Hydrologic Modification Impact Analysis

1.0 Introduction

One of the goals of the Office of Coastal Management (OCM) is to achieve a balance between conservation of coastal resources and development within the coastal zone. Development in the coastal zone is encouraged but avoidance of unnecessary impacts to coastal resources is essential in order to protect those resources for future generations. To accomplish this goal, OCM reviews every Coastal Use Permit (CUP) application with the objective of avoiding and/or minimizing adverse impacts wherever possible. Pursuant to La. RS 49:214.27.B and C., OCM uses the Coastal Use Guidelines, found in LAC Title 43, Part I, Chapter 7, Subpart B, §701-719, to determine the type of information needed to fully evaluate a particular use and the adverse impacts that must be avoided to the maximum extent practicable. All coastal uses must be in conformance with all applicable Coastal Use Guidelines in order to receive approval from OCM.

Parts of these guidelines require that OCM minimize adverse impacts from proposed uses that modify existing hydrologic conditions (i.e., quantity, movement, distribution, and quality of water). OCM is responsible for ensuring that a proposed coastal use does not adversely affect other properties or waterways. Projects proposed in the coastal zone of Louisiana cannot, to the maximum extent practicable, increase the potential for flooding or adverse drainage, negatively impact water quality, or unnecessarily conflict with other uses in the vicinity. If a proposed use would, in OCM's opinion, modify existing hydrologic conditions, the modification must be reviewed to determine if adverse impacts will occur. **Adverse impacts** resulting from modified hydrology include, but are not limited to, an increase in drainage from or flooding to other properties or waterways and alteration of water quality that increases total suspended solids (TSS), pollutants, contaminants and other applicable water quality parameters of surface waters in the project area. Since 1998, the National Oceanic and Atmospheric Administration (NOAA) and the US Environmental Protection Agency (EPA) has required coastal states to implement New Development Management Measures in order to protect and enhance the water quality of coastal waters through the reduction of TSS in surface water runoff. A Hydrologic Modification Impact Analysis (HMIA) typically investigates the pre- and post-development surface water conditions at a site proposed for development and is used by OCM to determine if adverse impacts to adjacent lands and/or waterways will occur as a result of the proposed use.

Projects that may require a HMIA include those which reduce the stormwater retention capabilities (i.e. permeability, storage, etc.) of the property proposed for development. Permeability of the land will decrease as the amount of impervious surface (i.e., concrete, asphalt, foundations, roofing etc.) installed on the property increases. Projects involving fill that result in an overall increase in post-development ground elevation that meets or exceeds 6 inches above pre-development ground elevations also may require a HMIA. Projects that result in an overall increase in the quantity, frequency and/or duration of stormwater runoff into an adjacent property or waterway will require a HMIA.

Developing a HMIA for water flow/volume/rate requires the establishment of the design storm. Storms are classified by intensity (inches of rainfall), duration (length of storm) and recurrence probability (what percent chance does the storm have to occur in a given year). The **design storm** is a storm that produces a certain amount of rainfall within a certain period of time and which has the probability of recurring with a certain frequency (ex. 5-year or 100-year storms). The design storm will allow for estimates of the quantity of stormwater runoff from the site, pre- and post-development. Once the volume of runoff is determined, the location and water quality of the runoff must be identified, and the capacity of the receiving land or water body must be determined. It is up to the applicant to select an appropriate design storm for the proposed development, however, the design storm chosen should represent a reasonable risk of flooding and address any potential changes to the 100-year flood zone as mapped. While OCM does not require a specific design storm, a minimum 10 inch/24-hour model or the model which meets local governmental requirements is recommended.

