BRITISH COLUMBIA LAND SURVEYOR'S SKETCH PLAN TO ACCOMPANY A DICLOSURE STATEMENT FOR A PROPOSED PHASED STRATA PLAN ON LOT P, PLAN BCP30017, DISTRICT LOTS 688, GROUP 1, NWD.

LEGEND

ALL DIMENSIONS ARE IN METRES AND DECIMALS THEREOF UNLESS OTHERWISE NOTED

C.P. DENOTES LIMITED COMMON PROPERTY
L.C.P. DENOTES LIMITED COMMON PROPERTY
S.L. DENOTES STRATA LOT
D DENOTES DECK
PA DENOTES PATIO
PO DENOTES LOBBY

CIVIC ADDRESS: 724 GIBSONS WAY, GIBSONS, B.C.

COMPILED FROM A DIGIT ARCHITECTURE FILE AND PAPER PLANS SUPPLIED BY SECOND NATURE DESIGNS, JULY 6, 2007.

ALL BALCONIES, PATIOS AND DECKS ARE DEFINED AS TO HEIGHT BY THE CENTER OF THE FLOOR ABOVE OR ITS EXTENSIONS, OR WHERE THERE IS NOT A FLOOR ABOVE BY THE AVERAGE HEIGHT OF A STRATA LOT WITHIN THE SAME BUILDING UNLESS INDICATED OTHERWISE.

STRATA LOTS ARE DERIVED FROM THE CENTER OF PROPOSED WALLS, UNLESS INDICATED OTHERWISE.

ALL STRATA LOTS ARE RESIDENTIAL.

NOTE : SIZE AND LOCATION OF LCP AND CP MAY CHANGE SLIGHTLY

I, _____ THE OWNER AND DEVELOPER OF THE STRATA PLAN SHOWN ON THIS SKETCH, HAVE INSPECTED THE SAID SKETCH AND AGREE TO DESIGNATIONS OF STRATA LOTS, LIMITED COMMON PROPERTY AND COMMON PROPERTY.

_____

_____
(PRINT NAME)

UNIT ENTITLEMENT

UNIT ENTITLEMENT = THE TOTAL HABITABLE AREA OF EACH STRATA LOT, ROUNDED TO A WHOLE NUMBER.

STRATA LOT 1 = 148
STRATA LOT 2 = 152
STRATA LOT 3 = 152
STRATA LOT 4 = 148
STRATA LOT 5 = 152
STRATA LOT 6 = 154
STRATA LOT 7 = 152
STRATA LOT 8 = 156
STRATA LOT 9 = 156
STRATA LOT 10 = 156
STRATA LOT 11 = 156
STRATA LOT 12 = 152
STRATA LOT 13 = 154
STRATA LOT 14 = 152
STRATA LOT 15 = 135
STRATA LOT 16 = 140
STRATA LOT 17 = 140
STRATA LOT 18 = 138
STRATA LOT 19 = 138

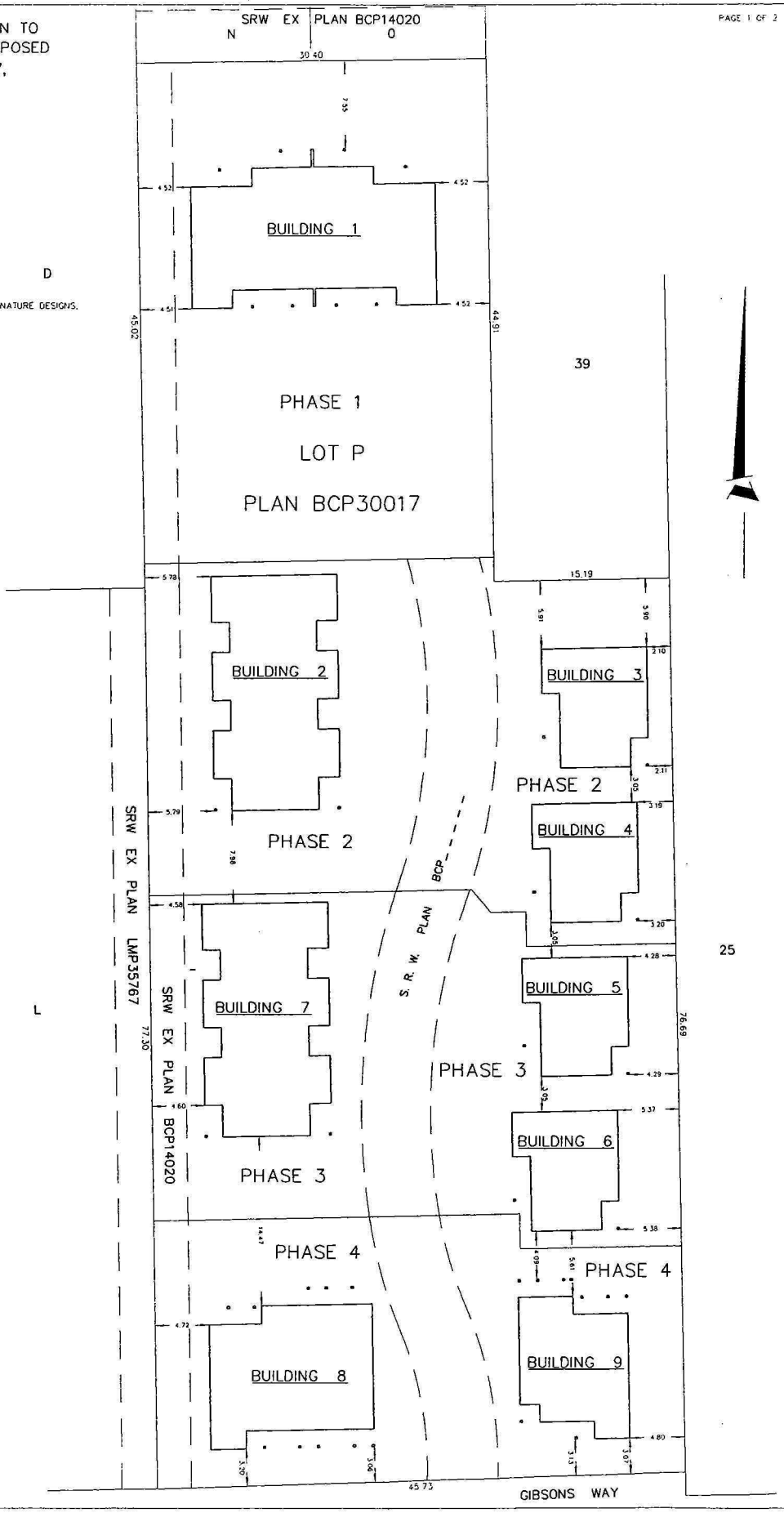
TOTAL UNIT ENTITLEMENT = 2666

NUMBER OF VOTES

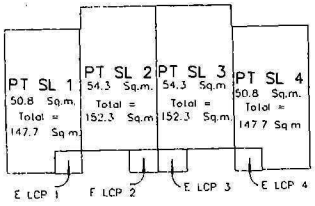
ALL STRATA LOTS HAVE ONE VOTE EACH.

