



PRYDE SCHROPP McCOMB INC.  
CONSULTING ENGINEERS

**STORMWATER MANAGEMENT REPORT (FINAL)**

**COBBLE BEACH DEVELOPMENT  
STAGE 1 (2007)**

**PART OF LOTS 28 TO 34, CONCESSION 3  
FORMER TOWNSHIP OF SARAWAK  
TOWNSHIP OF GEORGIAN BLUFFS  
COUNTY OF GREY**

Prepared for:  
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July, 2007

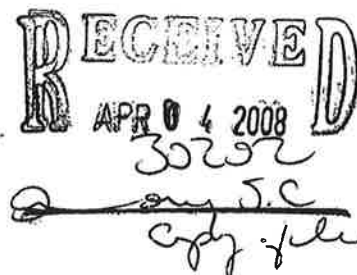
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Ministry of the Environment  
Ministère de l'Environnement

CERTIFICATE OF APPROVAL  
MUNICIPAL AND PRIVATE SEWAGE WORKS  
NUMBER 2080-74ZPJQ  
Issue Date: March 26, 2008

Georgian Villas Inc.  
Post Office Box, No. 911  
Owen Sound, Ontario  
N4K 6H6



Site Location: Cobble Beach- Stage 1  
Lot 28-32, Concession 3  
Georgian Bluffs Township,  
County of Grey.

*You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:*

establishment of Stormwater Management Works to service approximately 86ha. residential/golf course/commercial development and 11.4ha. external roadways (Grey County Road) except for the areas denoted as 210 (3.7ha.) and 211 (2.29ha.) located on the west shores of Owen Sound Bay (Georgian Bay), for normal level of quality control comprising of the following:

**Pond 2 (to service 14.5ha.):**

- a wet pond with two (2) open channel inlets consisting of approximate permanent pool volume of 6,100cu.m., extended detention volume of 1,512cu.m. and total storage volume of 7,612cu.m., together with:
- one (1) 150mm diameter outlet pipe to discharge onto a rip-rapped channel leading into the Owen's Sound Bay,
- one (1) 10m wide 900mm deep stepped trapezoidal overflow spillway to discharge pond water to the Owen's Sound Bay via a rip-rap channel,

**Pond 3 (to service 62.7ha.):**

- a wet pond with one (1) triple-500mm and one (1) 600mm diameter CSP inlets, one (1) 120m long approximately 5m wide natural forebay with two (2) open channel inlets, and consists of approximate permanent pool volume of 16,170cu.m., extended detention volume of 2,803cu.m. and total storage volume of 18,973cu.m. together with:
- one (1) 250mm diameter outlet pipe to discharge onto a rip-rap apron (discharge point DP#2) to the Owen's Sound of Georgian Bay via a 8m wide 1m deep, approximately 420m long grassed trapezoidal ditch and two (2) 1200mm diameter culverts under McLeese Drive,

- one (1) 13.6m wide 450mm deep trapezoidal overflow spillway to discharge pond water to the Owen's Sound Bay via the trapezoidal ditch and the twin culvert under McLeese Drive;

**Grassed swale/ditch** (to service 3.07ha. # 212 area): - one (1) 3.25m wide 500mm deep, approximately 150m long trapezoidal grassed swale/ditch complete with straw bale or rock check dams to discharge storm water onto a rip-rap apron (discharge point DP#3) of the Owen's Sound Bay at the east end of the Church Side Road East;

including appurtenances, spill control and erosion/sedimentation control measures to minimize the effects on external lands and to the receiver Bay;

all in accordance with the **Application for Approval of Municipal and Private Sewage Works, Stormwater Management Facility**, dated April 16 and received May 2, 2007, Stormwater Management Report July 2007, Plans drawing Map 6 (Rev 2) and addendum documents prepared and submitted by Stephen Cobean, P.Eng., Pryde Schropp McComb Inc., Consulting Engineers.

*For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:*

*"Certificate"* means this entire Certificate of Approval document, issued in accordance with Section 53 of the Ontario Water Resources Act, and includes any schedules;

*"Director"* means any Ministry employee appointed by the Minister pursuant to Section 5 of the Ontario Water Resources Act;

*"Ministry"* means the Ontario Ministry of the Environment;

*"District Manager"* means the District Manager of the Barrie District Office of the Ministry;

*"Owner"* means Georgian Villas Inc. and included its heirs and assignees.

*"Municipality"* means The Township of Georgian Bluffs; and,

*"Works"* means the sewage works described in the Owner's application, this Certificate and in the supporting documentation referred to herein, to the extent approved by this Certificate.

*You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:*

## TERMS AND CONDITIONS

### 1. GENERAL PROVISIONS

(1) Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and

maintain the Works in accordance with the description given in this Certificate, the application for approval of the works and the submitted supporting documents and plans and specifications as listed in this Certificate.

(2) Where there is a conflict between a provision of any submitted document referred to in this Certificate and the Conditions of this Certificate, the Conditions in this Certificate shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

(3) Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

(4) This certificate is for Phase 1 works only as shown on drawing No. MAP6 revision 2 and the Owner shall request amendment of the certificate for Phase 2 works, when future construction approval for the areas denoted as 210 (3.7ha.) and 211 (2.29ha.) is required.

2. EXPIRY OF APPROVAL

The approval issued by this Certificate will cease to apply to those parts of the Works which have not been constructed within five (5) years of the date of this Certificate.

3. CHANGE OF OWNER

The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within thirty (30) days of the change occurring:

- (a) change of Owner;
- (b) change of address of the Owner;
- (c) change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c.B17 shall be included in the notification to the District Manager; and
- (d) change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the District Manager.

4. OPERATION AND MAINTENANCE.

(1) The Owner shall ensure that the design minimum liquid retention volumes are maintained in the wetponds at all times.

(2) The Owner shall inspect the Works at least once a year and, if necessary, clean and maintain the Works to prevent the excessive build-up of sediments and/or vegetation.

(3) The Owner shall maintain a logbook to record the results of these inspections and any cleaning and maintenance operations undertaken, and shall keep the logbook updated and ready at the site for inspection by the Ministry. The logbook shall include the following:

- (a) the name of the Works; and
- (b) the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed.

5. RECORD KEEPING

The Owner shall retain for a minimum of five (5) years from the date of their creation, all records and information related to or resulting from the operation and maintenance activities required by this Certificate.

6. MONITORING OF THE POND EFFLUENT

The Owner shall carry out the following monitoring program for the performance evaluation of the facility to meet the design projected level of seventy percent (70%) removal of Total Suspended Solids (TSS) in the stormwater ponds prior discharge out to the Georgian Bay.

(1) At least thirty (30) days prior to the anticipated commencement date of the monitoring program, the Owner shall submit to the District Manager for review and approval a detailed work plan for the monitoring program outlining the parameters to be monitored, the sampling locations, sampling protocols, techniques and frequencies, as well as the detection limits of laboratory procedures.

(2) The monitoring program shall commence upon connection of the outlet control structure of the facilities to the receiving water course and shall continue for two years thereafter.

(3) Samples shall be collected at the following sampling points, at the frequency specified, by means of the specified sample type and analyzed for each parameter listed and all results recorded:

<b>Table 1 - Water Quality Monitoring</b>	
<b>Sampling Location:</b> 1. pond inlet structures and 2. at the proposed outlet headwalls (DP#1 and DP#2); Indian Creek (as control), Creek 1 and at Creek 2 as shown on MAP 6, dated 18.10.2007.	
<b>Type-</b> Grab	
<b>Frequency-</b> for the detailed characterization of the water quality treatment performance of the facility during a minimum of three (3) rainfall/run-off events per year (spring, summer and fall) at least one of the events being a spring freshet event. A minimum of three (3) grab samples at each location per year is necessary.	
<b>Parameters:</b>	
- CBOD5	
- Total Suspended Solids	
- Total Phosphorus	
- Dissolved Nutrients (including Phosphates, Nitrates, Nitrites and Ammonia)	
- Metals (including antimony, mercury, arsenic, cadmium, copper, lead, zinc, nickel, iron, vanadium, chromium, tin, and cobalt).	
- Chloride	

(4) The methods and protocols for sampling, analysis and recording shall conform, in order of precedence, to the methods and protocols specified in the following:

- (a) the Ministry's Procedure F-10-1, "Procedures for Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works (Liquid Waste Streams Only), as amended from time to time by more recently published editions;
- (b) the Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (January 1999), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions;
- (c) the publication "Standard Methods for the Examination of Water and Wastewater" (20th edition), as amended from time to time by more recently published editions;

(5) The Owner shall prepare, and submit to the District Manager a performance report, on an annual basis, by April 30th of each year. The first such report shall cover the annual period following the commencement of operation of the Works and subsequent reports shall be submitted to cover successive annual monitoring periods following thereafter. The reports shall contain, but not be limited to, the following information:

- (a) a summary and interpretation of all monitoring data and the performance of the facility based on Total Suspended Solids removal and its effect (if any) on the receiving water body, including comparison of the water quality data with applicable criteria such as the Provincial Water Quality Objectives (PWQOs);
- (b) an evaluation of the pond's performance and its ability to meet the design performance criteria of 70% Total Suspended Solids removal on a long-term average basis.
- (c) a description of any operating problems encountered and corrective actions taken during the reporting period and the need for further investigations in the following reporting period for pond refinements or ways of improving the performance of the facility to meet the performance target;
- (d) any need for modifications of the monitoring program and/or the work plan; and a summary of any complaints received during the reporting period and any steps taken to address the complaints;
- (f) any other information that is deemed to have been obtained by the Owner pursuant to the requirements of this certificate that the District Manager requires for inclusion in the reports from time to time.

(6) In the annual report prepared at the end of three (3), the Owner shall include recommendations for either continuation of the monitoring program, or the cessation of it, as appropriate from a conclusion based on all previous evaluations of the performance of the facility. A recommendation for the termination of the monitoring program must be accompanied by analytical interpretation of previous monitoring results and performance trends demonstrated to the satisfaction of the Ministry that the facility achieves its design target of 70% removal of Total Suspended Solids and metals on a reasonably continuous basis.

*The reasons for the imposition of these terms and conditions are as follows:*

1. Condition 1 is imposed to ensure that the Works are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the Certificate and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.
2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment..
3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to approved works and to ensure that subsequent owners of the works are made aware of the certificate and continue to operate the works in compliance with it.
4. Condition 4 is included to require that the Works be properly operated and maintained such that the environment is protected .
5. Condition 5 is included to require that all records are retained for a sufficient time period to adequately evaluate the long-term operation and maintenance of the Works.
6. Condition 6 is included to ensure that the effluent quality is monitored and the performance of the works is evaluated, recorded and reported on an annual basis to ensure that the Works are operated in a manner that minimizes any off property impacts from the construction works and stormwater discharged from the site is to the receiver sewer during periods and at rates that minimizes the environmental impact on the receiver.

*In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:*

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

*The Notice should also include:*

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

*And the Notice should be signed and dated by the appellant.*

*This Notice must be served upon:*

The Secretary\*  
Environmental Review Tribunal

The Director  
Section 53, *Ontario Water Resources Act*

2300 Yonge St., Suite 1700  
P.O. Box 2382  
Toronto, Ontario  
M4P 1E4

AND

Ministry of the Environment  
2 St. Clair Avenue West, Floor 12A  
Toronto, Ontario  
M4V 1L5

\* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or [www.ert.gov.on.ca](http://www.ert.gov.on.ca)

*The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.*

DATED AT TORONTO this 26th day of March, 2008

THIS CERTIFICATE WAS MAILED
ON <u>April 01, 2008</u>
<u>N.P</u>
(Signed)



Mansoor Mahmood, P.Eng.  
Director  
Section 53, Ontario Water Resources Act

MN/

c: District Manager, MOE Owen Sound  
Clerk, The Township of Georgian Bluffs.  
Stephen Cobean, P.Eng., Pryde Schropp McComb Inc. ✓



## **Table of Contents**

	<b>Page</b>
<b>1.0 INTRODUCTION</b>	<b>1</b>
1.1 Background and Objective	1
1.1.1 Phase 1 (File No. 42T-2004-02)	1
1.1.2 Phase 2 (File No. 42T-2006-02)	5
1.2 Site Description	6
1.3 Background Reports	7
1.4 Stormwater Management – Phase 1 and 2 (Preliminary)	9
1.5 Stormwater Management Criteria	10
<b>2.0 STORMWATER MANAGEMENT PLAN</b>	<b>12</b>
2.1 Methodology	12
2.2 Pre-Development Drainage Conditions	12
2.3 Post Development Drainage Conditions and Proposed Stormwater Management Plan	14
2.3.1 Description of Proposed Land Uses	14
2.3.2 Road Cross Section	14
2.3.3 Post Development Drainage Conditions	15
2.3.4 Major System Flow	20
2.3.5 Stormwater Quality Control	21
<b>3.0 FUTURE DEVELOPMENT</b>	<b>27</b>
<b>4.0 EROSION AND SEDIMENTATION CONTROL</b>	<b>28</b>
<b>5.0 CONCLUSION</b>	<b>30</b>

## **Table of Contents Continued**

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### **LIST OF FIGURES**

Figure 1	Regional Location Map	2
Figure 2	First Stage of Development	4
Figure 3	Typical Cross Section – 18.0 m	16
Figure 4	Typical Cross Section – 20.0 m	17
Figure 5	Typical Cross Section – 30.0 m	18

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### **LIST OF TABLES**

Table 1	Proposed Development Details	3
Table 2	Post Development Discharge Summary	20

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### **LIST OF MAPS**

Map 1	Post Development Drainage Map – Minor System	Enclosed
Map 2	Post Development Drainage Map – Major System	Enclosed
Map 3	Pond 2 Outlet Site Plan, Cross-Section and Details	Enclosed
Map 4	Pond 3 Outlet Site Plan, Cross-Section and Details	Enclosed
Map 5	Erosion and Sedimentation Control Plan	Enclosed

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### **LIST OF APPENDICES**

APPENDIX A	Draft Plan of Subdivision – January 24, 2006
APPENDIX B	Modeling Input Parameters
APPENDIX C	MIDUSS Output Files - Pond 2 & Pond 3, 2 Year – 2 Hour Storm
APPENDIX D	MIDUSS Output Files – 5 Year – 6 Hour Storm
APPENDIX E	MIDUSS Output Files – 100 Year – 6 Hour Storm
APPENDIX F	Storm Sewer Design Sheets
APPENDIX G	MIDUSS Output Files – 100 Year – Road Cross Section Analysis

## **1.0 Introduction**

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### **1.1 BACKGROUND AND OBJECTIVE**

The proposed Cobble Beach development (formerly Georgian Villas) is a new residential/golf course development located on the west shores of Owen Sound Bay (Georgian Bay). Refer to Figure 1 for the Regional Location Map of the site.

Phases 1 and 2 of the development will comprise of up to 352 single family residential units, 63 townhouse units and up to 191 multi-family units on approximately 86 ha of the site. A third phase, which will not be developed for a number of years, will consist of 184 single family units and 215 multi-family units. Table 1 provides details of the residential density being proposed for the various phases of the Cobble Beach Development.

As part of the review for Draft Plan Approval for Phase 2 (File No. 42T-2006-02), a report entitled **Stormwater Management Report – Cobble Beach Development – Phase 1 and 2**, August, 2006, as prepared by Pryde Schropp McComb, Inc.

Enclosed in Appendix A, are the Draft Plans for both Phase 1 and Phase 2 that have been approved by the County of Grey.

Plans are now underway for registration of portions of the two (2) Draft Plans to be referred to as **Stage 1 (2007)**. Figure 2 provides details of the first stage of registration planned for 2007. The objective of this report is to prepare a Stormwater Management (SWM) Plan for Stage 1 (2007) of the Cobble Beach Development that will address how runoff from the site will be handled on site, in order to meet the requirements of the Ministry of Environment, Grey Sauble Conservation Authority and Township of Georgian Bluffs. The design of the stormwater management facilities for Stage 1 (2007) will take into consideration all of Phases 1 and 2 to ensure that these facilities can accommodate the ultimate development of both phases.

The report will be used to assist in the satisfying of Conditions of Draft Approval as summarized below.

#### **1.1.1 Phase 1 (File No. 42T-2004-02)**

- 2. That Phase 1 consist of that portion of the golf course within this plan (Blocks 15, 16 & 17a & b) and the equivalent of 400 residential units. The type and location of these units will be determined through the zoning by-law amendment process. The zoning by-law process, including the use of the holding (-h) provision will include confirmation of approval from the Ministry of the Environment for the site servicing of Phase 1 which will include sewage collection, treatment and disposal, potable water distribution, storm water management and surface water drainage.*



MAP DERIVED FROM BRUCE PENINSULA REGIONAL MAP BY RAND McNALLY, 2005

Client/Project

SCALE 1:250,000

COBBLE BEACH

Georgian Bluffs, Ontario

Figure No.

1

Title

REGIONAL LOCATION MAP



**PRYDE SCHROPP McCOMB INC.**  
CONSULTING ENGINEERS



ORIGINAL SHEET - 8.5 X 11  
T:\Municipal-Private\Georgian Village\20202-Planning Approval\Figural\20202 Fig 1-Reg-Location  
2006 August 08, 1:28 p.m.



# **TABLE 1** **COBBLE BEACH** **PROPOSED DEVELOPMENT DETAILS**

## **RESIDENTIAL UNITS**

Development Stage <sup>5</sup>	Yrs: 2007-2009	Yrs: 2013-2020	Yrs: 2021-2028	TOTALS
	Stage 1 <sup>1</sup>	Balance of Draft Approved lands (Draft 1 & Draft 2) <sup>2,4</sup>	Future Development <sup>3</sup>	
Single-Family	72	280	169	<b>521 units</b>
Townhouse	28	35	0	<b>63 units</b>
Multiple Family	92	99	216	<b>407 units</b>
Village Centre Residential	0	200	0	<b>200 units</b>
<b>Total Residential Units</b>	<b>192</b>	<b>614</b>	<b>385</b>	<b>1,191 units</b>

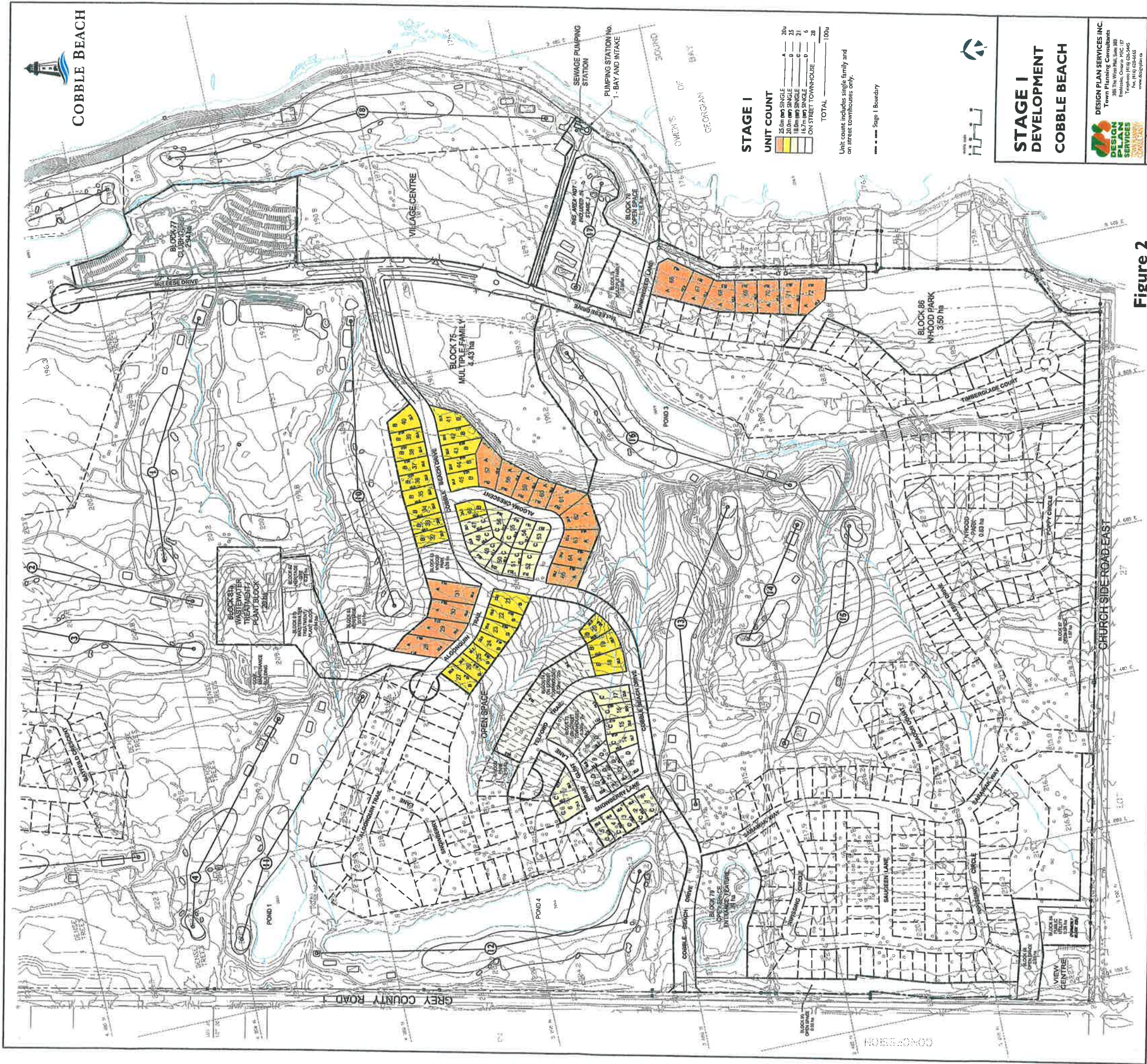
## **COMMERCIAL SQUARE FOOTAGE**

	Yrs: 2007-2012	Yrs: 2013-2018	Yrs: 2019-2025	TOTALS
Clubhouse/Inn <sup>6</sup>	27,484			<b>27,484 sq.ft.</b>
Starters Hut	1,000			<b>1,000 sq.ft.</b>
View House	3,300			<b>3,300 sq.ft.</b>
Village Centre Commercial <sup>7,8</sup>		26,911	26,910	<b>53,821 sq.ft.</b>
<b>TOTAL</b>	<b>31,784</b>	<b>26,911</b>	<b>26,910</b>	<b>85,605 sq.ft.</b>

### **Notes:**

- Unit Counts for Stage 1 based on a plan prepared by Design Plan Service dated February 8, 2007
- Unit Counts for Balance of Draft Approved Lands based on difference between Draft 1 (DPS Sept 14, 2007) and Draft 2 (DPS Feb 6, 2007) and Stage 1 dwg (DPS Feb 8, 2007)
- Unit Counts for Future Development based on Overall Development Concept dated December 14, 2006, as prepared by Design Plan Services.
- Unit Counts for Phases 1 and 2 represent the maximum units possible.
- Development Stage based on approximately 60 units per year absorption rate
- Clubhouse also includes a 2nd floor Inn (10 rooms) and basement cart storage.
- Nature of Village Centre commercial/retail space to be determined. It would likely contain a hotel/inn, small shops and restaurants along with some community areas like a Pavilion.
- Village Centre commercial includes a 36 room hotel.







*All other lands intended for residential, commercial or mixed use purposes, included in this approval will be subject to the holding provision until sufficient supply of municipal services (sewer and water) are confirmed by the appropriate authority.*

- 17. That a Master Servicing Plan be prepared by a technically qualified consultant for the approval of the Township of Georgian Bluffs in consultation with the Ministry of the Environment and Grey Sauble Conservation Authority. The Master Servicing Plan shall include provisions for sanitary sewage, potable water services, road construction, utility services and surface/storm water management. The report will also detail the methods that will be used to control surface water flow and erosion and sedimentation within the development lands and abutting properties during and following construction. The Master Servicing Plan shall include suitable provisions for phasing of certain works and be incorporated into the Subdivision Agreement.*
- 18. That Block 27 shall be deeded to the Township of Georgian Bluffs for storm water management purposes. The Subdivision Agreement shall contain appropriate provisions for the granting of an easement for Block 27 for the owner of the golf course to use and maintain the block as a golf course feature as well as provisions for the maintenance of the block for its storm water management purposes.*

**1.1.2 Phase 2 (File No. 42T-2006-02)**

- 18. That a Master Servicing Plan be prepared by a technically qualified consultant for the approval of the Township of Georgian Bluffs in consultation with the Ministry of the Environment and Grey Sauble Conservation Authority. The Master Servicing Plan shall include provisions for sanitary sewage, potable water services, road construction, utility services and surface/storm water management. The report will also detail the methods that will be used to control surface water flow and erosion and sedimentation within the development lands and abutting properties during and following construction. The Master Servicing Plan shall include suitable provisions for phasing of certain works and be incorporated into the Subdivision Agreement.*

This report will be submitted to the County of Grey's Planning Department, Township of Georgian Bluffs and Grey-Sauble Conservation Authority in support of the preparation of Clearance Letters to permit final approval of Stage 1 (2007) of the Cobble Beach project.

## **1.2 SITE DESCRIPTION**

The Cobble Beach property is located on the western shore of Owen Sound Bay (Georgian Bay) along Grey County Road No. 1, approximately 10 kms north of the City of Owen Sound.

The property is legally described as Part Lots 28, 29 and 34 and all of Lots 30 through 33, Concession 3, former Township of Sarawak, County of Grey.

The property is bounded on the south by Church Sideroad East, on the west by Grey County Rd. No. 1, on the north by Presqu'île Road, and on the east side by Owen Sound Bay. Phases 1 and 2 encompass approximately 86 hectares of the 235 hectare site. Phase 3 will be developed at a later time and will be handled by a separately approved stormwater management plan.

The existing land use of the property consists mainly of vacant grass fields and wooded areas. There is a single family residence located in the middle of the site on the southerly portion of the property.

As outlined above, Stage 1 (2007) is a combination of both Phases 1 and 2 as detailed in Figure 2. A golf course has been recently constructed on the site which will form part of the overall development.



### **1.3 BACKGROUND REPORTS**

The following background reports have been previously prepared which are relevant to the subject lands:

- **Georgian Villas Inc., Scoped Environmental Impact Study, Woodlot C and Phase 2 Final**, as prepared by SAAR, August 1, 2006 (Final Submission).
- **Georgian Villas Inc., Scoped Environmental Impact Assessment, Part Lots 28,29,34, All Lots 30-33, Concession III**, as prepared by SAAR, June 11, 2004
- **Georgian Villas Inc., Scoped Environmental Impact Assessment Interior Forest Birds and Fisheries Habitat 2002** (Submission for Team Review), as prepared by SAAR, February, 2002.
- **Georgian Villas Inc., Environmental Impact Assessment, Part Lots 28, 29, 34, All Lots 30-33, Concession III**, as prepared by SAAR, October 9, 2000.
- **Georgian Villas Inc., Cobble Beach, Township of Georgian Bluffs: Traffic Impact Study (Revised)**, as prepared by Stantec Consulting Ltd., July, 2006
- **Design Report, First Expansion of East Linton Water Treatment Plan and Storage Facilities**, as prepared by Henderson Paddon, September, 2006.
- **Internal Watermain Sizing Analysis, March 2005, (Revised)**, as prepared by Henderson Paddon & Associates Limited, April, 2006.
- **MEA Class Final EA Municipal Water Supply Volumes 1 & 2 2005**, as prepared by Henderson Paddon & Associates, July, 2005.
- **Detailed Cost Information, Class EA Municipal Supply**, as prepared by Henderson Paddon & Associates, December 2, 2004.
- **Summary Report, Open House Municipal Water Supply Class EA**, as prepared by Henderson Paddon & Associates, December, 2004.
- **Georgian Villas Water Sewage Servicing Study 2001**, as prepared by Pryde Schropp McComb, Inc and Stantec Consulting Ltd., December, 2001.
- **Cobble Beach Golf Links, Water Quality Monitoring Report**, as prepared by Pryde Schropp McComb, Inc., August, 2005.
- **Georgian Villas, Cobble Beach Golf Club Design Brief, Golf Club Irrigation System**, as prepared by Pryde Schropp McComb, Inc., February, 2005.
- **Cobble Beach SWM Erosion And Sedimentation Control Plan, Revision No. 1**, as prepared by Pryde Schropp McComb, Inc., August, 6 2004.
- **Cobble Beach Golf Course Permit to Take Water Application**, as prepared by Pryde Schropp McComb, Inc., August, 2004.
- **Georgian Villas Inc., Princess Beach Golf Course Operations Manual, Preliminary Report**, as prepared by Gartner Lee, August 6, 2003.

**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**  
TOWNSHIP OF GEORGIAN BLUFFS

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- **Georgian Villas Conceptual SWM Report, Proposed Golf Course Development, Phase 1**, as prepared by Pryde Schropp McComb, Inc., September, 2002. ✓
- **Georgian Villas Proposal for Water and Sewage Master Servicing Plan**, as prepared by Pryde Schropp McComb, Inc., June, 2001.
- **Georgian Villas Preliminary Environmental Operations and Monitoring Program**, as prepared by Stantec Consulting Ltd., April, 2006.
- **Georgian Villas Wastewater Treatment Design Brief**, as prepared by Stantec Consulting Ltd., April, 2006.
- **Cobble Beach Wastewater Pumping Station and Irrigation Lift Station General Specification**, as prepared by Stantec Consulting Ltd., August, 2006.
- **Georgian Villas Wastewater Treatment Class EA, Environmental Study Report Revision 1**, as prepared by Stantec Consulting Ltd., November, 2005.
- **Georgian Villas Wastewater Treatment EA Study Report**, as prepared by Stantec Consulting Ltd., December, 2004.
- **Georgian Villas Review of ATARA IBAC Wastewater Treatment Technology, System Report**, as prepared by Stantec Consulting Ltd., January 21, 2000.
- **Georgian Villas Preliminary Servicing Evaluation**, as prepared by Stantec Consulting Ltd., November, 1999.
- **Georgian Villas Proposed Water and Sewage Master Servicing Plan**, as prepared by Pryde Schropp McComb, Inc., June, 2001.
- **Georgian Villas Inc., Stage 3 Archaeological Assessments: Sites BdHf-6, BeHf-7, BeHf-12, and BeHf-13, Lots 29-31, Concession 3, Sarawak Township**, as prepared by Wm. Fitzgerald, August, 2003.
- **Georgian Villas Inc., Stage 1 and Stage 2 Archaeological Assessments: Lots 28-34, Concession 3, Sarawak Township**, as prepared by Wm. Fitzgerald, February, 2000.
- **Georgian Villas Inc., Magnetometer Survey, Sarawak Township**, as prepared by Piggot, University of Waterloo, June, 2003.
- **The Village at Cobble Beach, Planning Report – Phase Two**, as prepared by Cuesta Planning, July, 2006.
- **Georgian Villas Inc., Planning Justification Report, Part Lot 28, 29 & 34 and all of Lots 30-33, Concession 3, Township of Georgian Bluffs**, as prepared by Cuesta Planning, April 2004.
- **Georgian Villas Development, Trail, Park and Heritage Sites Master Plan**, as prepared by Pryde Schropp McComb, Inc., November, 2004.

