FINAL WATER QUALITY PLAN

PRELIMINARY DESIGNS FOR BMP"S,
STORMWATER MANAGEMENT PONDS, AND CULVERTS

CLARKSBURG TOWN CENTER

MONTGOMERY COUNTY, MD.

PHASES IA AND IB

Job No. 97P - 005

PREPARED FOR:

CLARKSBURG LIMITED PARTNERSHIP
c/o FIRST SUMNER L.L.C
342 HUNGERFORD DRIVE
ROCKVILLE, MD. 20850

PREPARED BY:

IRENE A. CARRATO, P.E.
Reg. No 15009

JULY, 1997
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MONTGOMERY/KONTGIAS ENTERPRISES
Engineers • Planners • Surveyors

Clarksburg Town Center
Phases IA and IB

Final Water Quality Plan

Preliminary Designs for BMP's,
Stormwater Management Ponds,
and Culverts

Approved
w/ conditions
1/15/98 RJG

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POND #1 AND ASSOCIATED BMP's

Pond #1 is an engineered wet pond which provides direct and compensatory 2 year control for the on-site area and half of the adjacent road rights-of-way. It also allows safe conveyance of run-off from the proposed 100 year storm for on-site and off-site areas. As with Pond #2, a storage credit is taken for BMP volumes for the 2 year routing.

The pond length to width ratio is roughly 2 to 1 to maximize hydraulic travel time, and a forebay area and middle cell are incorporated into the design to further encourage settling of suspended solids in advance of the main basin area. In an effort to trap as much debris as possible in the forebay area, the bench between the forebay and the middle cell will extend almost to the water surface, thus also offering an opportunity for a shallow wetland planting area. The top of the bench between the middle cell and the main basin will be located several feet below the permanent pool and will not be discernible at the surface. Additional wetland planting areas will be provided along the fringes of the permanent pool, and a safety bench above the permanent water surface elevation will also be provided.

Because Pond #1 is a wet pond, its thermal impact on the stream must be mitigated. In order to help achieve this, the shoreline of the pond will be forested to provide shade for the permanent pool. The low flow intake at the control structure will be reverse sloped to draw flows from storms up to the 2 year event from below the water surface, where temperatures might be slightly cooler. These lowflows will be split in the riser structure and pond outflows for storms up to the 1.5 inch event will be directed to CW#5, where they will be infiltrated. Additional information regarding this mitigation technique is presented in a subsequent section of this report. To insure that warm surface water does not leave the pond even for storms slightly in excess of the 2year, the riser high stage weirs have been located an additional 6 inches above the anticipated 2 year water surface. Further thermal mitigation for larger storms will include shading of the main rip-rap outfall channel, and reforestation of the eastern tributary.

Depressed dissolved oxygen levels can also be a problem within wet ponds. Therefore, an aerator and several fountains will be provided to augment the D.O. levels.

Water quality for the first 1" of run-off from impervious areas within the Pond #1 watershed is provided by a variety of BMP's as follows:

- SF's #12, #13, and #14 are sandfilters with overflows and underdrains outfalling into the pond. They are redundant with the permanent pool, and SF#14 relies on the permanent pool for additional water quality, since this facility is sized for the first 1/2 inch of run-off

- SF#8 is a pretreatment sand filter which is sized for the 1/2 inch and is redundant with adjacent CW#5 which provides infiltration for the full 1 inch of run-off from impervious areas within the SF#8 drainage area. SF#8 is fed by two splitters, and has an independent structural overflow.
- CW#5 also provides sufficient volume to infiltrate the outflow from Pond #1 for the 1.5 inch rainfall event. This is considered to be primarily a thermal mitigation practice, although some groundwater recharge and redundancy of quality treatment are also expected.
- CW#3 is a three celled infiltration facility, with the emergency underdrain from one cell outfalling to the top of storage of the subsequent cell. It is fed by a roofdrain system, and therefore does not require a pretreatment component. The emergency underdrain is linked to the storm drain at the lowest cell.
- CW#4 is similar to CW#3, except that it has a single cell.
- CW#6 is also similar to CW's #3 and #4, except that it accepts run-off from rooftops and grassed areas via a storm drain inlet. Because no impervious traffic areas contribute to its drainage area, pretreatment for CW#6 is not necessary.
- The sequence of the linking of these facilities through the storm drain is as follows. CW#3 and CW#4 to SF#14. CW#6 to SF#12.

