



## REVIEW CHECKLIST for STORMWATER MANAGEMENT PLANS

### DEVELOPMENT

NAME: \_\_\_\_\_ (PHASE/UNIT) \_\_\_\_\_

REVIEWED BY: \_\_\_\_\_ ENGINEER/PHONE # \_\_\_\_\_

DATE: \_\_\_\_\_ COMMERCIAL \_\_\_\_\_ INDUSTRIAL \_\_\_\_\_ MUNICIPAL \_\_\_\_\_ RESIDENTIAL \_\_\_\_\_

*Note: Plans must adhere to standards in the Georgia Stormwater Management Manual (GSMM) Volumes I and II*

### A. BACKGROUND/GENERAL INFORMATION

1. \_\_\_ Development name
2. \_\_\_ Engineer's seal, signature, address and telephone number
3. \_\_\_ Developer's name, address, and telephone number
4. \_\_\_ Date and vicinity map
5. \_\_\_ Include revision date
6. \_\_\_ Provide statement of post-construction pond/storm water drainage ownership.

### **B. REGULATORY**

1. \_\_\_ For all proposed developments, other than public single-family residential, execute and return the attached Operation & Maintenance Agreement. The Agreement must be approved and recorded prior to the pre-construction meeting.
2. \_\_\_ A stream buffer variance is required. Please contact the EPD and/or the Army Corp of Engineers for application. Please provide a copy of the approval with next submittal.
3. \_\_\_ Contact the Army Corps of Engineers for permit determination/ approval. ACOE approval is required prior to stormwater plan approval.
4. \_\_\_ Provide flood study per the Flood Plain Management Ordinance in accordance with FEMA approved methodology. The flood plain ordinance is available on the City of Perry Community Development website.
5. \_\_\_ Add engineer's certification to plans: "Engineer certifies that the flood study was prepared in accordance with a FEMA approved methodology". IF a LOMR or CLOMR, etc. is needed; the Applicant must send documents to FEMA w/copy sent along with plans to City of Perry Community Development.

**B. REGULATORY (cont'd)**

- 6. \_\_\_\_ Provide wetlands delineation. Show limits and area (acres or ft<sup>2</sup>) of encroachment.
- 7. \_\_\_\_ Offsite easements are/may be required (see plans). (Offsite easement needed for stormwater on a permanent basis must be delineated, legal description written and recorded in perpetuity at Houston County courthouse).
- 8. \_\_\_\_ Other \_\_\_\_\_

**C. STORMWATER MANAGEMENT REPORT/HYDRO**

- 1. \_\_\_\_ The submittal does not meet the requirements of the *Georgia Stormwater Management Manual*. Please refer to the appropriate sections in the manual that cover the topics of water quality treatment volume, channel protection volume, over-bank flood protection etc.
- 2. \_\_\_\_ Consider the use of available Better Site Design “credits” to reduce WQv and CPv.
- 3. \_\_\_\_ Provide supporting engineering calculations for all Better Site Design “credits”. Please see Section 1.4.4 of the GSMM for a complete listing of all available design credits.
- 4. \_\_\_\_ Provide brief summary of Better Site Design “credits”. Per the GSMM, design credits cannot be claimed twice for the same area. Credit areas and features must be identified and delineated on the construction drawings and final plat.
- 5. \_\_\_\_ Provide executive summary of the report’s findings to include a table similar to:

Flow Summary

Basin	Cumulative Drainage Area	Return Frequency (yrs)	Pre-development Flow (cfs)	Post-development Flow (cfs)	Ponding Elevation (ft)
A		2			
		5			
		10			
		25			
		50			
		100			

- 6. \_\_\_\_ Include a narrative paragraph/summary in the report that includes a description of existing site, soils, slopes, vegetative cover, and proposed improvements, methodologies and procedures, calculations, summary of results and a conclusion detailing the findings of the drainage investigation.
- 7. \_\_\_\_ State the existing and proposed impervious surface by acre and percent of site for each basin.
- 8. \_\_\_\_ Provide a breakdown of proposed impervious surface by roofs, roads, sidewalks, access drives, driveways, etc.
- 9. \_\_\_\_ Delineate all drainage areas/basins to include offsite drainage and bypass.
- 10. \_\_\_\_ Detailed pre and post developed drainage area maps are required.
- 11. \_\_\_\_ Rational “C” and/or SCS “CN” values need clarification and/or further explanation (see hydro).

