# Bill Williams Watershed Water Quality Assessments

## Watershed Description

The Santa Maria River and the Big Sandy River drainages merge at Alamo Lake to create the Bill Williams River, which connects to the Colorado River at Parker Dam. Land ownership is divided approximately as 45% federal, 28% state, and 27% private (no Tribal lands). With only 8,000 people (2000 census), this watershed does not have any large population centers. Open range grazing is the principal land use. A large mining complex is located in the Bagdad area, while historic mine sites are scattered throughout the watershed.

Elevations range from 8,417 feet (above sea level) at Hualupai Peak to 1,000 feet near the Colorado River. Most of the watershed is below 5,000 feet, with low desert fauna and flora (Sonoran Desert - Mohave Desert transition area) and warmwater aquatic communities where perennial waters exist.

## Water Resources

There is little precipitation, from 13 inches a year, with an additional inch of snowfall per year in higher elevations, so surface water resources are sparse. Perennial flow in this watershed is frequently interrupted (short segments), even on the larger main-stem rivers. The largest lake, Alamo Lake, covers 11,950 acres; however, only an estimated 1,415 acres are perennial.

An estimate of surface water resources in the Bill Williams Watershed is provided in the following table, based on USGS digitized hydrology at 1:100,000, rounded to the nearest 5 miles or 5 acres.

Estimated Surface Water Resources in the Bill Williams Watershed

| | Perennial | Intermittent | Ephemeral |
|---|---|---|---|
| Stream miles | 185 | 655 | 5035 |
| | Perennial | Non-perennial | |
| Lake acres | 1832 | 11,950 | |

Ambient monitoring focuses on perennial waters; however, special investigations may identify water quality problems on intermittent and even ephemeral waters.

## Assessments

The Bill Williams Watershed can be separated into the following drainage areas in Arizona:

| | |
|---|---|
| 15030201 | Big Sandy River |
| 15030202 | Burro Creek |
| 15030203 | Santa Maria River |
| 15030204 | Bill Williams River |

These drainage areas and the surface waters assessed as “attaining” or “impaired” are illustrated on the following watershed map. Methods used to complete these assessments are described in the “Surface Water Assessment Methods and Technical Support” document.



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# ALAMO LAKE

15030204-0040A
1415 Acres

**Category 5**
Impaired

## *Mercury in fish tissue (EPA 2002), Ammonia (2004) and high pH (1996)*

FC - Impaired • FBC - Impaired • AGL - Impaired
AWW - Impaired

## Exceedances

| Parameter | Applicable Standard | Date | Result | Designated use support comments |
|---|---|---|---|---|
| Dissolved oxygen (top 1 m) | 6.0 mg/L | 12/13/2010 | 1.98 mg/L | AWW is attaining with 3 exceedances in 29-31 samples in all three regions (lower, mid and upper) of the lake (binomial). October and November exceedances are due to lake turnover. |
| | | 5/9/2011 | 4.61 mg/L | |
| | | 10/18/2011 | 0.23 mg/L | |
| | | 11/18/2011 | 0.9 mg/L | |
| | | 12/19/2011 | 3.99 mg/L | |
| | | 11/30/2012 | 4.23 mg/L | |
| pH | Max 9.0 SU<br>Min 6.5 SU | 3/8/2011 | 9.3 SU | AWW, AGL and FBC remain impaired with 8 exceedances in 33 samples. |
| | | 5/9/2011 | 6.08 SU | |
| | | 6/7/2011 | 9.2 SU | |
| | | 8/15/2011 | 9.2 SU | |
| | | 4/3/2013 | 9.7 SU | |
| | | 7/25/2013 | 9.3 SU | |
| | | 8/21/2013 | 9.4 SU | |
| | | 9/18/2013 | 9.5 SU | |
| Ammonia | 0.634 mg/L chronic<br>@ pH 8.52 & Temp 22 C | 10/21/2012 | 1.1 mg/L | AWW chronic remains impaired with 1 exceedance. |



