TOWN OF CHAPEL HILL

ATTACHMENT 4

CONCEPT PLAN PROPOSAL

Applicant Information

Name: BILL DAVIS, AIA

Address: c/o INNOVATIVE DESIGN 850 WEST MORGAN STREET

City: RALEIGH State: NC Zip: 27603

Phone (Work): 832-6303 FAX: 832-3339 E-Mail: BILL@INNOVATIVEDESIGN.NET

Property Owner Information (included as attachment if more than one owner)

Name: MONTESSORI COMMUNITY SCHOOL Phone 493-8541

Address: 4512 POPE ROAD

City: DURHAM State: NC Zip: 27707

Development Information

Name of Development: MONTESSORI COMMUNITY SCHOOL EXPANSION

Tax Map: 481 DURHAM CO. Block: 7 Lot(s): 7A Parcel ID #: 141193

Address/Location: 4512 POPE ROAD DURHAM NC 27707

Existing Zoning: O/I-2 New Zoning District if Rezoning Proposed NA

Proposed Size of Development (Acres / Square Feet): 9.742 GLA / 424,345.5 SF

Permitted / Proposed Floor Area (Square Feet): 112,027 / 36,040

Minimum # Parking Spaces Required: 37 #Proposed 70

Proposed Number of Dwelling Units: NA # Units per Acre NA

Existing / Proposed Impervious Surface Area (Square Feet): 54,612.4 / 93,539.2 (.220)

Is this Concept Plan subject to additional review by Town Council? YES.

The undersigned applicant hereby certifies that: a) the property owner authorizes the filing of this proposal b) authorizes on-site review by authorized staff; and c) to the best of his/her knowledge and belief, all information supplied with this proposal is true and accurate.

Signature: [signature] Date: 6.13.2003

Please submit **20 sets** of all materials, or **30 sets of all materials including reduced (8 ½" by 11") copies of all plans if the Concept Plan is subject to additional review by the Town Council**, no later than the first day of the month. Materials must be collated and folded to fit into a 12" x 15" envelope.

The Community Design Commission meets regularly on the third Wednesday of each month. Meetings with the Town Council will be scheduled after the Community Design Commission meeting. For confirmation of a meeting dates and the placement of your request on the agenda, please call the Planning Department at (919) 968-2728.

Innovative Design
850 W. Morgan Street Raleigh, NC 27603 919-832-6303 Fax 919-832-3339

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June 13, 2002

Gene Povoromo
Town of Chapel Hill Planning Department
306 North Columbia Street
Chapel Hill, NC 27516-2124

Re: Montessori Community School Expansion
Durham County Tax Map #481, Block 7, Lot 7a
Developer's Program
Statement of Compliance

Mr. Povoromo:

We are pleased to submit this program of development to the Town of Chapel Hill on behalf of the Montessori Community School. We have designed this project with the North Carolina Building Code (2002 International Code with amendments) as well as the Town of Chapel Hill Land Use Management Ordinance.

Developer's Program

The Montessori Community School is a private, non-profit school for toddlers through sixth grade located in Durham County and part of the Town of Chapel Hill. The campus was last developed in 1999 when a gymnasium building was built. Prior to that development, in 1986, a three-classroom building was built along the South edge of the site.

At this time, the school intends to expand their campus to include two new buildings: a middle school building (two classrooms) and a music/art building (two classrooms). In addition to these new buildings, the music/art building includes expansion of the existing gymnasium to accommodate a full-sized basketball court. (Currently, the gymnasium is half-court sized.)

We are proposing to pave a portion of the existing fire access lane to provide access to a student drop-off area adjacent to the gymnasium. The location of the fire lane will stay intact, but it will be expanded to allow for a turn-around location for a ladder truck. (The proposed location has been preliminarily reviewed by the Town of Chapel Hill Fire Marshal, see attached letter.) Paving a portion of the fire lane will require the use of an Alternate Buffer along a portion of the roadway, which we propose to accommodate with a screen fence and dense planting.

In the past, two poorly designed and constructed stormwater retention basins have caused problems to the neighbors of the school. In an extreme storm event, the basin floods and impacts the neighboring properties. We are proposing to expand these basins to properly handle stormwater runoff. These areas will become constructed wetlands, which will act to cleanse the stormwater runoff, detain it on site and to act as a teaching tool for the science classrooms at the Montessori Community School. We also propose to collect rainwater from the roofs of the new construction and use this rainwater to irrigate the ball field and flush toilets within the new construction. These water-conserving techniques will provide significant improvement to stormwater runoff during storm events.

The goals and objectives of the Montessori Community School are:

To provide a well-rounded education to all of its students
To be a responsible and attentive neighbor
To expand their school to include 7th and 8th grade students

The primary objective of the Montessori Community School is to provide "a beautiful, rich and ordered environment so that each child will feel safe, secure, challenged, and respected." By providing this type of environment for the students, and by guiding their educational process, the Montessori method helps children teach themselves and learn how to learn.

To enrich the educational experience at the Montessori Community School, we are proposing to create a fine arts center (dedicated music and art classrooms) and to increase the size of their gymnasium, to full court size. These new buildings will expand the teaching curriculum in the fine arts as well as athletics.

The Montessori Community School teaches its students that the impact of their actions has repercussions on others, and on the environment. The school staff is keenly aware of the problems caused by stormwater runoff from their site. It is a very high priority for them to address these problems and lessen the impact that they have on their neighbors. By creating the constructed wetland areas on site, they will address stormwater runoff naturally, and by doing so, create a new learning experience for their students.

The expansion of the school to educate middle school students has been a goal of the Montessori Community School for some time. It is a natural expansion that is only possible after the development and success of the program for younger students. This modest expansion of the school (two classrooms) is expected to increase enrollment by approximately 40-50 students.

Statement of Compliance

The proposed development at the Montessori Community School has been designed using the North Carolina Building Code and the Town of Chapel Hill Land Use Management Ordinance. We have made every effort to discuss this project with the Town Planning and Engineering Departments prior to this submission. We have also discussed the project with the Town Fire Department for fire access to the new development.

The site is zoned Office/Institutional – 2 (O/I-2) and the GLA is 9.742 acres (424,345.5sf). There is currently 18,022sf of building area and 54,612sf of impervious surface (building + paving). The proposed development of approximately 18,018sf will create a Floor Area Ratio (FAR) of 0.080 (0.264 is the maximum allowed by the Dimensional Matrix – Table 3.8-1). After the proposed development, the Impervious Surface Ratio will be 0.22 (0.24 is the Low Density Option allowed by the Dimensional Matrix – Table 3.8-1).

The constructed wetlands on site have been reviewed with the Town's Stormwater Engineer, Fred Royal. The enclosed Stormwater Impact Statement has been prepared and the attached drawings show the intent and details of the constructed wetlands. These wetlands exceed the requirements for stormwater retention issued by the Town of Chapel Hill, and will minimize the stormwater impact on the school's neighbors.

The parking areas at the Montessori Community School site currently provide 78 spaces (4 accessible). Under the development ordinance, the minimum quantity is 1 per staff member (35). We are proposing to leave the current parking area intact, with the exception of removing 5 spaces to provide access to the Middle School Building. We also propose to incorporate two new accessible, and four new typical parking spaces into the cul-de-sac adjacent to the Middle School building. This is to provide accessible parking within reasonable proximity to this new building.

The buffers required for the project are Type "C" for Use Group "B" (as defined in the Use Matrix – Table 3.7-1). In most areas we will comply with the Type "C" Buffer. In location adjacent to the cul-de-sac, we will encroach on the buffer and will provide an Alternate Buffer with a combination of denser planting and a screen fence. This area is adjacent to the rear yard of an adjacent property, and should not be adversely affected by this alternate buffer.

The Fire-access Lane, which currently is a gravel path, will be upgraded to provide access by the Town of Chapel Hill's Tower truck (67'-6" turning radius, 71,080 lbs. fully-loaded). A portion of the new access road will be paved as sidewalk, and a portion will be engineered, grassy areas designed to accommodate the loads imposed by a fully-loaded fire truck. The access road will also be extended to provide a turn-around area for the trucks. This layout has been discussed and preliminarily approved by the Chapel Hill Fire Marshal (see attached letter).

The project submitted for development at the Montessori Community School is the result of hard work and success of this private, non-profit organization. Their desire for increased school facilities is in the spirit of education and community development. The staff at the Montessori Community School will be conducting a preliminary meeting with their neighbors to discuss this development. This is in addition to the Public Hearing required by the approvals process. It is important to the school to have the support of the neighboring community, and will take their suggestions and criticism to heart. We have also made every effort to discuss this project with the Town of Chapel Hill's Planning, Engineering and Fire Departments, and will continue to do so throughout the approvals process.

