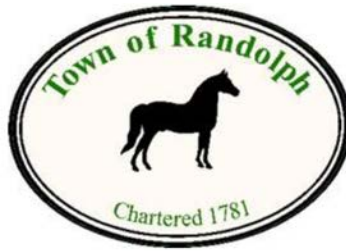


Randolph Stormwater Management Plan:



Village of Randolph

Completed by

Two Rivers-Ottawaquechee Regional Commission

with

Otter Creek Engineering

May 2019



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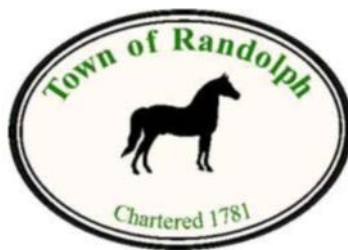
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Acknowledgements

The Two Rivers-Ottawaquechee Regional Commission (TRORC) would like to thank everyone who helped with aspects of this Stormwater Management Plan. We would like to thank The Ecosystem Restoration Program at the Vermont Department of Environmental Conservation for funding the project. We would like to thank Jim Pease at the Vermont Department of Environmental Conservation's Watershed Management Division for his comments and resources. We would like to thank Mary Russ and Greg Russ at the White River Partnership for their great work in the White River Watershed, most specifically the information they contributed regarding riparian conservation and restoration along the White River and its tributaries.

TRORC would like to thank DEC and Jim Pease for his assistance managing this grant and Hank Ainley for all of the stormwater data supporting in the development of this Plan.

TRORC would like to thank Mardee Sanchez, the zoning administrator for the Town of Randolph, as well as Mike Sargent and Bill Barrows of the highway department for their contributions to this Plan.



Introduction

Water does not abide by political boundaries, but instead adheres to the watershed concept, in which all water in a specific area drains to a specific point in an ecosystem. This Stormwater Management Plan intends to provide opportunities to preserve and remediate the integrity of clean water in Upper Third Branch of the White River Watershed and the land that contributes to its watershed.

This Stormwater Management Plan is for the Town of Randolph's developed lands. The upper Ayers Brook watershed is covered by the *Ayers Brook Watershed Stormwater Management Plan* by TRORC. Randolph Center is dominated by the Vermont Technical College and all its stormwater needs are managed by the state. VT DEC produced a report on its stormwater needs. Both reports are available here:

<https://anrweb.vt.gov/DEC/DEC/SWMapping.aspx?Folder=Town%20Reports%20and%20Maps\Randolph>.

Goals

This Stormwater Management Plan aims to:

- Reduce the impacts of stormwater runoff in the White River watershed;
- Reduce flooding damage to the Town of Randolph and communities downstream
- Identify problem areas that are contributing to stormwater runoff; and
- Identify and prioritize projects to actively restore the White River Watershed, including culvert upgrades, riparian buffers, and other project types.

Vermont's River Management Program also establishes the following management goal that intersects with this project: Manage toward, protect, and restore the equilibrium conditions of Vermont's rivers by resolving conflicts between human investments and river dynamics in the most economically and ecologically sustainable manner.

The Randolph Town Plan, which was adopted on September 17, 2013, also states their desires to protect water resources in their towns. The Randolph Town Plan states its intention to conserve "natural beauty and environmental health" and includes a goal in its plan to "Encourage the conservation of essential natural resources (agricultural soils, healthy forests, and clean water) and discourage uses that diminish or threaten their future viability." The Town Plan's "Natural Resources" chapter includes goals "to conserve natural resources for future generations for their own intrinsic value" and "to ensure that natural systems function and continue to support a healthy community." The "Water Resources" subchapter includes the goals "to maintain and improve the quality and quantity of both the surface and groundwater water resources, such as

the White River and tributaries, through careful management and through education about the threats to water resources” and “to maintain and enhance water resources for recreation, fisheries, wildlife habitats, and aesthetics.”

Stormwater Background

Stormwater is any form of precipitation, including rain and snow, which runs off the land. Usually this water either infiltrates the soil, where it is absorbed as groundwater, or becomes part of evapotranspiration, the combination of water that evaporates into the air and water that transpires from plants. Much of Vermont’s land is forested, where stormwater runoff is not a concern because it is naturally managed in an ecosystem that has evolved to handle precipitation events. However, stormwater runoff results and increases from all land clearing and land conversion activities.

Human beings live in landscapes that have been altered in many ways. Human development has significantly changed the hydrologic cycle. Human development, more specifically the construction of impervious surfaces, prevents stormwater runoff from effectively infiltrating the ground. Examples of impervious surfaces include paved surfaces, concrete, buildings, rooftops, and gravel roads. Because stormwater and the pollutants that accompany runoff cannot infiltrate the ground, they flow at rapid velocities and with high volumes during precipitation events. Impervious surfaces also prevent the natural purification in the soil of pollutants such as phosphorous, nitrogen, and sediment. Gravel road management concerns, such as improper ditching and improper maintenance of roads in deteriorating quality, also lead to stormwater impacts. Road failures in heavy storms are a significant contributor of sediment. Gravel roads are of particular concern in Orange County, Vermont where they make up the majority of roads in the region.

Impervious surface areas, and the resulting unmanaged stormwater runoff causes many detrimental effects. They lead to flow alterations in river bodies, such as channel erosion, channel instability, restriction of stream access to floodplains, and channel incision. These river corridor alterations result in increased flooding, which threatens houses and roads, and jeopardizes the resiliency of communities. Unmanaged stormwater runoff leads to pollutant runoff and concentration in water bodies, causes sediment plumes in surface water, and negatively impacts aquatic flora and fauna. Concentrated pollutants and sediment also detract from recreational activities around the state and property values of homes near these surface waters. Water quality is a highly valued natural resource in Vermont, and this value is reflected by many towns and their desire to protect the natural resources around them.

Stormwater runoff is interconnected throughout a watershed. A watershed is an area of land off of which all water that drains collects in the same place. If one section of a watershed, especially

a section that is higher in that watershed, is poorly managed, it will affect other parts of the watershed.

The Town of Randolph incorporates several sub-watersheds within the White River Watershed, which is characterized as Basin 9 by the Vermont Department of Environmental Conservation (VTDEC). The eastern portion of Randolph lies primarily within the Second Branch of the White River's watershed. The northwestern portion of Randolph includes the Ayers Brook watershed, which drains into the Third Branch of the White River. The western portion of Town also includes the outlet of the Headwaters of the Third Branch of the White River watershed and the Third Branch of the White River watershed. It is important to note that large portions of these sub-watersheds, especially the headwater areas, are located outside the Randolph's municipal boundaries. Therefore, some stormwater and water quality related concerns can originate outside of Randolph's municipal boundaries and flow downstream. Similarly, stormwater problems that originated within the densely populated Village of Randolph can impact downstream communities.