**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**  
TOWNSHIP OF GEORGIAN BLUFFS

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- **Georgian Villas, Geotechnical Report**, as prepared by Pryde Schropp McComb Inc., October, 2001.
- **Princess Beach Golf Course, Environmental Management Plan, Preliminary Report**, as prepared by Gartner Lee Limited, August 6, 2003.
- **Geotechnical Investigation, Georgian Villas Development, Part of Lots 28 and 34, Concession 3, Former Township of Sarawak, Township of Georgian Bluffs**, as prepared by Peto MacCallum Ltd., August 31, 2004.
- **Geotechnical Investigation, Georgian Villas Development, Church Sideroad East, Georgian Bay, Ontario**, as prepared by Peto MacCallum Ltd., September 17, 2004.
- **Geotechnical Investigation, Georgian Villas Development, Waste Water Treatment Plant and Pumping Station**, as prepared by Peto MacCallum Ltd., May 20, 2005.
- **Conceptual Stormwater Management Report – Proposed Golf Course Development – Phase I, Georgian Villas Inc.**, September, 2002.
- **Conceptual Stormwater Management Report, Georgian Villas Inc.**, January, 2002.

The above noted studies were reviewed in the development of this Report.

#### **1.4 STORMWATER MANAGEMENT – PHASE 1 AND 2 (PRELIMINARY)**

The **Stormwater Management Report for Cobble Beach for Phase 1 and 2**, as prepared by Pryde Schropp McComb, Inc., August, 2006, concluded the following:

1. *Stormwater quantity control of post-development runoff is not required at the subdivision. The minor and major flow systems will direct all runoff into Owen Sound Bay. Flows will be conveyed through two ponds prior to discharging into the bay.*
2. *The discharge point for Phase 1 and 2 into Owen Sound Bay has been classified as a Type 2 habitat. A 'Normal' protection level for all runoff leaving the site will therefore be provided to meet the Ministry of the Environment's guidelines for protecting Type 2 habitat.*
3. *Stormwater quality control for the development will be provided by the two existing ponds which will function as extended detention wet ponds.*
4. *An extended detention control device at the outlet of Ponds 2 and 3 will provide 24 hour drawdown of the volume of runoff to be generated under a 25 mm storm event.*
5. *Storm runoff will be conveyed through the development by means of a minor system designed to convey the 5 year storm event.*

**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**  
TOWNSHIP OF GEORGIAN BLUFFS

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6. *A two stage weir will be constructed at the outlet of each pond that will convey flows in excess of the 25 mm event. The first stage of the weir will convey storm events up to the 5 year event while the second stage will convey storms exceeding the 5 year event.*
7. *Flow from Pond 3 will be directed to Pond 2 via an open channel. A culvert will be placed under McLeese Drive that will allow runoff to flow across McLeese Drive. This culvert shall be designed to handle a minimum 25 year storm event.*
8. *The major system outlet for the subdivision will be through Ponds 2 and 3. Pond 2 will receive runoff from the entire Phase 1 and 2 development and will discharge this flow over the east side of the pond into Owen Sound Bay. The major system will also incorporate the existing drainage ditches located throughout the development in order to reduce the overland flow to be conveyed by the subdivision streets. These ditches will also provide outfall locations for the proposed storm sewer system which will allow a smaller pipe diameter to be used throughout the development.*
9. *Future phases of the development will consist of Phase 3 and a Village Centre. Stormwater Management Plans will be required to be prepared once these developments are submitted for Draft Plan approval. Pond 5 has been constructed as part of the golf course development and will be incorporated into the stormwater management plan for Phase 3 to address the quality control requirements for this phase of the development. It is proposed to incorporate Oil Grit Separators to meet the quality control requirements for the Village Centre portion of the development. Quantity control for both future phases is assumed not to be required as runoff will discharge directly into Owen Sound Bay.*

Since the submission of this report to the approval agencies as part of the Draft Plan review for Phase 2, there were no requested changes to the conclusions and as such the conclusions of the **Preliminary Stormwater Management Report for Phase 1 and 2** will serve as the basis for the Final Stormwater Management Plan to be prepared for Stage 1 (2007).

## **1.5 STORMWATER MANAGEMENT CRITERIA**

Based on current Stormwater Management (SWM) practises, the following site-specific SWM criteria have been identified:

- Ensure that all runoff discharging off-site from Stage 1 (2007) meets the required water quality protection level at each designated discharge point;
- Ensure that in the design of stormwater management facilities to accommodate Stage 1 (2007) that future registration of development associated with Cobble Beach are taken into consideration in the planning/design;
- Ensure there is no adverse flooding impact on properties located within the subdivision development;

**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**

TOWNSHIP OF GEORGIAN BLUFFS

---

- Ensure there is no adverse flooding impact on the shoreline residential properties that presently exist located downstream of the Cobble Beach Development;
- Ensure the development does not cause any significant water quality deterioration in any surface waters or ground water that receive stormwater flow from the development areas

## **2.0 Stormwater Management Plan**

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### **2.1 METHODOLOGY**

As discussed in Section 1.5, the objective of the Stormwater Management (SWM) Plan for Stage 1 (2007) of the Cobble Beach Development, is to review the need for stormwater quality control as well as ensure that there is no flooding impact on properties located within and downstream of the subject property. These objectives will be achieved by completing the following tasks:

- i. Determine existing drainage conditions;
- ii. Determine post development drainage conditions;
- iii. Determine the quality control discharge requirements at each discharge point;
- iv. Design SWM measures that meet the SWM criteria for the development;
- v. Summarize the analysis by identifying conclusions and recommendations.

### **2.2 PRE-DEVELOPMENT DRAINAGE CONDITIONS**

The proposed development prior to the construction of the golf course, consisted mainly of grassed fields with a number of wooded areas located throughout the site. Other than a single family dwelling constructed on the south side of the development, the property was vacant.

In 2004/2005, a golf course was constructed on the site. In 2005, a Maintenance Building located in the central portion of the site was constructed as well. A stormwater management plan for the golf course development was submitted to the Township, County and Conservation Authority in September 2002, to address the proposed management of runoff from the course. Stormwater Management for the Maintenance Building is part of a block of land that will drain directly into Owen Sound Bay. Stormwater quality provisions for this building include providing 600 mm sumps in the parking lot catchbasins and running eavestrough drains onto the grassed areas where possible. Drainage from the Maintenance Building eventually discharges into a natural ditch. This ditch will connect into the drainage outlet from Pond 5, on the east side of McLeese Drive and then flow into the Owen Sound Bay.

The native soils on the site generally consist of hard packed silt/clays over most of the property, with small pockets of sandy silt soils and cobbles on the east part of the site. The topography of the site is gentle with an average slope of approximately 1.0% towards the east. This encourages runoff from the site to drain via sheet flow over most of the site. There are a number of drainage ditches located throughout the site where the slope of land is steeper. These ditches however, disappear on the lower portion of the property on the east side of the property. Based on site inspections of the site, there are no visibly defined outlets discharging into Owen Sound Bay on the east side of the property.

**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**

TOWNSHIP OF GEORGIAN BLUFFS

---

A ridge crosses over most of the southern half of the property in a south to north direction and divides this portion of the site into two distinct elevation levels. Considerable soil erosion is occurring on the ridge as a result of runoff concentrating into channels as it flows down the face of the ridge. Runoff at the base tends to infiltrate rapidly into the sandy silt type soils found in this area. Overburden thickness here is very shallow (< 0.6 m in some areas) and is underlain by an impermeable layer of shale. Runoff infiltrating into the overburden soils drains in an eastward direction along the bedrock / overburden interface where it eventually drains into Owen Sound Bay. In some areas where the shale prevents positive drainage towards the bay, sub-surface water ponds to the surface creating temporary wetland areas.

A second ridge rises from the shoreline of Owen Sound Bay on much of the northern portion of the property. At its highest, this ridge is approximately 10 m to 12 metres above the lower shoreline. Overburden on top of the ridge is very shallow (< 0.6 m) and is underlain by impermeable shale bedrock. There is no distinct runoff discharge point along this ridge indicating that drainage from the northern portion of the site is by sheet flow and or infiltrated into the overburden soils.

There are numerous locations on the upper level of the site (west side) where runoff ponds in low lying areas. Due to the native silty clay soils, these areas remain wet throughout most of the spring and fall and encourage the growth of cattails and other wetland type vegetation.

There are five (5) culverts that drain the lands west of the Cobble Beach property on the west side of Grey Road 1. This catchment area does not drain into the Phase 1 and 2 drainage area. Runoff from this catchment area enters Ponds 1 and 4 located on the west side of the property. Pond 4 is interconnected to Pond 1 and will drain into Pond 1 under normal conditions. If Pond 4 surcharges, an emergency outlet will be provided on the east side of the pond which will outlet towards Snowberry Lane and discharge into the natural ravine area between Telford Lane and Algonquin Trail. Pond 1 outlets to the east via a drainage ditch which ultimately discharges into Owen Sound Bay.

Since all runoff from Stage 1 will discharge directly into Owen Sound Bay, there will be no requirement to over control the post-development flows from the site to meet pre-development peak flow conditions. Therefore, the pre-development flows for the site have not been modelled as part of this report.

## **2.3 POST DEVELOPMENT DRAINAGE CONDITIONS AND PROPOSED STORMWATER MANAGEMENT PLAN**

### **2.3.1 Description of Proposed Land Uses**

Stage 1 (2007) comprises of portions of Phases 1 and 2 of the proposed Cobble Beach development. Figure 2 provides details of the area that will be registered as part of the Stage 1 Development and will include:

- 18 Hole Championship Golf Course (already constructed)
- Golf Club House (27,484 ft<sup>2</sup>) including:
  - 210 Seat Restaurant
  - Pro Shop
  - Ten (10) Inn Hotel Rooms
  - Spa
- Residential
  - 72 residential units
  - 28 townhouse units
  - 92 multi-family units

As noted previously, the design of stormwater management facilities for Stage 1 (2007) will take into consideration the ultimate development associated with Phases 1 and 2 to ensure that these facilities can accommodate the entire development.

As Phase 3 (northern portion of site) will for the most part have an independent stormwater management facility (i.e. pond 5 at clubhouse), there is no need to undertake a detailed review/design of stormwater management facilities associated with the northern part of the development at this stage.

### **2.3.2 Road Cross Section**

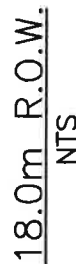
The development will consist of an extensive internal road network. All interior roads will be constructed to the Township's typical road cross section which utilizes concrete curb and gutter and storm sewers. A copy of the typical cross sections to be used for the various road allowance widths within the development are attached as Figures 3, 4 and 5 respectively.

The road cross section also incorporates a storm sewer collection system. The storm sewer system for the development will be designed to convey the runoff generated by a 5 year design storm.



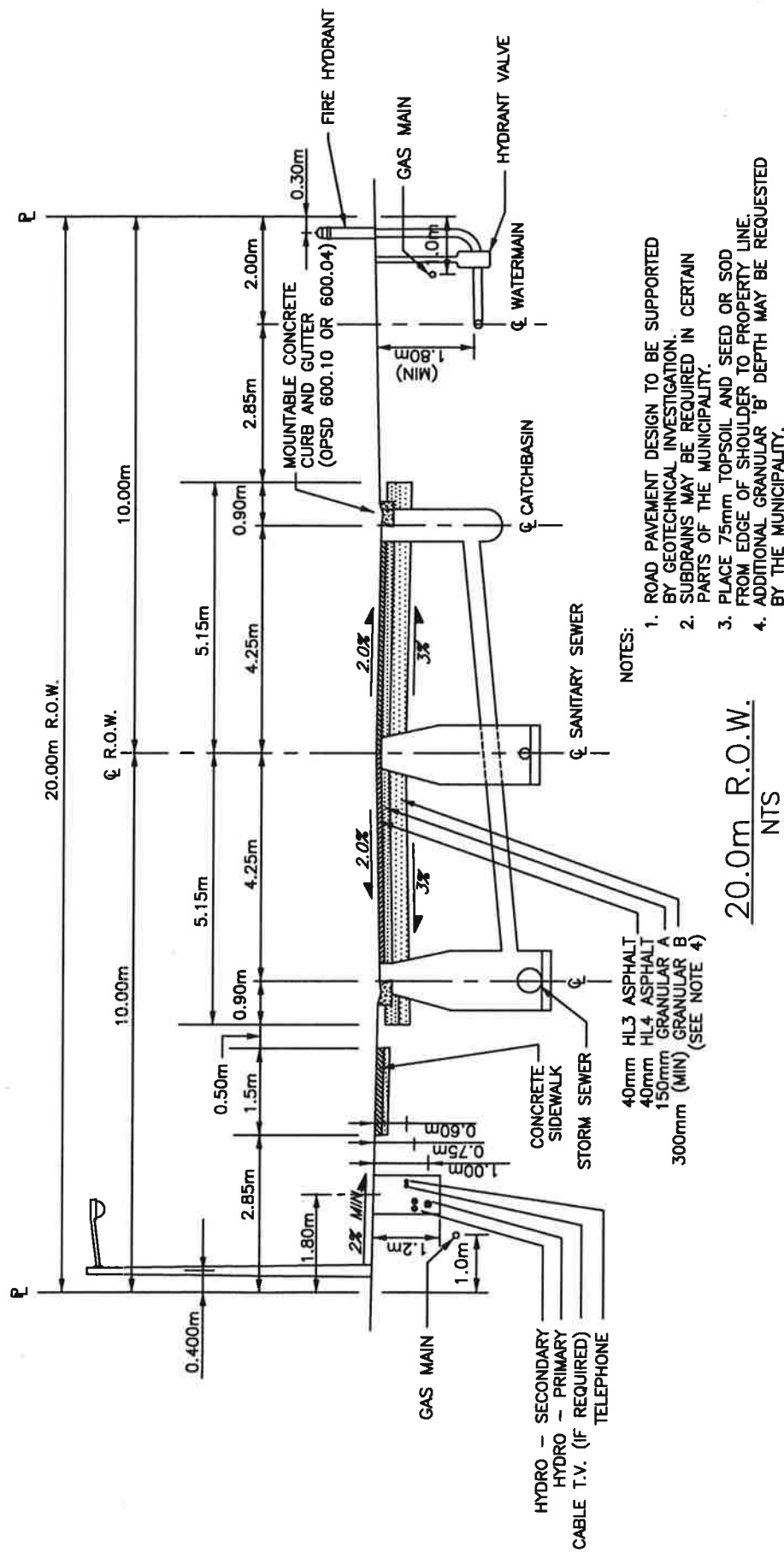
### **2.3.3 Post Development Drainage Conditions**

All runoff from Phases 1 and 2, including Stage 1 (2007), will follow existing drainage patterns and drain eastward into Owen Sound Bay. The proposed development will increase the overall impervious level of the property to approximately 20%, thus increasing the quantity of runoff generated at the site. Since all stormwater runoff discharges directly into Owen Sound Bay, there will be no requirement to reduce the quantity of post-development runoff from the site to pre-development conditions.



1. ROAD PAVEMENT DESIGN TO BE SUPPORTED BY GEOTECHNICAL INVESTIGATION.
2. SUBDRAINS MAY BE REQUIRED IN CERTAIN PARTS OF THE MUNICIPALITY.
3. PLACE 75mm TOPSOIL AND SEED OR SOD FROM EDGE OF SHOULDER TO PROPERTY LINE.
4. ADDITIONAL GRANULAR 'B' DEPTH MAY BE REQUESTED BY THE MUNICIPALITY.

**TYPICAL URBAN  
CROSS SECTION  
18.0m R.O.W.**



PRYDE SCHROPP MC-COMB INC.

CONSULTING ENGINEERS

ORIGINAL: 2007 - A3 X 11  
 1/2" = 1' (Horizontal Scale)  
 1/4" = 1' (Vertical Scale)  
 2007 July 04, 11:21 a.m.

Client/Project  
 COBBLE BEACH

Figure No. 4  
 Title

TYPICAL URBAN  
 CROSS SECTION  
 20.0m R.O.W.



**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**

TOWNSHIP OF GEORGIAN BLUFFS

The proposed minor flow system will consist of a storm sewer collection system that will be designed to convey the 5 year design storm event. The major flow system for Stage 1 (2007), which includes the remaining portions of Phase 1 and 2, will be conveyed by means of an overland flow route consisting of the subdivision roads and drainage ditches.

Phase 1 and 2 has been divided into thirteen catchment areas for modelling purposes. The catchment areas and flow directions for the minor system are delineated on Map 1 (back pocket). The catchment areas and flow direction for the major system are delineated on Map 2 (back pocket).

For the minor system, Catchments 201 to 206 drain the upper portion of Stage 1 to Pond 3. Catchment areas 207 to 209 drain the northern area of the lower portion of Stage 1 to Pond 2. Catchment areas 210 to 211 drain the southern area of the lower portion of the property directly into Owen Sound Bay. Catchment area 212 drains Timberglade Court southeast to the roadside ditch on Church Sideroad, which eventually discharges into Owen Sound Bay. Catchment area 213 will remain relatively undisturbed and will continue draining east into Georgian Bay. This catchment area will drain the rear yards of the houses located on the east side Timberglade Court as well as four lots on McLeese Drive.

The only difference between the major flow system and minor flow system is that Catchment Area 203 will by-pass the minor flow system outlet on the east side of the catchment area and flow directly into Catchment Area 210 for all storm events greater than the 5 year storm. Runoff will then discharge into the proposed drainage ditch from Pond 3 and continue flowing east into Owen Sound Bay.

Both stormwater management ponds have already been constructed as part of the golf course development. Pond 3 is located just below the bluff that separates the upper and lower portion of the development. This pond is approximately 11,500 m<sup>2</sup> in area and will provide stormwater quality control for Catchments 201 to 206. Pond 2 located east of Pond 3, is approximately 2,200 m<sup>2</sup> in area and will provide stormwater quality control for Catchments 207 to 209. The stormwater quality control provisions to be provided at the site will be discussed further in Section 2.3.5.

Both of the existing ponds will receive runoff from the 5 year and 100 year storm events. The outlets for each pond have been designed to accommodate the maximum peak flow. The outlets will be constructed as weirs placed into the side slope of the pond bank and protected with rip-rap. Outlet details for Ponds 2 and 3 are provided on Maps 3 and 4. Although quantity control will not be required, the configuration of each outlet will actually detain a portion of the runoff and reduce the overall peak flow discharging from each pond.

As will be discussed in Section 2.3.5, an orifice pipe will also be provided in the outlet of each pond. The size of the pipe has been designed to detain runoff during the stormwater quality storm event (2 yr. – 25 mm storm) for at least 24 hours as required by the Ministry of the Environment.

The hydrologic modeling software MIDUSS was used in conjunction with the Warton IDF rainfall curves to determine the peak flows and volume of runoff discharging into each pond. This model was then used to design the pond outlets. The parameters used in the model are contained in Appendix B.

**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**  
TOWNSHIP OF GEORGIAN BLUFFS

The post development peak flows for the 2 yr. – 2 hr., 5 yr. – 6 hr. and 100 yr. – 6 hr. storm events are summarized in Table 1 below. Appendix C contains the MIDUSS output files for Ponds 2 and 3 during the 2 yr. – 2 hr. storm event. Appendices D and E contain the MIDUSS output files for the 5 yr. – 6 hr. and 100 yr. – 6 hr. storm event. Both ponds were modelled together during the 5 year and 100 year storm events.

**Table 2**  
**Post Development Discharge Summary**

Storm Event	Pond 2 (m <sup>3</sup> /s)		Pond 3 (m <sup>3</sup> /s)	
	Inflow	Outflow	Inflow	Outflow
2 yr – 2hr.	0.25	0.03	0.66	0.09
5 yr – 6 hr.	1.03	0.51	3.66	1.32
100 yr – 6 hr.	2.77	2.10	9.64	7.73

**Notes:**

Pond #2 - Contributing catchments 207 – 209

Pond #3 - Contributing catchments 201 – 206

Catchment 203 will by-pass Pond 3 during the 100 yr. storm

Stormwater from Pond 2 will discharge directly into Owen Sound Bay. A spillway constructed out of large beach cobbles will line the spillway channel in order to prevent erosion of the side of the pond, as shown on Map 3.

Stormwater from Pond 3 will be directed under McLeese Drive at the south end of the pond and discharge into Owen Sound Bay, south of Pond 2. The spillway for Pond 3 will also be lined with large beach cobbles ( $D_{50} = 450$  mm) in order to prevent erosion of the side of the pond, as shown on Map 4.

Drawings No. C9 to C34, which are a part of the Detailed Engineering Drawing set, are enclosed and provide details of the sizing of the storm sewer system and road crossing culverts for Stage 1 (2007), along with details of the storm sewer system in the remaining portion of Phase 1 and 2.

Appendix F provides the storm sewer calculations for Stage 1 (2007) and the remaining portions of Phase 1 and 2.

#### **2.3.4 Major System Flow**

The major system flow route for Phases 1 and 2 including Stage 1 (2007), will use the interior road system in combination with the existing drainage ditches located throughout the property. Where the flow route is directed from the roadway to the ditch, the road profile will be designed as a sag, which will allow runoff to overflow the curb into the ditch system. This will occur at Catchments 201, 202, 203, 205, 208 and 210.

## **COBBLE BEACH DEVELOPMENT – STAGE 1 (2007) STORMWATER MANAGEMENT REPORT (FINAL)**

TOWNSHIP OF GEORGIAN BLUFFS

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The 100 year storm flow was modeled through all catchment areas, assuming the catchbasins were fully blocked to determine whether the runoff from this storm event could be safely conveyed within the road allowance. The Township's standard 20 metre road cross section comprising of a mountable curb and gutter (OPSD 600.100) was used in the model as this is the cross section that is proposed to be used throughout a majority of the development.

Based on the model results, the standard road cross section will be adequate to convey major flows on all side streets. The modelling indicates however that, a barrier type curb will be required on Sarawak Way on each side of the sag point, the lower portion of McLeese Drive east of Timberglade Court and along the entire length of Cobble Beach Drive in order to contain the runoff generated from the 100 year storm within the road allowance. Within the 30 metre section on McLeese Drive and Cobble Beach Drive, all major system flows will be contained within the road allowance.

Modeling results of the cross section analysis have been attached as Appendix G.

At the south end of Punkinseed Lane, the existing drainage ditch will be widened to accommodate the runoff from Catchment Areas 201 to 206 which will outlet through Pond 3, and Catchment Areas 210 and 211.

The following provides a summary of the required ditch dimensions to accommodate the 100 year peak flow:

- Base Width = 2.0 m
- Side slopes = 3:1 (minimum)
- Depth = minimum 1.2 m

The entire length of drainage ditch shall be lined with a minimum D<sub>50</sub> stone size of 450 mm.

### **2.3.5 Stormwater Quality Control**

The 2003 *Stormwater Management Planning and Design Manual* (SWMP&D Manual, 2003) recommends that the required level of water quality protection be associated with the habitat sensitivity of the receiving watercourse. According to the Fishery Habitat study completed by SAAR Environmental Ltd. in support of the proposed development, the area where the proposed storm outfall is to be discharging into Owen Sound Bay is located along the portion of shoreline that consists of a Type 2 habitat that is capable of supporting Carp, Yellow Perch, Smallmouth Bass and perhaps Largemouth Bass. Based on the Type 2 habitat classification, a 'Normal' water quality protection level will be used.

A treatment train approach to stormwater quality management has been proposed for this development. This approach consists of three (3) levels of treatment classified as follows:

- Lot level control measures
- Conveyance control measures
- End-of-Pipe control measures

The treatment train measures proposed for the development are as follows:

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#### **2.3.5.1 Lot Level Control Measures**

The impervious native soils located throughout the site precludes the use of drainage pits and infiltration trenches as lot level controls. Shallow lot grades will be utilized where possible to promote detention and settling of pollutants on individual lots. Maintaining existing drainage conditions by maintaining existing features will be the ultimate goal of lot level controls.

#### **2.3.5.2 Conveyance Control Measures**

Conveyance control measures for the Phase 1 and 2 including Stage 1 (2007), will be limited to grass swales located between each lot in order to promote natural filtration of solids, and infiltration into the soil where possible. Conveyance controls such as pervious storm sewer pipes (exfiltration) are not feasible for this development due to the imperviousness nature of the native soils.

#### **2.3.5.3 End-of-Pipe Control Measures**

The use of a wet pond was determined to be the most feasible end-of-pipe quality control measure at the site since this type of facility has the ability to accommodate large catchment areas. As discussed previously, the two ponds which have already been constructed as part of the golf course development will be used to provide the required water quality protection level for a majority of Stage 1 (2007).

These ponds were designed and constructed to provide sufficient active storage to detain the runoff from a 25 mm storm (simulated by a 2 year – 2 hour Chicago Storm Distribution) for 24 hours. The extended detention control device for Ponds 2 and 3 will each consist of a horizontal orifice pipe that will be constructed through the side of each pond. As previously discussed, both ponds will also be provided with outlets above the active storage level that will be designed to handle the 5 year and 100 year storm events.

The following summarizes the design details of Ponds 2 and 3. Refer to Map 3 and Map 4 for details of the extended detention control devices for each pond. The MIDUSS output file for the design of the outlet structures for each pond are included as Appendix C.

Please note that the ponds have been designed for the ultimate development of Phase 1 and 2.



**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**  
TOWNSHIP OF GEORGIAN BLUFFS

**a) Pond 2 Design Summary**

- Total Catchment Area      14.5 ha
- Impervious Area            5.3 ha
- % Impervious                37%

Pond Elevation Summary:

- Bottom of Pond               176.50 m +/-
- Permanent Pool              179.00 m
- Active Storage                179.40 m
- Top of Bank                  180.30 m

<b>TOTAL POND VOLUME REQUIRED</b>	
MOE Unit Volume Requirement to provide 'Normal' Protection Level based on 37% Impervious Area (MOE SWMPD Manual)	92.0 m <sup>3</sup> /ha
Total Pond Volume Required - based on MOE Unit Volume Requirement - Includes Active Storage and Permanent Pool	1,334 m <sup>3</sup>
<b>Total Pond Volume Provided</b>	<b>7,612 m<sup>3</sup></b>
<b>ACTIVE STORAGE REQUIREMENTS</b>	
Active Storage Volume Required – 40 m <sup>3</sup> /ha of total Catchment Area	580 m <sup>3</sup>
<b>Active Storage Volume Provided</b> - Elev. 179.0 to 179.4 m	<b>1,512 m<sup>3</sup></b>
<b>PERMANENT POOL REQUIREMENTS</b>	
Permanent Pool Volume Required – Difference between Total and Active Storage Volumes	754 m <sup>3</sup>
<b>Permanent Pool Volume Provided</b> - Elev. 176.5 to 179.0 m	<b>6,100 m<sup>3</sup></b>

**b) Pond 3 Design Summary**

- Total Catchment Area 62.7 ha
- Impervious Area 13.3 ha
- % Impervious 21%

Pond Elevation Summary:

- Bottom of Pond 187.50 m +/-
- Permanent Pool 189.80 m
- Active Storage 190.35 m
- Top of Bank 190.75 m

<b>TOTAL POND VOLUME REQUIRED</b>	
MOE Unit Volume Requirement to provide 'Normal' Protection Level based on 21% Impervious Area (MOE SWMPD Manual)	76.0 m <sup>3</sup> /ha
Total Pond Volume Required - based on MOE Unit Volume Requirement - Includes Active Storage and Permanent Pool	4,811 m <sup>3</sup>
<b>Total Pond Volume Provided</b>	<b>18,973 m<sup>3</sup></b>
<b>ACTIVE STORAGE REQUIREMENTS</b>	
Active Storage Volume Required - 40 m <sup>3</sup> /ha of total Catchment Area	2,532 m <sup>3</sup>
<b>Active Storage Volume Provided</b> - Elev. 189.80 to 190.30 m	<b>2,803 m<sup>3</sup></b>
<b>PERMANENT POOL REQUIREMENTS</b>	
Permanent Pool Volume Required – Difference between Total and Active Storage Volumes	2,279 m <sup>3</sup>
<b>Permanent Pool Volume Provided</b> - Elev. 187.50 to 189.80 m	<b>16,170 m<sup>3</sup></b>

**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**  
TOWNSHIP OF GEORGIAN BLUFFS

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Catchment Areas 210, 211, 212 and 213 will not be directed into either of the stormwater quality ponds. Quality control for these areas will be handled as follows:

**Catchment Area 210**

This catchment area comprises of two multi-family blocks and approximately 435 m of paved roads. The total imperviousness of this catchment area is approximately 44% and therefore, quality control is required to meet the MOE's normal protection level due to the high imperviousness of the catchment area.

