

MDOT Drainage Manual

Master Glossary

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Master Glossary

The glossary provides definitions for how MDOT uses each term in the Drainage Manual. It does not include every possible definition. Depending on the situation, a term may have several meanings.

1D - One Dimensional

2D - Two Dimensional

3D - Three Dimensional

AASHTO - American Association of State Highway and Transportation Officials

ADT - Average Daily Traffic

Aggradation - General and progressive buildup (long term) of the longitudinal profile of a channel bed due to sediment deposition.

Allowable High-Water (AHW) Elevation - The maximum water surface elevation (hydraulic grade line, HGL) allowed in the wet well.

Alluvial - Deposits of silts, sands, gravels, or similar detrital material that has been transported by running water.

Alluvial Channel - A channel that is formed wholly in alluvium with no bedrock exposed in the channel at low flow or likely to be exposed by erosion. A channel whose processes are controlled by flow and boundary interactions.

American National Standards Institute (ANSI) - ANSI facilitates and coordinates the U.S. voluntary standards and conformity assessment system.

American Water Works Association (AWWA) - A standards organization that develops and publishes voluntary consensus technical standards to describe the minimum requirements for design, installation, performance, manufacture, and testing used in the drinking water industry.

Annual Exceedance Probability (AEP) - The probability that the magnitude of the random variable (e.g., annual maximum water level) will be equaled or exceeded each year, often expressed as a percentage.

Annual Recurrence Interval (ARI) - The average time interval between occurrences of an event of a given or greater magnitude, usually expressed in years. The ARI is the reciprocal of the AEP of an event.

Antecedent Moisture - Water stored in the watershed prior to the start of rainfall.

AOR - Allowable Operating Range

APA - Authorized Public Agency

Apron - Protective material placed on a streambed to resist scour.

Armor Layer - Protective layer of rip rap on the outside or top of a revetment or seawall composed of armor units. The armor layer is one of three components of revetment design.

Artificial Channel - A roadside channel, irrigation channel, or county or agricultural drain that is:

- A constructed channel with regular geometric cross-sections.
- Unlined, or lined with artificial or natural material to protect against erosion.

ASTM International (ASTM) - A standards organization formerly known as American Society for Testing and Materials that develops and publishes voluntary consensus technical international standards for a wide range of materials, products, systems, and services.

Auxiliary Spillway - A flow path that bypasses the principal spillway for flows that exceed the design flow conditions (flow and capacity).

AWG - American Wire Gage

Axial Flow Propeller - A rotating element of a centrifugal axial flow pump, or propeller pump, that uses a propeller to move fluid in a direction parallel to the pump shaft.

Backwater - The increase in water surface elevation induced upstream from a bridge, culvert, dike, dam, another stream at a higher stage, or other similar structures or conditions that obstruct or constrict a channel relative to the elevation occurring under natural channel and floodplain conditions.

Base Flow - Normal or dry weather flow in an open channel or stormwater system.

BLM - Bureau of Land Management

BOBS - Bureau of Bridges and Structures

Boundary Condition - A boundary condition establishes the starting water surface elevation for the project study area. Under subcritical flow regime, only the downstream water surface elevation is needed. Under supercritical conditions, both upstream and downstream water surfaces are required.

Breaker Zone - The zone within which waves approaching the coastline commence breaking caused by the reduced depths.

Bridge - Under 23 CFR § 650.305, a bridge is defined as a structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and

having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between under copings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it includes multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening. Any three-sided (bottomless) structure is treated as a “bridge” in Chapter 6, regardless of span length.

Bypass - Flow which bypasses an inlet on grade and is carried in the street or channel to the next inlet downgrade.

Catch Basin (CB) - A structure for intercepting stormwater from a gutter or median and discharging the water through a conduit. In common usage, it is a grated inlet, a curb opening inlet, or a combination inlet with a sump.

CE - Categorical Exclusions

CEM - Coastal Engineering Manual

CEM – Corrected Effective Model

CEQ - Council on Environmental Quality

CFR - Code of Federal Regulations

Channel - The bed and banks that confine the surface flow of a stream up to the ordinary high water mark (OHWM).

Check Valve - A valve that only allows fluid to flow in one direction to prevent backflow in a piping system.

CIPP - Cured-in-Place Pipe

Clear Zone - A highway clear zone is an unobstructed, traversable area along a road or highway designed to allow a driver to safely recover from a vehicle that has left the roadway.

Clearance - An unobstructed vertical space between the OHWM elevation and the low chord of a structure.

Clear-Water Scour - Scour at a pier or abutment (or contraction scour) when there is little to no movement of the bed material upstream of the bridge crossing at the flow causing scour. Clear-water scour occurs where there is flowing water with minimal to no sediment transport or suspended material which is not re-deposited when flows recede.

CLOMR - Conditional Letter of Map Revision

CMP - Corrugated Metal Pipe

Coastal Roadway - Roads influenced by their presence in or near the water level, waves, and sand transport environment unique to a coast.

Collection System - A network of pipes, ditches, and other structures that collect and direct surface runoff from rainfall and snow melt to a designated location.

