KINGSVIEW AT MAPLE BAY

PRELIMINARY SITE SERVICING REPORT

MARCH 2016

WSP

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PRELIMINARY SITE SERVICING REPORT

TRANSTIDE KINGSVIEW LIMITED PARTNERSHIP

Project no: 141-13463-00
Date: March, 2016

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March 10, 2016
File: 141-13463-00

Mr. Rafer Strandlund,
Transtide Kingsview Limited Partnership
3378 Douglas Street
Victoria, B.C V8Z 3L3

Subject : **Kingsview at Maple Bay**

Preliminary Site-Servicing Report

Dear Sir,

WSP is pleased to present the preliminary servicing report for the captioned project. We trust that you will find all in order. If you have any questions or require additional information, please feel free to call.

Yours truly,

Harry Verstraaten, Eng.L., A.Sc.T.
Senior Project Engineer
Municipal Division

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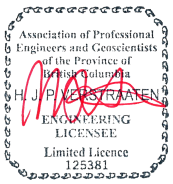

Harry Verstraaten, Eng.L., A.Sc.T.

TABLE OF CONTENTS

APPENDICES

1 BACKGROUND

1.1 INTRODUCTION

The Kingsview at Maple Bay (Kingsview) development lies on the northern face of Mount Tzouhalem in the District of North Cowichan, east of Quamichan Lake, and totals 106.5 hectares. The original development plan of what was then known as The Cliffs Over Maple Bay (COMB) included approximately 360 single family units, 5.54 Ha of multi-family development, a hotel, and an 18-hole golf course, expected to total approximately 700 residential equivalent units. Phase 1 for the extension of Kingsview Road and Nevilane Drive has been completed. Some of the infrastructure for extensions to Highwood Drive and Viewtop Road has been installed, however, the roads remain unfinished as at the date of this report. A new layout of the property without the originally planned golf course has been completed; the revised concept plan includes a mix of single family and multi-family units, totalling at least 1280 units, depending on the addition of legal suites.

A Site Servicing Pre-design Report was completed in September 2013 by WSP (formerly Genivar). Since then the proposed land use and lot layout for Kingsview has been changed, and as a result some of the material and conclusions of the 2013 report are no longer valid. The report in hand serves to revise the 2013 report, some sections of which have been copied herein.

WSP has been retained to review the impact of the increased density and revised lot layout on existing infrastructure. On-site utility layout is examined, including sanitary sewer, water, and storm drain. Off-site impacts for water and sanitary sewer has been determined by the District's engineering consultant using computer model software. Commentary from shallow utilities, including Fortis, Telus, BC Hydro, and Shaw, is included to determine the extent of improvements needed to support the revised lot configuration.

For the original development plan, WSP prepared a detailed stormwater management plan (SWMP), dated February 2008. This report builds on that SWMP, incorporating the revised lot layout and earthworks completed during Phases 1 and 2 of COMB. The primary goal is to identify potential issues with servicing the new lot configuration, including pipe/culvert capacity and stormwater detention. Once detailed design commences, the SWMP will be updated to include additional details such as groundwater flows and recharge, sediment and erosion control, and maintenance issues.

Stormwater detention systems for Kingsview will be designed to manage stormwater runoff such that during a 1:2 year storm event, post-development flows match pre-development rates. Total catchments contributing to each site discharge will remain relatively consistent between pre- and post-development to avoid unbalancing stormwater flows during high-intensity (overflow) events.

2 STORMWATER ANALYSIS

2.1 EXISTING CONDITIONS

The site has 14 existing stormwater outfalls to various channels, culverts, and drainage systems, often located in statutory right-of-ways (SRW) between single family lots. Much of the development site was cleared and stripped during the preliminary golf course grading work. Stormwater flows are managed with existing and recently created water courses with large culverts crossing Kingsview Road and Highwood Drive. Some temporary settling ponds have been created to improve stormwater quality and reduce the peak flows discharged from the site.