Sincerely,

Bill Davis, AIA
Innovative Design

Enc.

Letter from Fire Marshal Capt. Barry McLamb
Stormwater Impact Statement
CDC Hearing Minutes with architect's response

Innovative Design
850 W. Morgan Street Raleigh, NC 27603 919-832-6303 Fax 919-832-3339

(18)

July 22, 2002

Captain Barry McLamb, Assistant Fire Marshal
Town of Chapel Hill Fire Department
302 North Columbia Street
Chapel Hill, NC 27516

Re: Montessori Community School - Proposed Development

Captain McLamb:

Thank you for meeting with me this morning about the proposed work at the Montessori Community School. Early planning for fire access to campus buildings gives all parties involved a better sense of how existing sites can be best utilized.

As we discussed, the following items were discussed and if noted, will be revised on our drawings and resubmitted for your records:

- The fire access lane turn-around must accommodate a tower truck with a turning radius of 67'-6" (height and weight must also be addressed).
  The diameter of the turn-around will be changed from 95'-0" to 125'-0" and the fire access lane will be designed to accommodate the tower truck (specifications provided).
- The 20'-0" width access road can be a combination of paved surfaces and grass pavers, as long as the weight of the tower truck (plus a reasonable safety margin) can be accommodated by the fire access road.
- The "hammerhead" design for the internal site access and turn-around is acceptable by the Chapel Hill Fire Department. The tower truck will be able to pull straight through and back into position to fight fires in the courtyard formed by the buildings (existing and proposed).
- One new fire hydrant location must be added to the North side of the Phase 1 turn-around loop. Typically, hydrants are required within 50 feet of the fire department connection for a building, but due to the campus nature at the Montessori Community School, that requirement has been relaxed. The Fire Department will be able to connect to either of the Phase 1 buildings (Music/Art building and Middle School/Upper Elementary building) from this location. Further review will be required if the Montessori Community School decides to develop a separate middle school on the Northwest portion of the site.
  A new water line and fire hydrant will be added to the North side of the Phase 1 turn-around loop. The Fire Department connections for the new buildings will be as close as possible to this location.

Please contact me immediately if this letter does not completely address our discussions this morning, or if there are any additional issues that we need to address in our design. Again, thank you for your time this morning. Please sign and return a copy of this letter and keep a copy for your records.

Sincerely,

Bill Davis, AIA

Accepted by the Town of Chapel Hill Fire Department — Asst Fire Marshal (Title) — 7.24.02 (Date)

These comments were received by Innovative Design on June 3, 2003, six months after the CDC Review Hearing. After each of the comments, a response has been added by the architect.

COMMUNITY DESIGN COMMISSION

SUMMARY OF CONCEPT PLAN REVIEW

Montessori Community School
October 29, 2002

OVERVIEW

Prior to submittal of a formal development application, all major development proposals are required to be reviewed while they are still at a "conceptual" stage. In particular, it is the intent of the "Concept Plan" review process that citizens and members of the Community Design Commission have an opportunity to review a site analysis and a conceptual plan in order to evaluate the impact of a major development proposal on the character of the area in which it is proposed to be located. This process is intended to take into consideration the general form of the land before and after development as well as the spatial relationships of the proposed structures, open spaces, landscaped areas, and general access and circulation patterns as they relate to the proposed development and the surrounding area.

BACKGROUND

The Community Design Commission conducted a Concept Plan Review for this potential development on Tuesday, October 29, 2002. The existing Montessori School is located on the west side of Pope Road, between Newton Drive and Fountain Ridge Road. The school is situated on a 9.4-acre site that is located at 4512 Pope Road. The existing school includes 13,750 square feet of floor area and 78 parking spaces. The applicant is proposing to construct 17,250 square feet of new floor area (for a total of 35,000 square feet of floor area on the site) and to reduce parking to a total of 75 parking spaces. The new floor area would be for a new middle school building, a new music/art building, and an expansion of the existing half-court gym to a full-size gymnasium.

The site is located in the Office/Institutional-2 (OI-2) zoning district. The site is located in Durham County and is identified as Durham Triangle Township Tax Map 481, Block 7, Lot 7A. This proposal would require Council approval of a Special Use Permit application.

CITIZEN COMMENTS ON CONCEPT PLAN

Several citizens spoke on this Concept Plan at the meeting. The issues raised by these citizens at the meeting are as follows:

- One citizen expressed the opinion that this proposal cannot fulfill the 3rd Finding of approval for a Special Use Permit application, which requires that a development shall maintain the value of contiguous property; unless the development constitutes a public necessity. The citizen did not believe that the school was a public necessity; and, he did not believe that the school could successfully argue that expansion would maintain the value of contiguous properties.

RESPONSE: The value of contiguous properties is a concern of the Montessori Community School. From the comments of the CDC, we have redesigned the constructed wetlands to enable construction without encroaching on the 20 foot buffer to the South. We feel that that through the development of constructed wetlands and a rainwater collection system, we will minimize the stormwater impact currently experienced by residents to the North and to the West. This item alone will increase the property values of the affected properties. In areas where development is approaching the 20 foot buffers, increased plantings associated with the constructed wetlands will provide additional separation of the school from the neighbors. In one area, we are proposing an alternate buffer where our access road encroaches upon the 20 foot, type "C" buffer. This location is far from any existing residence, and there is currently no development on the affected adjacent property.

- Many citizens expressed concern about stormwater-related problems in this area. In particular, several citizens noted problems with flooding on their properties and flooding under their homes.

RESPONSE: The proposed constructed wetlands in conjunction with the rainwater collection system will reduce the school's stormwater impact on neighboring properties. As recommended by the CDC, we have discussed our strategies with Fred Royal, the Town's Stormwater Engineer. The detailed documents included with this submission were requested by Mr. Royal for his review and approval.

- Several citizens expressed concern that mold and mildew are very problematic issues for homeowners in this area. One citizen noted a belief that the excess moisture and storm drainage from the school site has created foundation problems for his home.

RESPONSE: Stormwater impact from the Montessori Community School will be reduced as discussed above.

- A couple of citizens expressed concerns regarding traffic in this area. One citizen believed that left turns onto Ephesus Church Road and Pope Road are very difficult, and that sight distances along Pope Road are too short to be safe for a school.

RESPONSE: Kumar Neppali, the Town's Traffic Engineer has reviewed the proposed development and the traffic along Pope Road, and has determined that traffic will not be impacted enough to warrant an additional Traffic Impact Analysis. A Traffic Impact Analysis exemption has been received by Innovative Design.

- Several citizens who reside immediately north of the school site, expressed their belief that the pond and associated dam on the northern edge of the school site pose a threat to their homes. One citizen believed that the school should have to provide insurance coverage that would cover the neighbors in the event of a problem.

RESPONSE: The proposed wetland on the North area of the site is designed and will be constructed using recommended practices, and will be approved by the design professional and the Town of Chapel Hill Engineering Department prior to use. The wetlands is designed to exceed the Town's stormwater requirements.

- One citizen expressed the opinion that the school has "40-acre aspirations on their 9-acre site."

RESPONSE: The proposed development (total impervious surface) is within the "Low Density Option" defined by the Chapel Hill Land Use Management Ordinance. The proposed building area (existing + new) is one-third of the allowable Floor-area ratio defined in the Chapel Hill Land Use Management Ordinance.

- A citizen who resides on Colony Woods Drive, east of this site, expressed frustration that the Town of Chapel Hill had not enlarged a storm drain underneath Colony Woods Drive. The citizen noted his belief that the existing storm drain, which has a pipe that is too small, backs water up under his house during heavy rains. The citizen was concerned that any further development on the school site, and related increase in impervious surface, would make this situation worse.

RESPONSE: As stated before, the constructed wetlands are designed to exceed the Town of Chapel Hill stormwater retention requirements, and will minimize the impact that stormwater from the Montessori Community School has on its neighbors. The existing stormwater infrastructure issue mentioned at the meeting is not within the limits of work for the Montessori School project, and must be addressed directly with the Town of Chapel Hill.

- Several citizens expressed personal frustration with regard to the inadequate buffer provided along the school's southern boundary. One citizen recommended that all existing vegetation should be retained and supplemented with additional plantings.

RESPONSE: As a result of the CDC Hearing, the South wetlands was redesigned and relocated to provide additional buffer to the South. The wetlands planting provided will increase the density of planting within this area.

CONCEPT PLAN REVIEW

The Community Design Commission reviewed the conceptual development plan submittal and discussed the following topics:

1. Several Commission members recommended that the applicant take steps to significantly improve stormwater runoff from the site. Many members encouraged the applicant to consult with the Town's Stormwater Engineer prior to submitting a formal development application for this site.

