



**Drainage Study Checklist**

**Background**

The City of North Las Vegas strives to provide the development community with adequate information to ensure the successful completion of any project in the City. To aid in the submittal of a complete, thorough drainage study, the following checklist has been compiled to assist the design engineer. This checklist focuses on requirements specific to the City of North Las Vegas. When preparing a drainage study, the engineer will still be required to adhere to all local criterion and guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) *Hydrologic Criteria and Drainage Design Manual (HCDDM)* and the *Uniform Standard Drawings for Public Works= Construction Off-site Improvements* for Clark County Area, Nevada. **In order to have a complete drainage study for submittal to the City, this checklist must be completed, signed, and stamped by the engineer in responsible charge for the completion of the drainage.** Incomplete submittals will not be accepted at the front counter.

**Checklist**

Provide N/A to an item that is not applicable for the subject site.

I. General Requirement		
Yes	No	
		Ensure that the new Standard Form 1 and 2 are utilized for all incoming drainage study submittals. The form can be acquired from the CCRFCD's website at <a href="http://www.ccrfcd.org/engineering.htm">http://www.ccrfcd.org/engineering.htm</a> .
		Ensure that the new 2008 CCRFCD's Master Plan Update (MPU) is utilized for all incoming drainage study submittals. Both the Flood Control Facilities and Facility Inventory Maps must be included with the drainage study.
		A copy of the approved zoning/planning conditions associated with this site must be included with the initial submittal to verify compliance with conditions.
		If offsite grading is anticipated, a notarized permission letter to construct from the property owner is required prior to the approval of this technical drainage study.
		If the site is proposing to increase or concentrate storm flow and/or nuisance flows onto the adjacent property. A notarized permission letter to accept from the property owner is required prior to the approval of this technical drainage study.
		The City of North Las Vegas (CNLV) does not allow valley gutters to be constructed across streets with right-of-way widths of 80 feet or greater.
		Provide map pockets in the back of the drainage study in order to keep the improvement plans with the study.
		Include a CD-ROM that contains a pdf of the entire study, including improvement plans.
		When submitting flow split analysis for a site, staff suggests using the Pima County flow split calculations. Make sure to provide all supporting documents.

		The project proposes to construct facilities and/or discharge flows within Nevada Department of Transportation (NDOT) right of way. The engineer must contact NDOT for an encroachment permit for the proposed project and it must be received prior to approval of the improvement plans. NOTE: NDOT does not allow for development to increase the 100-year flow rate into their ROW - onsite detention may be required.
		Where right-of-way does not exist, a roadway or drainage easement must be obtained from the adjacent property owner(s) prior to improvement plans approval. Roadway and drainage easement dedication documentation must be processed through the CNLV Real Property Services Division. For more information, please contact Lorena Candelario at 633-2396.
		This report serves as a master drainage study for the site. A separate technical drainage study will be required by the City of North Las Vegas upon development of areas shown on the conceptual site plan. Each technical drainage study should provide more detailed design information, including final grading plans with corresponding drainage facility details, hydraulic design calculations, etc.
		Ensure that the longitudinal slope used to calculate the 100-year flow depth for a given street matches with the slope indicated on the grading plans.
		The City of North Las Vegas (CNLV) is a member of the Community Rating System, which requires Base Flood Elevations (BFE's) to be indicated for any structures located within a Special Flood Hazard Area (SFHA) Zone A, AO, AE, etc. Please indicate the extent of the effective regulatory SFHA on the grading plan and show the BFE's of the affected lots.
		If a site is adjacent to a future Clark County Regional Flood Control Facility, the developer is required to construct drop inlets at the site's discharge point along the alignment, which will collect 100% of the site's 100-year discharge.
		If the proposed development is required to construct flood control facilities that are depicted on the Clark County Regional Flood Control District's Master Plan Update, structural drawings must be submitted with the drainage study for review and approval by the City of North Las Vegas prior to submitting to CCRFCD for concurrence.
		The City of North Las Vegas North Neighborhood Flood Control Master Plan (NNFCMP) has established centerline intersection grades with corresponding street slopes. Please ensure that the street intersection designs are compatible with the NNFCMP.
		For rectangular shaped culverts, the minimum shall be 6 feet in height and 5 feet in width.
		The City of North Las Vegas requires that all local drainage facilities identified on the North Neighborhood Flood Control Master Plan (NNFCMP) to be constructed by the developer for the full frontage of the site.
		This property is adjacent to Unincorporated Clark County. Please note that a copy of this study and any addenda must be submitted to Clark County Development Services for their review and concurrence.
		This property is adjacent to the City of Las Vegas. Please note that a copy of this study and any addenda must be submitted to City of Las Vegas for their review and concurrence.
		Side lot easement for all residential development will need to meet all the requirements as set forth in the City of North Las Vegas Municipal Code under Title 17.24.210.D.4