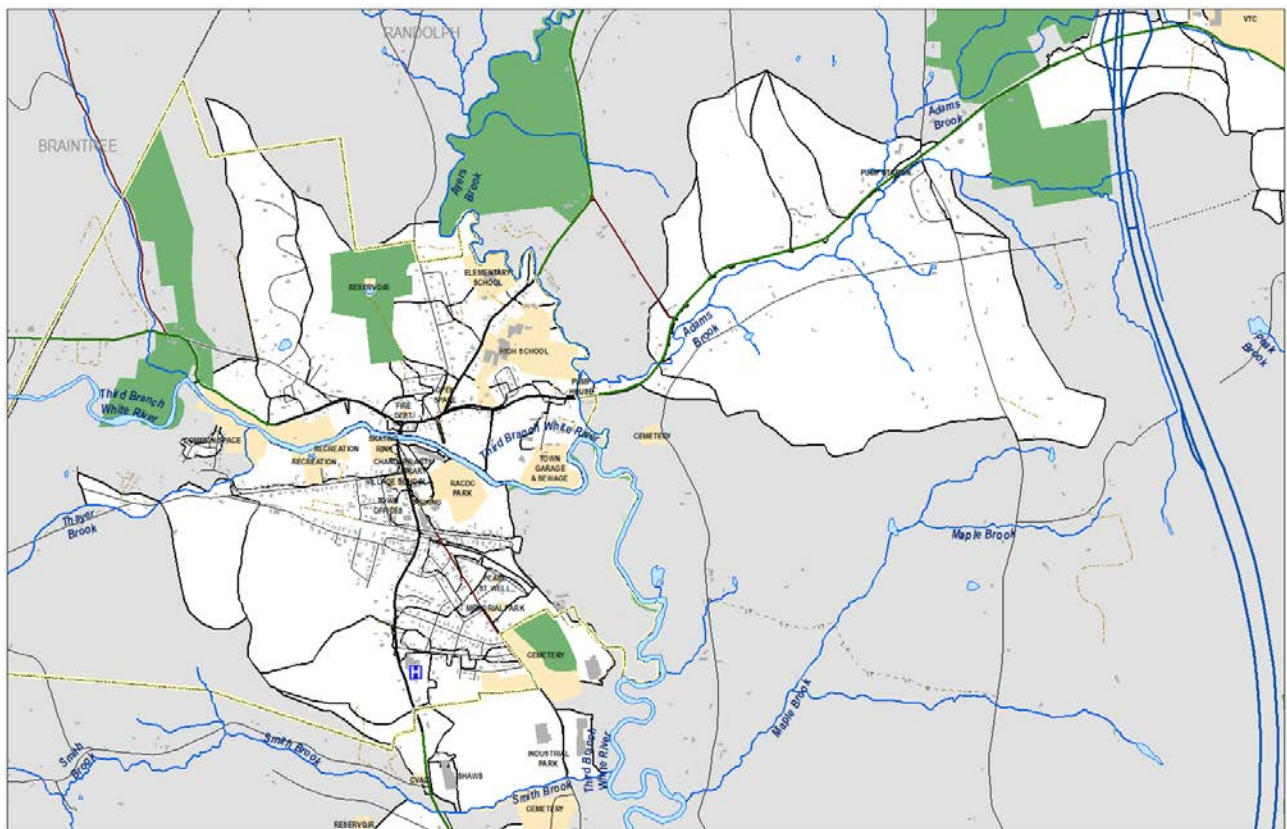


Figure 1 Randolph Village stormwater sub-watersheds, major tributaries, and selected lands

The Village of Randolph has the mainstem of the Third Branch flowing through the center and around the eastern edge (Figure 1). Ayers Brook flows from the north through farmland and then past the school complexes. Adams Brook flows down from Exit 4 along VT 66 and then

into Ayers Brook. Thayer Brook flows into the mainstem of the Third Branch on the west side and Smith Brook flows past the old landfill at the south end of the village and into the Third Branch.

The densest development is in the downtown but this is partially buffered by the Randolph Area Community Development Corporation (RACDC) floodplain forest park, the Lot, the golf course buffers and other forested buffers along the White as it heads south.

Stormwater Management Plan Development Process

In order to complete this project, the Two Rivers-Ottawaquechee Regional Commission (TRORC) compiled information from existing reports, analyzed existing data, and made site specific assessments. Specifically, TRORC staff:

- Issued SWMP Consultant RFP on 9/28/2018
- Selected consultant with town on 10/19/2018
- Coordinated with existing Ayers Brook Watershed Stormwater Master Plan grant
- Met with town officials and consultant for project kick off on 10/26/2018. The agenda included:
 - Project Schedule
 - Project Deliverables
 - Data Collection
 - Priority sub-watershed
- Coordinated priority site design list with town and consultant
- Obtained data from state and town for consultant support
 - Sent sewer line data from town to consultant
 - Obtained subwatershed boundaries from DEC
 - Obtained infrastructure layer files from DEC
- Drafted supporting maps
- Drafted village report and integrated SWMP consultant report
- Sent draft and final reports to DEC grant manager and town officials on 12/19/2018
- Final prioritization meeting with Town Engineer and Highway Superintendent on 12/27/2018
- Completed final deliverables on 1/2/2019

Current Conditions

Third Branch of the White River

The Third Branch of the White River, an eleven mile stretch from the Randolph/Bethel Town line until its confluence with Ayers Brook, is currently considered stressed by the Vermont Department of Conservation for sediment and nutrient pollutants due to stormwater runoff, agricultural runoff, streambank erosion, and loss of riparian vegetation. Due to the condition of the water, the aesthetics and aquatic life uses are also considered stressed.

The Third Branch downstream of the town line with Braintree is a highly active floodplain with



Figure 2 Third Branch changing meanders west of village

many meanders and bank failures. Much deposition is occurring in this stretch along with additional sediment acquisition from the bank failures. The stream boundary from the late 1990s compared to the 2016 shows the work of the active meanders (Figure 2).

The Third Branch starts at the town line on the western edge, continues past the Braintree Hill and Thayer Brook confluences and then continues through the town recreation complex area. It then continues past the RACDC floodplain forest trail parcel, past the WWTF and to the Ayers Brook confluence. The buffers along the recreation areas and the forested areas at the pump track and the floodplain forest provided excellent natural storage and filtering areas.

It then turns south and heads through the golf course and behind the industrial areas along and past the landfill and then into farmland. The golf course reaches are mostly well buffered and the lower farmland areas include some high bank failures but there are several amazing oxbows that have been created in just the past 20 years (Figure 3).

Further downstream, within the Town of Bethel, the Third Branch of the White River is considered water quality impaired by the Vermont DEC and is listed on the 2016 303(d) List of Impaired Waters due to consistently elevated E. Coli levels, it is impaired for contact recreation such as swimming.

Ayers Brook

Ayers Brook is a major tributary to the Third Branch of the White River. This is currently a stressed waterway, as identified by the 2016 Vermont Stressed Waters List. Current pollutants include sediment, Nickel, Chromium, and *E. Coli*, which have been caused by streambank instability and erosion, loss of riparian vegetation, and habitat alteration from agricultural activities throughout the Brook's watershed in Randolph, Braintree, and Brookfield. Ayers Brook is also stressed for aesthetics and aquatic life support.



Figure 3 Third Branch changing meanders south of village

Adams Brook

Adams Brook is a tributary to Ayers Brook that runs down the hill from Randolph Center along VT 66 to the Ayers Brook just upstream of the VT 66 bridge. It receives runoff from VT 66 and the corresponding developed area along this corridor as well as the development at Exit 4 of I-89 (Figure 4).

Thayer Brook

Thayer Brook is a tributary to the Third Branch that runs from Braintree on the east into the Village and then enters the Third Branch just upstream of the recreation fields. It is characterized by several large bank failures along the rail line and Brook Street as well as near the confluence with the Third Branch. The banks are all very steep and the stream is quite incised and carrying a lot of smaller and leger sediment and cobble from upstream through these reaches. The deposition can be seen just upstream of the confluence with the Third Branch (Figure 5).