CERTIFIED CORRECT ON THE ___th DAY OF _____, 200__

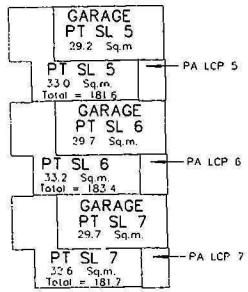
_____
MARTIN HARRICHHAUSEN, B.C.L.S. & C.L.S.



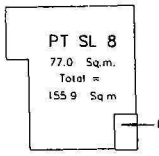
LEVEL 1



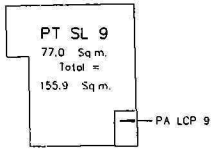
BUILDING 1



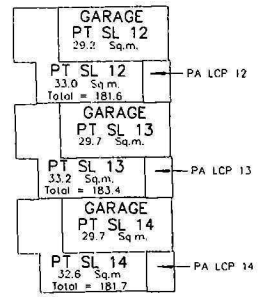
BUILDING 2



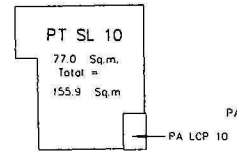
BUILDING 3



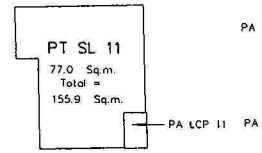
BUILDING 4



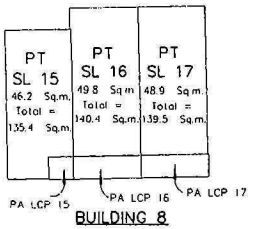
BUILDING 7



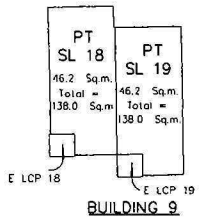
BUILDING 5



BUILDING 6

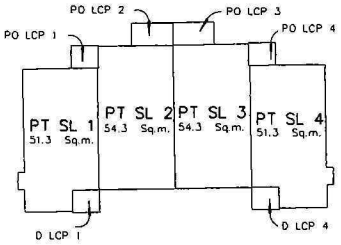


BUILDING 8

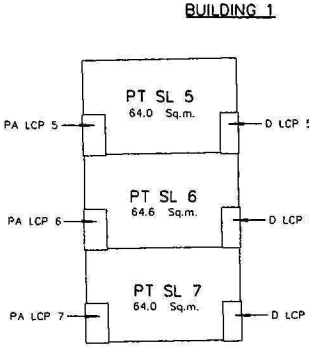


BUILDING 9

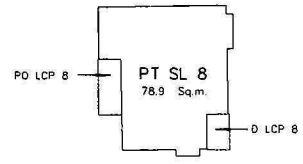
LEVEL 2



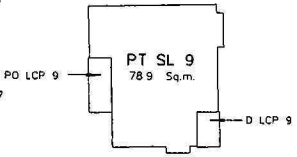
BUILDING 1



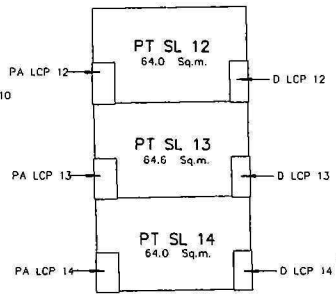
BUILDING 2



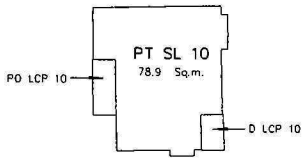
BUILDING 3



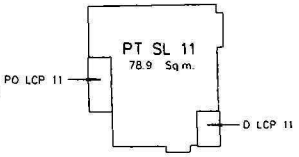
BUILDING 4



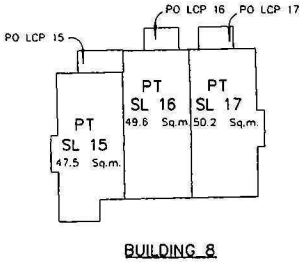
BUILDING 7



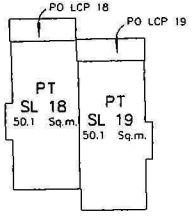
BUILDING 5



BUILDING 6

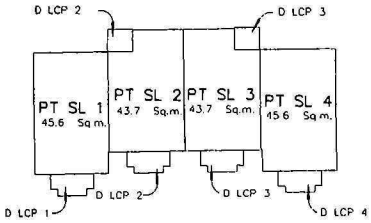


BUILDING 8

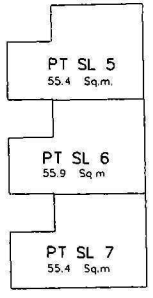


BUILDING 9

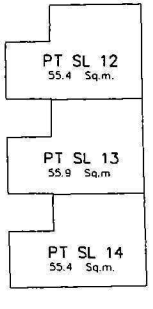
LEVEL 2



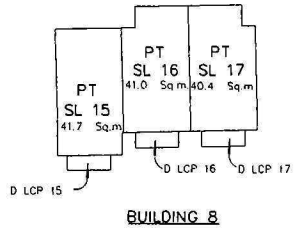
BUILDING 1



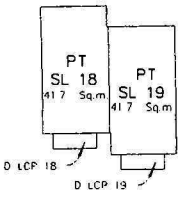
BUILDING 2



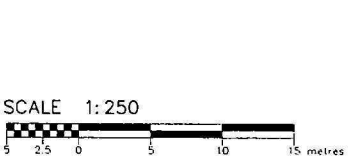
BUILDING 7

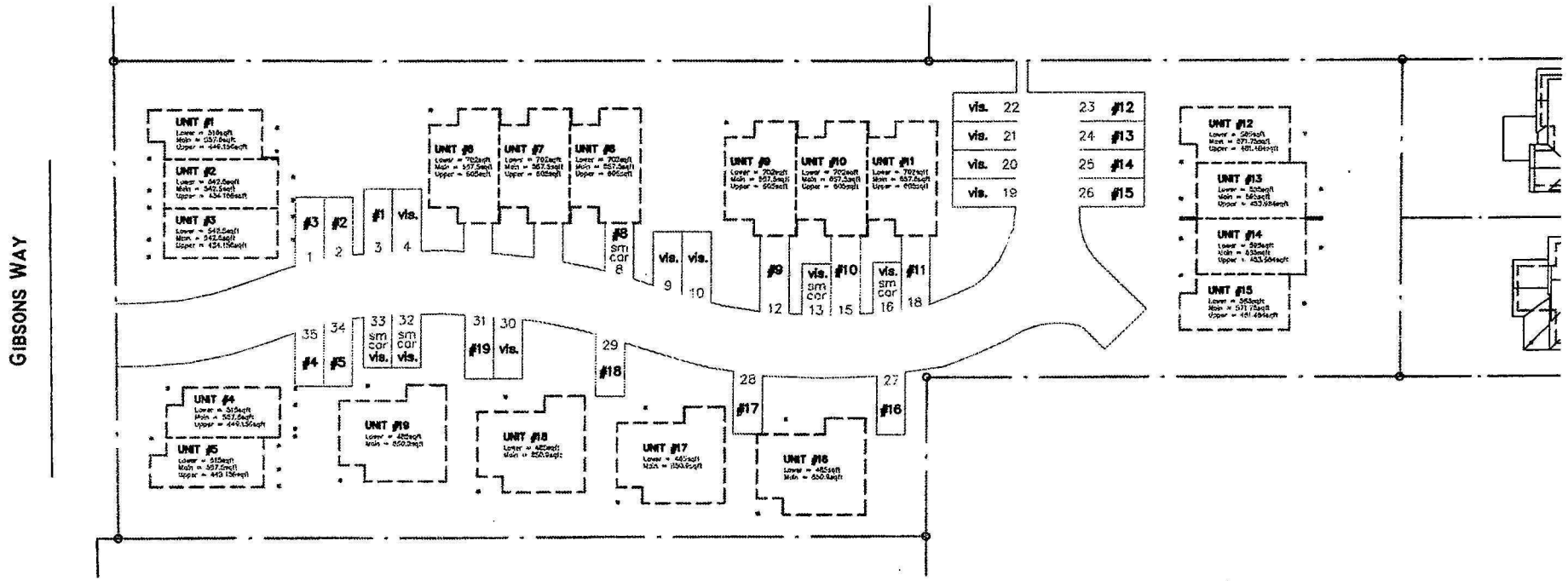


BUILDING 8



BUILDING 9





SITE

1/32" = 1'-0"

UNIT & PARKING PLAN

Exhibit E

Strata Property Act

Form J

RENTAL DISCLOSURE STATEMENT

(Section 139)

Re: Strata Plan comprised of 19 strata units to be constructed on the following described lands:

Assessment Area: North Shore – Squamish Valley
District: Sechelt Fire Protection
Parcel Identifier: 027-102-980
Lot P Block 7 District Lot 688 Group 1 New Westminster District Plan BCP30017

1. The development described above includes 19 residential strata lots.

2. The residential strata lots described below are rented out by the owner developer as of the date of this statement and the owner developer intends to rent out each strata lot until the date set out opposite its description.

Description of Strata Lot *[strata lot number as shown on strata plan]*	Date Rental Period Expires *[month day, year]*
NIL	

3. In addition to the number of residential strata lots rented out by the owner developer as of the date of this statement, the owner developer reserves the right to rent out a further 19 residential strata lots, as described below, until the date set out opposite each strata lot's description.

Description of Strata Lot *[strata lot number as shown on strata plan]*	Date Rental Period Expires *[month day, year]*
1 – 19 Inclusive	January 1, 2019

4. There is no bylaw of the strata corporation that restricts the rental of strata lots.

Date: June 2007

SUNBELT PROPERTIES LTD.

Per: _____
Signature of Owner Developer

HOLYWELL PROPERTIES
{ Commercial, Residential & Strata Management }

PO BOX 187
103–5711 MERMAID ST
SECHELT BC V0N 3A0
phone: 604.885.3460
fax: 604.740.0248
toll free: 1.800.905.3230
email: info@holywell.ca

Pre-Authorized Debit Agreement for Strata Fees

STRATA NAME: **BCS 2791 ISLAND VIEW LANES**

STRATA UNIT # _____

PAYOR NAME(S) _____

ADDRESS _____

CITY _____ POSTAL CODE_____

TELEPHONE _____ EMAIL _____

ACCOUNT HOLDER (PAYOR) FINANCIAL INSTITUTION/BANKING INFORMATION

*Please complete below **AND** attach a VOID CHEQUE*

Name of Financial Institution _____

Address _____

City/Province _____ Postal Code _____

