

**State of Nevada  
Division of State Lands**

**WATER QUALITY AND EROSION CONTROL  
GRANT APPLICATION**

for

***Marla Bay Water Quality Improvement Project***

***EIPNo.01.01.01.0154***

Submitted:  
January 29, 2021

**Prepared by:**

Nevada Tahoe Conservation District  
400 Dorla Ct, PO Box 915  
Zephyr Cove, NV 89448

## 1 Project Schedule

The proposed schedule provided in Table 1 for the Marla Bay Water Quality Improvement Project (Project) is based on funding being available by March 1, 2021. Dates for subtask indicated completion month and year.

**Table 1. Proposed Project Schedule**

<b>Project Phases and Tasks</b>	<b>Dates</b>
<b>Project Scoping and Funding</b>	<b>January 2021 – March 2021</b>
<b>Planning</b>	<b>March 2021 – March 2022</b>
Surveying & Mapping	June 2021
Existing Conditions, Public Scoping, and Alternatives Analysis	August 2021
Easement Acquisition and Access Agreements	August 2021
Regulatory Compliance & Permitting	February 2022
<b>Design</b>	<b>March 2021 – April 2022</b>
50% Design	October 2021
90% Design	December 2021
Construction Plans, Specifications, & Estimates (100%)	February 2022
Advertise and Bid	March 2022
<b>Construction</b>	<b>June 2022-October 2022</b>
Construction	October 2022
Construction Management	November 2022
<b>Project Management/Coordination</b>	<b>March 2021 – March 2023</b>
TAC Meeting and Facilitation	October 2022
Project Closeout	March 2023

## 2 Project Participants

The following list identifies anticipated project partners (individuals and organizations) and their project roles.

### 2.1 Project Partners

- Meghan Kelly, P.E., Nevada Tahoe Conservation District – Project Proponent and Manager
- Chris Holman and Devin Cartwright, Nevada Department of Transportation – Funder and Improvement Maintainer
- Pinewild HOA – Improvement Owner/Maintainer
- Marla Bay GID – Improvement Owner/Maintainer
- Zephyr Heights GID – Improvement Owner/Maintainer
- Bourne Meadows Private Property Owner – Conservation Easement Donor

- Courtney Walker, Douglas County Stormwater Program – TMDL Catchment Registration/Local Jurisdiction
- Chris LaCasse, Nevada Division of State Lands (NDSL) - Funding Partner, Possible Conservation Easement Recipient
- Jason Kuchnicki, Nevada Division of Environmental Protection (NDEP) - TAC Member
- Shannon Friedman, Tahoe Regional Planning Agency (TRPA) - TAC Member
- Jack Landy, Environmental Protection Agency (USEPA) – TAC Member and potential funder

### **3 Project Summary**

#### **3.1 Project Description**

Marla Bay and PineWild are highly constrained neighborhoods that surround Marla Bay on the southeast shore of Lake Tahoe. Both neighborhoods receive "run-on" from US-50 and upstream neighborhoods (Zephyr Heights). This project seeks to partner with NDOT, Douglas County, PineWild HOA, Zephyr Heights GID, Marla Bay GID, and a private landowner in Bourne Meadows to re-route much of the upland runoff to Bourne Meadows for treatment prior to discharging to Lake Tahoe. The overflow has also impacted McFaul Creek, and solutions for creek restoration for up to 1,000 feet of channel will be evaluated and implemented. Project may include treatment vaults, infiltration basins, and channel restoration. Project will work cooperatively with the NDOT Resurfacing, Restoration, and Rehabilitation (3R) Project on US-50 that is slated to occur in 2023.

The Nevada Tahoe Conservation District, NDOT, and Douglas County have been meeting with representatives from Marla Bay GID, PineWild HOA, and Zephyr Heights GID over the last 8 years in response to various drainage issues. Because the lakefront communities of PineWild and Marla Bay are spaced constrained with limited open parcels, NTCD reached out to the property owner at Bourne Meadows to discuss the possibility of a larger treatment option on that property. The property owner was receptive to the treatment and other treatments to improve the health of the meadow and McFaul Creek on his property. Other smaller opportunities exist within each neighborhood for stormwater source control and quantity reduction and those will also be evaluated during this project. The Project proposes to install an infiltration basin to treat runoff within the 98-acre watershed, retrofit existing infrastructure to reduce the quantity of stormwater downstream, and restore a portion of Bourne Meadows and McFaul Creek to promote groundwater recharge, water quality, and climate resilience.

#### **3.2 Project Background**

PineWild was developed as a condominium complex in 1971. At the time a small basin was installed at the south end of the property to collect stormwater. This basin is sited within 50 feet of McFaul Creek and suffers from poor drainage and design characteristics. It is also unsuited to treat both HOA runoff and upland runoff which includes US-50 and Zephyr Heights.

Streets in Marla Bay GID that are in the primary runoff flow path were retrofit with a series of large vaults that flow to a distinct outfall during a previous project. The vaults were not sized to take runoff upstream from Marla Bay and do not drain. Additionally, a small ditch that frequently overtops from the Marla Bay property line onto PineWild property delivers upstream runoff directly to Lake Tahoe (Attachment B, Photo Set 3).

Bourne Meadows is a historical and iconic meadow in the Lake Tahoe Basin (featured in the opening credits of the TV show “Bonanza”). For the past few decades, it was used as a home for thoroughbred horses. McFaul Creek historically ran closer to the center of the meadow but was likely realigned to increase the usable space in the meadow sometime in the early 1900s. US-50 is at its low point in the watershed at the Bourne Meadows location and there are numerous stormwater outfalls present just uphill of McFaul Creek. The creek itself is ephemeral thanks to a private lake upstream at the “Tranquility Estate,” but it is incised and disconnected from the surrounding meadow. Potential exists to reconnect the creek with its floodplain now that horses no longer occupy the meadow.

Zephyr Heights was primarily developed in the mid-1970s. The neighborhood and streets are steep and the stormwater collection system is undersized and outdated. There is no final treatment provided for any stormwater collected and so stormwater comingles with US-50 runoff before flowing across to Bourne Meadows, PineWild, and Marla Bay.

Full hydrology and an analysis of treatment opportunities within these neighborhoods was completed in 2019 and is included in Attachment C.

### **3.3 Project Priority**

Like much of Lake Tahoe, Marla Bay has seen a decline in nearshore water quality over the past few decades. Runoff from the Project area is directly connected to Lake Tahoe as it either flows into McFaul Creek and then to the Lake or flows directly the Lake through Marla Bay and Pinewild. The Project is also a high priority as preliminary analyses have shown a Lake Clarity Credit potential of 15 credits for NDOT and 37.5 credits for Douglas County. Simply constructing the Basin on Bourne Meadows should result in at least 18 credits in the area. If addition work is done to retrofit stormwater collection assets within Zephyr Heights, Marla Bay GID, and PineWild HOA, an additional 34 credits in the area are possible.

## **4 Conceptual Project Goals, Objectives, and Anticipated Results**

The Goal of the Marla Bay WQIP is to reduce the delivery of fine sediment to Lake Tahoe through implementation of area-wide stormwater treatments, creek and meadow restoration, and retrofit of outdated stormwater assets. Specific objectives are presented below.

1. Design and construct a ¼ acre infiltration basin within a conservation easement on APN 1318-15-101-009 that collects and treats the majority of runoff from a 40-acre sub watershed.
2. Design and construct innovative stormwater treatments and retrofits that treat stormwater from the remaining 58 acres of the watershed.



3. Work collaboratively with the NDOT US-50 3R project throughout Project design and install the Project prior to implementation of the 2023 3R project.
4. Work cooperatively with all project partners to ensure successful and sustainable stormwater management solutions.

## 5 Operations and Maintenance

Maintenance responsibilities are dependent on land ownership. All project participants will maintain the project facilities in a functioning condition for a minimum of 20 years after construction. NDOT will maintain the proposed basin on APN 1318-15-101-009 through a maintenance and access agreement with the easement holder of the conservation easement. PineWild HOA, Zephyr Heights GID, and Marla Bay GID will maintain any assets installed within their jurisdictional boundary. Douglas County will coordinate with these entities for the Lake Clarity Crediting Program. Facilities with a lifespan of more than 20 years will be maintained for the life of the facility by the entities discussed above. Inspection and maintenance schedules will be based on Best Management Practices Rapid Assessment Method (BMP RAM) requirements developed for the Lake Clarity Crediting Program. This includes annual inspection (and cleaning, as necessary) of all stormwater treatment facilities registered as part of the Marla Bay WQIP.

Development of the final Operations and Maintenance Plan will occur during the design phase of the project and be uploaded to Lake Tahoe Info Stormwater Tools (<https://stormwater.laketahoeinfo.org/>) with the project registration. This includes establishment of benchmark and threshold values for each registered treatment facility and entry of the treatment BMP data into the Lake Tahoe Info Stormwater Tools online database. Project registration is proposed to occur after the implementation of the planned 3R project. After registration, and on an annual basis, all inspection, operation, and maintenance data required by the Lake Clarity Crediting Program will be uploaded into Lake Tahoe Info Stormwater Tools, and any noteworthy issues will be summarized in NDOT's or Douglas County's annual stormwater reports.