Collector - Collectors serve the critical role of gathering and channeling traffic from Local Roads to the Arterial network.

Combination Inlet - A drainage inlet that uses a curb opening inlet and a grate inlet.

Combined Sewer - A combined sewer is a pipe that carries stormwater and sanitary sewage.

Computational Fluid Dynamics (CFD) - Three-dimensional (3D) modeling software used to calculate fluid flow characteristics based on the conservation of mass, momentum, and energy.

Contraction Scour - The removal of material from a channel bed and banks across all or most of the channel width within a natural channel or at a bridge crossing. This component of scour results from a contraction of the flow area at the bridge which causes an increase in velocity and shear stress on the channel bed and banks.

Conveyance - A measure, K , of the ability of a stream, channel, or conduit to convey water. In Manning's formula, $K = (1.49/n) AR^{2/3}$.

Countermeasure - An action or approach intended to monitor, prevent, delay, or mitigate the severity of hydraulic and/or erosion problems.

County Drain - Michigan's Drain Code, MCL 280.3, provides that a drain "...shall include the main stream or trunk and all tributaries or branches of any creek or river, any watercourse or ditch, either open or closed, any covered drain, any sanitary or any combined sanitary and storm sewer, or storm sewer or conduit composed of tile, brick, concrete or other material, any structures or mechanical devices, ...pumping equipment...any levee, dike, barrier, or a combination of any or all of the same ...for the purpose of drainage..." Therefore, a "county drain" or "intercounty drain" can be a natural or artificially constructed water conveyance system, provided it was legally established pursuant to the Michigan Drain Code (MCL 280) and falls under the jurisdiction of the County Drain office.

Cover - Distance from the outside top of the pipe or structure to the final grade of the ground surface or pavement.

CPE - Corrugated Polyethylene

CPV - Corrugated Polyvinyl Chloride

Critical Depth (d_c) - In hydraulic analysis, the depth when flow has a Froude number of 1.0. The depth associated with the minimum total energy to pass a given flow through a given cross section.

Crown - The highest interior elevation of a culvert, sewer, drain pipe, or stormwater tunnel. This may also be referred to as underclearance or low chord.

CSO - Combined Sewer Overflow

CSP - Corrugated Steel Pipe

CSV - Comma-Separated Values

Culvert - A structure that is usually designed hydraulically to convey flow through an embankment. The span length is less than 20 feet measured along the road centerline.

Curb Opening Inlet - A drainage inlet consisting of an opening in the roadway curb.

Cut-off Wall - A vertical wall, usually sheet piling or concrete, that extends below the channel bottom to scour-resistant material or the expected scour depth to reduce the risk of undermining. A cut-off wall is typically located at the end of the apron.

CWA - Clean Water Act

Dam - An artificial barrier, including dikes, embankments, and appurtenant works, that impounds, diverts, or is designed to impound or divert water or a combination of water and any other liquid or material in the water; that is or will be when complete 6 feet or more in height; and that has or will have an impounding capacity at design flood elevation of 5 surface acres or more. Dam does not include a storage or processing tank or standpipe constructed of steel or concrete, a roadway embankment not designed to impound water, or a dug pond where there is no impoundment of water or waste materials containing water at levels above adjacent natural grade levels. MCL 324.31502

Degradation - A general and progressive (long-term) lowering of the channel due to erosion of the channel bottom, over a relatively long channel length.

DEM - Duplicate Effective Model

Depressed Roadway - A roadway that is approximately 16 feet or more below the surface of the adjacent streets.

Depression Storage - The natural depressions within a watershed which store runoff.

Depth-limited - Wave height is limited by the local depth of water.

Design Discharge - The peak rate of flow (in cubic feet per second) for which a drainage facility (bridge, culvert, pipe, storage facility, etc.) is designed and expected to accommodate without exceeding the adopted design standards.

Design Life - The average usable life of a pipe or structure.

Design Storm - A selected storm of a given frequency (expressed as an AEP event) and duration used for designing features of a storm system including storm sewers, open channels, culvert, bridge, pump station, storage facilities, etc.

Design Wave Condition - A wave condition with a specified return period used in the design of coastal infrastructure. It is superimposed on the stillwater elevation.

Detention Basin - A storage facility incorporated into the watershed to temporarily store runoff by reducing the peak of the runoff hydrograph. Water is released over time through a structural control and no permanent pool remains.

Digital Elevation Model (DEM) - A representation of the bare ground (bare earth) topographic surface of the Earth excluding trees, buildings, and any other surface objects.

Drainage Area - The surface area draining to a given point producing runoff. Drainage area does not include non-contributing areas such as lakes, wetlands, potholes, etc.

Drainage Course - Any conveyance other than the defined "inland lake and stream." This is the natural flow of water over land as caused by the topography.

Drainage Structure - Refers to manholes, catch basins, leaching basins, inlets, and drop inlets detailed in the MDOT Road Standard Plans or contract plans.

Drop Inlet - An inlet directly connected to a vertical or steeply sloping pipe to drop water to a lower pipe.