Institution # (3 digit number) _____ Branch # (5 digit number) _____

Account # _____ ❒ Void cheque attached

PAYEE INFORMATION

PAYEE NAME: Holywell Properties ITF Strata Corporation BCS 2791

ADDRESS: Box 187 Sechelt BC V0N 3A0 TELEPHONE: 604-885-3460

EMAIL: accounting@holywell.ca FAX: 604-740-0248

1. In this Agreement "I", "me" and "my" refers to each Account Holder who signs below.
2. I agree to participate in this Pre-Authorized Debit Plan and authorize the Payee to draw a debit in paper, electronic or other form (a "Pre-Authorized Debit") on my account indicated above (the "Account") at the financial institution branch indicated above (the "Financial Institution") for the following purpose: For the payment of monthly strata fees under the terms and conditions agreed to by me with the Payee.
3. I may revoke this Agreement at any time by delivering a written notice of revocation to the Payee.
4. I authorize HOLYWELL PROPERTIES to increase or decrease amounts drawn on my Account from year-to-year as future budgets adopted by my Strata Corporation effect assessment fees. I agree to my current monthly strata fee, with reasonable latitude for adjustments, may be drawn from my Account on the first business day of each calendar month, beginning _____, 20____. The Payee will, to the best of its ability, advise me in writing of the revised amount at least 30 (thirty) days in advance of its effective date.
5. I agree that the delivery of this Agreement to the Payee constitutes delivery by me to the Financial Institution.
6. I will inform the Payee, in writing, of any change in the Account information provided in the Agreement prior to the next due-date of the Pre-Authorized Debit.
7. I agree that a $35.00 NSF administration fee will apply to my account should my pre-authorized debit be returned due to insufficient funds, account closure, or account freeze, etc.
8. I warrant that all persons whose signatures are required to sign the Account have signed this Agreement below.
9. I understand and agree to the foregoing terms and conditions and I acknowledge receipt of a copy of this Agreement.
10. I agree to comply with the Rules of the Canadian Payments Association (www.cdnpay.ca) or any other rules or regulations which may affect the services described herein, as may be introduced in the future or are currently in effect and I agree to execute any further documentation which may be prescribed from time to time by the Canadian Payments Association in respect of the services described herein.

_____ _____

Signature of Account Holder Date

_____ _____

Signature of Account Holder Date

Engineering Assessment of
Groundwater Flow

September 26, 2013 **Rev 0**

Location of Development:
728 Gibsons Way, Gibsons, BC

Attention: Board of Directors
C/o Malaspina Realty & Property Management

Project: TEL1364

Contents

TELDER ENGINEERING
Innovative | Design | Solutions

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
B.J. TELDER
#25966
30/09/13

Date: September 26, 2013

To: Board of Directors, Islandview Lanes, c/o Malaspina Realty & Property Management

Re: **Islandview Lanes, 728 Gibsons Way, Gibsons, BC**
Lot M Block 7 District Lot 688
Engineering Assessment of Groundwater Flow

TEL Project #: **1364**

Dear Sir,
At the request of Malaspina Realty & Property Management (herein referred to as "The Manager"), acting on your behalf I have assessed the groundwater problem identified for the property stated above. My report is detailed below.