## 6 Cost Estimate

A preliminary cost estimate based on conceptual improvements is provided in Tables 2, 3, and 4. The estimate includes anticipated costs for the planning, design, construction, and construction management activities required to implement Marla Bay WQIP. Costs for planning and design are based on NTCD's past project experience while construction costs are based on recent bid estimates. Match funding is being provided by NDOT for construction of the planned basin at Bourne Meadows. All costs are preliminary and subject to change as the project is developed.

**Table 2. Preliminary Estimate of Planning, Design, and Construction Costs**

Project Phases and Tasks	Estimated Cost
<b>Planning</b>	<b>\$100,000</b>
Surveying & Mapping	\$15,000
Existing Conditions, Public Scoping, and Alternatives Analysis	\$30,000
Easement Acquisition and Access	\$25,000

Regulatory Compliance & Permitting	\$30,000
<b>Design</b>	<b>\$80,000</b>
50% Design	\$25,000
90% Design	\$25,000
Construction Plans, Specifications, & Estimates (100%)	\$25,000
Advertise and Bid	\$5,000
<b>Construction</b>	<b>\$485,000</b>
Construction	\$473,000
Construction Management	\$12,000
<b>Project Management/Coordination</b>	<b>\$10,000</b>
TAC Meeting and Facilitation	\$8,500
Project Closeout	\$1,500

Table 3. Proposed Project Funding Sources

Funding Source	Design & Permitting	Construction	Percentage
Nevada Tahoe Bond Funds	\$25,000	\$275,000	44%
Nevada Department of Transportation	\$50,000	\$200,000	37%
USEPA	\$100,000	\$0	15%
Private/Local	\$15,000	\$10,000	4%
<b>Total</b>	<b>\$215,000</b>	<b>\$485,000</b>	<b>100%</b>

**Note:** USEPA Funds can only pay for community driven area-wide stormwater planning. This can be done concurrently or after the project is implemented.

Table 4. Engineer's Opinion of Probable Costs for Construction

**ENGINEER'S OPINION OF PROBABLE COSTS**  
Marla Bay Water Quality Improvement Project  
Prepared By: Nevada Tahoe Conservation District  
29-Jan-21

Item No.	Quantity	Unit	Item Description	Unit Price	Amount
1	1	LS	Mobilization and Demobilization (10%)	\$42,000.00	\$42,000
2	1	LS	Water Pollution Control (Temporary BMPs) (3%)	\$12,000.00	\$12,000
3	1	LS	Clearing and Grubbing	\$10,000.00	\$10,000
4	5	EA	Tree Removal	\$1,000.00	\$5,000
7	1	LS	Protect Utilities in Place	\$5,000.00	\$5,000
8	1	LS	Bourne Meadows Basin	\$165,000.00	\$165,000
9	6	EA	Vault Retrofit	\$1,500.00	\$9,000
10	15	EA	Drainage Inlets with Infiltration	\$6,000.00	\$90,000

11	1	LS	Basin Pretreatment (JDS or equivalent)	\$35,000.00	\$35,000
12	1	LS	Pinewild Basin and Conveyance	\$40,000.00	\$40,000
14	400	LF	Channel Retrofit	\$90.00	\$36,000
17	2	EA	Beach Outfall Improvements	\$4,500.00	\$9,000
14	1	LS	Creek Improvements	\$15,000.00	\$15,000
				<b>Total</b>	<b>\$473,000</b>

## 7 Easements/Acquisition

With the exception of the anticipated conservation easement to be donated from APN 1318-15-101-009, all improvements will be constructed on publicly owned land or HOA common areas. Temporary rights of entry and/or construction easements may be required in various areas to facilitate access and construction mobility.

## 8 Conformity

The Marla Bay WQIP will conform to all applicable local and regional land use plans.

