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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rev. 8/14 | | Bridge No. | | | | | | | | | | | |  | | | | | | |
| Job No. | | | | | | | | | | | | | |  | | | | | | |
| Missouri Department of Transportation | | | | | | | | | | | | | | | | | | | | |
| Culvert Hydraulics Report | | | | | | | | | | | | | | | | | | | | |
| Designer | |  | | | | | | | | | | | Date |  | | | | | | |
| Route | |  | | | County | |  | | Stream | |  | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| Purpose of Hydraulic Study | | | | | | | | | | | | | | | | | | | | |
| *(Write a brief statement describing project and purpose of hydraulic study)* | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| National Flood Insurance Program Information | | | | | | | | | | | | | | | | | | | | |
| Has a flood insurance study been performed for the community? *(*[*http://www.fema.gov/cis/MO.pdf*](http://www.fema.gov/cis/MO.pdf)*)* | | | | | | | | | | | | | |  | | | | | | |
| Is the culvert in a special flood hazard area? *(If yes, a floodplain development permit will be required)* | | | | | | | | | | | | | |  | | | | | | |
| Is the culvert in a designated floodway? *(If yes, a no-rise certification will be required)* | | | | | | | | | | | | | |  | | | | | | |
| Has a Flood Insurance Rate Map (FIRM) been published for the area? | | | | | | | | | | | | | |  | | | | | | |
| What is the flood hazard zone for the site (A, A1, B, C, AE etc.)? | | | | | | | | | | | | | |  | | | | | | |
| Base (100-yr) Flood Elevation | | | | | (ft), Datum = | | | | | Floodway width | | | |  | | | | | | |
| Map panel number | | | | |  | | | | | Map date | | | |  | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| **Additional comments on Flood Insurance Study:** | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| Discharge Data | | | | | | | | | | | | | | | | | | | | |
| **Drainage Area** | | | | | | | | | | | |  | | | | | | | (mi2) | |
| **Valley Slope** (average slope between points 10% and 85% of valley length upstream) | | | | | | | | | | | |  | | | | | | | (ft/mi) | |
|  | | | | | | | | | | | | | | | | | | | | |
| **Method of Analysis** (choose one or more) | | | | | | | | | | | **Q25** | **Q50** | | | **Q100** | | **Q500** | | | Use |
| USGS regression equations | | | | | | | | | | |  |  | | |  | | |  | |  |
| - Rural | Publication year = | | | | | Region = | | | | |  |  | | |  | | |  | |  |
| - Urban | Publication year = | | | | | % Impervious = | | | | |  |  | | |  | | |  | |  |
| Stream Gage | | | USGS Station Number = | | | | | | | |  |  | | |  | | |  | |  |
| FEMA Flood Insurance Study | | | | Community Name = | | | | | | |  |  | | |  | | |  | |  |
| Other = | | | | | | | | | | |  |  | | |  | | |  | |  |
|  | | | | | | | | | | | | | | | | | | | | |
| **Comments on Discharge calculations:** *(method chosen and why, expected level of upstream development, etc.)* | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| **Observed Extreme High Water** | | | | | | | | | | | | | | | | | | | | |
| Elevation =       (ft), Datum = | | | | | | | | Location = | | | | | | | | Date = | | | | |
| **Comments on Observed Extreme High Water:** *(discharge, if known, etc.)* | | | | | | | | | | | | | | | | | | | | |
| **Discuss flow conditions in reach and describe existing conditions that may influence hydraulic behavior in reach:** | | | | | | | | | | | | | | | | | | | | |

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| **Hydraulic Model** | |
| HY-8, Ver. | Other = |
| River Analysis System (HEC-RAS), Ver. | |

|  |  |  |
| --- | --- | --- |
| **Model Data** | | |
| Streambed Slope = |  | (ft/ft) |
|  | | |
| How was streambed slope determined? | | |
| Which cross section was used to determine high water surface elevations and why? | | |
| Which cross section was used to determine tailwater elevations and why? | | |
| **Describe the channel/overbank conditions and the roughness coefficients chosen:** | | |

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| **Culvert Geometry** | | | | | | | | | | | | | |
| Inlet Flowline Elevation | | | |  | | | | Outlet Flowline Elevation | | |  | | |
| Span |  | (ft) | Rise | |  | (ft) | Number of Barrels | |  | Length (headwall to headwall) | |  | (ft) |
|  | | | | | | | | | | | | | |
| **Comments on Culvert Geometry:** | | | | | | | | | | | | | |