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# Monitoring Summary

Sampling period: 10/19/2010 - 9/18/2013

| Site Name(s) | Site ID # | DEQ # | Sampling Agency | Purpose |
|---|---|---|---|---|
| AT DAM (Lower Lake) | BWALA-A | 101350 | ADEQ, COE | Clean Lakes Program, Data Sharing Partnership |
| MID LAKE (Upper Lake) | BWALA-B | 101351 | ADEQ, COE | Clean Lakes Program, Data Sharing Partnership |
| MID LAKE NORTH END (Mid Lake) | BWALA-C | 102514 | ADEQ, COE | Clean Lakes Program, Data Sharing Partnership |

| Metal Samples | Nutrients & Related Samples | Other Samples |
|---|---|---|
| (3-27) Antimony, arsenic, beryllium, boron, cadmium, chromium, copper, lead, manganese, mercury, selenium, zinc | (39-42) Ammonia, nitrite/ nitrate, nitrogen, phosphate, phosphorus, total Kjeldahl nitrogen | (2-97) Dissolved oxygen, pH, SSC, total dissolved solids |

## Data Gaps and Monitoring Needs

| | |
|---|---|
| Exceedances Needing More Samples to Assess | None |
| Missing Core Parameters | *E. coli* |
| Missing Seasonal Distribution | Zinc (dissolved), cadmium (dissolved), copper (dissolved), *E. coli*, copper, lead |
| Lab Detection Limits Not Low Enough | Mercury (dissolved) |

| Priority | Monitoring Recommendations |
|---|---|
| High | Collect more samples to support development of TMDLs for nutrients and mercury in fish tissue. |

| Impairment Discussion |
|---|
| Remains impaired for high pH (1996), ammonia (2004) and mercury in fish tissue (EPA, 2002). |



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# BIG SANDY RIVER

Stove Spring - Sycamore
15030201-006
2.83 Miles

**Category 2**
Attaining some uses

FC - Attaining • FBC - Inconclusive • AGL - Attaining
AWW - Inconclusive

Use Support

## Exceedances

| Parameter | Applicable Standard | Date | Result | Designated use support comments |
|---|---|---|---|---|
| *E. coli* | 235 cfu/100 ml | 8/14/2012 | 3629.4 cfu/100 mL | FBC is inconclusive with 1 exceedance in 4 samples. |
| SSC | 80 mg/L | 8/14/2012 | 360 mg/L | AWW is attaining with no median exceedances. |
| | | 11/28/2012 | 100 mg/L | |
| Bottom deposits | < 50% fines | 5/16/2013 | 64% | AWW is inconclusive. |

## Monitoring Summary

Sampling period: 8/14/2012 - 5/16/2013

| Site Name(s) | Site ID # | DEQ # | Sampling Agency | Purpose |
|---|---|---|---|---|
| EAST OF WIKIEUP | BWBSR037.79 | 107384 | ADEQ | Ambient Monitoring |

| Metal Samples | Nutrients & Related Samples | Other Samples |
|---|---|---|
| (4) Antimony, arsenic, beryllium, boron, cadmium, chromium, copper, lead, manganese, mercury, selenium, zinc | (4) Ammonia, nitrite/nitrate, nitrogen, phosphorus, total Kjeldahl nitrogen | (1-4) Dissolved oxygen, *E. coli*, pH, SSC, total dissolved solids, bottom deposits, biocriteria |

## Data Gaps and Monitoring Needs

| | |
|---|---|
| Exceedances Needing More Samples to Assess | Bottom deposits, *E. coli* |
| Missing Core Parameters | None |
| Missing Seasonal Distribution | None |
| Lab Detection Limits Not Low Enough | Selenium, mercury (dissolved) |

| Priority | Monitoring Recommendations |
|---|---|
| Medium | Collect bottom deposits and *E. coli* samples due to exceedances. Use lower detection limits for selenium and dissolved mercury. |



