



La Paz County Public Works Design and Construction Manual

La Paz County Public Works Department

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Glossary of Key Terms

APPROVAL: Written notice approving the design, progress, and completion of work by the La Paz County Public Works Director or County Engineer.

APPROVED PLANS: The most current grading and improvement plans and specifications. All approved plans are subject to a one-year approval limit.

BOARD OF DIRECTORS: La Paz County Flood Control District Board of Directors.

BOARD OF SUPERVISORS: La Paz County Board of Supervisors.

CIVIL ENGINEER: A Professional Engineer registered in the State of Arizona to practice Civil Engineering.

COUNTY: A La Paz County, Arizona, staff member designated by the La Paz County Public Works Director or County Engineer as having approval authority.

COUNTY ENGINEER: La Paz County Engineer, may be a staff member or consultant selected or appointed by the County.

DISTRICT: La Paz County Flood Control District or County staff member designated by the Floodplain Administrator as having approval authority.

FLOODPLAIN ADMINISTRATOR: A La Paz County staff member designated by title to administer and enforce the floodplain management regulations; may be a staff member or consultant selected or appointed by the County.

INSPECTOR: Person to perform inspection on grading and excavaton work, as directed by the La Paz County Public Works Director or County Engineer.

OWNER: An individual, agent, firm, partnership, association, corporation, or this State, or any agency or political subdivision having a legal or equitable interest in given real property. Further, the owner or his designated representative will be the responsible party with regard to compliance with this standard.

SITE: Any lot or parcel of land or contiguous combination thereof, under the same ownership or unified control, where the proposed grading is to be performed or permitted.



List of Acronyms and Abbreviations

ARS	Arizona Revised Statutes
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADOT Standards	ADOT Standard Specifications for Road & Bridge Construction and Standard Drawings
ADT	Average daily traffic
ADWR	Arizona Department of Water Resources
AZPDES	Arizona Pollutant Discharge Elimination System
BMP	Best Management Practice
CBC	Concrete Box Culvert
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
DDM	Drainage Design Manual for La Paz County
EPA	U.S. Environmental Protection Agency
FCDMC	Flood Control District of Maricopa County
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIS	Flood Insurance Study
FPS	Feet per Second
HDDM	Highway Drainage Design Manual
HD/W	Headwater/Depth Ratio
HEC-1	United States Army Corps of Engineers Hydrologic Engineering Center computer program for hydrologic modeling (DOS-based)
HEC-HMS	United States Army Corps of Engineers Hydrologic Engineering Center Hydrologic Modeling System computer program for hydrologic modeling (Windows-based)
HEC-RAS	United States Army Corps of Engineers Hydrologic Engineering Center River Analysis System computer program for hydraulic modeling of open channels and rivers (Windows-based)



HGL	Hydraulic Grade Line
Hydraulics Manual	FCDMC Drainage Design Manual – Hydraulics
ITE	Institute of Transportation Engineers
LOS	Level of Service
MAG	Maricopa Association of Governments
MAG Standards	MAG Uniform Standard Specifications and Details for Public Works Construction
MCDOT	Maricopa County Department of Transportation
MLRC	Municipality, Multi-Resolution Land Characteristics Consortium
MUTCD	Manual on Uniform Traffic Control Devices
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
RDM	Roadway Design Manual
ROAD	Repository of Online Archive Documents, ADOT
RV	Recreational vehicle
SCS	Soil Conservation Service, now NRCS
Standard Details	Uniform Standard Details for La Paz County
SWPPP	Stormwater Pollution Prevention Plan
TIA	Traffic Impact Analysis
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey



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1. Introduction

The laws of the state of Arizona and its political subdivisions, as presently constituted, require permits from various regulatory agencies for most activities involving construction, engineering, surveying, and associated practices. At the County level, these activities may involve design and construction. This *La Paz County Public Works Design and Construction Manual* (Manual) has been created to provide standards, specifications, and recommendations associated with good engineering practice and pertaining to hazard mitigation, public health, safety, and welfare in La Paz County.

The intent of these standards is to present clear and concise direction regarding technical requirements, policies, and processes needed to facilitate consistent uniform improvements through both the plan preparation and construction phases. However, the information presented is not intended to supersede sound engineering judgment.

Accordingly, development of new technologies, creative and innovative use of materials, system design, or construction practices may be accepted by County plan review personnel upon finding that public health, safety, and welfare is duly protected via a waiver process. It is also recognized that the use of standard designs and materials, especially for public facilities and works, often is more desirable than not when viewed from the perspective of efficiency of maintenance, repair, replacement, or public safety. It is anticipated that the primary users of these standards, specifications, and recommendations will be Developers, Engineers, and Contractors licensed in the State of Arizona.

1.1. Legal Authority

La Paz County, a political subdivision of the state of Arizona, will not knowingly issue any permit(s)—for construction of improvements on any property—that will allow an adversely impacting alteration of the volume, velocity, or location of waters entering or exiting adjoining properties.

The property owners, or their authorized representatives, applying for County-issued permits must obtain written approval from the County Engineer or his/her designee before issuance of permits. If the permit approval requires engineering analysis, then the engineer's report and construction plans must conform to the principals and practices in this La Paz County Public Works Manual and applicable local, state, and federal laws.



2. Purpose

This Manual serves as a technical guide for roadway, drainage, and site improvements in La Paz County. This document summarizes street drainage, roadway design, development, drainage planning, floodplain management, stormwater quality compliance, and drainage design criteria for both drainage infrastructure and surficial drainage within La Paz County. The intended user of this Manual is familiar with the fundamentals of engineering, hydrology, and hydraulics.



3. Applicability and Limitations

The standards presented in this Manual apply to all land within the unincorporated area of the County of La Paz and to those incorporated areas of La Paz County whose governing bodies adopt these standards. Limitations to the applicability of these standards exist. In accordance with Arizona Revised Statute (ARS) §11-812 (A), nothing contained in this document will:

- a) Affect existing uses of property or the right to its continued use or the reasonable repair or alteration of the property for the purpose for which used at the time the ordinance affecting the property takes effect.
- b) Prevent, restrict, or otherwise regulate the use or occupation of land or improvements for railroad, mining, metallurgical, grazing, or general agricultural purposes, if the tract concerned is five or more contiguous commercial acres.