Since this area cannot drain into either of the stormwater management ponds, it is proposed to install an oil-grit separator at the sag point of McLeese Road to achieve the required protection level prior to discharging stormwater into the downstream drainage ditch on the east side of McLeese Drive.

As this catchment area will be part of Stage 2, the design of the oil-grit separator system will be completed during the final design of this portion of the subdivision.

**Catchment Area 211**

This catchment area drains the southern end of Punkinseed Lane into an existing drainage ditch located at the end of the proposed cul-de-sac.

Since this area cannot drain into either of the stormwater management pond and the imperviousness of the drainage area is approximately 22% with only 12% being directly connected to the drainage system, it is proposed not to install an end-of-pipe stormwater control system for this area. Runoff from this catchment area will drain into the existing ditch system which then drains east into Georgian Bay. All catchbasins located in this area will be provided with 600 mm sumps to assist in removing larger sediments from the runoff.

**Catchment Area 212**

This catchment area drains the Timberglade Court drainage area south into the existing drainage ditch located on the north side of Church Side Road.

Since this area cannot drain into either of the stormwater management ponds and the imperviousness of this drainage area is approximately 25% with only 15% being directly connected to the drainage system, it is proposed not to install an end-of-pipe stormwater control system for this area.

Runoff from this catchment area will drain into the existing ditch system which then drains east into Georgian Bay. The total length of ditch is 100 m. It is proposed to re-shape this ditch and re-vegetate it in order to promote filtering of sediments from the runoff generated from this area. In addition, all catchbasins located in this area will be provided with 600 mm sumps to assist in removing larger sediments from the runoff.

**Catchment Area 213**

This catchment area will remain mostly undisturbed. No end-of-pipe stormwater quality control measures are proposed as no directly connected impervious areas drain into this area.

The rear yards of the lots fronting onto Timberglade Court and three lots on the east side of McLeese Drive will drain into this area as well as a portion of the houses associated with these lots. The runoff from the rear yards and roof tops of the houses will generally be of good quality.

The undisturbed wooded area will assist in filtering and settling out any sediments that may be contained in the runoff from this area prior to discharging off-site.

Please note that Catchment Areas 210, 212 and 213 are within the Stage 2 development boundary area.

### **3.0 FUTURE DEVELOPMENT**

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Future phases of the Cobble Beach development will comprise of a third phase of residential development located on the north side of the site and a Village Centre, which will be located on the east side of Owen Sound Bay, north of Pond 2 (See Map 1).

These future phases will require a separate Stormwater Management Plan to be prepared that will address both quantity and quality control. As shown on Map 1, Pond 5 has been constructed north of Pond 2 on the east side of the site. This pond will accommodate the quality control requirements for Phase 3. Similar to Phase 1 and 2, it has been assumed that quantity control will not be required for this phase and that direct discharge of the post-development peak flow into Owen Sound Bay will be permitted.

For the Village Centre area, quality control is proposed to be address with the use of oil-grit separators due to the lack of sufficient space to construct a wet pond. Quantity control is not expected to be required for this area as runoff will be discharged directly into Owen Sound Bay similar to the other phases.

## **4.0 EROSION AND SEDIMENTATION CONTROL**

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During construction of Stage 1 (2007), sedimentation and erosion control will be very important in order to prevent fine silt and clay materials from migrating to Owen Sound Bay.

As part of the construction of the Cobble Beach Golf Course over the past two years, a detailed Erosion and Sedimentation Control Plan was prepared and implemented throughout the duration of construction in order to prevent the erosion of materials into the Owen Sound Bay. It is proposed to continue with this detailed plan and amend it as required to suit the construction of the interior subdivision streets and residential dwellings.

The following erosion and sedimentation control measures will be used during construction of Stage 1 (2007)

### **Sediment Control**

Heavy duty silt fencing will be placed in intermittent drainage paths downstream from the construction site as identified on Map 5 (back pocket). A sedimentation pond will also be constructed in the future Village Centre area to assist in the removal of sediments prior to discharging runoff into Owen Sound Bay during construction of Stage 1.

It will be important to monitor the performance of the sediment control facilities and to make modifications as necessary to prevent sediment transport from the construction sites.

In addition, on exposed slopes it is proposed to scarify the ground surface. The scarification will be a series of low soil walls or terraces constructed perpendicular to the direction of drainage flow. The terraces will slow surface drainage and reduce erosion preventing washouts and gulley formation.

### **Stock Piled Fill / Topsoil**

Stock piled fill or topsoil will be protected using a perimeter silt fence. Topsoil stockpile areas are shown on Map 5.

In addition to the above, the following erosion and sedimentation control measures are to be implemented.

- Silt fencing and other erosion control measures will be inspected on a regular basis and after each storm event and repaired as required.
- The sides of all subdivision roads will be seeded immediately after construction is completed. In areas where steep slopes are located, the use of erosion control blankets in combination with seed will be used.

**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**

TOWNSHIP OF GEORGIAN BLUFFS

---

- Filter cloth placed under all catchbasin grates until the adjacent street is paved.
- All storm outfalls will be protected from erosion by placement of riprap placed on geotextile cloth.
- Re-vegetation of all developed lots by either seeding or sodding will be completed immediately after construction has been completed.

## **5.0 CONCLUSION**

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Based on the findings of the above report, the following conclusions are made:

1. Stormwater quantity control of post-development runoff is not required for the subdivision. The minor and major flow systems will direct all runoff into Owen Sound Bay. A majority of the flow from the Stage 1 will be conveyed through two ponds (Ponds 2 and 3) prior to discharging into the bay.
2. The area of Owen Sound Bay immediately east of the development has been classified as a Type 2 fish habitat. A 'Normal' protection level for all runoff leaving the site will therefore be provided to meet the Ministry of the Environment's guidelines for protecting Type 2 habitat.
3. Stormwater quality control for a majority of the development will be provided by the two existing ponds which will function as extended detention wet ponds.
4. An extended detention control device at the outlet of Ponds 2 and 3 will provide 24 hour drawdown of the volume of runoff to be generated under a 25 mm storm event.
5. Storm runoff will be conveyed through the development by means of a minor flow system designed to convey the 5 year storm event. The minor flow system will consist of closed pipe storm sewer system in combination with existing drainage ditches.
6. A spillway will be constructed at the outlet of each pond that will convey flows in excess of the 25 mm event. The first stage of the weir will convey storm events up to and including the 5 year event while the second stage will convey storms exceeding the 5 year event up to and including the 100 year storm event.
7. Flow from Pond 3 will be directed under McLeese Drive via two 1200 mm culverts. These culverts have been designed to handle the 25 year storm event.
8. The major flow system will consist of the proposed streets in combination with the existing drainage ditches located throughout the development. Stormwater modelling indicates that the Township's standard 20 m cross section using mountable curb is adequate for the side streets. A barrier type curb will be required at the south end of Sarawak Way on both sides of the sag point, along the entire lower section of McLeese Drive east of Timberglade Court and along the entire length of Cobble Beach Drive in order to contain stormwater runoff within the road allowance.
9. Future phases of the development will consist of Phase 3 and a Village Centre. Stormwater Management Plans will be required to be prepared once these developments are submitted for Draft Plan approval. Pond 5 has been constructed as part of the golf course development and will be incorporated into the stormwater management plan for Phase 3 to address the quality control requirements for this phase of the development. It is proposed to incorporate Oil Grit Separators to meet the quality control requirements for the Village Centre portion of the development.



**COBBLE BEACH DEVELOPMENT – STAGE 1 (2007)**  
**STORMWATER MANAGEMENT REPORT (FINAL)**

TOWNSHIP OF GEORGIAN BLUFFS

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10. Quantity control for both future phases is assumed not to be required as runoff will discharge directly into Owen Sound Bay.
11. Erosion and sedimentation control measures as detailed in this report, will be implemented during the site servicing of the development and once house construction commences.

All of which is respectfully submitted,

**PRYDE SCHROPP MCCOMB, INC.**



Stephen J. Cobean, P.Eng.  
Project Engineer

s:\projects\30202 georgian villas misc engineering services 42t-2004-02\reports\swm report\final stormwater management report\30202 final swm report sv 010807.doc



PRYDE SCHROPP McCOMB INC.  
CONSULTING ENGINEERS

**APPENDIX A**

**COBBLE BEACH DEVELOPMENT  
STAGE 1 (2007)**

**DRAFT PLAN OF SUBDIVISION  
JANUARY 24, 2006**



PRYDE SCHROPP McCOMB INC.  
CONSULTING ENGINEERS

## **APPENDIX B**

### **COBBLE BEACH DEVELOPMENT STAGE 1 (2007)**

#### **MODELING INPUT PARAMETERS**

Table A.1 Parameter Summary Table

Proposed Conditions										
Outlet Location	Model (MIDUSS) Catchment ID	Description	Area (ha)	Drainage Chnl (m)	Flow Length (m)	Gradient (%)	Imperv. Area Connected (%)	Manning's 'n'	Weighted CN Pervious	Initial Abstractions
Pond 3	201	Sarawak Way and Nipissing Circle	12.0	1290	47	2.0	19.2	0.25	84.1	4.8
Pond 3	202	Beacon Crest	1.23	160	38	2.0	26.6	0.25	84.5	4.6
Pond 3	203	McLeese Drive west of Timberglade Court	10.7	1090	49	2.0	15.6	0.25	84.0	4.8
Pond 3	204	Hole 14 and 15 area	11.1	705	79	2.0	0.0	0.35	83.2	5.1
Pond 3	205	Area north of Cobble Beach Drive	17.4	1974	44	2.0	18.6	0.25	82.3	5.5
Pond 3	206	Hole 13 Area	10.2	770	66	2.0	0.0	0.35	80.3	6.2
Pond 2	207	Cobbl Beach Dr. east of Algonquin Trail	5.5	700	39	2.0	20.6	0.25	84.0	4.9
Pond 2	208	McLeese Drive north of Punkinseed	7.02	1076	33	2.0	19.5	0.25	84.9	4.5
Pond 2	209	Punkinseed Lane - north and west end	1.93	265	36	2.0	21.0	0.25	84.2	4.8
Georgian Bay	210	McLeese Drive south of Punkin Seed	3.70	786	47	2.0	24.4	0.25	84.8	4.5
Georgian Bay	211	Punkinseed Lane - south end	2.29	202	57	2.0	12.4	0.25	83.8	4.9
Georgian Bay	212	Timberglade Court	3.07	240	64	2.0	15.2	0.25	83.8	4.9
Georgian Bay	213	Southeast portion of site	4.02	330	122	3.5	0.0	0.35	75.6	8.2

Table A.2 Site Soils: (as per Ontario Soil Survey Report No. 17 for Grey County)

**Soil Type**

Vincent Silt Clay Loam

**Hydrologic Soil Group**

C

TABLE OF CURVE NUMBERS (CN's)								
Land Use	Hydrologic Soil Type							
	A	AB	B	BC	C	CD	D	Manning's 'n'
Meadow	50	54	58	64.5	71	74.5	78	0.4
Woodlot	50	55.3	60.5	67	73.5	76.8	80	0.4
Long Grass	55	60	65	72	79	81.5	84	0.3
Lawns	60	65.5	71	77	83	86	89	0.25
Pasture/Range	58	61.5	65	70.5	76	78.5	81	0.17
Crop	66	70	74	78	82	84	86	0.13
Fallow (bare)	77	82	86	89	91	93	94	0.05
Built-up	60	65.5	71	77	83	89	89	0.25
Streets, paved	98	98	98	98	98	98	98	0.01

continuous grass  
forests  
natural, not maintained  
maintained  
farm pasture  
farm land  
idle farm land (bare)  
Lawns post development

HYDROLOGIC SOIL TYPE (%) - Proposed Conditions								
Catchment	Hydrologic Soil Type							
	A	AB	B	BC	C	CD	D	TOTAL
201	0	0	0	0	100	0	0	100
202	0	0	0	0	100	0	0	100
203	0	0	0	0	100	0	0	100
204	0	0	0	0	100	0	0	100
205	0	0	0	0	100	0	0	100
206	0	0	0	0	100	0	0	100
207	0	0	0	0	100	0	0	100
208	0	0	0	0	100	0	0	100
209	0	0	0	0	100	0	0	100
210	0	0	0	0	100	0	0	100
211	0	0	0	0	100	0	0	100
212	0	0	0	0	100	0	0	100
213	0	0	0	0	100	0	0	100

LAND USE (%) - Proposed Conditions										
Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Imperv. Not Connected (Rooftops)	Imperv. Connected	Total
201	0	0	0	67.9	0	0	0	12.9	19.2	100
202	0	5	0	45.9	0	0	0	22.6	26.6	100
203	0	0	0	71.9	0	0	0	12.6	15.6	100
204	0	0	15	82.5	0	0	0	2.5	0.0	100
205	0	10	10	50.7	0	0	0	10.7	18.6	100
206	0	30	0	70.0	0	0	0	0.0	0.0	100
207	0	0	0	68.5	0	0	0	10.9	20.6	100
208	0	0	0	58.6	0	0	0	21.9	19.5	100
209	0	0	0	65.1	0	0	0	14.0	21.0	100
210	0	0	0	55.7	0	0	0	19.9	24.4	100
211	0	0	0	77.9	0	0	0	9.7	12.4	100
212	0	0	0	75.4	0	0	0	9.3	15.2	100
213	0	85	0	11.1	0	0	0	3.9	0.0	100

CURVE NUMBER (CN) - Proposed Conditions												
Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Built-up	Imperv. Not Connected (Rooftops)	Weighted CN - Pervious	IA - Pervious	Manning's 'n'
201	0	0	0	83	0	0	0	0	90	84.1	4.8	0.25
202	0	74	0	83	0	0	0	0	90	84.5	4.6	0.25
203	0	0	0	83	0	0	0	0	90	84.0	4.8	0.25
204	0	0	79	83	0	0	0	0	90	83.2	5.1	0.35
205	0	74	79	83	0	0	0	0	90	82.3	5.5	0.25
206	0	74	0	83	0	0	0	0	90	80.3	6.2	0.35
207	0	0	0	83	0	0	0	0	90	84.0	4.9	0.25
208	0	0	0	83	0	0	0	0	90	84.9	4.5	0.25
209	0	0	0	83	0	0	0	0	90	84.2	4.8	0.25
210	0	0	0	83	0	0	0	0	90	84.8	4.5	0.25
211	0	0	0	83	0	0	0	0	90	83.8	4.9	0.25
212	0	0	0	83	0	0	0	0	90	83.8	4.9	0.25
213	0	74	0	83	0	0	0	0	90	75.6	8.2	0.35

**Table A.3: Impervious Area Determination for Subcatchment 201 - 213****Post-development Conditions**

<b>Area of Concern</b>	<b>Total Area (ha)</b>	<b>Impervious Area Connected</b>		<b>Impervious Area Not Connected (Rooftops)</b>		<b>Total (%)</b>
		<b>(ha)</b>	<b>(%)</b>	<b>(ha)</b>	<b>(%)</b>	
201	12.02	2.30	19.2	1.55	12.9	32.1
202	1.2	0.33	26.6	0.28	22.6	49.1
203	10.7	2.11	15.6	1.34	12.6	28.2
204	11.1	0.00	0.0	0.28	2.5	2.5
205	17.40	3.23	18.6	1.87	10.7	29.3
206	10.20	0.00	0.00	0.00	0.0	0.0
207	5.50	1.13	20.6	0.60	10.9	31.5
208	7.02	1.37	19.5	1.54	21.9	41.4
209	1.9	0.41	21.0	0.27	14.0	34.9
210	3.7	0.90	24.4	0.74	19.9	44.3
211	2.3	0.29	12.4	0.22	9.7	22.1
212	3.1	0.47	15.2	0.29	9.3	24.6
213	4.0	0.00	0.0	0.16	3.9	3.9



Table A.3 - Impervious Area Determination for Post Development Catchments 201 - 213

Catchment	1290 m of 84 driveways @ 84 single res. homes with roof area of 0 Multi-Family Blocks	20 90 m <sup>2</sup> @ 100% imperv. 185 m <sup>2</sup> 175 m <sup>2</sup>	m wide ROW @ 60% imperv.	Imperv. Area	Imperv %
201				1.55 ha 0.76 ha 1.55 ha 0.00 ha <b>3.86 ha</b>	12.88 % 6.29 % 12.93 % 0.00 %
202	160 m of 15 driveways @ 0 m <sup>2</sup> of private lane 15 single res. homes with roof area of 0 Multi-Family Blocks	20 90 m <sup>2</sup> @ 100% imperv. 185 m <sup>2</sup> 175 m <sup>2</sup>	m wide ROW @ 60% imperv.	0.19 ha 0.14 ha 0.00 ha 0.28 ha 0.00 ha <b>0.60 ha</b>	15.61 % 10.98 % 0.00 % 22.56 % 0.00 %
203	1090 m of 40.5 driveways @ 4400 m <sup>2</sup> of private lane 40.5 single res. homes with roof area of 34 Multi-Family Blocks	20 90 m <sup>2</sup> @ 100% imperv. 185 m <sup>2</sup> 175 m <sup>2</sup>	m wide ROW @ 60% imperv.	1.31 ha 0.36 ha 0.44 ha 0.75 ha 0.60 ha <b>3.46 ha</b>	12.22 % 3.41 % 4.11 % 7.00 % 5.56 %
204	0 m of 0 driveways @ 15 single res. homes with roof area of 0 Multi-Family Blocks	20 90 m <sup>2</sup> @ 100% imperv. 185 m <sup>2</sup> 175 m <sup>2</sup>	m wide ROW @ 60% imperv.	0.00 ha 0.00 ha 0.28 ha 0.00 ha <b>0.28 ha</b>	0.00 % 0.00 % 2.50 % 0.00 %
205	1936 m of 101 driveways @ 101 single res. homes with roof area of 0 Multi-Family Blocks	20 90 m <sup>2</sup> @ 100% imperv. 185 m <sup>2</sup> 175 m <sup>2</sup>	m wide ROW @ 60% imperv.	2.32 ha 0.91 ha 1.87 ha 0.00 ha <b>5.10 ha</b>	13.35 % 5.22 % 10.74 % 0.00 %



PRYDE SCHROPP McCOMB INC.  
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## **APPENDIX C**

### **COBBLE BEACH DEVELOPMENT STAGE 1 (2007)**

### **MIDUSS OUTPUT FILES - POND 2 & POND 3 2 YEAR - 2 HOUR STORM**

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.01  rev. 329"
"          MIDUSS created                      Monday, May 17, 2004"
"          10  Units used:                      ie METRIC"
"          Job folder:                        C:\Documents and Settings\scobean\
"                                     My Documents\MIDUSSdata\Georgian Villas\June 2007"
"          Output filename:                   30202 June 2007 25 mm pond 2 and 3 3.out"
"          Licensee name:                     Steve Cobean"
"          Company                           PSMI Inc."
"          Date & Time last used:             6/24/2007 at 9:55:10 AM"
" 31      TIME PARAMETERS"
"          10.000  Time Step"
"          1440.000 Max. Storm length"
"          2100.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1      Chicago storm"
"          285.000 Coefficient A"
"          2.500   Constant B"
"          0.650   Exponent C"
"          0.400   Fraction R"
"          120.000 Duration"
"          1.000   Time step multiplier"
"          Maximum intensity                   48.246   mm/hr"
"          Total depth                       25.037   mm"
"          7  25mmhyd  Hydrograph extension used in this file"
" 33      CATCHMENT 201"
"          1      Triangular SCS"
"          2      Proportional to %"
"          1      SCS method"
"          201    Catchment 201 - south of main entrance"
"          19.200 % Impervious"
"          12.000 Total Area"
"          47.000 Flow length"
"          2.000  Overland Slope"
"          9.696  Pervious Area"
"          47.000 Pervious length"
"          2.000  Pervious slope"
"          2.304  Impervious Area"
"          11.168 Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          84.100 Pervious SCS Curve No."
"          0.240  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          4.802  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.808  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          0.224  0.000  0.000  0.000 c.m/sec"
"          Catchment 201      Pervious      Impervious Total Area "
"          Surface Area      9.696      2.304      12.000      hectare"
"          Time of concentration 41.504      1.757      24.274      minutes"
"          Time to Centroid      114.912      67.672      94.433      minutes"
"          Rainfall depth      25.037      25.037      25.037      mm"

```

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

"	Rainfall volume	2427.61	576.86	3004.47	c.m"
"	Rainfall losses	19.049	5.754	16.497	mm"
"	Runoff depth	5.988	19.284	8.541	mm"
"	Runoff volume	580.58	444.30	1024.88	c.m"
"	Maximum flow	0.116	0.216	0.224	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.224	0.224	0.000	0.000"	
" 52	CHANNEL DESIGN"				
"	0.224	Current peak flow	c.m/sec"		
"	0.040	Manning 'n'"			
"	0.	Cross-section type: 0=trapezoidal; 1=general"			
"	0.600	Basewidth	metre"		
"	2.000	Left bank slope"			
"	2.000	Right bank slope"			
"	1.000	Channel depth	metre"		
"	5.000	Gradient	%"		
"		Depth of flow	0.174	metre"	
"		Velocity	1.358	m/sec"	
"		Channel capacity	9.309	c.m/sec"	
"		Critical depth	0.194	metre"	
" 53	ROUTE Channel Route 200"				
"	200.00	Channel Route 200 Reach length	( metre)"		
"	0.495	X-factor <= 0.5"			
"	110.531	K-lag ( seconds)"			
"	0.000	Default(0) or user spec.(1) values used"			
"	0.500	X-factor <= 0.5"			
"	30.000	K-lag ( seconds)"			
"	0.500	Beta weighting factor"			
"	100.000	Routing time step ( seconds)"			
"	1	No. of sub-reaches"			
"		Peak outflow	0.194	c.m/sec"	
"		0.224	0.224	0.194	0.000 c.m/sec"
" 40	HYDROGRAPH Combine 1"				
"	6	Combine "			
"	1	Node #"			
"	Confluence at Pond 3"				
"		Maximum flow	0.194	c.m/sec"	
"		Hydrograph volume	1024.887	c.m"	
"		0.224	0.224	0.194	0.194"
" 40	HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"			
"		0.224	0.000	0.194	0.194"
" 33	CATCHMENT 202"				
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	202	Catchment 202 - Beacon Crest"			
"	26.600	% Impervious"			
"	1.230	Total Area"			
"	38.000	Flow length"			
"	2.000	Overland Slope"			
"	0.903	Pervious Area"			
"	38.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.327	Impervious Area"			

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

```

"      13.771  Impervious length"
"      2.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      84.500  Pervious SCS Curve No."
"      0.248  Pervious Runoff coefficient"
"      0.100  Pervious Ia/S coefficient"
"      4.659  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"      98.000  Impervious SCS Curve No."
"      0.808  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"          0.031      0.000      0.194      0.194 c.m/sec"
"      Catchment 202      Pervious      Impervious Total Area "
"      Surface Area      0.903      0.327      1.230      hectare"
"      Time of concentration 36.067      1.993      17.883      minutes"
"      Time to Centroid      109.610      67.914      87.358      minutes"
"      Rainfall depth      25.037      25.037      25.037      mm"
"      Rainfall volume      226.04      81.92      307.96      c.m"
"      Rainfall losses      18.852      5.504      15.301      mm"
"      Runoff depth      6.186      19.533      9.736      mm"
"      Runoff volume      55.84      63.91      119.75      c.m"
"      Maximum flow      0.012      0.030      0.031      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4      Add Runoff "
"          0.031      0.031      0.194      0.194"
" 52      CHANNEL DESIGN"
"      0.031      Current peak flow      c.m/sec"
"      0.040      Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      1.000      Basewidth      metre"
"      3.000      Left bank slope"
"      3.000      Right bank slope"
"      1.000      Channel depth      metre"
"      3.000      Gradient      %"
"      Depth of flow      0.050      metre"
"      Velocity      0.538      m/sec"
"      Channel capacity      11.572      c.m/sec"
"      Critical depth      0.044      metre"
" 53      ROUTE      Channel Route 100"
"      100.00      Channel Route 100 Reach length      ( metre)"
"      0.495      X-factor <= 0.5"
"      139.087      K-lag      ( seconds)"
"      0.000      Default(0) or user spec.(1) values used"
"      0.500      X-factor <= 0.5"
"      30.000      K-lag      ( seconds)"
"      0.500      Beta weighting factor"
"      120.000      Routing time step      ( seconds)"
"          1      No. of sub-reaches"
"      Peak outflow      0.028      c.m/sec"
"          0.031      0.031      0.028      0.194 c.m/sec"
" 40      HYDROGRAPH Combine      1"
"          6      Combine "
"          1      Node #"
"          Confluence at Pond 3"
"      Maximum flow      0.222      c.m/sec"

```

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

```

"          Hydrograph volume          1144.642      c.m"
"          0.031      0.031      0.028      0.222"
" 40      HYDROGRAPH      Confluence      1"
"          7      Confluence "
"          1      Node #"
"          Confluence at Pond 3"
"          Maximum flow          0.222      c.m/sec"
"          Hydrograph volume          1144.642      c.m"
"          0.031      0.222      0.028      0.000"
" 52      CHANNEL DESIGN"
"          0.222      Current peak flow      c.m/sec"
"          0.040      Manning 'n'"
"          0.      Cross-section type: 0=trapezoidal; 1=general"
"          1.000      Basewidth      metre"
"          3.000      Left bank slope"
"          3.000      Right bank slope"
"          1.000      Channel depth      metre"
"          5.000      Gradient      %"
"          Depth of flow          0.132      metre"
"          Velocity          1.207      m/sec"
"          Channel capacity          14.940      c.m/sec"
"          Critical depth          0.147      metre"
" 53      ROUTE      Channel Route 330"
"          330.00      Channel Route 330 Reach length      ( metre)"
"          0.498      X-factor <= 0.5"
"          205.014      K-lag      ( seconds)"
"          0.000      Default(0) or user spec.(1) values used"
"          0.500      X-factor <= 0.5"
"          30.000      K-lag      ( seconds)"
"          0.500      Beta weighting factor"
"          200.000      Routing time step      ( seconds)"
"          1      No. of sub-reaches"
"          Peak outflow          0.220      c.m/sec"
"          0.031      0.222      0.220      0.000 c.m/sec"
" 40      HYDROGRAPH      Combine      2"
"          6      Combine "
"          2      Node #"
"          Pond 3 "
"          Maximum flow          0.220      c.m/sec"
"          Hydrograph volume          1144.662      c.m"
"          0.031      0.222      0.220      0.220"
" 40      HYDROGRAPH Start - New Tributary"
"          2      Start - New Tributary"
"          0.031      0.000      0.220      0.220"
" 33      CATCHMENT 203"
"          1      Triangular SCS"
"          2      Proportional to %"
"          1      SCS method"
"          203      Catchment 203 - Western Portion of McLeese Dr. "
"          15.600      % Impervious"
"          10.700      Total Area"
"          49.000      Flow length"
"          2.000      Overland Slope"
"          9.031      Pervious Area"
"          49.000      Pervious length"
"          2.000      Pervious slope"

```



**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

```

"      1.669  Impervious Area"
"      9.057  Impervious length"
"      2.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"    84.000  Pervious SCS Curve No."
"      0.238  Pervious Runoff coefficient"
"      0.100  Pervious Ia/S coefficient"
"      4.838  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"    98.000  Impervious SCS Curve No."
"      0.808  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"          0.165      0.000      0.220      0.220 c.m/sec"
"      Catchment 203      Pervious      Impervious      Total Area  "
"      Surface Area      9.031      1.669      10.700      hectare"
"      Time of concentration  42.693      1.550      27.419      minutes"
"      Time to Centroid      116.100      67.394      98.019      minutes"
"      Rainfall depth      25.037      25.037      25.037      mm"
"      Rainfall volume      2261.06      417.92      2678.98      c.m"
"      Rainfall losses      19.093      6.051      17.059      mm"
"      Runoff depth      5.944      18.986      7.978      mm"
"      Runoff volume      536.77      316.92      853.69      c.m"
"      Maximum flow      0.106      0.158      0.165      c.m/sec"
"  40      HYDROGRAPH Add Runoff  "
"          4      Add Runoff  "
"              0.165      0.165      0.220      0.220"
"  52      CHANNEL DESIGN"
"          0.165      Current peak flow      c.m/sec"
"          0.040      Manning 'n'"
"          0.      Cross-section type: 0=trapezoidal; 1=general"
"      10.000      Basewidth      metre"
"
"      10.000      Left bank slope"
"      10.000      Right bank slope"
"      10.000      Channel depth      metre"
"          5.000      Gradient      %"
"          Depth of flow      0.030      metre"
"          Velocity      0.531      m/sec"
"          Channel capacity      18488.199      c.m/sec"
"          Critical depth      0.030      metre"
"  53      ROUTE      Channel Route 0"
"          0.01      Channel Route 0 Reach length      ( metre)"
"          0.000      X-factor <= 0.5"
"          0.014      K-lag      ( seconds)"
"          0.000      Default(0) or user spec.(1) values used"
"          0.500      X-factor <= 0.5"
"      30.000      K-lag      ( seconds)"
"          0.973      Beta weighting factor"
"          0.521      Routing time step      ( seconds)"
"          1      No. of sub-reaches"
"          Peak outflow      0.165      c.m/sec"
"              0.165      0.165      0.165      0.220 c.m/sec"
"  40      HYDROGRAPH      Combine      2"
"          6      Combine  "
"          2      Node #"

```

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