As stated in the 2007 geotechnical report prepared by Levelton Consultants, the steep mountain face consists of rapidly drained shale, siltstone, sandstone, and conglomerate soils with little overburden and visible rock outcrops. Upon working the existing soils with heavy machinery, the material breaks down and forms an impermeable crust. To avoid surface pooling, the native fill material should be scarified prior to placing sand or topsoil and avoid tracking heavy equipment over fill areas once grading is complete.

Despite the free-draining base material, the underlying bedrock can lead to trapped groundwater or heavy discharge at interface locations. Groundwater flows can lead to slope instability which can be exasperated with excessive stormwater infiltration. Refer to Figure 1 for pre-development stormwater catchments.

2.2 STORMWATER MODEL DETAILS

A hydrologic model of the development, including Phases 1 and 2 of the Cliffs was created using EPA SWMM v5.1. Catchments were created for both pre and post-development conditions based on existing topography, land use, and lot layout; refer to Figures 1 and 2. Large culverts crossing Kingsview Road and Highview Drive are included with the stormwater model.

Rainfall information is based on data collected from the Atmospheric Environment Service's weather North Cowichan weather station, fit to a 24-hour SCS Type 1A storm distribution. Other model parameters are generally unchanged from the previous SWMP, with the exception of the SCS runoff curve number, which is now standardized at 39 for both pre- and post-development due to the removal of the golf course. All pre-development and greenspace catchments have been assigned an impervious percentage of 5%, based on rock outcrops and to account for channelized flow. Developed areas have impervious percentages of 50% for single family lots, 60% for small SF lots, 70% for multi-family sites and 80% for the commercial site.

The previous SWMP included a detailed analysis of groundwater conditions by EBA Engineering. We found that while groundwater contributed a considerable base-flow, it was relatively unchanged from pre- to post-development. Groundwater flows must be considered during detailed design for proper pipe and control structure sizing, building foundation stability, and downstream capacity calculations. However, since groundwater flows do not increase once the site is developed, they have not been considered for the purposes of this report.

2.3 STORMWATER DETENTION FACILITIES

To meet the District's requirement of zero increase in post-development flow rates during the 1:2 year storm event, detention ponds have been modelled to temporarily impound stormwater with release at

a controlled rate. For the purposes of the model, the ponds are assumed to be dry (no permanent storage) with 3:1 side slopes. Pond locations have been determined based on the catchment boundaries and lot layout.

While large detention ponds at the downstream end of catchments tend to be the easiest method to provide zero increase in flows, they also provide little stormwater treatment in the way of pollutant and sediment removal. Additionally, the topography of the site is such that pond grading is difficult and extensive earthworks / retaining structures may be required to obtain a moderate volume of stormwater detention. The results below are based upon on-site stormwater detention on all multi-family sites, and some single-family lots. Completion of the SWMP will determine final detention requirements.

Reduction of post-development flows during this exercise has been attained solely by use of detention ponds and residential detention tanks. It is important to note that further flow reduction, or smaller ponds can be achieved through use of a number of alternate stormwater management methods such as use of pervious surface treatments and roadside rain gardens.

2.4 RESULTS

2.4.1 OUTFALL FLOWS

The table below summarizes the pre- and post-development flows at each of the site's 14 outfalls during the 1:2 year storm. The Post-Development condition includes detention on all multi-family and commercial sites, and on selected single-family sites. Refer to Figures 2 and 3 for catchment boundaries, stormwater outfalls, and pond locations.

OUTFALL	1:2 YEAR RETURN MAXIMUM FLOW, L/S		% VARIANCE
	Pre-Development	Post-Development	
Out 1	13.7	15.8	15%
Out 2	87.4	83.6	-4%
Out 3	37.1	28.8	-22%
Out 4	31.9	31.9	0%
Out 5	26.8	18.7	-30%
Out 6	35.6	44.0	24%
Out 7	20.2	18.0	-11%
Out 8	24.6	24.6	0%
Out 9	35.5	30.5	-14%
Out 10	56.5	57.6	2%
Out 11	10.2	5.6	-45%
Out 12	25.4	24.5	-4%
Out 13	12.1	0	-100%
Out 14	14.6	12.4	-15%
Total:	**431.5**	**396.1**	**-8%**

No post-development flows are directed to outfall 13, which is a poorly defined channel to the east of the site. The predevelopment catchment for outfall 13 is relatively small. To mitigate downstream impacts, flows from this area will be directed to outfall 12 where there is a defined channel and downstream culverts.

