MASTER DRAINAGE PLAN

THREE SISTERS VILLAGE

JUNE 2020

THREE SISTERS mountain village

QUANTUM PLACE

wsp

REVISION HISTORY

April 30, 2020	**First Submission**	
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June 8, 2020	**Second Submission**	
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SIGNATURES

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2020-06-08

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Water Resources Engineer

APPROVED[1] BY

Jun. 8 2020

Josh Maxwell, M.Sc., P.Eng., PMP
Team Lead, Water Resources, Municipal

PERMIT TO PRACTICE

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WSP CANADA GROUP LIMITED
PERMIT NUMBER: P08845
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

[1] Approval of this document is an administrative function indicating readiness for release and does not impart legal liability on to the Approver for any technical content contained herein. Technical accuracy and fit-for-purpose of this content is obtained through the review process. The Approver shall ensure the applicable review process has occurred prior to signing the document.

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1 INTRODUCTION

1.1 GENERAL

WSP Canada group Limited was retained by QuantumPlace Developments Ltd. on behalf of Three Sisters Mountain Village (Client) to conduct a Master Drainage Plan study for the proposed Three Sisters Village (TSV) development. The TSV development is generally located along the southwest side of Three Sisters Parkway, in the Town of Canmore, Alberta (**Figure 1.0**). One prominent creek, Three Sisters Creek, flows through the proposed development. An intermittent unnamed drainage course, referred to as Creek X as per the 2018 BGC report, *Steep Creek Hazard and Risk Assessment: X, Y, and Z* Creeks is also adjacent to the study area. The creek and drainage originate from high mountainous terrain and generally flow from southwest to northeast, all eventually draining into the Bow River. The watershed areas are forested up to the treeline and consist of exposed rock surfaces above the treeline. Stewart Creek, Smith Creek, and Pigeon Creek are located on Client property but do not drain through the study area. The project area is part of the third reach of the Bow River basin which extends from Banff National Park to upstream of the Bearspaw Dam. The Bow River basin is the most populated river basin in Alberta and supplies water to more than a million people.

1.2 STUDY OBJECTIVES

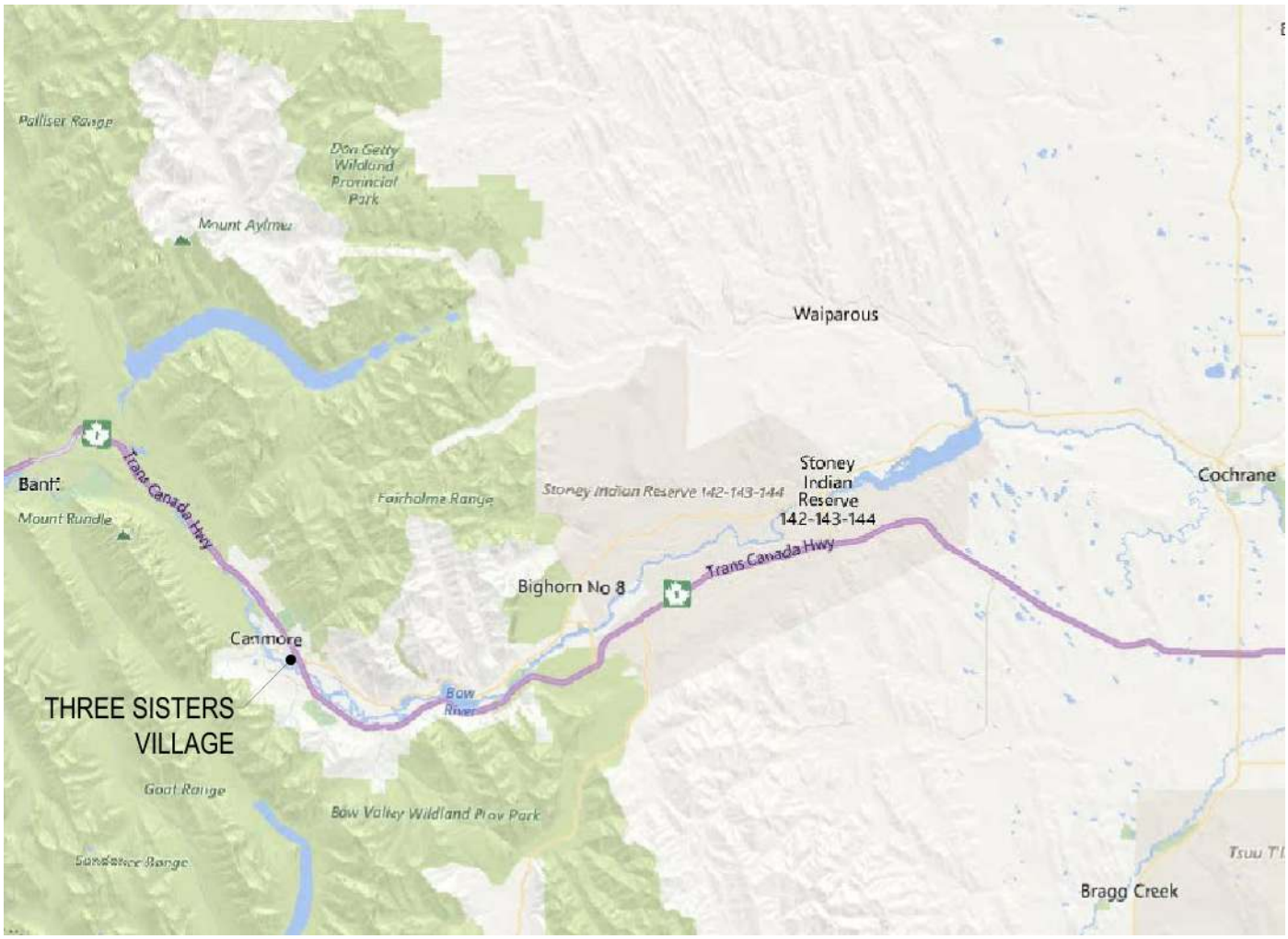
The purpose of this study is to present the stormwater management strategies for the proposed layout of the TSV development in support of the Area Structure Plan (ASP). The main objectives are to provide a hydrological and hydraulic assessment to estimate the on-site stormwater storage requirements.

The TSV development will include specific hydrological site considerations. These include the requirement to consider wetlands, ensure downstream infrastructure has sufficient capacity, and safeguard the development from drainage from the upstream basin.