This Manual will apply to the new construction of drainage, transportation, utility, and right-of-way facilities and improvements within the County. This Manual will apply to modifications of street features or existing facilities that are within the scope of reconstruction, widening, or narrowing, or to the extent they are expressly referred to in the Comprehensive Plan. This Manual will apply to every new placement and every planned, non-emergency replacement of existing utility poles, underground facilities, and other utility system structures within the County right of way. Every effort will be made to meet the standards during emergency replacements.

This Manual is not intended to interfere with, repeal, or do away with law or right, or annul any other ordinance, rule, or regulation, statute, or other provision of law except as provided in this Manual. Where any provision of this Manual imposes restrictions different from those imposed by any other provision of law, the provision that is more restrictive or imposes higher standards upon the development and use of land will control.



4. Key References

All design and construction in La Paz County, whether public or private, will be done in accordance with the principals, practices, and standards in the current version of the following publications:

- La Paz County Flood Control District Floodplain Management Ordinance No. FCD 2010-01 (or latest adopted version)
- La Paz County Subdivision Regulations (2008 or latest adopted version)
- La Paz County Zoning Regulations (2012 or latest adopted version)
- *La Paz County Comprehensive Plan*, Adopted May 2005, plus approved amendments (or latest adopted version)

Copies of these publications are available on the La Paz County website, or through the Public Works Department and Community Development Department. Additionally, La Paz County defers to other agency reference guidance throughout sections of this Manual for topics, as shown in Table 4-1, below.

Table 4-1. Summary of Sections with Main Topics Referring to Other Agencies

Topic	Agency	Applicability (typical)
Hydrology	Arizona Department of Transportation (ADOT)	Hydrology calculations
Hydraulics	Arizona Department of Transportation (ADOT)	Hydraulic calculations and design
Standard Specifications	Maricopa Association of Governments (MAG)	Standard specifications for construction
Standard Details	Maricopa Association of Governments (MAG)	Standard details for construction
Roadways	Maricopa County Department of Transportation (MCDOT)	Street and pavement design
Floodplain Management	Federal Emergency Management Agency (FEMA)	Flooding, floodplain management
Environmental, Air Quality	Arizona Department of Environmental Quality (ADEQ)	Water and sewer systems, air quality permitting
Water Resources	Arizona Department of Water Resources (ADWR)	Dams, water quality
Jurisdictional Washes	U.S. Army Corps of Engineers (USACE)	Clean Water Act, jurisdictional waters and wetlands

La Paz County will require all projects to comply with all requirements of the National Environmental Policy Act (NEPA), as well as all other federal, state, and local regulations. La Paz County will require compliance of all parties, both public and private. For private development, the Developer is to obtain any required environmental permits or clearances.

The Arizona Department of Environmental Quality (ADEQ) regulates water quality and the quality of stormwater discharges. All improvements, whether public or private, will adhere to ADEQ regulations. Projects disturbing one acre, or more are subject to the National Pollution Discharge Elimination System



(NPDES) requirements for construction sites under the U.S. Environmental Protection Agency (EPA) general permit for Arizona. Owners, developers, engineers, and/or contractors are required to prepare all documents required by this regulation, including but not limited to Stormwater Pollution Prevention Plans (SWPPPs), Notices of Intent (NOIs), and Notices of Termination (NOTs). See the Arizona Pollutant Discharge Elimination System (AZPDES) for details.



5. Improvement Planning

5.1. Data Collection

A thoroughly compiled and comprehensive catalogue of data sets the foundation for decision making and value engineering. Data sources that may help define the existing conditions are included in Table 5-1. These sources are representative of common data needs; however, data needs may vary, and this list should not be considered all-inclusive. Additional data sources may be available or required depending on project needs.

Table 5-1. Common Data Needs and Data Sources

Data Need (Existing Condition)	Data Source
Land Use, Land Cover	Municipality, Multi-Resolution Land Characteristics Consortium (MLRC), or as observed for existing conditions
Soil Characteristics	United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey
Floodwater Levels, Flood Risk	FEMA Flood Insurance Studies (FIS), www.msc.fema.gov
Watershed Peak Discharges	FEMA FIS, USGS StreamStats website/regression equations, or calculated using a method listed in Section 6
Public Engineering Records Public Right of Way ADOT Right of Way	La Paz County Public Works Repository of Online Archive Documents (ROAD), https://road.azdot.gov
Utilities	Arizona 811, http://www.arizona811.com/
County Ordinances and Regulations	See Section 4 for summary

Comprehensive facts and data should be collected and analyzed prior to initiating the design of any drainage projects. The basis of design should be presented and agreed upon by the governing agency for the project area.

5.2. Permitting

All permitting for development is overseen by the La Paz County Community Development Department. Anyone seeking permits should contact Community Development to determine the applicable permit and required items for submittal. Checklists have been created to guide the permitting and submittal process.

Right-of-way encroachment permits are overseen by the La Paz County Public Works Department for all work that may fall within the public right of way. Permits from both the Community Development Department and Public Works Department may be necessary for a project, depending on project specifics. Additionally, permits may be required from federal or state agencies; see Table 4-1 for a list of some permits that may be necessary. This list should not be considered comprehensive; your project may require additional permitting from other agencies.

Development in La Paz County must follow all federal, state, and local laws, rules, and regulations. Note that piecemeal permitting generally is not allowed and is strongly discouraged. The final use of the property must be reviewed and approved prior to issuing grading permits or other interim development items. Approval of a portion of development does not relieve the developer from additional or new



requirements for that same portion which may be required because of changes resulting from the final use design.

Development must follow applicable building codes and the fire code as adopted by La Paz County, including providing emergency vehicle access. The Community Development Department has a listing of current applicable codes.