Introduction

In order to assess the groundwater problem a site review was made on the 16th of September 2013. During the previous day a significant rainstorm event had occurred so it was obvious that some problems exist with groundwater at the lower portion of the development. In addition a review was made of the key plan for the development, as provided by The Manager. The site meeting occurred in the presence of The Manager and one of the Residents who provided additional anecdotal information from their personal experience.

A review was made of the Town of Gibsons Subdivision and Development Bylaw # 733 with amendments, as would have been in place at the time of development and also the current Subdivision. Further to this a review was also conducted of the Development Servicing and Stormwater Management Bylaw No. 1175, 2012 as adopted 5th February 2013. There is significant difference between the two documents vis-à-vis the handling of storm water and runoff in terms of both surface and sub-surface flows.

The site review suggested a number of potential causes for the observed groundwater problem. These are the apparent;

1. Lack of high side drainage.
2. Saturation of exfiltration/storage system.
3. Failure of driveway sub-grade to drain.

This report reviews the potential causes identified and recommends some remedial options.

Summary

The site has problems with drainage in excess of normally expected surface runoff due to increased groundwater. A number of means of diverting flows are recommended to enable the onsite groundwater recharge system to function as intended. The solutions proposed include a high side French drain, a set of cross drains under the driveway surface and increased storm water retention volume at the entrance. In addition the entrance requires some means of allowing excess storm water to couple into the Gibsons Way drainage ditch to prevent saturation of the soils in the entrance area.

Theory Review

Reference is made to a groundwater problem rather than a surface water problem in order to differentiate between flow on impermeable surfaces (driveways, etc) and flows through the soils beneath. The desired means of addressing onsite generated storm water flow is through ground water recharge; however this only accounts for water intercepted by the development site.

The expectation would be that some portion of the water will be taken up by trees and other plants for growth, retention and Evapotranspiration and this is normally the case. However when a significant volume of water falls in a short interval of time then only a portion will be retained this way with the majority being released to flow through the soil. Eventually this water will make its way into creeks, streams or rivers and down to the marine foreshore in what we consider to be a natural cycle. In developed areas it should be expected that a significant portion of this flow will be intercepted by drainage works and directed accordingly and ultimately to the marine foreshore.

With a sloped site water flow will be driven by hydraulic pressure, meaning the weight of water higher up in the slope exerts a force on water lower down, forcing it to flow. Soils can only support so much water interstitially, that is to say between the particles, which we refer to as a volume maximum. If permeable soils are deep enough then the water should flow unimpeded.

When a restrictive boundary such as a silt hardpan nears the surface in sloped areas where the contours level out and this volume maximum is exceeded the water starts to mound. If there is sufficient water volume this mound may approach or breach the surface. The soil is said to have become saturated and can be experienced naturally as hillside bogs (of which the Gibsons area has a few).

A given parcel will only intercept a finite amount of precipitation. However on sloped sites hydraulic pressure will cause water to migrate from neighboring higher parcels across lower parcels and the volume will accumulate. Where this becomes a problem for a development is when the flow intercepts a long impermeable or restrictive barrier, such as might be the case with a road or driveway. This water has to go somewhere and will obviously follow the path of least resistance.

It should be noted that during the process of construction the original soils and plants are often removed over the area of construction down to a more impermeable horizon upon which foundations are constructed and roadbeds lain. This process can contribute to poor site drainage. As can be seen in Lower Gibsons in general most all the streets have swales to address drainage requirements.

In more recent times municipalities have begun making use of permeable surfaces to address drainage via ground recharge rather than storm sewers or curbside swales to catch and divert flows elsewhere. According to The Manager, permeability of the driveway was a requirement of the Town to handle surface water flow onsite as opposed to curbside swales. Where this can be problematic is when a permeable drainage surface leads to a leveling of the contour and there is no path of least resistance to follow from there. One must consider that concrete road bases are generally hard packed and relatively impermeable.

One additional point to consider is that as mature trees are removed from a slope groundwater flows increase substantially because soils do not have the same retention capacity. This is an observed fact and it is why initial development in an area seems to have only a minor impact compared to subsequent development.

Site Review and Observations

The development consists of 19 strata homes of varying occupant capacity. The units are placed on the periphery of the parcel from Gibsons Way extending north to the property boundary. A central access driveway extends from Gibsons Way to the northern portion of the parcel. The northern 1/3rd of the parcel is relatively level whereas the southern 2/3rd is sloped. The parcel originally increased in mean elevation approximately 9 meters from the southernmost boundary (Gibsons Way) to the northernmost. As a result of development this is likely reduced however the surrounding undeveloped properties will still have their natural grades and elevations. This development is approximately halfway down the slope which Gibsons Way follows so the natural expectation is that some storm water flows from higher elevations may cross this parcel unless diverted.

The development as planned and as indicated in the Key Plan has a number of catch basins situated in the driveway. These catch basins are coupled to exfiltration trenches, referred to as exfiltration/storage chambers (also as groundwater recharge) that are placed in between the strata building complexes. This is illustrated in Figure 1, in the Appendix. This is a means of storm water management referred to in Bylaw #733 but not detailed to any degree, rather leaving it to the developer's engineer to inform and is the applied form of ground water recharge. It is assumed that most of the intercepted water is from the driveway surfaces. The Key Plan indicates that the building drains are connected by the storm sewer to the drainage ditch along Gibsons Way. Thus building roof loads are not coupled to the groundwater recharge system. The ground water recharge systems are not coupled to the storm sewer.

In considering the adjacent uphill (western) parcel the first 60 m along the adjoining property line share the steepest observed slope. It is perhaps significant that this is adjacent to the portion of Islandview Lanes which is experiencing groundwater extrusion. If no drainage exists along this property line then it is conceivable that accumulated groundwater can flow through this area.

It was noted that the lowest portion of the driveway starts with essentially level slope before increasing in slope to the north. Only the lowest portion of the parcel, along the centerline formed by the driveway was affected by ground water mounding. This extended from unit 6 down to the entrance onto Gibsons Way. It was also mentioned that during and after rain storms the ground became spongy between units 8 and 9 and adjacent to unit 6.

Observation of the catch basins showed that the lower ones, CB1 and CB2 and their associated exfiltration trenches are saturated and that the observed water levels were above the outlets but at least 15 cm (~ 6 inches). It is not known if the exfiltration lines are perforated their whole length so as to intercept ground water flow. The area in front of units 1 to 5 and below unit 6 all exhibited excessive saturation of the soil with the grass areas being spongy underfoot.

The driveway was constructed with impermeable concrete center panels and permeable brick shoulders and parking pads. Figure 2 shows that the center concrete pads seem to be floating on a saturated base with water exuding between the panels. In fact, when a local truck drove over the concrete panels, water could be seen oozing from the middle crack. Lower down, near the entrance, the brickwork appears to be floating on a saturated base with water clearly evident between the bricks. The obvious conclusion is that water is pooling under these surfaces. This is shown in greater detail in Figure 3.

Although there appeared to be some points along the driveway above unit 6 where the shoulder on the west side showed spongy behavior the concrete panels did not appear to have a problem and overall the brick shoulders do not demonstrate the same problem as seen lower down the driveway.