```

"      Pond 3 "
"      Maximum flow              0.356      c.m/sec"
"      Hydrograph volume         1998.342    c.m"
"      0.165      0.165      0.165      0.356"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"
"      0.165      0.000      0.165      0.356"
" 33      CATCHMENT 204"
"      1      Triangular SCS"
"      2      Proportional to %"
"      1      SCS method"
"      204      Hole 14 and 15 "
"      0.000      % Impervious"
"      11.100      Total Area"
"      79.000      Flow length"
"      2.000      Overland Slope"
"      11.100      Pervious Area"
"      79.000      Pervious length"
"      2.000      Pervious slope"
"      0.000      Impervious Area"
"      0.000      Impervious length"
"      2.000      Impervious slope"
"      0.350      Pervious Manning 'n'"
"      83.200      Pervious SCS Curve No."
"      0.222      Pervious Runoff coefficient"
"      0.100      Pervious Ia/S coefficient"
"      5.129      Pervious Initial abstraction"
"      0.015      Impervious Manning 'n'"
"      98.000      Impervious SCS Curve No."
"      0.808      Impervious Runoff coefficient"
"      0.100      Impervious Ia/S coefficient"
"      0.518      Impervious Initial abstraction"
"      0.089      0.000      0.165      0.356 c.m/sec"
"      Catchment 204      Pervious      Impervious Total Area "
"      Surface Area      11.100      0.000      11.100      hectare"
"      Time of concentration 71.415      0.001      71.415      minutes"
"      Time to Centroid      143.492      64.502      143.492      minutes"
"      Rainfall depth      25.037      25.037      25.037      mm"
"      Rainfall volume      2779.13      0.00      2779.13      c.m"
"      Rainfall losses      19.472      6.825      19.472      mm"
"      Runoff depth      5.565      18.213      5.565      mm"
"      Runoff volume      617.69      0.00      617.69      c.m"
"      Maximum flow      0.089      0.000      0.089      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"      0.089      0.089      0.165      0.356"
" 52      CHANNEL DESIGN"
"      0.089      Current peak flow      c.m/sec"
"      0.040      Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      10.000      Basewidth      metre"
"      10.000      Left bank slope"
"      10.000      Right bank slope"
"      10.000      Channel depth      metre"
"      5.000      Gradient      %"
"      Depth of flow              0.021      metre"

```

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

"	Velocity	0.418	m/sec"
"	Channel capacity	18488.199	c.m/sec"
"	Critical depth	0.020	metre"
" 53	ROUTE Zero Route"		
"	0.00 Zero Route Reach length ( metre) "		
"	0.089 0.089 0.089 0.356 c.m/sec"		
" 40	HYDROGRAPH Combine 2"		
"	6 Combine "		
"	2 Node #"		
"	Pond 3 "		
"	Maximum flow	0.389	c.m/sec"
"	Hydrograph volume	2616.035	c.m"
"	0.089 0.089 0.089 0.389"		
" 40	HYDROGRAPH Start - New Tributary"		
"	2 Start - New Tributary"		
"	0.089 0.000 0.089 0.389"		
" 33	CATCHMENT 205"		
"	1 Triangular SCS"		
"	2 Proportional to %"		
"	1 SCS method"		
"	205 Catchment 205 - north of Cobble Beach Drive"		
"	18.600 % Impervious"		
"	17.400 Total Area"		
"	44.000 Flow length"		
"	2.000 Overland Slope"		
"	14.164 Pervious Area"		
"	44.000 Pervious length"		
"	2.000 Pervious slope"		
"	3.236 Impervious Area"		
"	10.054 Impervious length"		
"	2.000 Impervious slope"		
"	0.250 Pervious Manning 'n' "		
"	82.300 Pervious SCS Curve No. "		
"	0.206 Pervious Runoff coefficient"		
"	0.100 Pervious Ia/S coefficient"		
"	5.463 Pervious Initial abstraction"		
"	0.015 Impervious Manning 'n' "		
"	98.000 Impervious SCS Curve No. "		
"	0.808 Impervious Runoff coefficient"		
"	0.100 Impervious Ia/S coefficient"		
"	0.518 Impervious Initial abstraction"		
"	0.313 0.000 0.089 0.389 c.m/sec"		
"	Catchment 205 Pervious Impervious Total Area "		
"	Surface Area 14.164 3.236 17.400 hectare"		
"	Time of concentration 42.315 1.650 23.659 minutes"		
"	Time to Centroid 116.795 67.535 94.197 minutes"		
"	Rainfall depth 25.037 25.037 25.037 mm"		
"	Rainfall volume 3546.17 810.31 4356.48 c.m"		
"	Rainfall losses 19.877 5.897 17.277 mm"		
"	Runoff depth 5.160 19.141 7.760 mm"		
"	Runoff volume 730.84 619.47 1350.31 c.m"		
"	Maximum flow 0.142 0.306 0.313 c.m/sec"		
" 40	HYDROGRAPH Add Runoff "		
"	4 Add Runoff "		
"	0.313 0.313 0.089 0.389"		

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

```

" 52      CHANNEL DESIGN"
"          0.313    Current peak flow      c.m/sec"
"          0.040    Manning 'n'"
"          0.       Cross-section type: 0=trapezoidal; 1=general"
"          0.700    Basewidth      metre"
"          2.000    Left bank slope"
"          2.000    Right bank slope"
"          1.000    Channel depth      metre"
"          5.000    Gradient      %"
"              Depth of flow              0.195      metre"
"              Velocity                    1.473      m/sec"
"              Channel capacity            9.786      c.m/sec"
"              Critical depth              0.220      metre"
" 53      ROUTE      Channel Route 221"
"          221.00    Channel Route 221 Reach length      ( metre)"
"          0.495    X-factor <= 0.5"
"          112.568   K-lag      ( seconds)"
"          0.000    Default(0) or user spec.(1) values used"
"          0.500    X-factor <= 0.5"
"          30.000   K-lag      ( seconds)"
"          0.500    Beta weighting factor"
"          100.000   Routing time step      ( seconds)"
"          1        No. of sub-reaches"
"              Peak outflow              0.265      c.m/sec"
"              0.313      0.313      0.265      0.389 c.m/sec"

" 40      HYDROGRAPH  Combine      2"
"          6        Combine "
"          2        Node #"
"          2        Pond 3 "
"              Maximum flow              0.628      c.m/sec"
"              Hydrograph volume          3966.359      c.m"
"              0.313      0.313      0.265      0.628"
" 40      HYDROGRAPH Start - New Tributary"
"          2        Start - New Tributary"
"              0.313      0.000      0.265      0.628"

" 33      CATCHMENT 206"
"          1        Triangular SCS"
"          2        Proportional to %"
"          1        SCS method"
"          206      Catchment 206 - South of Cobble Beach Drive"
"          0.000    % Impervious"
"          10.200   Total Area"
"          66.000   Flow length"
"          2.000    Overland Slope"
"          10.200   Pervious Area"
"          66.000   Pervious length"
"          2.000    Pervious slope"
"          0.000    Impervious Area"
"          0.000    Impervious length"
"          2.000    Impervious slope"
"          0.250    Pervious Manning 'n'"
"          80.300   Pervious SCS Curve No."
"          0.174    Pervious Runoff coefficient"
"          0.100    Pervious Ia/S coefficient"
"          6.231    Pervious Initial abstraction"

```

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.808	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.072	0.000	0.265	0.628 c.m/sec"
"		Catchment 206	Pervious	Impervious	Total Area "
"		Surface Area	10.200	0.000	10.200 hectare"
"		Time of concentration	57.761	0.001	57.761 minutes"
"		Time to Centroid	132.583	64.502	132.583 minutes"
"		Rainfall depth	25.037	25.037	25.037 mm"
"		Rainfall volume	2553.80	0.00	2553.80 c.m"
"		Rainfall losses	20.683	6.824	20.683 mm"
"		Runoff depth	4.354	18.213	4.354 mm"
"		Runoff volume	444.10	0.00	444.10 c.m"
"		Maximum flow	0.072	0.000	0.072 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.072	0.072	0.265	0.628"
" 52		CHANNEL DESIGN"			
"	0.072	Current peak flow	c.m/sec"		
"	0.040	Manning 'n'"			
"	0.	Cross-section type: 0=trapezoidal; 1=general"			
"	10.000	Basewidth	metre"		
"	10.000	Left bank slope"			
"	10.000	Right bank slope"			
"	1.000	Channel depth	metre"		
"	5.000	Gradient	%"		
"		Depth of flow	0.018	metre"	
"		Velocity	0.385	m/sec"	
"		Channel capacity	85.133	c.m/sec"	
"		Critical depth	0.017	metre"	
" 53		ROUTE Zero Route"			
"	0.00	Zero Route Reach length	( metre)"		
"		0.072	0.072	0.072	0.628 c.m/sec"
" 40		HYDROGRAPH Combine	2"		
"	6	Combine "			
"	2	Node #"			
"		Pond 3 "			
"		Maximum flow	0.657	c.m/sec"	
"		Hydrograph volume	4410.456	c.m"	
"		0.072	0.072	0.072	0.657"
" 40		HYDROGRAPH Confluence	2"		
"	7	Confluence "			
"	2	Node #"			
"		Pond 3 "			
"		Maximum flow	0.657	c.m/sec"	
"		Hydrograph volume	4410.456	c.m"	
"		0.072	0.657	0.072	0.000"
" 54		POND DESIGN"			
"	0.657	Current peak flow	c.m/sec"		
"	3.097	Target outflow	c.m/sec"		
"	4411.0	Hydrograph volume	c.m"		
"	30.	Number of stages"			
"	189.800	Minimum water level	metre"		
"	191.061	Maximum water level	metre"		

189.800		Starting water level		metre"	
0	Keep Design Data: 1 = True; 0 = False"				
	Level Discharge	Volume"			
	189.800	0.000	0.0"		
	189.838	0.004	348.7"		
	189.876	0.016	698.8"		
	189.914	0.034	1049.9"		
	189.952	0.054	1402.1"		
	189.990	0.074	1755.7"		
	190.028	0.074	2110.3"		
	190.066	0.074	2466.1"		
	190.104	0.079	2823.2"		
	190.142	0.084	3181.4"		
	190.180	0.088	3540.8"		
	190.218	0.093	3901.5"		
	190.256	0.097	4263.2"		
	190.294	0.101	4626.3"		
	190.332	0.193	4990.4"		
	190.370	0.398	5355.8"		
	190.400	0.611	5645.1"		
	190.446	1.162	6090.2"		
	190.484	1.779	6459.1"		
	190.522	2.511	6829.4"		
	190.560	3.346	7200.7"		
	190.598	4.277	7573.4"		
	190.636	5.301	7947.2"		
	190.674	6.414	8322.2"		
	190.712	7.615	8698.5"		
	190.750	8.900	9075.9"		
	190.788	10.269	9454.5"		
	190.864	13.257	10215.6"		
	190.942	16.664	11001.7"		
	191.020	20.413	11793.0"		
2.	WEIRS"				
	Crest	Weir	Crest	Left	Right"
	elevation	coefficie	breadth	sideslope	sideslope"
	190.300	0.900	10.000	4.000	4.000"
	190.400	0.900	10.000	4.000	4.000"
1.	LAYERS"				
	Bottom	Aspect	Bottom	Top	Average"
	area	ratio	elevation	elevation	sideslope"
	9163.000	2.000	189.800	191.061	2.000"
1.	OUTFLOW PIPE"				
	Upstream	Downstr'm	Pipe	Pipe	Manning
	invert	invert	Length	Diameter	'n'
	189.800	189.553	10.000	0.250	0.015
	Peak outflow		0.090	c.m/sec"	
	Maximum level		190.189	metre"	
	Maximum storage		3629.827	c.m"	
	Centroidal lag		11.201	hours"	
	0.072	0.657	0.090	0.000 c.m/sec"	
40	HYDROGRAPH Start - New Tributary"				
	2 Start - New Tributary"				
	0.072	0.000	0.090	0.000"	
33	CATCHMENT 207"				



**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

"	1	Triangular SCS"				
"	2	Proportional to %"				
"	1	SCS method"				
"	207	Catchment 207 - East end of Cobble Beach Drive"				
"	20.600	% Impervious"				
"	5.500	Total Area"				
"	39.000	Flow length"				
"	2.000	Overland Slope"				
"	4.367	Pervious Area"				
"	39.000	Pervious length"				
"	2.000	Pervious slope"				
"	1.133	Impervious Area"				
"	10.118	Impervious length"				
"	2.000	Impervious slope"				
"	0.350	Pervious Manning 'n' "				
"	84.000	Pervious SCS Curve No."				
"	0.238	Pervious Runoff coefficient"				
"	0.100	Pervious Ia/S coefficient"				
"	4.838	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n' "				
"	98.000	Impervious SCS Curve No."				
"	0.808	Impervious Runoff coefficient"				
"	0.100	Impervious Ia/S coefficient"				
"	0.518	Impervious Initial abstraction"				
"		0.110	0.000	0.090	0.000 c.m/sec"	
"		Catchment 207	Pervious	Impervious	Total Area	"
"		Surface Area	4.367	1.133	5.500	hectare"
"		Time of concentration	45.557	1.656	25.558	minutes"
"		Time to Centroid	118.767	67.544	95.433	minutes"
"		Rainfall depth	25.037	25.037	25.037	mm"
"		Rainfall volume	1093.38	283.67	1377.05	c.m"
"		Rainfall losses	19.099	5.888	16.378	mm"
"		Runoff depth	5.938	19.150	8.659	mm"
"		Runoff volume	259.31	216.97	476.27	c.m"
"		Maximum flow	0.050	0.107	0.110	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.110	0.110	0.090	0.000"	
" 33		CATCHMENT 208"				
"	1	Triangular SCS"				
"	2	Proportional to %"				
"	1	SCS method"				
"	208	Catchment 208 - McLeese Dr. north of Punkinseed Lane"				
"	19.500	% Impervious"				
"	7.020	Total Area"				
"	33.000	Flow length"				
"	2.000	Overland Slope"				
"	5.651	Pervious Area"				
"	33.000	Pervious length"				
"	2.000	Pervious slope"				
"	1.369	Impervious Area"				
"	7.994	Impervious length"				
"	2.000	Impervious slope"				
"	0.250	Pervious Manning 'n' "				
"	84.900	Pervious SCS Curve No."				
"	0.256	Pervious Runoff coefficient"				

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

```

"      0.100  Pervious Ia/S coefficient"
"      4.518  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"  98.000  Impervious SCS Curve No."
"      0.808  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"          0.138      0.110      0.090      0.000 c.m/sec"
"      Catchment 208      Pervious      Impervious Total Area "
"      Surface Area      5.651      1.369      7.020      hectare"
"      Time of concentration 32.718      1.438      19.711      minutes"
"      Time to Centroid      106.345      67.218      90.075      minutes"
"      Rainfall depth      25.037      25.037      25.037      mm"
"      Rainfall volume      1414.88      342.73      1757.61      c.m"
"      Rainfall losses      18.643      6.248      16.226      mm"
"      Runoff depth      6.394      18.789      8.811      mm"
"      Runoff volume      361.33      257.20      618.53      c.m"
"      Maximum flow      0.086      0.131      0.138      c.m/sec"
"  40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.138      0.247      0.090      0.000"
"  52      CHANNEL DESIGN"
"      0.247  Current peak flow      c.m/sec"
"      0.040  Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      1.000  Basewidth      metre"
"      2.000  Left bank slope"
"      2.000  Right bank slope"
"      1.000  Channel depth      metre"
"      5.000  Gradient      %"
"      Depth of flow      0.146      metre"
"      Velocity      1.313      m/sec"
"      Channel capacity      11.234      c.m/sec"
"      Critical depth      0.164      metre"
"  53      ROUTE      Channel Route 120"
"      120.00      Channel Route 120 Reach length      ( metre)"
"      0.493  X-factor <= 0.5"
"      68.487  K-lag      ( seconds)"
"      0.000  Default(0) or user spec.(1) values used"
"      0.500  X-factor <= 0.5"
"      30.000  K-lag      ( seconds)"
"      0.500  Beta weighting factor"
"      66.667  Routing time step      ( seconds)"
"      1      No. of sub-reaches"
"      Peak outflow      0.224      c.m/sec"
"          0.138      0.247      0.224      0.000 c.m/sec"
"  40      HYDROGRAPH Next link "
"      5      Next link "
"          0.138      0.224      0.224      0.000"
"  52      CHANNEL DESIGN"
"      0.224  Current peak flow      c.m/sec"
"      0.040  Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      2.000  Basewidth      metre"
"      3.000  Left bank slope"
"      3.000  Right bank slope"

```

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

"	1.000	Channel depth	metre"		
"	5.000	Gradient	%"		
"		Depth of flow		0.093	metre"
"		Velocity		1.055	m/sec"
"		Channel capacity		19.898	c.m/sec"
"		Critical depth		0.103	metre"
" 53		ROUTE	Channel Route 150"		
"	150.00	Channel Route 150 Reach length	( metre)"		
"	0.496	X-factor <= 0.5"			
"	106.581	K-lag ( seconds)"			
"	0.000	Default(0) or user spec.(1) values used"			
"	0.500	X-factor <= 0.5"			
"	30.000	K-lag ( seconds)"			
"	0.500	Beta weighting factor"			
"	100.000	Routing time step ( seconds)"			
"	1	No. of sub-reaches"			
"		Peak outflow		0.212	c.m/sec"
"		0.138 0.224 0.212		0.000	c.m/sec"
" 40		HYDROGRAPH Combine	3"		
"	6	Combine "			
"	3	Node #"			
"		Pond 2 Confluence"			
"		Maximum flow		0.212	c.m/sec"
"		Hydrograph volume		1094.817	c.m"
"		0.138 0.224 0.212		0.212	"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.138 0.000 0.212		0.212	"
" 33		CATCHMENT 209"			
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	209	Catchment 209 - Punkinseed Lane - north and west end"			
"	21.000	% Impervious"			
"	1.930	Total Area"			
"	36.000	Flow length"			
"	2.000	Overland Slope"			
"	1.525	Pervious Area"			
"	36.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.405	Impervious Area"			
"	9.570	Impervious ,length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n' "			
"	84.200	Pervious SCS Curve No. "			
"	0.242	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.766	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No. "			
"	0.808	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.040 0.000 0.212		0.212	c.m/sec"
"		Catchment 209 Pervious Impervious Total Area "			

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

"	Surface Area	1.525	0.405	1.930	hectare"
"	Time of concentration	35.255	1.602	19.894	minutes"
"	Time to Centroid	109.010	67.469	90.049	minutes"
"	Rainfall depth	25.037	25.037	25.037	mm"
"	Rainfall volume	381.74	101.48	483.22	c.m"
"	Rainfall losses	19.001	5.968	16.264	mm"
"	Runoff depth	6.036	19.069	8.773	mm"
"	Runoff volume	92.03	77.29	169.32	c.m"
"	Maximum flow	0.020	0.038	0.040	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"		0.040	0.040	0.212	0.212"
" 52	CHANNEL DESIGN"				
"	0.040	Current peak flow	c.m/sec"		
"	0.040	Manning 'n'"			
"	0.	Cross-section type: 0=trapezoidal; 1=general"			
"	0.500	Basewidth	metre"		
"	3.000	Left bank slope"			
"	3.000	Right bank slope"			
"	0.750	Channel depth	metre"		
"	20.000	Gradient	%"		
"		Depth of flow	0.048	metre"	
"		Velocity	1.280	m/sec"	
"		Channel capacity	12.379	c.m/sec"	
"		Critical depth	0.074	metre"	
" 53	ROUTE Channel Route 30"				
"	30.00	Channel Route 30 Reach length	( metre)"		
"	0.498	X-factor <= 0.5"			
"	17.590	K-lag ( seconds)"			
"	0.000	Default(0) or user spec.(1) values used"			
"	0.500	X-factor <= 0.5"			
"	30.000	K-lag ( seconds)"			
"	0.500	Beta weighting factor"			
"	17.647	Routing time step ( seconds)"			
"	1	No. of sub-reaches"			
"		Peak outflow	0.039	c.m/sec"	
"		0.040	0.040	0.039	0.212 c.m/sec"
" 40	HYDROGRAPH Combine 3"				
"	6	Combine "			
"	3	Node #"			
"		Pond 2 Confluence"			
"		Maximum flow	0.245	c.m/sec"	
"		Hydrograph volume	1264.139	c.m"	
"		0.040	0.040	0.039	0.245"
" 40	HYDROGRAPH Confluence 3"				
"	7	Confluence "			
"	3	Node #"			
"		Pond 2 Confluence"			
"		Maximum flow	0.245	c.m/sec"	
"		Hydrograph volume	1264.139	c.m"	
"		0.040	0.245	0.039	0.000"
" 54	POND DESIGN"				
"	0.245	Current peak flow	c.m/sec"		
"	2.235	Target outflow	c.m/sec"		
"	1270.0	Hydrograph volume	c.m"		
"	23.	Number of stages"			

**Cobble Beach Post-Development Miduss Summary:**  
**Pond 2 & Pond 3, 2 Year – 2 Hour Storm Event**

"	179.000	Minimum water level	metre"			
"	180.300	Maximum water level	metre"			
"	179.000	Starting water level	metre"			
"	0	Keep Design Data: 1 = True; 0 = False"				
"		Level Discharge	Volume"			
"	179.000	0.000	0.0"			
"	179.059	0.009	227.7"			
"	179.118	0.028	457.2"			
"	179.177	0.028	688.7"			
"	179.236	0.030	921.9"			
"	179.295	0.031	1157.0"			
"	179.355	0.033	1398.0"			
"	179.400	0.034	1580.0"			
"	179.473	0.133	1877.7"			
"	179.532	0.286	2120.2"			
"	179.591	0.495	2364.8"			
"	179.650	0.757	2611.2"			
"	179.709	1.073	2859.5"			
"	179.768	1.444	3109.8"			
"	179.827	1.871	3361.9"			
"	179.900	2.478	3676.5"			
"	179.945	3.046	3872.0"			
"	180.005	4.050	4134.3"			
"	180.064	5.246	4394.2"			
"	180.123	6.629	4656.1"			
"	180.182	8.191	4920.0"			
"	180.241	9.925	5185.7"			
"	180.300	11.832	5453.5"			
"	2.	WEIRS"				
"		Crest Weir Crest Left Right"				
"		elevation coefficie breadth sideslope sideslope"				
"		179.400 0.900 3.000 4.000 4.000"				
"		179.900 0.900 10.000 4.000 4.000"				
"	1.	LAYERS"				
"		Bottom Aspect Bottom Top Average"				
"		area ratio elevation elevation sideslope"				
"		3844.000 2.000 179.000 180.300 2.000"				
"	1.	OUTFLOW PIPE"				
"		Upstream Downstr'm Pipe Pipe Manning Entry"				
"		invert invert Length Diameter 'n' loss Ke"				
"		179.000 178.500 10.000 0.150 0.015 0.500"				
"		Peak outflow 0.031 c.m/sec"				
"		Maximum level 179.261 metre"				
"		Maximum storage 1020.233 c.m"				
"		Centroidal lag 8.424 hours"				
"		0.040 0.245 0.031 0.000 c.m/sec"				
" 38		START/RE-START TOTALS 3"				
"	3	Runoff Totals on EXIT"				
"		Total Catchment area 77.080 hectare"				
"		Total Impervious area 10.444 hectare"				
"		Total % impervious 13.550"				
" 19		EXIT"				



PRYDE SCHROPP McCOMB INC.  
CONSULTING ENGINEERS

## **APPENDIX D**

### **COBBLE BEACH DEVELOPMENT STAGE 1 (2007)**

### **MIDUSS OUTPUT FILES 5 YEAR – 6 HOUR STORM**



**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

```

"      MIDUSS Output ----->"
"      MIDUSS version                      Version 2.01  rev. 329"
"      MIDUSS created                      Monday, May 17, 2004"
"      10  Units used:                      ie METRIC"
"      Job folder:                        C:\Documents and Settings\scobean\
"                                     My Documents\MIDUSSdata\Georgian Villas\June 2007"
"      Output filename: 30202'June 2007 5 yr with ponds 2 and 3 6.out"
"      Licensee name:                      Steve Cobean"
"      Company                            PSMI Inc."
"      Date & Time last used:              6/25/2007 at 1:36:37 PM"
" 31      TIME PARAMETERS"
"          10.000  Time Step"
"          1440.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          622.420 Coefficient A"
"          7.184  Constant B"
"          0.690  Exponent C"
"          0.400  Fraction R"
"          360.000 Duration"
"          2.000  Time step multiplier"
"          Maximum intensity              61.324  mm/hr"
"          Total depth                    63.455  mm"
"          6  005hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 201"
"          1  Triangular SCS"
"          2  Proportional to %"
"          1  SCS method"
"          201 Catchment 201 - south of main entrance"
"          19.200 % Impervious"
"          12.000 Total Area"
"          47.000 Flow length"
"          2.000 Overland Slope"
"          9.696 Pervious Area"
"          47.000 Pervious length"
"          2.000 Pervious slope"
"          2.304 Impervious Area"
"          11.168 Impervious length"
"          2.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          84.100 Pervious SCS Curve No."
"          0.508 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          4.802 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.916 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"
"          0.818  0.000  0.000  0.000 c.m/sec"
"          Catchment 201      Pervious  Impervious Total Area "
"          Surface Area      9.696      2.304      12.000  hectare"
"          Time of concentration 23.122      1.502      16.875  minutes"
"          Time to Centroid    228.871     180.237     214.819  minutes"
"          Rainfall depth     63.455     63.455     63.455  mm"

```

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

"	Rainfall volume	6152.58	1462.00	7614.59	c.m"
"	Rainfall losses	31.270	8.416	26.882	mm"
"	Runoff depth	32.185	55.039	36.573	mm"
"	Runoff volume	3120.68	1268.10	4388.78	c.m"
"	Maximum flow	0.702	0.340	0.818	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.818	0.818	0.000	0.000"	
" 52	CHANNEL DESIGN"				
"	0.818	Current peak flow	c.m/sec"		
"	0.040	Manning 'n'"			
"	0.	Cross-section type: 0=trapezoidal; 1=general"			
"	0.600	Basewidth	metre"		
"	2.000	Left bank slope"			
"	2.000	Right bank slope"			
"	1.000	Channel depth	metre"		
"	5.000	Gradient	%"		
"	Depth of flow	0.334	metre"		
"	Velocity	1.928	m/sec"		
"	Channel capacity	9.309	c.m/sec"		
"	Critical depth	0.384	metre"		
" 53	ROUTE Channel Route 200"				
"	200.00	Channel Route 200 Reach length	( metre)"		
"	0.492	X-factor <= 0.5"			
"	77.805	K-lag ( seconds)"			
"	0.000	Default(0) or user spec.(1) values used"			
"	0.500	X-factor <= 0.5"			
"	30.000	K-lag ( seconds)"			
"	0.500	Beta weighting factor"			
"	75.000	Routing time step ( seconds)"			
"	1	No. of sub-reaches"			
"	Peak outflow	0.814	c.m/sec"		
"	0.818	0.818	0.814	0.000 c.m/sec"	
" 40	HYDROGRAPH Combine 1"				
"	6	Combine "			
"	1	Node #"			
"	Confluence at Pond 3"				
"	Maximum flow	0.814	c.m/sec"		
"	Hydrograph volume	4388.779	c.m"		
"	0.818	0.818	0.814	0.814"	
" 40	HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"			
"	0.818	0.000	0.814	0.814"	
" 33	CATCHMENT 202"				
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	202	Catchment 202 - Beacon Crest"			
"	26.600	% Impervious"			
"	1.230	Total Area"			
"	38.000	Flow length"			
"	2.000	Overland Slope"			
"	0.903	Pervious Area"			
"	38.000	Pervious length"			

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

```

"      2.000  Pervious slope"
"      0.327  Impervious Area"
"     13.771  Impervious length"
"      2.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"     84.500  Pervious SCS Curve No."
"      0.517  Pervious Runoff coefficient"
"      0.100  Pervious Ia/S coefficient"
"      4.659  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"     98.000  Impervious SCS Curve No."
"      0.916  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"          0.100      0.000      0.814      0.814 c.m/sec"
"      Catchment 202      Pervious      Impervious      Total Area "
"      Surface Area      0.903      0.327      1.230      hectare"
"      Time of concentration 20.222      1.703      13.145      minutes"
"      Time to Centroid      224.715      180.274      207.732      minutes"
"      Rainfall depth      63.455      63.455      63.455      mm"
"      Rainfall volume      572.88      207.61      780.49      c.m"
"      Rainfall losses      30.816      7.752      24.681      mm"
"      Runoff depth      32.639      55.703      38.774      mm"
"      Runoff volume      294.67      182.25      476.92      c.m"
"      Maximum flow      0.072      0.049      0.100      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.100      0.100      0.814      0.814"
" 52      CHANNEL DESIGN"
"      0.100      Current peak flow      c.m/sec"
"      0.040      Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      1.000      Basewidth      metre"
"      3.000      Left bank slope"
"      3.000      Right bank slope"
"      1.000      Channel depth      metre"
"      3.000      Gradient      %"
"      Depth of flow      0.098      metre"
"      Velocity      0.791      m/sec"
"      Channel capacity      11.572      c.m/sec"
"      Critical depth      0.091      metre"
" 53      ROUTE      Channel Route 100"
"      100.00      Channel Route 100 Reach length      ( metre)"
"      0.491      X-factor <= 0.5"
"      94.915      K-lag      ( seconds)"
"      0.000      Default(0) or user spec.(1) values used"
"      0.500      X-factor <= 0.5"
"      30.000      K-lag      ( seconds)"
"      0.500      Beta weighting factor"
"      85.714      Routing time step      ( seconds)"
"      1      No. of sub-reaches"
"      Peak outflow      0.094      c.m/sec"
"          0.100      0.100      0.094      0.814 c.m/sec"
" 40      HYDROGRAPH      Combine      1"
"      6      Combine "
"      1      Node #"

```

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