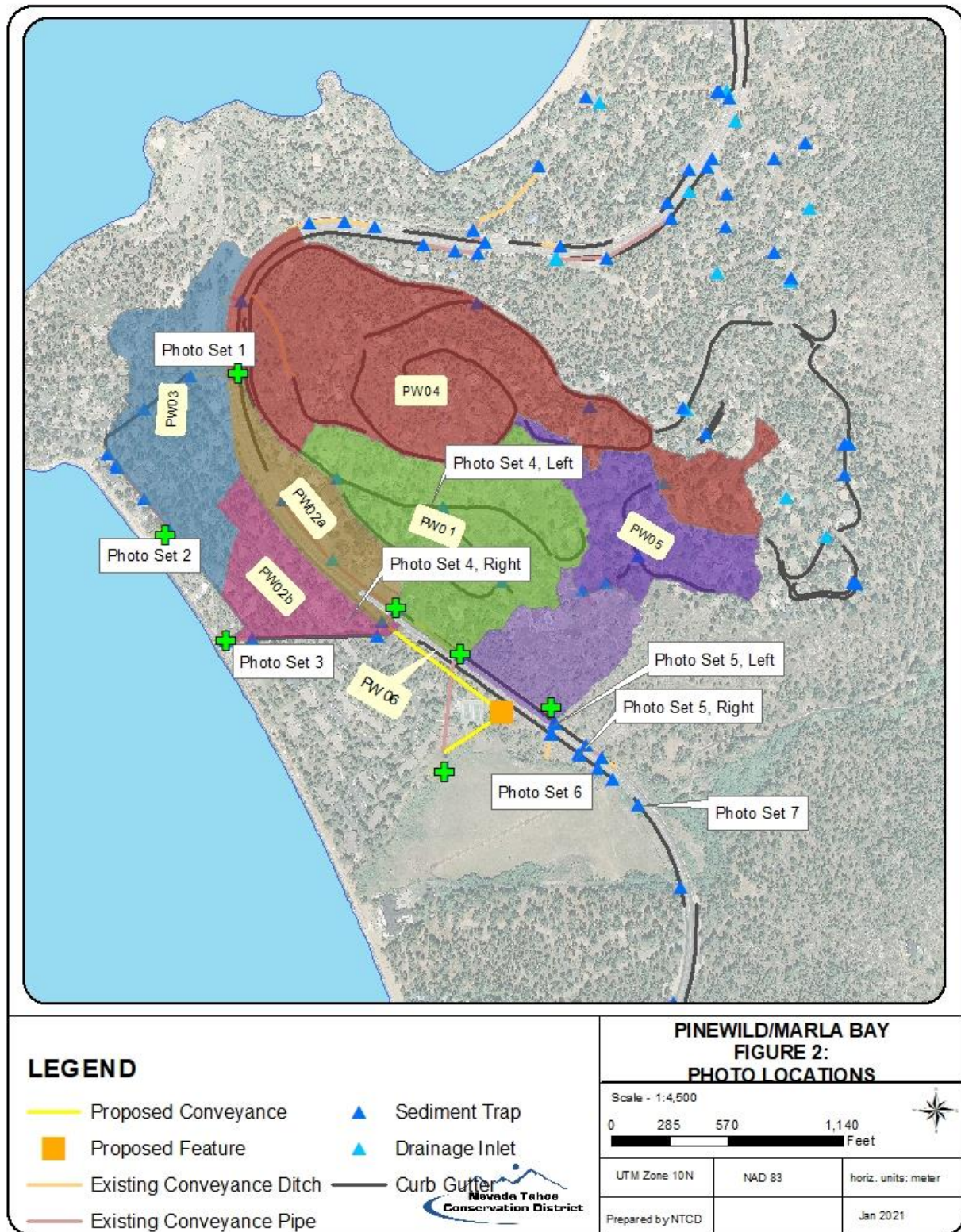
# Attachment A

---

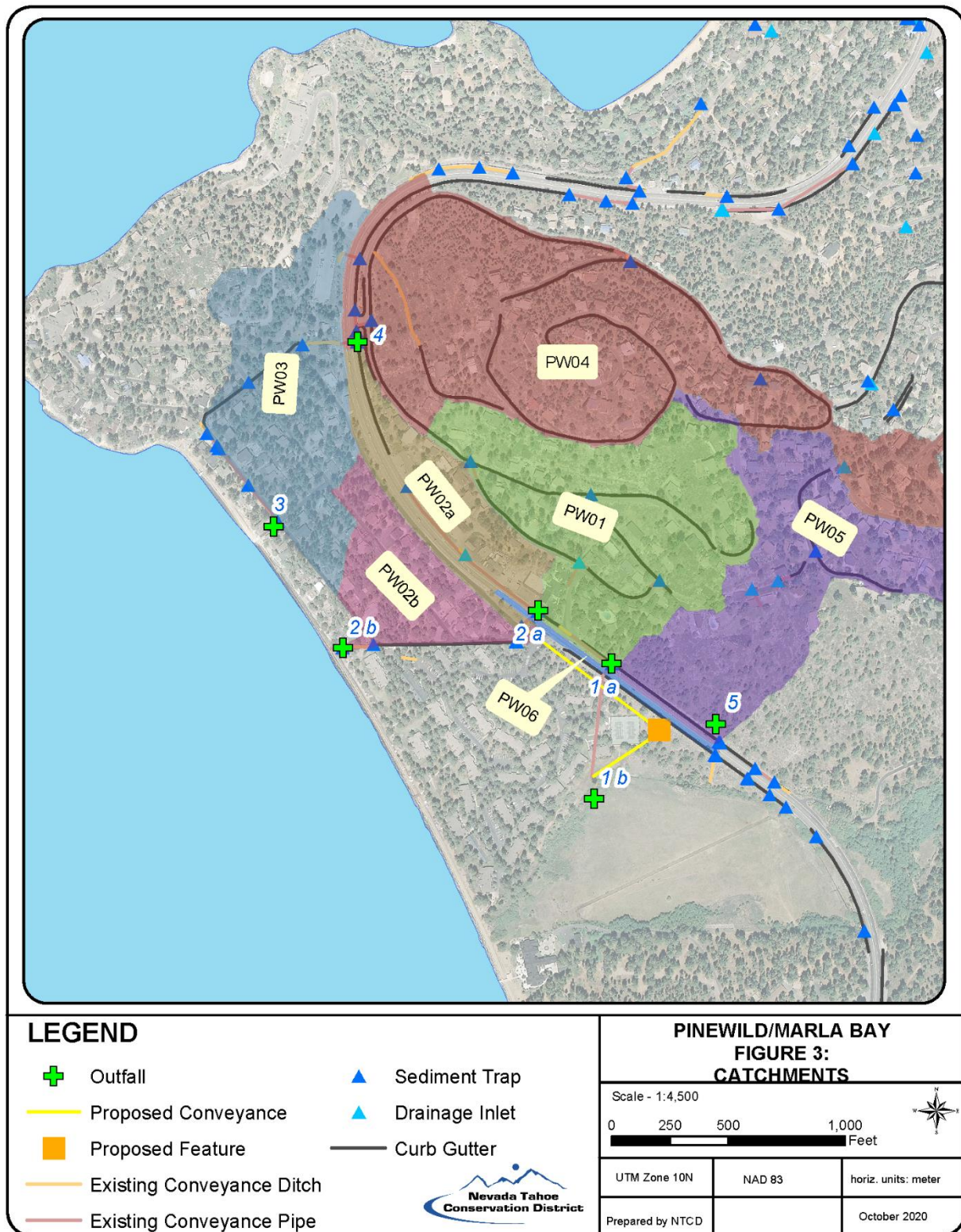
## Figures



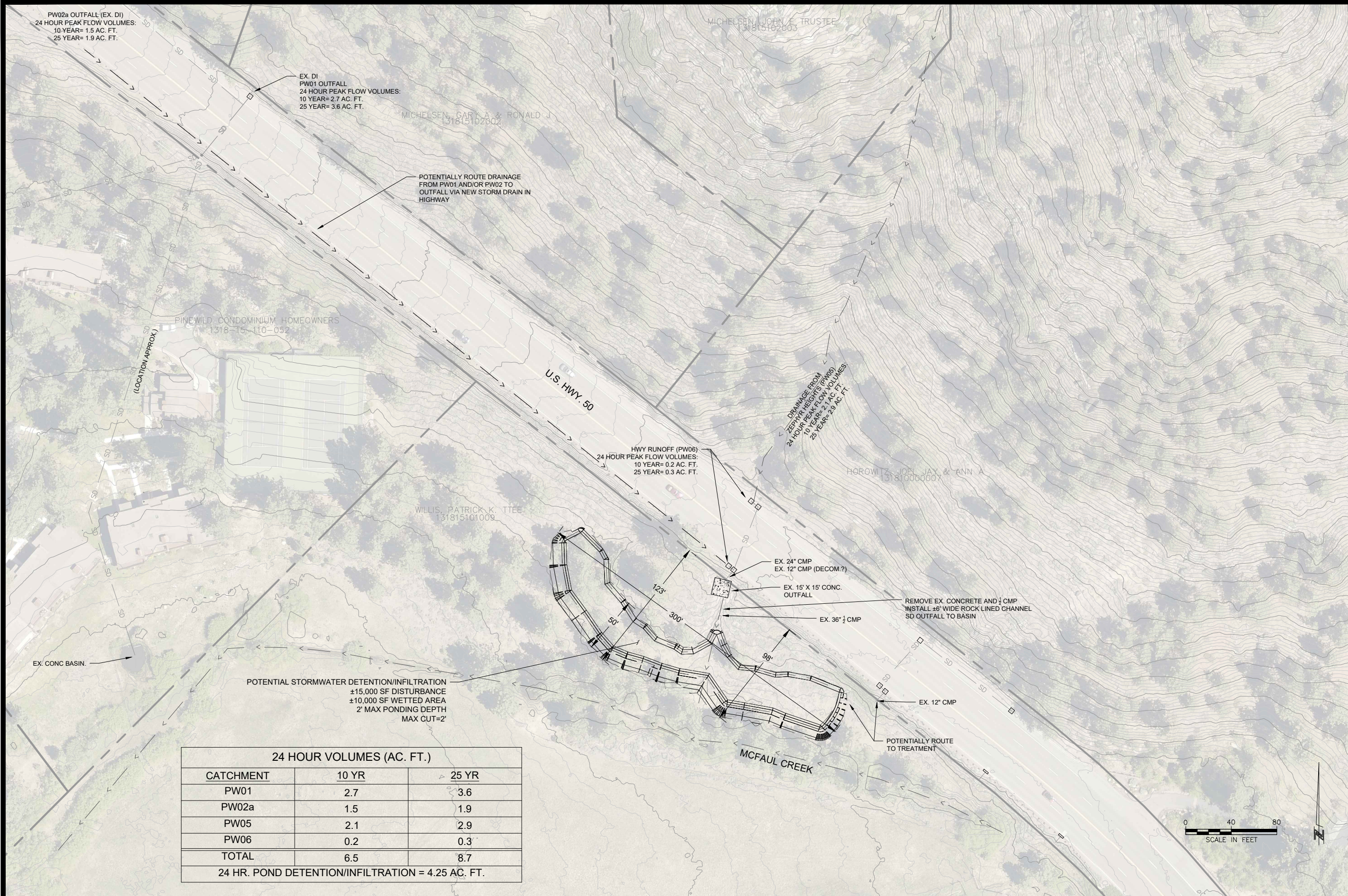
Figure 1: Project Location











PLAN

SCALE: 1"=40'

CONCEPT PLANS: NOT  
FOR CONSTRUCTION



# Attachment B

## *Project Area Photos*

---



Photo Set 1: Runoff from Catchment 4 (Zephyr Heights) is routed beneath the highway onto Tallac Dr. in Marla Bay. The channel and vaults along its path could be retrofit to provide treatment or infiltration.



Photo Set 2: The runoff takes a turn from Tallac Dr. and flows down an old boat ramp directly into Lake Tahoe. As a result, sand is eroded away.



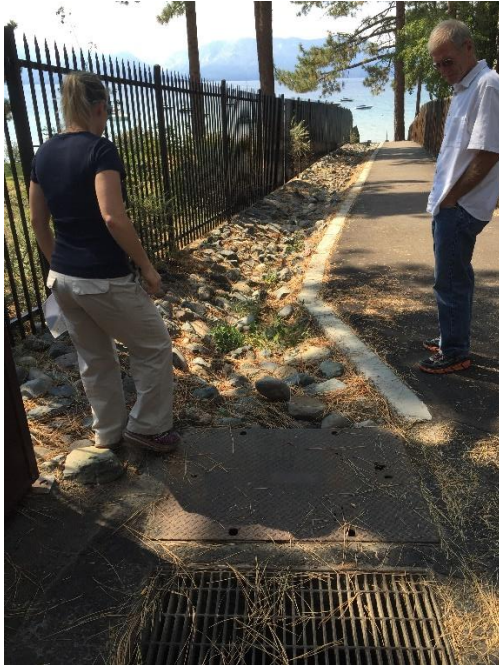


Photo Set 3: A second outfall in Marla Bay at the end of Lakeshore Drive receives runoff from catchments 1, 2a, and 2b with little treatment and discharges directly to the Lake. Runoff from 1 and 2b would be re-routed to the new treatment basin near Bourne Meadows. The existing rock ditch and vaults could be retrofit to treat runoff from 2a prior to discharging to the Lake.



Photo Set 4: Stormwater infrastructure installed in the 70s is out of date or undersized. Left photo – a typical drainage inlet in the steep neighborhood of Zephyr Heights. The project could update these to improve capture. Right: Basin installed during PineWild development never drains and is in a riparian zone. Relocation options exist.





Photo Set 5: Outfalls from US-50 uphill of Bourne Meadows lack treatment and go straight to McFaul Creek. Left Photo: this is the location of the proposed large basin. Right Photo: Just south of the outfall pictured on the left, this highway outfall can also be routed to the new basin.



Photo Set 6: Left: McFaul Creek has old concrete structures that could be removed. Right: Bourne Meadows could provide additional stormwater treatment and rewatering the meadow will have additional ecological benefits. Breakout channels like the one shown, could be utilized to create a healthier meadow.





Photo Set 7: Left: McFaul Creek passes under US-50 in 2 locations, this is the main one. Right: drainage inlets on US-50 drop water directly into McFaul Creek.