The Key Plan indicates that the site is built with a surface drainage swale to intercept surface water along the [lower] east property line at points labeled LB which directs it to some exfiltration/storage chambers, specifically CB4, CB5 and CB1. Due to the levelness of the upper area around CB4 it is not likely that excessive flow enters these exfiltration chambers. CB5 and CB1 however will capture more flow due to the slope of the parcel and in the case of CB1 may contribute to the saturation of CB1's exfiltration chambers. It should be recognized that this surface drainage swale is intended to limit surface water flow onto the adjacent [lower] parcel only. No such swale exists on the high side of the subject parcel. There is no indication in the Key Plan where foundation drainage (if any) is directed.

In fact, according to The Manager and the Key Plan, there is also no French drain on the west side of the subject parcel. Any ground water and in fact surface water flow from upslope to the west will likely flow south towards the gaps between the buildings and then east across the subject parcel. Figure 4, taken from an exposed slope on the adjacent west property, shows a photo of the type of soil in the general area. This loamy sand will absorb and hold a substantial amount of water but also allow for increased flow during saturation. In a situation of high precipitation loading it implies that a substantial amount of water could flow across the property line. This would affect the degree of saturation for the soils surrounding the exfiltration/storage chambers of CB2 and CB1 and to a lesser extent CB3.

In viewing the site and given the observed conditions it is conceivable that ground water is being constrained by the edge of the driveway to follow it down slope towards the entrance area. In principal the ground water should flow from there to the next lowest point.

The development is fronted by the drainage ditch system [adjacent to Gibsons Way], most likely constructed according to the requirements of the Town of Gibsons. This drainage ditch has two notable features being 1) it is constructed of an impermeable or semi-impermeable structure and 2) it is higher in grade than the development frontage. A likely consequence of this is that any water flowing to the lowest point of the development, i.e. the entrance driveway, may be constrained there. As the soils become saturated we could expect to see the conditions we observed.

Conclusions

In consideration of the theory and site observations it would seem that there are three ways to address the problem, 1) reduce the volume of water flowing through the soil in a given area, 2) reduce the hydraulic pressure of that water column and 3) implement an improved drainage scheme for the entranceway area. These first two are partially related in that reducing the volume of water decreases the potential for soil saturation and in so doing it may also reduce the hydraulic pressure.

Recommendations

The points raised in the conclusion can be addressed as follows:

1. A French drain on the west side of the property originating from at least the area of unit 6 down to the front of the parcel could reduce ground water influx from upslope sufficiently to allow the groundwater retention system to function as planned. However this drain needs somewhere to empty out. This drain should be at a depth sufficient to intercept the majority of groundwater flow.

2. The entrance driveway area acts as a catchment area for flow from higher up the parcel. The entrance could have additional exfiltration and storage incorporated beneath the driveway however it would need an egress point to enable subsequent drainage.

3. In the area of the permeable shoulder on the west side of the driveway construction of a means of periodic piping connections or cross drains to the east shoulder, under the driveway concrete panels, may alleviate the buildup of groundwater and reduce hydraulic pressure under the west shoulder.

4. Islandview Lanes would need to review the first two suggestions with the Town of Gibsons and arrange for a means to use the drainage ditch of Gibsons Way to accommodate the overflow requirements during a significant storm event.

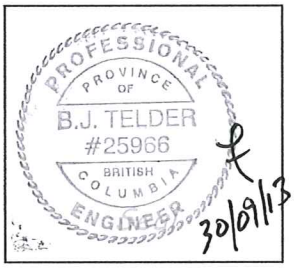
Some or all of the recommended actions can contribute to reducing or eliminating the floating and spongy effects observed in the entrance driveway area and the first portion of the concrete driveway.

Limitations

The conclusions and recommendations submitted in this report are based on information obtained from a visual reconnaissance of the subject property. The nature and extent of variations between the observed conditions and actual conditions, both surficial and subsurface, may not become evident until further investigation. The recommendations given are based on conditions encountered during the field assessment, current state of the property and on generally accepted engineering practices. No other warranty, expressed or implied, is made. Due to the geological randomness of soil formations, no interpolation of soil conditions between the documented conditions has been made or implied. Soil conditions are known only at referenced locations. If other soil conditions are encountered, or unanticipated conditions become known during construction, the recommendations may be altered or modified in writing by the undersigned.

Sincerely,

Telder Engineering Ltd.



Bert J. Telder, P. Eng.
CEO and Principal Engineer

Figures

Figure 1, Parcel detailed with (preconstruction) one meter contour overlay and features of note.