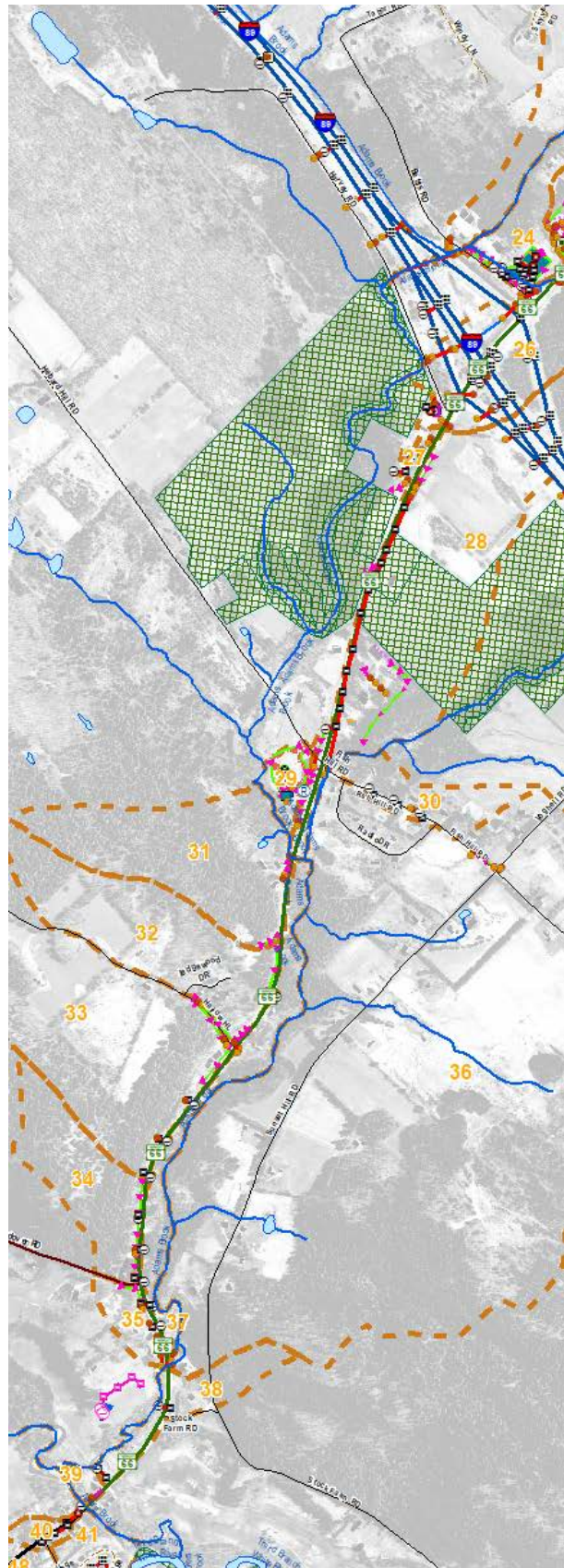


Figure 4 Adams Brook watershed along VT 66

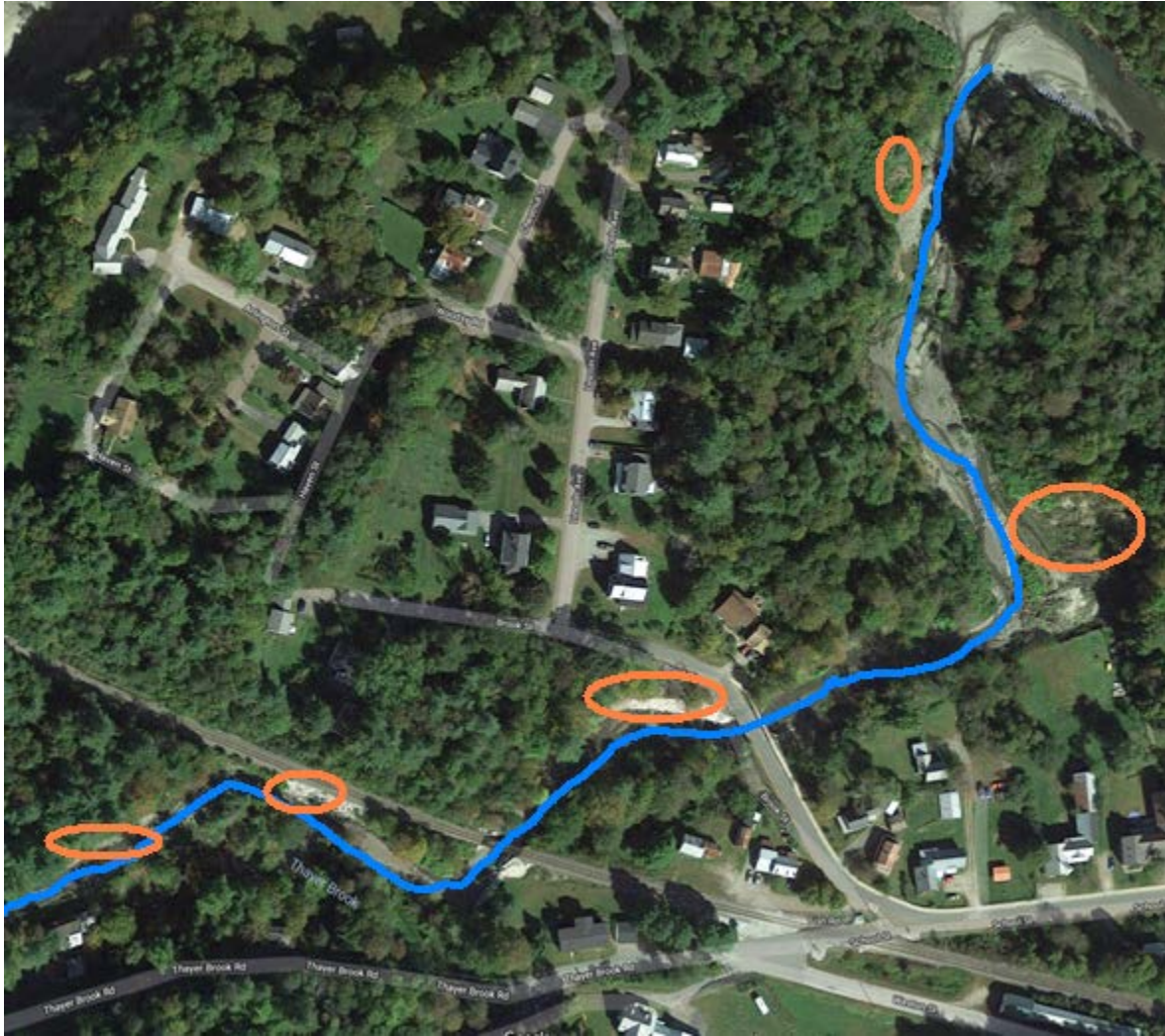


Figure 5 Thayer Brook bank failures and confluence with Third Branch

Smith Brook

Smith Brook is small tributary to the Third Branch at the south end of the village that runs along Tatro Hill Road and past the Justin Morgan Plaza with the large Shaw’s grocery parking lot. The lower reach of Smith Brook just south of the industrial development along Beanville Road is listed by VTDEC as a High Priority for water quality remediation as this was the site of the old landfill (Figure 6).

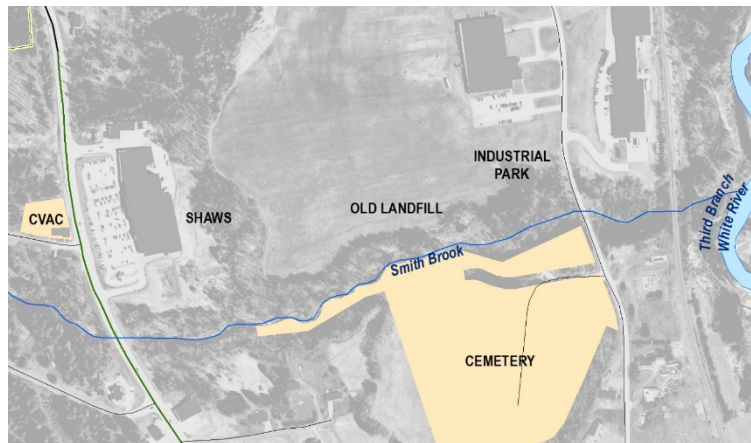


Figure 6 Smith flowing past Shaws and south of old landfill

Braintree Hill Brook

Braintree Hill Brook is a small tributary to the Third Branch at the west end of the village that runs along Braintree Hill Road to the Third Branch just upstream of the Thayer Brook confluence and the recreation fields. Most of the reaches are in the Town of Braintree and both Randolph and Braintree are working to implement better road runoff standards along the Braintree Hill Road's ditches and culverts.

Critical Floodplain and Open Areas

Randolph Recreation Areas

These include the ballfields and the pool complex on the north and south side of the Third Branch as well as the hockey rink and forested pump track area just before Main Street.

RUHS Athletic Fields

This area includes the athletic fields to the east of the high school and just west of the Adams Brook Ayers Brook confluence.

RADC Floodplain Forest

This 30-acre parcel owned by RADC is forested just to the east of downtown and just west of the mainstem of the Third Branch. It includes a walking loop where folks can see a true floodplain forest that includes sugar maples, basswoods and ostrich ferns (Figure 7).

Golf Course Floodplain

The golf course includes remnant forested areas acting as riparian buffers in several spots with rare plant species.

South Pleasant Street Woods

This is a 10-acre town parcel beyond the Southview cemetery that is wooded and includes a few trails. It serves as a partial riparian buffer to the Third Branch.

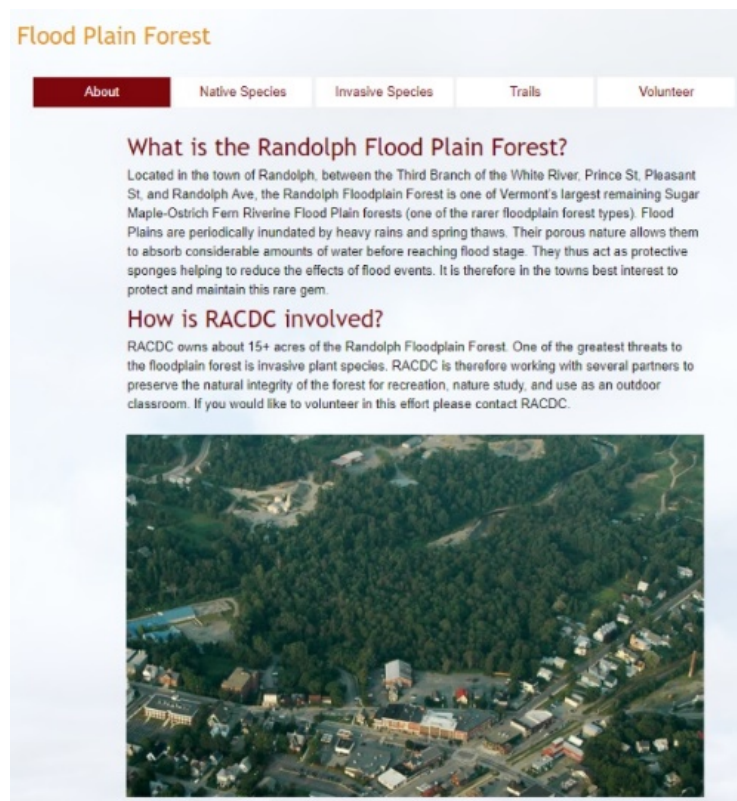


Figure 7

RACDC Floodplain Forest

Randolph-Bethel Floodplain

This floodplain area features Sugar Maple-Ostrich fern high terrace forest, steep eroding bluffs, a successional low floodplain community, and a low terrace floodplain forest. The high terrace forest communities located in this area are considered very rare in the State of Vermont. This floodplain area crosses the Town of Randolph's municipal boundary and includes part of the Town of Bethel; it is estimated that the Randolph portion consists of 50-60 acres, most of which is privately owned.

