BEST MANAGEMENT PRACTICES and STORM WATER MONITORING 2016 ANNUAL REPORT

Hecla Greens Creek Mining Company

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1.0 Introduction

This 2016 Best Management Practices (BMP) and Storm Water Report is submitted by Hecla Greens Creek Mining Company (HGCMC) pursuant to Parts 1.3, 1.6.2 and 2.2.6 of Alaska Pollutant Discharge Elimination System (APDES) Permit AK-0043206, effective 1 October 2015. This report summarizes the scope and dates of the comprehensive site compliance inspections/evaluations, major observations related to implementation of the BMP plan, corrective actions taken as a result of the inspections/evaluations, identification of potential incidents of noncompliance as they pertain to the BMP plan, description of the quantity and quality of the storm water discharged, and BMP plan modifications made during the year. The final section of this report contains the required annual certification under Permit Appendix A, Part 1.12.

2.0 Comprehensive Site Compliance Inspections/Evaluations, Incidents of Potential Noncompliance and Associated Corrective Actions

2.1 AK-CESCL Site Compliance Inspections

In April 2014, eight HGCMC personnel completed the 2-day Alaska Certified Erosion and Sediment Control Lead (AK-CESCL) storm water training program. The training program outlines the key elements of a storm water pollution prevention plan; provides detailed instructions on how to select, install and maintain storm water best management controls; and teaches how to conduct site inspections and monitoring. The class was developed with input from the USACE Alaska district, ADOT, ADEC, ADNR, ARRC, MOA and Alaska construction industry representatives. The AK-CESCL certification is for a period of three years from the date of the training.

Monthly storm water and BMP inspections were completed by certified inspectors, and can be considered site compliance inspections. The results of the inspections conducted in 2016 generally involved the need for maintenance activities to existing BMPs. Records of these inspections are retained onsite and are available upon request. Items noted as deficiencies during the 2016 inspections, as well as the corrective actions taken, included:

- During the January inspection it was noted that BMPs under the Zinc Creek Bridge were in need of maintenance. Extensive BMP work in the Zinc Creek Bridge area was completed by Surface Operations personnel during February and March.
- During the February inspection it was noted that ditches routing runoff to D-Pond were in need of maintenance. Surface Operations personnel completed this work on March 3.
- During the March inspection it was noted that ditches and settling sumps along the B-Road were in need of maintenance. Surface Operations personnel performed extensive ditch and BMP maintenance, including hydro-seeding, along the road system beginning in March and continued throughout the summer.

- During the April inspection it was noted that BMP maintenance was needed near the 1350 adit and along the access road. This work was completed in May.
- During the May inspection it was noted that straw wattles under the Zinc Creek Bridge needed to be replaced. Surface Operations personnel completed this work in June.
- During the September inspection it was noted that sediment sumps near 3.1 mile B-Road needed cleaning. Surface Operations personnel completed this work in September.

All inspections were conducted as outlined in the BMP plan, and copies of the inspection forms are available upon request.

2.2 Agency Site Compliance Evaluation Inspections

Agency personnel performed routine inspections to evaluate compliance with HGCMC operating plans and permits on twelve occasions in 2016. Each of these inspections was led by personnel from the U.S.D.A. Forest Service and some of them were accompanied by other agency personnel. Representatives from the Alaska Department of Fish & Game participated in three of the inspections, two of the inspections included a representative from the Alaska Department of Natural Resources, and Alaska Department of Environmental Conservation personnel participated in one of the inspections. The primary focus of these inspections was on compliance with the HGCMC BMP Plan. Action items noted on the Forest Service inspection reports include:

- The need for BMP modification/maintenance on the south side of the Zinc Creek Bridge at 3.1 mile B-Road was noted in January.
- The need to maintain water bars on the 1350 access road was noted in May.
- Concerns about accumulated sediments beneath the B-Road bridges at Falls Creek (3.4 mile) and Killer Creek (7.4 mile) as well as on the bridge splash guards was noted during multiple inspections.
- The need to clean sediment sumps near 4.7 mile B-Road was noted in October.

In addition to the routine agency inspections, personnel from the ADEC performed a two-day comprehensive site compliance evaluation inspection on November 9 and 10. This inspection focused on compliance with the APDES Permit and included a review of administrative records and plans, inspection of water treatment facilities, and inspection of each storm water outfall and associated BMPs as well as general BMPs throughout the site. This inspection also evaluated HGCMC's compliance with APDES Construction General Permit AKR10FA22 obtained for storm water discharges associated with the tailings facility expansion project.

Progress in 2016 included work on corrective and preventive actions from inspections, on continuous improvement projects on the various storm water outfall sites, as well as on improvements to BMPs. The list below summarizes the 2016 work and improvements, as well as plans for 2017:

- *Hawk Inlet Freight Barge Ramp*

During the ADEC inspection on November 10, which was during a rain event, turbidity was observed in Hawk Inlet beneath the freight barge ramp. The design of the barge ramp,

constructed in 2014, focused on the safety of forklift operations and failed to adequately address runoff management from the gravel roadway above the ramp. Following the inspection, a corrective action was promptly implemented by installing a flexible runoff deflector across the roadway to direct all runoff from above the ramp into a storm drain, which is pumped to water treatment facilities (photo 1). The flexible deflector provides effective runoff collection without hindering the safety of forklift operations during barge loading/unloading. This BMP has been added to the list of site specific BMPs for the Hawk Inlet Facilities and is being included in the monthly inspections.

- *Storm Water Outfall 004 Pit 7*

Additional reclamation material (i.e., organics, sands and gravels) salvaged from the tailings facility expansion project was stockpiled at Pit 7 in 2016. Prior to commencing haulage activities, engineered BMPs were designed and installed at Pit 7 for long-term management of storm water runoff. This included constructing a rip-rap armored conveyance channel along the eastern perimeter of the stockpile leading to a settling basin constructed on the north side of the Pit 7 access road (photo 2). Runoff from the haul road along the southern perimeter of the stockpile is also directed to the settling basin through ditches. Grading and stabilization of the outer slopes occurred concurrently with development of the stockpile.

- *Zinc Creek Bridge Area BMPs*

In March, accumulated sediment was cleared from underneath the bridge and existing BMPs were maintained. In July, HGCMC modified the BMPs by removing the silt fences on the south side of the bridge and replacing them with 12-inch diameter straw wattles (photo 3). Since their installation, the straw wattles have demonstrated to be effective at containing sediment.

In February, substantial modifications were made to BMPs located south of the Zinc Creek Bridge at 3.1 mile on the B-Road. During Forest Service inspections in December 2015 and January 2016 it was observed that the BMPs were not performing adequately and needed maintenance. The BMPs are located below a culvert that conveys runoff from the road, and consisted of a sediment sump and straw wattles (photo 4). To remedy this, HGCMC cleaned and enlarged the main sediment sump, installed several sumps and gravel filter berms between the culvert and the main sump, and directed the outflow from the main sump to a different location into the forest duff via a pipeline (photos 5 and 6). The modified BMPs have improved the capture of sediments from this section of the road.

- *Falls Creek Bridge 3.4-Mile*

In August, accumulated sediment was cleared from underneath the bridge and BMPs were installed to keep sediment out of the creek (photo 7). The BMPs were subsequently destroyed by high flows in the creek during a large rain event in September. Preliminary engineering work was completed to evaluate options for mitigating sediment concerns, including options for replacing or modifying the bridge.

- *Storm Water Outfall 005.3 Site E*

A collection pond was constructed at Site E in 2009 for management of storm water during active waste rock removal activities. During a routine inspection in September 2015 it was discovered that the pond liner had been damaged by bear activity. HGCMC Surface Operations personnel

installed new liner in the pond in May 2016 (photo 8). The pond is surrounded by an electric fence to keep bears away from the liner. There was no waste rock removal from Site E in 2016.

- *Storm Water Outfall 006 Pond D*

To significantly increase HGCMC's ability to manage large storm water flows from the 920 area, improvements have been made to the Pond D site. In 2009, these improvements included installation of a larger pump system to increase pumping capacity. On 6 May 2016, during a large rain event, the high flow electric pump in Pond D failed resulting in a discharge from the storm water outfall. The duration of the discharge was approximately 13.5 hours before a backup diesel pump could be installed. This was the first discharge from Pond D since 2005. The high flow pump was shipped off-site for rebuild and then reinstalled in June. There were no other discharges from Pond D in 2016.

- *Storm Water Outfall 007 Pond C*

Pond C consists of two ponds, an upper pond and lower pond. Storm water runoff from the 860 Area and a portion of the B-Road is collected in the upper pond. The lower pond collects runoff from outer slope of the waste rock pad that the 860 buildings were constructed on at the start of mine operations. The upper Pond C was reconstructed in 2011 to install an underdrain, lined collection pond, caisson, and duplex pump system. Water collected in the upper and lower Pond C is pumped to the Site 23 ditch along the B Road which reports to treatment.

The upper Pond C was thoroughly cleaned in July 2016 to remove accumulated sediments (photo 9). Monitoring in 2016 showed that there were no storm water discharges to Greens Creek from Pond C.

- *Storm Water Outfall 009 Site 1350*

To improve water quality at Outfall 009, during the summer of 2016 a shallow trench, caisson and pump system were installed to capture runoff from the remaining waste rock at Site 1350 (photo 10). Intercepted water is pumped to the 1350 adit where it enters the mine water system that is routed to treatment facilities. The pump system operated from September 1 through November 14 and was then decommissioned for the winter. This system will be utilized during non-winter months, generally April through November.

Other activities at Site 1350 in 2016 included performing additional hydro-seeding to improve vegetative cover on reclaimed areas and periodic removal of accumulated sediments at the 1350 adit entrance.