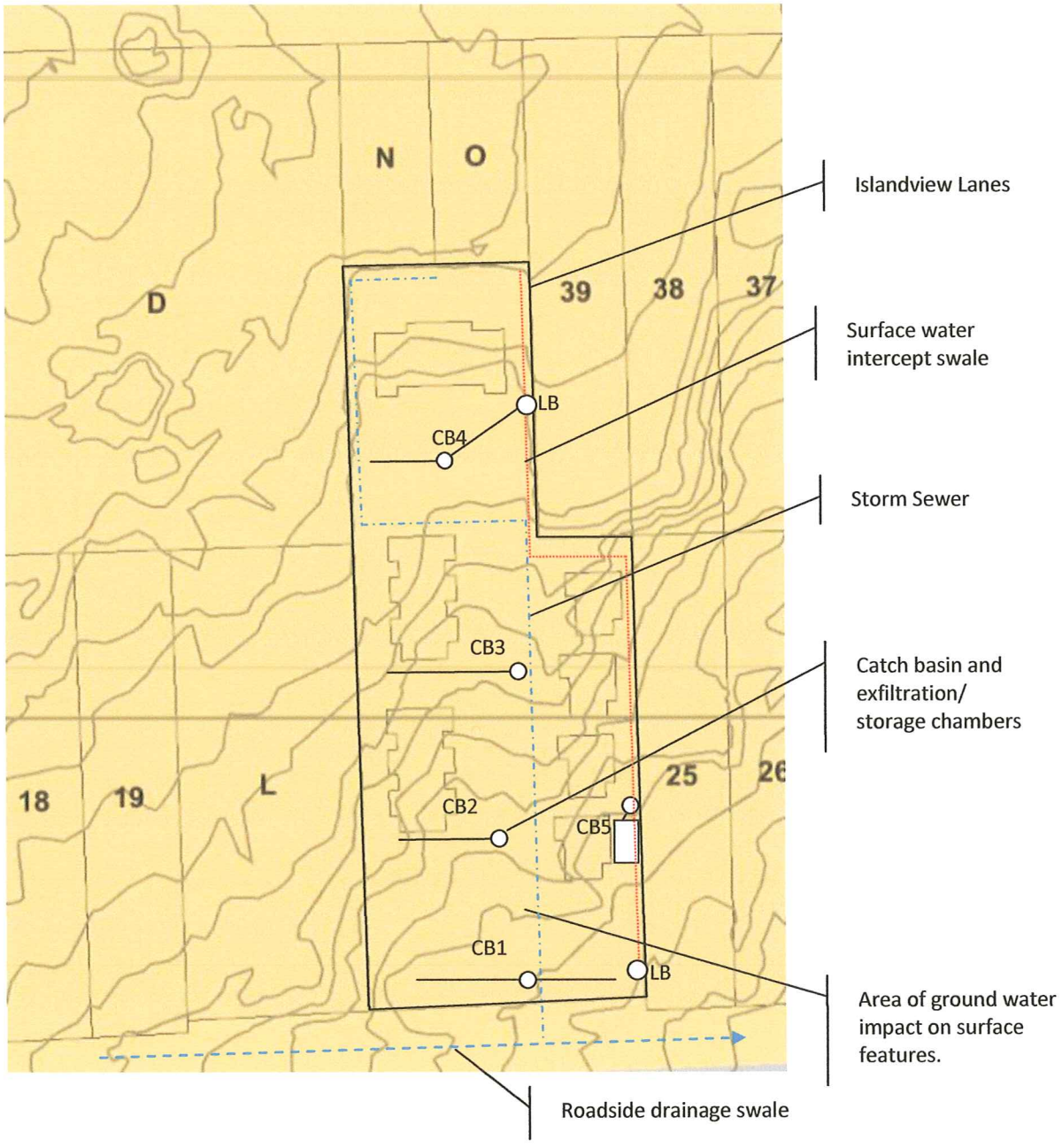


Figure 2, Evidence of high ground water at the driveway entrance.

This photo shows evidence of groundwater surfacing via the driveway. The photo was taken on 16 September 2013. The previous day saw a significant rainfall event wherein greater than average mm rainfall/hour occurred. Vehicle loading of the concrete pads resulted in water being extruded out from underneath. Pedestrian loading was sufficient to cause water extrusion on the brickwork.

This effect is only prominent on the lowest portion of the development driveway, i.e. the portion between the pedestrians and the viewer's location. This corresponds to the section between Unit 6 and the entrance. A similar, albeit lesser, effect of groundwater extrusion on the brickwork between Unit 9 and Unit 6 was also evident.

Figure 3, Close up view of brickwork with groundwater extrusion.

It is evident that this portion of the driveway is saturated with groundwater. Compared to adjacent areas this should have drained already. In fact the area surrounding the entrance also exhibited high ground water level and spongy behavior.

Figure 4, Soil profile from adjacent (upper) parcel.

Observation of the surface and near-surface soils of the adjacent upper parcel indicates that the upper soil horizon common to this area is loamy sand with reasonable cobble content. In this regard surface water will penetrate with a strong vertical component until it reaches either a more restrictive horizon or a barrier horizon of either hardpan or bedrock at which point the major flow component will become largely horizontal. Once a condition of saturation occurs (usually adjacent to the restrictive horizon) horizontal flow will occur with less resistance.

As there appears to be no swale or French drain on the high (west) side of the development to divert groundwater this flow will concentrate through more free flowing portions of the development. This effect will be more pronounced with increased precipitation during a finite time period.

Engineering Assessment of
Groundwater Flow

September 26, 2013 **Rev 0**

Location of Development:
728 Gibsons Way, Gibsons, BC

Attention: Board of Directors
C/o Malaspina Realty & Property Management

Project: TEL1364

Contents

TELDER ENGINEERING
Innovative | Design | Solutions

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
B.J. TELDER
#25966
30/09/13

Date: September 26, 2013

To: Board of Directors, Islandview Lanes, c/o Malaspina Realty & Property Management

Re: **Islandview Lanes, 728 Gibsons Way, Gibsons, BC**
Lot M Block 7 District Lot 688
Engineering Assessment of Groundwater Flow

TEL Project #: **1364**

Dear Sir,
At the request of Malaspina Realty & Property Management (herein referred to as "The Manager"), acting on your behalf I have assessed the groundwater problem identified for the property stated above. My report is detailed below.

Introduction

In order to assess the groundwater problem a site review was made on the 16th of September 2013. During the previous day a significant rainstorm event had occurred so it was obvious that some problems exist with groundwater at the lower portion of the development. In addition a review was made of the key plan for the development, as provided by The Manager. The site meeting occurred in the presence of The Manager and one of the Residents who provided additional anecdotal information from their personal experience.

A review was made of the Town of Gibsons Subdivision and Development Bylaw # 733 with amendments, as would have been in place at the time of development and also the current Subdivision. Further to this a review was also conducted of the Development Servicing and Stormwater Management Bylaw No. 1175, 2012 as adopted 5th February 2013. There is significant difference between the two documents vis-à-vis the handling of storm water and runoff in terms of both surface and sub-surface flows.

The site review suggested a number of potential causes for the observed groundwater problem. These are the apparent;

1. Lack of high side drainage.
2. Saturation of exfiltration/storage system.
3. Failure of driveway sub-grade to drain.

This report reviews the potential causes identified and recommends some remedial options.

Summary

The site has problems with drainage in excess of normally expected surface runoff due to increased groundwater. A number of means of diverting flows are recommended to enable the onsite groundwater recharge system to function as intended. The solutions proposed include a high side French drain, a set of cross drains under the driveway surface and increased storm water retention volume at the entrance. In addition the entrance requires some means of allowing excess storm water to couple into the Gibsons Way drainage ditch to prevent saturation of the soils in the entrance area.

Theory Review

Reference is made to a groundwater problem rather than a surface water problem in order to differentiate between flow on impermeable surfaces (driveways, etc) and flows through the soils beneath. The desired means of addressing onsite generated storm water flow is through ground water recharge; however this only accounts for water intercepted by the development site.

The expectation would be that some portion of the water will be taken up by trees and other plants for growth, retention and Evapotranspiration and this is normally the case. However when a significant volume of water falls in a short interval of time then only a portion will be retained this way with the majority being released to flow through the soil. Eventually this water will make its way into creeks, streams or rivers and down to the marine foreshore in what we consider to be a natural cycle. In developed areas it should be expected that a significant portion of this flow will be intercepted by drainage works and directed accordingly and ultimately to the marine foreshore.

With a sloped site water flow will be driven by hydraulic pressure, meaning the weight of water higher up in the slope exerts a force on water lower down, forcing it to flow. Soils can only support so much water interstitially, that is to say between the particles, which we refer to as a volume maximum. If permeable soils are deep enough then the water should flow unimpeded.

When a restrictive boundary such as a silt hardpan nears the surface in sloped areas where the contours level out and this volume maximum is exceeded the water starts to mound. If there is sufficient water volume this mound may approach or breach the surface. The soil is said to have become saturated and can be experienced naturally as hillside bogs (of which the Gibsons area has a few).

A given parcel will only intercept a finite amount of precipitation. However on sloped sites hydraulic pressure will cause water to migrate from neighboring higher parcels across lower parcels and the volume will accumulate. Where this becomes a problem for a development is when the flow intercepts a long impermeable or restrictive barrier, such as might be the case with a road or driveway. This water has to go somewhere and will obviously follow the path of least resistance.