Ellis Reserve

This 38-acre parcel surrounds the town reservoir on a high piece of land in the northern portion of the village.

Stormwater Requirements in Randolph Land Use Regulations

The Town of Randolph currently has several stormwater provisions as part of their Land Use Regulations which were last amended in 2017. These include management standards for a Floodplain Overlay District and a Water Conservation Overlay District.

Floodplain Overlay District

The purpose of the Flood Plain Overlay District is to protect the public safety, maintain eligibility in the National Flood Insurance Program, reduce costs to the municipality and to private individuals for damage resulting from development in floodplains, and conserve the natural water retention capacity and special natural resource characteristics of floodplains, including floodplain forests. A permit is required for all development in the FPO District, except if listed as Exempt Land Development. The FPO covers the Special Flood Hazard Area (SFHA) and the floodway, which is a subzone within the SFHA.

Water Conservation Overlay District

The purpose of this overlay district is to protect and enhance the water quality and natural beauty of the rivers that run through Randolph by precluding development in this area, while allowing utility, safety or bank stabilization projects as well as low-impact recreational uses.

The district boundaries are 75 feet from top of streambank on both sides of the Second and Third Branches of the White River and of Ayers Brook. The only permitted uses include passive recreation, streambank stabilization, utility projects, and other development required for safety or access.

Existing Reports

There are seven existing reports that were referenced extensively in the development of this Stormwater Management Plan. These reports made individual recommendations and aided the development of priority projects included in this plan.

Redstart Consulting, Middle and Third Branch Corridor Plan 2014

https://anrweb.vt.gov/DEC/SGA/report.aspx?rpId=114_CPA&option=download

VTDEC Updated Water Quality/Aquatic Habitat Assessment Report 2016

https://dec.vermont.gov/sites/dec/files/documents/mp_WaterQualityAssessmentReport_Basin9_WhiteRiver_2016-12.pdf

VTDEC Town of Randolph Stormwater Infrastructure Mapping Report 2015

<https://anrweb.vt.gov/DEC/DEC/SWMapping.aspx?Folder=Town%20Reports%20and%20Maps\Randolph>

TRORC Ayers Brook Watershed Stormwater Management Plan 2016

<https://anrweb.vt.gov/DEC/DEC/SWMapping.aspx?Folder=Town%20Reports%20and%20Maps\Randolph>

VTDEC 2018 White River Tactical Basin Plan 2018

<https://dec.vermont.gov/sites/dec/files/documents/2018%20White%20River%20Tactical%20Basin%20Plan.pdf>

VTDEC Story Map Online Presentation of White River Watershed and Plan

<https://arcg.is/1XDPvK>

TRORC Municipal Roads General Permit (MRGP) Road Erosion Inventory 2018

<https://anrweb.vt.gov/DEC/IWIS/MRGPRReportViewer.aspx?ViewParms=True&Report=Inventory&MunicipalityID=164>

Existing Water Quality Listings

2016 Stressed Water List:

http://dec.vermont.gov/sites/dec/files/documents/wsmd_mp_stressed_waters_list_2016.pdf

2016 Impaired Water List:

http://dec.vermont.gov/sites/dec/files/documents/WSMD_mapp_303d_Part_A_2016_final_complete.pdf

Third Branch Stressed Waters Entry:

THIRD BRANCH (WHITE RIVER), AYERS BRK TO BETHEL (11 MILES)
SEDIMENT, NUTRIENTS, AES, ALS
STORMWATER & AGRICULTURAL RUNOFF, LIVESTOCK ACCESS, LOSS RIPARIAN
VEGETATION, BANK EROSION

The State of Vermont includes the Third Branch in its 2016 Stressed Waters List. According to the 2016 Updated Water Quality/Aquatic Habitat Assessment Report, the Third Branch has fair to excellent macroinvertebrate assessments. *E. coli* assessments have revealed that levels from the mouth to the Stock Farm Rd have been elevated. Smith Brook, however has poor macroinvertebrate and fish assessments in 2014 due to the iron coating on the bottom of the streambed from the old landfill nearby. This is listed as a priority project in the 2018 White River Tactical Basin Plan. Finally, the New England Land Company site across the Main Street Bridge was a former gas station and the tanks were removed in 2006. New monitoring wells were installed in 2009 and in 2015 two wells had contaminant levels about VGES limits.

According to 2016 Updated Water Quality/Aquatic Habitat Assessment Report, Adams Brook has not been sampled since 2002 and 2006 at its two locations. Thayer Brook has never been sampled.

In September 2016, the White River Partnership removed the steel piling dam (Sargent, Osgood, Roundy Dam) underneath the Main Street bridge allowing fish access to 98 miles of the Third Branch and its tributaries.

ACT 64 and Vermont Water Quality

- A. For new development or redevelopment the thresholds below trigger a state stormwater permit:
- Discharges of stormwater runoff from new development in which the area of all impervious surfaces generating regulated stormwater runoff is equal to or greater than 1 acre;
 - Discharges of stormwater runoff from the expansion of existing impervious surfaces by 5,000 square feet, at an existing development, if total resulting impervious surface is greater than 1 acre;
 - Discharges of stormwater runoff from the redevelopment of 1 acre or more of existing impervious surfaces at an existing development;
- B. A new Municipal Roads General Permit (MRGP) is required for hydrologically connected segments of municipal roads to reduce erosion and improve quality in Vermont waterways. For these priority road segments, municipalities will need to integrate Best Management

Practices, such as stone lining ditches with slopes greater than 5%, road crowning, stabilizing exposed soils, installing culvert headers, stabilizing culvert outlets with stone-lined aprons, making U-shaped ditches, and establishing turnouts, in order to reduce erosion on municipal roads. Towns will develop a maintenance schedule to address these problems over 20 years. The MRGP Erosion Inventory was completed by TRORC during the summer of 2018.

Public Lots with >3-acre Impervious Surfaces

The Town must be aware of any town owned parcels with 3 acres or greater of impervious surface as they will be regulated with an upcoming stormwater general permit. Permit compliance will be required by 2033 and the state will not require towns to pump stormwater or treat it off-site. The list below has town parcels with significant areas of impervious surfaces. Designs and cost estimates were included in the appendix for all of these sites.

Town Garage and WWTF facility (sub watersheds 41, 42)

The area around Hedding Drive includes almost 4 acres of impervious surface in buildings and parking material storage lots. Restoring the material storage lots closest to the floodplain to natural floodplain should be a top priority and will lower the impervious area.

Landfill (sub watershed 82)

This area includes over 3 acres of impervious surface in material storage parking lots and driveways.

OSSD Randolph Elementary School (sub watershed 46)

The Elementary school and parking lots includes over 3 acres of impervious surface. Both the Elementary school and the high school are not owned by the town but by the Orange Southwest School District.

OSSD Randolph Union High School (sub watershed 45)

The high school buildings, parking, support buildings, supervisory union building and driveways include over 10 acres of impervious surface not including the recreational fields.

Town Office Complex Parking (sub watershed 53)

Most of the town office/USPO parking lot is owned by the town. This area only totals 0.9 acres including the roof of the town office. The portion of the lot behind the church is owned by the church.

Stormwater Areas of Concern and Problem Areas

The next section describes and illustrates areas of concern that are causing stormwater impacts in the village.

Village Stormwater Infrastructure Retrofit Sites

Otter Creek Engineering was hired by the town and TRORC to review all the high priority sites (red and orange) identified in the Town of Randolph Stormwater Infrastructure Mapping Report 2015 by the VTDEC. The town wanted to complete value-added 10% designs that included

initial engineering to develop preliminary cost estimates which could be used for budget planning for more detailed designs. Vermont Technical College was excluded as it is owned by the VT State Colleges. East Randolph Village does not include any stormwater sub watershed mapped by VTDEC in the 2015 Stormwater Infrastructure report. Finally, Highland Avenue and Maple Street are already having stormwater retrofits designed by DuBois & King through a separate town contract. Three sites were selected for 30% designs. These included plan sheets with construction notes and typical diagrams as well as site plans and cost estimates. These sites are all surface treatment areas that did not require geotechnical borings or other subsurface engineering. For these 3 sites, the 30% designs may be sufficient for bidding and construction since they do not include any advanced design work.

