunately, this eliminates any bookmarks associated with headings etc. |
| 2 | 1-1 | "… as accurate and precise as can be reasonably expected" might be a clearer way to write this | The change has been incorporated. |
| 3 | 1-3 | Lower case n (normals) | Spelling has been corrected. |
| 4 | 1-3 | Chart above shows October as higher than July | The associated text was modified to state that the months July-October have the highest rainfall totals. |
| 5 | 1-3 | Misspelling (thundersotrms), check WMP template because it may be misspelled in all | Spelling has been corrected. |
| 6 | 1-4 | Add discussion on the field samples collected? | Reference to the NRCS "Guide to Texture by Feel" method was added to the text. |
| 7 | 2-1 | This is up to you, but I have been told from our lidar people that the industry standard is to just use lidar like a normal word now and skip the acronym. | Spelling throughout the report was changed from "LiDAR" to "lidar". |
| 8 | 2-1 | Can remove hyphen | Spelling throughout the report was changed from "Arc-GIS" to "ArcGIS". |
| 9 | 2-3 | Add underscore between 106 and R2 | Cross-section label was changed to BA_A_106_R2. |
| 10 | 2-3 | Add underscore between 106 and R2 in the caption | Cross-section label was changed to BA_A_106_R2. |
| 11 | 2-4 | Change "marked" to "substantial" | Change has been incorporated in the revised manuscript. |
| 12 | 2-4 | City of Rio Rancho (spelling) | Spelling has been corrected. |
| 13 | 2-4 | Change this paragraph to present tense? | Change has been incorporated in the revised manuscript. |
| 14 | 2-6 | If this data is still available, a figure showing the overlays of different land use designations could be a nice addition | We estimated land use types for representative lots using the measurement tool available in ArcGIS and did not create corresponding feature classes; however, statistics for each category have been included in the "Barranca_Hydrology_Parameters.xlsx" file (see "Res_statistics" tab). |
| 15 | 2-8 | Estimate | Spelling has been corrected. |
| 16 | 2-9 | Maybe "using" or "based on" | Wording has been modified. |
| 17 | 2-9 | associated | Wording has been modified. |

| No | Page | Review Comment | SSCAFCA Response |
|---|---|---|---|
| 18 | 2-9 | Remove hyphen in ArcGIS | Spelling throughout the report was changed from "Arc-GIS" to "ArcGIS". |
| 19 | 2-9 | Bulking factors come from the SSCAFCA Hydrology Manual | Reference to SSCAFCA's Hydrology Manual was included in the report. |
| 20 | 2-9 | No mention of the diversion within the HMS model. This should probably be included as a simple statement in the report somewhere with a short description of its function. | A description of the flow split location has been included under section 2.9 (Existing Ponds and Diversions). Additionally, a callout indicating the location of the diversion has been added to Figure 2.1. |
| 21 | 2-10 | Could rewrite to mention again that the 100 year event is used for this planning effort (even though multiple return periods are listed in the table below) | Change has been incorporated in the revised manuscript. |
| 22 | 2-10 | How were the rainfall values obtained? Were they taken from a location matching the centroid of the watershed or did you download the NOAA rainfall rasters and average over the basin? Could call that out here for additional clarity. | Precipitation estimates are representative of the centroid of the watershed. A clarifying statement has been included in the text. |
| 23 | 2-11 | Did you think about adding labels for existing and DEVEX flows to each location as well as the location description (Basin ID) from HMS model where results were taken? | Labels for Hydro IDs as well as legends indicating Existing and DEVEX flows have been added to Figure 2.6. |
| 24 | 2-12 | Is depth-area reduction actually applied? Didn't see it called out in spreadsheet and this is usually used to support reductions for large basins. The SSCAFCA hydrology manual says only for 10 sq. mi or more and I think all basins in the HMS model are less than 1 sq. mile. See note in Table 2.6 as well that may need to be revised. Maybe in the past, the flows at these locations were not determined in HMS and so a regression or other approach was used that needed depth-area reduction and this language was carried over? | Consistent with previous regional watershed planning efforts by SSCAFCA, depth-area reduction was applied for analysis points with a contributing area exceeding one square mile. A corresponding statement has been added in the revised manuscript. |
| 25 | 2-16 | "… years and identifies …" (remove semi-colon and it) | Change has been incorporated in the revised manuscript. |
| 26 | B-2 | Drainage area missing for pond BA_B_103_Pond | Missing drainage area has been added to the table. |
| 27 | B-7 | Misspelling | Spelling has been corrected. |
| 28 | C-2 | What is this note asking? Is it needed? This goes back to my question on depth-area reductions. | Consistent with previous regional watershed planning efforts by SSCAFCA, the detailed model results reported in Appendix C are from model runs with no depth-area reduction factor. The note alerts the reader to that fact. |