It should be noted that during the process of construction the original soils and plants are often removed over the area of construction down to a more impermeable horizon upon which foundations are constructed and roadbeds lain. This process can contribute to poor site drainage. As can be seen in Lower Gibsons in general most all the streets have swales to address drainage requirements.

In more recent times municipalities have begun making use of permeable surfaces to address drainage via ground recharge rather than storm sewers or curbside swales to catch and divert flows elsewhere. According to The Manager, permeability of the driveway was a requirement of the Town to handle surface water flow onsite as opposed to curbside swales. Where this can be problematic is when a permeable drainage surface leads to a leveling of the contour and there is no path of least resistance to follow from there. One must consider that concrete road bases are generally hard packed and relatively impermeable.

One additional point to consider is that as mature trees are removed from a slope groundwater flows increase substantially because soils do not have the same retention capacity. This is an observed fact and it is why initial development in an area seems to have only a minor impact compared to subsequent development.

Site Review and Observations

The development consists of 19 strata homes of varying occupant capacity. The units are placed on the periphery of the parcel from Gibsons Way extending north to the property boundary. A central access driveway extends from Gibsons Way to the northern portion of the parcel. The northern 1/3rd of the parcel is relatively level whereas the southern 2/3rd is sloped. The parcel originally increased in mean elevation approximately 9 meters from the southernmost boundary (Gibsons Way) to the northernmost. As a result of development this is likely reduced however the surrounding undeveloped properties will still have their natural grades and elevations. This development is approximately halfway down the slope which Gibsons Way follows so the natural expectation is that some storm water flows from higher elevations may cross this parcel unless diverted.

The development as planned and as indicated in the Key Plan has a number of catch basins situated in the driveway. These catch basins are coupled to exfiltration trenches, referred to as exfiltration/storage chambers (also as groundwater recharge) that are placed in between the strata building complexes. This is illustrated in Figure 1, in the Appendix. This is a means of storm water management referred to in Bylaw #733 but not detailed to any degree, rather leaving it to the developer's engineer to inform and is the applied form of ground water recharge. It is assumed that most of the intercepted water is from the driveway surfaces. The Key Plan indicates that the building drains are connected by the storm sewer to the drainage ditch along Gibsons Way. Thus building roof loads are not coupled to the groundwater recharge system. The ground water recharge systems are not coupled to the storm sewer.

In considering the adjacent uphill (western) parcel the first 60 m along the adjoining property line share the steepest observed slope. It is perhaps significant that this is adjacent to the portion of Islandview Lanes which is experiencing groundwater extrusion. If no drainage exists along this property line then it is conceivable that accumulated groundwater can flow through this area.

It was noted that the lowest portion of the driveway starts with essentially level slope before increasing in slope to the north. Only the lowest portion of the parcel, along the centerline formed by the driveway was affected by ground water mounding. This extended from unit 6 down to the entrance onto Gibsons Way. It was also mentioned that during and after rain storms the ground became spongy between units 8 and 9 and adjacent to unit 6.

Observation of the catch basins showed that the lower ones, CB1 and CB2 and their associated exfiltration trenches are saturated and that the observed water levels were above the outlets but at least 15 cm (~ 6 inches). It is not known if the exfiltration lines are perforated their whole length so as to intercept ground water flow. The area in front of units 1 to 5 and below unit 6 all exhibited excessive saturation of the soil with the grass areas being spongy underfoot.

The driveway was constructed with impermeable concrete center panels and permeable brick shoulders and parking pads. Figure 2 shows that the center concrete pads seem to be floating on a saturated base with water exuding between the panels. In fact, when a local truck drove over the concrete panels, water could be seen oozing from the middle crack. Lower down, near the entrance, the brickwork appears to be floating on a saturated base with water clearly evident between the bricks. The obvious conclusion is that water is pooling under these surfaces. This is shown in greater detail in Figure 3.

Although there appeared to be some points along the driveway above unit 6 where the shoulder on the west side showed spongy behavior the concrete panels did not appear to have a problem and overall the brick shoulders do not demonstrate the same problem as seen lower down the driveway.

The Key Plan indicates that the site is built with a surface drainage swale to intercept surface water along the [lower] east property line at points labeled LB which directs it to some exfiltration/storage chambers, specifically CB4, CB5 and CB1. Due to the levelness of the upper area around CB4 it is not likely that excessive flow enters these exfiltration chambers. CB5 and CB1 however will capture more flow due to the slope of the parcel and in the case of CB1 may contribute to the saturation of CB1's exfiltration chambers. It should be recognized that this surface drainage swale is intended to limit surface water flow onto the adjacent [lower] parcel only. No such swale exists on the high side of the subject parcel. There is no indication in the Key Plan where foundation drainage (if any) is directed.

In fact, according to The Manager and the Key Plan, there is also no French drain on the west side of the subject parcel. Any ground water and in fact surface water flow from upslope to the west will likely flow south towards the gaps between the buildings and then east across the subject parcel. Figure 4, taken from an exposed slope on the adjacent west property, shows a photo of the type of soil in the general area. This loamy sand will absorb and hold a substantial amount of water but also allow for increased flow during saturation. In a situation of high precipitation loading it implies that a substantial amount of water could flow across the property line. This would affect the degree of saturation for the soils surrounding the exfiltration/storage chambers of CB2 and CB1 and to a lesser extent CB3.

In viewing the site and given the observed conditions it is conceivable that ground water is being constrained by the edge of the driveway to follow it down slope towards the entrance area. In principal the ground water should flow from there to the next lowest point.

The development is fronted by the drainage ditch system [adjacent to Gibsons Way], most likely constructed according to the requirements of the Town of Gibsons. This drainage ditch has two notable features being 1) it is constructed of an impermeable or semi-impermeable structure and 2) it is higher in grade than the development frontage. A likely consequence of this is that any water flowing to the lowest point of the development, i.e. the entrance driveway, may be constrained there. As the soils become saturated we could expect to see the conditions we observed.

Conclusions

In consideration of the theory and site observations it would seem that there are three ways to address the problem, 1) reduce the volume of water flowing through the soil in a given area, 2) reduce the hydraulic pressure of that water column and 3) implement an improved drainage scheme for the entranceway area. These first two are partially related in that reducing the volume of water decreases the potential for soil saturation and in so doing it may also reduce the hydraulic pressure.

Recommendations

The points raised in the conclusion can be addressed as follows:

1. A French drain on the west side of the property originating from at least the area of unit 6 down to the front of the parcel could reduce ground water influx from upslope sufficiently to allow the groundwater retention system to function as planned. However this drain needs somewhere to empty out. This drain should be at a depth sufficient to intercept the majority of groundwater flow.

2. The entrance driveway area acts as a catchment area for flow from higher up the parcel. The entrance could have additional exfiltration and storage incorporated beneath the driveway however it would need an egress point to enable subsequent drainage.

3. In the area of the permeable shoulder on the west side of the driveway construction of a means of periodic piping connections or cross drains to the east shoulder, under the driveway concrete panels, may alleviate the buildup of groundwater and reduce hydraulic pressure under the west shoulder.