Table 1: 3 sites selected for 30% Designs with Engineering and Cost Estimates

<i>Watershed</i>	<i>ROADS</i>	<i>COMMENTS</i>
41	VILLAGE CIR and TOWN GARAGE	Concerned about runoff from areas adjacent to WWTF
84	LINCOLN AVE, CHESTNUT ST	Concern along Lincoln Ave exiting watershed and draining into Third Branch
87	BRIGHAM CIR, WALLACE HILL RD	Drains into Third Branch White River

Interim Outfall Retrofit Sites

As it may take time to implement these projects, in the interim the town could address several of the worst stormwater outfalls in the village. TRORC surveyed these as part of the summer 2018 MRGP inventory. Treatments generally include repairing broken outfalls and stone lining the outlets with stone check dams.



Figure 8 MRGP Outfall Sites

Recommendations

Below are recommendations grouped by focus area. Many of these can be funded using grant opportunities, such as Vermont Agency of Transportation's Better Roads grants and Vermont Watershed Management Division's Ecosystem Restoration grants.

Stormwater Infrastructure Retrofit Sites

- Review sites with local landowners to determine interest. Focus on town/school/other quasi-public land initially.
- Integrate projects into capital planning budgets and lists

River Corridors

- Maintain current town and RACDC lands along the Third Branch and consider improving or enlarging buffers along the recreation fields.
- Monitor bank failures along Thayer Brook and the Third Branch above and below the Thayer Brook confluence. These are adding significant sediment to the White River. Work with landowners and the partners like the conservation commission and the White River Partnership to investigate stabilizing the tops and toes of these banks if possible.
- Permanent conservation through fee or easement of these and other floodplain areas to maintain floodplain and improve bank stability.

Zoning

- Consider adding river corridor protections to limit new development in the river corridor around the periphery of the village and along the larger streams in town with River Corridor delineation given the dynamic meander patterns clearly visible.
- Protect riparian buffer zones on all rivers and streams, especially along unstable reaches on the White River and its tributaries, in Randolph. All streams, rivers, and wetlands outside of core developed areas should have an undisturbed vegetated buffer strip that extends 50 feet from the top of all streambanks and wetlands. These riparian buffers should exclude clearing, excavation, filling, grading or development, with the exceptions of streambank stabilization and restoration, and crossings for roads (bridges etc.).
- Adopt site plan green infrastructure/low impact site plan/subdivision development requirements in existing zoning in the village as well as along Route 66 and Adams Brook.
- In order to maintain stream stability, the Towns of Randolph should limit all new development and construction project parcels to contain no greater than 10% impervious

surface. If projects contain greater than 10% impervious surface they should be required to conserve or protect vegetated and forested land elsewhere in order to achieve this ratio.

Highways

- The process of implementing the statewide Municipal Roads General Permit (MRGP) is a multi-year effort that aims to reduce road erosion, decrease sedimentation, and, improve water quality in surface waters. 15% of the non-complaint hydrologically connected road segments (surface, ditches and culverts with erosion present) must be upgraded by 2023 to meet the MRGP standards with full compliance on all hydrologically connected segments by 2036.
- Continue to abide by adopted 2013 Road and Bridge Standards. The Towns of Braintree, Brookfield, and Randolph adopted these standards in 2013. Towns should adopt new Road and Bridge Standards as they are developed.
- Review MRGP Inventory by TRORC during summer of 2018 and implement projects

Very High Priority Project Sites: Does not meet MRGP standards and road slope >10%

Project 1 Howard Hill Road	Sites 1-2
Project 2 Whalen Road	Site 3
Project 3 Dugout Road	Site 4

High Priority Project Sites: Does not meet MRGP standards

Project 4 Davis Road	Site 5
Project 5 Ferris Road	Site 6
Project 6 N Randolph Road	Sites 7-10
Project 7 Kibbee Road	Site 11
Project 8 Ski Tow Road	Site 12
Project 9 Sunset Hill Road	Site 13

Appendix One: Overall Project Listing

IDDE WATERSHEDS		
Watershed	ROADS	COMMENTS
60 65-68 73	MAPLE ST, HIGHLAND AVE	Significant issues (D&K handling redesign with another town contract)
39	VT66 AT AYERS BROOK	Bridge over Ayers Brook need to address runoff before reaches Brook
40	VT 66 AT HEDDING DR	Adjacent to Ayers Brook
41	VILLAGE CIR and TOWN GARAGE	Concerned about runoff from areas adjacent to WWTF
45	FOREST ST AT RUHS	Could be demonstration project with RTCC and VTC students
46	RANDOLPH ELEMENTARY	Includes a few residences
50	CENTRAL ST., N MAIN ST	Need to address runoff from Cumberland Farms and roadway
53	US POST OFFICE	Town office USPO complex highly visible
53	PRINCE ST	Downtown, highly visible
56	N MAIN ST	Downtown
55	RANDOLPH HOUSE	Elderly housing
61	PEARL ST, S PLEASANT ST	Downtown
82	LANDFILL RD	Need to address runoff from transfer station lots
84	LINCOLN AVE, CHESTNUT ST	Concern along Lincoln Ave exiting watershed and draining into Third Branch
87	BRIGHAM CIR, WALLACE HILL RD	Drains into Third Branch White River
3 5 6 7 8	VERMONT TECHNICAL COLLEGE	Concerns will be addressed by state college system
MRGP OUTFALLS IN VILLAGE		
O5632		Broken end but flowing well and has vegetation to drain before it hits waterway.
O5670		Needs cleaning, plugged with dirt. Steel
O6657		Could not locate.
O5162		Broken end but flowing well and has vegetation to drain before it hits waterway.
O5665		Broken end but flowing well and has vegetation to drain before it hits waterway.
MRGP TOWN HIGHWAYS		
Very High Priority Project Sites: Does not meet MRGP standards and road slope >10%		
Project 1	Howard Hill Road	Sites 1 Stone line ditches Site 2 Stone line ditches and turnouts
Project 2	Whalen Road	Site 3 Stone line ditches and remove high shoulder
Project 3	Dugout Road	Site 4 Address crown, hyd. hammer ledge and stone line ditches, and stone outlets
High Priority Project Sites: Does not meet MRGP standards		
Project 4	Davis Road	Site 5 Stone line ditch opposite stream side
Project 5	Ferris Road	Site 6 Stone line turnouts, lower culvert and high shoulder
Project 6	N Randolph Road	Sites 7-10 Stone line turnouts under guard rail, clean and reline ditch opposite side
Project 7	Kibbee Road	Site 11 Remove high shoulder, stone line turnouts to stream
Project 8	Ski Tow Road	Site 12 Remove high shoulder, stone line turnouts to stream, stone line opp. ditch
Project 9	Sunset Hill Road	Site 13 Stone line turnouts and culvert apron

Appendix Two: Stormwater Infrastructure Designs and Cost Estimates

All estimates including final design engineering except for Partridge Hill and Lincoln Ave.

For roughly \$100,000, the town can treat 26 acres of the first 6 sites (not including the HS).

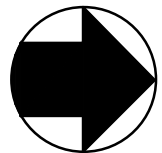
The VTDEC Town of Randolph Stormwater Infrastructure Mapping Report from 2015 identified two significant erosion sites caused by municipal stormwater discharges. They are located

