Response to Technical Review Comments

Clear River Energy Center and Burrillville Interconnection Project

Application No. 17-0079

Burrillville, Rhode Island

PREPARED FOR:
Clear River Energy LLC
One South Wacker Drive
Suite 1800
Chicago, IL 60606

The Narraganset Electric Company d/b/a National Grid
280 Melrose Street
Providence, Rhode Island 02907

PREPARED BY:
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10 Hemingway Drive, 2nd Floor
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ESS Project No. I108-013

December 2017

December 11, 2017

Chuck Horbert, Program Supervisor
RIDEM Office of Water Resources
Freshwater Wetlands Program
235 Promenade Street
Providence, RI 02908

Re: Clear River Energy Center, LLC
Burrillville RI
Application No. 17-0079

Dear Chuck,

Please find the enclosed responses to the biologist and engineer review comments provided on November 10, 2017. In addition to the responses, this submittal includes the following exhibits:

Exhibit 1 Volume 1: Drawing Package for Clear River Energy Center (Bound Separately - 24x36")

Exhibit 1 Volume II: Burrillville Interconnection Project RIDEM Permit Drawings (Bound Separately – 11x17")

Exhibit 2: Narragansett Indian Tribe letter to RIDEM (dated December 1, 2017)

Exhibit 3: Revised Wetland Impact Summary Tables

Exhibit 4: Wetland Field Maps - Staked Edge of Clearing per RIDEM Request

Exhibit 5: Flexible Pond Leveler™ Details

Exhibit 6: Drainage Report - revised December 2017 (Document Bound Separately)

Exhibit 7: Drainage Report - Section 1.0 Pre- and Post-development Drainage Area Maps (Bound Separately - 24x36"), and

Exhibit 8: Drainage Report - Section 9.0 Drainage Analysis Flood Impact Study Mapping (Bound Separately - 24x36")

As requested, we have attached three hard copies of the responses and associated exhibits. Please let us know if you have additional questions.

Sincerely,

ESS GROUP, INC.

Craig A. Wood
Principal Scientist

Attachment: Response to Comments

C: Bryan Schueler, Clear River Energy, LLC

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER RESOURCES
FRESHWATER WETLANDS PROGRAM

Technical Review Comments of Documents Received by RI DEM on September 19, 2017

APPLICANT: Algonquin Gas Transmission, LLC (c/o Clear River Energy, LLC)

APPLICATION NO: 17-0079

DATE: November 10, 2017

The following items must be addressed before your application can continue to be processed.

BIOLOGIST REVIEW COMMENTS (Nancy Freeman 401-222-6820, extension 7408):

1. To eliminate unnecessary sheets and reduce duplication in sheets, please remove the following sheets from the power plant site plan set: all "Overall Site Arrangement" plans; all "Layout Plans" (or these could be combined with the Grading Plans); all drainage and water quality plan sheets (except Sheet 01C400); and all "SESC Plan" sheets excepting necessary detail sheets (01C922 through 01C926). All of these plan sheets can be submitted separately as supporting documentation rather than included as part of the project site pan set.

   Response: The Overall Site Arrangement and the Layout Plans have been removed. The appropriate detail callouts have been added to the Grading Plan (Exhibit 1 Volume 1) and the SESC Plan sheets have been removed from the drawing set for Public Notice.

2. As previously requested, site plan sheets must be numbered sequentially. You may retain the current drawing number, but also include basic numbering (e.g. Sheet No 1 of x through x of x) and label in the index on the cover sheet next to the corresponding drawing number, if retained.

   Response: CREC drawings are now numbered 1 through 18. These numbers also show up in the Index on the cover sheet (Exhibit 1 Volume 1).

3. All work must be shown on the subject plans with the corresponding symbol in the site plan legend without reference to any sheets in the SESC. If there are details in the SESC that need to be shown in the overall site plan set (such as details of proper erosion control installation, or standard construction sequencing, sine management, and SESC implementation and maintenance notes), then include them accordingly.

   Response: The CREC drawings are now stand-alone and no longer refer to any details in the SESC plans.

4. Please provide sufficient typical cross sections along the proposed road to which shows the retaining walls, dimensions, elevations, roadway pavement and shoulder widths, and associated adjacent Limit of disturbance (LOD). Provide at least some corresponding details and labeling on the proposed grading plans (e.g. retaining wall, elevations of the top of wall, toe of slope etc.). At least one cross section should include the proposed ramped portion leading to and from the roadway. Reference Rule 7.03(L)(2).

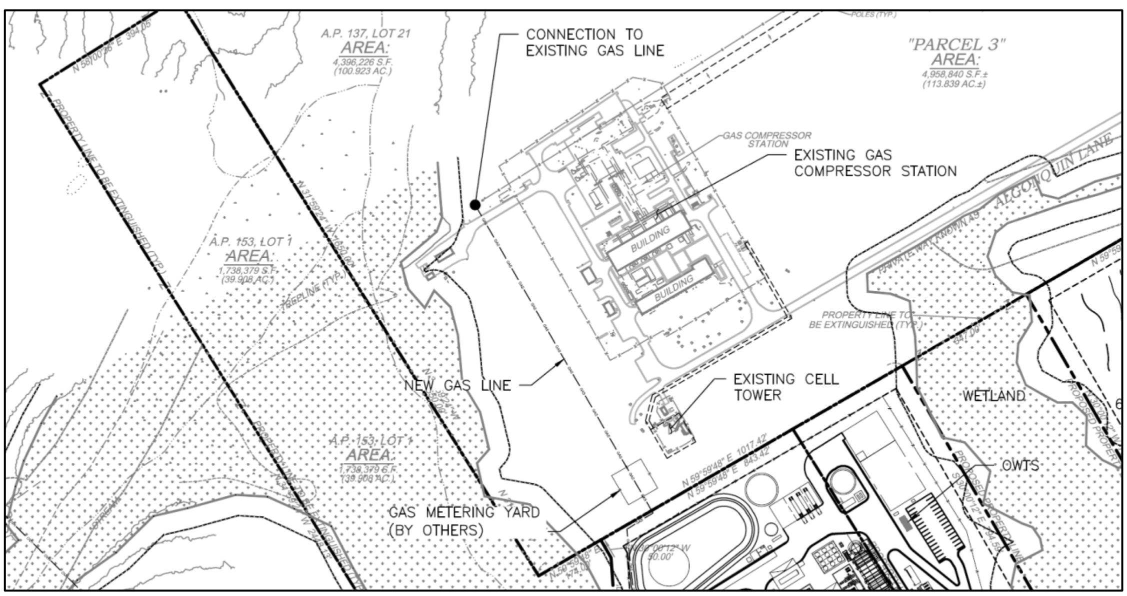
Response: Cross-Sections have been added on Drawing 17 of 18 plus additional spot elevations for top and bottom of the wall were added to the Roadway Plan and Profile, Sheets 8 and 9 of 18 (Exhibit 1 Volume 1).

5. It appears that the proposed grading formerly associated with a proposed OWTS is still depicted within portions of the perimeter wetland, but the revised plans now do not show any proposed OWTS. The response to comments indicates that it has been relocated, but it is not clear where. Please depict and label the proposed OWTS. As previously suggested, the OWTS should be located entirely outside of the perimeter wetland. Grading plans will need to be revised if grading is no longer proposed in the area of the previously proposed OWTS. HDR to annotate that the OWTS is now located next to the parking lot of the Admin Bldg.

   Response: Proposed grading for the former location of the OWTS has been removed from the Grading Plan, Sheet 6 of 18. The proposed location of the OWTS has been added on the proposed Grading Plan (Sheet 6 of 18) and on the proposed Drainage Plan (Sheet 7 of 18).

6. As previously requested, the gas line connection to Spectra Energy needs to be shown in its entirety at an appropriate scale in the site plan set since it is an integral component of the project. The Limit of Disturbance will need to be revised accordingly.

   Response: The gas line LOD can be found on the Proposed Grading Plan (Sheet 6 of 18) and on the Proposed Drainage Plan (Sheet 7 of 18) which identifies the extents of the gas line within the project LOD and its connection to Spectra. The approximate location of the pipeline connection to the Algonquin Gas Line is depicted on the figure below. The installation of this connection is not anticipated to require any additional impacts to wetlands or perimeter wetlands.



7. The Roadway Plan and Profile plans do not depict any proposed utilities (e.g. the water line from the supply well, electric power from the roadway into the site, sewer connections if applicable). Please provide details as applicable. In the case of any electric utilities, please specify whether connections will be underground conduit or overhead wires (in which case utility poles will need to be depicted);

Response: The Roadway Plan and Profile sheets (Sheets 8 and 9 of 18) as well as the Utility sheet (Sheet 5 of 18) now show the proposed water and electric lines. Note that the electric line is labeled Under Ground Electric (UGE) and the Water Line as "W". The distribution of these utilities within the footprint of the plant will be designed by the EPC contractor at a later date, along with the rest of the underground utilities.

8. The Limit of Disturbance (LOD) needs to be revised along the western side of the site to accommodate the proposed lines that will connect the proposed switching station to the "Burrillville Interconnection Site (BIP)" and need to be depicted in the exact locations of that corresponding plan set for the "BIP".

   Response: The break in the LOD line and an explanatory note have been added to the Proposed Grading Plan (Sheet 6 of 18) and on the Proposed Drainage Plan (Sheet 7 of 18) (see Exhibit 1 Volume 1).

9. The "Flood Plain Mitigation Area" needs to be better labeled. There is currently no corresponding symbol in the legend for it, and the call-out and arrow on the Grading Plan points to the road shoulder, not to the mitigation area.

   Response: The Flood Plain Mitigation Area has been added to the Legend sheet (Sheet 2 of 18).

10. It is unclear at this time what the project's source of industrial cooling water will be. Options appear (at least) to be 1) obtaining water from the Town of Johnston; 2) obtaining water from the Narragansett Indian Tribe, and 3) obtaining water from the City of Fall River, MA. At least 2 of these three options may potentially impact freshwater wetlands in RI, and further details are required since this water source is an integral part of this project proposal. In the case of the Town of Johnston, you must either demonstrate that an existing water outlet will be utilized by water transportation trucks (meaning that no new facility is proposed) **or** site plans must provide details of any facility construction or improvements that will be needed to fill transportation trucks, including any potential wetland alterations may be needed to implement such improvements. In the case of the Narragansett Indian Tribe, it is our understanding that no facility currently exists, and that water withdrawals will directly impacts wetland resources. Please update site plans, your impact avoidance and minimization statement and overall project evaluations to include all details related to off-site water withdrawal and associated wetland impacts. You must address Rule 10.02E(4)(d) with regards to proposed impacts to Groundwater and Surface Water supplies and specifically (i) Drainage Characteristics; (ii) Wetland Functions and Values and (iii) Proposed Impacts. In addition, you must address 10.02E(4)(e) with regards to Water Quality impacts. Site plans and details must indicate water withdrawal methods, rates, access and egress routes and all supporting calculations. The 200-foot radius map and list of abutters would also need to be updated to reflect any additional wetland alterations from water withdrawals. Finally, for any related alterations on property in Rhode Island that is not owned by either of the current co-applicants, the subject property owners would also have to sign on as co-applicants for this application. No such details or documents are required if the project's only water source is proposed to be from Fall River, MA.

    Response: As detailed in the CREC Water Supply Plan and Supplement submitted to the RIEFSB, process water for this air cooled plant, will be trucked to the site and stored in on-site storage tanks. The primary water supply source is from the Town of Johnston where CREC will own an existing building that the trucks will be housed in and filled from the existing water supply infrastructure. The truck fill building is existing, and no new building is required. There are no modifications, beyond adding garage doors to the building, that will accommodate the trucks. The secondary source of water, should it be needed, is from Benn Water and Heavy Transport Corp. Clear River also executed a contract with the Narragansett Indian Tribe ("NIT") for an additional contingent source of water in the unlikely event that the primary and secondary sources are not available. The details of the proposed water supply plan are included in the Water Supply Plan filed with the EFSB on January 11, 2017 and Supplement. These documents as available for download at:

http://www.ripuc.org/efsb/EFSB2/SB2015_06_INV_water.pdf
http://www.ripuc.org/efsb/EFSB2/SB2015_06_Inv_Water_supplement.pdf .

The Johnston and Benn Water supplies will utilize existing municipal infrastructure and will not require any improvements or activities which would alter wetland resource areas or require any wetlands permitting. The NIT well is to be located on tribal lands. We advised the NIT of your request for additional information. Note the NIT's response in the attached letter to RIDEM dated December 1, 2017. That being said, Invenergy did perform an evaluation of the proposed water withdrawal the CREC would make in the unlikely event that both Johnston and the back up source from Benn Water where unavailable. This document as available for download at:

http://www.ripuc.org/efsb/EFSB2/SB2015_06_Inv_Water_wood.pdf

11. Informal communications with consultants inferred that there would be some changes in what is proposed for permanent vehicular access along the BIP portion of the project. Please update the site plans along the BIP portion of the project if necessary to show any revisions to permanent road improvements along the proposed CERC ROW as compared to the current plans, and update your Avoidance and Minimization documentation and Evaluation accordingly.

    Response: A permanent rock ford is proposed to cross Wetland No. 2 located in the CREC ROW. The Impact tables have been revised to increase the total permanent impact and decrease the total temporary impact to Swamp by 2,498 square feet, respectively. POWER civil engineers prepared a revised access road layout to avoid the cultural resource on the CREC ROW (Exhibit 1 Volume II). This action did not result in any additional changes to wetland impacts. Revised Wetland Impact Summary tables (Table 5-1 and 5-6 – Exhibit 3) have been provided. The Avoidance and Minimization as well as Evaluation documentation will be updated along with the Mitigation documentation as soon as the Team is able to access the proposed mitigation parcel and prepare a reconnaissance report.

12. The size of the site plans, and the chosen match lines that split the project up on the site plans, makes review of the project difficult, particularly when trying view the overall project site. **While the site plans do meet our minimum requirements and no changes in plan size or layout is necessary,** we would like to suggest that, for the CREC portion of the project, 24x36 inch size plan sheets be considered. This may allow larger portions of the project to be displayed on one sheet, and myriad detail sheets to be combined into fewer sheets.

    Response: As clarified with RIDEM on November 27, 2017, all plan set drawings for the CREC have been revised to be full size (24-inch by 36-inch).

13. With the exception of swamp mats over a portion of swamp, and the proposed ramp, it does not appear any alterations are proposed in the proposed stockpile and laydown areas other than temporary clearing. Please clarify the nature of proposed alterations here, including whether

grade changes are proposed, and specifying what portions are to be both cleared and grubbed. Note we assume that stockpiling soil will result in at least temporary grade changes and do not need to be reflected as proposed grade changes.

Response: Given the complexities of maintaining the wetland that is in the middle of the stockpile and laydown area, this wetland will be quantified as a permanent impact in lieu of a temporary impact. Area to be cleared and grubbed, cover with aggregate for use as construction laydown and field office space.

14. All site plan sheets must bear the stamp of a RI Registered Professional Engineer. Currently, most of the sheets in the BIP set of site plans do not have a PE stamp.

    Response: All of the CREC plan sheets have been stamped by a Rhode Island registered professional engineer.

15. Please update your Impact Avoidance and Minimization documents and Evaluation to address impacts from the proposed new alterations to the laydown/stockpile area resulting from the newly verified wetland edges.

    Response: Revised Wetland Impact Summary tables have been provided (Exhibit 3). The Avoidance and Minimization as well as Evaluation documentation will be updated along with the Mitigation documentation as soon as the Team is able to access the proposed mitigation parcel and prepare a reconnaissance report.

16. It is evident that the anticipated mitigation plan for the proposed project is not yet completed. It is recommended that this plan be finalized and that the component of your mitigation plan be incorporated into the project design and supporting documents prior to the project application being sent out to Public Notice. With respect to the statement at the end of Section 7.0, "Should resource agencies agree, the Applicant will develop design details for agency consideration as the overall mitigation plan is refined.", it is respectfully noted that any mitigation design and plan it's the responsibility of the applicant to design based on what is anticipated to be the projects impacts of concern. This agency is not in a position to come to an agreement on a mitigation plan for which it has a responsibility to issue a regulatory decision. If applicable, please update the site plans and supporting documentation to include any impacts to freshwater wetlands either on-site or off-site that are for proposed mitigation proposed by the applicant or as may be required by the U.S. Army Corps of Engineers.

    Response: The Applicant understands RIDEM's request to have the mitigation plan finalized and incorporated into the project design prior to the project application being sent out to Public Notice. Invenergy has identified several suitable parcels within the same watershed that are believed to have the necessary attributes to be suitable for compensatory mitigation and is actively engaged in negotiations with landowners to obtain an option on several parcels to enable a more in-depth analysis of their conformance with the mitigation requirements. Invenergy will provide RIDEM with a proposed final mitigation plan once they have obtained an option on a property which will meet the applicable requirements. The mitigation plan will include the results of any assessments completed on the property. The intent will be to provide the plan to RIDEM as soon as it is available.

17. Please better clarify on the site plans which areas are proposed for reforestation (e.g. label area codes, show polygons of proposed vegetation etc,). The line drawings on the reforestation plans are quite indistinct and difficult to review.

Response: The reforestation information has been darkened on the drawing (see Sheet 10 of 18) and the Plant Quantities and Planting notes have been moved to Reforestation Notes and Planting Schedule (Sheet 11 of 18) to provide clarity (see Exhibit 1 Volume I).

18. Regarding the Abutters List, please confirm the property owner for Lot 71-014 (on Abutters Map Sheet 19 of 30). It is currently listed as John F. Swart, III & Lucille Beauchamp. The Department recently reviewed an application for a Mr. Brizard on this plat and lot. Also, DEM internal plat maps show Plat/Lot 102-5 within the 200-foot radius (immediately East of Wallum Lake Road). However, it appears based on your maps that perhaps this lot is now part of 102-6 (Theodore Bertrand). Please clarify.

    Response: The Burrillville Assessor's database was reviewed once again and the following clarifications are offered: 1) Parcel 071-014 is listed as being owned by Mark S. Brizard (address - 82 Stone Barn Road) and the property was sold on April 11, 2016 by John F. Swart III and Lucille Beauchamp; 2) Parcel 102-005 is not listed and we believe that parcel 102-005 was incorporated into parcel 102-006 as a result of a land transfer. Parcel 102-006 is listed as being owned by Theodore R. Bertrand and Linda A. Bertrand TE (address – 1335 Wallum Lake Road).

19. Although not required at this time, please be advised that prior to Public Notice, additional site work will be required along the BIP ROW (and National Grid ROW) to help facilitate our evaluation. Such work will likely include at least flagging the LOD within wetland clearing proposed along the Clear River (Sheet 17 of 63) and near Round Top Brook (Sheet 28 of 63) and along the wetland crossings along the new portion of the BIP connecting the CERC to the National Grid ROW.

    Response: The LOD within wetland clearing in requested locations has been staked in the field. Wetland Field Maps identifying locations and stake numbers are provided in Exhibit 4.

20. Regarding the BIP, portions of the project limits proposed along the Clear River have been recently inundated by Beaver Activity. If any action or special measures are proposed, please update the site plans accordingly.

    Response: As observed and noted by the RIDEM, beaver activity is noticeable on a section of the TNEC right-of-way (ROW) where the existing 347 and 341 345 kV overhead transmission lines cross the Clear River. A beaver dam was constructed along the southern edge of the cleared portion of the ROW causing inundation of the Clear River and ponding portions of the existing ROW, in between Structures 347-33 and 347-34, and 341-108 and 34 -109. The beaver dam has affected the flow of the river, as the river has re-established flow to the original riverbed east of the former riverbed. Flow at both discharge points is still visible. TNEC representatives inspected the area of inundation. The inundation on the ROW is not currently adversely affecting access because access to the ROW is available from the east off of East Wallum Lake Road, and from the west off of Wallum Lake Road (Route 100). However, the excessive inundation could affect the clearing crews' ability to safely complete their work and could affect the placement of required temporary wire pulling stations or some temporary swamp mats work pads. The level of inundation is not currently jeopardizing the structural integrity of existing transmission line structures or the locations of proposed transmission line structures.

    Temporary timber swamp mats are proposed within freshwater wetlands bordering the Clear River, including in areas of standing water. The temporary swamp matting is proposed to facilitate work on existing and proposed transmission line structures and to construct temporary wire pulling sites. Inundation caused by beaver activity can significantly change the habitat of the affected area, and the duration of the inundation may be temporary or extend for a longer duration of time. TNEC will continue to monitor the conditions at the Clear River. At this time, assuming that all approvals are received to construct the project, TNEC is proposing to install devices to lower and control the water elevation within the area of inundation similar to the measures previously implemented on the Interstate Reliability Project. TNEC is seeking RIDEM approval to install a water leveling device such as a flexible pond leveler to lower and manage the elevation of the ponding in the ROW (Exhibit 5). This response provides notification to the RIDEM of TNEC's intention to implement these measures to address the ROW inundation caused by the beaver dam. Depending on the field conditions when construction begins, TNEC may seek approval to remove the beaver dam.

ENGINEER REVIEW COMMENTS: (Nicholas A. Pisani, PE 401-222-6820, extension 7423):

(1) This reviewer has attempted to recommence review of this project but finds that the submitted node diagrams are poorly labeled. Please submit node/ drainage diagrams that are clearly labeled. Please note that labels for different nodes should not be labeled the same.

Response: New Node diagrams have been added as 24-inch by 36-inch drawings in a separate section in the calculations, Section 2.0 (Exhibit 6).

(2) Please include a node / routing diagram that clearly labels and describes all nodes. Please provide this node diagram as a separate diagram, as opposed to placing it on the watershed map, to provide improved clarity.

Response: Node diagrams have been added as 24-inch by 36-inch drawings in a separate section in the calculations, Section 2.0 (Exhibit 6).

(3) The submitted node /drainage diagrams do not explain the design points. Please provide an explanation of each of the design / analysis points on the submitted node diagram.

Response: An explanation of each of the design / analysis points (POI) is included in the Drainage Narrative and on the Node Diagram included in the revised Drainage Report (Exhibit 6).

(4) Much of the information on the submitted routing diagram and subwatershed maps are too small to be adequately legible. Please provide a legible routing diagram and subwatershed maps.

Response: Revised Watershed Maps are included in Section 1.1 (Exhibit 7) and revised Node Maps are included in Section 2.0 in the revised Drainage Report (Exhibit 6).

(5) Please clearly label the limits of proposed Dry Swales 1 through 4 on the proposed condition subwatershed map and on the plan.

Response: The proposed Dry Swales 1 through 4 are shown in Section 1.1, Exhibit 3.3A & 3.3B of the revised Drainage Report (Exhibit 7).

(6) The existing drainage area map (subwatershed map) does not appear to depict complete limits for existing condition subwatershed 1S, 3S, 5S, and 6S. Please clearly depict the complete limits of all existing condition subwatershed areas. There are similar issues for some of the larger subwatersheds on the proposed condition subwatershed map. Please ensure that all existing and proposed condition subwatersheds are represented by complete subwatershed limits.

Response: The complete existing drainage area is shown in the revised Drainage Report, Section 1.1 (Exhibit 7) and Section 2.0 (Exhibit 6). The complete post-development drainage area is shown in the revised Drainage Report, Section 1.1 (Exhibit 7) and Section 2.0 (Exhibit 6).

(7) The existing and proposed condition subwatershed maps are inadequate. Please refer to guidance in RISDISM Appendix K. Most notably, the subwatershed maps need to clearly depict topography and ground cover types.

Response: The existing and post-development drainage subwatershed maps meeting RISDISM Appendix K requirements are included in the revised Drainage Report Section 1.1 (Exhibit 7).

(8) This reviewer has attempted to recommence review of this project but finds that portions of the submittal have pages that have been numbered out of order. For example, in the 10-year proposed condition, pages are numbered 37, 36, 35, and so forth. Please revise the submittal of the drainage analysis book such that all pages are in proper order.

Response: A revised Drainage Report is provided herein (Exhibits 6, 7 and 8).

(9) Please address in detail the magnitude of any impacts of not providing recharge with the proposed design revisions.

Response: The design change, to account for no recharge, was due to not having the required three (3) feet of separation from the seasonal high groundwater per Section 5.7.1 Dry Swale Feasibility of the RIDEM Stormwater manual and the requirement of lined stormwater facilities as a land use with higher potential pollution loads stated in the RIDEM Manual Section 3.2.8. Furthermore, an infiltration rate lower than 0.5 ft/s would significantly reduce the benefit of infiltration as previously commented on. To compensate for the lack of infiltration the design does redirect the discharge of the collected treated stormwater to discharge to the original receiving wetland system at the surface. Those aquatic resources would benefit from receiving this treated runoff per Table 5-3 of Appendix A checklist.

(10) The submitted analysis has not adequately demonstrated that the total pre-project analysis area equals the total post-project analysis area. This reviewer is uncertain whether the absence of information for drainage area E is the reason for this inconsistency. Please provide complete revised existing and proposed condition analysis to fully address this matter.

Response: A comparison of the pre- and post-areas is shown in the calculations in Section 3.2 of the revised Drainage Report (Exhibit 6).

(11) With respect to the submitted CN analysis, most entries are stated in acres. However, some entries are in square feet. Please convert the entries that are given in square feet to acres, to provide consistency.

Response: The units for all area definitions have been revised to be acres.

(12) The submitted drainage report appears to include the downstream analysis materials within the typical proposed condition drainage analysis materials. If a downstream analysis is being presented, please provide all portions of the downstream analysis as a separate section of the drainage report. Also, please provide sufficient drainage narrative to fully describe what the submitted downstream analysis is intending to demonstrate.

Response: A downstream analysis is not being presented. These calculations were performed for RIDOT to demonstrate the impact to the culvert under Wallum Lake Road. These calculations have been moved and are now in Section 9.0 of the revised Drainage Report (Exhibit 6).

(13) Please explain why the Lag/CN method of time of concentration analysis was chosen over the more commonly utilized sheet flow/ shallow concentrated flow / channel flow calculation of subwatershed time of concentration. Please include a comparison of the two methods. Please describe what advantages and disadvantages each method has, especially with respect to the choice made in the selection of the Lag/CN method. Also, if the use of the Lag/CN method can be adequately substantiated by technical justification, then please provide all pertinent calculations. Notably, provide specific calculations for the average slope used in the submitted analysis.

Response: Please see the discussion titled Comparison of the Lag/CN Method and Velocity Method located in the preamble materials to the revised Drainage Report (Exhibit 6).

(14) The submitted analysis includes existing and proposed Design Point E. However, the submitted analysis does not appear to include any analysis materials to substantiate the flows to existing and proposed design point E. Please provide all pertinent analysis materials pertaining to existing and proposed design Point E.

Response: The calculations for POI-E are included in Section 8.0 of the revised Drainage Report (Exhibit 6). The Watershed Map is included in Section 1.1 (Exhibit 7) and the Node Map is in Section 2.0 (Exhibit 6).

(15) When analyzed alone, it appears that proposed Dry Swale 4 may not have enough surface area available to accomplish adequate water quality treatment of contributing subwatershed 34S. Please note that in the submitted analysis, the review of proposed Dry Swale 3 and 4 were accomplished together

Response: The Dry Swales have been broken-up and are now calculated separately in the revised Drainage Report. This revision shows that Dry Swale #4 has enough surface area to accomplish adequate water treatment.

(16) Please address this reviewer's concern that the proposed gravel inlet trench to proposed Detention Pond 2 will tend to clog with debris and will not allow for efficient conveyance of flow to proposed Detention Pond 2. Please address whether a design revision to provide a more clog-resistant design could be utilized in this location. Please address the use of a check dam to temporarily retain the depth of the water quality volume at this location. In any case, please indicate the size of the stone to be used in the proposed trench at this location.

Response: Details 6/01C804 and 4/01C804 (both on Sheet 16 of 18 - see Exhibit 1 Volume I) now show a gravel trench with pea gravel wrapped in filter fabric and a check dam before the gravel trench to slow the water down before it enters. The proposed trench is designed to be clog resistant.

(17) With respect to proposed Pond 3P: Gravel WVTS outlet structure, please provide a more concise detail specifically showing each of outlet devices #2, #3, #4, and #5 and provide a narrative to further explain the flow paths. Please also include a detailed plan view of the proposed outlet structure.

Response: Please see the attached detail sheet Control Structure for DP-1 (3P) which labels the outlet devices, presents a flow path chart, and provides a narrative of the gravel WVTS outlet structure (located in the preamble materials to the revised Drainage Report -Exhibit 6).

(18) Please provide complete footing details for all proposed culverts. Please clearly depict the limits of disturbance and all areas to remain protected and undisturbed during the culvert installation work. An explanation that the final design of the footing will be accomplished as a part of the final engineering design. However, the footing will not go beyond the LOD specified in the drawing.

Response: The final design of the footing will be accomplished as a part of the final engineering design for the project. However, the footings for the culverts will not extend beyond the LOD shown on the drawings (Exhibit 1 Volume I). The LOD is based on the width needed to properly excavate the trenches and includes sloped sidewalls. Thus, the width of the LOD is greater than then associated culvert and support structures.

(19) Please correct the following labeling issues on the proposed condition subwatershed map and drainage/node diagrams:

0. Subwatershed 12S does not appear to be properly identified and labeled on the submitted node diagram / subwatershed map.
1. Subwatershed 20S does not appear to be properly identified and labeled on the submitted node diagram / subwatershed map.
2. Subwatershed 23S in the submitted analysis is mislabeled as 4S on the submitted node diagram / subwatershed map.
3. Subwatershed 27S in the submitted analysis is mislabeled as 9S on the submitted node diagram / subwatershed map.
4. Point B analysis point is labeled as 22L in the submitted analysis but is mislabeled as 21L on the submitted node diagram / subwatershed map.
5. Subwatershed 19S is apparently mislabeled as 12S on the submitted node diagram / subwatershed map analysis.
6. Proposed Dry Swale (Reach 18R) is mentioned on the subwatershed map, but does not have an identifying node.
7. Please clearly identify Pond 23P of the submitted analysis as the end of Dry Swale 4 structure, if this is indeed what it represents.

Response: All issues have been corrected with new maps. The new Watershed maps are in Section 1.1 (Exhibit 7) and the new Node Maps are in Section 2.0 (Exhibit 6).

(20) With respect to the sharp-crested vee / trapezoidal weir that represents the secondary flow from Pond 23P (the end of Dry swale 4 structure), please clearly depict this detail on the site plan.

Response: The noted weir is shown on Detail 3/01C803 (Sheet 15 of 18 - Exhibit 1 Volume I).

(21) With respect to proposed condition subwatershed 19S please clearly identify the location of this subwatershed. Also, please clarify whether it contains any pavement area. This may be the case, given that it is proposed to flow to proposed Dry Swale 3.

Response: The proposed condition subwatershed 19S is shown in the revised Drainage Report, Section 1.1 (see Sheet 3.3A Exhibit 7). The pavement area has been hatched to help distinguish it from the grass area.

(22) With respect to the Pond 15 culvert at entrance plan detail, please clearly indicate on the plans:

0. The inlet and outlet inverts of the 18' pipe culverts;

1. The 3" high x 18" wide vertical orifice; and

2. The 72" x 72" (6' x 6') inlet structure dimensions.

Please note the following **responses**:

0. The inlet and outlet elevation of the 18-inch pipe culvert are shown on the Roadway Plan and Profile, Sheet 8 of 18. These inverts are also shown in the cross section for Culvert 1 on Sheet 17 of 18 (see Exhibit 1 Volume I).
1. The details of the 3-inch by 18-inch vertical orifice are shown on Detail 3/01C803, Sheet 15 of 17(see Exhibit 1 Volume I).
2. The dimensions of the inlet structure are shown on Detail 3/01C803, Sheet 15 of 17 (see Exhibit 1 Volume I).

(23) With respect to proposed Detention Pond 1, the submitted analysis indicates an 8" orifice at 558.0'. However, the submitted plans indicate a 9" office at this elevation. Please revise the plans and/or analysis to eliminate this inconsistency.

Response: The calculations are correct, the orifice is 8 inches in diameter. Details 2/01C803 (Sheet 15 of 18) and 2/01C801 (Sheet 13 of 18) have been corrected (see Exhibit 1 Volume I).

(24) With respect to RISDISM Section 7.2.8 please provide adequate debris screens/ trash racks to prevent clogging of orifices. The area of each of these devices should be at least ten times the area of the orifice being protected.

Response: A trash rack was added to the control structure for Detention Pond 2 which are depicted on Details 1/01C805, 2/01C805, and 3/01C805 on Sheet 16 of 18. The detail of the trash rack is shown on Detail 7/01C805 on Sheet 16 of 18(see Exhibit 1 Volume I).

The low flow orifice for Detention Pond 1 is 8 inches and therefore does not require a trash rack in accordance with Section H.2.1 of RISDISM.

(25) With respect to proposed Detention basin 1 and Detention Basin 2, as well as the proposed Sediment Forebay and Gravel WVTS, please provide a typical slope treatment detail. Slopes need to be either loamed and seeded or riprapped. Please also include adequate temporary slope treatment (matting) during the construction phase, until final stabilization is established.

Response: Slope treatment details are covered in the SESC Plan set. Per previous biologist comment 1, the SESC Plan sheets have been removed from the drawing set for Public Notice.

(26) With respect to RISDISM section 7.2.11 please address whether the principal spillway opening of each detention basin will prevent access by small children.

Response: The principal spillway for Detention Pond 1 has a fence around it as shown on Sheets 6 and 10 of the drawing set. The principal spillway for Detention Pond 2 has a trash rack on top (see Detail 3/01C804 on Sheet 16 of 18) which will prevent any unauthorized access (Exhibit 1 Volume I).

(27) With respect to the outlet of level spreader device for Detention Basin 1 will experience water levels higher than the 558.0' modeled tailwater elevation in the submitted analysis. Please provide monitoring results at this location during large storm events to demonstrate that no adverse tailwater conditions will occur except during perhaps extreme events. Please note that higher tailwater levels than the indicated 558.0' will likely decrease the efficiency of the proposed stormwater management practices and would need to be addressed by design changes. Please address this issue.

Response: The noted area (POI-A) does not flood. The 100-Year Storm Map that has been incorporated into the calculations now shows the location of the POI's as well as the estimated limits of the 100-year storm event. Note that Area POI-A is not predicted to be flooded.

(28) On "Proposed Drainage Map 2" a small area is labeled "drainage is collected and hauled offsite". Please provide complete details of the accommodations for this on the project plans. Include the details of any proposed holding tank structures as well as methods of collecting runoff from this area.

Response: The label noted above is in reference to oily wastes collected in the oil water separator. The small area in question is within the secondary containment for the onsite fuel oil storage tank. Stormwater that is collected within this area will flow to a central sump where it is then pumped to the facility oil water separator. Once treated in the oil water separator, the collected stormwater is routed to an onsite collection tank. Waters collected in this tank are treated and recycled for use as makeup water to the plant. Stormwater that is collected in the secondary containment is treated as contact water and will not enter into the stormwater collection system.

(29) With respect to the submitted floodplain study and volumetric floodplain compensation analysis, the submittal does not provide an adequate level of detail to allow review. Please provide the following information:

0. Provide overall watershed maps of each watershed studied in the submitted HEC-RAS analysis.

   Response: A separate map has been provided for each of the three watersheds included in the study (Exhibit 8).

1. The submitted HEC-RAS Model Geometry and Floodplain Delineation map is not sufficiently legible to permit any level of review. Topographic detail is too lightly printed and at too small a scale to allow reviews. The river section locations are not adequately legible. Provide a plan with sufficient legibility and of an adequate scale to allow detailed review.

Response: Additional Maps have been included in the Calculations Section 9. There are 6 maps ranging in scale from 1" = 1000' to 1" = 20' (Exhibit 8).

2. Please provide clear labeling of topography on the floodplain compensation plan.

   Response: The existing contours have been labeled on the drawings (Section 9.0 Exhibit 6).

3. Specifically show where the proposed floodplain displacement is located, both in terms of plan location and elevation range.

   Response: The plan area is shown on the Flood Plain Map 6 of 6 (Exhibit 8). The Flood Elevation is shown in the profile on sheet 8 of 18 (Exhibit 1 Volume I).

4. Unless this work is indicated as being done under the review of the engineer who stamped the drainage analysis, please provide an engineer's stamp on the submitted floodplain analysis.

   Response: The floodplain analysis is being done under the review of the engineer who stamped the revised Drainage Report.

(30) With respect to any resubmittal of plans and analysis materials, please provide a detailed listing of what specific items have been changed and what materials have not been changed. Please address any other changes made to the plans and analysis besides those specifically addressing RI DEM review comments.

Response: The only change to the drawings that is not addressed in the responses above is the proposed grading in the spoils, laydown and office areas for restoring that area to the original grade. All other changes to the drawings are in response to these comments. The specific items that have been changed are described in each of the responses.

CONCLUDING COMMENTS

1. Please submit three (3) sets of the revised site plans and any other revised supporting documents.

   Response: Three sets have been provided.

2. In order to facilitate the review of future revisions to your project, please address each of the above items in writing.

   Response: Written responses have been provided herein.

3. If you have any questions regarding this letter or the processing of your application, or with respect to any of the above-noted biological review comments, please contact Nancy Freeman at 401-222-6820, extension 7408.

   Response: So noted.

4. If you have any questions with respect to the above engineering review comments, please contact Nicholas A. Pisani, PE at 401-222-6820, extension 7423.

   Response: So noted.

List of Exhibits

Exhibit 1 Volume 1: Drawing Package for Clear River Energy Center (Bound Separately - 24x36")
Exhibit 1 Volume II: Burrillville Interconnection Project RIDEM Permit Drawings (Bound Separately – 11x17")
Exhibit 2: Narragansett Indian Tribe letter to RIDEM (dated December 1, 2017)
Exhibit 3: Revised Wetland Impact Summary Tables
Exhibit 4. Wetland Field Maps - Staked Edge of Clearing per RIDEM Request
Exhibit 5. Flexible Pond Leveler™ Details
Exhibit 6: Drainage Report - revised December 2017 (Document Bound Separately)
Exhibit 7: Drainage Report - Section 1.0 Pre- and Post-development Drainage Area Maps (Bound Separately - 24x36")
Exhibit 8: Drainage Report - Section 9.0 Drainage Analysis Flood Impact Study Mapping (Bound Separately - 24x36")

Exhibit 1

Volume I: Drawing Package for Clear River Energy Center (Bound Separately - 24"x36")

Volume II: Burrillville Interconnection Project RIDEM Permit Drawings (Bound Separately – 11"x17")

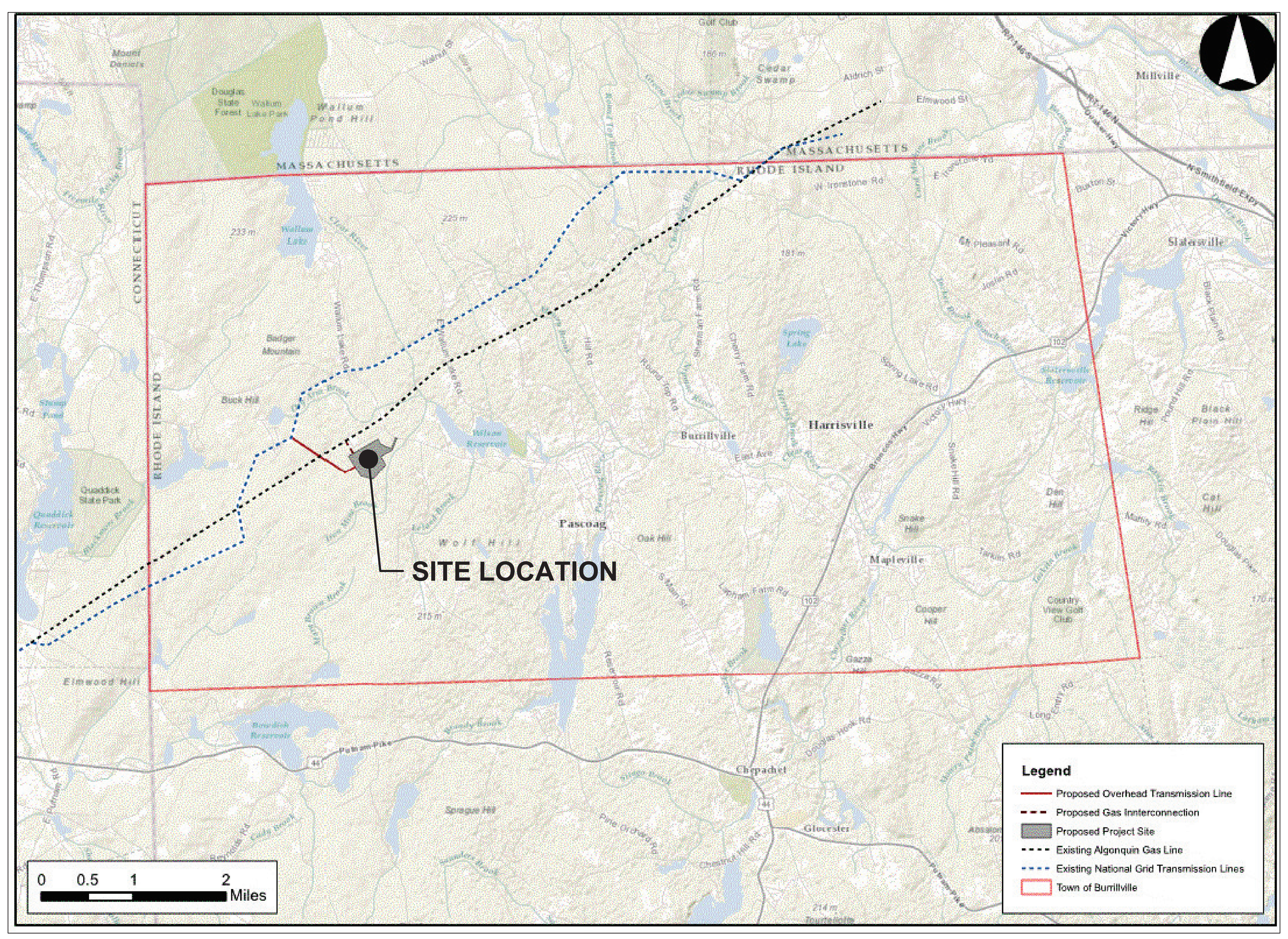
Drawing Package For

Clear River Energy Center Volume 1

Clear River Energy LLC

Project No.
000000010021318

Burrillville, Rhode Island
December, 2016



INDEX OF DRAWINGS

SITE PLANS

SEE VOULME 2 FOR BIP DRAWINGS

ALEXANDER DEUSON
No. 0011618
REGISTERED PROFESSIONAL ENGINEER
CIVIL

1 2 3 4 5 6 7 8

CIVIL MAPPING SYMBOLOGY

- OUTLET PROTECTION RIP-RAP PAD (FOR SIZE SEE DETAIL)
- (11R) HYDROCAD REFERENCE NODE FOR CALCS
- EXISTING SWAMP WETLAND
- EXISTING FORESTED WETLAND
- EXISTING SPECIAL AQUATIC SITE
- EXISTING AREA SUBJECT TO STORM FLOWAGE (ASSF)
- PROPOSED STORM STRUCTURE
- PROPOSED STORM PIPE
- EXISTING LIGHT POLE
- S EXISTING SIGN
- #XX EXISTING POWER POLE WITH IDENTIFICATION NUMBER
- BH-13 BORING HOLE LOCATION
- SOIL MAP UNIT
- POTABLE WATER WELL
- TP-5 TEST PIT LOCATION
- 1-50d WETLAND FLAG
- TIMBER MATTING
- A-X REFORESTATION AREA
- FLOOD PLAIN MITIGATION AREA
- 16' DOUBLE SWING GATE

UTILITY/CIVIL LINE SYMBOLOGY

- SPECTRA PROPERTY LINE
- PROPERTY LINE SETBACK
- PROPERTY LINE
- 500 EXISTING CONTOUR ELEVATIONS
- 500 PROPOSED CONTOUR ELEVATIONS
- WETLAND EDGE
- EXISTING PERENNIAL STREAM
- EXISTING INTERMITMENT STREAM
- EXISTING STREAM BANK
- 50' PERIMETER WETLAND
- 100' RIVERBANK WETLAND
- 200' RIVERBANK WETLAND
- RIGHT OF WAY
- TREELINE
- GAS PROPOSED GAS LINE
- LOD LIMITS OF DISTURBANCE
- FLOOD PLAIN LINE
- UGE PROPOSED UDERGROUND ELECTRIC
- W PROPOSED WATER LINE
- X PROPOSED FENCE

GENERAL NOTES:

1. THIS IS A STANDARD CIVIL SYMBOLOGY SHEET. ALL SYMBOLS ARE NOT NECESSARILY USED ON THIS PROJECT.

2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE-EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.

D C B A

HDR

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1	8/17/2016	SOIL EROSION SEDIMENT CONTROL PLAN

PROJECT MANAGER C. JACOBS

PROJECT NUMBER 10021318

ALEXANDER DEUSON No. 0011618 REGISTERED PROFESSIONAL ENGINEER CIVIL

CLEAR RIVER ENERGY LLC
CLEAR RIVER ENERGY CENTER
WALLUM LAKE ROAD LOT NO.
135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

LEGEND

FILENAME 01C001.dwg

SCALE NONE

SHEET 01C001

2 OF 18

PROJECT MANAGER C. JACOBS

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135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

EXISTING CONDITIONS

FILENAME 01C100.dwg
SCALE 1" = 100'

SHEET 01C100
3 OF 18

1 2 3 4 5 6 7 8

D C B A

TEST PIT DATA				
TEST PIT	DEPTH TO SEEPAGE (IN)	DEPTH TO PONDED WATER (IN)	EST. SEASONAL HIGH WATER (IN)	TOTAL DEPTH OF TEST HOLE (IN)
TP-S1	29	NOT OBSERVED	20	114
TP-S2	38	88 (AFTER 30 MINS)	22	89
TP-S3	NOT OBSERVED	NOT OBSERVED	22	43
TP-S4	NOT OBSERVED	NOT OBSERVED	21	48
TP-S5	31	43 (AFTER 10 MINS)	16	47
TP-S6	34	47 (AFTER 10 MINS)	20	48
TP-S7	NOT OBSERVED	NOT OBSERVED	18	48
TP-S8	45	49	20	49
TP-S9	37	46	18	47
TP-S10	39	43	16	47
TP-S11	52	53	17	53
TP-S12	46	46	12	46
TP-S13	NOT OBSERVED	NOT OBSERVED	19	47
TP-S14	24	52	12	58
TP-S15	NOT OBSERVED	NOT OBSERVED	19	45
TP-S16	30	44 (AFTER 10 MINS)	18	
TP-S17	NOT OBSERVED	NOT OBSERVED	15	34
TP-S18	NOT OBSERVED	NOT OBSERVED	19	52
TP-S19	NOT OBSERVED	NOT OBSERVED	17	44
TP-S20	NOT OBSERVED	NOT OBSERVED	14	43
TP-S21	22	34 (AFTER 5 MINS)	8	36
TP-S22	25	45 (AFTER 15 MINS)	10	44
TP-S23	15	36	4	40
TP-S24	40	42	6	44

TEST PIT DATA			
TEST PIT	INFILTRATION TEST NUMBER	DEPTH (FT)	VERTICAL HYDRAULIC CONDUCTIVITY (FT/DAY)
TP-3	3	4 TO 5	1.8
TP-5	2	2 TO 3	0.5
TP-5	2	4 TO 5	0.2
TP-6	1	2 TO 3	5.5
TP-6	1	4 TO 5	0.7

GROUNDWATER MEASUREMENTS			
BORING	DATE	DEPTH TO GROUNDWATER (FT)	ELEVATION (FT)
BH-07(OW)	10/30/2015	11.0	563
BH-07(OW)	11/04/2015	13.3	561
BH-13(OW)	10/29/2015	9.2	567
BH-13(OW)	11/4/2015	8.9	567

PROJECT MANAGER C. JACOBS

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ALEXANDER DEUSON
No. 0011618
REGISTERED PROFESSIONAL ENGINEER
CIVIL
12-6-17

CLEAR RIVER ENERGY LLC
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135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

EXISTING CONDITIONS TABLES

FILENAME 01C101.dwg
SCALE AS SHOWN

SHEET
01C101

PROJECT MANAGER C. JACOBS

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5	12/06/2017	REV. TECH. REVIEW 11/10/2017
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153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

PROPOSED UTILITY PLAN

FILENAME 01C200.dwg
SCALE 1" = 100'
SHEET **01C200**
5 OF 18

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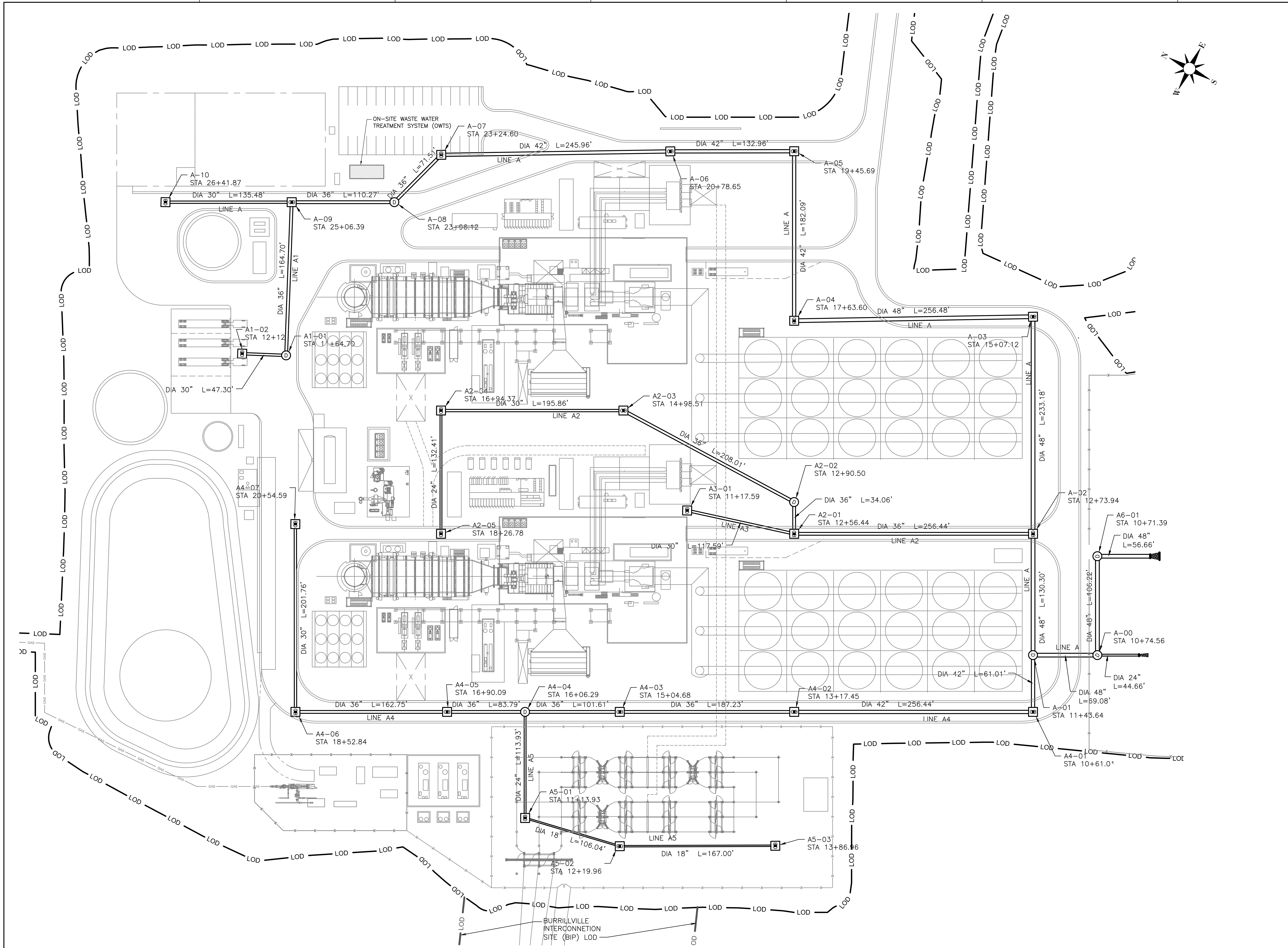
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

PROPOSED GRADING PLAN

FILENAME 01C300.dwg
SCALE 1" = 100'
SHEET 01C300
6 OF 18



STRUCTURE TABLE				
NAME	TYPE	LAYOUT COORDINATES	LID	SUMP ELEVATION
A-00	FLOW SPLITTER	N:320779.39 E:259167.35	575.96	562.96
A-01	MANHOLE	N:320837.98 E:259130.75	573.78	563.12
A-02	DROP BOX INLET	N:320907.01 E:259241.27	572.62	563.43
A-03	DROP BOX INLET	N:321030.54 E:259439.04	572.38	564.02
A-04	DROP BOX INLET	N:321245.76 E:259299.53	572.69	564.66
A-05	DROP BOX INLET	N:321342.22 E:259453.97	572.94	565.11
A-06	DROP BOX INLET	N:321454.91 E:259383.40	572.57	565.43
A-07	DROP BOX INLET	N:321661.52 E:259249.96	573.02	566.05
A-08	MANHOLE	N:321677.22 E:259180.19	573.50	566.25
A-09	DROP BOX INLET	N:321770.75 E:259121.77	573.00	566.52
A-10	DROP BOX INLET	N:321885.65 E:259050.00	573.00	566.86
A1-01	MANHOLE	N:321688.60 E:258979.02	573.36	566.89
A1-02	DROP BOX INLET	N:321729.69 E:258955.59	572.77	567.01
A2-01	DROP BOX INLET	N:321124.51 E:259105.41	573.16	564.09
A2-02	MANHOLE	N:321142.55 E:259134.30	573.59	564.18
A2-03	DROP BOX INLET	N:321350.11 E:259120.61	572.95	564.70
A2-04	DROP BOX INLET	N:321516.23 E:259016.85	572.95	565.19
A2-05	DROP BOX INLET	N:321446.08 E:258904.55	573.17	565.52
A3-01	DROP BOX INLET	N:321235.22 E:259065.79	573.16	564.88
A4-01	DROP BOX INLET	N:320805.65 E:259079.00	572.62	563.27

STRUCTURE TABLE				
NAME	TYPE	LAYOUT COORDINATES	LID	SUMP ELEVATION
A4-02	DROP BOX INLET	N:321023.15 E:258943.15	573.16	563.91
A4-03	DROP BOX INLET	N:321181.95 E:258843.96	573.16	564.38
A4-04	MANHOLE	N:321268.12 E:258790.13	574.34	564.63
A4-05	DROP BOX INLET	N:321339.19 E:258745.74	572.89	564.84
A4-06	DROP BOX INLET	N:321477.23 E:258659.52	573.50	565.29
A4-07	DROP BOX INLET	N:321584.23 E:258830.56	573.50	565.77
A5-01	DROP BOX INLET	N:321207.77 E:258693.50	574.34	564.91
A5-02	DROP BOX INLET	N:321105.53 E:258721.62	573.45	565.18
A5-03	DROP BOX INLET	N:320964.15 E:258810.50	573.26	565.60
A6-01	MANHOLE	N:320835.66 E:259257.44	574.84	562.43

STRUCTURE TABLE				
NAME	TYPE	LAYOUT COORDINATES	LID	SUMP ELEVATION
B-01	MANHOLE	N:321256.01 E:259815.13	558.92	551.20
B-02	MANHOLE	N:321225.30 E:259660.67	561.99	553.00
B-03	MANHOLE	N:321120.14 E:259459.76	565.53	555.27
B-04	MANHOLE	N:321016.43 E:259473.41	566.17	556.32

SEE LINE B, DETAIL 2/01C802

PROJECT MANAGER C. JACOBS

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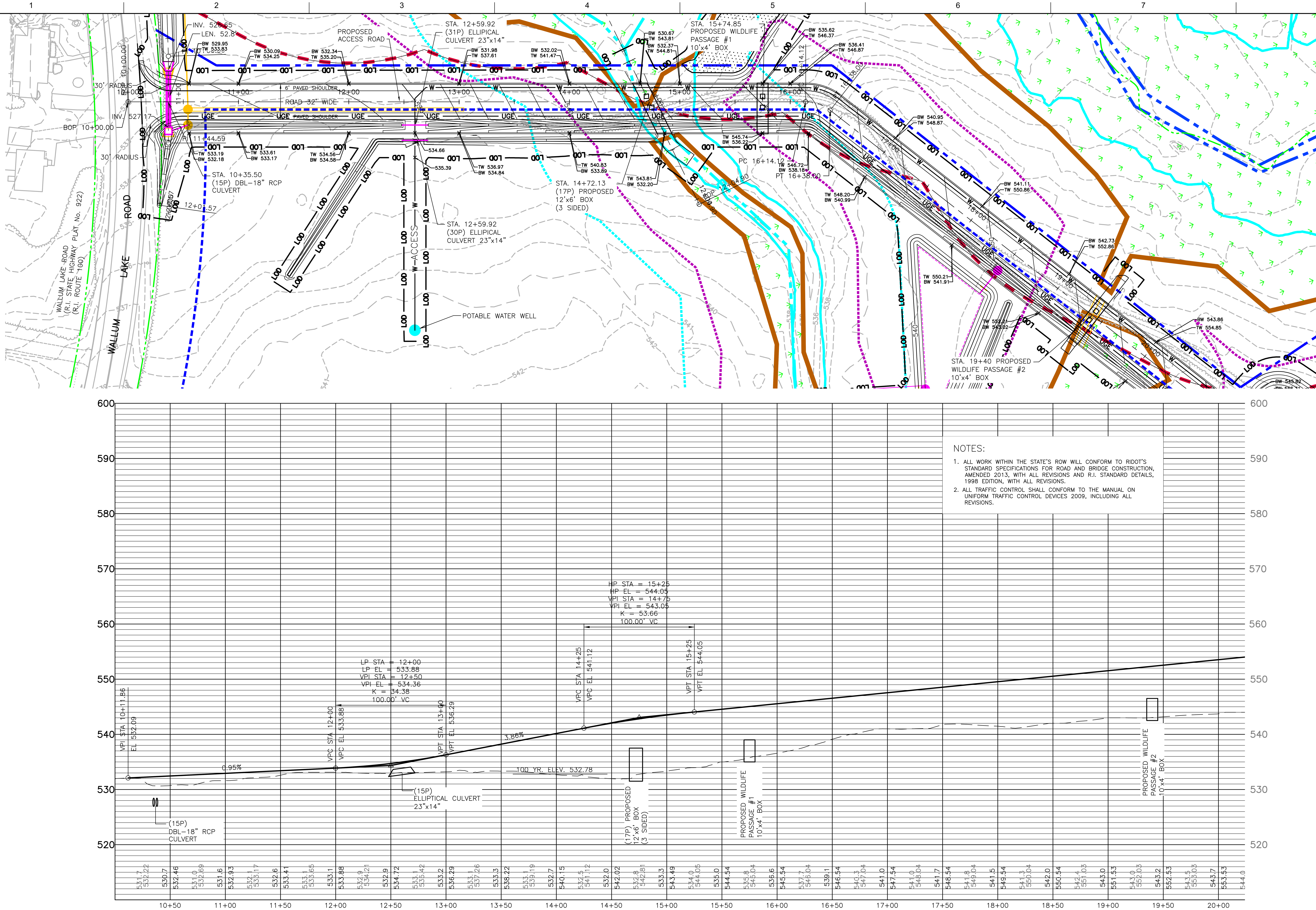
ALEXANDER DEUSON
No. 0011618
REGISTERED PROFESSIONAL ENGINEER CIVIL

CLEAR RIVER ENERGY LLC
CLEAR RIVER ENERGY CENTER
WALLUM LAKE ROAD LOT NO.
135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

PROPOSED DRAINAGE PLAN

FILENAME 01C400.dwg
SCALE 1" = 50'

SHEET 01C400
7 OF 18



NOTES:

1. ALL WORK WITHIN THE STATE'S ROW WILL CONFORM TO RIDOT'S STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, AMENDED 2013, WITH ALL REVISIONS AND R.I. STANDARD DETAILS, 1998 EDITION, WITH ALL REVISIONS.
2. ALL TRAFFIC CONTROL SHALL CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES 2009, INCLUDING ALL REVISIONS.

PROJECT MANAGER C. JACOBS

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CIVIL
12-6-17

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135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

ROADWAY PLAN & PROFILE

FILENAME 01C600.dwg
SCALE HOR. 1" = 40' VERT. 1" = 8'

SHEET
01C600

ISSUE	DATE	DESCRIPTION
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135-002, 137-002, 137-003, 137-021,
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PROVIDENCE COUNTY, RHODE ISLAND

ROADWAY PLAN & PROFILE

FILENAME 01C601.dwg

SCALE HOR. 1" = 40' VERT. 1" = 8'

SHEET 01C601

NOTE: REFER TO SHEET 01C701 FOR REFORESTATION NOTE, QUANTITIES, AND OTHER INFORMATION.

HDR

PROJECT MANAGER C. JACOBS

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135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

PROPOSED REFORESTATION PLAN

FILENAME 01C700.dwg
SCALE 1" = 100'
SHEET 01C700
10 OF 18

CLEAR RIVER ENERGY CENTER REFORESTATION PLANTING NOTES

1. Final approval of plant material will not be provided until delivery and review on site.
2. Trees with large circling roots or too deep root systems will be rejected. trees with large circling roots or too deep root systems will be rejected.
3. All root packages must be free of any weeds.
4. At the direction of the environmental specialist, pruning may be required to remove damaged, crossing, misshapen or low branching limbs. trees should not require significant pruning to correct health or aesthetic deficiencies.
5. Install 2" depth dark brown pinebark mulch around planting pits. install straw mulch in all reforestation areas.
6. Any plant material not meeting the specification's requirements for quality will be rejected by the environmental specialist.
7. Install minimum 8" depth salvaged topsoil in all reforestation areas.
8. Plant quality, size and condition as determined by standards set forth in the American Association of Nurserymen Standard ANSI 260.1-1973. Plant names shall conform to latest edition of "standardized plant names" as adopted by American Joint committee of Horticulture Nomenclature.
9. Reforestation plant sizes: sapling shall be a minimum of 5' high and "-3/4" cal. branching above 2.5'. shrubs shall be a minimum of 2.5'-3' high, full and bushy.
10. Planting time: planting of the reforestation work will occur from September 1-October 15th to ensure best establishment.
11. Tree shelters: Tubex tree guard shall be provided for all saplings to reduce rodent browsing. tree guards shall be removed after 2 years.
12. Maintenance: it shall be the contractor's responsibility to maintain the reforestation area for a period of one year after substantial completion. They will be responsible for watering during this time with an approved method.
13. Salvaged topsoil will be added as backfill in all planting pits.
14. Plantings will be supplemented with a conservation/wildlife seed mix or wetland seed mix. Seeding will occur after planting is complete to stabilize soil, reduce weed growth and provide and herbaceous forest floor.
15. Seeding: Uplands-Allens Conservation Mix, seeding rate 5 lb/1,000 sq ft. Wetlands-New England Wetland Seed Mix, seeding rate 0.5 lbs/1,000 sqft.
16. Native plantings are selected to thrive in the Clear River Energy site conditions. any additional fertilizer in the form of a slow release fertilizer shall be used only during the establishment period of the first three years, and then only as needed. Supplemental watering will only be used during the establishment period.
17. As deer can be an issue in rural areas, plants were selected to avoid those that are frequently severely damaged and focused on those that are rarely, seldom or occasionally damaged. Much of this depends on the severity of the winter months.

Plant Quantities Summary

Sapling Totals			Shrub Totals		
Common Name	**Scientific Name**	**Quantity**	**Common Name**	**Scientific Name**	**Quantity**
Black oak	*Quercus velutina*	96	Sweet pepperbush	*Clethra alnifolia*	438
Sassafras	*Sassafras albidum*	113	Highbush blueberry	*Vaccinium corymbosum*	384
Red oak	*Quercus rubra*	125	Lowbush blueberry	*Vaccinium angustifolium*	341
White oak	*Quercus alba*	110	Sheep laurel	*Kalmia angustifolia*	249
Red maple	*Acer rubrum*	91	Witch hazel	*Hamamelis virginiana*	352
White pine	*Pinus strobus*	112	Huckleberry	*Gaylussacia frondosa*	365
Tuliptree	*L. tulipifera*	47	Mountain laurel	*Kalmia latifolia*	171
Black gum	*Nyssa sylvatica*	13	Spicebush	*Lindera benzoin*	28
Shagbark hickory	*Carya ovata*	61	Winterberry	*Ilex verticillata*	28
Yellow birch	*B. alleghaniensis*	22	Arrowwood	*Viburnum dentatum*	39
Total		**789**	**Total**		**2395**

Reforestation Plant Quantity List

Area Code	Polygon Area (sq ft)	Saplings 1	Quantity	Saplings 2	Quantity	Total Saplings	Shrubs 1	Quantity	Shrubs 2	Quantity	Total Shrubs
A-1	18,601	Black oak	26	Sassafras	26	53	Highbush blueberry	80	Mountain laurel	80	161
A-2	9,974	White oak	14	Shagbark hickory	14	28	Lowbush blueberry	43	Huckleberry	43	86
A-3	13,774	Red oak	20	White pine	20	39	Sweet pepperbush	60	Witch hazel	60	119
A-4	20,488	White pine	29	Shagbark hickory	29	58	Witch hazel	89	Lowbush blueberry	89	177
A-5	14,478	Red maple	21	Red oak	21	41	Huckleberry	63	Sweet pepperbush	63	125
A-6	11,899	Sassafras	17	White oak	17	34	Sheep laurel	51	Highbush blueberry	51	103
A-7	19,820	Black oak	28	White oak	28	56	Highbush blueberry	86	Huckleberry	86	171
A-8	12,039	White oak	17	Shagbark hickory	17	34	Lowbush blueberry	52	Witch hazel	52	104
A-9	8,469	Red oak	12	Tuliptree	12	24	Sweet pepperbush	37	Sheep laurel	37	73
A-10	6,982	White pine	10	Red oak	10	20	Witch hazel	30	Huckleberry	30	60
A-11	4,913	Red maple	7	White pine	7	14	Huckleberry	21	Sweet pepperbush	21	42
A-12	20,608	Sassafras	29	Black oak	29	59	Sheep laurel	89	Sweet pepperbush	89	178
A-13	24,516	Tuliptree	35	Red maple	35	70	Highbush blueberry	106	Lowbush blueberry	106	212
A-14	9,511	White oak	14	White pine	14	27	Mountain laurel	41	Witch hazel	41	82
A-15	11,441	Red oak	16	Sassafras	16	33	Sweet pepperbush	49	Mountain laurel	49	99
A-16	7,203	White pine	10	Red oak	10	21	Witch hazel	31	Sheep laurel	31	62
A-17	7,516	Red maple	11	Sassafras	11	21	Huckleberry	32	Lowbush blueberry	32	65
A-18	11,428	White pine	16	Red oak	16	33	Witch hazel	49	Huckleberry	49	99
A-19	6,432	Yellow birch	9	Red maple	9	18	Spicebush	28	Winterberry	28	56
A-20	9,122	Black gum	13	Yellow birch	13	26	Arrowwood	39	Sweet pepperbush	39	79
B-1	9,432	Sassafras	13	White oak	13	27	Sheep laurel	41	Huckleberry	41	82
B-2	8,067	Black oak	11	Red oak	11	23	Highbush blueberry	35	Sweet pepperbush	35	70
B-3	4,360	White oak	6	White pine	6	12	Lowbush blueberry	19	Sweet pepperbush	19	38
CFS	6,009	Red oak	9	Red maple	9	17	Sweet pepperbush	26	Highbush blueberry	26	52

PROJECT MANAGER C. JACOBS

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2	2/17/2017	REVISION
1	8/17/2016	SOIL EROSION SEDIMENT CONTROL PLAN

PROJECT NUMBER 10021318

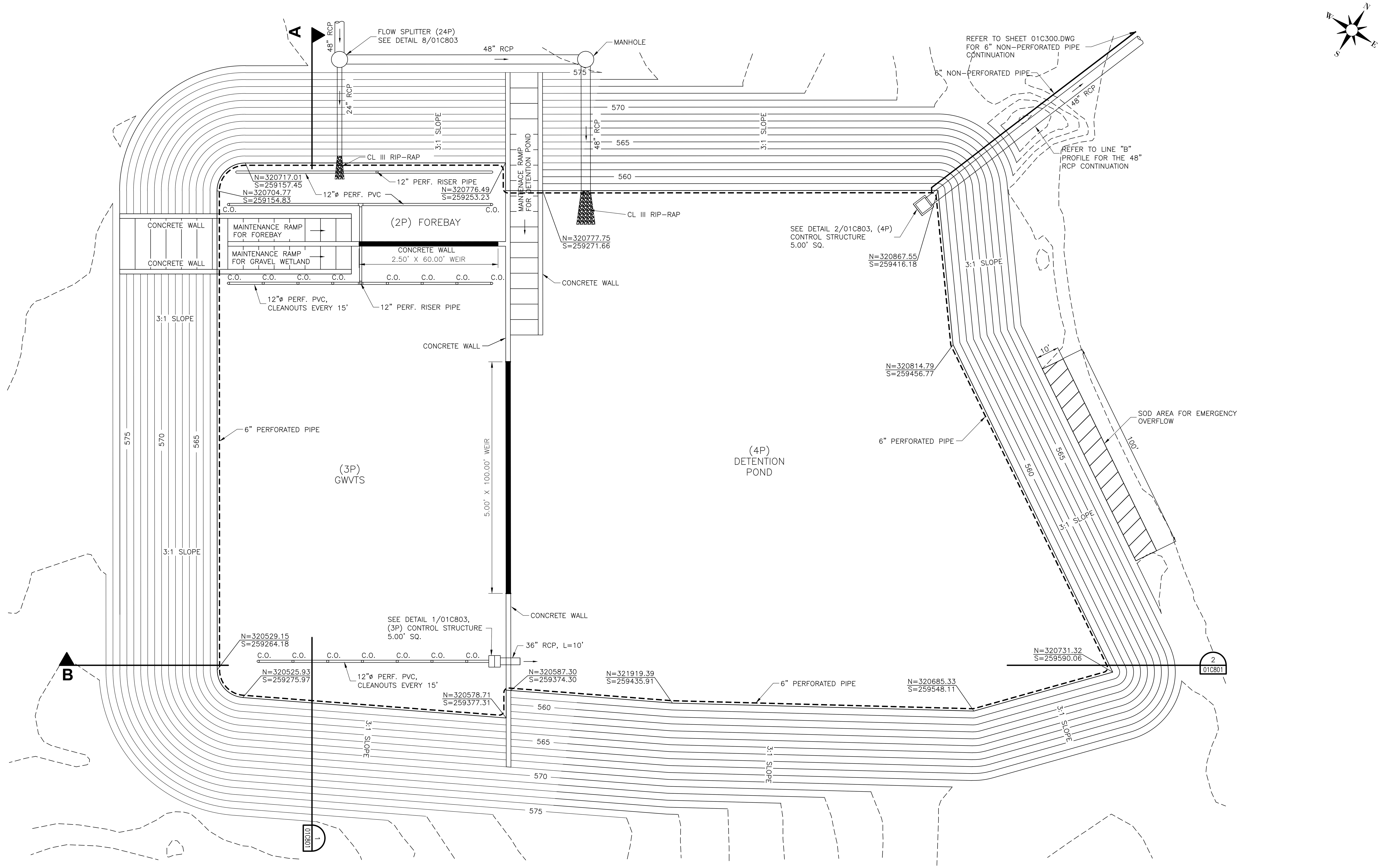
ALEXANDER DEUSON
12-6-17
STATE OF RHODE ISLAND
HOPE
No. 0011618
REGISTERED PROFESSIONAL ENGINEER CIVIL

CLEAR RIVER ENERGY LLC
CLEAR RIVER ENERGY CENTER
WALLUM LAKE ROAD LOT NO.
135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

PROPOSED REFORESTATION NOTES AND PLANTING SCHEDULE

FILENAME 01C701.dwg
SCALE NONE

SHEET 01C701



BASIN A DETAIL (2P)(3P)(4P)

SCALE: 1"=20'

1
01C800

ISSUE	DATE	DESCRIPTION
5	12/06/2017	REV. TECH. REVIEW 11/10/2017
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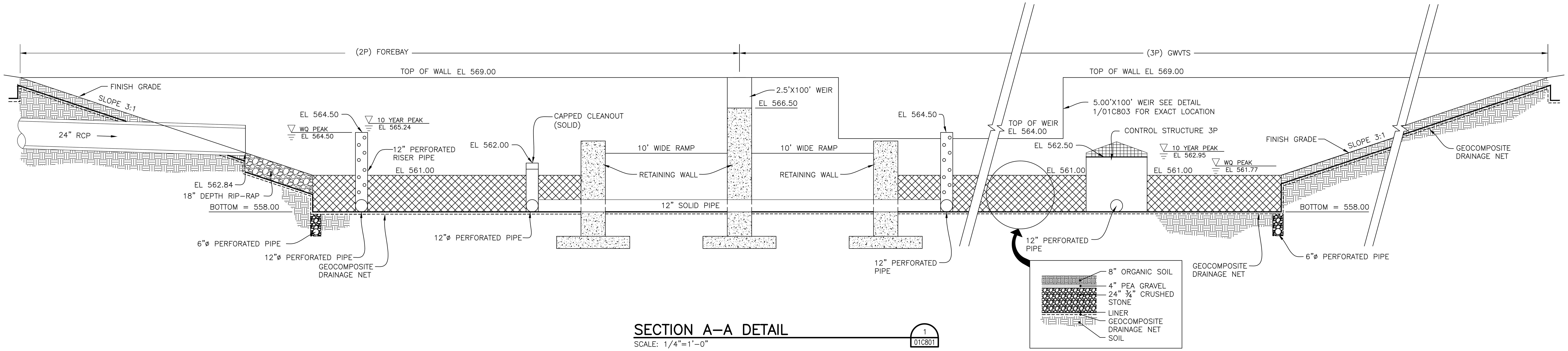
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

PROPOSED SITE DRAINAGE DETAILS

FILENAME 01C800.dwg

SCALE 1" = 20'

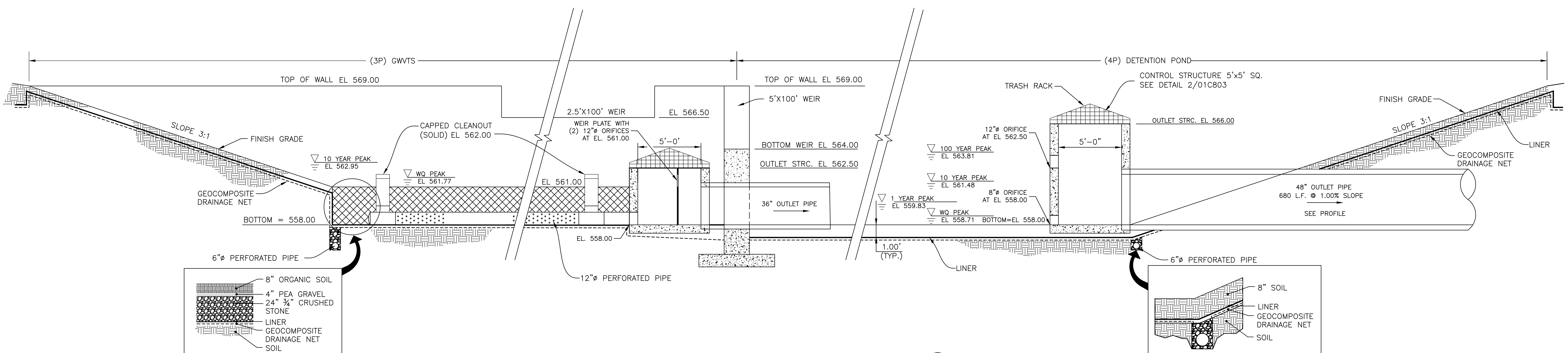
SHEET
01C800
12 OF 18



SECTION A–A DETAIL

SCALE: 1/4"=1'-0"

1 01C801



SECTION B–B DETAIL

SCALE: 1/4"=1'-0"

2 01C801

PROJECT MANAGER C. JACOBS

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153-001, 153-002
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PROVIDENCE COUNTY, RHODE ISLAND

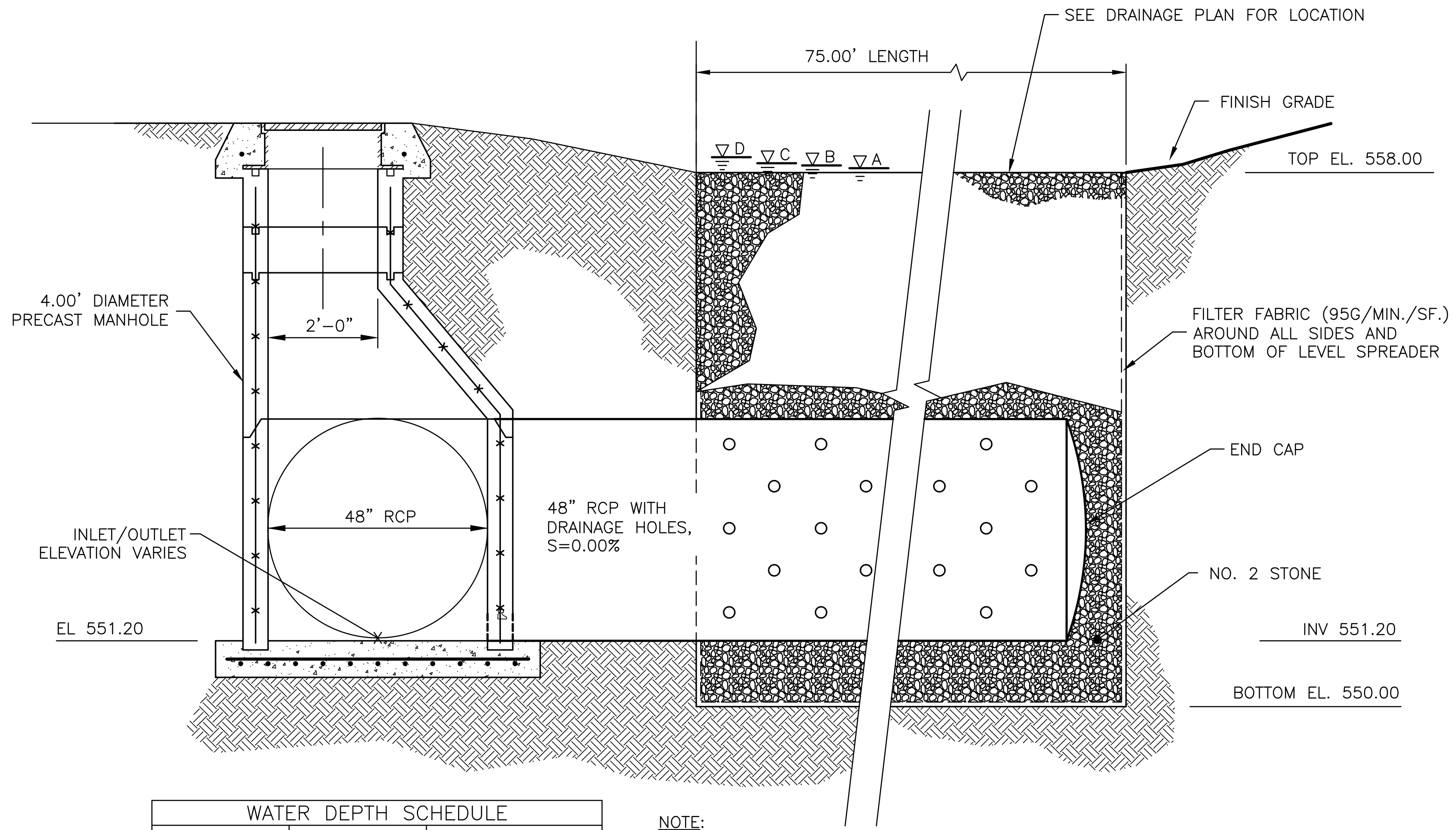
PROPOSED SITE DRAINAGE DETAILS

FILENAME 01C801.dwg

SCALE AS SHOWN

SHEET 01C801

13 OF 18



WATER DEPTH SCHEDULE		
	STORM EVENT	ELEVATION
A	WQ PEAK	558.07
B	1 YR PEAK	558.15
C	10 YR PEAK	558.27
D	100 YR PEAK	558.12

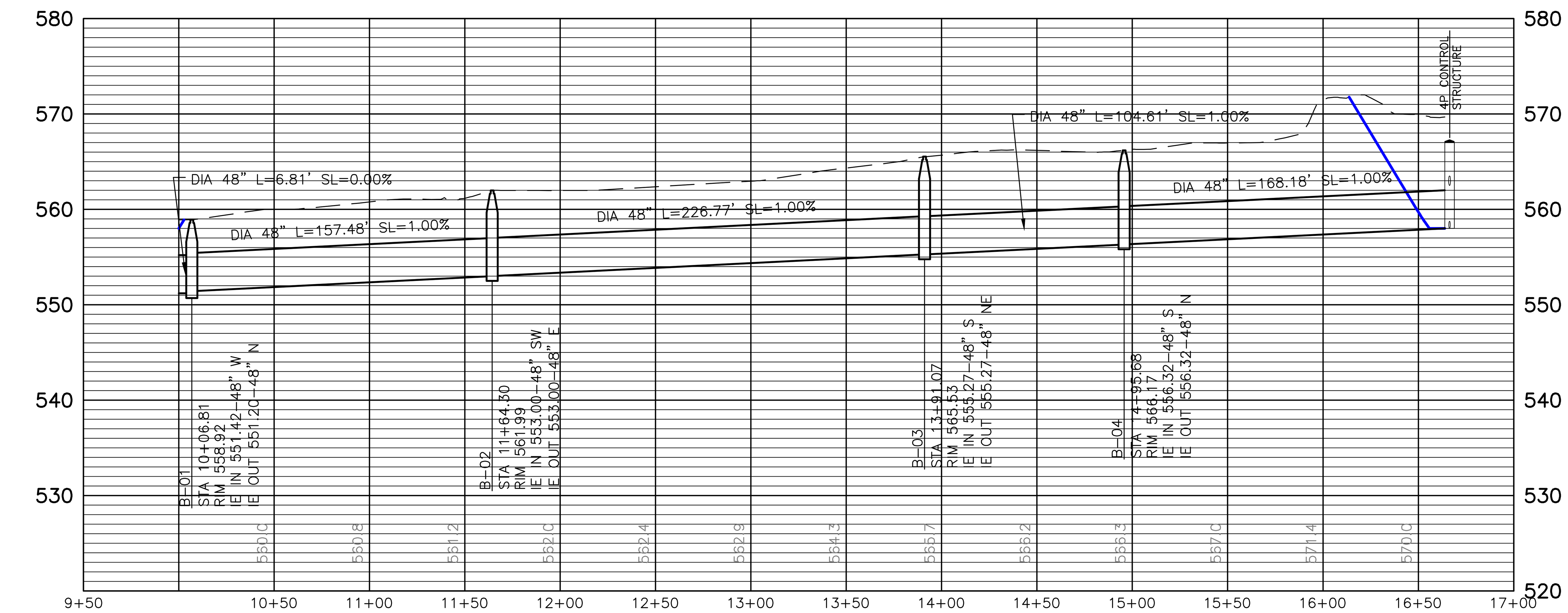
NOTE:

1) 48" I.D. PERFORATED UNDERDRAIN WITH FILTER SOCK. LAY PIPE WITH PERFORATIONS ON BOTTOM OF PIPE AND CAP END OF PIPE. LAY UNDERDRAIN AT 0.00% SLOPE FROM MANHOLE INVERT AND THRU BOTTOM OF LEVEL SPREADER.

2) WATER DEPTH MEASURED FROM TOP OF LEVEL SPREADER = EL 558.00.