		"Arizona" style crossing is not permitted within CNLV right-of-way. Culvert crossings, sized to convey the 100-year flow without any backwater effects, must be designed to convey the flow back to its historical path.
		The minimum pipe diameter to be constructed within public drainage easement or right-of-way shall be 18-inch in reinforced concrete pipe. HDPE pipes are allowed with the caveat that it must be slurry back fill.
		Backwater ponding limits that extend outside of the public right-of-way shall be delineated on the grading plans and a public drainage easement or right-of-way be obtained from the property owner. Roadway and drainage easement dedication documentation must be processed through the CNLV Real Property Services Division. For more information, please contact Lorena Candelario at 633-2396.
		When referencing other drainage studies, all relevant information such as approval letters, drainage basin maps, HEC-1 analyses, details, plans, etc. must be included with the study. The material being referenced should be highlighted in some manner to indicate what is being referenced.
		Provide a discussion and necessary analyses regarding Best Management Practice per Section 1500 of the Clark County Regional Flood Control District Hydrological Criteria and Drainage Design Manual.

II. Grading Plan Information		
Yes	No	
		24"X36" copies of Grading Plans including Detail Sheets. Additionally, Plan and Profile sheets must be provided for all public offsite streets and/or storm drain/channel system improvements. The information provided in profile shall include: stationing, length, slope, size, discharge (Q100), material, class of pipe (Class III, IV, V, etc.), hydraulic grade line, inlet locations, finished grade over the pipe and etc.
		On a 100' right-of-way street, the developer is required to build their half of the street, the median island, and one lane on the opposite side of the median. Additionally, the median island will be required to be landscaped.
		Alignment of all existing, proposed, or future Regional Flood Control Facilities adjacent to the site must be shown on the grading plans.
		Appropriate elevated "humps" 6 inches above the 100-year water surface elevation at all driveways location where the intent is to protect the site from the Q100 flows.
		Erosion protection must be provided at the upstream and downstream terminus of all public roadway improvements.
		Landscape berms used to protect property from flows in the adjacent streets must meet the criterium of being twice the depth of flow above the adjacent flowline up to 18 inches above the adjacent water surface.
		Temporary pavements used to satisfy Clark County PM-10 requirements cannot be used to establish centerline grades for any proposed streets. All proposed street improvements must be designed per the Uniform Standard Drawings for Public Works Construction, Offsite Improvements, Clark County Area, Nevada.
		Show cross sections along all project boundaries showing the elevational relationship, property line, and any existing or proposed walls.