# Attachment C

---

*Hydrology and PLRM Memorandums*

# Technical Memorandum



To: Stormwater Program Manager, Douglas County and Hydraulics, Nevada Department of Transportation

From: Nevada Tahoe Conservation District

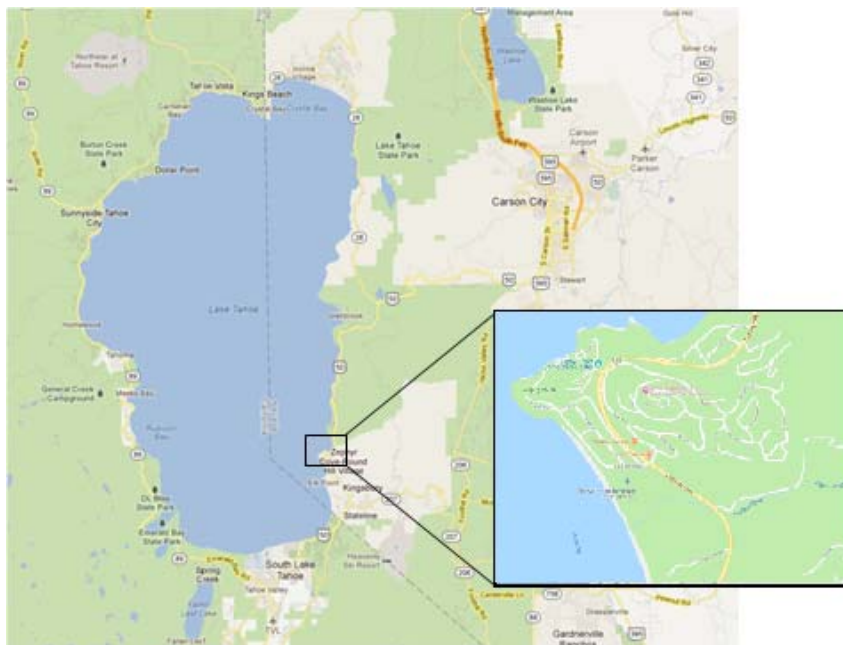
Date: 6/1/2019

Re: Pinewild/Marla Bay Existing Conditions and Initial Hydrology

The Douglas County, Lake Tahoe lakefront communities of PineWild and Marla Bay have experienced run-on issues from upslope stormwater for many years. Lakefront neighborhoods often have constraints for treating their own on-site runoff and since they are located at the bottom of the watershed, they often receive upland waters that inundate any infrastructure they install. With input from the Nevada Department of Transportation, Douglas County, and other stakeholders, NTCD has identified a location within the Pinewild HOA property to construct a potential stormwater treatment basin. NTCD has performed a basic existing conditions analysis and initial hydrology to support a water quality improvement project in the area. This memorandum summarizes the findings of the study.

## PROJECT LOCATION

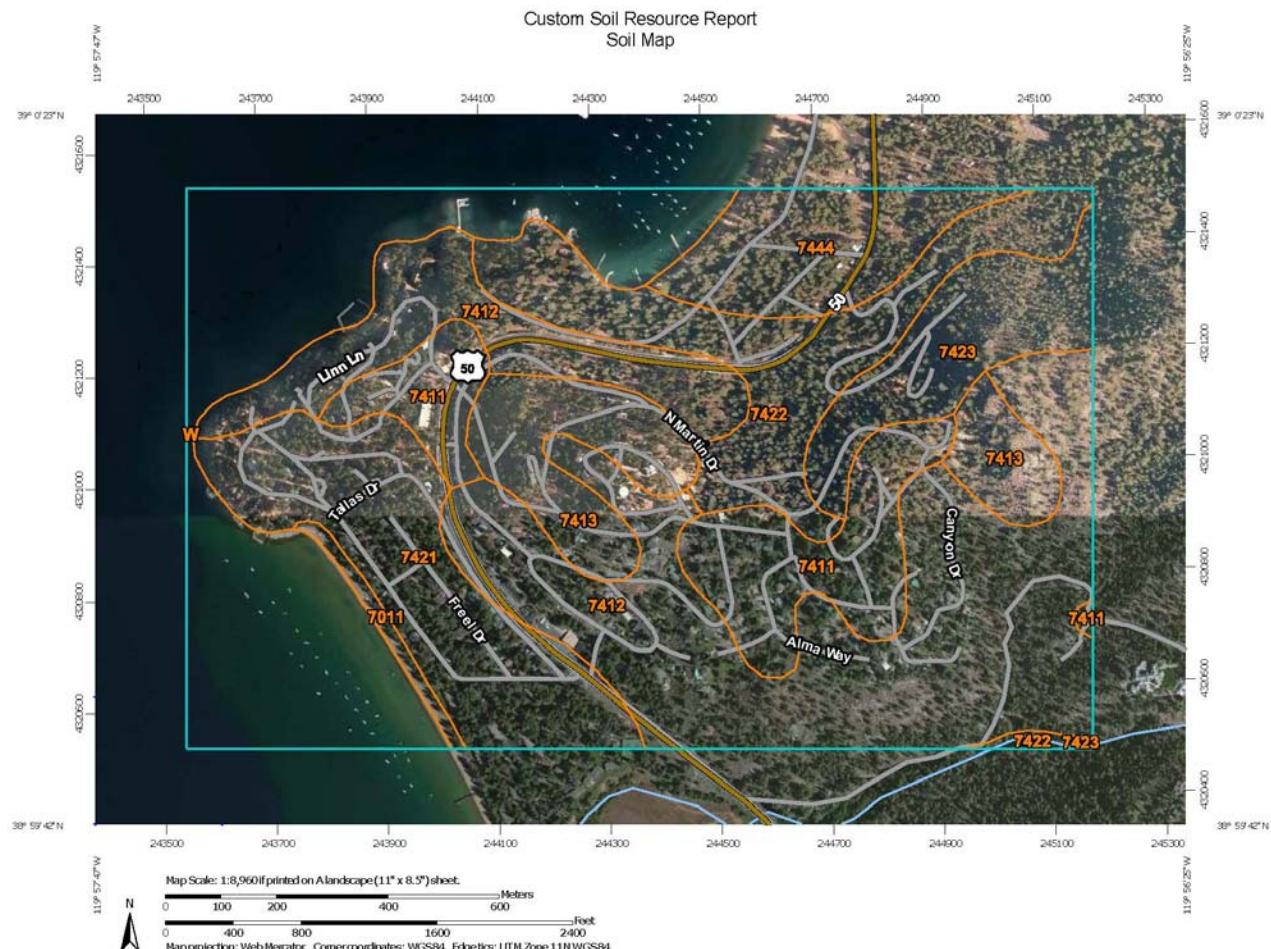
The Pinewild/Marla Bay Water Quality Improvement Project (Project) is located within Douglas County, in Zephyr Cove, Nevada, T13NR18E Sec10. The nearest cross streets are Highway 50 and Lakeshore Blvd. See Figure 1 below for Project vicinity.



**Figure 1. Project Area Location.**

## EXISTING SOILS

The Natural Resources Conservation Service (NRCS) soil survey indicates that the Project area is located within soil map units 7412, 7422, and 7444. Soil unit 7412 is Cagwin-Rock outcrop complex, 15 to 30 percent slopes, extremely stony. Unit 7422 is Cassenai gravelly loamy coarse sand, 15 to 30 percent slopes, very stony. Lastly, unit 7444 is Christopher-Gefo complex, 0 to 5 percent slopes. See Figure 2 for soils map. The soil in the Project area is in either Hydrologic group A or B. Locations of infiltration features are planned on group A soils only, which are very fast draining soils.



**Figure 2. Project Area NRCS Soil Map Units. The area of interest is outlined in blue.**

## CATCHMENTS

The watershed area and sub-watersheds (or catchments) were delineated by NTCD using 2010 USGS 1 foot LiDAR and ESRI ArcGIS software ArcMap 10.6.1. Catchments were then refined to incorporate the effects of the existing drainage system under Highway 50 and throughout the neighborhood. Field verification served as verification to the catchment delineation and hydrologic modeling. Figure 3 displays the catchment boundaries and outfall locations for the existing condition. There are five stormwater outfalls in the Project area. The largest catchment, producing the most water is PW04 with approximately 36 acres. All catchment above the Highway (PW01, PW02a, PW04, and PW05) have very steep and rocky terrain. The roads are abutted by gabion and wood retaining walls to help terrace the



roads, leaving little opportunities for stormwater collection and infiltration improvements. The lower catchments PW02b and PW03 are not as steep but are highly developed.

## DESIGN FLOWS

Design flows including peak flow and volumes were calculated using the SCS method in the NRCS TR-55 Bulletin and utilizing HEC-HMS version 4.2.