The ideal development would result in no net increase in quantity, frequency and/or duration of stormwater runoff pre- and post-development. This can be done with either a net zero change in permeability of the property or the addition of detention or retention ponds/basins designed to hold/store excess water until conditions are such that flooding or undesirable drainage is no longer a risk. **Detention ponds** are low lying areas that are designed to temporarily hold a set amount of water while slowly draining to another location. These areas eventually can be completely drained. **Retention ponds** are ponds designed to hold a specific amount of water indefinitely but partially draining to another location when maximum capacity is reached. These ponds consistently hold some volume of water.

Projects that may result in an adverse change in water quality also will require a HMIA. The LA Department of Environmental Quality (DEQ) is the state regulatory authority regarding water quality. Any known point or non-point discharge, including stormwater runoff, resulting from implementation and/or operation of a proposed coastal use must receive the necessary approval(s) from DEQ prior to initiation of the proposed use. If appropriate, OCM will condition Coastal Use Permits to include a requirement to obtain all necessary permits from DEQ. Please be advised however, that by granting approval for a proposed coastal use, OCM is not relieving the applicant of the requirement to obtain all other federal, state and local authorizations that may be required. OCM will initiate contact with DEQ for a Water Quality Certification but it is up to the coastal user to contact DEQ to initiate any other permit process(es) DEQ deems appropriate. OCM, through the authority of the Coastal Use Guidelines, must consider any adverse change in TSS and will require a HMIA for any proposed use that results in the permanent reduction of surface permeability at the proposed project site (See Section 3.0 below). Projects that do not require consideration of TSS include those occurring wholly in water, those that do not permanently change the extent of existing vegetative cover and/or ground permeability of the development area, and those which include bankline stabilization. All other proposed coastal uses may require a HMIA for TSS.

The ideal development would result in no adverse alteration of TSS at the development site. Sediment screens/fences used and maintained during and after construction, until such time as soil is stabilized, is one method of reducing sediment run-off. Vegetation buffers around ponds (if included) or along roads, ditches and waterways also is a method of reducing sediment run-off. Bankline stabilization also is a method of TSS reduction.

2.0 HMIA Requirements

If the above referenced ideal situations cannot be achieved, some adverse impacts from hydrologic modifications may occur. In order to identify what the impacts will be, a HMIA will be required during processing of a CUP. This guide is written to assist applicants with determining when a HMIA will be required and with the preparation of a HMIA adequate to evaluate impacts from the modifications. If the proposed development has an approved drainage plan from the parish or municipality in which the development will occur, a copy of the parish or municipality document granting approval of the drainage plan can be submitted in lieu of the below hydrology information.

2.1 Level 0 – No Modification

Level 0 modifications result in no evident alteration of existing hydrology or water quality. Level 0 types of projects can include, but are not limited to, the following:

- Projects that involve no fill or excavation
- Projects that include no new impervious surface
- Projects that include raised residential structures (houses, wharves, piers, boathouses)
- Projects that are limited solely to non-residential platforms and other structures raised on pilings above the ground
- Routine pipeline and utility maintenance, installation and removal
- Seismic surveys
- Access dredging in existing waterways

The information contained in a complete Coastal Use Permit application should be sufficient to address HMIA for Level 0 projects.

2.2 Level 1 – Minimal Modification

Level 1 modifications typically result in minor, localized changes in existing surface water hydrology and/or quality. Projects determined by OCM to result in Level 1 hydrologic modifications will require a minimal level of information to address the proposed modification. Level 1 projects can include, but are not limited to, the following:

- Projects that involve less than six (6) inches of fill
- Projects that involve less than one (1) acre development
- Projects that involve the installation of 4,400 sq. ft. or less of impervious surface
- Maintenance dredging of existing drainage canals
- Minor alteration of existing drainage features (i.e., water control structure maintenance and replacement)

Level 1 projects must identify existing surface water flow patterns and applicable water quality parameters and explain how the development will alter those patterns and parameters.

The Level 1 HMIA shall include, at a minimum, the following:

2.2.1 Hydrology

Information on the existing and post-project hydrologic conditions, including at a minimum, local topography, slope, surface condition, drainage pattern, response to storm event, etc. A map, or maps, showing existing and proposed water flow patterns shall be included in this discussion.