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# BILL WILLIAMS RIVER

Alamo Lake - Castaneda Wash
15030204-003
35.9 Miles

**Category 5**
Impaired

Bill Williams

## Ammonia (2006)

IMPAIRMENT STATUS

FC - Attaining • FBC - Attaining • AGL - Attaining
AWW - Impaired

## Exceedances

| Parameter | Applicable Standard | Date | Result | Designated use support comments |
|---|---|---|---|---|
| Ammonia | 0.344 mg/L chronic @ pH 9.2 & 15.5 C | 10/21/2012 | 0.79 mg/L | AWW remains impaired with 1 chronic exceedance. |
| Dissolved oxygen | 6.0 mg/L | 12/13/2010 | 4.26 mg/L | AWW is inconclusive with 5 exceedances in 31 sample (binomial). |
| | | 11/18/2011 | 5.16 mg/L | |
| | | 11/30/2012 | 5.78 mg/L | |
| | | 3/20/2013 | 5.62 mg/L | |
| | | 5/15/2013 | 5.7 mg/L | |
| pH | 9.0 SU | 10/21/2012 | 9.2 SU | AGL and FBC are attaining with 2 exceedances in 34 samples (binomial). |
| | | 4/3/2013 | 9.3 SU | |

## Monitoring Summary

Sampling period: 10/19/2010 - 9/17/2013

| Site Name(s) | Site ID # | DEQ # | Sampling Agency | Purpose |
|---|---|---|---|---|
| BELOW ALAMO DAM AT USGS GAGE | BWBWR038.52 | 102316 | USFWS | Data Sharing Partnership |
| AT ABOVE GROUND PIPELINE | BWBWR025.86 | 107385 | ADEQ | Ambient Monitoring |

| Metal Samples | Nutrients & Related Samples | Other Samples |
|---|---|---|
| (4-8) Antimony, arsenic, beryllium, boron, cadmium, chromium, copper, lead, manganese, mercury, selenium, zinc | (13-17) Ammonia, nitrite/nitrate, nitrogen, phosphate, phosphorus, total Kjeldahl nitrogen | (4-34) Dissolved oxygen, *E. coli*, pH, SSC, total dissolved solids |



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# Data Gaps and Monitoring Needs

| | |
|---|---|
| Exceedances Needing More Samples to Assess | Dissolved oxygen, ammonia |
| Missing Core Parameters | None |
| Missing Seasonal Distribution | None |
| Lab Detection Limits Not Low Enough | Chromium, selenium, mercury (dissolved) |

| Priority | Monitoring Recommendations |
|---|---|
| High | Collect more pH, ammonia and dissolved oxygen samples due to exceedances. |

| Impairment Discussion |
|---|
| Reach remains impaired for ammonia (2006) due to the chronic exceedance. AGL and FBC are no longer impaired for pH with 2 exceedances in 34 samples (binomial). Remove pH (2006) from the 303(d) list. |



ED_013248_00000549-00006

# BILL WILLIAMS RIVER

Mohave Wash - Colorado River
15030204-001
17.5 Miles

**Category 2**
Attaining some uses



FC - Inconclusive • FBC - Attaining • AGL - Inconclusive
AWW - Inconclusive

Use Support

## Exceedances

| Parameter | Applicable Standard | Date | Result | Designated use support comments |
|---|---|---|---|---|
| Dissolved oxygen | 6.0 mg/L | 5/19/2014 | 5.2 mg/L | AWW is attaining. Low dissolved oxygen is likely due to low flow and groundwater upwelling. |

## Monitoring Summary

Sampling period: 2/22/2011 - 5/19/2014

| Site Name(s) | Site ID # | DEQ # | Sampling Agency | Purpose |
|---|---|---|---|---|
| AT MINERAL WASH, NEAR PLANETUSGS 09426600 | BWBWR009.92 | 100924 | ADEQ | Ambient Monitoring |

| Metal Samples | Nutrients & Related Samples | Other Samples |
|---|---|---|
| (1) Antimony, arsenic, beryllium, boron, cadmium, chromium, copper, lead, manganese, mercury, selenium, zinc | (1-9) Ammonia, nitrate, nitrite, nitrite/nitrate, nitrite/nitrate, nitrogen, phosphate, phosphorus, total Kjeldahl nitrogen | (3-9) Dissolved oxygen, *E. coli*, pH, SSC, total dissolved solids |