- (1) At the rear of 13 Maple St
- (2) Just to the South of 72 S Pleasant Street

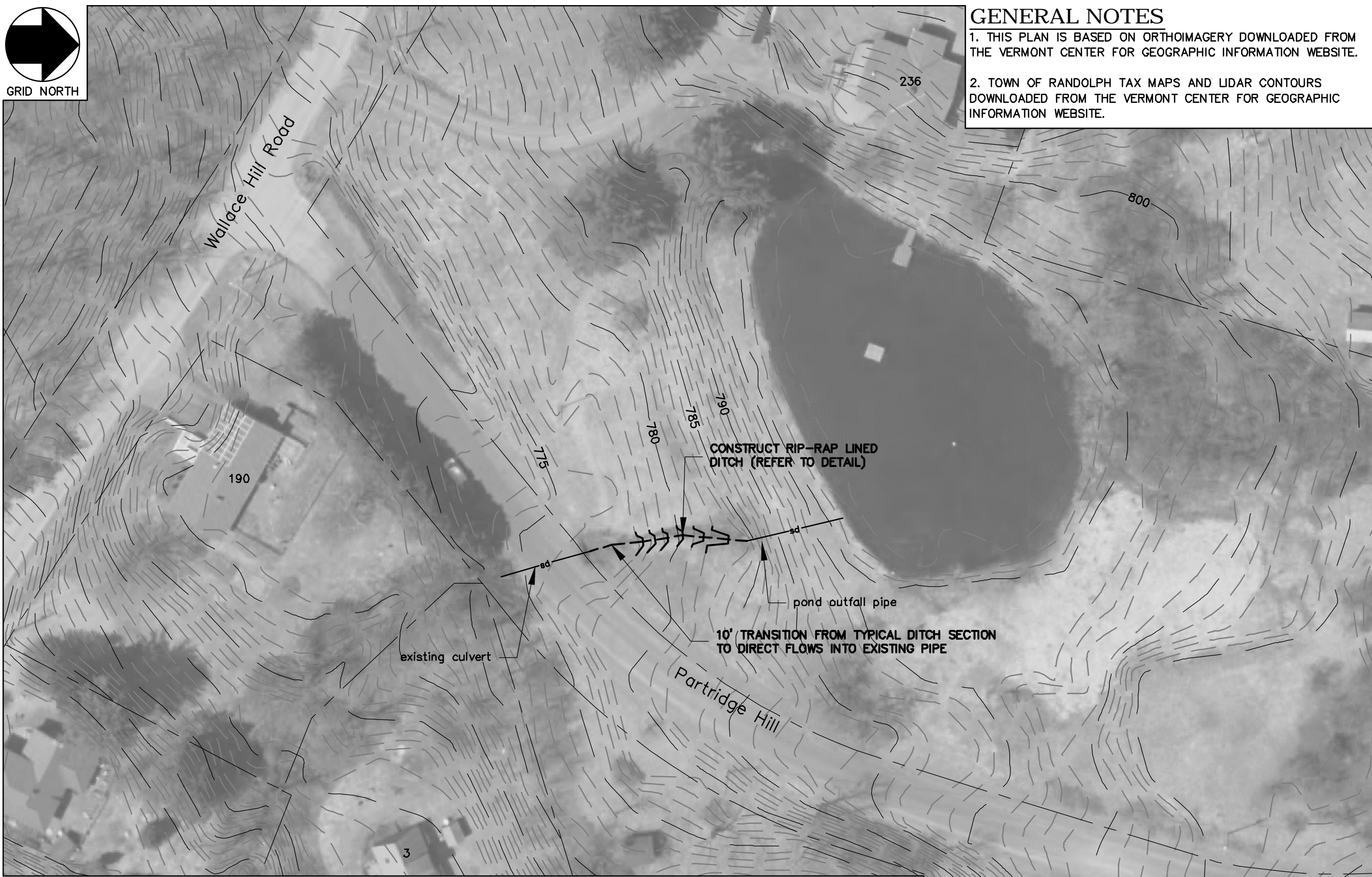
These two sites were not included in this report and should be addressed.

<i>Location</i>	<i>W#</i>	<i>Treatment</i>	<i>Owned</i>	<i>Cost</i>	<i>Cost25%</i>	<i>Area</i>	<i>Cost/acre</i>
Bingham Hill to Rec Fields N	87	Stone line ditch	town	\$4,875	\$6,500	7.2	\$677.08
Lincoln Ave	84	Stone line outlet	ROW/pri	\$1,875	\$2,500	1.5	\$1,250.00
High School	45	Infiltration basin	SCHOOL	\$27,422	\$36,562	10.0	\$2,750.40
Pearl St	61	Sediment forebay	in ROW	\$9,973	\$13,297	3.1	\$3,217.02
Prince St	53	Infiltration basin	ROW/pri	\$36,275	\$48,367	10.5	\$3,468.00
Old Foundry	82	Infiltration basin	private	\$16,352	\$21,803	2.6	\$6,289.33
Village Circle Town Garage	41	Dry swale filter bed	private	\$9,669	\$12,892	0.8	\$12,892.00
North Main St	56	Infiltration basin/hydrodynamic separator	town	\$50,054	\$66,739	2.7	\$18,538.61
VT 66 at Ayers Brook	39	4' deep sump	pump	\$14,804	\$19,739	0.4	\$37,010.63
Randolph House	55	surface sand filter	sm priv	\$26,946	\$35,928	0.7	\$38,494.29
Elementary School	46	Infiltration basin/hydrodynamic separator	SCHOOL	\$362,017	\$482,689	9.3	\$39,094.68
Main St at Cumbies	50	Jellyfish Treatment	in ROW	\$104,222	\$138,963	1.7	\$61,307.21
USPO	53	Bioretention Area	town	\$6,098	\$8,131	0.1	\$67,758.33
VT 66	40	Jellyfish Treatment	sm priv	\$99,596	\$132,794	0.8	\$132,794.00

Appendix Three: Three 30% Stormwater Designs and Cost Estimates



GRID NORTH



GENERAL NOTES

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**TWO RIVERS-OTTAUQUECHEE
REGIONAL COMMISSION
PARTRIDGE HILL
STORMWATER IMPROVEMENTS
RANDOLPH, VERMONT**

DATE ISSUED: 2/12/19

DRAWN BY: RR

CHECKED BY: BFR

SCALE: 1"=50'

PROJECT NO.: 923.001

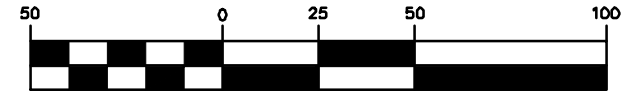
TITLE:

SITE PLAN

SKETCH NO.

1

REF. DRAWING: 923-001 SUB 87



(IN FEET)
1 inch = 50 ft.

CONSTRUCTION NOTES

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2. CONTRACTOR SHALL COORDINATE WITH DIG-SAFE (888)-344-7233 OR WWW.DIGSAFE.COM A MINIMUM OF 48 HOURS PRIOR TO PERFORMING ANY EXCAVATION.

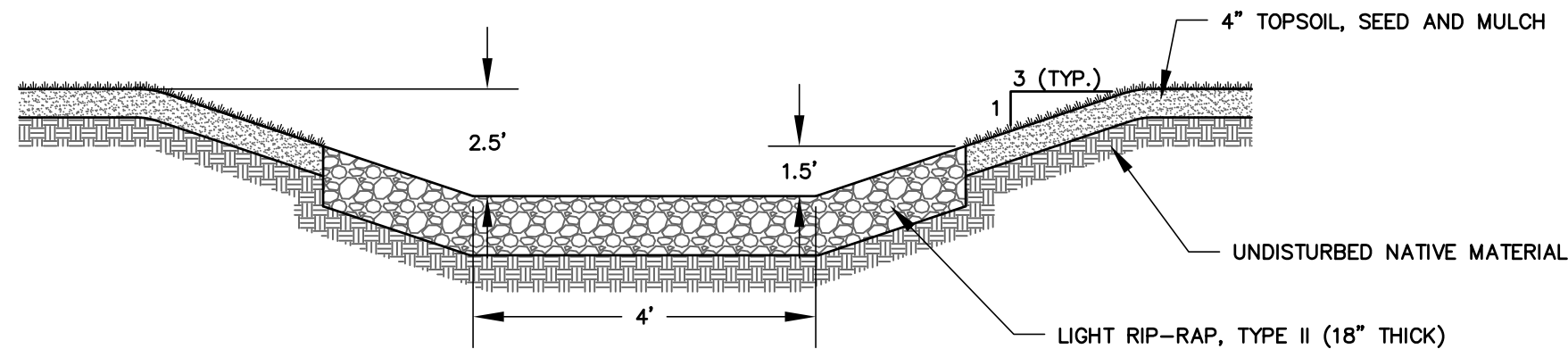


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LINED DITCH DETAIL

NOT TO SCALE

MATERIAL NOTES:

1. LIGHT RIP-RAP, TYPE II :
 - THE LONGEST DIMENSION OF STONE SHALL VARY FROM 2 TO 36 INCHES, AND AT LEAST 50 PERCENT OF THE VOLUME OF STONE IN PLACE SHALL HAVE AT LEAST DIMENSION OF 12 INCHES.
 - ROCK SHALL BE GREY OR GREYISH-BLUE IN COLOR.
 - ROUNDED UN-FRACTURED, SMOOTH ROCKS, QUARRY SCREENINGS AND TAILINGS SHALL NOT BE ACCEPTABLE RIP-RAP.
2. GRASS SEED SHALL BE "CONSERVATION MIX" OR APPROVED EQUAL.