RESPONSE: Fred Royal has reviewed the proposed development and has recommended that our Formal Submission to the Town include detailed drawings for the Engineering Department to review. These documents are included with this submission. Any additional comments or recommendations from Mr. Royal or the Town of Chapel Hill Engineering staff will be incorporated into these documents prior to construction.

2. One Commission member expressed the opinion that the applicant was proposing too much development on the site, given the size of the site.

RESPONSE: As stated before, the proposed development is well within the requirements outlined in the Land Use Management Ordinance, for floor-area ratio and for impervious surface.

3. A couple of Commission members emphasized the need to provide full-width, vegetated buffers. Several members echoed that alternative buffers would not be appropriate for this development.

RESPONSE: From the comments made at the CDC Hearing, the design has been modified to require only one alternate buffer. This buffer is located far from any existing development, and will be mediated through the use of a solid wood fence and increased density planting.

4. One Commission member noted her belief that many of the existing buffer plantings are not in good shape. In particular, she felt that the existing buffers are insensitive to the surrounding neighbors.

RESPONSE: During the course of design, all of the buffer plantings will be evaluated and will be replanted if necessary to provide a buffer as required by the Town of Chapel Hill.

5. A Commission member expressed the opinion that it is not prudent for the school to move forward with its proposal without seeking to upgrade the old, antiquated drainage infrastructure in the adjacent neighborhood.

RESPONSE: In our discussions with Fred Royal, we were told that the school would not be responsible for upgrading any stormwater infrastructure not on school property. The site stormwater management plan has been designed to greatly reduce the stormwater volume from the Montessori Community School, and will therefore help the off-site stormwater issues encountered by the neighbors.

6. Several Commission members expressed concern with regard to the increased traffic impact that a larger school would have on Pope Road. One member noted that it is very difficult to make left turns from the school onto Pope Road.

RESPONSE: As a result of the CDC Hearing, the sight triangles have been restored at the exit of the school property on to Pope Road. These sight triangles will be maintained and are shown in the current proposed plans.

7. A Commission member believed that the applicant's proposal did not provide enough stacking room for vehicles departing the site.

RESPONSE: The current parking lot is adequate for the future needs of the school, and during high-volume times, does not adversely affect the traffic on Pope Road.

8. Several Commission members noted their belief that there is a structure which interferes with the site triangle of vehicles departing the site onto Pope Road.

RESPONSE: The sight triangle encroachment was from a dense plant at the exit of the school's parking lot. This plant has been pruned, and the sight triangle will be maintained to the Town's standards.

9. A couple of Commission members believed that the proposed buildings would not look good on the site; and, they encouraged the applicant to pursue higher quality architecture for the buildings.

RESPONSE: The designs of the new buildings will fit with the existing architecture of the campus, and will be designed to the proper scale to match the character of the surrounding neighborhood. The buildings will address the requirements of the Town of Chapel Hill Comprehensive Plan, and plan to participate in the Chapel Hill Million Solar Roofs Initiative.

10. One Commission member requested that the applicant move the southern detention pond away from the buffers.

RESPONSE: The South wetlands has been redesigned so that it will not affect the required buffer to the South.

11. A Commission member expressed concern regarding the proposed grass fire access, and noted his belief that this proposal would not work.

RESPONSE: This system has been designed in many locations with great success. The manufacturer is Netlon by GridTech, and the details are included in the submission.

12. One Commission member expressed concern regarding mosquitoes, due to standing water in the area.

RESPONSE: The wetlands are designed with solar powered aerators and skimmers that promote continuous flow of water through the wetland. Mosquitoes will not breed in flowing water. In addition, attention has been placed on the selection of wetlands plantings which will promote the ecosystem of dragonflies, which feed on mosquito larvae.

13. A Commission member noted that the design of the wetlands would be important, as poorly designed facilities could lead to a "wash-out" of surrounding homes.

RESPONSE: As stated before, Mr. Royal has requested that detailed stormwater design documents could be submitted to him for his review. He reviewed the proposed work, and was supportive of the design concepts.

14. One Commission member expressed the belief that the northern detention pond has a breach, and that the dam needs to be repaired immediately. The member also expressed the opinion that the channel on the site is badly eroded, and needs to be stabilized.

RESPONSE: The breach has been repaired.

Original Minutes Prepared by: Terry Eason, Chair, Community Design Commission
Rob Wilson, Staff

Responses Prepared by: Bill Davis, AIA, Innovative Design

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Montessori School of Chapel Hill
Stormwater Impact Statement

by

B & F Consulting, Inc.
2805 Tobermory Drive
Raleigh, NC 27606
919-618-0180

and

Landis, Inc.
PO Box 30069
Raleigh, NC 27622
919-787-1617

NORTH CAROLINA PROFESSIONAL SEAL 889 ENGINEER RUSSELL BRIGGS
28 May '03

A. Site Analysis and Narrative.

The site is an existing school. The site is located on a high point, and the existing drainage patterns are to the north, south and west. Water drains from the existing road to the east onto the site.

Currently, two stormwater detention ponds provide the water quantity management with little, if any, impact on water quality. These detention devices have been problematic in the past, with complaints from nearby residents. One of the devices exhibits piping along the barrel.

The site is a mixture of impervious areas, grassed playfield areas, and wooded areas. The mixture will continue with the proposed additions, although changed.

The total area is 9.42 acres. Of this, currently 1.9 acres, or 20% of the site is impervious. An additional 1.3 acres are proposed as new impervious area, which gives a planned impervious percentage as 26%.

Since the site is at a high point, there are no upstream backwater impacts.

Downstream, the southern basin discharges into an existing, undersized culvert system that has previously been studied by the Town of Chapel Hill. The proposed improvements to the stormwater basins will lessen the impact of the school site to this existing problem area, but the school site is only a portion of the contributory drainage area, and this undersized system will continue to be a problem. With the improvement to the on-site detention basin, the development of the school site is effectively removed as a contributor to any downstream drainage problems up to and including the 100-year rainfall event.

While no similar downstream problems exist for the northern basin, again the development of the school site is effectively removed as a contributor to any flooding events up to and including the 100-year rainfall event.

Mr. Todd Tugwell of the United States Army Corps of Engineers Raleigh Regulatory Office inspected the project site on October 17, 2002 and found a short ephemeral stream channel above the existing northern stormwater basin as the only jurisdictional area on the property. A nationwide permit application has been submitted for this ephemeral stream channel. The ephemeral stream channel was evaluated using the NCDWQ stream classification system and was found to have a score consistent with an ephemeral channel.

There are no intermittent or perennial stream channels on the property. Based upon the USGS 7.5" maps an intermittent stream is located approximately 1,800 feet west of the property and a perennial pond is located approximately 1,700 feet north of the property. Based upon the Soil Survey of Durham County an drainage way is located on the northern portion of the property, which was determined to be an ephemeral channel by the Corps, and a drainage way is located approximately 100 southwest of the property and may become intermittent downstream of Colony Woods Drive.

B. Release Rate Management

Please find attached calculations for the release rate management achieved by detention.

Northern Pond

The Northern Pond meets the release rate management criteria. This pond reduces the 2-year post-development peak flow from 22 cfs to 14 cfs. Note that this is over 2 cfs *lower* than the pre-development peak. Also, the 100-year post-development peak flow is lower than the pre-development peak. The 100-year event passes through the facility with approximately one-foot of freeboard.

Southern Pond

The Southern Pond meets the release rate management criteria as well. The 2-year post-development peak flow is lower than the pre-development peak flow. Again, the 100-year post-development peak flow is lower than the pre-development peak. The 100-year event passes through the facility with approximately 1.5 feet of freeboard.

C. Volume Management

Volume management is achieved by two means. First, the rainwater catchment from the rooftops retains water on-site for irrigation and toilet flushing. Thus, this amount of stormwater leaves the site either by evapotranspiration and/or groundwater recharge in the case of irrigation, or through sewer pipes in the case of toilet flushing. The additional volume created by the additional impervious areas is captured and stored in the constructed wetland ponds. Within these ponds, the volume is then managed partly by evapotranspiration and groundwater recharge within the pond. Due to the nature of the wetland material, however, it is important to bring the water level back down over a period of five days to the normal pool elevation. Thus any water that is not evapotranspirated or recharged is shunted to a french drain which serves as an additional recharge below the ponds

Northern Pond

The northern pond has 1.0 acre of new impervious area. Of this, 0.51 acres is mitigated by rainwater catchment devices. This leaves 0.49 acres of new impervious area.

The 2-year runoff amount from new impervious areas is 3.6 inches. Given a NRCS Curve Number of 59, the existing runoff amount from a 3.6-inch rainfall event is 0.53 inches. Thus, the volume to be retained on site is 3.07 inches multiplied by the new impervious area less the rainwater catchment area. This equates to a volume of 5,500 cubic feet.