```

"      Confluence at Pond 3"
"      Maximum flow              0.906      c.m/sec"
"      Hydrograph volume          4865.696    c.m"
"      0.100      0.100      0.094      0.906"
40    HYDROGRAPH Confluence 1"
"      7 Confluence "
"      1 Node #"
"      Confluence at Pond 3"
"      Maximum flow              0.906      c.m/sec"
"      Hydrograph volume          4865.696    c.m"
"      0.100      0.906      0.094      0.000"
52    CHANNEL DESIGN"
"      0.906 Current peak flow      c.m/sec"
"      0.040 Manning 'n'"
"      0. Cross-section type: 0=trapezoidal; 1=general"
"      1.000 Basewidth      metre"
"      3.000 Left bank slope"
"      3.000 Right bank slope"
"      1.000 Channel depth      metre"
"      5.000 Gradient      %"
"      Depth of flow              0.275      metre"
"      Velocity                    1.804      m/sec"
"      Channel capacity            14.940      c.m/sec"
"      Critical depth              0.319      metre"
53    ROUTE Channel Route 330"
"      330.00 Channel Route 330 Reach length ( metre)"
"      0.496 X-factor <= 0.5"
"      137.221 K-lag ( seconds)"
"      0.000 Default(0) or user spec.(1) values used"
"      0.500 X-factor <= 0.5"
"      30.000 K-lag ( seconds)"
"      0.500 Beta weighting factor"
"      120.000 Routing time step ( seconds)"
"      1 No. of sub-reaches"
"      Peak outflow              0.890      c.m/sec"
"      0.100      0.906      0.890      0.000 c.m/sec"
40    HYDROGRAPH Combine 2"
"      6 Combine "
"      2 Node #"
"      Pond 3 "
"      Maximum flow              0.890      c.m/sec"
"      Hydrograph volume          4865.696    c.m"
"      0.100      0.906      0.890      0.890"
40    HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"
"      0.100      0.000      0.890      0.890"
33    CATCHMENT 203"
"      1 Triangular SCS"
"      2 Proportional to %"
"      1 SCS method"
"      203 Catchment 203 - Western Portion of McLeese Dr. "
"      15.600 % Impervious"
"      10.700 Total Area"
"      49.000 Flow length"
"      2.000 Overland Slope"
"      9.031 Pervious Area"

```

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

```

"      49.000  Pervious length"
"      2.000  Pervious slope"
"      1.669  Impervious Area"
"      9.057  Impervious length"
"      2.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"    84.000  Pervious SCS Curve No."
"      0.506  Pervious Runoff coefficient"
"      0.100  Pervious Ia/S coefficient"
"      4.838  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"   98.000  Impervious SCS Curve No."
"      0.916  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"          0.715      0.000      0.890      0.890 c.m/sec"
"      Catchment 203      Pervious      Impervious      Total Area "
"      Surface Area      9.031      1.669      10.700      hectare"
"      Time of concentration 23.746      1.324      18.399      minutes"
"      Time to Centroid      229.813      180.117      217.960      minutes"
"      Rainfall depth      63.455      63.455      63.455      mm"
"      Rainfall volume      5730.48      1059.19      6789.67      c.m"
"      Rainfall losses      31.451      9.223      27.983      mm"
"      Runoff depth      32.004      54.232      35.471      mm"
"      Runoff volume      2890.21      905.23      3795.44      c.m"
"      Maximum flow      0.638      0.241      0.715      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.715      0.715      0.890      0.890"
" 52      CHANNEL DESIGN"
"      0.715      Current peak flow      c.m/sec"
"      0.040      Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"    10.000      Basewidth      metre"
"    10.000      Left bank slope"
"    10.000      Right bank slope"
"    10.000      Channel depth      metre"
"      5.000      Gradient      %"
"          Depth of flow      0.072      metre"
"          Velocity      0.926      m/sec"
"          Channel capacity      18488.199      c.m/sec"
"          Critical depth      0.078      metre"
" 53      ROUTE      Channel Route 0"
"      0.01      Channel Route 0 Reach length      ( metre)"
"      0.000      X-factor <= 0.5"
"      0.008      K-lag      ( seconds)"
"      0.000      Default(0) or user spec.(1) values used"
"      0.500      X-factor <= 0.5"
"    30.000      K-lag      ( seconds)"
"      0.989      Beta weighting factor"
"      0.696      Routing time step      ( seconds)"
"      1      No. of sub-reaches"
"          Peak outflow      0.715      c.m/sec"
"          0.715      0.715      0.715      0.890 c.m/sec"
" 40      HYDROGRAPH      Combine      2"
"      6      Combine "

```

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

```

"      2   Node #"
"      Pond 3 "
"      Maximum flow           1.605      c.m/sec"
"      Hydrograph volume      8661.121    c.m"
"      0.715      0.715      0.715      1.605"
" 40      HYDROGRAPH Start - New Tributary"
"      2   Start - New Tributary"
"      0.715      0.000      0.715      1.605"
" 33      CATCHMENT 204"
"      1   Triangular SCS"
"      2   Proportional to %"
"      1   SCS method"
"      204  Hole 14 and 15 "
"      0.000  % Impervious"
"      11.100 Total Area"
"      79.000 Flow length"
"      2.000 Overland Slope"
"      11.100 Pervious Area"
"      79.000 Pervious length"
"      2.000 Pervious slope"
"      0.000 Impervious Area"
"      0.000 Impervious length"
"      2.000 Impervious slope"
"      0.350 Pervious Manning 'n'"
"      83.200 Pervious SCS Curve No."
"      0.489 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      5.129 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.916 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.562      0.000      0.715      1.605 c.m/sec"
"      Catchment 204      Pervious      Impervious Total Area "
"      Surface Area      11.100      0.000      11.100      hectare"
"      Time of concentration 39.213      0.001      39.213      minutes"
"      Time to Centroid      250.775      176.394      250.775      minutes"
"      Rainfall depth      63.455      63.455      63.455      mm"
"      Rainfall volume      7043.48      0.01      7043.49      c.m"
"      Rainfall losses      32.461      11.132      32.461      mm"
"      Runoff depth      30.994      52.323      30.994      mm"
"      Runoff volume      3440.33      0.01      3440.33      c.m"
"      Maximum flow      0.562      0.000      0.562      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4   Add Runoff "
"      0.562      0.562      0.715      1.605"
" 52      CHANNEL DESIGN"
"      0.562 Current peak flow      c.m/sec"
"      0.040 Manning 'n'"
"      0.   Cross-section type: 0=trapezoidal; 1=general"
"      10.000 Basewidth      metre"
"      10.000 Left bank slope"
"      10.000 Right bank slope"
"      10.000 Channel depth      metre"
"      5.000 Gradient      %"

```

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year - 6 Hour Storm Event**

"	Depth of flow	0.062	metre"
"	Velocity	0.847	m/sec"
"	Channel capacity	18488.199	c.m/sec"
"	Critical depth	0.067	metre"
" 53	ROUTE Zero Route"		
"	0.00 Zero Route Reach length ( metre)"		
"	0.562 0.562 0.562 1.605 c.m/sec"		
" 40	HYDROGRAPH Combine 2"		
"	6 Combine "		
"	2 Node #"		
"	Pond 3 "		
"	Maximum flow	2.092	c.m/sec"
"	Hydrograph volume	12101.456	c.m"
"	0.562 0.562 0.562 2.092"		
" 40	HYDROGRAPH Start - New Tributary"		
"	2 Start - New Tributary"		
"	0.562 0.000 0.562 2.092"		
" 33	CATCHMENT 205"		
"	1 Triangular SCS"		
"	2 Proportional to %"		
"	1 SCS method"		
"	205 Catchment 205 - north of Cobble Beach Drive"		
"	18.600 % Impervious"		
"	17.400 Total Area"		
"	44.000 Flow length"		
"	2.000 Overland Slope"		
"	14.164 Pervious Area"		
"	44.000 Pervious length"		
"	2.000 Pervious slope"		
"	3.236 Impervious Area"		
"	10.054 Impervious length"		
"	2.000 Impervious slope"		
"	0.250 Pervious Manning 'n' "		
"	82.300 Pervious SCS Curve No."		
"	0.471 Pervious Runoff coefficient"		
"	0.100 Pervious Ia/S coefficient"		
"	5.463 Pervious Initial abstraction"		
"	0.015 Impervious Manning 'n' "		
"	98.000 Impervious SCS Curve No."		
"	0.916 Impervious Runoff coefficient"		
"	0.100 Impervious Ia/S coefficient"		
"	0.518 Impervious Initial abstraction"		
"	1.093 0.000 0.562 2.092 c.m/sec"		
"	Catchment 205 Pervious Impervious Total Area "		
"	Surface Area 14.164 3.236 17.400 hectare"		
"	Time of concentration 22.894 1.410 16.551 minutes"		
"	Time to Centroid 230.229 180.183 215.454 minutes"		
"	Rainfall depth 63.455 63.455 63.455 mm"		
"	Rainfall volume 0.8987 0.2054 1.1041 ha-m"		
"	Rainfall losses 33.645 8.804 29.025 mm"		
"	Runoff depth 29.809 54.651 34.430 mm"		
"	Runoff volume 4222.09 1768.73 5990.83 c.m"		
"	Maximum flow 0.937 0.473 1.093 c.m/sec"		
" 40	HYDROGRAPH Add Runoff "		



**Cobble Beach Post-Development Miduss Summary:**  
**5 Year - 6 Hour Storm Event**

```

"      4      Add Runoff "
"      1.093      1.093      0.562      2.092"
" 52      CHANNEL DESIGN"
"      1.093      Current peak flow      c.m/sec"
"      0.040      Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      0.700      Basewidth      metre"
"      2.000      Left bank slope"
"      2.000      Right bank slope"
"      1.000      Channel depth      metre"
"      5.000      Gradient      %"
"      Depth of flow      0.368      metre"
"      Velocity      2.069      m/sec"
"      Channel capacity      9.786      c.m/sec"
"      Critical depth      0.427      metre"
" 53      ROUTE      Channel Route 221"
"      221.00      Channel Route 221 Reach length      ( metre)"
"      0.492      X-factor <= 0.5"
"      80.102      K-lag      ( seconds)"
"      0.000      Default(0) or user spec.(1) values used"
"      0.500      X-factor <= 0.5"
"      30.000      K-lag      ( seconds)"
"      0.500      Beta weighting factor"
"      75.000      Routing time step      ( seconds)"
"      1      No. of sub-reaches"
"      Peak outflow      1.087      c.m/sec"
"      1.093      1.093      1.087      2.092 c.m/sec"

" 40      HYDROGRAPH      Combine      2"
"      6      Combine "
"      2      Node #"
"      Pond 3 "
"      Maximum flow      3.116      c.m/sec"
"      Hydrograph volume      18092.279      c.m"
"      1.093      1.093      1.087      3.116"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"
"      1.093      0.000      1.087      3.116"
" 33      CATCHMENT 206"
"      1      Triangular SCS"
"      2      Proportional to %"
"      1      SCS method"
"      206      Catchment 206 - South of Cobble Beach Drive"
"      0.000      % Impervious"
"      10.200      Total Area"
"      66.000      Flow length"
"      2.000      Overland Slope"
"      10.200      Pervious Area"
"      66.000      Pervious length"
"      2.000      Pervious slope"
"      0.000      Impervious Area"
"      0.000      Impervious length"
"      2.000      Impervious slope"
"      0.250      Pervious Manning 'n'"
"      80.300      Pervious SCS Curve No."
"      0.432      Pervious Runoff coefficient"

```

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

"	0.100	Pervious Ia/S coefficient"			
"	6.231	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No."			
"	0.916	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.542	0.000	1.087	3.116 c.m/sec"
"		Catchment 206	Pervious	Impervious	Total Area "
"		Surface Area	10.200	0.000	10.200 hectare"
"		Time of concentration	30.205	0.001	30.205 minutes"
"		Time to Centroid	241.529	176.394	241.529 minutes"
"		Rainfall depth	63.455	63.455	63.455 mm"
"		Rainfall volume	6472.39	0.01	6472.40 c.m"
"		Rainfall losses	36.094	11.131	36.094 mm"
"		Runoff depth	27.361	52.324	27.361 mm"
"		Runoff volume	2790.85	0.01	2790.85 c.m"
"		Maximum flow	0.542	0.000	0.542 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.542	0.542	1.087	3.116"
" 52		CHANNEL DESIGN"			
"	0.542	Current peak flow	c.m/sec"		
"	0.040	Manning 'n' "			
"	0.	Cross-section type: 0=trapezoidal; 1=general"			
"	10.000	Basewidth	metre"		
"	10.000	Left bank slope"			
"	10.000	Right bank slope"			
"	1.000	Channel depth	metre"		
"	5.000	Gradient	%"		
"		Depth of flow	0.061	metre"	
"		Velocity	0.835	m/sec"	
"		Channel capacity	85.133	c.m/sec"	
"		Critical depth	0.065	metre"	
" 53		ROUTE Zero Route"			
"	0.00	Zero Route Reach length	( metre)"		
"		0.542	0.542	0.542	3.116 c.m/sec"
" 40		HYDROGRAPH Combine	2"		
"	6	Combine "			
"	2	Node #"			
"		Pond 3 "			
"		Maximum flow	3.658	c.m/sec"	
"		Hydrograph volume	20883.137	c.m"	
"		0.542	0.542	0.542	3.658"
" 40		HYDROGRAPH Confluence	2"		
"	7	Confluence "			
"	2	Node #"			
"		Pond 3 "			
"		Maximum flow	3.658	c.m/sec"	
"		Hydrograph volume	20883.137	c.m"	
"		0.542	3.658	0.542	0.000"
" 54		POND DESIGN"			
"	3.658	Current peak flow	c.m/sec"		
"	3.097	Target outflow	c.m/sec"		
"	20890.0	Hydrograph volume	c.m"		
"	21.	Number of stages"			

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

```

" 189.800 Minimum water level metre"
" 190.750 Maximum water level metre"
" 189.800 Starting water level metre"
" 0 Keep Design Data: 1 = True; 0 = False"
" Level Discharge Volume"
" 189.800 0.000 0.0"
" 189.848 0.000 4116.3"
" 189.895 0.000 4611.4"
" 189.943 0.000 5118.9"
" 189.990 0.000 5618.0"
" 190.038 0.000 6129.5"
" 190.100 0.000 6793.5"
" 190.133 0.000 7148.1"
"
" 190.180 0.000 7654.9"
" 190.228 0.000 8174.5"
" 190.275 0.000 8685.3"
" 190.300 0.000 8957.8"
" 190.370 0.290 9723.6"
" 190.417 0.636 10240.4"
" 190.465 1.079 10769.9"
" 190.512 1.592 11290.5"
" 190.560 2.191 11824.3"
" 190.607 2.848 12348.9"
" 190.655 3.588 12886.7"
" 190.702 4.378 13415.2"
" 190.750 5.252 13957.2"
"
" 1. WEIRS"
" Crest Weir Crest Left Right"
" elevation coefficie breadth sideslope sideslope"
" 190.300 0.900 10.000 4.000 4.000"
"
" 1. LAYERS"
" Bottom Aspect Bottom Top Average"
" area ratio elevation elevation sideslope"
" 10171.000 2.000 189.450 190.750 2.000"
" Peak outflow 1.319 c.m/sec"
" Maximum level 190.487 metre"
" Maximum storage 11013.102 c.m"
" Centroidal lag 5.087 hours"
" 0.542 3.658 1.319 0.000 c.m/sec"
" 40 HYDROGRAPH Next link "
" 5 Next link "
" 0.542 1.319 1.319 0.000"
" 52 CHANNEL DESIGN"
" 1.319 Current peak flow c.m/sec"
" 0.040 Manning 'n'"
" 0. Cross-section type: 0=trapezoidal; 1=general"
" 2.000 Basewidth metre"
" 3.000 Left bank slope"
" 3.000 Right bank slope"
" 0.600 Channel depth metre"
" 5.000 Gradient %"
" Depth of flow 0.254 metre"
" Velocity 1.878 m/sec"
" Channel capacity 6.844 c.m/sec"
" Critical depth 0.302 metre"

```

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

```

" 53      ROUTE      Channel Route 150"
"      150.00      Channel Route 150 Reach length      ( metre) "
"      0.491      X-factor <= 0.5"
"      59.916      K-lag      ( seconds) "
"      0.000      Default(0) or user spec.(1) values used"
"      0.500      X-factor <= 0.5"
"      30.000      K-lag      ( seconds) "
"      0.500      Beta weighting factor"
"      60.000      Routing time step      ( seconds) "
"      1          No. of sub-reaches"
"      Peak outflow      1.304      c.m/sec"
"      0.542      1.319      1.304      0.000 c.m/sec"
" 40      HYDROGRAPH Next link "
"      5          Next link "
"      0.542      1.304      1.304      0.000"
" 58      CULVERT"
"      1.304      Culvert Q      c.m/sec"
"      25.00      Length      metre"
"      0.015      Manning 'n'"
"      100.250      Upstream IL      metre"
"      100.000      Downstream IL      metre"
"      102.250      Weir Elev.      metre"
"      20.000      Weir Breadth.      metre"
"      25.000      Weir Left slope to 1"
"      25.000      Weir Right slope to 1"
"      100.000      Tail water elevation to 1"
"      1          Barrel Option (Pipe/Box/CSPA/HE/VE) "
"      1.200      Barrel Height/Diameter"
"      1.200      Barrel Width"
"      0.500      Coeff.of Discharge"
"      0.900      Entrance Energy loss coeff."
"      2          Number of Barrels"
"      0          Number of stages"
"      Level Discharge      Volume"
"      2.000      Channel Basewidth"
"      0.600      Channel Depth"
"      5.600      Channel Topwidth"
"      10.000      Grade Left"
"      10.000      Grade Right"
"      5.000      Grade %"
"      150.000      Length"
"      Peak outflow      1.304      c.m/sec"
"      Maximum level      100.918      metre"
"      Maximum storage      0.000      c.m"
"      Centroidal lag      0.000      hours"
"      Weir flow      0.000      c.m/sec"
"      0.542      1.304      1.304      0.000 c.m/sec"
" 40      HYDROGRAPH Combine 3"
"      6          Combine "
"      3          Node #"
"      DP#2"
"      Maximum flow      1.304      c.m/sec"
"      Hydrograph volume      11912.274      c.m"
"      0.542      1.304      1.304      1.304"
" 40      HYDROGRAPH Start - New Tributary"
"      2          Start - New Tributary"

```

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

"		0.542	0.000	1.304	1.304"
" 33	CATCHMENT 207"				
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	207	Catchment 207 - East end of Cobble Beach Drive"			
"	20.600	% Impervious"			
"	5.500	Total Area"			
"	39.000	Flow length"			
"	2.000	Overland Slope"			
"	4.367	Pervious Area"			
"	39.000	Pervious length"			
"	2.000	Pervious slope"			
"	1.133	Impervious Area"			
"	10.118	Impervious length"			
"	2.000	Impervious slope"			
"	0.350	Pervious Manning 'n' "			
"	84.000	Pervious SCS Curve No. "			
"	0.506	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.838	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No. "			
"	0.916	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.348	0.000	1.304	1.304 c.m/sec"
"		Catchment 207	Pervious	Impervious	Total Area "
"		Surface Area	4.367	1.133	5.500 hectare"
"		Time of concentration	25.339	1.415	17.994 minutes"
"		Time to Centroid	231.909	180.187	216.029 minutes"
"		Rainfall depth	63.455	63.455	63.455 mm"
"		Rainfall volume	2771.07	718.94	3490.02 c.m"
"		Rainfall losses	31.438	8.779	26.770 mm"
"		Runoff depth	32.017	54.676	36.685 mm"
"		Runoff volume	1398.19	619.48	2017.66 c.m"
"		Maximum flow	0.294	0.166	0.348 c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"		0.348	0.348	1.304	1.304"
" 33	CATCHMENT 208"				
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	208	Catchment 208 - McLeese Dr. north of Punkinseed Lane"			
"	19.500	% Impervious"			
"	7.020	Total Area"			
"	33.000	Flow length"			
"	2.000	Overland Slope"			
"	5.651	Pervious Area"			
"	33.000	Pervious length"			
"	2.000	Pervious slope"			
"	1.369	Impervious Area"			
"	7.994	Impervious length"			

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

"	2.000	Impervious slope"				
"	0.250	Pervious Manning 'n' "				
"	84.900	Pervious SCS Curve No."				
"	0.526	Pervious Runoff coefficient"				
"	0.100	Pervious Ia/S coefficient"				
"	4.518	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n' "				
"	98.000	Impervious SCS Curve No."				
"	0.916	Impervious Runoff coefficient"				
"	0.100	Impervious Ia/S coefficient"				
"	0.518	Impervious Initial abstraction"				
"		0.552	0.348	1.304	1.304 c.m/sec"	
"		Catchment 208	Pervious	Impervious	Total Area "	
"		Surface Area	5.651	1.369	7.020	hectare"
"		Time of concentration	18.461	1.229	13.610	minutes"
"		Time to Centroid	222.061	180.020	210.225	minutes"
"		Rainfall depth	63.455	63.455	63.455	mm"
"		Rainfall volume	3585.90	868.63	4454.53	c.m"
"		Rainfall losses	30.264	9.764	26.266	mm"
"		Runoff depth	33.191	53.691	37.189	mm"
"		Runoff volume	1875.66	734.98	2610.64	c.m"
"		Maximum flow	0.482	0.195	0.552	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.552	0.890	1.304	1.304"	
" 52		CHANNEL DESIGN"				
"	0.890	Current peak flow	c.m/sec"			
"	0.040	Manning 'n' "				
"	0.	Cross-section type: 0=trapezoidal; 1=general"				
"	1.000	Basewidth	metre"			
"	2.000	Left bank slope"				
"	2.000	Right bank slope"				
"	1.000	Channel depth	metre"			
"	5.000	Gradient	%"			
"		Depth of flow	0.293	metre"		
"		Velocity	1.918	m/sec"		
"		Channel capacity	11.234	c.m/sec"		
"		Critical depth	0.342	metre"		
" 53		ROUTE Channel Route 120"				
"	120.00	Channel Route 120 Reach length	( metre)"			
"	0.487	X-factor <= 0.5"				
"	46.929	K-lag ( seconds)"				
"	0.000	Default(0) or user spec.(1) values used"				
"	0.500	X-factor <= 0.5"				
"	30.000	K-lag ( seconds)"				
"	0.500	Beta weighting factor"				
"	46.154	Routing time step ( seconds)"				
"	1	No. of sub-reaches"				
"		Peak outflow	0.890	c.m/sec"		
"		0.552	0.890	0.890	1.304 c.m/sec"	
" 40		HYDROGRAPH Combine	4"			
"	6	Combine "				
"	4	Node #"				
"		Pond 2"				
"		Maximum flow	0.890	c.m/sec"		
"		Hydrograph volume	4628.303	c.m"		

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

"		0.552	0.890	0.890	0.890"
" 40	HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"			
"		0.552	0.000	0.890	0.890"
" 33	CATCHMENT 209"				
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	209	Catchment 209 - Punkinseed Lane - north and west end"			
"	21.000	% Impervious"			
"	1.930	Total Area"			
"	36.000	Flow length"			
"	2.000	Overland Slope"			
"	1.525	Pervious Area"			
"	36.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.405	Impervious Area"			
"	9.570	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n' "			
"	84.200	Pervious SCS Curve No. "			
"	0.510	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.766	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No. "			
"	0.916	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.144	0.000	0.890	0.890 c.m/sec"
"	Catchment 209	Pervious	Impervious	Total Area	"
"	Surface Area	1.525	0.405	1.930	hectare"
"	Time of concentration	19.672	1.369	13.997	minutes"
"	Time to Centroid	224.336	180.153	210.636	minutes"
"	Rainfall depth	63.455	63.455	63.455	mm"
"	Rainfall volume	967.50	257.18	1224.68	c.m"
"	Rainfall losses	31.245	8.998	26.573	mm"
"	Runoff depth	32.210	54.457	36.882	mm"
"	Runoff volume	491.11	220.71	711.82	c.m"
"	Maximum flow	0.122	0.059	0.144	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"		0.144	0.144	0.890	0.890"
" 52	CHANNEL DESIGN"				
"	0.144	Current peak flow		c.m/sec"	
"	0.040	Manning 'n' "			
"	0.	Cross-section type: 0=trapezoidal; 1=general"			
"	0.500	Basewidth metre"			
"	3.000	Left bank slope"			
"	3.000	Right bank slope"			
"	0.750	Channel depth		metre"	
"	20.000	Gradient %"			
"		Depth of flow	0.097	metre"	
"		Velocity	1.878	m/sec"	
"		Channel capacity	12.379	c.m/sec"	
"		Critical depth	0.151	metre"	



**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

```

" 53      ROUTE      Channel Route 30"
"      30.00      Channel Route 30 Reach length      ( metre)"
"      0.496      X-factor <= 0.5"
"      11.967      K-lag      ( seconds)"
"      0.000      Default(0) or user spec.(1) values used"
"      0.500      X-factor <= 0.5"
"      30.000      K-lag      ( seconds)"
"      0.500      Beta weighting factor"
"      12.000      Routing time step      ( seconds)"
"      1          No. of sub-reaches"
"      Peak outflow      0.143      c.m/sec"
"      0.144      0.144      0.143      0.890 c.m/sec"
" 40      HYDROGRAPH      Combine      4"
"      6      Combine "
"      4      Node #"
"      Pond 2"
"      Maximum flow      1.031      c.m/sec"
"      Hydrograph volume      5340.118      c.m"
"      0.144      0.144      0.143      1.031"
" 40      HYDROGRAPH      Confluence      4"
"      7      Confluence "
"      4      Node #"
"      Pond 2"
"      Maximum flow      1.031      c.m/sec"
"      Hydrograph volume      5340.118      c.m"
"      0.144      1.031      0.143      0.000"
" 54      POND DESIGN"
"      1.031      Current peak flow      c.m/sec"
"      2.235      Target outflow      c.m/sec"
"      5341.0      Hydrograph volume      c.m"
"      23.      Number of stages"
"      179.000      Minimum water level      metre"
"      180.300      Maximum water level      metre"
"      179.000      Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"      Level Discharge      Volume"
"      179.000      0.000      0.0"
"      179.059      0.000      227.7"
"      179.118      0.000      457.2"
"      179.177      0.000      688.7"
"      179.236      0.000      921.9"
"      179.295      0.000      1157.0"
"      179.355      0.000      1398.0"
"      179.400      0.000      1580.0"
"      179.473      0.097      1877.7"
"      179.532      0.250      2120.2"
"      179.591      0.457      2364.8"
"      179.650      0.718      2611.2"
"      179.709      1.033      2859.5"
"      179.768      1.403      3109.8"
"      179.827      1.828      3361.9"
"      179.900      2.434      3676.5"
"      179.945      3.001      3872.0"
"      180.005      4.004      4134.3"
"      180.064      5.199      4394.2"
"      180.123      6.582      4656.1"

```

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

"	180.182	8.142	4920.0"		
"	180.241	9.876	5185.7"		
"	180.300	11.781	5453.5"		
"	2.	WEIRS"			
"		Crest	Weir	Crest	Left Right
"		elevation	coefficie	breadth	sideslope sideslope"
"		179.400	0.900	3.000	4.000 4.000"
"		179.900	0.900	10.000	4.000 4.000"
"	1.	LAYERS"			
"		Bottom	Aspect	Bottom	Top Average"
"		area	ratio	elevation	elevation sideslope"
"		3844.000	2.000	179.000	180.300 2.000"
"		Peak outflow		0.505	c.m/sec"
"		Maximum level		179.602	metre"
"		Maximum storage		2409.830	c.m"
"		Centroidal lag		4.633	hours"
"		0.144	1.031	0.505	0.000 c.m/sec"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.144	0.000	0.505	0.000"
" 33		CATCHMENT 210"			
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	210	McLeese Drive south of Punkinseed Lane"			
"	24.400	% Impervious"			
"	3.700	Total Area"			
"	47.000	Flow length"			
"	2.000	Overland Slope"			
"	2.797	Pervious Area"			
"	47.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.903	Impervious Area"			
"	15.169	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n' "			
"	84.800	Pervious SCS Curve No. "			
"	0.524	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.553	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No. "			
"	0.916	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.274	0.000	0.505	0.000 c.m/sec"
"		Catchment 210	Pervious	Impervious	Total Area "
"		Surface Area	2.797	0.903	3.700 hectare"
"		Time of concentration	22.862	1.804	15.438 minutes"
"		Time to Centroid	227.850	180.263	211.074 minutes"
"		Rainfall depth	63.455	63.455	63.455 mm"
"		Rainfall volume	1774.96	572.87	2347.83 c.m"
"		Rainfall losses	30.289	7.504	24.729 mm"
"		Runoff depth	33.166	55.951	38.726 mm"
"		Runoff volume	927.73	505.13	1432.85 c.m"

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

"		Maximum flow	0.212	0.138	0.274	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.274	0.274	0.505	0.000"	
" 52		CHANNEL DESIGN"				
"	0.274	Current peak flow	c.m/sec"			
"	0.040	Manning 'n'"				
"	0.	Cross-section type: 0=trapezoidal; 1=general"				
"	10.000	Basewidth	metre"			
"	10.000	Left bank slope"				
"	10.000	Right bank slope"				
"	1.000	Channel depth	metre"			
"	10.000	Gradient	%"			
"		Depth of flow	0.033	metre"		
"		Velocity	0.799	m/sec"		
"		Channel capacity	120.397	c.m/sec"		
"		Critical depth	0.042	metre"		
" 53		ROUTE Zero Route"				
"	0.00	Zero Route Reach length	( metre)"			
"		0.274	0.274	0.274	0.000 c.m/sec"	
" 40		HYDROGRAPH Combine	3"			
"	6	Combine "				
"	3	Node #"				
"		DP#2"				
"		Maximum flow	1.385	c.m/sec"		
"		Hydrograph volume	13345.125	c.m"		
"		0.274	0.274	0.274	1.385"	
" 40		HYDROGRAPH Confluence	3"			
"	7	Confluence "				
"	3	Node #"				
"		DP#2"				
"		Maximum flow	1.385	c.m/sec"		
"		Hydrograph volume	13345.125	c.m"		
"		0.274	1.385	0.274	0.000"	
" 52		CHANNEL DESIGN"				
"	1.385	Current peak flow	c.m/sec"			
"	0.040	Manning 'n'"				
"	0.	Cross-section type: 0=trapezoidal; 1=general"				
"	2.000	Basewidth	metre"			
"	2.000	Left bank slope"				
"	2.000	Right bank slope"				
"	1.000	Channel depth	metre"			
"	5.000	Gradient	%"			
"		Depth of flow	0.272	metre"		
"		Velocity	2.005	m/sec"		
"		Channel capacity	16.224	c.m/sec"		
"		Critical depth	0.326	metre"		
" 53		ROUTE Channel Route 150"				
"	150.00	Channel Route 150 Reach length	( metre)"			
"	0.490	X-factor <= 0.5"				
"	56.101	K-lag ( seconds)"				
"	0.000	Default(0) or user spec.(1) values used"				
"	0.500	X-factor <= 0.5"				
"	30.000	K-lag ( seconds)"				
"	0.500	Beta weighting factor"				
"	54.545	Routing time step ( seconds)"				

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

"	1	No. of sub-reaches"			
"		Peak outflow	1.375	c.m/sec"	
"		0.274 1.385	1.375	0.000 c.m/sec"	
" 40		HYDROGRAPH Combine 5"			
"	6	Combine "			
"	5	Node #"			
"		DP#2 Confluence with Area 211"			
"		Maximum flow	1.375	c.m/sec"	
"		Hydrograph volume	13345.125	c.m"	
"		0.274 1.385	1.375	1.375"	
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.274 0.000	1.375	1.375"	
" 33		CATCHMENT 211"			
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	211	Punkinseed Lane - south end"			
"	12.400	% Impervious"			
"	2.290	Total Area"			
"	57.000	Flow length"			
"	2.000	Overland Slope"			
"	2.006	Pervious Area"			
"	57.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.284	Impervious Area"			
"	8.068	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n' "			
"	83.800	Pervious SCS Curve No."			
"	0.502	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.910	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No."			
"	0.916	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.144 0.000	1.375	1.375 c.m/sec"	
"		Catchment 211	Pervious	Impervious	Total Area "
"		Surface Area	2.006	0.284	2.290 hectare"
"		Time of concentration	26.087	1.236	21.283 minutes"
"		Time to Centroid	233.105	180.028	222.846 minutes"
"		Rainfall depth	63.455	63.455	63.455 mm"
"		Rainfall volume	1272.93	180.19	1453.12 c.m"
"		Rainfall losses	31.710	9.722	28.984 mm"
"		Runoff depth	31.745	53.733	34.471 mm"
"		Runoff volume	636.81	152.58	789.39 c.m"
"		Maximum flow	0.131	0.040	0.144 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.144 0.144	1.375	1.375"	
" 52		CHANNEL DESIGN"			
"	0.144	Current peak flow	c.m/sec"		
"	0.040	Manning 'n' "			

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