### **C. STORMWATER MANAGEMENT REPORT/HYDRO (cont'd)**

12. \_\_\_\_ Show segmented Tc flow paths on scaled drainage maps.
13. \_\_\_\_ The time of concentration (Tc) for pre and/or post developed conditions needs clarification and/or further explanation (see hydro).
14. \_\_\_\_ The SCS method and other approved methodologies are required for detention analysis. The Rational method is only acceptable for pipe design within certain acreage limits. The Modified Rational Method can be used for detention design for drainage areas up to 1 acre per the Local Design Manual (4.1).
15. \_\_\_\_ A 10% downstream analysis is required. See Section 2.1.9 (GSMM). Provide basin drainage map showing POS, and peak flow analysis results with and without detention.
16. \_\_\_\_ The 10% downstream analysis must specifically prove and state that no structures (businesses, homes, culverts, streets, etc) between the analysis points will be adversely impacted by the increase in site runoff.
17. \_\_\_\_ Provide WQv and CPv calculations.
18. \_\_\_\_ Provide fore bay calculations (0.1"/acre of impervious area). Can be counted towards total WQv.
19. \_\_\_\_ Provide WQv and/or CPv orifice sizing calculations for the 24-hour drawdown.
20. \_\_\_\_ Round orifice size up to the next highest whole number (e.g. computed = 2.6", round to 3").
21. \_\_\_\_ Spreadsheets for WQv, CPv, Orifice sizing, Bio-retention, Sand Filter sizing and the Manning's equation are available in excel format by request. Please use and include these with your submittal.
22. \_\_\_\_ The pond report (stage-storage) does not agree with what is dimensioned on the plans.
23. \_\_\_\_ The volumes required by the hydro do not agree with the proposed pond grading on the plans.
24. \_\_\_\_ Provide 50% of net WQv as dead pool storage for Wet Extended Detention pond.
25. \_\_\_\_ Micro pool pond required (10 – 25 acre drainage areas). Show 25-30% of net WQv as dead pool storage.
26. \_\_\_\_ Show that the 100-year storm, including offsite pass-through, is safely passed around the pond or through the emergency overflow weir. Otherwise, show how the offsite will be managed.
27. \_\_\_\_ Disturbed bypass areas greater than 10% of the drainage basin require water quality treatment.
28. \_\_\_\_ Extended dry detention may be used to fully meet CPv, Qp25 requirements only.
29. \_\_\_\_ Extended dry detention must be used in conjunction with other onsite BMPs to meet the 80% TSS water quality requirements of the GSMM.
30. \_\_\_\_ Underground detention must comply with Section 3.4.3 of the GSMM.
31. \_\_\_\_ Include OCS details and pond cross section details. See Section 3.2, and Appendix in the GSMM for pond detail requirements.

**C. STORMWATER MANAGEMENT REPORT/HYDRO(cont'd)**

32. \_\_\_\_ If CP<sub>v</sub> is waived, then the 2 through 25 year attenuation is required as well as safely passing the 100 year storm.
33. \_\_\_\_ If WQ<sub>v</sub> and CP<sub>v</sub> requirements are met, the only additional requirements are flood control for the 25-year event and safe passage of the 100-year event.
34. \_\_\_\_ Other \_\_\_\_\_