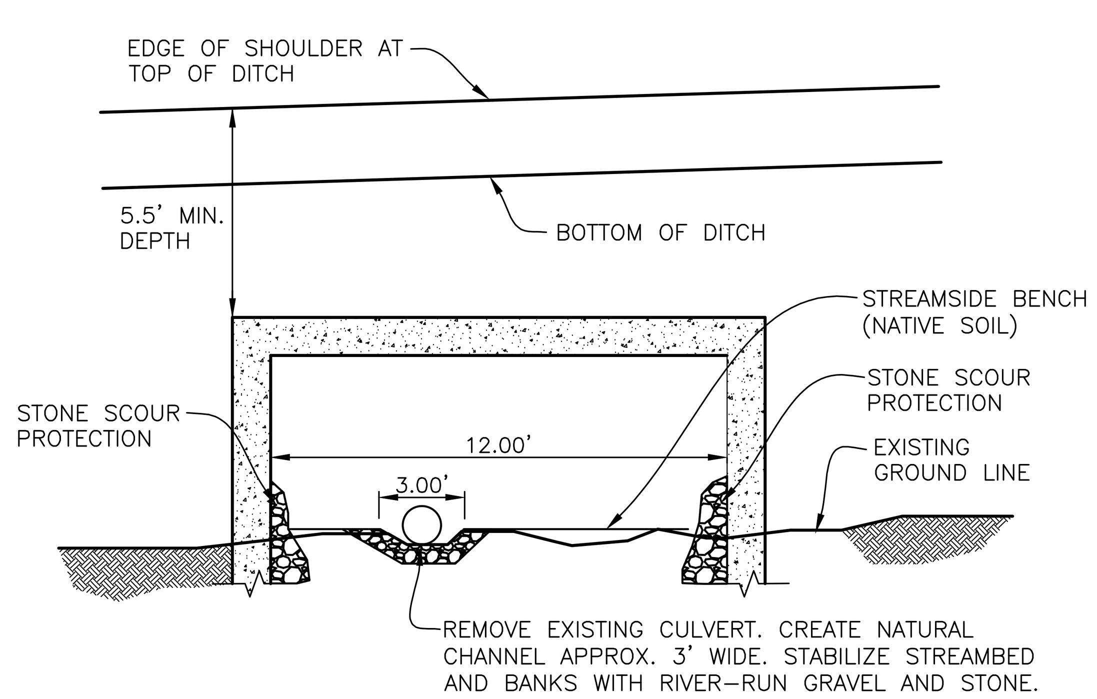
STILLING WELL–LEVEL SPREADER DETAIL (18P) 1 01C802

SCALE: 1/2"=1'-0"



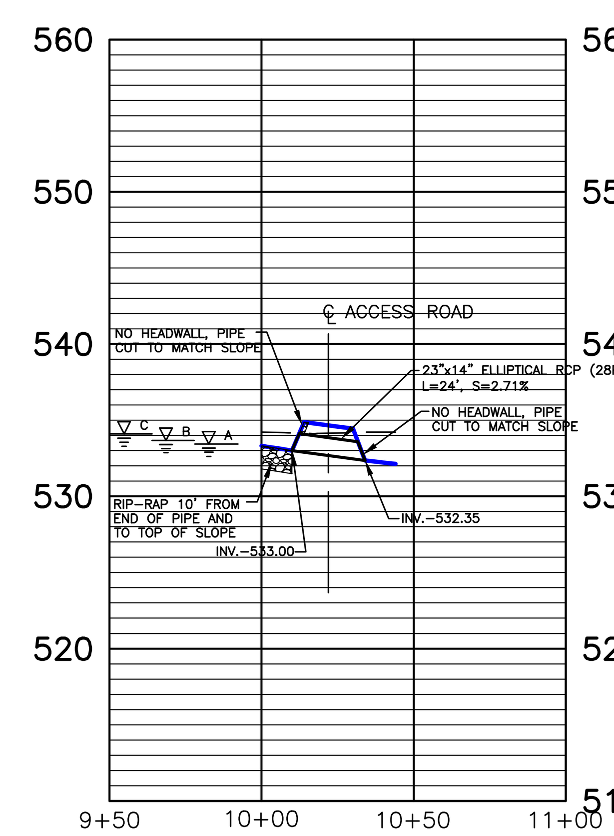
PROFILE OF LINE B 2 01C802

SCALE: HOR- 1"=50' VER- 1" = 5'



CULVERT #2 (17P) CONSTRUCTION DETAIL 3 01C802

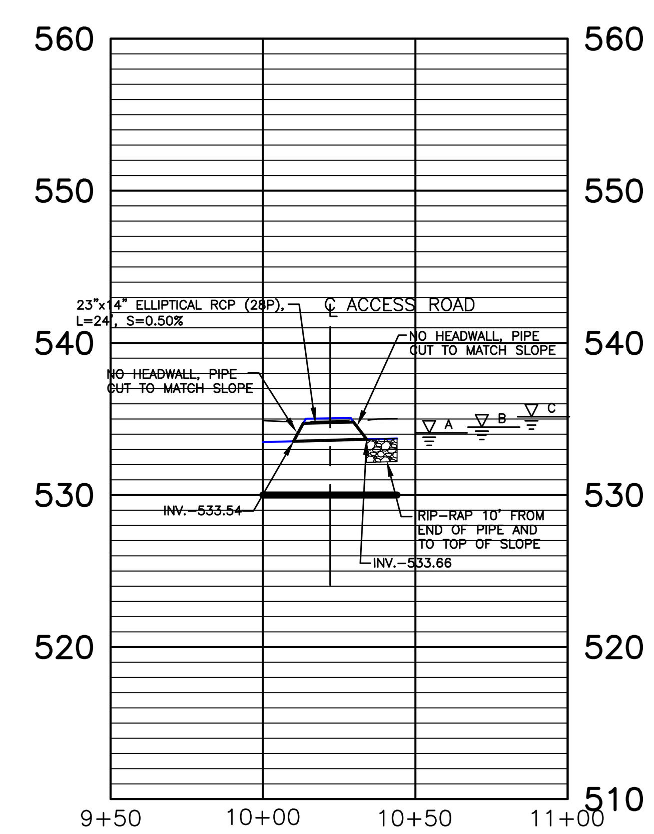
SCALE: 1/4"=1'-0"



WATER DEPTH SCHEDULE		
	STORM EVENT	ELEVATION
A	1 YR PEAK	533.44
B	10 YR PEAK	533.68
C	100 YR PEAK	534.01

ACCESS ROAD PIPE SECTION (31P) 4 01C802

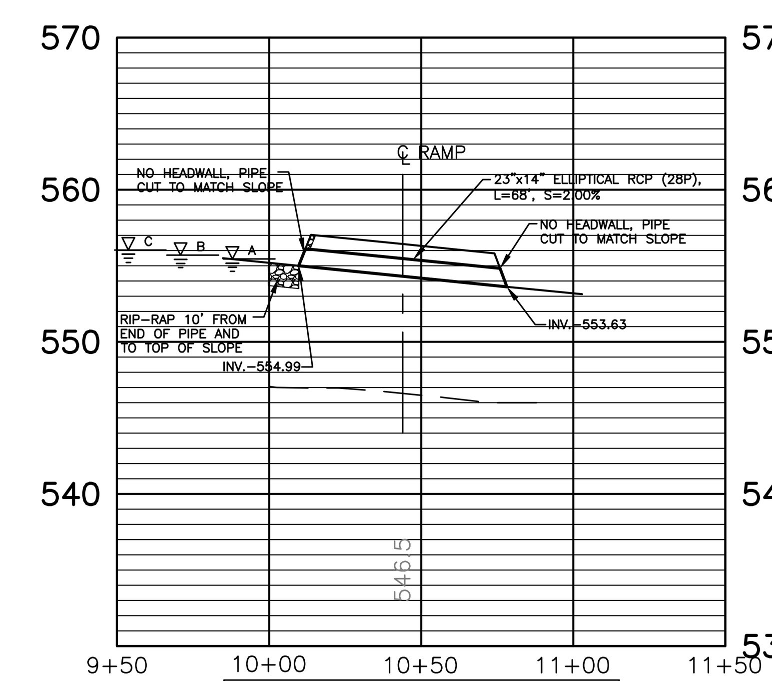
SCALE: HOR- 1"=50' VER- 1" = 5'



WATER DEPTH SCHEDULE		
	STORM EVENT	ELEVATION
A	1 YR PEAK	534.07
B	10 YR PEAK	534.46
C	100 YR PEAK	535.14

ACCESS ROAD PIPE SECTION (30P) 5 01C802

SCALE: HOR- 1"=50' VER- 1" = 5'



WATER DEPTH SCHEDULE		
	STORM EVENT	ELEVATION
A	1 YR PEAK	555.44
B	10 YR PEAK	555.69
C	100 YR PEAK	556.03

RAMP PIPE SECTION (28P) 6 01C802

SCALE: HOR- 1"=50' VER- 1" = 5'

HDR

PROJECT MANAGER C. JACOBS

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PROJECT NUMBER 10021318

ALEXANDER DEUSON No. 0011618 REGISTERED PROFESSIONAL ENGINEER CIVIL

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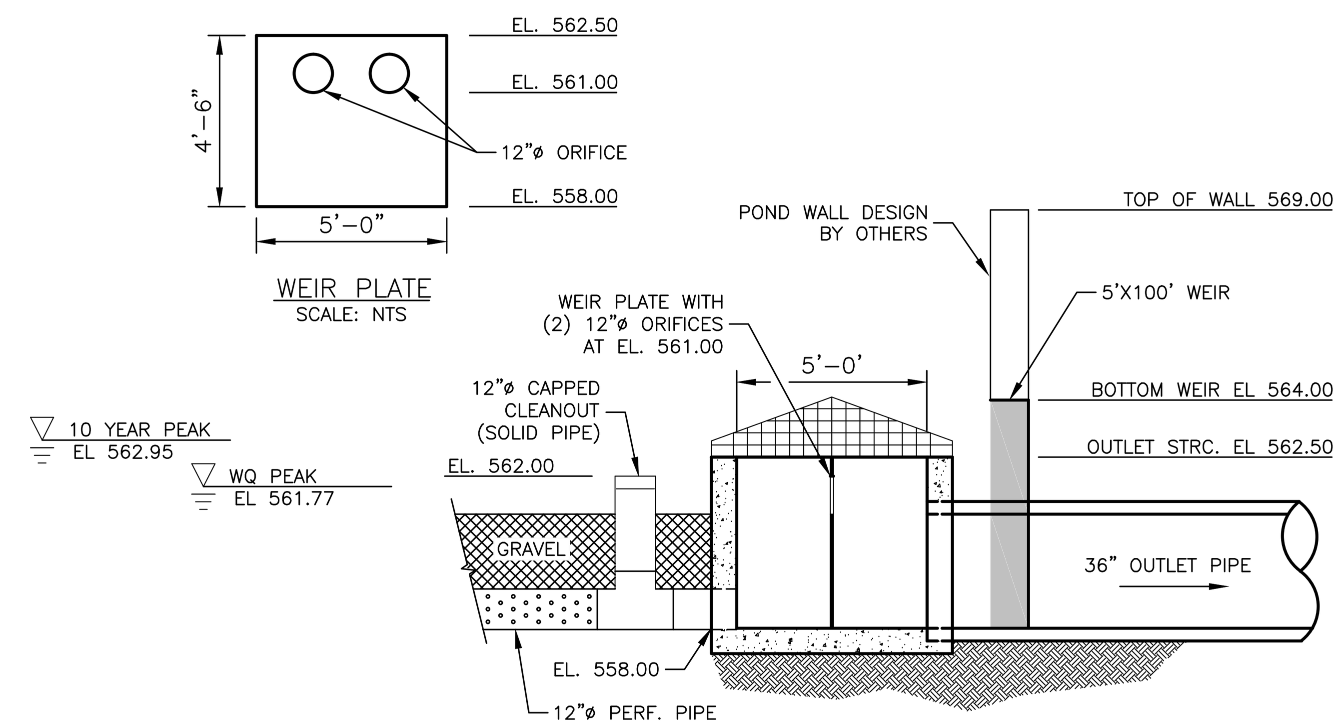
CLEAR RIVER ENERGY CENTER
WALLUM LAKE ROAD LOT NO.
135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

PROPOSED SITE DRAINAGE DETAILS

FILENAME 01C802.dwg

SCALE AS SHOWN

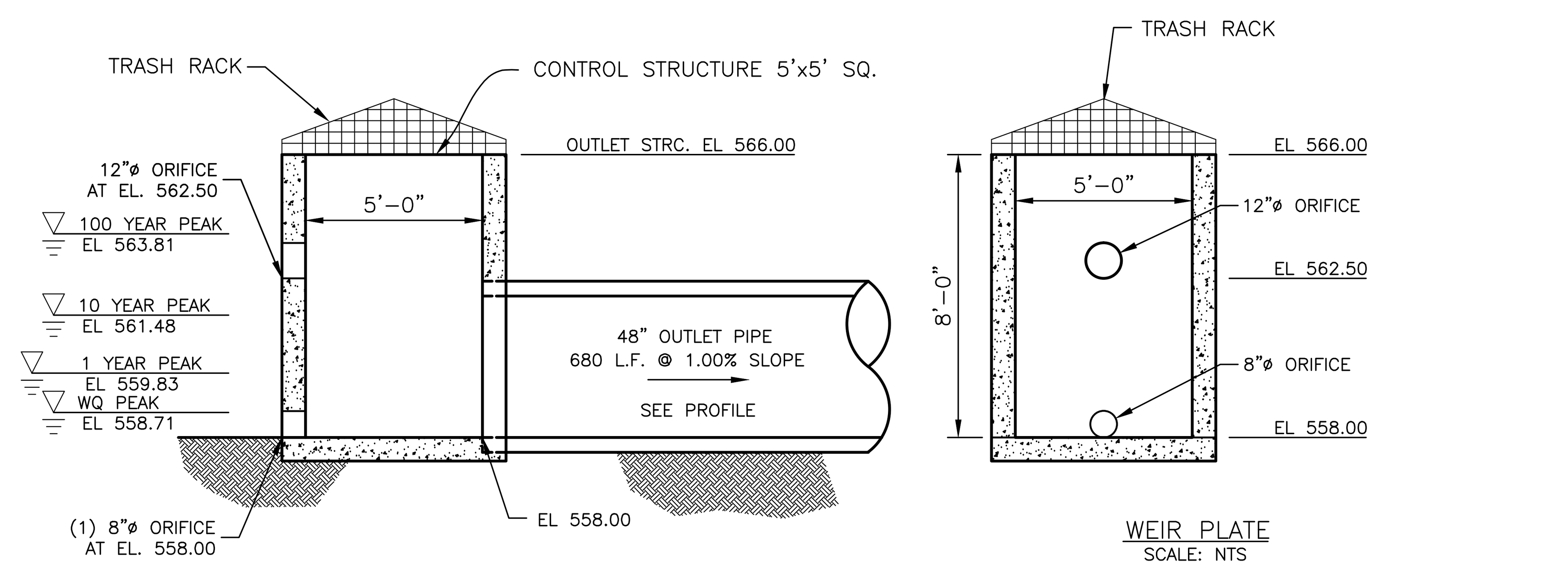
SHEET 01C802



CONTROL STRUCTURE DETAIL (3P)

SCALE: NTS

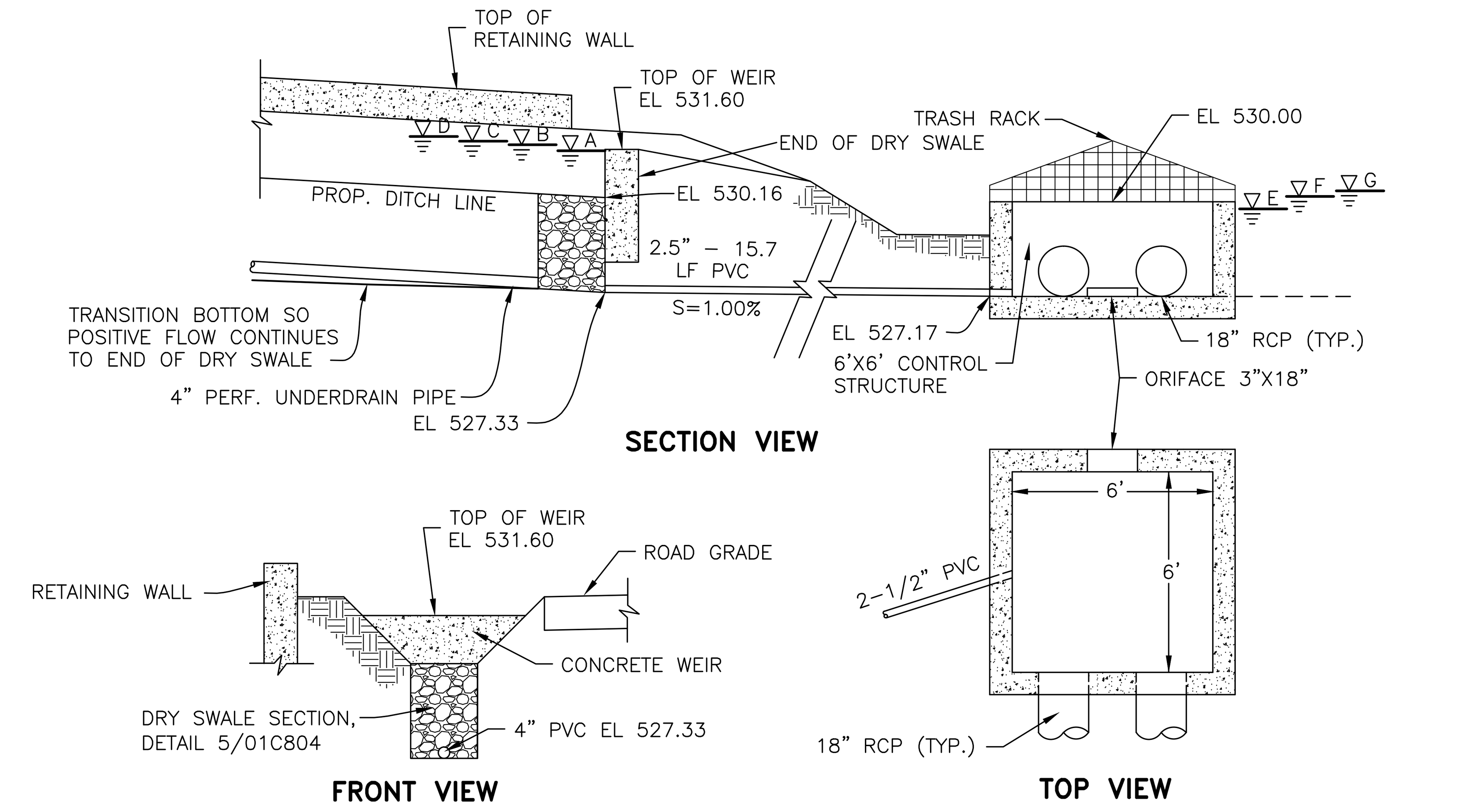
1 / 01C803



CONTROL STRUCTURE DETAIL (4P)

SCALE: NTS

2 / 01C803



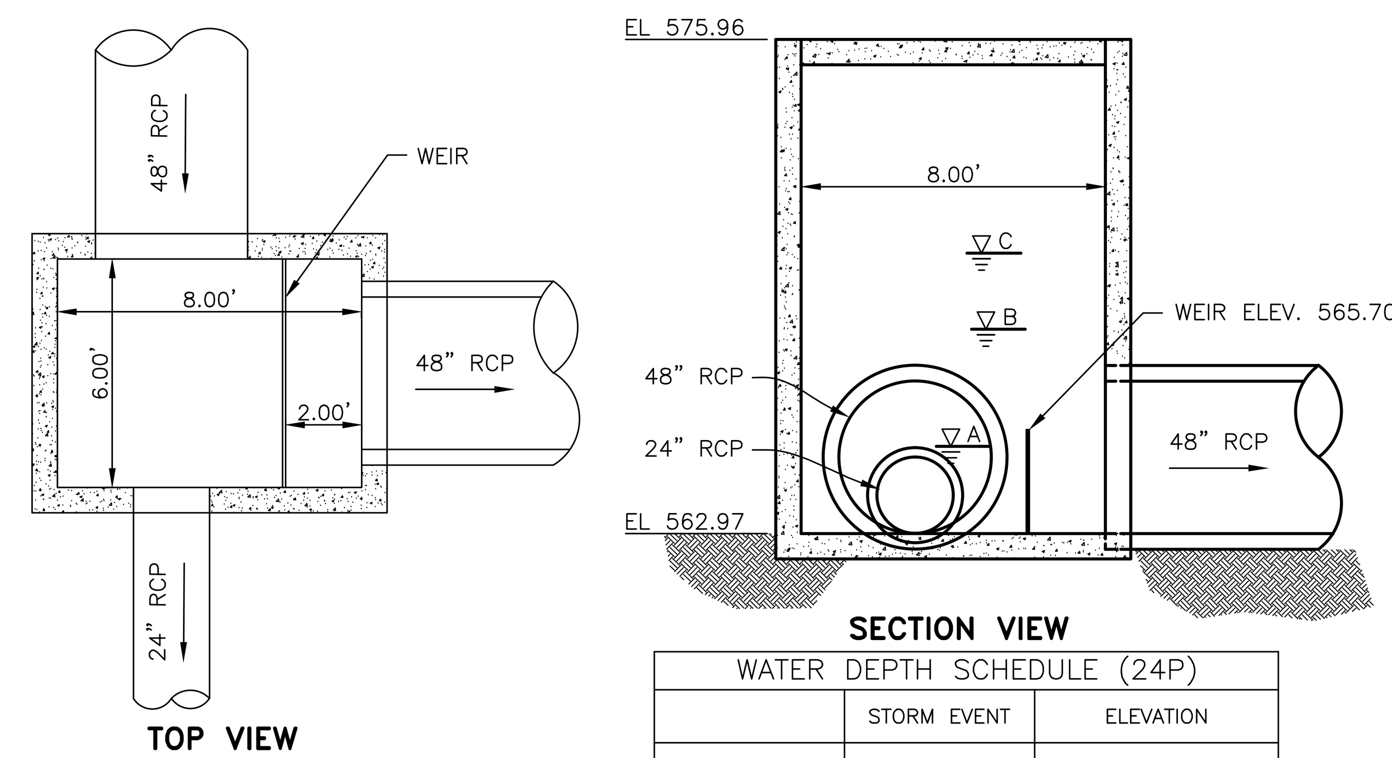
WATER DEPTH SCHEDULE (23P)		
	STORM EVENT	ELEVATION
A	WQ PEAK	530.99
B	1 YR PEAK	531.74
C	10 YR PEAK	531.86
D	100 YR PEAK	532.01

WATER DEPTH SCHEDULE (15P)		
	STORM EVENT	ELEVATION
E	1 YR PEAK	529.83
F	10 YR PEAK	530.16
G	100 YR PEAK	530.33

END OF SWALE (20R) DETAIL (23P)(15P)

SCALE: 1/4"=1'-0"

3 / 01C803

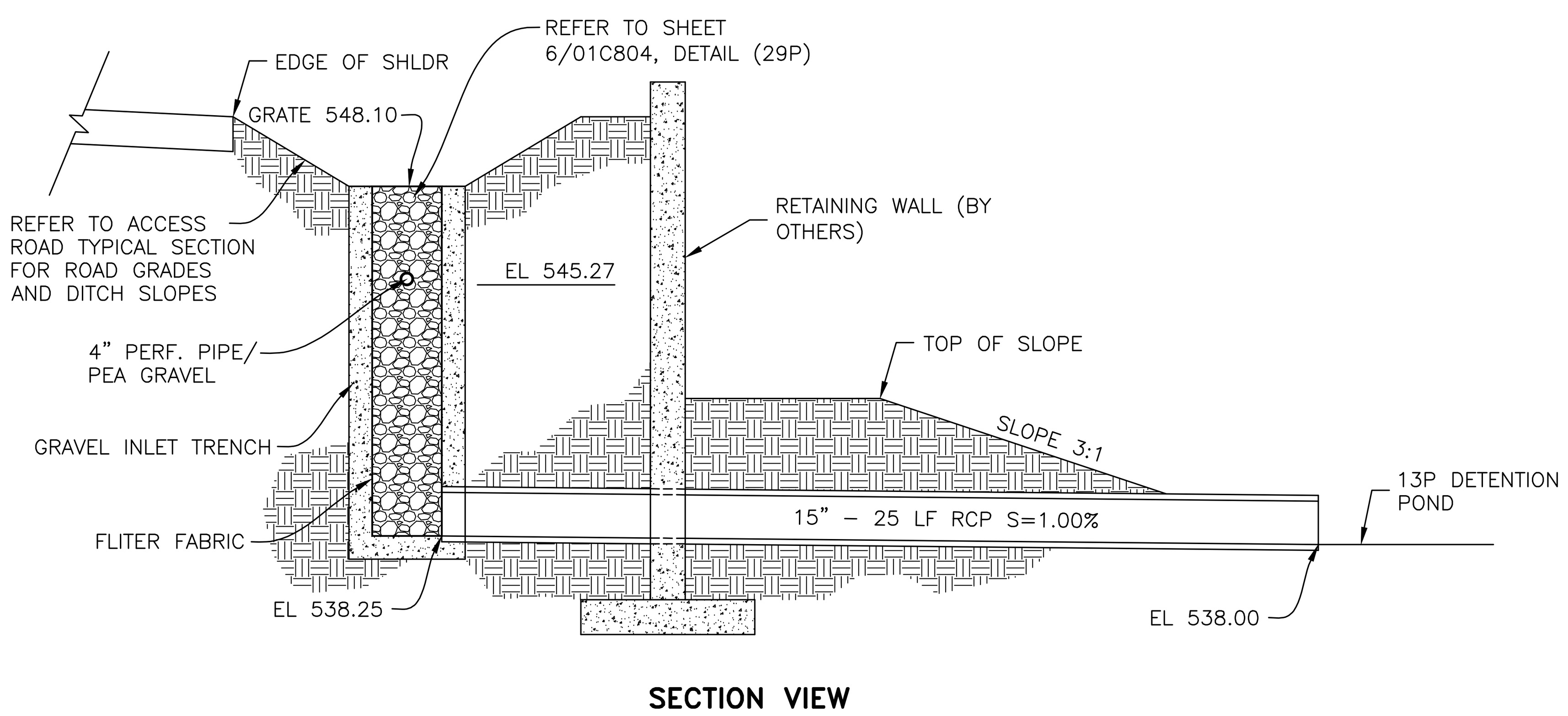


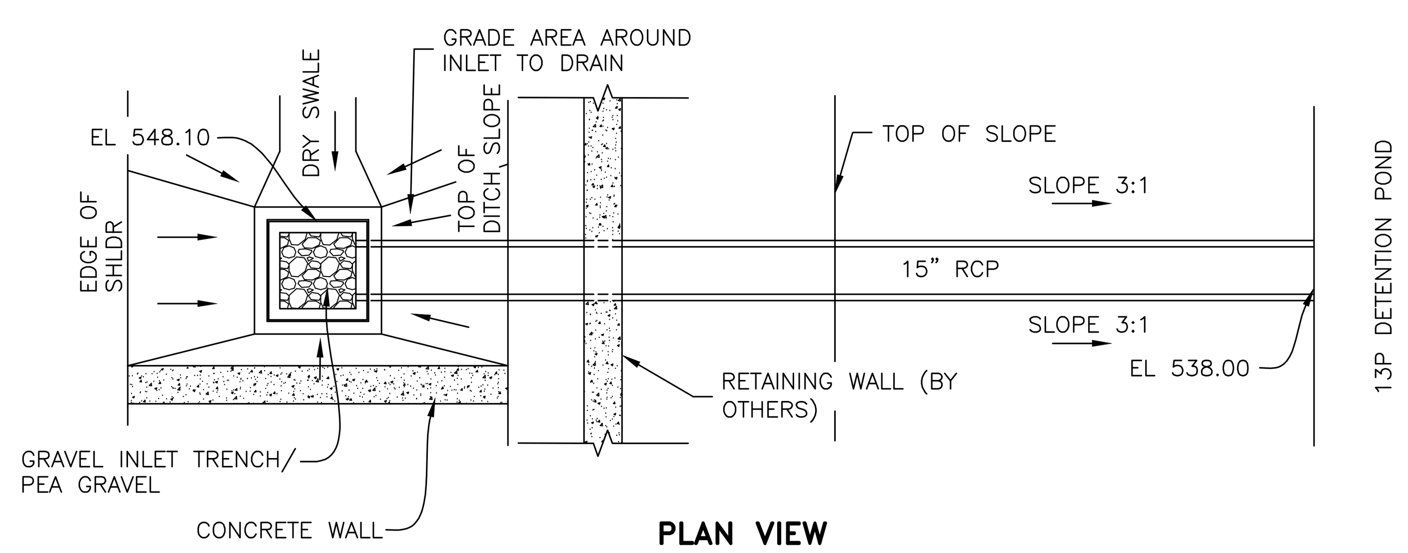
WATER DEPTH SCHEDULE (24P)		
	STORM EVENT	ELEVATION
A	WQ PEAK	565.26
B	10 YR PEAK	568.34
C	100 YR PEAK	570.34

FLOW SPLITTER (24P)

SCALE: 1/4"=1'-0"

8 / 01C803

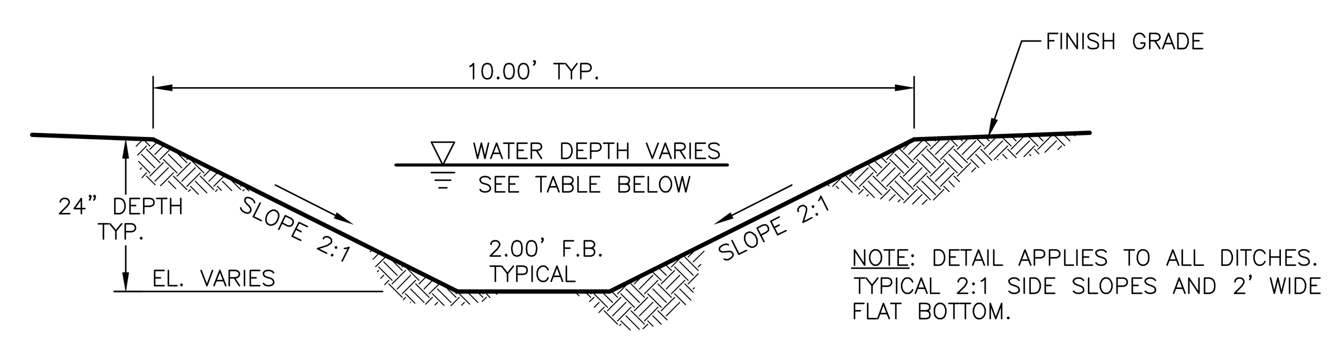




END OF SWALE DETAIL (29R)

SCALE: 1/4"=1'-0"

4 / 01C803



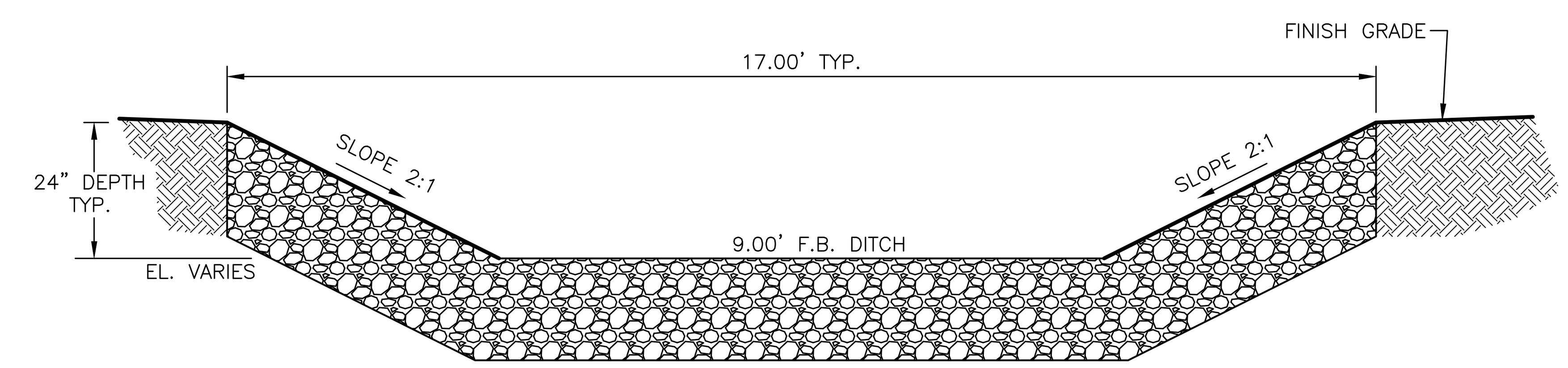
NOTE: DETAIL APPLIES TO ALL DITCHES. TYPICAL 2:1 SIDE SLOPES AND 2' WIDE FLAT BOTTOM.

WATER DEPTH SCHEDULE		
STORM EVENT	MAX. WATER DEPTH (IN FEET)	
	RE-ROUTING DITCH (23R)	RE-ROUTING DITCH (30R)
1 YR PEAK	0.19	0.23
10 YR PEAK	0.37	0.43
100 YR PEAK	0.58	0.67

TYPICAL DITCH SECTION (23R)(30R)

SCALE: 1/2"=1'-0"

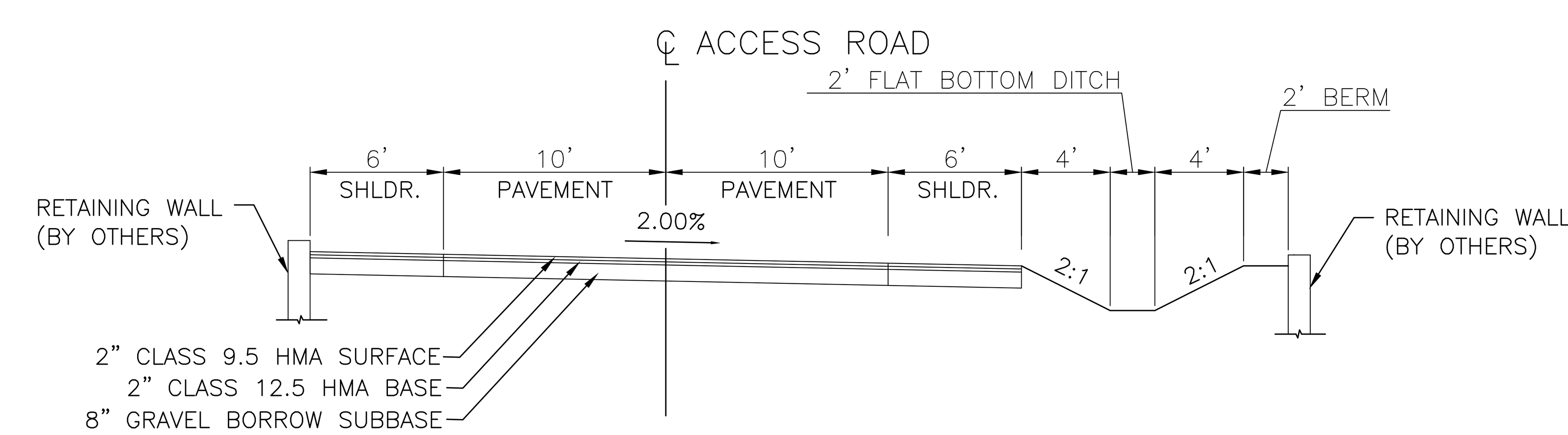
5 / 01C803



OUTLET CHANNEL FOR DBL 18" RCP (21R)

SCALE: 1/2"=1'-0"

6 / 01C803



ACCESS ROAD TYPICAL SECTION

SCALE: 1/4"=1-0'

7 / 01C803

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PROJECT MANAGER C. JACOBS

PROJECT NUMBER 10021318

ALEXANDER DEUSON
No. 0011618
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CIVIL

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135-002, 137-002, 137-003, 137-021,
153-001, 153-002
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PROVIDENCE COUNTY, RHODE ISLAND

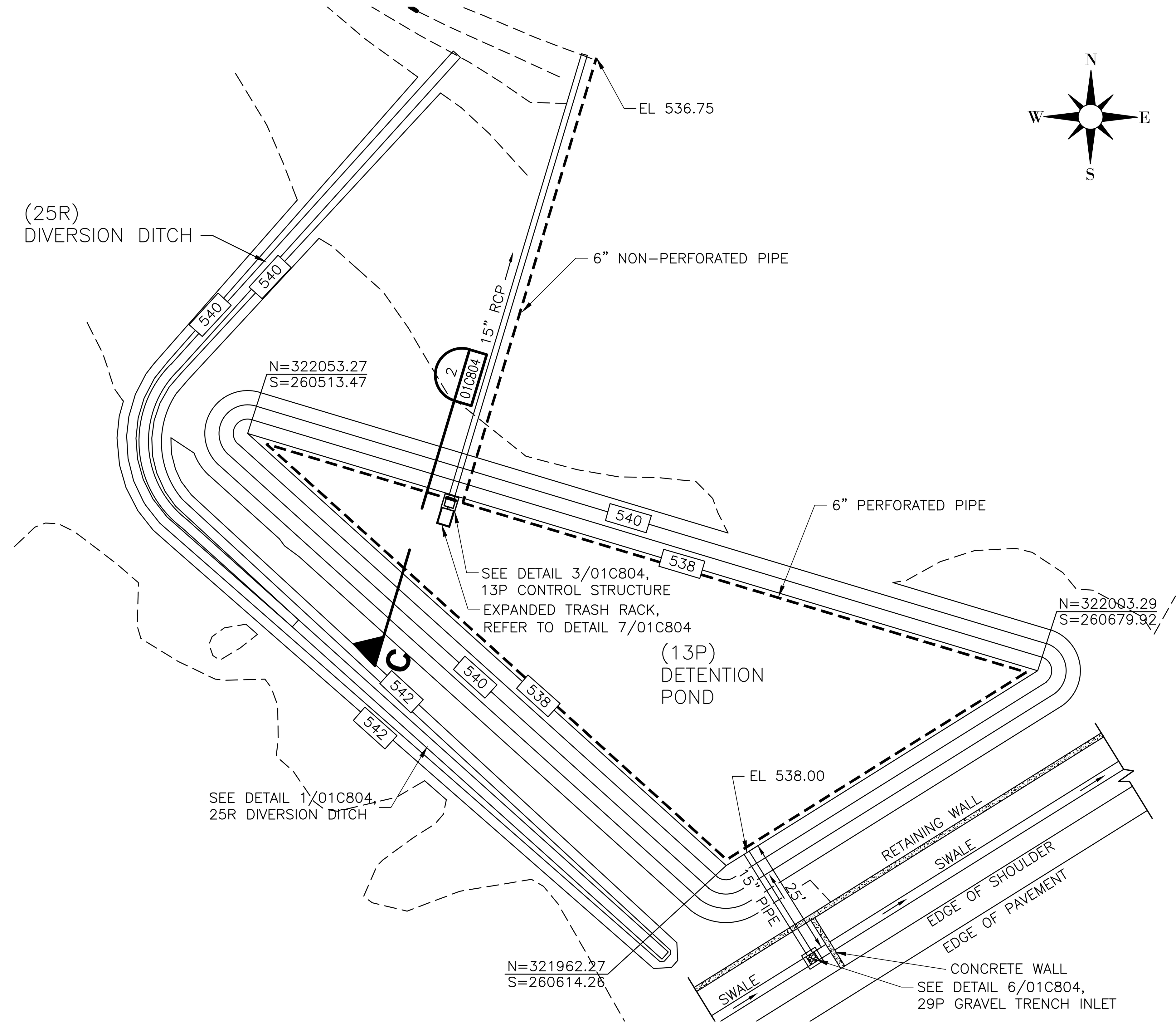
PROPOSED SITE DRAINAGE DETAILS

FILENAME 01C803.dwg

SCALE AS SHOWN

SHEET 01C803

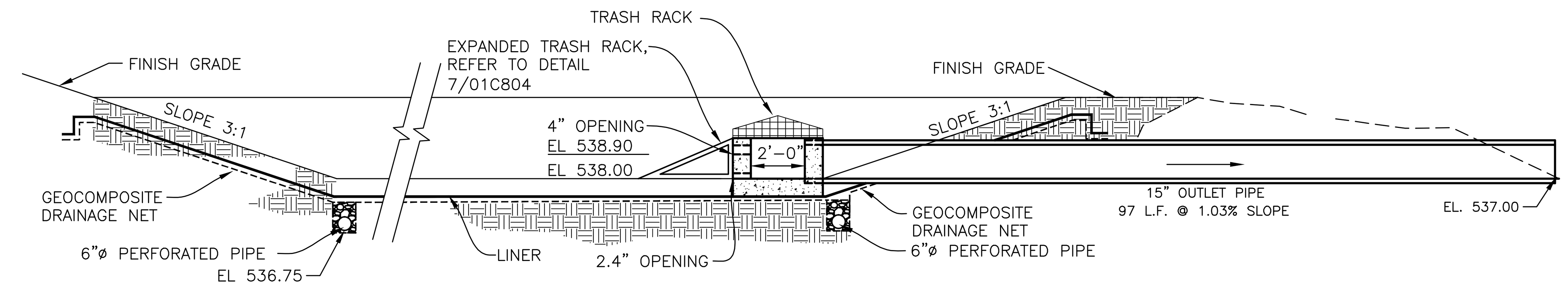
15 OF 18



BASIN B DETAIL (13P)

SCALE: 1"=20'

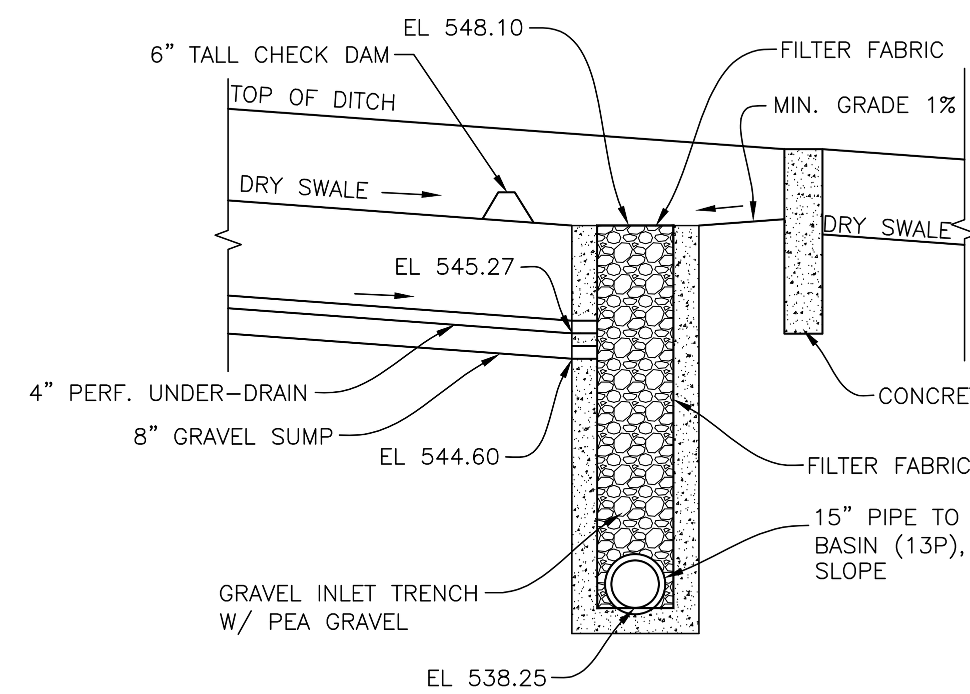
1 / 01C804



SECTION C–C DETAIL (13P)

SCALE: 1/4"=1'-0"

2 / 01C804

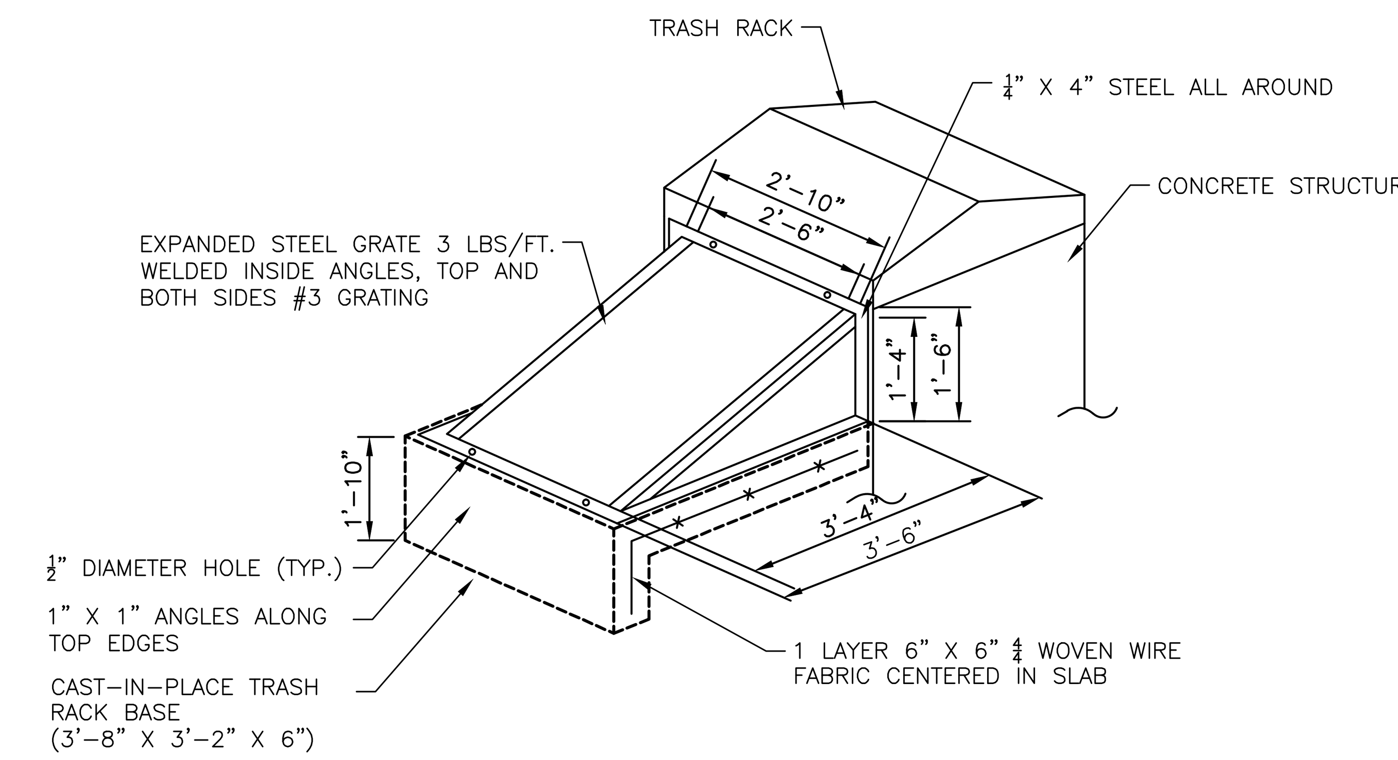


GRAVEL INLET TRENCH (29P)

SCALE: 1/4"=1'-0" (SEE DETAIL 4/01C803)

6 / 01C804

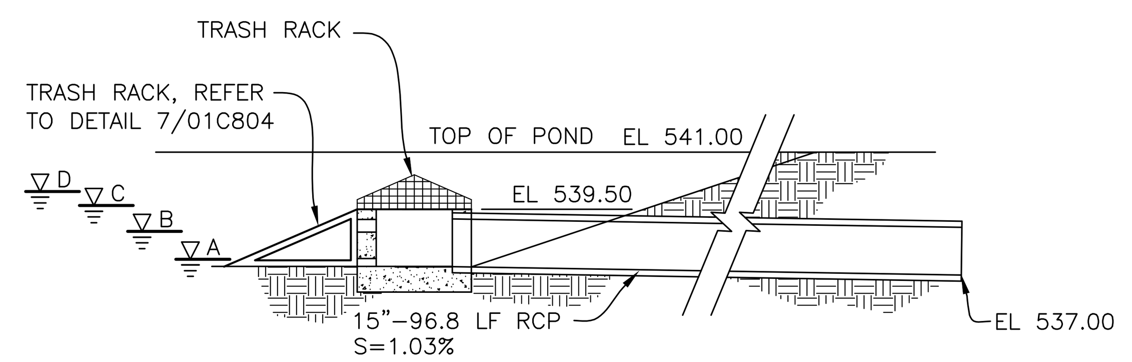
WATER DEPTH SCHEDULE (29P)		
	STORM EVENT	ELEVATION
A	WQ PEAK	538.59
B	1 YR PEAK	539.00
C	10 YR PEAK	539.59
D	100 YR PEAK	541.84



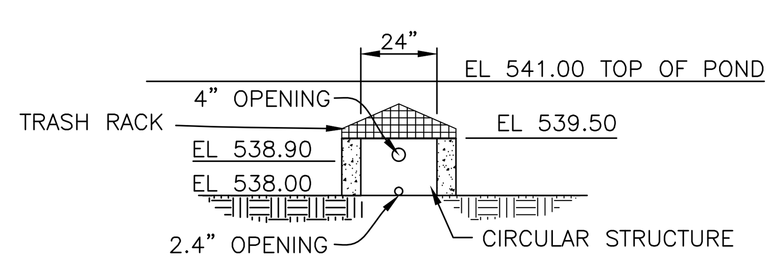
EXPANED TRASH RACK PROTECTION FOR LOW–FLOW ORIFACE

SCALE: 1/2"=1'-0"

7 / 01C804



SECTION VIEW



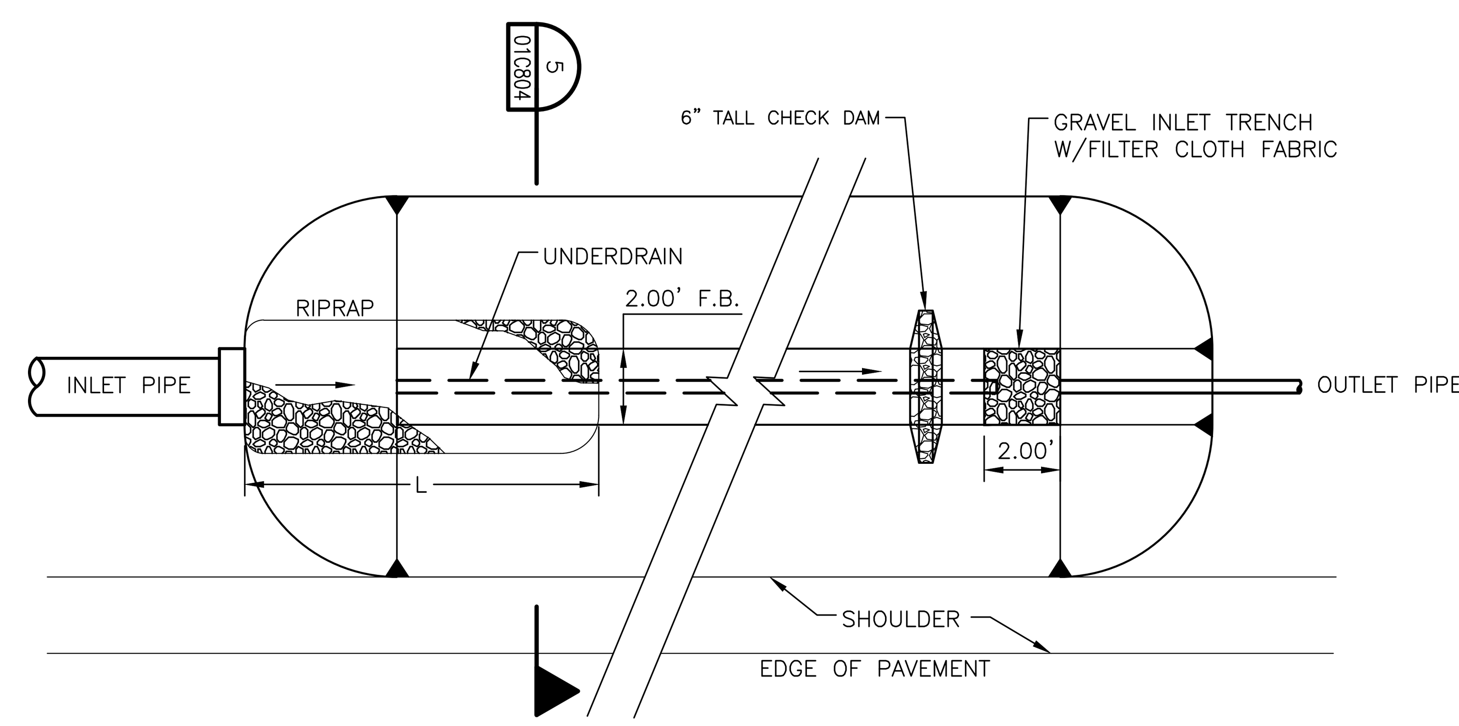
FRONT VIEW

WATER DEPTH SCHEDULE		
	STORM EVENT	ELEVATION
A	WQ PEAK	538.22
B	1 YR PEAK	538.86
C	10 YR PEAK	539.56
D	100 YR PEAK	539.89

CONTROL STRUCTURE DETAIL (13P)

SCALE: 1/4"=1'-0"

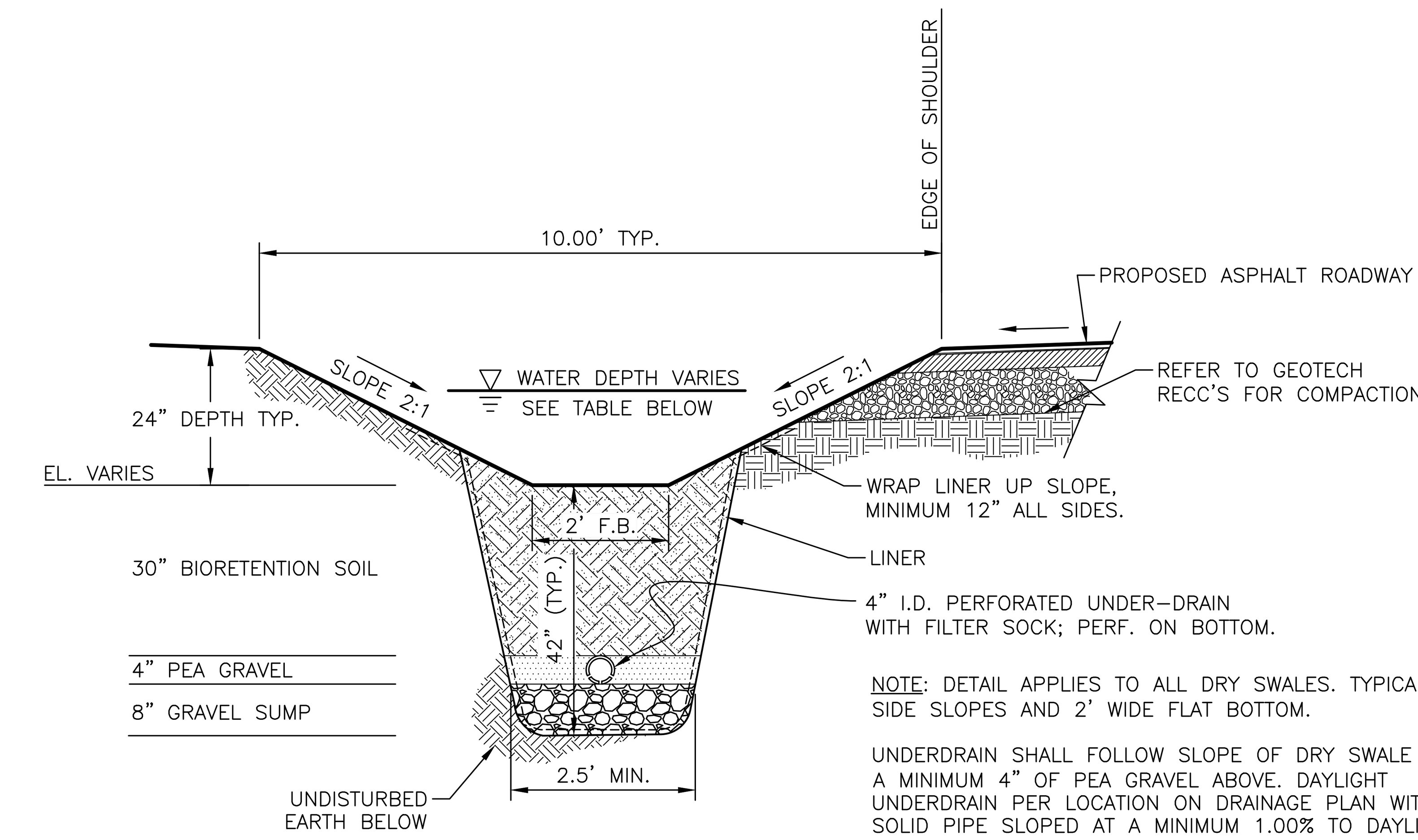
3 / 01C804



TYPICAL DRY SWALE DETAIL

SCALE: 1/4"=1'-0"

4 / 01C804



NOTE: DETAIL APPLIES TO ALL DRY SWALES. TYPICAL 2:1 SIDE SLOPES AND 2' WIDE FLAT BOTTOM.

UNDERDRAIN SHALL FOLLOW SLOPE OF DRY SWALE WITH A MINIMUM 4" OF PEA GRAVEL ABOVE. DAYLIGHT UNDERDRAIN PER LOCATION ON DRAINAGE PLAN WITH SOLID PIPE SLOPED AT A MINIMUM 1.00% TO DAYLIGHT.

WATER DEPTH SCHEDULE				
STORM EVENT	MAX. WATER DEPTH (IN FEET)			
	DRY SWALE – 1 (15R)	DRY SWALE – 2 (29R)	DRY SWALE – 3 (18R)	DRY SWALE – 4 (20R)
WATER QUALITY	0.11	0.13	0.04	0.14
1 YR PEAK	0.26	0.29	0.10	0.31
10 YR PEAK	0.40	0.45	0.16	0.47
100 YR PEAK	0.58	0.64	0.24	0.67

TYPICAL DRY SWALE SECTION (15R)(29R)(18R)(20R)

SCALE: 1/2"=1'-0"

5 / 01C804

PROJECT MANAGER C. JACOBS

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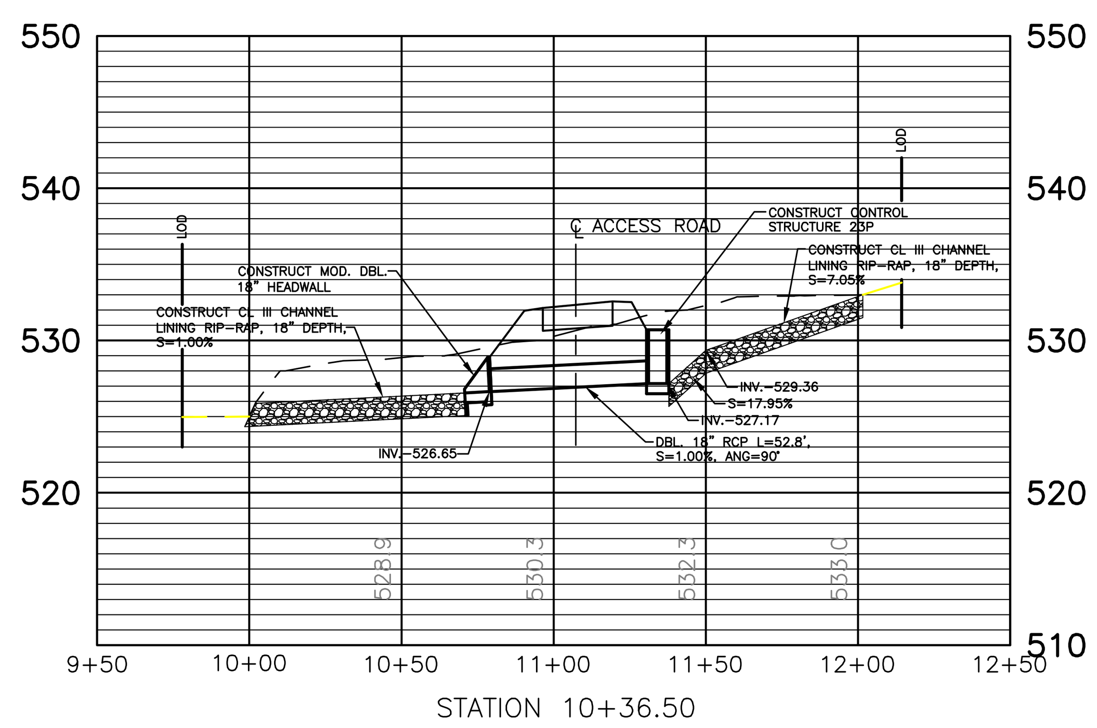
PROVIDENCE COUNTY, RHODE ISLAND

PROPOSED SITE DRAINAGE DETAILS

FILENAME 01C804.dwg
SCALE AS SHOWN

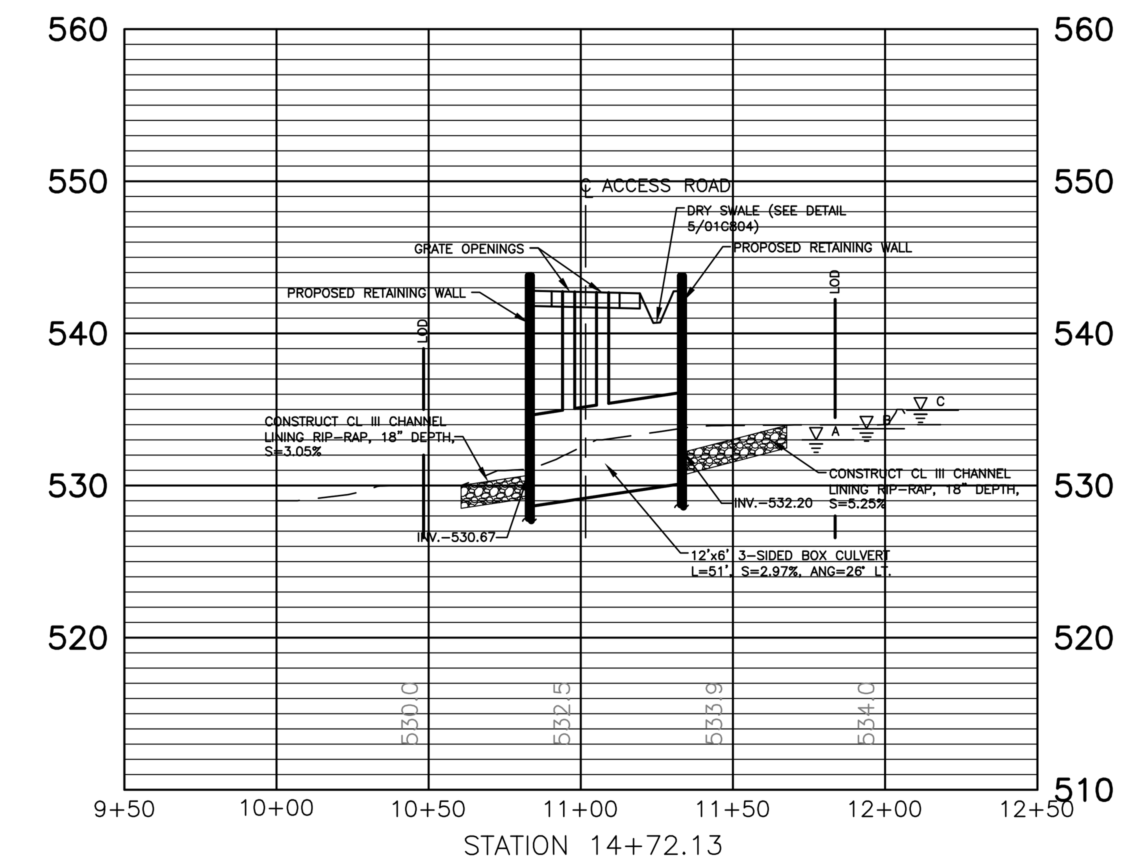
SHEET **01C804**
16 OF 18



CULVERT #1 SECTION (15P)

SCALE: HOR– 1"=50' VER– 1"=5'

1 / 01C805

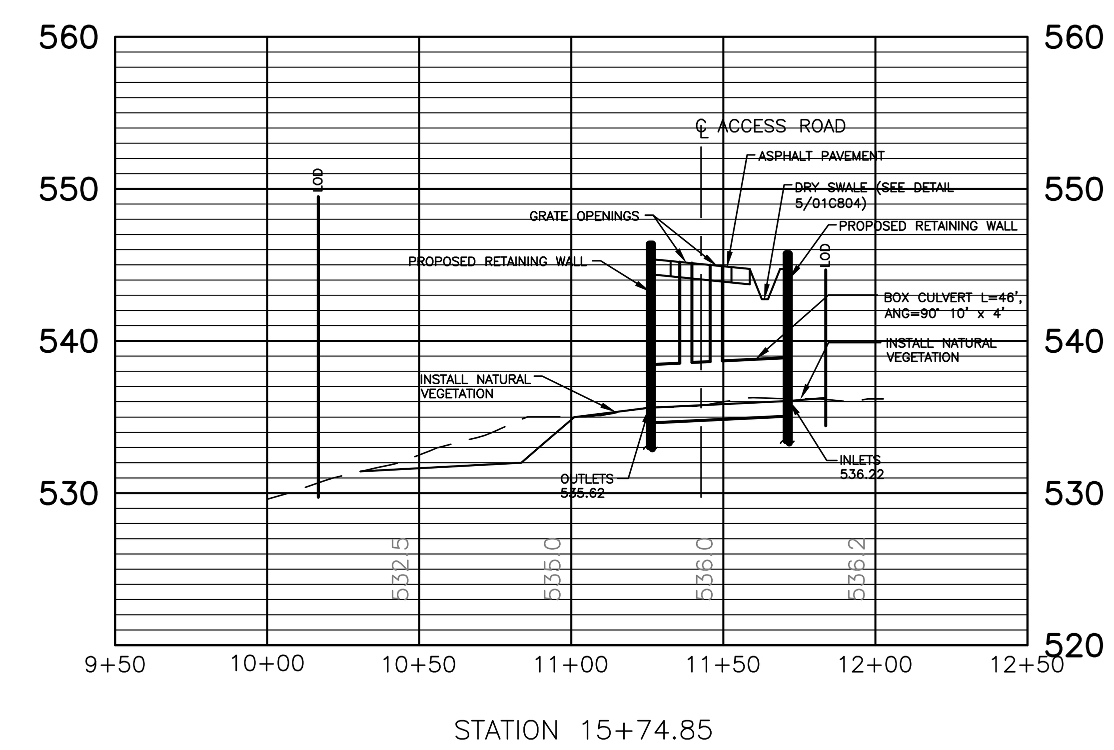


	WATER DEPTH SCHEDULE	
	STORM EVENT	ELEVATION
A	1 YR PEAK	533.00
B	10 YR PEAK	533.76
C	100 YR PEAK	534.93

CULVERT #2 SECTION (17P)

SCALE: HOR– 1"=50' VER– 1"=5'

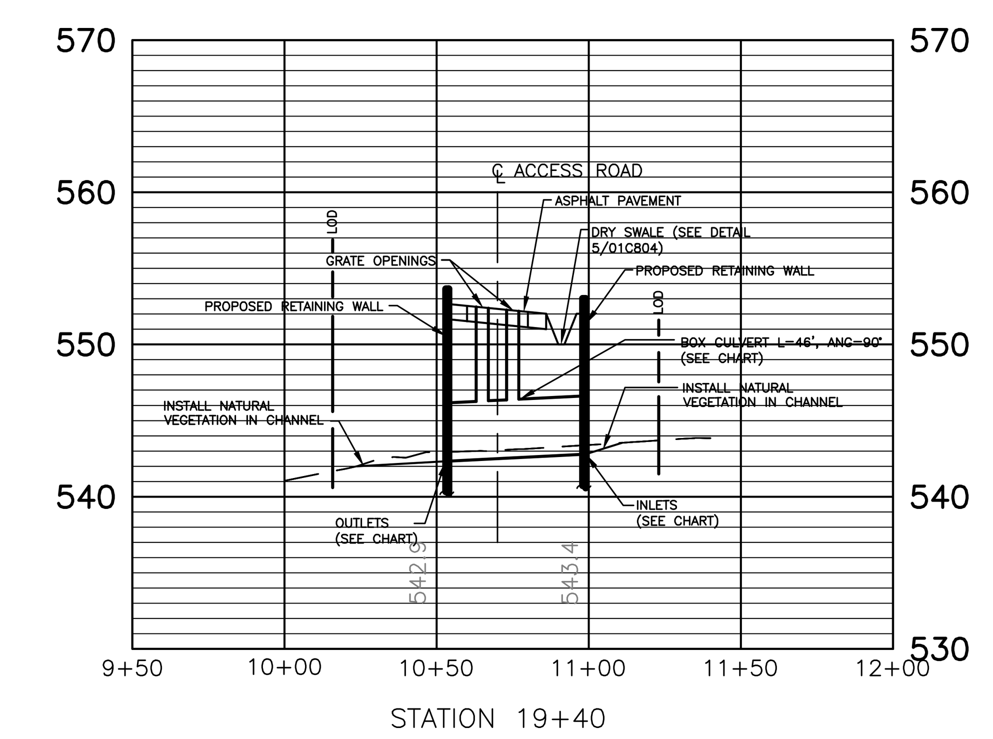
2 / 01C805



TYPICAL WILDLIFE PASSAGE #1

SCALE: HOR– 1"=50' VER– 1"=5'

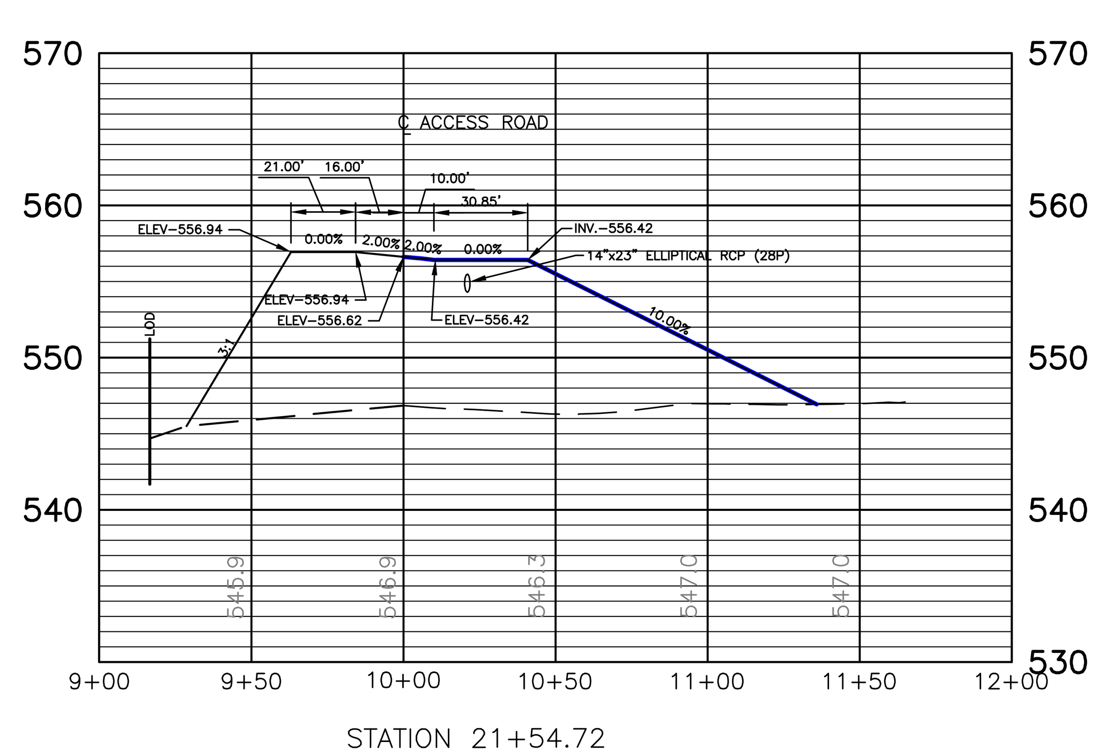
3 / 01C805



TYPICAL WILDLIFE PASSAGE #2

SCALE: HOR– 1"=50' VER– 1"=5'

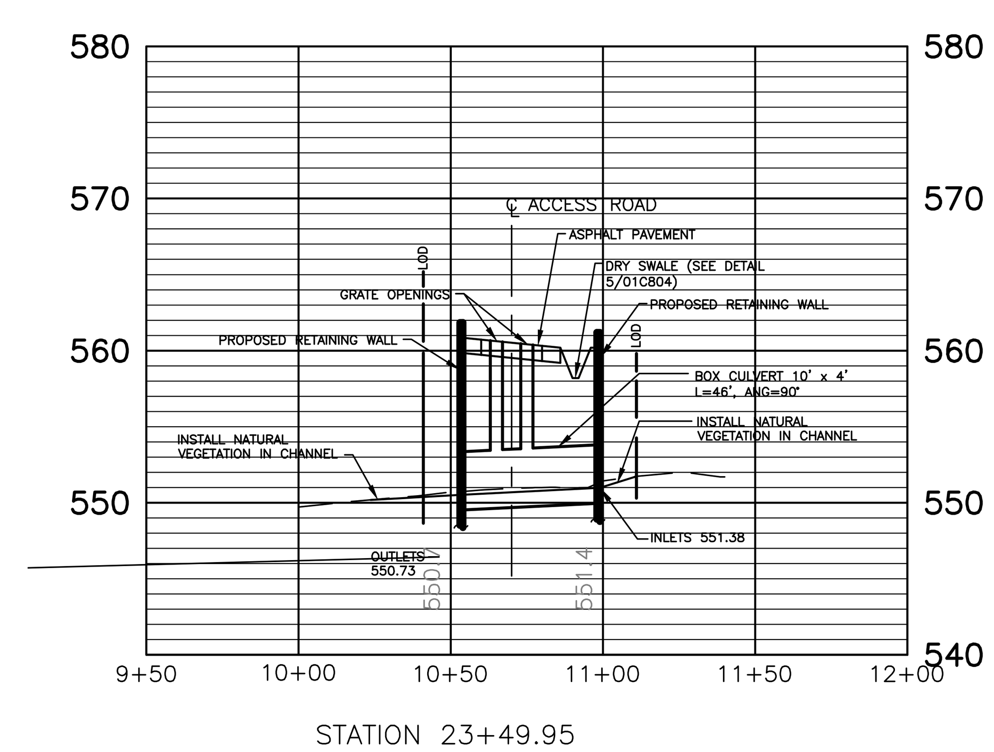
4 / 01C805



RAMP PIPE SECTION (28P)

SCALE: HOR– 1"=50' VER– 1"=5'

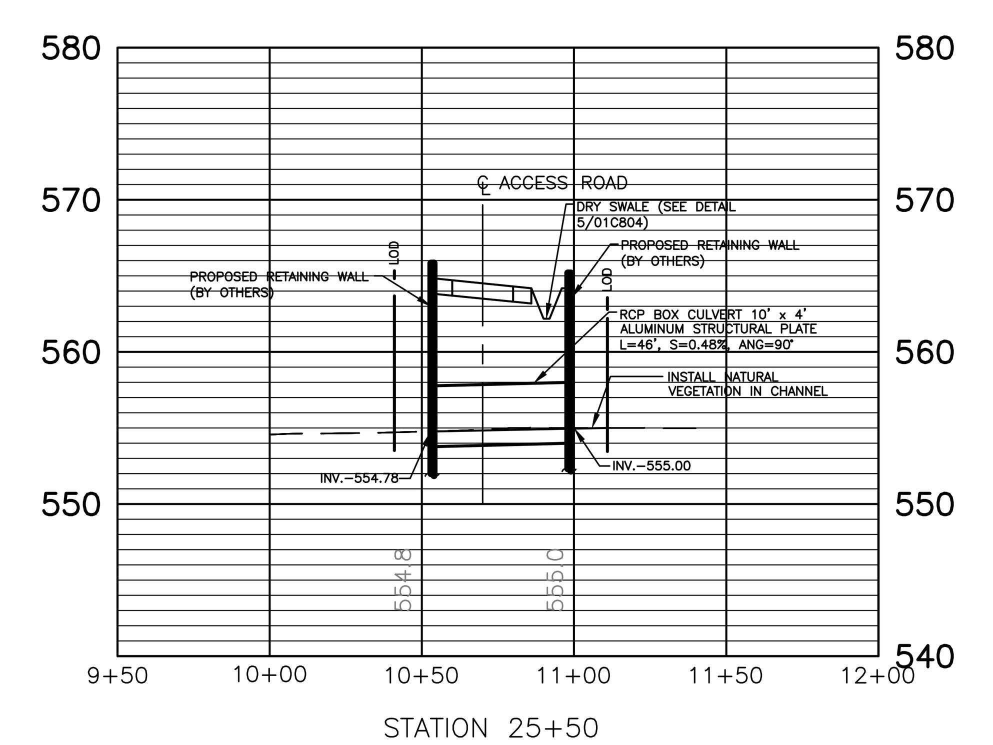
5 / 01C805



TYPICAL WILDLIFE PASSAGE #3

SCALE: HOR– 1"=50' VER– 1"=5'

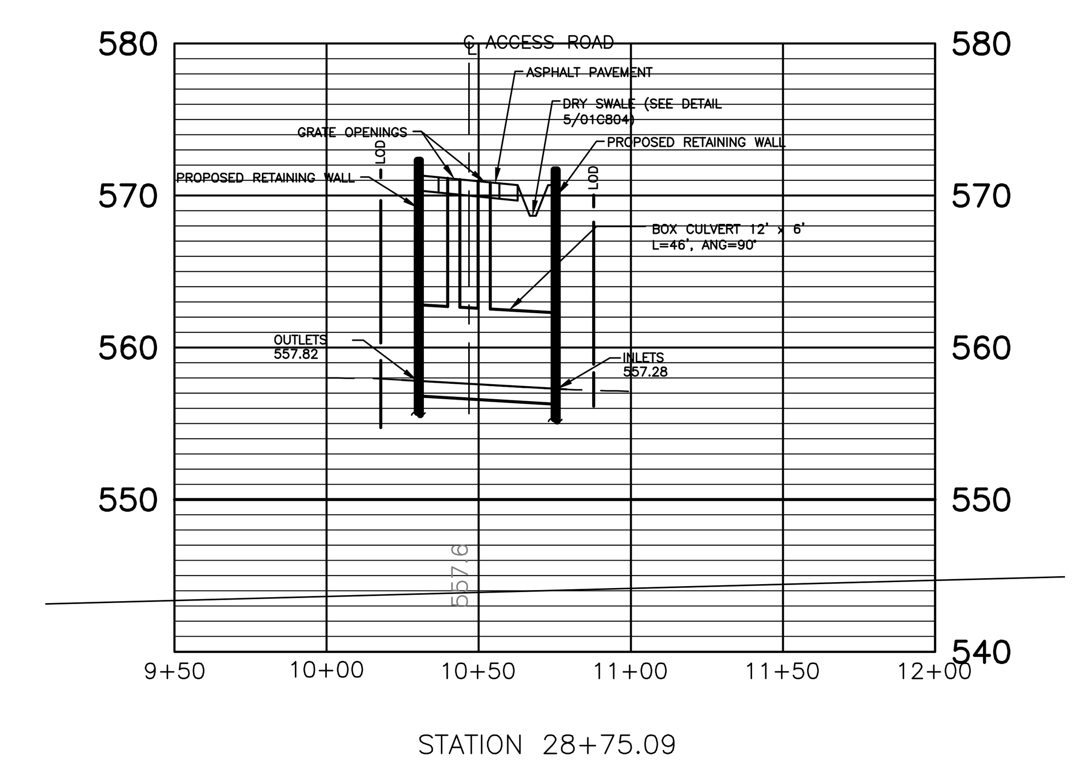
6 / 01C805



TYPICAL WILDLIFE PASSAGE #4

SCALE: HOR– 1"=50' VER– 1"=5'

7 / 01C805



TYPICAL WILDLIFE PASSAGE #5

SCALE: HOR– 1"=50' VER– 1"=5'

8 / 01C805

PROJECT MANAGER C. JACOBS

ISSUE	DATE	DESCRIPTION
5	12/06/2017	REV. TECH. REVIEW 11/10/2017
4	7/19/2017	REVISED PER TECHNICAL REVIEW COMMENTS BY RI DEM OF JUNE 19, 2017
3	3/27/2017	REVISION
2	2/17/2017	REVISION
1	8/17/2016	SOIL EROSION SEDIMENT CONTROL PLAN

PROJECT NUMBER 10021318

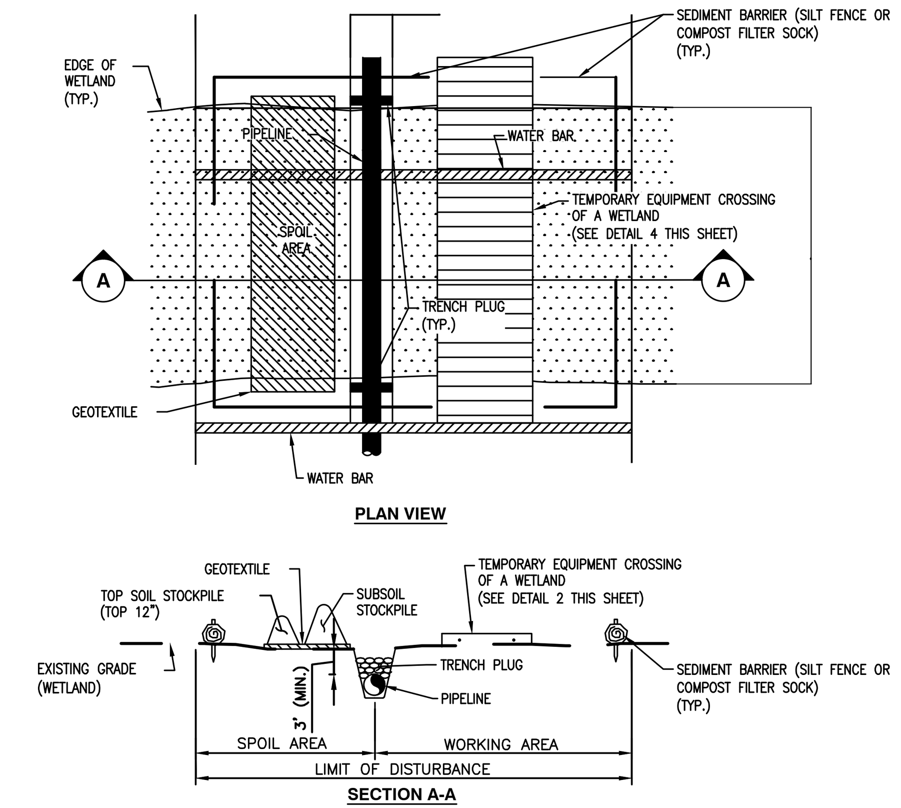
ALEXANDER DEUSON
No. 0011618
REGISTERED PROFESSIONAL ENGINEER CIVIL

CLEAR RIVER ENERGY LLC
CLEAR RIVER ENERGY CENTER
WALLUM LAKE ROAD LOT NO.
135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

PROPOSED SITE DRAINAGE DETAILS

FILENAME 01C805.dwg
SCALE AS SHOWN

SHEET **01C805**



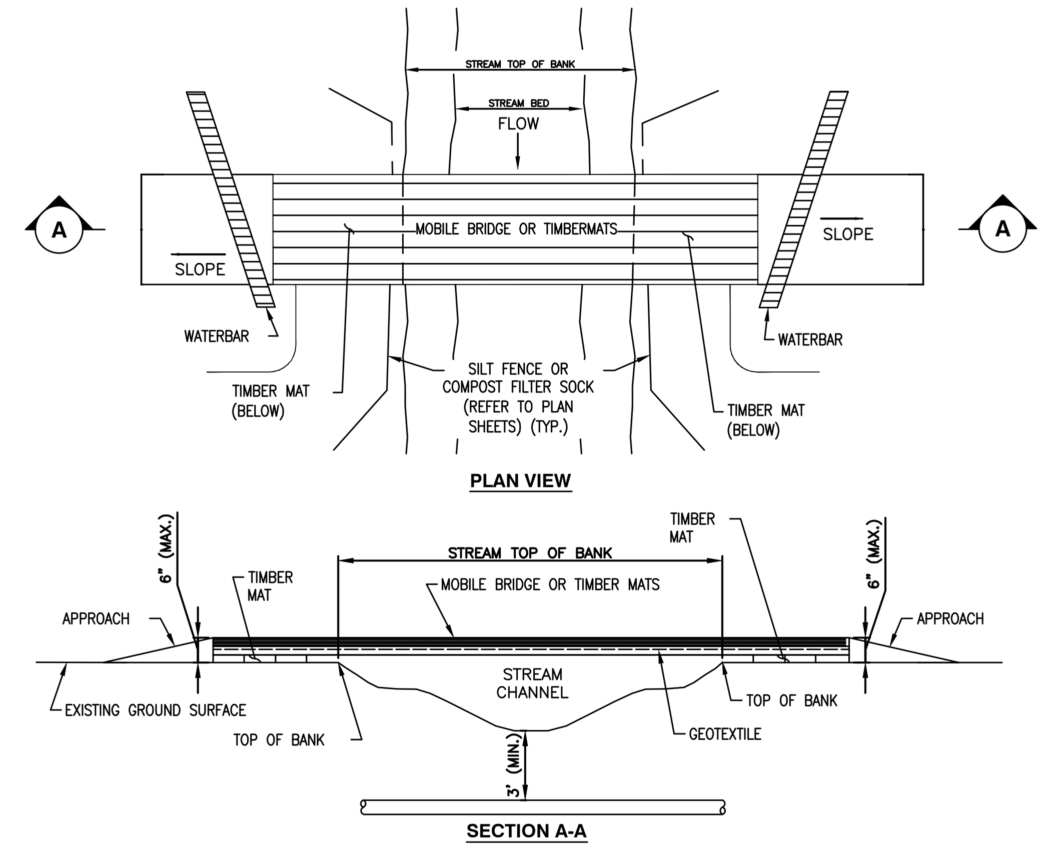
NOTES:

1. INSTALL COMPOST FILTER SOCK ACROSS THE RIGHT-OF-WAY IMMEDIATELY UP-SLOPE OF THE WETLAND BOUNDARY, AT THE EDGE OF THE LIMIT OF DISTURBANCE AND, AS NECESSARY, AROUND SOIL STOCKPILES.
2. PLACE A GEOTEXTILE UNDERLAYMENT IN AREAS WHERE WOOD MATS WILL BE PLACED FOR EQUIPMENT CROSSING, AND IN SPOIL AREAS.
3. INSTALL WOOD MATS AS NEEDED TO MINIMIZE DISTURBANCE/COMPACTION OF THE WETLAND.
4. INSTALL TRENCH PLUGS ON EACH END OF THE TRENCH TO PREVENT THE TRENCH FROM DRAINING WETLAND OR CHANGING HYDROLOGY.
5. WHEN EXCAVATING TRENCH IN WETLAND, EXCAVATE WETLAND TOPSOIL (TOP 12 INCHES) AND STOCKPILE SEPARATELY FROM SUBSOIL. DURING BACKFILLING OF TRENCH, REPLACE TOPSOIL IN TOP OF TRENCH TO RESTORE PRE-CONSTRUCTION SOIL SEQUENCE. STOCKPILE SOIL ONTO GEOTEXTILE IN THE SPOIL AREA NEXT TO THE TRENCH. (UNLESS THERE IS STANDING WATER OR THE SOIL IS TOO SATURATED TO SEGREGATE.)
6. UPON RESTORATION REMOVE GEOTEXTILE, WOOD MATS, AND RESTORE WETLAND TO EXISTING GRADE. WATERBARS WITHIN THE RIGHT-OF-WAY SHALL BE LEFT IN PLACE.

PIPELINE AND EQUIPMENT CROSSING OF WETLAND

NOT TO SCALE

1A
01C806



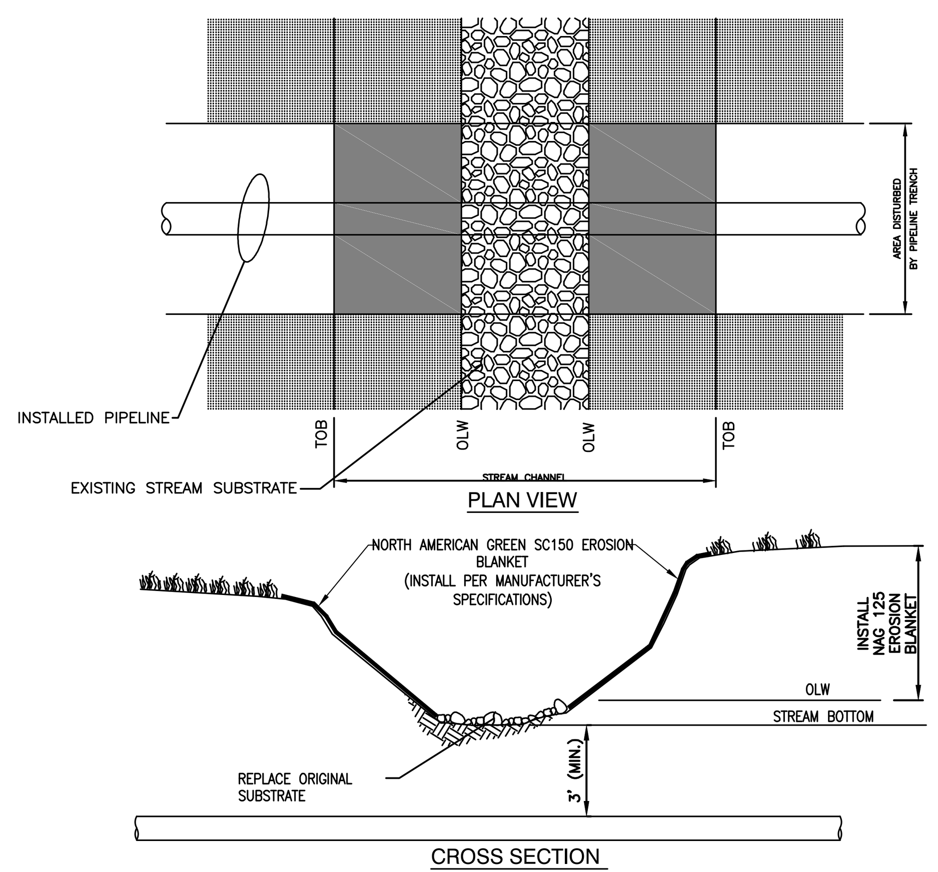
NOTES:

1. INSTALL WATERBARS AT APPROACHES TO STREAM CROSSING, AND COMPOST FILTER SOCK/SILT FENCE ALONG STREAM BANKS. INSTALL COMPOST FILTER SOCK AT OUTLET OF WATERBARS.
2. MAINTAIN SURFACE OF TEMPORARY BRIDGE TO PREVENT SOIL DISCHARGES TO STREAM. APPROACHES TO CROSSINGS ARE NOT TO EXCEED A DEPTH OF 6-INCHES ABOVE ORIGINAL GRADE.
3. GEOTEXTILE SHALL BE ATTACHED TO THE UNDER SIDE OF THE MOBILE BRIDGE.

TEMPORARY EQUIPMENT CROSSING OF A STREAM – MOBILE BRIDGE

NOT TO SCALE

1B
01C806



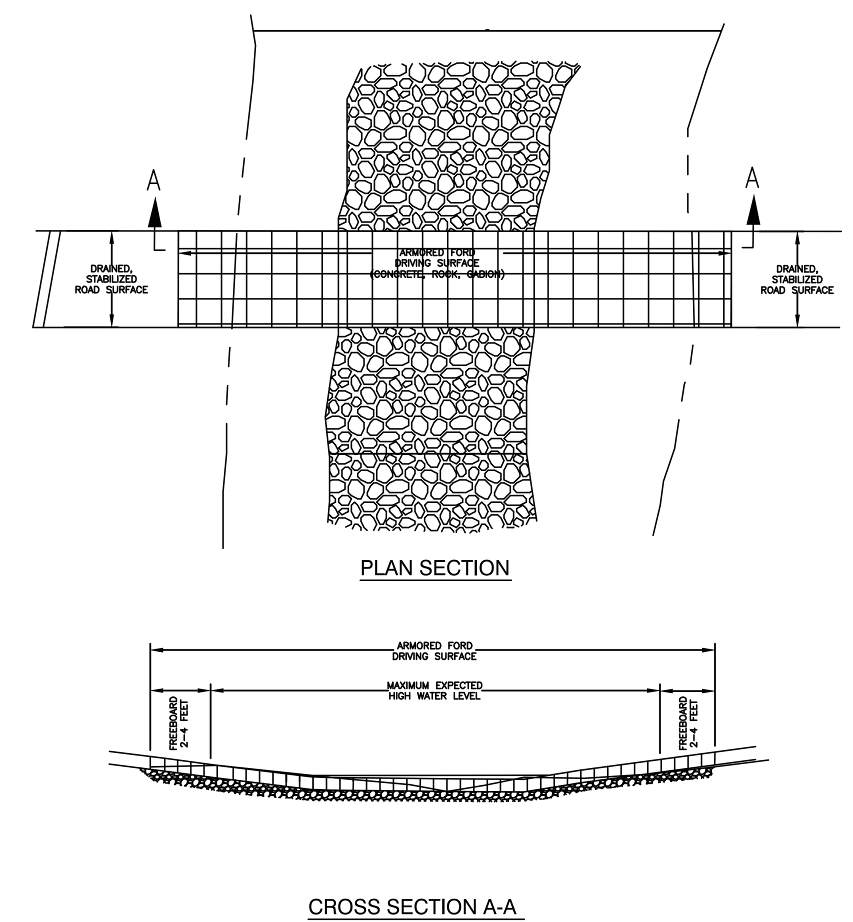
NOTES:

1. PRIOR TO WORKING IN STREAM CHANNEL, INSTALL ALL EROSION AND SEDIMENTATION CONTROL BEST MANAGEMENT PRACTICES SPECIFIED IN EROSION AND SEDIMENTATION PLAN AND DIVERT STREAM FLOW AROUND WORK AREA.
2. WHEN EXCAVATING PIPELINE TRENCH ACROSS STREAM, SEGREGATE AND SEPARATELY STOCKPILE STREAM SUBSTRATE.
3. AFTER INSTALLING PIPELINE IN TRENCH, REPLACE STOCKPILED SUBSTRATE ON SURFACE OF BOTTOM OF STREAM CHANNEL BELOW THE ORDINARY LOW WATER (OLW) LEVEL.
4. INSTALL NORTH AMERICAN GREEN S150 BLANKET ON STREAM BANKS FROM ORDINARY LOW WATER LEVEL TO TOP OF THE BANK, COVERING DISTURBED PORTIONS OF THE STREAM BANK. REFER TO E&S PLANS FOR STAPLE PATTERN.

STREAM CHANNEL RESTORATION

NOT TO SCALE

1C
01C806



NOTES:

1. PRIOR TO WORKING IN STREAM CHANNEL, INSTALL ALL EROSION AND SEDIMENTATION CONTROL BEST MANAGEMENT PRACTICES SPECIFIED IN EROSION AND SEDIMENTATION PLAN AND DIVERT STREAM FLOW AROUND WORK AREA.
2. AT THE END OF EVERY WORK DAY AND BEFORE RAINFALL EVENTS, 12IN SILT SOCK SHALL BE PLACED ACROSS ACCESS ROAD UNTIL THE SITE HAS BEEN SUFFICIENTLY STABILIZED.

STREAM – LOW WATER CROSSING

NOT TO SCALE

1D
01C806

HDR

ISSUE	DATE	DESCRIPTION
5	12/06/2017	REV. TECH. REVIEW 11/10/2017
4	7/19/2017	REVISED PER TECHNICAL REVIEW COMMENTS BY RI DEM OF JUNE 19, 2017
3	3/27/2017	REVISION
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1	8/17/2016	SOIL EROSION SEDIMENT CONTROL PLAN

PROJECT MANAGER C. JACOBS

PROJECT NUMBER 10021318

ALEXANDER DEUSON
No. 0011618
REGISTERED PROFESSIONAL ENGINEER CIVIL

CLEAR RIVER ENERGY LLC
CLEAR RIVER ENERGY CENTER
WALLUM LAKE ROAD LOT NO. 135-002, 137-002, 137-003, 137-021, 153-001, 153-002
TOWN OF BURRILLVILLE, PROVIDENCE COUNTY, RHODE ISLAND

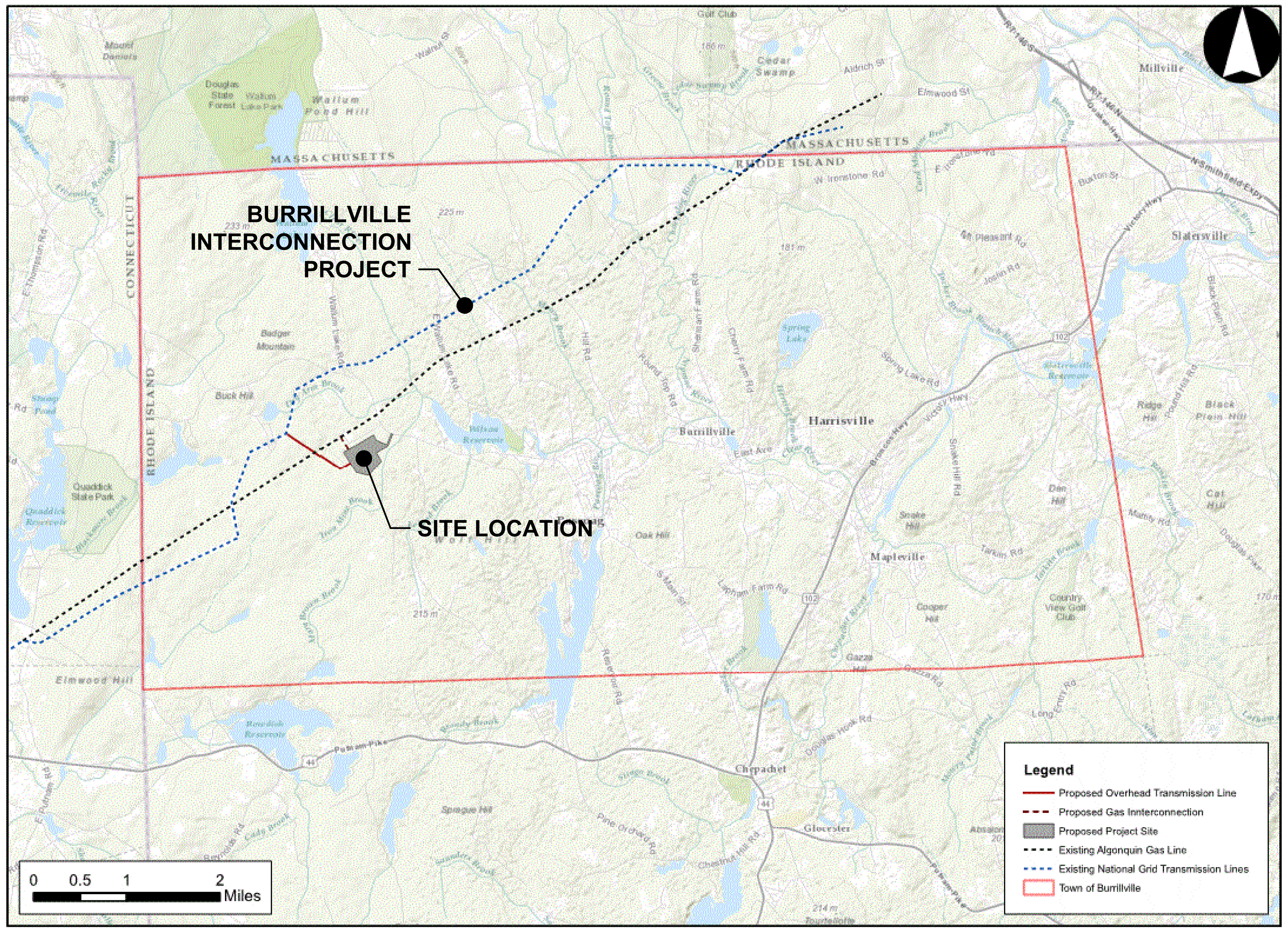
PROPOSED SITE DRAINAGE DETAILS

FILENAME 01C806.dwg

SCALE AS SHOWN

SHEET 01C806

18 OF 18



Drawing Package For

INVENERGY

Clear River Energy Center and Burrillville Interconnection Project

Project No.
10021318

Burrillville, Rhode Island
March, 2017

INDEX OF DRAWINGS

STORMWATER MANAGEMENT & SESC DRAWING PACKAGE

BURRILLVILLE INTERCONNECTION PROJECT RIDEM APPLICATION NO. 17-[illegible] DRAWING PACKAGE

3/30/2017 9:40:18 AM, ECHURCH

The Narragansett Electric Company d/b/a National Grid
Clear River Energy, LLC

Burrillville Interconnection Project
Burrillville, Rhode Island

RIDEM Application No. 15-0239

POWER Engineers, Inc
100 John L. Dietsch Square
North Attleboro, MA 02763

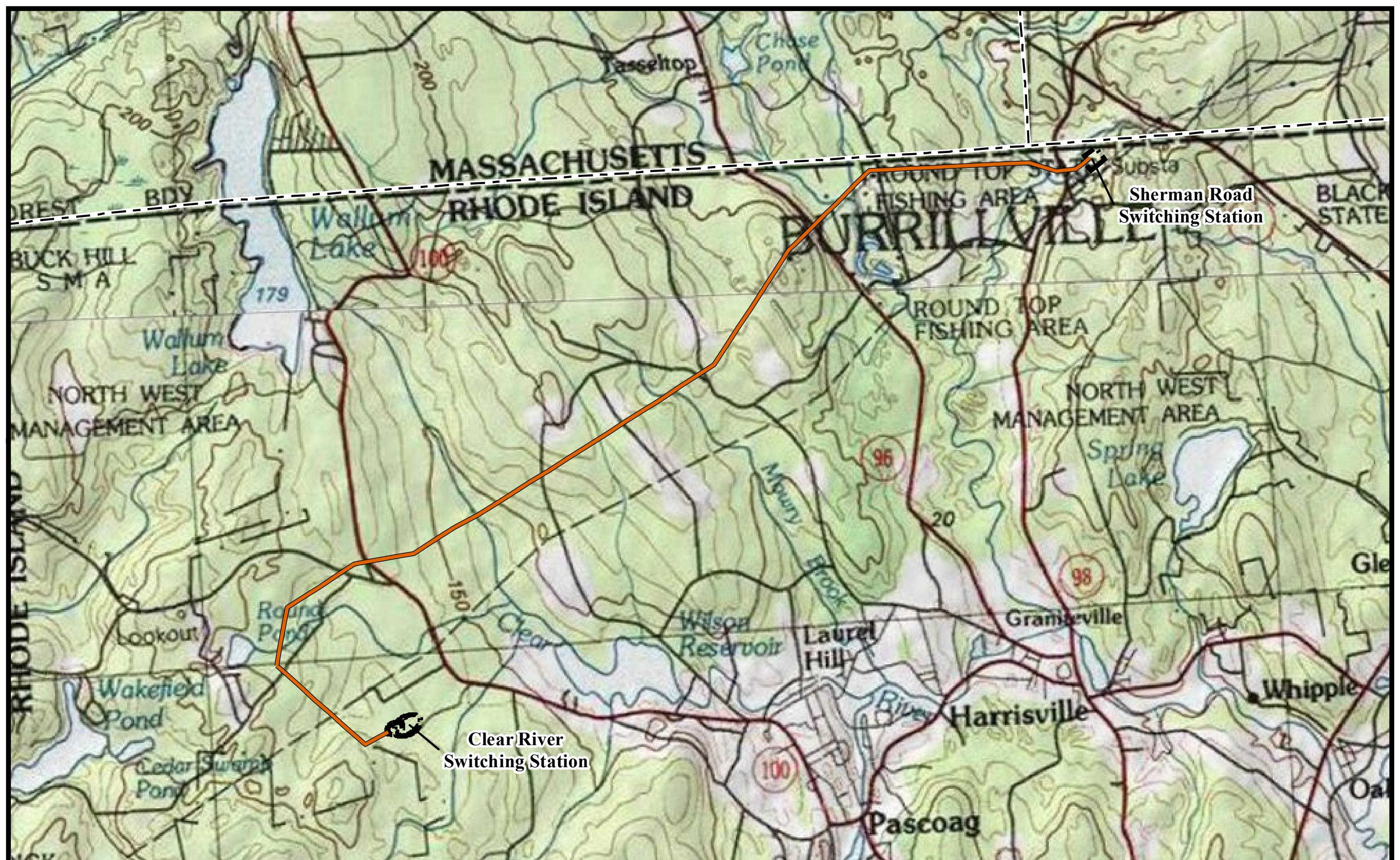
Owner/Applicant:
The Narragansett Electric Company d/b/a National Grid
280 Melrose Street
Providence, RI 02907

Clear River Energy, LLC
One South Wacker Drive, Suite 1800
Chicago, IL 60606

Plans

Issued for Permitting Not for Construction
Date Issued: March 27, 2017
Latest Issue: March 27, 2017

Index



1 " = 1 mile

POWER ENGINEERS

Plan Set
Notes

1. Planimetric Base Mapping - Planimetric base mapping was developed by James W. Sewall Company from April 15, 2007, 1:1200 scale color aerial photography. Scanned aerial photography was utilized to perform aerotriangulation and develop exterior orientation parameters, which were then used in subsequent photogrammetric compilation and orthorectification processes.

2. Contour Data - Contour data was acquired from RIGIS (Rhode Island Geographic Information System), 1:5000 scale two-foot contour line data dated 9/2013. Nominal point spacing (NPS) <= 1m, Vertical RMSE 15cm, Fundamental vertical accuracy 29.4cm @ 95% confidence level (open terrain).

3. Aerial Mapping - Aerial mapping utilized 1:6000 scale color imagery acquired from Google Earth 5/11/2016 and 8/23/2016.

4. Wetland Delineation on TNEC ROW performed by AECOM between May 2007 and November 2007, and updated in 2011 for the Interstate Reliability Project, RIDEM Permit to Alter Freshwater Wetlands, Application No. 12-0117 and RIPDES No. RIR 100950, issued October 9, 2013, revised April 14, 2014. Updates to the wetland delineation and additional field surveys performed by POWER Engineers on 8/2/2016, 8/5/2016, 8/30/2016, 9/1/2016, and 3/9/2017.

5. Wetland Delineation for CREC and CREC ROW performed by ESS Group between fall of 2014 and spring of 2015. RIDEM biologist verified wetland edges via RIDEM Application No. 15-0239 (January 28, 2016).

6. Wetland flags were located in the field with a Trimble GeoXT or Geo XH GPS receivers. Field data was postprocessed, differentially corrected, and back-checked on a series of 1:2000 scale aerial photo base maps.

7. Existing pole structure numbers and right-of-way boundary location is based on the following transmission line sheets (T-sheets) provided by Narragansett Electric Company: H300078-5 Rev 5 issued 6/10/16, T-4499 Rev. 9 issued 6/10/16, T-4498 Rev. 7 issued 6/10/16, T-4497 Rev. 8 issued 6/10/16, T-4496 Rev. 7 issued 6/10/16, T-4495 Rev. 7 issued 6/10/16, T-4604 Rev. 6 issued 6/10/16, T-5603 Rev. 6 issued 6/10/16, T-4602 Rev. 5 issued 6/10/16.

8. Limits of ROW shown are approximate.

9. Rhode Island PE Seal 9008 is applicable only to the proposed transmission structure locations shown.

10. Proposed transmission structure locations are approximate.

NOT FOR CONSTRUCTION

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. D/B/A NATIONAL GRID & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS TITLE SHEET AND NOTES BURRILLVILLE, RHODE ISLAND	
DATE: 3/27/2017	DRAWN: TDH	142704		SHEET 01 OF 63

Erosion and Sediment Control General Notes:

1. Areas outside the limit of work disturbed by the contractor's operations shall be restored by the contractor to their original condition at the contractor's expense, to the satisfaction of the National Grid Environmental Engineer.

2. Contractor shall be solely responsible for site security and job safety. All construction activity shall be in accordance with OSHA regulations and local and state requirements.

3. All materials are to be disposed of per applicable laws and regulations.

4. Dewatering activities shall occur outside of wetlands and watercourses with approved dewatering controls such as filter bags, filter socks, weir tanks or dewatering basins. Where this is not possible, dewatering effluent shall be transported offsite.

5. All work shall conform to and be in compliance with the individual permit issued by the U.S. Army Corp of Engineers for this project.

6. RIDEM file number signage and a copy of the completed RIPDES NOI as submitted to the RIDEM shall be conspicuously posted in agreed upon locations in each municipality prior to commencing work. Signage locations shall be determined in coordination with the National Grid Environmental Scientist.

7. All wetland and waterways shall be flagged prior to commencing work activities at the site.

8. Maintain undisturbed vegetated buffers between work areas and wetlands/waterways wherever possible.

9. Limit removal of, and damage to, existing vegetation wherever possible.

10. Avoid unnecessary disturbance of site soils wherever possible.

11. Upon completion of construction in a given location (structure, work area, etc.), disturbed or exposed soils shall be immediately stabilized with mulch, blankets or similar temporary erosion and sediment control practice adequate for providing temporary stabilization while vegetation becomes established.

12. Where temporary erosion control, or permanent seed mixes are placed, appropriate temporary measures shall be taken to prevent soil erosion while seed is germinating.

13. Mulch shall not be used as a temporary erosion control practice in drainageways. Mulch placement on steep slopes (>3:1) shall be limited to hydraulic mulch or rolled erosion control products (e.g., erosion control blankets, etc.).

14. Seeding shall occur only during specified planting seasons unless otherwise directed by the National Grid Environmental Scientist.

15. Seed mixes shall be approved by the National Grid Environmental Scientist prior to placement. Seed mixes shall be appropriate for the site conditions (e.g. wetland, upland, etc.).

16. Low growing, woody plant species and root systems shall be retained in locations where work pads and access roads are not proposed. Care shall be taken to protect such plants and their root systems from damage and compaction.

17. Perimeter sediment control locations shown on the plans contained herein are approximations, and may change depending on field conditions at the time of construction or as directed by the National Grid Environmental Scientist. Perimeter sediment controls shall not be installed directly in wetlands without prior written approval from the National Grid Environmental Scientist.

18. Where resources areas occur immediately adjacent to and down gradient from the work, sediment perimeter controls (e.g. straw wattles, compost filter socks, excelsior sediment logs, straw bales, reinforced silt fence, etc.) shall be placed between the resource area and the work zone prior to the commencement of work. Perimeter controls shall be installed as close to the area of disturbance as possible. Perimeter control selection should occur in coordination with the National Grid Environmental Scientist.

19. Perimeter sediment controls shall be placed along the down slope edge of unpaved access roads as indicated on the plans wherever wetlands resource areas are closer than 50' to the edge of road and/or adjacent to slopes exceeding a grade of 3:1, or as directed by the National Grid Environmental Scientist.

20. If required, alternatives to silt fence and/or straw/hay bales (e.g., compost socks, wattles, excelsior sediment logs, etc.) are preferred within wetlands adjacent to the edge of the construction pad. Care should be taken to avoid disturbing wetland soils outside of limits of the construction pad and/or area while installing perimeter controls (refer to general note 17).

21. Mud box/drill cutting box locations, dewatering areas, concrete washout areas, and temporary soil stockpile areas shown on the plan indicate only that such devices and practices may be required and do not approximate locations. Final locations for such devices and practices will be determined during construction as field condition require and allow. Dewatering may be required in additional locations depending on field conditions during construction.

22. Where water bars are installed on improved access roads, they should be installed such that runoff is directed to a level spreader, stabilized outlet, or other feature designed to prevent concentrated flows from eroding adjacent locations. Wherever possible, runoff should be directed away from wetlands, waterways, and waterbodies.

23. Install inlet protection if catch basins present.

24. When swamp mats are used in locations where excavations/mud boxes are required for structure installation, the swamp mat surface shall be adequately protected to prevent siltation through the swamp mats to wetlands below.