1.3 DESIGN CRITERIA

The Town of Canmore design criteria for stormwater management have several guiding documents, which include the following:

- Canmore Engineering Design & Construction Guidelines 2010
- Canmore Stormwater Master Plan 2005
- Central Canmore Stormwater Study Mountain Engineering
- Mountainous Terrain Guidelines – June 2006
- Engineering DCG Part 2.5 – Extra Reference, SWM Ref#1-Ref#7



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PROJECT:
THREE SISTERS VILLAGE
MASTER DRAINAGE PLAN

TITLE:
LOCATION PLAN

SCALE: NA
DATE: APRIL 2020
PROJECT NO: 16M-02148-02
DRAWING NO: FIGURE 1.0

2 BACKGROUND

2.1 OVERALL SITE DETAILS

The study area was previously used for industrial mining and was partially developed as a golf course, which is now abandoned. The resulting study area is a mix of previously logged forest, former mining works, and manmade grassy areas. The surrounding area is mostly dense forest, with some residential development to the east and on the north side of Three Sisters Parkway. The site generally slopes from southwest to northeast with slopes ranging from 2% to 15%. The topography is typical of mountain slope regions with two drainages (Three Sisters Creek and Creek X) flowing adjacent to the site. Within the study area, three manmade ponds exist, including one deep pool within the limits of the Three Sisters Creek. Ultimately the drainage courses and all runoff from the site discharge into the Bow River. The development is proposed to be residential, mixed-use, commercial land, park sites, and environmental reserve. The existing topography and proposed land use plan have been included as **Figures 2.0** and **2.1**.

2.2 PREVIOUS STUDIES

The following studies and guidelines have been reviewed and utilized in preparation of this report:

- UMA Engineering Ltd. 1991: Technical Report 9.5b Water Quality, Environmental Impact Assessment Report for the Three Sisters Golf Resorts Inc., September, 1991
- UMA Engineering Ltd. (November 1994, Calgary Alberta): Grassi - Three Sisters Area Structure Plan, Technical Appendix C, Hydrology & Stormwater Management. Prepared for Three Sisters Resorts Inc
- UMA Engineering Ltd. (May 1998, Calgary Alberta): Proposed Three Sisters Creek Subdivision, Storm Water Management Plan. Prepared for Three Sisters Resorts Inc
- Stantec Consulting Ltd. (June 2001, Calgary Alberta): Three Sisters Site 2A Phase 1 Stormwater management. Prepared for Three Sisters Resorts Inc
- Stantec Consulting Ltd. (July 2001, Calgary Alberta): Three Sisters Site 2A Stormwater management. Prepared for Three Sisters Resorts Inc
- Stantec Consulting Ltd. (September 2003, Calgary Alberta): Three Sisters Site 2A, Phase 2 - Stage 2. Prepared for Three Sisters Mountain Village Ltd
- Stantec Consulting Ltd. (May 2004, Calgary Alberta): DC sites 1 to 6 Stormwater Master Drainage Plan. Prepared for Three Sisters Mountain Village Ltd
- UMA Engineering Ltd. (May 2004, Edmonton Alberta): Three Sisters Creek - Regional Frequency Floods. Prepared for Three Sisters Mountain Village Ltd
- Westhoff Engineering Resources, Inc., (February 2004, Calgary Alberta): Master Drainage Plan prepared for Three Sisters Mountain Village

- Westhoff Engineering Resources, Inc., (May 2006, Calgary Alberta): Three Sisters Creek Golf Resort Management Strategies prepared for Three Sisters Mountain Village
- Westhoff Engineering Resources, Inc., (February 2013, Calgary Alberta): Master Drainage Plan for Three Sisters Mountain Village, prepared for Three Sisters Mountain Village
- BGC Engineering Inc., (October 2014): Three Sisters Creek Debris-Flood Hazard Assessment
- MMM Group Limited, (October 2016, Calgary, Alberta): Three Sisters Mountain Village Stormwater Management Strategies, prepared for Three Sisters Mountain Village Properties Ltd. and QuantumPlace Developments Ltd
- BGC Engineering Inc., (December 2018): Steep Creek Hazard and Risk Assessment: X, Y, and Z Creeks

2.3 RELEASE RATE

The Three Sisters Mountain Village Stormwater Master Drainage Plan (Stantec, 2004) determined a pre-development discharge rate of 4.5 L/s/ha for nearby creeks, based on a hydrological study using stream flow and rainfall data. The authors created a SWMHYMO model of the Three Sisters Creek watershed to compute a unit discharge rate. It is important to note that the authors determined that this rate was applicable to the nearby creeks, and not the Bow River. Subsequently, the authors of the Three Sisters Mountain Village Stormwater Management Strategies (MMM Group Limited, 2016) performed a regional flood frequency analysis (FFA) and calculated pre-development release rates ranging from 4.2 to 4.5 L/s/ha for the creeks in the study area. The report recommended using a release rate of 4.3 L/s/ha across the site.

While these reports have calculated a release rate value for the nearby creeks, the BGC 2014 report for Three Sisters Creek indicated that the applied methodology of regional FFA may not be an appropriate approach. BGC has since conducted multiple creek hazard reports for the 2013 events and has applied HEC-HMS, a rainfall-runoff model developed by the US Army Corps of Engineers, to generate a calibrated model (BGC, 2018). BGC's model has computed significantly higher peak rates compared to previous regional FFA's. For context, the estimated release rates by the previous FFA's was near 4.5 L/s/ha, while the estimated release rate from the calibrated 2018 HEC-HMS model for Creeks X, Y, and Z for the 100-year return events was within the range of 40 L/s/ha to 65 L/s/ha. Comparing the previously conducted models of release rate analysis with BGC's, the BGC analysis is considered to represent a more accurate rate than previously determined.

Presently there is no specific limitation on the allowable rate of discharge to the Bow River. This report proposes that the Three Sisters Village development be subject to a release rate of 30 L/s/ha. This rate was selected as it is within the estimated 100-year release rate for the Three Sisters Creek (BGC, 2014), and is below that of the estimated rates for Creek X, Y, and Z (BGC, 2018). This rate is also in agreement with the curve numbers, and hydrological methodology outlined in section 3.2. Adequate water quantity and quality control was also reviewed in support of the release rate. This report will outline the preliminary infrastructure required to meet the proposed release rate.

Review of the proposed release rate will be evaluated as further information becomes available for both the development lands and the regional hydrology. The proposed rate of 30L/s/Ha may be increased or decreased should further supporting information become available.