INSTALLATION NOTES:

1. CLEAR VEGETATION.
2. EXCAVATE TO GRADES, DEPTHS, AND DIMENSIONS SHOWN ON PLANS. DO NOT DISTURB SUBGRADE.
3. INSTALL FILTER FABRIC ON PREPARED SUBGRADE ACCORDING TO MANUFACTURES INSTRUCTIONS. FABRIC SHALL BE ROLLED OUT FLAT AND TIGHT WITH NO FOLDS.
4. PLACE RIP-RAP ATOP FABRIC, TAKE CARE NOT TO PUNCTURE OR RIP UNDERLYING FABRIC. RIP-RAP SYSTEM SHALL BE PLACED SUCH THAT THE END PRODUCT RESEMBLES A WELL GRADED AND CONSOLIDATED ROCK MASS. "DUMPING" OF ROCKS IS NOT ACCEPTABLE.
5. AREAS TO BE PLANTED SHALL BE RAKED TO REMOVE DEBRIS. PLACE 2" TOPSOIL AND APPLY SEED 5LB/1000SF LIGHTLY RAKE SEED INTO SURFACE. LIGHTLY ROLL SURFACE AND WATER WITH FINE SPRAY. WITHIN 24 HOURS MULCH SEEDED AREA.

**TWO RIVERS-OTTAUQUECHEE
REGIONAL COMMISSION
PARTRIDGE HILL
STORMWATER IMPROVEMENTS
RANDOLPH, VERMONT**

DATE ISSUED: 2/12/19

DRAWN BY: RR

CHECKED BY: BFR

SCALE: 1"=50'

PROJECT NO.: 923.001

TITLE:

DETAIL

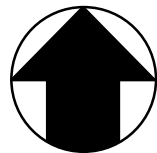
SKETCH NO.

2

REF. DRAWING: 923-001 SUB 87

WATERSHED #87:

Watershed #87					
Preliminary Opinion of Project Cost					
Item No.	Description	Unit Quantity		Unit Cost	Total Cost
1	Channel Excavation	100	LF	\$ 20	\$ 2,000
2	Riprap lined ditch from on-stream pond	70	CY	\$ 35	\$ 2,450
3	Mobilization / Demobilization	1	LS	\$ 500	\$ 500
4	EPSC Measures	1	LS	\$ 250	\$ 250
				Subtotal of Construction Cost	\$ 5,200
				Technical Services	\$ -
				Contingency (25%)	\$ 1,300
				Total Estimated Project Cost	\$ 6,500
<u>Notes:</u>					
1) Channel excavation 4-ft wide x 1.5-ft deep.					
2) Engineering Services not required/necessary.					
3) Riprap lined ditch 1.5-ft deep x 4-ft wide. (18sf x 100lf)					



GENERAL NOTES

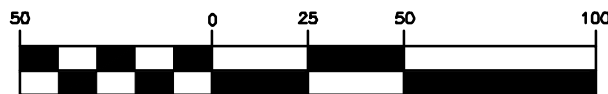
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GRID NORTH



CONSTRUCTION NOTES

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2. CONTRACTOR SHALL COORDINATE WITH DIG-SAFE (888)-344-7233 OR WWW.DIGSAFE.COM A MINIMUM OF 48 HOURS PRIOR TO PERFORMING ANY EXCAVATION.
3. PROVIDE TOPSOIL, SEED AND MULCH TO DISTURBED AREAS.
4. EXISTING VEGETATION SHALL BE CUT FULL TO EXISTING GRADE AS NECESSARY FOR RIP-RAP INSTALLATION.
5. GRUBBING OF ROOTS, STUMPS, ECT. SHALL BE LIMITED TO MAXIMUM EXTENT PRACTICABLE.



(IN FEET)
1 inch = 50 ft.



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LINCOLN AVENUE
STORMWATER IMPROVEMENTS
RANDOLPH, VERMONT**

DATE ISSUED: 2/12/19

DRAWN BY: RR

CHECKED BY: BFR

SCALE: 1"=50'

PROJECT NO.: 923.001

TITLE:

SITE PLAN

SKETCH NO.

1

REF. DRAWING: 923-001 SUB 84

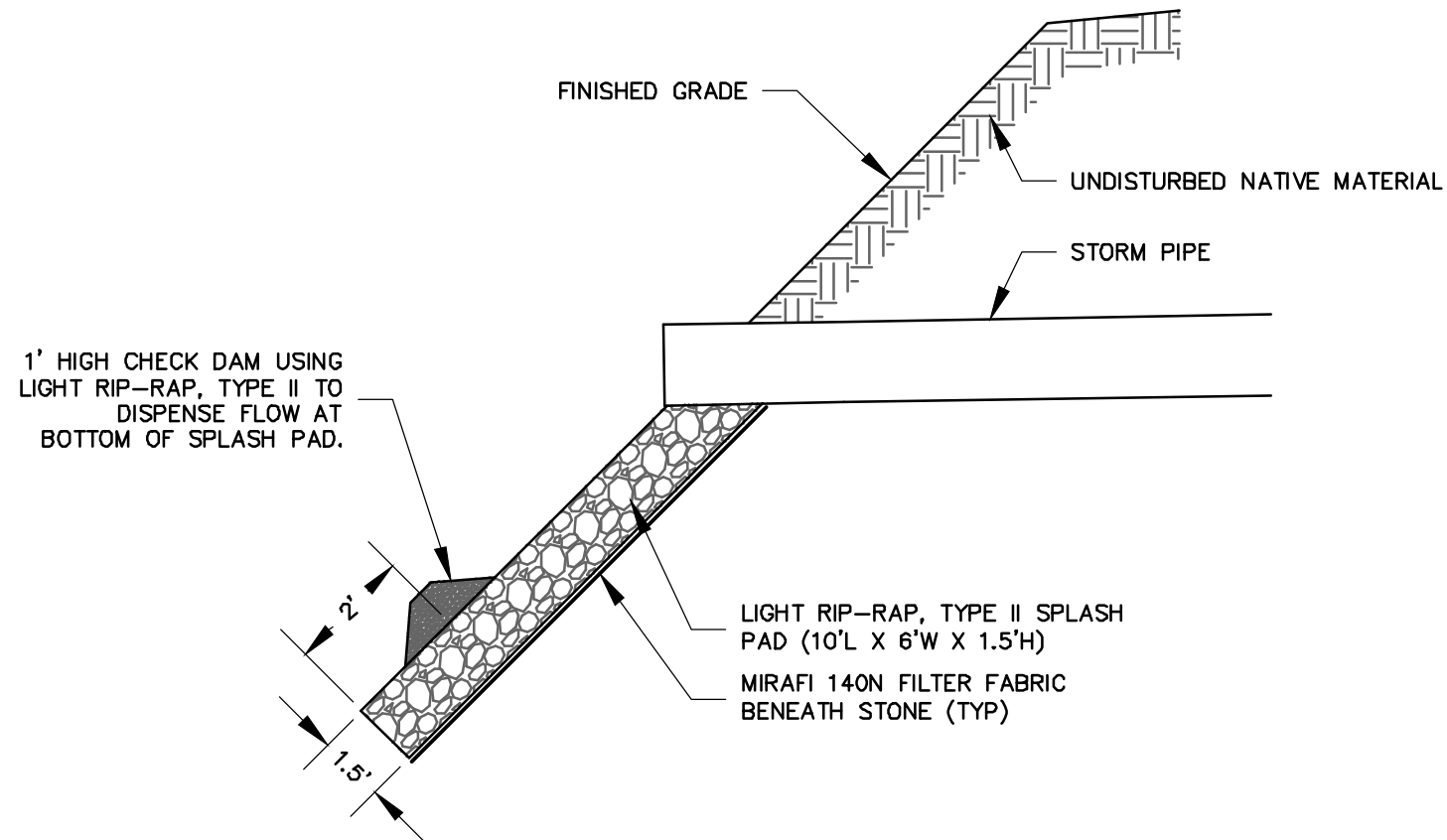


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OUTFALL PIPE DETAIL

NOT TO SCALE

MATERIAL NOTES:

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 - ROCK SHALL BE GREY OR GREYISH-BLUE IN COLOR.
 - ROUNDED UN-FRACTURED, SMOOTH ROCKS, QUARRY SCREENINGS AND TAILINGS SHALL NOT BE ACCEPTABLE RIP-RAP.
2. GRASS SEED SHALL BE "CONSERVATION MIX" OR APPROVED EQUAL.

INSTALLATION NOTES:

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5. AREAS TO BE PLANTED SHALL BE RAKED TO REMOVE DEBRIS. PLACE 2" TOPSOIL AND APPLY SEED 5LB/1000SF LIGHTLY RAKE SEED INTO SURFACE. LIGHTLY ROLL SURFACE AND WATER WITH FINE SPRAY. WITHIN 24 HOURS MULCH SEEDED AREA.

**TWO RIVERS-OTTAUQUECHEE
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RANDOLPH, VERMONT**

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SCALE: 1"=50'

PROJECT NO.: 923.001

TITLE:

DETAIL

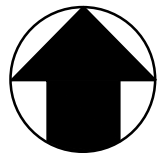
SKETCH NO.