25. Where necessary, or as directed by the National Grid Environmental Scientist, stone transition ramps shall be installed in association with swamp mats.

26. All erosion and sediment controls, devices, and practices shall be properly maintained, replaced, supplemented, or modified as necessary throughout the life of the project in order to minimize soil erosion and to prevent sediment from being deposited in any wetlands.

27. The Contractor shall prepare and follow an approved Snow Management Plan and a Wet Soil Management Plan.

28. Soil stockpiles shall be contained within approved construction work pads or designated stockpiling areas.

29. Where possible, soil stockpiles shall not exceed 5 feet high in height. Soil stockpiles shall be covered with matting, tarp, or other similar material and weights at the end of each construction day if necessary. Install perimeter controls around all stockpiles in close proximity to wetlands and buffers.

30. No vehicle or equipment refueling shall occur within 100 feet of a wetland, waterbody, or waterway.

31. Stone, soil, or other fill materials shall not be placed in any wetlands, waterbodies, or waterways.

32. Where work will occur in wetlands, or where waterway crossing are proposed, swamp mats, or swamp mat bridges shall be installed respectively prior to commencing construction.

33. Upon permanent stabilization of all disturbed soils, temporary erosion and/or sediment controls and swamp mats shall be removed from, and disposed of properly, off-site.

34. Unless otherwise directed, all erosion and sediment controls shall be installed in accordance with, and work shall conform to National Grid's Environmental Guidance-303.

35. Any potentially impacted soils or water encountered during construction activities shall be managed in accordance with applicable local, state and federal regulations.

Erosion and Sediment Control Maintenance During Construction:

1. All Erosion and sediment control measures shall be inspected for stability and proper function after every runoff producing storm event, or at least weekly. All necessary repairs shall be made immediately.

2. Trapped sediment shall be removed from behind perimeter control devices before the deposits reach 50 percent (1/2) of the above-ground height of the device, unless otherwise noted, or according to manufacturer's specifications.

3. Sediment shall be removed from sediment traps or sedimentation ponds when design capacity has been reduced by 50 percent (50%).

4. In disturbed areas where adequate seed stock is not present, or where topsoil has been displaced, soils shall be prepared in a manner suitable for supporting plant growth prior to placing seed, mulch, and or other erosion control practices appropriate for the site.

PAMELA S. KELLEY
STATE OF RHODE ISLAND
HOPE
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)

3/31/17

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_2_Erosion_Controls_Page.mxd

Invenergy

nationalgrid

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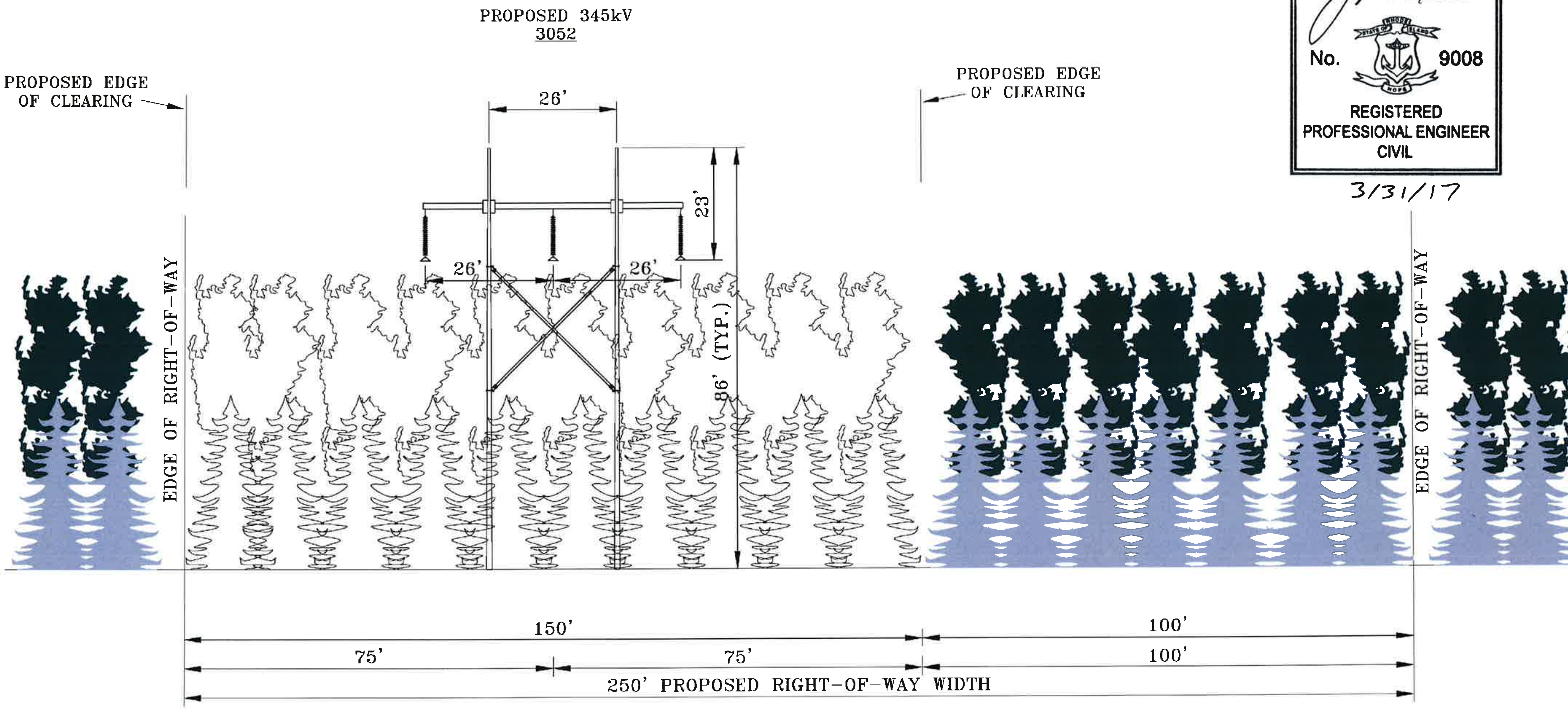
NOT FOR CONSTRUCTION

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS EROSION AND SEDIMENT CONTROL GENERAL NOTES BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-1	SHEET 02 OF 63

JOSEPH M. DROUIN
No. 9008
REGISTERED
PROFESSIONAL ENGINEER
CIVIL
3/31/17



View Facing Southeast Toward CREC

Segment 1 CREC ROW
Approximately 0.8 Mile

Notes:
-Proposed structure types and heights shown are typical. Final structure will vary.
-Existing ROW limits and proposed limits of clearing shown are approximate.

NOT FOR CONSTRUCTION

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_3_Greenfield_Cross_Section.mxd

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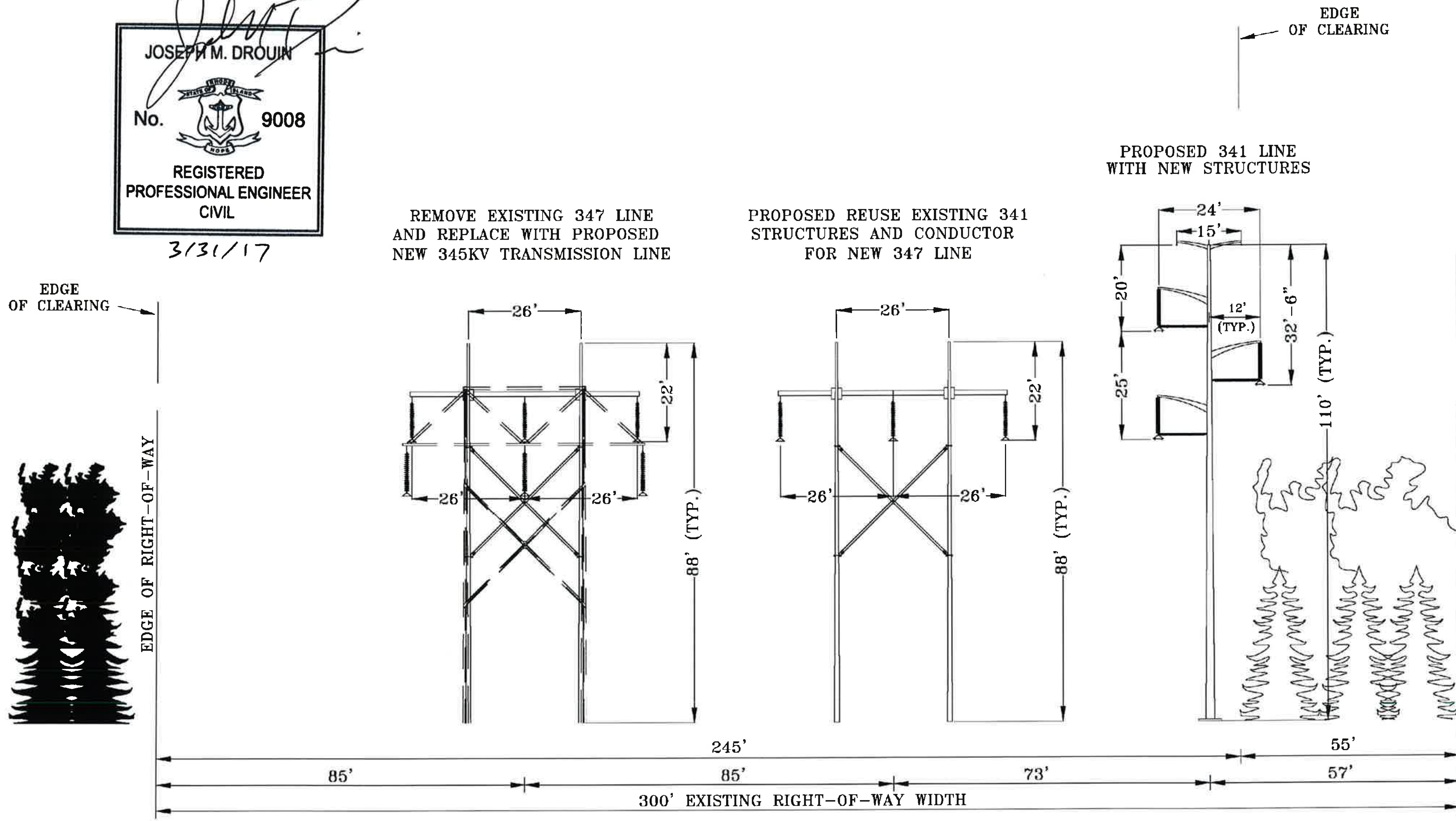
nationalgrid
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS TYPICAL RIGHT OF WAY CROSS SECTION BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-2	SHEET 03 OF 63

JOSEPH M. DROUIN
No. 9008
REGISTERED
PROFESSIONAL ENGINEER
CIVIL

3/31/17



View Facing Southwest

Segment 2 TNEC ROW to 0.19 Mile
West of the Clear River
Approximately 1.6 Miles

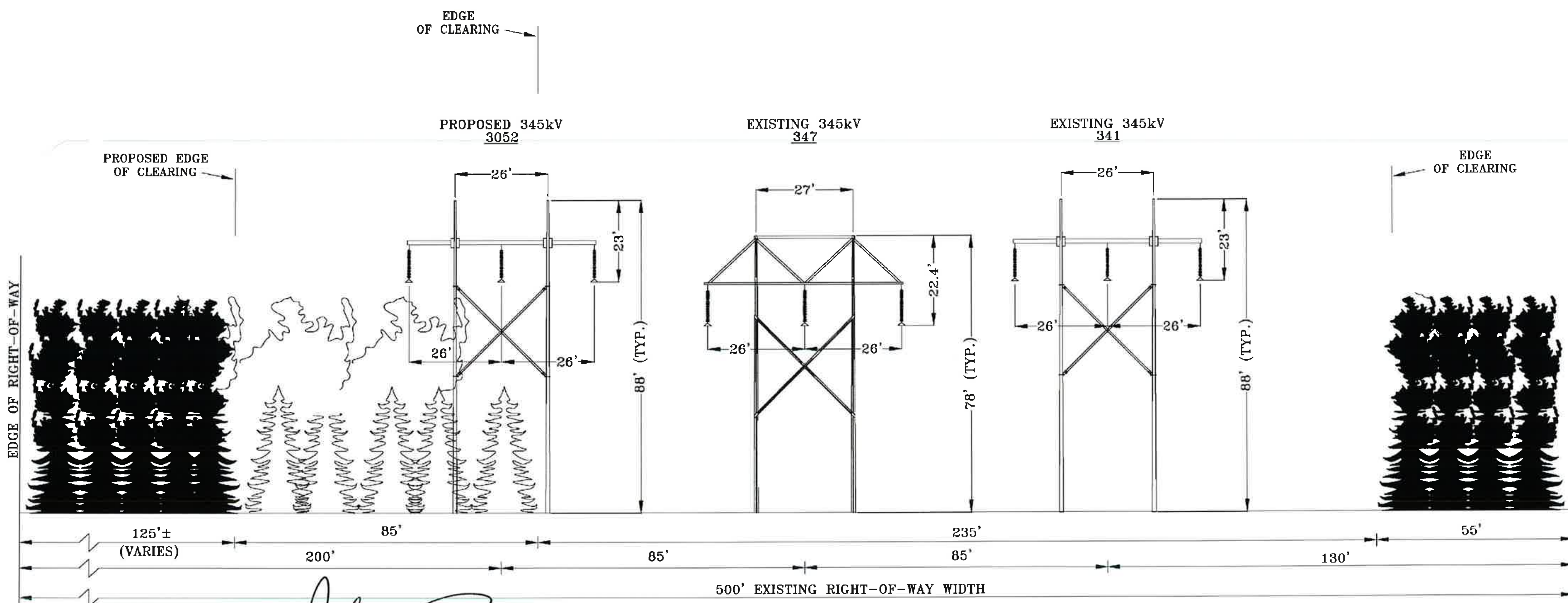
Notes:
-Proposed structure types and heights shown are typical. Final structure will vary.
-Existing ROW limits and proposed limits of clearing shown are approximate.

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_4_Replace_Existing_Line.mxd

NOT FOR CONSTRUCTION

Invenergy
nationalgrid
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS TYPICAL RIGHT OF WAY CROSS SECTION BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-2	SHEET 04 OF 63



JOSEPH M. DROUIN
No. 9008
REGISTERED
PROFESSIONAL ENGINEER
CIVIL

3/31/17

View Facing Southwest

Segment 3 0.19 Mile West of the Clear River to
Sherman Road Switching Station
Approximately 4.4 Miles

Notes:
-Proposed structure types and heights shown are typical. Final structure will vary.
-Existing ROW limits and proposed limits of clearing shown are approximate.

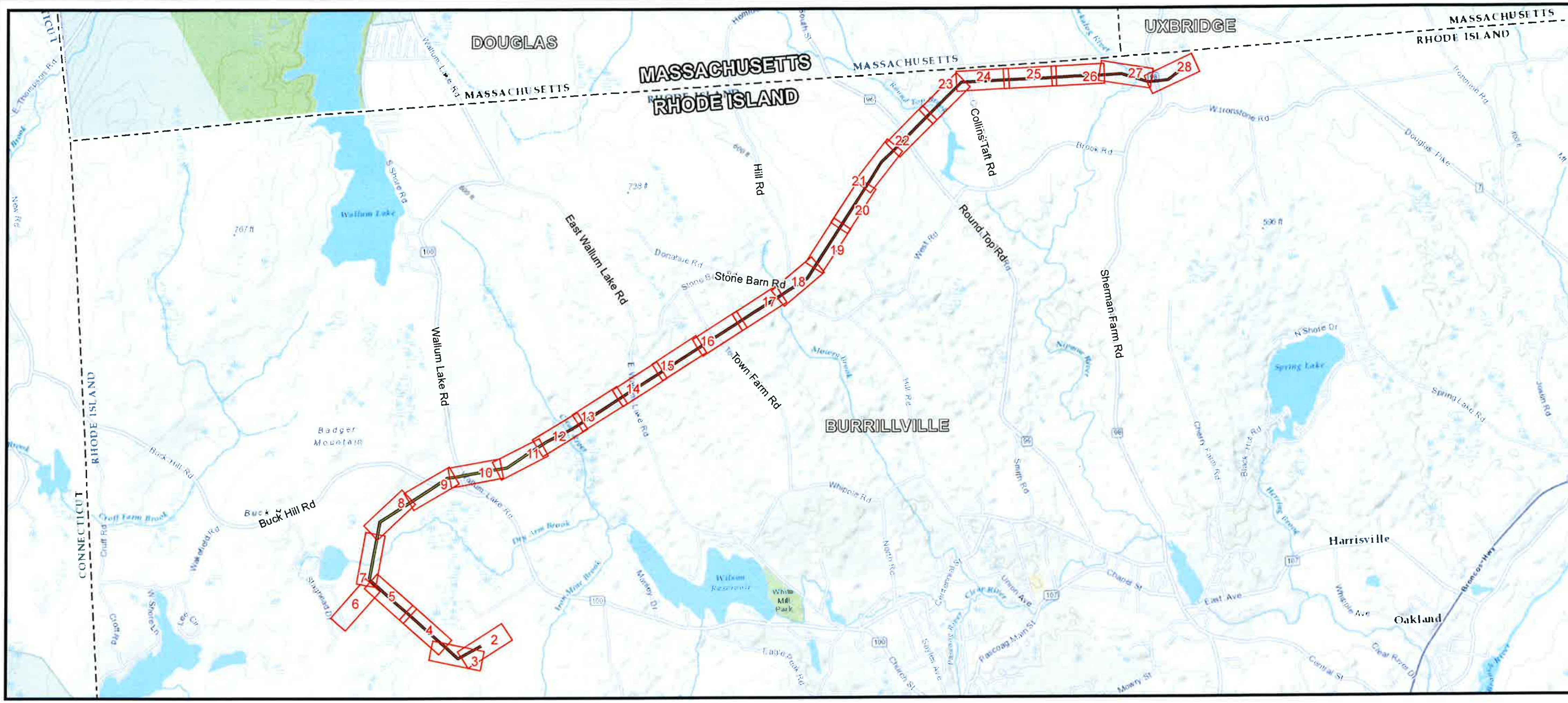
NOT FOR CONSTRUCTION

Invenergy

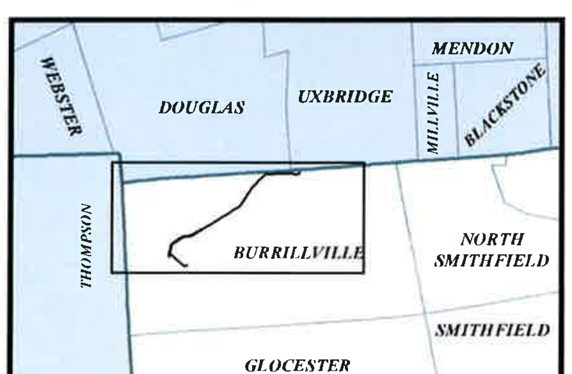
nationalgrid

POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS TYPICAL RIGHT OF WAY CROSS SECTION BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-2	SHEET 05 OF 63



Map Location



Legend

- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Town Boundary

Invenergy

POWER ENGINEERS

nationalgrid

1 " = 3,000 '

0 1,000 2,000 3,000 4,000 5,000 6,000 Feet

NOT FOR CONSTRUCTION

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS KEY SHEET BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 06 OF 63

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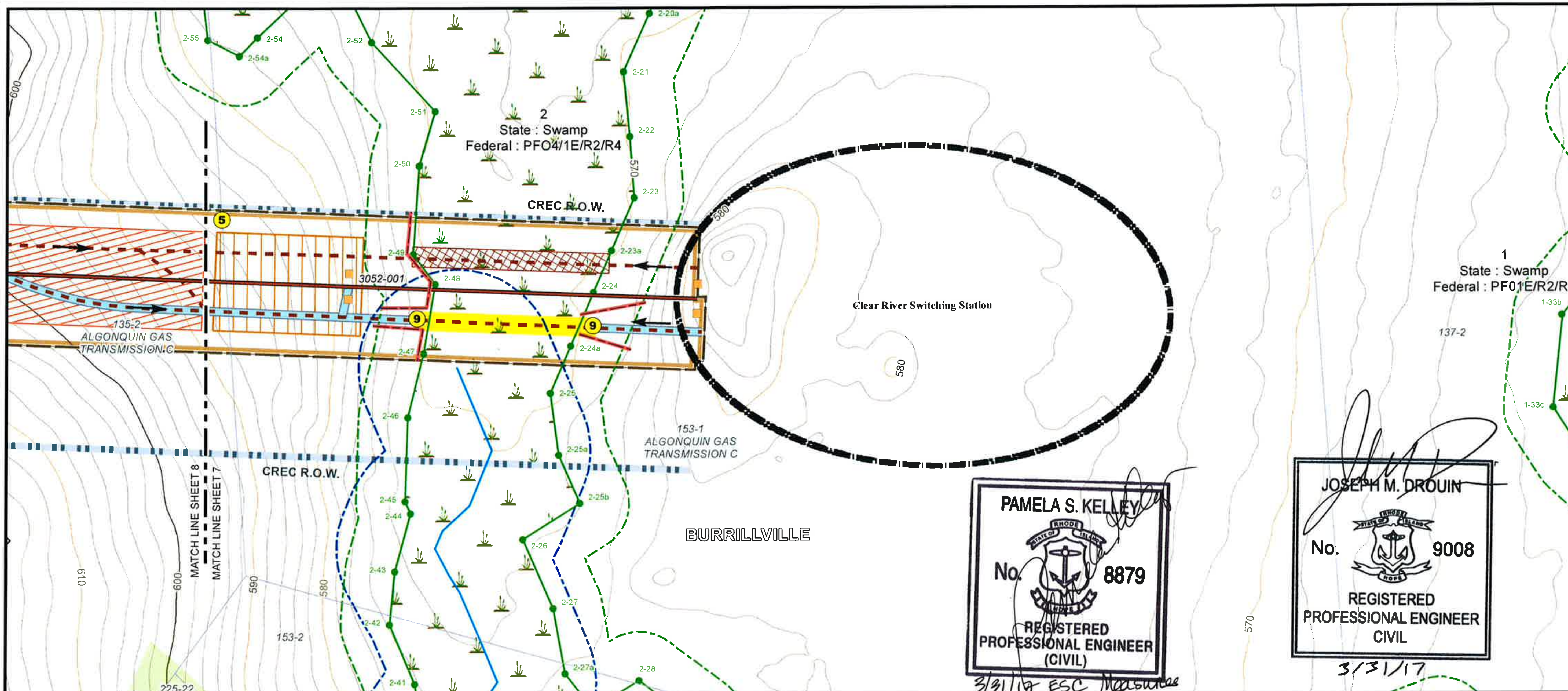
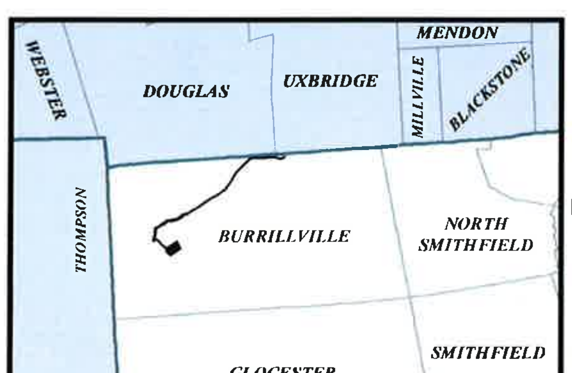


Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

1. Stabilized construction ingress/egress
2. Mud box / drill cutting box (see Erosion & Sediment Control General Notes)
3. Laydown or landing area
4. Stockpiling / staging area (see Erosion & Sediment Control General Notes)
5. Dewatering area (see Erosion & Sediment Control General Notes)
6. Concrete washout basin / testing area (see Erosion & Sediment Control General Notes)
7. If access road grading required on steep terrain (exceeding 3:1 slope), water bars should be installed during road bed preparation
8. Stream and ASSF crossings will be accomplished using one of the stream crossing techniques shown on the swamp mat details (mat bridge detail). Access road crossings and construction work pads will be elevated in such a manner to span the stream or ASSF and not obstruct the flow of water.
9. Perimeter soil erosion & sediment controls (see Erosion & Sediment Control General Notes)

Notes:
- Limits of ROW shown are approximate.
- Rhode Island PE Seal 9008 is applicable only to the proposed transmission structure locations shown.
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NOT FOR CONSTRUCTION

Invenergy

POWER ENGINEERS

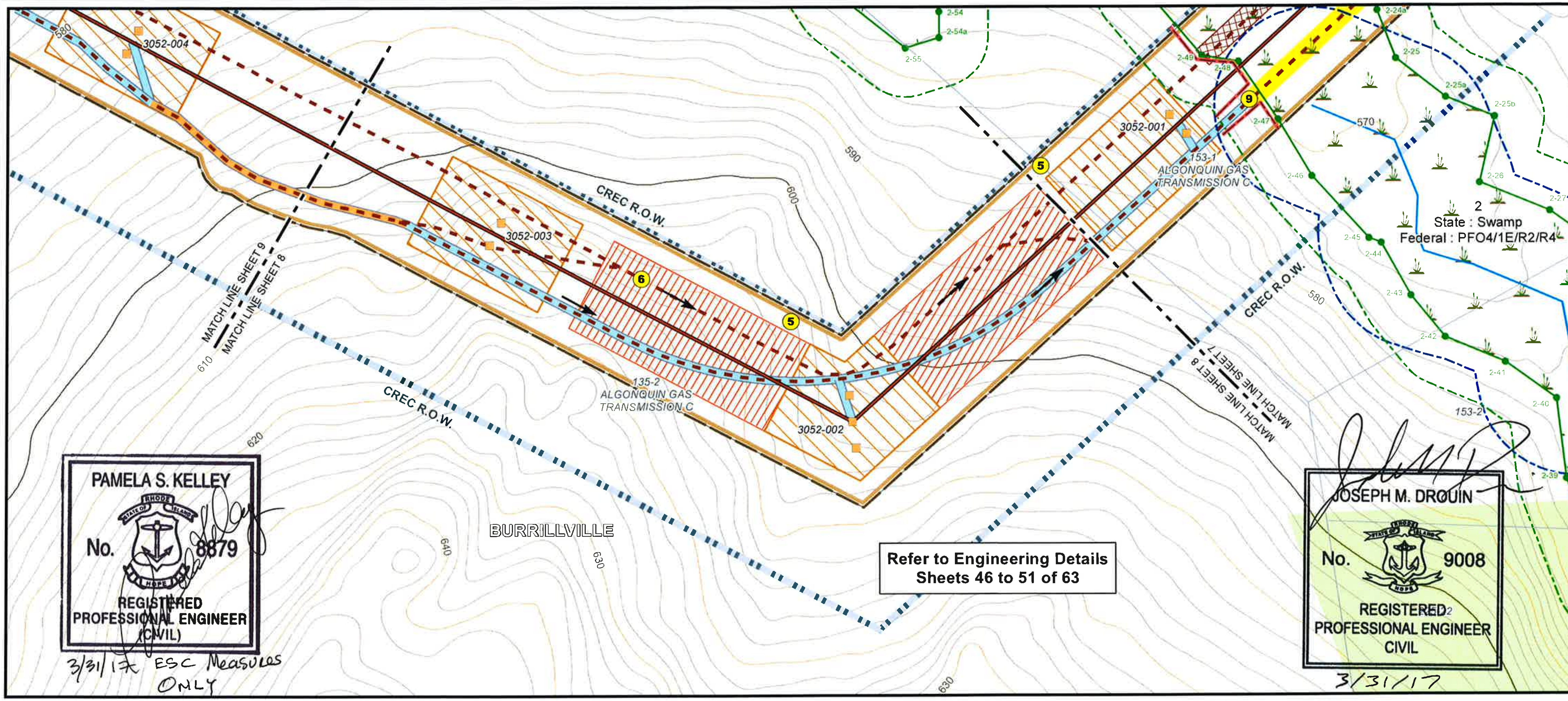
nationalgrid

1 " = 100 '

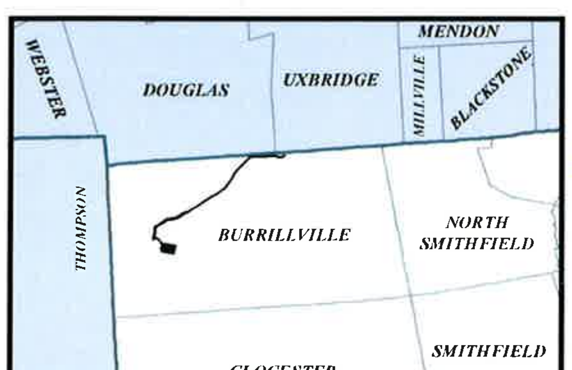
0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 07 OF 63

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_7_Map_Book.mxd



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr) Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

1. Stabilized construction ingress/egress
2. Mud box / drill cutting box (see Erosion & Sediment Control General Notes)
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9. Perimeter soil erosion & sediment controls (see Erosion & Sediment Control General Notes)

Notes:
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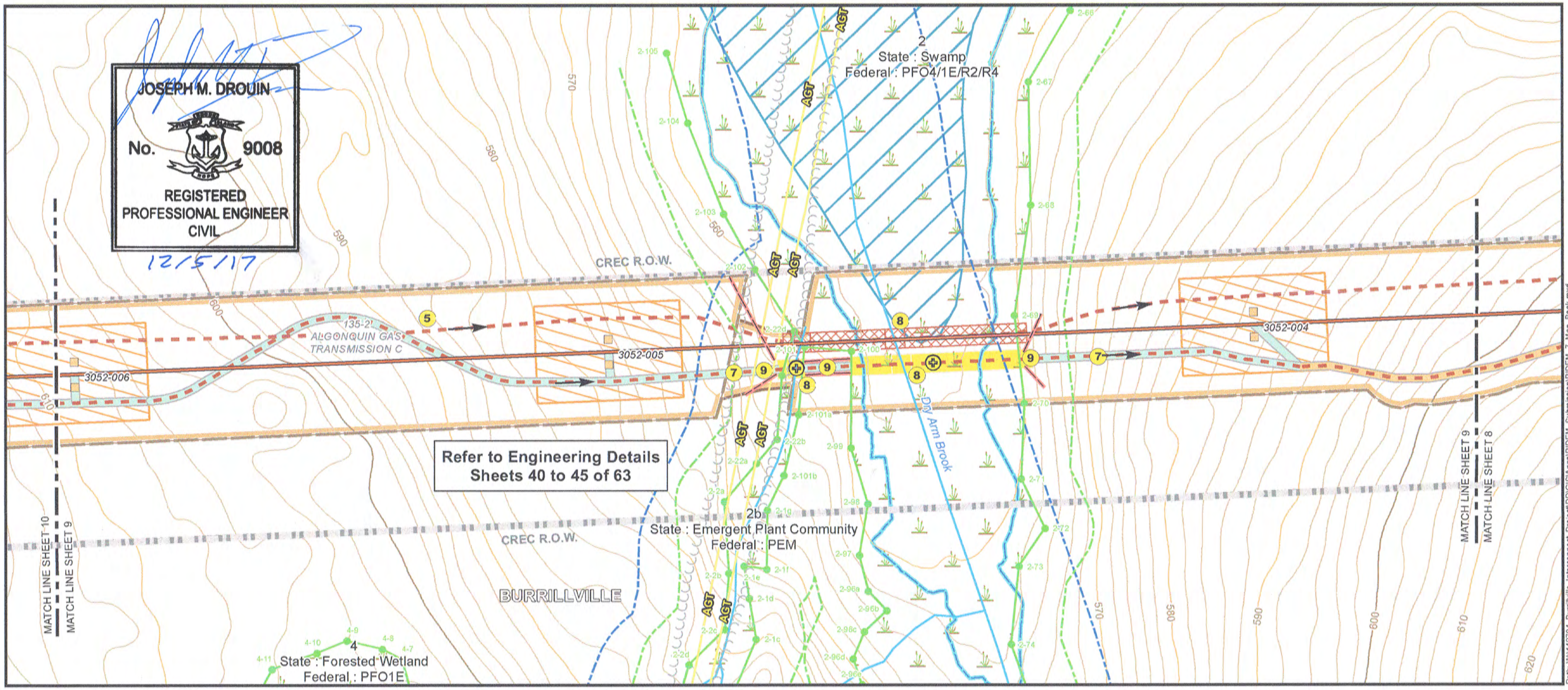
nationalgrid

N W E S

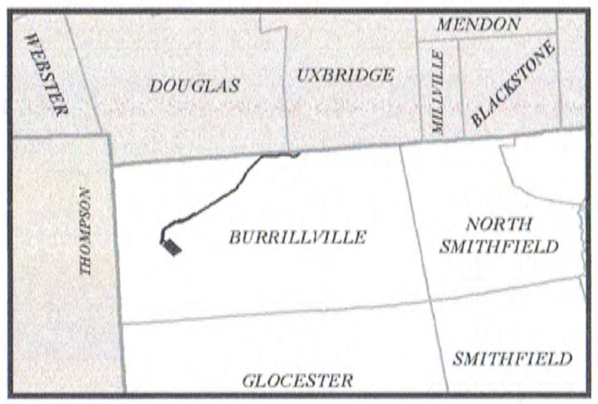
1 " = 100 '

0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 08 OF 63



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded Area
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access Road
- Improve Existing Road
- Construct New Access Road
- Tree Clearing Access Route
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad / Area
- Limit of Disturbance

1. Stabilized construction ingress/egress
2. Mud box / drill cutting box (see Erosion & Sediment Control General Notes)
3. Laydown or landing area
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9. Perimeter soil erosion & sediment controls (see Erosion & Sediment Control General Notes)

Notes:
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- Rhode Island PE Seal 9008 is applicable only to the proposed transmission structure locations shown.
- Proposed transmission structure locations are approximate.

NOT FOR CONSTRUCTION

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POWER ENGINEERS

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1 " = 100 '

0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT
THE NARRAGANSETT ELECTRIC CO.
& CLEAR RIVER ENERGY, LLC

RIDEM AND USACE PERMIT DRAWINGS
BURRILLVILLE, RHODE ISLAND

DATE: 12/5/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 09 OF 63

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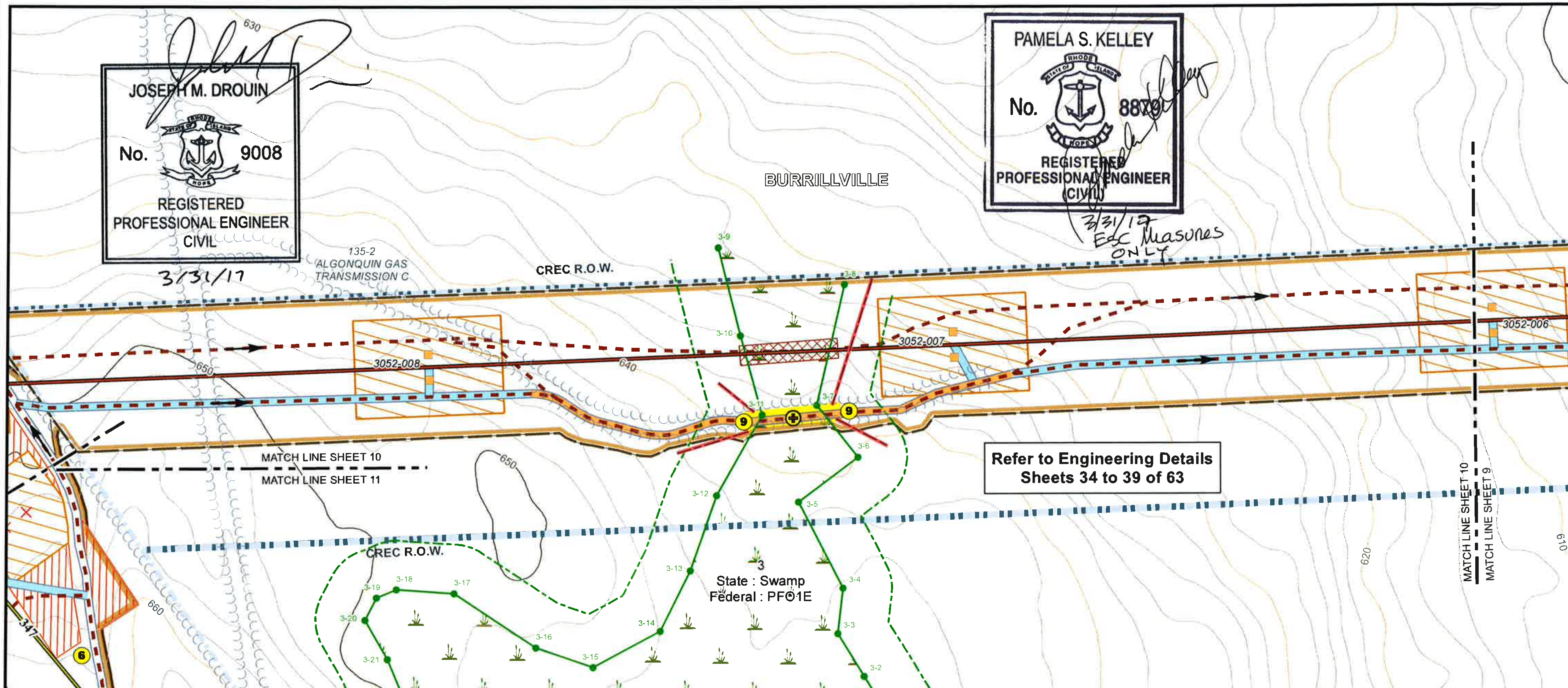
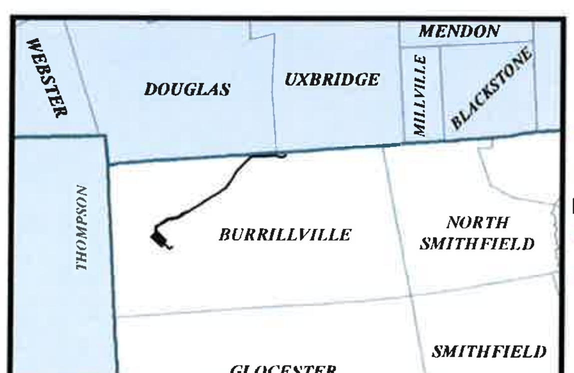


Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

1. Stabilized construction ingress/egress
2. Mud box / drill cutting box (see Erosion & Sediment Control General Notes)
3. Laydown or landing area
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6. Concrete washout basin / testing area (see Erosion & Sediment Control General Notes)
7. If access road grading required on steep terrain (exceeding 3:1 slope), water bars should be installed during road bed preparation
8. Stream and ASSF crossings will be accomplished using one of the stream crossing techniques shown on the swamp mat details (mat bridge detail). Access road crossings and construction work pads will be located in such a manner to span the stream or ASSF and not obstruct the flow of water.
9. Perimeter soil erosion & sediment controls (see Erosion & Sediment Control General Notes)

Notes:
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NOT FOR CONSTRUCTION

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POWER ENGINEERS

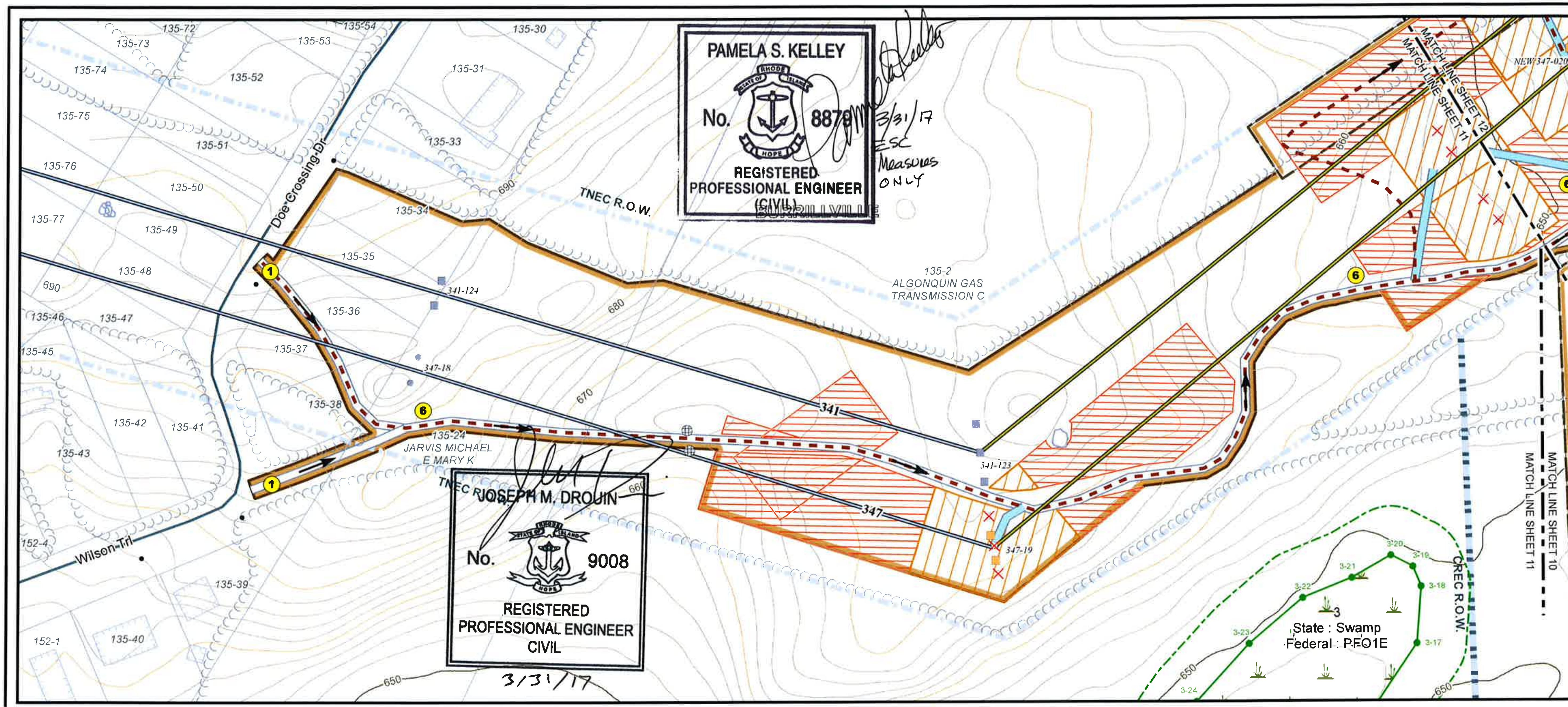
N E S W

1 " = 100 '

0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 10 OF 63

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_7_Map_Book.mxd



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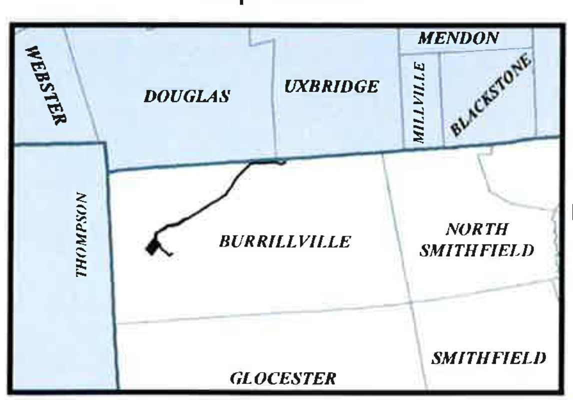

Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

1. Stabilized construction ingress/egress
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Invenergy

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nationalgrid

1 " = 100 '

0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 11 OF 63

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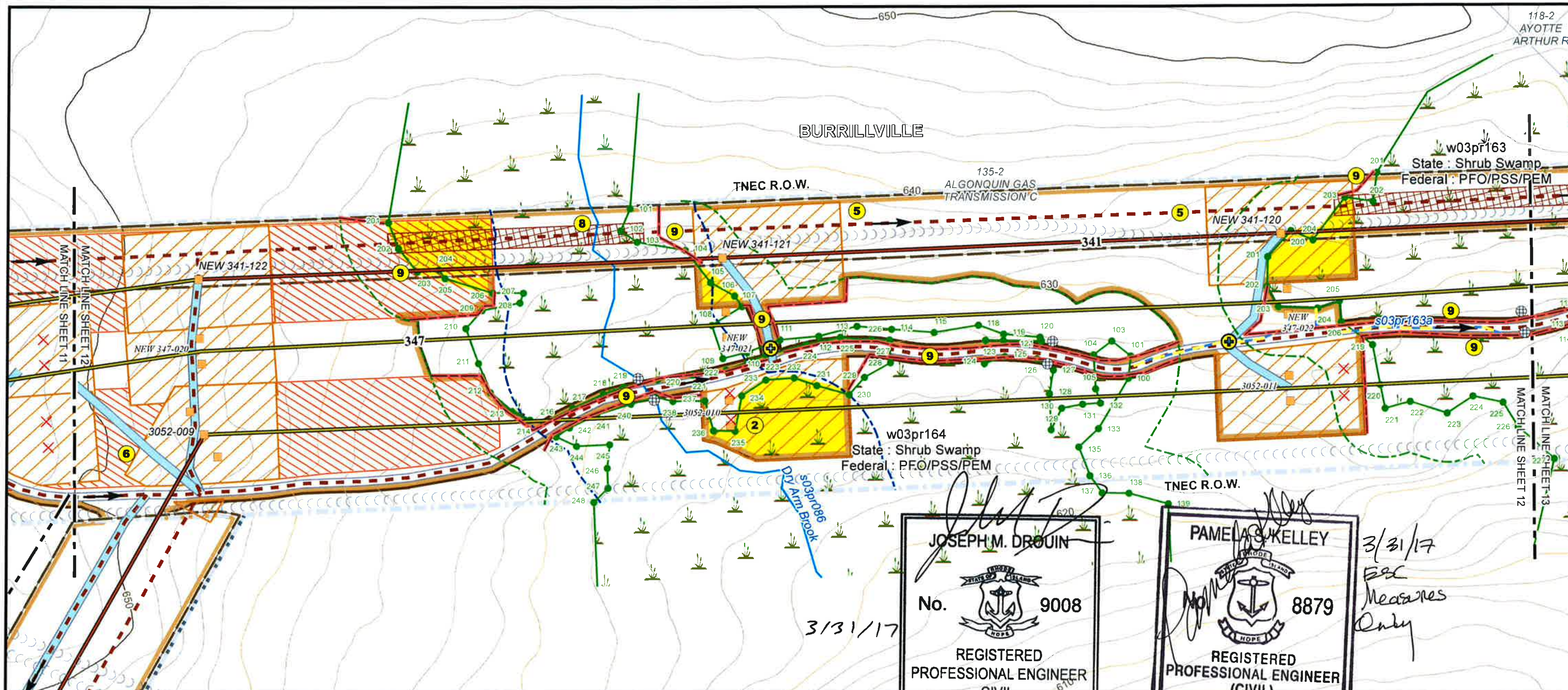
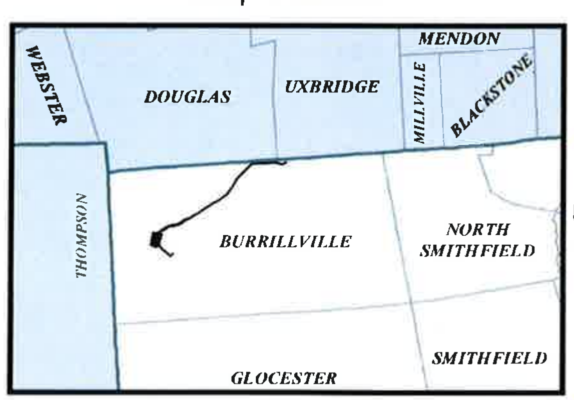


Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
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- Wetland Flag
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- 50' Perimeter Wetland
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- Vernal Pool Location
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- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
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- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
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0 100 200 Feet

Invenergy

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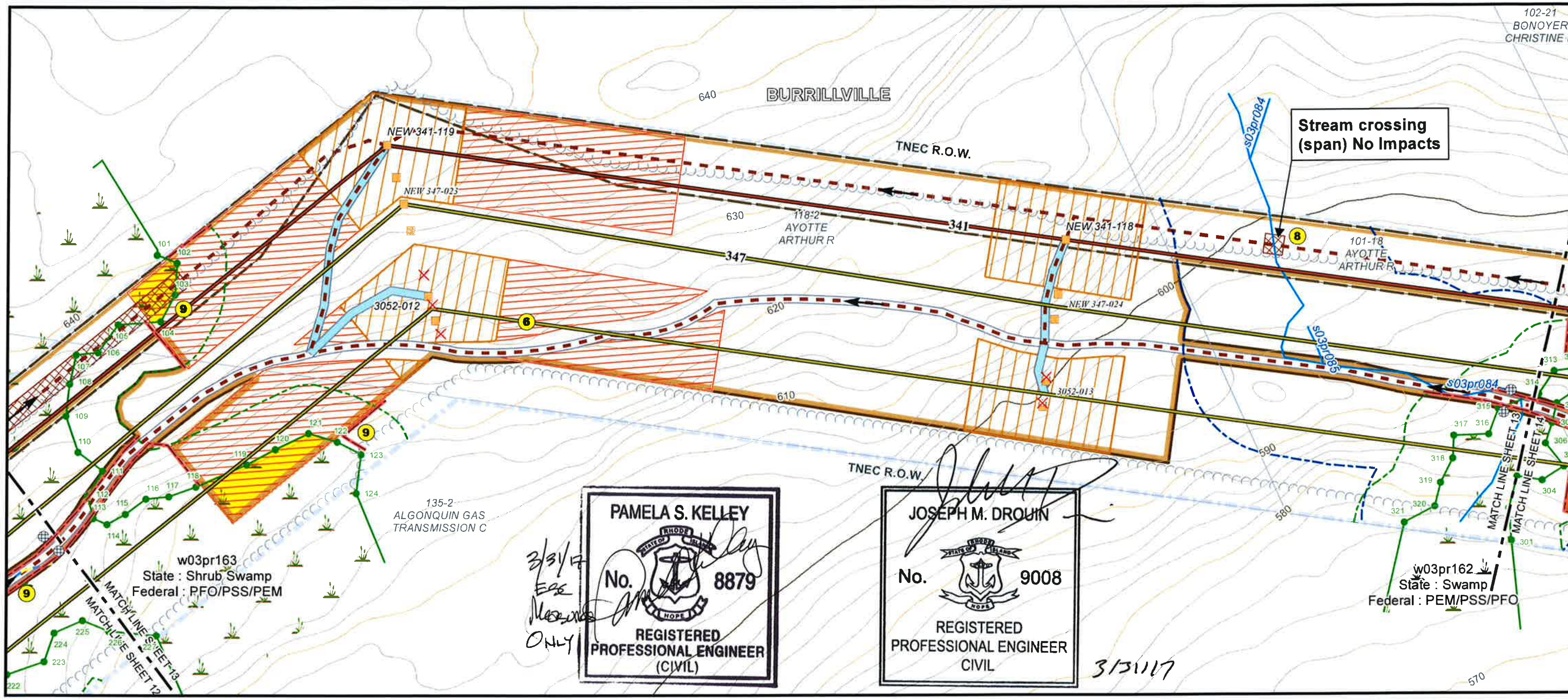
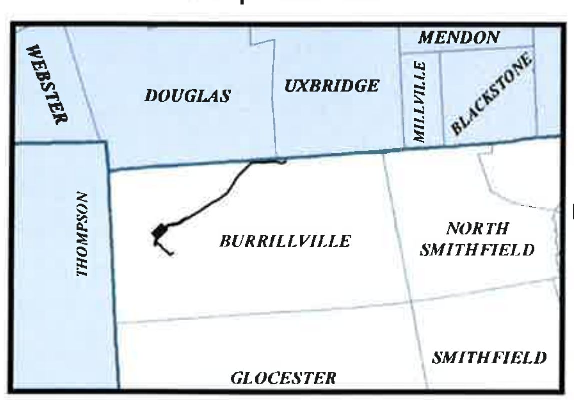
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 12 OF 63



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
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- Existing Power Facility
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- Field Delineated Wetland
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- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr) Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

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NOT FOR CONSTRUCTION

Invenergy

POWER ENGINEERS

nationalgrid

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0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 13 OF 63

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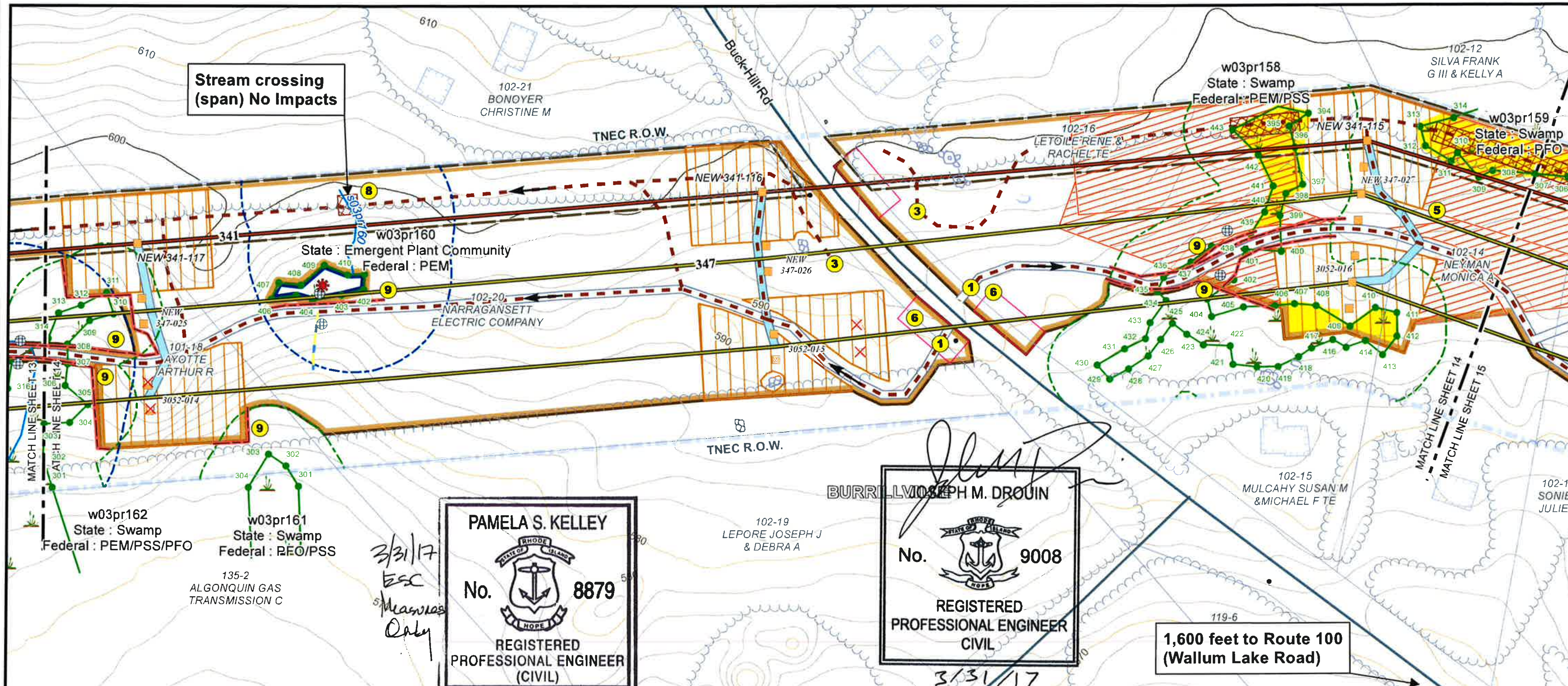

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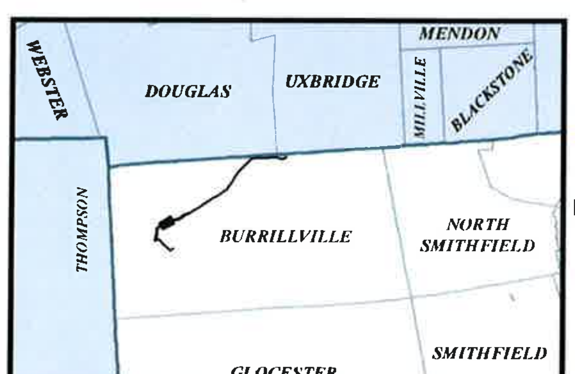
Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
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- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

1. Stabilized construction ingress/egress
2. Mud box / drill cutting box (see Erosion & Sediment Control General Notes)
3. Laydown or landing area
4. Stockpiling / staging area (see Erosion & Sediment Control General Notes)
5. Dewatering area (see Erosion & Sediment Control General Notes)
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Notes:
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NOT FOR CONSTRUCTION

1 " = 100 '

0 100 200 Feet

Invenergy

POWER ENGINEERS

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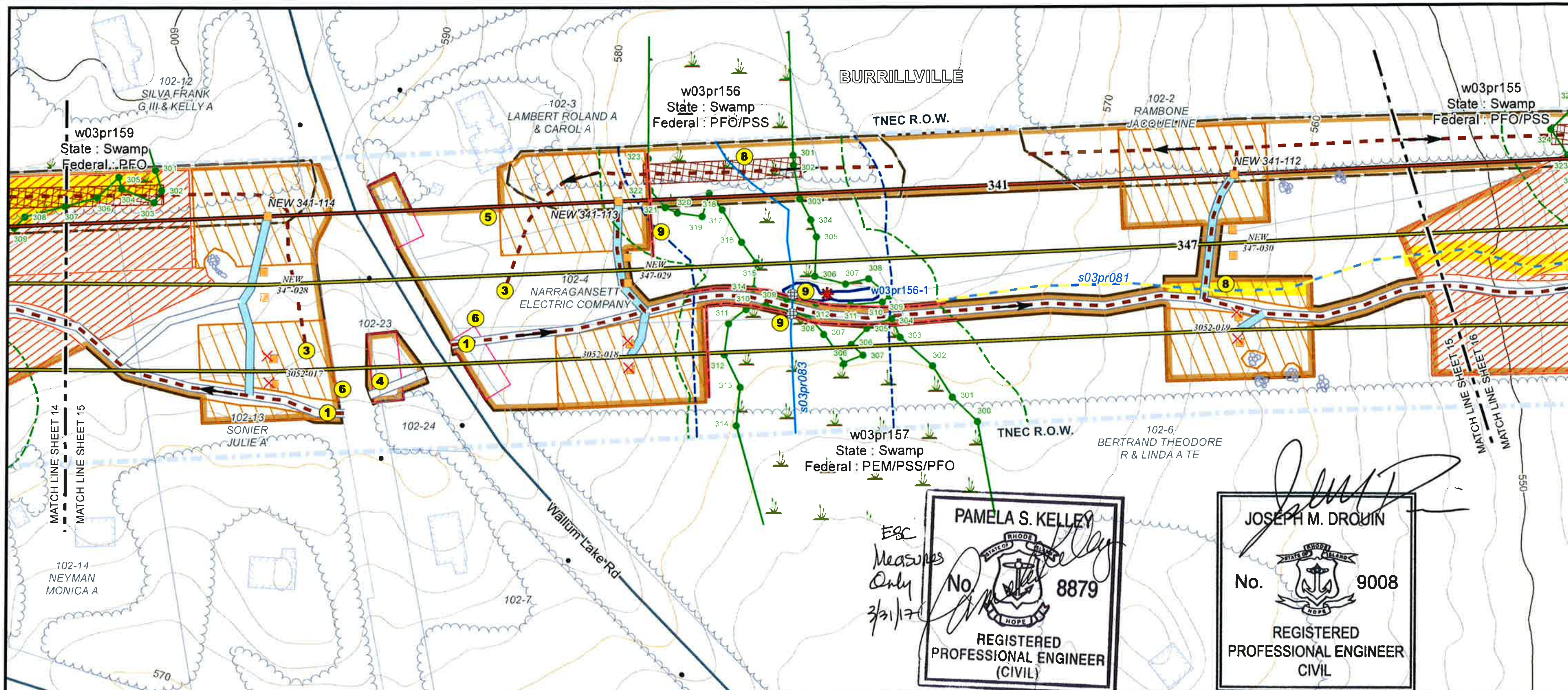
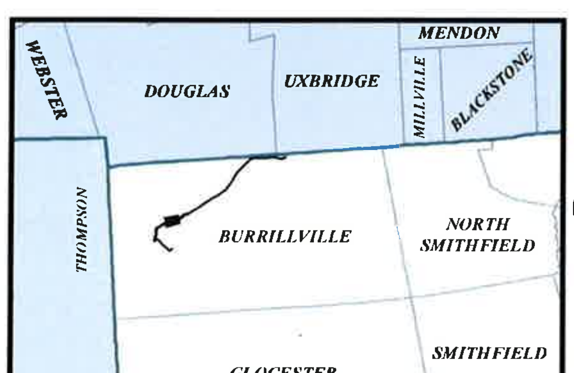
BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 14 OF 63



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
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- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
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- Tree Clearing Access
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- Limit of Tree Clearing
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Invenergy

POWER ENGINEERS

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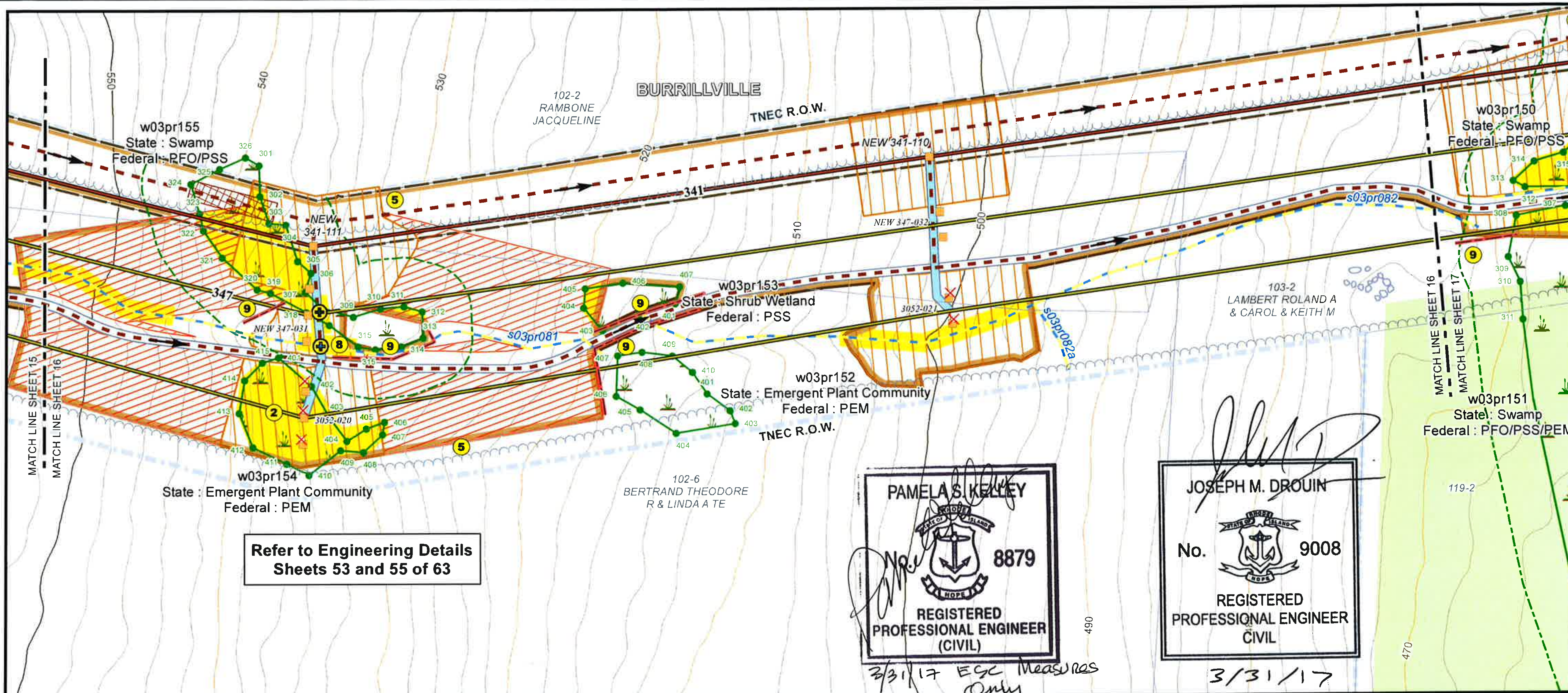
N W E S

1 " = 100 '

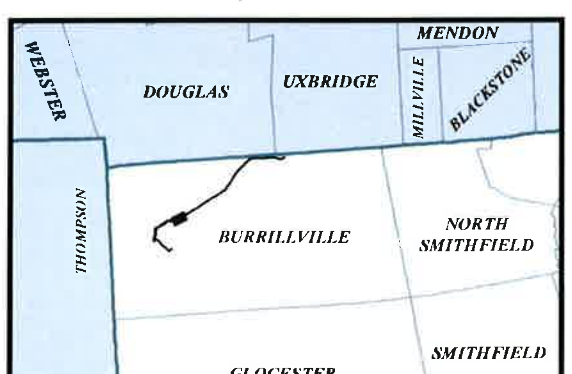
0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 15 OF 63

Path W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_7_Map_Book.mxd



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
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- Wetland Flag
- Field Delineated Wetland
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- Vernal Pool Location
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- Stone Feature
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- Stone Wall
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- Index Contour (10' Interval)
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- Protected Habitat
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Proposed

- Proposed or Reused Steel Pole
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- Wood Pole to be Removed
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- Proposed Clear River Switching Station
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- Perimeter Sediment Control
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Invenergy

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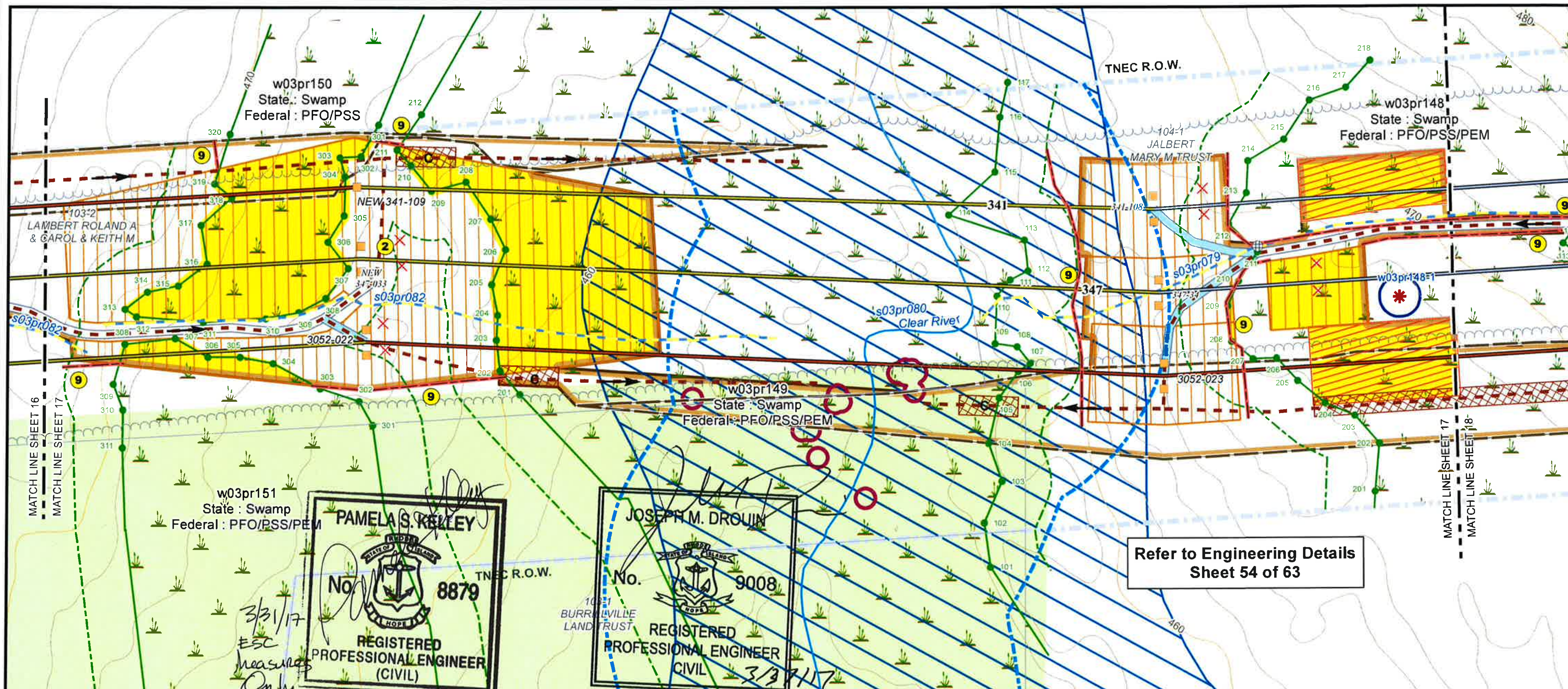
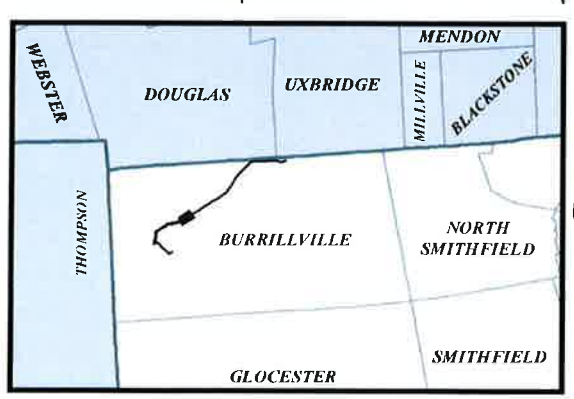
BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC	RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND
DATE: 3/30/2017 · DRAWN: TDH · 142704	FIGURE T-3 · SHEET 16 OF 63



Map Location



Existing Conditions

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- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
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NOT FOR CONSTRUCTION

1 " = 100 '

0 100 200 Feet

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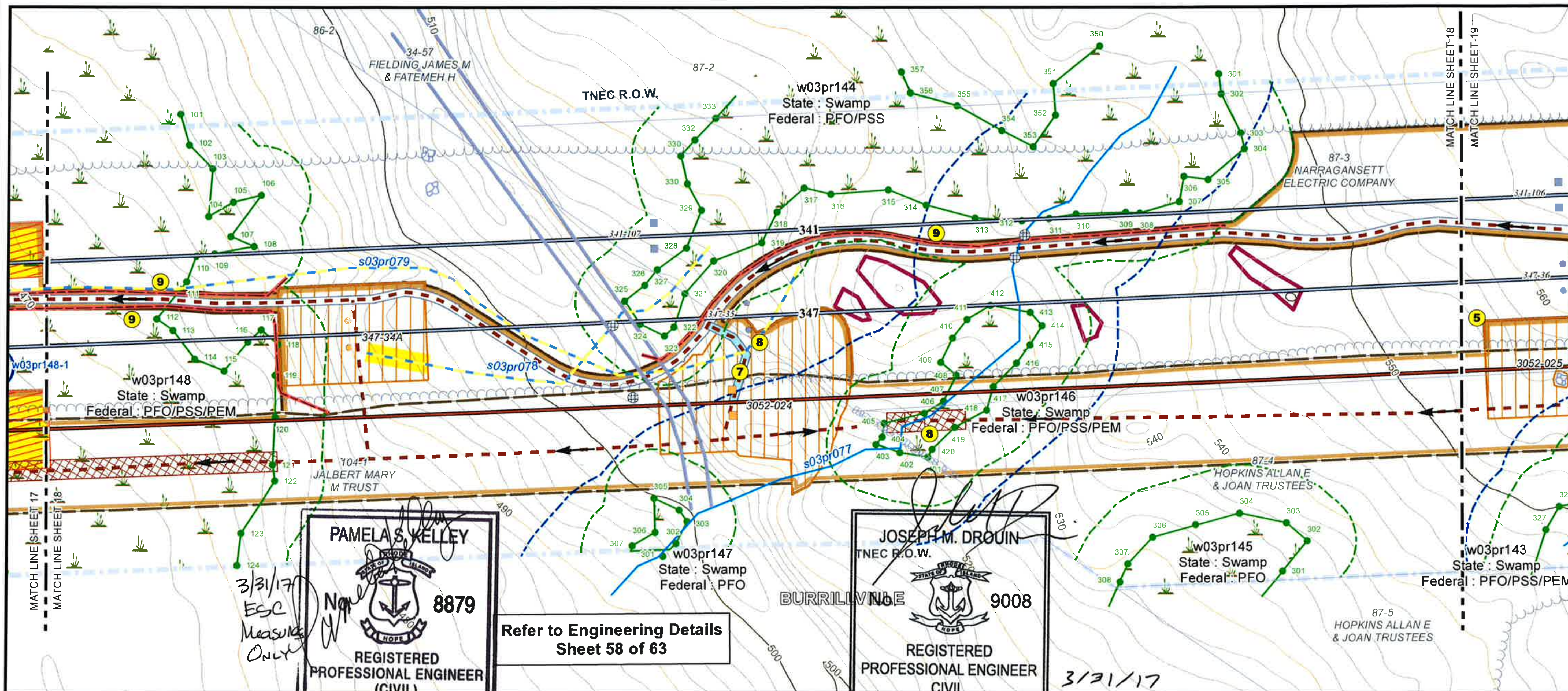
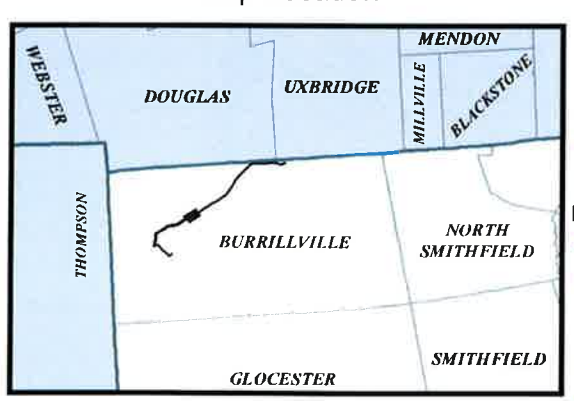
BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 17 OF 63

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_7_Map_Book.mxd



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
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- Existing Power Facility
- Existing Road
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- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain (DFIRM 100yr)
- FEMA Flood Hazard Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
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Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
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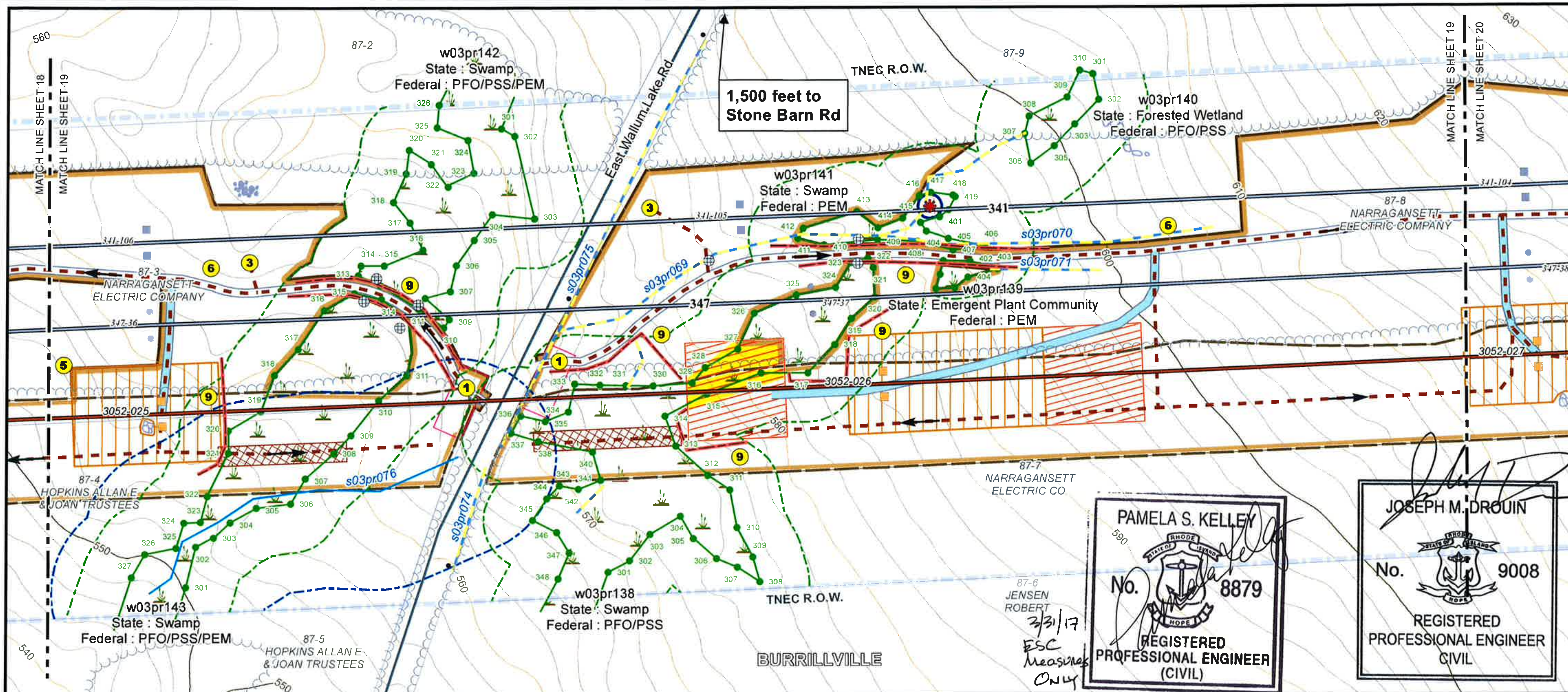
1 " = 100 '

0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 18 OF 63

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_7_Map_Book.mxd



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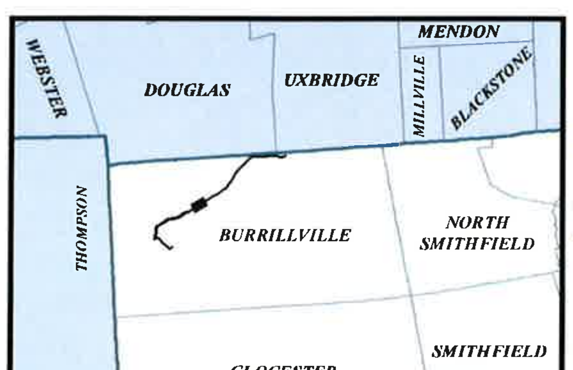

Existing Conditions

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- Wood Distribution Pole
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- Vernal Pool Location
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Proposed

- Proposed or Reused Steel Pole
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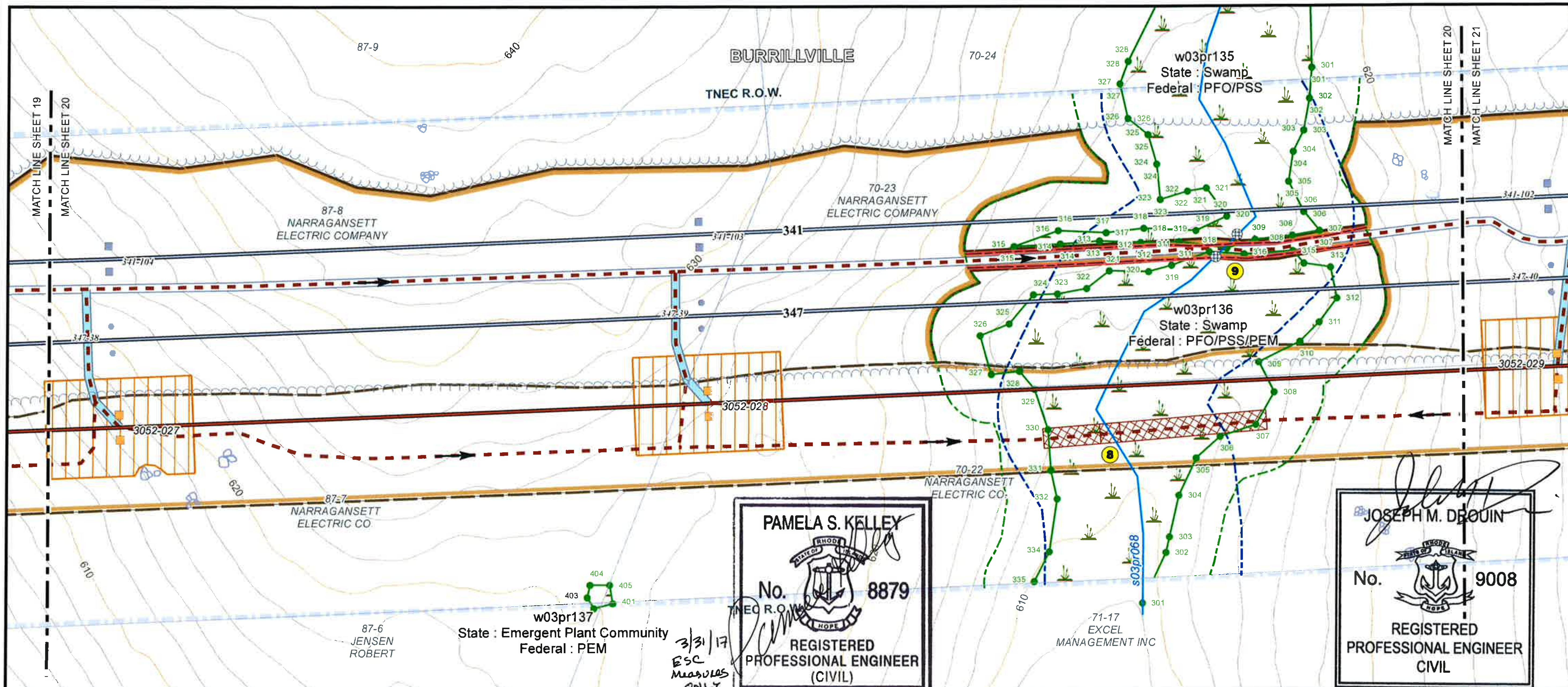
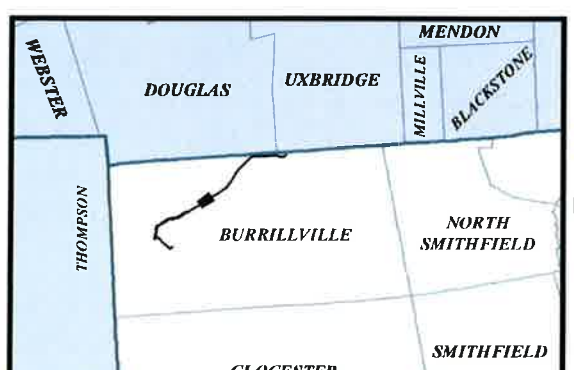
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 19 OF 63

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_7_Map_Book.mxd



Map Location



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DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 20 OF 63

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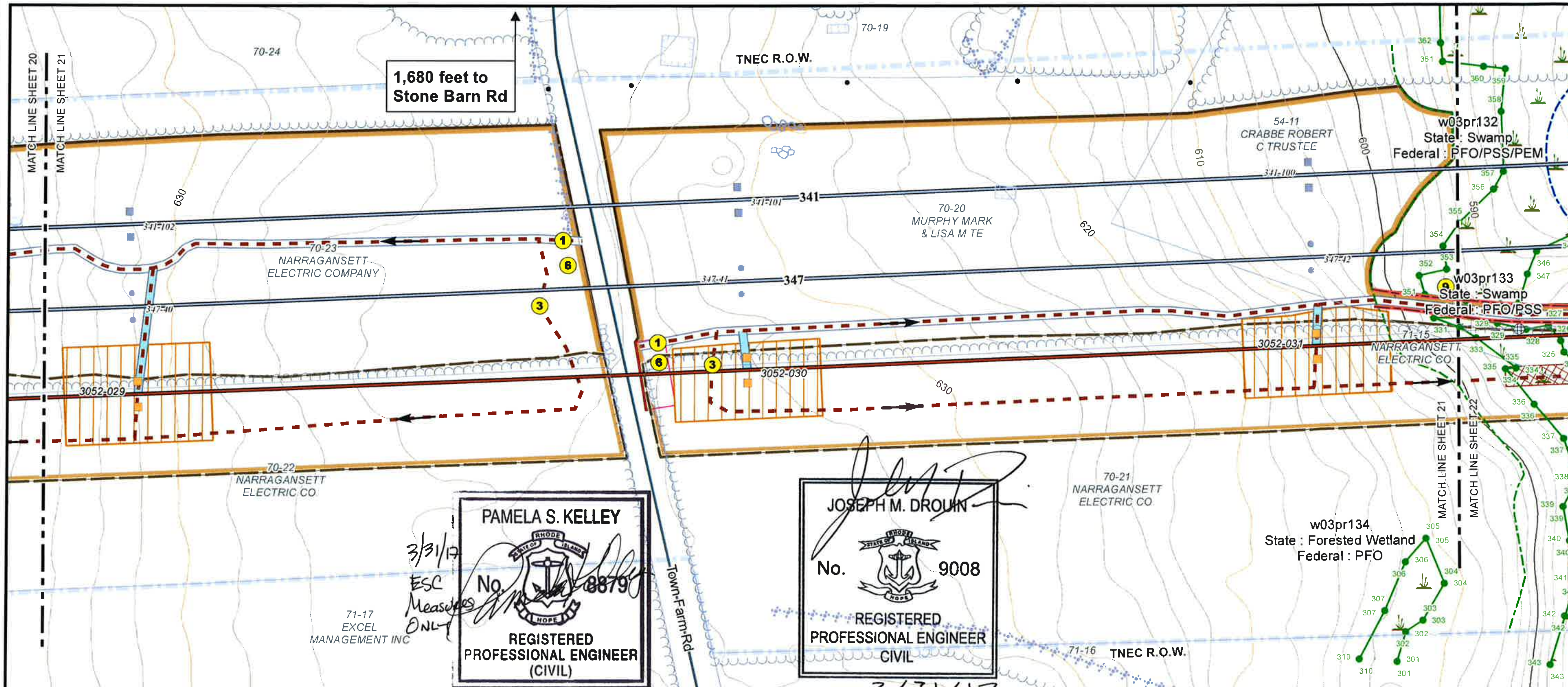

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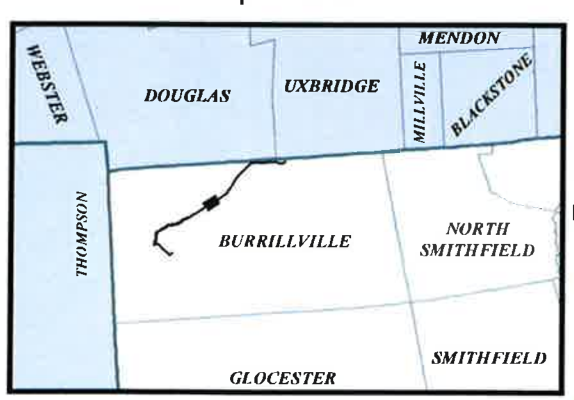

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NOT FOR CONSTRUCTION

Invenergy

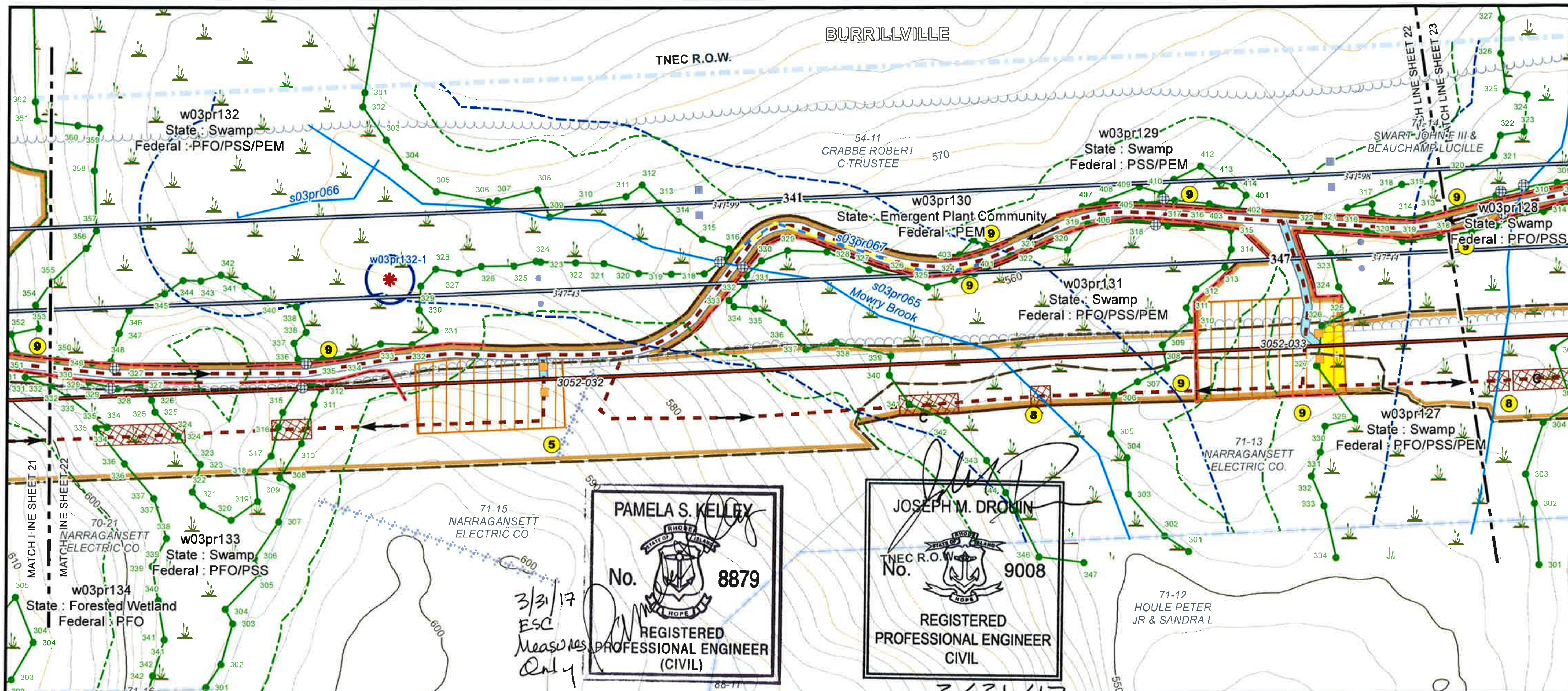
nationalgrid

POWER ENGINEERS

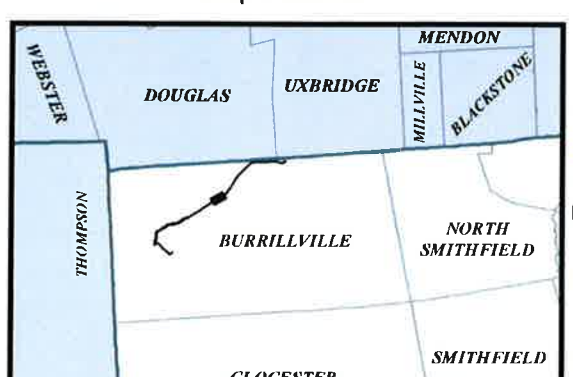
1 " = 100 '

0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 21 OF 63



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

1. Stabilized construction ingress/egress
2. Mud box / drill cutting box (see Erosion & Sediment Control General Notes)
3. Laydown or landing area
4. Stockpiling / staging area (see Erosion & Sediment Control General Notes)
5. Dewatering area (see Erosion & Sediment Control General Notes)
6. Concrete washout basin / testing area (see Erosion & Sediment Control General Notes)
7. If access road grading required on steep terrain (exceeding 3:1 slope), water bars should be installed during road bed preparation
8. Stream and ASSF crossings will be accomplished using one of the stream crossing techniques shown on the swamp mat details (mat bridge detail). Access road crossings and construction work pads will be elevated in such a manner to span the stream or ASSF and not obstruct the flow of water.
9. Perimeter soil erosion & sediment controls (see Erosion & Sediment Control General Notes)

Notes:
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Invenergy

POWER ENGINEERS

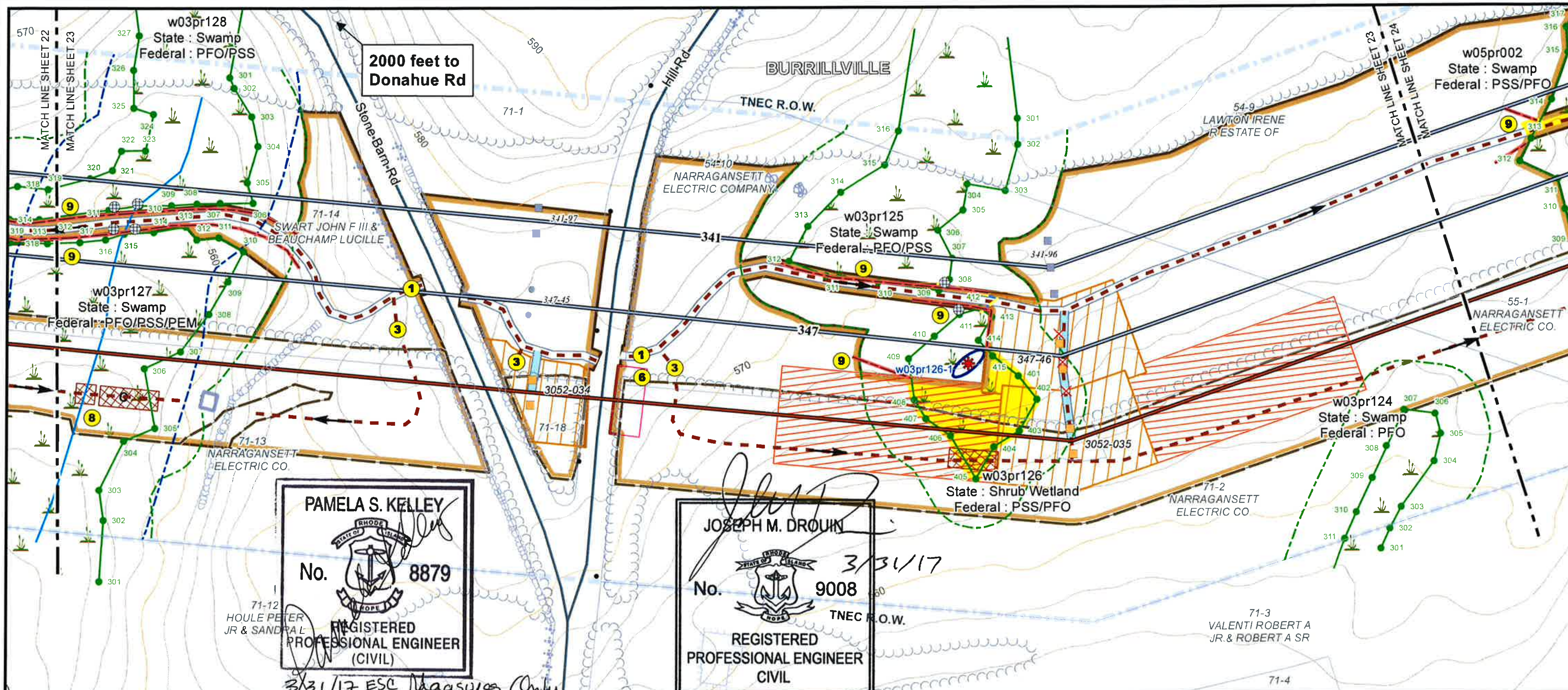
nationalgrid

1 " = 100 '

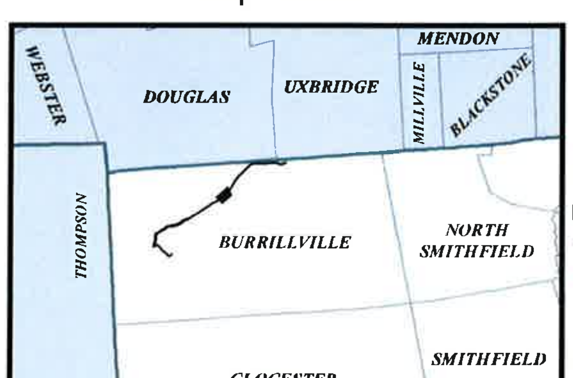
0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 22 OF 63