A grading permit is not required for the following:

1. Single-family residential, where the excavation is:
 - a. Less than 50 cubic yards; however, if a building or structure is being placed, a compaction report is needed prior to structure placement, even if the fill will be less than 50 cubic yards.
 - b. Less than 2 feet in depth (measured from existing grade), and
 - c. Does not create a cut slope 5 feet or greater in height and steeper than 1 unit vertical to 1.5 units horizontal.
2. When approved by the Public Works Director, County Engineer or his/her designee, grading is in an isolated, self-contained area if there is no impact or danger to private or public property.
3. An excavation below finished grade for basements and footings of a building, retaining wall, or other structure authorized by a valid building permit. This will not exempt any fill made with the material from such excavation or exempt any excavation having an unsupported height greater than 5 feet after the completion of such structure.
4. Cemetery graves.
5. Refuse disposal sites controlled by other regulations.
6. Excavations for wells, tunnels, or utilities.
7. Mining, quarrying, excavating, processing, or stockpiling of rock, sand, gravel, aggregate, or clay where established and provided-for by law, provided such operations do not affect the lateral support or increase the stresses in or pressure on any adjacent or contiguous property.
8. Exploratory excavations under the direction of soil engineers or geologists.
9. A fill less than 1 foot in depth and placed on natural terrain with a slope flatter than 1 unit vertical to 5 units horizontal, or less than 3 feet in depth, not intended to support structures, that does not exceed 50 cubic yards on any one lot and does not obstruct a drainage course.

A grading permit does not include the construction of retaining walls or other structures. Exemption from the permit requirements of this chapter will not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this chapter or any other laws or ordinances of this jurisdiction. The controlling criteria for the construction of earthwork in La Paz County will include the project-specific geotechnical report, the current International Building Code adopted by La Paz County, and MAG specifications and details.

5.3. Water and Wastewater Systems

La Paz County has a delegation agreement with ADEQ to review water and wastewater systems, but only under limited circumstances. Note that La Paz County generally cannot approve water and wastewater systems, except potentially for individual lots and small developments, and generally not commercial or subdivision developments. The list of review functions delegated to La Paz County can be found on the ADEQ website (www.azdeq.gov), or by contacting the Community Development Department.



6. Hydrology

The acceptable methods for performing hydrologic calculations used in determination of peak stormwater flow rates and runoff volumes will be one of the methods from the Arizona Department of Transportation (ADOT) *Highway Drainage Design Manual* (HDDM), Volume 2, Hydrology (ADOT, 2014), and as listed in this section. See Table 6-1 for a summary of methods and software. The County may require the specific use of one of the methods as applicable.

Table 6-1. Hydrologic Approach by Topic

Topic	Procedure/Method	Software or Guidance
Rainfall	Obtain precipitation depth and/or intensity from NOAA Atlas 14	National Weather Service, NOAA Rainfall Data Website ¹
Rainfall Losses	Green and Ampt Soil Method, Initial & Constant Loss Rate Method, or SCS Curve Number Method	HEC-HMS, HEC-1
Peak Discharge	Rational Method (watershed < 10 acres), Clark Unit Hydrograph Method, SCS Unit Hydrograph ² Method, Regional Regression Equations	ADOT Rational Method, HEC-HMS, HEC-HMS, USGS, StreamStats or Scientific Investigations Report (SIR) 2014-5211
Time of Concentration	Summation of overland flow and bankfull depth open channel flow travel times	Technical Release 55 (TR-55)
Channel Routing	Muskingum-Cunge, Kinematic Wave, and Modified Puls Routing Method	HEC-HMS
Storage Routing	Level pool storage routing method	HEC-HMS
Two-Dimensional (2-D) Modeling ³	Use 2-D Modeling and Model Review Guidance	FLO-2D or HEC-RAS ⁴
Flood Frequency Analysis	As described in ADOT HDDM, Volume 2, Hydrology	U.S. Geological Survey (USGS) Bulletin 17C

Notes:

- https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html
- Watersheds greater than 10 acres require use of SCS Unit Hydrograph Method. However, the Rational Method may be used for watersheds up to 160 acres with prior approval by the County Engineer.
- For 2-D modeling of FEMA regulatory floodplains and floodways, only certain software programs are permitted by FEMA. Please see FEMA's list of approved software for hydrologic and hydraulic modeling.
- Note that FLO-2D usage in La Paz County for FEMA studies is limited to versions approved by FEMA.



7. Off-Site Drainage

For storm runoff water from off-site that drains through the project, the following applies to the project area:

- Dispose of water in the same manner, amount, and location as before the planned development, keeping erosion to a minimum.
- Show all existing drainage patterns affecting the land.
- Provide drainageways for all channels and washes.
- Do not use streets to carry off-site drainage.
- Provide an erosion control system including channelization, erosion protection, lining, and riprap as required.
- Review all projects individually for approval by the County.

For all development and grading, all sources of off-site flow must be determined and quantified. Additionally, off-site flows must be routed from the same entrance and exit points, and not cause adverse impacts on neighboring properties. Any proposed development cannot adversely affect the water- and sediment-carrying capacity of watercourses, rivers, and washes. For the purposes of this Manual, “adversely affect” means that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase water surface elevations on other properties by a maximum of one foot, with the following exceptions:

- Where a floodway is defined, the maximum allowable rise is listed in the FEMA La Paz County Flood Insurance Study (www.msc.fema.gov).
- If a determination by the County Engineer indicates that a rise in the water surface elevation will cause water to leave the channel, avulse into different drainage paths, or cause existing development to be damaged by the increased water surface elevation, then a lesser or no rise may be required, or a drainage easement obtained over the affected land.

Note that this provision applies for all watercourses and not only the floodplains mapped by FEMA.



8. On-Site Drainage

On-site drainage must provide for the collection, conveyance, storage, and disposal of water in, nearly as much as possible, the same manner and amount as before planned development, keeping erosion to a minimum. Where a project is traversed by or abuts a stream, watercourse, wash, or proposed drainage way, a legal drainage way must be provided. The design must:

- Provide adequate facilities for disposal of stormwater, including underground pipes, inlets, catch basins, open drainage, ditches and washes, channels, pumps, lining, channelization, rock riprap, basins, and erosion control systems, as necessary.
- Provide and show routing through the project for the 100-year, 24-hour event (1-percent annual chance event).
- Assess damage potential to real property and provide assessment of hazard potential to human life.
- Ensure no increase in the amount of flow discharged from the property for the 100-year, 24-hour event (i.e., pre-development = post-development discharge amounts).
- Be compatible with the long-range goals of the County's *Comprehensive Plan*.