| No | Page | Review Comment | SSCAFCA Response |
|---|---|---|---|
| 29 | E-1 | breaking | Spelling has been corrected. |
| 30 | E-10 | Not sure about this allowable headwater? It looks like much more than 0.5 ft headwater could exist before overtopping. Seems more like 5 feet from pictures (although I know scale can do that) | The allowable headwater at this crossing structure is determined by a low point in the left bank; a corresponding note has been added. |
| 31 | E-16 | This allowable headwater also seems unreasonable unless there is a low point in the overbank along the road maybe? | The allowable headwater at this crossing structure is determined by a low point in the left bank; a corresponding note has been added. |
| 32 | | Several supporting datasets were not included with the submittal. Lines representing the location of the 8-point cross sections were not provided and would have been used to confirm that cross sections were taken from a location that is representative of the entire basin and does not cross over into adjacent basins. Streamlines corresponding to modeled reach segments were not provided for review and would have been used to confirm slopes and reach lengths (information within provided spreadsheets were confirmed to match the HEC-HMS model). | We acknowledge that streamlines and cross section locations were not included as part of the submittal. |
| 33 | Table 2.6 | After re-running HEC-HMS in version 4.7.1, there are 3 locations where the flows from the HMS model do not agree with the flows reported in Table 2.6 (see table below). | Discrepancies noted by the reviewer are due to depth-area reduction factors (see comment 24 above). The locations indicated in red have drainage areas of 5, 6 & 10 square miles, respectively. When running the mode with the corresponding depth-area reduction, peak runoff is reduced compared with a model run including no depth-area reduction. A brief explanation has been included in the text accompanying Table 2.6. |

| Location | Element | Ex HMS | Dev HMS | Ex Report | Dev Report | Diff, Ex | Diff, Dev |
|---|---|---|---|---|---|---|---|
| BA_01 | BA_A_105_J1 | 382.6 | 562.1 | 383 | 562 | 0.4 | -0.1 |
| BA_02 | BA_A_108_J2 | 1782.3 | 2836.9 | 1712 | 2736 | -70.3 | -100.9 |
| BA_03 | BA_A_110_J1 | 2065.1 | 3347.1 | 1975 | 3209 | -90.1 | -138.1 |
| BA_04 | BA_A_112_J1 | 2983.4 | 5159.8 | 2776 | 4859 | -207.4 | -300.8 |
| BA_05 | BA_B_104_J1 | 304 | 327.6 | 304 | 328 | 0 | 0.4 |
| BA_06 | BA_B_105_J1 | 346.9 | 401.2 | 347 | 401 | 0.1 | -0.2 |
| BA_07 | BA_B_106_J1 | 448.1 | 488.7 | 448 | 489 | -0.1 | 0.3 |
| BA_08 | BA_F_102_J1 | 523.6 | 860.4 | 524 | 860 | 0.4 | -0.4 |
| BA_09 | BA_F_104_J1 | 553.9 | 901.4 | 554 | 901 | 0.1 | -0.4 |
| BA_10 | BA_H_103_J1 | 651.7 | 1024.1 | 652 | 1024 | 0.3 | -0.1 |
| BA_11 | BA_H_105_J1 | 905.9 | 1321.2 | 906 | 1321 | 0.1 | -0.2 |
| BA_12 | BA_I_106_J1 | 587.1 | 796 | 587 | 796 | -0.1 | 0 |
| BA_13 | BA_I_107_J1 | 701.4 | 919.4 | 701 | 919 | -0.4 | -0.4 |

*Agency review, SSCAFCA and City of Rio Rancho*

| No | Page | Review Comment | SSCAFCA Response |
|---|---|---|---|
| 34 | inside cover | Add revision history. | History of revisions has been added to the inside cover. |
| 35 | cover | Use name from USGS topo map on the cover and at first mention in the text. | The name of the arroyo on the cover and the first it is mentioned in the text has been changed to "Arroyo de la Barranca" in accordance with the USGS topo map. |
| 36 | ii | Add appendix with applicable segment of Quality of Life Master Plan | Appendix I has been added to the report. |
| 37 | 1-1 | Developed flows in the City are supposed to now be limited to "pre-development" conditions. | A detailed discussion of future conditions scenarios and the justification for including them in the watershed management plan has been added under section 2.5. |
| 38 | 2-2 | Add legend for tributary colors. | The legend has been added to the map. |
| 39 | 2-2 | City Center diversion - include reference to city center facility plan. | Reference to the facility plan has been added to the map. |
| 40 | 2-5 | A portion of subbasin BA_H_102 is proposed to be diverted to the Venada Arroyo as part of the Paseo Gateway development. Should this be included in the model? | The proposed diversion has been included in the Ultimate conditions model; the area in question is hatched in Figure 2.1, and a callout explaining the planned diversion has been added to the map. |
| 41 | 2-7 | Add Mariposa and Campus Centre MPs | Mariposa and Campus Centre MPs have been added to Figure 2.5, as well as the reference list on page 2-8. |
| 42 | 2-7 | Are future densities in areas outside planned areas based on City's Comp plan? Should areas that are unplanned/TZ zoned be assumed to be developed more densely in the future? | Yes, for areas not covered by specific area plans or master plans, density assumptions were based on the City's Comprehensive Plan. To communicate uncertainty associated with these assumptions, the following statement has been included in the revised plan: "We acknowledge that the underlying land development assumptions may change; the plan should therefore be updated regularly." |
| 43 | 2-23 | Add link to SSCAFCA's web map so users can look at lateral erosion envelopes in detail. | A link to SSCAFCA's interactive web map has been added to the revised report. |
| 44 | 2-23 | Clarify threshold for LEE delineation | The text has been modified to reflect that LEE are delineated for any reach where peak discharge during the 100-year storm is expected to exceed 500 cfs during existing conditions, as well as for all SSCAFCA-owned arroyos. |
| 45 | 3-7 | Reference CoRR Chapter 153 ordinance. | The reference has been included in the revised report. |
| 46 | 3-9 | Add a map of the proposed quality of life improvements | Map has been added (see Figure 3-7). |