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_7_Map_Book.mxd



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
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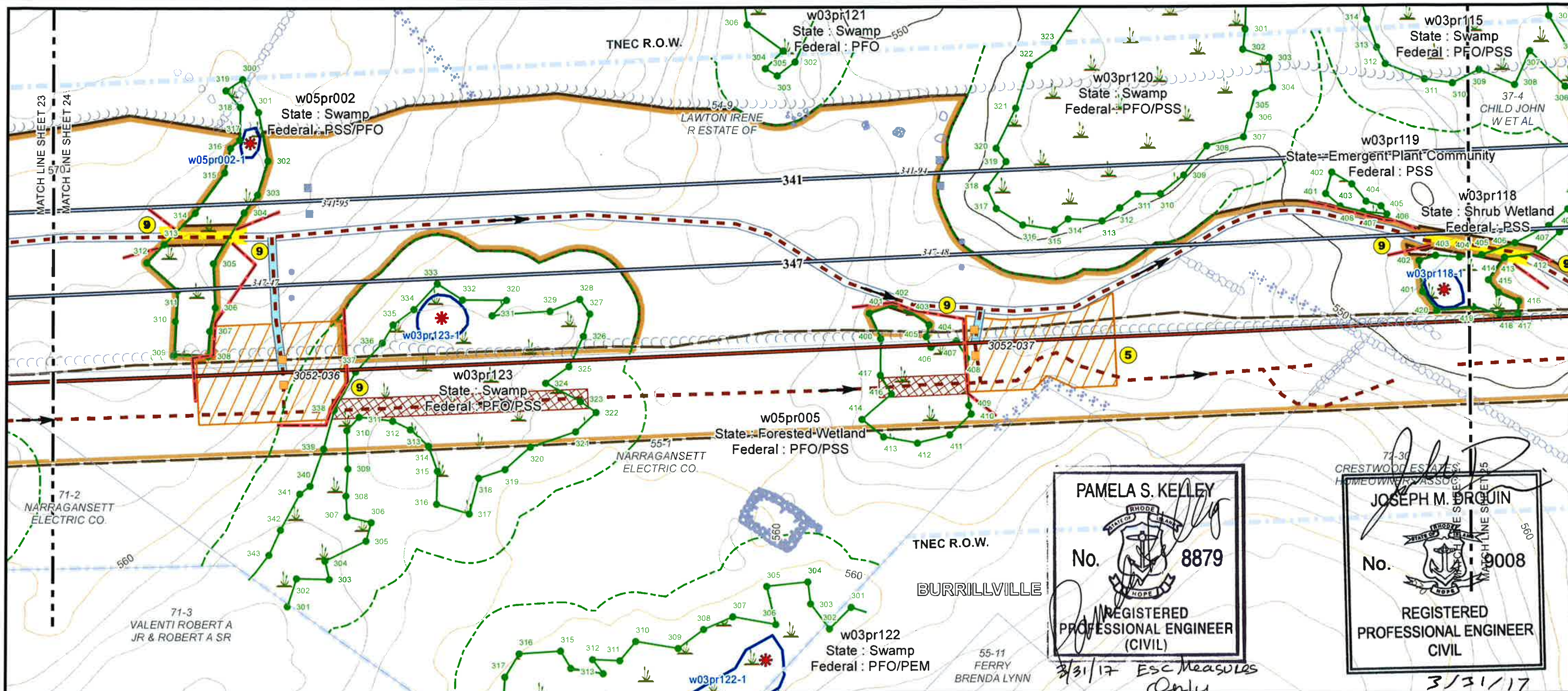
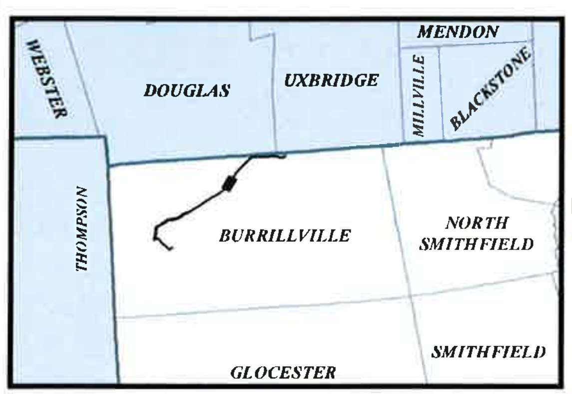
BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 23 OF 63

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_7_Map_Book.mxd



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
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- Wetland Flag
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- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
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- Wire Pulling Station
- Work Pad /
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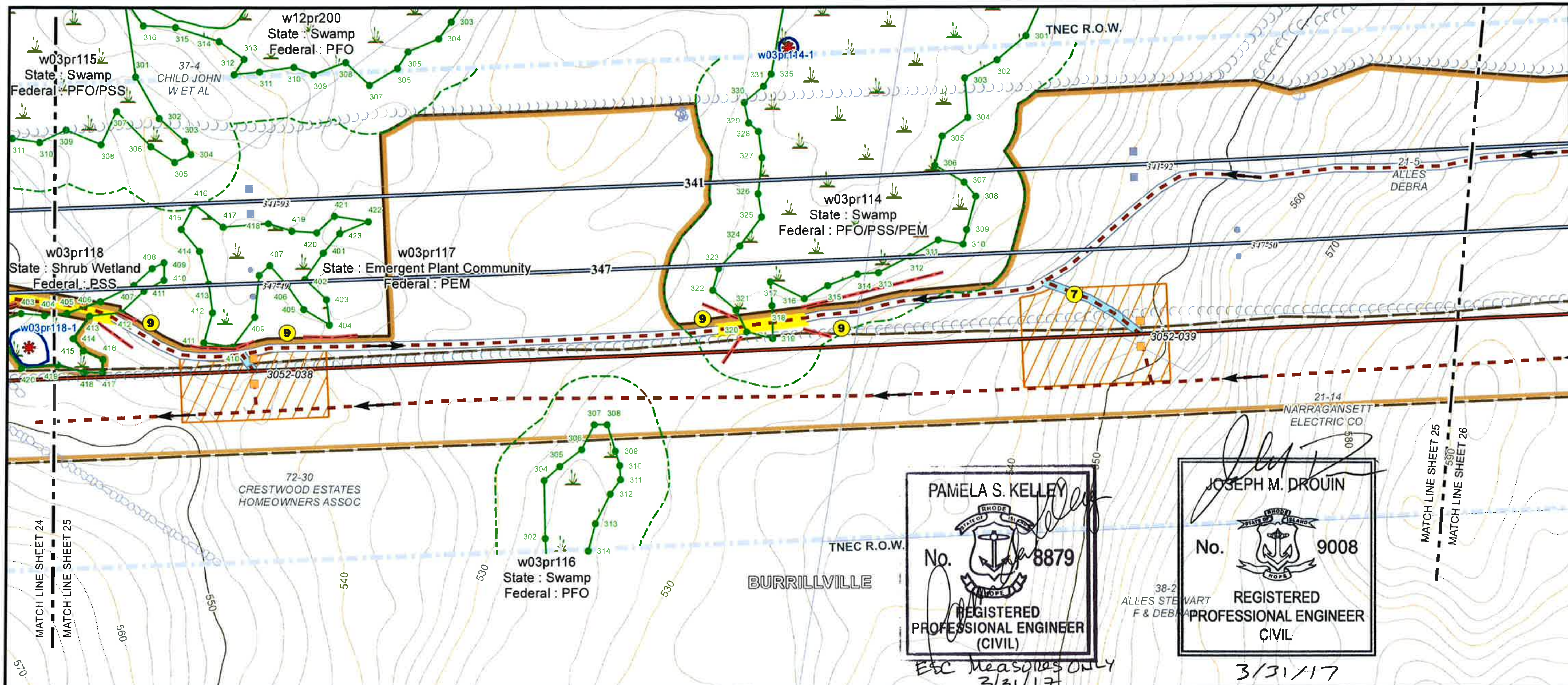
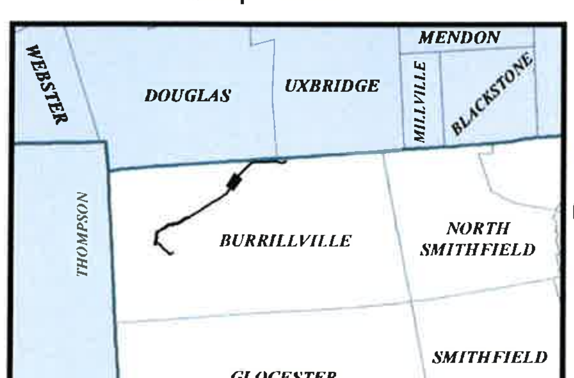
BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 24 OF 63



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
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- Work Pad /
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POWER ENGINEERS

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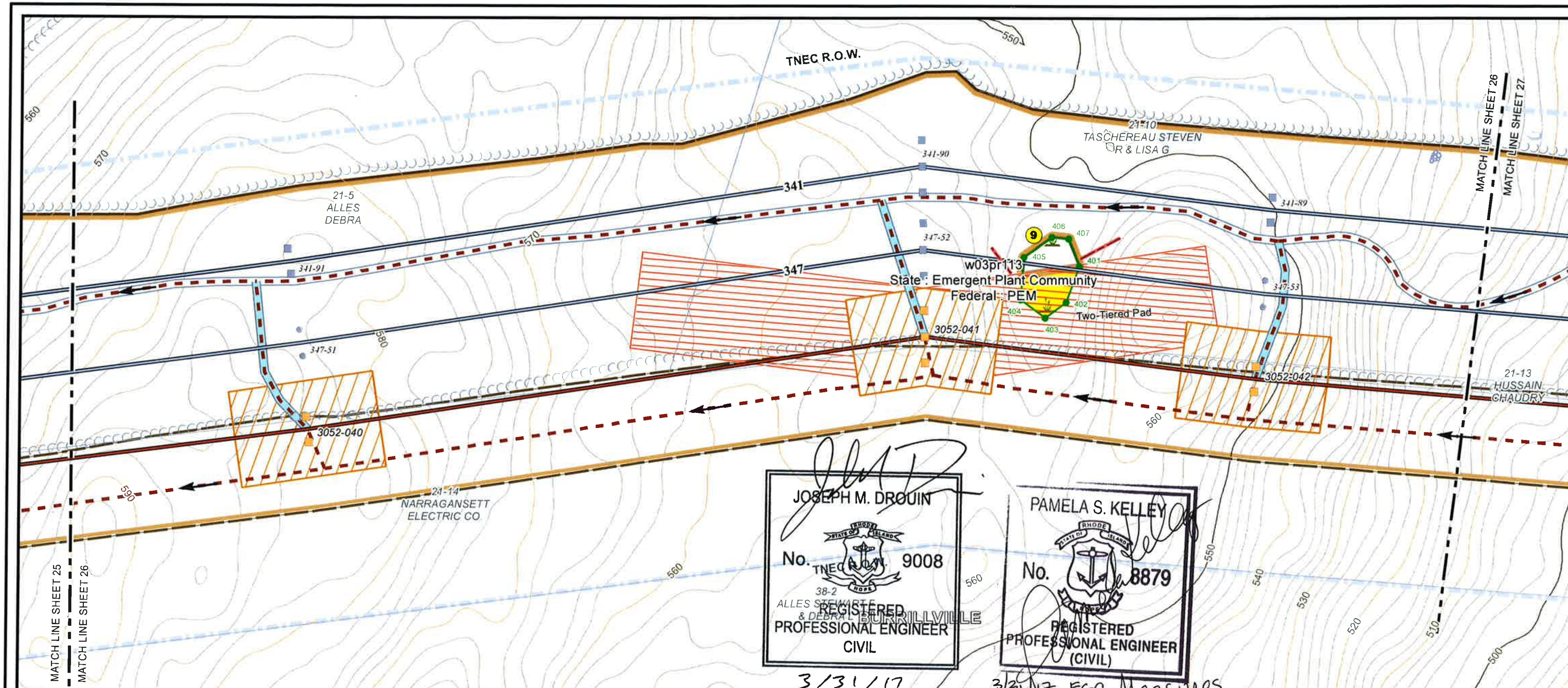
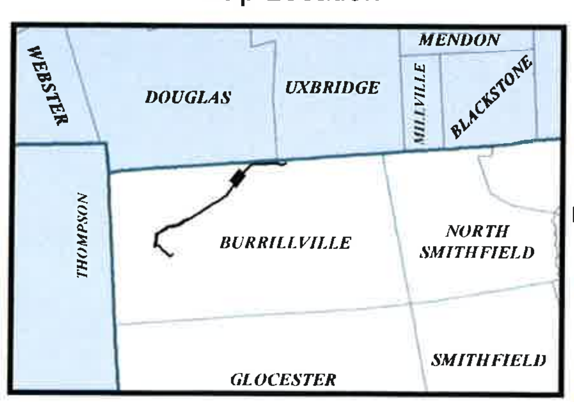
1 " = 100 '

0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 25 OF 63



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
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- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
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- Vernal Pool Location
- Surveyed Floodplain
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- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
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- Wire Pulling Station
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- Limit of Disturbance

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NOT FOR CONSTRUCTION

1 " = 100 '

0 100 200 Feet

Invenergy

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BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 26 OF 63

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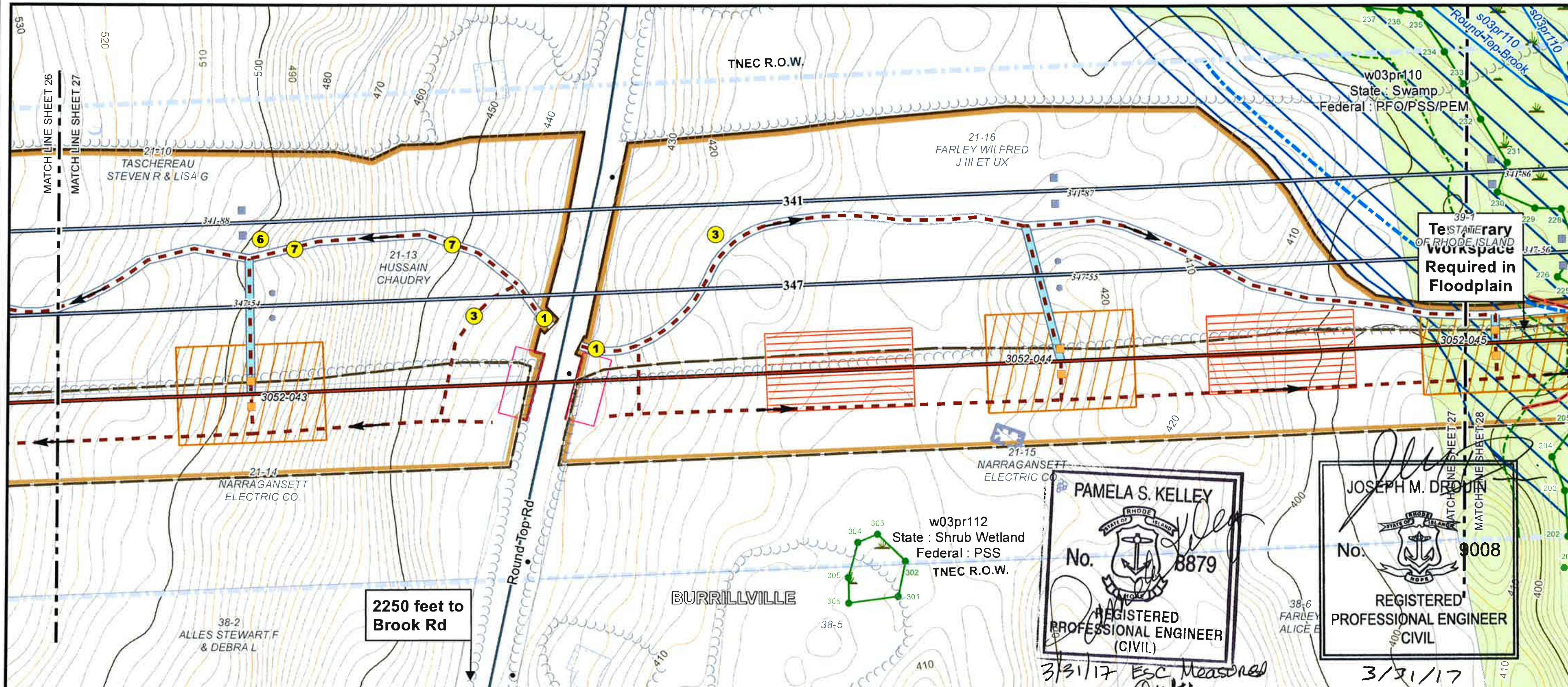
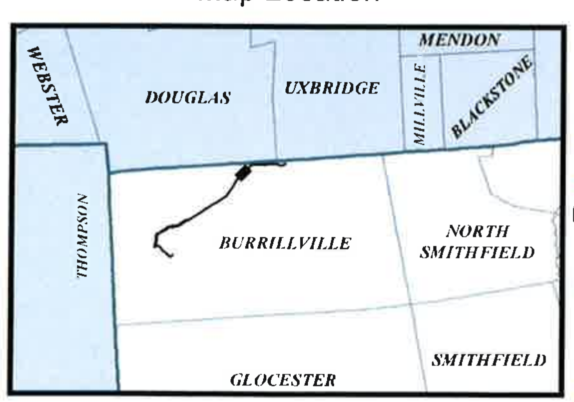


Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
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Proposed

- Proposed or Reused Steel Pole
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- Proposed Clear River Switching Station
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DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 27 OF 63

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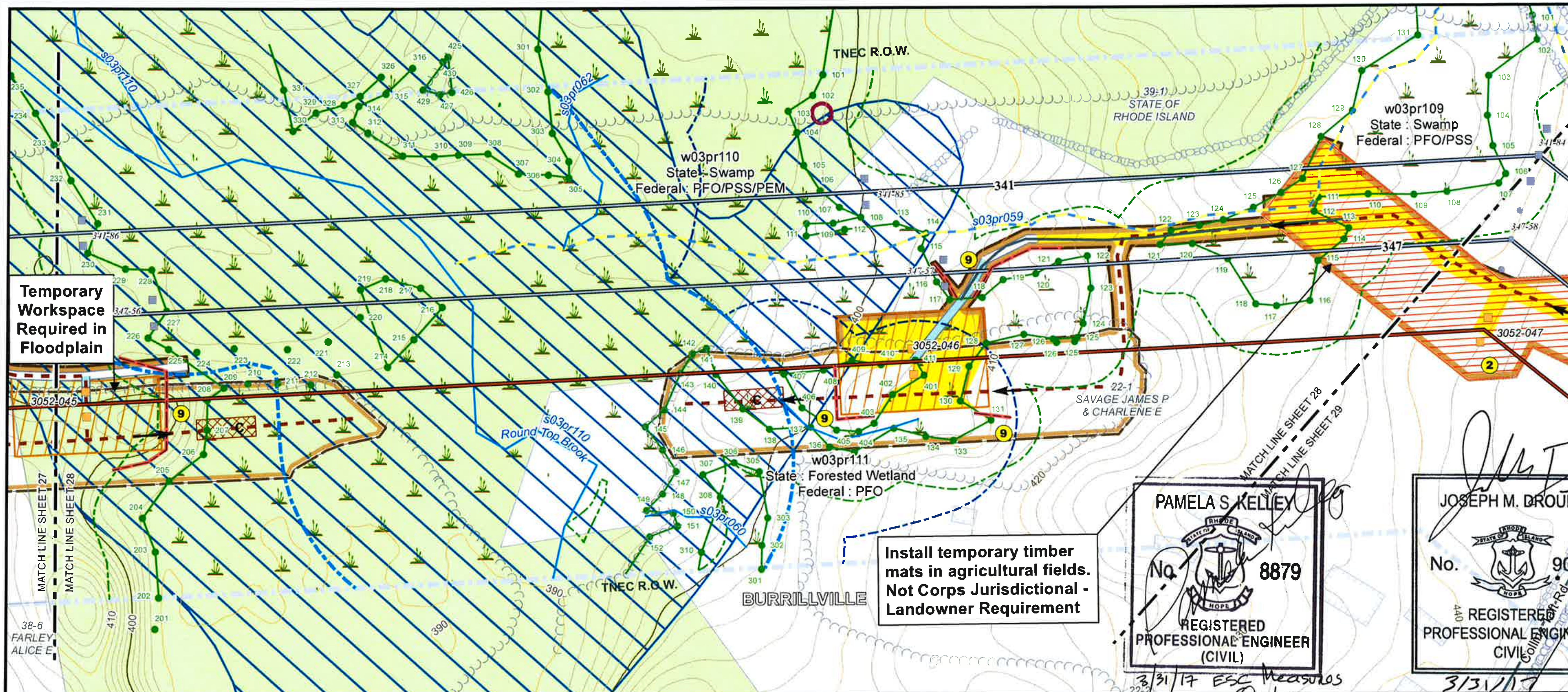
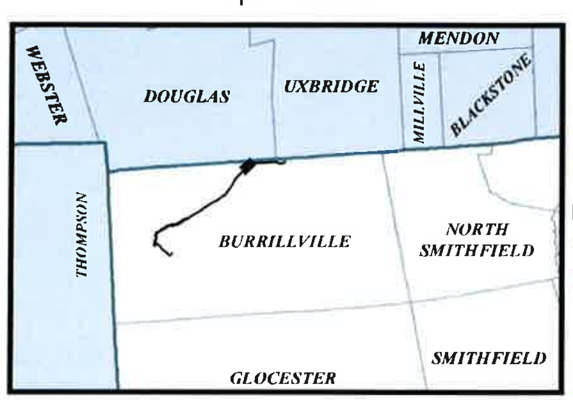


Map Location



Existing Conditions

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Proposed

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0 100 200 Feet

Invenergy

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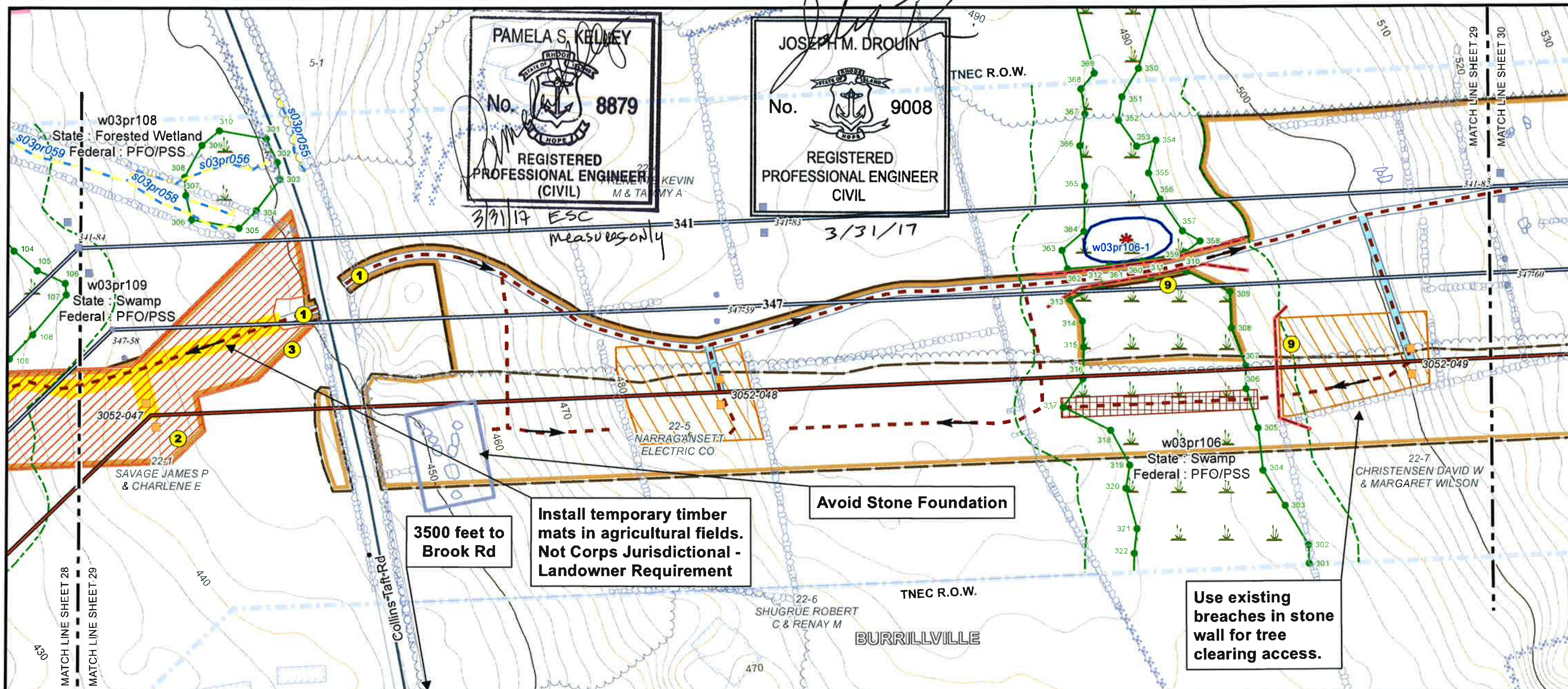
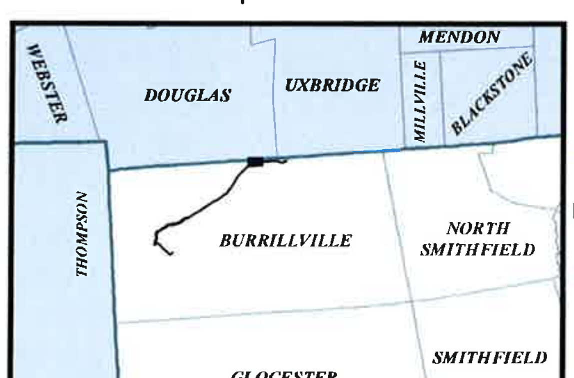
nationalgrid

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 28 OF 63



Map Location



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Existing Conditions

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- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

1. Stabilized construction ingress/egress
2. Mud box / drill cutting box (see Erosion & Sediment Control General Notes)
3. Laydown or landing area
4. Stockpiling / staging area (see Erosion & Sediment Control General Notes)
5. Dewatering area (see Erosion & Sediment Control General Notes)
6. Concrete washout basin / testing area (see Erosion & Sediment Control General Notes)
7. If access road grading required on steep terrain (exceeding 3:1 slope), water bars should be installed during road bed preparation
8. Stream and ASSF crossings will be accomplished using one of the stream crossing techniques shown on the swamp mat details (mat bridge detail). Access road crossings and construction work pads will be elevated in such a manner to span the stream or ASSF and not obstruct the flow of water.
9. Perimeter soil erosion & sediment controls (see Erosion & Sediment Control General Notes)

Notes:
- Limits of ROW shown are approximate.
- Rhode Island PE Seal 9008 is applicable only to the proposed transmission structure locations shown.
- Proposed transmission structure locations are approximate.

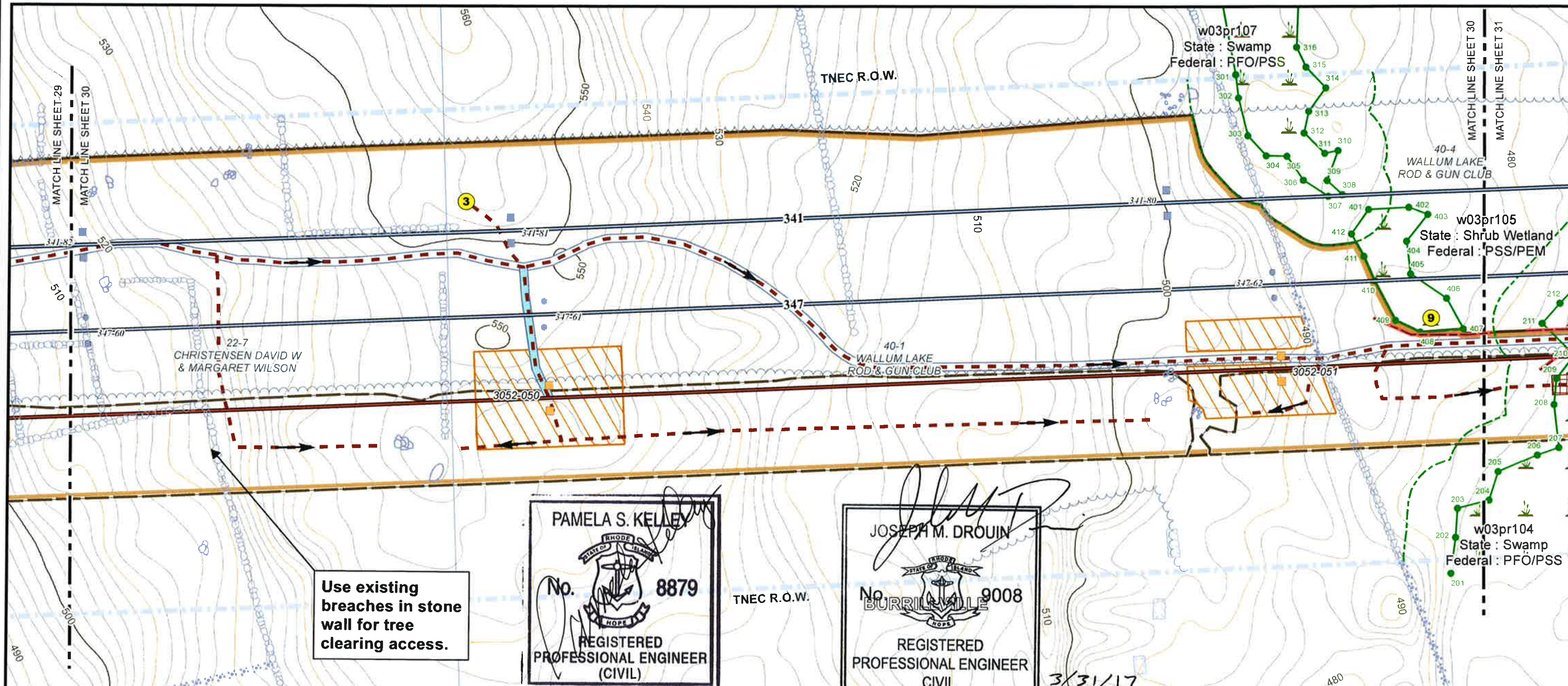
NOT FOR CONSTRUCTION

N W E S

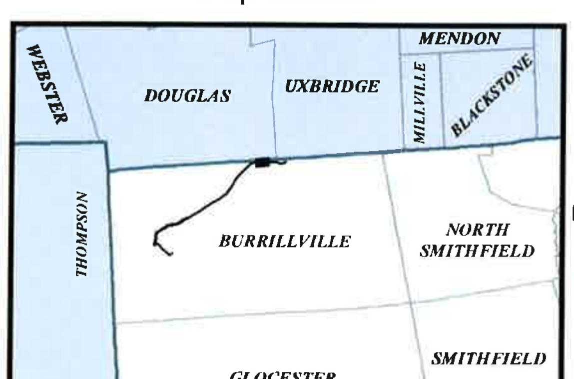
1 " = 100 '

0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 29 OF 63



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

1. Stabilized construction ingress/egress
2. Mud box / drill cutting box (see Erosion & Sediment Control General Notes)
3. Laydown or landing area
4. Stockpiling / staging area (see Erosion & Sediment Control General Notes)
5. Dewatering area (see Erosion & Sediment Control General Notes)
6. Concrete washout basin / testing area (see Erosion & Sediment Control General Notes)
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9. Perimeter soil erosion & sediment controls (see Erosion & Sediment Control General Notes)

Notes:
- Limits of ROW shown are approximate.
- Rhode Island PE Seal 9008 is applicable only to the proposed transmission structure locations shown.
- Proposed transmission structure locations are approximate.

NOT FOR CONSTRUCTION

Invenergy

nationalgrid

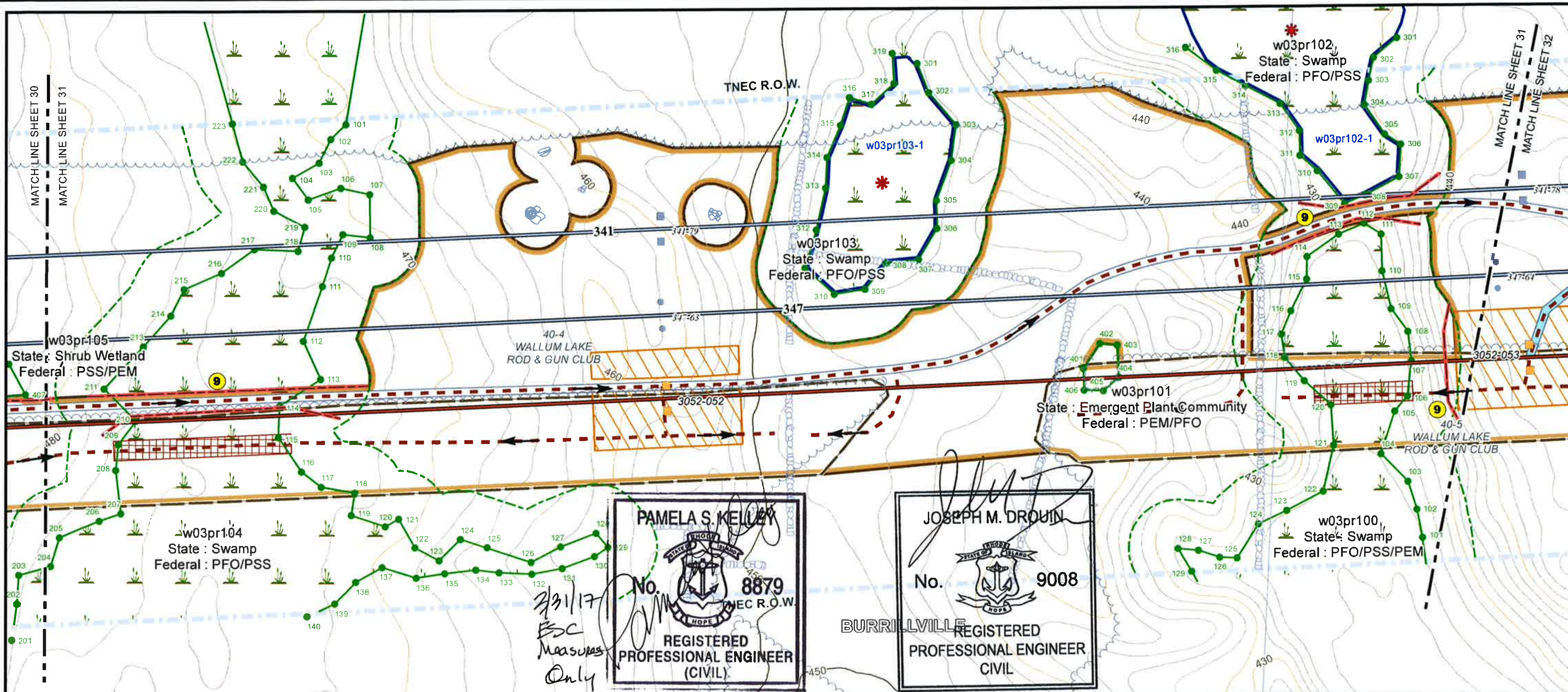
POWER ENGINEERS

N W E S

1 " = 100 '

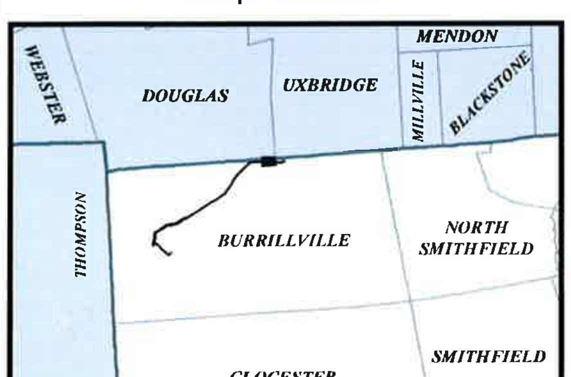
0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 30 OF 63



3/31/17

Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr)
- Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

1. Stabilized construction ingress/egress
2. Mud box / drill cutting box (see Erosion & Sediment Control General Notes)
3. Laydown or landing area
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9. Perimeter soil erosion & sediment controls (see Erosion & Sediment Control General Notes)

Notes:
- Limits of ROW shown are approximate.
- Rhode Island PE Seal 9008 is applicable only to the proposed transmission structure locations shown.
- Proposed transmission structure locations are approximate.

NOT FOR CONSTRUCTION

Invenergy

POWER ENGINEERS

nationalgrid

N E S W

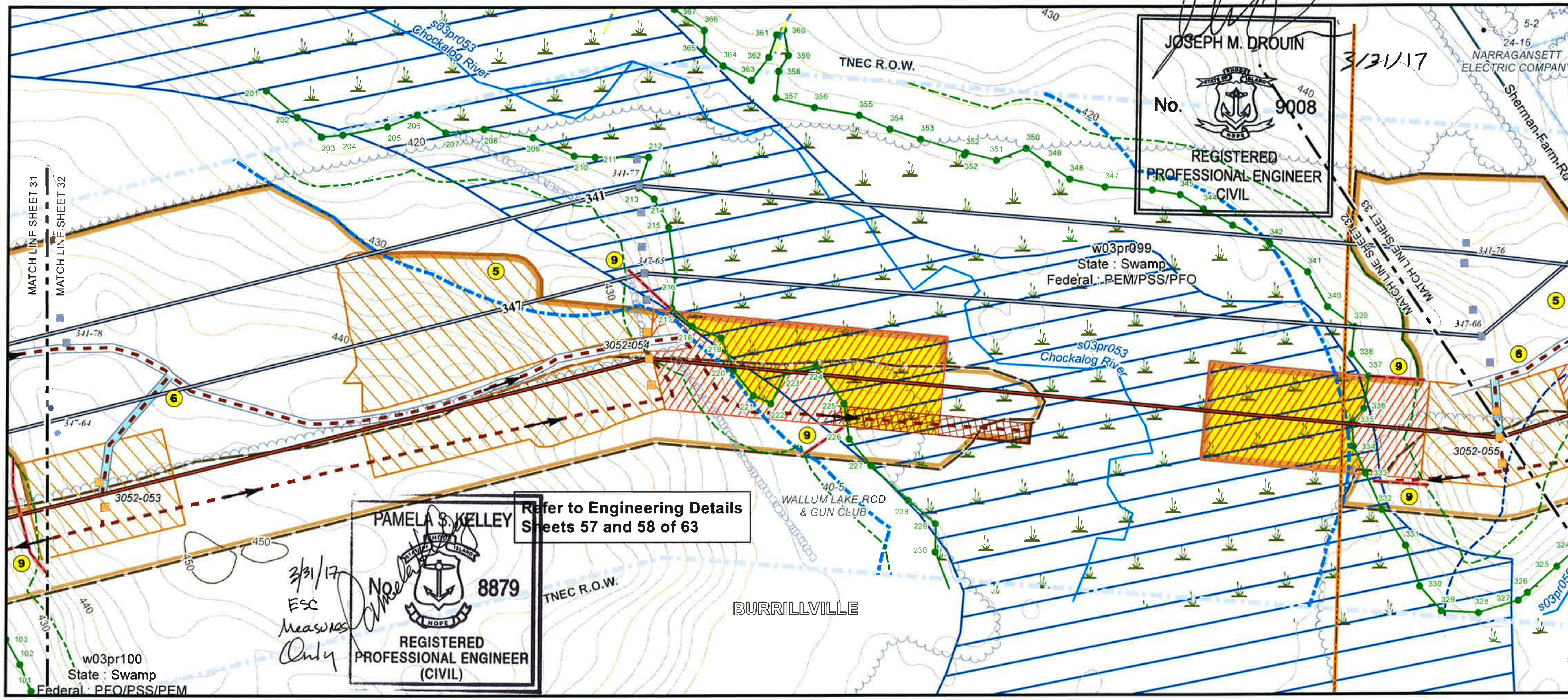
1 " = 100 '

0 100 200 Feet

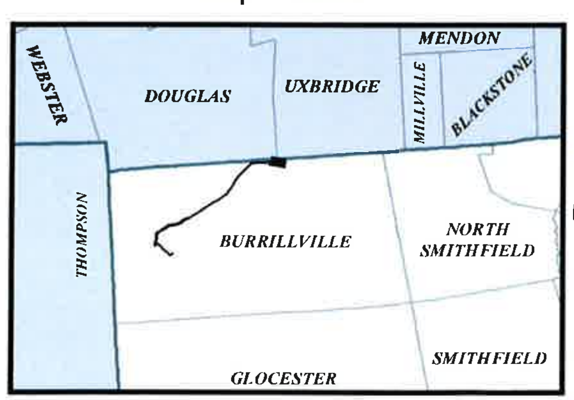
Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_7_Map_Book.mxd

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC	RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND

DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 31 OF 63



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain
- FEMA Flood Hazard (DFIRM 100yr) Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

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Notes:
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- Proposed transmission structure locations are approximate.

NOT FOR CONSTRUCTION

N W E S

1 " = 100 '

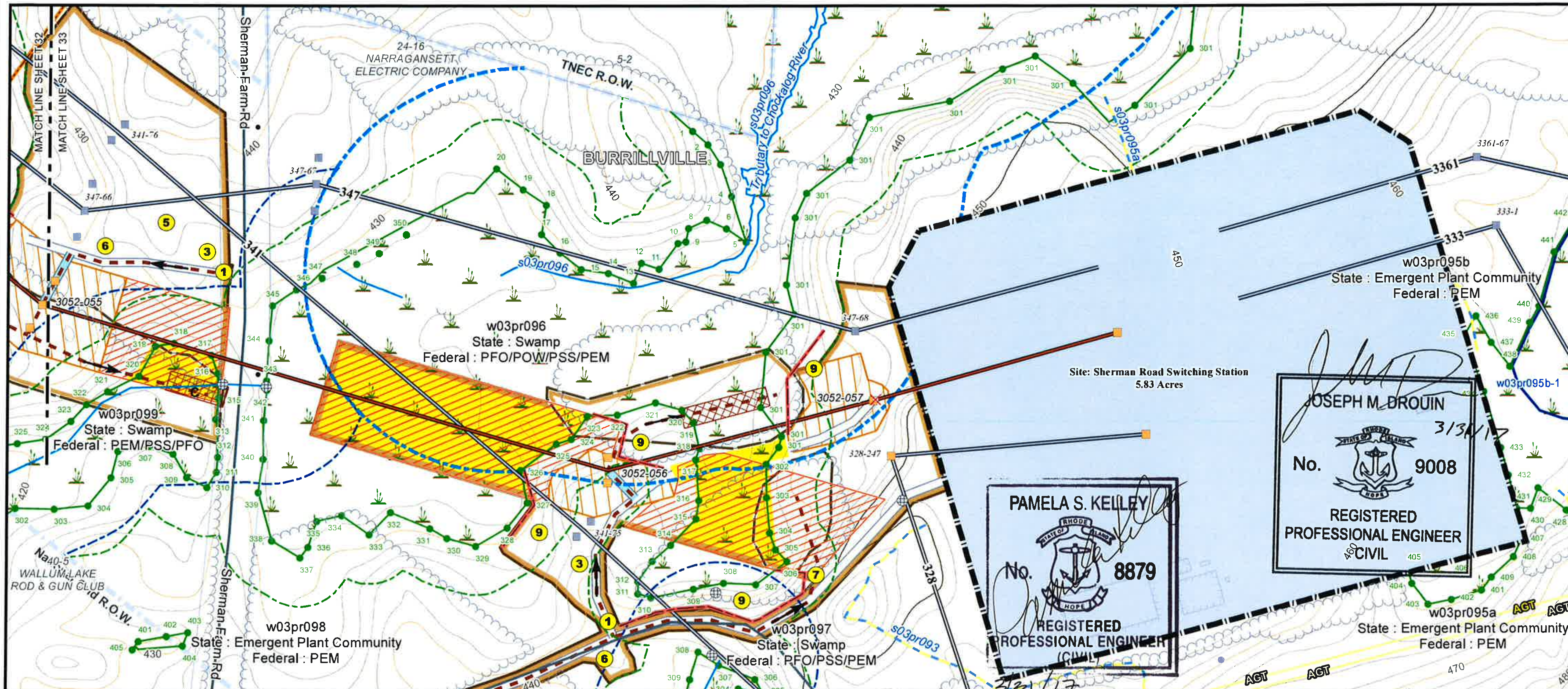
0 100 200 Feet

Invenergy

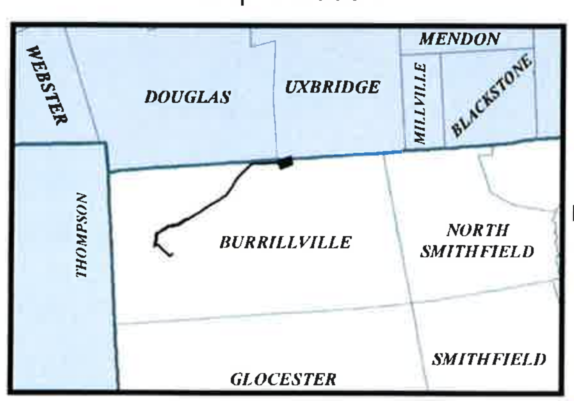
POWER ENGINEERS

nationalgrid

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 32 OF 63



Map Location



Existing Conditions

- Existing Steel Pole
- Existing Wood Pole
- Wood Distribution Pole
- Existing Transmission Line
- Natural Gas Pipeline
- AT&T Fiber Optic Line
- Existing Power Facility
- Existing Road
- Existing Right of Way
- Existing Culvert or Stream Ford
- Watercourse
- Area Subject to Storm Flowage (ASSF)
- 100' Riverbank Buffer
- 200' Riverbank Buffer
- Wetland Flag
- Field Delineated Wetland
- 50' Perimeter Wetland
- Vernal Pool
- Vernal Pool Location
- Surveyed Floodplain (DFIRM 100yr)
- FEMA Flood Hazard Floodway
- Parcel Boundary
- Building
- Edge of Wooded
- Stone Feature
- Stone Grouping
- Stone Wall
- Major Index Contour (50' Interval)
- Index Contour (10' Interval)
- Contour (2' Interval)
- Protected Habitat
- Conservation Land

Proposed

- Proposed or Reused Steel Pole
- Steel Pole to be Removed
- Proposed Wood Pole
- Wood Pole to be Removed
- Proposed 345 kV Transmission Line
- Replaced 345 kV Transmission Line
- Proposed Clear River Switching Station
- Proposed Culvert or Stream Ford
- Proposed New Right-of-Way
- Use Existing Access
- Improve Existing Road
- Construct New Access
- Tree Clearing Access
- Perimeter Sediment Control
- Limit of Tree Clearing
- Swamp Mat (Construction)
- Road Crossing Guard
- Swamp Mat (Tree Clearing)
- C Tree Clearing Cluster Mat
- Wire Pulling Station
- Work Pad /
- Limit of Disturbance

1. Stabilized construction ingress/egress
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9. Perimeter soil erosion & sediment controls (see Erosion & Sediment Control General Notes)

Notes:
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- Proposed transmission structure locations are approximate.

NOT FOR CONSTRUCTION

Invenergy

nationalgrid

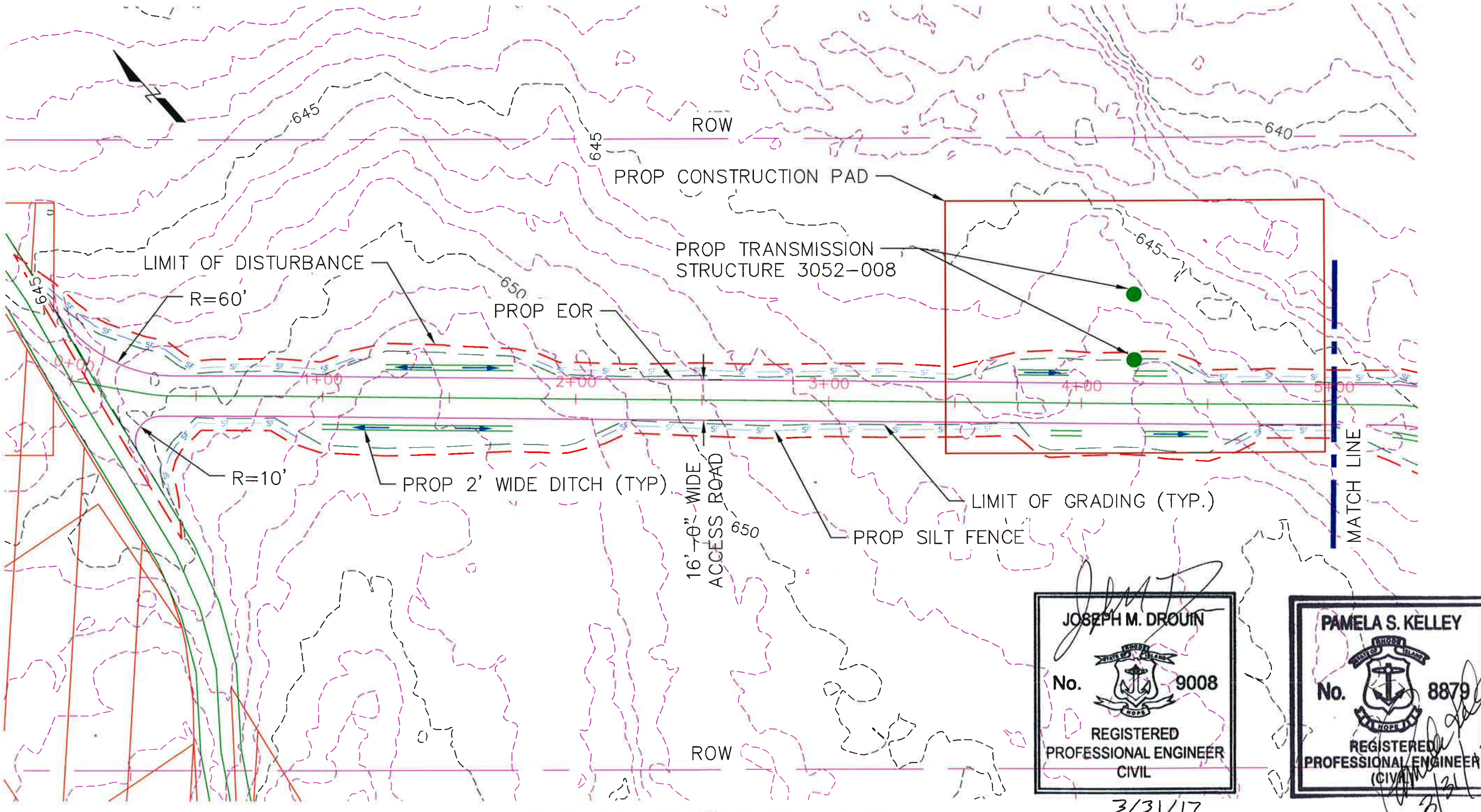
POWER ENGINEERS

1 " = 100 '

0 100 200 Feet

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS BURRILLVILLE, RHODE ISLAND	
DATE: 3/30/2017	DRAWN: TDH	142704	FIGURE T-3	SHEET 33 OF 63

Path: W:\142704_Burrillville_Interconnect_Project\DD\GIS\Apps\RIDEM_Submission\RIDEM_7_Map_Book.mxd



ROAD PLAN STATION 0+00 TO 5+00

SCALE: 1"=40'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

0 40 80 FEET

NOTE: THE LIMITS OF GRADING SHOWN ON THE PLANS ARE APPROXIMATE AND MAY NEED TO BE ADJUSTED BASED ON FIELD CONDITIONS. EXISTING GRADES ARE BASED OFF LIDAR SURVEY. LIMITS OF ROW SHOWN ARE APPROXIMATE. RHODE ISLAND PE SEAL 9008 IS APPLICABLE ONLY TO THE PROPOSED TRANSMISSION STRUCTURE LOCATIONS SHOWN. PROPOSED TRANSMISSION STRUCTURE LOCATIONS ARE APPROXIMATE.

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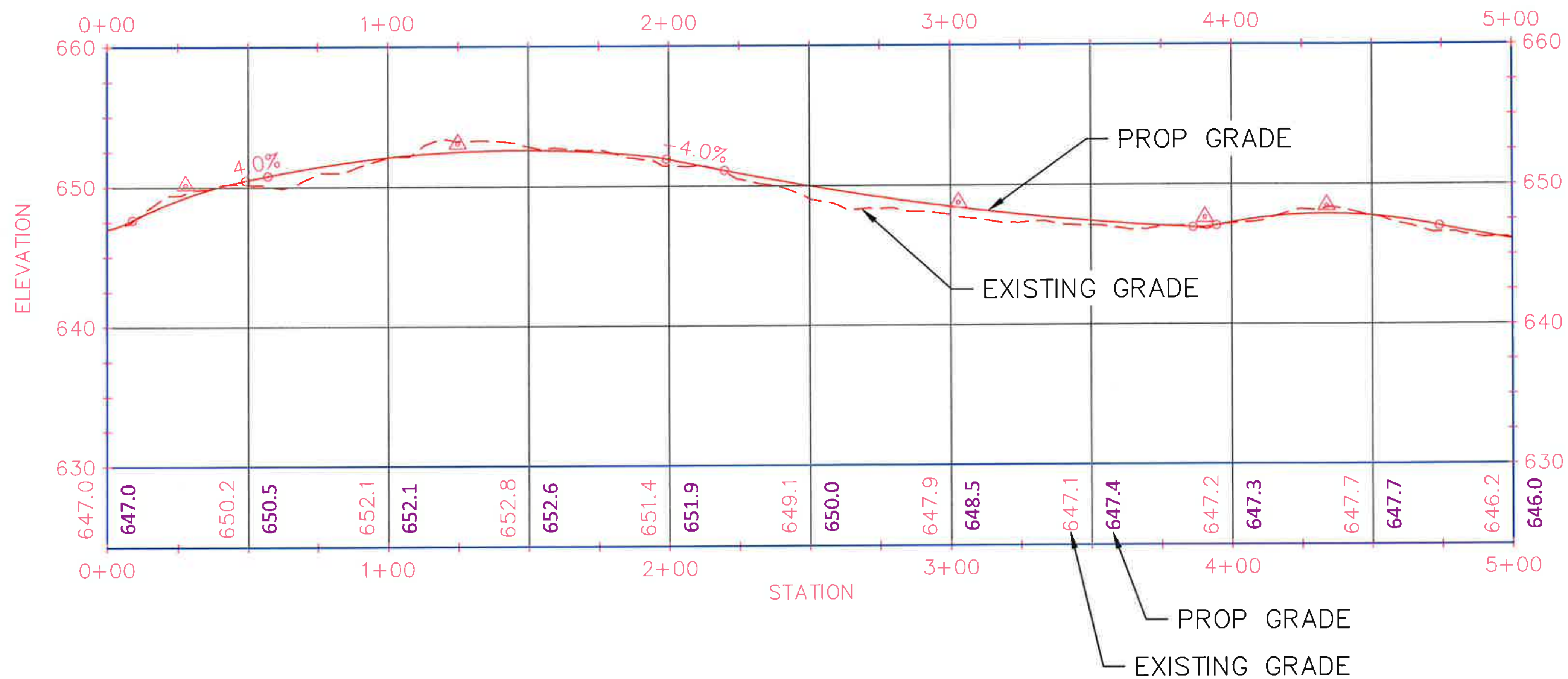
POWER ENGINEERS

NOT FOR CONSTRUCTION

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC	RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND

DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 34 OF 63



ROAD PROFILE STATION 0+00 TO 5+00
HORIZ. SCALE: 1"=50'
VERT. SCALE: 1"=10'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

HOR. SCALE IN FEET
0 50 100 FEET

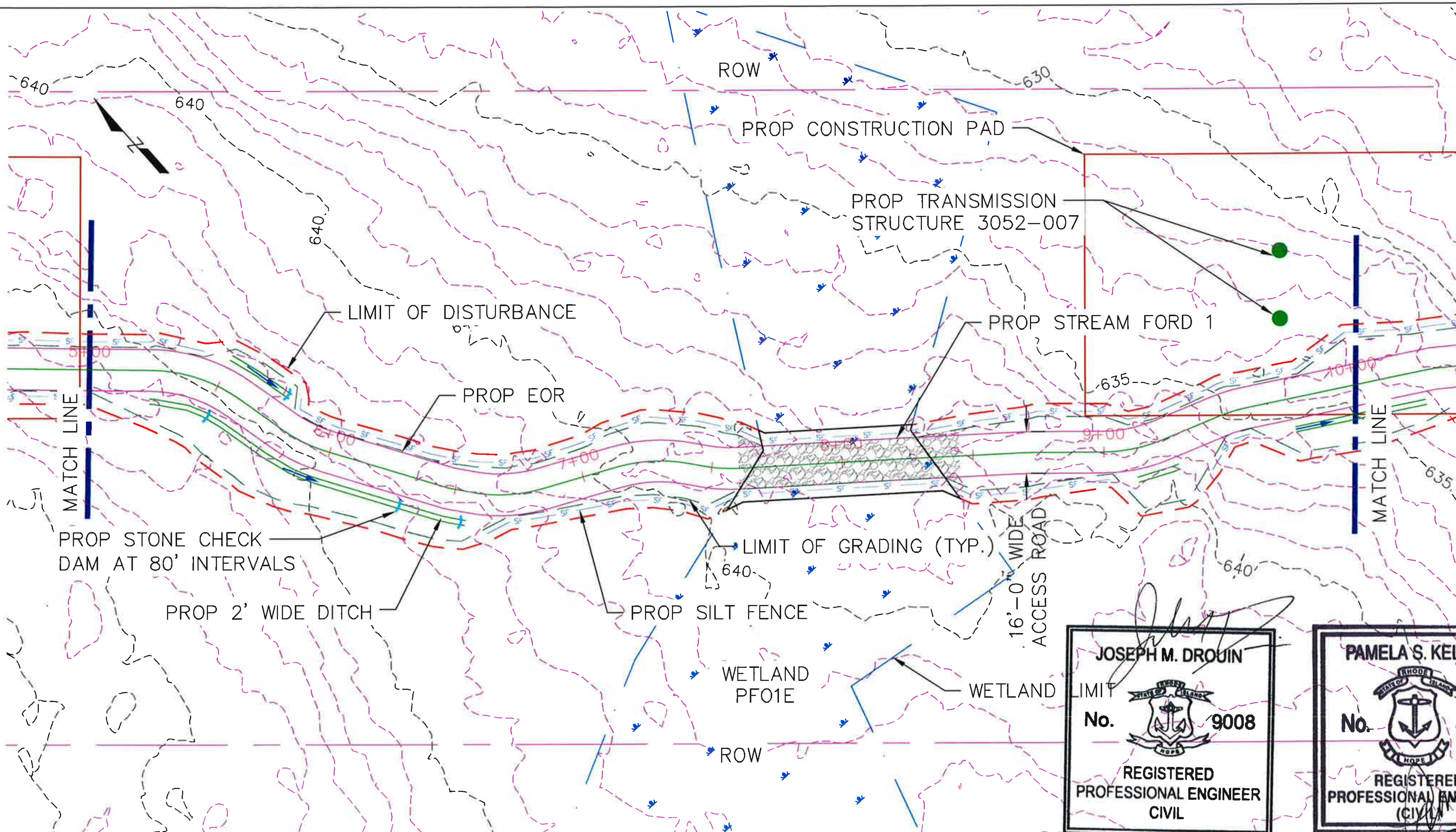
VER. SCALE IN FEET
0 10 20 FEET

Invenergy

nationalgrid

POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 35 OF 63



JOSEPH M. DROUIN
No. 9008
REGISTERED PROFESSIONAL ENGINEER
CIVIL
3/31/17

PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER
(CIVIL)
3/31/17

ROAD PLAN STATION 5+00 TO 10+00
SCALE: 1"=40'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

0 40 80 FEET

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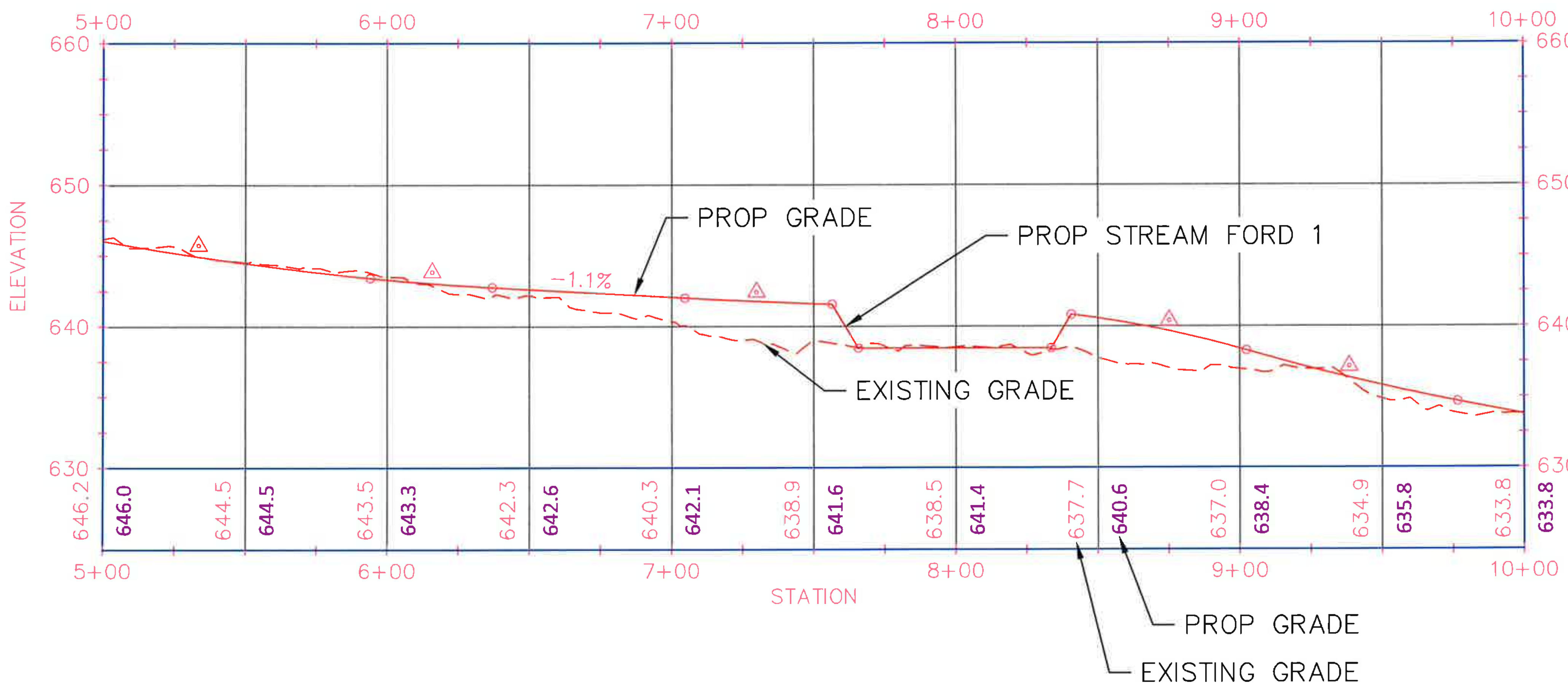
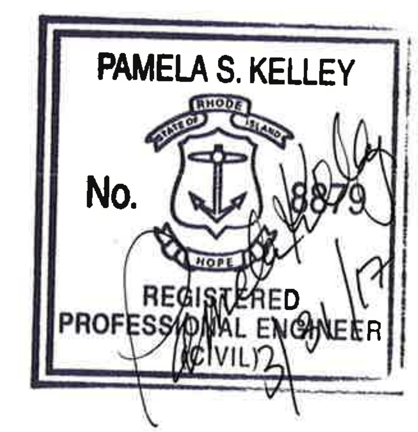
Invenergy

POWER ENGINEERS

nationalgrid

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 36 OF 63





ROAD PROFILE STATION 5+00 TO 10+00
HORIZ. SCALE: 1"=50'
VERT. SCALE: 1"=10'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

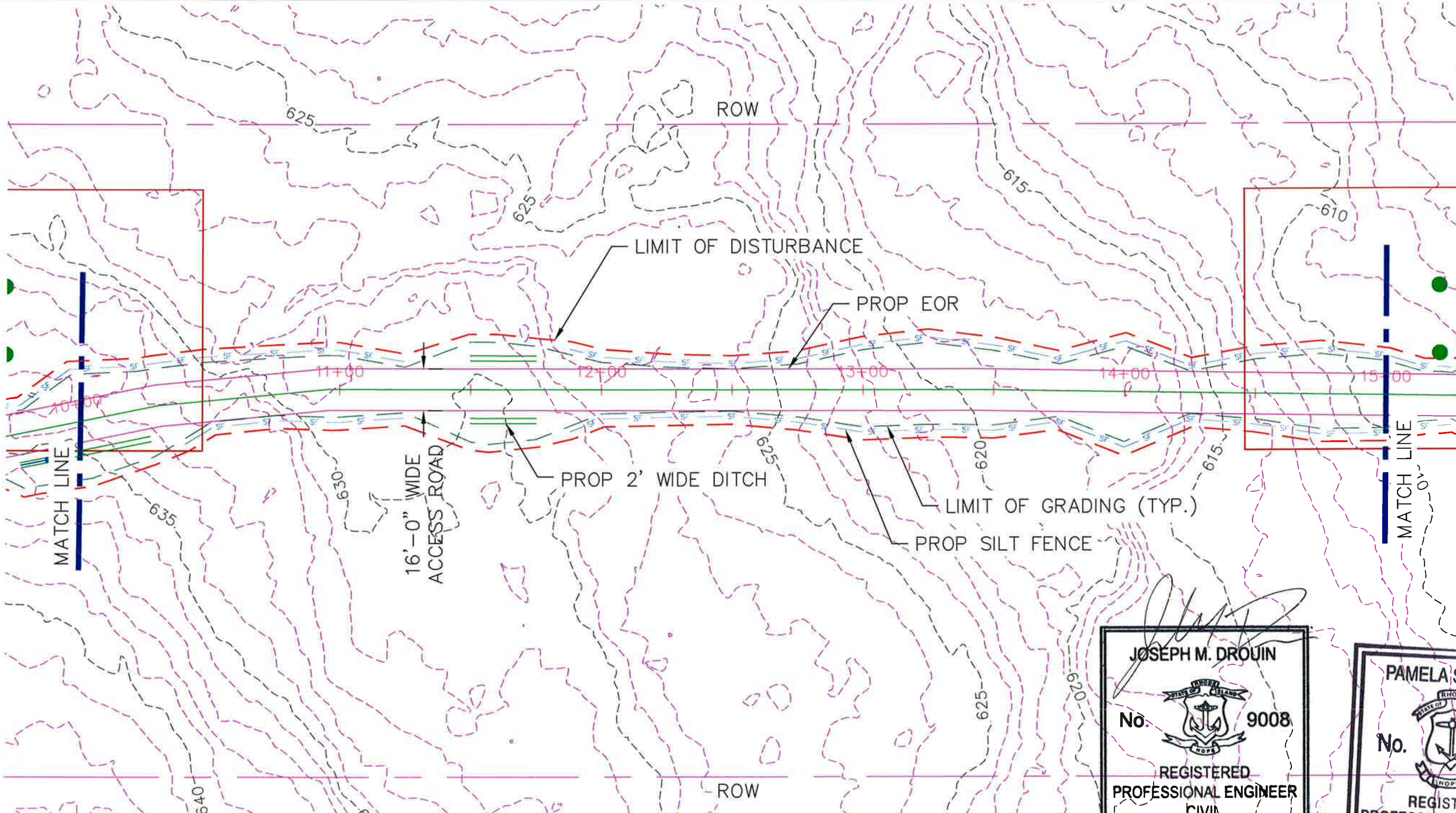
NOT FOR CONSTRUCTION

HOR. SCALE IN FEET
0 50 100 FEET

VER. SCALE IN FEET
0 10 20 FEET

Invenergy
nationalgrid
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 37 OF 63



ROAD PLAN STATION 10+00 TO 15+00
SCALE: 1"=40'

JOSEPH M. DROUIN
No. 9008
REGISTERED PROFESSIONAL ENGINEER CIVIL
3/31/17

PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)

0 40 80 FEET

NOTE: THE LIMITS OF GRADING SHOWN ON THE PLANS ARE APPROXIMATE AND MAY NEED TO BE ADJUSTED BASED ON FIELD CONDITIONS. EXISTING GRADES ARE BASED OFF LIDAR SURVEY. LIMITS OF ROW SHOWN ARE APPROXIMATE. RHODE ISLAND PE SEAL 9008 IS APPLICABLE ONLY TO THE PROPOSED TRANSMISSION STRUCTURE LOCATIONS SHOWN. PROPOSED TRANSMISSION STRUCTURE LOCATIONS ARE APPROXIMATE.

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

Invenergy

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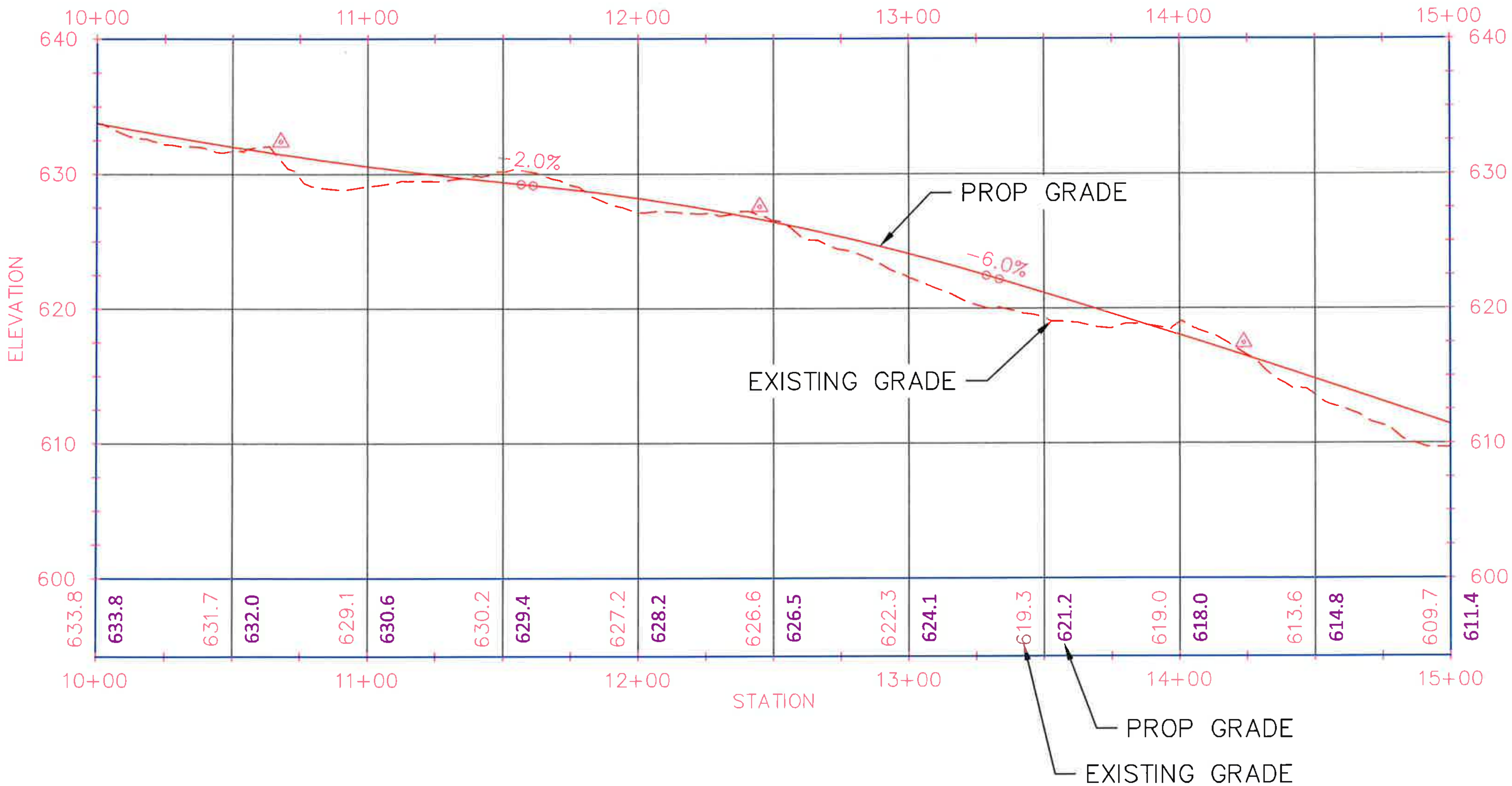
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 38 OF 63



ROAD PROFILE STATION 10+00 TO 15+00
HORIZ. SCALE: 1"=50'
VERT. SCALE: 1"=10'

PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

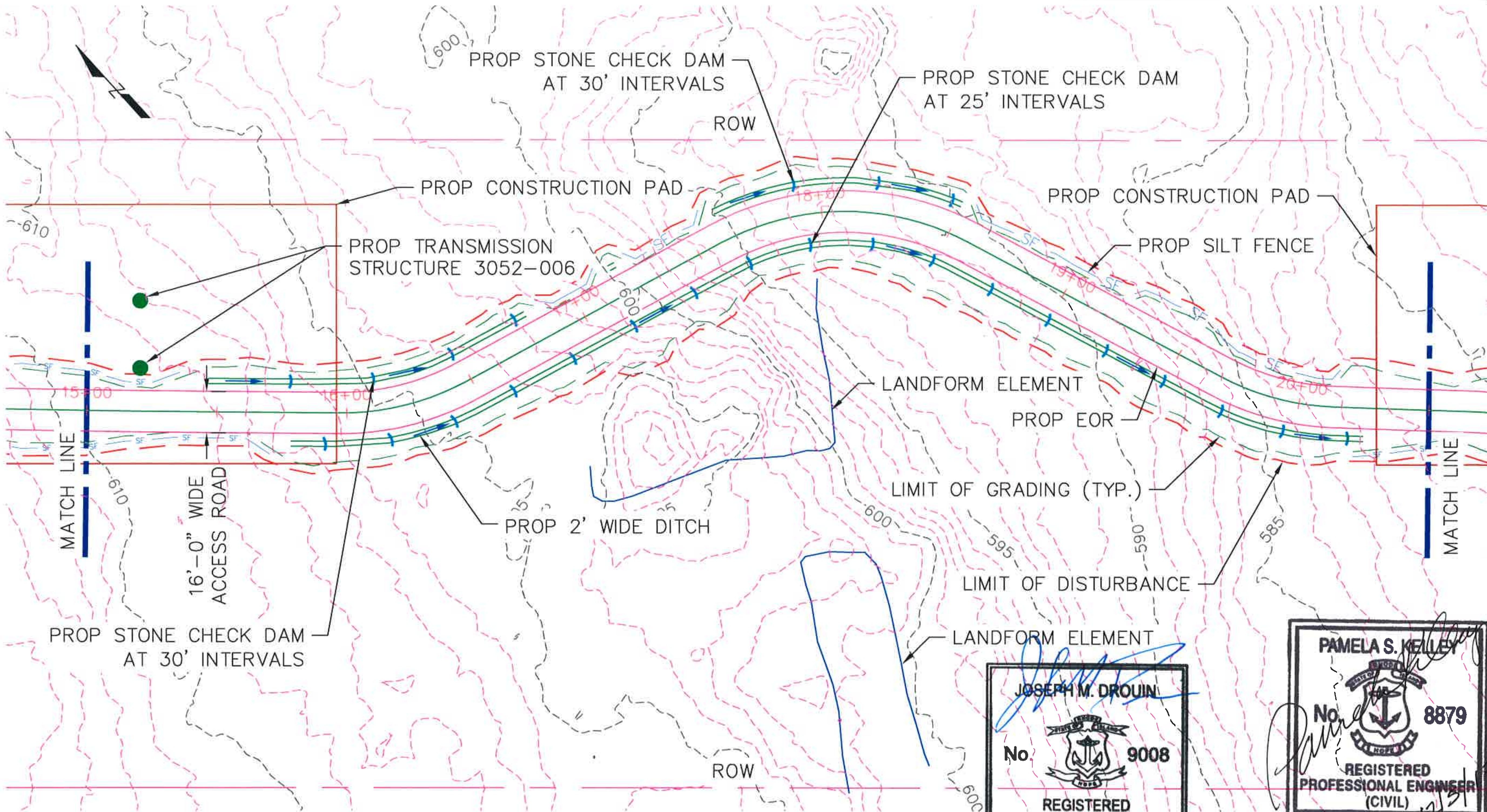
HOR. SCALE IN FEET
0 50 100 FEET

VER. SCALE IN FEET
0 10 20 FEET

Invenergy
nationalgrid
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC	RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND

DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 39 OF 63



JOSEPH M. DROUIN
No. 9008
REGISTERED PROFESSIONAL ENGINEER CIVIL
12/5/17

PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)

ROAD PLAN STATION 15+00 TO 20+50
SCALE: 1"=40'

0 40 80 FEET

NOTE: THE LIMITS OF GRADING SHOWN ON THE PLANS ARE APPROXIMATE AND MAY NEED TO BE ADJUSTED BASED ON FIELD CONDITIONS. EXISTING GRADES ARE BASED OFF LIDAR SURVEY. LIMITS OF ROW SHOWN ARE APPROXIMATE. RHODE ISLAND PE SEAL 9008 IS APPLICABLE ONLY TO THE PROPOSED TRANSMISSION STRUCTURE LOCATIONS SHOWN. PROPOSED TRANSMISSION STRUCTURE LOCATIONS ARE APPROXIMATE.

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

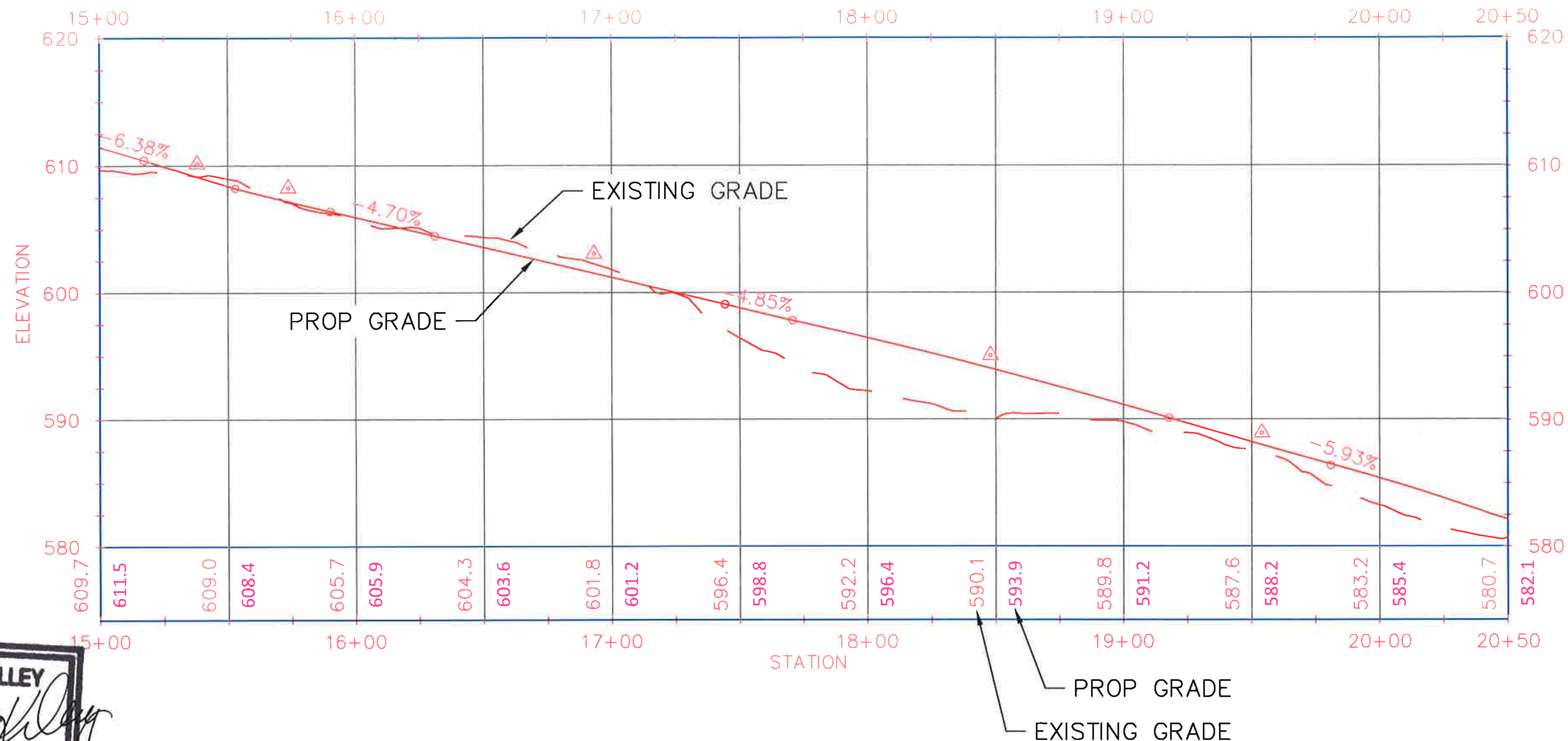
NOT FOR CONSTRUCTION

Invenergy

POWER ENGINEERS

nationalgrid

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 12/05/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 40 OF 63



PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
12/5/17

ROAD PROFILE STATION 15+00 TO 20+50
HORIZ. SCALE: 1"=50'
VERT. SCALE: 1"=10'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

HOR. SCALE IN FEET
0 50 100 FEET

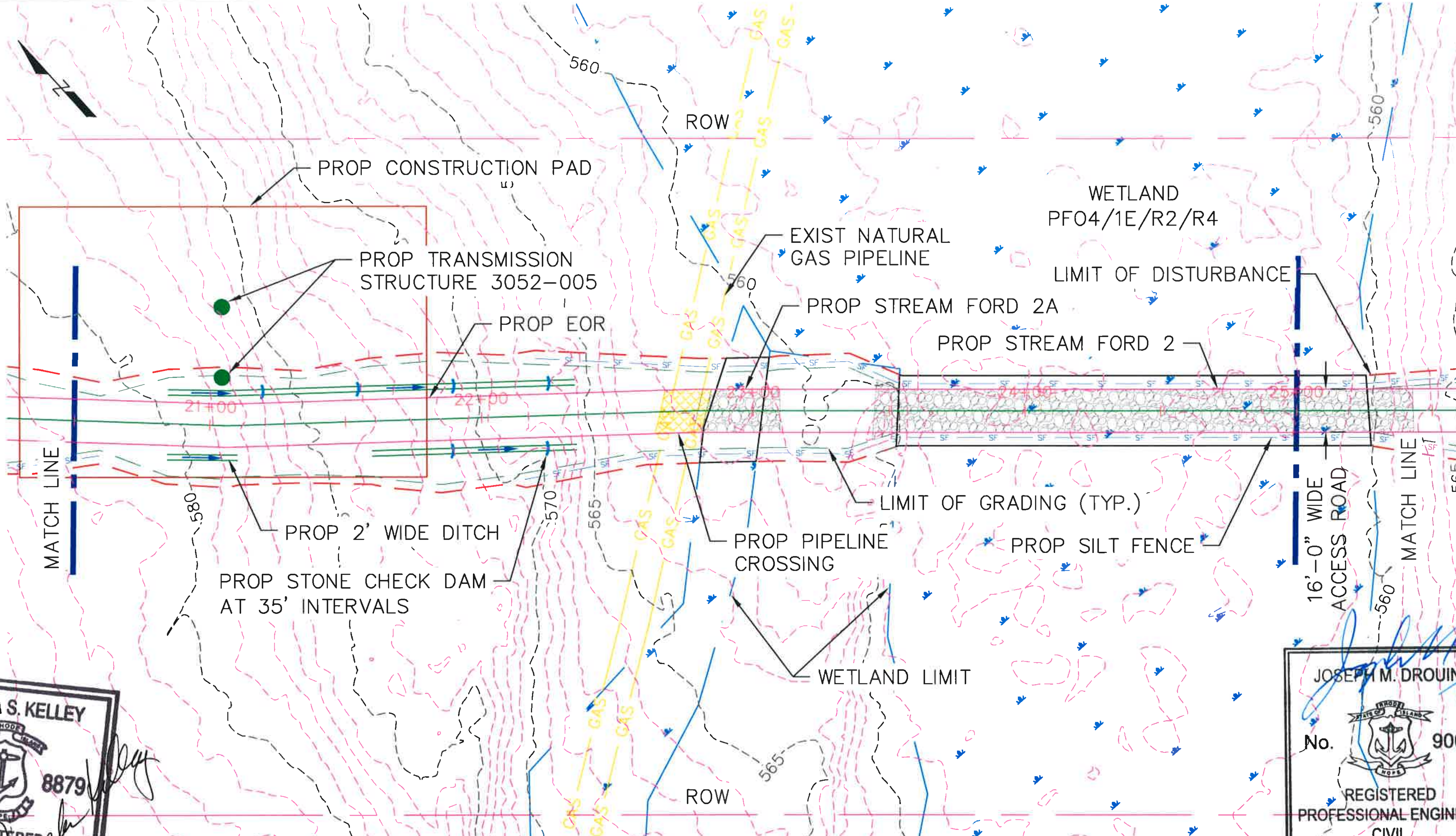
VER. SCALE IN FEET
0 10 20 FEET

Invenergy

nationalgrid

POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 12/05/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 41 OF 63



PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)

JOSEPH M. DROUIN
No. 9008
REGISTERED PROFESSIONAL ENGINEER CIVIL
12/5/17

ROAD PLAN STATION 20+50 TO 25+00

SCALE: 1"=40'

0 40 80 FEET

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOTE: THE LIMITS OF GRADING SHOWN ON THE PLANS ARE APPROXIMATE AND MAY NEED TO BE ADJUSTED BASED ON FIELD CONDITIONS. EXISTING GRADES ARE BASED OFF LIDAR SURVEY. LIMITS OF ROW SHOWN ARE APPROXIMATE. RHODE ISLAND PE SEAL 9008 IS APPLICABLE ONLY TO THE PROPOSED TRANSMISSION STRUCTURE LOCATIONS SHOWN. PROPOSED TRANSMISSION STRUCTURE LOCATIONS ARE APPROXIMATE.

NOT FOR CONSTRUCTION

Invenergy

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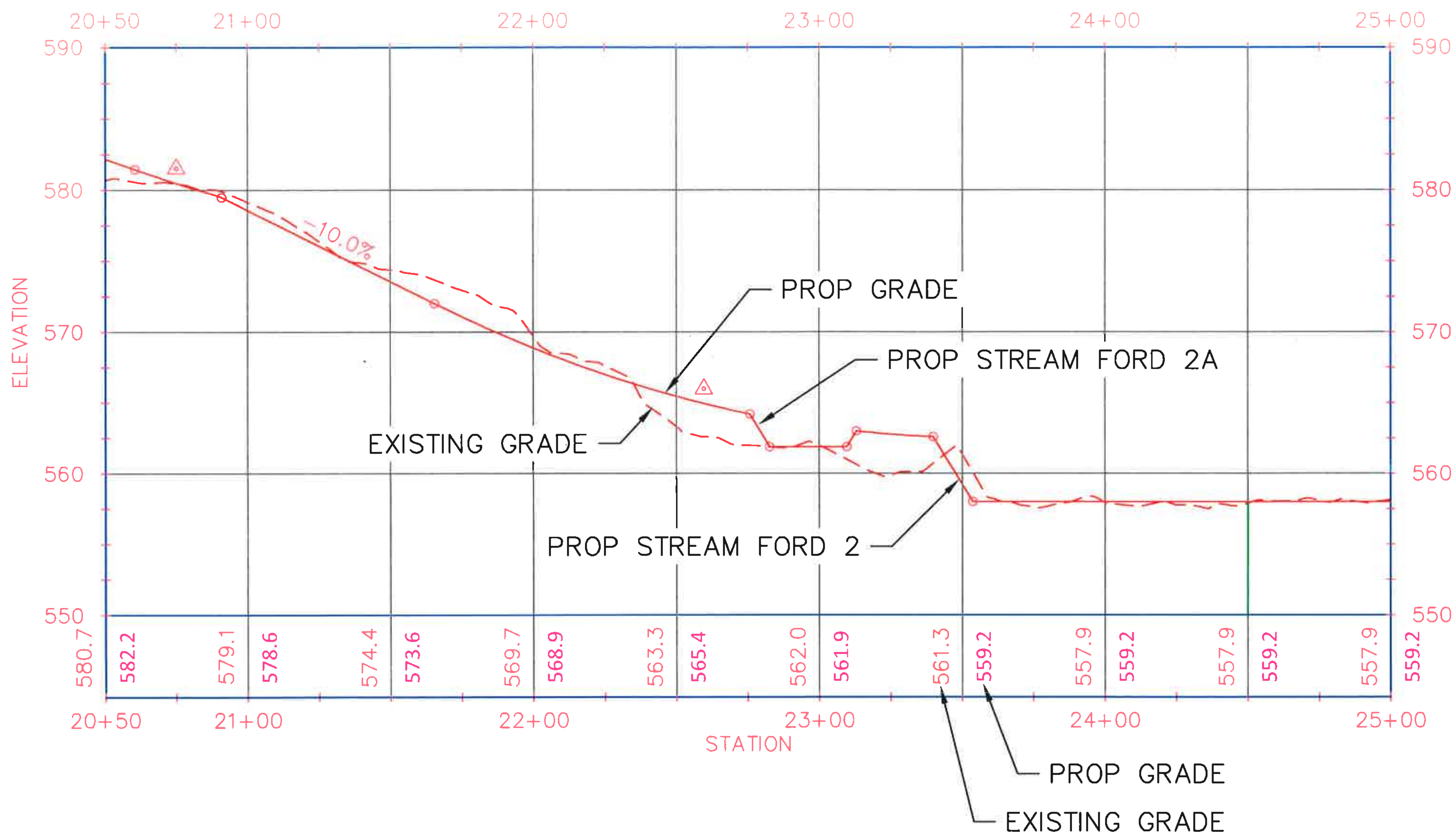
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 12/05/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 42 OF 63



PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)

ROAD PROFILE STATION 20+50 TO 25+00
HORIZ. SCALE: 1"=50'
VERT. SCALE: 1"=10'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

HOR. SCALE IN FEET
0 50 100 FEET

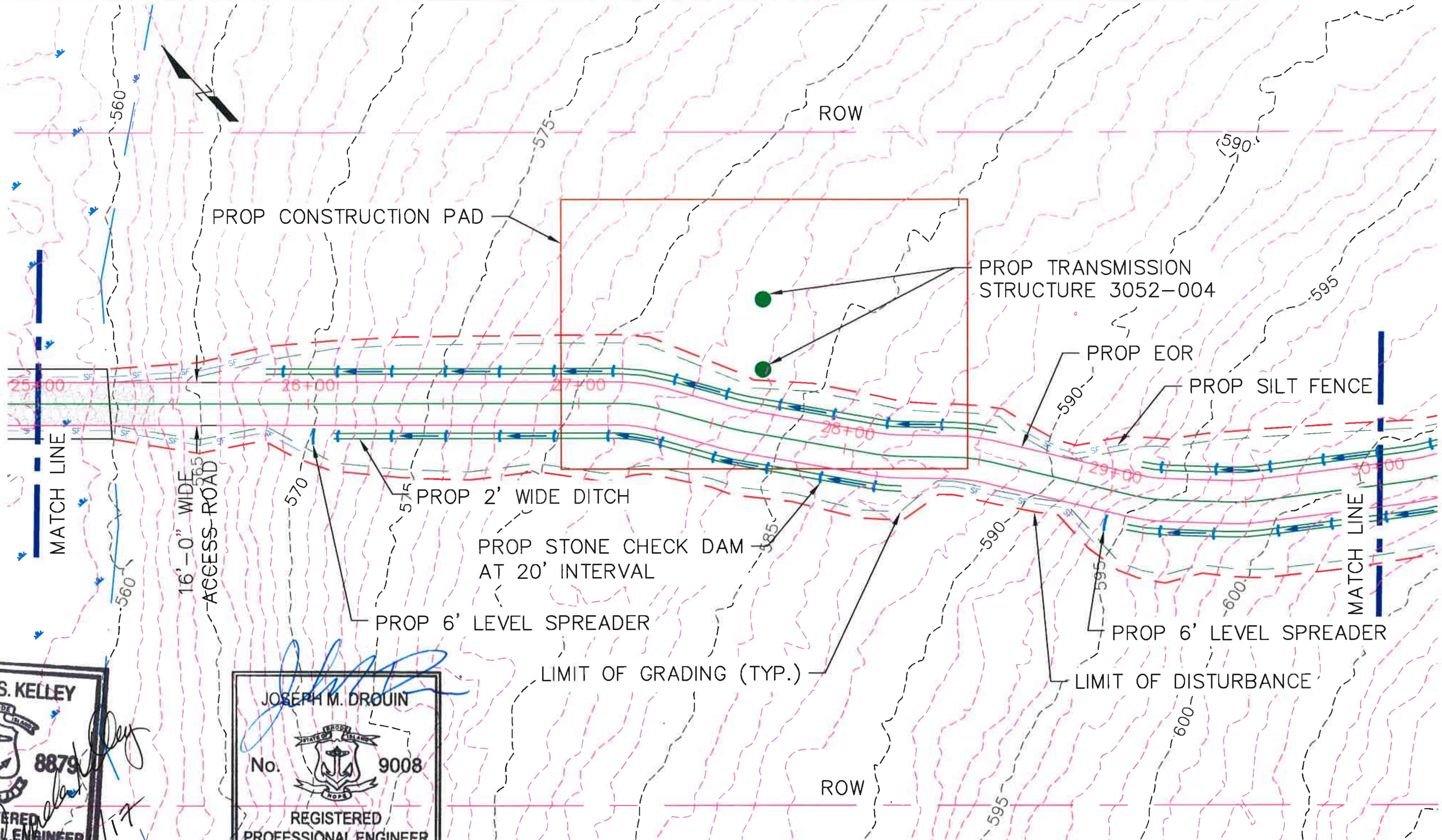
VER. SCALE IN FEET
0 10 20 FEET

Invenergy

nationalgrid

POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC	RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND
DATE: 12/05/2017 | DRAWN: RST | 142704	FIGURE T-4 | SHEET 43 OF 63



PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)

JOSEPH M. DROUIN
No. 9008
REGISTERED PROFESSIONAL ENGINEER CIVIL

12/5/17

ROAD PLAN STATION 25+00 TO 30+00
SCALE: 1"=40'

0 40 80 FEET

NOTE: THE LIMITS OF GRADING SHOWN ON THE PLANS ARE APPROXIMATE AND MAY NEED TO BE ADJUSTED BASED ON FIELD CONDITIONS. EXISTING GRADES ARE BASED OFF LIDAR SURVEY. LIMITS OF ROW SHOWN ARE APPROXIMATE. RHODE ISLAND PE SEAL 9008 IS APPLICABLE ONLY TO THE PROPOSED TRANSMISSION STRUCTURE LOCATIONS SHOWN. PROPOSED TRANSMISSION STRUCTURE LOCATIONS ARE APPROXIMATE.

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Invenergy

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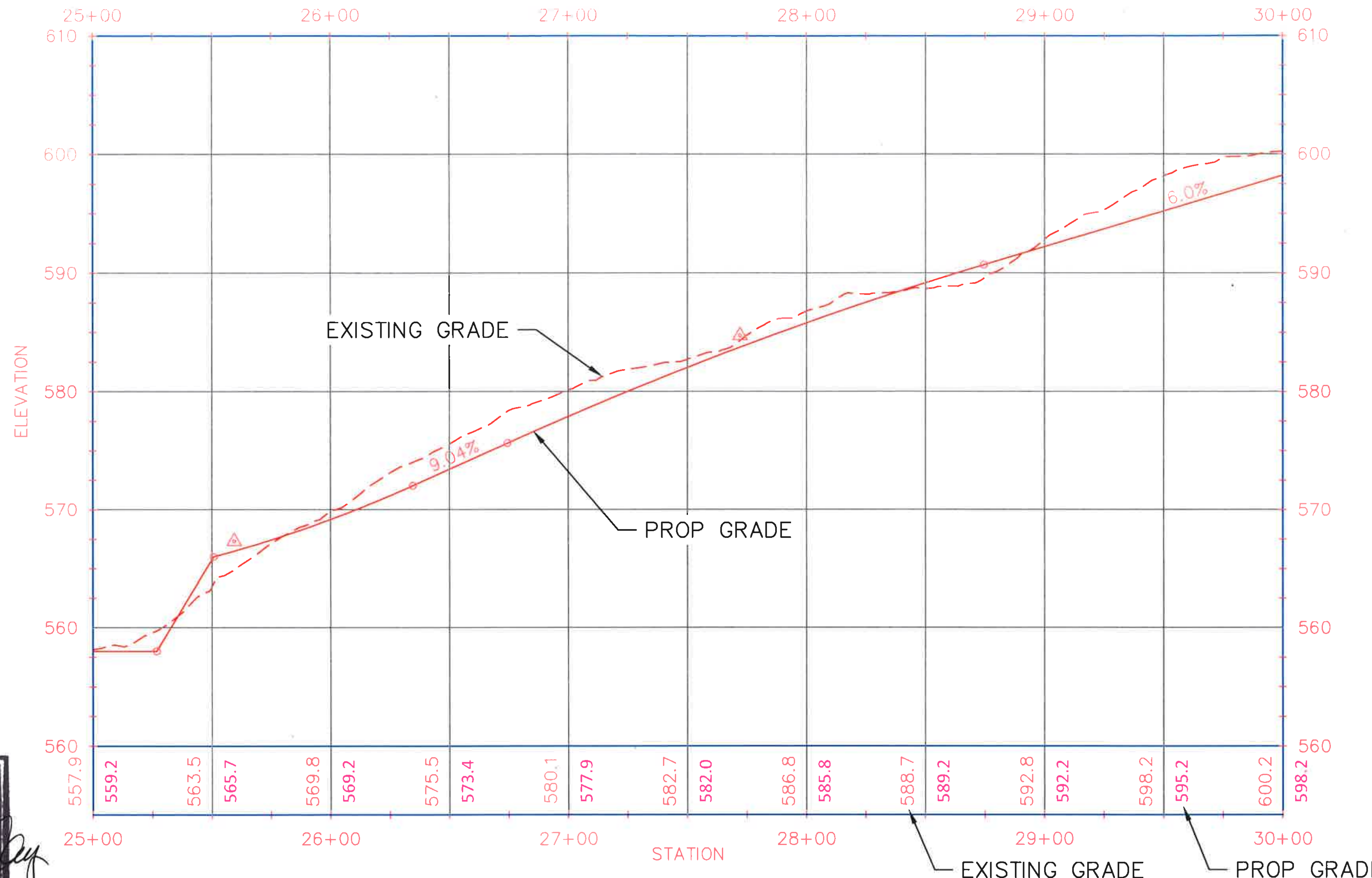
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 12/05/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 44 OF 63



PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
12/5/17

ROAD PROFILE STATION 25+00 TO 30+00

HORIZ. SCALE: 1"=50'

VERT. SCALE: 1"=10'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

HOR. SCALE IN FEET
0 50 100 FEET

VER. SCALE IN FEET
0 10 20 FEET

Invenergy

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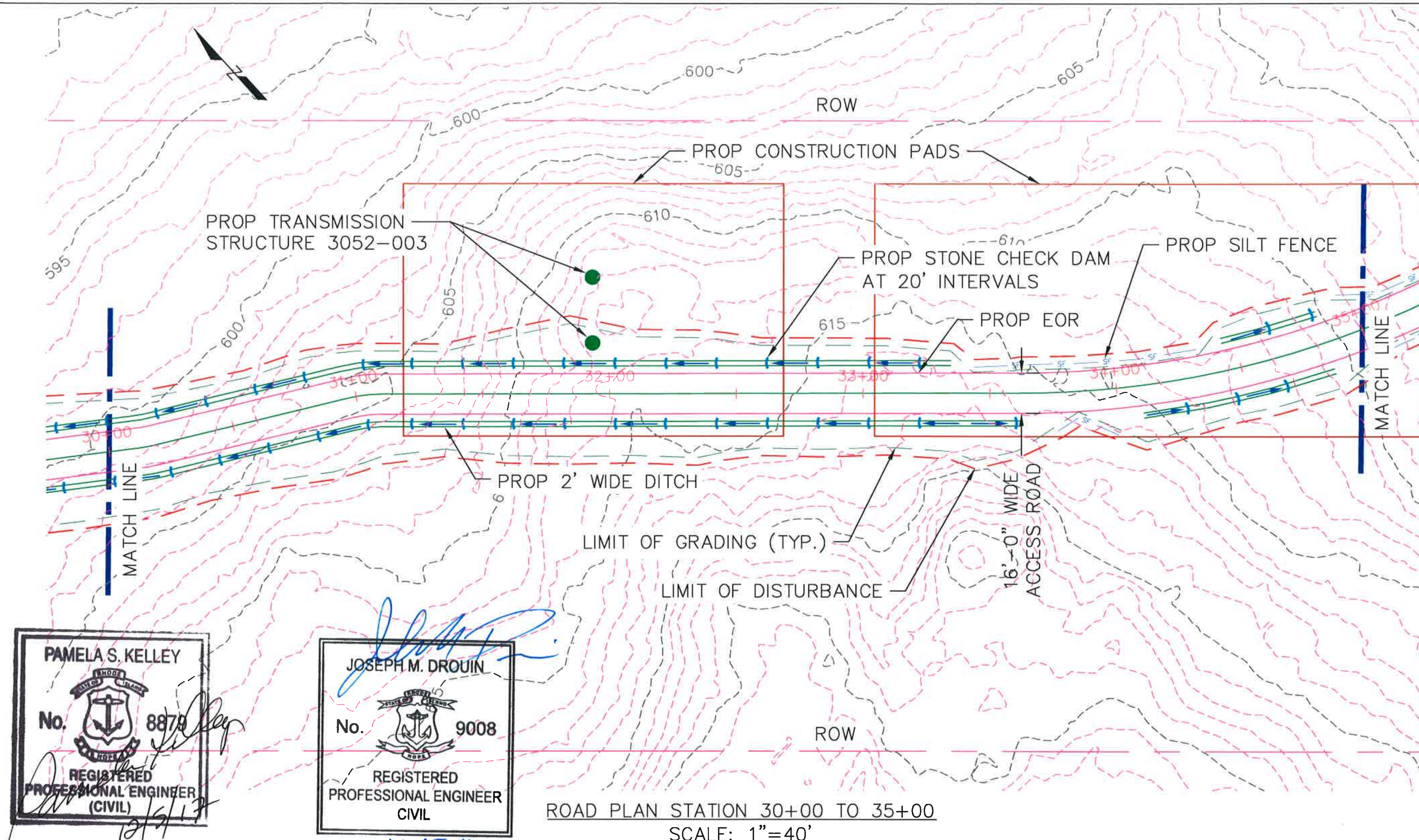
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC	RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND

DATE: 12/05/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 45 OF 63



ROAD PLAN STATION 30+00 TO 35+00
SCALE: 1"=40'

0 40 80 FEET

NOTE: THE LIMITS OF GRADING SHOWN ON THE PLANS ARE APPROXIMATE AND MAY NEED TO BE ADJUSTED BASED ON FIELD CONDITIONS. EXISTING GRADES ARE BASED OFF LIDAR SURVEY. LIMITS OF ROW SHOWN ARE APPROXIMATE. RHODE ISLAND PE SEAL 9008 IS APPLICABLE ONLY TO THE PROPOSED TRANSMISSION STRUCTURE LOCATIONS SHOWN. PROPOSED TRANSMISSION STRUCTURE LOCATIONS ARE APPROXIMATE.