The effect of these BMP's on groundwater recharge is discussed in a subsequent section.

POND #2 AND ASSOCIATED BMP's

Pond #2 is a natural pond created by the construction of a roadway embankment. In addition to providing direct and compensatory 2 year control for the on-site area and half of the adjacent road rights-of-way, it also allows safe conveyance of run-off from storms up to the proposed 100 year design event for on-site and off-site drainage areas. A storage credit is taken at Pond #2 for volume provided in the BMP's for the 2 year event.

The existing groundwater seeps at the upstream end of Pond #2 are a source of cool baseflow which must be preserved. This will be accomplished by afforesting the Pond #2 area, which will help shade the baseflow and minimize thermal increases. Also, the cool base flow will be split within the control structure, and a separate vegetated and shaded outfall will be provided to prevent baseflow warming within the main rip-rap outfall channel. Additional information regarding thermal mitigation is provided in a subsequent section of this report.

Because Pond #2 is to remain in a natural condition, it is desirable to prevent as much debris as possible from entering the pond through the storm drainage sytem. To this end, a forebay and trash rack will be provided upstream of Pond #2 to intercept the principal storm drain outfall.

Water quality for the first 1" of run-off from impervious areas within the Pond #2 watershed is provided by a variety of BMP's as follows:

- SF#15 is a sand filter with an overflow link to the storm drain. Its underdrain is connected to SF#1 for redundancy. It is fed by a splitter.
- SF#1 is a sand filter with an overflow link to the storm drain. It is fed by a splitter, and its underdrain outfalls to the main stream stem.
- SF#2 is a pretreatment sandfilter sized for 1/2 inch of storage, with an additional 1" of storage available in an infiltration trench for redundancy of treatment. It has an overflow link to the storm drain and is fed by a splitter.
- SF#3 is similar to SF#2, but has a structural overflow independent of the storm drain, and an underdrain which outfalls directly into the Pond 2 area.
- SF#6 is a sand filter with pretreatment cells to provide some level of redundancy and to extend the life of the facility. It is fed by a splitter and overflows back into the storm drain via the splitter pipe. Its underdrain empties into Pond#2.
- BR's #14, #13, #12, #3,and #2 are bioretention areas linked to the storm drain system by their overflows and also by their underdrains. All have splitters, except for BR#12, which is surface fed.
- BR #4 is similar in design to the aforementioned bioretention areas, but outfalls directly into the Pond #2 area.
- BR #15 is a bioretention facility with underlying infiltration. It is surface fed and connected to the storm drain by its overflow and underdrain.

- BR's #14, #13, #3, and #2 have volumes smaller than 1" over their impervious areas, but additional storage volume has been made available at SF#2 to offset this.
- The sequence of the linking of BMP's through the storm drain system is SF#15 to SF#1 to SF#2 to SF#6. BR#12 to SF#1. BR's#14, #13, #3, and # 2 to SF#2. BR#15 to SF#3. No link at BR#4.
- Future BMP's for the commercial area are included herein for preliminary sizing only. These are CW#1, CW#2, and BR#1. The location, number, treatment method, and method of redundancy of these facilities may change dependent on the future site layout and the outcome of additional hydrogeologic studies.

The effect of these BMP's on groundwater recharge is demonstrated in a subsequent section of this report.

THERMAL MITIGATION

By inspection of the attached rainfall data for the period 1984 to 1993, it was determined that 97% of all storms which fall in the hot weather months of May through September are 1.5 inch or less. This was therefore selected as the design storm for thermal considerations.