- *Containment Improvements at the 920 Area and Site 23*

Two projects were completed at the 920 Area and Site 23 in 2016 to improve the collection and containment of storm water and mine drainage:

  - Pond 23, which accumulates all runoff from waste rock Site 23 and the majority of the 920 area, was reconstructed in May. The pond was cleaned of all accumulated sediments, enlarged by raising the crest height approximately two feet, and lined with 80-mil HDPE liner (photo 11). This improvement increases HGCMC's ability to manage large storm flows from the 920 area.

- A section of the concrete roadway at the base of the ore pad hill was repaired in June to improve management of runoff in this area (photo 12).

- *Summary of Plans for 2017*
  - Drainage improvements in the ore pad area.
  - Improve BMPs at B-Road bridges to mitigate sediment concerns.

2.3 HGCMC Monthly Evaluations and Site Inspections

HGCMC environmental staff members conduct weekly, monthly and quarterly visual inspections of a variety of areas within the mine site to identify any potential breaches that may lead to pollutants entering the permitted outfalls, storm water drainage system, or surface waters. The results of the inspections conducted in 2016 generally involve maintenance activities to existing BMPs. Records of these inspections are noted on various inspection sheets (i.e., SPCC inspection forms, General Plan of Operations inspection forms, etc.), are retained on-site, and are available upon request. Any corrective actions needed to address findings from the inspections are conducted with coordination between the environmental department staff, the maintenance department staff, or the surface operations department staff.

Under the BMP Plan, monthly inspection sheets are completed for each outfall. A BMP Inspection Record Form is then completed for each month. This form compiles the dates of the inspections, as well as any noted deficiencies onto one page for all the outfalls, for easier tracking of corrective actions. All inspections were conducted as outlined in the BMP plan, and are available upon request.

3.0 BMP Plan Modifications in 2016

The HGCMC BMP Plan was updated in 2015 as required by the reissued APDES Permit. The BMP Plan addresses all components and facilities associated with the Greens Creek Mine. A copy of the Plan is available on-site and upon request. An electronic copy of the Plan was provided to the Forest Service and ADEC in December 2015.

Hand drawn edits were made on some of the BMP Plan figures to reflect BMPs that were added or changed in 2016, as discussed above. Formal edits using GIS software are in progress and revised figures will be provided to the Forest Service and ADEC when completed.

4.0 HGCMC 2016 Annual Storm Water Monitoring Report

The requirements for storm water monitoring in the reissued APDES permit, effective 1 October 2015, were changed from those of the previous 2005 permit. The current permit requires monitoring of the receiving water directly upstream and downstream of where each storm water outfall enters the receiving water, and for monitoring to be conducted semiannually and at the

same time (within three hours) as each associated outfall. Based on this, and the time required to visit all ten storm water outfalls and associated receiving water sites, it is likely that each semiannual monitoring event will occur over two days, and potentially during separate storm events.

For typical implementation of the storm water monitoring program, outfalls 003, 004, 005.2, 005.3, 005.4 and their associated receiving water sites are observed/sampled on one day, and the meteorological station located at the tailings facility is used as the reference for the storm event details. Outfalls 005.5, 006, 007, 008, 009 and their associated receiving water sites are potentially observed/sampled on a separate day, and the meteorological station located at the 920 mill site is used as the reference for the storm event details. If an outfall that normally discharges during storm events is not flowing on the date it is observed, then it is revisited during subsequent qualifying storm events until a sample is obtained.

In the re-issued APDES Permit, numeric effluent limits were not developed for the individual storm water outfalls. This is due to the difficulty in developing numeric limits for storm water discharges that are extremely variable in flow and pollutant concentrations and the uncertainty regarding the effect of the storm water discharges on the receiving waters. Instead, the permit requires HGCMC to implement corrective action if a storm water discharge exceeds a water quality criterion and results in a statistically significant reduction in receiving water quality. (Permit Number AK0043206 Fact Sheet).

Statistics can be used to define the statistical uncertainty between sample values collected at different sites (e.g., upstream and downstream receiving waters). Statistics can never prove that a difference between sample values is real, only the probability that one may exist, given the available data. Statistical tests rely on using estimates of the true mean and true variance of a population, where larger sample populations increase statistical confidence. With the upstream and downstream receiving water monitoring program having been implemented in 2016, there is not yet adequate data to perform valid statistical testing to determine if storm water outfall discharges are causing significant reduction in receiving water quality. For this report, monitoring results are discussed in general terms as well as in relation to Alaska Water Quality Standards.

Table 1, Storm Event Details Spring 2016, summarizes the precipitation and duration data associated with the sampling events that occurred in spring of 2016. Note that the tipping mechanism that records precipitation at the tailings meteorological station malfunctioned in late April and was not repaired until late May. Therefore the 920 mill site meteorological station was used as the reference for precipitation data during the April 30 and May 2 sampling events.

Table 1: Storm Event Details Spring 2016

Date	4/8/2016	4/9/2016	4/30/2016	5/2/2016
Outfalls Sampled	005.5, 008, 009	003, 005.3	005.3, 005.4	005.2
Outfalls Observed (not sampled)	006, 007	004, 005.2, 005.4		004
Meteorological Station Reference	Mill Site	Tailings	Mill Site	Mill Site
SAMPLE EVENT				
Duration (hours)	8.0	18.5	8.5	27.25
Started	4/8/16 6:00	4/8/16 13:00	4/30/16 5:15	5/1/16 8:15
Precipitation (inches)	0.3	0.91	0.37	1.38
Same Day Precip. (inches)	0.3	0.1	0.37	0.52
PRIOR EVENT				
Lapse Between Events (hours)	26.25	5.5	8.5	15.5
Duration (hours)	4.5	19.5	2	10.75
Started	4/6/16 23:15	4/7/16 12:00	4/29/16 18:45	4/30/16 5:15
Precipitation (inches)	0.19	0.23	0.1	0.39

Table 2, Storm Event Details Fall 2016 and Upset Event Monitoring, summarizes the precipitation and duration data associated with routine sampling events in September and two additional sampling events at specific outfalls during upset conditions. The first upset was on May 6 when a pump failed in Pond D resulting in storm water discharge from Outfall 006. The second upset was on November 10 when a power failure tripped a pump resulting in additional sources of storm water discharging through Outfall 003.

Table 2: Storm Event Details Fall 2016 and Upset Event Monitoring

Date	5/6/2016	9/6/2016	9/7/2016	11/10/2016
Outfalls Sampled	006	005.5, 008, 009	003, 005.2, 005.3, 005.4	003
Outfalls Observed (not sampled)		006, 007	004	
Meteorological Station Reference	Mill Site	Mill Site	Tailings	Tailings
SAMPLE EVENT				
Duration (hours)	44	29.5	8	5
Started	5/4/16 21:00	9/5/16 8:15	9/7/16 9:00	11/10/16 6:45
Precipitation (inches)	2.45	1.71	0.16	0.17
Same Day Precip. (inches)	1.64	0.91	0.18	0.17
PRIOR EVENT				
Lapse Between Events (hours)	57.5	154.75	8	24.5
Duration (hours)	27.25	6.5	40.75	38.5
Started	5/1/16 8:15	8/29/16 15:00	9/5/16 8:15	11/7/16 16:45
Precipitation (inches)	1.38	0.14	2.44	0.63

Table 3, Storm Water Outfall Area and Estimated Total Discharge Volume, presents the estimated total gallons of storm water discharged through the outfalls that were sampled. These discharge estimates were calculated using the rational method equation. Note that with the 2015 update of the BMP Plan, the figures associated with each storm water outfall were revised, and the catchment areas were recalculated based on updated high resolution LiDAR aerial imagery. The actual drainage area acreage for each outfall is lower than the conservative estimates that were provided in previous annual reports, and results in a more accurate estimation of the total discharge gallons during each storm event.

Table 3: Storm Water Outfall Area and Estimated Total Discharge Volume			
Outfall	**Date**	**Catchment Area (acre)**	**Total Discharge (gallons)**
003	4/09/2016	0.2	3,419
	9/07/2016	0.2	605
	11/10/2016	0.2	642
005.2	5/02/2016	0.6	6,687
	9/07/2016	0.6	776
005.3	4/09/2016	6.8	98,246
	9/07/2016	6.8	14,650
005.4	4/30/2016	1.9	7,655
	9/07/2016	1.9	3,274
005.5	4/08/2016	5.3	13,008
	9/06/2016	5.3	73,260
008	4/08/2016	0.7	2,294
	9/06/2016	0.7	12,903
009	4/08/2016	3.3	10,805
	9/06/2016	3.3	60,817

Table 4, 2016 HGCMC Storm Water Outfall and Receiving Water Results, presents the required monitoring parameters for each outfall and associated receiving water sites. Also provided are the method detection limit (MDL) and method limit (ML) for total recoverable lead, oil and grease, total suspended solids, and total recoverable zinc. As required by Permit Part 1.3.6, if a value is less than the MDL it is reported as less than the numeric value of the MDL, and if a value is less than the ML it is reported as less than the numeric value of the ML.

The results in Table 4 are organized first by the permitted outfall, and then by the date of the sample or observation. The results for the storm water effluent (S) are grouped with the receiving water upstream sites (RU) and downstream sites (RD), as appropriate for each sampling event. Figures showing site locations are included as an attachment to this report. A discussion and evaluation of the results for each outfall and sampling event is provided below.