2.2.2 Water Quality

Information on BMPs to be implemented during and after construction to prevent impacts to surface water and/or coastal resources.

In lieu of the information outlined in 2.2.1 and 2.2.2 above, a statement from the applicant attesting that site runoff with regard to hydrology and water quality will be the same both pre- and post-construction, is sufficient to address a Level 1 HMIA (see Section 3.0 below).

2.3 Level 2 – Intermediate Modification

Level 2 modifications typically have more of an impact on surface water, or impact a larger area than Level 1 alterations. Projects determined by OCM to result in Level 2 hydrologic modifications will require a moderate level of information to address the proposed modification. Level 2 projects can include, but are not limited to, the following:

- Projects that involve six (6) or more inches of fill
- Projects that involve the installation of more than 4,400 sq. ft. of impervious surface
- Projects that involve one (1) or more acres being developed
- Small subdivisions (10 or less houses on 5 or less acres, no new access)
- Small marinas (boat launch, pier/wharf, bait shop/store/diner, parking)
- Major new pipeline and utility installation
- Permittee responsible mitigation plans and Mitigation Banks that include minor alteration to existing hydrology

Level 2 projects must identify existing surface water discharge patterns, quantity and rate and affected water quality parameters. A HMIA must explain how the development will modify existing conditions and must identify measures taken to reduce adverse impacts resulting from the modifications.

The Level 2 HMIA shall include, at a minimum, the following:

2.3.1 Hydrology

1. A map showing existing and proposed water flow patterns.
2. Identification of the design storm event and the drainage network to be impacted.

3. Information relative to the pre-and post-project volume/rate of runoff expected for the design storm event.
4. Information on the pre- and post-project hydrologic conditions, including at a minimum, local topography, slope, surface condition, drainage pattern, response to storm event, etc.
5. A discussion of how the runoff identified in #4 above will affect adjacent and other properties and the existing drainage network.
6. Identification of measures to be taken to lessen impact on adjacent and other properties and the existing drainage network.

2.3.2 Water Quality

1. Identification of water quality parameters to be affected by the proposed development (TSS and other applicable parameters.)
2. Identification of the steps, procedures and/or BMPs to be used to lessen point source and non-point source impacts on surface water quality (see Section 3.0 below)
3. Identification of the necessary permits to be obtained from other federal, state and local authorities
4. Inclusion of the in-place spill response plan for the release of oil and grease (marinas only)

2.4 Level 3 – Moderate Modification

Level 3 modifications involve larger quantities of water and affect larger areas than Level 2 modifications. These modifications also may have varying short- and long-term impacts on the immediate region. Projects determined by OCM to result in Level 3 hydrologic modifications will require a significant level of information to address the proposed modification. Level 3 projects can include, but are not limited to, the following:

- Marsh management and water management plans
- Permittee responsible mitigation plans and mitigation banks that include significant alteration to existing hydrology
- New elevated roads if no access channel needed
- New levees and re-establishment of existing, degraded levees that impact and/or impound <150 acres (<300 acres if impact/impound existing agricultural lands)
- Mitigation and restoration projects that alter the volume of water to adjacent properties
- Expansion of existing pump stations
- Ports
- Medium and large subdivisions (more than 10 houses and/or 5 acres with new access)
- Medium and large marinas (on-site boat storage, overnight accommodations)

Level 3 projects must provide information relative to how the development will alter quantities, rates and water quality parameters in the affected region and must identify measures taken to reduce adverse impacts resulting from the alteration.