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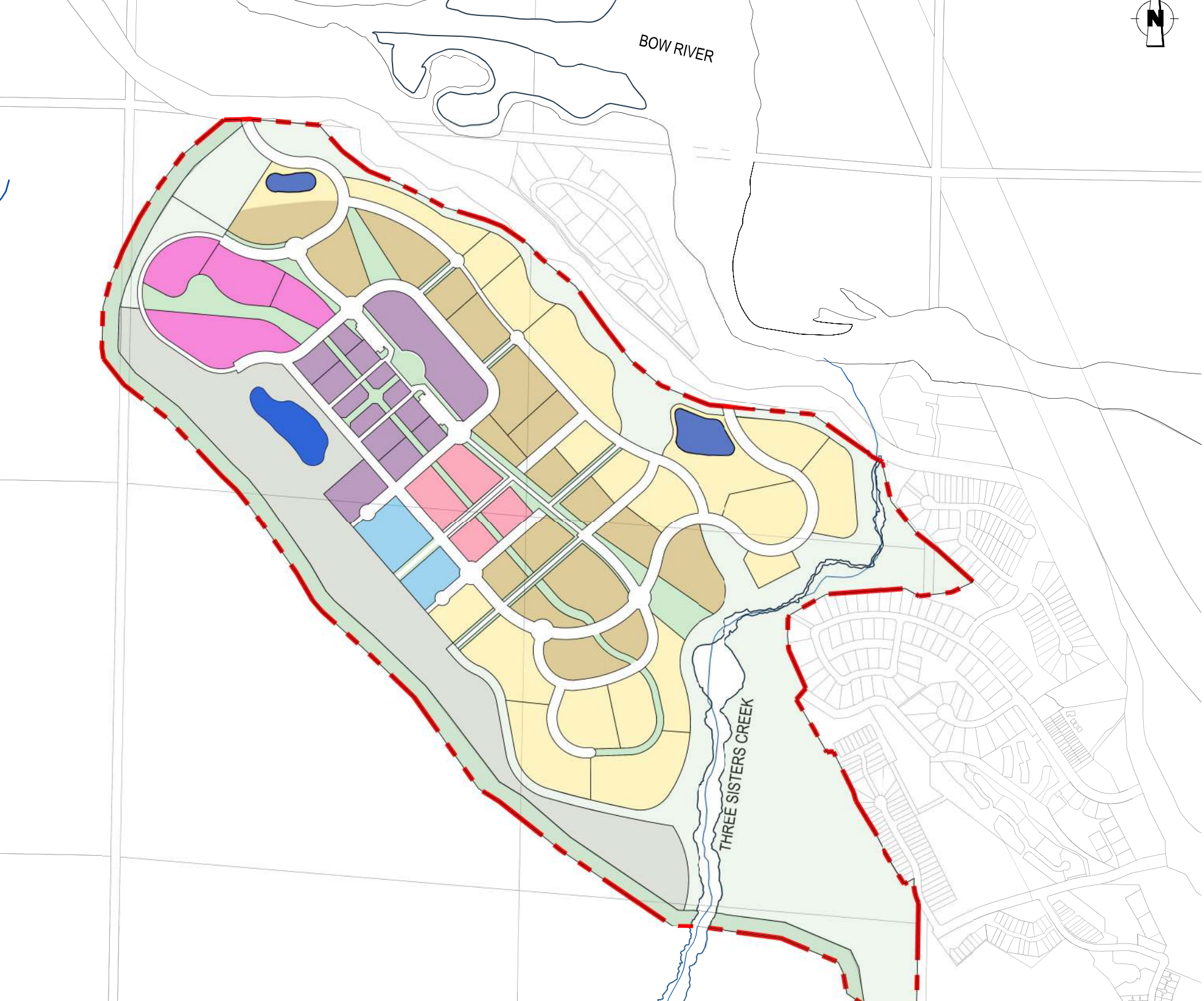

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3 DRAINAGE ANALYSIS

3.1 MODEL DEVELOPMENT

A stormwater drainage model was developed using PCSWMM (Version: 2019 Professional 2D) software. This software is a Windows-based stormwater management modeling system that is capable of evaluating hydrologic and hydraulic performance of stormwater infrastructure. The model has a hydrological component that computes runoff from sub-catchments, which is then routed through the hydraulic components which consist of various conveyance systems, hydraulic structures and storage elements. The model is used to evaluate the performance of the stormwater infrastructure and assist in the development of solutions for managing runoff.

3.2 METHODOLOGY

The model was developed following the Canmore Engineering Design & Construction Guidelines 2010 and considers the guidance of the current draft engineering guidelines as provided by the Town in early 2020. The following primary sources of information were utilized to construct the model:

- CAD drawings of existing and proposed utilities
- Previous drawings of record plans
- LiDAR data, 2015
- NRCAN Geo Spatial Data DEM
- Aerial imagery to evaluate land use, 2019
- Surficial Geology of Alberta, Alberta Energy Regulator, 2016
- Environment Canada Intensity-Duration-Frequency Data

The Intensity-Duration-Frequency (IDF) data from Environment Canada was utilized to determine the applicable rainfall amount for the site. City of Calgary design events have been applied as prescribed in the Canmore Design Guidelines. The design events selected were the 5, 25, and 100 return year events over a 24 hour duration with a Chicago distribution. The 24 hour events simulate long duration events, highlighting issues associated with volume concerns, and release rates, while the Chicago distribution of the event assists in assessing peak flow conditions.

The varying design events were analyzed in conjunction with the proposed development plan, using PCSWMM software, to determine an effective stormwater management strategy. Two stormwater management facilities (SWMFs) were proposed to manage the runoff to an appropriate release rate, and to provide water quality treatment.

3.3 HYDROLOGY

The hydrologic section of the model was used to compute runoff hydrographs from the basins. These runoff hydrographs are then routed through the conveyance system by the model. The computation of the runoff hydrographs is based on the catchment characteristics and the methodology applied for the hydrological calculations was the runoff curve number method. This methodology was applied as it is a common and recognized procedure and also follows previously conducted analysis in the area by BGC (2014, 2018).This curve number analysis applies a value (curve number) that ranges from 0 to 100, which determines the amount of rainfall that is infiltrated and stored as soil moisture. Runoff curves numbers that are larger will generate more runoff and smaller numbers will result in the opposite. Values for the runoff curve numbers are evaluated based on the type of surface and soil type. The applied values were referenced from the National Engineering Handbook (NEH) Part 630 Hydrology Chapter 9 Hydrologic Soil-Cover Complexes, as well as compared to the previously analyzed values by BGC. The general surficial geology of the study area is a mix of moraine and fluvial deposits, as indicated by the map Surficial Geology of Alberta, Alberta Energy Regulator, 2013. The following table presents the catchment parameters and infiltration parameters. **Figures 3.0** and **3.1** illustrate the delineated offsite and onsite major stormwater basins for the site respectively.