Table 4: 2016 HGCMC Storm Water Outfall and Receiving Water Results

Outfall	Type *	Site	Date	Time	Flow (gpm)	pH (su)	Hardness (mg/L)	Lead-TR (µg/L)	MDL	ML	Oil & Grease (mg/L)	MDL	ML	TSS (mg/L)	MDL	ML	Zinc-TR (µg/L)	MDL	ML
003	S	527SW	9-Apr	16:10	0.15	7.98	207	22.4	0.1	0.5	<2	2	10	46	5	20	426	2	5
	RD	529SW	9-Apr	16:16		7.84	5500	<0.5	0.1	0.5	<2.1	2.1	10.3	35	5	20	13	2	5
	S	527SW	7-Sep	14:50	0.46	7.74	174	13.5	0.1	0.5	<1.9	1.9	9.3	<5	5	20	54	2	5
	RD	529SW	7-Sep	15:30		7.93	4080	<0.5	0.1	0.5	<1.9	1.9	9.3	<20	5	20	8	2	5
	S	527SW	10-Nov	10:00	2		80	30.1	0.1	0.5	<1.9	1.9	9.3	<20	5	20	74	2	5
004	S	520SW	9-Apr	15:40	No sample taken due to no discharge														
	S	520SW	2-May	15:55	No sample taken due to no discharge														
	RU	532SW	2-May	16:05		5.14	8.9	<0.5	0.1	0.5	<2	2	10	<5	5	20	5	2	5
	RD	524SW	2-May	16:00		5.42	9.9	0.5	0.1	0.5	<2	2	10	<5	5	20	8	2	5
	S	520SW	7-Sep	14:00	No sample taken due to no discharge														
005.2	S	539SW	2-May	14:20	5	4.57	26	5.1	0.1	0.5	<2.1	2.1	10.6	<5	5	20	28	2	5
	RU	371SW	2-May	14:00		7.59	26	<0.5	0.1	0.5	<2	2	10	<5	5	20	16	2	5
	RD	368SW	2-May	14:30		7.45	26	<0.5	0.1	0.5	<2	2	10	<5	5	20	10	2	5
	S	539SW	7-Sep	12:10	1	4.43	41	6.8	0.1	0.5	<1.9	1.9	9.3	<5	5	20	56	2	5
	RU	371SW	7-Sep	12:00		7.92	38	<0.5	0.1	0.5	<9.4	1.9	9.4	<5	5	20	9	2	5
	RD	368SW	7-Sep	12:30		7.55	38	<0.5	0.1	0.5	<1.9	1.9	9.4	<5	5	20	8	2	5
005.3	S	545SW	9-Apr	9:47	10	7.51	360	3.1	0.1	0.5	<10	2	10	<5	5	20	564	2	5
	RU	595SW	9-Apr	13:18	46,200	7.98	55	<0.5	0.1	0.5	<10	2	10	<5	5	20	6	2	5
	RD	591SW	9-Apr	12:23		7.91	54	<0.5	0.1	0.5	<10	2	10	<5	5	20	5	2	5
	S	545SW	30-Apr	14:36	55	7.78	324	151.5	0.1	0.5	<2	2	10.2	218	5	20	976	2	5
	RU	595SW	30-Apr		No sample taken due to unsafe access (bear activity)														
	RD	591SW	30-Apr		No sample taken due to unsafe access (bear activity)														
	S	545SW	7-Sep	11:15	200	7.58	126	2.6	0.1	0.5	<1.9	1.9	9.4	<5	5	20	299	2	5
	RU	595SW	7-Sep	9:50	62,400	7.68	53	0.5	0.1	0.5	<1.9	1.9	9.4	<5	5	20	9	2	5
	RD	591SW	7-Sep	9:30		7.59	54	0.6	0.1	0.5	<1.9	1.9	9.4	<5	5	20	12	2	5
005.4	S	547SW	9-Apr	10:05	No sample taken due to no discharge														
	S	547SW	30-Apr	14:17		7.51	90	<0.1	0.1	0.5	<2	2	10	<5	5	20	<2	2	5
	RU	595SW	30-Apr		No sample taken due to unsafe access (bear activity)														
	RD	591SW	30-Apr		No sample taken due to unsafe access (bear activity)														

Table 4: 2016 HGCMC Storm Water Outfall and Receiving Water Results

Outfall	Type *	Site	Date	Time	Flow (gpm)	pH (su)	Hardness (mg/L)	Lead-TR (µg/L)	MDL	ML	Oil & Grease (mg/L)	MDL	ML	TSS (mg/L)	MDL	ML	Zinc-TR (µg/L)	MDL	ML
005.4	S	547SW	7-Sep	10:55	1	7.45	62	<0.1	0.1	0.5	<1.9	1.9	9.4	<5	5	20	<5	2	5
	RU	595SW	7-Sep	9:50	62,400	7.68	53	0.5	0.1	0.5	<1.9	1.9	9.4	<5	5	20	9	2	5
	RD	591SW	7-Sep	9:30		7.59	54	0.6	0.1	0.5	<1.9	1.9	9.4	<5	5	20	12	2	5
005.5	S	560SW	8-Apr	13:53	6	8.51	375	4340	0.5	3	<10	2	10	2280	100	400	4720	10	30
	RU	6SW	8-Apr	13:33	30,518	7.95	43	<0.5	0.1	0.5	<10	2	10	<5	5	20	10	2	5
	RD	590SW	8-Apr	14:09		8.01	48	0.6	0.1	0.5	<2	2	10	<5	5	20	9	2	5
	S	560SW	6-Sep	10:05	0.26	7.55	253	2390	0.1	0.5	<9.3	1.9	9.3	1210	20	80	3380	2	5
	RU	6SW	6-Sep	10:55	33,660	7.76	46	0.5	0.1	0.5	<1.8	1.8	9.2	<5	5	20	11	2	5
	RD	590SW	6-Sep	10:20		7.78	50	1.1	0.1	0.5	<1.8	1.8	9.2	<5	5	20	14	2	5
006	S	562SW	6-May	12:05	500	7.41	352	373.2	0.1	0.5				201	5	20	1040	2	5
	RU	6SW	6-May	12:25	89,600	7.73	67	5.6	0.1	0.5				72	5	20	45	2	5
	RD	590SW	6-May	13:10		7.58	174	14.7	0.1	0.5				95	5	20	73	2	5
008	S	570SW	8-Apr	11:40	7	7.86	159	<0.5	0.1	0.5				<5	5	20	28	2	5
	RU	1SW	8-Apr	12:12	30,518	7.99	46	<0.5	0.1	0.5				<5	5	20	9	2	5
	RD	6SW	8-Apr	13:33		7.95	43	<0.5	0.1	0.5	<10	2	10	<5	5	20	10	2	5
	S	570SW	6-Sep	13:10	5	7.57	216	<0.5	0.1	0.5				<5	5	20	27	2	5
	RU	1SW	6-Sep	11:15	33,660	7.78	53	0.8	0.1	0.5				<5	5	20	10	2	5
	RD	6SW	6-Sep	10:55		7.76	46	0.5	0.1	0.5	<1.8	1.8	9.2	<5	5	20	11	2	5
009	S	580SW	8-Apr	11:12	10	7.4	119	0.7	0.1	0.5				<5	5	20	936	2	5
	RU	48SW	8-Apr	11:59		7.99	45	<0.5	0.1	0.5				<20	5	20	8	2	5
	RD	1SW	8-Apr	12:12	30,518	7.99	46	<0.5	0.1	0.5				<5	5	20	9	2	5
	S	580SW	6-Sep	12:55	5	7.52	93	0.5	0.1	0.5				<5	5	20	305	2	5
	RU	48SW	6-Sep	11:30		7.8	46	0.6	0.1	0.5				<5	5	20	11	2	5
	RD	1SW	6-Sep	11:15	33,660	7.78	53	0.8	0.1	0.5				<5	5	20	10	2	5

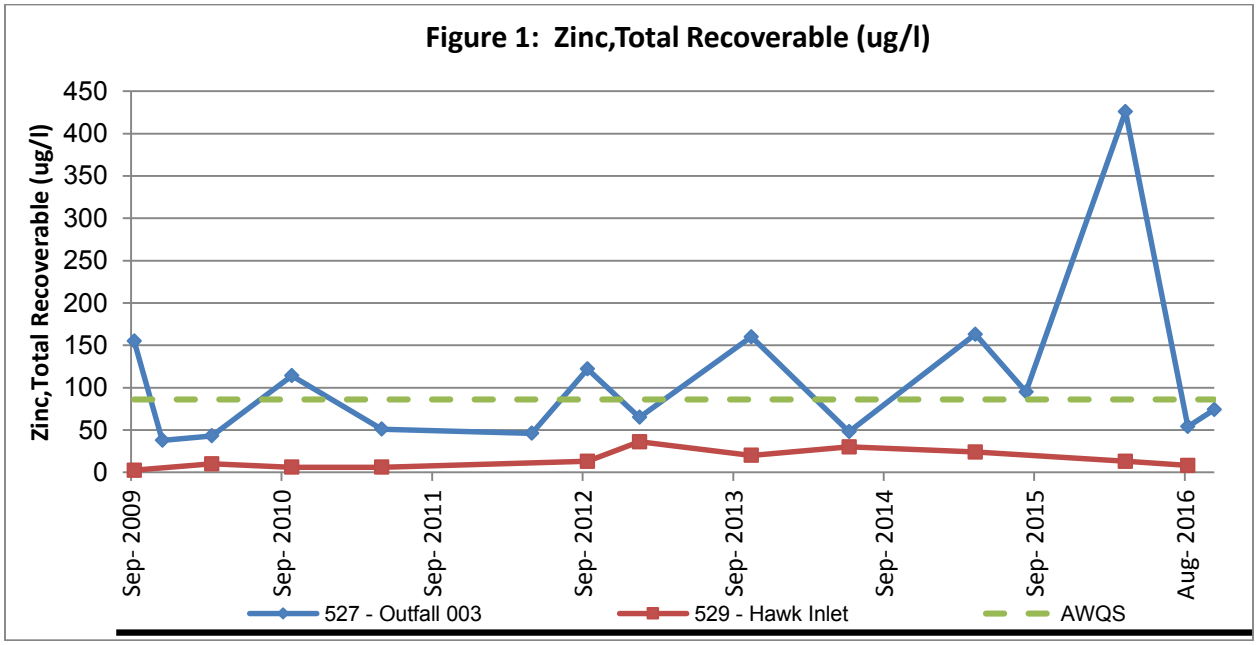
Note * S = Stormwater
RU = Receiving water upstream
RD = Receiving water downstream

4.1 Storm Water Outfall 003 – Hawk Inlet

Outfall 003 is a culvert pipe located adjacent to the North Cannery Building and drains the storm water runoff from a small area approximately 0.2 acres in size. Prior to 2009, this outfall had a larger draiange area encompassing portions of the shift-housing units and included flow from a building foundation drain. The building foundation drain was found to be the primary source of zinc that was historically measured in the storm water monitoring. A shallow caisson and pump system were installed above the culvert inlet to capture the drainage from the housing units and route it to treatment facilities. Since the installation of the pump system, zinc concentrations at the outfall have decreased from an average of over 280 µg/L to approximately 100 µg/L.