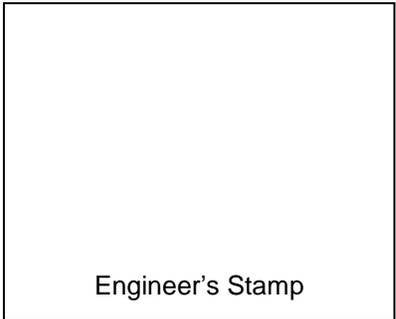
		Verify all finished floor elevations of the proposed development meet Section 304.4 of the HCDDM.
		All onsite drainage swale must maintain a minimum of 1% slope. If < 1% is anticipated, concrete valley gutter is required.
		Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), utilities conflict (if any), design hydraulic grade line (HGL) and the 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying the off-site flows.
		Identify all adjacent parcels with the appropriate assessor parcel number and ownership information.
		The Engineer must show existing and proposed development at least 100-feet beyond the project site limits. Finished floor elevations of existing buildings, centerline grades, centerline slopes, and top of existing curb elevations must be shown. Reference all adjacent existing improvements with a CNLV Project #. Ensure that it matches with the approved civil plans.
		Make every effort to provide plan sheets that are clean and clear to review. Be sure to eliminate superimposed text.
		Due to air quality regulations, all proposed streets must maintain a total of 32' asphalt area. For instance, a 60' half-street improvements will require an additional of 9-foot of overpaving from the centerline.
		Full intersection designs abutting the proposed development must be provided to ensure that all quadrants of the intersection will drain properly.
		Provide slopes of driveway fronting all public right-of-ways. Per CNLV Fire Code, the angles of approach and angles of departure must not exceed 6%.
		For commercial and industrial developments, landscape areas are not allowed to sheet flow over the sidewalk. Provide flow lines with grades and sidewalk under drains for all landscape areas draining to the streets.

III. Hydrologic and Hydraulic Analyzes		
Yes	No	
		Verify that the street capacity calculations for "ABC" and "XYZ" streets were completed for the worst case scenario for both water surface elevation and velocity (flattest and steepest slopes). In the interim condition, provide street capacity calculations for the 100-year event. In the ultimate condition, provide street capacity calculations for the 10-year and 100-year events.
		For 100-year street flows with depths greater than 0.6' and velocities higher than 5 fps, erosion resistant landscaping or pony walls at the back of sidewalk (to the height of the flow in the street) must be provided.
		If a CNLV modified 60' standard street section with offset sidewalk is to be proposed with the development. Ensure that the Flowmaster calculations and improvement drawings are reflected with the correct cross section.
		For 80' and greater streets, if a median island is proposed with the site, ensure that the street capacity calculations are reflected with a median island.

		For 80' and greater streets, the actual 12' dry lane determination must be shown on the Q10 street capacity calculations. CNLV only requires this criterion to be met in the FUTURE condition. Please note that the dual left turn lane and center median island cannot be used to satisfy the 12' dry lane criterion. Therefore, a minimum of 19' on each half of the street must be achieved for the entire stretch of the site.
		<p>All drainage studies for sites located within the North Neighborhood Flood Control Master Plan (NNFCMP) area must analyze four (4) separate conditions.</p> <ol style="list-style-type: none"> <li>a. A pure existing condition analysis that quantifies the amount of flow impacting the site in the existing condition. This condition has existing improvements and curve numbers for both onsite and offsite basins. Offsite basins should generally follow contours or existing development drainage patterns.</li> <li>b. An interim condition, where the offsite basins are the same as in the pure existing condition and the onsite basins are developed. The flows in this condition are modeled in the proposed half-streets being constructed with the development and homes/buildings must be at or above the WSE in the street.</li> <li>c. The NNFCMP existing condition flows are analyzed assuming a full street section, the CCRFCD street flow criterion does not need to be met, and the adjacent finished floor elevations must be above the associated WSE.</li> <li>d. The NNFCMP future condition flows are analyzed assuming a full street section, all CCRFCD street flow criteria must be met, and the finished floor elevations must have the required freeboard above the associated WSE.</li> </ol>
		For parcels impacted by a FEMA Special Flood Hazard Area, analyses of the floodzone, utilizing the FEMA effective flowrate must be completed for both pre- and post-development cases. The post-development analysis must tie into the effective SFHA in both width and water surface elevation.
		For proposed storm drain connecting into other existing storm drain system, supporting documents must be provided for the beginning HGL used in the hydraulic modeling.
		For the purpose of establishing adequate finished floor elevations for those structures adjacent to the proposed drainage easement, the City requires that submerged weir calculations are submitted. As the sidewalks at the upstream entrance of the drainage easement will effectively act as a broad-crested weir with a submerged tailwater, the water surface elevations at the easement entrances must be calculated as such.
		The engineer must provide inlet control nomograph (see HCDDM) calculations for all proposed drop inlets to ensure that the storm sewer will have the capacity to convey the anticipated 100-year peak flow.
		The CNLV requires that all drop inlet sizing to be performed with the HEC-22 software which can be acquired from the Federal Highway Administration's website at <a href="http://www.fhwa.dot.gov/engineering/hydraulics/software.cfm">http://www.fhwa.dot.gov/engineering/hydraulics/software.cfm</a>
		Concrete headwalls are required at the inlet and outlet of all culvert installations. Flare end sections are acceptable for culvert less than 30-inch.
		Erosion protection and/or cut off walls may be required at the upstream and downstream of a culvert.
		For the ease of maintainability and constructability, all storm drain pipes must be designed with a soffit to soffit connections.