Attenuation for the small amount of excess flow to Outfall 1 can be done by constructing a small pond at the bottom of that catchment. Similarly, a small pond or underground tank constructed at the south side of Highwood Road at the western boundary can be used to attenuate the additional flow to Outfall 6.

2.4.2 DETENTION POND SIZING

As noted previously, stormwater detention ponds have been designed to provide zero increase in post-development flows during a 1:2 year storm event. Below is a table summarizing the pond volumes and maximum discharge rate during the 1:2 year storm for the five major ponds. Pond numbers relate to outflows to which they are connected (Figure 3).

POND	MAX VOLUME	MAX OUTFLOW
	cu.m	**l/s**
Pond 4	533	31.9
Pond 8	32	24.6
Pond 10a	750	17.8
Pond 10b	3,401	40.4
Pond 12	343	24.5

2.4.3 CULVERT CAPACITY

Included in the stormwater model are culverts crossing both Kingsview Road and Highwood Drive, which are mostly 900mm diameter and are installed in existing ravines. Upstream catchment areas will discharge to these culverts rather than the municipal stormwater network within road right-of-ways to preserve capacity in existing pipes. To meet the DNC specifications, however, the capacity must be verified using the rational method, which will be completed during detailed design. We do not anticipate any upgrades will be required to increase culvert capacity with the new lot layout.

2.5 STORMWATER RECOMMENDATIONS

2.5.1 ENVIRONMENTAL

With some ponds proposed on existing watercourses, notification and/or approval from the Ministry of Environment will be required. A Qualified Environmental Professional (QEP) will be required to assess the site and provide documentation to the Ministry. The QEP will also advise on what mitigation measures, which may need to be undertaken during the late summer Fisheries window, would be necessary during construction

2.5.2 ON-LOT DETENTION

To reduce the size of the stormwater management ponds, or where detention ponds cannot be built, on-lot detention can be utilized. In some cases it will be necessary that these be constructed on

single family lots. This is generally the case for single-family lots at the most downstream extents of a catchment, and where there is little or no room for detention between those lots and the downstream drainage channel. Also, small efforts such as disconnecting roof leaders, creation of rain gardens, and rainwater harvesting are encouraged and can have a significant impact on stormwater rate, quantity, and quality; however, these methods have not been included in this analysis.

On multi-family sites, formal stormwater detention structures are more feasible due to the availability of larger treatment areas, and maintenance which can be provided by the strata. Methods to reduce stormwater peak flow from multi-family sites can include pervious pavement, underground tanks, green roofs, rain gardens, or reduction in impervious areas. The criterion for this property has been set so that all multi-family sites are to include a stormwater management system which will limit post-development 1:2 year flows to pre-development rates. Once stormwater management guidelines are developed during detailed design for individual multi-family sites, the downstream detention requirements can be revaluated. The requirement for design and construction of all such facilities would need to be covered under a covenant registered on the property.

2.5.3 PIPE ROUTING

A conceptual pipe network has been completed for the revised lot layout at Kingsview based on the post-development catchment areas; refer to Figure 3. Due to the topography, some pipe routes will be outside the road right-of-way, which will require SRWs in favour of the District for access and maintenance. With some roads constructed on steep sideslopes, the elevation difference from front yards down to rear yards can be significant, necessitating servicing along the backs of some lower lots.

To avoid costly replacement of infrastructure, all new storm pipes should be designed to discharge to culverts, rather than to existing pipes on Kingsview Road and Highview Drive. By doing so the capacity of these existing systems is preserved, despite the increase in upstream density. An extensive amount of re-grading will be required to accommodate the new lot layout, including overland stormwater flow in ditches.