Dry Pit Pump Station - A pump station comprised of two separate chambers: a dry well to house pumping equipment and a wet well.

DSD - Development Service Division

EA - Environmental Assessment

Easement - Specific rights of use from a landowner. MDOT secures its right-of-way (ROW) either by easement, statutory (law), or fee (purchase). County drain rights-of-way are normally obtained by easement.

EFA - Erosion Function Apparatus

EGLE - Michigan Department of Environment, Great Lakes, and Energy

EIS - Environmental Impact Statement

Energy Grade Line (EGL) - The plotted line that represents the total energy of flow at a location. It is the sum of the elevation head, pressure head, and velocity head.

EPE - Early Preliminary Engineering

Erosion - Displacement of soil particles due to water or wind action.

ESA - Endangered Species Act

Evapotranspiration - Surface evaporation of water and transpiration through plants.

FAA - Federal Aviation Administration

FBFM - Flood Boundary and Floodway Map

FEIS - Final Environmental Impact Statement

FEMA - Federal Emergency Management Agency

Fetch - The uninterrupted distance or area in which wind blows across the water in a constant direction forming waves.

FHBM - Flood Hazard Boundary Map

FHPM – Federal-Aid Highway Program Manual

FHWA - Federal Highway Administration

FIRM - Flood Insurance Rate Map

FIS - Flood Insurance Study

Flap Gate - A flow control device consisting of a heavy-duty hinged plate that functions as a check valve but are also used to restrict flow.

Floodplain - Per MDOT, a floodplain is any land area susceptible to inundation by floodwaters. Per State of Michigan floodplain rules, an area of land adjoining a river or stream that will be inundated by a 1% AEP (100-year) flood. MCL 324.3103, R 323.1311e

Floodwaters - Waters that have escaped from a watercourse (and its overflow channels) or, due to the intensity of rainfall, waters that cannot enter a watercourse. These waters then flow or stand over adjoining lands. They remain floodwaters until they disappear from the surface by infiltration or evaporation or return to a natural watercourse.

Floodway - The channel of a river or stream and those parts of the floodplain adjoining the channel that are reasonably required to carry and discharge a 1% AEP (100-year) flood. MCL 324.3103, R 323.1311

Flow Line - The lowest physical surface elevation in a drainage system. For storm sewers, the flow line is the same as the invert. For recessed culverts, the flow line is the top of sediment inside the barrel.

Flow Type - The USGS has established seven culvert flow types which assist in determining the flow conditions at a culvert site. Diagrams of these flow types are provided in the design methods, Section 5.4.

FONSI - Finding of No Significant Impact

Free Outlet - An outlet that has a tailwater equal to or lower than critical depth. For culverts having free outlets, lowering the tailwater has no effect on the discharge or the backwater profile upstream of the tailwater.

Freeboard - The vertical distance between the design water surface elevation and a point of interest such as a low chord of a bridge beam, crown of a culvert, or specific location on the roadway grade, for example, the bottom of subbase grade.

Freeway - A freeway is an access-controlled, divided highway designed for the unimpeded movement of large volumes of traffic. Characteristics of a freeway include controlled access through the use of interchanges, and use of underpasses or overpasses at intersections.

Frontal Flow - The portion of flow that passes over the upstream side of a grate.

FWCA - Fish and Wildlife Coordination Act

Gaged Sites - A location where instruments measure the depth and flow of the water in a stream and the stream flow record is long enough to be statistically analyzed to estimate peak discharges. Most sites in this category have tributary areas greater than two square miles.

Gate Valve - A shut-off device that is used to isolate pumps and equipment for maintenance or removal.

Geotextile - Synthetic non-woven fabric used as the base layer in revetment design.

GIS - Geographic Information System

GLUMBR - Great Lakes-Upper Mississippi River Board

GP - General Permit

Grate Inlet - A drainage inlet composed of a grate in the roadway section or at the roadside in a low point, swale, or channel.

Grate Perimeter - Perimeter of the grate disregarding the side against the curb. Used in weir flow computations.

Groundwaters - Groundwaters are divided into two classes: percolating waters and underground streams. Percolating waters generally include all waters that pass through the ground beneath the surface of the earth without a definite channel. The general rule is that all underground waters are presumed to be percolating. To take them out of the percolating class, the existence and course of a permanent channel must be clearly shown. Underground streams are waters passing through the ground beneath the surface in permanent, distinct, and well-defined channels.

GSN - Geotechnical Scour Number

Gutter - The portion of roadway section adjacent to the curb that is utilized to convey stormwater runoff.

Harmful Interference - Causing an increased stage or change in direction of flow of a river or stream that causes, or is likely to cause, any of the following: i) Damage to property, ii) A threat to life, iii) A threat of personal injury, iv) Pollution, impairment, or destruction of water or other natural resources. MCL 324.3103, R 323.1311g

HDPE - High-Density Polyethylene

HDS # - Hydraulic Design Series a technical publication by FHWA

Headcutting - Channel degradation associated with abrupt changes in bed elevation that generally migrates in an upstream direction. The occurrence can be natural or in response to channel cleanouts, dam removals, bridge/culvert installations, or increases in discharge.