The contributing watershed to the Pinewild/Marla Bay WQIP project area is approximately 143 acres. The watershed was divided into six (6) existing catchments based on outlets and proposed treatment locations. The peak flow and quantity of runoff for the 2, 25, 50, and 100-year, 24-hour storm events were determined for each catchment and each outlet. The precipitation intensity,  $i$ , was determined using the National Oceanic and Atmospheric Administration's (NOAA's) Precipitation Frequency Data Server. The 25-year, 24-hour storm is the design storm for Project conveyance per Douglas County standards. All treatment facilities are designed to the maximum extent practicable. The design storm results for the outfalls in existing conditions are summarized below in Table 1. The HEC-HMS input and results of the volume peak flow for existing conditions and all alternatives are displayed in Attachment 1: Preliminary Hydrology (HEC-HMS).

**Table 1. Existing Conditions Design Storm (25-year, 24-hour) HEC-HMS Results**

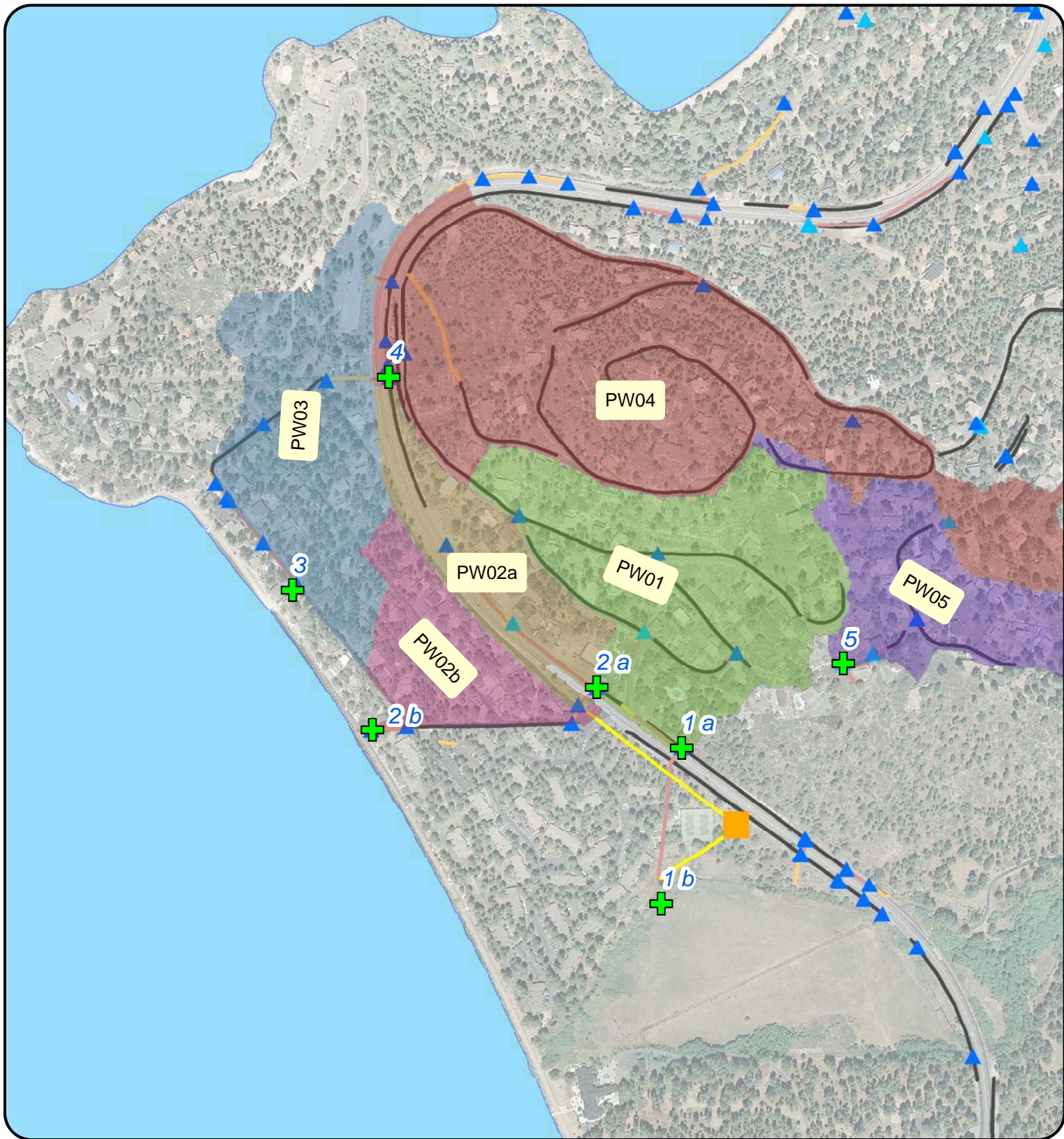
<b>Outfall No.: Description</b>	<b>Drainage Area (mi<sup>2</sup>)</b>	<b>Peak Flow (cfs)</b>	<b>Volume (ac-ft)</b>
1: Drains PW01 in Zephyr Heights neighborhood	0.033	9.9	3.6
Junction 2a: Drains PW2a in Zephyr Heights neighborhood and Highway 50, potential diversion location	0.013	5.9	1.9
2: Drains PW2a and PW2b, which is the Marla Bay neighborhood	0.024	7.2	2.7
3: Drains PW03 and PW04 in the Marla Bay neighborhood	0.081	17.6	7.9
4: Drains PW04, the northernmost Zephyr Heights neighborhood	0.056	14.1	6.1
5: Drains PW05 in the Zephyr Heights neighborhood, no NDOT	0.016	5.3	1.8

## OPPORTUNITIES AND CONSTRAINTS: PROPERTY OWNERSHIP









NTCD reviewed public property ownership in the watershed. County, State, and federal parcels were identified as potential areas for treatment first using GIS software and secondly in the field. The GIS analysis determined which publicly owned parcels had any potential to treat stormwater based on flow concentration. Figure 4 shows property ownership in the watershed and selected parcels. The field analysis observed the feasibility of each parcel to accept and treat stormwater via infiltration based on existing slope, soils, and configuration. NTCD found no parcels to be acceptable for larger infiltration treatments, mainly due to extremely steep slopes and rocky soil conditions with the exception of one county owned parcel, APN 1318-09-702-001, which currently has a rock lined channel. Snow coverage at the time made a full channel assessment impossible. The channel should be observed in the spring or summer months for condition and in-line treatments should be considered. Small treatment areas may also be considered in the N. Martin Rd. road shoulder adjacent to the parcel. Pictures of public parcels considered for treatment are given in Attachment 2.

NTCD has also explored private property owner partnerships. The Pinewild HOA is a project partner and is willing to provide an easement for infiltration facilities on their property. An infiltration basin was sized on a conceptual level for two alternatives. One with a small basin limited to Pinewild HOA property and a second larger basin, which would utilize both the Pinewild HOA and adjacent private property. It is unknown if the adjacent property owner would allow an easement at this time. Figure 5 shows conceptual design for basin sizing. PLRM modeling was also completed for the two basin sizes. A memo describing PLRM inputs and results is given as Attachment 3





## LEGEND

- |  |                           |   |                |
|--|---------------------------|---|----------------|
|  | Outfall                   |  | Sediment Trap  |
|  | Proposed Conveyance       |  | Drainage Inlet |
|  | Proposed Feature          |  | Curb Gutter    |
|  | Existing Conveyance Ditch |   |                |
|  | Existing Conveyance Pipe  |   |                |