## Data Gaps and Monitoring Needs

| | |
|---|---|
| Exceedances Needing More Samples to Assess | None |
| Missing Core Parameters | Zinc (dissolved), copper, lead, mercury (or mercury in fish tissue) |
| Missing Seasonal Distribution | Zinc (dissolved), copper, lead, mercury |
| Lab Detection Limits Not Low Enough | Mercury (dissolved) |

| Priority | Monitoring Recommendations |
|---|---|
| Low | Collect core parameters to represent at least 3 seasons during an assessment period. |



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# BOULDER CREEK

Wilder Creek - Butte Creek
15030202-005A
1.4 Miles

**Category 4A**
Not attaining

*Arsenic, copper, and zinc (1998)*
*Beryllium, manganese, and low pH (2006/2008)*

FC - Not Attaining • FBC - Not Attaining • AGI - Not Attaining
AGL - Not Attaining • AWW - Not Attaining

## Exceedances

| Parameter | Applicable Standard | Date | Result | Designated use support comments |
|---|---|---|---|---|
| Arsenic | 2000 ug/L (AGI)<br>200 ug/L (AGL)<br>80 ug/L (FC)<br>30 ug/L (FBC) | 5/21/2013 | 2400 ug/L | AGI, AGL, FC and FBC remain not-attaining with 2 exceedances in 2 samples (binomial). |
| | | 5/28/2015 | 4280 ug/L | |
| Arsenic (dissolved) | 340 ug/L acute<br>150 ug/L chronic | 5/21/2013 | 2300 ug/L | AWW remains not-attaining with 2 exceedances in 2 samples. |
| | | 5/28/2015 | 2780 ug/L | |
| Dissolved oxygen | 6.0 mg/L | 5/28/2015 | 0.69 mg/L | AWW is attaining. Low dissolved oxygen due to groundwater upwelling. |
| Zinc (dissolved) | 379.298 ug/L acute & chronic @ 400 mg/L hardness | 5/21/2013 | 1100 ug/L | AWW remains not-attaining with 2 exceedances in 2 samples. |
| | | 5/28/2015 | 1290 ug/L | |

## Monitoring Summary

Sampling period: 5/21/2013 - 5/28/2015

| Site Name(s) | Site ID # | DEQ # | Sampling Agency | Purpose |
|---|---|---|---|---|
| SITE G- BELOW HILLSIDE MINE LOWER TAILINGS PIL | BWBOU007.13 | 101010 | ADEQ | TMDL Monitoring |
| SITE H - BETWEEN MIDDLE AND LOWER TAILINGS PILE | BWBOU007.76 | 101011 | ADEQ | TMDL Monitoring |
| AT HILLSIDE MINE ADIT | BWBOU007.83 | 102024 | ADEQ | TMDL Monitoring |
| SITE JJ - UPSTREAM OF TAILINGS PILES | BWBOU008.28 | 101439 | ADEQ | TMDL Monitoring |
| ABOVE HILLSIDE MINE | BWBOU008.42 | 102023 | ADEQ | TMDL Monitoring |



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| Metal Samples | Nutrients & Related Samples | Other Samples |
|---|---|---|
| (6) Antimony, arsenic, beryllium, boron, cadmium, chromium, copper, lead, manganese, mercury, selenium, zinc | (0) None | (5-6) Dissolved oxygen, pH, total dissolved solids |