9. Stormwater Facilities

9.1. Stormwater Storage

9.1.1. Detention/Retention Basins and Facilities

Stormwater storage is a means to attenuate peak flows and store the increase in runoff volumes resulting from development. Stormwater storage in La Paz County includes the design of detention and retention basins. Calculations must be provided to document adequate storage or detention in facilities for the volume generated for excess peak discharges of direct on-site runoff increased from a pre-development to a post-development status. In other words, the designer will compare the area under the hydrograph for the event associated with the duration and frequency listed in Table 9-1 in pre-development and post-development scenarios and detain the difference in volumes and peak flows. The design documentation must show how the runoff reaches the storage areas. Peak discharges at the lower boundary of the proposed development will not be increased as a result of development.

Sites with watersheds greater than 10 acres must use the SCS Unit Hydrograph Method (or Rational Method for watersheds up to 160 acres with approval by the County Engineer). The detention/retention basin must fully drain within three days at the end of the storm event. On-site retention facilities must be sized to contain the entire volume of storm precipitation falling on the individual parcel, lot, space, or block, as listed in Table 9-1 and Table 9-2. Calculations will be provided to substantiate the design. No consideration may be given to rainfall absorbed by the ground.

Table 9-1. Detention/Retention Basin Design Standards

Design Criteria	Standard
Rainfall Depth	Retention/Detention: 1-Hr Duration 100-Year Frequency, plus as necessary to allow for no increase in the 100-year, 24-hour downstream flows, or as listed in Table 9-2.
Ponding	3 days maximum
Design Volume	Must hold direct on-site runoff increased from a pre-development to a post-development status and/or the 100-yr/1-hr rainstorm for the project area, whichever is greater.
Design Capacity	$(1.25 \times \text{Design Volume}) = \text{minimum}$, i.e., provide 25% additional volume over the design volume
Storm Drain/Bleed-Off/Discharge Line Freeboard	1 foot minimum (between top of grade and the high water elevation)
Storm Drain/Bleed-Off/Discharge Line Diameter	12-inch minimum
Fencing and Gating ¹	Basins deeper than 4 feet must be fenced with a 6-foot-high fence or masonry wall with locked 16-foot wide gate.
Basin Side Slope	3H:1V Maximum
Basin Bottom Slope	0.5%, Grassed-area bottom 0.3%, Non-grassed-area bottom



Design Criteria	Standard
Irrigation Sprinkler System and/or Landscaping	Desert landscaping with plantings or grass with an irrigation sprinkler system is required for unfenced, residential basins.
Location Spacing ²	One basin per 40 acres, minimum.
Emergency Overflow	Required
Maintenance Access	Vehicle ramp required that spans basin depth ¹ not to exceed a 20% grade (1V:5H) for skid-loader and backhoe access.

1. Basin depth is taken from the lowest finished grade adjustment to the basin.
2. Location of basin within a project to be approved by the County Engineer.

Table 9-2. Retention Basin Design Rainfall Standards

Retention Basin (or Facility) Location	Design Rainfall ¹			
	Duration	Frequency	-	Depth
Commercial/Industrial	1-Hr	100-Yr	or	2.25 inches
Residential with Drained Streets	1-Hr	100-Yr	or	2.25 inches
Residential with Streets Drained onto Lot	6-Hr	100-Yr	or	3.05 inches
Recreational Vehicle (RV) Parks	1-Hr	100-Yr	or	2.25 inches
Mobile Home Park with Drained Streets	1-Hr	100-Yr	or	2.25 inches
Mobile Home Park with Streets Drained onto Lot	6-Hr	100-Yr	or	3.05 inches
Other	1-Hr	100-Yr	or	2.25 inches

1. The Design Rainfall Depth will be the greater of the NOAA Atlas 14 Precipitation Depth associated with the Duration and Frequency listed and the Depth listed.

If the basin receives stormwater runoff from the public right of way, the basin will be dedicated for drainage and public use. For properties adjacent to the Colorado River, retention of the first flush may be allowed with approval from the County Engineer. The first flush is equivalent to retaining the first 0.5-inches of direct runoff from a storm event experienced on the project area.

9.1.1.1. Outlet Measures

Ponded water must leave the detention/retention facility within three days via:

1. Percolation or infiltration into the ground where the groundwater table is at least 10 feet below ground
2. Pumping or controlled bleeding of the collected runoff into watercourses, storm conduits, or drainage ways in a judicious manner, after peak flows in those watercourses have passed
3. Pumping or controlled bleeding of the collected runoff into dry wells for infiltration into sub-surface zones; in urbanized areas, this option is allowed only where the groundwater table is at least 10 feet below ground
4. Evaporation with any combination of 1 through 3, above, or as approved by the County Engineer



If evaporation and percolation cannot totally remove the water within three days, controlled bleeding or pumping of the basin into an approved disposal facility will be required. A drywell and sump must be constructed in all retention basins with bleeding or pumping facilities.

Calculations will be provided to show pipe draining, evaporation, and percolation. The final decision as to whether bleeding or pumping is required will be made by the County Engineer.

9.2. Underground Storage

No underground stormwater retention/detention is allowed in La Paz County, unless it drains into a lift station vault with emergency generator backup.

9.3. Open Channels

Open channels may be used to convey stormwater. Channel lining may be required depending on the velocity, side slopes, channel geometry, and Froude number, as shown in Table 9-3. Channels must be designed to provide protection from excessive silt deposition due to low velocities. Open channel design standards are listed in Table 9-3.

Table 9-3. Open Channel Design Standards

Design Criteria	Standard
Storm Frequency:	
Flood control open channels	100-year, 24-hour
Roadside ditches	10-year, 2-hour, where the runoff exceeds the capacity of the ditch, a closed storm sewer system shall be required.
Bed Slope	0.5% minimum No specified maximum, see channel lining in this table for velocity specifications
Side Slope	3H:1V maximum, unless an engineered and erosion-protected slope is provided
Freeboard	1-foot for all design frequencies less than the 100-year event and all supercritical flow regimes
Channel Lining for Sandy Soil:	
Velocity < 5 fps, or Side slopes 3H:1V or flatter	No lining required
5 fps ≤ Velocity ≤ 10 fps, or Side slopes steeper than 3H:1V, or Rapid changes in channel geometry, or Froude Number > 0.80	Erosion control or channel lining required
Velocity > 10 fps	Use in-channel energy dissipating devices
Channel Drops	Use when required to achieve desirable bed slope Use erosion protection measures at all drops, such as cutoff walls, riprap, stilling basins, or similar



9.4. Storm Drains

Storm drains typically are provided in urban areas to convey storm runoff below ground and meet drainage design standards for roadways, development, etc. In La Paz County, storm sewers must be designed to convey at least the 10-year, 24-hour event, unless otherwise approved by the County Engineer. Table 9-4 contains standards for storm drain design.