# Appendix H

# Quality of Life Master Plan

This appendix contains the segment of SSCAFCA's Quality of Life Master Plan discussing the watershed of the Barranca Arroyo. For the full document, please refer to SSCAFCA's website (https://www.sscafca.org/quality-of-life/) .

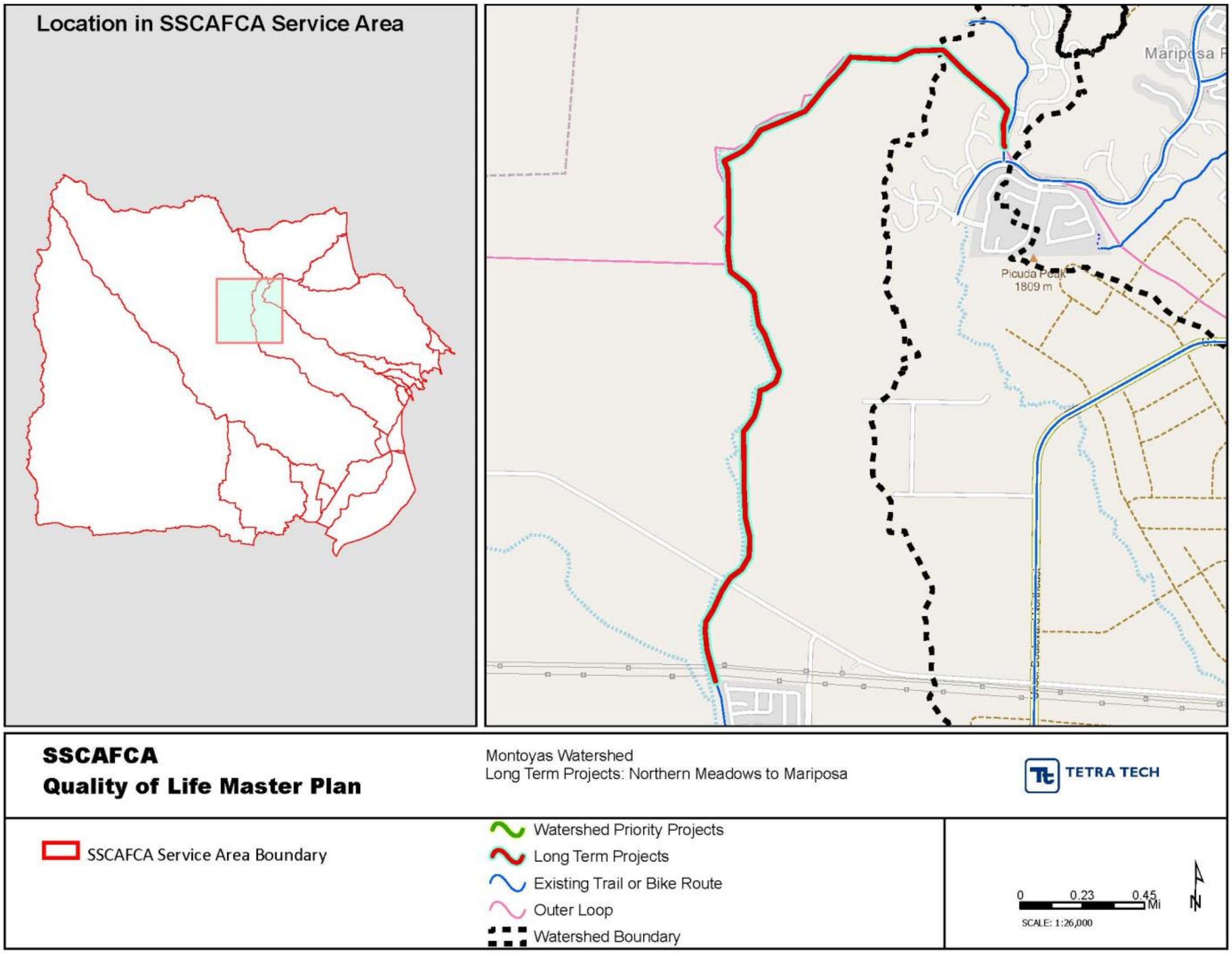



Figure 23. Northern Meadows to Mariposa

## 7.4 BARRANCA ARROYO WATERSHED

The 25 square mile Barranca Arroyo Watershed is situated between the Montoyas and Venada watersheds and encompasses the unincorporated Rio Rancho Estates community in the northwest portion of the watershed to the River's Edge residential area near the Rio Grande (Figure 24).