Outfall 003 discharges directly into Hawk Inlet, and therefore there is only one associated receiving water monitoring site (Site 529). Routine storm water monitoring for 2016 was performed on April 9 and September 7. An additional sample was collected from the outfall on November 10 when a power outage occurred and the pump system did not operate for about 4 hours. The total recoverable zinc concentration in the April 9 sample was measured at 426 µg/L, which is the highest concentration measured since the pump system was installed. Based on the concentration, it is suspected that a small amount of the foundation drain water may have bypassed the collection system during the storm event.

Comparison of monitoring results from 2009 through 2016 shows there is no correlation between the zinc concentrations in the Outfall 003 discharge and those measured in the Hawk Inlet receiving water (see Figure 1). This is attributed to the low discharge rate through the outfall and the immense dilution volume of Hawk Inlet. While the storm water periodically exceeds the Alaska Water Quality Standards for marine water, the zinc concentration in Hawk Inlet is well below the chronic aquatic life criteria of 86 µg/L. HGCMC plans to improve the collection and pump system at the outfall in 2017 with a goal of reducing the zinc concentration in the discharge.



4.2 Storm Water Outfall 004 – Pit 7

Outfall 004 is located downgradient of a constructed wetlands that receives runoff from Pit 7, which is a former rock quarry and current reclamation material storage pile. Flow has not been observed at this outfall during storm events since 2012, and there was no flow observed during the 2016 storm event monitoring. It was observed during two storm events in the spring, on April 9 and May 2, and during the fall storm event monitoring on September 7.

As required by the re-issued APDES Permit, HGCMC established a new up-gradient receiving water monitoring site (Site 532) for comparison with the existing downgradient site (Site 524) that was established in 2005. Outfall 004 was not sampled in 2016 due to no observed discharge. However, during the May 2 storm event HGCMC collected receiving water samples from both the upstream and downstream sites. This was done to begin establishing a data set for the new upstream site. The results from these samples are provided in Table 4 and show that there was a slight increase in total recoverable zinc. It is worth noting that the 8 µg/L of zinc is the lowest measured at the downstream Site 524.

4.3 Storm Water Outfall 005.2 – Zinc Creek Bridge

Outfall 005.2 is located near the bottom of the north abutment, upstream side, of the Zinc Creek Bridge. The drainage area for this outfall is approximately 0.6 acres in size, and captures runoff from a short section of road and a portion of the abutment. Receiving water monitoring is performed at Site 371 (upstream) and Site 368 (downstream) in Zinc Creek.

Storm event monitoring for 2016 was performed on May 2 and September 7. The results in Table 4 show that the storm water effluent is weakly acidic and contains detectable concentrations of lead and zinc. The receiving water samples showed no measureable change in lead concentration and the zinc concentrations were actually lower at the downstream site than at the upstream site during both monitoring events. This demonstrates that the low volume of storm water runoff through this outfall is not having an adverse impact on the water quality of Zinc Creek.

4.4 Storm Water Outfall 005.3 – Site E

Outfall 005.3 is located in a small drainage that runs between the B-Road and inactive waste rock Site E. The drainage area contributing to the outfall location is approximately 6.8 acres. The drainage flows into Greens Creek approximately one-half mile from the outfall location. Receiving water monitoring is performed in Greens Creek at newly established Site 595 (upstream) and Site 591 (downstream) that was established in 2005.

Water quality at the outfall is influenced by the Site E waste rock and has exhibited highly variable lead and zinc concentrations throughout its monitoring history, including in 2016. Outfall 005.3 was sampled two times in conjunction with the receiving water sites, on April 9 and September 7. An additional sample was collected during an April 30 storm event while sampling Outfall 005.4, which is located in the same drainage up-gradient from Outfall 005.3. The same receiving water

sites apply to both outfalls, but the receiving water sites were not able to be sampled on April 30 due to bear activity near the trail. The April 30 sample showed the highest lead and zinc concentrations of the three sampling events. The results from the April 9 storm event did not show any influence on the receiving water quality. During the September 7 storm event there was a slight, but measurable, increase in the lead and zinc concentrations at the downstream Site 591. The concentrations in Greens Creek were well below the Alaska Water Quality Standards.

In 2008, HGCMC initiated a program of removing Site E waste rock for co-disposal in the tailings facility. Through 2015, over 120,000 cubic yards of material have been removed. The water quality at Outfall 005.3 is expected to show gradual improvement as the waste rock removal activities progress.

4.5 Storm Water Outfall 005.4 – Pit 6

Outfall 005.4 is the discharge location for runoff from a reclamation material storage area in an old road construction quarry called Pit 6. The catchment area draining to the outfall is approximately 0.9 acres in size. There has been no activity in Pit 6 since 2009 and the area is stabilized and vegetated. Storm water runoff flows into Greens Creek approximately one-half mile from the outfall location. Receiving water monitoring is performed in Greens Creek at newly established Site 595 (upstream) and Site 591 (downstream) that was established in 2005.

Storm event monitoring for 2016 was performed on April 30 and September 7. However, the receiving water was not sampled on April 30 due to bear activity on the trail. Water quality at Outfall 005.4 is excellent, with lead and zinc concentrations consistently near or below detection limits for the past several years.

4.6 Storm Water Outfall 005.5 – 7.8 Mile B-Road Culvert

Outfall 005.5 is a culvert that drains a portion of the B-Road surface near mile 7.8. The catchment area draining to the culvert is approximately 5.3 acres, most of which is undisturbed forest on the uphill side of the road. Discharge from the culvert is to a forested hillside, approximately 200 feet from Greens Creek. Flows through the culvert during storm event monitoring since 2005 have been low and typically less than 10 gpm. As a result, the drainage infiltrates into the forest duff and a point source discharge to Greens Creek has not been observed.

Access to this section of Greens Creek below the culvert is challenging, particularly during storm events. Therefore, the sites for the upstream and downstream receiving water monitoring were chosen to address safety concerns while also satisfying the intent of the Permit. Site 6, which is also sampled on a monthly basis under the Fresh Water Monitoring Program (FWMP), was selected as the upstream receiving water site. Site 590, located below mile 7.6, was selected as the downstream site.

Storm event monitoring for 2016 was performed on April 8 and September 6. As shown in Table 4, the outfall samples contained high concentrations of lead, zinc and total suspended solids due

to the road runoff. However, the receiving water samples on April 8 showed a slight decrease in the total recoverable zinc concentrations between the upstream and downstream sites, indicating that the storm water discharge was not impacting Greens Creek. For the September 6 storm event, there was a slight increase in both lead and zinc between the upstream and downstream sites. However, there was a lesser load of lead and zinc in the culvert discharge (i.e., lower flow and lower concentrations) compared to the April sample, and the Greens Creek flows were higher during the September event at 75 cfs versus 68 cfs as measured at the 920 weir. Based on the flows and concentrations measured at the outfall and in Greens Creek, the outfall accounted for only 3 percent of the increased lead load and 0.8 percent of the increased zinc load between the upstream and downstream sites during the September event. This suggests that there are additional sources of loading between the upstream and downstream sites to account for the slight increase in Greens Creek. Lead and zinc concentrations in Greens Creek were below the Alaska Water Quality Standards during both storm events as calculated based on the hardness at the upstream site.

Although the storm water discharge at Outfall 005.5 is having minimal impact on Greens Creek, HGCMC acknowledges that additional measures are needed to improve the quality and reduce the loading to the environment from this section of the road. Methods to improve the BMPs at this outfall will be evaluated in 2017.

4.7 Storm Water Outfall 006 – Pond D Overflow

As discussed in Section 2 above, the high flow electric pump in Pond D failed during a large storm event on May 6 resulting in a discharge of approximately 300,000 gallons over a 13.5 hour period. This event was immediately reported to ADEC as a notice of non-compliance. The results from samples collected during the event show that there was a substantial increase in lead and zinc concentrations between the upstream monitoring site (Site 6) and the downstream monitoring site (Site 590). Loading calculations show that the storm water discharge accounted for a large percentage of the increase. The pump in Pond D was repaired and there were no other discharges through Outfall 006 in 2016. The pumps in Pond D will be on a schedule for routine periodic maintenance to reduce the potential for future upsets.

4.8 Storm Water Outfall 007 – Pond C Overflow

There were no storm water discharges through Outfall 007 in 2016, and therefore no samples were collected. If a discharge were to occur in the future, receiving water monitoring in Greens Creek would be performed at Site 1, located at the 920 weir, for the upstream site and at Site 6 for the downstream site.

4.8 Storm Water Outfall 008 – 960 Site

Outfall 008 is the discharge location for runoff from a former waste rock storage pile placed during initial development of the 920 mine portal. The majority of the waste rock was removed in 2005

and only a small quantity remains that is in the road prism for the 1350 Site access road. The catchment area contributing runoff to the outfall is approximately 0.7 acres. Since removal of the waste rock material the water quality at the outfall has consistently met the Alaska Water Quality Standards for lead and zinc.

Storm event monitoring for 2016 was performed on April 8 and September 6. Receiving water monitoring was performed in Greens Creek at Site 1 (upstream) and Site 6 (downstream).