Headwater (HW) - The water surface elevation on the upstream side of a culvert providing the energy to force water through the culvert.

HEC # - Hydraulic Engineering Circular a technical publication by FHWA

HEC - Hydraulic Engineering Center (USACE)

HEC-RAS - Hydraulic Engineering Center's River Analysis System

HI - Hydraulic Institute

HSG - Hydrologic Soil Group

Hydraulic Design Flood - The peak discharge, volume (if appropriate), stage, or wave crest elevation of the flood associated with the probability of exceedance selected for the design of a highway encroachment.

Hydraulic Engineer - An engineer who has a working knowledge of state drainage laws, environmental rules and regulations, and permit requirements including an understanding of the rights and responsibilities of both the DOT and adjacent property owners.

Hydraulic Grade Line (HGL) - A plotted line coinciding with the level of flowing water in an open channel or conduit. In a closed conduit flowing under pressure, the HGL is the level to which water would rise in a vertical tube at any point along the pipe. It is equal to the EGL minus the velocity head ($V^2/2g$).

Hydraulic Jump - A rapid rise in the level of water when the water transforms from a supercritical to subcritical flow regime.

Hydraulic Length - Length of a bridge substructure unit, measured parallel to the principal flow direction. Single span bridges are measured from the ends of the wingwalls. Multiple span bridges are measured from the ends of the piers.

Hydraulic Roughness - A composite of the physical characteristics which influence the depth and flow of water across the surface, whether natural, channelized, or in a pipe.

Hydraulic Span - Opening of the bridge between bridge substructure unit faces measured perpendicular to the principal flow direction.

Hydrodynamic Separators - Hydrodynamic separators are flow-through structures with a separation or settling unit to remove sediments, debris, and other pollutants.

Hydrograph - A plot of flow versus time.

Hydrologic Unit Code (HUC) - A numerical code applied to watersheds delineated by USGS using a nationwide system based on surface hydrologic features.

Hyetograph - A graph of the rainfall intensity (or depth) versus time over a watershed.

IDF - Intensity Duration Frequency

IEEE - Institute of Electrical and Electronics Engineers

Improved Inlet - An inlet that has an entrance geometry which decreases the flow contraction hydraulic losses at the inlet, increasing the capacity of culverts flowing under inlet control conditions. Improved inlets are referred to as either side- or slope-tapered and sometimes are bevel edged.

Incipient Overtopping Event - The event that produces a water surface elevation where the water will begin to spill over the bridge deck.

Infiltration - The process of water on the ground surface entering the soil.

Infiltration Basin or Trench - A storage facility or trench that discharges stored water into the ground. A basin or trench used for flood control has no auxiliary flow path up to the design event.

Inland Lake or Stream - (i) An artificial or natural lake, pond, or impoundment that is a water of the United States as that term is used in section 502(7) of the federal water

pollution control act, 33 USC 1362 (ii) A natural or artificial lake, pond, or impoundment; a river, stream, or creek which may or may not be serving as a drain as defined by the Michigan Drain Code of 1956, 1956 PA 40, MCL 280.1 to 280.630; or any other body of water that has definite banks, a bed, and visible evidence of a continued flow or continued occurrence of water, including the St. Marys, St. Clair, and Detroit Rivers. Inland lake or stream does not include the Great Lakes, Lake St. Clair, or a lake or pond that has a surface area of less than 5 acres. MCL 324.30101

Inlet - A structure, without a sump, for capturing concentrated surface flow. May be located along the roadway, or in a gutter, the highway median, or a field.

Inlet Control - Occurs when the culvert barrel can convey more flow than the inlet will accept.

Inlet Efficiency - The ratio of flow intercepted by an inlet to total design flow in the gutter.

Instrumentation - The hardware, software, and devices that monitor and display the status process equipment and systems.

Interception - The removal of water from runoff that wets and adheres to objects above ground such as buildings, trees, and vegetation.

Intercounty Drain - Legally established drain whose drainage district is comprised of lands in multiple counties. Intercounty drains are managed by a Drainage Board chaired by the Michigan Department of Agriculture and Rural Development.

Interstate Routes - The Dwight D. Eisenhower National System of Interstate and Defense Highways consists of controlled-access freeways numbered within the United States and signed with an Interstate route shield. All Interstate routes within Michigan are under the jurisdiction of MDOT.

Invert - The lowest interior elevation of a culvert, sewer, or stormwater tunnel.

ITM - Illinois Transient Model

Lag Time - The time measured from the centroid of the excess rainfall to the peak of the hydrograph.

LAP - Local Agency Program

Lateral Sewer Line - A sewer line that connects inlet structures to the trunk sewer.

Leaching Basin - A drainage structure with a porous sump bottom, as opposed to the concrete sump of the catch basin. Leaching basins may only be used where soils will allow infiltration and where potential groundwater contaminants will not be introduced through stormwater.

LED - Light Emitting Diode

LiDAR - Light Detection and Ranging

Littoral Drift - The movement of sediment parallel to the shoreline driven by breaking waves and longshore current.