Southern Pond

The southern pond has 0.3 acres of new impervious area. Rainwater catchment devices mitigate none of this area.

The 2-year runoff amount from new impervious areas is 3.6 inches. Given a NRCS Curve Number of 59, the existing runoff amount from a 3.6-inch rainfall event is 0.53 inches. Thus, the volume to be retained on site is 3.07 inches multiplied by the new impervious area. This equates to a volume of 3,400 cubic feet.

Both ponds achieve this by setting the skimmer device at normal pool elevation with the riser for the principal spillway set at a slightly higher elevation. Thus, no water enters the riser until this volume is held in the pond.

D. Water Quality Management

The site meets the water quality management objectives by the two extended detention wetland ponds. Eight-five percent or more of the total suspended solids (TSS) are removed by implementing this approved best management practice (BMP).

Proposed Mitigation Measures

Due to the existing downstream drainage problems, we are proposing several types of mitigation measures, which are as follows:

a. All new buildings will utilize rainwater catchment systems to capture runoff from the roofs. The rainwater will be stored in above and below ground cisterns. The rainwater will used for landscape irrigation on the property. Any overflow will be directed into one of the stormwater basins.

b. The existing northern stormwater basin is proposed to:
   i. Be enlarged to control the 100-year, 24-hour rainfall runoff peak discharge rate to the pre-developed site conditions.
   ii. Provide for retention of the volume from the 2-year, 24-hour rainfall post development runoff event. The 2-year volume will be slowly drained using a "2-Inch Faircloth Skimmer". Maximum storage volume will be approximately 5,500 cubic feet. Ponding depth will be approximately 2-feet.
   iii. Provide for a permanent wet pond and forebay system (4,800 square feet of normal pool surface area) to be planted with wetland vegetation.
   iv. Provide for a fountain aerator to maintain oxygen levels in the pond and to control misquotes.
   v. Provide for PAM log upstream from the inlet to each pond for dispersal of flocculants during runoff events. Typically PAM logs will need to be replaced four times per year). Or as an alternate, periodic broadcasting of dolomitic agricultural lime (typically 100 lbs. per pond six times per year or as needed) in ponds to control turbidity. After broadcasting of lime in ponds leave fountain aerator running for approximately two hours for dispersial, then turn off fountain aerator for twenty-four hours to allow for settlement.

c. The existing southern stormwater basin is proposed to:
   i. Be enlarged to control the 100-year, 24-hour rainfall runoff peak discharge rate to the pre-developed site conditions.
   ii. Provide for retention of the volume from the 2-year, 24-hour rainfall post development runoff event. The 2-year volume

will be slowly drained using a "2-Inch Faircloth Skimmer". Maximum storage volume will be approximately 3,400 cubic feet. Ponding depth will be approximately 0.3 feet.

iii. Provide for a permanent wet pond and forebay system (10,700 square feet of normal pool surface area) to be planted with wetland vegetation.

iv. Provide for a fountain aerator to maintain oxygen levels in the pond and to control misquotes.

v. Provide for PAM log upstream from the inlet to each pond for dispersal of flocculants during runoff events. Typically PAM logs will need to be replaced four times per year). Or as an alternate, periodic broadcasting of dolomitic agricultural lime (typically 100 lbs. per pond six times per year or as needed) in ponds to control turbidity. After broadcasting of lime in ponds leave fountain aerator running for approximately two hours for dispersial, then turn off fountain aerator for twenty-four hours to allow for settlement.

E. Nutrient Loading Calculations

The tract is denoted as "Office/Institutional" and the corresponding loading rates for Nitrogen and Phosphorous are 8.8 and 1.6 lbs./acre/year respectively. Based on a total area of 10 acres, then the nutrient loadings are:

Nitrogen	33.0 lbs./acre/year
Phosphorous	25.0 lbs./acre/year.

However, the stormwater wetland systems have been designed to achieve approximately 85% reduction in the above nitrogen and phosphorus loadings. The phosphorous is removed primarily by settling of suspended clay and organic particles in the ponds and secondarily by nutrient uptake by the wetland vegetation. The nitrogen is removed by a combination of nutrient uptake by the wetland vegetation and denitrification in the wetland fringe areas of less than one foot of ponding.

G. Maintenance and Operation Plan

Maintenance of Embankments

A. Vegetation

The embankment has a ground cover of fescue, which if properly maintained will prevent erosion of the embankment and provide an easy surface for inspection. The grass will be most difficult to obtain in the area subject to water level fluctuation below the top of the riser. Grass should be fertilized every October and April.

- Re-Seeding – periodically re-seeding may be required to establish grass on areas where seek did not take or has been destroyed. Before seeding, fertilizer (12-12-12) should be applied at a minimum rate of 12 to 15 pounds per 1,000 SF. The seed should be evenly sewn at a rate of three pounds per 1,000 SF. The seed should be covered with soil to the depth of approximately ¼". Immediately following the planting, the area should be mulched with straw.

- Trees & Shrubs – trees, shrubs, and other landscape vegetation should be permitted only as shown on the approved planting plan.

- Mowing – grass mowing, brush cutting and removal of weed vegetation will be necessary for the proper maintenance of the embankment. All embankment slopes and vegetation of spillways should be mowed when the grass exceeds 8" in height. Acceptable methods include the use of weed whips or power brush cutters and mowers.

B. Erosion

Erosion occurs when the water concentrates causing failure of the vegetation or when vegetation dies and sets up the environment for rill erosion and eventually gullies from the stormwater runoff. The dam should be inspected for these areas. Proper care of vegetative areas that develop erosion is required to prevent more serious damage to the embankment. Rills and gullies should be filled with suitable soil compacted and then seeded. Methods described in Section I-A, on vegetation, should be used to properly establish the grass surface. Where eroded areas are detected, the cause of the erosion should be addressed to prevent a continued maintenance problem. Frequently problems result from the concentration of runoff to one point of the embankment crest instead of a uniform distribution of runoff. This can be corrected by reshaping the crest to more evenly distribute the runoff to areas, which are not experiencing erosion problems. The top of the dam should not be used for pedestrian or bicycle traffic.

- Abutment Areas -- the abutment is the line formed where the embankment fill comes into contact with the existing slope. Runoff from rainfall concentrates in these gutter areas and can reach erosive velocities because of the steep slopes. If a normal stand of grass cannot be maintained on the abutments, additional measures may be needed such as jute matting to provide for the establishment of a good ground cover.

- Upstream Embankment Slope – Erosion problems can develop on the upstream face of the dam due to the fluctuation of water level in the pond. This is a result of a combination of wave actions and ground saturation, which occurs from the elevated water levels. The erosion generally occurs as the water level falls and the saturated ground becomes subjected to the wave action. If erosion becomes a problem, it may necessitate the installation of a stone armoring along the zone subject to fluctuating water level. This would consist of 18" of NCDOT Class B stone for erosion control underlain with Mirifi 140 geotextile fabric. It should be centered at the point of the erosion problem and covering an area 2' above and below the approximate center of the eroded area.

C. Seepage

- Detection – due to the fact that the "permanent" impoundment level is only 6' deep, and the road embankment is immediately downstream and continuous with the dam embankment, seepage should not be expected on the downstream slope of the embankment. However, a cursory inspection of the road embankment should be made for completeness of the inspection. Seepage may vary in appearance from a soft wet area to a flowing spring. It may show up first as only an area where the vegetation is more lush and darker green. Cattails, reeds, mosses and other marsh vegetation often become established in a seepage area. The downstream abutment areas where the embankment fill and natural ground interface are very common locations for seepage. Also the contact between the embankment and the spillway conduit is a very common location which is generally attributed to poor compaction around the conduit. Due to the way in which conduits are put in, this is generally most evident on the underside of the conduit. Slides may result from excessively saturated embankment slopes. The natural foundation area immediately downstream of the dam abutment should also be inspected to ensure that "piping" is not occurring underneath the embankment. "Piping" may appear as a "boil" evident as spring carries soil. The soil usually deposits around the boil area and is evident by the sedimentary deposits accompanying it. Seepage can also occur into the spillway conduit through cracks in the pipe or improperly sealed joints. These can be seen by observing the conduit when the water level is high. The movement of the water itself is not dangerous, but if soil particles are being carried with it, then it can create a shortcut for the piping of soil. This might show up on the upstream face of the embankment roughly along the line of the conduit itself.

D. Cracks, Slides, Sloughing, and Settlement

- Cracks – the entire embankment should be inspected for cracks. Short, isolated cracks are usually not significant, but larger cracks (wider than ¼"), well-defined cracks indicate a serious problem. There are two types of cracks: transverse and longitudinal.

  Traverse cracks appear crossing the embankment and indicated difference of settlement within the embankment. These cracks provide avenues for seepage and piping could develop.