Table 3.1 Applied Hydrological Parameters for PCSWMM Model

Subcatchment Hydrological Parameters	
Pervious Area Manning's Coefficient	0.250
Impervious Area Manning's Coefficient	0.018
Pervious Area Depression Storage (mm)	2.5
Impervious Area Depression Storage (mm)	1.3
Predevelopment/ Natural Area Curve Number	70
Post Development Curve Number	77

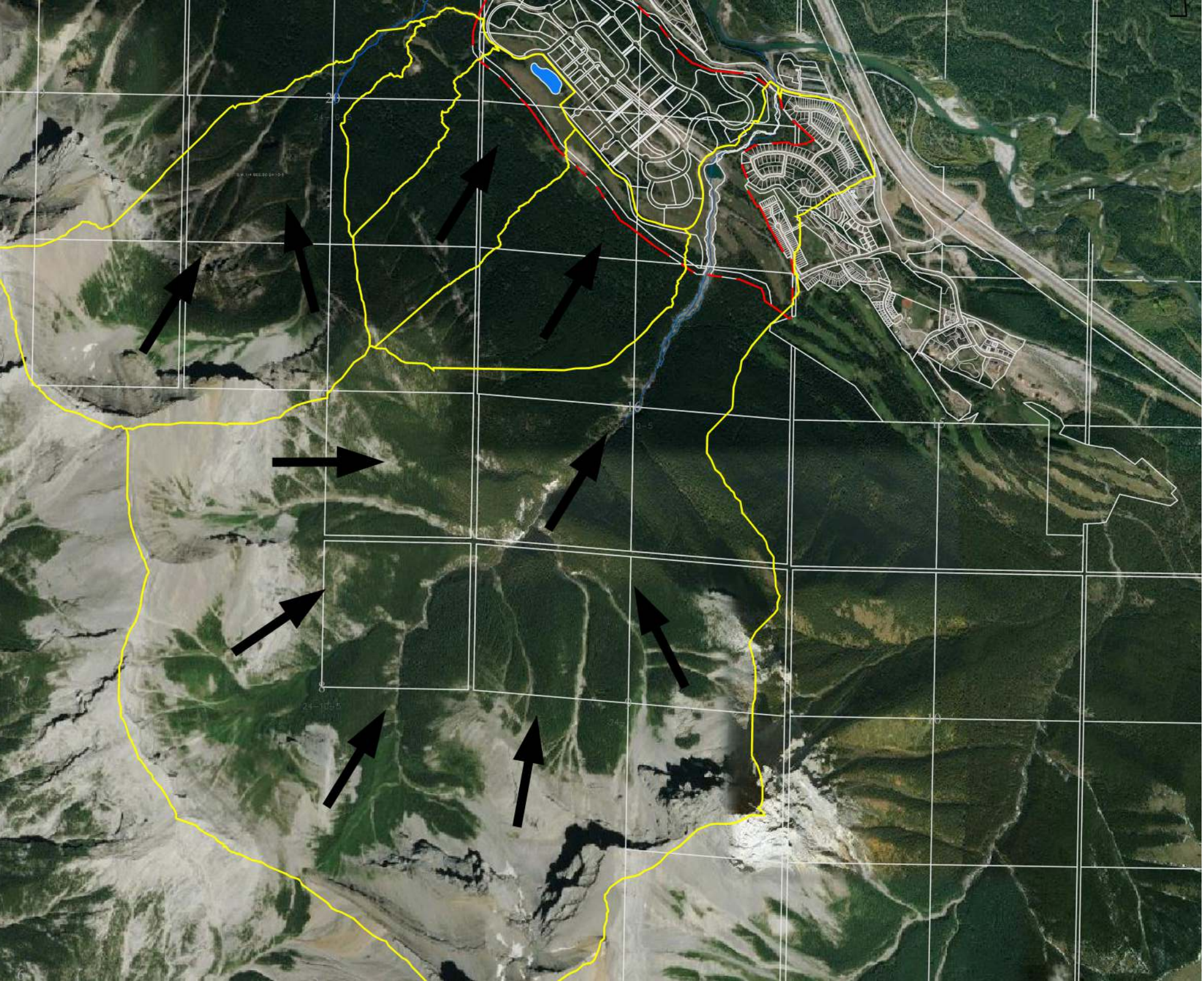
BGC had previously determined a range of 63 to 71 for the varying natural cover watersheds in the area. A value of 70 was applied as a composite curve number value for all of the predevelopment and natural watersheds. The post development portion of the site had a lump sum value of 77 applied, as it was estimated to represent a mix of residential, commercial, mixed use, and natural zoning.

The catchment areas were delineated using PCSWMM's watershed delineation tool, and were assessed using available terrain data, aerial imagery, street level view imagery and previous report information. These basins were then connected to the hydraulic network. The impervious percentage values for the contributing catchments were estimated using the proposed land use in conjunction with the design standards. A detailed stormwater design will be required at a later stage to analyze the finalized plan and land use types.

3.4 HYDRAULICS

The hydraulic analysis consists of a one-dimensional (1D) system that conveys flow along delineated flow paths. A conveyance system was implemented in the model to represent drainage infrastructure such as ditches, pipes, culverts, and overland major drainage. The conveyance system was developed with the

available plan, but as the development plan is still being designed some assumptions regarding the characteristics of the drainage infrastructure had to be made. It was assumed that flows conveyed by the drainage infrastructure were done so by an oversized conveyance system, as to ensure all runoff reached its respective SWMF, and to provide the most efficient routing method for the flows. The minor system was assumed to have a Manning's 'n' value of 0.013, as for concrete pipes. The storage capacities of the SWMFs were determined through an iterative process of analyzing the volume of flow and adjusting the SWMF to perform optimally.