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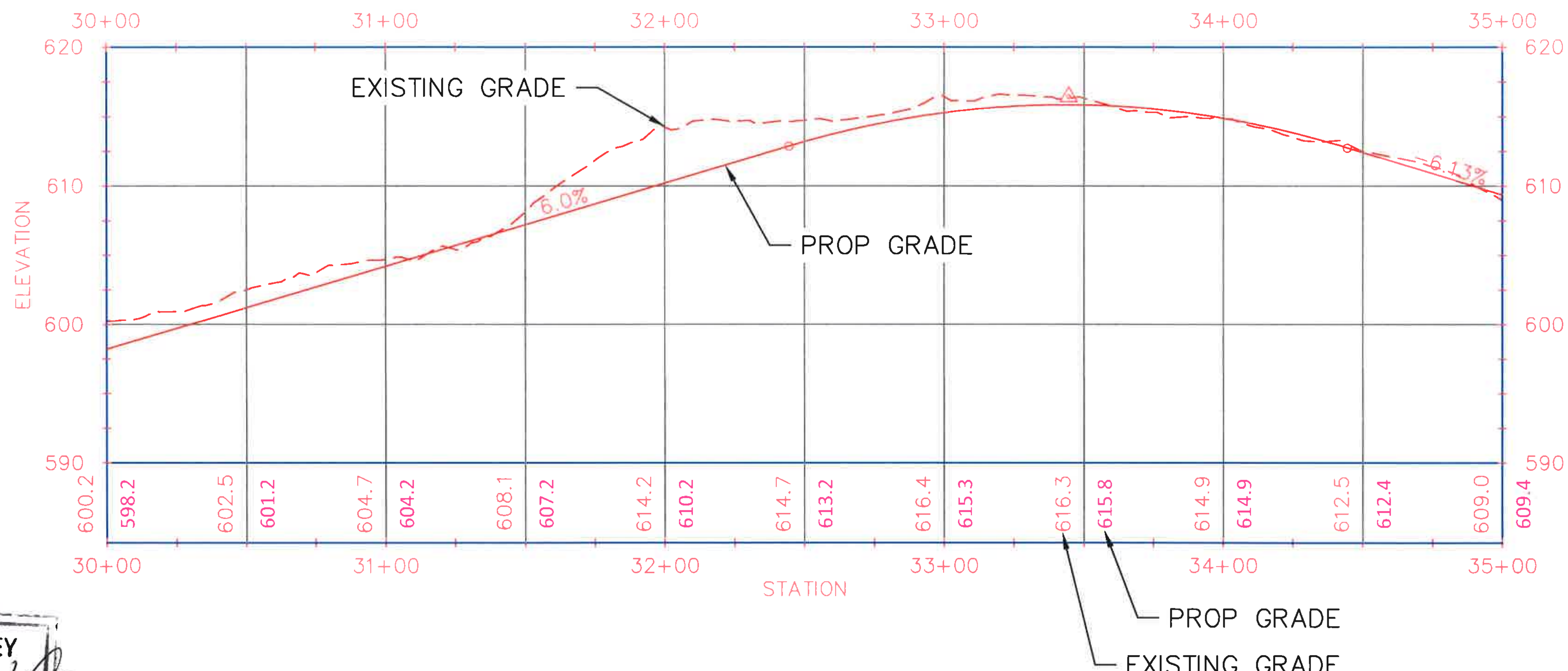
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 12/05/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 46 OF 63



ROAD PROFILE STATION 30+00 TO 35+00

HORIZ. SCALE: 1"=50'

VERT. SCALE: 1"=10'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

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POWER ENGINEERS

HOR. SCALE IN FEET

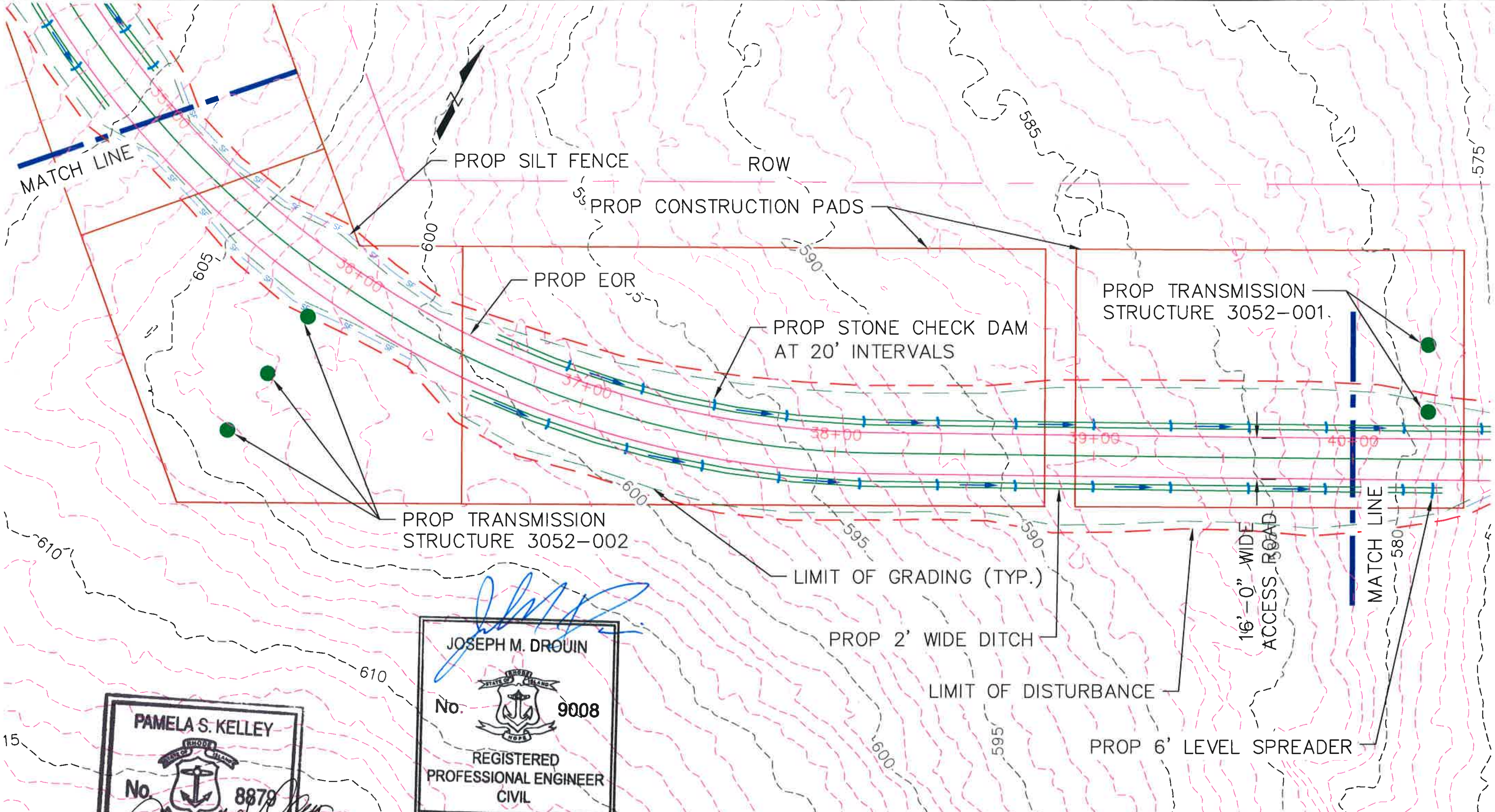
0 50 100 FEET

VER. SCALE IN FEET

0 10 20 FEET

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC	RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND

DATE: 12/05/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 47 OF 63



JOSEPH M. DROUIN
No. 9008
REGISTERED PROFESSIONAL ENGINEER CIVIL
12/5/17

PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
12/5/17

ROAD PLAN STATION 35+00 TO 40+00
SCALE: 1"=40'

0 40 80 FEET

NOTE: THE LIMITS OF GRADING SHOWN ON THE PLANS ARE APPROXIMATE AND MAY NEED TO BE ADJUSTED BASED ON FIELD CONDITIONS. EXISTING GRADES ARE BASED OFF LIDAR SURVEY. LIMITS OF ROW SHOWN ARE APPROXIMATE. RHODE ISLAND PE SEAL 9008 IS APPLICABLE ONLY TO THE PROPOSED TRANSMISSION STRUCTURE LOCATIONS SHOWN. PROPOSED TRANSMISSION STRUCTURE LOCATIONS ARE APPROXIMATE.

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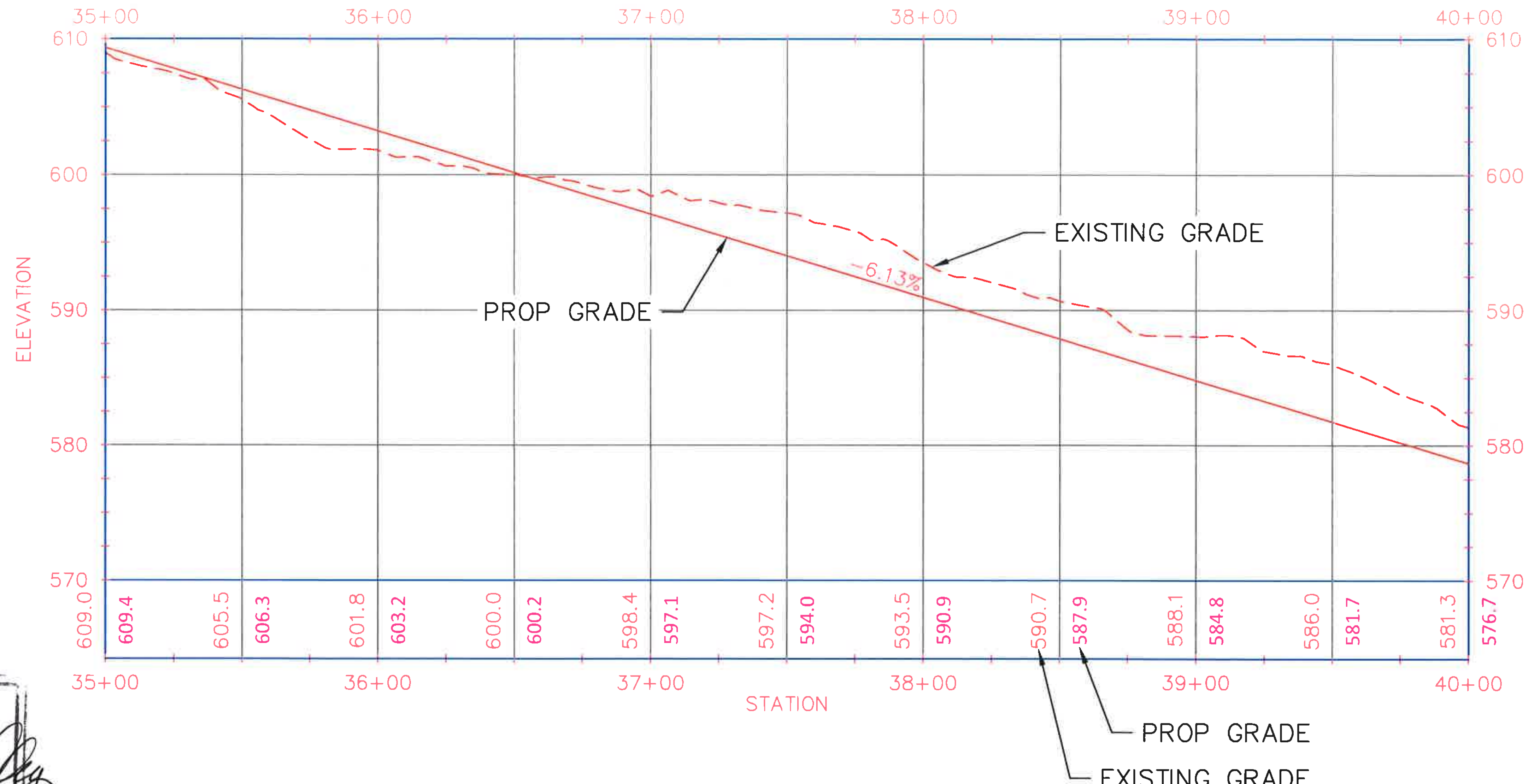
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 12/05/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 48 OF 63



PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
12/5/17

ROAD PROFILE STATION 35+00 TO 40+00
HORIZ. SCALE: 1"=50'
VERT. SCALE: 1"=10'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

HOR. SCALE IN FEET
0 50 100 FEET

VER. SCALE IN FEET
0 10 20 FEET

Invenergy

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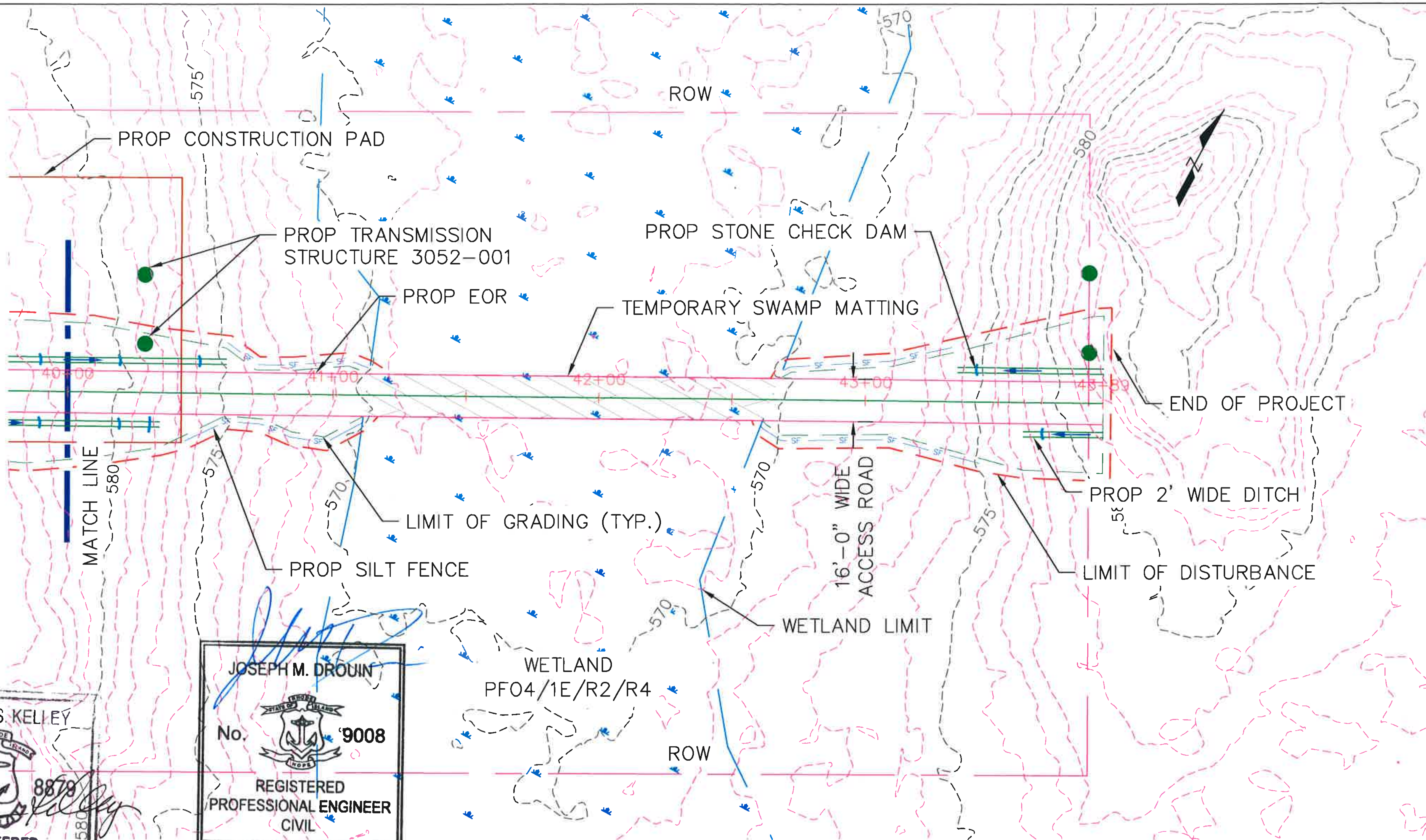
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC	RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND
DATE: 12/05/2017 | DRAWN: RST | 142704	FIGURE T-4 | SHEET 49 OF 63



JOSEPH M. DROUIN
No. 9008
REGISTERED PROFESSIONAL ENGINEER CIVIL
12/5/17

PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
12/5/17

ROAD PLAN STATION 40+00 TO 43+89
SCALE: 1"=40'

0 40 80 FEET

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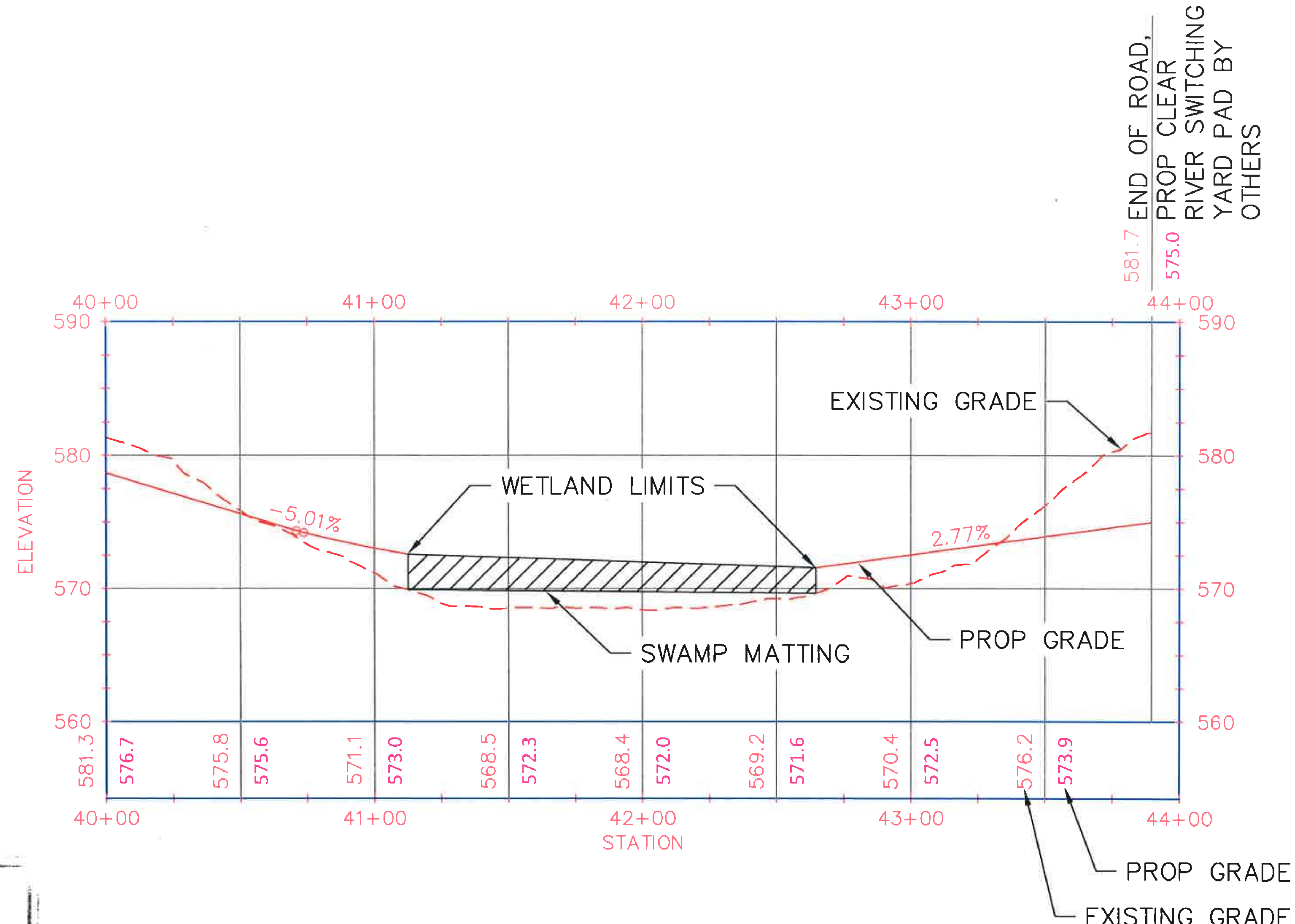
BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND	
DATE: 12/05/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 50 OF 63



PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
12/5/17

ROAD PROFILE STATION 40+00 TO 45+00
HORIZ. SCALE: 1"=50'
VERT. SCALE: 1"=10'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

HOR. SCALE IN FEET
0 50 100 FEET

VER. SCALE IN FEET
0 10 20 FEET

Invenergy

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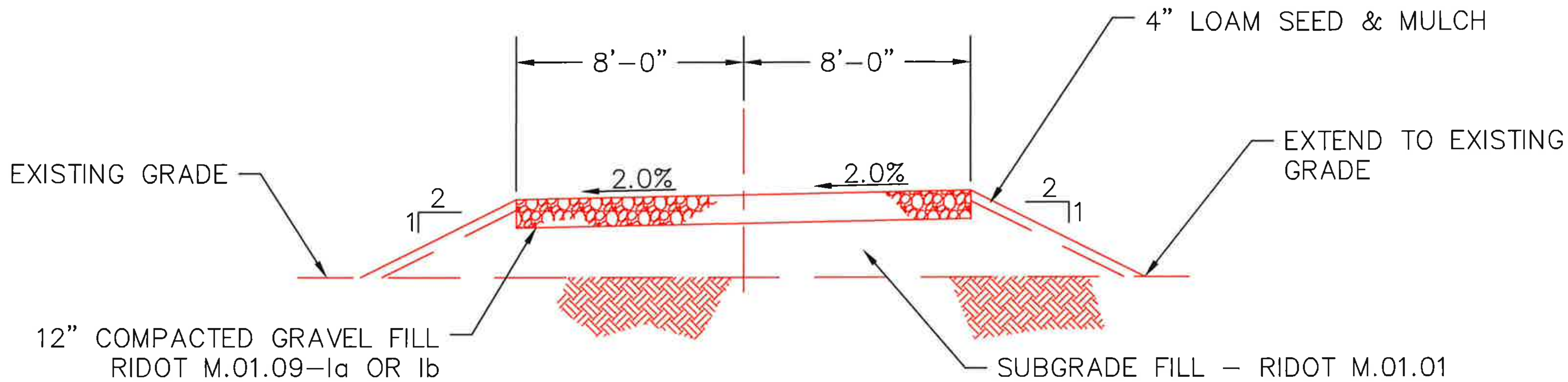
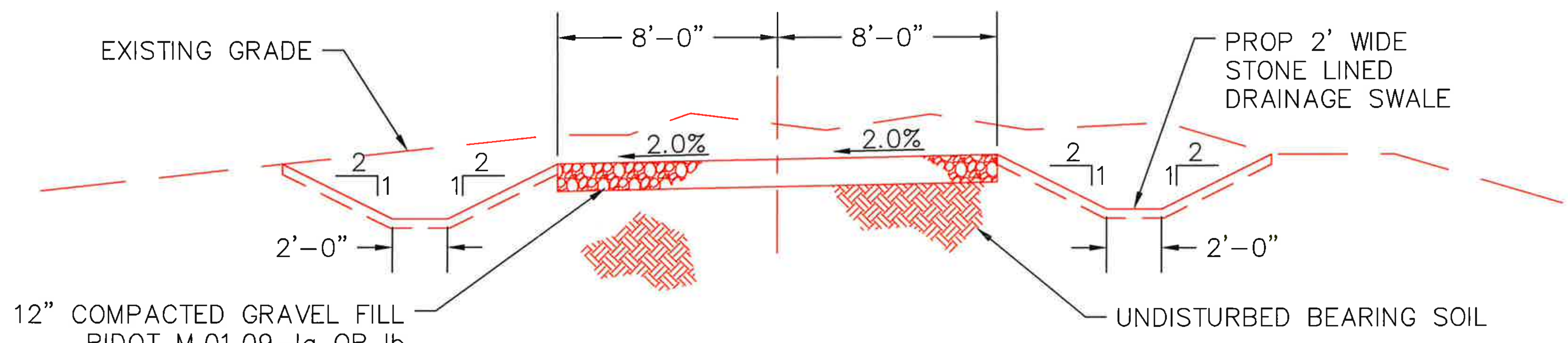
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC	RIDEM AND USACE PERMIT DRAWINGS PROPOSED ACCESS ROAD BURRILLVILLE, RHODE ISLAND

DATE: 12/05/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 51 OF 63



TYPICAL ACCESS ROAD AND SPUR SECTION AT FILL AREA



TYPICAL ACCESS ROAD SECTION AT CUT AREA

PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER CIVIL
3/31/17

TYPICAL ACCESS ROAD SECTIONS
SCALE: 1"=5'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

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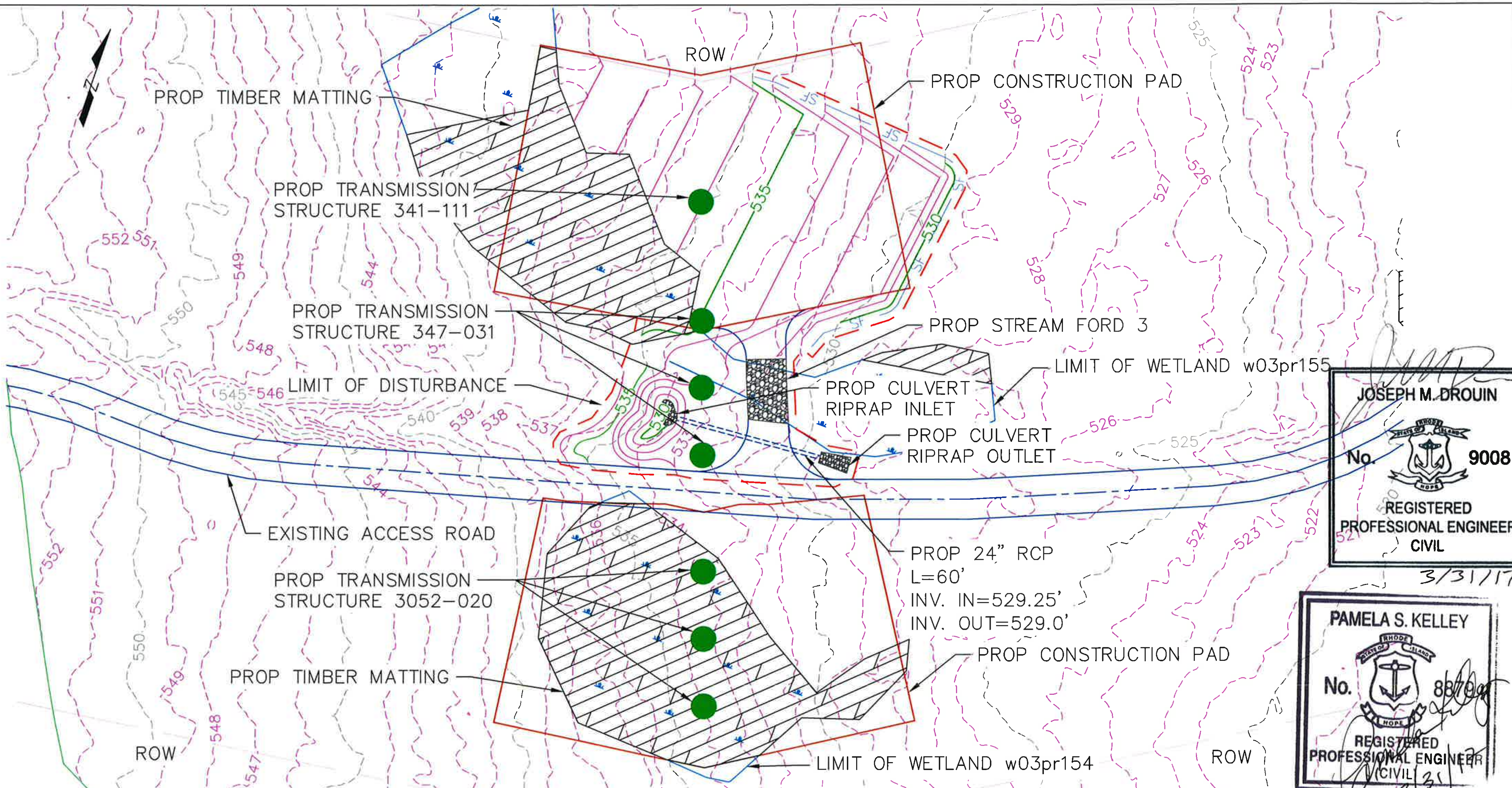
0 5 10 FEET

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS ACCESS ROAD CROSS SECTIONS BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 52 OF 63



PROPOSED GRADING PLAN
AROUND STRUCTURE 347-031
SCALE: 1"=40'

0 40 80 FEET

NOTE: THE LIMITS OF GRADING SHOWN ON THE PLANS ARE APPROXIMATE AND MAY NEED TO BE ADJUSTED BASED ON FIELD CONDITIONS. EXISTING GRADES ARE BASED OFF LIDAR SURVEY. LIMITS OF ROW SHOWN ARE APPROXIMATE. RHODE ISLAND PE SEAL 9008 IS APPLICABLE ONLY TO THE PROPOSED TRANSMISSION STRUCTURE LOCATIONS SHOWN. PROPOSED TRANSMISSION STRUCTURE LOCATIONS ARE APPROXIMATE.

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

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Invenergy

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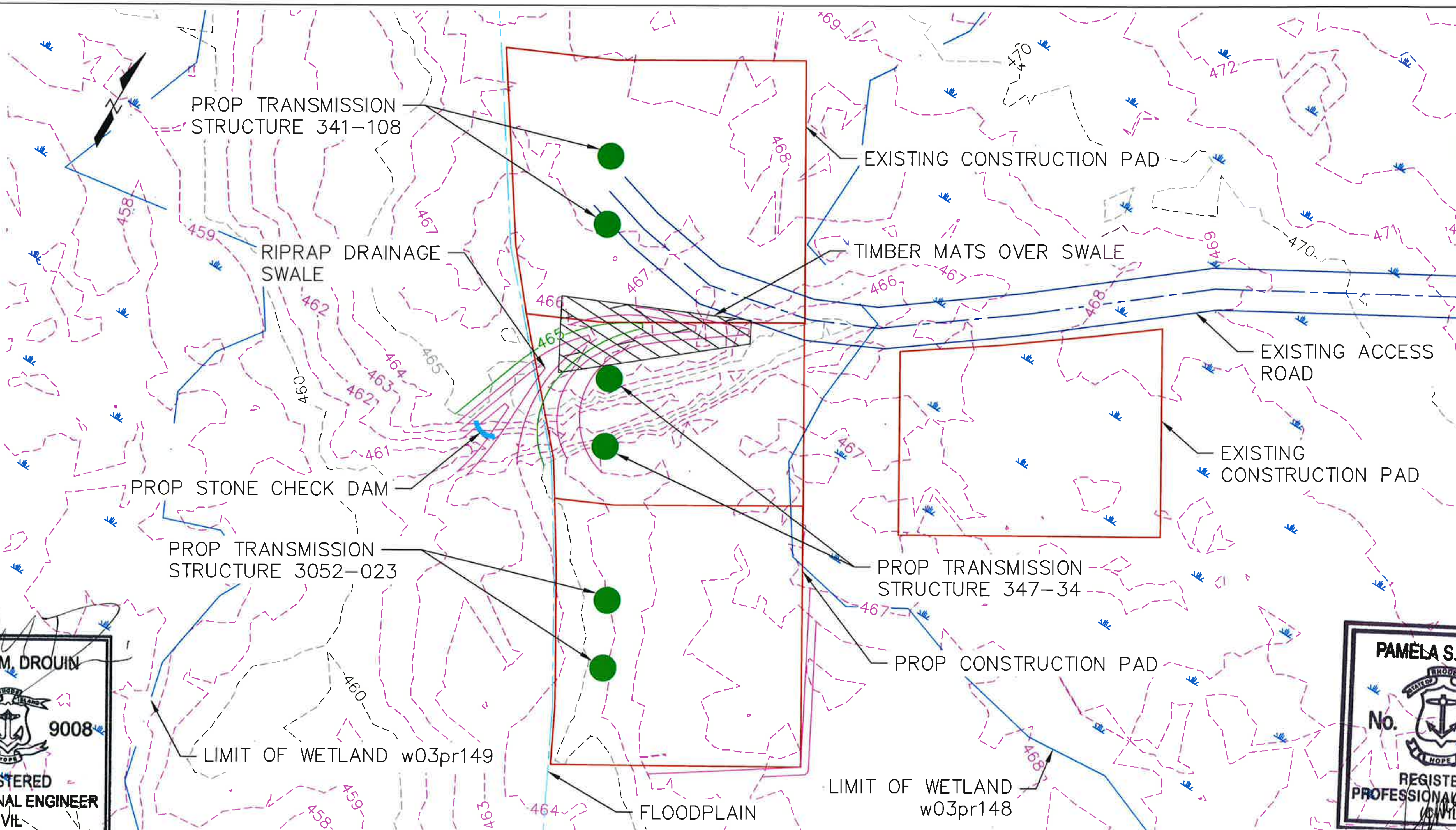
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC	RIDEM AND USACE PERMIT DRAWINGS CONSTRUCTION PAD GRADING BURRILLVILLE, RHODE ISLAND

DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 53 OF 63



JOSEPH M. DROUIN
No. 9008
REGISTERED PROFESSIONAL ENGINEER
CIVIL
3/31/17

PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER
(CIVIL)
3/31/17

PROPOSED GRADING PLAN
AROUND STRUCTURE 347-034
SCALE: 1"=40'

0 40 80 FEET

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

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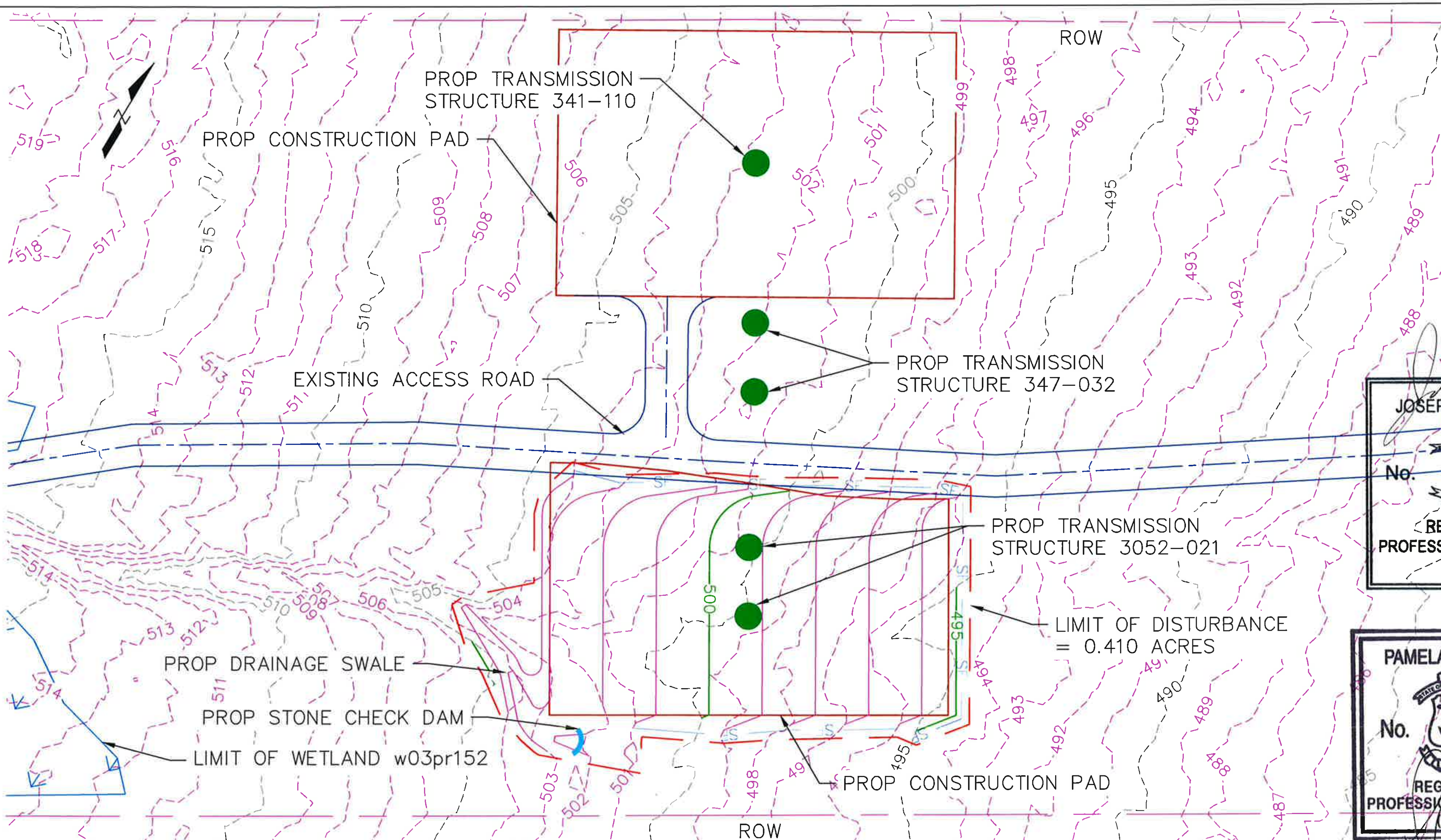
BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS CONSTRUCTION PAD GRADING BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 54 OF 63



JOSEPH M. DROUIN
No. 9008
REGISTERED PROFESSIONAL ENGINEER CIVIL
3/31/17

PAMELA S. KELLEY
No. 8879
REGISTERED PROFESSIONAL ENGINEER (CIVIL)

PROPOSED GRADING PLAN
AROUND STRUCTURE 3052-021
SCALE: 1"=40'

0 40 80 FEET

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

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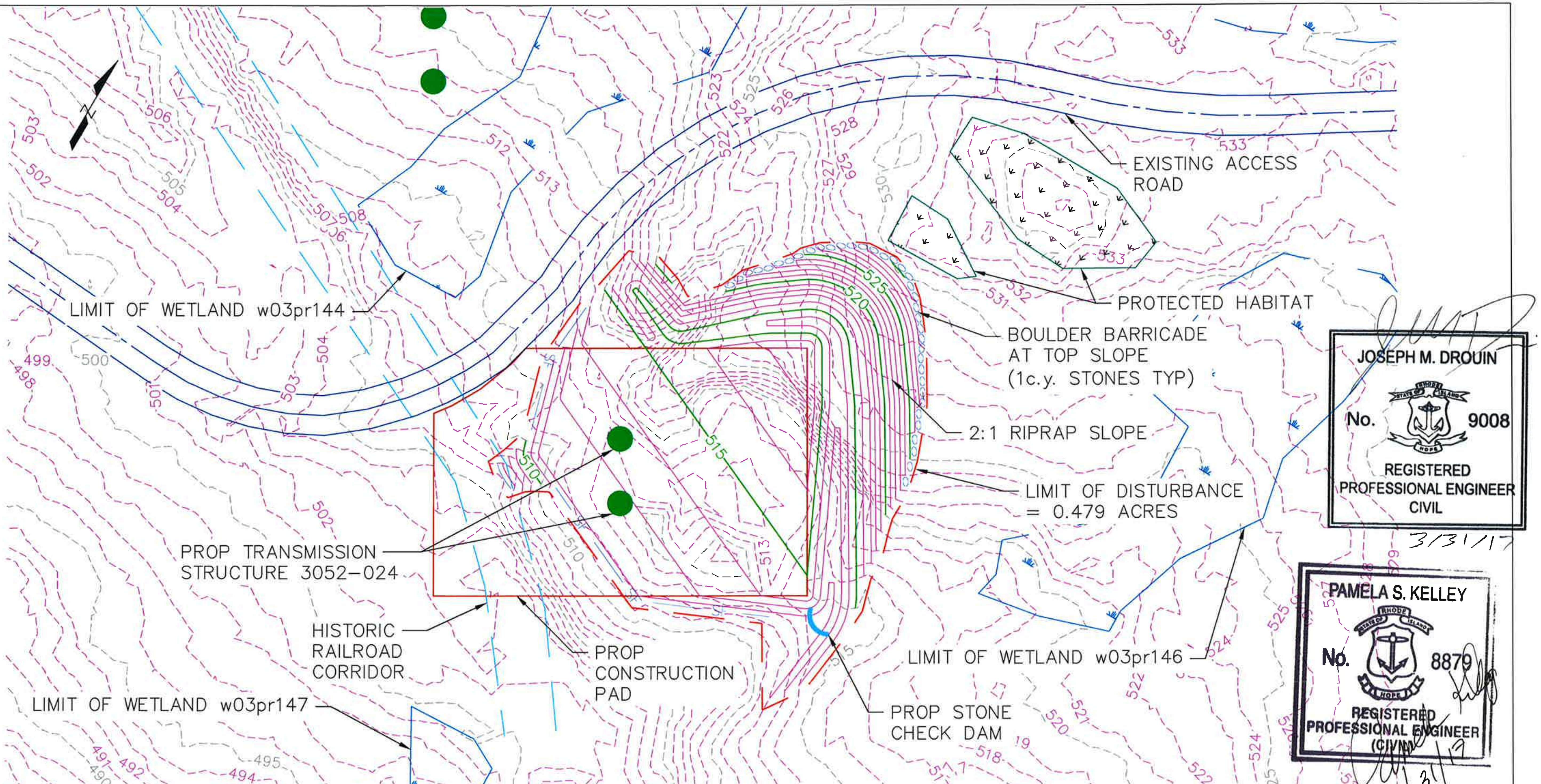
BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS CONSTRUCTION PAD GRADING BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 55 OF 63



PROPOSED GRADING PLAN
AROUND STRUCTURE 3052-024
SCALE: 1"=40'

0 40 80 FEET

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

NOT FOR CONSTRUCTION

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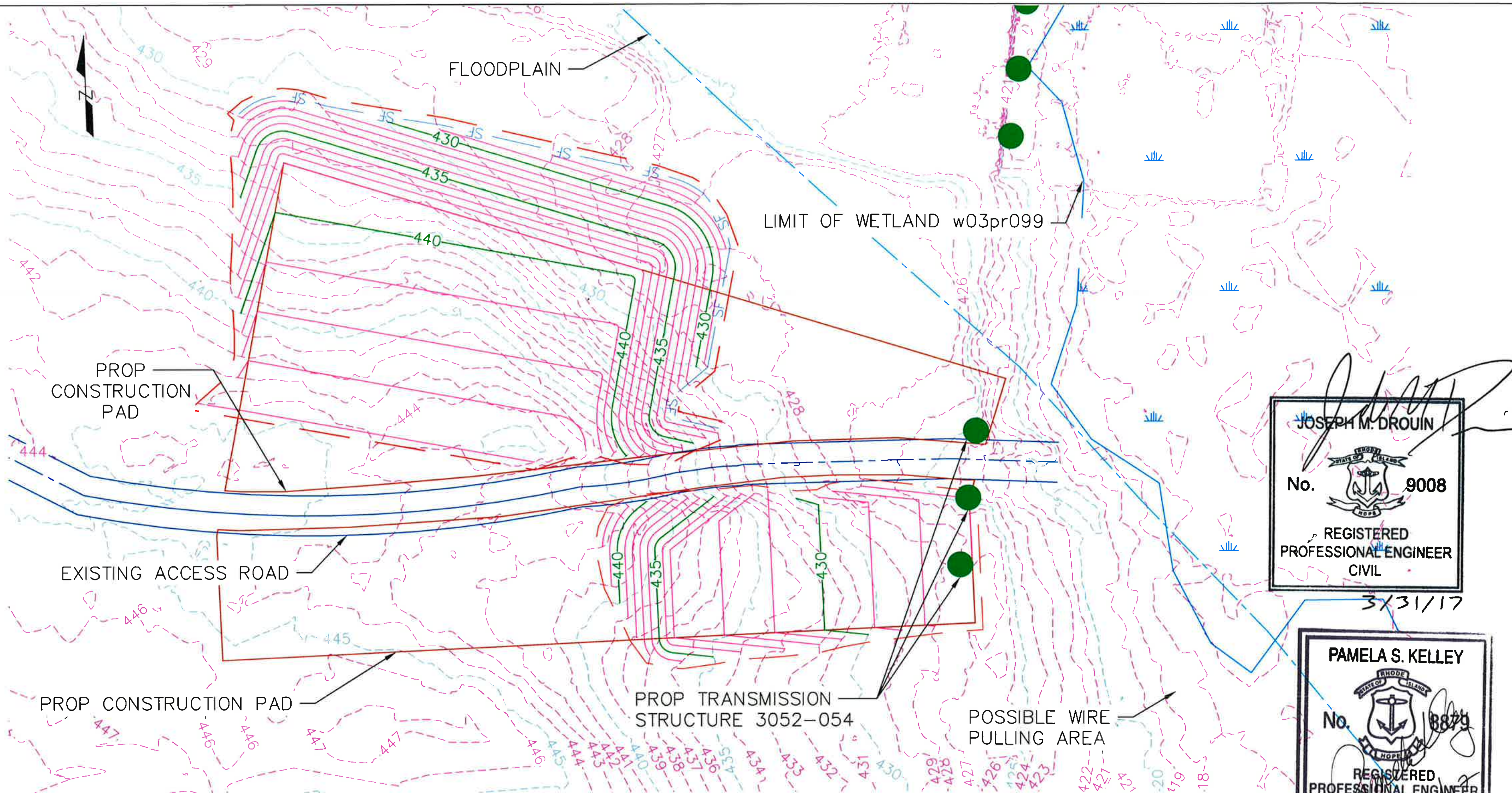
BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS CONSTRUCTION PAD GRADING BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 56 OF 63



PROPOSED GRADING PLAN
AROUND STRUCTURE 3052-054
SCALE: 1"=40'

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

0 40 80 FEET

NOTE: THE LIMITS OF GRADING SHOWN ON THE PLANS ARE APPROXIMATE AND MAY NEED TO BE ADJUSTED BASED ON FIELD CONDITIONS. EXISTING GRADES ARE BASED OFF LIDAR SURVEY. LIMITS OF ROW SHOWN ARE APPROXIMATE. RHODE ISLAND PE SEAL 9008 IS APPLICABLE ONLY TO THE PROPOSED TRANSMISSION STRUCTURE LOCATIONS SHOWN. PROPOSED TRANSMISSION STRUCTURE LOCATIONS ARE APPROXIMATE.

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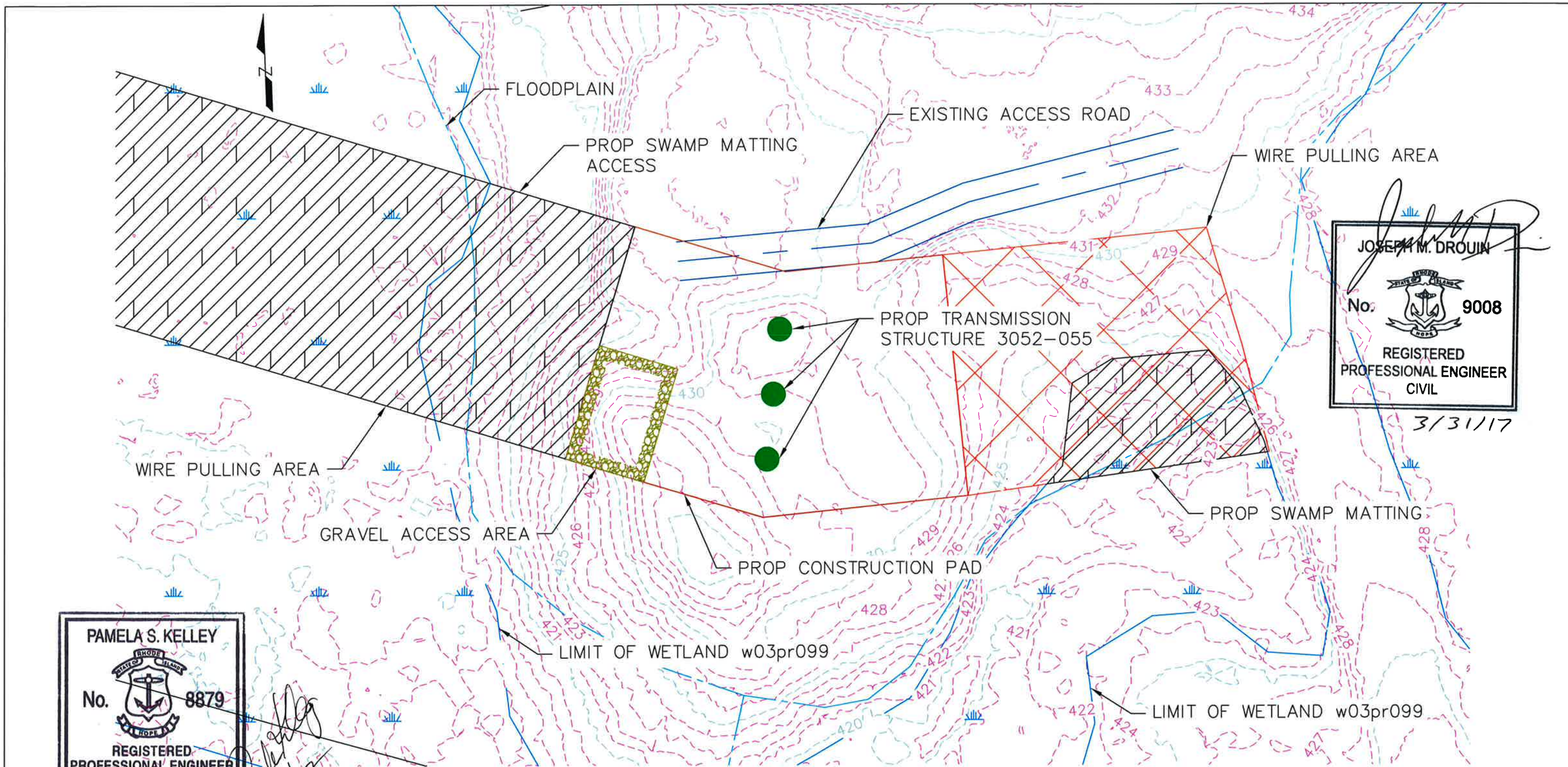
NOT FOR CONSTRUCTION

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS CONSTRUCTION PAD GRADING BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 57 OF 63



PROPOSED GRADING PLAN
AROUND STRUCTURE 3052-055

SCALE: 1"=40'

0 40 80 FEET

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

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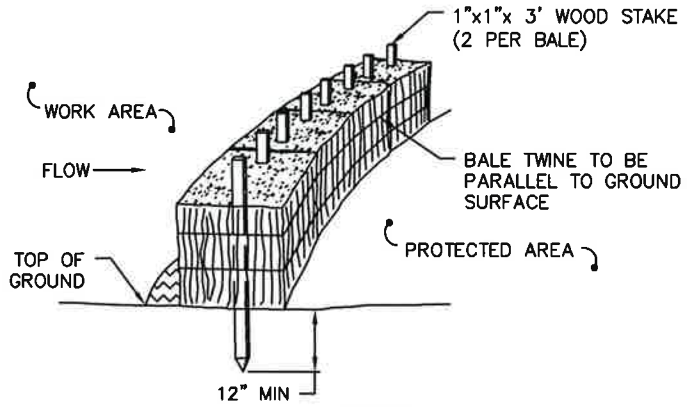
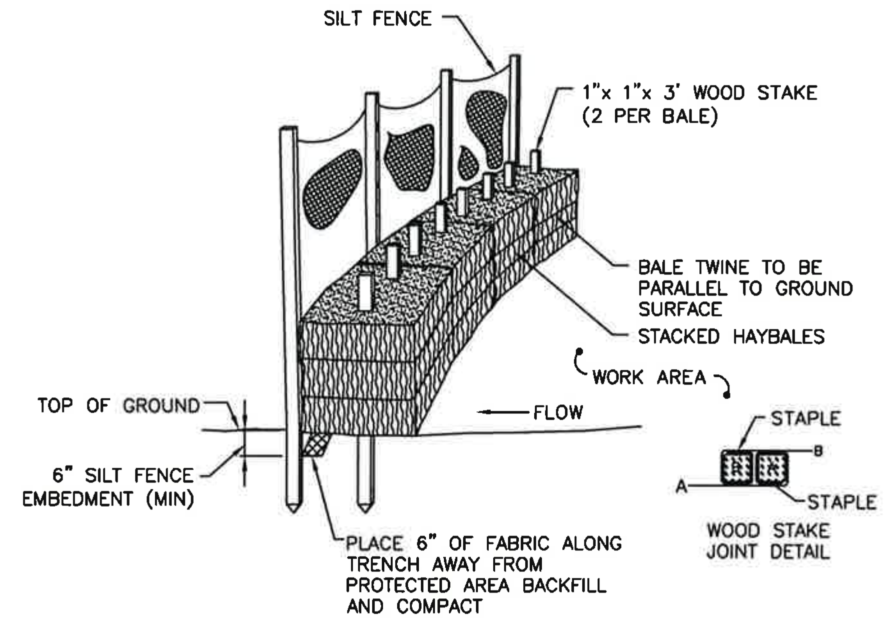
POWER ENGINEERS

BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS CONSTRUCTION PAD GRADING BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 58 OF 63

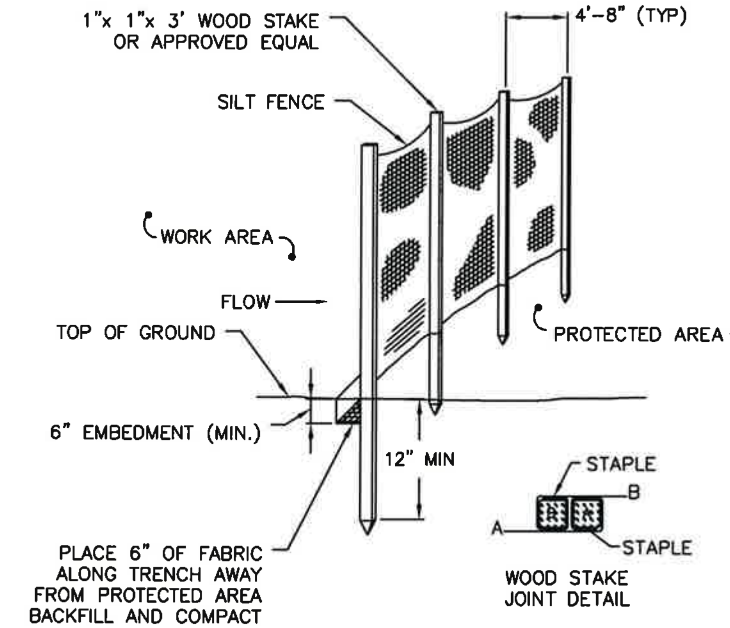


NOTES:
STRAW BALES SHALL BE USED INSTEAD OF HAY BALES IN AREAS (PARTICULARLY WETLANDS) WHERE POTENTIAL INTRODUCTION OF INVASIVE PLANT SPECIES IS OF CONCERN.

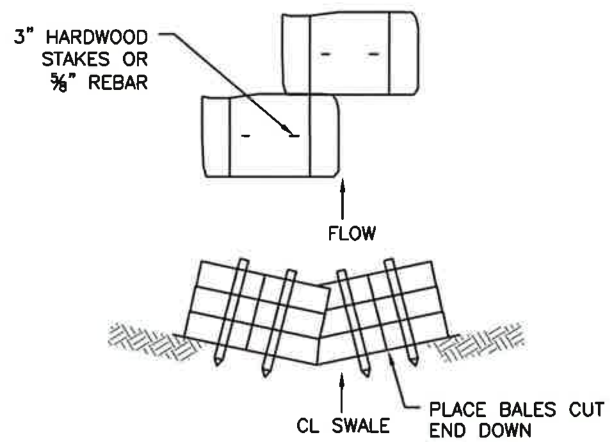
HAYBALE BARRIER NON-EMBEDDED
N.T.S.



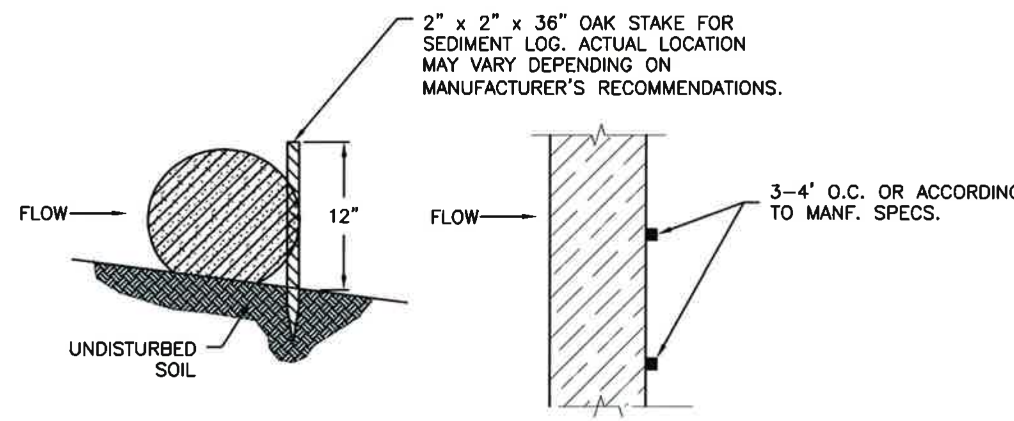
STACKED HAYBALES AND SILT FENCE
N.T.S.



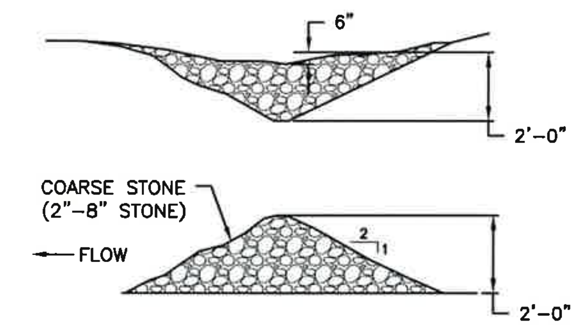
SILT FENCE BARRIER
N.T.S.



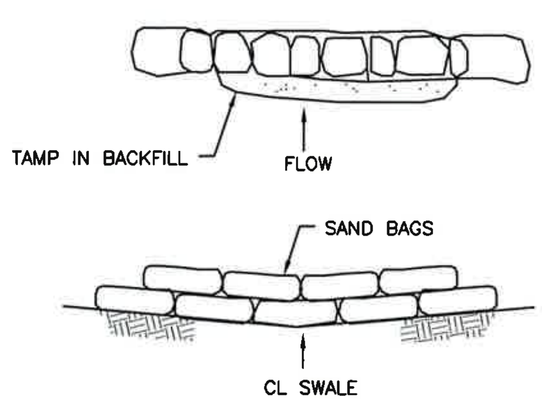
STRAW/HAYBALE CHECK DAM
N.T.S.



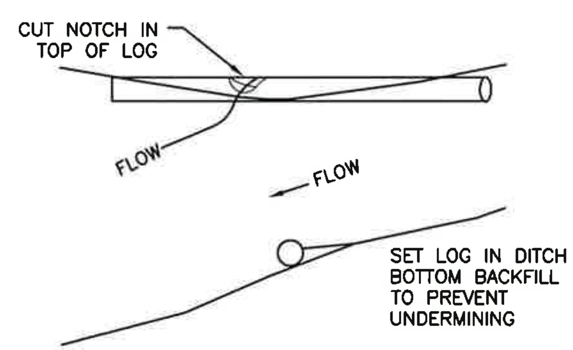
STRAW WATTLE (BIOROLL BARRIER)
N.T.S.



STONE CHECK DAM
N.T.S.



SANDBAG CHECK DAM
N.T.S.



LOG CHECK DAM
N.T.S.

PAMELA S. KELLEY
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REGISTERED
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(CIVIL)

RHODE ISLAND PE SEAL 8879 IS APPLICABLE ONLY TO THE PROPOSED SITEWORK AND ESC MEASURES.

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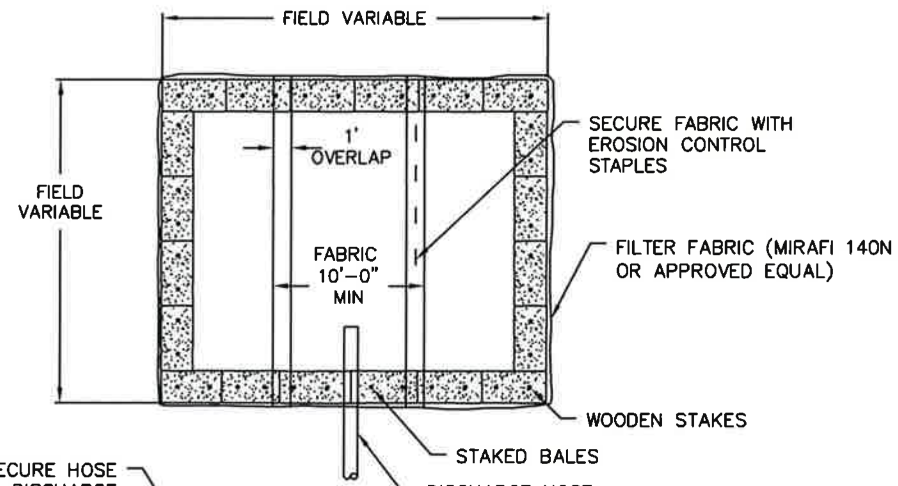
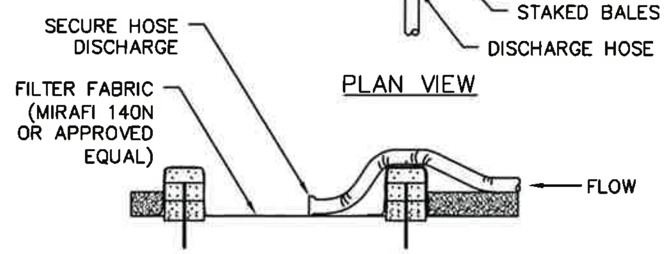
BURRILLVILLE INTERCONNECTION PROJECT THE NARRAGANSETT ELECTRIC CO. & CLEAR RIVER ENERGY, LLC			RIDEM AND USACE PERMIT DRAWINGS EROSION CONTROL DETAILS BURRILLVILLE, RHODE ISLAND	
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 59 OF 63



PLAN VIEW

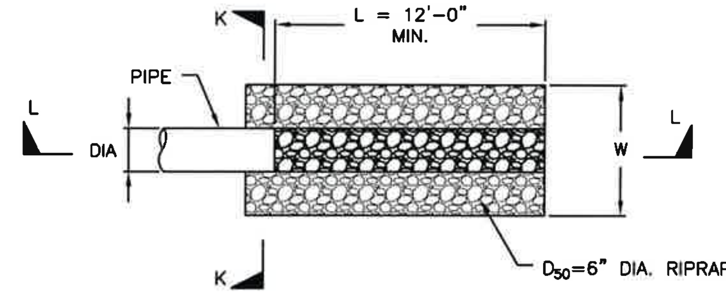


SECTION VIEW

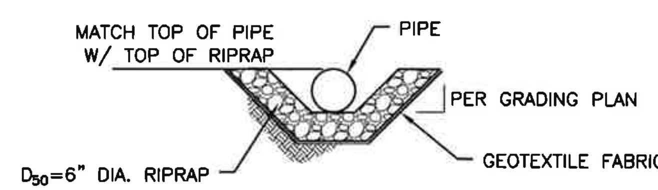
NOTES
1. NUMBER OF BALES MAY VARY DEPENDING ON SITE CONDITIONS.
2. THE BASIN TO BE SIZED TO PREVENT DISCHARGE WATER FROM OVERTOPPING BASIN.
3. KEEP AS FAR FROM WETLANDS AS PRACTICAL.
4. CLEAN, REMOVE AND REPLACE AGGREGATE SURFACING AS SOON AS DEWATERING IS COMPLETE.

DEWATERING HAYBALE BASIN
N.T.S.

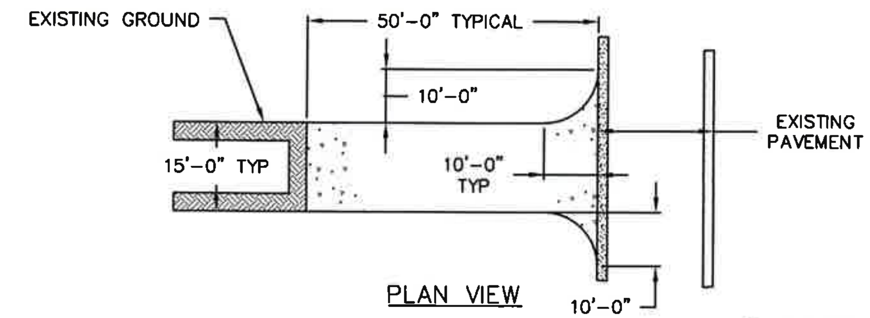
OUTLET PIPE DIA.	L(FT)	W(FT)
24"	35	20
30"	40	25



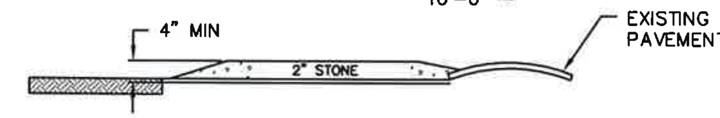
PLAN



SECTION K–K



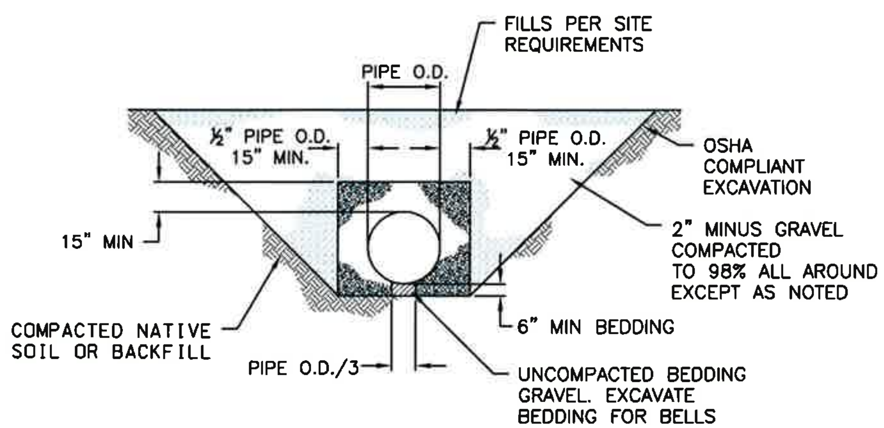
PLAN VIEW



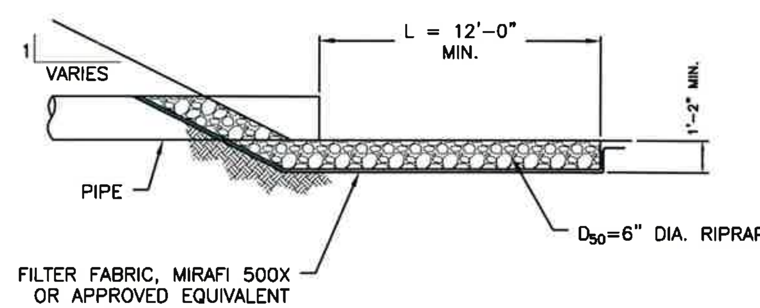
SECTION VIEW

CONSTRUCTION SPECIFICATIONS:
1. STONE SIZE – USE 2" STONE (MINIMUM) TO 6" STONE (MAXIMUM).
2. LENGTH – GREATER THAN OR EQUAL TO 50 FEET.
3. THICKNESS – 4".
4. WIDTH – FIFTEEN (15) FEET TYP., BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. SURFACE WATER – ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM SHALL BE PERMITTED.
6. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH SHALL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO ANY PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO ANY PUBLIC RIGHT-OF-WAYS MUST BE REMOVED IMMEDIATELY.
7. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED. DEPENDING UPON SITE CONDITIONS, THIS ENTRANCE MAY OR MAY NOT BE PERMANENT.

STABILIZED CONSTRUCTION EXIT
N.T.S.



TYPICAL CULVERT SECTION
N.T.S.



SECTION L–L
CULVERT INLET/OUTLET PROTECTION DETAIL
N.T.S.

CULVERT TABLE			
POLE #	DIA.	INV. IN	LENGTH
347–021	30"	624.75'	FIELD
347–022	30"	623.75'	FIELD
347–034	24"	529.25'	60'

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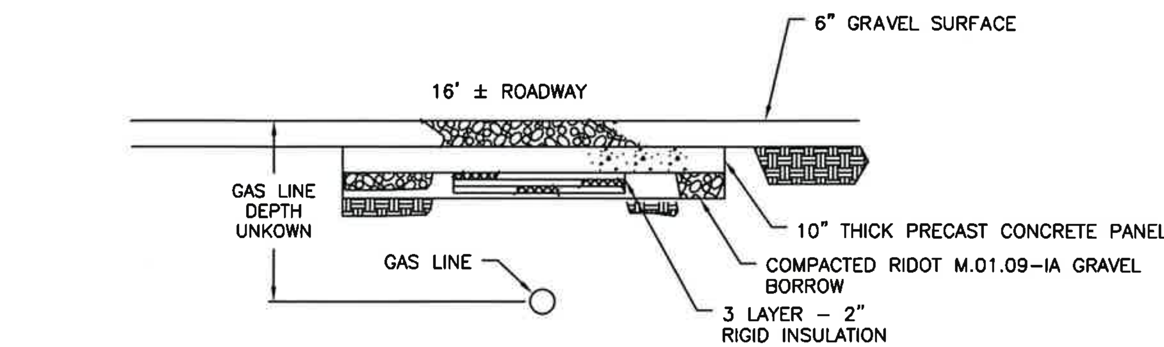
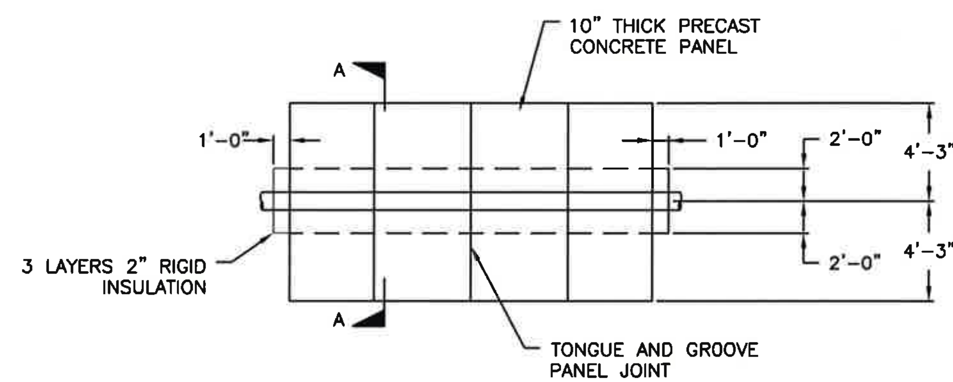
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 60 OF 63



SECTION A–A



PIPELINE CROSSING PLAN
N.T.S.

NOTES:
CONTRACTOR TO VERIFY FINAL PIPELINE CROSSING DETAILS WITH PIPELINE OWNER BEFORE CONSTRUCTION.

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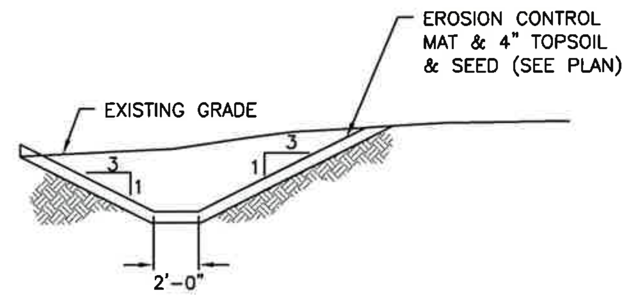
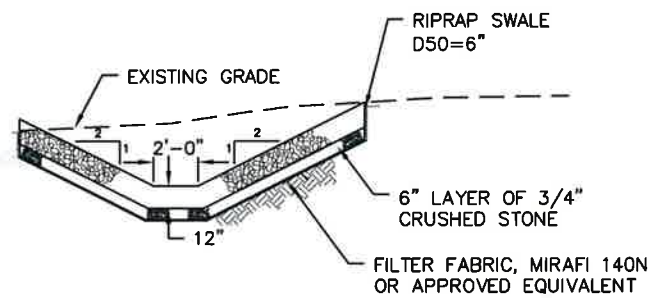
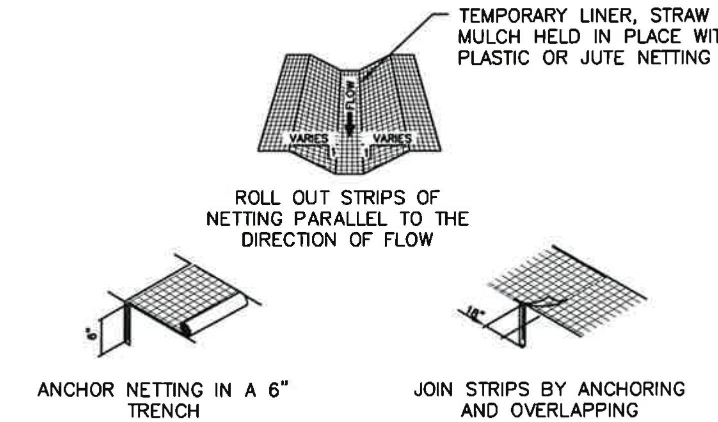
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 61 OF 63



TYPICAL VEGETATED SWALE SECTION
N.T.S.

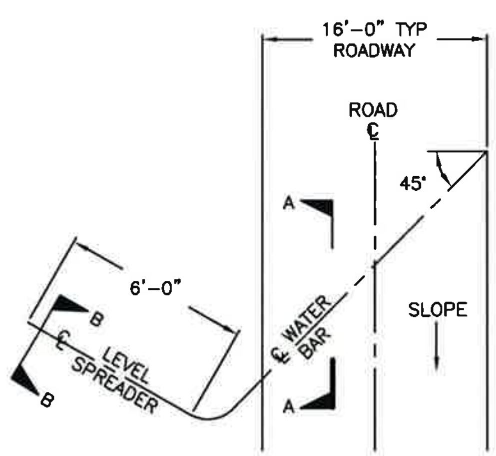


TYPICAL RIPRAP SWALE SECTION
N.T.S.

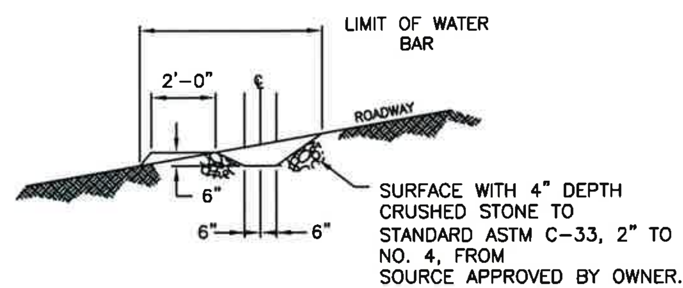


1. EXCAVATE THE CHANNEL AND SHAPE IT TO AN EVEN CROSS-SECTION AS SHOWN. WHEN STAKING INDICATE A 0.2' OVERCUT AROUND THE CHANNEL PERIMETER FOR SILTING AND BULKING.
2. GRADE SOIL AWAY FROM CHANNEL SO THAT SURFACE WATER MAY ENTER FREELY.
3. APPLY LIME, FERTILIZER AND SEED TO THE CHANNEL AND ADJOINING AREAS IN ACCORDANCE WITH THE EROSION CONTROL PLAN.
4. SPREAD HAY OR STRAW MULCH AT THE RATE OF 100 LB/1000 SF.
5. HOLD MULCH IN PLACE IMMEDIATELY AFTER SPREADING WITH A PLASTIC NETTING INSTALLED AS SHOWN.
6. START LAYING THE NET FROM THE TOP OF THE UPSTREAM AND OF THE CHANNEL AND UNROLL IT DOWN GRADE. DO NOT STRETCH THE NETTING.
7. BURY THE UP SLOPE END AND STAPLE THE NET EVERY 12" ACROSS THE TOP END, EVERY 3 FT AROUND THE EDGES AND ACROSS THE NET SO THAT THE STRAW IS HELD CLOSELY AGAINST THE SOIL. HOWEVER, DO NOT STRETCH THE NETTING WHEN STAPLING.
8. NETTING STRIPS SHALL BE JOINED TOGETHER ALONG THE SIDES WITH A 3" OVERLAP AND STAPLED TOGETHER.
9. TO JOIN ENDS OF STRIPS, INSERT A NEW ROLL OF NET IN A TRENCH AS WITH THE UP SLOPE END AND OVERLAP IT 18" WITH THE PREVIOUSLY LAID UPPER ROLL. TURN UNDER 6" OF THE 18" OVERLAP AND STAPLE EVERY 12" ACROSS THE END.

EROSION CONTROL MAT DETAIL
NTS



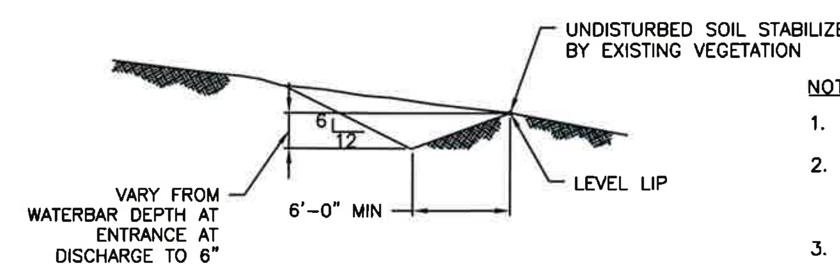
WATER BAR AND LEVEL SPREADER PLAN
N.T.S.



NOTES:
1. SLOPES OF WATER BAR TO BE MAINTAINED AT 1 ON 4
2. CLEAN 3 FT BEYOND LIMITS OF EXCAVATION FOR LEVEL SPREADER.

ROAD SLOPE PERCENT	WATER BAR SPACING – FT
5	150
10	100
15 AND OVER	50

SECTION "A–A"
(THROUGH WATER BAR)
N.T.S.



NOTES:
1. ALL LEVEL SPREADERS SHALL HAVE A LENGTH OF 6 FEET.
2. ALL DISTURBED SOIL TO BE STABILIZED, MULCHED AND SEEDED SUBJECT TO APPROVAL OF THE CORPORATION.
3. LEVEL LIP TO BE MAINTAINED AT CONSTANT ELEVATION OVER FULL LENGTH OF SPREADER.

SECTION "B–B"
(THROUGH LEVEL SPREADER)
N.T.S.

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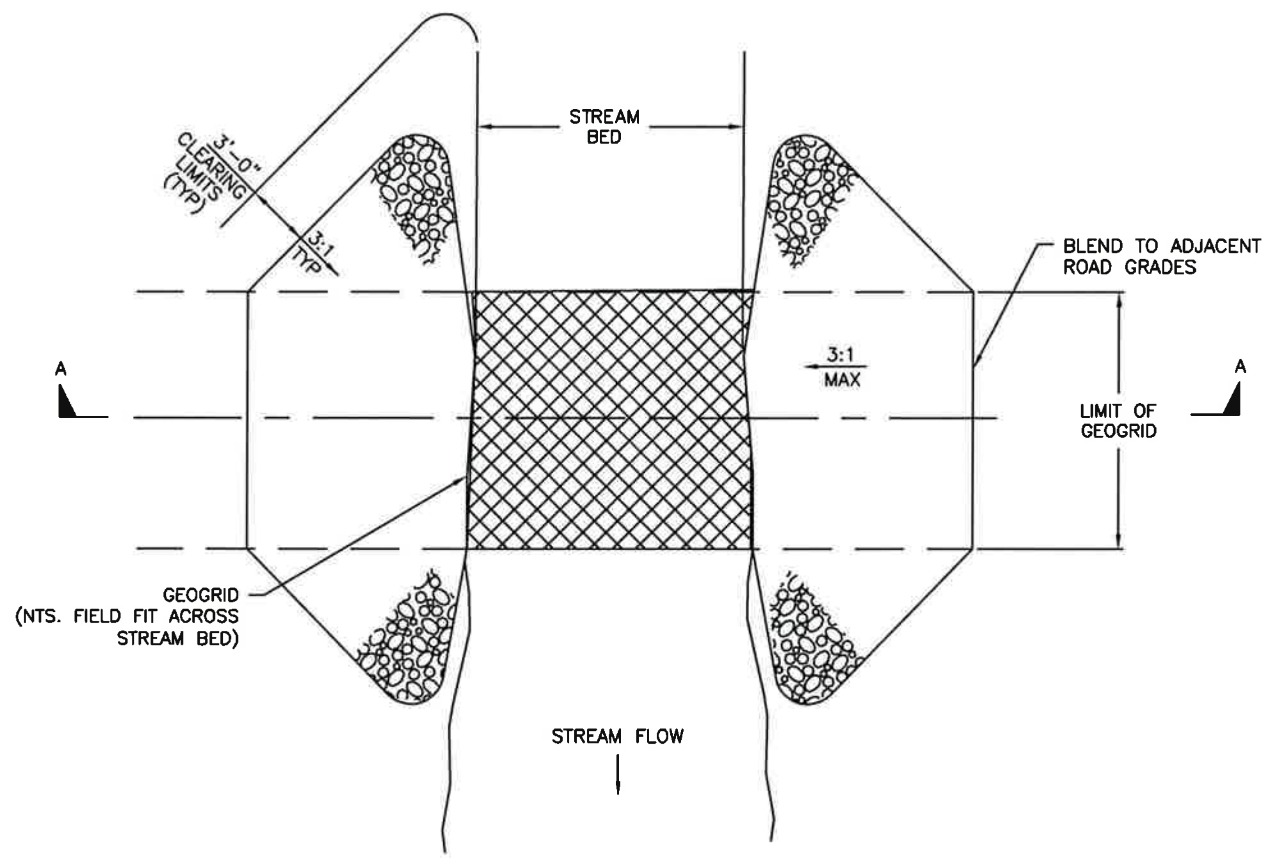
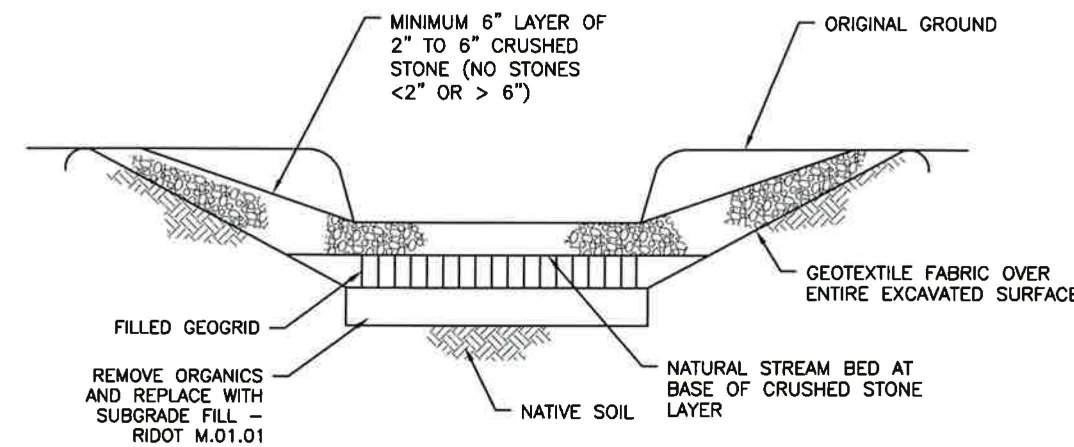
DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 62 OF 63



PLAN



SECTION A–A

STREAM FORD
N.T.S.

NOTES:

1. USE PRESTO GEOSYSTEMS GEOWEB (OR APPROVED EQUAL) FOR GEOGRID AND CONNECT EACH SECTION TOGETHER.
2. ANCHOR GEOGRID IN PLACE WITH STAKES
3. FILL GEOGRID WITH AASHTO #5 CRUSHED STONE (OR APPROVED SIMILAR) TO STABILIZE EACH CELL.
4. LIMIT FILL DROP HEIGHT TO 3 FEET.
5. OVERFILL CELLS AT LEAST 2 INCHES BEFORE COMPACTING.

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DATE: 3/22/2017	DRAWN: RST	142704	FIGURE T-4	SHEET 63 OF 63

Exhibit 2

Narragansett Indian Tribe letter to RIDEM (dated December 1, 2017)

www.essgroup.com

PANNONE LOPES
DEVEREAUX & O'GARA LLC
counselors at law

Patrick J. McBurney
401 824-5100
pmcburney@pldolaw.com

December 1, 2017

Charles A. Horbert, Program Supervisor
Rhode Island Department of Environmental Management
Office of Water Resources
235 Promenade Street
Providence, RI 02908

Re: Narragansett Indian Tribe

Dear Mr. Horbert:

The Narragansett Indian Tribe hereby objects to the Rhode Island Department of Environmental Management's ("RIDEM") recent request for information regarding site plans for facilities existing within Tribal lands; impact avoidance and minimization statements regarding use of water located within the Narragansett Indian Tribe's lands; and overall project evaluations to include details related to water withdrawal and wetland impacts for water withdrawn from Tribal lands.

The Narragansett Indian Tribe is a federally recognized sovereign Indian Nation. It is well established that federal law generally prohibits states from exercising regulatory authority on Indian lands unless Congress has explicitly authorized such action. *See California v. Cabazon Band of Mission Indians*, 480 U.S. 202, 221-22 (1987) (determining that the State of California's regulation of tribal bingo impermissibly infringed upon tribal government); *McClanahan v. Arizona State Tax Commission*, 411 U.S. 164 (1973) (holding that Arizona could not tax an individual tribal member's earned income because that income was earned exclusively through tribal sources). This well recognized principle was established through what is commonly known as the "Marshall Trilogy": three United States Supreme Court Cases decided under the Chief Justice John Marshall court. Two of the Marshall Trilogy cases are: *Johnson v. M'Intosh*, 21 U.S. 543 (1843) and *Cherokee Nation v. Georgia*, 30 U.S. 1 (1831). The third case, *Worcester v. Georgia*, 31 U.S. 515 (1832), held that even though tribes were classified as "domestic dependent nations," this status did not extinguish a tribe's preexisting powers to govern internal tribal affairs within its reservation boundaries. Importantly, the Court determined that only the federal government, and not any state government, could potentially infringe upon tribal authority on reservation lands. *Id.* at 594.

It is equally well established that tribes are afforded specific and significant rights over their own environmental resources located on tribal lands, including water resources. In *Winters v. United States*, 207 U.S. 564 (1908), the Supreme Court determined that when the federal government reserves land for tribes, that reservation implicitly confers a right to the surface water located within such land for the use of the particular tribe. This right is superior to any other claim of right to the water located within such tribal land, including any claim made by appurtenant land owners or state agencies. *Id.* at 577-78. Recently, the Ninth Circuit of the United States Court of Appeals extended the *Winters Doctrine* to groundwater located within tribal lands. *See Agua Caliente Band of Cahuilla Indians v. Coachella Valley Water Dist.*, 849 F.3d 1262 (9th Cir. 2016).

Additionally, the EPA has recognized "tribal governments as sovereign entities with primary authority and responsibility for the reservation populace." *See* EPA Indian Policy of November 1984. In fact, the EPA has stated: "In keeping with the principle of Indian self-government, the EPA policy provides that tribal governments are the primary parties for setting standards . . . and managing programs for reservations. Moreover, federal courts have approved the EPA's decisions to grant Indian Tribes the same degree of autonomy to determine the quality of their environment as was granted to the States." *See* Janet K. Baker, *Tribal Water Quality Standards, Are There Any Limits?*, 7 Duke Envtl. Law & Policy 367, 378 n.89 (1997) (quoting an EPA statement made in support of water standards for the Colville Indian Reservation). Not surprisingly, Congress has authorized the EPA to treat tribes as states under the Clean Water Act. *See* 33 U.S.C. § 1377(e). Accordingly, once a tribe receives treatment as a state status, the tribe has the ability to set water quality standards for water located within its tribal lands. These standards are separate and distinct from any standards set by state regulatory agencies.

Taken as a whole, it is clear that RIDEM's role with respect to water located within the lands of the Narragansett Indian Tribe has been preempted by federal law. In *New Mexico v. Mescalero Apache Tribe*, 462 U.S. 324, 331 (1983), the Court specifically concluded that:

> "In this case the governing body of an Indian Tribe, working closely with the Federal Government and under the authority of federal law, has exercised its lawful authority to develop and manage the reservation's resources for the benefit of its members. **The exercise of concurrent jurisdiction by the State would effectively nullify the Tribe's unquestioned authority to regulate the use of its resources by members and nonmembers, interfere with the comprehensive tribal regulatory scheme, and threaten Congress' firm commitment to the encouragement of tribal self-sufficiency and economic development.** Given the strong interests favoring exclusive tribal jurisdiction and the absence of State interests which justify the assertion of concurrent authority, **we conclude that the application of the State's hunting and fishing laws to the reservation is preempted."** *Id.* at 343-44 (emphasis added).

Similarly, the Narragansett Indian Tribe has exercised lawful authority to manage Tribal environmental resources for the benefit of its members. Any interference by a state agency, such as the RIDEM, would threaten the commitment of the Federal Government to encourage tribal self-sufficiency and recognize the sovereign status of tribal nations. We hope that you will recognize these principles in this particular matter and any dealing you may have with the Narragansett Indian Tribal government.

Please contact me with any additional questions or concerns regarding this matter.

Very truly yours,

PANNONE LOPES DEVEREAUX & O'GARA LLC

Patrick J. McBurney

PJM

cc:

Alan Shoer, Esq.
William P. Devereaux, Esq.

Exhibit 3

Revised Wetland Impact Summary Tables

Original

Table 5-1: Summary of Potential CREC Impacts to Wetlands, Watercourses, and Floodplain

	Biological Wetland	Intermittent Stream	Perimeter Wetland	100' Riverbank Wetland	200' Riverbank Wetland	100-Year Floodplain
Wetland ID	Acres	Linear Feet	Acres	Acres	Acres	Acres
Wetland 1	0.48	136	1.0	0.5	0.71	0.13
Wetland 2	-	-	0.04	-	NA	-
Wetland 3	-	-	-	NA	NA	-
SAS 1	0.02	-	NA	NA	NA	-
SAS 2	-	-	NA	NA	NA	-
Totals (ac)	0.50	136	1.04	0.5	0.71	0.13

Revised

Table 5-1: Summary of Potential CREC Impacts to Wetlands, Watercourses, and Floodplain*

Wetland ID	Biological Wetland (Acres)		Intermittent Stream (Linear Feet)	Perimeter Wetland (Acres)		100' Riverbank Wetland (Acres)		200' Riverbank Wetland (Acres)	100-Year Floodplain (Acres)
	Permanent	Temporary	Permanent	Permanent	Temporary	Permanent	Temporary	Permanent	Permanent
Wetland 1	0.48	0.21	136	1.0	1.08	0.5	0.03	0.71	0.13
Wetland 2	-		-	0.04		-		NA	-
Wetland 3	-		-	-		NA		NA	-
Wetland 6	-	0.16	-	-		-		-	-
SAS 1	0.02		-	NA		NA		NA	-
SAS 2	-		-	NA		NA		NA	-
Totals	0.50	0.37	136	1.04	1.08	0.5	0.03	0.71	0.13

*New information

Table 5-6: Summary of Potential Impacts on Wetlands, Watercourses, and Floodplain from the BIP (RIDEM Wetland Jurisdiction)

Impact Type		Impact Area (ft^2)										
		Swamp	Forested Wetland	Shrub Wetland	Emergent Plant Community	50' Perimeter Wetland	100-Yr Floodplain	100' Riverbank	200' Riverbank	ASSF**	Stream (lf)	Total
Proposed CREC ROW (Greenfield ROW)												
Right of Way Work Pads												0
Temporary Guard Structure Pads												0
Temporary Access Roads		712				27					40	779
Access Routes for Vegetation Removal		9,304				6,424		615			180	16,344
Permanent Work Pads						354						354
Permanent Access Roads		9,273			312	13,119		2,114			64	24,882
Permanent New Structures												0
Total Temporary Impacts		10,016			0	6,451		615			220	17,302
Total Permanent Impacts		9,273			312	13,473		2,114			64	25,236
Total Tree Removal Within ROW		67,111			119	43,917		3,875				115,022

Table 5-6: Summary of Potential Impacts on Wetlands, Watercourses, and Floodplain from the BIP (RIDEM Wetland Jurisdiction)												
Impact Type		Impact Area (ft^2)										
		Swamp	Forested Wetland	Shrub Wetland	Emergent Plant Community	50' Perimeter Wetland	100-Yr Floodplain	100' Riverbank	200' Riverbank	ASSF**	Stream (lf)	Total
Total Conversion*		22,633			119	16,774		2,308				41,833
Existing TNEC ROW												
Right of Way Work Pads		200,120	10,941	24,312	10,447	110,169		601				356,590
Temporary Guard Structure Pads						2,520		1,675				4,196
Temporary Access Roads		11,449	400	553		8,638		799				21,839
Access Routes for Vegetation Removal		78,483	14,483	0		51,667	703	10,903	703		320	156,943
Permanent Work Pads		197		56	60	143,482	20,701	17,918	29,859			212,271
Permanent Access Roads		228		16		20,362	605	377	900	150		22,638
Permanent New Structures		45			71	429	47	24	95			711
Total Temporary Impacts		290,051	25,824	24,866	10,447	172,994	703	13,979	703		320	539,568

Table 5-6: Summary of Potential Impacts on Wetlands, Watercourses, and Floodplain from the BIP (RIDEM Wetland Jurisdiction)												
Impact Type		Impact Area (ft^2)										
		Swamp	Forested Wetland	Shrub Wetland	Emergent Plant Community	50' Perimeter Wetland	100-Yr Floodplain	100' Riverbank	200' Riverbank	ASSF**	Stream (lf)	Total
Total Permanent Impacts		469		72	130	164,273	21,353	18,319	30,854	150		235,470
Total Tree Removal Within ROW		325,294	54,243	4		316,612	17,506	64,155	7,565			785,378
Total Conversion*		107,116	25,824	4		125,098	11,382	29,194	4,265			302,882
Grand Total (State Categories)												
Total Temporary Impacts	ft^2	300,067	25,824	24,866	10,447	179,446	703	14,594	703		540	556,650
	acres	6.89	0.59	0.57	0.24	4.12	0.02	0.34	0.02	0.00	0.01	12.78
Total Permanent Impacts	ft2	9,742		72	442	177,746	21,353	20,434	30,854	150	64	260,643
	acres	0.22	0.00	0.00	0.01	4.08	0.49	0.47	0.71	0.00	0.00	5.98
Total Conversion*	ft2	129,749	25,824	4	119	141,872	11,382	31,501	4,265			344,716
	acres	2.98	0.59	0.00	0.00	3.26	0.26	0.72	0.10	0.00	0.00	7.91

* This number removes the tree clearing areas that are overlapping impacts from construction features so as not to "double count" the impact area.