  Longitudinal cracks run parallel to the embankment and may signal the early stages of a slide. In recently built structures, these cracks may be indicative of poor compaction or poor foundation preparation resulting in consolidation after construction.

- Slides – Slides and slumps are serious threats to the safety of an embankment. Slides can be detected easily unless obscured by vegetation. Arch shaped cracks are indications that slides are slipping or beginning to slip. These cracks soon develop into large scarps in the slope at the top of the slide.

- Settlement – settlement occurs both during construction and after the embankment has been completed and places in service. To a certain degree this is normal and should be experienced. It is usually the most pronounced at the location of maximum foundation depth or embankment height. Excessive settlement will reduce the free board (difference in elevation between the water surface and the top of the dam). Any area of excessive settlement should be restored to original elevation and condition to reduce the risk of overtopping. A relatively large amount of settlement (more than 6") within a small area could indicate serious problems in the foundation or perhaps the lower part of the embankment. Settlement accompanied by cracking often precedes failure.

- What to do if seepage, cracks, slides or settlement are detected: If any of the above items are detected there may be signs of significant problems, which could lead, to the failure of the structure. A geotechnical or civil engineer should be consulted regarding the origin of these problems and for the assessment of the appropriate solutions for correcting them. If the professional is not immediately able to inspect the dam, then the bottom drain should be opened and the water level lowered to remove the risk of failure until a professional can observe these problems.

E. Rodent Control

Generally in this urban environment, rodents are not a problem. Rodents such as ground hogs, muskrats, and beavers are attracted to dams and reservoirs and can be quite dangerous to structural integrity and proper performance of the embankment and spillway. Groundhog and muskrats thrive on burrowing in the manmade earth embankments, which become pathways for seepage. In the event that burrows are detected within the dam, then the rodents should be dealt with by removal.

Maintenance of Spillways and Control Structures

A. Inspection of Spillway Conduits

Conduits should be inspected thoroughly once a year. Conduits should be visually inspected by actually entering the conduit a sufficient distance between the riser structure and the outlet to check all the joints. Because the outlet works tie into the street storm sewer system, catch basins and pipes. Conduit should be inspected for proper alignment (sagging), elongation and displacement at joints, cracks, leaks, surface water, surface wear, loss of protective coating, corrosion and blocking. Problems with conduits most often occurs at joints and special attention should be given to them during inspection. Joints should be checked for gaps caused by elongation or settlement and loss of joint filler material. Open joints can permit erosion of the embankment material and possibly the piping of soil material through the joints. Catch basin should be checked for signs that water is seeping along the exterior surface of the pipe where it enters the catch basin. A depression in the soil surface over the pipe may be signs that soil is being removed from around the pipe.

- What to do if problems are detected with the spillway: Retain the assistance of a civil engineer or geotechnical engineer qualified in the design of embankments to perform an inspection of the dam. If in doubt, lower the water surface elevation of the pond until such time as a qualified professional can perform an inspection.

B. Trashracks on Pipe Spillways

The spillway riser for this dam is the only spillway structure. The intake structure has been fitted with a trashrack to prevent debris from entering the spillway structure. Most of the runoff entering the pond comes in through grated inlets, which have essentially provided filtration of the runoff and should limit the size of the debris that enters the basin to floating debris which will most likely pass through the trashrack. The opening between the trashrack and riser is smaller than the opening of the outlet pipe. The intent is that any debris, which passes through the trashrack, will be easily passed by the pipe outlet.

Maintenance should include periodically checking the rack for rusted or broken sections and repairing as needed. The trashrack should be checked frequently during and after storm events to ensure that it is properly functioning and to remove accumulated debris.

Operation

A. Lake Drains

Lake drains should always be operable so that the pool level can be drawn down in case of an emergency or for repairs or maintenance. Lake drain valves or gates that have not been operated for a long time present a special problem. Generally, when draining the pond, it should be drained slowly. Open the drain until a good flow of water is present but not a torrent, so that the water level can be drained over a period of 48 hours or more. Rapidly lowering the water level in the pond can cause permanent damage to the embankment and must be avoided. The gate valve controlling the lake drain should be operated from fully closed to fully opened position at least twice a year.

B. Record Keeping

Operation of a dam should include recording of the following:

- Annual Inspection Reports – a collection of written inspection report should be kept on record in Section IV of this manual. Inspection should be conducted annually. Copies should be provided to the Town of Chapel Hill Stormwater Management Section of the Engineering Division.
- Observations – all observations should be recorded. Where periodic inspections are performed following significant rainfall events, these inspections should be logged into the Periodic Inspection, Operation & Maintenance Form in Section IV of this manual.
- Maintenance – written records of maintenance and/or repairs should be recorded on the Periodic Inspection, Operation & Maintenance Form in Section IV of this manual.
- Other Operation Procedures – the owner should maintain a complete and up-to-date set of plans (as-built drawings) and all changes made to the dam over time should be recorded on the as-builts.

C. Sedimentation & Dredging

Sedimentation from establishing areas tributary to the pond will eventually result in the reduction of the retention pool and eventually will have to be removed. The frequency of this sediment removal can be reduced by ensuring that the site areas around the building be stabilized with a vegetative ground cover such that it restrains erosion. This would include a periodic application of fertilizer and other treatments necessary to promote a stable groundcover and minimize sedimentation to the pond. The maintenance on this pond requires that when the sediment level (as measured from the top of the riser to the sediment pool) is within 72" of the top of the riser that the sediment must be removed and the original pond restored. For aesthetic purposes it may be desirable to maintain it prior to this point. Generally, the dredging process begins with the removal of as much water as possible from the deposited silt and so the material can be excavated with conventional equipment for trucking offsite. The removed material should be hauled offsite to a suitable landfill site or mounded somewhere on site and stabilized with a groundcover sufficient to restrain erosion.

Inspection, Operation and Maintenance Checklists

See following pages

(37)

POND INSPECTION CHECKLIST

Date: ________
Time: ________

(Project Name): ____________________________ Watershed Protection Pond # ____, Chapel Hill, NC

SPILLWAYS – DRAINS – OUTLETS

Check/Circle Condition Noted	Observations	Action – Repair	Action – Monitor	Action – Investigative
Principal Spillway	**Type:**			
Trashracks/Debris				
Cracks/Deterioration				
Joint Deterioration				
Improper Alignment				
Cracks/Deterioration				
Joint Deterioration				
Seepage/Piping				
Undercutting				
Erosion				
Debris				
Lake Drain/Other Outlets	**Type:**			
Gates/Valves				
Operability				

General Comments, Sketches & Field Measurements

POND INSPECTION CHECKLIST

Date: ________
Time: ________

(Project Name): ____________________________ Watershed Protection Pond # ____, Chapel Hill, NC

EMBANKMENT -- POOL

Check/Circle Condition Noted	Observations	Action – Repair	Action – Monitor	Action -- Investigative
U/S Slope	**Type:**			
Vegetation/Riprap				
Beaching/slides/cracks				
Undermining/erosion				
Rodent burrows				
Crest	**Type:**			
Ruts/erosion				
Cracks/settlement				
Poor alignment				
D/S Slope	**Type:**			
Vegetation/erosion				
Rodent burrows				
Sloughs/slides/cracks				
Seepage/wetness				
Pool	**Type:**			
Erosion/ground cover				
Sedimentation				
Water quality				
Abutment	**Type:**			
Vegetation/erosion				
Slough/slides/cracks				
Seepage/wetness				

General Comments, Sketches & Field Measurements

PERODIC INSPECTION, OPERATION & MAINTENANCE RECORDS

(Project Name): ______________________________ Watershed Protection Pond # ____, Chapel Hill, NC

Date	Time	Rain "	Pool Level	Weather Conditions	General Observations or Comments	Recorded By

Date	Maintenance Performed	Comments	Recorded By

Date	Equipment Operated	Comments	Recorded By

HYDROGRAPH PARAMETERS

Item		Existing	Proposed	
Drainage Area				
Pervious	[acres]	6.40	4.60	
Impervious	[acres]	0.0	1.80	
Drainage Area	**[acres]**	**6.40**	**6.4**	
Rational C				
Pervious C		0.45	0.45	
Impervious C			0.95	
Composite Rational C		**0.45**	**0.59**	
Time of Concentration, Tc				
Tc	***[min]***	**5.0**	**5.0**	
Intensities, I				
2-year	[in/hr]	5.76	5.76	
50	[in/hr]	9.00	9.00	
100-year	[in/hr]			
Peak Discharge, Qp				Q = CIA
2-year	[cfs]	16.6	21.8	
50	[cfs]	25.9	34.0	
100-year	[cfs]			
Curve Number, CN				
Soil Type				
Hydrologic Soil Group		B		
Pervious CN		59.0	59.0	
Impervious CN		99.0	99.0	
Composite CN		**59.0**	**70.3**	
S		**6.9**	**4.2**	
Precipitation Amount, P for 24 hour storm				
2-year	[inches]	3.60	3.60	
100-year	[inches]	8.00	8.00	
Volume of Runoff, V, from 24-hour storm				v = ((p-.2S)^2)/(p+.8s)
2-year	[inches]	0.53	1.08	
100-year	[inches]		4.49	
2-year	[acre-feet]		0.58	
100-year	[acre-feet]		2.40	
Time-to-Peak, Tp (for use in routing)				
2-year	[minutes]		13.9	Tp = V/(1.39*Qp)
50.0	[minutes]		36.8	
Time Interval for Routing				
2-year	[minutes]	2		
100	[minutes]	2		