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| **Inlet Configuration** | | | | | | | | | | | | | | |
| Straight Wings | | Flared Wings | | | | Improved Inlet (describe) | | | | |  | | | |
|  | | | | | | | | | | | | | | |
| **Comments on Inlet Configuration:** | | | | | | | | | | | | | | |
| **Section 404 Permit Regional Condition Requirements** | | | | | | | | | | | | | | |
| Stream Type: | Perennial | | Intermittent | | Ephemeral | | | |  | | | | | |
| Bankfull Water Surface Elevation =       (ft) | | | | | | | Bankfull Discharge =       (cfs) | | | | | | | |
| Preconstruction Bankfull Area =       (ft2) | | | | | | | Invert Embedment Depth =       (ft) | | | | | | | |
| Velocity at Bankfull Discharge (ft/s) | | | | Average Within Culvert = | | | |  | | Upstream = | |  | Downstream = |  |
|  | | | | | | | | | | | | | | |
| Comments on stream type: *(how determined, certainty/uncertainty of type , etc.)* | | | | | | | | | | | | | | |
| Comments on bankfull water surface elevation and discharge: *(sections used and why, how elevation and discharge were determined, etc.)* | | | | | | | | | | | | | | |
| Additional comments on regional condition requirements: *(velocities, bankfull area, embedment depth, USACOE jurisdiction, etc.)* | | | | | | | | | | | | | | |

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| **Filenames** | | | | | | | | |
| **Describe files used in culvert calculations:** *(Hy-8 filenames and descriptions, etc.)* | | | | | | | | |
|  | | | | | | | | |
| **Culvert Calculation Results** | | | | | | | | |
|  | Existing Conditions | | | | Proposed Conditions | | | |
| Frequency | **Q****25** | **Q50** | **Q100** | **Q500** | Q25 | Q50 | **Q100** | **Q500** |
| High Water Surface Elevation (ft) |  |  |  |  |  |  |  |  |
| Headwater Elevation (ft) |  |  |  |  |  |  |  |  |
| Backwater (ft) |  |  |  |  |  |  |  |  |
| Inlet or Outlet Control |  |  |  |  |  |  |  |  |
| Culvert Outlet Velocity (ft/s) |  |  |  |  |  |  |  |  |
| Tailwater Depth (ft) |  |  |  |  |  |  |  |  |
| Tailwater Velocity (ft/s) |  |  |  |  |  |  |  |  |
| % of flow overtopping road |  |  |  |  |  |  |  |  |
| Overtopping (OT) frequency =  High Water Surface Elev. measured at  Backwater measured at | | | | | | | | |
|  | | | | | | | | |
| **Comments on culvert calculations:** *(backwater, velocities, unusual conditions, comparison to observed high water data, etc.)* | | | | | | | | |

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| **Scour Protection Measures** |
| **General Scour Information:** *(Describe soil conditions in streambed and overbanks)* |
| What measures are required to protect against scour? |
| **Additional comments on scour protection:** |

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| **General Information** |
| Are there any improvements/buildings/crops/livestock that might be affected by alterations to the floodplain? *(Include description and estimated value)* |
| **Special Considerations:** *(Describe any other special conditions or considerations which affect this project)* |

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| **Culvert Layout Summary** | | | | | | | |
| Culvert Layout | |  | | | | Skew |  |
| Loading |  | | Roadway Width |  | Alignment | |  |
| Tie Sta. |  | | | | | | |
|  | | | | | | | |
| **Design Exceptions:** *(Provide an explanation of any design exceptions requested and approved for this project)* | | | | | | | |

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| **Hydraulic Analysis Summary** |

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| Hydrologic Data |
| Drainage Area =      mi2 |
| Roadway Design |
| Design Frequency =      years  Design Discharge =      cfs  Design High Water (DHW) Elev. =  Design Elev. (1’ below shoulder) = |
| **Backwater/Base Flood Data (100-year)** |
| High Water Elev. =  Base Flood Discharge =      cfs  Estimated Backwater =      ft  Outlet Velocity =      ft/s |
| Roadway Overtopping |
| Overtopping Flood Discharge =      cfs  Overtopping Flood Frequency =      years |