4.10 Storm Water Outfall 009 – 1350 Site

Outfall 009 monitors the runoff quality from an inactive waste rock pile that was placed during the development of the 1350 adit. Between 2005 and 2015, over 80 percent of the waste rock was removed for disposal in the underground mine. The catchment area contributing runoff to the outfall is approximately 3.3 acres in size. Receiving water monitoring is performed in Greens Creek at Site 48 (upstream) and Site 1 (downstream). Site 48, also sampled monthly as part of the FWMP, is located upstream of all mining activity and represents natural background quality for Greens Creek.

Storm event monitoring for 2016 was performed on April 8 and September 6. The zinc concentration in the storm water runoff was elevated in the April sample, with the source of the zinc being the remaining waste rock near the 1350 adit. During the summer of 2016, HGCMC installed a collection trench and pump system to intercept runoff from the waste rock and route it to treatment facilities. The pump system became operational on September 1 and a substantial reduction in the zinc concentration was measured in the September 6 storm event monitoring.

Storm event monitoring has been performed at Outfall 009 since 1998. Throughout its history the flows have always been low, and consequently the runoff has not shown a significant impact on Greens Creek. Nonetheless, HGCMC will continue to collect the runoff from the remaining waste rock for as long as necessary to protect the water quality at the storm water outfall.

5.0 Certification

Fulfillment of requirements set forth in Permit AK-0043206 are met with the above report, the inspections and evaluations for 2016, and the BMP plan.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Christopher Wallace
Environmental Affairs Manager
Hecla Greens Creek Mining Company

Photographs

PHOTO 1. Corrective action implemented to capture storm water runoff at the Hawk Inlet barge ramp.

PHOTO 2. Rip-rap armored storm water conveyance channel and settling basin at Pit 7.

PHOTO 3. Zinc Creek Bridge BMPs during rain event.

PHOTO 4. Settling sump at 3.1 Mile B-Road before modification.

PHOTO 5. Modified settling sump at 3.1 Mile B-Road.

PHOTO 6. Outlet of modified settling sump at 3.1 Mile B-Road.

PHOTO 7. Sediment removal and BMPs beneath Falls Creek Bridge (3.4 Mile).

PHOTO 8. New liner in storm water collection pond at Site E.

PHOTO 9. Removing accumulated sediment from Upper Pond C.

PHOTO 10. Trench and pump system for runoff collection at 1350 Site

PHOTO 11. Installing new liner in modified Pond 23.

PHOTO 12. Repairing damaged section of concrete road below ore pad hill.

SITE SPECIFIC BEST MANAGEMENT PRACTICES
APDES OUTFALL 003 HAWK INLET FACILITIES

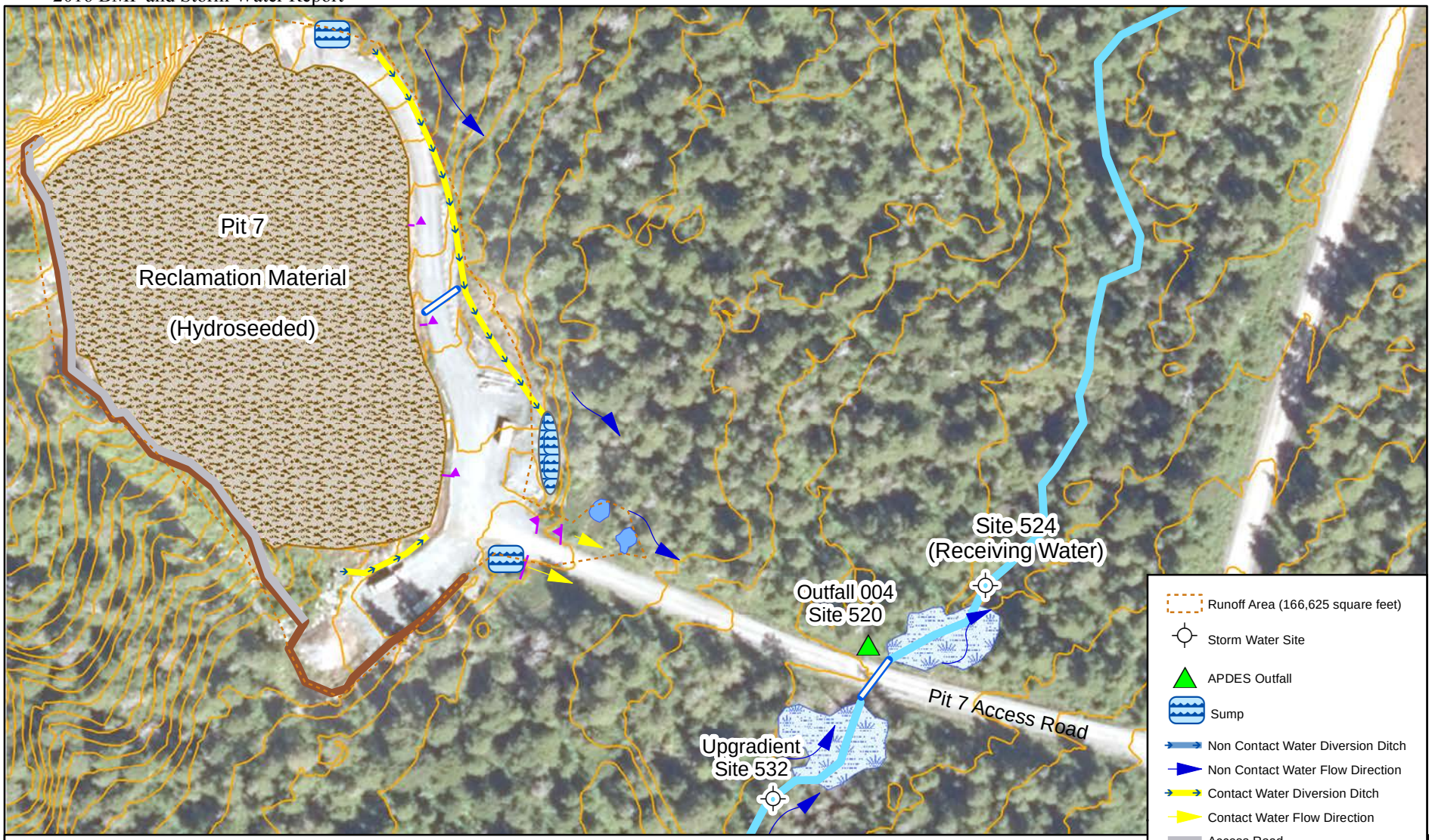
Hecla GREENS CREEK

N

0 100 200 300 400
Feet

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.

- Runoff Area (8646 square feet)
- APDES Outfall
- Pump Station
- Spill Kit
- SD Storm Drain
- Sump
- Stormwater Diversion Berm
- Pipeline to WTP
- Road Contact Water Ditch
- Road Contact Water Flow Direction
- Culvert
- Non Contact Flow Direction
- Non Contact Water Ditch
- Fuel Pipeline
- Diesel Tank
- RoadLines
- Propane Tank
- Gasoline Tank
- Oil Tanks
- Storm Water Tank
- Potable Water Tank
- Dock Facility
- Facility Building
- Housing
- Sea Van (Connex)
- Degrit Basin
- Transformer
- Containment