**ASSF = Area Subject to Storm Flowage

This is an area of trees within the limits of an emergent plant community. This number can be added to the total tree removal in PFO or Swamp if warranted.

Exhibit 4

Wetland Field Maps - Staked Edge of Clearing per RIDEM Request

Path: J:\I108 - Invenergy Burrillville\04 Graphics\GIS\00 MXD\FieldStakesFigureSet\I108_FieldMaps_Fig03_201711.mxd

Drawing Date: 12/11/2017 Author: SDeHainaut

ESS group
environmental consulting & engineering services

Invenergy, LLC
Clear River Energy Center
Burrillville, RI

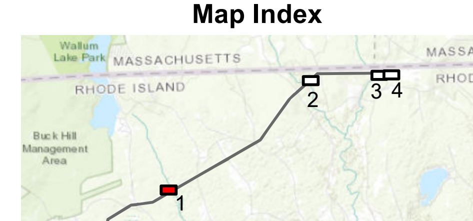
Source: 1) ESRI, World Imagery, 2016
2) Waterman Engineering Co., Field Survey, Nov. 2017

0 50 100 Feet

Legend

- Field Stake with ID Number
- Project Limits of Disturbance
- 50' Perimeter Wetland
- Wetland Area

Map Index

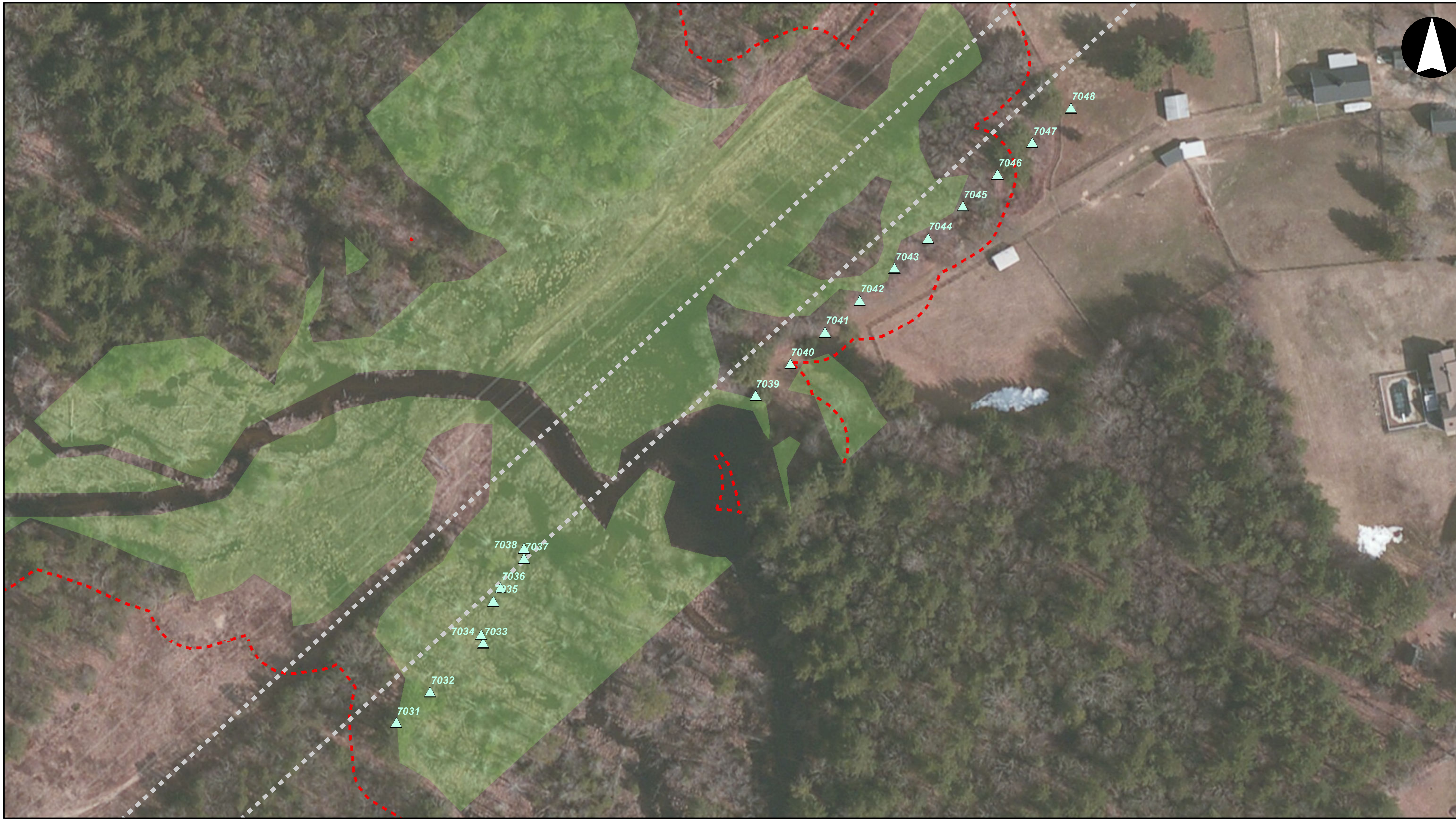


Wetland Field Maps - Staked Edge of Clearing per RIDEM Request

Sheet 1 of 4

Path: J:\1108 - Invenergy Burrillville\04 Graphics\GIS\00 MXD\FieldStakesFigureSet\1108_FieldMaps_Fig03_201711.mxd

Drawing Date: 12/11/2017 Author: SDeHainaut



ESS group
environmental consulting & engineering services

0 50 100 Feet

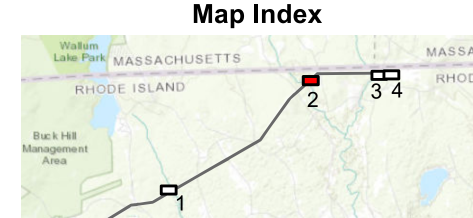
Invenergy, LLC
Clear River Energy Center
Burrillville, RI

Source: 1) ESRI, World Imagery, 2016
2) Waterman Engineering Co., Field Survey, Nov. 2017

Legend

- Field Stake with ID Number
- Project Limits of Disturbance
- 50' Perimeter Wetland
- Wetland Area

Map Index



Wetland Field Maps - Staked Edge of Clearing per RIDEM Request

Sheet 2 of 4

Path: J:\1108 - Invenergy Burrillville\04 Graphics\GIS\00 MXD\FieldStakesFigureSet\1108_FieldMaps_Fig03_201711.mxd

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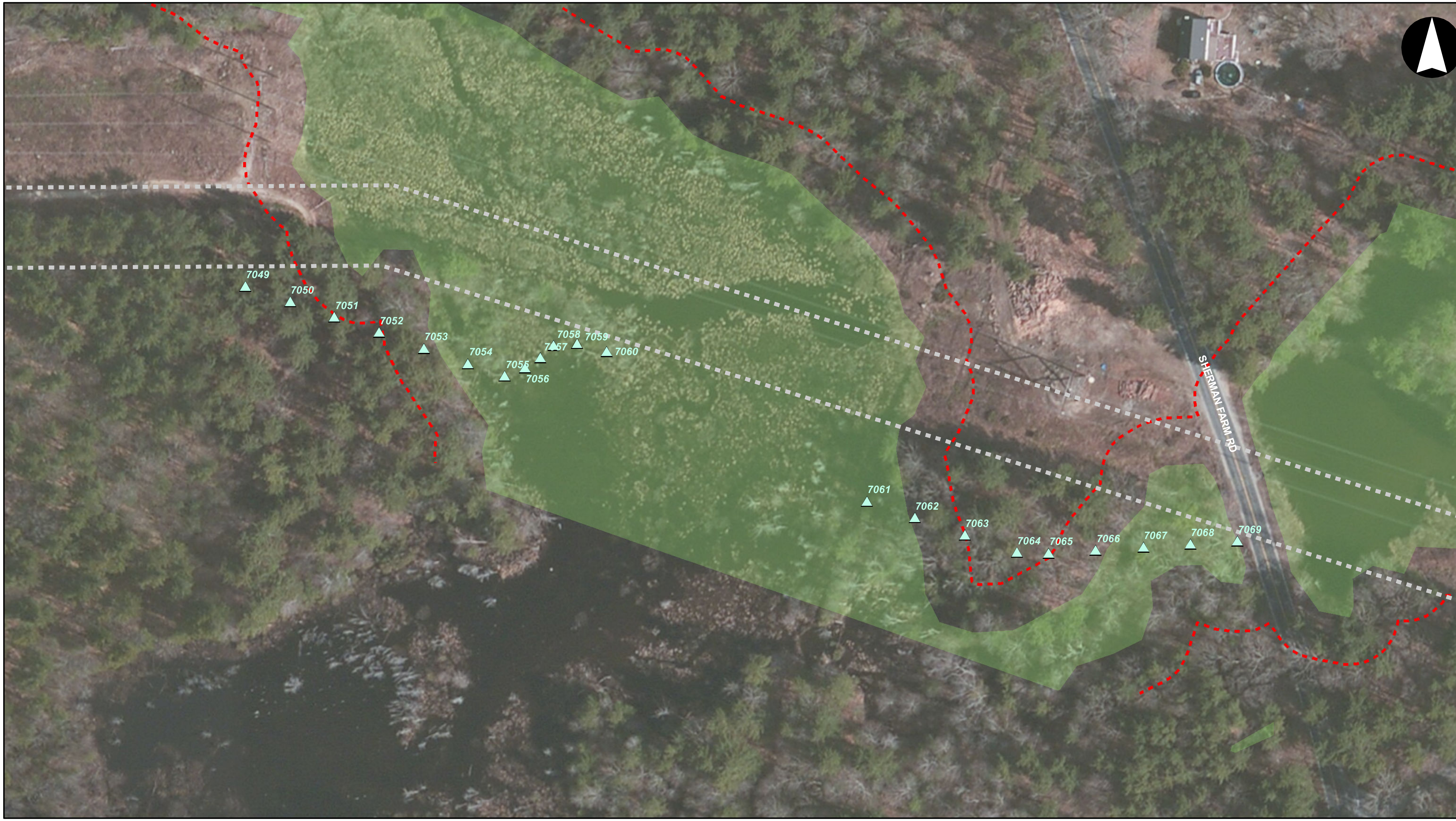


ESS group
environmental consulting & engineering services

0 50 100 Feet

Invenergy, LLC
Clear River Energy Center
Burrillville, RI

Source: 1) ESRI, World Imagery, 2016
2) Waterman Engineering Co., Field Survey, Nov. 2017

Legend

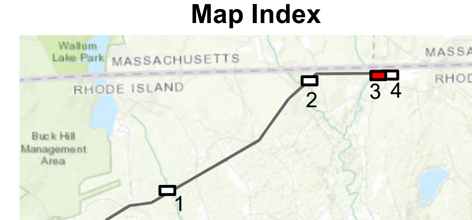
Field Stake with ID Number

Project Limits of Disturbance

50' Perimeter Wetland

Wetland Area

Map Index



Wetland Field Maps - Staked Edge of Clearing per RIDEM Request

Sheet 3 of 4

Path: J:\1108 - Invenergy Burrillville\04 Graphics\GIS\00 MXD\FieldStakesFigureSet\1108_FieldMaps_Fig03_201711.mxd

Drawing Date: 12/11/2017 Author: SDeHainaut

ess group
environmental consulting & engineering services

0 50 100 Feet

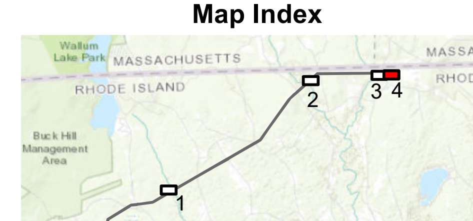
Invenergy, LLC
Clear River Energy Center
Burrillville, RI

Source: 1) ESRI, World Imagery, 2016
2) Waterman Engineering Co., Field Survey, Nov. 2017

Legend

- Field Stake with ID Number
- Project Limits of Disturbance
- 50' Perimeter Wetland
- Wetland Area

Map Index



Wetland Field Maps - Staked Edge of Clearing per RIDEM Request

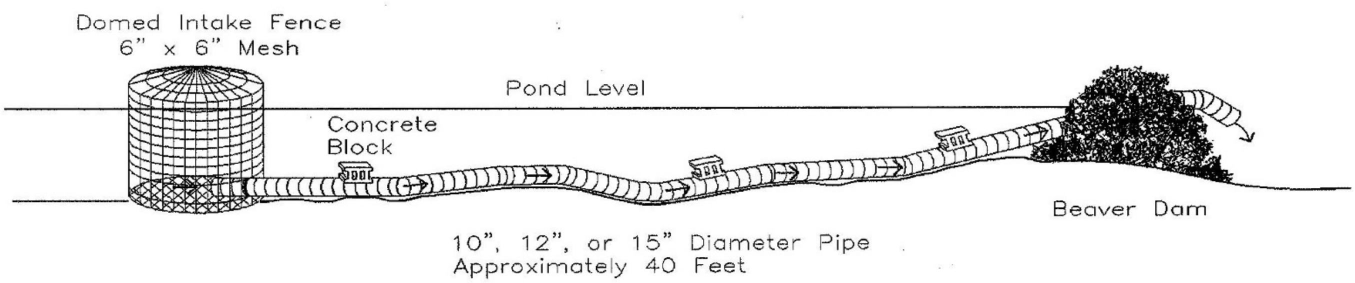
Sheet 4 of 4

Exhibit 5

Flexible Pond Leveler™ Details

Flexible Pond Leveler™

When flooding from a beaver dam threatens human property, health or safety, a Beaver Solutions Flexible Pond Leveler™ pipe system can be a very effective solution. This flow device will create a permanent leak through the beaver dam that the beavers cannot stop. This eliminates the need for repeated trapping despite the presence of beavers.



In order for these pipe systems to be effective, they must be designed so that beavers cannot detect the flow of water into the pipe. The Flexible Pond Leveler™ does this by surrounding the submerged intake of the pipe with a large cylinder of fencing which is placed in as deep water as possible. This prevents the beavers from detecting the flow of water into the pipe. As a result, the beavers do not try to clog the pipe, and a safe water level can be maintained.

The height of the pipe in the dam determines the pond level (see diagram). Water will flow through the pipe unless the pond level drops below the peak of the pipe. The pipe is set in the dam at the desired pond level, and can be adjusted up or down if necessary.

Unlike road culverts, Flexible Pond Leveler™ pipes do not need to be sized to handle catastrophic storm events because heavy storm runoff will simply flow over the top of the dam. Following the storm the pipe will return the pond to the normal level.

When installing a pipe system it is very important to lower a pond only enough to protect human interests. The more a pond is lowered the more likely it is beavers will build a new dam to render the pipe ineffective. Lowering a beaver pond by up to one vertical foot is generally not a problem.

Whenever a pond must be lowered by two feet or more, a single round of trapping may be needed prior to installing the pipe. Following trapping new beavers relocating into the area are more likely to tolerate the smaller pond because they do not have the memory of the larger pond.

With routine maintenance this flow device will remain effective for many years. Since our customer's satisfaction and our reputation are very important to us, we offer an optional low cost Maintenance Plan. A "Worry-Free Guarantee" is included with every Maintenance Plan at no additional cost. See attached. However, if you prefer to do the maintenance, we are always available to answer any questions at no charge because we are committed to your satisfaction and our good reputation.

BEAVER SOLUTIONS

14 Mountain Rd, Southampton, MA 01073
Phone: (413) 695-0484
Website: www.beaversolutions.com

Installation Procedures for a Culvert Protective Fence and Pipe Flow Device

1. To install the flow device the local BOH first issues a 10 Day Emergency beaver permit. Then the Conservation Commission reviews plan and issues their Emergency Permit with any conditions needed to protect the wetland resource.

2. All materials and tools are brought manually to the site.

3. No heavy equipment to be used at any time during the project. No significant damage is expected to any grassy, upland, wetland or other areas as a result of this work.

4. The culvert should be open without damming materials inside it. Typically when a culvert is cleaned out there is no threat of downstream flooding since flow is restricted by the size of the culvert. However, it is best to be aware if there is an undersized/smaller culvert immediately downstream before a full culvert is unblocked.

5. Flash boards can be placed in front of most culverts if needed to slow water flow.

6. The Culvert Protective Fence is made from a concrete reinforcing mesh with 6"by 6" openings. It is assembled on dry land at the site using simple hand tools. The Flexible Pond Leveler is made from the same concrete mesh, as well as black corrugated polyethylene pipe.

7. Once assembled they are manually put in place on the upstream side of the culvert.

8. Steel fence posts are hand driven along the perimeter of the fence, and the fence is secured to the posts with heavy gauge wire. The pipe is weighted down underwater with concrete blocks, and the intake end of the pipe is sunk in the pond 30 to 40 feet upstream of the culvert.

9. Occasionally a small fence is installed across the outlet end of the culvert to prevent beavers accessing the culvert from the downstream side.

10. Typically the entire flow device is installed in one day.

11. Beavers will usually try to dam on the upstream culvert fence in an attempt to raise

the water level but will be unsuccessful because the Flexible Pond Leveler installed through that fence will control the pond level.

Feel free to contact Beaver Solutions™ with any questions or concerns.

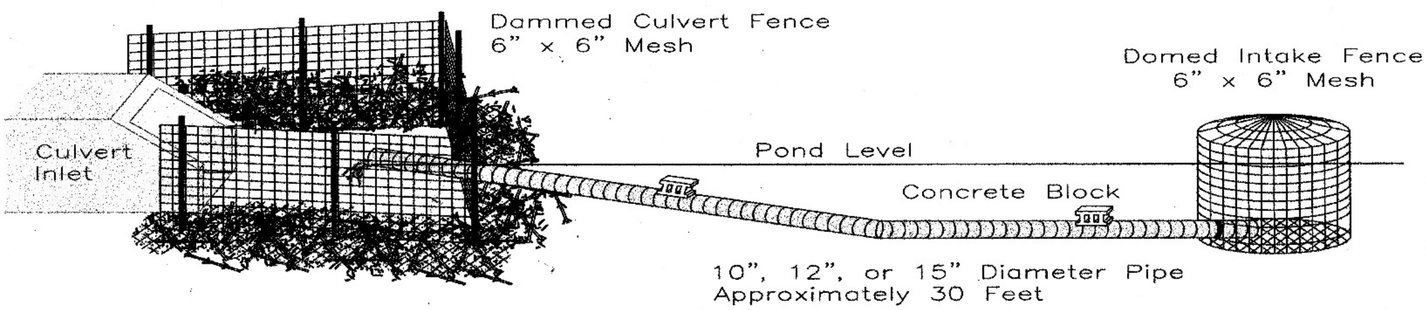
Sincerely,

Mike Callahan, Owner
Beaver Solutions LLC
"Working With Nature"

Fence and Pipe Flow Device

A Fence and Pipe flow device is a very effective method to protect culverts or spillways in manmade dams from beaver damming. A Flexible Pond Leveler™ pipe maintains a steady flow of water, while an exclusion fence keeps all beaver damming away from the culvert or spillway. See diagram.

Beaver damming on the culvert fence does not raise the water level due to the permanent leak created by the pond leveler pipe. The pipe system controls the pond at a safe level and prevents flooding damage to the road or manmade dam, while the fence ensures the culvert remains completely open.



FENCE AND PIPE DIAGRAM
(Side View)

The pipe outlet elevation determines the pond level. This end of the pipe can be adjusted up or down if a higher or lower pond level is desired. Water will continuously flow from the pipe outlet unless the pond level drops below the peak of the pipe.

The domed intake fence prevents beavers from hearing or feeling the flow of water into the pipe. Therefore they ignore the intake end of the pipe, and only dam on the culvert fence where they hear the water flowing.

Unlike road culverts, Flexible Pond Leveler™ pipes do not need to be sized to handle catastrophic storm events because heavy storm runoff will simply flow over the top of the dam on the fence and through the unblocked culvert or spillway. Some mild pond fluctuations are possible following very wet periods, but the pond will be controlled at a safe level.

With routine maintenance this flow device will remain effective for many years. Since our customer's satisfaction and our reputation are very important to us, we offer an optional low cost Maintenance Plan. A "Worry-Free Guarantee" is included with every Maintenance Plan at no additional cost. See attached. However, if you prefer to do the maintenance, we are always available to answer any questions at no charge because we are committed to the success of our flow devices, your satisfaction and our good reputation.

Exhibit 6

Drainage Report - revised December 2017 (Document Bound Separately)

Drainage Report

For

Clear River Energy LLC
Rhode Island

March 2017
Rev. December 2017

ALEXANDER DEUSON
STATE OF RHODE ISLAND
No. 0011618
REGISTERED
PROFESSIONAL ENGINEER
CIVIL

INDEX

DRAINAGE NARRATIVE

- **Detailed description of existing condition hydrology:**
  The primary surface hydrologic feature, Iron Mine Brook, is located east of the CREC site. Iron Mine Brook is a perennial stream that flows in a northeasterly direction through the southern portion of the wetlands. Iron Mine Brook is a lower perennial stream (R2) with a sandy bottom. Iron Mine Brook flows beneath Wallum Lake Road to the east of the proposed CREC via a culvert and eventually discharges to the Clear River. Iron Mine Brook is a RIDEM Category 3 river, meaning that there is insufficient or no data to identify its designated uses, and is classified as a Class-B waterbody. A Class-B waterbody can be considered potentially suitable for bathing, fish and wildlife habitat, recreational use, agricultural use, industrial supply and other legitimate uses, including navigation. Iron Mine Brook is approximately 10 to 12 feet wide; it therefor has an associated 200-foot Riverbank Wetland per the Rhode Island Department of Environmental Management (RIDEM) Wetland Regulations.

  Two unnamed intermittent streams are present in the eastern Project area. Both of these streams originate north of the Project area, and flow under Algonquin Lane via culverts. The two streams meet in the northeastern portion of the wetland and flow south, passing through a metal pipe culvert under the woods road, until ultimately reaching Iron Mine Brook. These streams average less than 10 feet wide in their reach through the proposed Project site; they therefor have an associated 100-foot Riverbank Wetland per the RIDEM Wetland Regulations.

  The primary surface hydrologic feature in the western portion of the proposed Project area is an unnamed perennial tributary to Dry Arm Brook, which flows through the western branch of Wetland 2 in a generally northeasterly direction. This perennial stream is designated as a Class-B waterbody. In its reach through the proposed Project site, this stream is a lower perennial stream with a sandy and muddy bottom (R2). Where it passes through the proposed Project area, this stream averages less than 10 feet wide; it therefor has an associated 100-foot Riverbank Wetland per the RIDEM Wetland Regulations.

  Two unnamed intermittent streams are located in the western portion of the proposed Project site, which discharge into the unnamed perennial tributary to Dry Arm Brook. A fifth unnamed, intermitted stream is located in the central Project area and flows through a forested wetland. Each of these streams average less than 10 feet wide in their reach through the proposed Project site; they therefor have an associated 100-foot Riverbank Wetland per the RIDEM Wetland Regulations.

- **Description of existing drainage systems:**
  The only existing drainage system is a culvert under the existing cart path. The culvert is silted-in and no longer functions.

- **Design storms for all proposed drainage systems:**
  - Water Quality Flow (WQ_f) – 1.2 inch Type III 24-hr Storm (AMC 2) – Used for flow diversion structures for off-line stormwater treatment practices. This storm is designed to bypass flows greater than the WQ_f. The WQ_f shall be calculated using the WQ_v and a modified curve number (CN) for small storm events.

- 1-Year Storm – 2.70 inch Type III 24-hr Storm (AMC 2) – Used for channel protection volume (CP_v).

- 10-Year Storm – 4.90 inch Type III 24-hr Storm (AMC 2) – Used for peak flow attenuation.

- 100-Year Storm – 8.70 inch Type III 24-hr Storm (AMC 2) – Used for peak flow attenuation.

- **Design capacity of all proposed drainage systems:**
  The design capacity information is included Section 7.0

- **Description of each of the Point Of Interest (POI):**
  Portions of the project site proposed for improvement have been analyzed in accordance with guidance presented in Appendix K of the RISDISM. Six Points of Interest (POIs) have been established, POI A though POI F and shown on the drawings. The same POIs are used in the pre- and post-development conditions. There are minor existing roadway culverts within the project area, which are proposed for removal or replacement. The only known existing drainage facilities in any POI drainage areas is the culverts under the existing cart path. Cover types within all drainage areas are currently forested.

  - **POI A** is at the proposed discharge structure from the powerblock's detention facility. POI A drains to Iron Mine Brook, and is set in existing wetlands.

  - **POI B** is set at the downstream end of the proposed culvert for an unnamed stream (and approximately location of a culver for the existing wood road). POI B discharges to Iron Mine Brook.

  - **POI C** has been established immediately south of Wallum Lake Road at the downstream end of a proposed roadway culvert. POI C discharges to Iron Mine Brook.

  - **POI D** is an off-site point of interest, needed to determine the peak runoff reduction caused by the project at this off-site area. The proposed grading plan results in a small amount of area tributary to POI D being diverted to POIs A and B. This reduction is quantified in the calculations.

  - **POI E** is at the existing road culvert for Iron Mine Brook. POI E is needed to check the impact to the culvert under Wallum Lake Road.

  - **POI F** is set at the downstream end of a proposed wildlife crossing culvert (and the approximate location of a culvert under the existing wood road). POI F discharges to Iron Mine Brook.

- **Description of any upgradient areas:**
  The majority of the site receives runoff from offsite areas. This constraint has been mitigated through the site grading plan and proposed stormwater management system. The watershed maps in Section 1.0 have detailed information on the soils, land cover types and topography.

- **Description of the site:**
  Sensitive resources that exist at the site are described herein. Impact to these features or mitigation to such impact has been the primary goal of the site design.

  - Floodplains: there are no FEMA-mapped floodplains on site or within the limits of disturbance.

  - Steep slopes (>15%): According to elevation data collected in 2011 with Light Detection and Ranging technology and obtained from the Rhode Island GIS database, the elevation of the proposed site varies from approximately 530 to 590 feet above sea level, with the parcel sloping downward from southwest to northeast. The average grade on the property is 5.5%, but the hill in the southwestern portion of the Site has steeper slopes. This hill (area of steep slopes) has been avoided to preclude future slope stability issues.

  - Areas with the potential to receive run-on from off-site areas: The majority of the site receives runoff from offsite areas. This constraint has been mitigated through the site grading plan and stormwater management system proposed.

  - Erodible soils: the preliminary geotechnical report prepared for the project site did not note specific erodible soils.

  - Wetlands, hydric soils, surface waters, and their riparian buffers, specimen trees, natural vegetation, forest areas, and stream crossings: these constraints are described above under the <u>existing condition hydrology</u> section.

  - Historic properties, historic cemeteries or cultural resources: There are no conflicts.

- **Analysis methods used:**
  - Autodesk Storm and Sanitary Analysis 2016 for the Powerblock onsite storm pipe design.

  - HydroCad version 10.00; Runoff by SCS TR-20 method; Reach routing and Pond routing by Dyn-Stor-Ind method; and used for Pre- and Post-design features.

  - HEC-RAS version 4.1.0; steady state flow mode; used to calculate the overflow from Dry Arm Branch to Iron Mine Branch and tail water elevations.

- **Permits and Goals of the analysis:**
  - Freshwater Wetland Alteration Permit (includes RIPDES Multi-Sector General Permit and Construction Stormwater permit) – RIDEM/USACE

  - Air Permit – RIDEM

  - License to construct an Energy Facility – EFSB

  - License to construct a new Transmission Line – EFSB

- Onsite Wastewater Treatment System – RIDEM
- Land Development – Burrillville Planning/Zoning Board
- Building Permit – Burrillville Building Official
- FAA Determination of NO Hazard to Air Navigation – FAA
- RIDOT PAP (Physical Alteration Permit)

- **Description of water quality and water quantity mitigation:**
  - The Main Site (Powerblock) has a WVTS for water quality and a detention pond (4P) with a Stilling Well – Level Spreader to manage water quantity.
  - The Access Road has a series of Dry Swales for water quality and a small detention pond (13P) to manage water quantity.

- **Summery of the results of the analysis:**
  Summaries of all calculations are included in Section 3.0

- **Discussion of any diversion structures:**
  - Flow Splitter MH (24P) – used to reroute storms larger than the WQf storm away from the Forebay (2P) and the Gravel WVTS (3P) to the Detention Pond – 1 (4P).
  - Ditch to reduce flow from the Culvert at the Road Entrance (15P) - The Rerouted area (25S) goes through the following elements Rerouting Ditch 1 (23R) and Culvert 2 (30P) at which point Rerouted Area B (29S) is add in and both are routed through Rerouted Ditch Below Culvert (30R) to the Box Culvert for Stream (17P).
  - Ditch 25R to re-route Drainage Area 24S around Detention Basin 2 (13P).

Additional Explanation of Selected Items

Comparison of the Lag/CN method and Velocity method

Comment

13. Please explain why the Lag/CN method of time of concentration analysis was chosen over the more commonly utilized sheet flow/ shallow concentrated flow/ channel flow calculation of subwatershed time of concentration. Please include a comparison of the two methods. Please describe what advantages and disadvantages each method has, especially with respect to the choice made in the selection of the Lag/CN method. Also, if the use of the Lag/CN method can be adequately substantiated by technical justification, then please provide all pertinent calculations. Notably, provide specific calculations for the average slope used in the submitted analysis.

Technical Justification

HDR notes the Lag/CN method was used where appropriate in the submitted calculation package, and the sheet flow/shallow concentrated flow/channel flow method (Velocity method) applied where justifiable. Specifically, and as described below, the Lag/CN method is inappropriate for closed conduit systems, thus the Velocity method was used at node 1S in the proposed condition. The Lag/CN method is not appropriate for the Downstream Analysis, which is not an urbanized watershed, so the Velocity method was used for that portion of the hydrologic analyses. The Lag/CN method is appropriate for the bulk of site development work, where it was applied.

HDR has consistently applied appropriate methods to analyze areas in pre- and post-construction. HDR concurs using the Velocity method in lieu of Lag/CN would yield differing results, but offers that these results would differ commensurately from pre- to post-construction.

Comparison of Methods

In Chapter 15 of the National Engineering Handbook, Part 630, Hydrology by the Natural Resources Conservation Service (NRCS) (formally the Soil Conservation Service (SCS)) presented two primary methods to computing the Time of Concentration (Tc):

a) Watershed lag method (also known as the Curve Number Method (CN)) and
b) Velocity method (what you refer to as the sheet flow/ shallow concentrated flow/ channel flow)

In July of 1984, Richard H. McCuen, et. al. published a paper in the Journal of Hydraulic Engineering, (Vol. 110, No. 7) titled Estimating Urban Time of Concentration. This paper compared eleven (11) equations for estimating Tc to measured data from 48 watersheds. The Lag method and the Velocity method were both included in the study. The paper used two criteria for the comparisons, precision and bias. A method is biased if it consistently over estimates or underestimates. A comparison of just the Lag and Velocity methods from the data provided in the paper shows that the Lag method outperforms the Velocity method in precision and with less bias. The Velocity method has a tendency to overestimate the Tc. A portion of the data is included below:

Method	Standardized bias	Mean Tc* (hrs)
SCS Lag	-0.17	1.81
SCS Velocity	0.51	3.09

* The mean of the measured Tc values was 1.49 hr.

Calculations for Lag/CN method

The formulas for the Lag/CN method are:

Time of Concentration:

$$T_c = \frac{l^{0.8}(S+1)^{0.7}}{1140Y^{0.5}}$$

Where:

T_c = time of concentration, hr.
ℓ = flow length, ft.
Y = average watershed land slope, %
S = maximum potential retention, in

Maximum Potential Retention:

$$S = \frac{1000}{CN} - 10$$

Where:

CN = retardance factor

Average Land Slope:

$$Y = \frac{100(CI)}{A}$$

Where:

Y = average land slope, %
C = sum of the length of the contour lines that pass through the watershed drainage area, ft
I = contour interval used, ft
A = drainage area, ft^2 (1 acre = 43,560 ft^2)

Calculations for Velocity method

The formulas for the Velocity method are:

$$T_c = T_{t1} + T_{t2} + T_{t3} + \ldots T_{tn} \qquad \text{(eq. 15–7)}$$

where:

T_c = time of concentration, h
T_{tn} = travel time of a segment n, h
n = number of segments comprising the total hydraulic length

$$T_t = \frac{0.007(n\ell)^{0.8}}{(P_2)^{0.5} S^{0.4}} \qquad \text{(eq. 15–8)}$$

where:
T_t = travel time, h
n = Manning's roughness coefficient (table 15–1)
ℓ = sheet flow length, ft
P_2 = 2-year, 24-hour rainfall, in
S = slope of land surface, ft/ft

Advantages/Disadvantages of Methods

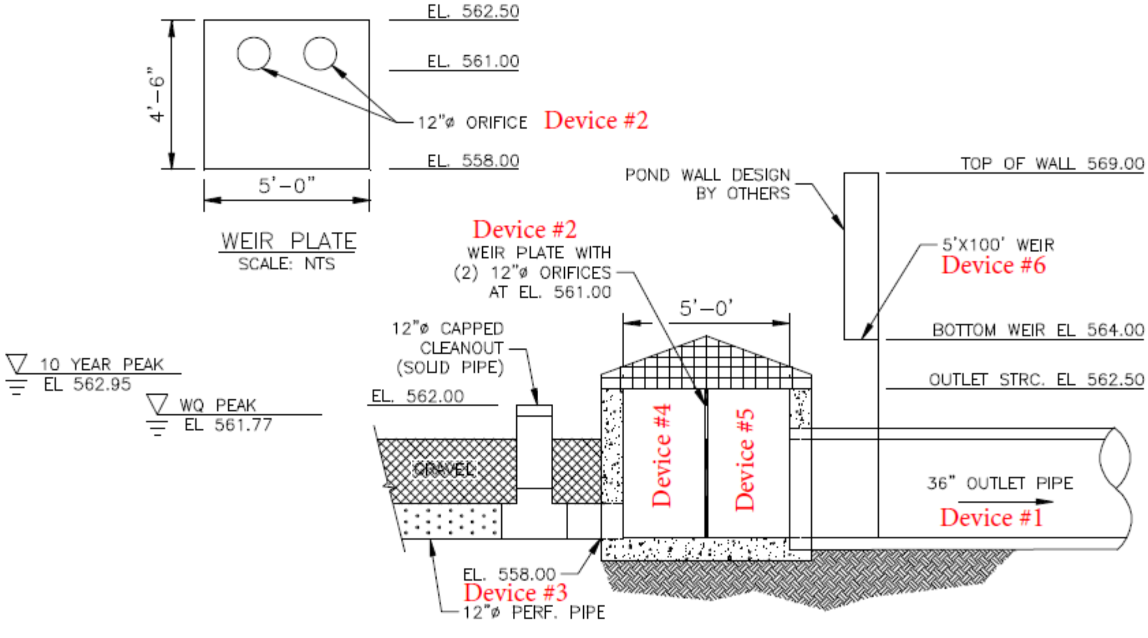
The velocity method of computing time of concentration is hydraulically sound and provides the opportunity to incorporate changes in individual flow segments if needed. However if the stream is quite sinuous (which is the case in existing conditions at the project site), the channel length and valley length may be significantly different and it is up to the modeler to determine which is the appropriate length to use for the depth of flow of the event under consideration. This leads to subjective determinations which can be inconsistent.

The Lag/CN method of computing time of concentration is also hydraulically sound and, as described above, has been shown to demonstrate less bias than the Velocity method for sites similar to the project site. The Lag/CN method best described the sinuous nature of waterways in the existing on-site conditions; if used in pre-development, practice dictates the method be employed in post-development (where studies have shown it appropriately describes the hydrologic system). Using the Lag/CN method results in consistency across designers and reviewers. The Lag/CN method is not appropriate for non-urbanized watersheds or concentration travel paths experiencing closed-system pipe hydraulics.

Calculations
Per the comment request, calculations showing the average slopes used in the analysis are included herein.

Modern day computers make calculating the average land slope extremely easy. Using Autodesk Civil3D we place a boundary around the area of interest (drainage boundary) and the program will give us the minimum, maximum and average slope. I like this method because it is consistent. No matter who does it you will get the same results every time. Unfortunately, that means that there are no calculations for the average land slope for me to provide you.

Control Structure for DP-1 (3P)



CONTROL STRUCTURE DETAIL (3P)

SCALE: NTS

1
01C803

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**36.0" Round Culvert** L= 20.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	561.00'	**12.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 2	558.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	564.00'	**100.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=23.97 cfs @ 12.24 hrs HW=562.95' TW=560.17' (Dynamic Tailwater)
- **1=Culvert** (Passes 23.97 cfs of 56.81 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 9.11 cfs @ 5.80 fps)
    - **3=Orifice/Grate** (Passes < 5.28 cfs potential flow)
    - **5=Orifice/Grate** (Passes < 14.86 cfs potential flow)
  - **4=Orifice/Grate** (Weir Controls 14.86 cfs @ 2.20 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=561.00' TW=558.00' (Dynamic Tailwater)
- **6=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Narrative of Flow Paths

During the WQ Storm:

1. Water filters through the gravel and through Device #3 into the control structure.
2. Water rises in the Control Structure flows through the 2 – 12” orifices (Device #2) in the Weir Plate.
3. From there the water flows out of the Control Structure through the 36” Outlet Pipe (Device #1)

During the 10-Year Storm water has 3 paths through the Control Structure:

- Path – A
    1. Water filters through the gravel and through Device #3 into the control structure.
    2. Water rises in the Control Structure flows through the 2 – 12” orifices (Device #2) in the Weir Plate.
    3. From there the water flows out of the Control Structure through the 36” Outlet Pipe (Device #1)

- Path – B
    1. Water overtops the Control Structure and flows through the rectangular orifice (Device #4) into the Control Structure.
    2. From there the water moves through the 2 – 12” orifices (Device #2) in the Weir Plate.
    3. And finally out of the Control Structure through the 36” Outlet Pipe (Device #1)

- Path – C
    1. Water overtops the Control Structure and flows through the rectangular orifice (Device #5) into the Control Structure.
    2. And finally out of the Control Structure through the 36” Outlet Pipe (Device #1)

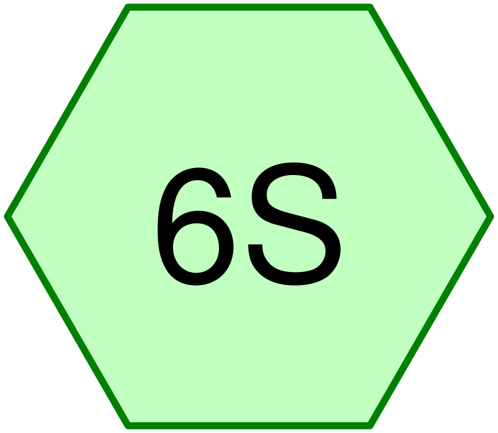
Section 1.0

Pre- and Post-development Drainage Area Maps

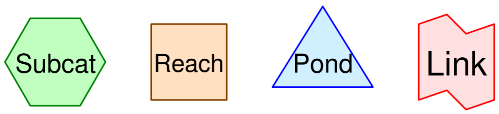
Section 2.0

Node Diagrams

POI E is at the existing road culvert for Iron Mine Brook. POI E is needed to check the impact to the culvert under Wallum Lake Road.



Exist DA at POI - E



Routing Diagram for Proposed
Prepared by HDR Inc, Printed 12/4/2017
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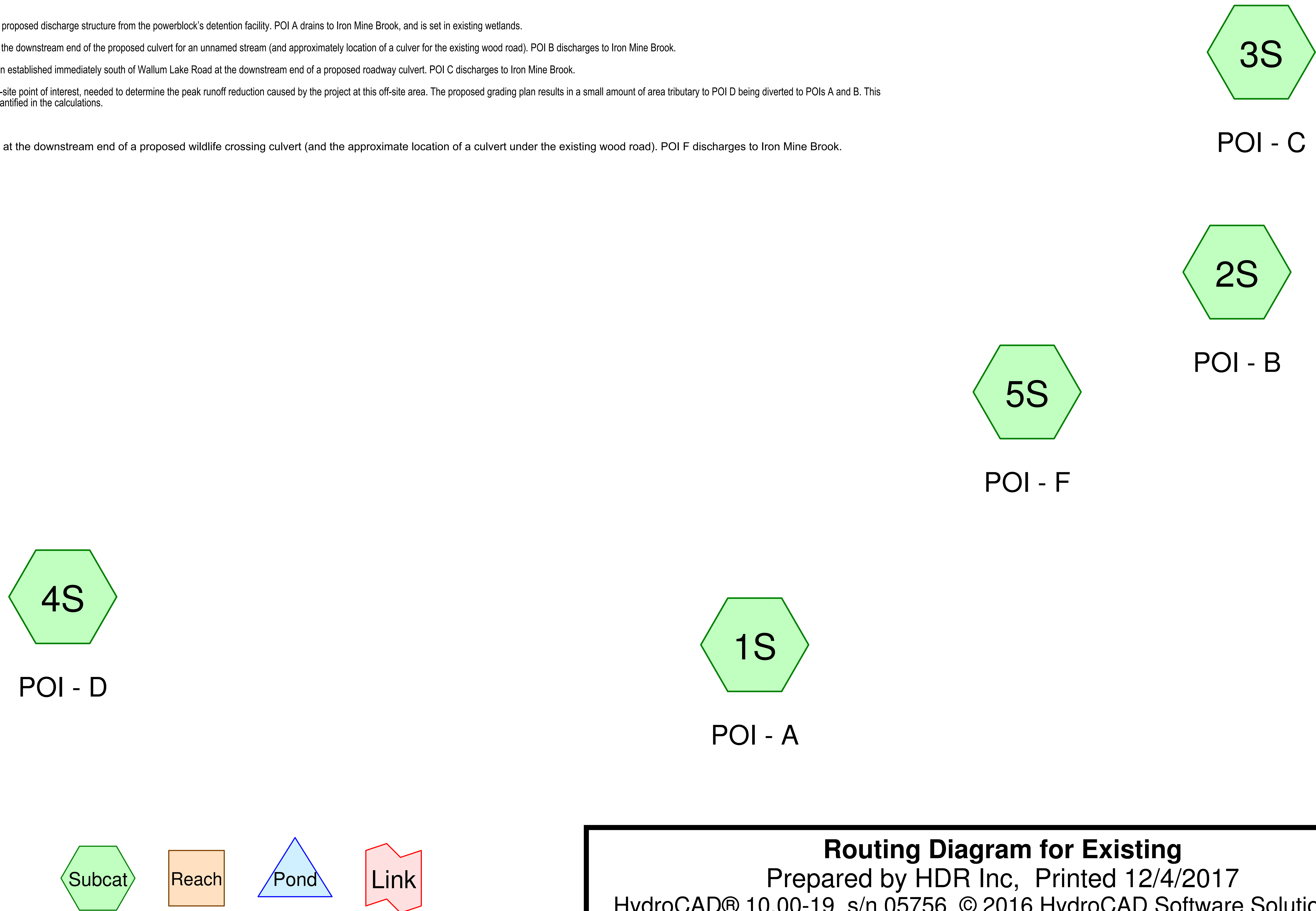
POI A is at the proposed discharge structure from the powerblock's detention facility. POI A drains to Iron Mine Brook, and is set in existing wetlands.

POI B is set at the downstream end of the proposed culvert for an unnamed stream (and approximately location of a culver for the existing wood road). POI B discharges to Iron Mine Brook.

POI C has been established immediately south of Wallum Lake Road at the downstream end of a proposed roadway culvert. POI C discharges to Iron Mine Brook.

POI D is an off-site point of interest, needed to determine the peak runoff reduction caused by the project at this off-site area. The proposed grading plan results in a small amount of area tributary to POI D being diverted to POIs A and B. This reduction is quantified in the calculations.

POI F is set at the downstream end of a proposed wildlife crossing culvert (and the approximate location of a culvert under the existing wood road). POI F discharges to Iron Mine Brook.



Routing Diagram for Existing
Prepared by HDR Inc, Printed 12/4/2017
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POI A is at the proposed discharge structure from the powerblock's detention facility. POI A drains to Iron Mine Brook, and is set in existing wetlands.

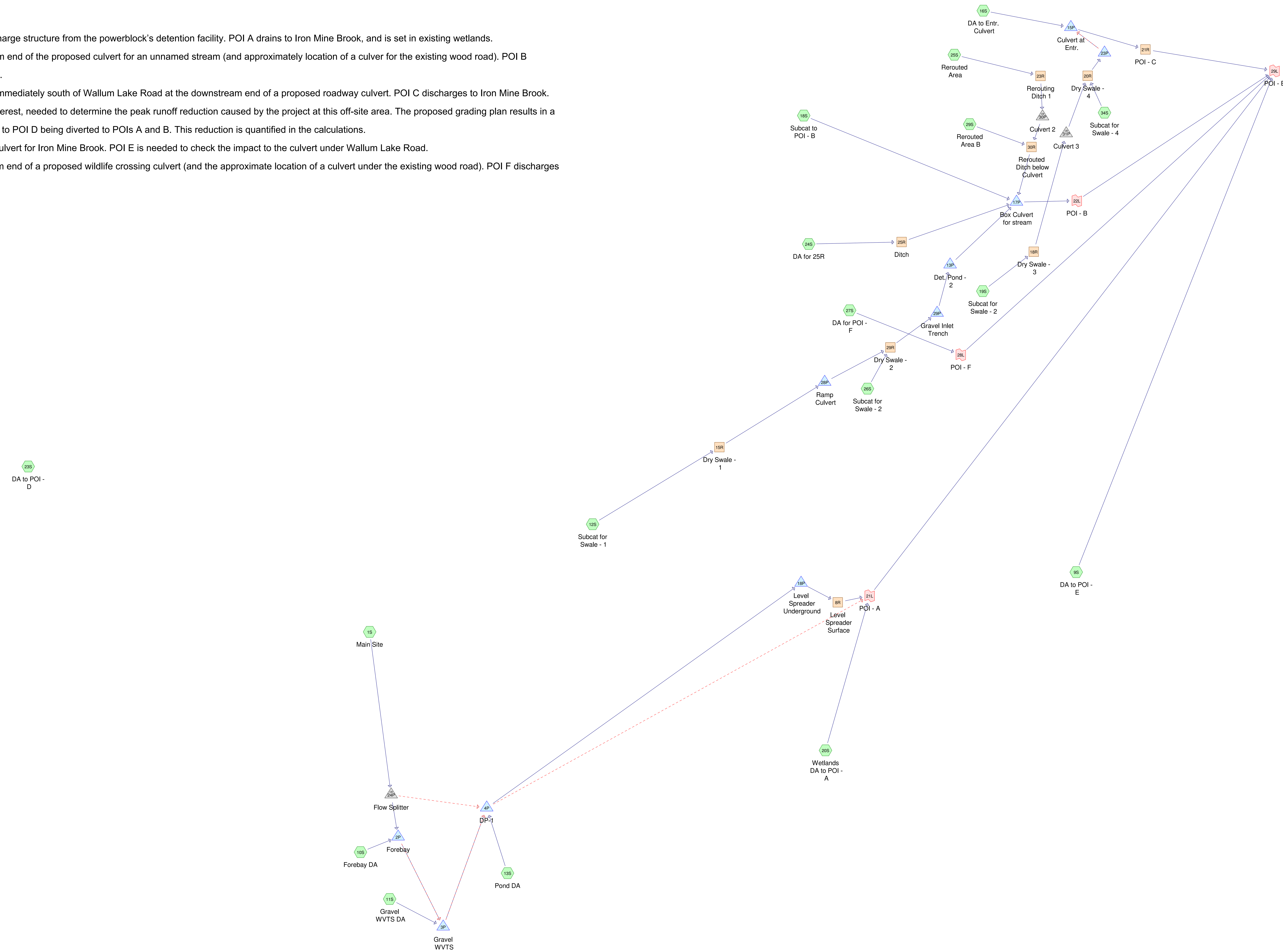
POI B is set at the downstream end of the proposed culvert for an unnamed stream (and approximately location of a culver for the existing wood road). POI B discharges to Iron Mine Brook.

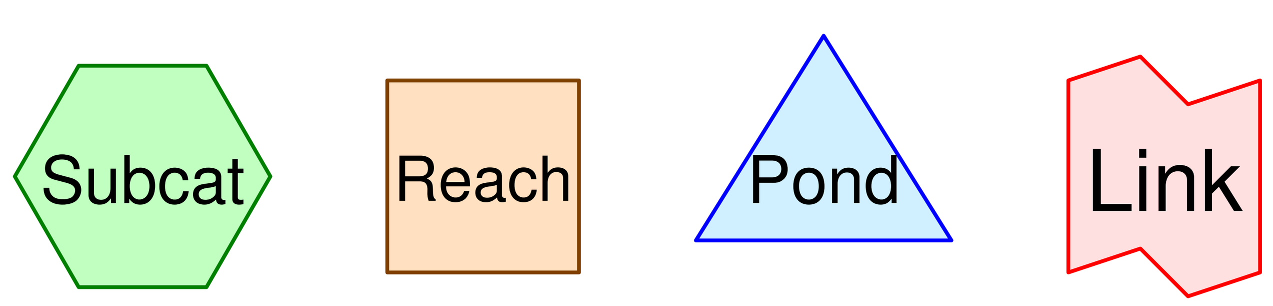
POI C has been established immediately south of Wallum Lake Road at the downstream end of a proposed roadway culvert. POI C discharges to Iron Mine Brook.

POI D is an off-site point of interest, needed to determine the peak runoff reduction caused by the project at this off-site area. The proposed grading plan results in a small amount of area tributary to POI D being diverted to POIs A and B. This reduction is quantified in the calculations.

POI E is at the existing road culvert for Iron Mine Brook. POI E is needed to check the impact to the culvert under Wallum Lake Road.

POI F is set at the downstream end of a proposed wildlife crossing culvert (and the approximate location of a culvert under the existing wood road). POI F discharges to Iron Mine Brook.





Routing Diagram for Proposed
Prepared by HDR Inc, Printed 12/4/2017
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Section 3.0

Drainage Analysis
Summary of the Output Data

DISCHARGE POINT COMPARISONS

Point A			
Storm	**Existing (1S)**	**Proposed (21L)**	**Velocity [1] (fps)**
10-Year Flow	20.16 cfs	17.72 cfs	0.77 fps
100-Year Flow	46.68 cfs	39.67 cfs	1.05 fps

Note [1] - Exit at Level Spreader

Point B			
Storm	**Existing (2S)**	**Proposed (22L)**	
10-Year Flow	86.73 cfs	74.75 cfs	
100-Year Flow	181.63 cfs	174.13 cfs	

Point C			
Storm	**Existing (3S)**	**Proposed (21R)**	
10-Year Flow	9.01 cfs	8.29 cfs	-11.11%
100-Year Flow	20.85 cfs	18.29 cfs	-10.00%

Point D			
Storm	**Existing (4S)**	**Proposed (23S)**	**% Increase**
10-Year Flow	140.96 cfs	137.55 cfs	-2.42%
10-Year Volume	18.145ac-ft	17.681 ac-ft	-2.53%
100-Year Flow	327.06 cfs	319.56 cfs	-2.29%
100-Year Volume	42.299 ac-ft	41.217ac-ft	-2.57%

DISCHARGE POINT COMPARISONS

Point E (at Culvert under Wallum Lake Road)			
Storm	**Existing**	**Proposed**	**% Increase**
10-Year Flow	137.11 cfs	119.16 cfs	-13.09%
10-Year Volume	99.050 ac-ft	102.171 ac-ft	3.15%
100-Year Flow	324.16 cfs	279.00 cfs	-13.93%
100-Year Volume	230.904 ac-ft	233.994 ac-ft	1.34%

Point F			
Storm	**Existing**	**Proposed**	**% Increase**
10-Year Flow	13.08 cfs	7.01 cfs	-46.41%
100-Year Flow	30.37 cfs	16.28 cfs	-46.39%

AREA COMPARISONS

There two main discharge points, POI-E and POI-D. The POIs A, B, C, and F are subcatchments of POI-E. The is a small area on the site which will be collected and transported off site.

POI - A			
Proposed (21L)		Existing (1S)	
SubCatchment	Area (ac)	SubCatchment	Area (ac)
1S	16.505	1S	11.793
10S	0.354		
11S	1.129		
13S	1.949		
20S	7.773		
Sum =	27.71	Sum =	11.793

POI - B			
Proposed (22L)		Existing (2S)	
SubCatchment	Area (ac)	SubCatchment	Area (ac)
12S	0.918	2S	63.36
26S	0.341		
24S	0.916		
18S	1.38		
25S	0.867		
29S	53.103		
Sum =	57.525	Sum =	63.36

POI - C			
Proposed (21R)		Existing (3S)	
SubCatchment	Area (ac)	SubCatchment	Area (ac)
19S	0.544	3S	4.464
34S	0.261		
16S	3.196		
Sum =	4.001	Sum =	4.464

AREA COMPARISONS

There two main discharge points, POI-E and POI-D. The POIs A, B, C, and F are subcatchments of POI-E. The is a small area on the site which will be collected and transported off site.

POI - D			
Proposed (23R)		**Existing (4S)**	
SubCatchment	**Area (ac)**	**SubCatchment**	**Area (ac)**
23S	83.546	4S	85.739
Sum =	83.546	Sum =	85.739

POI - E (at Culvert under Wallum Lake Road)			
Proposed		**Existing**	
SubCatchment	**Area (ac)**	**SubCatchment**	**Area (ac)**
9S	374.70	6S	468.04
POI - A	27.71		
POI - B	57.53		
POI - C	4.00		
POI - F	5.04		
Sum =	468.98	Sum =	468.04

POI - F			
Proposed		**Existing**	
SubCatchment	**Area (ac)**	**SubCatchment**	**Area (ac)**
27S	5.04	5S	9.4
Sum =	5.04	Sum =	9.4

Total			
Proposed		**Existing**	
POIs	**Area (ac)**	**POIs**	**Area (ac)**
D	83.55	D	85.74
E	468.98	E	468.04
Transported Off-Site	1.25	Transported Off-Site	0.00
Sum =	553.78	Sum =	553.78

DITCH CALCULATIONS

Dry Swale - 1 (15R)			
Storm	**Flow**	**Depth[1]**	**Velocity**
WQv	0.38	0.11	1.49
1-Year	1.58	0.26	2.40
10-Year	3.47	0.40	3.05
100-Year	6.75	0.58	3.69
Note 1 - Depth of ditch is 2 feet			

Dry Swale - 2 (29R)			
Storm	**Flow**	**Depth[1]**	**Velocity**
WQv	0.47	0.13	1.64
1-Year	1.94	0.29	2.62
10-Year	4.30	0.45	3.33
100-Year	8.38	0.64	4.02
Note 1 - Depth of ditch is 2 feet			

Dry Swale - 3 (18R)			
Storm	**Flow**	**Depth[1]**	**Velocity**
WQv	0.28	0.04	1.03
1-Year	1.11	0.10	1.75
10-Year	2.41	0.16	2.34
100-Year	4.65	0.24	2.99
Note 1 - Depth of ditch is 2 feet			

DITCH CALCULATIONS

Dry Swale - 4 (20R)			
Storm	**Flow**	**Depth[1]**	**Velocity**
WQv	0.4	0.14	1.27
1-Year	1.61	0.31	1.99
10-Year	3.52	0.47	2.52
100-Year	6.82	0.67	3.03
Note 1 - Depth of ditch is 2 feet			

Rerouting Ditch (23R)			
Storm	**Flow**	**Depth[1]**	**Velocity**
1-Year	0.95	0.19	2.06
10-Year	2.95	0.37	2.94
100-Year	6.85	0.58	3.76
Note 1 - Ditch is 1' deep; 2' wide; with 2:1 side slopes			

Ditch below Culvert (30R)			
Storm	**Flow**	**Depth[1]**	**Velocity**
1-Year	1.56	0.23	2.81
10-Year	4.87	0.43	3.99
100-Year	11.31	0.67	5.07
Note 1 - Ditch is 1' deep; 2' wide; with 2:1 side slopes			

Level Spreader (8R)			
Storm	**Flow**	**Depth**	**Velocity**
1-Year	2.57	0.05	0.67
10-Year	3.75	0.06	0.77
100-Year	8.38	0.10	1.05

DITCH CALCULATIONS

Entr. Pipe Exit Ditch (21R)			
Storm	**Flow**	**Depth[1]**	**Velocity**
1-Year	2.88	0.15	2.02
10-Year	8.29	0.29	3.00
100-Year	18.29	0.46	4.00
Note 1 - Ditch is 1' deep; 10' wide; with 2:1 side slopes			

STORM WATER CALCULATIONS

Flow Splitter

Storms	24P (Flow Splitter)		
	Proposed thru Secondary	Proposed thru Primary (cfs)	Water Elev. (ft)
WQ_f	0	17.23	565.26
10-Year	54.59	26.66	568.34
100-Year	105.27	33.99	570.34

POINT A

Storms	2P (Forebay)		
	Existing Calculated (cfs)	Total Proposed (cfs)	Water Elev. (ft)
WQ_f	6.72	5.10	564.50
10-Year		27.83	565.24
100-Year		36.51	565.30

STORM WATER CALCULATIONS

	3P (Gravel WVTS)		
Storms			
	Total	**Total**	
	In (cfs)	**Out (cfs)**	**Water Elev. (ft)**
WQ_f		3.31	561.77
10-Year		23.97	562.95
100-Year		37.4	563.86

	4P (Detention Pond)		
Storms			
	Total	**Total**	
	In (cfs)	**Out (cfs)**	**Water Elev. (ft)**
WQ_f		1.07	558.74
10-Year		3.08	561.7
100-Year		7.62	563.93
1-Year		2.16	559.99

STORM WATER CALCULATIONS

	18P (Level Spreader)		
Storms			
	Total In (cfs)	**Total Out (cfs)**	**Water Elev. (ft)**
WQ_f		1.07	558.07
10-Year		3.08	558.15
100-Year		7.62	558.27
1-Year		2.16	558.12

	21L (POI-A)		
Storms			
	Existing Calculated (cfs)	**Proposed Total (cfs)**	**Water Elev. (ft)**
WQ_f^1	6.72	1.13	
10-Year	20.16	17.72	
100-Year	46.68	39.67	

Note 1 = Calculated

STORM WATER CALCULATIONS

POINT B

	28P (DP for Ramp Culvert)		
Storms			
	Existing Total (cfs)	**Proposed Total (cfs)**	**Water Elev. (ft)**
1-Year		1.58	555.44
10-Year		3.46	555.69
100-Year		6.71	556.03

	29P (Gravel Inlet for Swale into 13P)		
Storms			
	Existing Total (cfs)	**Proposed Total (cfs)**	**Water Elev. (ft)**
WQ_f		0.47	538.59
1-Year		1.94	539.00
10-Year		4.30	539.59
100-Year		8.38	541.84

STORM WATER CALCULATIONS

	13P (DP for Swale - 1 & 2)		
Storms			
	Existing Total (cfs)	**Proposed Total (cfs)**	**Water Elev. (ft)**
WQ_f	0.22	0.05	538.22
1-Year	0.14	0.13	538.86
10-Year		0.78	539.56
100-Year		6.50	539.89

STORM WATER CALCULATIONS

	17P (12' x 6' Box)		
Storms			
	Existing Total (cfs)	**Proposed Total (cfs)**	**Water Elev. (ft)**
1-Year	28.94	24.02	533.00
10-Year	86.73	74.75	533.76
100-Year[1]	181.63	174.13	534.93

1. Includes flow crossing from the Dry Arm Basin

	30P (Culvert 2)		
Storms			
	Existing Total (cfs)	**Proposed Total (cfs)**	**Water Elev. (ft)**
1-Year		0.95	534.07
10-Year		2.95	534.46
100-Year[1]		6.85	535.14

STORM WATER CALCULATIONS

	22L (POI-B)		
Storms			
	Existing Total (cfs)	Proposed Total (cfs)	Water Elev. (ft)
1-Year	28.94	24.02	
10-Year	86.73	74.75	
100-Year[1]	181.63	174.13	

1. Includes flow crossing from the Dry Arm Basin

STORM WATER CALCULATIONS

POINT C

	15P (POI-C - Culvert at Entr.)		
Storms			
	Existing Total (cfs)	Proposed Total (cfs)	Water Elev. (ft)
1-Year	2.89	2.88	529.83
10-Year	9.01	8.29	530.16
100-Year	20.85	18.29	530.33

	31P (Culvert 3)		
Storms			
	Existing Total (cfs)	Proposed Total (cfs)	Water Elev. (ft)
1-Year		1.11	533.44
10-Year		2.41	533.68
100-Year[1]		4.65	534.01

STORM WATER CALCULATIONS

	23P (DP for Swell at Entrence)		
Storms			
	Existing Total (cfs)	**Proposed Total (cfs)**	**Water Elev. (ft)**
WQ_f	0.22	0.22	530.99
1-Year		1.56	531.74
10-Year		3.47	531.86
100-Year		6.73	532.01

STORM WATER CALCULATIONS

POINT D

	POI-D		
Storms			
	Existing Total (cfs)	Proposed Total (cfs)	% Reduction
1-Year	45.55	44.54	2.22%
10-Year	140.96	137.55	2.42%
100-Year	327.06	319.56	2.29%

STORM WATER CALCULATIONS

POINT F

	(Wildlife Crossing #2)		
Storms			
	Existing Total (cfs)	Proposed Total (cfs)	Water Elev. (ft)
1-Year	4.23	2.27	
10-Year	13.08	7.01	
100-Year	30.37	16.28	

	28L (POI-F)		
Storms			
	Existing Total (cfs)	Proposed Total (cfs)	Water Elev. (ft)
1-Year	4.23	2.27	
10-Year	13.08	7.01	
100-Year	30.37	16.28	

Invenergy – Rhode Island - Clear River Energy
Polution Calculations Summary Tables

Polution Calculations for Main Site (2P & 3P)			
Pollutant	Pre-Development	Post with out BMP Net Increase	Post with BMP Net Increase
TSS (lbs TN/year)	477.3	19,242.7	5,123.4
TP (lbs TN/year)	1.0	40.1	13.1
TN(lbs TN/year)	16.3	328.8	187.4
Bacteria (#col/100ml/year)	2,807.5	391,592.8	124,918.1

Polution Calculations for Dry Swale (15R & 29R)			
Pollutant	Pre-Development	Post with out BMP Net Increase	Post with BMP Net Increase
TSS (lbs TN/year)	33.4	1,320.3	132.0
TP (lbs TN/year)	0.1	2.2	1.5
TN(lbs TN/year)	1.1	19.6	8.8
Bacteria (#col/100ml/year)	196.5	15,146.0	4,543.8

Polution Calculations for Dry Swale (18R & 20R)			
Pollutant	Pre-Development	Post with out BMP Net Increase	Post with BMP Net Increase
TSS (lbs TN/year)	21.4	866.8	86.7
TP (lbs TN/year)	0.0	1.4	1.0
TN(lbs TN/year)	0.7	12.9	5.8
Bacteria (#col/100ml/year)	125.6	9,940.5	2,982.2

Section 4.0

Drainage Analysis
Hand Calculations

(Rev, WQv, WQf, CN, Af and CPv)

Invenergy – Rhode Island - Clear River Energy

Main Site (2P & 3P)

Total Drainage Area = 17.993 ac
Impervious Area = 16.51 ac
HSG = D

Groundwater Recharge (Re_v)

Note: LUHPPL therefore no infiltration required

$$Re_v = (1")(F)\left(\frac{I}{12}\right)$$

Table 3-4	
HSG	Recharge Factor (F)
A	0.60
B	0.35
C	0.25
D	0.10

F = recharge factor (Table 3-4)
I = 16.51 impervious area (ac)

Re_v = 1*F*(I/12)

Re_v = 0 groundwater recharge volume (ac-ft)

Re_v = 0 groundwater recharge volume (ft^3)

Water Quality Volume (WQ_v)

Note:

$$WQ_v = (1")\left(\frac{I}{12}\right)$$

I = 16.51 impervious area (ac)

WQ_v = 1*(I/12)

WQ_v = 1.376 Total Water Quality Volume (ac-ft) **OR** 59,931 ft^3 — 65,192 ft^3 - Actual Total Volume; 1.4966 ac-ft - Actual Total Volume

Forbay = 0.14 10% of WQ_v in ac-ft **OR** 5,993 ft^3 — 19,882 ft^3 - Actual Forbay volume

WQ_v = 1.24 90% of WQ_v in ac-ft **OR** 53,938 ft^3 — 45,310 ft^3 - Actual rest of the WQ volume

---

Modified CN

Note:

$$CN = 1000/\left[10 + 5P + 10Q - 10\left(Q^2 + 1.25QP\right)^{1/2}\right]$$

P = 1.2 rainfall in inches (use 1.2 inches for the Water Quality Storm)
Q = 0.92 runoff volume in watershed inches (equal to WQ_v / total drainage area)
A_t = 17.993 total drainage area in acres

CN = 1000/(10+5*P+10*Q-10*((Q^2)+1.25*Q*P)^(1/2))

CN = 97.26 Use = 98

Invenergy – Rhode Island - Clear River Energy

Main Site (2P & 3P)

Water Quality Flow (WQ_f)

Note:

$$WQ_f = (q_u)(A)(Q)$$

I_a = 0.04

T_c = 6 min. **OR** 0.10 hrs

I_a/P = 0.03

q_u = 260 unit peak discharge in cfs/mi^2/inch (from Exhibit 4-III of the TR-55 Manual)

A = 0.028 drainage area in mi^2

Q = 0.92

WQ_f = qu*A*Q

WQ_f = 6.71 peak discharge for a water quality event (cfs)

WQ_{f_actual} = 5.10 actual peak discharge for a water quality event (cfs) from HydroCAD **OK**

Surface Area of Filter Bed (A_f)

Note: LUHPPL therefore no infiltration required

$$A_f = (WQ_v)(d_f)/[(k)(h_f + d_f)(t_f)]$$

WQ_v = 59,931 Water Quality Volume in ft^3

d_f = Filter Bed Depth in ft

k = Coefficient of Permeability of Filter Media in ft/day

h_f = Average height of water above surface in ft

t_f = Design filter bed drain time in days

A_f = (WQv*df)/((k)*(hf+df)*(tf))

A_f = Surface area of filter bed in ft^2

Channel Protection Volume (CP_v)

Note:

$$CP_v = (V_r) \times (0.65)$$

V_r = 147,973 runoff volume from 1-yr 24-hr Type III storm (ft^3)

T = 86400 Extended detention time (24 hrs) sec

CP_v = 96,182 required channel protection storage volume (ft^3)

CP_v / T = 1.11 Average Release Rate (cfs)

(CP_v / T)*2 = 2.23 Maximum Release Rate (cfs)

Invenergy – Rhode Island - Clear River Energy

Main Site (2P & 3P)

2.16 Actual Release Rate (cfs) from HydroCAD **OK**

Downstream Analysis (Point E)

Note: Flow rates are from HydroCAD

DA_{total} =	468.979	total drainage area in acres
DA_{site} =	16.505	Site impervious drainage area in acres
	3.52%	
Pre_{10} =	137.39	cfs
$Post_{10}$ =	119.16	cfs
	13.27%	decrease
Pre_{100} =	324.81	cfs
$Post_{100}$ =	278.98	cfs
	14.11%	decrease

Gravel WVTS Surface Analysis

Note:

DA_{site} =	16.505	site drainage area in acres	
DA_{site} =	718,958	site drainage area in sq. ft.	
Min-$WVTS_{surface}$ =	2,516	required minimum surface area for WVTS in sq. ft.	
$Forebay_{surface}$ =	3,802	14.21% minimum is 10%	**OK**
$WVTS_{surface}$ =	22,959		
$WVTS_{surface}$ =	26,761	Actual WVTS surface area provided in sq ft	**OK**

Invenergy – Rhode Island - Clear River Energy

Entrance Road - West End (15R) from Site to Ramp

Total Drainage Area =	0.92	ac
Impervious Area =	0.665	ac
HSG =	D	

Groundwater Recharge (Re_v)

Note: Infiltration rate is < 0.5 inch/hr

$$Re_v = (1")(F)\left(\frac{I}{12}\right)$$

Table 3-4	
HSG	**Recharge Factor (F)**
A	0.60
B	0.35
C	0.25
D	0.10

F = recharge factor (Table 3-4)
I = 0.665 impervious area (ac)

Re_v = 1*F*(I/12)

Re_v = 0 groundwater recharge volume (ac-ft)

Re_v = 0 groundwater recharge volume (ft^3)

Water Quality Volume (WQ_v)

Note:

$$WQ_v = (1")\left(\frac{I}{12}\right)$$

I = 0.665 impervious area (ac)

WQ_v = 1*(I/12)

WQ_v = 0.055 Water Quality Volume (ac-ft) **OR** 2,414 ft^3

$Re_v + WQ_v$ = 2,414 ft^3 Actual = 3,616 ft^3 **OK**

$Re_v + WQ_v$ = 0.055 ac-ft Actual = 0.083 ac-ft

Modified CN

Note:

$$CN = 1000/\left[10 + 5P + 10Q - 10\left(Q^2 + 1.25QP\right)^{1/2}\right]$$

P = 1.2 rainfall in inches (use 1.2 inches for the Water Quality Storm)
Q = 0.72 runoff volume in watershed inches (equal to WQ_v / total drainage area)
A_t = 0.918 total drainage area in acres

CN = 1000/(10+5*P+10*Q-10*((Q^2)+1.25*Q*P)^(1/2))

CN = 94.79 Use = 95 Composit CN

Invenergy – Rhode Island - Clear River Energy

Entrance Road - West End (15R) from Site to Ramp

Surface Area of Filter Bed (A_f)

Note: For Dry Swale 1

$$A_f = (WQ_v)(d_f)/[(k)(h_f + d_f)(t_f)]$$

WQ_v =	2,414	Water Quality Volume in ft^3
d_f =	2.5	Filter Bed Depth in ft
k =	1	Coefficient of Permeability of Filter Media in ft/day
h_f =	0.59	Average height of water above surface in ft
t_f =	2	Design filter bed drain time in days

A_f = (WQv*df)/((k)*(hf+df)*(tf))

A_f = 977 Surface area of filter bed in ft^2

2,571 Actual surface area **OK**

Invenergy – Rhode Island - Clear River Energy

Entrance Road - West End (29R) from Ramp to DP 13P

Total Drainage Area = 0.34 ac
Impervious Area = 0.234 ac
HSG = D

Groundwater Recharge (Re_v)

Note: Infiltration rate is < 0.5 inch/hr

$$Re_v = (1")(F)\left(\frac{I}{12}\right)$$

HSG	Table 3-4 Recharge Factor (F)
A	0.60
B	0.35
C	0.25
D	0.10

F = recharge factor (Table 3-4)
I = 0.234 impervious area (ac)

Re_v = 1*F*(I/12)

Re_v = 0 groundwater recharge volume (ac-ft)

Re_v = 0 groundwater recharge volume (ft^3)

Water Quality Volume (WQ_v)

Note:

$$WQ_v = (1")\left(\frac{I}{12}\right)$$

I = 0.234 impervious area (ac)

WQ_v = 1*(I/12)

WQ_v = 0.020 Water Quality Volume (ac-ft) **OR** 849 ft^3

$Re_v + WQ_v$ = 849 ft^3 Actual = 1,092 ft^3 **OK**

$Re_v + WQ_v$ = 0.019 ac-ft Actual = 0.025 ac-ft

Modified CN

Note:

$$CN = 1000/\left[10 + 5P + 10Q - 10\left(Q^2 + 1.25QP\right)^{1/2}\right]$$

P = 1.2 rainfall in inches (use 1.2 inches for the Water Quality Storm)
Q = 0.69 runoff volume in watershed inches (equal to WQ_v / total drainage area)
A_t = 0.341 total drainage area in acres

CN = 1000/(10+5*P+10*Q-10*((Q^2)+1.25*Q*P)^(1/2))

CN = 94.22 Use = 95 Composit CN

Invenergy – Rhode Island - Clear River Energy

Entrance Road - West End (29R) from Ramp to DP 13P

Water Quality Flow (WQ_f)

Note: This includes the flow from Drainage Areas 12S and 26S

$$WQ_f = (q_u)(A)(Q)$$

I_a = 0.11

T_c = 6 min. **OR** 0.10 hrs

I_a/P = 0.09

q_u = 260 unit peak discharge in cfs/mi^2/inch (from Exhibit 4-III of the TR-55 Manual)

A = 1.26 drainage area in ac

A = 0.002 drainage area in mi^2

Q = 0.69

WQ_f = qu*A*Q

WQ_f = $\boxed{0.35}$ allowable peak discharge for a water quality event (cfs)

0.08 Actual peak discharge (cfs) from HydroCad (13P) **OK**

Surface Area of Filter Bed (A_f)

Note: For Dry Swale 2

$$A_f = (WQ_v)(d_f)/[(k)(h_f + d_f)(t_f)]$$

WQ_v = 849 Water Quality Volume in ft^3

d_f = 2.5 Filter Bed Depth in ft

k = 1 Coefficient of Permeability of Filter Media in ft/day

h_f = 0.59 Average height of water above surface in ft

t_f = 2 Design filter bed drain time in days

A_f = (WQv*df)/((k)*(hf+df)*(tf))

A_f = $\boxed{344}$ Surface area of filter bed in ft^2

2,571 Actual surface area **OK**

Channel Protection Volume (CP_v)

Note: West End Ditch from 29P

$$CP_v = (V_r) \times (0.65)$$

V_r = 8,102 runoff volume from 1-yr 24-hr Type III storm (ft^3)

T = 86400 Extended detention time (24 hrs) sec

CP_v = $\boxed{5,266}$ required channel protection storage volume (ft^3)

CP_v / T = 0.06 Average Release Rate (cfs)

(CP_v / T)*2 = 0.12 Maximum Release Rate (cfs)

Invenergy – Rhode Island - Clear River Energy

Entrance Road - West End (29R) from Ramp to DP 13P

1.94	Actual Release Rate (cfs) from HydroCAD	**OK - below 2 cfs**

Invenergy – Rhode Island - Clear River Energy

Entrance Road - East End (19S) From DP 13P to Access Road for Well

Total Drainage Area =	0.54	ac
Impervious Area =	0.4	ac
HSG =	D	

Groundwater Recharge (Re_v)

Note: Seperation from SHWT is less than 3 feet

$$Re_v = (1")(F)\left(\frac{I}{12}\right)$$

Table 3-4	
HSG	**Recharge Factor (F)**
A	0.60
B	0.35
C	0.25
D	0.10

F = recharge factor (Table 3-4)

I = 0.4 impervious area (ac)

Re_v = 1*F*(I/12)

Re_v = 0 groundwater recharge volume (ac-ft)

Re_v = 0 groundwater recharge volume (ft^3)

Water Quality Volume (WQ_v)

Note:

$$WQ_v = (1")\left(\frac{I}{12}\right)$$

I = 0.4 impervious area (ac)

WQ_v = 1*(I/12)

WQ_v = 0.033 Water Quality Volume (ac-ft) **OR** 1,452 ft^3

$Re_v + WQ_v$ = 1,452 ft^3 Actual = 2,200 ft^3 **OK**

$Re_v + WQ_v$ = 0.033 ac-ft Actual = 0.051 ac-ft

Modified CN

Note:

$$CN = 1000/\left[10 + 5P + 10Q - 10\left(Q^2 + 1.25QP\right)^{1/2}\right]$$

P = 1.2 rainfall in inches (use 1.2 inches for the Water Quality Storm)

Q = 0.74 runoff volume in watershed inches (equal to WQ_v / total drainage area)

A_t = 0.544 total drainage area in acres

CN = 1000/(10+5*P+10*Q-10*((Q^2)+1.25*Q*P)^(1/2))

CN = 94.94 Use = 95

Invenergy – Rhode Island - Clear River Energy

Entrance Road - East End (19S) From DP 13P to Access Road for Well

Surface Area of Filter Bed (A_f)

Note: For Dry Swale 3

$$A_f = (WQ_v)(d_f)/[(k)(h_f + d_f)(t_f)]$$

WQ_v =	1,452	Water Quality Volume in ft^3
d_f =	2.5	Filter Bed Depth in ft
k =	1	Coefficient of Permeability of Filter Media in ft/day
h_f =	0.31	Average height of water above surface in ft
t_f =	2	Design filter bed drain time in days

A_f = (WQv*df)/((k)*(hf+df)*(tf))

A_f = $\boxed{646}$ Surface area of filter bed in ft^2

1,415 Actual surface area **OK**

Invenergy – Rhode Island - Clear River Energy

Entrance Road - East End (34S)

Total Drainage Area = 0.26 ac
Impervious Area = 0.189 ac
HSG = D

Groundwater Recharge (Re_v)

Note: Seperation from SHWT is less than 3 feet

$$Re_v = (1")(F)\left(\frac{I}{12}\right)$$

HSG	Table 3-4 Recharge Factor (F)
A	0.60
B	0.35
C	0.25
D	0.10

F = recharge factor (Table 3-4)
I = 0.189 impervious area (ac)

Re_v = 1*F*(I/12)

Re_v = 0 groundwater recharge volume (ac-ft)

Re_v = 0 groundwater recharge volume (ft^3)

Water Quality Volume (WQ_v)

Note:

$$WQ_v = (1")\left(\frac{I}{12}\right)$$

I = 0.189 impervious area (ac)

WQ_v = 1*(I/12)

WQ_v = 0.016 Water Quality Volume (ac-ft) **OR** 686 ft^3

$Re_v + WQ_v$ = 686 ft^3 Actual = 792 ft^3 **OK**

$Re_v + WQ_v$ = 0.016 ac-ft Actual = 0.018 ac-ft

Modified CN

Note:

$$CN = 1000/\left[10 + 5P + 10Q - 10\left(Q^2 + 1.25QP\right)^{1/2}\right]$$

P = 1.2 rainfall in inches (use 1.2 inches for the Water Quality Storm)
Q = 0.72 runoff volume in watershed inches (equal to WQ_v / total drainage area)
A_t = 0.261 total drainage area in acres

CN = 1000/(10+5*P+10*Q-10*((Q^2)+1.25*Q*P)^(1/2))

CN = 94.78 Use = 95

Invenergy – Rhode Island - Clear River Energy

Entrance Road - East End (34S)

Water Quality Flow (WQ_f)

Note: This includes the flow from Drainage Areas 19S and 34S

$$WQ_f = (q_u)(A)(Q)$$

I_a = 0.11
T_c = 6 min. **OR** 0.10 hrs

I_a /P = 0.09

q_u = 260 unit peak discharge in cfs/mi^2/inch (from Exhibit 4-III of the TR-55 Manual)
A = 0.81 drainage area in ac
A = 0.001 drainage area in mi^2
Q = 0.72

WQ_f = qu*A*Q

WQ_f = 0.24 allowable peak discharge for a water quality event (cfs)

0.23 Actual peak discharge (cfs) **OK**

Surface Area of Filter Bed (A_f)

Note: For Dry Swale 4

$$A_f = (WQ_v)(d_f)/[(k)(h_f + d_f)(t_f)]$$

WQ_v = 686 Water Quality Volume in ft^3
d_f = 2.5 Filter Bed Depth in ft
k = 1 Coefficient of Permeability of Filter Media in ft/day
h_f = 0.31 Average height of water above surface in ft
t_f = 2 Design filter bed drain time in days

A_f = (WQv*df)/((k)*(hf+df)*(tf))

A_f = 305 Surface area of filter bed in ft^2

1,415 Actual surface area **OK**

Channel Protection Volume (CP_v)

Note: Next to Wallum Road (23P)

$$CP_v = (V_r) \times (0.65)$$

V_r = 10,873 runoff volume from 1-yr 24-hr Type III storm (ft^3)

T = 86400 Extended detention time (24 hrs) sec

CP_v = 7,067 required channel protection storage volume (ft^3)

CP_v / T = 0.08 Average Release Rate (cfs)

(CP_v / T)*2 = 0.16 Maximum Release Rate (cfs)

Invenergy – Rhode Island - Clear River Energy

Entrance Road - East End (34S)

1.56	Actual Release Rate (cfs) from HydroCAD	**OK - below 2 cfs**

Section 5.0

Drainage Analysis
Pollution Calculations

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Main Site (2P & 3P) for TSS

A = 17.99 drainage area in acres
P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:
Note: Site is Undeveloped/Rural

TSS = 51 mg/l (Table H-2)

Post-Development:
Note: Site is Industrial

TSS = 120 mg/l (Table H-2)

TSS Removal
Note: For Main Site

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:
Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	51	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	17.99	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D34*D35*D36)/12)*D37*D38*2.72

L = 477.3 lbs TN/year

Post-Development:
Note: Site is Industrial

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.878	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	120	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	17.99	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 92 the percent of site imperviousness

L = ((D54*D55*D56)/12)*D57*D58*2.72

L = 19,720.0 lbs

Conclusion:

Net = 19,242.7 Increase in TSS

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Main Site (2P & 3P) for TSS

Pollutant Removal:

1st BMP:

Note: Forebay

RE = 25% Removal Efficiency from Table H-4

LR = 4,810.7 Load Reduction (lbs TN/year)

Net Load = 14,432.1 lbs TN/year

2nd BMP:

Note: Gravel WVTS
2nd BMP will operate at 75% efficiency

RE = 86% Removal Efficiency from Table H-3

LR = 9,308.7 Load Reduction (lbs TN/year)

TSS Net Load = **5,123.4** lbs TN/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Main Site (2P & 3P) for TP

A = 17.99 drainage area in acres
P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:
Note: Site is Undeveloped/Rural

TP = 0.11 mg/l (Table H-2)

Post-Development:
Note: Site is Industrial

TP = 0.25 mg/l (Table H-2)

TSS Removal
Note: For Main Site

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:
Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	0.11	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	17.99	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D34*D35*D36)/12)*D37*D38*2.72

L = 1.0 lbs TN/year

Post-Development:
Note: Site is Industrial

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.878	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	0.25	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	17.99	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 92 the percent of site imperviousness

L = ((D54*D55*D56)/12)*D57*D58*2.72

L = 41.1 lbs

Conclusion:

Net = 40.1 Increase in TSS

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Main Site (2P & 3P) for TP

Pollutant Removal:

1st BMP:
Note: Forebay

RE =	8%	Removal Efficiency from Table H-4
LR =	3.2	Load Reduction (lbs TN/year)
Net Load =	36.8	lbs TN/year

2nd BMP:
Note: Gravel WVTS
2nd BMP will operate at 75% efficiency

RE =	86%	Removal Efficiency from Table H-3
LR =	23.8	Load Reduction (lbs TN/year)
TP Net Load =	**13.1**	lbs TN/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Main Site (2P & 3P) for TN

A = 17.99 drainage area in acres

P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:

Note: Site is Undeveloped/Rural

TN = 1.74 mg/l (Table H-2)

Post-Development:

Note: Site is Industrial

TN = 2.1 mg/l (Table H-2)

TSS Removal

Note: For Main Site

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:

Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	1.74	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	17.99	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D34*D35*D36)/12)*D37*D38*2.72

L = 16.3 lbs TN/year

Post-Development:

Note: Site is Industrial

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.878	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	2.1	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	17.99	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 92 the percent of site imperviousness

L = ((D54*D55*D56)/12)*D57*D58*2.72

L = 345.1 lbs

Conclusion:

Net = 328.8 Increase in TSS

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Main Site (2P & 3P) for TN

Pollutant Removal:

1st BMP:

Note: Forebay

RE =	3%	Removal Efficiency from Table H-4
LR =	9.9	Load Reduction (lbs TN/year)
Net Load =	319.0	lbs TN/year

2nd BMP:

Note: Gravel WVTS

2nd BMP will operate at 75% efficiency

RE =	55%	Removal Efficiency from Table H-3
LR =	131.6	Load Reduction (lbs TN/year)
TN Net Load =	**187.4**	lbs TN/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Main Site (2P & 3P) for Bacteria

A = 17.99 drainage area in acres

P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:

Note: Site is Undeveloped/Rural

Bacteria = 300 #col/100ml (Table H-2)

Post-Development:

Note: Site is Industrial

Bacteria = 2400 #col/100ml (Table H-2)

TSS Removal

Note: For Main Site

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:

Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	300	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	17.99	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D26*D27*D28)/12)*D29*D30*2.72

L = 2,807.5 lbs TN/year

Post-Development:

Note: Site is Industrial

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.878	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	2400	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	17.99	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 92 the percent of site imperviousness

L = ((D46*D47*D48)/12)*D49*D50*2.72

L = 394,400.3 lbs

Conclusion:

Net = 391,592.8 Increase in TSS

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Main Site (2P & 3P) for Bacteria

Pollutant Removal:

1st BMP:

Note: Forebay

RE =	12%	Removal Efficiency from Table H-4
LR =	46,991.1	Load Reduction (lbs TN/year)
Net Load =	344,601.7	lbs TN/year

2nd BMP:

Note: Gravel WVTS

2nd BMP will operate at 75% efficiency

RE =	85%	Removal Efficiency from Table H-3
LR =	219,683.6	Load Reduction (lbs TN/year)
Bacteria Net Load =	**124,918.1**	#col/100ml/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (15R & 29R) for TSS

A = 1.259 drainage area in acres
P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:
Note: Site is Undeveloped/Rural

TSS = 51 mg/l (Table H-2)

Post-Development:
Note: Site is a Road

TSS = 150 mg/l (Table H-2)

TSS Removal

Note: For Dry Swale along West half of Road

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:
Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	51	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	1.259	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D26*D27*D28)/12)*D29*D30*2.72

L = 33.4 lbs TN/year

Post-Development:
Note: Site is a Road

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.689	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	150	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	1.259	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 71 the percent of site imperviousness

L = ((D46*D47*D48)/12)*D49*D50*2.72

L = 1,353.7 lbs

Conclusion:

Net = 1,320.3 Increase in TSS

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (15R & 29R) for TSS

Pollutant Removal:

1st BMP:
Note: Dry Swale

	RE =	90%	Removal Efficiency from Table H-3
	LR =	1,188.3	Load Reduction (lbs TN/year)
TSS	**Net Load =**	**132.0**	lbs TN/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (15R & 29R) for TP

A = 1.259 drainage area in acres
P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:
Note: Site is Undeveloped/Rural

TP = 0.11 mg/l (Table H-2)

Post-Development:
Note: Site is a Road

TP = 0.25 mg/l (Table H-2)

TSS Removal

Note: For Dry Swale along West half of Road

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:
Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	0.11	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	1.259	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D26*D27*D28)/12)*D29*D30*2.72

L = 0.1 lbs TN/year

Post-Development:
Note: Site is a Road

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.689	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	0.25	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	1.259	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 71 the percent of site imperviousness

L = ((D46*D47*D48)/12)*D49*D50*2.72

L = 2.3 lbs

Conclusion:

Net = 2.2 Increase in TSS

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (15R & 29R) for TP

Pollutant Removal:

1st BMP:

Note: Dry Swale

	RE =	30%	Removal Efficiency from Table H-3
	LR =	0.7	Load Reduction (lbs TN/year)
TP	**Net Load =**	**1.5**	lbs TN/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (15R & 29R) for TN

A =	1.259	drainage area in acres
P =	51	rainfall depth (inches) - from Figure H-8

Pre-Development:
Note: Site is Undeveloped/Rural

TN = 1.74 mg/l (Table H-2)

Post-Development:
Note: Site is a Road

TN = 2.3 mg/l (Table H-2)

TSS Removal
Note: For Dry Swale along West half of Road

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:
Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	1.74	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	1.259	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D26*D27*D28)/12)*D29*D30*2.72

L = 1.1 lbs TN/year

Post-Development:
Note: Site is a Road

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.689	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	2.3	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	1.259	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 71 the percent of site imperviousness

L = ((D46*D47*D48)/12)*D49*D50*2.72

L = 20.8 lbs

Conclusion:

Net = 19.6 Increase in TSS

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (15R & 29R) for TN

Pollutant Removal:

1st BMP:
Note: Dry Swale

RE = 55% Removal Efficiency from Table H-3

LR = 10.8 Load Reduction (lbs TN/year)

TN Net Load = 8.8 lbs TN/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (15R & 29R) for Bacteria

A = 1.259 drainage area in acres
P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:
Note: Site is Undeveloped/Rural

Bacteria = 300 #col/100ml (Table H-2)

Post-Development:
Note: Site is a Road

Bacteria = 1700 #col/100ml (Table H-2)

TSS Removal

Note: For Dry Swale along West half of Road

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:
Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	300	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	1.259	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D26*D27*D28)/12)*D29*D30*2.72

L = 196.5 #col/100ml/year

Post-Development:
Note: Site is a Road

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.689	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	1700	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	1.259	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 71 the percent of site imperviousness

L = ((D46*D47*D48)/12)*D49*D50*2.72

L = 15,342.4 lbs

Conclusion:

Net = 15,146.0 Increase

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (15R & 29R) for Bacteria

Pollutant Removal:

1st BMP:

Note: Dry Swale

	RE =	70%	Removal Efficiency from Table H-3
	LR =	10,602.2	Load Reduction
Bacteria	**Net Load =**	**4,543.8**	#col/100ml/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (18R & 20R) for TSS

A = 0.805 drainage area in acres
P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:
Note: Site is Undeveloped/Rural

TSS = 51 mg/l (Table H-2)

Post-Development:
Note: Site is a Road

TSS = 150 mg/l (Table H-2)

TSS Removal
Note: For Dry Swale along West half of Road

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:
Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	51	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	0.805	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D26*D27*D28)/12)*D29*D30*2.72

L = 21.4 lbs TN/year

Post-Development:
Note: Site is a Road

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.707	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	150	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	0.805	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 73 the percent of site imperviousness

L = ((D46*D47*D48)/12)*D49*D50*2.72

L = 888.2 lbs

Conclusion:

Net = 866.8 Increase

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (18R & 20R) for TSS

Pollutant Removal:

1st BMP:
Note: Dry Swale

	RE =	90%	Removal Efficiency from Table H-3
	LR =	780.2	Load Reduction
TSS	**Net Load =**	**86.7**	lbs TN/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (18R & 20R) for TP

A = 0.805 drainage area in acres
P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:
Note: Site is Undeveloped/Rural

TP = 0.11 mg/l (Table H-2)

Post-Development:
Note: Site is a Road

TP = 0.25 mg/l (Table H-2)

TSS Removal

Note: For Dry Swale along West half of Road

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:
Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	0.11	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	0.805	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D26*D27*D28)/12)*D29*D30*2.72

L = 0.0 lbs TN/year

Post-Development:
Note: Site is a Road

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.707	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	0.25	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	0.805	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 73 the percent of site imperviousness

L = ((D46*D47*D48)/12)*D49*D50*2.72

L = 1.5 lbs

Conclusion:

Net = 1.4 Increase

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (18R & 20R) for TP

Pollutant Removal:

1st BMP:

Note: Dry Swale

	RE =	30%	Removal Efficiency from Table H-3
	LR =	0.4	Load Reduction
TP	**Net Load =**	**1.0**	lbs TN/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (18R & 20R) for TN

A = 0.805 drainage area in acres
P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:
Note: Site is Undeveloped/Rural

TN = 1.74 mg/l (Table H-2)

Post-Development:
Note: Site is a Road

TN = 2.3 mg/l (Table H-2)

TSS Removal
Note: For Dry Swale along West half of Road

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:
Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	1.74	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	0.805	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D26*D27*D28)/12)*D29*D30*2.72

L = 0.7 lbs TN/year

Post-Development:
Note: Site is a Road

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.707	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	2.3	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	0.805	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 73 the percent of site imperviousness

L = ((D46*D47*D48)/12)*D49*D50*2.72

L = 13.6 lbs

Conclusion:

Net = 12.9 Increase

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (18R & 20R) for TN

Pollutant Removal:

1st BMP:
Note: Dry Swale

	RE =	55%	Removal Efficiency from Table H-3
	LR =	7.1	Load Reduction
TN	**Net Load =**	**5.8**	lbs TN/year

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (18R & 20R) for Bacteria

A = 0.805 drainage area in acres
P = 51 rainfall depth (inches) - from Figure H-8

Pre-Development:
Note: Site is Undeveloped/Rural

Bacteria = 300 #col/100ml (Table H-2)

Post-Development:
Note: Site is a Road

Bacteria = 1700 #col/100ml (Table H-2)

TSS Removal
Note: For Dry Swale along West half of Road

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

Pre-Development:
Note: Site is Undeveloped/Rural

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.05	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	300	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	0.805	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 0 the percent of site imperviousness

L = ((D26*D27*D28)/12)*D29*D30*2.72

L = 125.6 #col/100ml/year

Post-Development:
Note: Site is a Road

P =	51	rainfall depth (inches) - from Figure H-8
Pj =	0.9	rainfall correction factor
Rv =	0.707	runoff coefficient expressing the fraction of rainfall converted to runoff
C =	1700	flow-weighted mean concentration of the pollutant in urban runoff (mg/L) - from Table H-2
A =	0.805	contributing drainage area of development site (acres)

Rv = 0.05 + 0.009(%I)

%I = 73 the percent of site imperviousness

L = ((D46*D47*D48)/12)*D49*D50*2.72

L = 10,066.2 lbs

Conclusion:

Net = 9,940.5 Increase

Invenergy – Rhode Island - Clear River Energy

Polution Calculations for Dry Swale (18R & 20R) for Bacteria

Pollutant Removal:

1st BMP:
Note: Dry Swale

	RE =	70%	Removal Efficiency from Table H-3
	LR =	6,958.4	Load Reduction
Bacteria	**Net Load =**	**2,982.2**	#col/100ml/year

Section 6.0

Drainage Analysis
Storm Sewer Calculations

MH STORM SEWER CALCULATIONS
10-YEAR STORM

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)
1	A-01	563.12	573.78	10.66	57.29	0.00	564.44	1.32
2	A-02	563.43	572.62	9.19	39.47	3.86	564.44	1.01
3	A-03	564.02	572.38	8.36	22.19	3.05	564.45	0.43
4	A-04	564.66	572.69	8.03	19.99	3.39	564.80	0.14
5	A-05	565.11	572.94	7.83	17.22	2.61	565.25	0.14
6	A-06	565.44	572.57	7.13	15.18	2.53	565.56	0.13
7	A-07	566.05	573.02	6.97	13.01	3.31	566.16	0.11
8	A-08	566.25	573.84	7.59	9.91	0.00	566.36	0.11
9	A-09	566.52	572.90	6.38	10.08	2.40	566.63	0.11
10	A-10	566.86	572.90	6.04	2.40	2.40	566.92	0.06
11	A1-01	566.89	573.36	6.47	5.48	0.00	566.97	0.08
12	A1-02	567.01	572.77	5.76	5.50	5.50	567.10	0.09
13	A2-01	564.09	573.16	9.07	14.50	3.39	564.45	0.36
14	A2-02	564.18	573.59	9.41	8.57	0.00	564.45	0.27
15	A2-03	564.70	572.95	8.25	9.11	3.31	564.81	0.11
16	A2-04	565.19	572.95	7.76	6.40	3.31	565.28	0.09
17	A2-05	565.52	573.17	7.65	3.31	3.31	565.59	0.07
18	A3-01	564.88	573.16	8.28	3.31	3.31	564.96	0.08
19	A4-01	563.27	572.62	9.35	17.99	2.24	564.44	1.17
20	A4-02	563.91	573.16	9.25	16.24	3.02	564.44	0.53
21	A4-03	564.38	573.16	8.78	13.71	3.31	564.52	0.14
22	A4-04	564.63	574.34	9.71	10.93	0.00	564.76	0.13
23	A4-05	564.84	572.89	8.05	9.17	4.43	564.95	0.11
24	A4-06	565.29	573.50	8.21	5.41	3.05	565.37	0.08
25	A4-07	565.77	573.50	7.73	2.68	2.68	565.83	0.06
26	A5-01	564.91	574.34	9.43	2.44	0.00	564.98	0.07
27	A5-02	565.18	573.45	8.27	2.67	1.67	565.25	0.07
28	A5-03	565.60	573.26	7.66	1.25	1.25	565.65	0.05
29	A6-01	562.43	574.84	12.41	47.21	0.00	563.81	1.38

MH STORM SEWER CALCULATIONS
100-YEAR STORM

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)
1	A-01	563.12	573.78	10.66	121.90	0.00	564.49	1.37
2	A-02	563.43	572.62	9.19	83.74	6.88	564.51	1.08
3	A-03	564.02	572.38	8.36	47.71	5.44	564.52	0.50
4	A-04	564.66	572.69	8.03	42.32	6.04	564.88	0.22
5	A-05	565.11	572.94	7.83	36.32	4.65	565.32	0.21
6	A-06	565.44	572.57	7.13	31.70	4.51	565.63	0.20
7	A-07	566.05	573.02	6.97	27.21	5.90	566.22	0.17
8	A-08	566.25	573.84	7.59	21.33	0.00	566.41	0.16
9	A-09	566.52	572.90	6.38	20.81	4.27	566.69	0.17
10	A-10	566.86	572.90	6.04	4.27	4.27	566.96	0.10
11	A1-01	566.89	573.36	6.47	12.36	0.00	567.01	0.12
12	A1-02	567.01	572.77	5.76	9.80	9.80	567.14	0.13
13	A2-01	564.09	573.16	9.07	29.80	6.04	564.52	0.43
14	A2-02	564.18	573.59	9.41	17.74	0.00	564.53	0.35
15	A2-03	564.70	572.95	8.25	17.70	5.90	564.87	0.17
16	A2-04	565.19	572.95	7.76	11.79	5.90	565.34	0.15
17	A2-05	565.52	573.17	7.65	5.90	5.90	565.64	0.12
18	A3-01	564.88	573.16	8.28	5.90	5.90	565.01	0.13
19	A4-01	563.27	572.62	9.35	39.11	4.00	564.50	1.23
20	A4-02	563.91	573.16	9.25	35.26	5.39	564.51	0.60
21	A4-03	564.38	573.16	8.78	29.89	5.90	564.59	0.21
22	A4-04	564.63	574.34	9.71	23.56	0.00	564.83	0.20
23	A4-05	564.84	572.89	8.05	18.13	7.89	565.02	0.18
24	A4-06	565.29	573.50	8.21	10.23	5.44	565.42	0.13
25	A4-07	565.77	573.50	7.73	5.31	4.79	565.87	0.10
26	A5-01	564.91	574.34	9.43	5.23	0.00	565.03	0.12
27	A5-02	565.18	573.45	8.27	5.20	2.97	565.30	0.12
28	A5-03	565.60	573.26	7.66	2.23	2.23	565.68	0.08
29	A6-01	562.43	574.84	12.41	93.67	0.00	563.82	1.39