```

"      0.   Cross-section type: 0=trapezoidal; 1=general"
"      0.500   Basewidth   metre"
"      2.000   Left bank slope"
"      2.000   Right bank slope"
"      0.500   Channel depth   metre"
"      3.000   Gradient   %"
"          Depth of flow           0.170   metre"
"          Velocity                 1.012   m/sec"
"          Channel capacity         1.370   c.m/sec"
"          Critical depth           0.163   metre"
" 53      ROUTE   Channel Route 20"
"          20.00   Channel Route 20 Reach length   ( metre)"
"          0.427   X-factor <= 0.5"
"          14.815   K-lag   ( seconds)"
"          0.000   Default(0) or user spec.(1) values used"
"          0.500   X-factor <= 0.5"
"          30.000   K-lag   ( seconds)"
"          0.500   Beta weighting factor"
"          16.667   Routing time step   ( seconds)"
"          1       No. of sub-reaches"
"          Peak outflow           0.144   c.m/sec"
"          0.144   0.144   0.144   1.375 c.m/sec"
" 40      HYDROGRAPH   Combine   5"
"          6   Combine "
"          5   Node #"
"          DP#2 Confluence with Area 211"
"          Maximum flow           1.420   c.m/sec"
"          Hydrograph volume       14134.506   c.m"
"          0.144   0.144   0.144   1.420"
" 40      HYDROGRAPH   Confluence   5"
"          7   Confluence "
"          5   Node #"
"          DP#2 Confluence with Area 211"
"          Maximum flow           1.420   c.m/sec"
"          Hydrograph volume       14134.506   c.m"
"          0.144   1.420   0.144   0.000"
" 52      CHANNEL DESIGN"
"          1.420   Current peak flow   c.m/sec"
"          0.040   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"          2.000   Basewidth   metre"
"          3.000   Left bank slope"
"          3.000   Right bank slope"
"          1.000   Channel depth   metre"
"          3.000   Gradient   %"
"          Depth of flow           0.304   metre"
"          Velocity                 1.605   m/sec"
"          Channel capacity         15.413   c.m/sec"
"          Critical depth           0.315   metre"
" 53      ROUTE   Channel Route 100"
"          100.00   Channel Route 100 Reach length   ( metre)"
"          0.473   X-factor <= 0.5"
"          46.733   K-lag   ( seconds)"
"          0.000   Default(0) or user spec.(1) values used"
"          0.500   X-factor <= 0.5"
"          30.000   K-lag   ( seconds)"

```

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year - 6 Hour Storm Event**

"	0.500	Beta weighting factor"			
"	46.154	Routing time step ( seconds)"			
"	1	No. of sub-reaches"			
"		Peak outflow	1.420	c.m/sec"	
"		0.144	1.420	1.420	0.000 c.m/sec"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.144	0.000	1.420	0.000"
" 33		CATCHMENT 212"			
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	212	Timberglade Court"			
"	15.200	% Impervious"			
"	3.070	Total Area"			
"	64.000	Flow length"			
"	2.000	Overland Slope"			
"	2.603	Pervious Area"			
"	64.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.467	Impervious Area"			
"	11.472	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n' "			
"	83.800	Pervious SCS Curve No. "			
"	0.502	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.910	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No. "			
"	0.916	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.190	0.000	1.420	0.000 c.m/sec"
"		Catchment 212	Pervious	Impervious	Total Area "
"		Surface Area	2.603	0.467	3.070 hectare"
"		Time of concentration	27.964	1.526	21.694 minutes"
"		Time to Centroid	235.515	180.249	222.407 minutes"
"		Rainfall depth	63.455	63.455	63.455 mm"
"		Rainfall volume	1651.96	296.11	1948.06 c.m"
"		Rainfall losses	31.672	8.323	28.123 mm"
"		Runoff depth	31.783	55.132	35.332 mm"
"		Runoff volume	827.42	257.27	1084.69 c.m"
"		Maximum flow	0.169	0.069	0.190 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.190	0.190	1.420	0.000"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.190	0.000	1.420	0.000"
" 33		CATCHMENT 213"			
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	213	Southeast undeveloped portion of the site"			
"	0.000	% Impervious"			

**Cobble Beach Post-Development Miduss Summary:**  
**5 Year – 6 Hour Storm Event**

"	4.020	Total Area"			
"	122.000	Flow length"			
"	3.500	Overland Slope"			
"	4.020	Pervious Area"			
"	122.000	Pervious length"			
"	3.500	Pervious slope"			
"	0.000	Impervious Area"			
"	0.000	Impervious length"			
"	3.500	Impervious slope"			
"	0.350	Pervious Manning 'n' "			
"	75.600	Pervious SCS Curve No. "			
"	0.351	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	8.198	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No. "			
"	0.916	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.120	0.000	1.420	0.000 c.m/sec"
"		Catchment 213	Pervious	Impervious	Total Area "
"		Surface Area	4.020	0.000	4.020 hectare"
"		Time of concentration	49.112	0.001	49.112 minutes"
"		Time to Centroid	269.669	176.394	269.669 minutes"
"		Rainfall depth	63.455	63.455	63.455 mm"
"		Rainfall volume	2550.88	0.00	2550.89 c.m"
"		Rainfall losses	41.223	11.132	41.223 mm"
"		Runoff depth	22.232	52.322	22.232 mm"
"		Runoff volume	893.71	0.00	893.71 c.m"
"		Maximum flow	0.120	0.000	0.120 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"		4 Add Runoff "			
"		0.120	0.120	1.420	0.000"
" 38		START/RE-START TOTALS 213"			
"		3 Runoff Totals on EXIT"			
"		Total Catchment area		90.160	hectare"
"		Total Impervious area		12.097	hectare"
"		Total % impervious		13.418"	
" 19		EXIT"			



PRYDE SCHROPP McCOMB INC.  
CONSULTING ENGINEERS

## **APPENDIX E**

### **COBBLE BEACH DEVELOPMENT STAGE 1 (2007)**

### **MIDUSS OUTPUT FILES 100 YEAR - 6 HOUR STORM**



**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.01  rev. 329"
"          MIDUSS created                      Monday, May 17, 2004"
"          10  Units used:                      ie METRIC"
"          Job folder:                      C:\Documents and Settings\scobean\
"                                     My Documents\MIDUSSdata\Georgian Villas\June 2007"
" 31          TIME PARAMETERS"
"          10.000  Time Step"
"          1440.000  Max. Storm length"
"          1500.000  Max. Hydrograph"
" 32          STORM Chicago storm"
"          1  Chicago storm"
"          1242.840  Coefficient A"
"          11.180  Constant B"
"          0.704  Exponent C"
"          0.400  Fraction R"
"          360.000  Duration"
"          2.000  Time step multiplier"
"          Maximum intensity          105.988  mm/hr"
"          Total depth          115.765  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"          1  Triangular SCS"
"          2  Proportional to %"
"          1  SCS method"
"          201  Catchment 201 - south of main entrance"
"          19.200  % Impervious"
"          12.000  Total Area"
"          47.000  Flow length"
"          2.000  Overland Slope"
"          9.696  Pervious Area"
"          47.000  Pervious length"
"          2.000  Pervious slope"
"          2.304  Impervious Area"
"          11.168  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          84.100  Pervious SCS Curve No."
"          0.669  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          4.802  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."
"          0.953  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          2.237  0.000  0.000  0.000 c.m/sec"
"          Catchment 201  Pervious  Impervious Total Area "
"          Surface Area  9.696  2.304  12.000  hectare"
"          Time of concentration  16.824  1.201  13.107  minutes"
"          Time to Centroid  212.999  176.760  204.376  minutes"
"          Rainfall depth  115.765  115.765  115.765  mm"
"          Rainfall volume  1.1225  0.2667  1.3892  ha-m"
"          Rainfall losses  38.584  14.344  33.930  mm"
"          Runoff depth  77.181  101.422  81.836  mm"
"          Runoff volume  7483.52  2336.76  9820.28  c.m"

```

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	Maximum flow	1.963	0.580	2.237	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	2.237	2.237	0.000	0.000"	
" 52	CHANNEL DESIGN"				
"	2.237 Current peak flow	c.m/sec"			
"	0.040 Manning 'n'"				
"	0. Cross-section type: 0=trapezoidal; 1=general"				
"	0.600 Basewidth	metre"			
"	2.000 Left bank slope"				
"	2.000 Right bank slope"				
"	1.000 Channel depth	metre"			
"	5.000 Gradient	%"			
"	Depth of flow	0.536	metre"		
"	Velocity	2.499	m/sec"		
"	Channel capacity	9.309	c.m/sec"		
"	Critical depth	0.628	metre"		
" 53	ROUTE Channel Route 200"				
"	200.00 Channel Route 200 Reach length	( metre)"			
"	0.488 X-factor <= 0.5"				
"	60.030 K-lag ( seconds)"				
"	0.000 Default(0) or user spec.(1) values used"				
"	0.500 X-factor <= 0.5"				
"	30.000 K-lag ( seconds)"				
"	0.500 Beta weighting factor"				
"	60.000 Routing time step ( seconds)"				
"	1 No. of sub-reaches"				
"	Peak outflow	2.160	c.m/sec"		
"	2.237	2.237	2.160	0.000 c.m/sec"	
" 40	HYDROGRAPH Combine 1"				
"	6 Combine "				
"	1 Node #"				
"	Confluence at Pond 3"				
"	Maximum flow	2.160	c.m/sec"		
"	Hydrograph volume	9820.309	c.m"		
"	2.237	2.237	2.160	2.160"	
" 40	HYDROGRAPH Start - New Tributary"				
"	2 Start - New Tributary"				
"	2.237	0.000	2.160	2.160"	
" 33	CATCHMENT 202"				
"	1 Triangular SCS"				
"	2 Proportional to %"				
"	1 SCS method"				
"	202 Catchment 202 - Beacon Crest"				
"	26.600 % Impervious"				
"	1.230 Total Area"				
"	38.000 Flow length"				
"	2.000 Overland Slope"				
"	0.903 Pervious Area"				
"	38.000 Pervious length"				
"	2.000 Pervious slope"				
"	0.327 Impervious Area"				
"	13.771 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	84.500 Pervious SCS Curve No."				

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

```

"      0.676   Pervious Runoff coefficient"
"      0.100   Pervious Ia/S coefficient"
"      4.659   Pervious Initial abstraction"
"      0.015   Impervious Manning 'n'"
" 98.000   Impervious SCS Curve No."
"      0.953   Impervious Runoff coefficient"
"      0.100   Impervious Ia/S coefficient"
"      0.518   Impervious Initial abstraction"

"              0.254      0.000      2.160      2.160 c.m/sec"
"      Catchment 202      Pervious      Impervious Total Area "
"      Surface Area      0.903      0.327      1.230      hectare"
"      Time of concentration 14.756      1.362      10.415      minutes"
"      Time to Centroid 210.206      176.952      199.428      minutes"
"      Rainfall depth 115.765      115.765      115.765      mm"
"      Rainfall volume 1045.15      378.76      1423.92      c.m"
"      Rainfall losses 37.794      12.590      31.090      mm"
"      Runoff depth 77.971      103.175      84.676      mm"
"      Runoff volume 703.94      337.57      1041.51      c.m"
"      Maximum flow 0.196      0.083      0.254      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"              0.254      0.254      2.160      2.160"
" 52      CHANNEL DESIGN"
"      0.254      Current peak flow      c.m/sec"
"      0.040      Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      1.000      Basewidth      metre"
"      3.000      Left bank slope"
"      3.000      Right bank slope"
"      1.000      Channel depth      metre"
"      3.000      Gradient      %"
"      Depth of flow      0.163      metre"
"      Velocity      1.049      m/sec"
"      Channel capacity      11.572      c.m/sec"
"      Critical depth      0.159      metre"
" 53      ROUTE      Channel Route 100"
"      100.00      Channel Route 100 Reach length      ( metre)"
"      0.486      X-factor <= 0.5"
"      71.509      K-lag      ( seconds)"
"      0.000      Default(0) or user spec.(1) values used"
"      0.500      X-factor <= 0.5"
"      30.000      K-lag      ( seconds)"
"      0.500      Beta weighting factor"
"      66.667      Routing time step      ( seconds)"
"      1      No. of sub-reaches"
"      Peak outflow      0.242      c.m/sec"
"              0.254      0.254      0.242      2.160 c.m/sec"
" 40      HYDROGRAPH      Combine      1"
"      6      Combine "
"      1      Node #"
"      Confluence at Pond 3"
"      Maximum flow      2.394      c.m/sec"
"      Hydrograph volume      10861.823      c.m"
"              0.254      0.254      0.242      2.394"
" 40      HYDROGRAPH      Confluence      1"

```

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

```

"      7  Confluence "
"      1  Node #"
"      Confluence at Pond 3"
"      Maximum flow          2.394      c.m/sec"
"      Hydrograph volume      10861.823  c.m"
"      0.254      2.394      0.242      0.000"
" 52      CHANNEL DESIGN"

"      2.394  Current peak flow      c.m/sec"
"      0.040  Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      1.000  Basewidth      metre"
"      3.000  Left bank slope"
"      3.000  Right bank slope"
"      1.000  Channel depth      metre"
"      5.000  Gradient      %"
"      Depth of flow          0.441      metre"
"      Velocity              2.337      m/sec"
"      Channel capacity      14.940      c.m/sec"
"      Critical depth        0.523      metre"
" 53      ROUTE      Channel Route 330"
"      330.00      Channel Route 330 Reach length  ( metre)"
"      0.494  X-factor <= 0.5"
" 105.893  K-lag  ( seconds)"
"      0.000  Default(0) or user spec.(1) values used"
"      0.500  X-factor <= 0.5"
"      30.000  K-lag  ( seconds)"
"      0.500  Beta weighting factor"
" 100.000  Routing time step  ( seconds)"
"      1  No. of sub-reaches"
"      Peak outflow          2.389      c.m/sec"
"      0.254      2.394      2.389      0.000 c.m/sec"
" 40      HYDROGRAPH  Combine  2"
"      6  Combine "
"      2  Node #"
"      Pond 3 "
"      Maximum flow          2.389      c.m/sec"
"      Hydrograph volume      10861.882  c.m"
"      0.254      2.394      2.389      2.389"
" 40      HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.254      0.000      2.389      2.389"
" 33      CATCHMENT 203"
"      1  Triangular SCS"
"      2  Proportional to %"
"      1  SCS method"
"      203  Catchment 203 - Western Portion of McLeese Dr. "
"      15.600  % Impervious"
"      10.700  Total Area"
"      49.000  Flow length"
"      2.000  Overland Slope"
"      9.031  Pervious Area"
"      49.000  Pervious length"
"      2.000  Pervious slope"
"      1.669  Impervious Area"
"      9.057  Impervious length"

```

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n' "			
"	84.000	Pervious SCS Curve No."			
"	0.667	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.838	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No."			
"	0.953	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		1.939	0.000	2.389	2.389 c.m/sec"
"		Catchment 203	Pervious	Impervious	Total Area "
"		Surface Area	9.031	1.669	10.700 hectare"
"		Time of concentration	17.266	1.059	14.140 minutes"
"		Time to Centroid	213.650	176.524	206.490 minutes"
"		Rainfall depth	115.765	115.765	115.765 mm"
"		Rainfall volume	1.0455	0.1932	1.2387 ha-m"
"		Rainfall losses	38.802	16.267	35.286 mm"
"		Runoff depth	76.964	99.499	80.479 mm"
"		Runoff volume	6950.44	1660.83	8611.27 c.m"
"		Maximum flow	1.815	0.418	1.939 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		1.939	1.939	2.389	2.389"
" 56		DIVERSION"			
"	203	Node number"			
"	0.715	Overflow threshold"			
"	1.000	Required diverted fraction"			
"	0	Conduit type; 1=Pipe;2=Channel"			
"		Peak of diverted flow	1.224		c.m/sec"
"		Volume of diverted flow	2194.189		c.m"
"		DIV00203.100hyd"			
"		Major flow at 203"			
"		1.939	1.939	0.715	2.389 c.m/sec"
" 40		HYDROGRAPH Combine	2"		
"	6	Combine "			
"	2	Node #"			
"		Pond 3 "			
"		Maximum flow	3.104		c.m/sec"
"		Hydrograph volume	17278.955		c.m"
"		1.939	1.939	0.715	3.104"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		1.939	0.000	0.715	3.104"
" 33		CATCHMENT 204"			
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	204	Hole 14 and 15 "			
"	0.000	% Impervious"			
"	11.100	Total Area"			
"	79.000	Flow length"			
"	2.000	Overland Slope"			
"	11.100	Pervious Area"			
"	79.000	Pervious length"			

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	2.000	Pervious slope"			
"	0.000	Impervious Area"			
"	0.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.350	Pervious Manning 'n' "			
"	83.200	Pervious SCS Curve No."			
"	0.653	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	5.129	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No."			
"	0.953	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		1.741	0.000	0.715	3.104 c.m/sec"
"		Catchment 204	Pervious	Impervious	Total Area "
"		Surface Area	11.100	0.000	11.100 hectare"
"		Time of concentration	28.349	0.001	28.349 minutes"
"		Time to Centroid	228.742	173.408	228.742 minutes"
"		Rainfall depth	115.765	115.765	115.765 mm"
"		Rainfall volume	1.2850	0.0000	1.2850 ha-m"
"		Rainfall losses	40.261	16.521	40.261 mm"
"		Runoff depth	75.504	99.244	75.504 mm"
"		Runoff volume	8380.97	0.01	8380.98 c.m"
"		Maximum flow	1.741	0.000	1.741 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		1.741	1.741	0.715	3.104"
" 52		CHANNEL DESIGN"			
"	1.741	Current peak flow	c.m/sec"		
"	0.040	Manning 'n' "			
"	0.	Cross-section type: 0=trapezoidal; 1=general"			
"	10.000	Basewidth	metre"		
"	10.000	Left bank slope"			
"	10.000	Right bank slope"			
"	10.000	Channel depth	metre"		
"	5.000	Gradient	%"		
"		Depth of flow	0.121	metre"	
"		Velocity	1.279	m/sec"	
"		Channel capacity	18488.199	c.m/sec"	
"		Critical depth	0.139	metre"	
" 53		ROUTE Zero Route"			
"	0.00	Zero Route Reach length	( metre)"		
"		1.741	1.741	1.741	3.104 c.m/sec"
" 40		HYDROGRAPH Combine	2"		
"	6	Combine "			
"	2	Node #"			
"		Pond 3 "			
"		Maximum flow	4.790	c.m/sec"	
"		Hydrograph volume	25659.939	c.m"	
"		1.741	1.741	1.741	4.790"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		1.741	0.000	1.741	4.790"
" 33		CATCHMENT 205"			
"	1	Triangular SCS"			

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

```

"          2   Proportional to %"
"          1   SCS method"
"         205   Catchment 205 - north of Cobble Beach Drive"
"        18.600 % Impervious"
"        17.400 Total Area"
"        44.000 Flow length"
"         2.000 Overland Slope"
"        14.164 Pervious Area"
"        44.000 Pervious length"
"         2.000 Pervious slope"
"         3.236 Impervious Area"
"        10.054 Impervious length"
"         2.000 Impervious slope"
"         0.250 Pervious Manning 'n'"
"        82.300 Pervious SCS Curve No."
"         0.637 Pervious Runoff coefficient"
"         0.100 Pervious Ia/S coefficient"
"         5.463 Pervious Initial abstraction"
"         0.015 Impervious Manning 'n'"
"       98.000 Impervious SCS Curve No."
"         0.953 Impervious Runoff coefficient"
"         0.100 Impervious Ia/S coefficient"
"         0.518 Impervious Initial abstraction"
"          3.191      0.000      1.741      4.790 c.m/sec"
"          Catchment 205      Pervious      Impervious Total Area "
"          Surface Area      14.164      3.236      17.400      hectare"
"          Time of concentration      16.446      1.127      12.803      minutes"
"          Time to Centroid      214.074      176.647      205.173      minutes"
"          Rainfall depth      115.765      115.765      115.765      mm"
"          Rainfall volume      1.6397      0.3747      2.0143      ha-m"
"          Rainfall losses      42.190      15.291      37.187      mm"
"          Runoff depth      73.575      100.475      78.579      mm"
"          Runoff volume      1.0421      0.3252      1.3673      ha-m"
"          Maximum flow      2.939      0.813      3.191      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"          4      Add Runoff "
"          3.191      3.191      1.741      4.790"
" 52          CHANNEL DESIGN"
"          3.191      Current peak flow      c.m/sec"
"          0.040      Manning 'n'"
"          0.      Cross-section type: 0=trapezoidal; 1=general"
"          0.700      Basewidth      metre"
"          2.000      Left bank slope"
"          2.000      Right bank slope"
"          1.000      Channel depth      metre"
"          5.000      Gradient      %"
"          Depth of flow      0.609      metre"
"          Velocity      2.730      m/sec"
"          Channel capacity      9.786      c.m/sec"
"          Critical depth      0.723      metre"
" 53          ROUTE      Channel Route 221"
"          221.00      Channel Route 221 Reach length      ( metre)"
"          0.487      X-factor <= 0.5"
"          60.714      K-lag      ( seconds)"
"          0.000      Default(0) or user spec.(1) values used"
"          0.500      X-factor <= 0.5"

```

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

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"      30.000   K-lag   ( seconds)"
"      0.500   Beta weighting factor"
"      60.000   Routing time step   ( seconds)"
"      1      No. of sub-reaches"
"      Peak outflow                3.161      c.m/sec"
"      3.191      3.191      3.161      4.790 c.m/sec"
" 40      HYDROGRAPH   Combine      2"
"      6      Combine "
"      2      Node #"
"      Pond 3 "
"      Maximum flow                7.951      c.m/sec"
"      Hydrograph volume            39332.695      c.m"
"      3.191      3.191      3.161      7.951"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"
"      3.191      0.000      3.161      7.951"
" 33      CATCHMENT 206"
"      1      Triangular SCS"
"      2      Proportional to %"
"      1      SCS method"
"      206    Catchment 206 - South of Cobble Beach Drive"
"      0.000   % Impervious"
"      10.200  Total Area"
"      66.000  Flow length"
"      2.000   Overland Slope"
"      10.200  Pervious Area"
"      66.000  Pervious length"
"      2.000   Pervious slope"
"      0.000   Impervious Area"
"      0.000   Impervious length"
"      2.000   Impervious slope"
"      0.250   Pervious Manning 'n'"
"      80.300  Pervious SCS Curve No."
"      0.603   Pervious Runoff coefficient"
"      0.100   Pervious Ia/S coefficient"
"      6.231   Pervious Initial abstraction"
"      0.015   Impervious Manning 'n'"
"      98.000  Impervious SCS Curve No."
"      0.953   Impervious Runoff coefficient"
"      0.100   Impervious Ia/S coefficient"
"      0.518   Impervious Initial abstraction"
"      1.693      0.000      3.161      7.951 c.m/sec"
"      Catchment 206      Pervious      Impervious Total Area "
"      Surface Area      10.200      0.000      10.200      hectare"
"      Time of concentration  21.393      0.001      21.393      minutes"
"      Time to Centroid      221.902      173.408      221.902      minutes"
"      Rainfall depth      115.765      115.765      115.765      mm"
"      Rainfall volume      1.1808      0.0000      1.1808      ha-m"
"      Rainfall losses      46.141      16.520      46.141      mm"
"      Runoff depth      69.625      99.245      69.625      mm"
"      Runoff volume      7101.70      0.01      7101.71      c.m"
"      Maximum flow      1.693      0.000      1.693      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"      1.693      1.693      3.161      7.951"
" 52      CHANNEL DESIGN"

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**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	1.693	Current peak flow	c.m/sec"	
"	0.040	Manning 'n'"		
"	0.	Cross-section type: 0=trapezoidal; 1=general"		
"	10.000	Basewidth	metre"	
"	10.000	Left bank slope"		
"	10.000	Right bank slope"		
"	1.000	Channel depth	metre"	
"	5.000	Gradient	%"	
"		Depth of flow	0.119	metre"
"		Velocity	1.266	m/sec"
"		Channel capacity	85.133	c.m/sec"
"		Critical depth	0.136	metre"
" 53		ROUTE Zero Route"		
"	0.00	Zero Route Reach length	( metre)"	
"		1.693	1.693	1.693 7.951 c.m/sec"
" 40		HYDROGRAPH Combine	2"	
"	6	Combine "		
"	2	Node #"		
"		Pond 3 "		
"		Maximum flow	9.644	c.m/sec"
"		Hydrograph volume	46434.391	c.m"
"		1.693	1.693	1.693 9.644"
" 40		HYDROGRAPH Confluence	2"	
"	7	Confluence "		
"	2	Node #"		
"		Pond 3 "		
"		Maximum flow	9.644	c.m/sec"
"		Hydrograph volume	46434.391	c.m"
"		1.693	9.644	1.693 0.000"
" 54		POND DESIGN"		
"	9.644	Current peak flow	c.m/sec"	
"	3.097	Target outflow	c.m/sec"	
"	46435.0	Hydrograph volume	c.m"	
"	26.	Number of stages"		
"	189.800	Minimum water level	metre"	
"	190.750	Maximum water level	metre"	
"	189.800	Starting water level	metre"	
"	0	Keep Design Data: 1 = True; 0 = False"		
"		Level Discharge	Volume"	
"	189.800	0.000	0.0"	
"	189.838	0.000	4011.1"	
"	189.876	0.000	4411.0"	
"	189.914	0.000	4812.0"	
"	189.952	0.000	5214.3"	
"	189.990	0.000	5618.0"	
"	190.028	0.000	6022.8"	
"	190.066	0.000	6428.9"	
"	190.104	0.004	6836.4"	
"	190.142	0.134	7245.0"	
"	190.180	0.355	7654.9"	
"	190.218	0.644	8066.2"	
"	190.256	0.989	8478.6"	
"	190.294	1.387	8892.4"	
"	190.332	1.833	9307.4"	
"	190.370	2.325	9723.6"	
"	190.408	2.863	10141.3"	

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	190.446	3.444	10560.1"		
"	190.484	4.068	10980.1"		
"	190.522	4.734	11401.7"		
"	190.560	5.442	11824.3"		
"	190.598	6.191	12248.4"		
"	190.636	6.981	12673.6"		
"	190.674	7.812	13100.1"		
"	190.712	8.684	13528.1"		
"	190.750	9.596	13957.2"		
"	1.	WEIRS"			
"		Crest	Weir	Crest	Left Right"
"		elevation	coefficie	breadth	sideslope sideslope"
"		190.100	0.900	10.000	4.000 4.000"
"	1.	LAYERS"			
"		Bottom	Aspect	Bottom	Top Average"
"		area	ratio	elevation	elevation sideslope"
"		10171.000	2.000	189.450	191.235 2.000"
"		Peak outflow		7.726	c.m/sec"
"		Maximum level		190.670	metre"
"		Maximum storage		13056.153	c.m"
"		Centroidal lag		4.194	hours"
"		1.693	9.644	7.726	0.000 c.m/sec"
" 40		HYDROGRAPH Next link "			
"	5	Next link "			
"		1.693	7.726	7.726	0.000"
" 52		CHANNEL DESIGN"			
"	7.726	Current peak flow		c.m/sec"	
"	0.040	Manning 'n'"			
"	0.	Cross-section type: 0=trapezoidal; 1=general"			
"	2.000	Basewidth		metre"	
"	3.000	Left bank slope"			
"	3.000	Right bank slope"			
"	1.000	Channel depth		metre"	
"	5.000	Gradient		%"	
"		Depth of flow		0.637	metre"
"		Velocity		3.101	m/sec"
"		Channel capacity		19.898	c.m/sec"
"		Critical depth		0.789	metre"
" 53		ROUTE Channel Route 150"			
"	150.00	Channel Route 150 Reach length		( metre)"	
"	0.479	X-factor <= 0.5"			
"	36.274	K-lag ( seconds)"			
"	0.000	Default(0) or user spec.(1) values used"			
"	0.500	X-factor <= 0.5"			
"	30.000	K-lag ( seconds)"			
"	0.500	Beta weighting factor"			
"	37.500	Routing time step ( seconds)"			
"	1	No. of sub-reaches"			
"		Peak outflow		7.597	c.m/sec"
"		1.693	7.726	7.597	0.000 c.m/sec"
" 40		HYDROGRAPH Next link "			
"	5	Next link "			
"		1.693	7.597	7.597	0.000"
" 58		CULVERT"			
"	7.597	Culvert Q		c.m/sec"	
"	25.00	Length		metre"	

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	0.015	Manning 'n'"			
"	100.250	Upstream IL	metre"		
"	100.000	Downstream IL	metre"		
"	102.250	Weir Elev.	metre"		
"	20.000	Weir Breadth.	metre"		
"	25.000	Weir Left slope to 1"			
"	25.000	Weir Right slope to 1"			
"	100.000	Tail water elevation to 1"			
"	1	Barrel Option (Pipe/Box/CSPA/HE/VE)"			
"	1.200	Barrel Height/Diameter"			
"	1.200	Barrel Width"			
"	0.500	Coeff.of Discharge"			
"	0.900	Entrance Energy loss coeff."			
"	2.	Number of Barrels"			
"	0	Number of stages"			
"		Level Discharge	Volume"		
"	2.000	Channel Basewidth"			
"	1.000	Channel Depth"			
"	5.600	Channel Topwidth"			
"	10.000	Grade Left"			
"	10.000	Grade Right"			
"	5.000	Grade %"			
"	150.000	Length"			
"		Peak outflow	7.597	c.m/sec"	
"		Maximum level	102.250	metre"	
"		Maximum storage	0.000	c.m"	
"		Centroidal lag	0.000	hours"	
"		Weir flow	0.000	c.m/sec"	
"		1.693	7.597	7.597	0.000 c.m/sec"
" 40		HYDROGRAPH Combine	3"		
"	6	Combine "			
"	3	Node #"			
"		DP#2"			
"		Maximum flow	7.597	c.m/sec"	
"		Hydrograph volume	39766.195	c.m"	
"		1.693	7.597	7.597	7.597"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		1.693	0.000	7.597	7.597"
" 33		CATCHMENT 207"			
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	207	Catchment 207 - East end of Cobble Beach Drive"			
"	20.600	% Impervious"			
"	5.500	Total Area"			
"	39.000	Flow length"			
"	2.000	Overland Slope"			
"	4.367	Pervious Area"			
"	39.000	Pervious length"			
"	2.000	Pervious slope"			
"	1.133	Impervious Area"			
"	10.118	Impervious length"			
"	2.000	Impervious slope"			
"	0.350	Pervious Manning 'n'"			
"	84.000	Pervious SCS Curve No."			