SITE SPECIFIC BEST MANAGEMENT PRACTICES
APDES OUTFALL 004 - PIT 7 ON 'A' ROAD

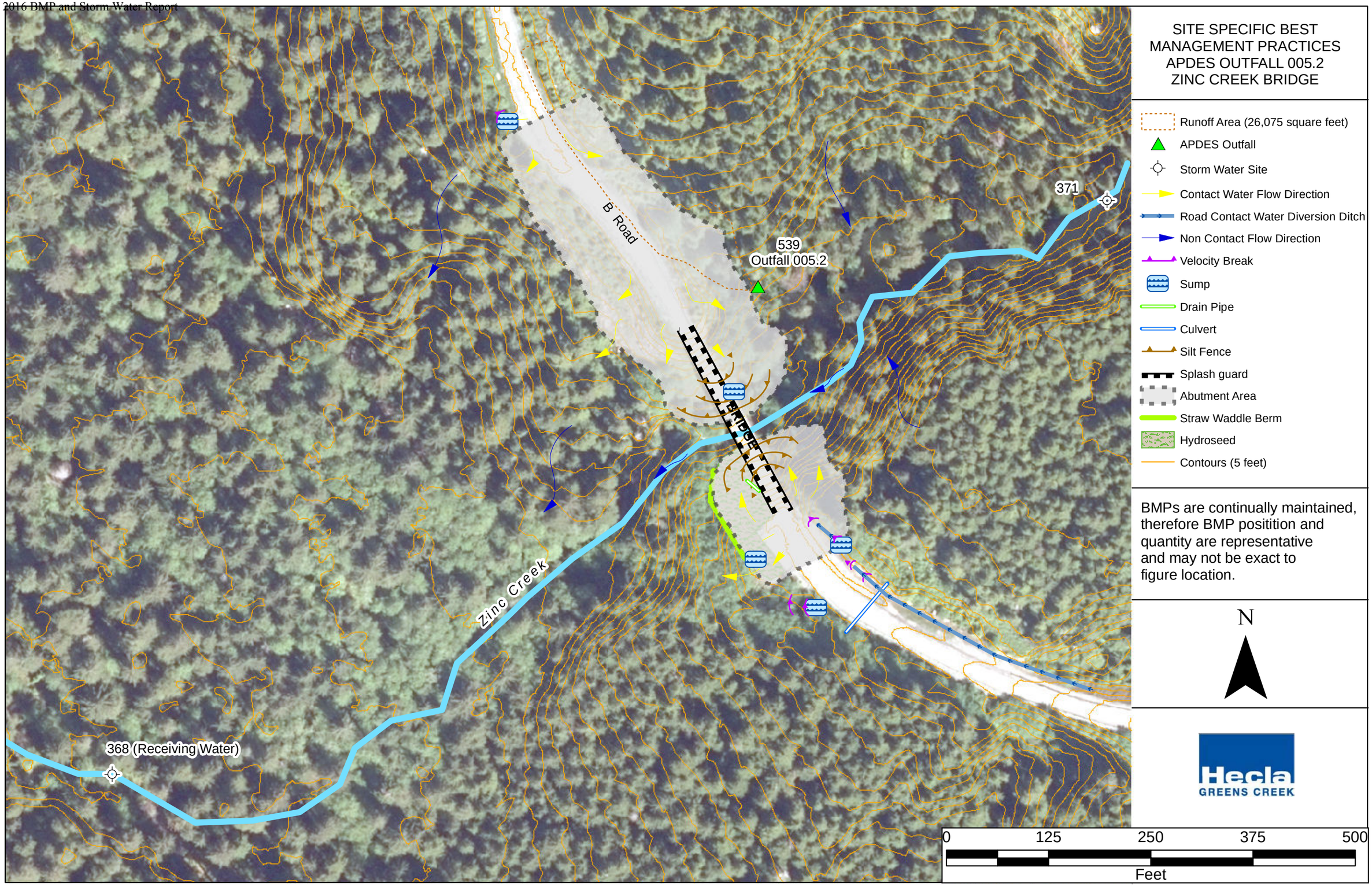
Hecla GREENS CREEK

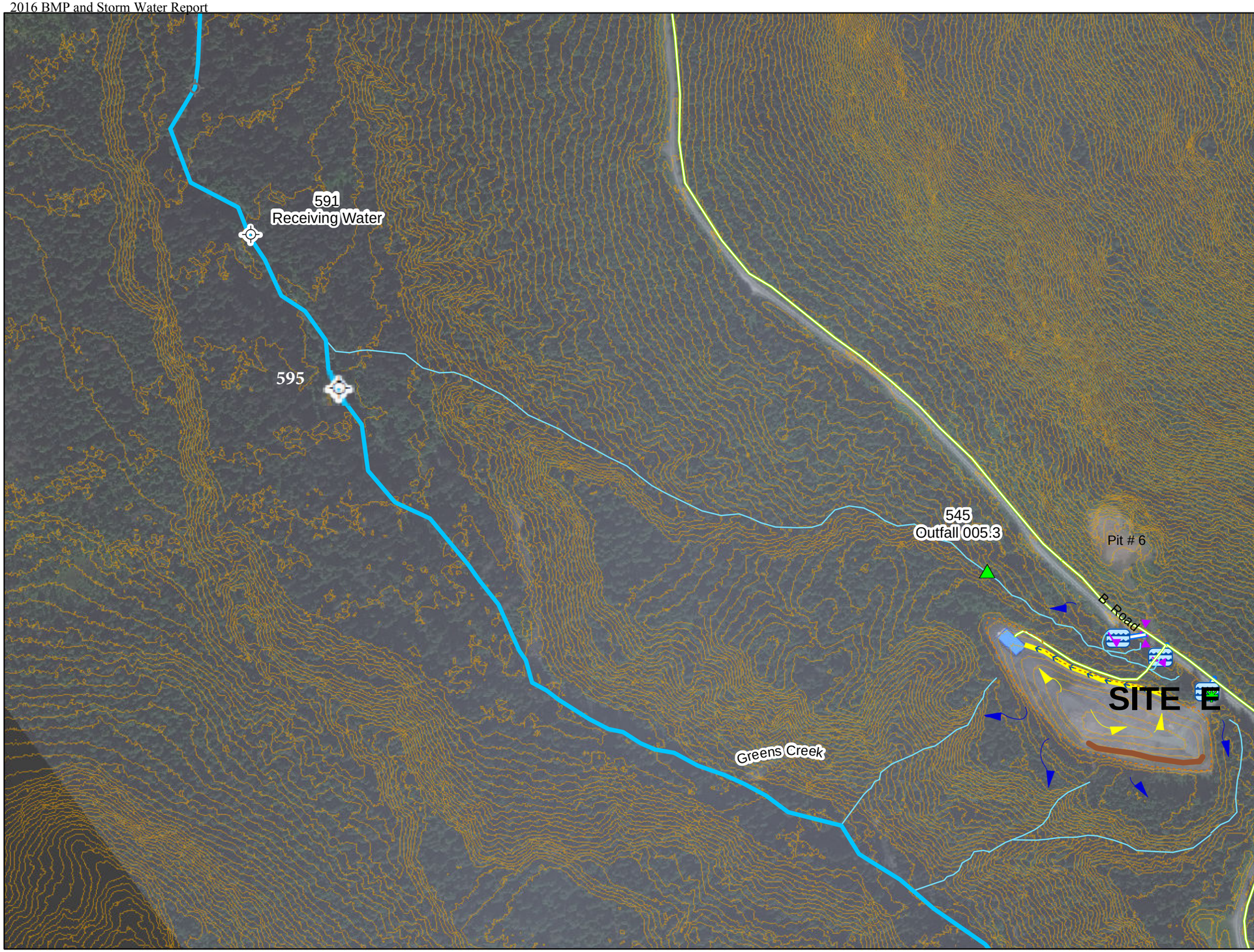
0 125 250 375 500
Feet

N

- Runoff Area (166,625 square feet)
- Storm Water Site
- APDES Outfall
- Sump
- Non Contact Water Diversion Ditch
- Non Contact Water Flow Direction
- Contact Water Diversion Ditch
- Contact Water Flow Direction
- Access Road
- Berm
- Culvert
- Pit 7 Creek
- Velocity Break
- Pond
- Reclamation Material (Hydroseed)
- Wetland
- Contours (5 feet)

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.


SITE SPECIFIC BEST MANAGEMENT PRACTICES
APDES OUTFALL 005.2
ZINC CREEK BRIDGE
Runoff Area (26,075 square feet)
APDES Outfall
Storm Water Site
Contact Water Flow Direction
Road Contact Water Diversion Ditch
Non Contact Flow Direction
Velocity Break
Sump
Drain Pipe
Culvert
Silt Fence
Splash guard
Abutment Area
Straw Waddle Berm
Hydroseed
Contours (5 feet)
BMPs are continually maintained, therefore BMP positition and quantity are representative and may not be exact to figure location.
N
Hecla
GREENS CREEK
0
125
250
375
500
Feet
B Road
539
Outfall 005.2
371
BRIDGE
Zinc Creek
368 (Receiving Water)



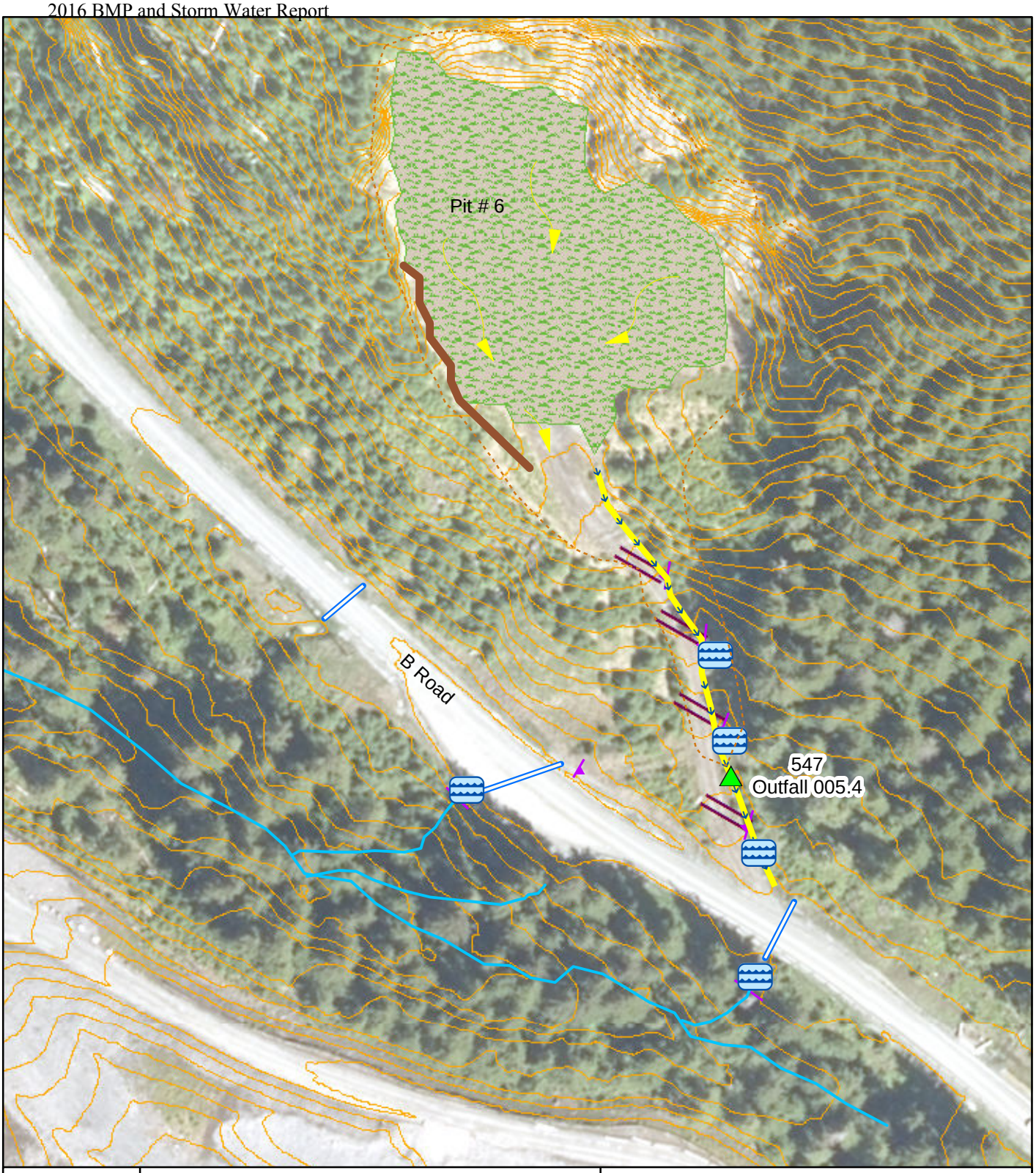
SITE SPECIFIC BEST MANAGEMENT PRACTICES APDES OUTFALL 005.3 - SITE E WASTE ROCK

- Runoff Area (298,200 sq feet)
- APDES Sample Site
- Stormwater Site
- Effluent Pipeline to WTP
- Contact Water Ditch
- Contact Flow Direction
- Non Contact Flow Direction
- Greens Creek
- Drainage
- Berm
- Velocity Break
- Spill Response
- Sump
- Culvert
- Contours (10 feet)

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.