PIPES FOR STORM SEWER CALCULATIONS

SN	LINE ID	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Diameter (inches)	Manning's Roughness
28	P-00	A-0	Out-02	44.65	562.96	562.00	2.1500	24.000	0.0130
12	P-01	A-01	A-0	69.08	563.12	562.96	0.2300	48.000	0.0130
2	P-02	A-02	A-01	130.31	563.43	563.12	0.2400	48.000	0.0130
3	P-03	A-03	A-02	233.18	564.02	563.43	0.2500	48.000	0.0130
4	P-04	A-04	A-03	256.48	564.66	564.02	0.2500	48.000	0.0130
5	P-05	A-05	A-04	182.09	565.11	564.66	0.2500	42.000	0.0130
6	P-06	A-06	A-05	132.96	565.43	565.11	0.2400	42.000	0.0130
7	P-07	A-07	A-06	245.96	566.05	565.43	0.2500	42.000	0.0130
8	P-08	A-08	A-07	78.69	566.25	566.05	0.2500	36.000	0.0130
9	P-09	A-09	A-08	110.45	566.52	566.25	0.2500	36.000	0.0130
1	P-10	A-10	A-09	135.48	566.86	566.52	0.2500	30.000	0.0130
10	P-11	A1-01	A-09	148.86	566.89	566.52	0.2500	36.000	0.0130
11	P-12	A1-02	A1-01	47.30	567.01	566.89	0.2500	30.000	0.0130
22	P-13	A2-01	A-02	256.44	564.09	563.43	0.2600	36.000	0.0130
23	P-14	A2-02	A2-01	34.06	564.18	564.09	0.2700	36.000	0.0130
24	P-15	A2-03	A2-02	208.02	564.70	564.18	0.2500	36.000	0.0130
25	P-16	A2-04	A2-03	195.86	565.19	564.70	0.2500	30.000	0.0130
26	P-17	A2-05	A2-04	132.41	565.52	565.19	0.2500	24.000	0.0130
27	P-18	A3-01	A2-01	117.59	564.88	564.59	0.2500	30.000	0.0130
13	P-19	A4-01	A-01	61.01	563.27	563.12	0.2500	42.000	0.0130
14	P-20	A4-02	A4-01	256.44	563.91	563.27	0.2500	42.000	0.0130
29	P-21	A4-03	A4-02	187.23	564.38	563.91	0.2500	36.000	0.0130
15	P-22	A4-04	A4-03	101.61	564.63	564.38	0.2500	36.000	0.0130
16	P-23	A4-05	A4-04	83.80	564.84	564.63	0.2500	36.000	0.0130
17	P-24	A4-06	A4-05	162.75	565.29	564.84	0.2800	36.000	0.0130
18	P-25	A4-07	A4-06	201.76	565.77	565.29	0.2400	30.000	0.0130
19	P-26	A5-01	A4-04	113.93	564.91	564.63	0.2500	30.000	0.0130
20	P-27	A5-02	A5-01	106.04	565.18	564.91	0.2500	24.000	0.0130
21	P-28	A5-03	A5-02	167.00	565.60	565.18	0.2500	24.000	0.0130
30	P-29	A6-01	Out-01	56.66	562.43	558.00	7.8200	48.000	0.0150
31	P-30	A-0	A6-01	96.09	562.97	562.49	0.5000	48.000	0.0150

Section 7.0

Drainage Analysis
HydroCad Calculations

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.860	98	Paved parking, HSG D (2S)
172.896	77	Woods, Good, HSG D (1S, 2S, 3S, 4S, 5S)
174.756	**77**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
174.756	HSG D	1S, 2S, 3S, 4S, 5S
0.000	Other	
174.756		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	1.860	0.000	1.860	Paved parking	2S
0.000	0.000	0.000	172.896	0.000	172.896	Woods, Good	1S, 2S, 3S, 4S, 5S
0.000	**0.000**	**0.000**	**174.756**	**0.000**	**174.756**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: POI - A Runoff Area=11.793 ac 0.00% Impervious Runoff Depth=0.87"
Flow Length=1,588' Slope=0.0303 '/' Tc=29.0 min CN=77 Runoff=6.50 cfs 0.854 af

Subcatchment 2S: POI - B Runoff Area=63.360 ac 2.94% Impervious Runoff Depth=0.92"
Flow Length=3,073' Slope=0.0291 '/' Tc=48.6 min CN=78 Runoff=28.94 cfs 4.860 af

Subcatchment 3S: POI - C Runoff Area=4.464 ac 0.00% Impervious Runoff Depth=0.87"
Flow Length=1,034' Slope=0.0331 '/' Tc=19.7 min CN=77 Runoff=2.89 cfs 0.323 af

Subcatchment 4S: POI - D Runoff Area=85.739 ac 0.00% Impervious Runoff Depth=0.87"
Flow Length=3,135' Slope=0.0762 '/' Tc=31.5 min CN=77 Runoff=45.55 cfs 6.206 af

Subcatchment 5S: POI - F Runoff Area=9.400 ac 0.00% Impervious Runoff Depth=0.87"
Flow Length=2,185' Slope=0.0219 '/' Tc=44.0 min CN=77 Runoff=4.23 cfs 0.680 af

Total Runoff Area = 174.756 ac Runoff Volume = 12.923 af Average Runoff Depth = 0.89"
98.94% Pervious = 172.896 ac 1.06% Impervious = 1.860 ac

Summary for Subcatchment 1S: POI - A

Runoff = 6.50 cfs @ 12.44 hrs, Volume= 0.854 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
11.793	77	Woods, Good, HSG D
11.793		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.0	1,588	0.0303	0.91		**Lag/CN Method,**

Summary for Subcatchment 2S: POI - B

Runoff = 28.94 cfs @ 12.69 hrs, Volume= 4.860 af, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
61.500	77	Woods, Good, HSG D
1.860	98	Paved parking, HSG D
63.360	78	Weighted Average
61.500		97.06% Pervious Area
1.860		2.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.6	3,073	0.0291	1.05		**Lag/CN Method,**

Summary for Subcatchment 3S: POI - C

Runoff = 2.89 cfs @ 12.29 hrs, Volume= 0.323 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
4.464	77	Woods, Good, HSG D
4.464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	1,034	0.0331	0.88		**Lag/CN Method,**

Summary for Subcatchment 4S: POI - D

Runoff = 45.55 cfs @ 12.49 hrs, Volume= 6.206 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
85.739	77	Woods, Good, HSG D
85.739		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	3,135	0.0762	1.66		**Lag/CN Method,**

Summary for Subcatchment 5S: POI - F

Runoff = 4.23 cfs @ 12.66 hrs, Volume= 0.680 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
9.400	77	Woods, Good, HSG D
9.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.0	2,185	0.0219	0.83		**Lag/CN Method,**

Summary for Subcatchment 1S: POI - A

Runoff = 20.16 cfs @ 12.41 hrs, Volume= 2.496 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
11.793	77	Woods, Good, HSG D
11.793		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.0	1,588	0.0303	0.91		**Lag/CN Method,**

Summary for Subcatchment 2S: POI - B

Runoff = 86.73 cfs @ 12.69 hrs, Volume= 13.871 af, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
61.500	77	Woods, Good, HSG D
1.860	98	Paved parking, HSG D
63.360	78	Weighted Average
61.500		97.06% Pervious Area
1.860		2.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.6	3,073	0.0291	1.05		**Lag/CN Method,**

Summary for Subcatchment 3S: POI - C

Runoff = 9.01 cfs @ 12.28 hrs, Volume= 0.945 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
4.464	77	Woods, Good, HSG D
4.464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	1,034	0.0331	0.88		**Lag/CN Method,**

Summary for Subcatchment 4S: POI - D

Runoff = 140.96 cfs @ 12.43 hrs, Volume= 18.145 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
85.739	77	Woods, Good, HSG D
85.739		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	3,135	0.0762	1.66		**Lag/CN Method,**

Summary for Subcatchment 5S: POI - F

Runoff = 13.08 cfs @ 12.61 hrs, Volume= 1.989 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
9.400	77	Woods, Good, HSG D
9.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.0	2,185	0.0219	0.83		**Lag/CN Method,**

Summary for Subcatchment 1S: POI - A

Runoff = 46.68 cfs @ 12.40 hrs, Volume= 5.818 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
11.793	77	Woods, Good, HSG D
11.793		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.0	1,588	0.0303	0.91		**Lag/CN Method,**

Summary for Subcatchment 2S: POI - B

Runoff = 197.47 cfs @ 12.64 hrs, Volume= 31.899 af, Depth= 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
61.500	77	Woods, Good, HSG D
1.860	98	Paved parking, HSG D
63.360	78	Weighted Average
61.500		97.06% Pervious Area
1.860		2.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.6	3,073	0.0291	1.05		**Lag/CN Method,**

Summary for Subcatchment 3S: POI - C

Runoff = 20.85 cfs @ 12.27 hrs, Volume= 2.202 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
4.464	77	Woods, Good, HSG D
4.464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	1,034	0.0331	0.88		**Lag/CN Method,**

Summary for Subcatchment 4S: POI - D

Runoff = 327.06 cfs @ 12.43 hrs, Volume= 42.299 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
85.739	77	Woods, Good, HSG D
85.739		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	3,135	0.0762	1.66		**Lag/CN Method,**

Summary for Subcatchment 5S: POI - F

Runoff = 30.37 cfs @ 12.57 hrs, Volume= 4.637 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
9.400	77	Woods, Good, HSG D
9.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.0	2,185	0.0219	0.83		**Lag/CN Method,**

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.576	74	>75% Grass cover, Good, HSG C (12S, 19S, 26S, 34S)
1.188	80	>75% Grass cover, Good, HSG D (10S, 11S, 13S)
0.854	98	Paved parking, HSG C (12S, 34S)
17.665	98	Paved parking, HSG D (1S, 16S, 18S, 26S)
1.661	98	Water Surface, HSG C (13S, 19S)
0.691	98	Water Surface, HSG D (10S, 11S)
155.187	77	Woods, Good, HSG D (11S, 13S, 16S, 18S, 20S, 23S, 24S, 25S, 27S, 29S)
177.822	**79**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.091	HSG C	12S, 13S, 19S, 26S, 34S
174.731	HSG D	1S, 10S, 11S, 13S, 16S, 18S, 20S, 23S, 24S, 25S, 26S, 27S, 29S
0.000	Other	
177.822		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.576	1.188	0.000	1.764	>75% Grass cover, Good	10S, 11S, 12S, 13S, 19S, 26S, 34S
0.000	0.000	0.854	17.665	0.000	18.519	Paved parking	1S, 12S, 16S, 18S, 26S, 34S
0.000	0.000	1.661	0.691	0.000	2.352	Water Surface	10S, 11S, 13S, 19S
0.000	0.000	0.000	155.187	0.000	155.187	Woods, Good	11S, 13S, 16S, 18S, 20S, 23S, 24S, 25S, 27S, 29S
0.000	**0.000**	**3.091**	**174.731**	**0.000**	**177.822**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1S	0.00	0.00	135.0	0.0025	0.013	30.0	0.0	0.0
2	1S	0.00	0.00	110.0	0.0025	0.013	36.0	0.0	0.0
3	1S	0.00	0.00	79.0	0.0025	0.013	36.0	0.0	0.0
4	1S	0.00	0.00	246.0	0.0025	0.013	42.0	0.0	0.0
5	1S	0.00	0.00	133.0	0.0025	0.013	42.0	0.0	0.0
6	1S	0.00	0.00	182.0	0.0025	0.013	42.0	0.0	0.0
7	1S	0.00	0.00	256.0	0.0025	0.013	48.0	0.0	0.0
8	1S	0.00	0.00	233.0	0.0025	0.013	48.0	0.0	0.0
9	1S	0.00	0.00	130.0	0.0025	0.013	48.0	0.0	0.0
10	1S	0.00	0.00	113.0	0.0025	0.013	48.0	0.0	0.0
11	2P	558.00	558.00	20.0	0.0000	0.013	12.0	0.0	0.0
12	3P	558.00	558.00	20.0	0.0000	0.013	36.0	0.0	0.0
13	4P	558.00	551.36	663.9	0.0100	0.013	48.0	0.0	0.0
14	13P	538.00	537.00	94.0	0.0106	0.013	15.0	0.0	0.0
15	15P	527.17	526.65	52.8	0.0098	0.013	18.0	0.0	0.0
16	17P	532.20	530.66	51.5	0.0299	0.024	144.0	60.0	0.0
17	23P	527.33	527.17	16.0	0.0100	0.013	2.5	0.0	0.0
18	24P	562.96	562.00	44.7	0.0215	0.013	24.0	0.0	0.0
19	24P	562.96	562.43	106.2	0.0050	0.013	48.0	0.0	0.0
20	28P	555.00	553.62	30.0	0.0460	0.013	23.0	14.0	0.0
21	29P	538.25	538.00	25.0	0.0100	0.013	15.0	0.0	0.0
22	30P	533.66	533.54	24.0	0.0050	0.013	23.0	14.0	0.0
23	31P	533.00	532.35	24.0	0.0271	0.013	23.0	14.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Main Site Runoff Area=16.505 ac 100.00% Impervious Runoff Depth=2.47"
Flow Length=1,775' Tc=7.4 min CN=98 Runoff=41.05 cfs 3.397 af

Subcatchment 10S: Forebay Area Runoff Area=0.354 ac 24.29% Impervious Runoff Depth=1.27"
Tc=5.0 min CN=84 Runoff=0.55 cfs 0.038 af

Subcatchment 11S: Gravel WVTS Runoff Area=1.129 ac 53.59% Impervious Runoff Depth=1.63"
Tc=5.0 min CN=89 Runoff=2.23 cfs 0.153 af

Subcatchment 12S: Subcat for Swale - 1 Runoff Area=0.918 ac 72.44% Impervious Runoff Depth=1.79"
Flow Length=993' Slope=0.1266 '/' Tc=6.0 min CN=91 Runoff=1.91 cfs 0.137 af

Subcatchment 13S: Pond Runoff Area=1.949 ac 64.70% Impervious Runoff Depth=1.88"
Tc=5.0 min CN=92 Runoff=4.39 cfs 0.305 af

Subcatchment 16S: DA to Entr. Culvert Runoff Area=3.196 ac 0.88% Impervious Runoff Depth=0.87"
Flow Length=1,034' Slope=0.0359 '/' Tc=18.9 min CN=77 Runoff=2.11 cfs 0.231 af

Subcatchment 18S: Subcat to Box Culvert Runoff Area=53.103 ac 1.69% Impervious Runoff Depth=0.87"
Flow Length=3,073' Slope=0.0324 '/' Tc=47.5 min CN=77 Runoff=22.91 cfs 3.844 af

Subcatchment 19S: Subcat for Swale - 3 Runoff Area=0.544 ac 73.53% Impervious Runoff Depth=1.88"
Flow Length=313' Slope=0.1239 '/' Tc=2.3 min CN=92 Runoff=1.35 cfs 0.085 af

Subcatchment 20S: Wetlands Runoff Area=7.773 ac 0.00% Impervious Runoff Depth=0.87"
Flow Length=1,002' Slope=0.0286 '/' Tc=20.6 min CN=77 Runoff=4.95 cfs 0.563 af

Subcatchment 23S: Point D Runoff Area=83.546 ac 0.00% Impervious Runoff Depth=0.87"
Flow Length=3,135' Slope=0.0772 '/' Tc=31.3 min CN=77 Runoff=44.54 cfs 6.047 af

Subcatchment 24S: DA for 25R Runoff Area=0.916 ac 0.00% Impervious Runoff Depth=0.87"
Flow Length=1,580' Slope=0.0192 '/' Tc=36.2 min CN=77 Runoff=0.46 cfs 0.066 af

Subcatchment 25S: Rerouted Area Runoff Area=1.380 ac 0.00% Impervious Runoff Depth=0.87"
Flow Length=734' Slope=0.0260 '/' Tc=16.9 min CN=77 Runoff=0.95 cfs 0.100 af

Subcatchment 26S: Subcat for Swale - 2 Runoff Area=0.341 ac 68.62% Impervious Runoff Depth=1.71"
Flow Length=293' Slope=0.1266 '/' Tc=2.3 min CN=90 Runoff=0.78 cfs 0.049 af

Subcatchment 27S: DA for Point F Runoff Area=5.040 ac 0.00% Impervious Runoff Depth=0.87"
Flow Length=2,185' Slope=0.0219 '/' Tc=44.0 min CN=77 Runoff=2.27 cfs 0.365 af

Subcatchment 29S: Rerouted Area B Runoff Area=0.867 ac 0.00% Impervious Runoff Depth=0.87"
Flow Length=599' Slope=0.0260 '/' Tc=14.3 min CN=77 Runoff=0.64 cfs 0.063 af

Subcatchment 34S: Subcat for Swale - 4 Runoff Area=0.261 ac 72.41% Impervious Runoff Depth=1.79"
Flow Length=292' Slope=0.1265 '/' Tc=2.2 min CN=91 Runoff=0.62 cfs 0.039 af

Reach 8R: Level Spreader Avg. Flow Depth=0.05' Max Vel=0.63 fps Inflow=2.16 cfs 3.578 af
n=0.030 L=48.0' S=0.0100 '/' Capacity=439.80 cfs Outflow=2.16 cfs 3.578 af

Reach 15R: Dry Swale - 1 Avg. Flow Depth=0.26' Max Vel=2.40 fps Inflow=1.91 cfs 0.137 af
n=0.030 L=904.0' S=0.0190 '/' Capacity=87.10 cfs Outflow=1.58 cfs 0.137 af

Reach 18R: Dry Swale - 3 Avg. Flow Depth=0.10' Max Vel=1.75 fps Inflow=1.35 cfs 0.085 af
n=0.030 L=550.0' S=0.0273 '/' Capacity=54.76 cfs Outflow=1.11 cfs 0.085 af

Reach 20R: Dry Swale - 4 Avg. Flow Depth=0.31' Max Vel=1.99 fps Inflow=1.66 cfs 0.124 af
n=0.030 L=198.0' S=0.0109 '/' Capacity=66.01 cfs Outflow=1.61 cfs 0.124 af

Reach 21R: Point C Avg. Flow Depth=0.15' Max Vel=2.02 fps Inflow=2.88 cfs 0.356 af
n=0.024 L=77.4' S=0.0136 '/' Capacity=240.09 cfs Outflow=2.88 cfs 0.356 af

Reach 23R: Rerouting Ditch 1 Avg. Flow Depth=0.19' Max Vel=2.06 fps Inflow=0.95 cfs 0.100 af
n=0.025 L=171.0' S=0.0137 '/' Capacity=20.18 cfs Outflow=0.95 cfs 0.100 af

Reach 25R: Ditch Avg. Flow Depth=0.16' Max Vel=1.25 fps Inflow=0.46 cfs 0.066 af
n=0.025 L=262.2' S=0.0064 '/' Capacity=60.53 cfs Outflow=0.45 cfs 0.066 af

Reach 29R: Dry Swale - 2 Avg. Flow Depth=0.29' Max Vel=2.62 fps Inflow=1.96 cfs 0.186 af
n=0.030 L=273.0' S=0.0203 '/' Capacity=90.04 cfs Outflow=1.94 cfs 0.186 af

Reach 30R: Rerouted Ditch below Avg. Flow Depth=0.23' Max Vel=2.81 fps Inflow=1.56 cfs 0.163 af
n=0.013 L=212.0' S=0.0058 '/' Capacity=25.17 cfs Outflow=1.56 cfs 0.163 af

Pond 2P: Forebay Peak Elev=565.19' Storage=23,758 cf Inflow=21.45 cfs 3.107 af
Primary=5.53 cfs 2.601 af Secondary=15.94 cfs 0.503 af Outflow=21.33 cfs 3.105 af

Pond 3P: Gravel WVTS Peak Elev=562.63' Storage=66,078 cf Inflow=23.38 cfs 3.258 af
Primary=9.25 cfs 3.242 af Secondary=0.00 cfs 0.000 af Outflow=9.25 cfs 3.242 af

Pond 4P: DP-1 Peak Elev=559.99' Storage=98,834 cf Inflow=27.87 cfs 3.874 af
Primary=2.16 cfs 3.579 af Secondary=0.00 cfs 0.000 af Outflow=2.16 cfs 3.579 af

Pond 13P: Det. Pond - 2 Peak Elev=538.86' Storage=4,803 cf Inflow=1.94 cfs 0.186 af
Outflow=0.13 cfs 0.181 af

Pond 15P: Culvert at Entr. Peak Elev=529.83' Storage=245 cf Inflow=3.00 cfs 0.356 af
Outflow=2.88 cfs 0.356 af

Pond 17P: Box Culvert for stream Peak Elev=533.00' Storage=0 cf Inflow=24.02 cfs 4.254 af
144.0" x 60.0" Box Culvert n=0.024 L=51.5' S=0.0299 '/' Outflow=24.02 cfs 4.254 af

Pond 18P: Level Spreader Peak Elev=558.12' Storage=7,473 cf Inflow=2.16 cfs 3.579 af
Outflow=2.16 cfs 3.578 af

Pond 23P: Peak Elev=531.74' Storage=546 cf Inflow=1.61 cfs 0.124 af
Primary=0.23 cfs 0.093 af Secondary=1.36 cfs 0.031 af Outflow=1.56 cfs 0.124 af

Pond 24P: Flow Splitter Peak Elev=567.10' Inflow=41.05 cfs 3.397 af
Primary=20.93 cfs 3.070 af Secondary=20.12 cfs 0.327 af Outflow=41.05 cfs 3.397 af

Pond 28P: Ramp Culvert Peak Elev=555.44' Storage=54 cf Inflow=1.58 cfs 0.137 af
23.0" x 14.0", R=22.0" Elliptical Culvert n=0.013 L=30.0' S=0.0460 '/' Outflow=1.58 cfs 0.137 af

Pond 29P: Gravel Inlet Trench Peak Elev=539.00' Storage=1 cf Inflow=1.94 cfs 0.186 af
15.0" Round Culvert n=0.013 L=25.0' S=0.0100 '/' Outflow=1.94 cfs 0.186 af

Pond 30P: Culvert 2 Peak Elev=534.07' Inflow=0.95 cfs 0.100 af
23.0" x 14.0", R=22.0" Elliptical Culvert n=0.013 L=24.0' S=0.0050 '/' Outflow=0.95 cfs 0.100 af

Pond 31P: Culvert 3 Peak Elev=533.44' Inflow=1.11 cfs 0.085 af
23.0" x 14.0", R=22.0" Elliptical Culvert n=0.013 L=24.0' S=0.0271 '/' Outflow=1.11 cfs 0.085 af

Link 21L: Point A Inflow=6.18 cfs 4.140 af
Primary=6.18 cfs 4.140 af

Link 22L: Point B Inflow=24.02 cfs 4.254 af
Primary=24.02 cfs 4.254 af

Link 28L: Point F Inflow=2.27 cfs 0.365 af
Primary=2.27 cfs 0.365 af

Total Runoff Area = 177.822 ac Runoff Volume = 15.482 af Average Runoff Depth = 1.04"
88.26% Pervious = 156.951 ac 11.74% Impervious = 20.871 ac

Summary for Subcatchment 1S: Main Site

Runoff = 41.05 cfs @ 12.10 hrs, Volume= 3.397 af, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
16.505	98	Paved parking, HSG D
16.505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	158	0.0100	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	135	0.0025	4.18	20.51	**Pipe Channel, 130-131** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
0.4	110	0.0025	4.72	33.35	**Pipe Channel, 131-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.3	79	0.0025	4.72	33.35	**Pipe Channel, 132-133** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.8	246	0.0025	5.23	50.30	**Pipe Channel, 133-134** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.4	133	0.0025	5.23	50.30	**Pipe Channel, 134-135** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.6	182	0.0025	5.23	50.30	**Pipe Channel, 135-136** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.7	256	0.0025	5.72	71.82	**Pipe Channel, 136-137** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.7	233	0.0025	5.72	71.82	**Pipe Channel, 137-138** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.4	130	0.0025	5.72	71.82	**Pipe Channel, 138-139** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.3	113	0.0025	5.72	71.82	**Pipe Channel, 139-Outlet** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
7.4	1,775	Total			

Summary for Subcatchment 10S: Forebay Area

Runoff = 0.55 cfs @ 12.08 hrs, Volume= 0.038 af, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
0.268	80	>75% Grass cover, Good, HSG D
0.086	98	Water Surface, HSG D
0.354	84	Weighted Average
0.268		75.71% Pervious Area
0.086		24.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 11S: Gravel WVTS

Runoff = 2.23 cfs @ 12.07 hrs, Volume= 0.153 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
0.605	98	Water Surface, HSG D
0.296	80	>75% Grass cover, Good, HSG D
0.228	77	Woods, Good, HSG D
1.129	89	Weighted Average
0.524		46.41% Pervious Area
0.605		53.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 12S: Subcat for Swale - 1

Runoff = 1.91 cfs @ 12.09 hrs, Volume= 0.137 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (ac)	CN	Description
	0.253	74	>75% Grass cover, Good, HSG C
*	0.665	98	Paved parking, HSG C
	0.918	91	Weighted Average
	0.253		27.56% Pervious Area
	0.665		72.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	993	0.1266	2.77		**Lag/CN Method,**

Summary for Subcatchment 13S: Pond

Runoff = 4.39 cfs @ 12.07 hrs, Volume= 0.305 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
1.261	98	Water Surface, HSG C
0.624	80	>75% Grass cover, Good, HSG D
0.064	77	Woods, Good, HSG D
1.949	92	Weighted Average
0.688		35.30% Pervious Area
1.261		64.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 16S: DA to Entr. Culvert

Runoff = 2.11 cfs @ 12.28 hrs, Volume= 0.231 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
3.168	77	Woods, Good, HSG D
0.028	98	Paved parking, HSG D
3.196	77	Weighted Average
3.168		99.12% Pervious Area
0.028		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	1,034	0.0359	0.91		**Lag/CN Method,**

Summary for Subcatchment 18S: Subcat to Box Culvert

Runoff = 22.91 cfs @ 12.72 hrs, Volume= 3.844 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
52.205	77	Woods, Good, HSG D
0.898	98	Paved parking, HSG D
53.103	77	Weighted Average
52.205		98.31% Pervious Area
0.898		1.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.5	3,073	0.0324	1.08		**Lag/CN Method,**

Summary for Subcatchment 19S: Subcat for Swale - 3

Runoff = 1.35 cfs @ 12.03 hrs, Volume= 0.085 af, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (ac)	CN	Description
	0.400	98	Water Surface, HSG C
*	0.144	74	>75% Grass cover, Good, HSG C
	0.544	92	Weighted Average
	0.144		26.47% Pervious Area
	0.400		73.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	313	0.1239	2.27		**Lag/CN Method,**

Summary for Subcatchment 20S: Wetlands

Runoff = 4.95 cfs @ 12.31 hrs, Volume= 0.563 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
7.773	77	Woods, Good, HSG D
7.773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	1,002	0.0286	0.81		**Lag/CN Method,**

Summary for Subcatchment 23S: Point D

Runoff = 44.54 cfs @ 12.48 hrs, Volume= 6.047 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
83.546	77	Woods, Good, HSG D
83.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.3	3,135	0.0772	1.67		**Lag/CN Method,**

Summary for Subcatchment 24S: DA for 25R

Runoff = 0.46 cfs @ 12.55 hrs, Volume= 0.066 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
0.916	77	Woods, Good, HSG D
0.916		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
36.2	1,580	0.0192	0.73		**Lag/CN Method,**

Summary for Subcatchment 25S: Rerouted Area

Runoff = 0.95 cfs @ 12.26 hrs, Volume= 0.100 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
1.380	77	Woods, Good, HSG D
1.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	734	0.0260	0.73		**Lag/CN Method,**

Summary for Subcatchment 26S: Subcat for Swale - 2

Runoff = 0.78 cfs @ 12.03 hrs, Volume= 0.049 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (ac)	CN	Description
*	0.234	98	Paved parking, HSG D
	0.107	74	>75% Grass cover, Good, HSG C
	0.341	90	Weighted Average
	0.107		31.38% Pervious Area
	0.234		68.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	293	0.1266	2.08		**Lag/CN Method,**

Summary for Subcatchment 27S: DA for Point F

Runoff = 2.27 cfs @ 12.66 hrs, Volume= 0.365 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
5.040	77	Woods, Good, HSG D
5.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.0	2,185	0.0219	0.83		**Lag/CN Method,**

Summary for Subcatchment 29S: Rerouted Area B

Runoff = 0.64 cfs @ 12.21 hrs, Volume= 0.063 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (ac)	CN	Description
0.867	77	Woods, Good, HSG D
0.867		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	599	0.0260	0.70		**Lag/CN Method,**

Summary for Subcatchment 34S: Subcat for Swale - 4

Runoff = 0.62 cfs @ 12.03 hrs, Volume= 0.039 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (ac)	CN	Description
*	0.072	74	>75% Grass cover, Good, HSG C
*	0.189	98	Paved parking, HSG C
	0.261	91	Weighted Average
	0.072		27.59% Pervious Area
	0.189		72.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	292	0.1265	2.17		**Lag/CN Method,**

Summary for Reach 8R: Level Spreader

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 2.15" for 1-Year event
Inflow = 2.16 cfs @ 18.11 hrs, Volume= 3.578 af
Outflow = 2.16 cfs @ 18.12 hrs, Volume= 3.578 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.63 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.43 fps, Avg. Travel Time= 1.8 min

Peak Storage= 166 cf @ 18.12 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.00' Flow Area= 105.0 sf, Capacity= 439.80 cfs

75.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 30.0 '/' Top Width= 135.00'
Length= 48.0' Slope= 0.0100 '/'
Inlet Invert= 558.00', Outlet Invert= 557.52'

Summary for Reach 15R: Dry Swale - 1

Inflow Area = 0.918 ac, 72.44% Impervious, Inflow Depth = 1.79" for 1-Year event
Inflow = 1.91 cfs @ 12.09 hrs, Volume= 0.137 af
Outflow = 1.58 cfs @ 12.14 hrs, Volume= 0.137 af, Atten= 18%, Lag= 3.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.40 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 0.72 fps, Avg. Travel Time= 21.0 min

Peak Storage= 595 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 87.10 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 904.0' Slope= 0.0190 '/'
Inlet Invert= 572.17', Outlet Invert= 555.00'

Summary for Reach 18R: Dry Swale - 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 1.88" for 1-Year event
Inflow = 1.35 cfs @ 12.03 hrs, Volume= 0.085 af
Outflow = 1.11 cfs @ 12.08 hrs, Volume= 0.085 af, Atten= 18%, Lag= 2.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.75 fps, Min. Travel Time= 5.2 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 19.2 min

Peak Storage= 349 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 54.76 cfs

6.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 550.0' Slope= 0.0273 '/'
Inlet Invert= 548.05', Outlet Invert= 533.01'

‡

Summary for Reach 20R: Dry Swale - 4

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 1.85" for 1-Year event
Inflow = 1.66 cfs @ 12.06 hrs, Volume= 0.124 af
Outflow = 1.61 cfs @ 12.08 hrs, Volume= 0.124 af, Atten= 3%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.99 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 5.7 min

Peak Storage= 160 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 66.01 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 198.0' Slope= 0.0109 '/'
Inlet Invert= 532.35', Outlet Invert= 530.19'

Summary for Reach 21R: Point C

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 1.07" for 1-Year event
Inflow = 2.88 cfs @ 12.31 hrs, Volume= 0.356 af
Outflow = 2.88 cfs @ 12.31 hrs, Volume= 0.356 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.02 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.67 fps, Avg. Travel Time= 1.9 min

Peak Storage= 110 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 240.09 cfs

9.00' x 2.00' deep channel, n= 0.024
Side Slope Z-value= 2.0 '/' Top Width= 17.00'
Length= 77.4' Slope= 0.0136 '/'
Inlet Invert= 526.65', Outlet Invert= 525.60'

‡

Summary for Reach 23R: Rerouting Ditch 1

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 0.87" for 1-Year event
Inflow = 0.95 cfs @ 12.26 hrs, Volume= 0.100 af
Outflow = 0.95 cfs @ 12.27 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.06 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.73 fps, Avg. Travel Time= 3.9 min

Peak Storage= 79 cf @ 12.27 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 20.18 cfs

2.00' x 1.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 171.0' Slope= 0.0137 '/'
Inlet Invert= 536.00', Outlet Invert= 533.66'

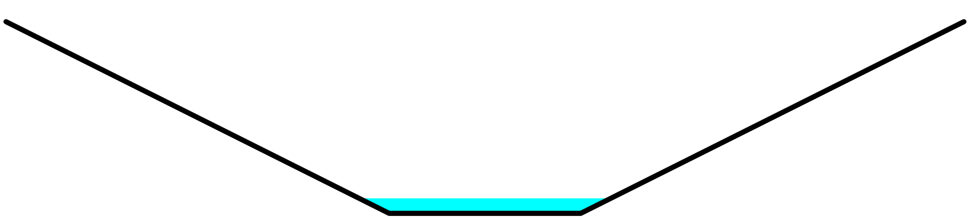
Summary for Reach 25R: Ditch

Inflow Area = 0.916 ac, 0.00% Impervious, Inflow Depth = 0.87" for 1-Year event
Inflow = 0.46 cfs @ 12.55 hrs, Volume= 0.066 af
Outflow = 0.45 cfs @ 12.59 hrs, Volume= 0.066 af, Atten= 1%, Lag= 2.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.25 fps, Min. Travel Time= 3.5 min
Avg. Velocity = 0.51 fps, Avg. Travel Time= 8.6 min

Peak Storage= 95 cf @ 12.59 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 60.53 cfs

2.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 262.2' Slope= 0.0064 '/'
Inlet Invert= 540.67', Outlet Invert= 539.00'



Summary for Reach 29R: Dry Swale - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 1.77" for 1-Year event
Inflow = 1.96 cfs @ 12.11 hrs, Volume= 0.186 af
Outflow = 1.94 cfs @ 12.14 hrs, Volume= 0.186 af, Atten= 1%, Lag= 1.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.62 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 0.80 fps, Avg. Travel Time= 5.7 min

Peak Storage= 202 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 90.04 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 273.0' Slope= 0.0203 '/'
Inlet Invert= 553.62', Outlet Invert= 548.08'

Summary for Reach 30R: Rerouted Ditch below Culvert

Inflow Area = 2.247 ac, 0.00% Impervious, Inflow Depth = 0.87" for 1-Year event
Inflow = 1.56 cfs @ 12.24 hrs, Volume= 0.163 af
Outflow = 1.56 cfs @ 12.26 hrs, Volume= 0.163 af, Atten= 0%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.81 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.99 fps, Avg. Travel Time= 3.6 min

Peak Storage= 117 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 25.17 cfs

2.00' x 1.00' deep channel, n= 0.013
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 212.0' Slope= 0.0058 '/'
Inlet Invert= 533.54', Outlet Invert= 532.32'

Summary for Pond 2P: Forebay

Inflow Area = 16.859 ac, 98.41% Impervious, Inflow Depth = 2.21" for 1-Year event
Inflow = 21.45 cfs @ 12.10 hrs, Volume= 3.107 af
Outflow = 21.33 cfs @ 12.11 hrs, Volume= 3.105 af, Atten= 1%, Lag= 0.8 min
Primary = 5.53 cfs @ 12.03 hrs, Volume= 2.601 af
Secondary = 15.94 cfs @ 12.11 hrs, Volume= 0.503 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 3,802 sf Storage= 3,789 cf
Peak Elev= 565.19' @ 12.11 hrs Surf.Area= 5,780 sf Storage= 23,758 cf (19,969 cf above start)
Flood Elev= 568.00' Surf.Area= 7,249 sf Storage= 42,057 cf (38,268 cf above start)

Plug-Flow detention time= 74.0 min calculated for 3.018 af (97% of inflow)
Center-of-Mass det. time= 41.1 min (806.9 - 765.8)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	49,579 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	2,536	269.1	0.0	0	0	2,536
559.00	2,944	279.8	40.0	1,095	1,095	3,078
560.00	3,366	290.5	40.0	1,261	2,356	3,641
561.00	3,802	301.2	40.0	1,433	3,789	4,225
562.00	4,252	312.0	100.0	4,025	7,814	4,835
563.00	4,716	322.7	100.0	4,482	12,296	5,462
564.00	5,194	333.4	100.0	4,953	17,249	6,110
565.00	5,687	344.1	100.0	5,439	22,687	6,779
566.00	6,193	354.8	100.0	5,938	28,626	7,469
567.00	6,714	365.5	100.0	6,452	35,077	8,180
568.00	7,249	376.2	100.0	6,980	42,057	8,912
569.00	7,798	386.9	100.0	7,522	49,579	9,666

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	565.00'	**60.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=5.52 cfs @ 12.03 hrs HW=565.14' TW=561.73' (Dynamic Tailwater)
1=Culvert (Inlet Controls 5.52 cfs @ 7.02 fps)

Secondary OutFlow Max=15.93 cfs @ 12.11 hrs HW=565.19' TW=561.96' (Dynamic Tailwater)
2=Sharp-Crested Rectangular Weir (Weir Controls 15.93 cfs @ 1.42 fps)

Summary for Pond 3P: Gravel WVTS

Inflow Area = 17.988 ac, 95.60% Impervious, Inflow Depth = 2.17" for 1-Year event
Inflow = 23.38 cfs @ 12.10 hrs, Volume= 3.258 af
Outflow = 9.25 cfs @ 12.54 hrs, Volume= 3.242 af, Atten= 60%, Lag= 26.4 min
Primary = 9.25 cfs @ 12.54 hrs, Volume= 3.242 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 22,959 sf Storage= 27,438 cf
Peak Elev= 562.63' @ 12.54 hrs Surf.Area= 24,553 sf Storage= 66,078 cf (38,640 cf above start)
Flood Elev= 568.00' Surf.Area= 30,084 sf Storage= 212,684 cf (185,246 cf above start)

Plug-Flow detention time= 272.0 min calculated for 2.611 af (80% of inflow)
Center-of-Mass det. time= 119.1 min (926.5 - 807.4)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	243,305 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	22,771	626.2	0.0	0	0	22,771
559.00	22,834	626.9	40.0	9,121	9,121	23,401
560.00	22,897	627.7	40.0	9,146	18,267	24,034
561.00	22,959	628.5	40.0	9,171	27,438	24,667
562.00	23,935	639.2	100.0	23,445	50,884	25,919
563.00	24,924	649.9	100.0	24,428	75,312	27,192
564.00	25,928	660.6	100.0	25,424	100,736	28,486
565.00	26,947	671.3	100.0	26,436	127,172	29,801
566.00	27,978	682.1	100.0	27,461	154,633	31,146
567.00	29,024	692.8	100.0	28,499	183,132	32,504
568.00	30,084	703.5	100.0	29,552	212,684	33,883
569.00	31,161	714.3	100.0	30,621	243,305	35,293

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**36.0" Round Culvert** L= 20.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	561.00'	**12.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 2	558.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	564.00'	**100.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=9.25 cfs @ 12.54 hrs HW=562.63' TW=559.01' (Dynamic Tailwater)
└─**1=Culvert** (Passes 9.25 cfs of 56.41 cfs potential flow)
  └─**2=Orifice/Grate** (Passes 7.04 cfs of 8.03 cfs potential flow)
    └─**3=Orifice/Grate** (Orifice Controls 4.82 cfs @ 6.14 fps)
    └─**5=Orifice/Grate** (Weir Controls 2.21 cfs @ 1.16 fps)
  └─**4=Orifice/Grate** (Weir Controls 2.21 cfs @ 1.16 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=561.00' TW=558.00' (Dynamic Tailwater)
└─**6=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4P: DP-1

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 2.33" for 1-Year event
Inflow = 27.87 cfs @ 12.10 hrs, Volume= 3.874 af
Outflow = 2.16 cfs @ 18.10 hrs, Volume= 3.579 af, Atten= 92%, Lag= 360.1 min
Primary = 2.16 cfs @ 18.10 hrs, Volume= 3.579 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 559.99' @ 18.10 hrs Surf.Area= 51,727 sf Storage= 98,834 cf
Flood Elev= 565.00' Surf.Area= 62,400 sf Storage= 384,495 cf

Plug-Flow detention time= 594.7 min calculated for 3.579 af (92% of inflow)
Center-of-Mass det. time= 542.5 min (1,442.6 - 900.0)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	651,999 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	47,688	883.6	0	0	47,688
559.00	49,705	899.0	48,693	48,693	50,047
560.00	51,750	914.4	50,724	99,417	52,448
561.00	53,824	929.8	52,784	152,201	54,888
562.00	55,926	945.2	54,872	207,072	57,370
563.00	58,056	960.6	56,988	264,060	59,893
564.00	60,214	976.1	59,132	323,192	62,470
565.00	62,400	991.5	61,304	384,495	65,075
566.00	64,615	1,006.9	63,504	448,000	67,720
567.00	66,858	1,022.3	65,733	513,733	70,405
568.00	69,129	1,037.7	67,990	581,723	73,132
569.00	71,429	1,053.2	70,276	651,999	75,915

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**48.0" Round Culvert** L= 663.9' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 551.36' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	558.00'	**8.0" Vert. Orifice/Grate** C= 0.600

#3	Device 1	562.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	566.00'	**60.0" W x 60.0" H Vert. Orifice/Grate** C= 0.600
#5	Secondary	567.00'	**45.0 deg x 100.0' long x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)

Primary OutFlow Max=2.16 cfs @ 18.10 hrs HW=559.99' TW=558.12' (Dynamic Tailwater)
└1=**Culvert** (Passes 2.16 cfs of 18.79 cfs potential flow)
  ├2=**Orifice/Grate** (Orifice Controls 2.16 cfs @ 6.20 fps)
  ├3=**Orifice/Grate** (Controls 0.00 cfs)
  └4=**Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=558.00' TW=0.00' (Dynamic Tailwater)
└5=**Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 13P: Det. Pond - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 1.77" for 1-Year event
Inflow = 1.94 cfs @ 12.14 hrs, Volume= 0.186 af
Outflow = 0.13 cfs @ 14.75 hrs, Volume= 0.181 af, Atten= 93%, Lag= 156.4 min
Primary = 0.13 cfs @ 14.75 hrs, Volume= 0.181 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 538.86' @ 14.75 hrs Surf.Area= 6,074 sf Storage= 4,803 cf
Flood Elev= 541.00' Surf.Area= 8,791 sf Storage= 20,626 cf

Plug-Flow detention time= 484.7 min calculated for 0.181 af (98% of inflow)
Center-of-Mass det. time= 470.0 min (1,294.3 - 824.3)

Volume	Invert	Avail.Storage	Storage Description
#1	538.00'	20,626 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
538.00	5,054	387.0	0	0	5,054
539.00	6,243	405.8	5,638	5,638	6,305
540.00	7,489	424.7	6,857	12,495	7,621
541.00	8,791	423.9	8,131	20,626	8,049

Device	Routing	Invert	Outlet Devices
#1	Primary	538.00'	**15.0" Round Culvert** L= 94.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.00' / 537.00' S= 0.0106 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	538.00'	**2.4" Vert. Orifice/Grate** C= 0.600
#3	Device 1	538.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	539.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.13 cfs @ 14.75 hrs HW=538.86' TW=533.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.13 cfs of 2.87 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.13 cfs @ 4.21 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 15P: Culvert at Entr.

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 1.07" for 1-Year event
Inflow = 3.00 cfs @ 12.24 hrs, Volume= 0.356 af
Outflow = 2.88 cfs @ 12.31 hrs, Volume= 0.356 af, Atten= 4%, Lag= 4.0 min
Primary = 2.88 cfs @ 12.31 hrs, Volume= 0.356 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 529.83' @ 12.31 hrs Surf.Area= 238 sf Storage= 245 cf

Plug-Flow detention time= 0.5 min calculated for 0.356 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (857.0 - 856.6)

Volume	Invert	Avail.Storage	Storage Description
#1	527.17'	1,407 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.17	6	14.0	0	0	6
528.00	44	35.0	18	18	90
529.00	121	58.1	79	98	268
530.00	266	92.9	189	286	693
531.00	555	117.6	402	688	1,120
532.00	897	157.4	719	1,407	2,001

Device	Routing	Invert	Outlet Devices
#1	Primary	527.17'	**18.0" Round Culvert X 2.00** L= 52.8' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 527.17' / 526.65' S= 0.0098 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	527.17'	**18.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	530.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.88 cfs @ 12.31 hrs HW=529.83' TW=526.80' (Dynamic Tailwater)
└─**1=Culvert** (Passes 2.88 cfs of 25.01 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 2.88 cfs @ 7.67 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 17P: Box Culvert for stream

Inflow Area = 57.525 ac, 3.12% Impervious, Inflow Depth > 0.89" for 1-Year event
Inflow = 24.02 cfs @ 12.71 hrs, Volume= 4.254 af
Outflow = 24.02 cfs @ 12.71 hrs, Volume= 4.254 af, Atten= 0%, Lag= 0.0 min
Primary = 24.02 cfs @ 12.71 hrs, Volume= 4.254 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 533.00' @ 12.71 hrs Surf.Area= 413 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (916.8 - 916.8)

Volume	Invert	Avail.Storage	Storage Description
#1	533.00'	25,714 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
533.00	412	159.8	0	0	412
534.00	5,210	513.7	2,362	2,362	19,382
535.00	11,714	795.5	8,245	10,608	48,748
536.00	18,774	996.6	15,106	25,714	77,441

Device	Routing	Invert	Outlet Devices
#1	Primary	532.20'	**144.0" W x 60.0" H Box Culvert** L= 51.5' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 532.20' / 530.66' S= 0.0299 '/' Cc= 0.900 n= 0.024, Flow Area= 60.00 sf

Primary OutFlow Max=27.58 cfs @ 12.71 hrs HW=533.00' TW=0.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 27.58 cfs @ 2.87 fps)

Summary for Pond 18P: Level Spreader

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 2.15" for 1-Year event
Inflow = 2.16 cfs @ 18.10 hrs, Volume= 3.579 af
Outflow = 2.16 cfs @ 18.11 hrs, Volume= 3.578 af, Atten= 0%, Lag= 0.6 min
Primary = 2.16 cfs @ 18.11 hrs, Volume= 3.578 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 558.00' Surf.Area= 2,625 sf Storage= 7,350 cf
Peak Elev= 558.12' @ 18.11 hrs Surf.Area= 2,625 sf Storage= 7,473 cf (123 cf above start)

Plug-Flow detention time= 91.1 min calculated for 3.410 af (95% of inflow)
Center-of-Mass det. time= 0.9 min (1,443.5 - 1,442.6)

Volume	Invert	Avail.Storage	Storage Description
#1	551.00'	8,400 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 21,000 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
551.00	2,625	0	0
556.00	2,625	13,125	13,125
557.00	2,625	2,625	15,750
558.00	2,625	2,625	18,375
559.00	2,625	2,625	21,000

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**75.0" x 35.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.16 cfs @ 18.11 hrs HW=558.12' TW=558.05' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 2.16 cfs @ 1.01 fps)

Summary for Pond 23P:

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 1.85" for 1-Year event
Inflow = 1.61 cfs @ 12.08 hrs, Volume= 0.124 af
Outflow = 1.56 cfs @ 12.10 hrs, Volume= 0.124 af, Atten= 4%, Lag= 1.4 min
Primary = 0.23 cfs @ 12.04 hrs, Volume= 0.093 af
Secondary = 1.36 cfs @ 12.10 hrs, Volume= 0.031 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 531.74' @ 12.10 hrs Surf.Area= 810 sf Storage= 546 cf

Plug-Flow detention time= 8.5 min calculated for 0.124 af (100% of inflow)
Center-of-Mass det. time= 8.5 min (823.3 - 814.7)

Volume	Invert	Avail.Storage	Storage Description
#1	527.33'	793 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.33	4	8.0	0.0	0	0	4
527.34	4	8.0	35.0	0	0	4
530.16	4	8.0	35.0	4	4	27
530.19	56	110.4	100.0	1	5	991
531.00	317	180.9	100.0	137	141	2,630
532.01	1,044	364.9	100.0	652	793	10,626

Device	Routing	Invert	Outlet Devices
#1	Primary	527.33'	**2.5" Round Culvert** L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 527.33' / 527.17' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.03 sf
#2	Secondary	531.60'	**30.0 deg x 7.7' long x 0.40' rise Sharp-Crested Vee/Trap Weir** Cv= 2.61 (C= 3.26)

Primary OutFlow Max=0.23 cfs @ 12.04 hrs HW=531.64' TW=527.66' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.23 cfs @ 6.79 fps)

Secondary OutFlow Max=1.35 cfs @ 12.10 hrs HW=531.74' TW=528.92' (Dynamic Tailwater)
└─**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 1.35 cfs @ 1.23 fps)

Summary for Pond 24P: Flow Splitter

Inflow Area =	16.505 ac,100.00% Impervious,	Inflow Depth = 2.47"	for 1-Year event
Inflow =	41.05 cfs @ 12.10 hrs,	Volume=	3.397 af
Outflow =	41.05 cfs @ 12.10 hrs,	Volume=	3.397 af, Atten= 0%, Lag= 0.0 min
Primary =	20.93 cfs @ 12.10 hrs,	Volume=	3.070 af
Secondary =	20.12 cfs @ 12.10 hrs,	Volume=	0.327 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 567.10' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	562.96'	**24.0" Round Culvert** L= 44.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.00' S= 0.0215 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Secondary	562.96'	**48.0" Round Culvert** L= 106.2' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.43' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#3	Device 2	565.70'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=20.92 cfs @ 12.10 hrs HW=567.10' TW=565.19' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 20.92 cfs @ 6.66 fps)

Secondary OutFlow Max=20.10 cfs @ 12.10 hrs HW=567.10' TW=558.64' (Dynamic Tailwater)
└─**2=Culvert** (Passes 20.10 cfs of 76.05 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 20.10 cfs @ 3.87 fps)

Summary for Pond 28P: Ramp Culvert

Inflow Area =	0.918 ac, 72.44% Impervious,	Inflow Depth = 1.79"	for 1-Year event
Inflow =	1.58 cfs @ 12.14 hrs,	Volume=	0.137 af
Outflow =	1.58 cfs @ 12.15 hrs,	Volume=	0.137 af, Atten= 0%, Lag= 0.4 min
Primary =	1.58 cfs @ 12.15 hrs,	Volume=	0.137 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 555.44' @ 12.15 hrs Surf.Area= 151 sf Storage= 54 cf
Flood Elev= 557.00' Surf.Area= 534 sf Storage= 342 cf

Plug-Flow detention time= 2.7 min calculated for 0.137 af (100% of inflow)
Center-of-Mass det. time= 1.6 min (824.3 - 822.7)

Volume	Invert	Avail.Storage	Storage Description
#1	554.61'	342 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
554.61	4	8.0	0	0	4
555.00	56	45.8	10	10	166
556.00	337	150.1	177	187	1,795
556.36	534	184.0	155	342	2,698

Device	Routing	Invert	Outlet Devices
#1	Primary	555.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 30.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 555.00' / 553.62' S= 0.0460 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=1.57 cfs @ 12.15 hrs HW=555.44' TW=553.91' (Dynamic Tailwater)
└─**1=RCP_Elliptical 23x14** (Inlet Controls 1.57 cfs @ 2.44 fps)

Summary for Pond 29P: Gravel Inlet Trench

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 1.77" for 1-Year event
Inflow = 1.94 cfs @ 12.14 hrs, Volume= 0.186 af
Outflow = 1.94 cfs @ 12.14 hrs, Volume= 0.186 af, Atten= 0%, Lag= 0.0 min
Primary = 1.94 cfs @ 12.14 hrs, Volume= 0.186 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 539.00' @ 12.14 hrs Surf.Area= 4 sf Storage= 1 cf

Plug-Flow detention time= 0.1 min calculated for 0.186 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (824.3 - 824.3)

Volume	Invert	Avail.Storage	Storage Description
#1	538.25'	14 cf	**2.00'W x 2.00'L x 9.75'H Prismatoid** 39 cf Overall x 35.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	538.25'	**15.0" Round Culvert** L= 25.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.25' / 538.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=1.94 cfs @ 12.14 hrs HW=539.00' TW=538.43' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.94 cfs @ 3.63 fps)

Summary for Pond 30P: Culvert 2

Inflow Area =	1.380 ac,	0.00% Impervious,	Inflow Depth = 0.87"	for 1-Year event	
Inflow =	0.95 cfs @	12.27 hrs,	Volume=	0.100 af	
Outflow =	0.95 cfs @	12.27 hrs,	Volume=	0.100 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.95 cfs @	12.27 hrs,	Volume=	0.100 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 534.07' @ 12.27 hrs
Flood Elev= 534.87'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.66'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.66' / 533.54' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=0.95 cfs @ 12.27 hrs HW=534.07' TW=533.77' (Dynamic Tailwater)
└─**1=RCP_Elliptical 23x14** (Barrel Controls 0.95 cfs @ 2.33 fps)

Summary for Pond 31P: Culvert 3

Inflow Area =	0.544 ac,	73.53% Impervious,	Inflow Depth = 1.88"	for 1-Year event	
Inflow =	1.11 cfs @	12.08 hrs,	Volume=	0.085 af	
Outflow =	1.11 cfs @	12.08 hrs,	Volume=	0.085 af,	Atten= 0%, Lag= 0.0 min
Primary =	1.11 cfs @	12.08 hrs,	Volume=	0.085 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 533.44' @ 12.08 hrs
Flood Elev= 538.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.00' / 532.35' S= 0.0271 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=1.11 cfs @ 12.08 hrs HW=533.44' TW=532.66' (Dynamic Tailwater)
└─**1=RCP_Elliptical 23x14** (Inlet Controls 1.11 cfs @ 1.72 fps)

Summary for Link 21L: Point A

Inflow Area =	27.710 ac,	66.61% Impervious,	Inflow Depth > 1.79"	for 1-Year event	
Inflow =	6.18 cfs @	12.31 hrs,	Volume=	4.140 af	
Primary =	6.18 cfs @	12.31 hrs,	Volume=	4.140 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 22L: Point B

Inflow Area = 57.525 ac, 3.12% Impervious, Inflow Depth > 0.89" for 1-Year event
Inflow = 24.02 cfs @ 12.71 hrs, Volume= 4.254 af
Primary = 24.02 cfs @ 12.71 hrs, Volume= 4.254 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 28L: Point F

Inflow Area = 5.040 ac, 0.00% Impervious, Inflow Depth = 0.87" for 1-Year event
Inflow = 2.27 cfs @ 12.66 hrs, Volume= 0.365 af
Primary = 2.27 cfs @ 12.66 hrs, Volume= 0.365 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment 1S: Main Site

Runoff = 75.45 cfs @ 12.10 hrs, Volume= 6.414 af, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
16.505	98	Paved parking, HSG D
16.505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	158	0.0100	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	135	0.0025	4.18	20.51	**Pipe Channel, 130-131** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
0.4	110	0.0025	4.72	33.35	**Pipe Channel, 131-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.3	79	0.0025	4.72	33.35	**Pipe Channel, 132-133** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.8	246	0.0025	5.23	50.30	**Pipe Channel, 133-134** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.4	133	0.0025	5.23	50.30	**Pipe Channel, 134-135** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.6	182	0.0025	5.23	50.30	**Pipe Channel, 135-136** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.7	256	0.0025	5.72	71.82	**Pipe Channel, 136-137** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.7	233	0.0025	5.72	71.82	**Pipe Channel, 137-138** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.4	130	0.0025	5.72	71.82	**Pipe Channel, 138-139** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.3	113	0.0025	5.72	71.82	**Pipe Channel, 139-Outlet** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
7.4	1,775	Total			

Summary for Subcatchment 10S: Forebay Area

Runoff = 1.36 cfs @ 12.07 hrs, Volume= 0.094 af, Depth= 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
0.268	80	>75% Grass cover, Good, HSG D
0.086	98	Water Surface, HSG D
0.354	84	Weighted Average
0.268		75.71% Pervious Area
0.086		24.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 11S: Gravel WVTS

Runoff = 4.90 cfs @ 12.07 hrs, Volume= 0.346 af, Depth= 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
0.605	98	Water Surface, HSG D
0.296	80	>75% Grass cover, Good, HSG D
0.228	77	Woods, Good, HSG D
1.129	89	Weighted Average
0.524		46.41% Pervious Area
0.605		53.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 12S: Subcat for Swale - 1

Runoff = 4.01 cfs @ 12.08 hrs, Volume= 0.297 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (ac)	CN	Description
	0.253	74	>75% Grass cover, Good, HSG C
*	0.665	98	Paved parking, HSG C
	0.918	91	Weighted Average
	0.253		27.56% Pervious Area
	0.665		72.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	993	0.1266	2.77		**Lag/CN Method,**

Summary for Subcatchment 13S: Pond

Runoff = 8.98 cfs @ 12.07 hrs, Volume= 0.648 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
1.261	98	Water Surface, HSG C
0.624	80	>75% Grass cover, Good, HSG D
0.064	77	Woods, Good, HSG D
1.949	92	Weighted Average
0.688		35.30% Pervious Area
1.261		64.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 16S: DA to Entr. Culvert

Runoff = 6.55 cfs @ 12.26 hrs, Volume= 0.676 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
3.168	77	Woods, Good, HSG D
0.028	98	Paved parking, HSG D
3.196	77	Weighted Average
3.168		99.12% Pervious Area
0.028		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	1,034	0.0359	0.91		**Lag/CN Method,**

Summary for Subcatchment 18S: Subcat to Box Culvert

Runoff = 70.88 cfs @ 12.66 hrs, Volume= 11.238 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
52.205	77	Woods, Good, HSG D
0.898	98	Paved parking, HSG D
53.103	77	Weighted Average
52.205		98.31% Pervious Area
0.898		1.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.5	3,073	0.0324	1.08		**Lag/CN Method,**

Summary for Subcatchment 19S: Subcat for Swale - 3

Runoff = 2.77 cfs @ 12.03 hrs, Volume= 0.181 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (ac)	CN	Description
	0.400	98	Water Surface, HSG C
*	0.144	74	>75% Grass cover, Good, HSG C
	0.544	92	Weighted Average
	0.144		26.47% Pervious Area
	0.400		73.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	313	0.1239	2.27		**Lag/CN Method,**

Summary for Subcatchment 20S: Wetlands

Runoff = 15.41 cfs @ 12.29 hrs, Volume= 1.645 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
7.773	77	Woods, Good, HSG D
7.773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	1,002	0.0286	0.81		**Lag/CN Method,**

Summary for Subcatchment 23S: Point D

Runoff = 137.55 cfs @ 12.44 hrs, Volume= 17.681 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
83.546	77	Woods, Good, HSG D
83.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.3	3,135	0.0772	1.67		**Lag/CN Method,**

Summary for Subcatchment 24S: DA for 25R

Runoff = 1.41 cfs @ 12.51 hrs, Volume= 0.194 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
0.916	77	Woods, Good, HSG D
0.916		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
36.2	1,580	0.0192	0.73		**Lag/CN Method,**

Summary for Subcatchment 25S: Rerouted Area

Runoff = 2.96 cfs @ 12.23 hrs, Volume= 0.292 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
1.380	77	Woods, Good, HSG D
1.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	734	0.0260	0.73		**Lag/CN Method,**

Summary for Subcatchment 26S: Subcat for Swale - 2

Runoff = 1.67 cfs @ 12.03 hrs, Volume= 0.107 af, Depth= 3.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (ac)	CN	Description
*	0.234	98	Paved parking, HSG D
	0.107	74	>75% Grass cover, Good, HSG C
	0.341	90	Weighted Average
	0.107		31.38% Pervious Area
	0.234		68.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	293	0.1266	2.08		**Lag/CN Method,**

Summary for Subcatchment 27S: DA for Point F

Runoff = 7.01 cfs @ 12.61 hrs, Volume= 1.067 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
5.040	77	Woods, Good, HSG D
5.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.0	2,185	0.0219	0.83		**Lag/CN Method,**

Summary for Subcatchment 29S: Rerouted Area B

Runoff = 1.98 cfs @ 12.20 hrs, Volume= 0.183 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
0.867	77	Woods, Good, HSG D
0.867		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	599	0.0260	0.70		**Lag/CN Method,**

Summary for Subcatchment 34S: Subcat for Swale - 4

Runoff = 1.31 cfs @ 12.03 hrs, Volume= 0.084 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (ac)	CN	Description
*	0.072	74	>75% Grass cover, Good, HSG C
*	0.189	98	Paved parking, HSG C
	0.261	91	Weighted Average
	0.072		27.59% Pervious Area
	0.189		72.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	292	0.1265	2.17		**Lag/CN Method,**

Summary for Reach 8R: Level Spreader

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 4.16" for 10-Year event
Inflow = 3.08 cfs @ 18.09 hrs, Volume= 6.915 af
Outflow = 3.08 cfs @ 18.10 hrs, Volume= 6.913 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.72 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 1.4 min

Peak Storage= 206 cf @ 18.10 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 105.0 sf, Capacity= 439.80 cfs

75.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 30.0 '/' Top Width= 135.00'
Length= 48.0' Slope= 0.0100 '/'
Inlet Invert= 558.00', Outlet Invert= 557.52'

‡

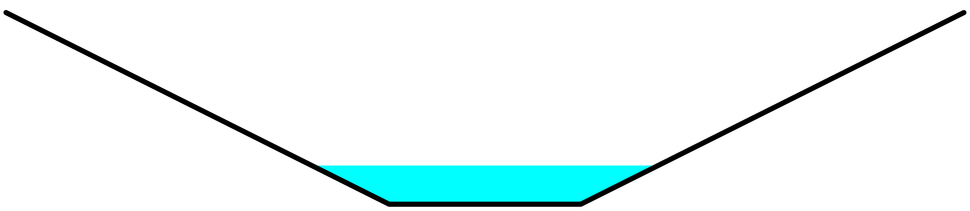
Summary for Reach 15R: Dry Swale - 1

Inflow Area = 0.918 ac, 72.44% Impervious, Inflow Depth = 3.89" for 10-Year event
Inflow = 4.01 cfs @ 12.08 hrs, Volume= 0.297 af
Outflow = 3.47 cfs @ 12.13 hrs, Volume= 0.297 af, Atten= 13%, Lag= 2.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.05 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 0.87 fps, Avg. Travel Time= 17.3 min

Peak Storage= 1,028 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 87.10 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 904.0' Slope= 0.0190 '/'
Inlet Invert= 572.17', Outlet Invert= 555.00'



Summary for Reach 18R: Dry Swale - 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 3.99" for 10-Year event
Inflow = 2.77 cfs @ 12.03 hrs, Volume= 0.181 af
Outflow = 2.41 cfs @ 12.07 hrs, Volume= 0.181 af, Atten= 13%, Lag= 2.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.34 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 16.1 min

Peak Storage= 565 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 54.76 cfs

6.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 550.0' Slope= 0.0273 '/'
Inlet Invert= 548.05', Outlet Invert= 533.01'

‡

Summary for Reach 20R: Dry Swale - 4

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 3.96" for 10-Year event
Inflow = 3.59 cfs @ 12.05 hrs, Volume= 0.265 af
Outflow = 3.52 cfs @ 12.07 hrs, Volume= 0.265 af, Atten= 2%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.52 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 4.7 min

Peak Storage= 277 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 66.01 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 198.0' Slope= 0.0109 '/'
Inlet Invert= 532.35', Outlet Invert= 530.19'

Summary for Reach 21R: Point C

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 2.82" for 10-Year event
Inflow = 8.29 cfs @ 12.24 hrs, Volume= 0.942 af
Outflow = 8.29 cfs @ 12.24 hrs, Volume= 0.942 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.00 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 1.5 min

Peak Storage= 214 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 240.09 cfs

9.00' x 2.00' deep channel, n= 0.024
Side Slope Z-value= 2.0 '/' Top Width= 17.00'
Length= 77.4' Slope= 0.0136 '/'
Inlet Invert= 526.65', Outlet Invert= 525.60'

‡

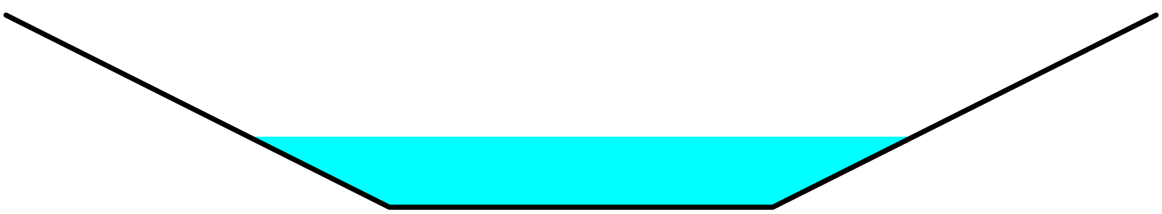
Summary for Reach 23R: Rerouting Ditch 1

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 2.96 cfs @ 12.23 hrs, Volume= 0.292 af
Outflow = 2.95 cfs @ 12.24 hrs, Volume= 0.292 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.94 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 2.9 min

Peak Storage= 172 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 20.18 cfs

2.00' x 1.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 171.0' Slope= 0.0137 '/'
Inlet Invert= 536.00', Outlet Invert= 533.66'



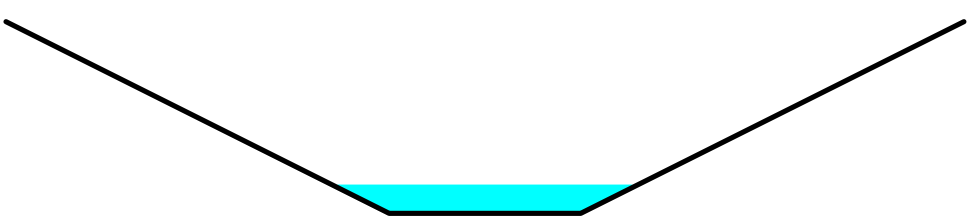
Summary for Reach 25R: Ditch

Inflow Area = 0.916 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 1.41 cfs @ 12.51 hrs, Volume= 0.194 af
Outflow = 1.40 cfs @ 12.54 hrs, Volume= 0.194 af, Atten= 1%, Lag= 1.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.80 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.67 fps, Avg. Travel Time= 6.5 min

Peak Storage= 205 cf @ 12.54 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 60.53 cfs

2.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 262.2' Slope= 0.0064 '/'
Inlet Invert= 540.67', Outlet Invert= 539.00'



Summary for Reach 29R: Dry Swale - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 3.85" for 10-Year event
Inflow = 4.33 cfs @ 12.11 hrs, Volume= 0.404 af
Outflow = 4.30 cfs @ 12.12 hrs, Volume= 0.404 af, Atten= 1%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.33 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 4.7 min

Peak Storage= 353 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 90.04 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 273.0' Slope= 0.0203 '/'
Inlet Invert= 553.62', Outlet Invert= 548.08'

Summary for Reach 30R: Rerouted Ditch below Culvert

Inflow Area = 2.247 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 4.88 cfs @ 12.22 hrs, Volume= 0.476 af
Outflow = 4.87 cfs @ 12.24 hrs, Volume= 0.476 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.99 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 2.7 min

Peak Storage= 259 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 25.17 cfs

2.00' x 1.00' deep channel, n= 0.013
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 212.0' Slope= 0.0058 '/'
Inlet Invert= 533.54', Outlet Invert= 532.32'

Summary for Pond 2P: Forebay

Inflow Area = 16.859 ac, 98.41% Impervious, Inflow Depth = 3.79" for 10-Year event
Inflow = 27.95 cfs @ 12.10 hrs, Volume= 5.323 af
Outflow = 27.83 cfs @ 12.11 hrs, Volume= 5.320 af, Atten= 0%, Lag= 0.7 min
Primary = 5.36 cfs @ 11.70 hrs, Volume= 4.011 af
Secondary = 23.18 cfs @ 12.11 hrs, Volume= 1.309 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 3,802 sf Storage= 3,789 cf
Peak Elev= 565.24' @ 12.11 hrs Surf.Area= 5,806 sf Storage= 24,063 cf (20,274 cf above start)
Flood Elev= 568.00' Surf.Area= 7,249 sf Storage= 42,057 cf (38,268 cf above start)

Plug-Flow detention time= 63.1 min calculated for 5.232 af (98% of inflow)
Center-of-Mass det. time= 41.9 min (797.7 - 755.8)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	49,579 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	2,536	269.1	0.0	0	0	2,536
559.00	2,944	279.8	40.0	1,095	1,095	3,078
560.00	3,366	290.5	40.0	1,261	2,356	3,641
561.00	3,802	301.2	40.0	1,433	3,789	4,225
562.00	4,252	312.0	100.0	4,025	7,814	4,835
563.00	4,716	322.7	100.0	4,482	12,296	5,462
564.00	5,194	333.4	100.0	4,953	17,249	6,110
565.00	5,687	344.1	100.0	5,439	22,687	6,779
566.00	6,193	354.8	100.0	5,938	28,626	7,469
567.00	6,714	365.5	100.0	6,452	35,077	8,180
568.00	7,249	376.2	100.0	6,980	42,057	8,912
569.00	7,798	386.9	100.0	7,522	49,579	9,666

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	565.00'	**60.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=5.35 cfs @ 11.70 hrs HW=565.11' TW=561.90' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 5.35 cfs @ 6.81 fps)

Secondary OutFlow Max=23.18 cfs @ 12.11 hrs HW=565.24' TW=562.84' (Dynamic Tailwater)
└─**2=Sharp-Crested Rectangular Weir** (Weir Controls 23.18 cfs @ 1.62 fps)

Summary for Pond 3P: Gravel WVTS

Inflow Area =	17.988 ac, 95.60% Impervious,	Inflow Depth = 3.78"	for 10-Year event	
Inflow =	32.38 cfs @	12.10 hrs, Volume=	5.665 af	
Outflow =	23.97 cfs @	12.24 hrs, Volume=	5.648 af,	Atten= 26%, Lag= 8.8 min
Primary =	23.97 cfs @	12.24 hrs, Volume=	5.648 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 22,959 sf Storage= 27,438 cf
Peak Elev= 562.95' @ 12.24 hrs Surf.Area= 24,875 sf Storage= 74,094 cf (46,656 cf above start)
Flood Elev= 568.00' Surf.Area= 30,084 sf Storage= 212,684 cf (185,246 cf above start)

Plug-Flow detention time= 229.6 min calculated for 5.018 af (89% of inflow)
Center-of-Mass det. time= 114.9 min (912.4 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	243,305 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	22,771	626.2	0.0	0	0	22,771
559.00	22,834	626.9	40.0	9,121	9,121	23,401
560.00	22,897	627.7	40.0	9,146	18,267	24,034
561.00	22,959	628.5	40.0	9,171	27,438	24,667
562.00	23,935	639.2	100.0	23,445	50,884	25,919
563.00	24,924	649.9	100.0	24,428	75,312	27,192
564.00	25,928	660.6	100.0	25,424	100,736	28,486
565.00	26,947	671.3	100.0	26,436	127,172	29,801
566.00	27,978	682.1	100.0	27,461	154,633	31,146
567.00	29,024	692.8	100.0	28,499	183,132	32,504
568.00	30,084	703.5	100.0	29,552	212,684	33,883
569.00	31,161	714.3	100.0	30,621	243,305	35,293

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**36.0" Round Culvert** L= 20.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	561.00'	**12.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 2	558.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	564.00'	**100.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=23.97 cfs @ 12.24 hrs HW=562.95' TW=560.17' (Dynamic Tailwater)
└─**1=Culvert** (Passes 23.97 cfs of 56.81 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 9.11 cfs @ 5.80 fps)
  │ ├─**3=Orifice/Grate** (Passes < 5.28 cfs potential flow)
  │ └─**5=Orifice/Grate** (Passes < 14.86 cfs potential flow)
  └─**4=Orifice/Grate** (Weir Controls 14.86 cfs @ 2.20 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=561.00' TW=558.00' (Dynamic Tailwater)
└─**6=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4P: DP-1

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 4.50" for 10-Year event
Inflow = 74.97 cfs @ 12.11 hrs, Volume= 7.481 af
Outflow = 3.08 cfs @ 18.08 hrs, Volume= 6.916 af, Atten= 96%, Lag= 358.3 min
Primary = 3.08 cfs @ 18.08 hrs, Volume= 6.916 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 561.70' @ 18.08 hrs Surf.Area= 55,296 sf Storage= 190,514 cf
Flood Elev= 565.00' Surf.Area= 62,400 sf Storage= 384,495 cf

Plug-Flow detention time= 760.3 min calculated for 6.915 af (92% of inflow)
Center-of-Mass det. time= 705.3 min (1,577.1 - 871.8)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	651,999 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	47,688	883.6	0	0	47,688
559.00	49,705	899.0	48,693	48,693	50,047
560.00	51,750	914.4	50,724	99,417	52,448
561.00	53,824	929.8	52,784	152,201	54,888
562.00	55,926	945.2	54,872	207,072	57,370
563.00	58,056	960.6	56,988	264,060	59,893
564.00	60,214	976.1	59,132	323,192	62,470
565.00	62,400	991.5	61,304	384,495	65,075
566.00	64,615	1,006.9	63,504	448,000	67,720
567.00	66,858	1,022.3	65,733	513,733	70,405
568.00	69,129	1,037.7	67,990	581,723	73,132
569.00	71,429	1,053.2	70,276	651,999	75,915

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**48.0" Round Culvert** L= 663.9' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 551.36' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	558.00'	**8.0" Vert. Orifice/Grate** C= 0.600

#3	Device 1	562.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	566.00'	**60.0" W x 60.0" H Vert. Orifice/Grate** C= 0.600
#5	Secondary	567.00'	**45.0 deg x 100.0' long x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)

Primary OutFlow Max=3.08 cfs @ 18.08 hrs HW=561.70' TW=558.15' (Dynamic Tailwater)
└─**1=Culvert** (Passes 3.08 cfs of 62.80 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.08 cfs @ 8.84 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=558.00' TW=0.00' (Dynamic Tailwater)
└─**5=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 13P: Det. Pond - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 3.85" for 10-Year event
Inflow = 4.30 cfs @ 12.12 hrs, Volume= 0.404 af
Outflow = 0.78 cfs @ 12.72 hrs, Volume= 0.399 af, Atten= 82%, Lag= 35.9 min
Primary = 0.78 cfs @ 12.72 hrs, Volume= 0.399 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 539.56' @ 12.72 hrs Surf.Area= 6,928 sf Storage= 9,328 cf
Flood Elev= 541.00' Surf.Area= 8,791 sf Storage= 20,626 cf

Plug-Flow detention time= 390.7 min calculated for 0.399 af (99% of inflow)
Center-of-Mass det. time= 381.7 min (1,181.1 - 799.4)

Volume	Invert	Avail.Storage	Storage Description
#1	538.00'	20,626 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
538.00	5,054	387.0	0	0	5,054
539.00	6,243	405.8	5,638	5,638	6,305
540.00	7,489	424.7	6,857	12,495	7,621
541.00	8,791	423.9	8,131	20,626	8,049

Device	Routing	Invert	Outlet Devices
#1	Primary	538.00'	**15.0" Round Culvert** L= 94.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.00' / 537.00' S= 0.0106 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	538.00'	**2.4" Vert. Orifice/Grate** C= 0.600
#3	Device 1	538.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	539.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.78 cfs @ 12.72 hrs HW=539.56' TW=533.74' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.78 cfs of 5.72 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.18 cfs @ 5.82 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.30 cfs @ 3.38 fps)
  └─**4=Orifice/Grate** (Weir Controls 0.31 cfs @ 0.81 fps)

Summary for Pond 15P: Culvert at Entr.

Inflow Area =	4.001 ac, 15.42% Impervious, Inflow Depth = 2.82" for 10-Year event			
Inflow =	8.29 cfs @	12.24 hrs, Volume=	0.942 af	
Outflow =	8.29 cfs @	12.24 hrs, Volume=	0.942 af,	Atten= 0%, Lag= 0.0 min
Primary =	8.29 cfs @	12.24 hrs, Volume=	0.942 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 530.16' @ 12.24 hrs Surf.Area= 306 sf Storage= 333 cf

Plug-Flow detention time= 0.6 min calculated for 0.942 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (830.9 - 830.5)

Volume	Invert	Avail.Storage	Storage Description
#1	527.17'	1,407 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.17	6	14.0	0	0	6
528.00	44	35.0	18	18	90
529.00	121	58.1	79	98	268
530.00	266	92.9	189	286	693
531.00	555	117.6	402	688	1,120
532.00	897	157.4	719	1,407	2,001

Device	Routing	Invert	Outlet Devices
#1	Primary	527.17'	**18.0" Round Culvert X 2.00** L= 52.8' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 527.17' / 526.65' S= 0.0098 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	527.17'	**18.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	530.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=8.29 cfs @ 12.24 hrs HW=530.16' TW=526.94' (Dynamic Tailwater)
└─**1=Culvert** (Passes 8.29 cfs of 27.35 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.06 cfs @ 8.16 fps)
  └─**3=Orifice/Grate** (Weir Controls 5.23 cfs @ 1.33 fps)

Summary for Pond 17P: Box Culvert for stream

Inflow Area = 57.525 ac, 3.12% Impervious, Inflow Depth = 2.57" for 10-Year event
Inflow = 74.83 cfs @ 12.62 hrs, Volume= 12.306 af
Outflow = 74.75 cfs @ 12.65 hrs, Volume= 12.306 af, Atten= 0%, Lag= 1.8 min
Primary = 74.75 cfs @ 12.65 hrs, Volume= 12.306 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 533.76' @ 12.65 hrs Surf.Area= 3,542 sf Storage= 1,301 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.1 min (878.2 - 878.1)

Volume	Invert	Avail.Storage	Storage Description
#1	533.00'	25,714 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
533.00	412	159.8	0	0	412
534.00	5,210	513.7	2,362	2,362	19,382
535.00	11,714	795.5	8,245	10,608	48,748
536.00	18,774	996.6	15,106	25,714	77,441

Device	Routing	Invert	Outlet Devices
#1	Primary	532.20'	**144.0" W x 60.0" H Box Culvert** L= 51.5' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 532.20' / 530.66' S= 0.0299 '/' Cc= 0.900 n= 0.024, Flow Area= 60.00 sf

Primary OutFlow Max=74.75 cfs @ 12.65 hrs HW=533.76' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 74.75 cfs @ 4.00 fps)

Summary for Pond 18P: Level Spreader

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 4.16" for 10-Year event
Inflow = 3.08 cfs @ 18.08 hrs, Volume= 6.916 af
Outflow = 3.08 cfs @ 18.09 hrs, Volume= 6.915 af, Atten= 0%, Lag= 0.6 min
Primary = 3.08 cfs @ 18.09 hrs, Volume= 6.915 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 558.00' Surf.Area= 2,625 sf Storage= 7,350 cf
Peak Elev= 558.15' @ 18.09 hrs Surf.Area= 2,625 sf Storage= 7,505 cf (155 cf above start)

Plug-Flow detention time= 55.4 min calculated for 6.746 af (98% of inflow)
Center-of-Mass det. time= 0.7 min (1,577.8 - 1,577.1)

Volume	Invert	Avail.Storage	Storage Description
#1	551.00'	8,400 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 21,000 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
551.00	2,625	0	0
556.00	2,625	13,125	13,125
557.00	2,625	2,625	15,750
558.00	2,625	2,625	18,375
559.00	2,625	2,625	21,000

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**75.0" x 35.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.08 cfs @ 18.09 hrs HW=558.15' TW=558.06' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 3.08 cfs @ 1.14 fps)

Summary for Pond 23P:

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 3.96" for 10-Year event
Inflow = 3.52 cfs @ 12.07 hrs, Volume= 0.265 af
Outflow = 3.47 cfs @ 12.08 hrs, Volume= 0.265 af, Atten= 1%, Lag= 0.8 min
Primary = 0.23 cfs @ 13.96 hrs, Volume= 0.156 af
Secondary = 3.32 cfs @ 12.08 hrs, Volume= 0.109 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 531.86' @ 12.08 hrs Surf.Area= 908 sf Storage= 645 cf

Plug-Flow detention time= 8.4 min calculated for 0.265 af (100% of inflow)
Center-of-Mass det. time= 8.3 min (799.5 - 791.2)

Volume	Invert	Avail.Storage	Storage Description
#1	527.33'	793 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.33	4	8.0	0.0	0	0	4
527.34	4	8.0	35.0	0	0	4
530.16	4	8.0	35.0	4	4	27
530.19	56	110.4	100.0	1	5	991
531.00	317	180.9	100.0	137	141	2,630
532.01	1,044	364.9	100.0	652	793	10,626

Device	Routing	Invert	Outlet Devices
#1	Primary	527.33'	**2.5" Round Culvert** L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 527.33' / 527.17' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.03 sf
#2	Secondary	531.60'	**30.0 deg x 7.7' long x 0.40' rise Sharp-Crested Vee/Trap Weir** Cv= 2.61 (C= 3.26)

Primary OutFlow Max=0.23 cfs @ 13.96 hrs HW=531.58' TW=527.56' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.23 cfs @ 6.82 fps)

Secondary OutFlow Max=3.31 cfs @ 12.08 hrs HW=531.86' TW=530.14' (Dynamic Tailwater)
└─**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 3.31 cfs @ 1.65 fps)

Summary for Pond 24P: Flow Splitter

Inflow Area =	16.505 ac,100.00% Impervious,	Inflow Depth = 4.66"	for 10-Year event
Inflow =	75.45 cfs @ 12.10 hrs,	Volume=	6.414 af
Outflow =	75.45 cfs @ 12.10 hrs,	Volume=	6.414 af, Atten= 0%, Lag= 0.0 min
Primary =	26.66 cfs @ 12.10 hrs,	Volume=	5.229 af
Secondary =	48.79 cfs @ 12.10 hrs,	Volume=	1.185 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 568.34' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	562.96'	**24.0" Round Culvert** L= 44.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.00' S= 0.0215 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Secondary	562.96'	**48.0" Round Culvert** L= 106.2' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.43' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#3	Device 2	565.70'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=26.65 cfs @ 12.10 hrs HW=568.34' TW=565.24' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 26.65 cfs @ 8.48 fps)

Secondary OutFlow Max=48.75 cfs @ 12.10 hrs HW=568.34' TW=559.57' (Dynamic Tailwater)
└─**2=Culvert** (Passes 48.75 cfs of 97.98 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 48.75 cfs @ 5.31 fps)

Summary for Pond 28P: Ramp Culvert

Inflow Area =	0.918 ac, 72.44% Impervious,	Inflow Depth = 3.89"	for 10-Year event
Inflow =	3.47 cfs @ 12.13 hrs,	Volume=	0.297 af
Outflow =	3.46 cfs @ 12.14 hrs,	Volume=	0.297 af, Atten= 0%, Lag= 0.4 min
Primary =	3.46 cfs @ 12.14 hrs,	Volume=	0.297 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 555.69' @ 12.14 hrs Surf.Area= 224 sf Storage= 99 cf
Flood Elev= 557.00' Surf.Area= 534 sf Storage= 342 cf

Plug-Flow detention time= 1.7 min calculated for 0.297 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (799.5 - 798.3)

Volume	Invert	Avail.Storage	Storage Description
#1	554.61'	342 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
554.61	4	8.0	0	0	4
555.00	56	45.8	10	10	166
556.00	337	150.1	177	187	1,795
556.36	534	184.0	155	342	2,698

Device	Routing	Invert	Outlet Devices
#1	Primary	555.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 30.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 555.00' / 553.62' S= 0.0460 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=3.46 cfs @ 12.14 hrs HW=555.69' TW=554.07' (Dynamic Tailwater)
↑**1=RCP_Elliptical 23x14** (Inlet Controls 3.46 cfs @ 3.11 fps)

Summary for Pond 29P: Gravel Inlet Trench

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 3.85" for 10-Year event
Inflow = 4.30 cfs @ 12.12 hrs, Volume= 0.404 af
Outflow = 4.30 cfs @ 12.12 hrs, Volume= 0.404 af, Atten= 0%, Lag= 0.0 min
Primary = 4.30 cfs @ 12.12 hrs, Volume= 0.404 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 539.59' @ 12.18 hrs Surf.Area= 4 sf Storage= 2 cf

Plug-Flow detention time= 0.1 min calculated for 0.404 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (799.4 - 799.3)

Volume	Invert	Avail.Storage	Storage Description
#1	538.25'	14 cf	**2.00'W x 2.00'L x 9.75'H Prismatoid** 39 cf Overall x 35.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	538.25'	**15.0" Round Culvert** L= 25.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.25' / 538.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=4.20 cfs @ 12.12 hrs HW=539.53' TW=539.01' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 4.20 cfs @ 4.15 fps)

Summary for Pond 30P: Culvert 2

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 2.95 cfs @ 12.24 hrs, Volume= 0.292 af
Outflow = 2.95 cfs @ 12.24 hrs, Volume= 0.292 af, Atten= 0%, Lag= 0.0 min
Primary = 2.95 cfs @ 12.24 hrs, Volume= 0.292 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 534.46' @ 12.24 hrs
Flood Elev= 534.87'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.66'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.66' / 533.54' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=2.95 cfs @ 12.24 hrs HW=534.46' TW=533.97' (Dynamic Tailwater)
└**1=RCP_Elliptical 23x14** (Barrel Controls 2.95 cfs @ 3.11 fps)

Summary for Pond 31P: Culvert 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 3.99" for 10-Year event
Inflow = 2.41 cfs @ 12.07 hrs, Volume= 0.181 af
Outflow = 2.41 cfs @ 12.07 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.0 min
Primary = 2.41 cfs @ 12.07 hrs, Volume= 0.181 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 533.68' @ 12.07 hrs
Flood Elev= 538.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.00' / 532.35' S= 0.0271 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=2.40 cfs @ 12.07 hrs HW=533.68' TW=532.82' (Dynamic Tailwater)
└**1=RCP_Elliptical 23x14** (Inlet Controls 2.40 cfs @ 2.18 fps)

Summary for Link 21L: Point A

Inflow Area = 27.710 ac, 66.61% Impervious, Inflow Depth > 3.71" for 10-Year event
Inflow = 17.72 cfs @ 12.29 hrs, Volume= 8.558 af
Primary = 17.72 cfs @ 12.29 hrs, Volume= 8.558 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 22L: Point B

Inflow Area = 57.525 ac, 3.12% Impervious, Inflow Depth = 2.57" for 10-Year event
Inflow = 74.75 cfs @ 12.65 hrs, Volume= 12.306 af
Primary = 74.75 cfs @ 12.65 hrs, Volume= 12.306 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 28L: Point F

Inflow Area = 5.040 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 7.01 cfs @ 12.61 hrs, Volume= 1.067 af
Primary = 7.01 cfs @ 12.61 hrs, Volume= 1.067 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment 1S: Main Site

Runoff = 134.52 cfs @ 12.10 hrs, Volume= 11.636 af, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
16.505	98	Paved parking, HSG D
16.505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	158	0.0100	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	135	0.0025	4.18	20.51	**Pipe Channel, 130-131** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
0.4	110	0.0025	4.72	33.35	**Pipe Channel, 131-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.3	79	0.0025	4.72	33.35	**Pipe Channel, 132-133** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.8	246	0.0025	5.23	50.30	**Pipe Channel, 133-134** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.4	133	0.0025	5.23	50.30	**Pipe Channel, 134-135** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.6	182	0.0025	5.23	50.30	**Pipe Channel, 135-136** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.7	256	0.0025	5.72	71.82	**Pipe Channel, 136-137** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.7	233	0.0025	5.72	71.82	**Pipe Channel, 137-138** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.4	130	0.0025	5.72	71.82	**Pipe Channel, 138-139** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.3	113	0.0025	5.72	71.82	**Pipe Channel, 139-Outlet** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
7.4	1,775	Total			

Summary for Subcatchment 10S: Forebay Area

Runoff = 2.81 cfs @ 12.07 hrs, Volume= 0.200 af, Depth= 6.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.268	80	>75% Grass cover, Good, HSG D
0.086	98	Water Surface, HSG D
0.354	84	Weighted Average
0.268		75.71% Pervious Area
0.086		24.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 11S: Gravel WVTS

Runoff = 9.47 cfs @ 12.07 hrs, Volume= 0.694 af, Depth= 7.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.605	98	Water Surface, HSG D
0.296	80	>75% Grass cover, Good, HSG D
0.228	77	Woods, Good, HSG D
1.129	89	Weighted Average
0.524		46.41% Pervious Area
0.605		53.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 12S: Subcat for Swale - 1

Runoff = 7.56 cfs @ 12.08 hrs, Volume= 0.583 af, Depth= 7.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (ac)	CN	Description
	0.253	74	>75% Grass cover, Good, HSG C
*	0.665	98	Paved parking, HSG C
	0.918	91	Weighted Average
	0.253		27.56% Pervious Area
	0.665		72.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	993	0.1266	2.77		**Lag/CN Method,**

Summary for Subcatchment 13S: Pond

Runoff = 16.77 cfs @ 12.07 hrs, Volume= 1.257 af, Depth= 7.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
1.261	98	Water Surface, HSG C
0.624	80	>75% Grass cover, Good, HSG D
0.064	77	Woods, Good, HSG D
1.949	92	Weighted Average
0.688		35.30% Pervious Area
1.261		64.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 16S: DA to Entr. Culvert

Runoff = 15.19 cfs @ 12.25 hrs, Volume= 1.577 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
3.168	77	Woods, Good, HSG D
0.028	98	Paved parking, HSG D
3.196	77	Weighted Average
3.168		99.12% Pervious Area
0.028		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	1,034	0.0359	0.91		**Lag/CN Method,**

Summary for Subcatchment 18S: Subcat to Box Culvert

Runoff = 164.85 cfs @ 12.62 hrs, Volume= 26.198 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
52.205	77	Woods, Good, HSG D
0.898	98	Paved parking, HSG D
53.103	77	Weighted Average
52.205		98.31% Pervious Area
0.898		1.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.5	3,073	0.0324	1.08		**Lag/CN Method,**

Summary for Subcatchment 19S: Subcat for Swale - 3

Runoff = 5.16 cfs @ 12.03 hrs, Volume= 0.351 af, Depth= 7.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (ac)	CN	Description
	0.400	98	Water Surface, HSG C
*	0.144	74	>75% Grass cover, Good, HSG C
	0.544	92	Weighted Average
	0.144		26.47% Pervious Area
	0.400		73.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	313	0.1239	2.27		**Lag/CN Method,**

Summary for Subcatchment 20S: Wetlands

Runoff = 35.64 cfs @ 12.28 hrs, Volume= 3.835 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
7.773	77	Woods, Good, HSG D
7.773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	1,002	0.0286	0.81		**Lag/CN Method,**

Summary for Subcatchment 23S: Point D

Runoff = 319.56 cfs @ 12.42 hrs, Volume= 41.217 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
83.546	77	Woods, Good, HSG D
83.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.3	3,135	0.0772	1.67		**Lag/CN Method,**

Summary for Subcatchment 24S: DA for 25R

Runoff = 3.27 cfs @ 12.51 hrs, Volume= 0.452 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.916	77	Woods, Good, HSG D
0.916		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
36.2	1,580	0.0192	0.73		**Lag/CN Method,**

Summary for Subcatchment 25S: Rerouted Area

Runoff = 6.87 cfs @ 12.23 hrs, Volume= 0.681 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
1.380	77	Woods, Good, HSG D
1.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	734	0.0260	0.73		**Lag/CN Method,**

Summary for Subcatchment 26S: Subcat for Swale - 2

Runoff = 3.18 cfs @ 12.03 hrs, Volume= 0.213 af, Depth= 7.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (ac)	CN	Description
*	0.234	98	Paved parking, HSG D
	0.107	74	>75% Grass cover, Good, HSG C
	0.341	90	Weighted Average
	0.107		31.38% Pervious Area
	0.234		68.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	293	0.1266	2.08		**Lag/CN Method,**

Summary for Subcatchment 27S: DA for Point F

Runoff = 16.28 cfs @ 12.57 hrs, Volume= 2.486 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
5.040	77	Woods, Good, HSG D
5.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.0	2,185	0.0219	0.83		**Lag/CN Method,**

Summary for Subcatchment 29S: Rerouted Area B

Runoff = 4.60 cfs @ 12.19 hrs, Volume= 0.428 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.867	77	Woods, Good, HSG D
0.867		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	599	0.0260	0.70		**Lag/CN Method,**

Summary for Subcatchment 34S: Subcat for Swale - 4

Runoff = 2.47 cfs @ 12.03 hrs, Volume= 0.166 af, Depth= 7.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (ac)	CN	Description
*	0.072	74	>75% Grass cover, Good, HSG C
*	0.189	98	Paved parking, HSG C
	0.261	91	Weighted Average
	0.072		27.59% Pervious Area
	0.189		72.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	292	0.1265	2.17		**Lag/CN Method,**

Summary for Reach 8R: Level Spreader

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 7.33" for 100-Year event
Inflow = 7.62 cfs @ 14.64 hrs, Volume= 12.178 af
Outflow = 7.62 cfs @ 14.65 hrs, Volume= 12.174 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.02 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.69 fps, Avg. Travel Time= 1.2 min

Peak Storage= 360 cf @ 14.65 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 105.0 sf, Capacity= 439.80 cfs

75.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 30.0 '/' Top Width= 135.00'
Length= 48.0' Slope= 0.0100 '/'
Inlet Invert= 558.00', Outlet Invert= 557.52'

‡

Summary for Reach 15R: Dry Swale - 1

Inflow Area = 0.918 ac, 72.44% Impervious, Inflow Depth = 7.62" for 100-Year event
Inflow = 7.56 cfs @ 12.08 hrs, Volume= 0.583 af
Outflow = 6.75 cfs @ 12.12 hrs, Volume= 0.583 af, Atten= 11%, Lag= 2.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.69 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 1.06 fps, Avg. Travel Time= 14.2 min

Peak Storage= 1,651 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.58'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 87.10 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 904.0' Slope= 0.0190 '/'
Inlet Invert= 572.17', Outlet Invert= 555.00'

Summary for Reach 18R: Dry Swale - 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 7.74" for 100-Year event
Inflow = 5.16 cfs @ 12.03 hrs, Volume= 0.351 af
Outflow = 4.65 cfs @ 12.06 hrs, Volume= 0.351 af, Atten= 10%, Lag= 1.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.99 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 0.69 fps, Avg. Travel Time= 13.2 min

Peak Storage= 857 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 54.76 cfs

6.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 550.0' Slope= 0.0273 '/'
Inlet Invert= 548.05', Outlet Invert= 533.01'

‡

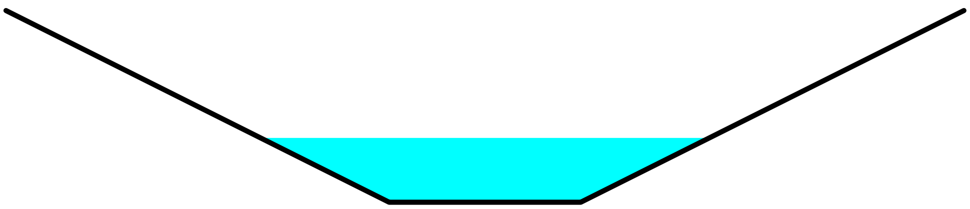
Summary for Reach 20R: Dry Swale - 4

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 7.70" for 100-Year event
Inflow = 6.94 cfs @ 12.05 hrs, Volume= 0.516 af
Outflow = 6.82 cfs @ 12.06 hrs, Volume= 0.516 af, Atten= 2%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.03 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 3.9 min

Peak Storage= 445 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 66.01 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 198.0' Slope= 0.0109 '/'
Inlet Invert= 532.35', Outlet Invert= 530.19'



Summary for Reach 21R: Point C

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 6.28" for 100-Year event
Inflow = 18.29 cfs @ 12.24 hrs, Volume= 2.093 af
Outflow = 18.29 cfs @ 12.24 hrs, Volume= 2.093 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.00 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 1.2 min

Peak Storage= 354 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 240.09 cfs

9.00' x 2.00' deep channel, n= 0.024
Side Slope Z-value= 2.0 '/' Top Width= 17.00'
Length= 77.4' Slope= 0.0136 '/'
Inlet Invert= 526.65', Outlet Invert= 525.60'

‡

Summary for Reach 23R: Rerouting Ditch 1

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 5.92" for 100-Year event
Inflow = 6.87 cfs @ 12.23 hrs, Volume= 0.681 af
Outflow = 6.85 cfs @ 12.24 hrs, Volume= 0.681 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.76 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.23 fps, Avg. Travel Time= 2.3 min

Peak Storage= 312 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.58'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 20.18 cfs

2.00' x 1.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 171.0' Slope= 0.0137 '/'
Inlet Invert= 536.00', Outlet Invert= 533.66'

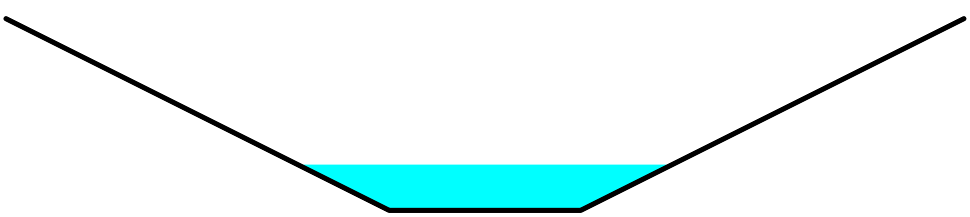
Summary for Reach 25R: Ditch

Inflow Area = 0.916 ac, 0.00% Impervious, Inflow Depth = 5.92" for 100-Year event
Inflow = 3.27 cfs @ 12.51 hrs, Volume= 0.452 af
Outflow = 3.26 cfs @ 12.52 hrs, Volume= 0.452 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.31 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.83 fps, Avg. Travel Time= 5.3 min

Peak Storage= 369 cf @ 12.52 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 60.53 cfs

2.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 262.2' Slope= 0.0064 '/'
Inlet Invert= 540.67', Outlet Invert= 539.00'



Summary for Reach 29R: Dry Swale - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 7.58" for 100-Year event
Inflow = 8.43 cfs @ 12.10 hrs, Volume= 0.795 af
Outflow = 8.38 cfs @ 12.12 hrs, Volume= 0.795 af, Atten= 1%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.02 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.19 fps, Avg. Travel Time= 3.8 min

Peak Storage= 569 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 90.04 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 273.0' Slope= 0.0203 '/'
Inlet Invert= 553.62', Outlet Invert= 548.08'

Summary for Reach 30R: Rerouted Ditch below Culvert

Inflow Area = 2.247 ac, 0.00% Impervious, Inflow Depth = 5.92" for 100-Year event
Inflow = 11.33 cfs @ 12.22 hrs, Volume= 1.109 af
Outflow = 11.31 cfs @ 12.23 hrs, Volume= 1.109 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.07 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.67 fps, Avg. Travel Time= 2.1 min

Peak Storage= 473 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 25.17 cfs

2.00' x 1.00' deep channel, n= 0.013
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 212.0' Slope= 0.0058 '/'
Inlet Invert= 533.54', Outlet Invert= 532.32'

Summary for Pond 2P: Forebay

Inflow Area = 16.859 ac, 98.41% Impervious, Inflow Depth = 6.30" for 100-Year event
Inflow = 36.64 cfs @ 12.10 hrs, Volume= 8.855 af
Outflow = 36.51 cfs @ 12.11 hrs, Volume= 8.850 af, Atten= 0%, Lag= 0.6 min
Primary = 5.22 cfs @ 10.36 hrs, Volume= 5.271 af
Secondary = 32.14 cfs @ 12.11 hrs, Volume= 3.579 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 3,802 sf Storage= 3,789 cf
Peak Elev= 565.30' @ 12.11 hrs Surf.Area= 5,835 sf Storage= 24,399 cf (20,611 cf above start)
Flood Elev= 568.00' Surf.Area= 7,249 sf Storage= 42,057 cf (38,268 cf above start)

Plug-Flow detention time= 62.9 min calculated for 8.761 af (99% of inflow)
Center-of-Mass det. time= 49.3 min (796.8 - 747.5)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	49,579 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	2,536	269.1	0.0	0	0	2,536
559.00	2,944	279.8	40.0	1,095	1,095	3,078
560.00	3,366	290.5	40.0	1,261	2,356	3,641
561.00	3,802	301.2	40.0	1,433	3,789	4,225
562.00	4,252	312.0	100.0	4,025	7,814	4,835
563.00	4,716	322.7	100.0	4,482	12,296	5,462
564.00	5,194	333.4	100.0	4,953	17,249	6,110
565.00	5,687	344.1	100.0	5,439	22,687	6,779
566.00	6,193	354.8	100.0	5,938	28,626	7,469
567.00	6,714	365.5	100.0	6,452	35,077	8,180
568.00	7,249	376.2	100.0	6,980	42,057	8,912
569.00	7,798	386.9	100.0	7,522	49,579	9,666

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	565.00'	**60.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=5.21 cfs @ 10.36 hrs HW=565.05' TW=562.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 5.21 cfs @ 6.64 fps)

Secondary OutFlow Max=32.11 cfs @ 12.11 hrs HW=565.30' TW=563.16' (Dynamic Tailwater)
2=Sharp-Crested Rectangular Weir (Weir Controls 32.11 cfs @ 1.80 fps)

Summary for Pond 3P: Gravel WVTS

Inflow Area = 17.988 ac, 95.60% Impervious, Inflow Depth = 6.37" for 100-Year event
Inflow = 45.42 cfs @ 12.09 hrs, Volume= 9.544 af
Outflow = 37.08 cfs @ 12.14 hrs, Volume= 9.514 af, Atten= 18%, Lag= 2.8 min
Primary = 37.08 cfs @ 12.14 hrs, Volume= 9.514 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 22,959 sf Storage= 27,438 cf
Peak Elev= 563.97' @ 14.47 hrs Surf.Area= 25,900 sf Storage= 100,017 cf (72,579 cf above start)
Flood Elev= 568.00' Surf.Area= 30,084 sf Storage= 212,684 cf (185,246 cf above start)

Plug-Flow detention time= 262.7 min calculated for 8.882 af (93% of inflow)
Center-of-Mass det. time= 169.2 min (964.4 - 795.2)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	243,305 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	22,771	626.2	0.0	0	0	22,771
559.00	22,834	626.9	40.0	9,121	9,121	23,401
560.00	22,897	627.7	40.0	9,146	18,267	24,034
561.00	22,959	628.5	40.0	9,171	27,438	24,667
562.00	23,935	639.2	100.0	23,445	50,884	25,919
563.00	24,924	649.9	100.0	24,428	75,312	27,192
564.00	25,928	660.6	100.0	25,424	100,736	28,486
565.00	26,947	671.3	100.0	26,436	127,172	29,801
566.00	27,978	682.1	100.0	27,461	154,633	31,146
567.00	29,024	692.8	100.0	28,499	183,132	32,504
568.00	30,084	703.5	100.0	29,552	212,684	33,883
569.00	31,161	714.3	100.0	30,621	243,305	35,293

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**36.0" Round Culvert** L= 20.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	561.00'	**12.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 2	558.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	564.00'	**100.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=36.74 cfs @ 12.14 hrs HW=563.20' TW=562.03' (Dynamic Tailwater)
└─**1=Culvert** (Passes 36.74 cfs of 36.76 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 8.17 cfs @ 5.20 fps)
  │ ├─**3=Orifice/Grate** (Passes < 4.08 cfs potential flow)
  │ └─**5=Orifice/Grate** (Passes < 28.57 cfs potential flow)
  └─**4=Orifice/Grate** (Weir Controls 28.57 cfs @ 2.73 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=561.00' TW=558.00' (Dynamic Tailwater)
└─**6=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4P: DP-1

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 8.28" for 100-Year event
Inflow = 151.64 cfs @ 12.10 hrs, Volume= 13.750 af
Outflow = 7.62 cfs @ 14.63 hrs, Volume= 12.180 af, Atten= 95%, Lag= 151.8 min
Primary = 7.62 cfs @ 14.63 hrs, Volume= 12.180 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 563.93' @ 14.63 hrs Surf.Area= 60,062 sf Storage= 318,983 cf
Flood Elev= 565.00' Surf.Area= 62,400 sf Storage= 384,495 cf

Plug-Flow detention time= 709.3 min calculated for 12.180 af (89% of inflow)
Center-of-Mass det. time= 600.7 min (1,495.5 - 894.8)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	651,999 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	47,688	883.6	0	0	47,688
559.00	49,705	899.0	48,693	48,693	50,047
560.00	51,750	914.4	50,724	99,417	52,448
561.00	53,824	929.8	52,784	152,201	54,888
562.00	55,926	945.2	54,872	207,072	57,370
563.00	58,056	960.6	56,988	264,060	59,893
564.00	60,214	976.1	59,132	323,192	62,470
565.00	62,400	991.5	61,304	384,495	65,075
566.00	64,615	1,006.9	63,504	448,000	67,720
567.00	66,858	1,022.3	65,733	513,733	70,405
568.00	69,129	1,037.7	67,990	581,723	73,132
569.00	71,429	1,053.2	70,276	651,999	75,915

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**48.0" Round Culvert** L= 663.9' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 551.36' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	558.00'	**8.0" Vert. Orifice/Grate** C= 0.600

#3	Device 1	562.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	566.00'	**60.0" W x 60.0" H Vert. Orifice/Grate** C= 0.600
#5	Secondary	567.00'	**45.0 deg x 100.0' long x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)

Primary OutFlow Max=7.62 cfs @ 14.63 hrs HW=563.93' TW=558.27' (Dynamic Tailwater)
└─**1=Culvert** (Passes 7.62 cfs of 94.70 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.98 cfs @ 11.39 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 3.65 cfs @ 4.64 fps)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=558.00' TW=0.00' (Dynamic Tailwater)
└─**5=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 13P: Det. Pond - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 7.58" for 100-Year event
Inflow = 8.38 cfs @ 12.12 hrs, Volume= 0.795 af
Outflow = 6.50 cfs @ 12.23 hrs, Volume= 0.789 af, Atten= 22%, Lag= 6.7 min
Primary = 6.50 cfs @ 12.23 hrs, Volume= 0.789 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 539.94' @ 12.23 hrs Surf.Area= 7,405 sf Storage= 12,015 cf
Flood Elev= 541.00' Surf.Area= 8,791 sf Storage= 20,626 cf

Plug-Flow detention time= 249.7 min calculated for 0.789 af (99% of inflow)
Center-of-Mass det. time= 244.2 min (1,023.9 - 779.7)

Volume	Invert	Avail.Storage	Storage Description
#1	538.00'	20,626 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
538.00	5,054	387.0	0	0	5,054
539.00	6,243	405.8	5,638	5,638	6,305
540.00	7,489	424.7	6,857	12,495	7,621
541.00	8,791	423.9	8,131	20,626	8,049

Device	Routing	Invert	Outlet Devices
#1	Primary	538.00'	**15.0" Round Culvert** L= 94.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.00' / 537.00' S= 0.0106 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	538.00'	**2.4" Vert. Orifice/Grate** C= 0.600
#3	Device 1	538.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	539.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.50 cfs @ 12.23 hrs HW=539.94' TW=534.02' (Dynamic Tailwater)
└─**1=Culvert** (Passes 6.50 cfs of 6.65 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.20 cfs @ 6.52 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.39 cfs @ 4.49 fps)
  └─**4=Orifice/Grate** (Weir Controls 5.91 cfs @ 2.16 fps)

Summary for Pond 15P: Culvert at Entr.