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	0.667	Pervious	Runoff coefficient"		
"	0.100	Pervious	Ia/S coefficient"		
"	4.838	Pervious	Initial abstraction"		
"	0.015	Impervious	Manning 'n' "		
"	98.000	Impervious	SCS Curve No."		
"	0.953	Impervious	Runoff coefficient"		
"	0.100	Impervious	Ia/S coefficient"		
"	0.518	Impervious	Initial abstraction"		
"		0.978	0.000	7.597	7.597 c.m/sec"
"		Catchment 207	Pervious	Impervious	Total Area "
"		Surface Area	4.367	1.133	5.500 hectare"
"		Time of concentration	18.424	1.132	14.043 minutes"
"		Time to Centroid	215.232	176.654	205.458 minutes"
"		Rainfall depth	115.765	115.765	115.765 mm"
"		Rainfall volume	5055.48	1311.62	6367.10 c.m"
"		Rainfall losses	38.898	15.232	34.023 mm"
"		Runoff depth	76.867	100.533	81.743 mm"
"		Runoff volume	3356.80	1139.04	4495.84 c.m"
"		Maximum flow	0.864	0.285	0.978 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.978	0.978	7.597	7.597"
" 33		CATCHMENT 208"			
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	208	Catchment 208 - McLeese Dr. north of Punkinseed Lane"			
"	19.500	% Impervious"			
"	7.020	Total Area"			
"	33.000	Flow length"			
"	2.000	Overland Slope"			
"	5.651	Pervious Area"			
"	33.000	Pervious length"			
"	2.000	Pervious slope"			
"	1.369	Impervious Area"			
"	7.994	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n' "			
"	84.900	Pervious SCS Curve No."			
"	0.683	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.518	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No."			
"	0.953	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		1.461	0.978	7.597	7.597 c.m/sec"
"		Catchment 208	Pervious	Impervious	Total Area "
"		Surface Area	5.651	1.369	7.020 hectare"
"		Time of concentration	13.510	0.983	10.574 minutes"
"		Time to Centroid	208.297	176.311	200.802 minutes"
"		Rainfall depth	115.765	115.765	115.765 mm"
"		Rainfall volume	6542.02	1584.71	8126.74 c.m"
"		Rainfall losses	37.587	17.001	33.573 mm"
"		Runoff depth	78.178	98.765	82.193 mm"

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	Runoff volume	4417.92	1351.99	5769.92	c.m"
"	Maximum flow	1.207	0.342	1.461	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	1.461 2.439 7.597 7.597"				
" 52	CHANNEL DESIGN"				
"	2.439 Current peak flow c.m/sec"				
"	0.040 Manning 'n'"				
"	0. Cross-section type: 0=trapezoidal; 1=general"				
"	1.000 Basewidth metre"				
"	2.000 Left bank slope"				
"	2.000 Right bank slope"				
"	1.000 Channel depth metre"				
"	5.000 Gradient %"				
"	Depth of flow 0.489 metre"				
"	Velocity 2.524 m/sec"				
"	Channel capacity 11.234 c.m/sec"				
"	Critical depth 0.584 metre"				
" 53	ROUTE Channel Route 120"				
"	120.00 Channel Route 120 Reach length ( metre)"				
"	0.480 X-factor <= 0.5"				
"	35.660 K-lag ( seconds)"				
"	0.000 Default(0) or user spec.(1) values used"				
"	0.500 X-factor <= 0.5"				
"	30.000 K-lag ( seconds)"				
"	0.500 Beta weighting factor"				
"	35.294 Routing time step ( seconds)"				
"	1 No. of sub-reaches"				
"	Peak outflow 2.383 c.m/sec"				
"	1.461 2.439 2.383 7.597 c.m/sec"				
" 40	HYDROGRAPH Combine 4"				
"	6 Combine "				
"	4 Node #"				
"	Pond 2"				
"	Maximum flow 2.383 c.m/sec"				
"	Hydrograph volume 10265.783 c.m"				
"	1.461 2.439 2.383 2.383"				
" 40	HYDROGRAPH Start - New Tributary"				
"	2 Start - New Tributary"				
"	1.461 0.000 2.383 2.383"				
" 33	CATCHMENT 209"				
"	1 Triangular SCS"				
"	2 Proportional to %"				
"	1 SCS method"				
"	209 Catchment 209 - Punkinseed Lane - north and west end"				
"	21.000 % Impervious"				
"	1.930 Total Area"				
"	36.000 Flow length"				
"	2.000 Overland Slope"				
"	1.525 Pervious Area"				
"	36.000 Pervious length"				
"	2.000 Pervious slope"				
"	0.405 Impervious Area"				
"	9.570 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	84.200	Pervious SCS Curve No."			
"	0.671	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.766	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No."			
"	0.953	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.388	0.000	2.383	2.383 c.m/sec"
"		Catchment 209	Pervious	Impervious	Total Area "
"		Surface Area	1.525	0.405	1.930 hectare"
"		Time of concentration	14.324	1.095	10.934 minutes"
"		Time to Centroid	209.895	176.590	201.361 minutes"
"		Rainfall depth	115.765	115.765	115.765 mm"
"		Rainfall volume	1765.08	469.20	2234.27 c.m"
"		Rainfall losses	38.593	15.748	33.795 mm"
"		Runoff depth	77.173	100.017	81.970 mm"
"		Runoff volume	1176.65	405.37	1582.02 c.m"
"		Maximum flow	0.326	0.102	0.388 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.388	0.388	2.383	2.383"
" 52		CHANNEL DESIGN"			
"	0.388	Current peak flow	c.m/sec"		
"	0.040	Manning 'n' "			
"	0.	Cross-section type: 0=trapezoidal; 1=general"			
"	0.500	Basewidth	metre"		
"	3.000	Left bank slope"			
"	3.000	Right bank slope"			
"	0.750	Channel depth	metre"		
"	20.000	Gradient	%"		
"		Depth of flow	0.160	metre"	
"		Velocity	2.470	m/sec"	
"		Channel capacity	12.379	c.m/sec"	
"		Critical depth	0.250	metre"	
" 53		ROUTE Channel Route 30"			
"	30.00	Channel Route 30 Reach length	( metre)"		
"	0.493	X-factor <= 0.5"			
"	9.109	K-lag ( seconds)"			
"	0.000	Default(0) or user spec.(1) values used"			
"	0.500	X-factor <= 0.5"			
"	30.000	K-lag ( seconds)"			
"	0.500	Beta weighting factor"			
"	9.091	Routing time step ( seconds)"			
"	1	No. of sub-reaches"			
"		Peak outflow	0.386	c.m/sec"	
"		0.388	0.388	0.386	2.383 c.m/sec"
" 40		HYDROGRAPH Combine	4"		
"	6	Combine "			
"	4	Node #"			
"		Pond 2"			
"		Maximum flow	2.769	c.m/sec"	
"		Hydrograph volume	11847.808	c.m"	
"		0.388	0.388	0.386	2.769"
" 40		HYDROGRAPH Confluence	4"		

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

```

"      7  Confluence "
"      4  Node #"
"      Pond 2"
"      Maximum flow          2.769    c.m/sec"
"      Hydrograph volume     11847.808 c.m"
"      0.388    2.769    0.386    0.000"
" 54      POND DESIGN"
"      2.769    Current peak flow    c.m/sec"
"      2.235    Target outflow    c.m/sec"
"      11850.0    Hydrograph volume    c.m"
"      23.    Number of stages"
"      179.000    Minimum water level    metre"
"      180.300    Maximum water level    metre"
"      179.000    Starting water level    metre"
"      0    Keep Design Data: 1 = True; 0 = False"
"      Level Discharge    Volume"
"      179.000    0.000    0.0"
"      179.059    0.000    227.7"
"      179.118    0.000    457.2"
"      179.177    0.000    688.7"
"      179.236    0.000    921.9"
"      179.295    0.000    1157.0"
"      179.355    0.000    1398.0"
"      179.400    0.000    1580.0"
"      179.473    0.097    1877.7"
"      179.532    0.250    2120.2"
"      179.591    0.457    2364.8"
"      179.650    0.718    2611.2"
"      179.709    1.033    2859.5"
"      179.768    1.403    3109.8"
"      179.827    1.828    3361.9"
"      179.900    2.434    3676.5"
"      179.945    3.001    3872.0"
"      180.005    4.004    4134.3"
"      180.064    5.199    4394.2"
"      180.123    6.582    4656.1"
"      180.182    8.142    4920.0"
"      180.241    9.876    5185.7"
"      180.300    11.781    5453.5"
"      2.    WEIRS"
"      Crest    Weir    Crest    Left    Right"
"      elevation coefficie breadth sideslope sideslope"
"      179.400    0.900    3.000    4.000    4.000"
"      179.900    0.900    10.000    4.000    4.000"
"      1.    LAYERS"
"      Bottom    Aspect    Bottom    Top    Average"
"      area    ratio elevation elevation sideslope"
"      3844.000    2.000    179.000    180.300    2.000"
"      Peak outflow          2.104    c.m/sec"
"      Maximum level          179.860    metre"
"      Maximum storage          3505.124    c.m"
"      Centroidal lag          3.999    hours"
"      0.388    2.769    2.104    0.000 c.m/sec"
" 40      HYDROGRAPH Start - New Tributary"
"      2    Start - New Tributary"
"      0.388    0.000    2.104    0.000"

```

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

```

" 33      CATCHMENT 210"
"          1    Triangular SCS"
"          2    Proportional to %"
"          1    SCS method"
"          210   McLeese Drive south of Punkinseed Lane"
"          24.400 % Impervious"
"          3.700  Total Area"
"          47.000  Flow length"
"          2.000  Overland Slope"
"          2.797  Pervious Area"
"          47.000  Pervious length"
"          2.000  Pervious slope"
"          0.903  Impervious Area"
"          15.169  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          84.800  Pervious SCS Curve No."
"          0.682  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          4.553  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."
"          0.953  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"                  0.727      0.000      2.104      0.000 c.m/sec"

"          Catchment 210      Pervious      Impervious      Total Area  "
"          Surface Area      2.797      0.903      3.700      hectare"
"          Time of concentration  16.718      1.443      12.152      minutes"
"          Time to Centroid      212.281      177.022      201.740      minutes"
"          Rainfall depth      115.765      115.765      115.765      mm"
"          Rainfall volume      3238.19      1045.13      4283.32      c.m"
"          Rainfall losses      37.119      11.855      30.955      mm"
"          Runoff depth      78.646      103.911      84.811      mm"
"          Runoff volume      2199.89      938.11      3138.00      c.m"
"          Maximum flow      0.578      0.231      0.727      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4    Add Runoff "
"                  0.727      0.727      2.104      0.000"
" 52      CHANNEL DESIGN"
"          0.727  Current peak flow      c.m/sec"
"          0.040  Manning 'n'"
"          0.    Cross-section type: 0=trapezoidal; 1=general"
"          10.000  Basewidth      metre"
"          10.000  Left bank slope"
"          10.000  Right bank slope"
"          1.000  Channel depth      metre"
"          10.000  Gradient      %"
"          Depth of flow      0.059      metre"
"          Velocity      1.158      m/sec"
"          Channel capacity      120.397      c.m/sec"
"          Critical depth      0.079      metre"
" 53      ROUTE Zero Route"
"          0.00  Zero Route Reach length      ( metre)"

```



**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

```

"          0.727      0.727      0.727      0.000 c.m/sec"
" 40      HYDROGRAPH  Combine      3"
"          6  Combine "
"          3  Node #"
"          DP#2"
"          Maximum flow          8.069      c.m/sec"
"          Hydrograph volume      42904.176      c.m"
"          0.727      0.727      0.727      8.069"
" 40      HYDROGRAPH Start - New Tributary"
"          2  Start - New Tributary"
"          0.727      0.000      0.727      8.069"
" 47      FILEI_O Read/Open DIV00203.100hyd"
"          1  1=read/open; 2=write/save"
"          2  1=rainfall; 2=hydrograph"
"          2  1=runoff; 2=inflow; 3=outflow; 4=junction"
"          DIV00203.100hyd"
"          Major flow at 203"
"          Total volume          2194.189      c.m"
"          Maximum flow          1.224      c.m/sec"
"          0.727      1.224      0.727      8.069 c.m/sec"
" 52      CHANNEL DESIGN"
"          1.224  Current peak flow      c.m/sec"
"          0.040  Manning 'n'"
"          0.    Cross-section type: 0=trapezoidal; 1=general"
"          10.000 Basewidth      metre"
"          10.000 Left bank slope"
"          10.000 Right bank slope"
"          1.000  Channel depth      metre"
"          10.000 Gradient      %"
"          Depth of flow          0.081      metre"
"          Velocity          1.405      m/sec"
"          Channel capacity      120.397      c.m/sec"
"          Critical depth          0.111      metre"
" 53      ROUTE      Channel Route 0"
"          0.00  Channel Route 0 Reach length ( metre)"
"          0.000  X-factor <= 0.5"
"          0.001  K-lag ( seconds)"
"          0.000  Default(0) or user spec.(1) values used"
"          0.500  X-factor <= 0.5"
"          30.000 K-lag ( seconds)"
"          0.998  Beta weighting factor"
"          0.254  Routing time step ( seconds)"
"          1  No. of sub-reaches"
"          Peak outflow          1.224      c.m/sec"
"          0.727      1.224      1.224      8.069 c.m/sec"
" 40      HYDROGRAPH  Combine      3"
"          6  Combine "
"          3  Node #"
"          DP#2"
"          Maximum flow          8.772      c.m/sec"
"          Hydrograph volume      45098.410      c.m"
"          0.727      1.224      1.224      8.772"
" 40      HYDROGRAPH  Confluence      3"
"          7  Confluence "
"          3  Node #"
"          DP#2"

```

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

```

"           Maximum flow                8.772      c.m/sec"
"           Hydrograph volume            45098.410    c.m"
"           0.727      8.772      1.224      0.000"
" 52      CHANNEL DESIGN"
"           8.772      Current peak flow      c.m/sec"
"           0.040      Manning 'n'"
"           0.       Cross-section type: 0=trapezoidal; 1=general"
"           2.000      Basewidth      metre"
"           2.000      Left bank slope"
"           2.000      Right bank slope"
"           1.000      Channel depth      metre"
"           5.000      Gradient      %"
"           Depth of flow                0.735      metre"
"           Velocity                    3.439      m/sec"
"           Channel capacity            16.224      c.m/sec"
"           Critical depth              0.923      metre"
" 53      ROUTE      Channel Route 150"
"           150.00      Channel Route 150 Reach length      ( metre)"
"           0.475      X-factor <= 0.5"
"           32.716      K-lag      ( seconds)"
"           0.000      Default(0) or user spec.(1) values used"
"           0.500      X-factor <= 0.5"
"           30.000      K-lag      ( seconds)"
"           0.500      Beta weighting factor"
"           33.333      Routing time step      ( seconds)"
"           1      No. of sub-reaches"
"           Peak outflow                8.687      c.m/sec"
"           0.727      8.772      8.687      0.000 c.m/sec"
" 40      HYDROGRAPH      Combine      5"
"           6      Combine "
"           5      Node #"
"           DP#2 Confluence with Area 211"
"           Maximum flow                8.687      c.m/sec"
"           Hydrograph volume            45098.332    c.m"
"           0.727      8.772      8.687      8.687"
" 40      HYDROGRAPH Start - New Tributary"
"           2      Start - New Tributary"
"           0.727      0.000      8.687      8.687"
" 33      CATCHMENT 211"
"           1      Triangular SCS"
"           2      Proportional to %"
"           1      SCS method"
"           211      Punkinseed Lane - south end"
"           12.400      % Impervious"
"           2.290      Total Area"
"           57.000      Flow length"
"           2.000      Overland Slope"
"           2.006      Pervious Area"
"           57.000      Pervious length"
"           2.000      Pervious slope"
"           0.284      Impervious Area"
"           8.068      Impervious length"
"           2.000      Impervious slope"
"           0.250      Pervious Manning 'n'"
"           83.800      Pervious SCS Curve No."
"           0.664      Pervious Runoff coefficient"

```

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

```

"      0.100  Pervious Ia/S coefficient"
"      4.910  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"  98.000  Impervious SCS Curve No."
"      0.953  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"          0.412      0.000      8.687      8.687 c.m/sec"
"      Catchment 211      Pervious      Impervious Total Area "
"      Surface Area      2.006      0.284      2.290      hectare"
"      Time of concentration 18.941      0.988      16.162      minutes"
"      Time to Centroid      216.129      176.329      209.968      minutes"
"      Rainfall depth      115.765      115.765      115.765      mm"
"      Rainfall volume      2322.30      328.73      2651.03      c.m"
"      Rainfall losses      39.396      16.955      36.614      mm"
"      Runoff depth      76.369      98.811      79.152      mm"
"      Runoff volume      1531.99      280.58      1812.58      c.m"
"      Maximum flow      0.392      0.071      0.412      c.m/sec"
"  40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.412      0.412      8.687      8.687"
"  52      CHANNEL DESIGN"
"      0.412  Current peak flow      c.m/sec"
"      0.040  Manning 'n'"
"      0.      Cross-section type: 0=trapezoidal; 1=general"
"      0.500  Basewidth      metre"
"      2.000  Left bank slope"
"      2.000  Right bank slope"
"      0.500  Channel depth      metre"
"      3.000  Gradient      %"
"      Depth of flow      0.286      metre"
"      Velocity      1.342      m/sec"
"      Channel capacity      1.370      c.m/sec"
"      Critical depth      0.285      metre"
"  53      ROUTE      Channel Route 20"
"      20.00      Channel Route 20 Reach length      ( metre)"
"      0.385  X-factor <= 0.5"
"      11.176  K-lag      ( seconds)"
"      0.000  Default(0) or user spec.(1) values used"
"      0.500  X-factor <= 0.5"
"      30.000  K-lag      ( seconds)"
"      0.500  Beta weighting factor"
"      13.636  Routing time step      ( seconds)"
"      1      No. of sub-reaches"
"      Peak outflow      0.412      c.m/sec"
"          0.412      0.412      0.412      8.687 c.m/sec"
"  40      HYDROGRAPH      Combine      5"
"      6      Combine "
"      5      Node #"
"          DP#2 Confluence with Area 211"
"      Maximum flow      9.010      c.m/sec"
"      Hydrograph volume      46910.910      c.m"
"          0.412      0.412      0.412      9.010"
"  40      HYDROGRAPH      Confluence      5"
"      7      Confluence "
"      5      Node #"