At Pond #1, the 1.5 inch event was routed and resulted in a peak outflow of 0.90 cfs and a volume of outflow of 0.54 acft. A lowflow diversion pipe from the riser was sized accordingly and the required storage volume was created at CW#5, where the full volume can be infiltrated, and the thermal impact fully mitigated.

The 1.5 inch event was also routed at Pond #2, where it resulted in no ponding and no outflow. This indicated that diversion of baseflow upstream of the riser to avoid a warm pool of empounded water would not be necessary, and in fact would be detrimental to the tributary, because it would deprive the lower reaches of the trib of baseflow. It was therefore decided that a baseflow diversion pipe would be installed in the riser, with a separate vegetated outfall to prevent baseflow heating on rip-rap.

GROUNDWATER RECHARGE

While soil boring results indicate that infiltration is not possible at all BMP locations, it has been incorporated where ever possible. The BMP's which provide groundwater recharge through infiltration are SF#2, SF#3, and BR#15 in Phase IA and SF#8, CW#3, CW#4 and CW#6 in Phase IB. The following calculations demonstrate that these facilities can provide sufficient recharge to offset the loss due to development. Based on the information provided by the Geotechnical Engineer, and the calculations presented herein, the level of recharge should exceed the 80% originally estimated in the appended hydregeological report.

DISCUSSION OF DAM BREACH

Two separate dam breach scenarios are investigated in this section. The first situation will exist during the construction phases of IA and IB, when a total of six sediment basins will be located upstream of the existing Stringtown Road culvert. Additionally, three of these basins (in Phase IA) will also be located upstream of Street K, and the impact of a dam breach must be analyzed for this road as well. The site of the Street K breach is the future location of SWM Pond #2, but this pond cannot be used for sediment control because it is within the stream buffer. Therefore, the riser will not be installed until it is time to convert to stormwater management, and during the interim construction phase, the barrels and pond embankment will function as a typical culvert crossing.

The second dam breach condition will exist when Basin 1B is converted to stormwater management and/or Pond #2 is completed. The existing culvert under Stringtown Road must already be replaced by this time, in order for the overtopping at Stringtown Road due to dam breach to be in the acceptable range for a class "a" facility.

The dam breach analyses presented herein are based on the formula $Q_{BR}=3.2H^{2.5}$ and demonstrate that the overtopping at both K Street and Stringtown Road will not exceed 1.5 feet under any scenario. More in-depth HEC-2 studies can be presented, if necessary, during the final design of sediment control and stormwater management.

Pond #2 BMP Design

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	BY: *I. A. Carrato*	CHECKED:	DATE: *6/20/97*
	PROJECT: *CLARKSBURG*	JOB NO: *97005*	PAGE: *1*

SANDFILTER # BR2

SANDFILTER DESIGN:

TOTAL D.A.= **0.4** AC.

IMPERV D A.= **0.25** AC.

% IMPERV = **62.5 %**

FIRST FLUSH RUN-OFF DEPTH(R.O.")= **0.596** IN.

VOLUME REQUIRED=IMPERV. D A. X R.O."/12= **0.012 ACFT.**

MIN. S A. OF SAND\PEA GRAVEL WINDOW=50+(IMPERV D.A.-0.1AC)X167= **75.05 SQFT.**

SPLITTER DESIGN:

FLOW RATE REQUIRED=(IMPERV D.A./640AC /SQMI.)XR O."X1010CSM= **0.24 CFS**

SPLITTER PIPE DIAMETER= **6** IN.

CROSS-SECTIONAL AREA OF SPLITTER PIPE= **0.196 SF**

INVERT OF SPLITTER PIPE IN STRUCTURE= **641.4**

INVERT OF OUTGOING STORM DRAIN= **642.5**

HEAD ON SPLITTER=INV. S.D -INV. SPLITTER-DIA./24= **0.85 FT.**

SPLITTER FLOWRATE=0.6XAREA OF SPLITTERX(64.4XHEAD)$^{0.5}$= **0.87 CFS**