Table 9-4. Storm Drain Design Standards

Design Criteria	Standard
Storm Event	Not less than the 10-year, 24-hour; or per the applicable design standard
Velocity	15 fps maximum
Diameter ¹	18-inch minimum
Hydraulic Grade Line (HGL)	Below the ground surface
Material	Concrete, corrugated metal pipe, high density polyethylene, or polyvinyl chloride allowed.
Outlets	Flared-end sections or headwalls with erosion protection required
Manholes	One manhole every 350 feet maximum, and at changes of grade or alignment; note that a pipe collar may be sufficient for some instances; see Section 9.5

1. Minimum diameter for storm drain bleed-off line for detention basins differs. See Table 9-1.

If not located in a public right of way and not a private system, storm drain pipelines require an easement dedicated to La Paz County. Pipelines shall be designed to prevent excessive silt deposition within the system due to low flushing velocities.

9.5. Catch Basins, Manholes, and Junction Structures

Catch basins, inlets, manholes, and junction structures for use in the public right of way will be per ADOT or MAG standard details. Alternate designs are allowed with approval by the County Engineer.

Interception design and calculations will conform to Federal Highway Administration (FHWA) procedures and hydraulic engineering circulars. Junction structures such as manholes or pipe collars will be provided at all changes of grade and alignment. One manhole per every 350 feet maximum is required. A pipe collar or pre-cast junction in lieu of a manhole may be used if a manhole is located within 150 feet of the location. Pre-cast junctions include Tees and Wyes.

The use of temporary subgrade drains shall be constructed to allow roadway drainage during construction with connections to catch basins.

9.6. Culverts and Bridges

When public streets on sustained gradients cross natural drainage courses, adequate culverts will be provided to accommodate at least the 50-year, 24-hour storm, with stipulations, as follows:

- Lesser design frequencies and at-grade crossings may be allowed with the approval of the County Engineer. However, in no case will the maximum floodwater depth over the road for the 100-year, 24-hour event exceed 0.5 feet and 10 fps velocity. Structures such as culverts or bridges will be provided in all cases to ensure this depth and velocity threshold is maintained.



- FEMA-mapped floodplains with floodways may require additional capacity so that the floodplain standards for the watercourse are maintained (see the La Paz County Flood Insurance Study for the applicable watercourse for flow and allowable rise standards).

Table 9-5 includes design standards for culverts. Alternative designs may be allowed with approval by the County Engineer or Public Works Director.

Table 9-5. Culvert Design Standards

Design Criteria	Culvert Design Standard
Storm Event	50-year, 24-hour or as necessary to ensure the 100-year, 24-hour event does not exceed 0.5 feet depth and 10 fps velocity over the traveled surface
Diameter	18-inch round minimum, OR 22-inch x 13-inch arch minimum, OR 23-inch x 14-inch elliptical minimum 4-foot x 4-foot concrete box culvert (CBC)

Diversion of ponded water at culverts to other drainage areas is NOT permitted. The downstream end of all culverts must be protected from erosion and include a flared-end section, headwall, riprap, or similar measure. Culverts' hydraulic design capacity, HW/D, will conform to the guidance set forth in the ADOT HDDM.

Low water crossings, or dip crossings, shall only be permitted after approval of the concept by the County Engineer or Public Works Director. If such a crossing is permitted, the roadway embankment slopes shall be adequately protected.

Culverts should be designed in plan and profile to avoid sediment build-up.

Bridges must be designed per the ADOT *Bridge Design Guidelines*, found on the Bridge Engineering and Construction page of the ADOT website, <https://azdot.gov/business/engineering-and-construction/bridge/bridge-design-guidelines>.

9.7. Maintenance

Maintenance of storm drainage facilities will be clearly established and acceptable to the County. Drainage easements are required for County-owned/maintained channels or storm drains. Access must be provided to all drainage structures owned and/or maintained by La Paz County. The facilities should be accessible to agencies' maintenance equipment for routine operations; removal of debris, if applicable; and any needed repair of damages. To reduce maintenance activities, facilities should be designed to avoid movable parts and should use parts, including but not limited to, outlets, orifices, pipes, structures, and weirs.

If operation and maintenance manuals are warranted to accompany the basin and/or best management practice (BMP) facility designs, those documents will be provided to La Paz County by the project engineer or owner. Inspections should be performed regularly to ensure the basin is draining within three days of a storm event.



10. Erosion Control

Erosion control is required for many drainage structures to prevent damage and channel degradation. In general, velocities that will cause site soils and materials to erode and side slopes steeper than 3:1 will require erosion control measures. The following erosion control measures are allowable. The ADOT HDDM may be used to select and design the items listed below. Additionally, standard details for erosion control items found in the MAG and ADOT publications are acceptable for use, with the considerations listed below.

- Riprap and Grouted Riprap: The design concepts in the ADOT HDDM may be used to design riprap in La Paz County, including size, gradation, etc.
- Energy-Dissipating Devices: The concepts and designs in the ADOT HDDM may be used to select and design energy dissipators in La Paz County.
- Bank Protection/Channel Linings: Acceptable bank protection types in La Paz County include cutoff walls, riprap, grouted rock, ADOT Rail Bank protection, and anchored articulating concrete blocks. Additional types listed below may be acceptable with the following limitations and/or design considerations:
 - Soil cement: Soil cement may be used and should be placed in stepped horizontal layers. Placement of the material in horizontal layers is necessary as placing the lining following grade on steep slopes results in lining failures over time.
 - Concrete lining: Concrete is a rigid revetment that does not conform to changes in bank geometry and is subject to failure; the loss of even a small section of supporting embankment can lead to failure. This rigid protection material may be used with approval from the County Engineer, with proper end and side treatments to protect against flow flanking, with expansion/contraction joints to prevent cracking. Weep holes will be provided to relieve hydrostatic pressures.
 - Shotcrete lining: Similar to concrete lining, shotcrete is a rigid revetment and generally is not permitted for use as it is subject to failure. Use of this material should be limited in extent and requires approval of the County Engineer.
 - Gabion baskets and revetment: Approval is required for the use of gabion baskets and generally should be limited to low-height, minor side slope support not subject to water overflow. Gabion baskets should not be used for drop structures. Gabion revetment lining, consisting of one layer of rock enclosed in wire as an interconnected lining, may be used if proper side and end protection is provided.