[minutes] 60 to ensure basin empties

BASIN PARAMETERS

Riser	Barrel	Emergency Spillway
36 = Dia. riser (inches)	18 = Dia. barrel (inches)	50 = Length
3.3 = Cw riser	0.6 = Cd barrel	3.00 = Cw
314.5 = Crest elev. riser	308 = Invert elev. barrel	317.5 = Crest elevation
1 = height outlet 1 [in.]	Basin	
0.083 = length outlet1 [ft]	70 = width @ normal pool	
0.6 = Cd outlet 1	65 = length @ normal pool	
313.0 = Invert outlet 1	7 :1 = side slopes	
0 = height outlet 2[in.]	313.0 = Initial elev. water level	
0 = length outlet 2 [ft]		
0.6 = Cd outlet 2		

Results

Event	Pre-Development		Post Development With Controls			Post Development No controls		
	Peak Discharge [cfs]	Volume [ac-ft]	Peak Discharge [cfs]	Peak Elevation	Volume [ac-ft]	Peak Discharge [cfs]	Volume [ac-ft]	
2	16.6		14.1	315.09		21.8		
100	25.9	n/a	23.6	316.49		34.0		

ROUTING AND ANALYSIS --2-year storm

Time [min]	Inflow [cfs]	Storage [cubic ft]	Stage [ft]	Outflow [cfs]	Surf. Area [sq.ft]	Q_barrel	Outlet Hydraulics Q_riser weir	orifice	Q em.spil	Q outlet1
0	0.0	0	313.0	0.0	4550	17.5	0.0	0.0	0	0.0
2	1.1	0	313.0	0.0	4550	17.5	0.0	0.0	0	0.0
4	4.2	132	313.0	0.0	4605	17.6	0.0	0.0	0	0.0
6	8.6	632	313.1	0.0	4809	17.8	0.0	0.0	0	0.0
8	13.5	1,661	313.3	0.0	5217	18.2	0.0	0.0	0	0.0
10	17.8	3,276	313.6	0.0	5831	18.8	0.0	0.0	0	0.0
12	20.8	5,414	314.0	0.0	6607	19.4	0.0	0.0	0	0.0
14	21.8	7,907	314.4	0.0	7473	20.1	0.0	0.0	0	0.0
16	20.5	10,514	314.7	3.0	8345	20.7	2.9	15.5	0	0.0
18	17.5	12,624	315.0	10.0	9032	21.2	10.0	23.3	0	0.0
20	14.5	13,519	315.1	13.6	9319	21.4	13.6	25.8	0	0.0
22	12.0	13,623	315.1	14.1	9352	21.4	14.0	26.1	0	0.0
24	10.0	13,377	315.1	13.1	9273	21.3	13.0	25.5	0	0.0
26	8.3	13,007	315.0	11.6	9155	21.3	11.5	24.4	0	0.0
28	6.9	12,614	315.0	10.0	9028	21.2	10.0	23.3	0	0.0
30	5.7	12,236	314.9	8.6	8907	21.1	8.5	22.1	0	0.0
32	4.7	11,890	314.9	7.3	8795	21.0	7.3	21.0	0	0.0
34	3.9	11,578	314.8	6.2	8693	21.0	6.2	19.9	0	0.0
36	3.2	11,299	314.8	5.3	8602	20.9	5.3	18.8	0	0.0
38	2.7	11,051	314.8	4.5	8521	20.9	4.5	17.8	0	0.0
40	2.2	10,831	314.7	3.9	8449	20.8	3.8	16.9	0	0.0
42	1.8	10,636	314.7	3.3	8385	20.8	3.2	16.0	0	0.0
44	1.5	10,462	314.7	2.8	8328	20.7	2.8	15.2	0	0.0
46	1.3	10,308	314.7	2.4	8277	20.7	2.4	14.4	0	0.0
48	1.1	10,171	314.7	2.1	8232	20.7	2.0	13.7	0	0.0
50	0.9	10,050	314.6	1.8	8192	20.6	1.7	13.0	0	0.0
52	0.7	9,941	314.6	1.5	8156	20.6	1.5	12.4	0	0.0
54	0.6	9,844	314.6	1.3	8124	20.6	1.3	11.7	0	0.0
56	0.5	9,758	314.6	1.1	8095	20.6	1.1	11.2	0	0.0
58	0.4	9,680	314.6	1.0	8070	20.5	0.9	10.6	0	0.0
60	0.3	9,611	314.6	0.9	8047	20.5	0.8	10.1	0	0.0
62	0.3	9,549	314.6	0.7	8026	20.5	0.7	9.6	0	0.0
64	0.2	9,494	314.6	0.7	8007	20.5	0.6	9.2	0	0.0
66	0.2	9,444	314.6	0.6	7991	20.5	0.5	8.8	0	0.0
68	0.2	9,399	314.6	0.5	7976	20.5	0.5	8.3	0	0.0
70	0.1	9,358	314.6	0.4	7962	20.5	0.4	8.0	0	0.0
72	0.1	9,321	314.5	0.4	7950	20.5	0.3	7.6	0	0.0
74	0.1	9,288	314.5	0.3	7939	20.5	0.3	7.2	0	0.0
76	0.1	9,258	314.5	0.3	7929	20.4	0.3	6.9	0	0.0
78	0.1	9,231	314.5	0.3	7920	20.4	0.2	6.6	0	0.0
			315.1	14.1	< == maximum 2-yr					

ROUTING AND ANALYSIS -- 100-year storm

Time [min]	Inflow [cfs]	Storage [cubic ft]	Stage [ft]	Outflow [cfs]	Surf. Area [sq.ft]	Outlet Hydraulics Q_barrel	Q_riser weir	Q_riser orifice	Q em.spil	Q outlet1
0	0.0	0	313.0	0.0	4550	17.5	0.0	0.0	0	0.0
2	0.2	0	313.0	0.0	4550	17.5	0.0	0.0	0	0.0
4	1.0	30	313.0	0.0	4562	17.5	0.0	0.0	0	0.0
6	2.2	148	313.0	0.0	4611	17.6	0.0	0.0	0	0.0
8	3.8	410	313.1	0.0	4719	17.7	0.0	0.0	0	0.0
10	5.8	866	313.2	0.0	4903	17.9	0.0	0.0	0	0.0
12	8.2	1,565	313.3	0.0	5180	18.2	0.0	0.0	0	0.0
14	10.8	2,544	313.5	0.0	5556	18.5	0.0	0.0	0	0.0
16	13.6	3,834	313.7	0.0	6037	19.0	0.0	0.0	0	0.0
18	16.4	5,457	314.0	0.0	6623	19.5	0.0	0.0	0	0.0
20	19.3	7,426	314.3	0.0	7309	20.0	0.0	0.0	0	0.0
22	22.2	9,741	314.6	1.1	8090	20.6	1.1	11.1	0	0.0
24	24.8	12,268	314.9	8.7	8917	21.1	8.6	22.2	0	0.0
26	27.3	14,206	315.2	16.6	9537	21.5	16.5	27.6	0	0.0
28	29.4	15,491	315.3	21.7	9942	21.7	22.4	30.5	0	0.1
30	31.2	16,415	315.4	21.9	10231	21.9	26.8	32.4	0	0.1
32	32.6	17,534	315.5	22.1	10578	22.1	32.4	34.5	0	0.1
34	33.5	18,794	315.7	22.3	10966	22.3	38.9	36.7	0	0.1
36	34.0	20,139	315.8	22.6	11376	22.6	46.0	38.8	0	0.1
38	33.9	21,510	315.9	22.8	11790	22.8	53.6	40.8	0	0.1
40	33.4	22,849	316.1	23.0	12192	23.0	61.0	42.6	0	0.1
42	32.4	24,098	316.2	23.2	12564	23.2	68.1	44.2	0	0.1
44	30.9	25,201	316.3	23.3	12890	23.3	74.5	45.5	0	0.1
46	29.1	26,109	316.4	23.5	13158	23.5	79.8	46.6	0	0.1
48	27.1	26,782	316.4	23.6	13355	23.6	83.7	47.3	0	0.1
50	25.2	27,205	316.5	23.6	13479	23.6	86.2	47.8	0	0.1
52	23.5	27,399	316.5	23.6	13536	23.6	87.4	48.0	0	0.1
54	21.9	27,384	316.5	23.6	13532	23.6	87.3	48.0	0	0.1
56	20.4	27,176	316.5	23.6	13471	23.6	86.1	47.8	0	0.1
58	19.0	26,793	316.4	23.6	13359	23.6	83.8	47.4	0	0.1
60	17.7	26,248	316.4	23.5	13199	23.5	80.6	46.7	0	0.1
62	16.5	25,558	316.3	23.4	12996	23.4	76.6	46.0	0	0.1
64	15.4	24,733	316.2	23.3	12752	23.3	71.8	45.0	0	0.1
66	14.3	23,788	316.2	23.1	12472	23.1	66.4	43.8	0	0.1
68	13.4	22,734	316.1	23.0	12157	23.0	60.4	42.5	0	0.1
70	12.4	21,581	315.9	22.8	11811	22.8	53.9	40.9	0	0.1
72	11.6	20,340	315.8	22.6	11437	22.6	47.1	39.1	0	0.1
74	10.8	19,021	315.7	22.4	11035	22.4	40.1	37.0	0	0.1
76	10.1	17,633	315.5	22.1	10609	22.1	32.9	34.7	0	0.1
78	9.4	16,185	315.4	21.9	10159	21.9	25.7	31.9	0	0.1
			316.5	23.6	< == maximum (100-yr)					