		Swales that are designed to carry the 100-year flow must maintain a minimum freeboard of six inches above the depth of flow. Provide hydraulic calculations for verification.
		For project sites that are 40 acres or greater, flow values must be labeled at the outlet point of each individual drainage basin and concentration points on all drainage basin maps.
		The soil's map must include both the off-site and on-site sub-basin delineations for all drainage conditions.
<b>IV. Local Entity Criteria - City of North Las Vegas - HCDDM Section 1603</b>		
Yes	No	
		Within the interior streets of a residential subdivision, the depth times velocity for the major storm event shall be less than or equal to 6.
		When downstream storm sewer facilities are not available, the City of North Las Vegas requires bubbler laterals for the conveyance of storm water under streets with right-of-way widths greater than or equal to 80 feet. The bubbler laterals must consist of a minimum 18-inch diameter reinforced concrete pipe. To accommodate the draining of the bubbler system prior to future downstream extension of the storm sewer system, a minimum 6-inch diameter PVC pipe must be daylighted downstream.
		The City of North Las Vegas does not permit the construction of permanent structures within a Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area (SFHA). Under this policy, any developer/builder proposing to place structures within a SFHA must meet the following requirements prior to the issuance of various permits and certificates-of-occupancy: <ol style="list-style-type: none"> <li>1. Grading and off-site construction permits may be issued by the CNLV Department of Public Works once the improvement plans and drainage study have been approved and a copy of the completed Conditional Letter of Map Revision (CLOMR) application has been submitted to FEMA for processing.</li> <li>2. Building permits can be issued once a favorable CLOMR has been obtained from FEMA.</li> <li>3. Certificates-of-occupancy can be issued once a Letter of Map Revision (LOMR) has been obtained from FEMA.</li> </ol>
		The City of North Las Vegas requires that stormwater drop inlet signage be affixed to any installed drop inlets. The plaque must read "Don't pollute - drains to Lake Mead" in English and Spanish. CNLV Quality Control/Offsite inspectors will verify that the signs are properly installed.
		The City of North Las Vegas requires surface nuisance flows be mitigated for all residential developments. All proposed residential subdivisions greater than 10 acres must disconnect surface nuisance flows through design to minimize impact to the downstream developments. Also nuisance drop inlets must also be sized to match the capacity of the outletting storm drain pipe size.
		A minimum longitudinal street slope of 0.4 percent (0.004 ft/ft) shall be used. If the Engineer can demonstrate, to the satisfaction and approval of the City Engineer, severe topographic constraints or other mitigating factors, the design of streets with slopes less than 0.4 percent may be permitted.
		Side lot drainage easements are generally discouraged unless the engineer can demonstrate design constraints that render alternative site layout and drainage facility design options as impossible or impractical.

		All wall openings must be designed to pass the 100-year storm event flows using the assumption that the bottom 50% of the openings are obstructed.
		When a storm drain system is proposed at a sump area, a non-damaging emergency surface flow path must be provided to convey the 100-year flows. Adjacent finished floor elevations must be adequately protected.
		For any ground-mounted air-conditioning pad that encroaches to within three (3) feet of a property line, the engineer must indicate on the plot plans how lot drainage will be accommodated beneath the pad. This can include, but is not limited to, the placement of a 4-inch diameter PVC pipe, with the inlet and outlet inverts of the pipe constructed to correspond with the flow line of the obstructed lot drainage swale.



Engineer's Stamp

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*Engineer in Responsible Charge Name (Printed)*

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*Approved by CNLV Development and Flood Control*

*Date*