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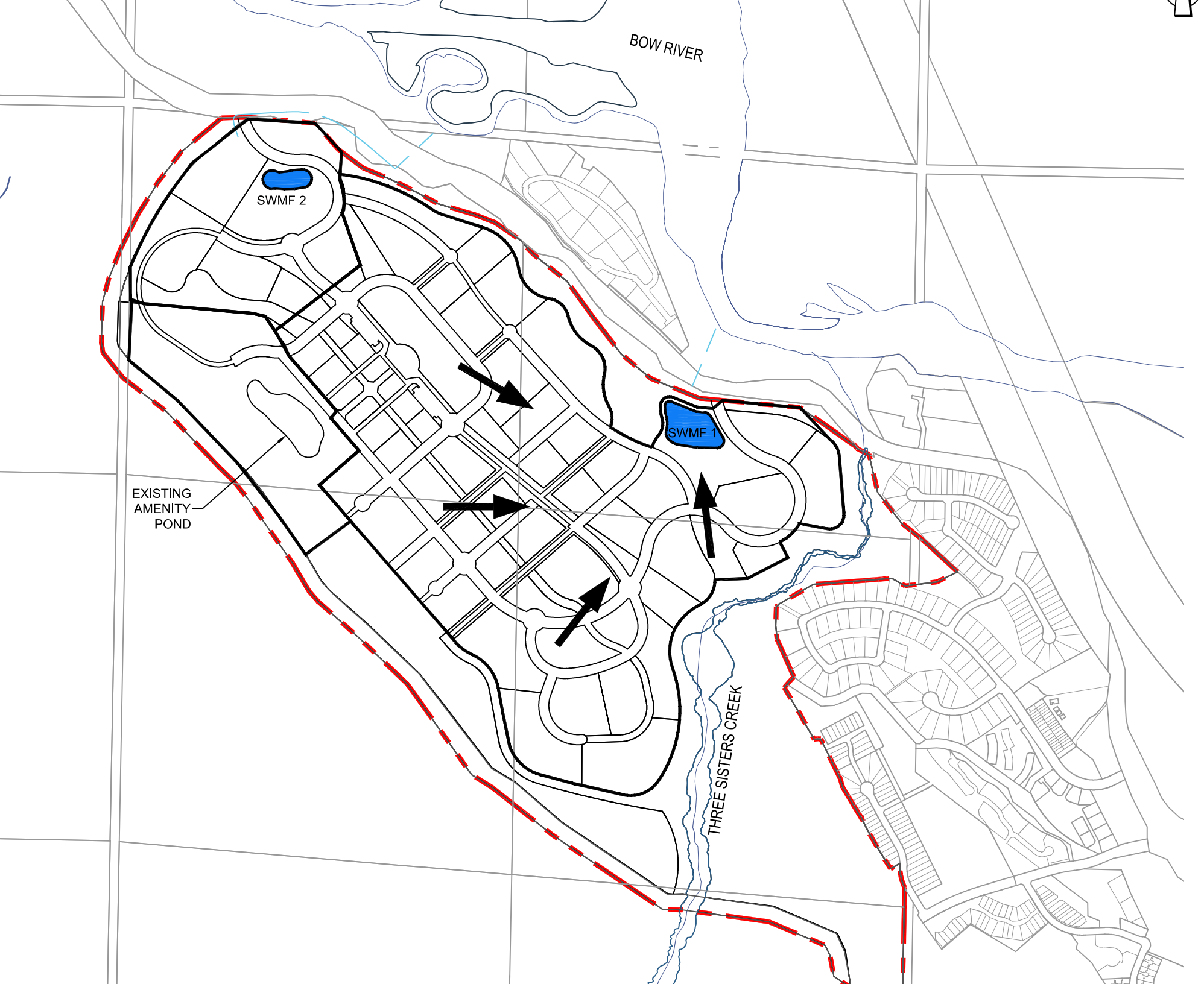

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4 RESULTS AND RECOMMENDATIONS

4.1 GENERAL

The proposed stormwater system will be designed following the major and minor methodology. The minor storm system will be designed to convey the 1 in 5-year storm runoff. The streets and gutters will be used to convey flows exceeding the 1 in 5-year storm (i.e. major) to the proposed SWMF. The minor system will be designed in detail at a later phase, but the methodology to be applied is the unit area release rate approach, applying a minimum rate of 70 L/s/ha, and a maximum of 120 L/s/ha. The roads throughout the development will be built conforming to Canmore's design guidelines. The SWMFs will be designed to detain excess run-off for the most critical design storm event, and will discharge at the pre-development release rate. **Figure 4.0** indicates the proposed stormwater infrastructure. The illustrated sizing, and location of the stormwater infrastructure is preliminary and subject to modification upon future detailed analysis.

4.2 STORMWATER MANAGEMENT FACILITIES

The purpose of this report is to outline the preliminary stormwater management infrastructure, and to estimate the required volume to provide adequate servicing. Two SWMFs are proposed for the site to provide water quality and quantity control. The performance of the facilities was modelled utilizing PCSWMM, and was applied to calculate the preliminary runoff volumes, pond water levels, and peak flows. The finalized volumes will depend upon the overall plan, allowable release rate, and overall efficiency of the design of the facility. At this phase it is undetermined if the SWMF's will be a wet pond or a dry pond - either type of facility will have the same storage requirements and provide sufficient water quality control. This pond design optioning has been discussed with the Town, and they are in agreement reviewing this at a later phase. This supports flexibility in the design process and allows the all parties to further evaluate the outcomes as they impact capital cost, maintenance, performance and amenity.

Table 4.1: SWMF 1 Modelling Results

SUMMARY OF MODELING RESULTS SWMF 1			
Contributing Areas	83.7 ha		
Allowable Peak Discharge (m^3/s)	2.51		
Available Live Storage (m^3)	14000		
Rainfall Event	Rainfall (mm)	Runoff (mm)	Estimated Volume Required (m^3)
5 Year - 24 Hour Chicago	51.2	30.5	4900
25 Year - 24 Hour Chicago	72.1	47.9	9000
100 Year - 24 Hour Chicago	89.4	62.9	13000

Table 4.2 SWMF 2 Modelling Results

SUMMARY OF MODELING RESULTS SWMF 2			
Contributing Areas	13.5 ha		
Allowable Peak Discharge (m^3/s)	0.41		
Available Live Storage (m^3)	3200		
Rainfall Event	Rainfall (mm)	Runoff (mm)	Estimated Volume Required (m^3)
5 Year - 24 Hour Chicago	51.2	30.5	720
25 Year - 24 Hour Chicago	72.1	47.9	1200
100 Year - 24 Hour Chicago	89.4	62.9	1800

4.2.1 WATER QUALITY

Calculations were completed to evaluate the preliminary water quality treatment performance of the proposed facilities. **Tables 4.3** and **4.4** below support the preliminary analysis of the sediment removal capabilities of the facilities as the drawdown times exceed the required effective settling time. A detailed water quality analysis is recommended during the detailed design phase.