Potential watershed park amenities include opportunities to construct multi-use facilities in CORR and Village of Corrales centers, State Land Office projects, and the connection to Rio Rancho Open Space projects. The existing developments in this area include the RRCC, a UNM branch campus, and mixed-use residential, commercial, and employment uses. SSCAFCA views this area, Barranca Arroyo Watershed Park, as a stakeholder location, that will need to keep its high desert character for human enjoyment and protect native plants and wildlife (Community Sciences Corporation 2006).

The *Barranca Watershed Park Management Plan* (WH Pacific 2010) discussed multiple-use trails on major and secondary arroyos in order to incorporate the Watershed Park concept on the main branch of the Barranca Arroyo (from the headwaters to the Rio Grande). Many of these segments have been constructed with some constraints to access under NM528. Recommended projects would aid in filling in the remaining gaps.

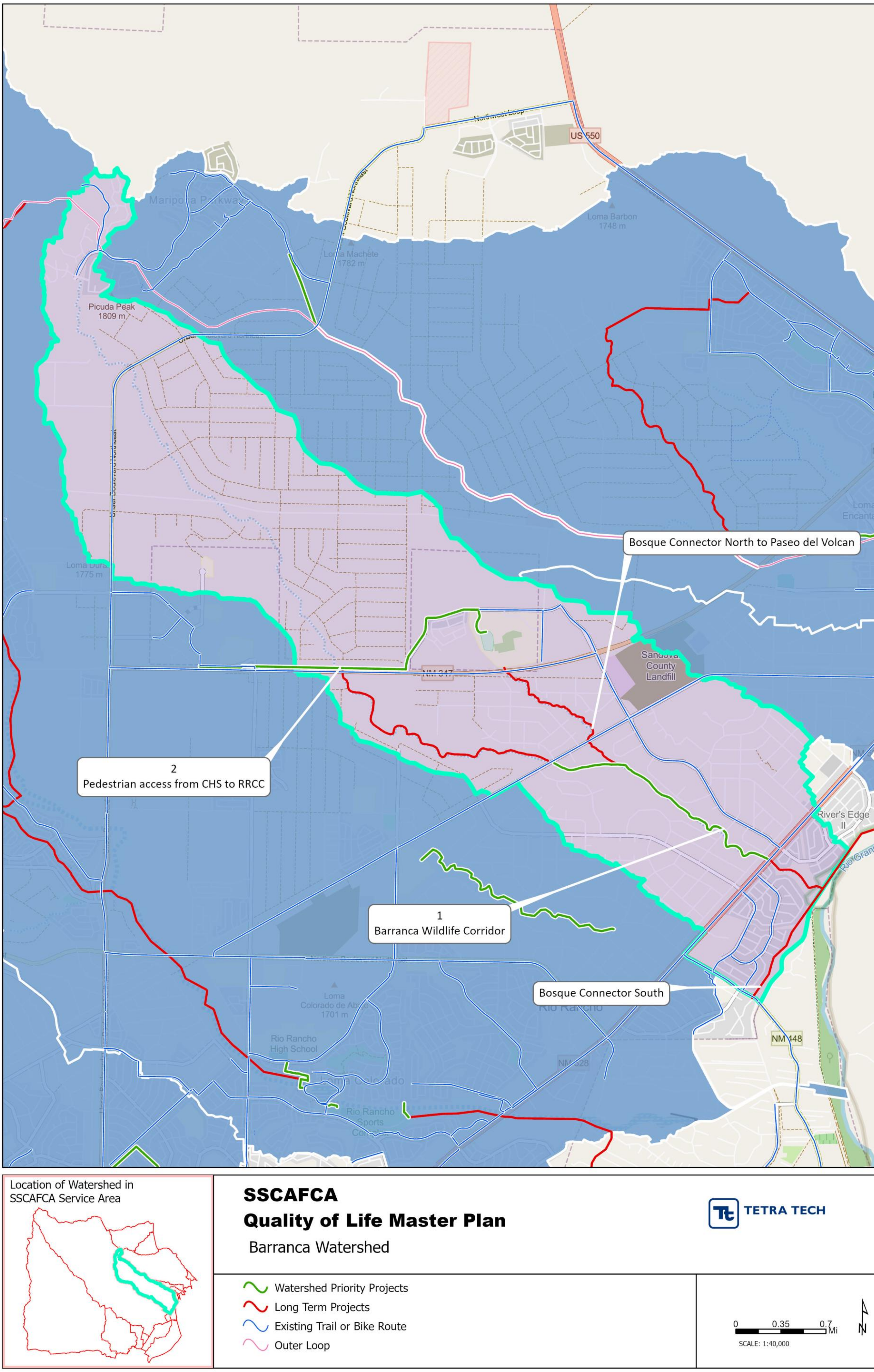



Figure 24. Barranca Watershed

## 7.4.1 Barranca Arroyo Watershed Short-term Priority Projects

The following priority projects have been identified in this QOLMP and/or in the various planning documents described above.