Live-Bed Scour - Scour at a pier or abutment (or contraction scour) when the bed material in the channel upstream of the bridge has suspended streambed particles in the flow causing scour. Live-bed scour occurs where there is flowing water with sediment transport or suspended material that can be re-deposited when the flows recede.

Local Roads - Local Roads account for the largest percentage of all roadways in terms of mileage. They are not intended for use in long distance travel due to their provision of direct access to abutting land. They are often designed to discourage through traffic.

Local Scour - Removal of material around the piers, abutments, and embankments caused by an acceleration of flow and resulting vortices induced by obstructions to the flow.

Longshore Current - The littoral current in the breaker zone moving essentially parallel to the shore, usually generated by waves breaking at an angle to the shoreline.

LTD - Long-term Degradation

Manhole (MH) - A drainage structure that provides access to a closed drainage system.

MBTA - Migratory Bird Treaty Act

MCC - Motor Control Center

MCL - Michigan Compiled Laws

MDA - Michigan Drain Assessment

MDARD - Michigan Department of Agriculture and Rural Development

MDOT - Michigan Department of Transportation

Meteotsunami - Long-wave motions principally caused by meteorologically-induced disturbances, including those associated with pressure jumps, frontal passages, and squalls.

MHMCC - Michigan Hazard Mitigation Coordinating Council

MiASIM - Michigan Ancillary Structures Inspection Manual

Mild Slope - For a given discharge, hydraulically mild slopes occur where critical depth is less than normal depth (subcritical flow).

Minor Arterials - Minor Arterials provide service for trips of moderate length and offer connectivity to the higher Principal Arterial system. In an urban context, they interconnect and augment the higher Principal Arterial system and provide intracommunity continuity.

MIOSHA - Michigan Occupational Safety and Health Act

MiSIM - Michigan Structure Inspection Manual

Mixed Flow Impeller - A rotating component of a centrifugal pump that causes fluid to flow radially and axially to the pump outlet.

MP - Minor Permit

MS4 - Municipal Separate Storm Sewer System

MSA - Michigan Statutes Annotated

MSE3 - Midwest and Southeast United States Type 3

MSE4 - Midwest and Southeast United States Type 4

NAVD88 - North American Vertical Datum of 1988

NBI - National Bridge Inventory

NBIS - National Bridge Inventory System

NEC - National Electrical Code

NEMA - National Electrical Manufacturers Association

NEPA - National Environmental Policy Act

NFC - National Functional Class

NFHL - National Flood Hazard Layer

NFIP - National Flood Insurance Program

NFPA - National Fire Protection Association

NHPA - National Historic Preservation Act

NHPP - National Highway Performance Program

NHS - National Highway System

NMFS - National Marine Fisheries Service

NOAA - National Oceanic and Atmospheric Administration

NOC - Notice of Coverage

Nomograph - A diagram that represents the relationship between multiple variable quantities by means of several scales, so arranged that an outcome can be found by drawing a straight line intersecting other scales at appropriate values.

Non-Reversing Ratchet - A mechanism that prevents a shaft from rotating in reverse.

Normal Depth (d_n) - The depth of flow in a pipe when the flow is uniform and steady and the water surface and pipe slope are the same. It occurs when the gravitational force of the water is equal to the friction drag along the pipe, and there is no acceleration of flow.

Normal Depth Analysis - Analysis that uses the Manning's equation to compute the normal depth of flow given the discharge and cross-section properties including geometry, channel, slope, and roughness.

Normal Water Level - The surface of the water if all wave and wind action were to cease. It is also referred to as quiescent water level.

NOS - National Ocean Service

NPDES - National Pollutant Discharge Elimination System

NPSH - Net Positive Suction Head

NRCS - Natural Resources Conservation Service

NREPA - Natural Resources Environmental Protection Act, Michigan Act 451, Public Acts of 1994, as amended

n-values - Manning's roughness values used to calculate friction losses within channel sections.

Open Channel - A natural or constructed conveyance for water in which:

- The water surface is exposed to the atmosphere.
- The gravity force component in the direction of motion is the driving force.

ORD - Open Roads Designer

ORD D&U - Open Roads Designer, Drainage and Utilities

Ordinary High Water Mark (OHWM) - The line between upland and bottomland that persists through successive changes in water levels, below which the presence and action of the water is so common or recurrent that the character of the land is marked distinctly from the upland and is apparent in the soil itself, the configuration of the surface of the soil, and the vegetation. On an inland lake that has a level established by law, it means the high established level. Where water returns to its natural level as the result of the permanent removal or abandonment of a dam, it means the natural ordinary high water mark. MCL 324.30101. On Great Lakes, the ordinary high water mark is published in Section 32502 of Part 325 of NREPA.

Outfall - The location at which a point source discharge first enters a surface water of the state.

Outlet - The location at which a point source discharge leaves the MDOT right-of-way and discharges to something other than a water of the state.

Outlet Control - Occurs when the culvert barrel is not capable of conveying as much flow as the inlet opening will accept.

Overtopping - Passing of water over the top of a structure or roadway as a result of an elevated lake level, wave runup, or surge action.