2.5.4 CULVERTS

Four culverts have been constructed on Kingsview Road, and 4 on Highview Drive. These culverts will receive stormwater flows from upstream development. Additional road crossing culverts will be required in future phases. As noted, the existing culverts have capacity for the proposed development; however, two culverts on Highwood Drive require reconfiguration: The first culvert crosses Highview Road and discharges to Pond 8. Depending on the final alignment of access to the multi-family site on the north side of Highwood Drive, this culvert may need to be extended. Secondly, the inlet of the easternmost 900 mm culvert on Highwood Drive is located in the centre of a proposed road. This culvert should be extended southward to clear the new road.

2.6 SUMMARY

Based on the findings of the stormwater model, the District's requirement for zero increase in runoff during the 1:2 year storm event can be achieved with a combination of on-lot detention, and detention ponds. Further stormwater management techniques can be used to both reduce the load on the ponds and improve water quality. The majority of existing stormwater infrastructure can remain in place.

Moving forward in the planning and design stage of the project, we recommend a hydrogeologist and a Qualified Environmental Professional be retained to review the possible implications of groundwater

flows and work in existing streams. A comprehensive landscaping and vegetation management plan. Managing vegetation should be developed to aid in controlling stormwater runoff rate and quality.

3 SANITARY SEWER NETWORK

The proposed sanitary sewer network will follow roadways, with some interconnections through SRW's registered on private properties. Flows will be directed to existing downstream manholes at a number of locations, shown on Figure 4. Pipes have been constructed on Viewtop Raod and Highwood Road, which drain to the existing 'Highwood' pump station. These pipes and the pump station currently serve the existing units on Kingsview Road and Nevilane Drive. The Kingsview station pumps through a forcemain which discharges to the sewer system on Crestwood Drive. No new pump stations will be needed.

WSP provided the District with the proposed sanitary network layout for Kingsview for modelling by their engineering consultant, Parsons. Preliminary results of the modeling has identified the need for upgrading downstream infrastructure, including a number of pipes and three pump stations. The requirement for downstream upgrades has been made necessary by the proposed Kingsview development, other proposed developments that would be contributing to the same downstream system, and existing units already connected to the system. Further study is required to verify the model's results and to determine mutually-agreeable cost sharing for funding the improvements.

4 WATER NETWORK

The overall watermain network remains relatively unchanged from the previous conceptual design. The site will include 6 pressure zones, 9 new pressure reducing valve (PRV) stations, a booster pump station, and a new reservoir. Watermains will be looped where possible to provide redundancy and improved fire flow; refer to Figure 5 for a conceptual pipe layout.

Pressure zones are dictated by the existing connections to neighbouring properties and fix the location of pressure reducing valves. Some lots will require individual pressure reducing valves as the watermain line pressure will exceed the recommended maximum pressure in the District of North Cowichan specifications (580 kPa / 84 psi). Watermains will be sized based on results of an updated water model during detailed design. Generally, fire flows dictate watermain diameters

4.1 RESERVOIRS

As with the original plan, the existing reservoir with a top water level (TWL) of 258m will be supplemented by a new reservoir with a TWL of 376.6 m. A new booster pump station and dedicated feed line will be required to supply the new reservoir. Sizing is based on the maximum daily demand of the development, plus the required fire flow. The new reservoir will need to be constructed prior to development of any lots in zones 5, 6, or 7, located south of Kingsview Road. Development of Kingsview, including the new reservoir, PRV stations, and watermain loops will provide increased fire protection to existing properties.

4.2 OFF-SITE IMPROVEMENTS

WSP provided the District with the proposed water network layout for Kingsview for modelling by their engineering consultant, Parsons. Preliminary results of the modeling has identified the need for upgrading two pump stations. The requirement for these upgrades has been made necessary by the proposed Kingsview development, other proposed developments that would be feeding from the same system, and existing units already connected to the system. Further study is required to verify the model's results and to determine mutually-agreeable cost sharing for funding the improvements. Upgrades to the existing pipe network, if required, have not been identified.