### 7.4.1.1 Barranca Wildlife Corridor

The Barranca watershed is a relatively undeveloped area. Antiquated platting and ownership has led to a highly sporadic building pattern, dominated by individual single family home development projects performed by owners or custom builders. There is no large-scale organized subdivision construction within this watershed at this time. The lack of this large-scale development presents interesting possibilities to provide a rural-style trail along the Barranca arroyo. The other consequence of this sparce, low density development is that wildlife along the Barranca arroyo corridor is plentiful, consisting of numerous bird and mammal species. With both of these potential benefits, SSCAFCA is proposing the construction of the Barranca Wildlife Corridor.

The Barranca Wildlife Corridor would run from NM528 (Pat D'Arco Highway) west to Idalia Road. This approximately 2.0-mile-long trail would be designed to double both as a pedestrian trail as well as an access road for SSCAFCA equipment and vehicles to perform arroyo maintenance. It is likely that a basecourse or dirt trail would be proposed. The ROW is entirely owned by SSCAFCA. However, there are sections of the arroyo that have meandered outside of this ROW presenting issues with arroyo access and maintenance. This could be resolved by purchasing additional ROW in areas where the arroyo has meandered outside of the dedicated ROW. Constrained ROW might also present an issue of trail maintenance. In areas where the trail is constructed adjacent to the natural arroyo, actions would need to be taken to preserve the bank to limit lateral erosion and damage to the trail.

The location of the Barranca Wildlife Corridor is shown on Figure 25.

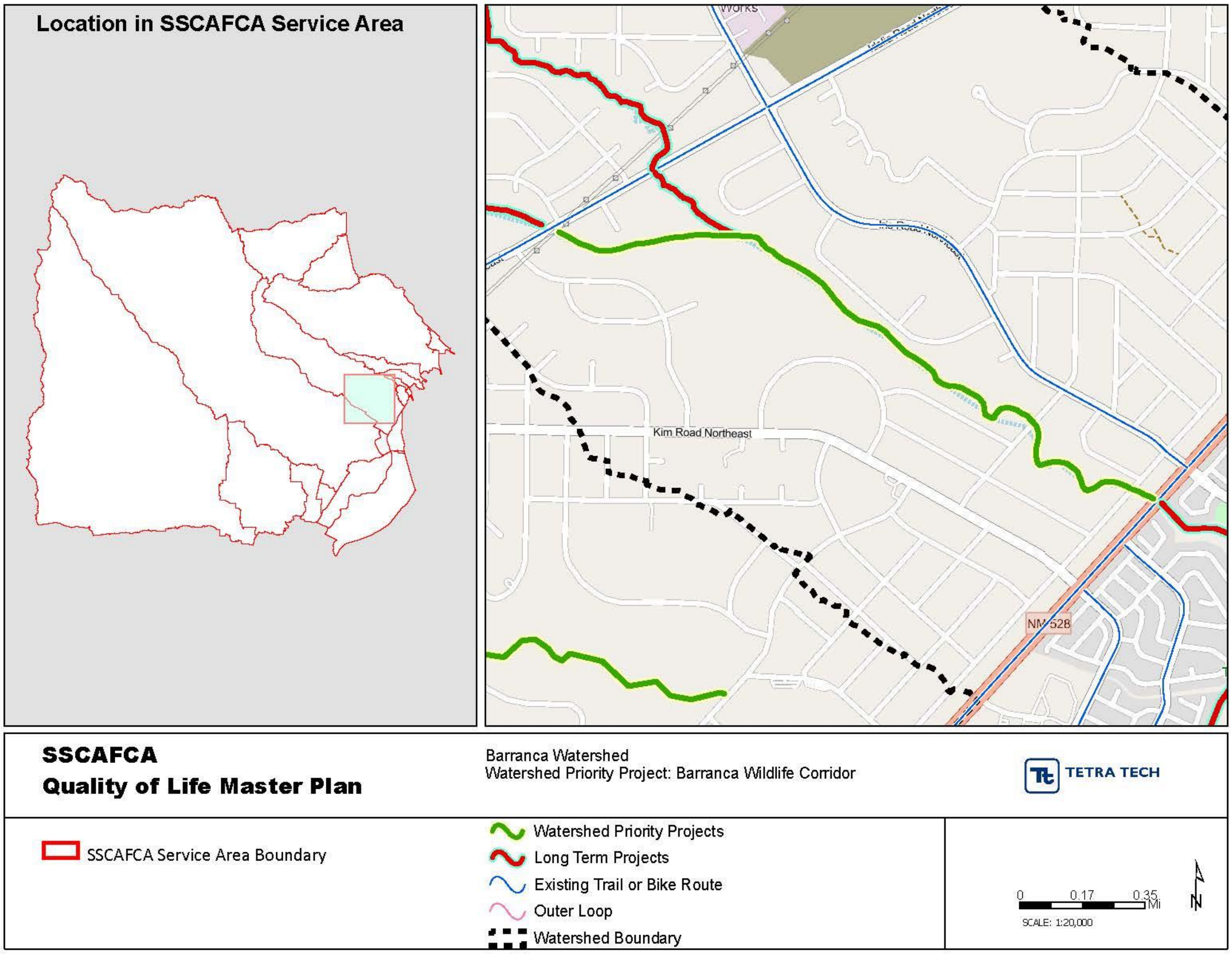



Figure 25. Barranca Wildlife Corridor

## 7.4.2 Barranca Arroyo Watershed Long-term Projects

The following additional projects are of interest but long-term in nature.