Table 4.3: Water Quality Analysis for SWMF 1's Sediment Settling Capacity

Settling Capacity for Three Sisters SWMF 1	
Active Storage Depth (m)	2.0
Maximum Settling Depth (m)	2.0
Storage Volume (m^3)	14000
Approximate Drawdown Time (hrs)	6.0
Particle Diameter (µm)	75
Density of Sediments (kg/m^3)	2650
Density of Water (kg/m^3)	1000
Dynamic Viscosity of Water (kg/m.s)	0.00131
Theoretical Settling Velocity Analysis (Stokes Law)	
Settling Velocity (m/s)	0.00438
Settling Time (s)	457
Settling Time (hrs)	**0.13**

Table 4.4 Water Quality Analysis for SWMF 2's Sediment Settling Capacity

Settling Capacity for Three Sisters SWMF 2	
Active Storage Depth (m)	2.0
Maximum Settling Depth (m)	2.0
Storage Volume (m^3)	3200
Approximate Drawdown Time (hrs)	5.0
Particle Diameter (µm)	75
Density of Sediments (kg/m^3)	2650
Density of Water (kg/m^3)	1000
Dynamic Viscosity of Water (kg/m.s)	0.00131
Theoretical Settling Velocity (Stokes Law)	
Settling Velocity (m/s)	0.00438
Settling Time (s)	457
Settling Time (hrs)	**0.13**

4.2.2 BEST MANAGEMENT PRACTICES

Canmore guidelines indicate that the Town is in support of the application of Low Impact Development (LID) and Best Management Practices (BMP) for stormwater treatment. BMPs are methods of managing stormwater for adequate conveyance and control, and are economically acceptable to the community. The Town outlines several best management practices, and the overall site will be evaluated in the implementation of these features. LID focuses on maintaining and restoring the natural hydrological processes of a site, which in turn reduces runoff volumes and peaks, and provides enhanced water quality. The key elements of LID can include the utilization of natural site features, small scale local stormwater control features, prolonging runoff flow paths and times, and creating multi-functional landscapes. These principles promote the hydrological cycle by improving absorption, infiltration, evaporation, evapotranspiration, filtration, pollutant uptake, and biodegradation of pollutants.

LID-BMP features that could potentially be implemented on site include bioretention (rain gardens), and naturalized drainage ways. These features make use of greenspace along drainage routes, and can be outlined as a part of the detailed servicing phase of the design.

4.3 CONTROL STRUCTURE AND OUTFALLS

The two proposed SWMFs will each include a control structure that will outlet to the downstream stormwater system. An existing stormwater outfall located on the southern bank of the Bow River was constructed as part of the golf course development. SWMF 1 is proposed to outlet to this existing structure. SWMF 2 is proposed to outlet to the Three Sisters Parkway southern roadside ditch, and then utilize existing culverts to cross the Parkway for conveyance to the Bow River. The control structures in the SWMFs will be designed to limit discharge from the critical design storm event to the pre-development rates of 30 L/s/ha. These

structures will be designed to achieve the drawdown performance required by the Town, while maintaining discharge rates which ensure no net impact to existing downstream infrastructure.

Both SWMFs discharge to existing conveyances. Currently, details of each outfall structure are still limited. The overall capacity of the existing outfall in the Bow River has yet to be confirmed, however it is known that the structure is a 2100 mm diameter structure. A 2100 mm pipe will be able to accommodate the required flows from SWMF 1 with a gradient of only 0.2%. Given the topography of the site, we are confident the outfall has grades in excess of what is required. A site investigation and review of as-built drawings for the outfall and upstream pipe will be completed during future design phases.

The ditch that is proposed to service SWMF 2 has been analyzed at a desktop level to evaluate its suitability as an outlet for the facility. The overall catchment discharging into this ditch will be reduced with the proposed development. Currently, about 20.7 ha from the study area drains to the ditch, while the post development contributory area will be approximate 15 ha, of which 13.5 ha will be controlled in SWMF 2. As such, the proposed development will have a positive impact on the amount of discharge conveyed by the existing facility. To confirm this, the Three Sister Parkway ditch and downstream outfall infrastructure to the Bow River will be reviewed at a later design phase to ensure flows are routed appropriately and that they have sufficient conveyance capacity.

All future evaluation of release rate will be matched with an analysis of downstream capacity.

4.4 UPSTREAM BASIN AND CREEK DIVERSION

The proposed development site sits below a large area of mountainous terrain and drainage from this area naturally runs through the site. Flows from the upstream basins will have to be managed by stormwater infrastructure at the interface of the upstream basin and the development. Typically, this includes a series of walls, berms, and/ or drainage channels to attenuate and direct flows to a controlled location. **Figure 4.0** illustrates the general recommended locations of such infrastructure. The ultimate design of the diversion infrastructure will be dependent upon the finalized plan, and recommendations made by BGC's ongoing steep creek hazard assessments for the area.