11. Floodplain Management

The La Paz County Floodplain Management Ordinance governs floodplain regulations in La Paz County. The Floodplain Administrator manages this program for the County and the Flood Control District. La Paz County participates in the FEMA-administered National Flood Insurance Program (NFIP). Developments will comply, at a minimum, to 44 Code of Federal Regulations (CFR) §60.3. Per ARS Title 48, Chapter 21, Article 1 (§ 48-3601, et seq.), the Arizona State Legislature delegates responsibility to each county flood control district to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry, which is covered by the La Paz County Flood Control District Floodplain Management Ordinance No. FCD 2010-01, which states, “*It is unlawful for a person to engage in any development or to divert, retard, or obstruct the flow of waters in a watercourse without securing written authorization from the La Paz County Flood Control District Board of Directors.*”

The Ordinance additionally contains provisions for development along the Colorado River. The Colorado River floodway is an extremely hazardous area and has additional provisions for the floodway, floodway fringe, and flood-related erosion-prone areas of the Colorado River.

The La Paz County Floodplain Management Ordinance is available for download from the La Paz County website, or from the Community Development department. Note that this ordinance is updated periodically and the most recent, adopted version shall be used.



12. Roadway Design

Portions of the Maricopa County Department of Transportation (MCDOT) *Roadway Design Manual* (RDM), updated February 2020 or latest edition, will be used to govern roadway design in La Paz County. Note that only certain sections of this document are applicable in La Paz County, as listed below. Additionally, Section 13 of this manual lists the standard details and specifications for use in La Paz County.

12.1. Geometric Design and Roadway Classification

The design of roadways will be per the MCDOT RDM, Chapter 5, Geometric Design Standards, with the following exceptions:

- ADOT Standard Details may be substituted for MAG Standard Details where referenced.

12.1.1. Alleys

Alleys function as secondary access to properties whose primary access is a local road or street. Alleys will not be constructed in new single-tenant residential developments unless the new development is in an area where an alley system already exists. Alleys must be designed and improved along rear lots for commercial or multiple-dwelling use.

12.1.2. Cul-de-Sacs and Knuckles

Cul-de-sacs are turnarounds and will be provided on dead-end roads that serve more than one property owner with only one direct access to the public right of way or access easement. The requirement applies to both public and private streets and will be designed to accommodate emergency equipment such as fire trucks. The minimum radius in residential areas will be 50 feet with an improved traffic turning circle of 45 feet. Alternate street terminations may be used with approval of the County Engineer; however, the alternate termination still will provide adequate emergency vehicle accommodations.

Knuckles are areas on the roadway expanded to provide turnaround and additional access or lot frontage. Knuckles are required at intersections where the street extends in only one direction from the intersection.

12.1.3. Sidewalks

Sidewalks must be constructed per Section 5.36 of the MCDOT RDM and MAG Standard Specifications and Details. Additionally, concrete sidewalks must be constructed in all areas zoned to permit commercial uses and all urban areas zoned to permit residential uses, unless otherwise approved by the Public Works Department or County Engineer. For rural areas, sidewalks generally will not be required.

12.1.4. Curb Returns

The minimum curb return radii for various types of intersections are listed in Table 12-1. Larger radii may be required by the County Engineer of Public Works Department.

Table 12-1. Curb Return Radii Design Standards

Intersection Type	Minimum Curb Return Radius (feet)
Local and Local	25
Local and Collector	25
Local and Arterial	30
Local and Parkway	30



Intersection Type	Minimum Curb Return Radius (feet)
Collector and Arterial	30
Collector and Parkway	40
Arterial and Parkway	40
Parkways and ADOT Roads	40

12.2. Roadway Pavement Design

Pavement design will be per Chapter 10 of the MCDOT *Roadway Design Manual* with the following exceptions:

- Unpaved roads: Unpaved roads may be allowed for use in La Paz County with approval by the Public Works Director or County Engineer. The design will provide a minimum of a 4-inch aggregate base (AB) layer unless alternative design approval is given by the County Engineer. Milled AC or a 50/50 blend of milled AC and AB may be used in lieu of AB. The milled AC will be comprised of asphalt grindings / asphalt millings. The surface layer shall have a dust palliative treatment, preservative seal coat or chip seal treatment for dust prevention. Note that the designer will coordinate guidance from the latest County-adopted version of the International Fire Code (IFC) to provide a roadway structural section design that accommodates weights of fire trucks and emergency vehicles, and geometric design that accommodates turning radii and turn-arounds.
- Pavement design method for paved roads: Note that a simplified, alternative design method is in the MCDOT RDM for paved local and collector roads; however, in no case will the asphaltic concrete thickness be less than 2.5 inches and the minimum base course thickness will not be less than 4 inches unless approval is given by the County Engineer. Should the designer wish to skip pavement design, a section of 3-inch asphaltic concrete on 6-inch aggregate base material may be used on local and collector roads in lieu of performing the detailed or alternative pavement design methodology.

The standard cross slope for paved surfaces shall be 0.02 ft/ft. The standard cross slope for unpaved surfaces shall be 0.03 ft/ft.

12.3. Roadway Drainage

The use of streets and roads for collection and movement of storm runoff water is a secondary function of the street and, therefore, has certain limitations. Generally, the larger the average daily traffic (ADT), the higher the classification of the street. Additional drainage design for items associated with roadway drainage, such as storm drains and culverts, are found in Chapter 9 of this Manual.

The roadway must channel surficial peak flows per the standards in Table 12-2. If the standards cannot be met, underground pipes or drainage channels of sufficient size to carry the excess will be installed. Streets must not be used to carry off-site drainage.