## Data Gaps and Monitoring Needs

| | |
|---|---|
| Exceedances Needing More Samples to Assess | Dissolved oxygen |
| Missing Core Parameters | *E. coli* |
| Missing Seasonal Distribution | Zinc (dissolved), dissolved oxygen, pH, cadmium (dissolved), copper (dissolved), *E. coli*, boron, manganese, copper, lead, mercury |
| Lab Detection Limits Not Low Enough | Antimony (dissolved), selenium, mercury (dissolved) |

| Priority | Monitoring Recommendations |
|---|---|
| Medium | Collect arsenic, copper, zinc, beryllium, manganese and pH samples during critical conditions. Collect core parameters to represent at least 3 seasons during an assessment period. |

| Impairment Discussion |
|---|
| Reach remains not-attaining for arsenic, copper, and zinc (1998) and beryllium, manganese, and low pH (2006/2008). TMDL for arsenic, copper, and zinc completed in 2004. |



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# BOULDER CREEK

Butte Creek - Copper Creek
15030202-005B
1.8 Miles

**Category 4A**
Not attaining

## IMPAIRMENT STATUS

*Arsenic (1998)*

FC - Inconclusive • FBC - Not Attaining • AGI - Inconclusive
AGL - Inconclusive • AWW - Inconclusive

**No Exceedances**

## Monitoring Summary

Sampling period: No samples

| Site Name(s) | Site ID # | DEQ # | Sampling Agency | Purpose |
|---|---|---|---|---|
| N/A | | | | |

| Metal Samples | Nutrients & Related Samples | Other Samples |
|---|---|---|
| (0) None | (0) None | (0) None |

## Data Gaps and Monitoring Needs

| | |
|---|---|
| Exceedances Needing More Samples to Assess | None |
| Missing Core Parameters | All core parameters |
| Missing Seasonal Distribution | All core parameters |
| Lab Detection Limits Not Low Enough | N/A |

| Priority | Monitoring Recommendations |
|---|---|
| Medium | Collect arsenic samples during critical conditions and in critical locations. Collect core parameters to represent at least 3 seasons during an assessment period. |

| Impairment Discussion |
|---|
| Reach remains not-attaining for arsenic (1998). TMDL for arsenic completed in 2004. The Hillside mine, located upstream of this reach, continues to degrade water quality. Additional sampling under critical conditions is needed to determine attainment of water quality standards. |



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# BOULDER CREEK

Tributary at 344114 / 1130334 - Wilder Creek
15030202-006B
14.4 Miles

**Category 5**
Impaired

Bill Williams

## IMPAIRMENT STATUS

*Beryllium (2010)*

FC - Inconclusive • FBC - Inconclusive • AGI - Inconclusive
AGL - Inconclusive • AWW - Impaired

**No Exceedances**

## Monitoring Summary

Sampling period: No samples

| Site Name(s) | Site ID # | DEQ # | Sampling Agency | Purpose |
|---|---|---|---|---|
| N/A | | | | |

| Metal Samples | Nutrients & Related Samples | Other Samples |
|---|---|---|
| (0) None | (0) None | (0) None |

## Data Gaps and Monitoring Needs

| | |
|---|---|
| Exceedances Needing More Samples to Assess | None |
| Missing Core Parameters | All core parameters |
| Missing Seasonal Distribution | All core parameters |
| Lab Detection Limits Not Low Enough | N/A |

| Priority | Monitoring Recommendations |
|---|---|
| High | Collect dissolved beryllium samples in support of TMDL development. Collect core parameters to represent at least 3 seasons during an assessment period. |

| Impairment Discussion |
|---|
| Remains impaired for beryllium (2010). |



ED_013248_00000549-00011

# BURRO CREEK

Francis Creek - Boulder Creek
15030202-008
13.811 Miles

**Category 1**
Attaining all uses

FC - Attaining • FBC - Attaining • AGL - Attaining
AWW - Attaining

Use Support

## No Exceedances

## Monitoring Summary

Sampling period: 9/20/2012 - 4/29/2013

| Site Name(s) | Site ID # | DEQ # | Sampling Agency | Purpose |
|---|---|---|---|---|
| ABOVE BOULDER CREEK | BWBR0029.91 | 100404 | ADEQ | Ambient Monitoring |

| Metal Samples | Nutrients & Related Samples | Other Samples |
|---|---|---|
| (4) Antimony, arsenic, beryllium, boron, cadmium, chromium, copper, lead, manganese, mercury, selenium, zinc | (4) Ammonia, nitrite/nitrate, nitrogen, phosphorus, total Kjeldahl nitrogen | (1-4) Dissolved oxygen, *E. coli*, pH, SSC, total dissolved solids, bottom deposits, biocriteria |