5 POPULATION DENSITY ASSUMPTIONS

The portion of the Kingsview catchment containing 'The Properties', that is that area generally west of the western boundary of Kingsview as far as Maple Bay Road, had been modeled with a population density of 3.1 persons per unit (ppu). The population density for these existing units remains unchanged in the current model. In the earlier 2013 study undertaken by Parsons (then Delcan), a population density of 3.1 ppu was assigned to the proposed Cliffs Over Maple Bay development. Since the time that study was completed it has been recognized and accepted by MNC that a density of 2.5 ppu, which is being used for the neighbouring Stone Hill proposed development, can also be used for Kingsview. As it relates to the water system and sanitary sewer models, establishing existing and future population densities is under review as at this report. Final decisions on assignment of densities in the models may affect the results, with corresponding implications to the amount of downstream improvements that will be required.

6 SHALLOW UTILITIES

Representatives from Fortis, BC Hydro, Telus, and Shaw were contacted to determine the extent of improvements that would be required to support the proposed additional density at Kingsview. A summary of their initial findings are below.

6.1 FORTIS

Nevilane Drive was constructed with a 114 mm PE gas main, which is oversized for the original development and, according to Fortis, has 'abundant gas capacity' for the planned project. This Nevilane Drive gas main will become the backbone of the gas network for servicing future phases.

6.2 BC HYDRO

BC Hydro has indicated that major feeder upgrades will be required to support the full build-out density proposed at Kingsview. We are awaiting further details of these upgrades, including magnitude of cost and the number of developable lots before the upgrades are required.

6.3 TELUS

Generally, the existing Telus infrastructure can be extended to service the proposed units at Kingsview. A new cabinet for fibre optic facilities will be required in one of the future phases.

6.4 SHAW

An initial review of the existing infrastructure by Shaw shows no areas of concern. Generally, the existing facilities can support the increased density. Future phases will include multiple above ground pedestals, which is typical of developments this size.

7 CONCLUSIONS

The additional density proposed at Kingsview can be supported with some upgrades to existing infrastructure. With appropriate phasing, a significant number of units can be developed before offsite improvements are required. Stormwater management ponds will be required to attenuate peak flows to pre-development levels, as required by the District. The model indicates this target is achievable; however, implementation of on-lot best management practices (rain gardens, pervious pavement, infiltration galleries, etc.) can reduce the size and visual impact of the ponds. Significant grading efforts are anticipated to accommodate the proposed lot layout due to the steep slopes, stormwater ponds, and grading already completed on the unfinished golf course.

The requirements for water and sanitary sewer servicing remain generally unchanged from the original Cliffs plan. A new water reservoir is needed as well as a number PRVs. Upgrades to all three sewage pump stations (Highwood, Kingsview and Maple Bay) may be required at different milestones of development within both the Kingsview property and the region as a whole (although the Maple Bay station is already undersized, without additional development).

Initial review of the increased density by the shallow utilities indicates no capacity issues with the exception of BC Hydro. The existing hydro system can support some development before significant feeder upgrades are required. We are awaiting further information to determine when the upgrades will be required.

The neighbouring 300-unit Stone Hill development will have an impact on utilities in the area, so cost sharing of infrastructure upgrades common to both projects should be expected. The District of North Cowichan has identified some of the required downstream improvements as Development Cost Charge (DCC) projects. DCC projects are eligible for funding from the District using monies collected from other lot sales. This could reduce the capital cost of off-site improvements for Kingsview. The upgrades eligible for DCC funding include a number of pipe replacements, and upgrades to the Maple Bay Road Pump station.

Based on the results of our review and the Parsons sanitary and water feasibility studies, the infrastructure upgrades required to support Kingsview development do not extend far beyond those originally required for The Cliffs. However further consideration is required to confirm population densities assigned to the models, and the results of the model output require verification. The precise scope of the upgrades and associated costs will be determined as preliminary and detailed design progress.