ROUTING AND ANALYSIS -- large time increment to analyze basin emptying time

Time [hours]	Inflow [cfs]	Storage [cubic ft]	Stage [ft]	Outflow [cfs]	Surf. Area [sq.ft]	Q_barrel	Outlet Hydraulics Q_riser weir	orifice	Q em.spil	Q outlet1
0	0.0	8,750	314.5	0.00	7826	20.4	0.0	0.0	0	0.0
24	0.0	5,664	314.0	0.03	6696	19.5	0.0	0.0	0	0.0
48	0.0	3,072	313.6	0.03	5755	18.7	0.0	0.0	0	0.0
72	0.0	1,210	313.3	0.02	5040	18.0	0.0	0.0	0	0.0

HYDROGRAPH PARAMETERS

Item		**Existing**	**Proposed**	
Drainage Area				
Pervious	[acres]	3.20	1.80	
Impervious	[acres]	0.0	1.40	
Drainage Area	**[acres]**	**3.20**	**3.2**	
Rational C				
Pervious C		0.45	0.45	
Impervious C			0.95	
Composite Rational C		**0.45**	**0.67**	
Time of Concentration, Tc				
Tc	***[min]***	**5.0**	**5.0**	
Intensities, I				
2-year	[in/hr]	5.76	5.76	
50	[in/hr]	9.00	9.00	
100-year	[in/hr]			
Peak Discharge, Qp				Q = CIA
2-year	[cfs]	8.3	12.3	
50	[cfs]	13.0	19.3	
100-year	[cfs]			
Curve Number, CN				
Soil Type				
Hydrologic Soil Group		B		
Pervious CN		59.0	59.0	
Impervious CN		99.0	99.0	
Composite CN		**59.0**	**76.5**	
S		**6.9**	**3.1**	
Precipitation Amount, P for 24 hour storm				
2-year	[inches]	3.60	3.60	
100-year	[inches]	8.00	8.00	
Volume of Runoff, V, from 24-hour storm				
2-year	[inches]	0.53	1.47	v = ((p-.2S)^2)/(p+.8s)
100-year	[inches]		5.22	
2-year	[acre-feet]		0.39	
100-year	[acre-feet]		1.39	
Time-to-Peak, Tp (for use in routing)				
2-year	[minutes]		16.6	Tp = V/(1.39*Qp)
50.0	[minutes]		37.7	
Time Interval for Routing				
2-year	[minutes]	2		
100	[minutes]	2		

[minutes] 60 to ensure basin empties

BASIN PARAMETERS

Riser	Barrel	Emergency Spillway
36 = Dia. riser (inches)	15 = Dia. barrel (inches)	50 = Length
3.3 = Cw riser	0.6 = Cd barrel	3.00 = Cw
316.3 = Crest elev. riser	312 = Invert elev. barrel	319.0 = Crest elevation
1 = height outlet 1 [in.]	Basin	
0.083 = length outlet1 [ft]	103 = width @ normal pool	
0.6 = Cd outlet 1	102 = length @ normal pool	
316.0 = Invert outlet 1	7 :1 = side slopes	
0 = height outlet 2[in.]	316.0 = Initial elev. water level	
0 = length outlet 2 [ft]		
0.6 = Cd outlet 2		

Results

Event	Pre-Development		Post Development With Controls			Post Development No controls		
	Peak Discharge [cfs]	Volume [ac-ft]	Peak Discharge [cfs]	Peak Elevation	Volume [ac-ft]	Peak Discharge [cfs]	Volume [ac-ft]	
2	8.3		8.0	316.70		12.3		
100	13.0	n/a	12.8	317.35		19.3		

ROUTING AND ANALYSIS --2-year storm

Time [min]	Inflow [cfs]	Storage [cubic ft]	Stage [ft]	Outflow [cfs]	Surf. Area [sq.ft]	Q_barrel	Outlet Hydraulics Q_riser weir	Q_riser orifice	Q em.spil	Q outlet1
0	0.0	0	316.0	0.0	10506	10.8	0.0	0.0	0	0.0
2	0.4	0	316.0	0.0	10506	10.8	0.0	0.0	0	0.0
4	1.7	52	316.0	0.0	10520	10.8	0.0	0.0	0	0.0
6	3.6	254	316.0	0.0	10575	10.9	0.0	0.0	0	0.0
8	5.8	680	316.1	0.0	10691	10.9	0.0	0.0	0	0.0
10	8.1	1,375	316.1	0.0	10878	11.0	0.0	0.0	0	0.0
12	10.1	2,345	316.2	0.0	11137	11.2	0.0	0.0	0	0.0
14	11.6	3,557	316.3	0.1	11457	11.3	0.1	5.3	0	0.0
16	12.3	4,931	316.4	1.7	11815	11.5	1.7	12.9	0	0.0
18	12.1	6,201	316.5	3.9	12141	11.7	3.9	17.0	0	0.0
20	11.1	7,189	316.6	5.9	12392	11.8	5.9	19.6	0	0.0
22	9.6	7,812	316.7	7.3	12549	11.9	7.3	21.0	0	0.0
24	8.2	8,083	316.7	8.0	12617	11.9	7.9	21.6	0	0.0
26	7.0	8,111	316.7	8.0	12625	11.9	8.0	21.6	0	0.0
28	6.0	7,989	316.7	7.7	12594	11.9	7.7	21.4	0	0.0
30	5.1	7,780	316.7	7.2	12541	11.9	7.2	20.9	0	0.0
32	4.4	7,525	316.7	6.7	12477	11.8	6.6	20.3	0	0.0
34	3.7	7,251	316.6	6.1	12408	11.8	6.0	19.7	0	0.0
36	3.2	6,974	316.6	5.5	12337	11.8	5.4	19.0	0	0.0
38	2.7	6,703	316.6	4.9	12269	11.7	4.9	18.3	0	0.0
40	2.3	6,445	316.6	4.4	12203	11.7	4.3	17.7	0	0.0
42	2.0	6,202	316.5	3.9	12141	11.7	3.9	17.0	0	0.0
44	1.7	5,976	316.5	3.5	12083	11.7	3.4	16.3	0	0.0
46	1.5	5,766	316.5	3.1	12030	11.6	3.1	15.7	0	0.0
48	1.3	5,572	316.5	2.7	11980	11.6	2.7	15.1	0	0.0
50	1.1	5,395	316.5	2.4	11934	11.6	2.4	14.5	0	0.0
52	0.9	5,231	316.5	2.2	11892	11.6	2.1	14.0	0	0.0
54	0.8	5,082	316.5	1.9	11854	11.5	1.9	13.4	0	0.0
56	0.7	4,945	316.4	1.7	11818	11.5	1.7	12.9	0	0.0
58	0.6	4,819	316.4	1.5	11786	11.5	1.5	12.4	0	0.0
60	0.5	4,704	316.4	1.4	11756	11.5	1.3	12.0	0	0.0
62	0.4	4,599	316.4	1.2	11729	11.5	1.2	11.5	0	0.0
64	0.4	4,503	316.4	1.1	11704	11.5	1.1	11.1	0	0.0
66	0.3	4,414	316.4	1.0	11681	11.5	1.0	10.7	0	0.0
68	0.3	4,333	316.4	0.9	11660	11.4	0.9	10.3	0	0.0
70	0.2	4,259	316.4	0.8	11640	11.4	0.8	9.9	0	0.0
72	0.2	4,191	316.4	0.7	11623	11.4	0.7	9.6	0	0.0
74	0.2	4,128	316.4	0.6	11606	11.4	0.6	9.2	0	0.0
76	0.1	4,070	316.4	0.6	11591	11.4	0.6	8.9	0	0.0
78	0.1	4,017	316.4	0.5	11577	11.4	0.5	8.6	0	0.0
			316.7	8.0	< == maximum 2-yr					