Overtopping Flood - The flood described by the probability of exceedance and water surface elevation at which flow occurs over the highway, over the watershed divide, or through structure(s) provided for emergency relief.

PA - Public Act

PC-SCM - Post-Construction Stormwater Control Measure

Peak Discharge - The maximum flow rate of water in cubic feet per second passing a given point as a result of a rainfall event or snowmelt; sometimes called peak flow.

Peak Shave - Reduction in hydrograph peak flow to a downstream system. Generally achieved using a diversion chamber with high overflow weir and a restrictive outlet.

Point of Discharge - The location of a point source discharge where stormwater is discharged directly into a separate storm sewer system.

Point Source Discharge - A discharge from any discrete conveyance, including but not limited to any pipe, ditch, channel, stormwater tunnel, or pipe.

PPP - Polypropylene Pipe

Practicable - Capable of being done within reasonable natural, social, or economic constraints.

Pre-project - The last land use prior to the planned new development or redevelopment (the existing conditions).

Post-development or Post-Construction - The land use including the planned new development or redevelopment.

Pressure Flow - Flow not exposed to atmospheric pressure.

Pressure Head - The height of a column of water that would exert a unit pressure equal to the pressure of the water. This head is measured from the hydraulic grade line down to a point in the water column such as the invert.

PRF - Peak Rate Factor

Principal Arterials - These roadways usually serve cities and metropolitan areas, but also can provide a high degree of mobility to and throughout rural areas. Unlike Interstates, Freeways, and Expressways, Other Principal Arterials can directly service abutting land uses via driveways and at-grade intersections.

Principal Spillway - A structural control designed with sufficient capacity to convey the design flood before flow occurs in the auxiliary spillway.

Probability of Exceedance - The probability that the magnitude of the random variable (e.g., annual maximum flood peak) will be equaled or exceeded over a given time period, expressed as a percentage.

PROTECT - Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation

Pump - A device that uses suction or pressure to raise or move fluids. In other words, a pump adds energy to a body of fluid to move it from one point to another.

Pump Control - A device that activates a pump based on water level in the wet well. The control regulates the pump activity until the desired water level in the wet well is reached.

Pump Driver - A device used to provide power to a pump.

Pump House - A building, room, or structure that contains pump controls and electrical/instrumentation equipment for a pump station. A pump house may also contain pump drivers and valves.

Pump Station - A structure containing pumps and equipment for moving fluids from one place to another.

PVC - Polyvinyl Chloride

Radial Flow Impeller - A rotating component of a centrifugal (radial) pump that moves fluid outward from its center of rotation. The action of the impeller increases the fluid's velocity and pressure and directs it to the pump outlet.

Rainfall Excess - The portion of rainfall that causes direct runoff. It equals the total rainfall minus the interception, depression storage, evapotranspiration, and infiltration.

RCN - Runoff Curve Number

RCP - Reinforced Concrete Pipe

RDC - Region Drainage Coordinator

Revetement - A layer or layers of stone, concrete, etc., to protect an embankment, or shore structure, against erosion by wave action or currents. Riprap used in coastal revetment design often consists of heavier stone than riverine riprap.

Riprap - Layer(s) of rock placed to protect a structure or embankment from erosion.

River - A flowing body of water or a portion or tributary of a flowing body of water, including streams, creeks, or impoundments and small lakes thereon. MCL 324.30501

River Training Structure - Any structure constructed in a stream or placed on, adjacent to, or in the vicinity of a streambank to deflect current, induce sediment deposition or scour, or in some other way alter the flow and sediment regimes of the stream.

RMS - Root Mean Square

Roadside Ditch - An artificial channel, smaller than a canal or stream, that conveys runoff from a road and adjacent drainage area.

Routing - The process of transposing an inflow hydrograph through a detention basin and determining the outflow hydrograph from the structure.

ROW - Right-of-Way

RQD - Rock Quality Designation

Runoff Volume - The area under a hydrograph minus the base flow.

RVSS - Reduced Voltage Soft Starters

Sag Point - The lowest point in a vertical road or gutter profile.

Sanitary Sewer - A conduit or pipe system that carries household and/or industrial waste. Sanitary sewers do not convey stormwater.

SCADA (Supervisory Control and Data Acquisition) - A computerized system used to monitor and control process equipment and systems. Hardware and software systems collect and store data which operators analyze to assist with control, reporting, and system maintenance. Remote monitoring and control are possible with telemetry equipment.

Scour - Erosion of streambed or bank material due to flowing water; often considered as being localized around piers and abutments of bridges. (23 CFR § 650.305)

Scour Check Flood - A flow (flood) of an annual exceedance probability selected to estimate scour for an evaluation of the bridge foundation. The scour check flood has a lesser flood frequency (i.e., greater flood flow rate and greater recurrence interval) than the scour design flood. If a flood event is greater than the scour design flood but less than the scour check flood and it causes greater stresses on the bridge, (e.g. incipient overtopping flood), it is used as the scour check flood.

Scour Countermeasure Design Flood - A flow (flood) of an annual exceedance probability selected to determine parameters for the design and evaluation of scour countermeasures.