Appendix A

FIGURES

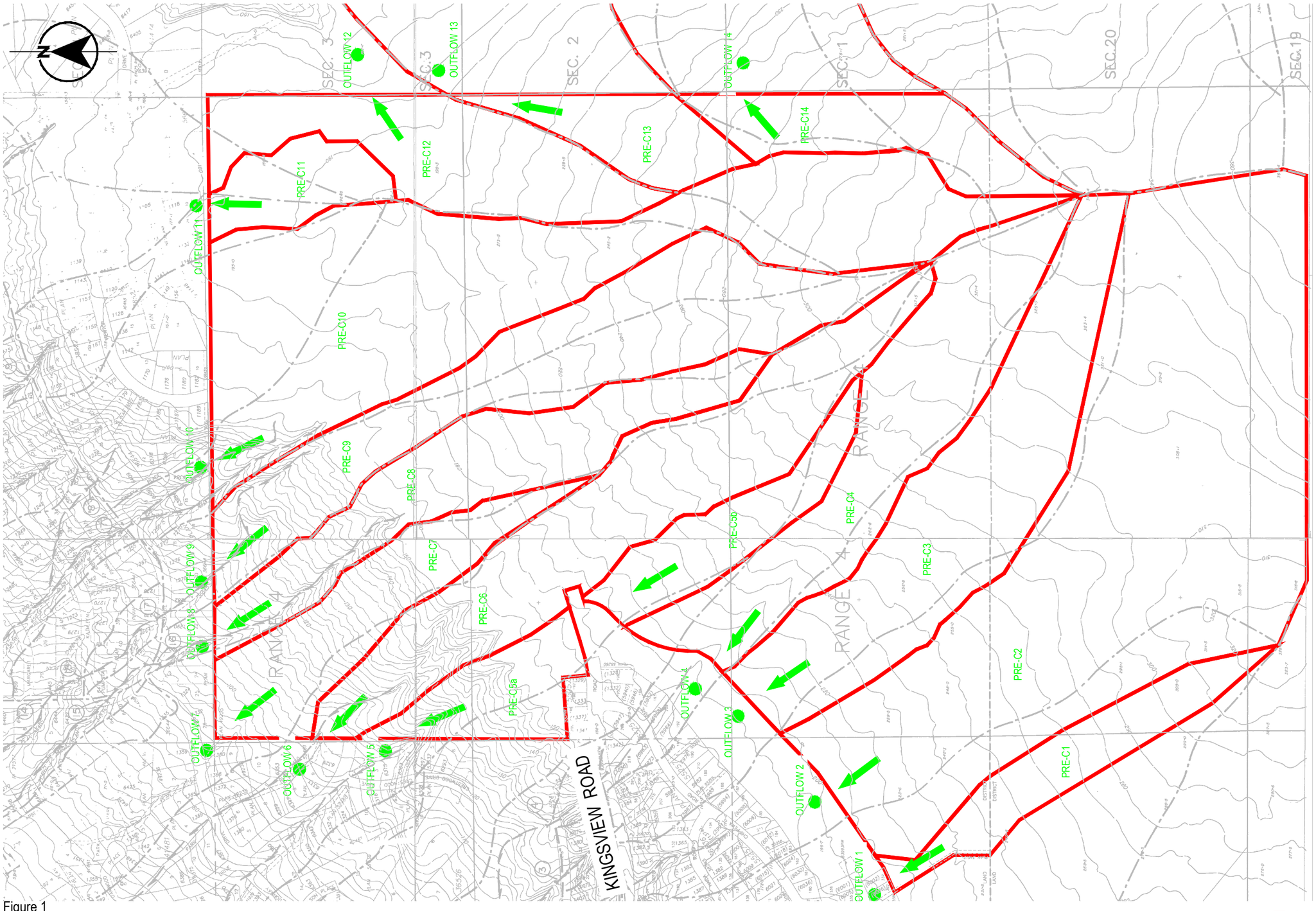

Figure 1
Pre-Development Subcatchment Areas
Kingsview at Maple Bay
1:6000

LEGEND

C10f Catchment ID

Catchment Boundary

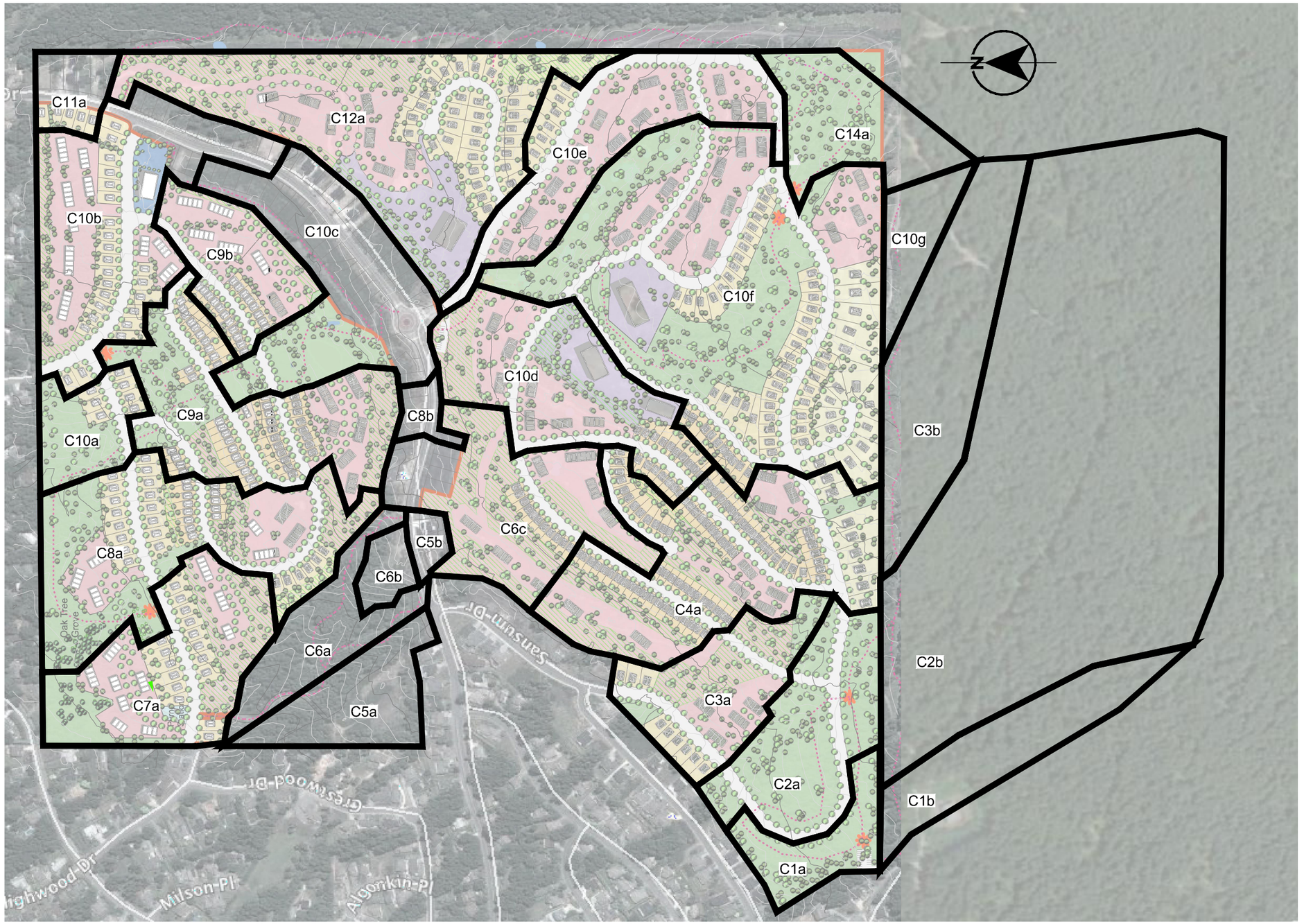

Figure 2
Drainage Catchments
Kingsview at Maple Bay
1:6000

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LEGEND

- Existing Drain Main
- Proposed Drain Main
- (11) Outfall ID
- (P) Pond
- ▲ Single Family, On-Lot Detention

Figure 3
Drain Network Schematic
Kingsview at Maple Bay
1:6000

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N

LEGEND

- Existing Sanitary Main
- Proposed Sanitary Main
- LS Lift Station

Figure 4
Sanitary Network Schematic
Kingsview at Maple Bay
1:6000

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