```

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

```

"          DP#2 Confluence with Area 211"
"          Maximum flow              9.010      c.m/sec"
"          Hydrograph volume          46910.910   c.m"
"          0.412      9.010      0.412      0.000"
" 52          CHANNEL DESIGN"
"          9.010      Current peak flow      c.m/sec"
"          0.040      Manning 'n'"
"          0.          Cross-section type: 0=trapezoidal; 1=general"
"          2.000      Basewidth      metre"
"          3.000      Left bank slope"
"          3.000      Right bank slope"
"          1.000      Channel depth      metre"
"          3.000      Gradient      %"
"          Depth of flow              0.777      metre"
"          Velocity                    2.679      m/sec"
"          Channel capacity            15.413      c.m/sec"
"          Critical depth              0.853      metre"
" 53          ROUTE      Channel Route 100"
"          100.00      Channel Route 100 Reach length      ( metre)"
"          0.438      X-factor <= 0.5"
"          27.998      K-lag      ( seconds)"
"          0.000      Default(0) or user spec.(1) values used"
"          0.500      X-factor <= 0.5"
"          30.000      K-lag      ( seconds)"
"          0.500      Beta weighting factor"
"          30.000      Routing time step      ( seconds)"
"          1          No. of sub-reaches"
"          Peak outflow              8.935      c.m/sec"
"          0.412      9.010      8.935      0.000 c.m/sec"
" 40          HYDROGRAPH Start - New Tributary"
"          2          Start - New Tributary"
"          0.412      0.000      8.935      0.000"
" 33          CATCHMENT 212"
"          1          Triangular SCS"
"          2          Proportional to %"
"          1          SCS method"
"          212      Timberglade Court"
"          15.200      % Impervious"
"          3.070      Total Area"
"          64.000      Flow length"
"          2.000      Overland Slope"
"          2.603      Pervious Area"
"          64.000      Pervious length"
"          2.000      Pervious slope"
"          0.467      Impervious Area"
"          11.472      Impervious length"
"          2.000      Impervious slope"
"          0.250      Pervious Manning 'n'"
"          83.800      Pervious SCS Curve No."
"          0.664      Pervious Runoff coefficient"
"          0.100      Pervious Ia/S coefficient"
"          4.910      Pervious Initial abstraction"
"          0.015      Impervious Manning 'n'"
"          98.000      Impervious SCS Curve No."
"          0.953      Impervious Runoff coefficient"
"          0.100      Impervious Ia/S coefficient"

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**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	0.518	Impervious Initial abstraction"				
"		0.534	0.000	8.935	0.000 c.m/sec"	
"		Catchment 212	Pervious	Impervious	Total Area	"
"		Surface Area	2.603	0.467	3.070	hectare"
"		Time of concentration	20.304	1.220	16.631	minutes"
"		Time to Centroid	217.837	176.787	209.936	minutes"
"		Rainfall depth	115.765	115.765	115.765	mm"
"		Rainfall volume	3013.79	540.21	3554.00	c.m"
"		Rainfall losses	39.322	14.109	35.490	mm"
"		Runoff depth	76.443	101.657	80.276	mm"
"		Runoff volume	1990.09	474.37	2464.46	c.m"
"		Maximum flow	0.495	0.118	0.534	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.534	0.534	8.935	0.000"	
" 40		HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"				
"		0.534	0.000	8.935	0.000"	
" 33		CATCHMENT 213"				
"	1	Triangular SCS"				
"	2	Proportional to %"				
"	1	SCS method"				
"	213	Southeast undeveloped portion of the site"				
"	0.000	% Impervious"				
"	4.020	Total Area"				
"	122.000	Flow length"				
"	3.500	Overland Slope"				
"	4.020	Pervious Area"				
"	122.000	Pervious length"				
"	3.500	Pervious slope"				
"	0.000	Impervious Area"				
"	0.000	Impervious length"				
"	3.500	Impervious slope"				
"	0.350	Pervious Manning 'n' "				
"	75.600	Pervious SCS Curve No. "				
"	0.527	Pervious Runoff coefficient"				
"	0.100	Pervious Ia/S coefficient"				
"	8.198	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n' "				
"	98.000	Impervious SCS Curve No. "				
"	0.953	Impervious Runoff coefficient"				
"	0.100	Impervious Ia/S coefficient"				
"	0.518	Impervious Initial abstraction"				
"		0.452	0.000	8.935	0.000 c.m/sec"	
"		Catchment 213	Pervious	Impervious	Total Area	"
"		Surface Area	4.020	0.000	4.020	hectare"
"		Time of concentration	33.641	0.001	33.640	minutes"
"		Time to Centroid	241.007	173.408	241.007	minutes"
"		Rainfall depth	115.765	115.765	115.765	mm"
"		Rainfall volume	4653.77	0.00	4653.77	c.m"
"		Rainfall losses	54.814	16.523	54.814	mm"
"		Runoff depth	60.952	99.243	60.952	mm"
"		Runoff volume	2450.26	0.00	2450.26	c.m"
"		Maximum flow	0.452	0.000	0.452	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year - 6 Hour Storm Event**

"	0.452	0.452	8.935	0.000"	
" 38	START/RE-START TOTALS 213"				
"	3 Runoff Totals on EXIT"				
"	Total Catchment area		90.160	hectare"	
"	Total Impervious area		12.097	hectare"	
"	Total % impervious		13.418"		
" 19	EXIT"				



PRYDE SCHROPP McCOMB INC.  
CONSULTING ENGINEERS

## **APPENDIX F**

### **COBBLE BEACH DEVELOPMENT STAGE 1 (2007)**

### **STORM SEWER DESIGN SHEETS**

SUBDIVISION				STORM SEWER DESIGN SHEET										DESIGN PARAMETERS			
COBBLE BEACH - STAGE 1 TWP. OF GEORGIAN BLUFFS																	
DATE: February 2007 DESIGNED BY: SJC CHECKED BY: BRP				FILE NUMBERS: 30202 DESIGN STORM 1 in 5 Years MANNINGS N = 0.013										a= 712.886 b= 5.395 c= 0.7390  I = a / ( ( tc + b ) ^ c )			
LOCATION				DRAINAGE AREA					PIPE SELECTION								
CATCHMENT AREA ID	FROM M.H.	TO M.H.	AREA (ha)	C	A x R (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/s)	TIME OF FLOW (min)		
Sarawak Drive																	
1	CBMH10	STMMH4	0.231	0.79	0.18	0.18	10.00	94.52	0.048	10.0	300	1.20	0.106	1.50	0.11		
9	CBMH8	STMMH4	2.650	0.64	1.70	1.70	10.00	94.52	0.445	8.5	525	1.10	0.451	2.08	0.07		
	STMMH4	CBMH6A	0.000	0.00	0.00	1.88	10.11	94.02	0.473	54.0	750	0.40	0.704	1.59	0.56		
10	DICB1	CBMH7	0.864	0.80	0.52	0.52	10.00	94.52	0.136	6.0	375	1.00	0.175	1.59	0.06		
2	CBMH7	STMMH2	0.452	0.65	0.29	2.69	10.68	91.57	0.694	82.0	750	0.40	0.704	1.59	0.86		
11	CBMH5	STMMH2	0.956	0.79	0.76	0.76	10.00	94.52	0.198	9.0	450	0.50	0.202	1.27	0.12		
3	STMMH2	CBMH4	0.340	0.70	0.24	3.68	11.53	88.12	0.902	65.0	900	0.40	1.145	1.80	0.60		
12	DICB2	CBMH4	0.941	0.59	0.56	0.56	10.00	94.52	0.146	5.0	375	1.00	0.175	1.59	0.05		
4	CBMH3	STMMH1	0.172	0.76	0.13	4.37	12.14	85.87	1.042	49.0	900	0.40	1.145	1.80	0.45		
8	CBMH1A	STMMH1	2.410	0.65	1.57	1.57	10.00	94.52	0.411	25.0	525	1.00	0.430	1.99	0.21		
5	STMMH1/CBMH2	TICBMH1	0.220	0.75	0.17	6.10	12.59	84.27	1.428	65.0	1050	0.40	1.727	1.99	0.54		
7	INLET	TICBMH1	1.810	0.50	0.91	0.91	10.00	94.52	0.238	5.0	525	0.50	0.304	1.40	0.06		
6	TICBMH1	Outfall	0.300	0.68	0.20	7.21	13.13	82.43	1.651	15.0	1050	0.50	1.931	2.23	0.11		
Cobble Beach Drive																	
13	CB8	CBMH10A	0.375	0.60	0.23	0.23	10.00	94.52	0.059	61.8	300	2.87	0.184	2.32	0.44		
14	CBMH10A	CBMH12A	0.141	0.72	0.10	0.33	10.44	92.56	0.094	62.0	300	2.08	0.139	1.97	0.52		
15	CBMH12A	CBMH12	0.122	0.76	0.09	0.42	10.97	90.36	0.105	66.8	300	3.84	0.189	2.68	0.42		
16	CBMH12	CBMH13	0.135	0.73	0.10	0.52	11.38	88.70	0.128	50.7	300	4.92	0.214	3.03	0.28		
17	CBMH13	STMMH3	0.118	0.73	0.09	0.60	11.66	87.63	0.147	17.5	300	4.92	0.214	3.03	0.10		
Snowberry Lane																	
26	CBMH24	CBMH22	0.402	0.68	0.27	0.27	10.00	94.52	0.072	36.0	375	0.50	0.124	1.12	0.53		
25	CBMH22	CBMH21	0.366	0.69	0.27	0.54	10.53	92.17	0.138	68.0	375	3.80	0.342	3.09	0.37		
24	CBMH21	STMMH3	0.468	0.68	0.32	0.86	10.90	90.64	0.216	68.0	450	3.50	0.533	3.35	0.34		
Cobble Beach Drive																	
	STMMH3	CBMH14	0.000	0.00	0.00	1.46	11.76	0.00	0.363	58.0	450	5.08	0.643	4.04	0.24		
18	CBMH14	CBMH15	0.244	0.70	0.17	1.63	12.00	86.38	0.392	60.4	450	4.92	0.632	3.98	0.25		
19	CBMH15	STMMH6	0.213	0.75	0.16	1.79	12.25	85.46	0.425	16.7	450	5.00	0.638	4.01	0.07		
Telford Trail																	
31	CBMH30	CBMH29	0.400	0.71	0.28	0.28	10.00	94.52	0.075	53.2	300	1.18	0.105	1.49	0.60		
30	CBMH29	STMMH8	0.227	0.86	0.20	0.48	10.60	91.91	0.122	16.7	300	3.40	0.178	2.52	0.11		
Braw Gint Lane																	
32	CBMH32	STMMH8	0.539	0.68	0.37	0.37	10.00	94.52	0.096	16.7	375	0.50	0.124	1.12	0.25		
Telford Trail																	
	STMMH8	CBMH28	0.000	0.00	0.00	0.85	10.71	0.00	0.205	37.2	450	5.43	0.664	4.18	0.15		
29	CBMH28	CBMH27	0.264	0.81	0.21	1.06	10.86	90.82	0.267	47.1	450	6.00	0.698	4.39	0.18		
28	CBMH27	CBMH26	0.202	0.83	0.17	1.23	11.03	90.09	0.307	19.2	450	6.20	0.710	4.46	0.07		
27	CBMH26	CBMH25	0.104	0.80	0.08	1.31	11.11	89.80	0.327	55.9	450	3.33	0.520	3.27	0.28		
69	CBMH25	STMMH6	0.842	0.60	0.51	1.82	11.39	88.67	0.447	17.6	525	1.20	0.471	2.18	0.13		
Cobble Beach Drive																	
	STMMH6	CBMH16	0.000	0.00	0.00	3.61	12.32	0.00	0.873	64.8	525	5.02	0.964	4.45	0.24		
20	CBMH16	TICBMH5	0.387	0.66	0.26	3.86	12.56	84.36	0.905	69.6	750	2.06	1.598	3.62	0.32		
Algonquin Trail																	
41	CBMH42	CBMH41	1.164	0.58	0.68	0.68	10.00	94.52	0.177	59.0	450	1.00	0.285	1.79	0.55		
40	CBMH41	STMMH9	0.287	0.66	0.19	0.86	10.55	92.11	0.221	59.0	525	1.00	0.430	1.99	0.49		



SUBDIVISION				STORM SEWER DESIGN SHEET										DESIGN PARAMETERS			
COBBLE BEACH - STAGE 1 TWP. OF GEORGIAN BLUFFS														I = a / ((( tc + b ) ^ c )			
DATE: February 2007 DESIGNED BY: SJC CHECKED BY: BRP				FILE NUMBERS: 30202 DESIGN STORM 1 in 5 Years MANNINGS N = 0.013										a= 712.886 b= 5.395 c= 0.7390			
LOCATION				DRAINAGE AREA							PIPE SELECTION						
CATCHMENT AREA ID	FROM M.H.	TO M.H.	AREA (ha)	C	A x R	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/s)	TIME OF FLOW (min)		
Snowberry Lane	39	CBMH80	0.377	0.71	0.27	0.27	10.00	94.52	0.070	55.3	375	0.50	0.124	1.12	0.82		
	38	CBMH79	0.443	0.66	0.29	0.56	10.82	90.96	0.142	8.8	450	0.50	0.202	1.27	0.12		
	Algonquin Trail																
	37	STMMH9	0.000	0.00	0.00	1.42	11.04	0.00	0.363	58.9	525	1.00	0.430	1.99	0.49		
Cobble Beach Drive	36	CBMH39	0.353	0.65	0.23	1.65	11.54	88.10	0.405	58.9	525	1.00	0.430	1.99	0.49		
	35	CBMH37	0.465	0.66	0.31	1.96	10.00	94.52	0.515	73.2	525	3.60	0.816	3.77	0.32		
	34	CBMH35	0.553	0.64	0.35	2.31	10.32	93.08	0.599	54.0	525	7.50	1.178	5.44	0.17		
	33	CBMH34	0.605	0.63	0.38	2.70	10.49	92.37	0.682	55.3	525	3.80	0.838	3.87	0.24		
Cobble Beach Drive	33	STMMH7	0.677	0.61	0.41	3.11	10.73	91.36	0.789	14.8	750	1.00	1.113	2.52	0.10		
	23	CBMH20	0.000	0.00	0.00	3.11	10.82	0.00	0.789	50.8	750	1.64	1.426	3.23	0.26		
	21	TICBMH5	0.188	0.72	0.14	3.24	11.09	89.88	0.810	79.3	750	0.89	1.050	2.38	0.56		
	22	Outfall	0.280	0.69	0.19	0.19	10.00	94.52	0.051	8.0	450	1.00	0.285	1.79	0.07		
Cobble Beach Drive	42	CBMH43	0.184	0.70	0.13	0.13	10.00	94.52	0.034	45.6	300	6.58	0.248	3.51	0.22		
	43	CBMH44	0.421	0.67	0.28	0.41	10.22	93.55	0.107	16.8	300	5.24	0.221	3.13	0.09		
	Algoma Crescent																
	48	CBMH52	0.135	0.77	0.10	0.10	10.00	94.52	0.027	86.3	300	1.70	0.126	1.78	0.81		
Cobble Beach Drive	49	CBMH54	0.423	0.67	0.28	0.39	10.81	91.03	0.098	72.3	300	1.25	0.108	1.53	0.79		
	50	CBMH55	0.571	0.63	0.36	0.75	11.59	87.89	0.182	39.9	450	1.25	0.319	2.00	0.33		
	51	STMMH10	0.240	0.69	0.17	0.91	11.93	86.64	0.220	9.3	450	1.25	0.319	2.00	0.08		
	Cobble Beach Drive																
McLeese Drive	44	CBMH45	0.000	0.00	0.00	1.32	12.00	86.35	0.326	75.5	525	2.48	0.677	3.13	0.40		
	45	CBMH47	0.605	0.66	0.40	1.72	12.41	84.91	0.406	82.3	525	3.45	0.709	3.69	0.37		
	46	CBMH49	0.468	0.64	0.30	2.02	12.78	83.82	0.470	95.1	525	2.26	0.647	2.99	0.53		
	47	CBMH50	0.257	0.69	0.18	2.20	13.31	81.86	0.500	54.0	600	1.00	0.614	2.17	0.41		
McLeese Drive	53	STMMH11	0.191	0.66	0.13	2.33	13.72	80.55	0.520	32.2	600	1.00	0.614	2.17	0.25		
	54	CBMH61	0.000	0.00	0.00	2.33	13.97	0.00	0.520	53.5	750	0.60	0.862	1.95	0.46		
	55	CBMH62	0.221	0.66	0.15	2.47	14.43	78.42	0.538	78.1	750	0.56	0.833	1.89	0.69		
	56	STMMH12	0.230	0.66	0.15	2.62	15.12	76.46	0.557	56.4	750	0.35	0.659	1.49	0.63		
The Villas	68	CBMH63	5.173	0.74	3.83	3.83	12.00	86.37	0.918	30.0	900	0.50	1.280	2.01	0.25		
	56	CBMH63	0.000	0.00	0.00	6.45	15.75	0.00	1.476	42.6	1050	0.50	1.931	2.23	0.32		
	57	TICBMH8	0.163	0.67	0.11	6.56	16.07	73.95	1.348	72.1	1050	0.53	1.988	2.30	0.52		
	Outfall								1.359	13.5	1050	0.50	1.931	2.23	0.10		
	60	CBMH71	0.093	0.84	0.08	0.08	10.00	94.52	0.021	58.0	300	0.40	0.061	0.87	1.12		
	61	CBMH72	0.122	0.80	0.10	0.18	11.12	89.76	0.044	56.0	300	0.40	0.061	0.87	1.08		

SUBDIVISION		STORM SEWER DESIGN SHEET										DESIGN PARAMETERS		
COBBLE BEACH - STAGE 1 TWP. OF GEORGIAN BLUFFS		FILE NUMBERS: 30202 DESIGN STORM 1 in 5 Years MANNINGS N = 0.013										$I = a / ((tc + b) ^ c)$  a= 712.886 b= 5.395 c= 0.7390		
DATE: February 2007 DESIGNED BY: SJC CHECKED BY: BRP		DRAINAGE AREA A x R C AREA (ha)										PIPE SELECTION SLOPE % PIPE SIZE (mm)		
CATCHMENT AREA ID	FROM M.H.	TO M.H.	AREA (ha)	C	A x R (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	LENGTH (m)	PIPE SIZE (mm)	CAP. (FULL) (m3/s)	VEL. (FULL) (m/s)	TIME OF FLOW (min)
67	Multifamily	CBMH74	0.988	0.78	0.78	0.78	10.00	94.52	0.204	15.0	525	0.272	1.26	0.20
62	CBMH74	TICBMH10	0.110	0.83	0.09	1.05	12.20	85.65	0.249	44.5	600	0.388	1.37	0.54
65	CBMH13	CBMH12	0.143	0.81	0.12	0.12	10.00	94.52	0.030	92.0	300	0.074	1.04	1.47
66	Multifamily	CBMH12	1.432	0.76	1.09	1.20	10.00	94.52	0.316	15.0	600	0.388	1.37	0.18
64	CBMH12	TICBMH10	0.180	0.83	0.15	1.47	11.47	88.36	0.361	54.0	600	0.388	1.37	0.66
63	TICBMH10	Outfall	0.190	0.81	0.15	2.67	12.74	83.76	0.621	17.0	750	0.704	1.59	0.18
Punkinseed Lane														
59	CR60	CBMH66	0.118	0.73	0.09	0.09	10.00	94.52	0.023	58.0	300	0.270	3.82	0.25
71	Multifamily	CBMH66	0.438	0.75	0.33	0.33	10.00	94.52	0.086	15.0	450	0.202	1.27	0.20
70	CBMH66	Outlet	0.115	0.73	0.08	0.50	10.25	93.39	0.129	63.8	450	0.638	4.00	0.27
72	CBMH66A	STMMH15	0.134	0.74	0.10	0.60	10.52	92.24	0.153	10.0	450	0.636	4.00	0.04
73	CBMH67	STMMH15	0.916	0.61	0.56	0.56	10.00	94.52	0.147	26.0	450	0.180	1.13	0.38
74	STMMH15	Outfall	0.000	0.00	0.00	1.16	10.38	92.84	0.298	21.4	600	0.32	1.23	0.29
75	CBMH68	CBMH69	0.825	0.62	0.51	0.51	10.00	94.52	0.134	70.0	450	0.202	1.27	0.92
76	CBMH69	CBMH70	0.774	0.58	0.45	0.96	10.92	90.55	0.242	55.0	525	0.272	1.26	0.73
Snowberry Way														
77	CBMH70	Outfall	0.682	0.58	0.40	1.36	11.65	87.67	0.330	20.0	600	0.388	1.37	0.24
	TICBMH7	Outfall	0.979	0.67	0.66	0.66	10.00	94.52	0.172	15.0	750	0.787	1.78	0.14
McLeese Drive (North)														
80	CR57	CBMH65	0.163	0.75	0.12	0.12	10.00	94.52	0.032	72.3	300	0.061	0.87	1.39
83	Multifamily	CBMH65	3.970	0.76	3.02	3.02	10.00	94.52	0.792	15.0	750	0.862	1.95	0.13
81	CBMH65	TICBMH9	0.160	0.73	0.12	3.26	11.39	88.66	0.802	74.8	900	1.145	1.80	0.69
85	Multifamily	CBMHA	3.310	0.76	2.52	2.52	10.00	94.52	0.661	220.0	600	0.727	2.57	1.43
84	CBMHA	TICBMH9	0.588	0.77	0.45	2.97	11.43	88.53	0.730	75.0	750	1.113	2.52	0.50
	TICBMH9	Outfall	0.00	0.00	0.00	6.22	12.09	86.05	1.488	15.0	1050	1.727	1.99	0.13



PRYDE SCHROPP McCOMB INC.  
CONSULTING ENGINEERS

## **APPENDIX G**

**COBBLE BEACH DEVELOPMENT  
STAGE 1 (2007)**

**MIDUSS OUTPUT FILES  
100 YEAR – ROAD CROSS SECTION ANALYSIS**

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year Road Cross Section Analysis**

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.01  rev. 329"
"          MIDUSS created                      Monday, May 17, 2004"
"          10  Units used:                      ie METRIC"
"          Job folder:                      C:\Documents and Settings\scobean\
"                                     My Documents\MIDUSSdata\Georgian Villas\June 2007"
" 31          TIME PARAMETERS"
"          10.000  Time Step"
"          1440.000  Max. Storm length"
"          1500.000  Max. Hydrograph"
" 32          STORM Chicago storm"
"          1  Chicago storm"
"          1242.840  Coefficient A"
"          11.180  Constant B"
"          0.704  Exponent C"
"          0.400  Fraction R"
"          360.000  Duration"
"          2.000  Time step multiplier"
"          Maximum intensity          105.988  mm/hr"
"          Total depth          115.765  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"          1  Triangular SCS"
"          2  Proportional to %"
"          1  SCS method"
"          201  Catchment 201 - south of main entrance"
"          19.200  % Impervious"
"          12.000  Total Area"
"          47.000  Flow length"
"          2.000  Overland Slope"
"          9.696  Pervious Area"
"          47.000  Pervious length"
"          2.000  Pervious slope"
"          2.304  Impervious Area"
"          11.168  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          84.100  Pervious SCS Curve No."
"          0.669  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          4.802  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."
"          0.953  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          2.237  0.000  0.000  0.000 c.m/sec"
"          Catchment 201          Pervious  Impervious Total Area  "
"          Surface Area          9.696  2.304  12.000  hectare"
"          Time of concentration  16.824  1.201  13.107  minutes"
"          Time to Centroid      212.999  176.760  204.376  minutes"
"          Rainfall depth        115.765  115.765  115.765  mm"
"          Rainfall volume        1.1225  0.2667  1.3892  ha-m"
"          Rainfall losses        38.584  14.344  33.930  mm"
"          Runoff depth           77.181  101.422  81.836  mm"
"          Runoff volume          7483.52  2336.76  9820.28  c.m"

```

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year Road Cross Section Analysis**

"	Maximum flow	1.963	0.580	2.237	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	2.237 2.237 0.000 0.000"				
" 52	CHANNEL DESIGN"				
"	2.237 Current peak flow c.m/sec"				
"	0.015 Manning 'n'"				
"	1. Cross-section type: 0=trapezoidal; 1=general"				
"	7. Define an arbitrary cross-section"				
"	0.000 5.000 5.000 10.000 15.000"				
"	15.000 20.000"				
"	100.165 100.065 99.920 100.000 99.920"				
"	100.060 100.160"				
"	0.240 Channel depth metre"				
"	0.400 Gradient %"				
"	0. Variable roughness: 0=False; 1=True"				
"	0.0400 0.0400 0.0400 0.0400 0.0400"				
"	0.0400 0.0400"				
"	Depth of flow 0.226 metre"				
"	Velocity 1.016 m/sec"				
"	Channel capacity 2.626 c.m/sec"				
"	Critical depth 0.219 metre"				
" 40	HYDROGRAPH Start - New Tributary"				
"	2 Start - New Tributary"				
"	2.237 0.000 0.000 0.000"				
" 33	CATCHMENT 205"				
"	1 Triangular SCS"				
"	2 Proportional to %"				
"	1 SCS method"				
"	205 Catchment 205 - north of Cobble Beach Drive"				
"	18.600 % Impervious"				
"	17.400 Total Area"				
"	44.000 Flow length"				
"	2.000 Overland Slope"				
"	14.164 Pervious Area"				
"	44.000 Pervious length"				
"	2.000 Pervious slope"				
"	3.236 Impervious Area"				
"	10.054 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	82.300 Pervious SCS Curve No."				
"	0.637 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	5.463 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n'"				
"	98.000 Impervious SCS Curve No."				
"	0.953 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	3.191 0.000 0.000 0.000 c.m/sec"				
"	Catchment 205 Pervious Impervious Total Area "				
"	Surface Area 14.164 3.236 17.400 hectare"				
"	Time of concentration 16.446 1.127 12.803 minutes"				
"	Time to Centroid 214.074 176.647 205.173 minutes"				
"	Rainfall depth 115.765 115.765 115.765 mm"				

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year Road Cross Section Analysis**

"	Rainfall volume	1.6397	0.3747	2.0143	ha-m"
"	Rainfall losses	42.190	15.291	37.187	mm"
"	Runoff depth	73.575	100.475	78.579	mm"
"	Runoff volume	1.0421	0.3252	1.3673	ha-m"
"	Maximum flow	2.939	0.813	3.191	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	3.191	3.191	0.000	0.000"	
" 52	CHANNEL DESIGN"				
"	3.191	Current peak flow	c.m/sec"		
"	0.015	Manning 'n'"			
"	1.	Cross-section type: 0=trapezoidal; 1=general"			
"	7.	Define an arbitrary cross-section"			
"	0.000	5.000	5.000	10.000	15.000"
"	15.000	20.000"			
"	100.165	100.065	99.920	100.000	99.920"
"	100.060	100.160"			
"	0.240	Channel depth	metre"		
"	1.000	Gradient	%"		
"	0.	Variable roughness: 0=False; 1=True"			
"	0.0400	0.0400	0.0400	0.0400	0.0400"
"	0.0400	0.0400"			
"	Depth of flow	0.216	metre"		
"	Velocity	1.576	m/sec"		
"	Channel capacity	4.152	c.m/sec"		
"	Critical depth	0.254	metre"		
" 40	HYDROGRAPH Start - New Tributary"				
"	2 Start - New Tributary"				
"	3.191	0.000	0.000	0.000"	
" 33	CATCHMENT 207"				
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	207	Catchment 207 - East end of Cobble Beach Drive"			
"	20.600	% Impervious"			
"	5.500	Total Area"			
"	39.000	Flow length"			
"	2.000	Overland Slope"			
"	4.367	Pervious Area"			
"	39.000	Pervious length"			
"	2.000	Pervious slope"			
"	1.133	Impervious Area"			
"	10.118	Impervious length"			
"	2.000	Impervious slope"			
"	0.350	Pervious Manning 'n'"			
"	84.000	Pervious SCS Curve No."			
"	0.667	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.838	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.953	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.978	0.000	0.000	0.000	c.m/sec"
"	Catchment 207	Pervious	Impervious	Total Area	"

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year Road Cross Section Analysis**

"	Surface Area	4.367	1.133	5.500	hectare"
"	Time of concentration	18.424	1.132	14.043	minutes"
"	Time to Centroid	215.232	176.654	205.458	minutes"
"	Rainfall depth	115.765	115.765	115.765	mm"
"	Rainfall volume	5055.48	1311.62	6367.10	c.m"
"	Rainfall losses	38.898	15.232	34.023	mm"
"	Runoff depth	76.867	100.533	81.743	mm"
"	Runoff volume	3356.80	1139.04	4495.84	c.m"
"	Maximum flow	0.864	0.285	0.978	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"		0.978	0.978	0.000	0.000"
" 33	CATCHMENT 208"				
"	1 Triangular SCS"				
"	2 Proportional to %"				
"	1 SCS method"				
"	208 Catchment 208 - McLeese Dr. north of Punkinseed Lane"				
"	19.500 % Impervious"				
"	7.020 Total Area"				
"	33.000 Flow length"				
"	2.000 Overland Slope"				
"	5.651 Pervious Area"				
"	33.000 Pervious length"				
"	2.000 Pervious slope"				
"	1.369 Impervious Area"				
"	7.994 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n' "				
"	84.900 Pervious SCS Curve No. "				
"	0.683 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	4.518 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n' "				
"	98.000 Impervious SCS Curve No. "				
"	0.953 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"		1.461	0.978	0.000	0.000 c.m/sec"
"	Catchment 208	Pervious	Impervious	Total Area	"
"	Surface Area	5.651	1.369	7.020	hectare"
"	Time of concentration	13.510	0.983	10.574	minutes"
"	Time to Centroid	208.297	176.311	200.802	minutes"
"	Rainfall depth	115.765	115.765	115.765	mm"
"	Rainfall volume	6542.02	1584.71	8126.74	c.m"
"	Rainfall losses	37.587	17.001	33.573	mm"
"	Runoff depth	78.178	98.765	82.193	mm"
"	Runoff volume	4417.92	1351.99	5769.92	c.m"
"	Maximum flow	1.207	0.342	1.461	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"		1.461	2.439	0.000	0.000"
" 52	CHANNEL DESIGN"				
"	2.439 Current peak flow	c.m/sec"			
"	0.015 Manning 'n' "				
"	1. Cross-section type: 0=trapezoidal; 1=general"				
"	11. Define an arbitrary cross-section"				

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year Road Cross Section Analysis**

"	0.000	6.200	6.700	11.700	12.200"
"	15.000	17.800	18.300	23.800	24.300"
"	30.000"				
"	100.020	99.900	99.750	99.850	100.000"
"	100.056	100.000	99.850	99.750	99.900"
"	100.020"				
"	0.270	Channel depth	metre"		
"	0.600	Gradient	%"		
"	0.	Variable roughness: 0=False; 1=True"			
"	0.0400	0.0400	0.0400	0.0400	0.0400"
"	0.0400	0.0400	0.0400	0.0400	0.0400"
"	0.0400"				
"		Depth of flow	0.210	metre"	
"		Velocity	1.196	m/sec"	
"		Channel capacity	4.243	c.m/sec"	
"		Critical depth	0.223	metre"	
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		1.461	0.000	0.000	0.000"
" 33		CATCHMENT 210"			
"	1	Triangular SCS"			
"	2	Proportional to %"			
"	1	SCS method"			
"	210	McLeese Drive south of Punkinseed Lane"			
"	24.400	% Impervious"			
"	3.700	Total Area"			
"	47.000	Flow length"			
"	2.000	Overland Slope"			
"	2.797	Pervious Area"			
"	47.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.903	Impervious Area"			
"	15.169	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n' "			
"	84.800	Pervious SCS Curve No. "			
"	0.682	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	4.553	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n' "			
"	98.000	Impervious SCS Curve No. "			
"	0.953	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.727	0.000	0.000	0.000 c.m/sec"
"		Catchment 210	Pervious	Impervious	Total Area "
"		Surface Area	2.797	0.903	3.700 hectare"
"		Time of concentration	16.718	1.443	12.152 minutes"
"		Time to Centroid	212.281	177.022	201.740 minutes"
"		Rainfall depth	115.765	115.765	115.765 mm"
"		Rainfall volume	3238.19	1045.13	4283.32 c.m"
"		Rainfall losses	37.119	11.855	30.955 mm"
"		Runoff depth	78.646	103.911	84.811 mm"
"		Runoff volume	2199.89	938.11	3138.00 c.m"
"		Maximum flow	0.578	0.231	0.727 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			



**Cobble Beach Post-Development Miduss Summary:**  
**100 Year Road Cross Section Analysis**

"	4	Add Runoff "				
"		0.727	0.727	0.000	0.000	"
"	52	CHANNEL DESIGN"				
"		0.727	Current peak flow	c.m/sec"		
"		0.040	Manning 'n'"			
"		0.	Cross-section type: 0=trapezoidal; 1=general"			
"		10.000	Basewidth	metre"		
"		10.000	Left bank slope"			
"		10.000	Right bank slope"			
"		1.000	Channel depth	metre"		
"		10.000	Gradient	%"		
"			Depth of flow	0.106	metre"	
"			Velocity	1.154	m/sec"	
"			Channel capacity	150.867	c.m/sec"	
"			Critical depth	0.079	metre"	
"	53	ROUTE Zero Route"				
"		0.00	Zero Route Reach length	( metre)"		
"			0.727	0.727	0.727	0.000 c.m/sec"
"	40	HYDROGRAPH Combine	3"			
"		6	Combine "			
"		3	Node #"			
"			McLeese Drive"			
"			Maximum flow	0.727	c.m/sec"	
"			Hydrograph volume	3137.998	c.m"	
"			0.727	0.727	0.727	0.727"
"	40	HYDROGRAPH Start - New Tributary"				
"		2	Start - New Tributary"			
"			0.727	0.000	0.727	0.727"
"	33	CATCHMENT 203"				
"		1	Triangular SCS"			
"		2	Proportional to %"			
"		1	SCS method"			
"		203	Catchment 203 - Western Portion of McLeese Dr. "			
"		15.600	% Impervious"			
"		10.700	Total Area"			
"		49.000	Flow length"			
"		2.000	Overland Slope"			
"		9.031	Pervious Area"			
"		49.000	Pervious length"			
"		2.000	Pervious slope"			
"		1.669	Impervious Area"			
"		9.057	Impervious length"			
"		2.000	Impervious slope"			
"		0.250	Pervious Manning 'n'"			
"		84.000	Pervious SCS Curve No."			
"		0.667	Pervious Runoff coefficient"			
"		0.100	Pervious Ia/S coefficient"			
"		4.838	Pervious Initial abstraction"			
"		0.015	Impervious Manning 'n'"			
"		98.000	Impervious SCS Curve No."			
"		0.953	Impervious Runoff coefficient"			
"		0.100	Impervious Ia/S coefficient"			
"		0.518	Impervious Initial abstraction"			
"			1.939	0.000	0.727	0.727 c.m/sec"
"		Catchment 203	Pervious	Impervious	Total Area "	
"		Surface Area	9.031	1.669	10.700	hectare"

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year Road Cross Section Analysis**

"	Time of concentration	17.266	1.059	14.140	minutes"
"	Time to Centroid	213.650	176.524	206.490	minutes"
"	Rainfall depth	115.765	115.765	115.765	mm"
"	Rainfall volume	1.0455	0.1932	1.2387	ha-m"
"	Rainfall losses	38.802	16.267	35.286	mm"
"	Runoff depth	76.964	99.499	80.479	mm"
"	Runoff volume	6950.44	1660.83	8611.27	c.m"
"	Maximum flow	1.815	0.418	1.939	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	1.939	1.939	0.727	0.727"	
" 52	CHANNEL DESIGN"				
"	1.939	Current peak flow	c.m/sec"		
"	0.040	Manning 'n'"			
"	0.	Cross-section type: 0=trapezoidal; 1=general"			
"	10.000	Basewidth	metre"		
"	10.000	Left bank slope"			
"	10.000	Right bank slope"			
"	1.000	Channel depth	metre"		
"	10.000	Gradient	%"		
"	Depth of flow	0.153	metre"		
"	Velocity	1.655	m/sec"		
"	Channel capacity	150.867	c.m/sec"		
"	Critical depth	0.149	metre"		
" 53	ROUTE Zero Route"				
"	0.00	Zero Route Reach length	( metre)"		
"	1.939	1.939	1.939	0.727 c.m/sec"	
" 40	HYDROGRAPH Combine 3"				
"	6	Combine "			
"	3	Node #"			
"	McLeese Drive"				
"	Maximum flow	2.649	c.m/sec"		
"	Hydrograph volume	11749.268	c.m"		
"	1.939	1.939	1.939	2.649"	
" 40	HYDROGRAPH Confluence 3"				
"	7	Confluence "			
"	3	Node #"			
"	McLeese Drive"				
"	Maximum flow	2.649	c.m/sec"		
"	Hydrograph volume	11749.268	c.m"		
"	1.939	2.649	1.939	0.000"	
" 52	CHANNEL DESIGN"				
"	2.649	Current peak flow	c.m/sec"		
"	0.015	Manning 'n'"			
"	1.	Cross-section type: 0=trapezoidal; 1=general"			
"	7.	Define an arbitrary cross-section"			
"	0.000	5.000	5.000	10.000	15.000"
"	15.000	20.000"			
"	100.165	100.065	99.920	100.000	99.920"
"	100.060	100.160"			
"	0.240	Channel depth	metre"		
"	0.560	Gradient	%"		
"	0.	Variable roughness: 0=False; 1=True"			
"	0.0400	0.0400	0.0400	0.0400	0.0400"
"	0.0400	0.0400"			
"	Depth of flow	0.226	metre"		

**Cobble Beach Post-Development Miduss Summary:**  
**100 Year Road Cross Section Analysis**

"	Velocity	1.203	m/sec"
"	Channel capacity	3.107	c.m/sec"
"	Critical depth	0.236	metre"
" 38	START/RE-START TOTALS 3"		
"	3 Runoff Totals on EXIT"		
"	Total Catchment area	56.320	hectare"
"	Total Impervious area	10.614	hectare"
"	Total % impervious	18.846"	
" 19	EXIT"		