Scour Design Flood - A flow (flood) of an annual exceedance probability selected to estimate scour for the design and evaluation of the bridge foundation. The scour design flood has a lesser flood frequency (i.e., greater flood flow rate and greater recurrence interval) than the hydraulic design flood. If the overtopping discharge is less than the scour design flood discharge, it is used as the scour design flood.

Scupper - A small opening (usually vertical) in a bridge deck, curb, or barrier through which water can flow.

Seawall - Structure, often concrete or stone, built along a portion of a coast to prevent erosion and other damage by wave action. Often it retains earth against its shoreward face.

Sediment Forebay - A portion of a storage facility that provides coarse sediment capture to extend the life of the storage facility and ease maintenance efforts.

Seiche - A standing wave oscillating in a body of water that continues, in pendulum fashion, after cessation of the originating force. Seiches are caused when strong winds and rapid changes in atmospheric pressure push water from one end of a body of water to the other.

SESC - Soil Erosion and Sedimentation Control

Set Back Ratio - The ratio of the distance from the OHWM to the face of the abutment (measured perpendicular to flow) against the hydraulic depth at the design flood in the main channel.

SFHA - Special Flood Hazard Area

Shallow Water - Shallow water refers to areas where the water depth is less than $1/20$ of the wavelength of surface waves and the bottom topography significantly affects wave propagation.

SHPO - State Historic Preservation Officer

Side Flow - Flow which is intercepted along the side of a grate inlet, as opposed to the front.

Significant Wave Height - The primary measure of wave height in an area that is not influenced by the lake bottom. This wave height is calculated as the average of the highest 33% of waves.

Slab Culvert - A culvert that is located on a footing and has a natural floor, also referred to as a three-sided box culvert.

Slotted Drain Inlets - A drainage inlet composed of a continuous slot built into the top of a pipe which serves to intercept, collect, and transport the flow.

SMS - Surface-Water Modeling System

SPH - Starts per Hour

Spillway - A structure used to provide the controlled release of water to a downstream channel.

Splash-Over - The portion of frontal flow at a grate which skips or splashes over the grate and is not intercepted.

Spread - A measure of the transverse distance from the curb or barrier face to the limit of the water flowing on the roadway.

Stage - The height of the water surface above a specified elevation datum at a specific location.

Standard Step Method - An iterative use of the energy equation for determining the gradually varied water surface profile of an open channel.

STBG - Surface Transportation Block Grant

Steep Slope - For a given discharge, hydraulically steep slopes occur where critical depth is greater than normal depth (supercritical flow).

Stillwater Elevation (SWEL) - The water level that includes the normal water level with influence of a storm surge and wave setup but does not include wave height. SWEL can vary depending on the fluctuations in normal water level. HEC-25 refers to stillwater elevation with the acronym SWL.

Storage Facility - A drainage control facility that is designed to hold water for a considerable length of time and then release it at a controlled rate or infiltrate the stored water.

Storm Sewer - A pipe that conveys stormwater that has been collected by inlets to an outfall. It generally consists of laterals or leads, and trunk lines or mains. Culverts connected to the storm sewer system are considered part of the storm sewer.

Storm Surge - A rise in water level above the normal level due to the action of a storm. Storm surge results from wind stress and changes in atmospheric pressure.

Stormwater - The runoff generated when precipitation from rain and snowmelt events flows over land or impervious surfaces without percolating into the ground.

Stormwater Control Measure (SCM) - A temporary or permanent physical feature, structural device, or nonstructural practice that is designed to reduce or prevent pollutants from entering stormwater runoff or to treat polluted stormwater. A SCM can also be used to mitigate and manage flood risks. When used for long-term impacts of stormwater runoff from a project, a SCM is called a post-construction stormwater control measure (PC-SCM). An example of a SCM for flood control is a storage basin.

Stormwater Tunnel - In Chapter 7, stormwater tunnel refers to the main component of a stormwater storage system. These stormwater tunnels are not part of the National Tunnel Inventory Program that focuses on enclosed roadways for vehicle traffic.

Stream Channel - A natural conveyance for water with the following characteristics:

- Size and shape determined by natural forces.
- Compound in cross-section with a main channel for conveying low flows and a floodplain to transport flood flows.
- Shaped geomorphologically over time by sediment load and water discharge.

Stream Channelization - Anything that straightens or changes the geometry to a fixed cross-section.

Structural Control - Use of engineered facilities and restricted outlets to control the rate of stormwater runoff released from a storage facility.

Subcritical Flow - Depths of flow greater than critical depth.

Submerged Inlet - An inlet is submerged when the headwater is greater than 1.2 times the culvert diameter or rise.

Submerged Outlet - An outlet is submerged when the tailwater elevation is higher than the crown of the culvert.

Submersible Pump - An electric pump that has a hermetically sealed motor close-coupled to the pump body.

Sump - A pit below the bottom of a wet well, dry well, or building that collects liquid, solids, and debris.