**D. PLAN/DETAIL SHEETS**

1. \_\_\_\_ Show existing and proposed R/W lines, lot lines/building envelop pavement and other impervious areas, curb and gutter, and R/W widths.
2. \_\_\_\_ Provide floodplain statement. Reference the 2006 FEMA Firm Panel number.
3. \_\_\_\_ Provide wetlands statement.
4. \_\_\_\_ Delineate wetland areas and note the areas (in acres/ft<sup>2</sup>) to be impacted.
5. \_\_\_\_ Provide a copy of wetland study and/or N.W.I. Map number..
6. \_\_\_\_ Show areas of proposed cut/fill in the floodplain. Provide cut and fill sections. Cut and fill must balance, within boundary of site against floodplain. See Floodplain Management Ordinance for additional cut/fill requirements.
7. \_\_\_\_ Show all existing and proposed lakes with surface area, normal pool elevation, and dam height, top width, % slopes. Provide details for existing/proposed outlets/drain pipes and spillways.
8. \_\_\_\_ Show/note all Minimum Floor Elevations (MFE) for all lots located adjacent to the FEMA designated flood hazard area. For residential developments, the MFE is measured as 3' above the 100-year flood elevation to the bottom of the footing.
9. \_\_\_\_ Show/note the 100-year flood plain limits/sections, elevations, floodway limits. Indicate the source of the information.
10. \_\_\_\_ Provide copy of FEMA approved methodology flood study.
11. \_\_\_\_ Show the 25' (state) undisturbed stream buffers.
12. \_\_\_\_ Show stream buffer as measured from the wrested bank, not the centerline of the creek.
13. \_\_\_\_ Show/note the boundaries of other natural feature protection and conservation areas such as wetlands, lakes, ponds, and other setbacks (e.g. septic tank and drinking water well setbacks).
14. \_\_\_\_ Provide plan view of major manhole junctions to include pipe sizes, materials, angles and invert elevations.
15. \_\_\_\_ Identify/show/delineate all Better Site Design "credits". Note on plan that any conservation areas will be recorded at the Houston County Courthouse in perpetuity with the affected properties.

#### D. PLAN/DETAIL SHEETS(cont'd)

16. \_\_\_\_ Show grading of all open channels. Include cross-sections and calculations to provide 25-year storm capacity, velocities, dimensions, freeboard, and permanent grassing/sodding details to sustain the  $Q_{p25}$  velocity.
17. \_\_\_\_ Drainage other than sheet flow across two or more lots requires a dedicated drainage easement.
18. \_\_\_\_ Show a 20 ft minimum Access/Maintenance/Utility easement to and around the outer limits of the pond(s).
19. \_\_\_\_ Use Figure 1 at end of this section to determine the minimum drainage easement width requirement per Section 3-8-108 (Easements & Widths) (20' minimum).
20. \_\_\_\_ Show storm sewers extending to the rear of the lot unless discharging to defined channel approved by the City of Perry Public Works Dept.
21. \_\_\_\_ Show water quality ponds and BMPs outside of creeks/streams, floodplains, wetlands, and buffers.
22. \_\_\_\_ General minimum slope for pond(s) is 3:1. Show 3:1 grading of pond(s).
23. \_\_\_\_ Residential pond(s) should be located within a subdivision common place. No part of the facility should be located on private property.
24. \_\_\_\_ Pond construction requires minimum setback of 20' from property line, 100' to 250' from a private well and 50' from a septic tank/leach field
25. \_\_\_\_ Show and dimension the aquatic bench.
26. \_\_\_\_ Show the fore bay. (0.1" per impervious acre)
27. \_\_\_\_ Show the micro pool (25-30% of net WQ<sub>v</sub>).
28. \_\_\_\_ Show a safety bench if the pond is deeper than 4' or required slopes of greater than 3:1.
29. \_\_\_\_ Provide pond under drain (3" min. drain pipe with 3" min. gate valve located in OCS). Also, provide manufacturer and maintenance specs.
30. \_\_\_\_ **Add note to plan:** "The pond's maintenance under drain is intended to drain the pond for infrequent maintenance and inspection purposes. The gate valve must be closed immediately after construction of the pond. After construction is completed, it can only be opened upon authorization by the City of Perry Public Works Department.
31. \_\_\_\_ Provide a **complete pond profile detail sheet** including compaction detail, water surface elevations, structure and freeboard elevations, perforated and wrapped under drain pipe, material specifications, cutoff trench with anti-seep collar, orifice and spillway sizes and location, minimum 10' embankment berm width and minimum slopes of 3:1 per GSMM. (only excavated ponds require an 8' berm).
32. \_\_\_\_ Provide construction detail for emergency spillway.
33. \_\_\_\_ Consider use of reverse slope pipe attached to riser, with its inlet submerged 1' below the permanent pool elevation.