The use of inverted-crown streets will be permitted if approved by the County Engineer. In the event inverted-crown streets are used, a 4-foot-wide concrete valley gutter will be required for conveyance of on-site drainage.



Table 12-2. Local Roadway Drainage Design Standards

Design Criteria	Standard
Storm Frequency	10-Yr (Arterial, Collector, and Residential Streets) 25-Yr (Parkways)
Minimum Time of Concentration	10 Minutes
Street Flow:	
Max Flooded Width	Width between top of curbs: ½ Through Traffic Lane (Arterial and Collector Streets Only)
Max Flooded Depth	0.5 ft (Uniform Street Flow)
Max Velocity	5 fps (Uniform Street Flow) 3 fps (Residential Street Flat Areas Gutters Only) 10 fps (Deepest Water in Parking Lot)
Curb Type	Per MAG or ADOT standard details, rolled or vertical curb acceptable
Erosion	100-Yr flow must be contained between property lines without erosion
Minimum Street Grade	0.20% (Roads with Concrete Gutters) 0.30% (Roads with Asphalt Surfacing)
Minimum Concrete Cross Gutter and Valley Gutter Grade	0.20%
Concrete Valley Gutter Width	4 feet (or per MAG or ADOT)

12.4. Traffic Impact Analyses, Access Management, and Traffic Control

12.4.1. Traffic Impact Analyses

The following scenarios will require a Traffic Impact Analysis (TIA):

- Proposed new development with more than 50 lots/Recreational Vehicle (RV) spaces or anticipated traffic generation of 50 or more trips per day
- Expansion of an existing development to more than 50 lots/RV spaces or anticipated traffic generation of 50 or more trips per day
- 10,000 gross square feet or more of commercial or industrial usable space

A traffic impact analysis may be required for smaller developments or for any deviation from the County access control standards, and the County Engineer will set or waive requirements. La Paz County desires to operate a safe and efficient transportation network. The management of access to the network is vital to maintaining the overall safety and efficiency of the system. The purpose of the TIA is to:

- Determine the transportation impacts of the project on the existing and future public transportation networks.



- Highlight any special or unusual transportation conditions that may exist or be anticipated and describe how they will be handled.
- Provide sufficient information for an assessment of the fair costs to address the impacts of the development.
- Coordinate circulation aspects of the project with those of other projects, existing developments, and the County's *Comprehensive Plan* and specific plans.
- Ensure uniform requirements and treatment for all developers.

A traffic impact analysis will address the following elements:

- Current and design year traffic. A 20-year horizon design year generally is acceptable, unless otherwise approved by the County Engineer or Public Works Department.
- Non-site traffic in the vicinity of the proposed site.
- Site-generated traffic as prescribed in the most recent publication of the Institute of Transportation Engineers (ITE) *Trip Generation Manual*.
- Trip distribution and traffic assignment.
- Design, operation, and circulation elements for the planned street system, access points, and driveway types.
- Guide for Multimodal Analysis as prescribed in the Highway Capacity Manual, Sixth Edition, Transportation Research Board.
- Warrant analyses for signalized traffic control of intersections as contained in the *Manual on Uniform Traffic Control Devices*.

The complete traffic impact study report will contain the following information:

- A vicinity map displaying the location of the site relative to the La Paz County transportation system.
- A summary table listing legend code, land use, unit number, daily trip rate, morning peak hourly trip rate, evening peak hourly trip rate, and trip generation.
- A site plan showing the location of each building according to the legend code listed in the summary table.
- Trip distribution percentages.
- Traffic volume graphics that depict the A.M. peak hour, the P.M. peak hour, and the day for site traffic, non-site traffic, and total traffic conditions for impacted intersections. This information must be provided for both the current year and the design year.
- Level of service (LOS) tables that reveal the operation of impacted intersections during the peak hours and the peak period adjusted peak hour for non-site traffic and total traffic conditions. This information must be provided for both the current year and the design year.
- Sample calculations or sample computer output that shows the methodologies used to determine LOS.
- Calculations that reveal the signalization and stop sign traffic control warrant analyses and results.
- Intersection and driveway schematics that reveal existing and proposed lane configurations and existing and proposed intersection control. This information must be provided for both the current year and the design year.

Traffic studies must be prepared under the supervision of a licensed professional engineer. If the County obtains the traffic study, the developer(s) will pay all costs for the study.



12.4.2. Access Control

Access control standards are intended to protect the public health, safety, and welfare. They are designed to balance the mobility and local access needs of the County with the County transportation system function. The statutory authority to control access on County roads is defined in the Arizona Revised Statutes, Sections 11 and 28, along with the various County ordinances.

The County must maintain a balanced transportation system, which will be achieved by the use of appropriate access control guidelines that correspond to the functional classification of La Paz County roadways (local, collector, arterial, and parkway). Access control on roadways owned, managed, or controlled by others, such as ADOT highways, are controlled by the associated agency and are not under the jurisdiction of La Paz County. The functional classification of roadways will determine the emphasis placed on mobility—that is, the preference given to through traffic versus local access needs. In general, the higher the functional class, the greater the emphasis on mobility, which then requires a higher degree of access control. Table 12-3 summarizes the degree of access control intended for each roadway classification. The degree of access control for each roadway classification is further defined in the succeeding paragraphs of this section.

Table 12-3. Access Control Design Standards

Functional Classification	Degree of Access Control
Parkways (Area Service Highways)	Moderate to High
Arterial Streets	Moderate
Collector Streets	Low to Moderate
Local Streets	Low

12.4.2.1. Parkways (Area Service Highways)

Parkways will be designed to provide a relatively high overall travel speed with minimum interference to through traffic movements. These routes are intended to achieve a posted speed limit of 45 mph in urban areas and 55 mph in rural areas.

To provide the desired level of service, direct private access will be permitted only when the property in question has no other reasonable access to the general street system. If direct private access must be provided, then the following options will be considered:

- Direct private access will be permitted until such time that reasonable access to a lower functional class roadway is available and permitted.
- No more than one access for an individual parcel or contiguous parcel under the same ownership unless additional access would benefit the safety and operation of the highway, or only one access would be determined as detrimental to public health, safety, and welfare.
- Large-acre tracts may be permitted more than one access, according to driveway spacing listed in Section 12.4.2.5 of these standards.
- Direct private access will be limited to right turns only, unless:
 - The access location has the potential to be signalized.
 - Left turns would not create congestion or lower the level of service.
 - Alternatives to left turns would cause unacceptable traffic operations and safety hazards.
- Left turns may be permitted at direct private access points that have the potential for signalization if the spacing requirements are met for intersections and median openings, and the left-turn movements will not interfere with the location, planning, and operation of the County road system.