Sump Pump - A pump installed within a sump. In a wet well, a sump pump is used to pump out the water remaining in the well after the water level has dropped and the primary pumps are no longer pumping. In a dry well or building, a sump pump is used to pump out water that has drained from the floor.

Supercritical Flow - Depths of flow less than critical depth.

Surface Waters - Stormwater or groundwater that runs off or otherwise flows onto the land surface, including lakes, ponds, rivers, and streams. In some instances, wetlands may also be classified as surface waters.

Tailwater - The depth of flow directly downstream of a storm sewer system or culvert, measured from the invert at the storm sewer system or culvert outlet.

TAMP - Transportation Asset Management Plan

TDH - Total Dynamic Head

TEFC - Totally Enclosed Fan Cooled Enclosures

Telemetry - Automated measurement and wireless transmission of data from a source to receiving hardware to support remote monitoring and control.

Temporary Haul Road - Short-term construction access that includes fill above the existing streambed or ground elevation. Includes temporary work pads.

Thalweg - The lowest bed elevation in a natural channel cross-section. Also used in reference to the profile line extending down a channel along the lowest bed elevation.

Time of Concentration, T_c - The time for water to flow from the hydraulically most distant point in the watershed to the outlet or discharge point.

Total Scour - The summation of long-term degradation, contraction scour, and local (abutment and pier) scour.

TR - Township and Range

Trunk Line - The main storm sewer line. Lateral sewer lines may be connected to the trunk line at inlet structures or manholes. A trunk line is sometimes referred to as a "main."

Trunkline - Roadway (I, M, or US route) under MDOT jurisdiction.

TSC - Transportation Service Center

UL - Underwriters Laboratories

Ungaged Sites - Sites where no recorded stream flow data are available.

Ungula - A section or part of a cylinder cut off by a plane oblique to the base. Used to describe the volume of water (in-line) in the sloping pipe upstream of a pump station.

Unit Hydrograph - The direct runoff hydrograph resulting from a rainfall event that has a specific temporal and spatial distribution. A unit hydrograph lasts for a specific duration and has unit volume. When a unit hydrograph is shown with units of cubic feet per second, it is implied that the ordinates are cubic feet per second per inch of direct runoff.

USACE - United States Army Corps of Engineers

USBR - United States Bureau of Reclamation

USC - United States Code

USCG - United States Coast Guard

Useable Storage Volume - The volume in a wet well between elevations where a pump starts and stops.

USEPA - United States Environmental Protection Agency

USFWS - United States Fish and Wildlife Service

USGS - United States Geological Survey

Variable Frequency Drive (VFD) - A motor controller that drives an electric motor by varying the frequency and voltage supplied to the motor.

Velocity Head - A quantity proportional to the kinetic energy of flowing water expressed as a height or head of water.

Vertical Lineshaft Pump - Pumps that utilize a long shaft to connect the pump driver to the pump impeller or propeller.

VPD - Vehicles per day

Waters of the State - Groundwaters, lakes, rivers, and streams and all other watercourses and waters, including the Great Lakes, within the jurisdiction of this state. MCL 324.3101

Wave - A ridge, deformation, or undulation of the surface of a liquid.

Wave Crest - The highest part of a wave measured from the still water level to the top of the wave.

Wave Height - The vertical distance between a crest and the preceding trough.

Wave Period - The time period between arrivals of successive wave crests at a point (typically 3-5 seconds in the Great Lakes).

Wave Runup - The elevation reached by a wave on a beach or coastal structure relative to SWEL.

Wavelength - The horizontal distance between similar points on two successive waves measured perpendicular to the crest.

Weir Flow - Flow calculation used when flow overtops the road embankment or other long hydraulic control with a well-defined head discharge relationship.

Wet Detention Basin - A basin or reservoir that stores water and regulates peak discharge. It has a controlled outlet. The stored water is released to the downstream drainage system during and after a storm event. The release is through a gravity system or a pumped system. The basin maintains a permanent pool elevation, which is not included in the stage-storage curve.

Wet Pit Pump Station - A pump station is comprised of one or more wet wells and a pump house.

Wet Well - A chamber from which stormwater is pumped. Generally, a wet well, or wet pit is rectangular or circular.

Wetland - As defined in Part 303 of the NREPA (Public Act 451 of 1994), a wetland means a land or water feature, commonly referred to as a bog, swamp, or marsh, inundated or saturated by water at a frequency and duration sufficient to support, and that under normal circumstances does support, hydric soils and a predominance of wetland vegetation or aquatic life. A land or water feature is not a wetland unless it meets any of the following:

- Is a water of the United States as that term is used in section 502(7) of the federal water pollution control act, 33 USC 1362.
- Is contiguous to the Great Lakes, Lake St. Clair, an inland lake or pond, or a stream. As used in this subparagraph, "pond" does not include a farm or stock pond constructed consistent with the exemption under section 30305(2)(g).
- Is more than 5 acres in size.
- Has the documented presence of an endangered or threatened species under part 365 or the endangered species act of 1973, Public Law 93-205.
- Is a rare and imperiled wetland.

WSE - Water Surface Elevation

WSPRO - Water Surface Profile Computation Model

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