## PINEWILD/MARLA BAY FIGURE 3: CATCHMENTS

Scale - 1:4,500

0 170 340 680  
Feet



UTM Zone 10N

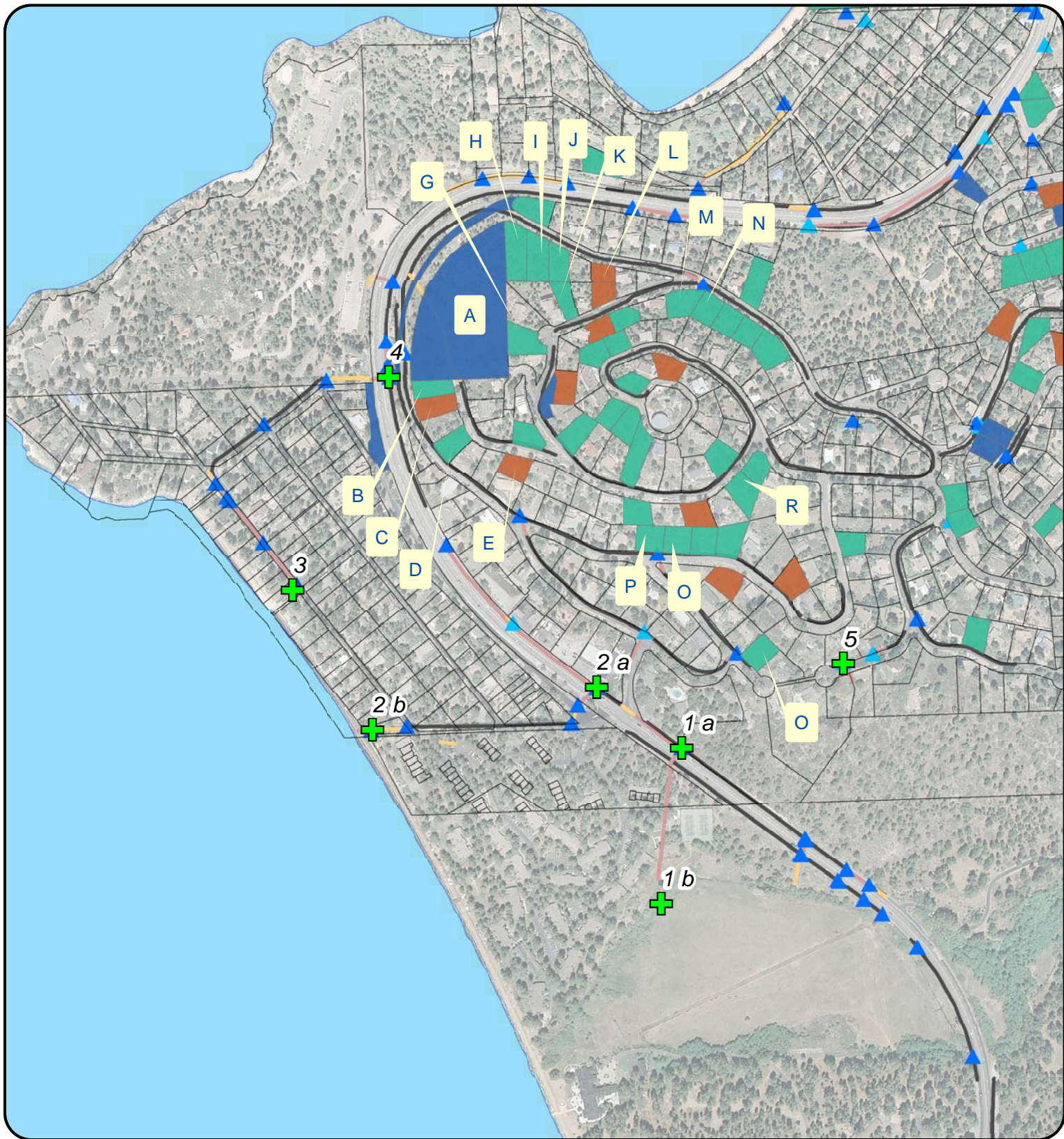
NAD 83

horiz. units: meter

Prepared by NTCD

May 2018





## LEGEND

PARCEL BOUNDARIES

### PUBLIC OWNERSHIP

DOUGLAS COUNTY

NDSL

USFS

Outfall

Existing Conveyance Ditch

Existing Conveyance Pipe

Sediment Trap

Drainage Inlet

Curb Gutter



## PINEWILD/MARLA BAY

### FIGURE 4: PUBLIC OWNERSHIP PARCELS

Scale - 1:4,500

0 170 340 680  
Feet



UTM Zone 10N

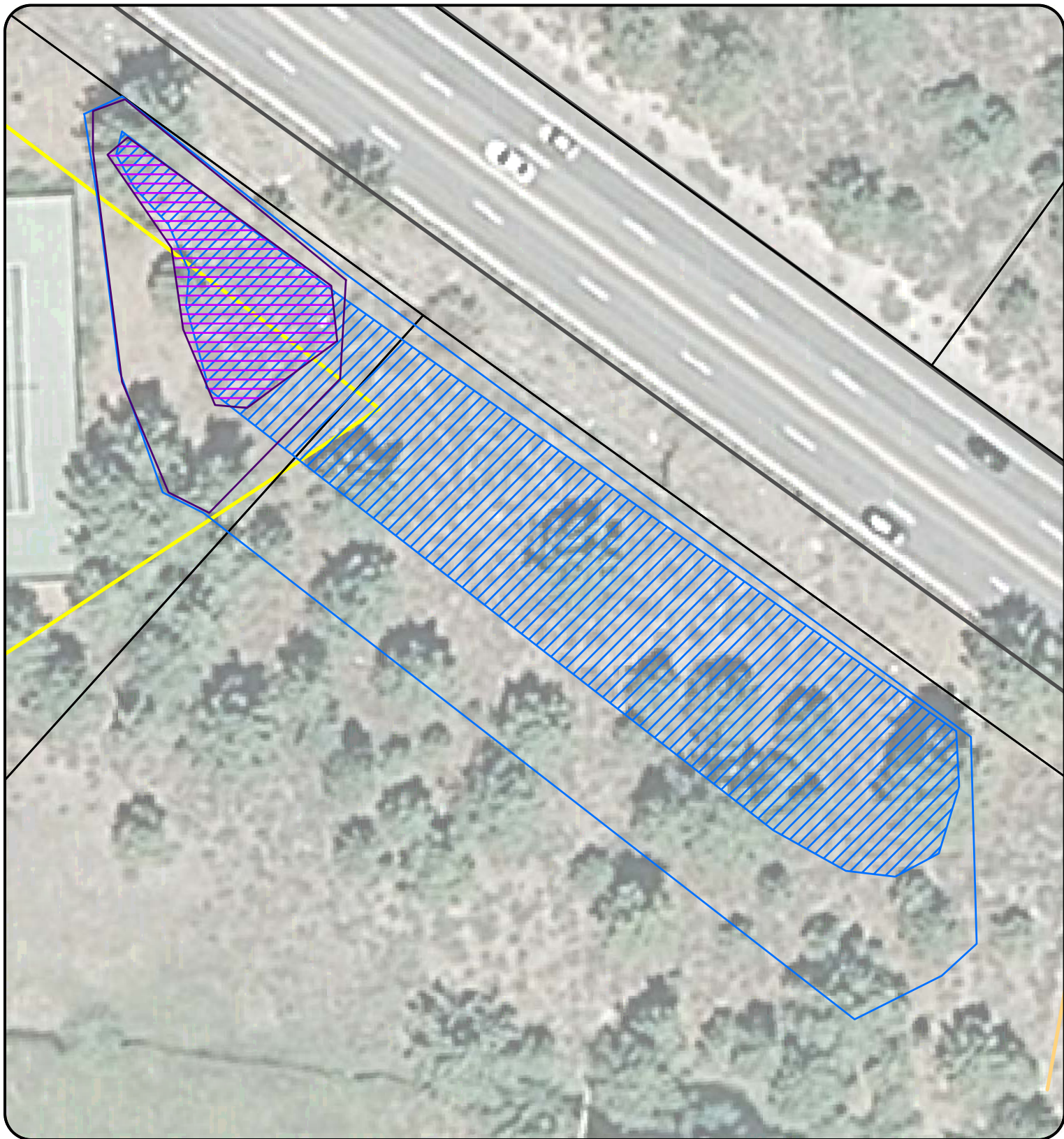
NAD 83

horiz. units: meter

Prepared by NTCD

May 2018





## Legend

- |  |                              |   |                           |
|--|------------------------------|---|---------------------------|
|  | Small Basin Disturbance Area |  | Proposed Conveyance       |
|  | Small Basin Wetted Area      |  | Existing Conveyance Ditch |
|  | Large Basin Disturbance Area |  | Existing Conveyance Pipe  |
|  | Large Basin Wetted Area      |  | Curb Gutter               |
|  | Outfall                      |  | Parcel Boundary           |

## PINEWILD/MARLA BAY

### FIGURE 5:

### Conceptual Design- Proposed Basin

Scale - 1:4,500

0 12.5 25 50  
Feet



UTM Zone 10N

NAD 83

horiz. units: meter

Prepared by NTCD

May 2018

## ATTACHMENT 1: PRELIMINARY HYDROLOGY (HEC-HMS)

Table A.1 Pinewild/Marla Bay Existing Conditions HEC-HMS model input for SCS Method					Notes
Catchment Number	Total Area [Mi^2]	Composite Curve Number (CN)	Impervious %	Lag Time [min]	
PW01	0.032536	78.0	27.35%	10.17	Outfall #1
PW02a	0.012871	85.7	56.17%	3.78	Outfall#2
PW02b	0.011448	67.4	32.62%	14.80	Upstream Highway #2
PW03	0.024413	68.3	29.13%	15.05	Outfall#3
PW04	0.056451	77.0	25.65%	19.91	Outfall#4- upstream of #3
PW05	0.015815	78.5	32.08%	3.11	Zephyr Heights only, no NDOT

**Table A.2: HEC-HMS Existing Conditions Results for Outfalls**

Outfall. Description	Drainage Area (mi <sup>2</sup> )	Frequency Storm	Peak Discharge (cfs)	Volume (ac-ft)
1: Drains PW01 in Zephyr Heights neighborhood	0.033	2 year, 24 hour	2.8	1.3
		25 year, 24 hour	9.9	3.6
		100 year, 24 hour	14.9	5.2
Junction 2a: Drains PW02a in Zephyr Heights neighborhood and Highway 50, potential diversion location	0.013	2 year, 24 hour	2.4	0.8
		25 year, 24 hour	5.9	1.9
		100 year, 24 hour	8.2	2.6
2: Drains PW02a and PW02b, which is the Marla Bay neighborhood	0.024	2 year, 24 hour	2.4	1.0
		25 year, 24 hour	7.2	2.7
		100 year, 24 hour	10.7	3.9
3: Drains PW03 and PW04 in the Marla Bay neighborhood	0.081	2 year, 24 hour	3.9	2.7
		25 year, 24 hour	17.6	7.9
		100 year, 24 hour	28.1	11.6
4: Drains PW04, the northernmost Zephyr Heights neighborhood	0.056	2 year, 24 hour	3.7	2.2
		25 year, 24 hour	14.1	6.1
		100 year, 24 hour	21.8	8.8
5: Drains PW05 in the Zephyr Heights neighborhood, no NDOT	0.016	2 year, 24 hour	1.6	0.7
		25 year, 24 hour	5.3	1.8
		100 year, 24 hour	7.9	2.6

## ATTACHMENT 2: PUBLIC PARCEL PHOTOGRAPHS



## Attachment 2: Public Parcels Considered for Stormwater Infiltration Improvements



A: Douglas County parcel; left photo- steep slopes and gabion wall on downhill end of parcel on N. Martin Drive potential linear shoulder treatment at break in gabion; right photo- looking from rock lined channel up to the end of S. Martin Drive potential linear treatment in rock-lined channel. Additional field reconnaissance is recommended in Spring after snow has melted.