4. Islandview Lanes would need to review the first two suggestions with the Town of Gibsons and arrange for a means to use the drainage ditch of Gibsons Way to accommodate the overflow requirements during a significant storm event.

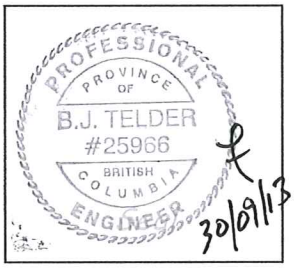
Some or all of the recommended actions can contribute to reducing or eliminating the floating and spongy effects observed in the entrance driveway area and the first portion of the concrete driveway.

Limitations

The conclusions and recommendations submitted in this report are based on information obtained from a visual reconnaissance of the subject property. The nature and extent of variations between the observed conditions and actual conditions, both surficial and subsurface, may not become evident until further investigation. The recommendations given are based on conditions encountered during the field assessment, current state of the property and on generally accepted engineering practices. No other warranty, expressed or implied, is made. Due to the geological randomness of soil formations, no interpolation of soil conditions between the documented conditions has been made or implied. Soil conditions are known only at referenced locations. If other soil conditions are encountered, or unanticipated conditions become known during construction, the recommendations may be altered or modified in writing by the undersigned.

Sincerely,

Telder Engineering Ltd.



Bert J. Telder, P. Eng.
CEO and Principal Engineer

Figures

Figure 1, Parcel detailed with (preconstruction) one meter contour overlay and features of note.

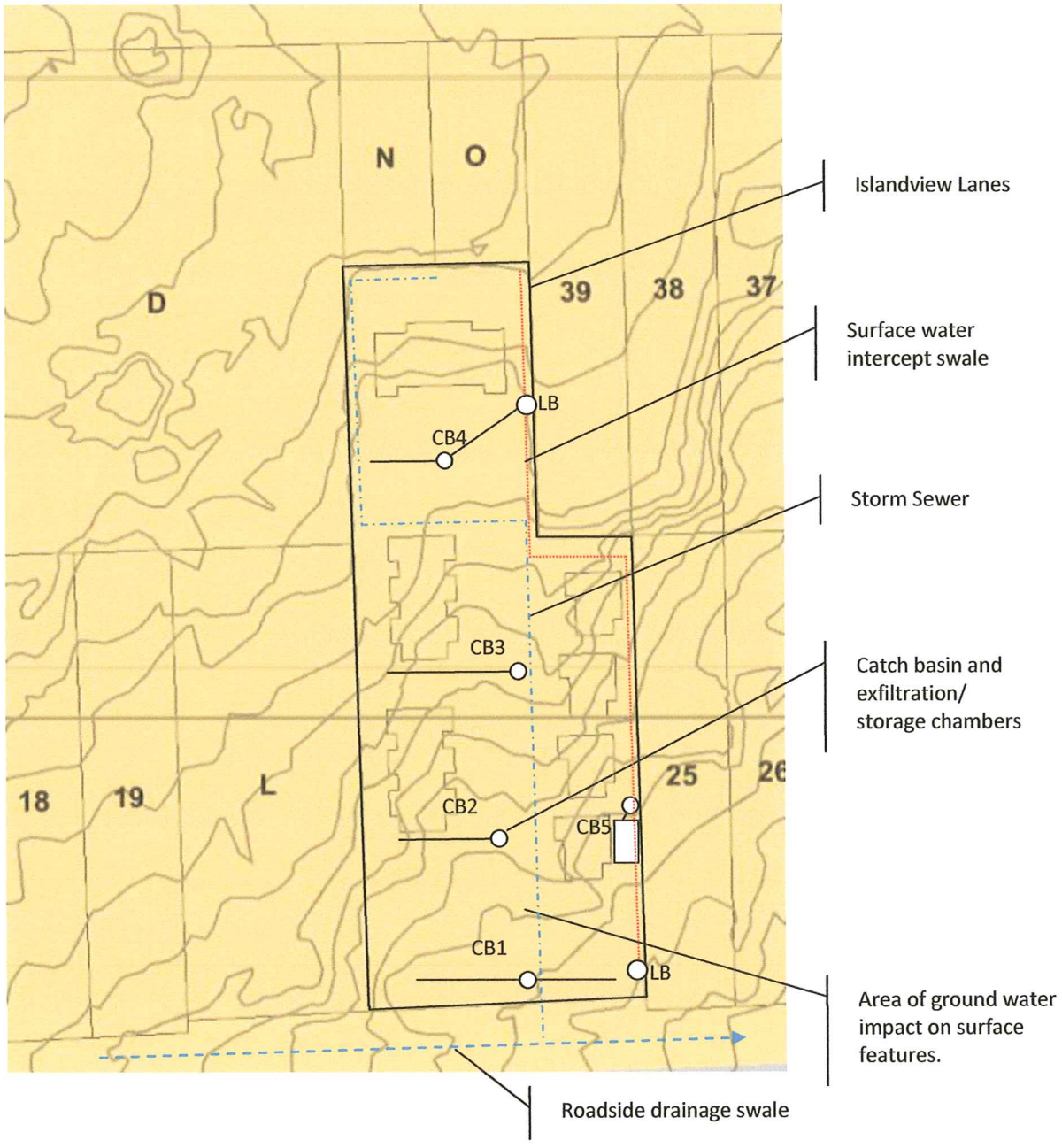


Figure 2, Evidence of high ground water at the driveway entrance.

This photo shows evidence of groundwater surfacing via the driveway. The photo was taken on 16 September 2013. The previous day saw a significant rainfall event wherein greater than average mm rainfall/hour occurred. Vehicle loading of the concrete pads resulted in water being extruded out from underneath. Pedestrian loading was sufficient to cause water extrusion on the brickwork.

This effect is only prominent on the lowest portion of the development driveway, i.e. the portion between the pedestrians and the viewer's location. This corresponds to the section between Unit 6 and the entrance. A similar, albeit lesser, effect of groundwater extrusion on the brickwork between Unit 9 and Unit 6 was also evident.

Figure 3, Close up view of brickwork with groundwater extrusion.

It is evident that this portion of the driveway is saturated with groundwater. Compared to adjacent areas this should have drained already. In fact the area surrounding the entrance also exhibited high ground water level and spongy behavior.

Figure 4, Soil profile from adjacent (upper) parcel.

Observation of the surface and near-surface soils of the adjacent upper parcel indicates that the upper soil horizon common to this area is loamy sand with reasonable cobble content. In this regard surface water will penetrate with a strong vertical component until it reaches either a more restrictive horizon or a barrier horizon of either hardpan or bedrock at which point the major flow component will become largely horizontal. Once a condition of saturation occurs (usually adjacent to the restrictive horizon) horizontal flow will occur with less resistance.

As there appears to be no swale or French drain on the high (west) side of the development to divert groundwater this flow will concentrate through more free flowing portions of the development. This effect will be more pronounced with increased precipitation during a finite time period.