## Data Gaps and Monitoring Needs

| | |
|---|---|
| Exceedances Needing More Samples to Assess | None |
| Missing Core Parameters | None |
| Missing Seasonal Distribution | None |
| Lab Detection Limits Not Low Enough | Selenium, mercury (dissolved) |

| Priority | Monitoring Recommendations |
|---|---|
| Low | Good core parameter coverage. Use lower lab reporting limits for selenium and dissolved mercury. |



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# PEOPLES CANYON CREEK

Headwaters - Santa Maria River
15030203-524
8.222 Miles

**Category 1**
Attaining all uses

FC - Attaining • FBC - Attaining • AGL - Attaining
AWW - Attaining

## No Exceedances

## Monitoring Summary

Sampling period: 10/23/2012 - 4/2/2013

| Site Name(s) | Site ID # | DEQ # | Sampling Agency | Purpose |
|---|---|---|---|---|
| AT SPRING | BWPEE003.51 | 100407 | ADEQ | Ambient Monitoring |

| Metal Samples | Nutrients & Related Samples | Other Samples |
|---|---|---|
| (4) Antimony, arsenic, beryllium, boron, cadmium, chromium, copper, lead, manganese, mercury, selenium, zinc | (4) Ammonia, nitrite/nitrate, nitrogen, phosphorus, total Kjeldahl nitrogen | (1-4) Dissolved oxygen, *E. coli*, pH, SSC, total dissolved solids, bottom deposits, biocriteria |

## Data Gaps and Monitoring Needs

| | |
|---|---|
| Exceedances Needing More Samples to Assess | None |
| Missing Core Parameters | None |
| Missing Seasonal Distribution | None |
| Lab Detection Limits Not Low Enough | Selenium, mercury (dissolved) |

| Priority | Monitoring Recommendations |
|---|---|
| Low | Good core parameter coverage. Use lower lab reporting limits for selenium and dissolved mercury. |



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# TROUT CREEK

Cow Creek - Knight Creek
15030201-014
32.099 Miles

**Category 2**
Attaining some uses

FC - Attaining • FBC - Attaining • AGL - Attaining
AWW - Inconclusive

Use Support

## Exceedances

| Parameter | Applicable Standard | Date | Result | Designated use support comments |
|---|---|---|---|---|
| Dissolved oxygen | 6.0 mg/L | 8/14/2012 | 5.57 mg/L | AWW is inconclusive with 1 exceedance in 4 samples. |

## Monitoring Summary

Sampling period: 8/14/2012 - 5/16/2013

| Site Name(s) | Site ID # | DEQ # | Sampling Agency | Purpose |
|---|---|---|---|---|
| NEAR WIKIEUP | BWTRT002.43 | 100397 | ADEQ | Ambient Monitoring |

| Metal Samples | Nutrients & Related Samples | Other Samples |
|---|---|---|
| (4) Antimony, arsenic, beryllium, boron, cadmium, chromium, copper, lead, manganese, mercury, selenium, zinc | (4) Ammonia, nitrite/nitrate, nitrogen, phosphorus, total Kjeldahl nitrogen | (1-4) Dissolved oxygen, *E. coli*, pH, SSC, total dissolved solids, bottom deposits, biocriteria |

## Data Gaps and Monitoring Needs

| | |
|---|---|
| Exceedances Needing More Samples to Assess | Dissolved oxygen |
| Missing Core Parameters | None |
| Missing Seasonal Distribution | None |
| Lab Detection Limits Not Low Enough | Selenium, mercury (dissolved) |

| Priority | Monitoring Recommendations |
|---|---|
| Low | Collect additional dissolved oxygen samples due to the exceedance. |



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