### 7.4.2.1 Bosque Connector South

This 1-mile proposed natural surfaces trail links the Montoyas Watershed to Barranca Watershed the via a trail moving southwest from the outlet of the Barranca Arroyo to the proposed Bosque Connector to Idalia Road trail. ROW along this segment includes the CORR bosque and SSCAFCA ROW (Figure 26). When considering the extension of the Bosque Connector South trail toward NM 528, consideration should be given to limiting off-road vehicle access to and traffic along this segment of the Barranca Arroyo corridor.

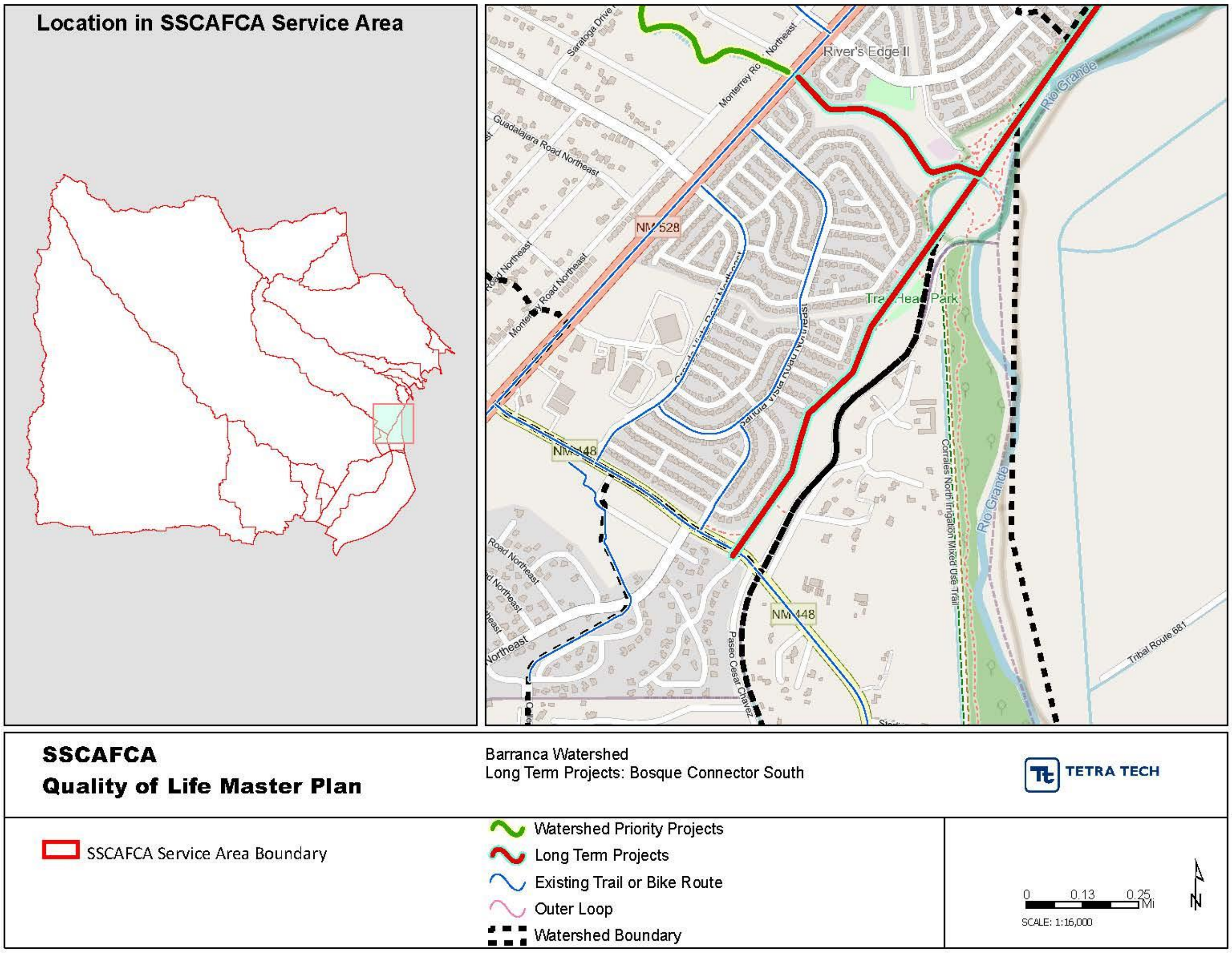



Figure 26. Bosque Connector South

### 7.4.2.2 Bosque Connector North

This 1.7-mile proposed paved trail is located at the intersection of the proposed Bosque Connector South and Bosque Connector North to Paseo del Volcan trails near the outlet of the Barranca Arroyo (Figure 27). This proposed trail forms a connection from existing North Loop and Willow Creek Loop NE trails near the outlet of the Venada Watershed in the floodplain of the Rio Grande. ROW along this segment includes the CORR bosque and SCCAFCA ROW. Specific activities in this trail segment include birdwatching and amenities could include educational signage. Due to some existing non-disturbance agreements and the presence of Pueblo of Sandia owned property along this alignment, the trail may need to be left in a undeveloped condition.