#### **D. PLAN/DETAIL SHEETS (cont'd)**

34. \_\_\_\_ For earthen embankments, use impervious cut-off trench with anti-seep collar to restrict piping of soils through embankment.
35. \_\_\_\_ Provide a trash rack or skimmer hood. (a flat top trash rack is not advised for private developments. It is not allowed for public single-family residential developments). Trash rack must have 10 times the surface area of the orifice it protects.
36. \_\_\_\_ Provide a wetland seeding schedule for extended detention wet pond. See Appendix F of the GSMM.
37. \_\_\_\_ Add note to plan: "No woody vegetation is allowed within 15' of the downstream toe of earthen embankment". (i.e. stumps, etc)
38. \_\_\_\_ Add note to plans that all retaining wall designs greater than 4' in height shall be submitted and approved by the City of Perry Community Development Department prior to installation. Keystone block walls are unacceptable for the pond's retaining wall.
39. \_\_\_\_ HDPE pipe is only allowed outside of the R/W and on non-single family projects (i.e. commercial, industrial). (Junction boxes are required to have manhole access. Plans should reference AASHTO M294 requirements.
40. \_\_\_\_ Provide pipe bedding detail.
41. \_\_\_\_ Show curb inlet placement at low points in road.
42. \_\_\_\_ Show the 100-year ponding elevation at inlet. Ponding shall not occur on adjacent property without obtaining a drainage easement.
43. \_\_\_\_ Provide appropriate energy dissipation devices at all pipe outlets, open channels, and outlet control structures and culverts if exit velocities exceed 5 fps. Show/note the type of energy dissipation to be provided. Provide sizing calculations if rip-rap is proposed.
44. \_\_\_\_ Provide emergency spillway construction detail.
45. \_\_\_\_ Provide 4' chain link fence with two (2) 10' gates. Fence to be placed along the outer edge of the 20' access/maintenance easement around the pond.

#### **Figure 1**

#### **Drainage Easement Worksheet**

**The following formula/worksheet is a tool to be used in determining the required width for drainage easements assigned to storm pipes.**

The minimum required easement width for storm pipe installation is a function of the required clearance on each side of the pipe, the pipe diameter, the embankment slope and the pipe's depth at the deepest point.

Given a minimum 2 feet of clearance between the pipe walls and an embankment slope of 2:1 (H:V), the formula is:

*Minimum easement width = 4' + diameter + (4 x maximum depth) = total easement width (feet), to be centered on structure/pipe.*

## E. PIPE PROFILES/CULVERT DESIGN/OPEN CHANNELS

### **Pipe**

1. \_\_\_\_ Show a minimum of 12" of cover for pipe. Additional cover may be required depending on expected loading.
2. \_\_\_\_ All pipes requiring a manhole base larger than 48" in diameter must be identified by showing base unit and reduction cone, inverts of pipes, etc.
3. \_\_\_\_ Verify that the pond outlet discharge pipe has been checked for inlet and outlet control.
4. \_\_\_\_ Match crowns on adjacent pipe.
5. \_\_\_\_ Provide a minimum of 12" vertical and horizontal separation between all buried utilities & storm pipes.
6. \_\_\_\_ Show all sanitary and water line, and other utility crossings on storm profiles.
7. \_\_\_\_ Show catch basin top and pipe invert elevations.
8. \_\_\_\_ Show curb inlet at low point of street
9. \_\_\_\_ Provide pipe profiles with existing and proposed ground surface profiles, pipe lengths, slopes, inverts, and type.
10. \_\_\_\_ Show 25-year hydraulic grade line. It must be below the crown of the pipe. Please provide supporting data in pipe profile chart or hydro study.
11. \_\_\_\_ Note on plans: All storm pipe and structures shall comply with GADOT standards for design, construction, and installation.
12. \_\_\_\_ Inverts on all structures shown to be paved smooth.
13. \_\_\_\_ All metal pipes used must be BCCMP with re-rolled ends and hugger/corrugated bands used for connection.
14. \_\_\_\_ Minimum acceptable pipe diameter is 18 inches.
15. \_\_\_\_ Minimum slope is 1% for BCCMP and 0.50% for RCP. For slopes < 1%, show that a minimum of 2.5 fps is attained for the 2-year frequency event.
16. \_\_\_\_ Velocity in pipe No. (s) \_\_\_\_\_ exceeds 15 fps. Velocities should be between 3-15 fps.
17. \_\_\_\_ CMP or BCCMP pipe(s) exceed(s) 12% slope. RCP pipe exceed(s) 12% slope.
18. \_\_\_\_ On CMP pipe exceeding a 12% slope, show anchor collars. Provide construction detail and locations.