B,C, &D: USFS and NDSL parcels. Steep slopes and gabion wall prevent any treatment.



## Attachment 2: Public Parcels Considered for Stormwater Infiltration Improvements



E: NDSL parcel off South Martin Drive. Very steep terrain, not acceptable for improvements.



F & G: USFS parcels off Point Road. Very steep and rocky terrain, not acceptable for improvements.

## Attachment 2: Public Parcels Considered for Stormwater Infiltration Improvements



H, I, J, M&N: USFS parcels along S. Martin Drive have steep slopes and gabion wall preventing any stormwater improvements



K&L: USFS and NDSL parcel respectively. Both parcels off closed road (Zephyr Heights Road) in very steep terrain. Not acceptable for improvements.



## Attachment 2: Public Parcels Considered for Stormwater Infiltration Improvements



O & P: USFS parcels off of Don Drive. Parcels are too steep and rocky for stormwater improvements.



Q: USFS parcel off of Lakeview Drive. Parcel is too steep and rocky for stormwater improvements.

## ATTACHMENT 3: PLRM MEMORANDUM



PO Box 915  
400 Dorla Court  
Zephyr Cover, NV 89448  
Phone (775) 586-1610  
Fax (775) 586-1612  
www.ntcd.org

**TO:** MONICA GRAMMENOS  
**FROM:** DOMI FELLERS  
**SUBJECT:** NDOT & DOUGLAS COUNTY PINEWILD PLRM RESULTS  
**DATE:** 7/15/2019  
**CC:** MEGHAN KELLY

NTCD performed PLRM modeling for the 'NDOT Pinewild Proposed Infiltration Basin.' For clarification the project is labeled Pinewild because the potential proposed basin would be built on the Pinewild HOA property. The proposed basin would actually treat portions of NDOT HWY 50 and Zephyr Heights stormwater runoff.

For NDOT and Douglas County to have a better understanding of the PLRM results, NTCD compared the Baseline pollutant loads from 2013 to the potentially updated 2019 pollutant loads. The 2013 Baseline results were modeled using PLRM v1.1 which is no longer accessible; thus, NTCD cannot verify the PLRM inputs utilized. The 2013 Baseline results in Table 1 below were copied from the 2013 Baseline Report (NTCD, 2013).

**Table 1. Baseline Pollutant Load Comparison from 2013 to 2019.**

Implementer	2013 Baseline					2019 Baseline			
	Catchments	slope	Connectivity	FSP w/2013 Connectivity	FSP w/100% connectivity	Catchments	slope	Connectivity	FSP w/100% connectivity
NDOT	5011a		100%	4837	4837	5011a	1%	100%	448
						5011b	1%	100%	3044
	5012a		0%		n/a	5012a	1%	100%	1204
	5012tv		100%	1174	1174	5012TV	1%	100%	943
	<b>Total FSP</b>			<b>6011</b>	<b>6011</b>				<b>5639</b>
	<b>Total Credits</b>			<b>30</b>	<b>30</b>				<b>28</b>
Douglas County	ZH01	32%	60%	1828	3047	ZH01a	10%	100%	703
						ZH01b	10%	100%	1018
						ZH01c	10%	100%	1555
						ZH01d	10%	100%	924
	MB01	12%	100%	332	332	MB01a	1%	100%	450
						MB01b	1%	100%	449
	ZP01	9%	100%	1017	1017	ZP01	5%	100%	354
	ZK01	25%	40%	260	650	ZK01	10%	100%	1202
	DC07	9%	100%	26	26	DC07	10%	100%	845
	<b>Total FSP</b>			<b>3463</b>	<b>5072</b>				<b>7500</b>
	<b>Total Credits</b>			<b>17</b>	<b>25</b>				<b>37</b>
Overall	<b>Overall Total FSP</b>			<b>9474</b>	<b>11083</b>				<b>13139</b>
	<b>Overall Total Credits</b>			<b>47</b>	<b>55</b>				<b>66</b>

1 credit = 200.42

Mission Statement: To promote the conservation and improvement of the Lake Tahoe Basin's natural resources by providing leadership, education and technical assistance to all basin users.

Table 1 shows the new 2019 Baseline pollutant load for the project area is 66 credits or 13,139 lbs/yr FSP with NDOT responsible for 28.1 credits and Douglas County for 37.4 credits.

The NDOT Baseline pollutant load actually decreases by 2 credits which may be a result of utilizing less steep slopes or the catchment boundaries were adjusted using ArcGIS and Lidar enforced data. It is also important to note the 2013 Baseline load for catchment 5012a is not accessible since it was modeled in PLRM v1.1 and it was not reported in the 2013 Baseline Report (NTCD, 2013).

The Douglas County (DC) Baseline pollutant load increased by 20 credits which may be a result of:

1. The connectivity is increased to 100% for every DC catchment.
2. The percent directly connected impervious area (DCIA) is increased for most every catchment (Table 2 below).
3. Dividing one large catchment into multiple smaller catchments tends to increase the pollutant load (Zephyr Heights catchment ZH01 was divided into 4 smaller catchments); however, this is necessary to accurately model the area to be treated by the proposed basin.

As mentioned above, NTCD increased the DCIA percentage for almost every Douglas County catchment because the values appeared quite low after reviewing the contours and assessing the direction of stormwater runoff. (DCIA does not apply to NDOT catchments because NDOT does not have SFR, MFR and CICU landuse.) Prior to design, NTCD should perform an additional field exercise to assess the percent DCIA as DCIA is a sensitive PLRM input. Table 2 shows the updated 2019 DCIA percentages compared to the 2013 values utilized.

**Table 2. Douglas County Percent DCIA per Catchment.**

<b>Percent DCIA per Douglas County Catchment</b>						
<b>Catchment</b>	<b>SFR</b>		<b>MFR</b>		<b>CICU</b>	
	<b>2013</b>	<b>2019</b>	<b>2013</b>	<b>2019</b>	<b>2013</b>	<b>2019</b>
ZH01a	15	15	35	40	50	80
ZH01b	15	35	35	n/a	50	75
ZH01c	15	35	35	n/a	50	50
ZH01d	15	35	35	n/a	50	0
DC07	25	25	n/a	25	n/a	25
ZK01	25	35	25	n/a	50	n/a
ZP01	n/a	11	35	50	n/a	n/a
MB01a	11	11	35	50	50	50
MB01b	11	11	35	n/a	50	n/a

Additionally, NTCD extracted the parcel BMP percentages using the Lake Tahoe Info Stormwater Tools on April 15, 2019 (Table 3). TRPA is assessing the ownership of a few final parcels, but the results should not change much except for catchment DC07. Catchment DC07 would not be treated by the proposed basin; thus, the parcel BMP percentage for catchment DC07 is only of concern if additional treatment is added or if DC would like to register the catchment for parcel BMPs only.

**Table 3. Douglas County Parcel BMP Percentages.**

<b>Lake Tahoe Info Stormwater Tools Parcel BMP Percentages (5/31/2019)</b>								
<b>Catchment</b>	<b>%</b>	<b>Data</b>	<b>SFR</b>		<b>MFR</b>		<b>CICU</b>	
	<b>Unknown</b>	<b>Approved</b>	<b>BMP</b>	<b>SCO</b>	<b>BMP</b>	<b>SCO</b>	<b>BMP</b>	<b>SCO</b>
ZH01a	3.8	5/31/2019	50.7	0.0	10.1	0.0	67.1	6.1
ZH01b	22.6	5/31/2019	38.6	4.4	n/a	n/a	52.2	0.0
ZH01c	48.2	5/31/2019	33.1	3.1	n/a	n/a	0.0	0.0
ZH01d	7	5/31/2019	29.8	8.8	n/a	n/a	0.0	0.0
DC07	2.0	5/31/2019	94.6	0.2	n/a	n/a	7.0	0.0
ZK01	40.8	5/31/2019	45.7	0.9	n/a	n/a	n/a	n/a
ZP01	0.0	5/31/2019	28.2	0.0	1.7	0.0	n/a	n/a
MB01a	2.8	5/31/2019	15.3	0.0	0.6	0.0	0.0	0.0
MB01b	0.1	5/31/2019	25.1	0.0	n/a	n/a	n/a	n/a

Including the adjustments and current May 31, 2019 parcel BMP percentages stated above, the PLRM results for installing a new infiltration basin (2 different sizes) on the Pinewild HOA property are shown in Table 4 below. Table 5 breaks the credits down per implementer and per treatment BMP.