The Level 3 HMIA shall include, at a minimum, the following:

2.4.1 Hydrology

1. A map showing existing and proposed water flow patterns.
2. Identification of the design storm event and the drainage network to be impacted.
3. Information relative to the pre-and post-project volume/rate of runoff expected for the design storm event.
4. Information on the existing and post-project hydrologic conditions, including at a minimum, local topography, slope, surface condition, drainage pattern, response to storm event, etc.
5. A discussion of how the runoff identified in #4 above will affect adjacent properties and the existing drainage network.
6. Monitoring data which establishes background hydrologic conditions over a one-year period (i.e. rainfall data, tide data etc.).
7. An evaluation of the short- and long-term changes anticipated to the hydrologic system resulting from construction, operation and maintenance of the proposed activity.
8. A site-specific study predicting the response of the existing drainage network to the alteration under normal conditions and from the design storm, the 100-year storm and a Category 1 tropical storm event with associated storm surge. (Please note that a detailed regional study or model can be used in place of a site-specific study.)
9. Elevation details, capacity and operational schedule for all proposed water control structures (WCS) or pumps (if proposed).

2.4.2 Water Quality

1. Identification of water quality parameters to be affected by the proposed development (TSS and other applicable parameters.).
2. An evaluation of the short- and long-term point and non-point source impacts to water quality resulting from construction, operation and maintenance of the proposed activity.
3. Identification of the necessary permits to be obtained from other federal, state and local authorities.
4. Identification of the steps, procedures and/or BMPs to be used to lessen point source and non-point source impacts on surface water quality (see Section 3.0 below).

2.5 Level 4 – Significant Modification

Level 4 alterations have the potential to affect large quantities of water over large areas. For this reason, projects determined by OCM to result in Level 4 hydrologic modifications must provide an extensive level of information to demonstrate how the proposed coastal use will affect regional surface water.

The Level 4 HMIA shall include, at a minimum, the following:

- New or expanded drainage features, new pump stations, re-establishment of existing drainage features that have ≥80% filled in
- New levees and re-establishment of existing, degraded levees that impact and/or impound ≥150 acres or more (≥300 acres or more if impact/impound agricultural lands)
- New inland access channels
- River diversions and restoration projects that significantly alter the flow of surface water to adjacent lands
- New roads constructed at grade and elevated roads with new access channel

2.5.1 Hydrology

1. A map showing existing and proposed water flow patterns.
2. Identification of the design storm event and the drainage network to be impacted.
3. Information relative to the pre-and post-project volume/rate of runoff expected for the design storm event.
4. Information on the existing and post-project hydrologic conditions, including at a minimum, local topography, slope, surface condition, drainage pattern, response to storm event, etc.
5. A discussion of how the runoff identified in #4 above will affect adjacent properties and the existing drainage network.
6. Monitoring data which establishes background hydrologic conditions over a multi-year period (i.e. rainfall data, tide data etc.).
7. An evaluation of the short- and long-term changes anticipated to the hydrologic system resulting from construction, operation and maintenance of the proposed activity.
8. Elevation details (including geoid used if available), capacity and operational schedule for all proposed water control structures (WCS) and/or pumps (if proposed).
9. A site-specific study predicting the response of the existing drainage network to the alteration from the design storm, the 100-year storm and a Category 1 tropical storm event with associated storm surge.

2.5.2 Water Quality

1. Identification of water quality parameters to be affected by the proposed development (TSS and other applicable parameters.)
2. An evaluation of the short- and long-term point and non-point source impacts to water quality resulting from construction, operation and maintenance of the proposed activity.
3. Identification of the necessary permits to be obtained from other federal, state and local authorities.
4. Identification of the steps, procedures and/or BMPs to be used to lessen point source and non-point source impacts on surface water quality.