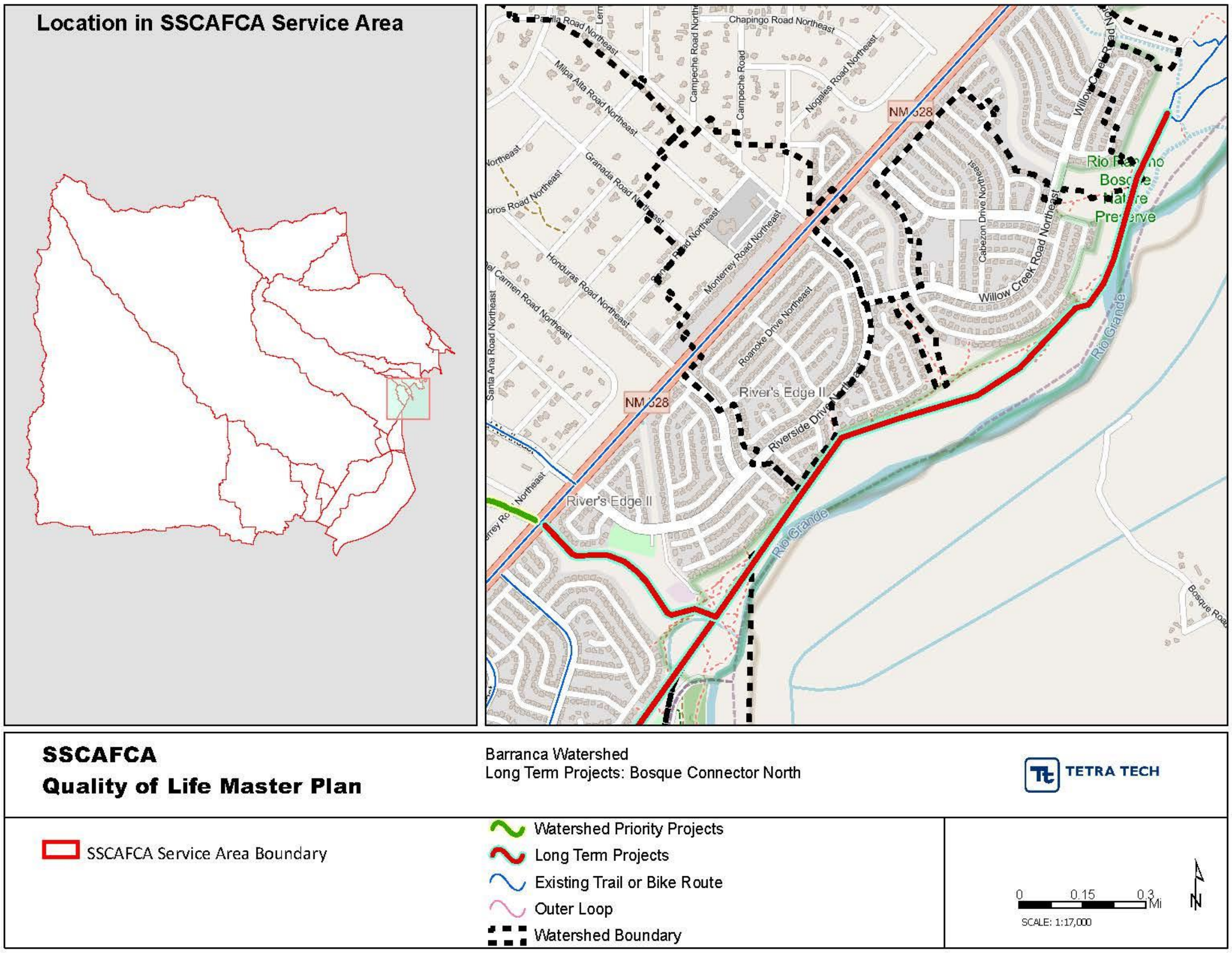



Figure 27. Bosque Connector North

### 7.4.2.3 Bosque Connector North to Paseo del Volcan

This 6.1-mile proposed paved trail is within SSCAFCA ROW and begins at the intersection of the Bosque Connector South and North trails and extends northwest along the Barranca Arroyo until is splits approximately 0.25-miles southeast of Idalia Road. (Figure 28) The southern trail segment parallels the Barranca Arroyo and the other proposed segment to the north and follows another trail feature, with both trail segments terminating near the proposed V. Sue Cleveland High School to Rio Rancho City Center trail. The southern fork terminates at Paseo del Volcan approximately 0.75-miles east of City Center. The northern fork terminates at Paseo del Volcan near V. Sue Cleveland High School. Approximately half of this proposed segment is within SSCAFCA ROW and the other remaining half is not within ROW of SSCAFCA or CORR.