2

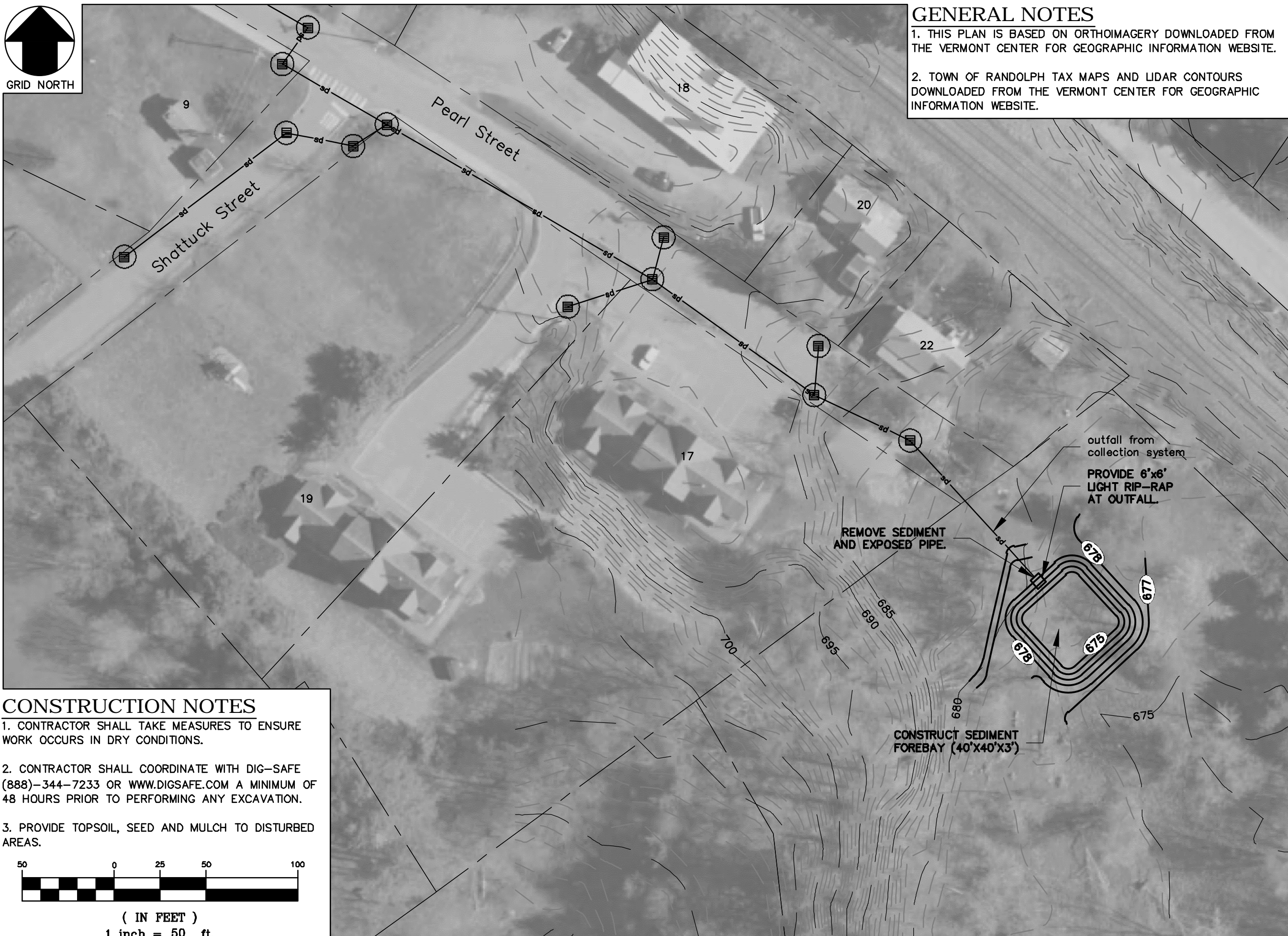
REF. DRAWING: 923-001 SUB 84

WATERSHED #84:

Watershed #84					
Preliminary Opinion of Project Cost					
Item No.	Description	Unit Quantity		Unit Cost	Total Cost
1	Riprap lined outlet	1	LS	\$ 1,250	\$ 1,250
2	Mobilization / Demobilization	1	LS	\$ 500	\$ 500
3	EPSC Measures	1	LS	\$ 250	\$ 250
Subtotal of Construction Cost					\$ 2,000
Engineering Services					\$ -
Contingency (25%)					\$ 500
Total Estimated Project Cost					\$ 2,500
Notes:					
1) Riprap lined outlet (10-ft x 6-ft x 1.5-ft deep).					
2) Engineering Services not required/necessary.					



GRID NORTH

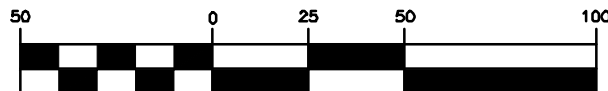


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(IN FEET)
1 inch = 50 ft.



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PEARL STREET
STORMWATER IMPROVEMENTS
RANDOLPH, VERMONT**

DATE ISSUED: 2/12/19

DRAWN BY: RR

CHECKED BY: BFR

SCALE: 1"=50'

PROJECT NO.: 923.001

TITLE:

SITE PLAN

SKETCH NO.

1

REF. DRAWING: 923-001 SUB 61



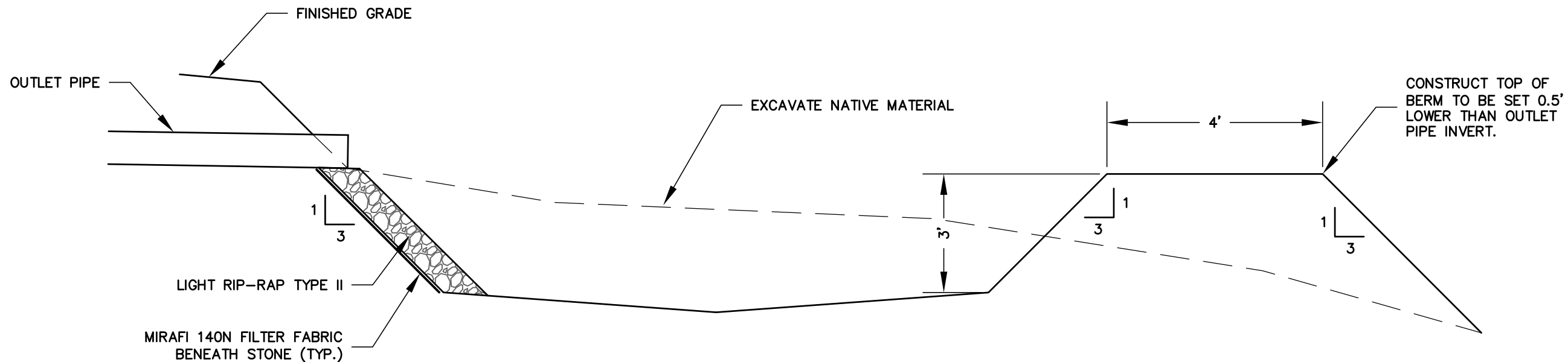
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RANDOLPH, VERMONT**



SEDIMENT FOREBAY DETAIL

NOT TO SCALE

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DATE ISSUED: 2/12/19

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CHECKED BY: BFR

SCALE: 1"=50'

PROJECT NO.: 923.001

TITLE:

DETAIL

SKETCH NO.

2

REF. DRAWING: 923-001 SUB 61

WATERSHED #61:

Watershed #61					
Preliminary Opinion of Project Cost					
Item No.	Description	Unit Quantity		Unit Cost	Total Cost
1	Earthwork (Sediment Forebay)	225	CY	\$ 20	\$ 4,500
2	Riprap at Outlet	1	LS	\$ 1,500	\$ 1,500
3	Surface Restoration	1	LS	\$ 750	\$ 750
4	Mobilization / Demobilization	1	LS	\$ 750	\$ 750
5	EPSC Measures (3.5%)	1	LS	\$ 263	\$ 263
6	General Conditions (5%)	1	LS	\$ 375	\$ 375
Subtotal of Construction Cost					\$ 8,138
Engineering Services					\$ 2,500
Contingency (25%)					\$ 2,659
Total Estimated Project Cost					\$ 13,297
Notes:					
1) Sediment Forebay is assumed to be 50% of WQv, 45-ft x 45-ft x 3-ft deep.					
2) Rip Rap Outlet assumes one dump truck load.					
3) Limited EPSC Measures, based on size and scope of project.					
4) General Conditions includes necessary bonds, insurance, site maintenance.					