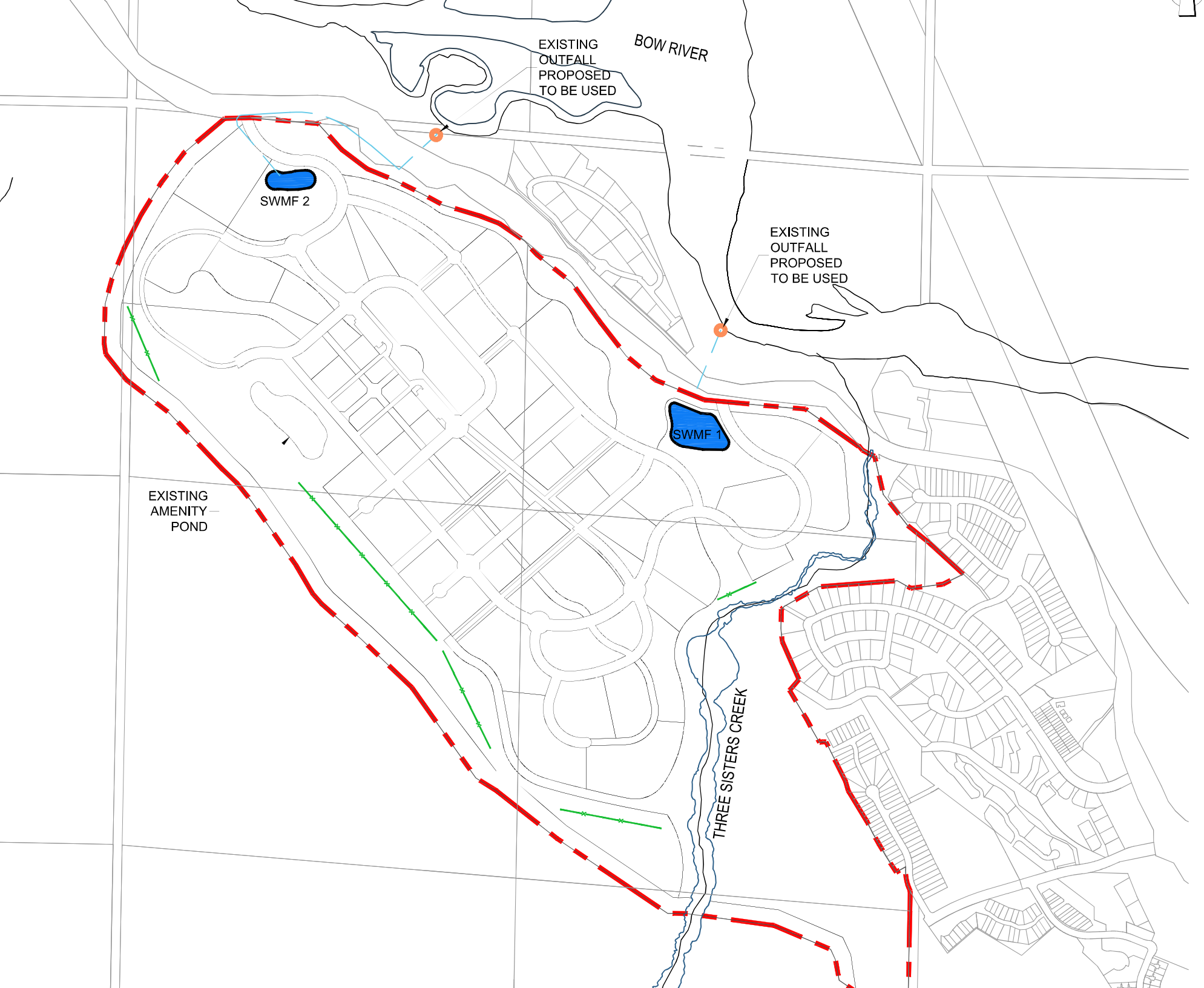
A portion of the upstream basin drains towards an existing pond on the southwest corner of the site. The pond was used abandoned golf course for an amenity feature and irrigation water source. As such, the pond is located in an influenced catchment and not a catchment indicative of a natural pond. This pond is currently being assessed to determine if it can be utilized as an amenity feature for the development. This report does not consider the use of this existing pond for management of stormwater runoff from the development lands. Should further design indicate the pond would receive development runoff, we would recommend enhanced stormwater infrastructure to provide enhanced water quality prior to discharge into the pond. The pond will need to be analyzed in detail to determine its capability to act as a means of control for the upstream catchment and would likely require an outlet to ensure effective hydraulic performance.

Three Sisters Creek and Creek X present a concern for the site if flood mitigation measures are not implemented. As indicated in the BGC, 2014 and 2018 reports a portion of the development is within the

steep creek hazard zones of these creeks. The ongoing assessment and identification of potential mitigation of hazards is being completed by BGC under a separate cover. Recommendations from these reports will be coordinated with the detailed design of the project site.

4.4.1 CAIRNS ON THE BOW

The proposed TSV development has taken consideration to ensure it has no impact on the downstream development of Cairns on the Bow. Cairns on the Bow contains an existing drainage course that is integrated as a water feature. It has been indicated that the structure has limited capacity and is not intended for major storm event design flows. This drainage course is not proposed to be utilized as a part of the TSV drainage plan. Portions of the proposed development will continue to discharge to this location as it currently exists, but no additional catchment will be routed to this location. The Cairn's feature will not see an increase in flow, as to ensure no negative impacts occur. A review is recommended to be conducted at a detailed design phase to confirm that no negative impact is being made to this feature.



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5 CONCLUSION

Based upon the analysis, the following conclusions are presented:

- There is no established allowable rate of discharge to the Bow River. Reviewing previous reports, it has been determined that previously completed regional flood frequency analyses are not consistent with measured rates. As such, values from the calibrated model by BGC were utilized to produce a design rate of 30 L/s/ha. This will continue to be evaluated as further information about the regional hydrology and development lands become available.

- A PCSWMM model was generated to analyze the performance of the conceptually designed stormwater infrastructure.

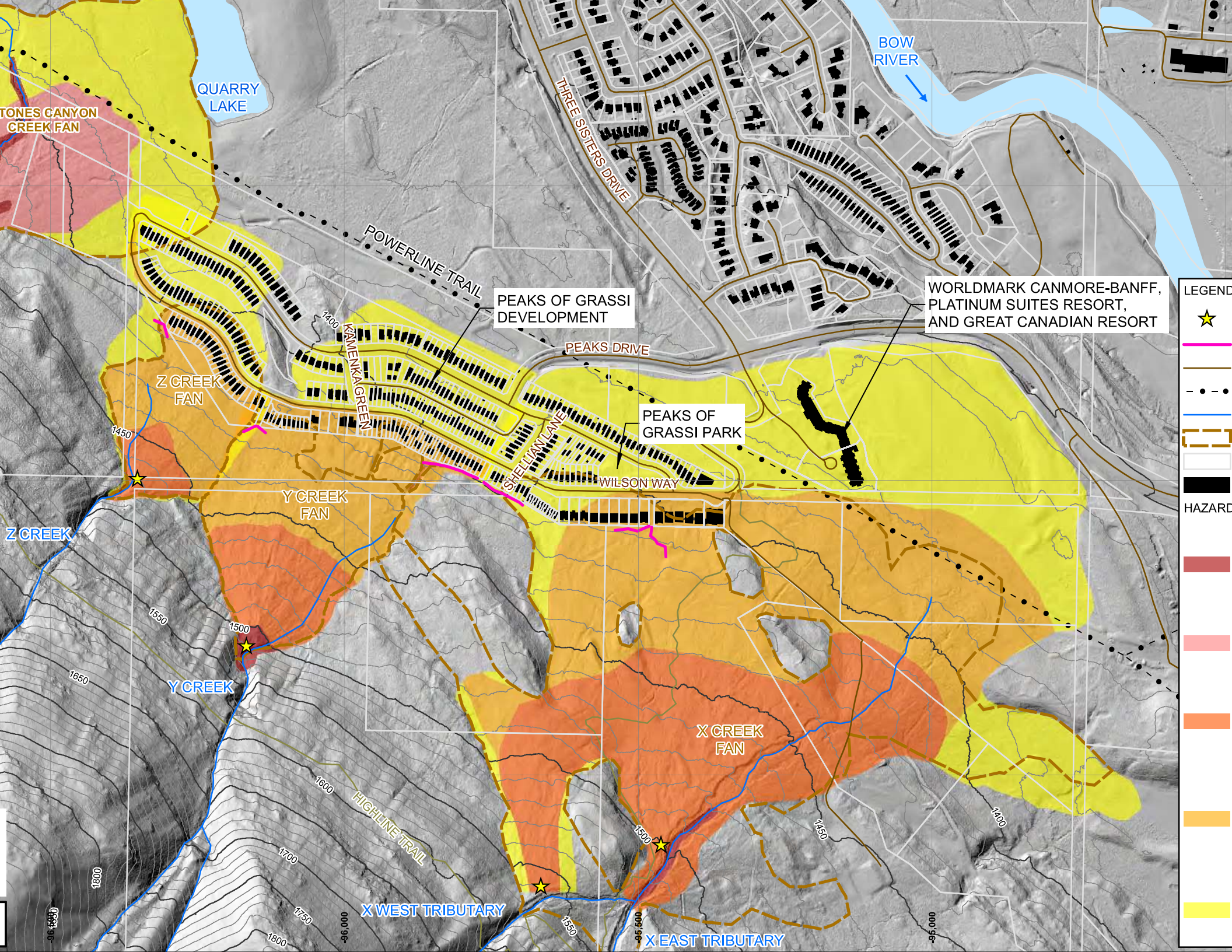
- Two stormwater storage facilities locations were proposed to serve the proposed development, providing an approximate 14000 m^3 and 3200 m^3 of active storage volume. These are preliminary required storage volumes and will be subject to the finalized development site plan and approved release rate. The SWMFs can function as either wet ponds or dry ponds.