3.0 Development Management Measures for the Control of Non-point Source Pollution

OCM, under the direction of the National Oceanic and Atmospheric Administration (NOAA) and in cooperation with LA DEQ and the US Environmental Protection Agency (EPA), has agreed to implement New Development Management Measures in order to reduce non-point source water pollution. In particular, these measures will help protect and enhance the water quality of coastal waters through reduction of TSS in surface water runoff. These measures are intended to decrease the potential erosion and runoff caused by development, remove suspended solids and other pollutants taken up by runoff, retain pre-project hydrologic conditions and preserve natural systems. Acceptable Development Management Measures can include the use of infiltration systems, filtration systems and detention/retention ponds. **Infiltration systems** can include trenches, basins and porous surfaces that allow water to percolate through soils prior to release from the site. **Filtration systems** can include filter strips, grassed swales and vegetation buffers that allow solids to settle out of the water prior to release from the site. Detention and retention ponds referenced previously in this document also allow for the settlement of solids prior to release of stored water.

HMIA Levels 1 - 4 require that the appropriate Development Management Measures be implemented. This requirement can be met for Level 1 by:

1. Providing a statement from the applicant, attesting that site runoff with regard to water quality will be the same both pre- and post-construction.

   OR

2. Providing a description of the BMPs to be implemented to minimize sediment runoff during and after construction.

HMIA Levels 2-4 will require additional documentation over that required for HMIA Level 1. This documentation should demonstrate that:

3. By design or performance:
   a. After construction has been completed and the site is permanently stabilized, the average annual TSS loading is reduced by 80 percent. For the purposes of this measure, an 80 percent TSS reduction is to be determined based on the average annual TSS loadings from all storms less than or equal to the 2-year/24-hour storm. TSS loadings from storms greater than the 2-year/24-hour storm are not expected to be included in the calculation of the average annual TSS loadings.
      OR
   b. The post-development loadings of TSS is reduced so that the average annual TSS loadings are no greater than pre-development loadings

   AND

4. To the extent practicable, post-development peak runoff rate and average volume are maintained at levels that are similar to pre-development levels.

To determine the percent reduction in TSS post-development, combine the reduction potential of each BMP to be implemented. This will provide the total anticipated reduction in TSS over what would have been released without the implementation of the chosen BMPs. For example, a proposed coastal use includes a vegetated filter strip and an infiltration basin as BMPs to reduce TSS. The TSS reduction potential of the vegetated strip is 65% and the TSS reduction potential of the infiltration basin is 75%. The overall TSS reduction potential of the proposed BMPs would be 65% plus 75% of the remaining 35% (26.25%) for a total TSS reduction potential of 91.25%. More information regarding TSS reduction can be found at: http://water.epa.gov/polwaste/nps/czara/index.cfm. Table 4.7 in Chapter 4 provides a list of various BMPs and the TSS removal efficiencies of each management practices.

4.0 Available Sources

The following are some suggestions on where to find the information needed to complete a HMIA. This list is by no means comprehensive and the analyses requested are not required to use, nor be limited to the use of, these sources.

4.1 Rainfall data:

NOAA Current Precipitation Frequency information for Louisiana
http://hdsc.nws.noaa.gov/hdsc/pfds/other/la_pfds.html

4.2 Stream Data:

USGS Water Resources, Louisiana Streamflow Data
http://waterdata.usgs.gov/la/nwis/current?type=flow

US Army Corps of Engineers Water Level of Rivers and Lakes data:
http://www2.mvr.usace.army.mil/WaterControl/new/layout.cfm

CPRA Coastwide Reference Monitoring System data
http://lacoast.gov/crms2/home.aspx

4.3 Water Quality Data:

LDNR OCM Urban Best Management Practices Manual
http://dnr.louisiana.gov/assets/docs/coastal/interagencyaff/non-point/urban/BMP-Publication-Urban-Final.pdf

LDNR OCM Hydromodification Best Management Practices Manual
http://dnr.louisiana.gov/assets/docs/coastal/interagencyaff/non-point/hydro/BMP-Publication-Hydromodification-Final.pdf

EPA's Guidance Specifying Management Measures for Sources of Non-point Pollution on Coastal Waters
http://water.epa.gov/polwaste/nps/czara/index.cfm