## **E. PIPE PROFILES/CULVERT DESIGN/OPEN CHANNELS (cont'd)**

19. \_\_\_ RCP is required / recommended under roads.
20. \_\_\_ Angle conflict among pipes will require a larger manhole for structure.

### **Pipe chart indicating the following:**

1. \_\_\_ Pipe Numbers
2. \_\_\_ Invert elevations
3. \_\_\_ Pipe Sizes
4. \_\_\_ Pipe Slope
5. \_\_\_ Pipe Length
6. \_\_\_ Contributing Drainage Area
7. \_\_\_ Design discharge ( $Q_{25}$  for piped drainage;  $Q_{100}$  for culverts)
8. \_\_\_ Design storm frequency (25-year for piped drainage; 100-year for culverts)
9. \_\_\_ Runoff Coefficient for CMP
10. \_\_\_ Pipe material/coating. Indicate corrugation spacing and height
11. \_\_\_ Velocity ( $V_{25}$  may not exceed erosive velocity at outlet headwall unless additional energy dissipation is provided.)
12. \_\_\_ Gutter spread (not to exceed  $\frac{1}{2}$  travel lane width on 25-year design storm)

### **Open channel chart indicating the following:**

1. \_\_\_ Open Channel Numbers
2. \_\_\_ Contributing Drainage Area
3. \_\_\_ Runoff coefficient (per future land use plan and assuming no detention)
4. \_\_\_ Conveyance Size. Provide typical cross section
5. \_\_\_ Lining Material (riprap, sod, vegetative, etc.)
6. \_\_\_ Channel Length
7. \_\_\_ Channel Slope (for min and max values)
8. \_\_\_ Velocity ( $V_{25}$  may not exceed erosive velocity)
9. \_\_\_ Design Storm frequency (25-year)
10. \_\_\_ Design discharge (25-year)
11. \_\_\_ Normal Flow Depth (25-year)
12. \_\_\_ Indicate free board capacity

### **Culverts**

1. \_\_\_ Headwater & Tailwater Limitations: For drainage facilities with cross-sectional areas equal to or less than  $30 \text{ ft}^2$ , HW/D for the 100-year frequency storm must be equal to or less than 1.5. For drainage facilities with cross-sectional areas greater than  $30 \text{ ft}^2$ , HW/D for the 100-year frequency storm must be equal to or less than 1.2. Culverts must be sized to maintain flood-free conditions on major thoroughfares with at least 18-inches freeboard at the low-point of the road. (All criteria from Section 4.3, culvert design, of the GSMM are required.)

2. \_\_\_\_ As stated above, inlet/outlet control calculations are required for all street crossings in addition to Manning's equation. Insure that  $T_c$  is representative of the drainage area.
3. \_\_\_\_ The weighted runoff coefficient for major culvert analysis ( $Q=CfCIA$ ) should be based on full build-out using the current zoning plan for the entire receiving area.
4. \_\_\_\_ Show 100-year ponding limits above pipe (culvert).
5. \_\_\_\_ Show 100-year hydraulic grade line in all culverts.
6. \_\_\_\_ RCP is required for culvert(s) placed in streams with any base flow.

**OTHER REVIEW COMMENTS:**

**CITY OF PERRY GA**

Direct questions regarding the above issues to:

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