**Table 4. Pinewild PLRM Potential Credits.**

<b>Pinewild PLRM v2.1 Results</b>				
<b>PLRM Scenario</b>	<b>small basin</b>		<b>large basin</b>	
	<b>Pollutant Load (FSP lbs/yr)</b>	<b>Credits</b>	<b>Pollutant Load (FSP lbs/yr)</b>	<b>Credits</b>
2019 Baseline	13138	65.6	13138	65.6
Road Operations @ 2.5	10294	51.4	10294	51.4
Treatment BMPs	6863	34.2	6529	32.6
<b>Road Operations Load Reduction</b>	<b>2844</b>	<b>14.2</b>	<b>2844</b>	<b>14.2</b>
<b>Treatment BMPs Load Reduction</b>	<b>3431</b>	<b>17.1</b>	<b>3765</b>	<b>18.8</b>

**Table 5. Pinewild PLRM Potential Credits per Implementer.**

<b>Treatment BMPs Credit Breakdown per Implementer</b>		
	<b>small basin</b>	<b>large basin</b>
NDOT Road Shoulder	4	4
NDOT basin	5.4	6.3
DC parcel BMPs	2.8	2.8
DC basin	4.9	5.7
<b>Total Credits</b>	<b>17.1</b>	<b>18.8</b>
NDOT Credits	9.4	10.3
DC Credits	7.7	8.5
<b>Total Credits</b>	<b>17.1</b>	<b>18.8</b>

Table 5 shows the smaller infiltration basin would provide 10.3 total credits, with 53% or 5.4 credits for NDOT and 47% or 4.9 credits for DC. (The percent treated per implementer was based on the amount of pollutant load entering the basin per implementer's catchments.) The remaining credits are from NDOT road shoulder improvements (4 credits) and DC parcel BMPs

(2.8). Please note these credits are for the entire project area (Figure 1) and not just the catchments being treated by the proposed infiltration basin.

Additionally, Table 5 shows a 1.7 credit increase by installing a larger infiltration basin. The small basin treats 86% of the flow and the large basin treats 100% of the flow; however, for only an additional 1.7 credits, the large basin may not be worth the hassle of acquiring the land acquisition. A mid-size basin (4,000 square foot footprint, 28,000 cubic foot volume capacity and 0.4 in/hr infiltration rate) would treat 98% of the flow and provide 11.8 credits.

PLRM was set-up with a flow divider at 5.9 cfs for NDOT catchment 5011b and DC catchment ZH01b; however, this divider was not needed since only a total of 5.2 cfs is being routed to the proposed basin from all catchments (5011a, 5011b, ZH01a and ZH01b).

The 7.7 credits DC would receive with this project may not outweigh the 20 credit Baseline increase; however, the connectivity of DC catchments ZH01d, DC07 and ZK01 should be re-evaluated with a field visit. This entire DC Roads area of the project is highly disconnectly according to the PLRM Road Connectivity GIS shapefile, meaning the road runoff does not concentrate in a curb & gutter situation but rather sheetflows across the road into the private parcel pervious areas. The low road connectivity decreases the pollutant load, which considering the steep slopes of the area would be worth a field check as well, especially catchment ZP01. DC could also have TRPA target this area to implement their parcel BMPs and/or qualify for an area-wide project which could increase the credit potential.

Because NTCD was not too concerned with the pollutant load for the catchments not being treated by the proposed infiltration basin, neither the pre- nor post-2004 treatment BMPs (Vortech treatment vaults, concrete settling basin, settling vaults) installed within the catchments (5012TV, ZK01, etc) were included in the PLRM model, especially since the baseline reports state these treatment BMPs provide little treatment for fine sediment particles (FSP).

Lastly, Table 6 lists the remaining catchments within the project area where no treatment is currently proposed. However, NTCD could look into retrofitting, rebuilding or installing new treatment for these catchments. The potential credits are 5 for NDOT and 29 for DC.



**Table 6. Opportunities for Additional Treatment and Credit Potential.**

<b>Catchment</b>	<b>Pollutant Load (lbs/yr FSP)</b>	<b>Credits</b>	<b>Possible Treatment</b>
5012b	409	2.0	retrofit rock-lined channel to improve infiltration (DCCD0465)
5012TV	577	2.9	retrofit (DCTV0005, DCSB0004)
ZH01c	1542	7.7	add step-pools to existing rock-lined channel to improve infiltration (DCCD0403)
MB01a	475	2.4	research existing Type B Sediment Control Vaults (DCST0610, 612, 615-617) to improve infiltration
MB01b	449	2.2	retrofit existing rock-lined channel to improve infiltration & outlet to Lake Tahoe (DCCD0430)
ZH01d	910	4.5	install treatment
ZP01	413	2.1	TRPA target for parcel BMP implementation
ZK01	1169	5.8	install treatment
DC07	844	4.2	TRPA target for parcel BMP implementation, perform Road Operations
<b>Total Potential Credits</b>		<b>33.9</b>	
1 credit =	200.4204		



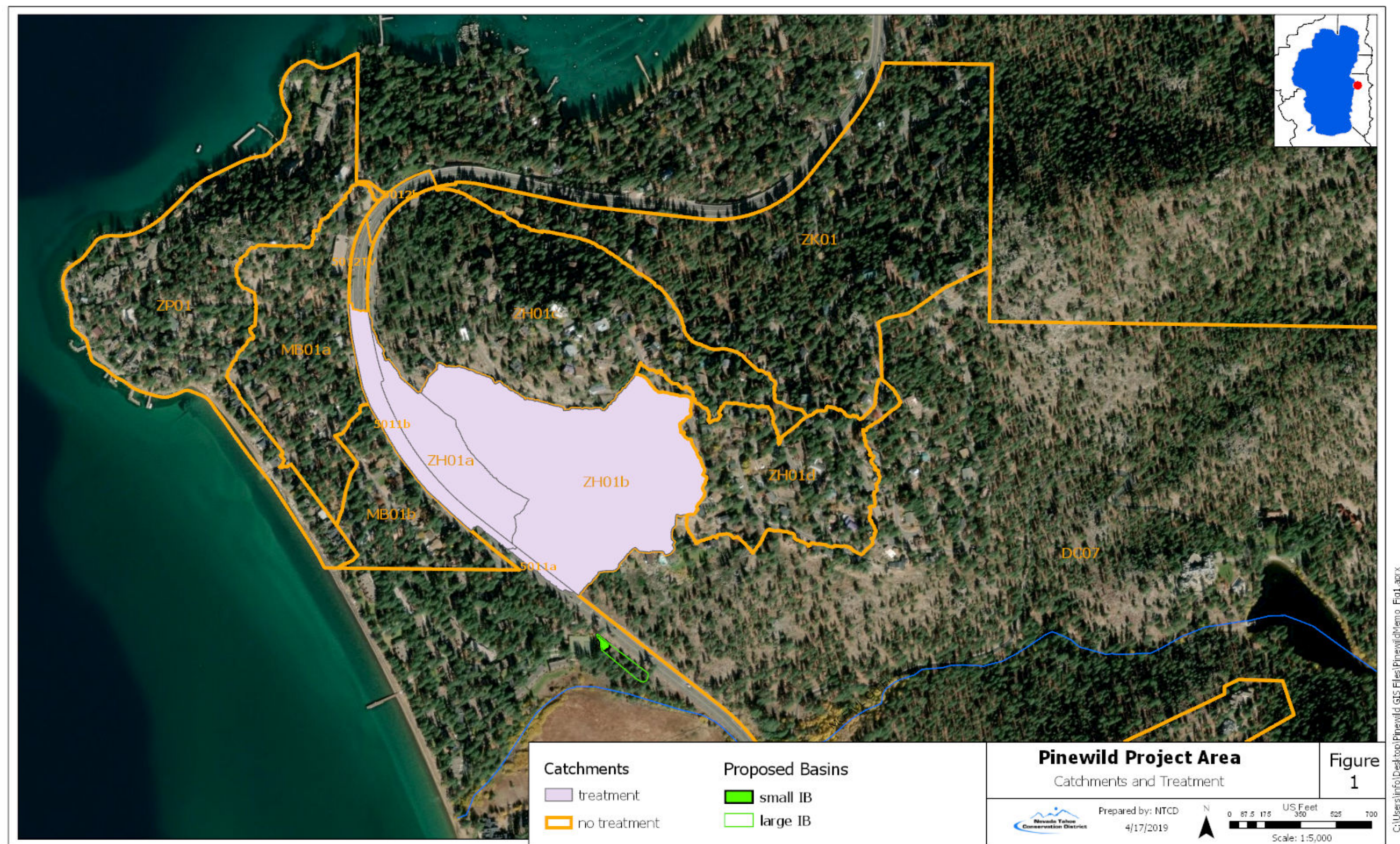


Figure 1. Pinewild Project Area Catchments and Proposed Treatment.