- The study area sits below a large area of mountainous terrain. Drainage from this natural catchment is a key consideration for the development

- The proposed storm servicing concepts shown in **Figures 3.1** and **4.0** should be adopted as the basis for future storm design for the Three Sisters Village development. Detailed engineering should be undertaken at each stage of development, along with a review of the concept and overall conformity.

- Implementation of Low Impact Development and Best Management Practices for stormwater management will be considered in later design stages.

APPENDIX A - STEEP CREEK HAZARD MAPS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BOW RIVER
THREE SISTERS DRIVE
POWERLINE TRAIL
PEAKS OF GRASSI DEVELOPMENT
WORLDMARK CANMORE-BANFF, PLATINUM SUITES RESORT, AND GREAT CANADIAN RESORT
PEAKS DRIVE
KAMENKA GREEN
SHELLIAN LANE
PEAKS OF GRASSI PARK
WILSON WAY
Z CREEK FAN
Y CREEK FAN
X CREEK FAN
Z CREEK
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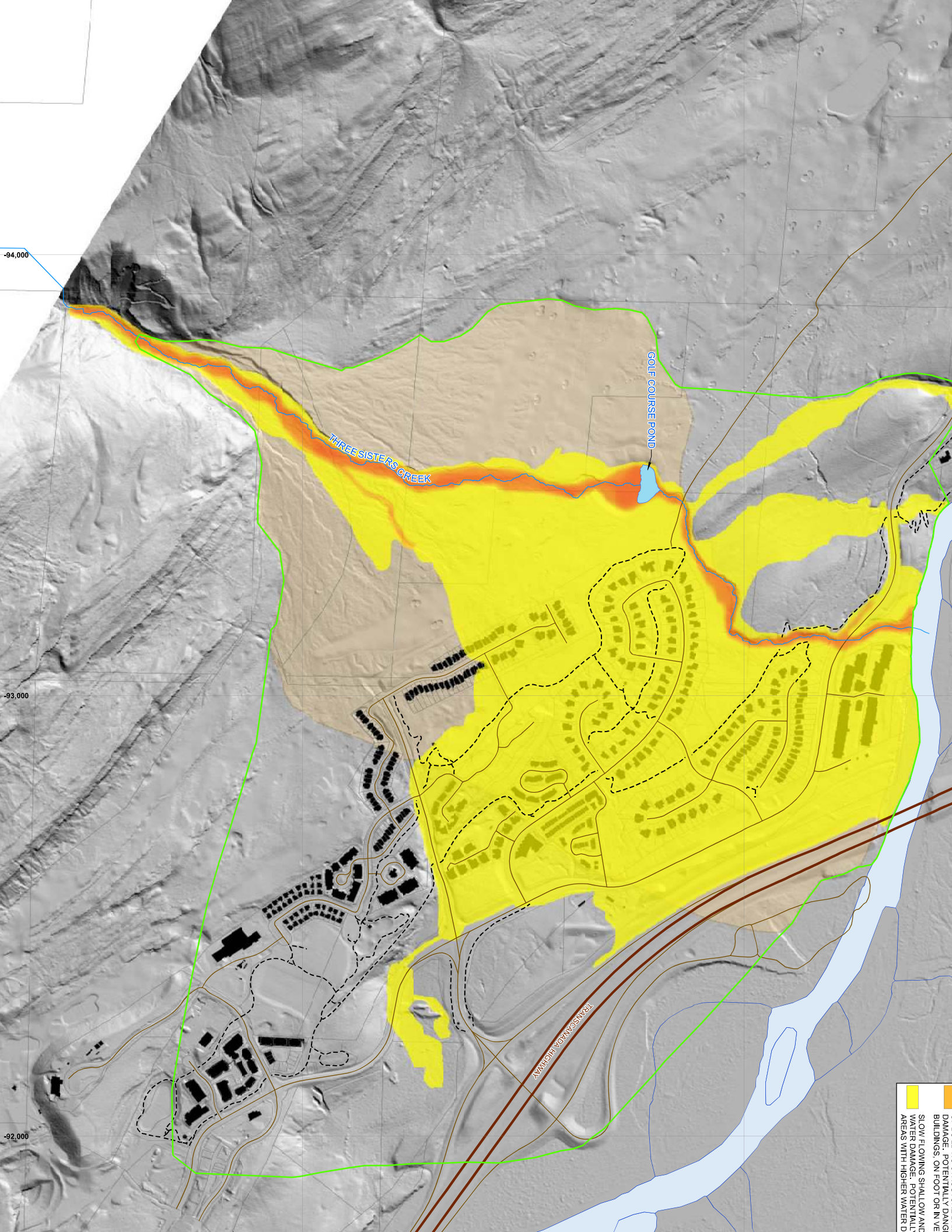
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GOLF COURSE POND
TRANSCANADA HIGHWAY
SLOW FLOWING SHALLOW ANE
WATER DAMAGE. POTENTIALL
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