ROUTING AND ANALYSIS -- 10-year storm

Time [min]	Inflow [cfs]	Storage [cubic ft]	Stage [ft]	Outflow [cfs]	Surf. Area [sq.ft]	Q_barrel	Outlet Hydraulics Q_riser weir	orifice	Q em.spil	Q outlet1
0	0.0	0	316.0	0.0	10506	10.8	0.0	0.0	0	0.0
2	0.1	0	316.0	0.0	10506	10.8	0.0	0.0	0	0.0
4	0.5	16	316.0	0.0	10510	10.8	0.0	0.0	0	0.0
6	1.2	80	316.0	0.0	10528	10.9	0.0	0.0	0	0.0
8	2.1	221	316.0	0.0	10566	10.9	0.0	0.0	0	0.0
10	3.2	468	316.0	0.0	10633	10.9	0.0	0.0	0	0.0
12	4.4	846	316.1	0.0	10736	11.0	0.0	0.0	0	0.0
14	5.8	1,376	316.1	0.0	10879	11.0	0.0	0.0	0	0.0
16	7.4	2,075	316.2	0.0	11066	11.1	0.0	0.0	0	0.0
18	8.9	2,956	316.3	0.0	11299	11.3	0.0	0.0	0	0.0
20	10.5	4,027	316.4	0.5	11580	11.4	0.5	8.7	0	0.0
22	12.1	5,227	316.5	2.2	11891	11.6	2.1	13.9	0	0.0
24	13.6	6,423	316.6	4.3	12197	11.7	4.3	17.6	0	0.0
26	15.0	7,539	316.7	6.7	12481	11.8	6.7	20.4	0	0.0
28	16.3	8,538	316.7	9.1	12732	12.0	9.0	22.5	0	0.0
30	17.3	9,405	316.8	11.2	12948	12.1	11.2	24.2	0	0.0
32	18.2	10,137	316.9	12.1	13129	12.1	13.1	25.5	0	0.0
34	18.8	10,862	316.9	12.2	13308	12.2	15.1	26.8	0	0.0
36	19.2	11,651	317.0	12.3	13501	12.3	17.4	28.0	0	0.0
38	19.3	12,473	317.0	12.4	13702	12.4	19.8	29.3	0	0.0
40	19.1	13,297	317.1	12.5	13901	12.5	22.3	30.4	0	0.0
42	18.7	14,089	317.2	12.6	14092	12.6	24.7	31.5	0	0.0
44	18.0	14,821	317.2	12.6	14267	12.6	27.0	32.5	0	0.0
46	17.1	15,462	317.3	12.7	14420	12.7	29.1	33.3	0	0.0
48	16.0	15,985	317.3	12.7	14545	12.7	30.8	33.9	0	0.0
50	14.9	16,374	317.3	12.8	14637	12.8	32.1	34.4	0	0.0
52	13.9	16,630	317.3	12.8	14698	12.8	32.9	34.7	0	0.0
54	13.0	16,764	317.3	12.8	14730	12.8	33.4	34.8	0	0.0
56	12.1	16,786	317.3	12.8	14735	12.8	33.4	34.9	0	0.0
58	11.3	16,703	317.3	12.8	14715	12.8	33.1	34.8	0	0.0
60	10.6	16,524	317.3	12.8	14673	12.8	32.6	34.6	0	0.0
62	9.9	16,257	317.3	12.8	14610	12.8	31.7	34.2	0	0.0
64	9.2	15,908	317.3	12.7	14527	12.7	30.5	33.8	0	0.0
66	8.6	15,485	317.3	12.7	14426	12.7	29.2	33.3	0	0.0
68	8.0	14,993	317.2	12.7	14309	12.7	27.6	32.7	0	0.0
70	7.5	14,437	317.2	12.6	14176	12.6	25.8	32.0	0	0.0
72	7.0	13,825	317.1	12.5	14028	12.5	23.9	31.2	0	0.0
74	6.5	13,159	317.1	12.5	13868	12.5	21.8	30.3	0	0.0
76	6.1	12,446	317.0	12.4	13695	12.4	19.7	29.2	0	0.0
78	5.7	11,690	317.0	12.3	13511	12.3	17.5	28.1	0	0.0
			317.3	12.8	< == maximum (100-yr)					

ROUTING AND ANALYSIS -- large time increment to analyze basin emptying time

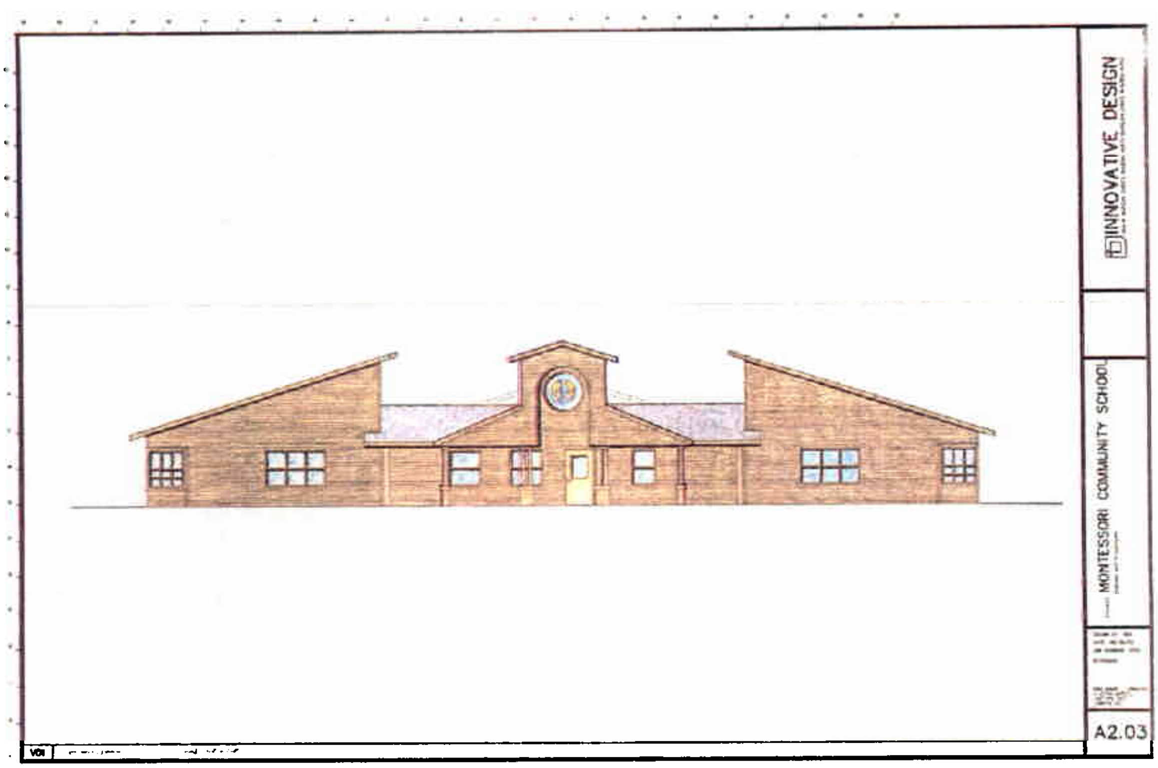
Time [hours]	Inflow [cfs]	Storage [cubic ft]	Stage [ft]	Outflow [cfs]	Surf. Area [sq.ft]	Outlet Hydraulics Q_barrel	Q_riser weir	Q_riser orifice	Q em.spil	Q outlet1
0	0.0	3,300	316.3	0.00	11385	11.3	0.0	0.0	0	0.0
24	0.0	1,943	316.2	0.01	11030	11.1	0.0	0.0	0	0.0
48	0.0	904	316.1	0.01	10751	11.0	0.0	0.0	0	0.0
72	0.0	505	316.0	0.00	10643	10.9	0.0	0.0	0	0.0

Photo #9

Photo #10

Photo #11

Photo #12



Proposed Cosmetic Renovations to Administration Building


Photo #1


Photo #2


Photo #3


Photo #4


Photo #5


Photo #6


Photo #7


Photo #8