N

Hecla GREENS CREEK



N

SITE SPECIFIC BEST MANAGEMENT PRACTICES APDES OUTFALL 005.4 - PIT 6

Hecla GREENS CREEK

0 75 150 225 300
Feet

Runoff Area (83,167)
Water Bar
APDES Outfall
Sump
Berm
Contact Water Diversion Ditch
Contact Water Flow Direction
Non Contact Water Flow Direction
Culvert
Drainage
Velocity Break
Hydroseed

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.

SITE SPECIFIC BEST MANAGEMENT PRACTICES APDES OUTFALL 005.5 - CULVERT AT 7.8 MILE 'B' ROAD

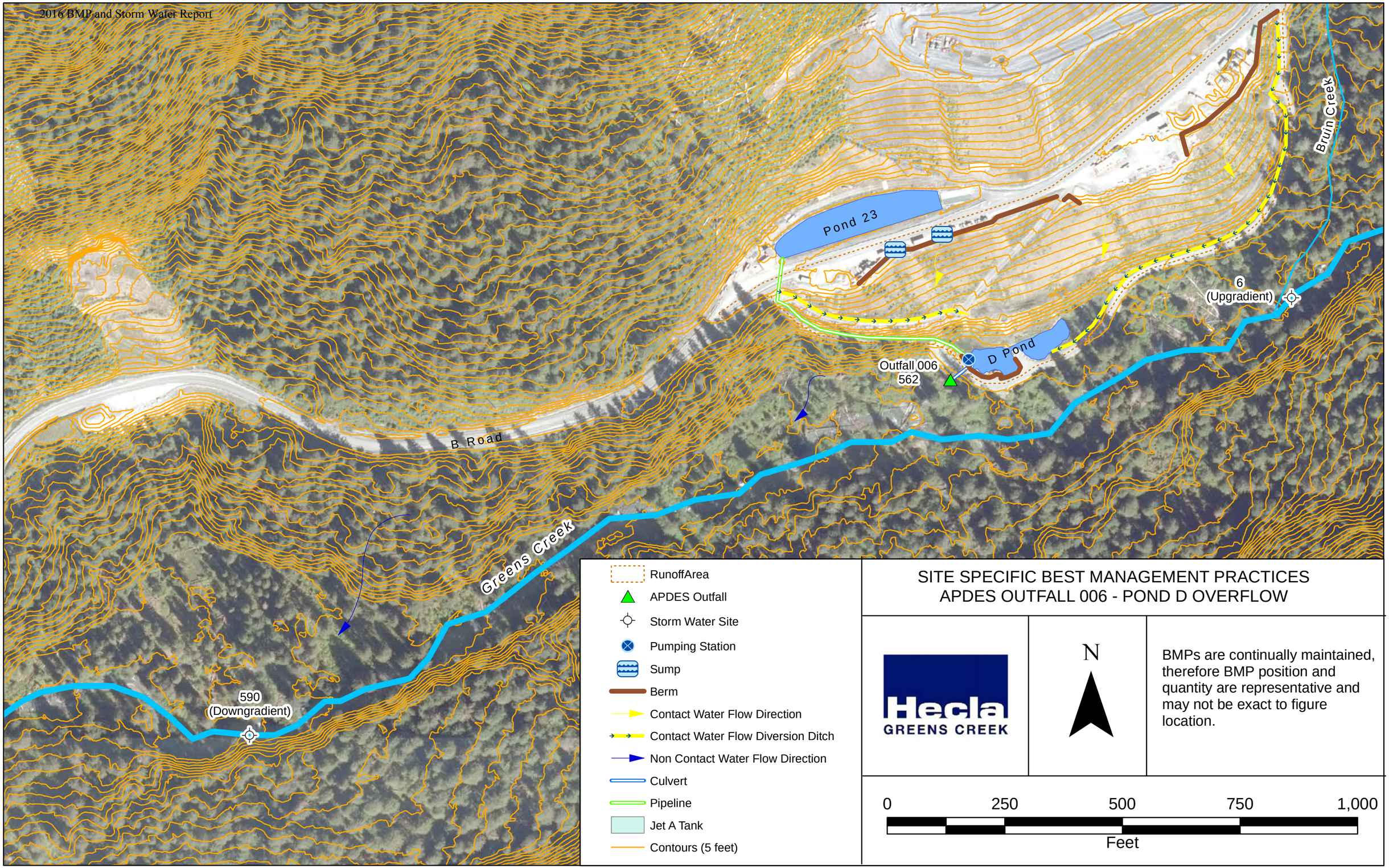
- Runoff Area (229,059 square feet)
- APDES Outfall
- Storm Water Site
- Sump
- Road Contact Water Flow Direction
- Road Contact Water Diversion Ditch
- Non Contact Water Flow Direction
- Culvert
- Velocity Break
- Contours (5 feet)

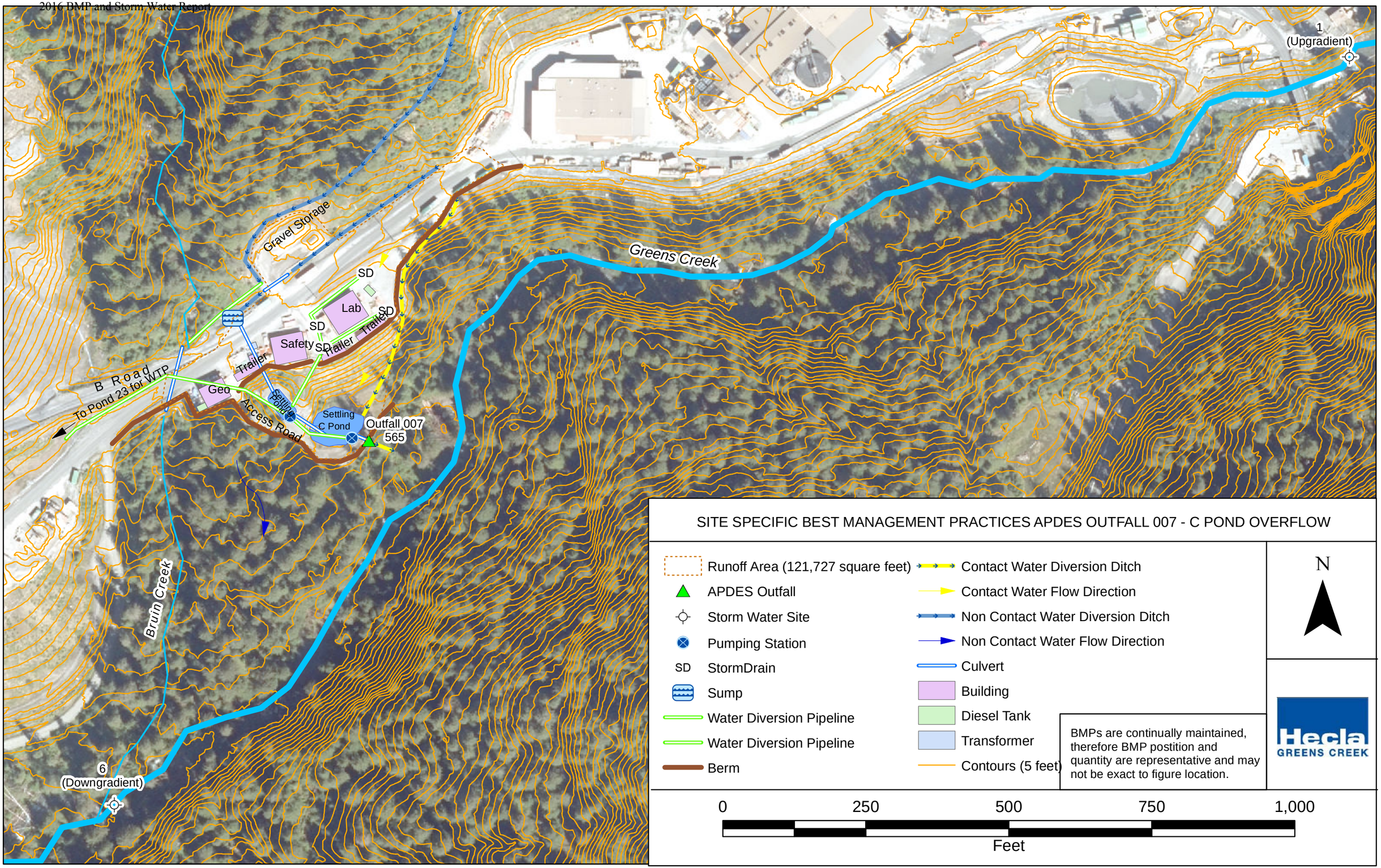
BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.