- Driveways will be so designed to provide vehicle ingress and egress without requiring vehicles to back out of the driveway.

Spacing of all intersections with public streets, roads, and highways will be on one-half mile intervals, plus or minus approximately 200 feet, and based on section lines whenever feasible and not limited by topographical constraints. Traffic signal spacing will be maintained at one-half mile intervals, whenever feasible, to achieve good speed, capacity, and optimum signal progression. Median openings will be limited to one-quarter mile spacing.

12.4.2.2. Arterial Streets

Arterial and major collector streets will be designed for moderate to high travel speeds and traffic volumes. It is intended that arterial streets achieve 50 mph in urban areas and 60 mph in rural areas for rolling terrain conditions. It is intended that major collector streets achieve 35 mph in urban areas and 45 mph in rural areas.

No more than one access point is permitted to individual parcels or to contiguous parcels of the same ownership, unless:

- Additional access would not be detrimental to the operation and safety of the road and is necessary for the safe and efficient use of the property.
- The additional access would not be detrimental to public health, safety, and welfare.
- Large-acre tracts may be permitted more than one access point, according to the driveway spacing listed in Section 12.4.2.5.
- All turning movements, including left turns, will be allowed provided that left turns would not create congestion or lower the level of service and that adequate safety and design standards are met.

Spacing of intersections at all public streets, roads, and highways and other major access should be one-half or one-quarter mile, plus or minus 200 feet, and based on section lines whenever feasible and not limited by topographical constraints. The minimum spacing for traffic signals is one-quarter mile. In urban areas or where significant development is expected in the foreseeable future, public access should be carefully planned to ensure good signal progression. The desired minimum spacing between median openings is one-eighth mile.

12.4.2.3. Collector Streets

The primary purpose of collector streets is to collect traffic from local streets and distribute it to the arterial street system. Access roads are balanced with through traffic movements without compromising the public health, welfare, or safety. It is intended that collector streets achieve 30 mph in urban areas and 35 mph in rural areas. One direct access will be permitted to each individual parcel or to contiguous parcels under the same ownership or control.

Additional access may be permitted to a parcel when there will not be any significant safety or operational problems, when spacing meets the safe sight distance, and when additional access would not knowingly cause a hardship to an adjacent property. All turning movements, including left turns, will be allowed provided that adequate safety and design standards are met. Minimum spacing between signals should be that which is necessary for the safe operation and proper design of adjacent accesses.

12.4.2.4. Local Streets

The primary purpose of this classification of roadway is to provide safe and reasonable access to abutting property. Access needs take priority over through traffic movements without compromising the public health, welfare, or safety. One direct access will be provided to each individual parcel. Additional access may be permitted to a parcel when there will not be any significant safety or operational problems, when



spacing meets the safe sight distance, and when additional access would not knowingly cause a hardship to an adjacent property. All turning movements, including left turns, will be allowed provided that adequate safety and design standards are met.

12.4.2.5. Driveways/Curb Cuts

A driveway or curb cut is an access within a public right of way that connects a public road with an abutting property. Driveways serve residential, commercial, and industrial land uses. All new driveway accesses will have a La Paz County permit to use county rights of way. Driveways accessing major collectors, arterials, and area service highways must provide turn arounds so that vehicles will always exit the driveway in a forward motion. The minimum driveway spacing for the indicated land uses is per Table 12-4.

Table 12-4. Driveway Spacing Design Standards

Land Use	Spacing Between Driveways (feet)
Single Family	50
Multi Family, >2 units	165
Multi Family, >50 units	330
Commercial (Minor)	165
Commercial (Major)	330 (or greater, as required by the County Engineer)
Industrial	165

A new access driveway may not be permitted:

- Within the limits of a curb return at a street intersection
- Within 50 feet of the intersecting property lines of a residential street
- To a major collector, arterial, or area service highway, within 200 feet of a property line along an intersecting major collector, arterial, or area service highway
- Within 200 feet of a median opening unless access is directly opposite of the median opening
- Within 25 feet of a guardrail ending
- Within 100 feet of a bridge structure

Exceptions may be made by the Department of Public Works where application of these standards would create hardship on the abutting property owner.

Where obstructions (such as public utility structures, traffic control devices, etc.) occur, a minimum clearance of 2 feet for residential driveways and 4 feet for commercial and industrial driveways is required. Common driveways may be approved by the Department of Public Works, provided that a notarized agreement has been consummated between property owners for joint use of right of way.

Every driveway must provide access to an off-street parking area or loading area located on private property. Maintenance of driveway approaches, including drainage culverts, will be the responsibility of the owners whose property they serve.

If sight distance problems are anticipated at the location of a proposed driveway, then only one driveway that provides the safest access to the public right of way will be permitted.



12.4.2.6. All Weather Access

All weather access to subdivisions, manufactured home parks, and recreational vehicle parks will correspond to standards established in the La Paz County Floodplain Regulations and this Manual, and will include a paved roadway with a minimum 26-foot width.

Access within subdivisions, manufactured home parks, and recreational vehicle parks will be designed so that all lots and structures within a development will be accessible from the boundary of that development by at least one route during the peak flow runoff from a 100-year, 24-hour frequency storm.

12.4.3. Traffic Control

Projects in a County right of way using non-County personnel will require a written traffic control plan reviewed and accepted by the Public Works Department, along with an encroachment permit. Traffic control must use and conform to the *Manual on Uniform Traffic Control Devices* (MUTCD), published by FHWA, and any project-specific specifications.



13. Standard Plans and Specifications

Construction specifications and standard details will be per the MAG *Uniform Standard Specifications for Public Works Construction* and the *Uniform Standard Details for Public Works Construction* (2019 Revision to the 2015 Edition, or latest version). Additionally, as an alternate, the ADOT *Standard Specifications for Road and Bridge Construction* and *Construction Standard Drawings* may be used in La Paz County.



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