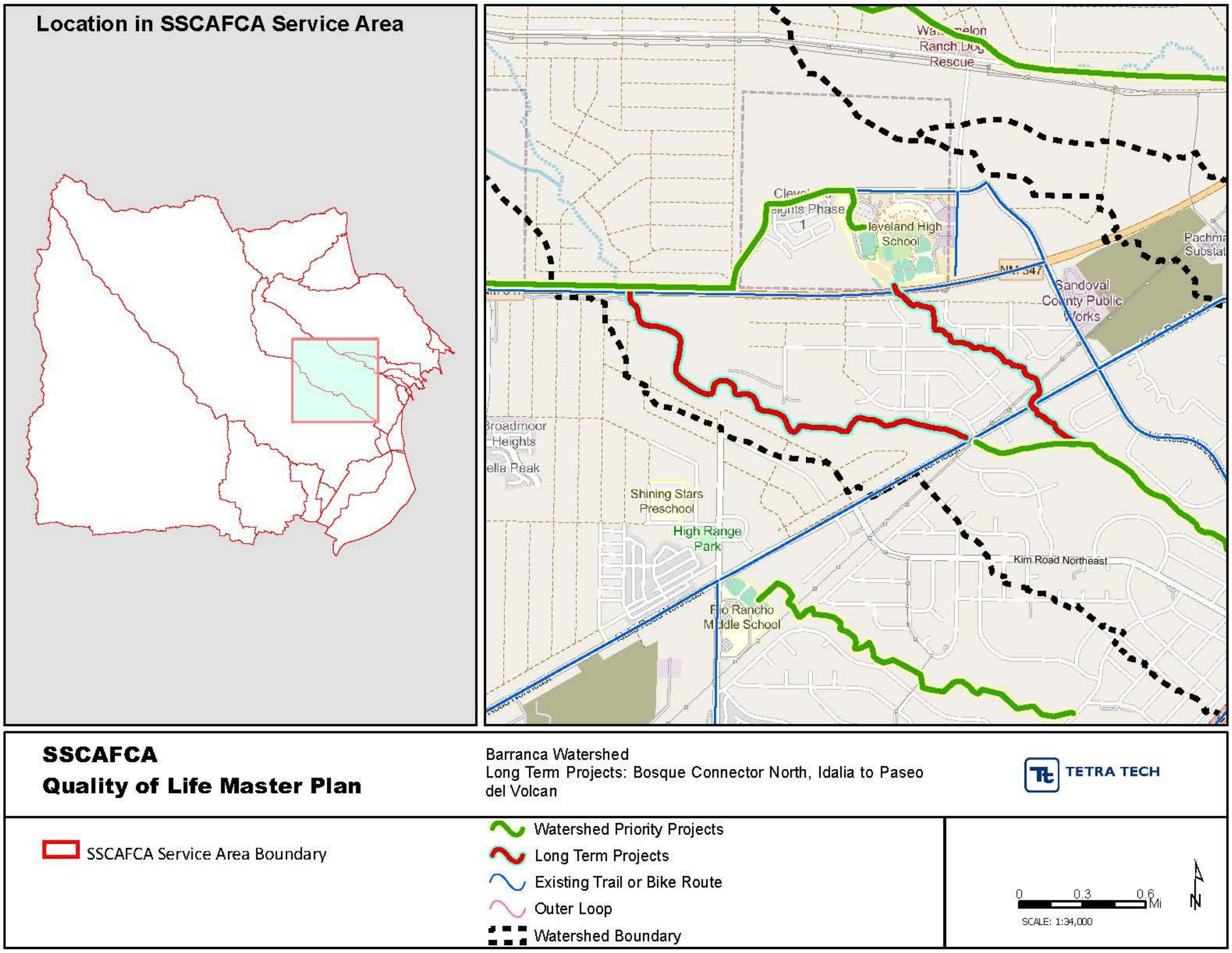



Figure 28. Bosque Connector North, Idalia to Paseo del Volcan

## 7.5 VENADA ARROYO WATERSHED

The Venada Arroyo Watershed encompasses 15 square miles within the SSCAFCA service area and is primarily located south of US550 on the northern edge of the SSCAFCA service area (Figure 29). The watershed contains several tributaries divided into four specific reaches: Unser Boulevard, Middle Venada, Enchanted Hills and Lower Venada, that drain into the main branch of the Venada Arroyo, which eventually reaches the Rio Grande.

The *Venada Arroyo Watershed Park Management Plan Technical Addendum* (ASCG 2002b) identified that approximately 50% of the watershed was developed, although significant construction of housing and other forms of development have occurred over the past 18 years.

The Venada Arroyo Watershed Management Plan (ASCG 2002a) summarizes the drainage strategy for the area but also includes plan criteria and objectives to provide for a Venada Parkway Corridor and multiple use trails and recreation.