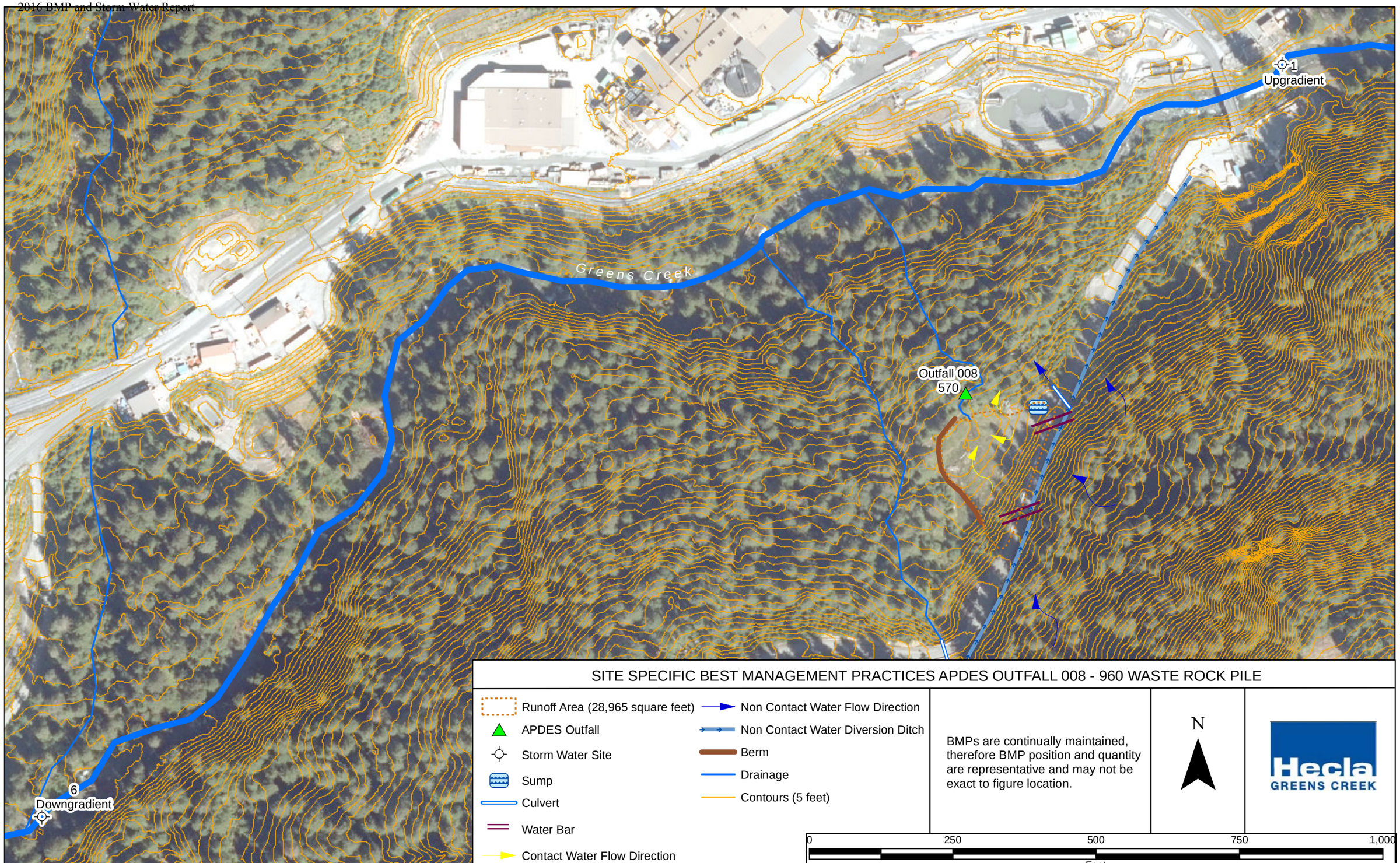
0 125 250 375 500
Feet

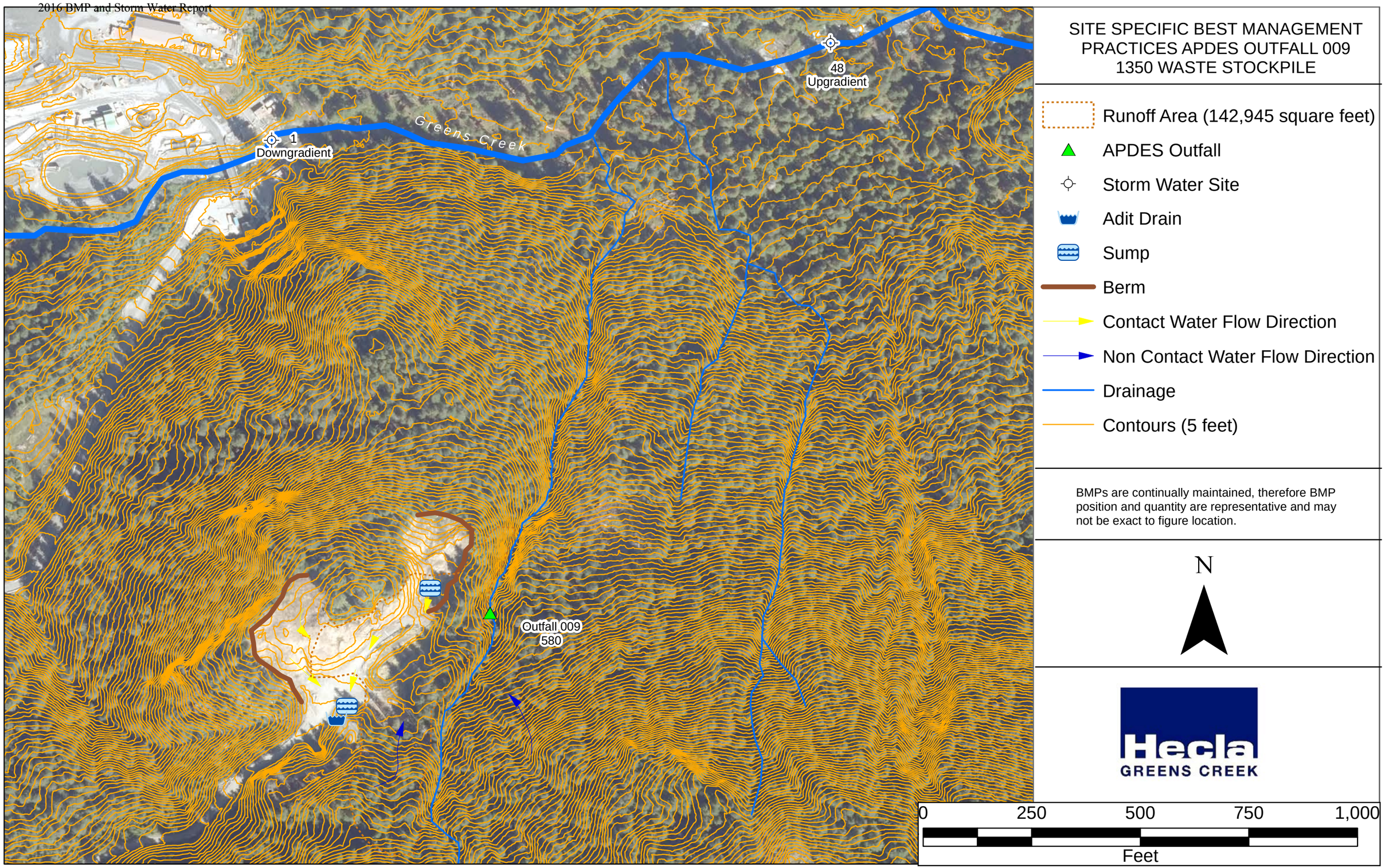
N

Hecla GREENS CREEK


Pond 23
D Pond
Outfall 006
562
6
(Upgradient)
590
(Downgradient)
B Road
Greens Creek
Bruin Creek
RunoffArea
APDES Outfall
Storm Water Site
Pumping Station
Sump
Berm
Contact Water Flow Direction
Contact Water Flow Diversion Ditch
Non Contact Water Flow Direction
Culvert
Pipeline
Jet A Tank
Contours (5 feet)
SITE SPECIFIC BEST MANAGEMENT PRACTICES
APDES OUTFALL 006 - POND D OVERFLOW
Hecla
GREENS CREEK
N
BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
0
250
500
750
1,000
Feet


SITE SPECIFIC BEST MANAGEMENT PRACTICES APDES OUTFALL 007 - C POND OVERFLOW
Runoff Area (121,727 square feet)
APDES Outfall
Storm Water Site
Pumping Station
SD StormDrain
Sump
Water Diversion Pipeline
Water Diversion Pipeline
Berm
Contact Water Diversion Ditch
Contact Water Flow Direction
Non Contact Water Diversion Ditch
Non Contact Water Flow Direction
Culvert
Building
Diesel Tank
Transformer
Contours (5 feet)
BMPs are continually maintained, therefore BMP postition and quantity are representative and may not be exact to figure location.
N
Hecla GREENS CREEK
0
250
500
750
1,000
Feet
1 (Upgradient)
6 (Downgradient)
Greens Creek
Bruin Creek
Gravel Storage
SD
Lab
Trailer
Safety
Geo
B Road
To Pond 23 for WTP
Access Road
Settling Pond
Settling C Pond
Outfall 007
565


1
Upgradient
Greens Creek
Outfall 008
570
6
Downgradient
SITE SPECIFIC BEST MANAGEMENT PRACTICES APDES OUTFALL 008 - 960 WASTE ROCK PILE
Runoff Area (28,965 square feet)
APDES Outfall
Storm Water Site
Sump
Culvert
Water Bar
Contact Water Flow Direction
Non Contact Water Flow Direction
Non Contact Water Diversion Ditch
Berm
Drainage
Contours (5 feet)
BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
N
Hecla
GREENS CREEK
0
250
500
750
1,000
Feet


SITE SPECIFIC BEST MANAGEMENT PRACTICES APDES OUTFALL 009
1350 WASTE STOCKPILE
Runoff Area (142,945 square feet)
APDES Outfall
Storm Water Site
Adit Drain
Sump
Berm
Contact Water Flow Direction
Non Contact Water Flow Direction
Drainage
Contours (5 feet)
BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
N
Hecla
GREENS CREEK
0
250
500
750
1,000
Feet
Greens Creek
1
Downgradient
48
Upgradient
Outfall 009
580