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 6.28" for 100-Year event
Inflow = 18.30 cfs @ 12.24 hrs, Volume= 2.093 af
Outflow = 18.29 cfs @ 12.24 hrs, Volume= 2.093 af, Atten= 0%, Lag= 0.0 min
Primary = 18.29 cfs @ 12.24 hrs, Volume= 2.093 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 530.33' @ 12.24 hrs Surf.Area= 351 sf Storage= 389 cf

Plug-Flow detention time= 0.4 min calculated for 2.093 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (809.7 - 809.2)

Volume	Invert	Avail.Storage	Storage Description
#1	527.17'	1,407 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.17	6	14.0	0	0	6
528.00	44	35.0	18	18	90
529.00	121	58.1	79	98	268
530.00	266	92.9	189	286	693
531.00	555	117.6	402	688	1,120
532.00	897	157.4	719	1,407	2,001

Device	Routing	Invert	Outlet Devices
#1	Primary	527.17'	**18.0" Round Culvert X 2.00** L= 52.8' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 527.17' / 526.65' S= 0.0098 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	527.17'	**18.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	530.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=18.29 cfs @ 12.24 hrs HW=530.33' TW=527.11' (Dynamic Tailwater)
└─**1=Culvert** (Passes 18.29 cfs of 28.48 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.15 cfs @ 8.39 fps)
  └─**3=Orifice/Grate** (Weir Controls 15.14 cfs @ 1.89 fps)

Summary for Pond 17P: Box Culvert for stream

Inflow Area = 57.525 ac, 3.12% Impervious, Inflow Depth = 5.96" for 100-Year event
Inflow = 175.13 cfs @ 12.61 hrs, Volume= 28.547 af
Outflow = 174.13 cfs @ 12.64 hrs, Volume= 28.547 af, Atten= 1%, Lag= 1.8 min
Primary = 174.13 cfs @ 12.64 hrs, Volume= 28.547 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 534.93' @ 12.64 hrs Surf.Area= 11,204 sf Storage= 9,851 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.3 min (849.1 - 848.7)

Volume	Invert	Avail.Storage	Storage Description
#1	533.00'	25,714 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
533.00	412	159.8	0	0	412
534.00	5,210	513.7	2,362	2,362	19,382
535.00	11,714	795.5	8,245	10,608	48,748
536.00	18,774	996.6	15,106	25,714	77,441

Device	Routing	Invert	Outlet Devices
#1	Primary	532.20'	**144.0" W x 60.0" H Box Culvert** L= 51.5' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 532.20' / 530.66' S= 0.0299 '/' Cc= 0.900 n= 0.024, Flow Area= 60.00 sf

Primary OutFlow Max=174.11 cfs @ 12.64 hrs HW=534.93' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 174.11 cfs @ 5.31 fps)

Summary for Pond 18P: Level Spreader

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 7.33" for 100-Year event
Inflow = 7.62 cfs @ 14.63 hrs, Volume= 12.180 af
Outflow = 7.62 cfs @ 14.64 hrs, Volume= 12.178 af, Atten= 0%, Lag= 0.4 min
Primary = 7.62 cfs @ 14.64 hrs, Volume= 12.178 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 558.00' Surf.Area= 2,625 sf Storage= 7,350 cf
Peak Elev= 558.27' @ 14.64 hrs Surf.Area= 2,625 sf Storage= 7,632 cf (282 cf above start)

Plug-Flow detention time= 34.0 min calculated for 12.009 af (99% of inflow)
Center-of-Mass det. time= 0.5 min (1,496.0 - 1,495.5)

Volume	Invert	Avail.Storage	Storage Description
#1	551.00'	8,400 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 21,000 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
551.00	2,625	0	0
556.00	2,625	13,125	13,125
557.00	2,625	2,625	15,750
558.00	2,625	2,625	18,375
559.00	2,625	2,625	21,000

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**75.0" x 35.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=7.62 cfs @ 14.64 hrs HW=558.27' TW=558.10' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 7.62 cfs @ 1.55 fps)

Summary for Pond 23P:

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 7.70" for 100-Year event
Inflow = 6.82 cfs @ 12.06 hrs, Volume= 0.516 af
Outflow = 6.73 cfs @ 12.08 hrs, Volume= 0.516 af, Atten= 1%, Lag= 0.8 min
Primary = 0.23 cfs @ 15.93 hrs, Volume= 0.231 af
Secondary = 6.58 cfs @ 12.08 hrs, Volume= 0.286 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 532.01' @ 12.08 hrs Surf.Area= 1,041 sf Storage= 790 cf

Plug-Flow detention time= 8.6 min calculated for 0.516 af (100% of inflow)
Center-of-Mass det. time= 8.6 min (781.2 - 772.6)

Volume	Invert	Avail.Storage	Storage Description
#1	527.33'	793 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.33	4	8.0	0.0	0	0	4
527.34	4	8.0	35.0	0	0	4
530.16	4	8.0	35.0	4	4	27
530.19	56	110.4	100.0	1	5	991
531.00	317	180.9	100.0	137	141	2,630
532.01	1,044	364.9	100.0	652	793	10,626

Device	Routing	Invert	Outlet Devices
#1	Primary	527.33'	**2.5" Round Culvert** L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 527.33' / 527.17' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.03 sf
#2	Secondary	531.60'	**30.0 deg x 7.7' long x 0.40' rise Sharp-Crested Vee/Trap Weir** Cv= 2.61 (C= 3.26)

Primary OutFlow Max=0.23 cfs @ 15.93 hrs HW=531.57' TW=527.61' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.23 cfs @ 6.77 fps)

Secondary OutFlow Max=6.57 cfs @ 12.08 hrs HW=532.01' TW=530.29' (Dynamic Tailwater)
└─**2=Sharp-Crested Vee/Trap Weir** (Orifice Controls 6.57 cfs @ 2.10 fps)

Summary for Pond 24P: Flow Splitter

Inflow Area = 16.505 ac,100.00% Impervious, Inflow Depth = 8.46" for 100-Year event
Inflow = 134.52 cfs @ 12.10 hrs, Volume= 11.636 af
Outflow = 134.52 cfs @ 12.10 hrs, Volume= 11.636 af, Atten= 0%, Lag= 0.0 min
Primary = 33.99 cfs @ 12.10 hrs, Volume= 8.655 af
Secondary = 100.53 cfs @ 12.10 hrs, Volume= 2.980 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 570.34' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	562.96'	**24.0" Round Culvert** L= 44.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.00' S= 0.0215 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Secondary	562.96'	**48.0" Round Culvert** L= 106.2' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.43' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#3	Device 2	565.70'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=33.98 cfs @ 12.10 hrs HW=570.34' TW=565.30' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 33.98 cfs @ 10.82 fps)

Secondary OutFlow Max=100.46 cfs @ 12.10 hrs HW=570.34' TW=561.68' (Dynamic Tailwater)
└─**2=Culvert** (Passes 100.46 cfs of 140.16 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 100.46 cfs @ 7.05 fps)

Summary for Pond 28P: Ramp Culvert

Inflow Area = 0.918 ac, 72.44% Impervious, Inflow Depth = 7.62" for 100-Year event
Inflow = 6.75 cfs @ 12.12 hrs, Volume= 0.583 af
Outflow = 6.71 cfs @ 12.13 hrs, Volume= 0.582 af, Atten= 0%, Lag= 0.6 min
Primary = 6.71 cfs @ 12.13 hrs, Volume= 0.582 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 556.03' @ 12.13 hrs Surf.Area= 350 sf Storage= 196 cf
Flood Elev= 557.00' Surf.Area= 534 sf Storage= 342 cf

Plug-Flow detention time= 1.2 min calculated for 0.582 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (780.0 - 779.1)

Volume	Invert	Avail.Storage	Storage Description
#1	554.61'	342 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
554.61	4	8.0	0	0	4
555.00	56	45.8	10	10	166
556.00	337	150.1	177	187	1,795
556.36	534	184.0	155	342	2,698

Device	Routing	Invert	Outlet Devices
#1	Primary	555.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 30.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 555.00' / 553.62' S= 0.0460 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=6.71 cfs @ 12.13 hrs HW=556.03' TW=554.25' (Dynamic Tailwater)
↑—**1=RCP_Elliptical 23x14** (Inlet Controls 6.71 cfs @ 3.96 fps)

Summary for Pond 29P: Gravel Inlet Trench

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 7.58" for 100-Year event
Inflow = 8.38 cfs @ 12.12 hrs, Volume= 0.795 af
Outflow = 8.38 cfs @ 12.12 hrs, Volume= 0.795 af, Atten= 0%, Lag= 0.0 min
Primary = 8.38 cfs @ 12.12 hrs, Volume= 0.795 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 541.84' @ 12.13 hrs Surf.Area= 4 sf Storage= 5 cf

Plug-Flow detention time= 0.2 min calculated for 0.795 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (779.7 - 779.7)

Volume	Invert	Avail.Storage	Storage Description
#1	538.25'	14 cf	**2.00'W x 2.00'L x 9.75'H Prismatoid** 39 cf Overall x 35.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	538.25'	**15.0" Round Culvert** L= 25.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.25' / 538.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=8.33 cfs @ 12.12 hrs HW=541.83' TW=539.84' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 8.33 cfs @ 6.79 fps)

Summary for Pond 30P: Culvert 2

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 5.92" for 100-Year event
Inflow = 6.85 cfs @ 12.24 hrs, Volume= 0.681 af
Outflow = 6.85 cfs @ 12.24 hrs, Volume= 0.681 af, Atten= 0%, Lag= 0.0 min
Primary = 6.85 cfs @ 12.24 hrs, Volume= 0.681 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 535.14' @ 12.24 hrs
Flood Elev= 534.87'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.66'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.66' / 533.54' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=6.85 cfs @ 12.24 hrs HW=535.14' TW=534.21' (Dynamic Tailwater)
↑—**1=RCP_Elliptical 23x14** (Inlet Controls 6.85 cfs @ 3.75 fps)

Summary for Pond 31P: Culvert 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 7.74" for 100-Year event
Inflow = 4.65 cfs @ 12.06 hrs, Volume= 0.351 af
Outflow = 4.65 cfs @ 12.06 hrs, Volume= 0.351 af, Atten= 0%, Lag= 0.0 min
Primary = 4.65 cfs @ 12.06 hrs, Volume= 0.351 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 534.01' @ 12.06 hrs
Flood Elev= 538.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.00' / 532.35' S= 0.0271 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=4.65 cfs @ 12.06 hrs HW=534.01' TW=533.02' (Dynamic Tailwater)
↑—**1=RCP_Elliptical 23x14** (Inlet Controls 4.65 cfs @ 2.77 fps)

Summary for Link 21L: Point A

Inflow Area = 27.710 ac, 66.61% Impervious, Inflow Depth > 6.93" for 100-Year event
Inflow = 39.67 cfs @ 12.29 hrs, Volume= 16.009 af
Primary = 39.67 cfs @ 12.29 hrs, Volume= 16.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 22L: Point B

Inflow Area =	57.525 ac,	3.12% Impervious,	Inflow Depth = 5.96"	for 100-Year event	
Inflow =	174.13 cfs @	12.64 hrs,	Volume=	28.547 af	
Primary =	174.13 cfs @	12.64 hrs,	Volume=	28.547 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 28L: Point F

Inflow Area =	5.040 ac,	0.00% Impervious,	Inflow Depth = 5.92"	for 100-Year event	
Inflow =	16.28 cfs @	12.57 hrs,	Volume=	2.486 af	
Primary =	16.28 cfs @	12.57 hrs,	Volume=	2.486 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment 1S: Main Site

Runoff = 17.23 cfs @ 12.10 hrs, Volume= 1.356 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
16.505	98	Paved parking, HSG D
16.505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	158	0.0100	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	135	0.0025	4.18	20.51	**Pipe Channel, 130-131** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
0.4	110	0.0025	4.72	33.35	**Pipe Channel, 131-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.3	79	0.0025	4.72	33.35	**Pipe Channel, 132-133** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.8	246	0.0025	5.23	50.30	**Pipe Channel, 133-134** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.4	133	0.0025	5.23	50.30	**Pipe Channel, 134-135** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.6	182	0.0025	5.23	50.30	**Pipe Channel, 135-136** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.7	256	0.0025	5.72	71.82	**Pipe Channel, 136-137** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.7	233	0.0025	5.72	71.82	**Pipe Channel, 137-138** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.4	130	0.0025	5.72	71.82	**Pipe Channel, 138-139** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.3	113	0.0025	5.72	71.82	**Pipe Channel, 139-Outlet** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
7.4	1,775	Total			

Summary for Subcatchment 10S: Forebay Area

Runoff = 0.09 cfs @ 12.09 hrs, Volume= 0.007 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
0.268	80	>75% Grass cover, Good, HSG D
0.086	98	Water Surface, HSG D
0.354	84	Weighted Average
0.268		75.71% Pervious Area
0.086		24.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 11S: Gravel WVTS

Runoff = 0.55 cfs @ 12.08 hrs, Volume= 0.039 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
0.605	98	Water Surface, HSG D
0.296	80	>75% Grass cover, Good, HSG D
0.228	77	Woods, Good, HSG D
1.129	89	Weighted Average
0.524		46.41% Pervious Area
0.605		53.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 12S: Subcat for Swale - 1

Runoff = 0.54 cfs @ 12.09 hrs, Volume= 0.039 af, Depth= 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

	Area (ac)	CN	Description
	0.253	74	>75% Grass cover, Good, HSG C
*	0.665	98	Paved parking, HSG C
	0.918	91	Weighted Average
	0.253		27.56% Pervious Area
	0.665		72.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	993	0.1266	2.77		**Lag/CN Method,**

Summary for Subcatchment 13S: Pond

Runoff = 1.31 cfs @ 12.08 hrs, Volume= 0.090 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
1.261	98	Water Surface, HSG C
0.624	80	>75% Grass cover, Good, HSG D
0.064	77	Woods, Good, HSG D
1.949	92	Weighted Average
0.688		35.30% Pervious Area
1.261		64.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 16S: DA to Entr. Culvert

Runoff = 0.12 cfs @ 12.51 hrs, Volume= 0.027 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
3.168	77	Woods, Good, HSG D
0.028	98	Paved parking, HSG D
3.196	77	Weighted Average
3.168		99.12% Pervious Area
0.028		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	1,034	0.0359	0.91		**Lag/CN Method,**

Summary for Subcatchment 18S: Subcat to Box Culvert

Runoff = 1.40 cfs @ 12.93 hrs, Volume= 0.448 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
52.205	77	Woods, Good, HSG D
0.898	98	Paved parking, HSG D
53.103	77	Weighted Average
52.205		98.31% Pervious Area
0.898		1.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.5	3,073	0.0324	1.08		**Lag/CN Method,**

Summary for Subcatchment 19S: Subcat for Swale - 3

Runoff = 0.40 cfs @ 12.04 hrs, Volume= 0.025 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

	Area (ac)	CN	Description
	0.400	98	Water Surface, HSG C
*	0.144	74	>75% Grass cover, Good, HSG C
	0.544	92	Weighted Average
	0.144		26.47% Pervious Area
	0.400		73.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	313	0.1239	2.27		**Lag/CN Method,**

Summary for Subcatchment 20S: Wetlands

Runoff = 0.29 cfs @ 12.54 hrs, Volume= 0.066 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
7.773	77	Woods, Good, HSG D
7.773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	1,002	0.0286	0.81		**Lag/CN Method,**

Summary for Subcatchment 23S: Point D

Runoff = 2.65 cfs @ 12.69 hrs, Volume= 0.704 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
83.546	77	Woods, Good, HSG D
83.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.3	3,135	0.0772	1.67		**Lag/CN Method,**

Summary for Subcatchment 24S: DA for 25R

Runoff = 0.03 cfs @ 12.75 hrs, Volume= 0.008 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
0.916	77	Woods, Good, HSG D
0.916		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
36.2	1,580	0.0192	0.73		**Lag/CN Method,**

Summary for Subcatchment 25S: Rerouted Area

Runoff = 0.05 cfs @ 12.49 hrs, Volume= 0.012 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
1.380	77	Woods, Good, HSG D
1.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	734	0.0260	0.73		**Lag/CN Method,**

Summary for Subcatchment 26S: Subcat for Swale - 2

Runoff = 0.20 cfs @ 12.04 hrs, Volume= 0.013 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

	Area (ac)	CN	Description
*	0.234	98	Paved parking, HSG D
	0.107	74	>75% Grass cover, Good, HSG C
	0.341	90	Weighted Average
	0.107		31.38% Pervious Area
	0.234		68.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	293	0.1266	2.08		**Lag/CN Method,**

Summary for Subcatchment 27S: DA for Point F

Runoff = 0.14 cfs @ 12.86 hrs, Volume= 0.042 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
5.040	77	Woods, Good, HSG D
5.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.0	2,185	0.0219	0.83		**Lag/CN Method,**

Summary for Subcatchment 29S: Rerouted Area B

Runoff = 0.04 cfs @ 12.44 hrs, Volume= 0.007 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

Area (ac)	CN	Description
0.867	77	Woods, Good, HSG D
0.867		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	599	0.0260	0.70		**Lag/CN Method,**

Summary for Subcatchment 34S: Subcat for Swale - 4

Runoff = 0.17 cfs @ 12.04 hrs, Volume= 0.011 af, Depth= 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr WQv Rainfall=1.20"

	Area (ac)	CN	Description
*	0.072	74	>75% Grass cover, Good, HSG C
*	0.189	98	Paved parking, HSG C
	0.261	91	Weighted Average
	0.072		27.59% Pervious Area
	0.189		72.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	292	0.1265	2.17		**Lag/CN Method,**

Summary for Reach 8R: Level Spreader

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 0.75" for WQv event
Inflow = 1.07 cfs @ 16.70 hrs, Volume= 1.248 af
Outflow = 1.07 cfs @ 16.72 hrs, Volume= 1.248 af, Atten= 0%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.47 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 2.6 min

Peak Storage= 108 cf @ 16.72 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 1.00' Flow Area= 105.0 sf, Capacity= 439.80 cfs

75.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 30.0 '/' Top Width= 135.00'
Length= 48.0' Slope= 0.0100 '/'
Inlet Invert= 558.00', Outlet Invert= 557.52'

Summary for Reach 15R: Dry Swale - 1

Inflow Area = 0.918 ac, 72.44% Impervious, Inflow Depth = 0.50" for WQv event
Inflow = 0.54 cfs @ 12.09 hrs, Volume= 0.039 af
Outflow = 0.38 cfs @ 12.17 hrs, Volume= 0.039 af, Atten= 29%, Lag= 4.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.49 fps, Min. Travel Time= 10.1 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 26.5 min

Peak Storage= 232 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 87.10 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 904.0' Slope= 0.0190 '/'
Inlet Invert= 572.17', Outlet Invert= 555.00'

Summary for Reach 18R: Dry Swale - 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 0.56" for WQv event
Inflow = 0.40 cfs @ 12.04 hrs, Volume= 0.025 af
Outflow = 0.28 cfs @ 12.10 hrs, Volume= 0.025 af, Atten= 30%, Lag= 3.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.03 fps, Min. Travel Time= 8.9 min
Avg. Velocity = 0.41 fps, Avg. Travel Time= 22.4 min

Peak Storage= 151 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 54.76 cfs

6.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 550.0' Slope= 0.0273 '/'
Inlet Invert= 548.05', Outlet Invert= 533.01'

‡

Summary for Reach 20R: Dry Swale - 4

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 0.54" for WQv event
Inflow = 0.42 cfs @ 12.07 hrs, Volume= 0.036 af
Outflow = 0.40 cfs @ 12.10 hrs, Volume= 0.036 af, Atten= 4%, Lag= 1.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.27 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 0.45 fps, Avg. Travel Time= 7.4 min

Peak Storage= 63 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 66.01 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 198.0' Slope= 0.0109 '/'
Inlet Invert= 532.35', Outlet Invert= 530.19'

Summary for Reach 21R: Point C

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 0.19" for WQv event
Inflow = 0.34 cfs @ 12.50 hrs, Volume= 0.063 af
Outflow = 0.34 cfs @ 12.52 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.88 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.55 fps, Avg. Travel Time= 2.4 min

Peak Storage= 30 cf @ 12.52 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 240.09 cfs

9.00' x 2.00' deep channel, n= 0.024
Side Slope Z-value= 2.0 '/' Top Width= 17.00'
Length= 77.4' Slope= 0.0136 '/'
Inlet Invert= 526.65', Outlet Invert= 525.60'

‡

Summary for Reach 23R: Rerouting Ditch 1

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 0.10" for WQv event
Inflow = 0.05 cfs @ 12.49 hrs, Volume= 0.012 af
Outflow = 0.05 cfs @ 12.53 hrs, Volume= 0.012 af, Atten= 2%, Lag= 2.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.73 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 0.39 fps, Avg. Travel Time= 7.3 min

Peak Storage= 12 cf @ 12.53 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 20.18 cfs

2.00' x 1.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 171.0' Slope= 0.0137 '/'
Inlet Invert= 536.00', Outlet Invert= 533.66'

Summary for Reach 25R: Ditch

Inflow Area = 0.916 ac, 0.00% Impervious, Inflow Depth = 0.10" for WQv event
Inflow = 0.03 cfs @ 12.75 hrs, Volume= 0.008 af
Outflow = 0.03 cfs @ 12.90 hrs, Volume= 0.008 af, Atten= 6%, Lag= 8.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.45 fps, Min. Travel Time= 9.7 min
Avg. Velocity = 0.35 fps, Avg. Travel Time= 12.5 min

Peak Storage= 15 cf @ 12.90 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 60.53 cfs

2.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 262.2' Slope= 0.0064 '/'
Inlet Invert= 540.67', Outlet Invert= 539.00'

Summary for Reach 29R: Dry Swale - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 0.49" for WQv event
Inflow = 0.48 cfs @ 12.17 hrs, Volume= 0.051 af
Outflow = 0.47 cfs @ 12.20 hrs, Volume= 0.051 af, Atten= 1%, Lag= 1.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.64 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 0.61 fps, Avg. Travel Time= 7.4 min

Peak Storage= 78 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 90.04 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 273.0' Slope= 0.0203 '/'
Inlet Invert= 553.62', Outlet Invert= 548.08'

Summary for Reach 30R: Rerouted Ditch below Culvert

Inflow Area = 2.247 ac, 0.00% Impervious, Inflow Depth = 0.10" for WQv event
Inflow = 0.09 cfs @ 12.50 hrs, Volume= 0.019 af
Outflow = 0.09 cfs @ 12.54 hrs, Volume= 0.019 af, Atten= 1%, Lag= 2.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.00 fps, Min. Travel Time= 3.5 min
Avg. Velocity = 0.53 fps, Avg. Travel Time= 6.7 min

Peak Storage= 18 cf @ 12.54 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 25.17 cfs

2.00' x 1.00' deep channel, n= 0.013
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 212.0' Slope= 0.0058 '/'
Inlet Invert= 533.54', Outlet Invert= 532.32'

Summary for Pond 2P: Forebay

Inflow Area = 16.859 ac, 98.41% Impervious, Inflow Depth = 0.97" for WQv event
Inflow = 17.32 cfs @ 12.10 hrs, Volume= 1.363 af
Outflow = 5.10 cfs @ 12.41 hrs, Volume= 1.360 af, Atten= 71%, Lag= 18.4 min
Primary = 5.10 cfs @ 12.41 hrs, Volume= 1.360 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 3,802 sf Storage= 3,789 cf
Peak Elev= 564.50' @ 12.45 hrs Surf.Area= 5,436 sf Storage= 19,882 cf (16,094 cf above start)
Flood Elev= 568.00' Surf.Area= 7,249 sf Storage= 42,057 cf (38,268 cf above start)

Plug-Flow detention time= 101.4 min calculated for 1.273 af (93% of inflow)
Center-of-Mass det. time= 42.5 min (826.4 - 783.9)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	49,579 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	2,536	269.1	0.0	0	0	2,536
559.00	2,944	279.8	40.0	1,095	1,095	3,078
560.00	3,366	290.5	40.0	1,261	2,356	3,641
561.00	3,802	301.2	40.0	1,433	3,789	4,225
562.00	4,252	312.0	100.0	4,025	7,814	4,835
563.00	4,716	322.7	100.0	4,482	12,296	5,462
564.00	5,194	333.4	100.0	4,953	17,249	6,110
565.00	5,687	344.1	100.0	5,439	22,687	6,779
566.00	6,193	354.8	100.0	5,938	28,626	7,469
567.00	6,714	365.5	100.0	6,452	35,077	8,180
568.00	7,249	376.2	100.0	6,980	42,057	8,912
569.00	7,798	386.9	100.0	7,522	49,579	9,666

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	565.00'	**60.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=5.10 cfs @ 12.41 hrs HW=564.49' TW=561.57' (Dynamic Tailwater)
1=Culvert (Inlet Controls 5.10 cfs @ 6.49 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=561.00' TW=561.00' (Dynamic Tailwater)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 3P: Gravel WVTS

Inflow Area = 17.988 ac, 95.60% Impervious, Inflow Depth > 0.93" for WQv event
Inflow = 5.31 cfs @ 12.36 hrs, Volume= 1.399 af
Outflow = 3.31 cfs @ 13.42 hrs, Volume= 1.384 af, Atten= 38%, Lag= 63.8 min
Primary = 3.31 cfs @ 13.42 hrs, Volume= 1.384 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 22,959 sf Storage= 27,438 cf
Peak Elev= 561.77' @ 13.42 hrs Surf.Area= 23,705 sf Storage= 45,310 cf (17,872 cf above start)
Flood Elev= 568.00' Surf.Area= 30,084 sf Storage= 212,684 cf (185,246 cf above start)

Plug-Flow detention time= 413.2 min calculated for 0.754 af (54% of inflow)
Center-of-Mass det. time= 130.8 min (958.1 - 827.3)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	243,305 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	22,771	626.2	0.0	0	0	22,771
559.00	22,834	626.9	40.0	9,121	9,121	23,401
560.00	22,897	627.7	40.0	9,146	18,267	24,034
561.00	22,959	628.5	40.0	9,171	27,438	24,667
562.00	23,935	639.2	100.0	23,445	50,884	25,919
563.00	24,924	649.9	100.0	24,428	75,312	27,192
564.00	25,928	660.6	100.0	25,424	100,736	28,486
565.00	26,947	671.3	100.0	26,436	127,172	29,801
566.00	27,978	682.1	100.0	27,461	154,633	31,146
567.00	29,024	692.8	100.0	28,499	183,132	32,504
568.00	30,084	703.5	100.0	29,552	212,684	33,883
569.00	31,161	714.3	100.0	30,621	243,305	35,293

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**36.0" Round Culvert** L= 20.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	561.00'	**12.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 2	558.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	564.00'	**100.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=3.31 cfs @ 13.42 hrs HW=561.77' TW=558.41' (Dynamic Tailwater)
└─**1=Culvert** (Passes 3.31 cfs of 42.23 cfs potential flow)
  ├─**2=Orifice/Grate** (Passes 3.31 cfs of 3.85 cfs potential flow)
  │ ├─**3=Orifice/Grate** (Orifice Controls 3.31 cfs @ 4.21 fps)
  │ └─**5=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=561.00' TW=558.00' (Dynamic Tailwater)
└─**6=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4P: DP-1

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 0.89" for WQv event
Inflow = 3.42 cfs @ 13.37 hrs, Volume= 1.474 af
Outflow = 1.07 cfs @ 16.69 hrs, Volume= 1.248 af, Atten= 69%, Lag= 199.3 min
Primary = 1.07 cfs @ 16.69 hrs, Volume= 1.248 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 558.74' @ 16.69 hrs Surf.Area= 49,170 sf Storage= 35,690 cf
Flood Elev= 565.00' Surf.Area= 62,400 sf Storage= 384,495 cf

Plug-Flow detention time= 522.6 min calculated for 1.248 af (85% of inflow)
Center-of-Mass det. time= 426.4 min (1,377.1 - 950.7)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	651,999 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	47,688	883.6	0	0	47,688
559.00	49,705	899.0	48,693	48,693	50,047
560.00	51,750	914.4	50,724	99,417	52,448
561.00	53,824	929.8	52,784	152,201	54,888
562.00	55,926	945.2	54,872	207,072	57,370
563.00	58,056	960.6	56,988	264,060	59,893
564.00	60,214	976.1	59,132	323,192	62,470
565.00	62,400	991.5	61,304	384,495	65,075
566.00	64,615	1,006.9	63,504	448,000	67,720
567.00	66,858	1,022.3	65,733	513,733	70,405
568.00	69,129	1,037.7	67,990	581,723	73,132
569.00	71,429	1,053.2	70,276	651,999	75,915

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**48.0" Round Culvert** L= 663.9' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 551.36' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	558.00'	**8.0" Vert. Orifice/Grate** C= 0.600

#3	Device 1	562.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	566.00'	**60.0" W x 60.0" H Vert. Orifice/Grate** C= 0.600
#5	Secondary	567.00'	**45.0 deg x 100.0' long x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)

Primary OutFlow Max=1.07 cfs @ 16.69 hrs HW=558.74' TW=558.07' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.07 cfs of 1.74 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.07 cfs @ 3.06 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=558.00' TW=0.00' (Dynamic Tailwater)
└─**5=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 13P: Det. Pond - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 0.49" for WQv event
Inflow = 0.47 cfs @ 12.20 hrs, Volume= 0.051 af
Outflow = 0.05 cfs @ 14.35 hrs, Volume= 0.048 af, Atten= 89%, Lag= 128.9 min
Primary = 0.05 cfs @ 14.35 hrs, Volume= 0.048 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 538.22' @ 14.35 hrs Surf.Area= 5,300 sf Storage= 1,117 cf
Flood Elev= 541.00' Surf.Area= 8,791 sf Storage= 20,626 cf

Plug-Flow detention time= 378.7 min calculated for 0.048 af (94% of inflow)
Center-of-Mass det. time= 348.0 min (1,216.7 - 868.7)

Volume	Invert	Avail.Storage	Storage Description
#1	538.00'	20,626 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
538.00	5,054	387.0	0	0	5,054
539.00	6,243	405.8	5,638	5,638	6,305
540.00	7,489	424.7	6,857	12,495	7,621
541.00	8,791	423.9	8,131	20,626	8,049

Device	Routing	Invert	Outlet Devices
#1	Primary	538.00'	**15.0" Round Culvert** L= 94.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.00' / 537.00' S= 0.0106 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	538.00'	**2.4" Vert. Orifice/Grate** C= 0.600
#3	Device 1	538.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	539.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.05 cfs @ 14.35 hrs HW=538.22' TW=533.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.05 cfs of 0.22 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.05 cfs @ 1.64 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 15P: Culvert at Entr.

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 0.19" for WQv event
Inflow = 0.34 cfs @ 12.50 hrs, Volume= 0.063 af
Outflow = 0.34 cfs @ 12.50 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min
Primary = 0.34 cfs @ 12.50 hrs, Volume= 0.063 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 527.35' @ 12.50 hrs Surf.Area= 11 sf Storage= 2 cf

Plug-Flow detention time= 0.2 min calculated for 0.063 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (902.5 - 902.4)

Volume	Invert	Avail.Storage	Storage Description
#1	527.17'	1,407 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.17	6	14.0	0	0	6
528.00	44	35.0	18	18	90
529.00	121	58.1	79	98	268
530.00	266	92.9	189	286	693
531.00	555	117.6	402	688	1,120
532.00	897	157.4	719	1,407	2,001

Device	Routing	Invert	Outlet Devices
#1	Primary	527.17'	**18.0" Round Culvert X 2.00** L= 52.8' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 527.17' / 526.65' S= 0.0098 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	527.17'	**18.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	530.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.34 cfs @ 12.50 hrs HW=527.35' TW=526.69' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.34 cfs @ 2.13 fps)
  ├─**2=Orifice/Grate** (Passes 0.34 cfs of 0.37 cfs potential flow)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 17P: Box Culvert for stream

Inflow Area = 57.525 ac, 3.12% Impervious, Inflow Depth > 0.11" for WQv event
Inflow = 1.52 cfs @ 12.93 hrs, Volume= 0.523 af
Outflow = 1.52 cfs @ 12.93 hrs, Volume= 0.523 af, Atten= 0%, Lag= 0.0 min
Primary = 1.52 cfs @ 12.93 hrs, Volume= 0.523 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 533.00' @ 0.00 hrs Surf.Area= 412 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	533.00'	25,714 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
533.00	412	159.8	0	0	412
534.00	5,210	513.7	2,362	2,362	19,382
535.00	11,714	795.5	8,245	10,608	48,748
536.00	18,774	996.6	15,106	25,714	77,441

Device	Routing	Invert	Outlet Devices
#1	Primary	532.20'	**144.0" W x 60.0" H Box Culvert** L= 51.5' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 532.20' / 530.66' S= 0.0299 '/' Cc= 0.900 n= 0.024, Flow Area= 60.00 sf

Primary OutFlow Max=0.00 cfs @ 12.93 hrs HW=533.00' TW=0.00' (Dynamic Tailwater)
1=Culvert (Passes 0.00 cfs of 27.56 cfs potential flow)

Summary for Pond 18P: Level Spreader

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 0.75" for WQv event
Inflow = 1.07 cfs @ 16.69 hrs, Volume= 1.248 af
Outflow = 1.07 cfs @ 16.70 hrs, Volume= 1.248 af, Atten= 0%, Lag= 0.8 min
Primary = 1.07 cfs @ 16.70 hrs, Volume= 1.248 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 558.00' Surf.Area= 2,625 sf Storage= 7,350 cf
Peak Elev= 558.07' @ 16.71 hrs Surf.Area= 2,625 sf Storage= 7,427 cf (77 cf above start)

Plug-Flow detention time= 223.3 min calculated for 1.079 af (86% of inflow)
Center-of-Mass det. time= 1.2 min (1,378.3 - 1,377.1)

Volume	Invert	Avail.Storage	Storage Description
#1	551.00'	8,400 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 21,000 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
551.00	2,625	0	0
556.00	2,625	13,125	13,125
557.00	2,625	2,625	15,750
558.00	2,625	2,625	18,375
559.00	2,625	2,625	21,000

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**75.0" x 35.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.07 cfs @ 16.70 hrs HW=558.07' TW=558.03' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 1.07 cfs @ 0.79 fps)

Summary for Pond 23P:

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 0.54" for WQv event
Inflow = 0.40 cfs @ 12.10 hrs, Volume= 0.036 af
Outflow = 0.22 cfs @ 12.38 hrs, Volume= 0.036 af, Atten= 45%, Lag= 16.5 min
Primary = 0.22 cfs @ 12.38 hrs, Volume= 0.036 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 530.99' @ 12.38 hrs Surf.Area= 314 sf Storage= 139 cf

Plug-Flow detention time= 3.0 min calculated for 0.036 af (100% of inflow)
Center-of-Mass det. time= 2.9 min (858.0 - 855.2)

Volume	Invert	Avail.Storage	Storage Description
#1	527.33'	793 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.33	4	8.0	0.0	0	0	4
527.34	4	8.0	35.0	0	0	4
530.16	4	8.0	35.0	4	4	27
530.19	56	110.4	100.0	1	5	991
531.00	317	180.9	100.0	137	141	2,630
532.01	1,044	364.9	100.0	652	793	10,626

Device	Routing	Invert	Outlet Devices
#1	Primary	527.33'	**2.5" Round Culvert** L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 527.33' / 527.17' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.03 sf
#2	Secondary	531.60'	**30.0 deg x 7.7' long x 0.40' rise Sharp-Crested Vee/Trap Weir** Cv= 2.61 (C= 3.26)

Primary OutFlow Max=0.22 cfs @ 12.38 hrs HW=530.99' TW=527.35' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.22 cfs @ 6.47 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=527.33' TW=527.17' (Dynamic Tailwater)
└─**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 24P: Flow Splitter

Inflow Area = 16.505 ac,100.00% Impervious, Inflow Depth = 0.99" for WQv event
Inflow = 17.23 cfs @ 12.10 hrs, Volume= 1.356 af
Outflow = 17.23 cfs @ 12.10 hrs, Volume= 1.356 af, Atten= 0%, Lag= 0.0 min
Primary = 17.23 cfs @ 12.10 hrs, Volume= 1.356 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 565.26' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	562.96'	**24.0" Round Culvert** L= 44.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.00' S= 0.0215 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Secondary	562.96'	**48.0" Round Culvert** L= 106.2' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.43' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#3	Device 2	565.70'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=17.21 cfs @ 12.10 hrs HW=565.25' TW=563.34' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 17.21 cfs @ 5.48 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=562.96' TW=558.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)
  └─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 28P: Ramp Culvert

Inflow Area = 0.918 ac, 72.44% Impervious, Inflow Depth = 0.50" for WQv event
Inflow = 0.38 cfs @ 12.17 hrs, Volume= 0.039 af
Outflow = 0.38 cfs @ 12.18 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.5 min
Primary = 0.38 cfs @ 12.18 hrs, Volume= 0.038 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 555.21' @ 12.18 hrs Surf.Area= 95 sf Storage= 25 cf
Flood Elev= 557.00' Surf.Area= 534 sf Storage= 342 cf

Plug-Flow detention time= 6.6 min calculated for 0.038 af (99% of inflow)
Center-of-Mass det. time= 3.0 min (868.3 - 865.3)

Volume	Invert	Avail.Storage	Storage Description
#1	554.61'	342 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
554.61	4	8.0	0	0	4
555.00	56	45.8	10	10	166
556.00	337	150.1	177	187	1,795
556.36	534	184.0	155	342	2,698

Device	Routing	Invert	Outlet Devices
#1	Primary	555.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 30.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 555.00' / 553.62' S= 0.0460 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=0.38 cfs @ 12.18 hrs HW=555.21' TW=553.75' (Dynamic Tailwater)
↑—**1=RCP_Elliptical 23x14** (Inlet Controls 0.38 cfs @ 1.64 fps)

Summary for Pond 29P: Gravel Inlet Trench

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 0.49" for WQv event
Inflow = 0.47 cfs @ 12.20 hrs, Volume= 0.051 af
Outflow = 0.47 cfs @ 12.20 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min
Primary = 0.47 cfs @ 12.20 hrs, Volume= 0.051 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 538.59' @ 12.20 hrs Surf.Area= 4 sf Storage= 0 cf

Plug-Flow detention time= 0.1 min calculated for 0.051 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (868.7 - 868.7)

Volume	Invert	Avail.Storage	Storage Description
#1	538.25'	14 cf	**2.00'W x 2.00'L x 9.75'H Prismatoid** 39 cf Overall x 35.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	538.25'	**15.0" Round Culvert** L= 25.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.25' / 538.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.47 cfs @ 12.20 hrs HW=538.59' TW=538.08' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.47 cfs @ 2.66 fps)

Summary for Pond 30P: Culvert 2

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 0.10" for WQv event
Inflow = 0.05 cfs @ 12.53 hrs, Volume= 0.012 af
Outflow = 0.05 cfs @ 12.53 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min
Primary = 0.05 cfs @ 12.53 hrs, Volume= 0.012 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 533.76' @ 12.53 hrs
Flood Elev= 534.87'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.66'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.66' / 533.54' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=0.05 cfs @ 12.53 hrs HW=533.76' TW=533.58' (Dynamic Tailwater)
1=RCP_Elliptical 23x14 (Barrel Controls 0.05 cfs @ 1.05 fps)

Summary for Pond 31P: Culvert 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 0.56" for WQv event
Inflow = 0.28 cfs @ 12.10 hrs, Volume= 0.025 af
Outflow = 0.28 cfs @ 12.10 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min
Primary = 0.28 cfs @ 12.10 hrs, Volume= 0.025 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 533.21' @ 12.10 hrs
Flood Elev= 538.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.00' / 532.35' S= 0.0271 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=0.28 cfs @ 12.10 hrs HW=533.21' TW=532.49' (Dynamic Tailwater)
1=RCP_Elliptical 23x14 (Inlet Controls 0.28 cfs @ 1.17 fps)

Summary for Link 21L: Point A

Inflow Area = 27.710 ac, 66.61% Impervious, Inflow Depth > 0.57" for WQv event
Inflow = 1.13 cfs @ 16.46 hrs, Volume= 1.313 af
Primary = 1.13 cfs @ 16.46 hrs, Volume= 1.313 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 22L: Point B

Inflow Area =	57.525 ac,	3.12% Impervious,	Inflow Depth > 0.11"	for WQv event
Inflow =	1.52 cfs @	12.93 hrs,	Volume=	0.523 af
Primary =	1.52 cfs @	12.93 hrs,	Volume=	0.523 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 28L: Point F

Inflow Area =	5.040 ac,	0.00% Impervious,	Inflow Depth = 0.10"	for WQv event
Inflow =	0.14 cfs @	12.86 hrs,	Volume=	0.042 af
Primary =	0.14 cfs @	12.86 hrs,	Volume=	0.042 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Section 8.0

Drainage Analysis
POI-E
Wallum Lake Road Culvert

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.860	98	Paved parking, HSG D (6S)
551.916	77	Woods, Good, HSG D (4S, 6S)
553.776	**77**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
553.776	HSG D	4S, 6S
0.000	Other	
553.776		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	1.860	0.000	1.860	Paved parking	6S
0.000	0.000	0.000	551.916	0.000	551.916	Woods, Good	4S, 6S
0.000	**0.000**	**0.000**	**553.776**	**0.000**	**553.776**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 4S: POI - D Runoff Area=85.739 ac 0.00% Impervious Runoff Depth=2.54"
Flow Length=3,135' Slope=0.0762 '/' Tc=31.5 min CN=77 Runoff=140.96 cfs 18.145 af

Subcatchment 6S: Exist DA at POI - E Runoff Area=468.037 ac 0.40% Impervious Runoff Depth=2.54"
Flow Length=11,874' Tc=430.9 min CN=77 Runoff=137.11 cfs 99.050 af

Total Runoff Area = 553.776 ac Runoff Volume = 117.195 af Average Runoff Depth = 2.54"
99.66% Pervious = 551.916 ac 0.34% Impervious = 1.860 ac

Summary for Subcatchment 4S: POI - D

Runoff = 140.96 cfs @ 12.43 hrs, Volume= 18.145 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
85.739	77	Woods, Good, HSG D
85.739		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	3,135	0.0762	1.66		**Lag/CN Method,**

Summary for Subcatchment 6S: Exist DA at POI - E

Runoff = 137.11 cfs @ 17.72 hrs, Volume= 99.050 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
466.177	77	Woods, Good, HSG D
1.860	98	Paved parking, HSG D
468.037	77	Weighted Average
466.177		99.60% Pervious Area
1.860		0.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	80	0.0480	0.26		**Sheet Flow,** Range n= 0.130 P2= 3.30"
391.3	7,875	0.0180	0.34		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
34.5	3,919	0.0130	1.90	182.01	**Channel Flow,** Area= 96.0 sf Perim= 81.1' r= 1.18' n= 0.100 Very weedy reaches w/pools
430.9	11,874	Total			

Summary for Subcatchment 4S: POI - D

Runoff = 327.06 cfs @ 12.43 hrs, Volume= 42.299 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
85.739	77	Woods, Good, HSG D
85.739		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	3,135	0.0762	1.66		**Lag/CN Method,**

Summary for Subcatchment 6S: Exist DA at POI - E

Runoff = 324.16 cfs @ 17.71 hrs, Volume= 230.904 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
466.177	77	Woods, Good, HSG D
1.860	98	Paved parking, HSG D
468.037	77	Weighted Average
466.177		99.60% Pervious Area
1.860		0.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	80	0.0480	0.26		**Sheet Flow,** Range n= 0.130 P2= 3.30"
391.3	7,875	0.0180	0.34		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
34.5	3,919	0.0130	1.90	182.01	**Channel Flow,** Area= 96.0 sf Perim= 81.1' r= 1.18' n= 0.100 Very weedy reaches w/pools
430.9	11,874	Total			

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.576	74	>75% Grass cover, Good, HSG C (12S, 19S, 26S, 34S)
1.188	80	>75% Grass cover, Good, HSG D (10S, 11S, 13S)
0.854	98	Paved parking, HSG C (12S, 34S)
17.665	98	Paved parking, HSG D (1S, 16S, 18S, 26S)
1.661	98	Water Surface, HSG C (13S, 19S)
0.691	98	Water Surface, HSG D (10S, 11S)
529.890	77	Woods, Good, HSG D (9S, 11S, 13S, 16S, 18S, 20S, 23S, 24S, 25S, 27S, 29S)
552.525	**78**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.091	HSG C	12S, 13S, 19S, 26S, 34S
549.434	HSG D	1S, 9S, 10S, 11S, 13S, 16S, 18S, 20S, 23S, 24S, 25S, 26S, 27S, 29S
0.000	Other	
552.525		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.576	1.188	0.000	1.764	>75% Grass cover, Good	10S, 11S, 12S, 13S, 19S, 26S, 34S
0.000	0.000	0.854	17.665	0.000	18.519	Paved parking	1S, 12S, 16S, 18S, 26S, 34S
0.000	0.000	1.661	0.691	0.000	2.352	Water Surface	10S, 11S, 13S, 19S
0.000	0.000	0.000	529.890	0.000	529.890	Woods, Good	9S, 11S, 13S, 16S, 18S, 20S, 23S, 24S, 25S, 27S, 29S
0.000	**0.000**	**3.091**	**549.434**	**0.000**	**552.525**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1S	0.00	0.00	135.0	0.0025	0.013	30.0	0.0	0.0
2	1S	0.00	0.00	110.0	0.0025	0.013	36.0	0.0	0.0
3	1S	0.00	0.00	79.0	0.0025	0.013	36.0	0.0	0.0
4	1S	0.00	0.00	246.0	0.0025	0.013	42.0	0.0	0.0
5	1S	0.00	0.00	133.0	0.0025	0.013	42.0	0.0	0.0
6	1S	0.00	0.00	182.0	0.0025	0.013	42.0	0.0	0.0
7	1S	0.00	0.00	256.0	0.0025	0.013	48.0	0.0	0.0
8	1S	0.00	0.00	233.0	0.0025	0.013	48.0	0.0	0.0
9	1S	0.00	0.00	130.0	0.0025	0.013	48.0	0.0	0.0
10	1S	0.00	0.00	113.0	0.0025	0.013	48.0	0.0	0.0
11	2P	558.00	558.00	20.0	0.0000	0.013	12.0	0.0	0.0
12	3P	558.00	558.00	20.0	0.0000	0.013	36.0	0.0	0.0
13	4P	558.00	551.36	663.9	0.0100	0.013	48.0	0.0	0.0
14	13P	538.00	537.00	94.0	0.0106	0.013	15.0	0.0	0.0
15	15P	527.17	526.65	52.8	0.0098	0.013	18.0	0.0	0.0
16	17P	532.20	530.66	51.5	0.0299	0.024	144.0	60.0	0.0
17	23P	527.33	527.17	16.0	0.0100	0.013	2.5	0.0	0.0
18	24P	562.96	562.00	44.7	0.0215	0.013	24.0	0.0	0.0
19	24P	562.96	562.43	106.2	0.0050	0.013	48.0	0.0	0.0
20	28P	555.00	553.62	30.0	0.0460	0.013	23.0	14.0	0.0
21	29P	538.25	538.00	25.0	0.0100	0.013	15.0	0.0	0.0
22	30P	533.66	533.54	24.0	0.0050	0.013	23.0	14.0	0.0
23	31P	533.00	532.35	24.0	0.0271	0.013	23.0	14.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Main Site Runoff Area=16.505 ac 100.00% Impervious Runoff Depth=4.66"
Flow Length=1,775' Tc=7.4 min CN=98 Runoff=75.45 cfs 6.414 af

Subcatchment 9S: DA to POI - E Runoff Area=374.703 ac 0.00% Impervious Runoff Depth=2.54"
Flow Length=11,874' Tc=430.9 min CN=77 Runoff=109.77 cfs 79.298 af

Subcatchment 10S: Forebay DA Runoff Area=0.354 ac 24.29% Impervious Runoff Depth=3.18"
Tc=5.0 min CN=84 Runoff=1.36 cfs 0.094 af

Subcatchment 11S: Gravel WVTS DA Runoff Area=1.129 ac 53.59% Impervious Runoff Depth=3.68"
Tc=5.0 min CN=89 Runoff=4.90 cfs 0.346 af

Subcatchment 12S: Subcat for Swale - 1 Runoff Area=0.918 ac 72.44% Impervious Runoff Depth=3.89"
Flow Length=993' Slope=0.1266 '/' Tc=6.0 min CN=91 Runoff=4.01 cfs 0.297 af

Subcatchment 13S: Pond DA Runoff Area=1.949 ac 64.70% Impervious Runoff Depth=3.99"
Tc=5.0 min CN=92 Runoff=8.98 cfs 0.648 af

Subcatchment 16S: DA to Entr. Culvert Runoff Area=3.196 ac 0.88% Impervious Runoff Depth=2.54"
Flow Length=1,034' Slope=0.0359 '/' Tc=18.9 min CN=77 Runoff=6.55 cfs 0.676 af

Subcatchment 18S: Subcat to POI - B Runoff Area=53.103 ac 1.69% Impervious Runoff Depth=2.54"
Flow Length=3,073' Slope=0.0324 '/' Tc=47.5 min CN=77 Runoff=70.88 cfs 11.238 af

Subcatchment 19S: Subcat for Swale - 2 Runoff Area=0.544 ac 73.53% Impervious Runoff Depth=3.99"
Flow Length=313' Slope=0.1239 '/' Tc=2.3 min CN=92 Runoff=2.77 cfs 0.181 af

Subcatchment 20S: Wetlands DA to POI - A Runoff Area=7.773 ac 0.00% Impervious Runoff Depth=2.54"
Flow Length=1,002' Slope=0.0286 '/' Tc=20.6 min CN=77 Runoff=15.41 cfs 1.645 af

Subcatchment 23S: DA to POI - D Runoff Area=83.546 ac 0.00% Impervious Runoff Depth=2.54"
Flow Length=3,135' Slope=0.0772 '/' Tc=31.3 min CN=77 Runoff=137.55 cfs 17.681 af

Subcatchment 24S: DA for 25R Runoff Area=0.916 ac 0.00% Impervious Runoff Depth=2.54"
Flow Length=1,580' Slope=0.0192 '/' Tc=36.2 min CN=77 Runoff=1.41 cfs 0.194 af

Subcatchment 25S: Rerouted Area Runoff Area=1.380 ac 0.00% Impervious Runoff Depth=2.54"
Flow Length=734' Slope=0.0260 '/' Tc=16.9 min CN=77 Runoff=2.96 cfs 0.292 af

Subcatchment 26S: Subcat for Swale - 2 Runoff Area=0.341 ac 68.62% Impervious Runoff Depth=3.78"
Flow Length=293' Slope=0.1266 '/' Tc=2.3 min CN=90 Runoff=1.67 cfs 0.107 af

Subcatchment 27S: DA for POI - F Runoff Area=5.040 ac 0.00% Impervious Runoff Depth=2.54"
Flow Length=2,185' Slope=0.0219 '/' Tc=44.0 min CN=77 Runoff=7.01 cfs 1.067 af

Subcatchment 29S: Rerouted Area B Runoff Area=0.867 ac 0.00% Impervious Runoff Depth=2.54"
Flow Length=599' Slope=0.0260 '/' Tc=14.3 min CN=77 Runoff=1.98 cfs 0.183 af

Subcatchment 34S: Subcat for Swale - 4 Runoff Area=0.261 ac 72.41% Impervious Runoff Depth=3.89"
Flow Length=292' Slope=0.1265 '/' Tc=2.2 min CN=91 Runoff=1.31 cfs 0.084 af

Reach 8R: Level Spreader Surface Avg. Flow Depth=0.06' Max Vel=0.72 fps Inflow=3.08 cfs 6.915 af
n=0.030 L=48.0' S=0.0100 '/' Capacity=439.80 cfs Outflow=3.08 cfs 6.913 af

Reach 15R: Dry Swale - 1 Avg. Flow Depth=0.40' Max Vel=3.05 fps Inflow=4.01 cfs 0.297 af
n=0.030 L=904.0' S=0.0190 '/' Capacity=87.10 cfs Outflow=3.47 cfs 0.297 af

Reach 18R: Dry Swale - 3 Avg. Flow Depth=0.16' Max Vel=2.34 fps Inflow=2.77 cfs 0.181 af
n=0.030 L=550.0' S=0.0273 '/' Capacity=54.76 cfs Outflow=2.41 cfs 0.181 af

Reach 20R: Dry Swale - 4 Avg. Flow Depth=0.47' Max Vel=2.52 fps Inflow=3.59 cfs 0.265 af
n=0.030 L=198.0' S=0.0109 '/' Capacity=66.01 cfs Outflow=3.52 cfs 0.265 af

Reach 21R: POI - C Avg. Flow Depth=0.29' Max Vel=3.00 fps Inflow=8.29 cfs 0.942 af
n=0.024 L=77.4' S=0.0136 '/' Capacity=240.09 cfs Outflow=8.29 cfs 0.942 af

Reach 23R: Rerouting Ditch 1 Avg. Flow Depth=0.37' Max Vel=2.94 fps Inflow=2.96 cfs 0.292 af
n=0.025 L=171.0' S=0.0137 '/' Capacity=20.18 cfs Outflow=2.95 cfs 0.292 af

Reach 25R: Ditch Avg. Flow Depth=0.30' Max Vel=1.80 fps Inflow=1.41 cfs 0.194 af
n=0.025 L=262.2' S=0.0064 '/' Capacity=60.53 cfs Outflow=1.40 cfs 0.194 af

Reach 29R: Dry Swale - 2 Avg. Flow Depth=0.45' Max Vel=3.33 fps Inflow=4.33 cfs 0.404 af
n=0.030 L=273.0' S=0.0203 '/' Capacity=90.04 cfs Outflow=4.30 cfs 0.404 af

Reach 30R: Rerouted Ditch below Avg. Flow Depth=0.43' Max Vel=3.99 fps Inflow=4.88 cfs 0.476 af
n=0.013 L=212.0' S=0.0058 '/' Capacity=25.17 cfs Outflow=4.87 cfs 0.476 af

Pond 2P: Forebay Peak Elev=565.24' Storage=24,063 cf Inflow=27.95 cfs 5.323 af
Primary=5.36 cfs 4.011 af Secondary=23.18 cfs 1.309 af Outflow=27.83 cfs 5.320 af

Pond 3P: Gravel WVTS Peak Elev=562.95' Storage=74,094 cf Inflow=32.38 cfs 5.665 af
Primary=23.97 cfs 5.648 af Secondary=0.00 cfs 0.000 af Outflow=23.97 cfs 5.648 af

Pond 4P: DP-1 Peak Elev=561.70' Storage=190,514 cf Inflow=74.97 cfs 7.481 af
Primary=3.08 cfs 6.916 af Secondary=0.00 cfs 0.000 af Outflow=3.08 cfs 6.916 af

Pond 13P: Det. Pond - 2 Peak Elev=539.56' Storage=9,328 cf Inflow=4.30 cfs 0.404 af
Outflow=0.78 cfs 0.399 af

Pond 15P: Culvert at Entr. Peak Elev=530.16' Storage=333 cf Inflow=8.29 cfs 0.942 af
Outflow=8.29 cfs 0.942 af

Pond 17P: Box Culvert for stream Peak Elev=533.76' Storage=1,301 cf Inflow=74.83 cfs 12.306 af
144.0" x 60.0" Box Culvert n=0.024 L=51.5' S=0.0299 '/' Outflow=74.75 cfs 12.306 af

Pond 18P: Level Spreader Underground Peak Elev=558.15' Storage=7,505 cf Inflow=3.08 cfs 6.916 af
Outflow=3.08 cfs 6.915 af

Pond 23P: Peak Elev=531.86' Storage=645 cf Inflow=3.52 cfs 0.265 af
Primary=0.23 cfs 0.156 af Secondary=3.32 cfs 0.109 af Outflow=3.47 cfs 0.265 af

Pond 24P: Flow Splitter Peak Elev=568.34' Inflow=75.45 cfs 6.414 af
Primary=26.66 cfs 5.229 af Secondary=48.79 cfs 1.185 af Outflow=75.45 cfs 6.414 af

Pond 28P: Ramp Culvert Peak Elev=555.69' Storage=99 cf Inflow=3.47 cfs 0.297 af
23.0" x 14.0", R=22.0" Elliptical Culvert n=0.013 L=30.0' S=0.0460 '/' Outflow=3.46 cfs 0.297 af

Pond 29P: Gravel Inlet Trench Peak Elev=539.59' Storage=2 cf Inflow=4.30 cfs 0.404 af
15.0" Round Culvert n=0.013 L=25.0' S=0.0100 '/' Outflow=4.30 cfs 0.404 af

Pond 30P: Culvert 2 Peak Elev=534.46' Inflow=2.95 cfs 0.292 af
23.0" x 14.0", R=22.0" Elliptical Culvert n=0.013 L=24.0' S=0.0050 '/' Outflow=2.95 cfs 0.292 af

Pond 31P: Culvert 3 Peak Elev=533.68' Inflow=2.41 cfs 0.181 af
23.0" x 14.0", R=22.0" Elliptical Culvert n=0.013 L=24.0' S=0.0271 '/' Outflow=2.41 cfs 0.181 af

Link 21L: POI - A Inflow=17.72 cfs 8.558 af
Primary=17.72 cfs 8.558 af

Link 22L: POI - B Inflow=74.75 cfs 12.306 af
Primary=74.75 cfs 12.306 af

Link 28L: POI - F Inflow=7.01 cfs 1.067 af
Primary=7.01 cfs 1.067 af

Link 29L: POI - E Inflow=119.16 cfs 102.171 af
Primary=119.16 cfs 102.171 af

Total Runoff Area = 552.525 ac Runoff Volume = 120.446 af Average Runoff Depth = 2.62"
96.22% Pervious = 531.654 ac 3.78% Impervious = 20.871 ac

Summary for Subcatchment 1S: Main Site

Runoff = 75.45 cfs @ 12.10 hrs, Volume= 6.414 af, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
16.505	98	Paved parking, HSG D
16.505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	158	0.0100	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	135	0.0025	4.18	20.51	**Pipe Channel, 130-131** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
0.4	110	0.0025	4.72	33.35	**Pipe Channel, 131-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.3	79	0.0025	4.72	33.35	**Pipe Channel, 132-133** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.8	246	0.0025	5.23	50.30	**Pipe Channel, 133-134** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.4	133	0.0025	5.23	50.30	**Pipe Channel, 134-135** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.6	182	0.0025	5.23	50.30	**Pipe Channel, 135-136** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.7	256	0.0025	5.72	71.82	**Pipe Channel, 136-137** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.7	233	0.0025	5.72	71.82	**Pipe Channel, 137-138** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.4	130	0.0025	5.72	71.82	**Pipe Channel, 138-139** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.3	113	0.0025	5.72	71.82	**Pipe Channel, 139-Outlet** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
7.4	1,775	Total			

Summary for Subcatchment 9S: DA to POI - E

Runoff = 109.77 cfs @ 17.72 hrs, Volume= 79.298 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
374.703	77	Woods, Good, HSG D
374.703		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	80	0.0480	0.26		**Sheet Flow,** Range n= 0.130 P2= 3.30"
391.3	7,875	0.0180	0.34		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
34.5	3,919	0.0130	1.90	182.01	**Channel Flow,** Area= 96.0 sf Perim= 81.1' r= 1.18' n= 0.100 Very weedy reaches w/pools
430.9	11,874	Total			

Summary for Subcatchment 10S: Forebay DA

Runoff = 1.36 cfs @ 12.07 hrs, Volume= 0.094 af, Depth= 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
0.268	80	>75% Grass cover, Good, HSG D
0.086	98	Water Surface, HSG D
0.354	84	Weighted Average
0.268		75.71% Pervious Area
0.086		24.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 11S: Gravel WVTS DA

Runoff = 4.90 cfs @ 12.07 hrs, Volume= 0.346 af, Depth= 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (ac)	CN	Description
	0.605	98	Water Surface, HSG D
	0.296	80	>75% Grass cover, Good, HSG D
	0.228	77	Woods, Good, HSG D
	1.129	89	Weighted Average
	0.524		46.41% Pervious Area
	0.605		53.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 12S: Subcat for Swale - 1

Runoff = 4.01 cfs @ 12.08 hrs, Volume= 0.297 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (ac)	CN	Description
	0.253	74	>75% Grass cover, Good, HSG C
*	0.665	98	Paved parking, HSG C
	0.918	91	Weighted Average
	0.253		27.56% Pervious Area
	0.665		72.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	993	0.1266	2.77		**Lag/CN Method,**

Summary for Subcatchment 13S: Pond DA

Runoff = 8.98 cfs @ 12.07 hrs, Volume= 0.648 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (ac)	CN	Description
	1.261	98	Water Surface, HSG C
	0.624	80	>75% Grass cover, Good, HSG D
	0.064	77	Woods, Good, HSG D
	1.949	92	Weighted Average
	0.688		35.30% Pervious Area
	1.261		64.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 16S: DA to Entr. Culvert

Runoff = 6.55 cfs @ 12.26 hrs, Volume= 0.676 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
3.168	77	Woods, Good, HSG D
0.028	98	Paved parking, HSG D
3.196	77	Weighted Average
3.168		99.12% Pervious Area
0.028		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	1,034	0.0359	0.91		**Lag/CN Method,**

Summary for Subcatchment 18S: Subcat to POI - B

Runoff = 70.88 cfs @ 12.66 hrs, Volume= 11.238 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
52.205	77	Woods, Good, HSG D
0.898	98	Paved parking, HSG D
53.103	77	Weighted Average
52.205		98.31% Pervious Area
0.898		1.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.5	3,073	0.0324	1.08		**Lag/CN Method,**

Summary for Subcatchment 19S: Subcat for Swale - 2

Runoff = 2.77 cfs @ 12.03 hrs, Volume= 0.181 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (ac)	CN	Description
	0.400	98	Water Surface, HSG C
*	0.144	74	>75% Grass cover, Good, HSG C
	0.544	92	Weighted Average
	0.144		26.47% Pervious Area
	0.400		73.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	313	0.1239	2.27		**Lag/CN Method,**

Summary for Subcatchment 20S: Wetlands DA to POI - A

Runoff = 15.41 cfs @ 12.29 hrs, Volume= 1.645 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
7.773	77	Woods, Good, HSG D
7.773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	1,002	0.0286	0.81		**Lag/CN Method,**

Summary for Subcatchment 23S: DA to POI - D

Runoff = 137.55 cfs @ 12.44 hrs, Volume= 17.681 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
83.546	77	Woods, Good, HSG D
83.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.3	3,135	0.0772	1.67		**Lag/CN Method,**

Summary for Subcatchment 24S: DA for 25R

Runoff = 1.41 cfs @ 12.51 hrs, Volume= 0.194 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
0.916	77	Woods, Good, HSG D
0.916		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
36.2	1,580	0.0192	0.73		**Lag/CN Method,**

Summary for Subcatchment 25S: Rerouted Area

Runoff = 2.96 cfs @ 12.23 hrs, Volume= 0.292 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
1.380	77	Woods, Good, HSG D
1.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	734	0.0260	0.73		**Lag/CN Method,**

Summary for Subcatchment 26S: Subcat for Swale - 2

Runoff = 1.67 cfs @ 12.03 hrs, Volume= 0.107 af, Depth= 3.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (ac)	CN	Description
*	0.234	98	Paved parking, HSG D
	0.107	74	>75% Grass cover, Good, HSG C
	0.341	90	Weighted Average
	0.107		31.38% Pervious Area
	0.234		68.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	293	0.1266	2.08		**Lag/CN Method,**

Summary for Subcatchment 27S: DA for POI - F

Runoff = 7.01 cfs @ 12.61 hrs, Volume= 1.067 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
5.040	77	Woods, Good, HSG D
5.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.0	2,185	0.0219	0.83		**Lag/CN Method,**

Summary for Subcatchment 29S: Rerouted Area B

Runoff = 1.98 cfs @ 12.20 hrs, Volume= 0.183 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (ac)	CN	Description
0.867	77	Woods, Good, HSG D
0.867		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	599	0.0260	0.70		**Lag/CN Method,**

Summary for Subcatchment 34S: Subcat for Swale - 4

Runoff = 1.31 cfs @ 12.03 hrs, Volume= 0.084 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (ac)	CN	Description
*	0.072	74	>75% Grass cover, Good, HSG C
*	0.189	98	Paved parking, HSG C
	0.261	91	Weighted Average
	0.072		27.59% Pervious Area
	0.189		72.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	292	0.1265	2.17		**Lag/CN Method,**

Summary for Reach 8R: Level Spreader Surface

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 4.16" for 10-Year event
Inflow = 3.08 cfs @ 18.09 hrs, Volume= 6.915 af
Outflow = 3.08 cfs @ 18.10 hrs, Volume= 6.913 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.72 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 1.4 min

Peak Storage= 206 cf @ 18.10 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 105.0 sf, Capacity= 439.80 cfs

75.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 30.0 '/' Top Width= 135.00'
Length= 48.0' Slope= 0.0100 '/'
Inlet Invert= 558.00', Outlet Invert= 557.52'

‡

Summary for Reach 15R: Dry Swale - 1

Inflow Area =	0.918 ac, 72.44% Impervious, Inflow Depth = 3.89" for 10-Year event		
Inflow =	4.01 cfs @ 12.08 hrs, Volume=	0.297 af	
Outflow =	3.47 cfs @ 12.13 hrs, Volume=	0.297 af, Atten= 13%, Lag= 2.8 min	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.05 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 0.87 fps, Avg. Travel Time= 17.3 min

Peak Storage= 1,028 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 87.10 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 904.0' Slope= 0.0190 '/'
Inlet Invert= 572.17', Outlet Invert= 555.00'

Summary for Reach 18R: Dry Swale - 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 3.99" for 10-Year event
Inflow = 2.77 cfs @ 12.03 hrs, Volume= 0.181 af
Outflow = 2.41 cfs @ 12.07 hrs, Volume= 0.181 af, Atten= 13%, Lag= 2.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.34 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 16.1 min

Peak Storage= 565 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 54.76 cfs

6.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 550.0' Slope= 0.0273 '/'
Inlet Invert= 548.05', Outlet Invert= 533.01'

‡

Summary for Reach 20R: Dry Swale - 4

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 3.96" for 10-Year event
Inflow = 3.59 cfs @ 12.05 hrs, Volume= 0.265 af
Outflow = 3.52 cfs @ 12.07 hrs, Volume= 0.265 af, Atten= 2%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.52 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 4.7 min

Peak Storage= 277 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 66.01 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 198.0' Slope= 0.0109 '/'
Inlet Invert= 532.35', Outlet Invert= 530.19'

Summary for Reach 21R: POI - C

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 2.82" for 10-Year event
Inflow = 8.29 cfs @ 12.24 hrs, Volume= 0.942 af
Outflow = 8.29 cfs @ 12.24 hrs, Volume= 0.942 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.00 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 1.5 min

Peak Storage= 214 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 240.09 cfs

9.00' x 2.00' deep channel, n= 0.024
Side Slope Z-value= 2.0 '/' Top Width= 17.00'
Length= 77.4' Slope= 0.0136 '/'
Inlet Invert= 526.65', Outlet Invert= 525.60'

‡

Summary for Reach 23R: Rerouting Ditch 1

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 2.96 cfs @ 12.23 hrs, Volume= 0.292 af
Outflow = 2.95 cfs @ 12.24 hrs, Volume= 0.292 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.94 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 2.9 min

Peak Storage= 172 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 20.18 cfs

2.00' x 1.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 171.0' Slope= 0.0137 '/'
Inlet Invert= 536.00', Outlet Invert= 533.66'

Summary for Reach 25R: Ditch

Inflow Area = 0.916 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 1.41 cfs @ 12.51 hrs, Volume= 0.194 af
Outflow = 1.40 cfs @ 12.54 hrs, Volume= 0.194 af, Atten= 1%, Lag= 1.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.80 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.67 fps, Avg. Travel Time= 6.5 min

Peak Storage= 205 cf @ 12.54 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 60.53 cfs

2.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 262.2' Slope= 0.0064 '/'
Inlet Invert= 540.67', Outlet Invert= 539.00'

Summary for Reach 29R: Dry Swale - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 3.85" for 10-Year event
Inflow = 4.33 cfs @ 12.11 hrs, Volume= 0.404 af
Outflow = 4.30 cfs @ 12.12 hrs, Volume= 0.404 af, Atten= 1%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.33 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 4.7 min

Peak Storage= 353 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 90.04 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 273.0' Slope= 0.0203 '/'
Inlet Invert= 553.62', Outlet Invert= 548.08'

Summary for Reach 30R: Rerouted Ditch below Culvert

Inflow Area = 2.247 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 4.88 cfs @ 12.22 hrs, Volume= 0.476 af
Outflow = 4.87 cfs @ 12.24 hrs, Volume= 0.476 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.99 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 2.7 min

Peak Storage= 259 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 25.17 cfs

2.00' x 1.00' deep channel, n= 0.013
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 212.0' Slope= 0.0058 '/'
Inlet Invert= 533.54', Outlet Invert= 532.32'

Summary for Pond 2P: Forebay

Inflow Area = 16.859 ac, 98.41% Impervious, Inflow Depth = 3.79" for 10-Year event
Inflow = 27.95 cfs @ 12.10 hrs, Volume= 5.323 af
Outflow = 27.83 cfs @ 12.11 hrs, Volume= 5.320 af, Atten= 0%, Lag= 0.7 min
Primary = 5.36 cfs @ 11.70 hrs, Volume= 4.011 af
Secondary = 23.18 cfs @ 12.11 hrs, Volume= 1.309 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 3,802 sf Storage= 3,789 cf
Peak Elev= 565.24' @ 12.11 hrs Surf.Area= 5,806 sf Storage= 24,063 cf (20,274 cf above start)
Flood Elev= 568.00' Surf.Area= 7,249 sf Storage= 42,057 cf (38,268 cf above start)

Plug-Flow detention time= 63.1 min calculated for 5.232 af (98% of inflow)
Center-of-Mass det. time= 41.9 min (797.7 - 755.8)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	49,579 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	2,536	269.1	0.0	0	0	2,536
559.00	2,944	279.8	40.0	1,095	1,095	3,078
560.00	3,366	290.5	40.0	1,261	2,356	3,641
561.00	3,802	301.2	40.0	1,433	3,789	4,225
562.00	4,252	312.0	100.0	4,025	7,814	4,835
563.00	4,716	322.7	100.0	4,482	12,296	5,462
564.00	5,194	333.4	100.0	4,953	17,249	6,110
565.00	5,687	344.1	100.0	5,439	22,687	6,779
566.00	6,193	354.8	100.0	5,938	28,626	7,469
567.00	6,714	365.5	100.0	6,452	35,077	8,180
568.00	7,249	376.2	100.0	6,980	42,057	8,912
569.00	7,798	386.9	100.0	7,522	49,579	9,666

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	565.00'	**60.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=5.35 cfs @ 11.70 hrs HW=565.11' TW=561.90' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 5.35 cfs @ 6.81 fps)

Secondary OutFlow Max=23.18 cfs @ 12.11 hrs HW=565.24' TW=562.84' (Dynamic Tailwater)
└─**2=Sharp-Crested Rectangular Weir** (Weir Controls 23.18 cfs @ 1.62 fps)

Summary for Pond 3P: Gravel WVTS

Inflow Area = 17.988 ac, 95.60% Impervious, Inflow Depth = 3.78" for 10-Year event
Inflow = 32.38 cfs @ 12.10 hrs, Volume= 5.665 af
Outflow = 23.97 cfs @ 12.24 hrs, Volume= 5.648 af, Atten= 26%, Lag= 8.8 min
Primary = 23.97 cfs @ 12.24 hrs, Volume= 5.648 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 22,959 sf Storage= 27,438 cf
Peak Elev= 562.95' @ 12.24 hrs Surf.Area= 24,875 sf Storage= 74,094 cf (46,656 cf above start)
Flood Elev= 568.00' Surf.Area= 30,084 sf Storage= 212,684 cf (185,246 cf above start)

Plug-Flow detention time= 229.6 min calculated for 5.018 af (89% of inflow)
Center-of-Mass det. time= 114.9 min (912.4 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	243,305 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	22,771	626.2	0.0	0	0	22,771
559.00	22,834	626.9	40.0	9,121	9,121	23,401
560.00	22,897	627.7	40.0	9,146	18,267	24,034
561.00	22,959	628.5	40.0	9,171	27,438	24,667
562.00	23,935	639.2	100.0	23,445	50,884	25,919
563.00	24,924	649.9	100.0	24,428	75,312	27,192
564.00	25,928	660.6	100.0	25,424	100,736	28,486
565.00	26,947	671.3	100.0	26,436	127,172	29,801
566.00	27,978	682.1	100.0	27,461	154,633	31,146
567.00	29,024	692.8	100.0	28,499	183,132	32,504
568.00	30,084	703.5	100.0	29,552	212,684	33,883
569.00	31,161	714.3	100.0	30,621	243,305	35,293

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**36.0" Round Culvert** L= 20.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	561.00'	**12.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 2	558.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	564.00'	**100.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=23.97 cfs @ 12.24 hrs HW=562.95' TW=560.17' (Dynamic Tailwater)
└─**1=Culvert** (Passes 23.97 cfs of 56.81 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 9.11 cfs @ 5.80 fps)
  │ ├─**3=Orifice/Grate** (Passes < 5.28 cfs potential flow)
  │ └─**5=Orifice/Grate** (Passes < 14.86 cfs potential flow)
  └─**4=Orifice/Grate** (Weir Controls 14.86 cfs @ 2.20 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=561.00' TW=558.00' (Dynamic Tailwater)
└─**6=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4P: DP-1

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 4.50" for 10-Year event
Inflow = 74.97 cfs @ 12.11 hrs, Volume= 7.481 af
Outflow = 3.08 cfs @ 18.08 hrs, Volume= 6.916 af, Atten= 96%, Lag= 358.3 min
Primary = 3.08 cfs @ 18.08 hrs, Volume= 6.916 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 561.70' @ 18.08 hrs Surf.Area= 55,296 sf Storage= 190,514 cf
Flood Elev= 565.00' Surf.Area= 62,400 sf Storage= 384,495 cf

Plug-Flow detention time= 760.3 min calculated for 6.915 af (92% of inflow)
Center-of-Mass det. time= 705.3 min (1,577.1 - 871.8)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	651,999 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	47,688	883.6	0	0	47,688
559.00	49,705	899.0	48,693	48,693	50,047
560.00	51,750	914.4	50,724	99,417	52,448
561.00	53,824	929.8	52,784	152,201	54,888
562.00	55,926	945.2	54,872	207,072	57,370
563.00	58,056	960.6	56,988	264,060	59,893
564.00	60,214	976.1	59,132	323,192	62,470
565.00	62,400	991.5	61,304	384,495	65,075
566.00	64,615	1,006.9	63,504	448,000	67,720
567.00	66,858	1,022.3	65,733	513,733	70,405
568.00	69,129	1,037.7	67,990	581,723	73,132
569.00	71,429	1,053.2	70,276	651,999	75,915

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**48.0" Round Culvert** L= 663.9' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 551.36' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	558.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	562.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	566.00'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	567.00'	**45.0 deg x 100.0' long x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)

Primary OutFlow Max=3.08 cfs @ 18.08 hrs HW=561.70' TW=558.15' (Dynamic Tailwater)
└─**1=Culvert** (Passes 3.08 cfs of 62.80 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.08 cfs @ 8.84 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=558.00' TW=0.00' (Dynamic Tailwater)
└─**5=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 13P: Det. Pond - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 3.85" for 10-Year event
Inflow = 4.30 cfs @ 12.12 hrs, Volume= 0.404 af
Outflow = 0.78 cfs @ 12.72 hrs, Volume= 0.399 af, Atten= 82%, Lag= 35.9 min
Primary = 0.78 cfs @ 12.72 hrs, Volume= 0.399 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 539.56' @ 12.72 hrs Surf.Area= 6,928 sf Storage= 9,328 cf
Flood Elev= 541.00' Surf.Area= 8,791 sf Storage= 20,626 cf

Plug-Flow detention time= 390.7 min calculated for 0.399 af (99% of inflow)
Center-of-Mass det. time= 381.7 min (1,181.1 - 799.4)

Volume	Invert	Avail.Storage	Storage Description
#1	538.00'	20,626 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
538.00	5,054	387.0	0	0	5,054
539.00	6,243	405.8	5,638	5,638	6,305
540.00	7,489	424.7	6,857	12,495	7,621
541.00	8,791	423.9	8,131	20,626	8,049

Device	Routing	Invert	Outlet Devices
#1	Primary	538.00'	**15.0" Round Culvert** L= 94.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.00' / 537.00' S= 0.0106 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	538.00'	**2.4" Vert. Orifice/Grate** C= 0.600
#3	Device 1	538.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	539.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.78 cfs @ 12.72 hrs HW=539.56' TW=533.74' (Dynamic Tailwater)
└—**1=Culvert** (Passes 0.78 cfs of 5.72 cfs potential flow)
  ├—**2=Orifice/Grate** (Orifice Controls 0.18 cfs @ 5.82 fps)
  ├—**3=Orifice/Grate** (Orifice Controls 0.30 cfs @ 3.38 fps)
  └—**4=Orifice/Grate** (Weir Controls 0.31 cfs @ 0.81 fps)

Summary for Pond 15P: Culvert at Entr.

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 2.82" for 10-Year event
Inflow = 8.29 cfs @ 12.24 hrs, Volume= 0.942 af
Outflow = 8.29 cfs @ 12.24 hrs, Volume= 0.942 af, Atten= 0%, Lag= 0.0 min
Primary = 8.29 cfs @ 12.24 hrs, Volume= 0.942 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 530.16' @ 12.24 hrs Surf.Area= 306 sf Storage= 333 cf

Plug-Flow detention time= 0.6 min calculated for 0.942 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (830.9 - 830.5)

Volume	Invert	Avail.Storage	Storage Description
#1	527.17'	1,407 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.17	6	14.0	0	0	6
528.00	44	35.0	18	18	90
529.00	121	58.1	79	98	268
530.00	266	92.9	189	286	693
531.00	555	117.6	402	688	1,120
532.00	897	157.4	719	1,407	2,001

Device	Routing	Invert	Outlet Devices
#1	Primary	527.17'	**18.0" Round Culvert X 2.00** L= 52.8' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 527.17' / 526.65' S= 0.0098 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	527.17'	**18.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	530.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=8.29 cfs @ 12.24 hrs HW=530.16' TW=526.94' (Dynamic Tailwater)
└─**1=Culvert** (Passes 8.29 cfs of 27.35 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.06 cfs @ 8.16 fps)
  └─**3=Orifice/Grate** (Weir Controls 5.23 cfs @ 1.33 fps)

Summary for Pond 17P: Box Culvert for stream

Inflow Area = 57.525 ac, 3.12% Impervious, Inflow Depth = 2.57" for 10-Year event
Inflow = 74.83 cfs @ 12.62 hrs, Volume= 12.306 af
Outflow = 74.75 cfs @ 12.65 hrs, Volume= 12.306 af, Atten= 0%, Lag= 1.8 min
Primary = 74.75 cfs @ 12.65 hrs, Volume= 12.306 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 533.76' @ 12.65 hrs Surf.Area= 3,542 sf Storage= 1,301 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.1 min (878.2 - 878.1)

Volume	Invert	Avail.Storage	Storage Description
#1	533.00'	25,714 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
533.00	412	159.8	0	0	412
534.00	5,210	513.7	2,362	2,362	19,382
535.00	11,714	795.5	8,245	10,608	48,748
536.00	18,774	996.6	15,106	25,714	77,441

Device	Routing	Invert	Outlet Devices
#1	Primary	532.20'	**144.0" W x 60.0" H Box Culvert** L= 51.5' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 532.20' / 530.66' S= 0.0299 '/' Cc= 0.900

n= 0.024, Flow Area= 60.00 sf

Primary OutFlow Max=74.75 cfs @ 12.65 hrs HW=533.76' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 74.75 cfs @ 4.00 fps)

Summary for Pond 18P: Level Spreader Underground

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 4.16" for 10-Year event
Inflow = 3.08 cfs @ 18.08 hrs, Volume= 6.916 af
Outflow = 3.08 cfs @ 18.09 hrs, Volume= 6.915 af, Atten= 0%, Lag= 0.6 min
Primary = 3.08 cfs @ 18.09 hrs, Volume= 6.915 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 558.00' Surf.Area= 2,625 sf Storage= 7,350 cf
Peak Elev= 558.15' @ 18.09 hrs Surf.Area= 2,625 sf Storage= 7,505 cf (155 cf above start)

Plug-Flow detention time= 55.4 min calculated for 6.745 af (98% of inflow)
Center-of-Mass det. time= 0.7 min (1,577.8 - 1,577.1)

Volume	Invert	Avail.Storage	Storage Description
#1	551.00'	8,400 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 21,000 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
551.00	2,625	0	0
556.00	2,625	13,125	13,125
557.00	2,625	2,625	15,750
558.00	2,625	2,625	18,375
559.00	2,625	2,625	21,000

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**75.0" x 35.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.08 cfs @ 18.09 hrs HW=558.15' TW=558.06' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 3.08 cfs @ 1.14 fps)

Summary for Pond 23P:

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 3.96" for 10-Year event
Inflow = 3.52 cfs @ 12.07 hrs, Volume= 0.265 af
Outflow = 3.47 cfs @ 12.08 hrs, Volume= 0.265 af, Atten= 1%, Lag= 0.8 min
Primary = 0.23 cfs @ 13.96 hrs, Volume= 0.156 af
Secondary = 3.32 cfs @ 12.08 hrs, Volume= 0.109 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 531.86' @ 12.08 hrs Surf.Area= 908 sf Storage= 645 cf

Plug-Flow detention time= 8.4 min calculated for 0.265 af (100% of inflow)

Center-of-Mass det. time= 8.3 min (799.5 - 791.2)

Volume	Invert	Avail.Storage	Storage Description
#1	527.33'	793 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.33	4	8.0	0.0	0	0	4
527.34	4	8.0	35.0	0	0	4
530.16	4	8.0	35.0	4	4	27
530.19	56	110.4	100.0	1	5	991
531.00	317	180.9	100.0	137	141	2,630
532.01	1,044	364.9	100.0	652	793	10,626

Device	Routing	Invert	Outlet Devices
#1	Primary	527.33'	**2.5" Round Culvert** L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 527.33' / 527.17' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.03 sf
#2	Secondary	531.60'	**30.0 deg x 7.7' long x 0.40' rise Sharp-Crested Vee/Trap Weir** Cv= 2.61 (C= 3.26)

Primary OutFlow Max=0.23 cfs @ 13.96 hrs HW=531.58' TW=527.56' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 0.23 cfs @ 6.82 fps)

Secondary OutFlow Max=3.31 cfs @ 12.08 hrs HW=531.86' TW=530.14' (Dynamic Tailwater)
↑—**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 3.31 cfs @ 1.65 fps)

Summary for Pond 24P: Flow Splitter

Inflow Area = 16.505 ac,100.00% Impervious, Inflow Depth = 4.66" for 10-Year event
Inflow = 75.45 cfs @ 12.10 hrs, Volume= 6.414 af
Outflow = 75.45 cfs @ 12.10 hrs, Volume= 6.414 af, Atten= 0%, Lag= 0.0 min
Primary = 26.66 cfs @ 12.10 hrs, Volume= 5.229 af
Secondary = 48.79 cfs @ 12.10 hrs, Volume= 1.185 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 568.34' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	562.96'	**24.0" Round Culvert** L= 44.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.00' S= 0.0215 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Secondary	562.96'	**48.0" Round Culvert** L= 106.2' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.43' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#3	Device 2	565.70'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=26.65 cfs @ 12.10 hrs HW=568.34' TW=565.24' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 26.65 cfs @ 8.48 fps)

Secondary OutFlow Max=48.75 cfs @ 12.10 hrs HW=568.34' TW=559.57' (Dynamic Tailwater)
└─**2=Culvert** (Passes 48.75 cfs of 97.98 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 48.75 cfs @ 5.31 fps)

Summary for Pond 28P: Ramp Culvert

Inflow Area = 0.918 ac, 72.44% Impervious, Inflow Depth = 3.89" for 10-Year event
Inflow = 3.47 cfs @ 12.13 hrs, Volume= 0.297 af
Outflow = 3.46 cfs @ 12.14 hrs, Volume= 0.297 af, Atten= 0%, Lag= 0.4 min
Primary = 3.46 cfs @ 12.14 hrs, Volume= 0.297 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 555.69' @ 12.14 hrs Surf.Area= 224 sf Storage= 99 cf
Flood Elev= 557.00' Surf.Area= 534 sf Storage= 342 cf

Plug-Flow detention time= 1.7 min calculated for 0.297 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (799.5 - 798.3)

Volume	Invert	Avail.Storage	Storage Description
#1	554.61'	342 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
554.61	4	8.0	0	0	4
555.00	56	45.8	10	10	166
556.00	337	150.1	177	187	1,795
556.36	534	184.0	155	342	2,698

Device	Routing	Invert	Outlet Devices
#1	Primary	555.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 30.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 555.00' / 553.62' S= 0.0460 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=3.46 cfs @ 12.14 hrs HW=555.69' TW=554.07' (Dynamic Tailwater)
└─**1=RCP_Elliptical 23x14** (Inlet Controls 3.46 cfs @ 3.11 fps)

Summary for Pond 29P: Gravel Inlet Trench

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 3.85" for 10-Year event
Inflow = 4.30 cfs @ 12.12 hrs, Volume= 0.404 af
Outflow = 4.30 cfs @ 12.12 hrs, Volume= 0.404 af, Atten= 0%, Lag= 0.0 min
Primary = 4.30 cfs @ 12.12 hrs, Volume= 0.404 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 539.59' @ 12.18 hrs Surf.Area= 4 sf Storage= 2 cf

Plug-Flow detention time= 0.1 min calculated for 0.404 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (799.4 - 799.3)

Volume	Invert	Avail.Storage	Storage Description
#1	538.25'	14 cf	**2.00'W x 2.00'L x 9.75'H Prismatoid** 39 cf Overall x 35.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	538.25'	**15.0" Round Culvert** L= 25.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.25' / 538.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=4.20 cfs @ 12.12 hrs HW=539.53' TW=539.01' (Dynamic Tailwater)
1=Culvert (Outlet Controls 4.20 cfs @ 4.15 fps)

Summary for Pond 30P: Culvert 2

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 2.95 cfs @ 12.24 hrs, Volume= 0.292 af
Outflow = 2.95 cfs @ 12.24 hrs, Volume= 0.292 af, Atten= 0%, Lag= 0.0 min
Primary = 2.95 cfs @ 12.24 hrs, Volume= 0.292 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 534.46' @ 12.24 hrs
Flood Elev= 534.87'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.66'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.66' / 533.54' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=2.95 cfs @ 12.24 hrs HW=534.46' TW=533.97' (Dynamic Tailwater)
1=RCP_Elliptical 23x14 (Barrel Controls 2.95 cfs @ 3.11 fps)

Summary for Pond 31P: Culvert 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 3.99" for 10-Year event
Inflow = 2.41 cfs @ 12.07 hrs, Volume= 0.181 af
Outflow = 2.41 cfs @ 12.07 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.0 min
Primary = 2.41 cfs @ 12.07 hrs, Volume= 0.181 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 533.68' @ 12.07 hrs
Flood Elev= 538.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.00' / 532.35' S= 0.0271 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=2.40 cfs @ 12.07 hrs HW=533.68' TW=532.82' (Dynamic Tailwater)
1=RCP_Elliptical 23x14 (Inlet Controls 2.40 cfs @ 2.18 fps)

Summary for Link 21L: POI - A

Inflow Area = 27.710 ac, 66.61% Impervious, Inflow Depth > 3.71" for 10-Year event
Inflow = 17.72 cfs @ 12.29 hrs, Volume= 8.558 af
Primary = 17.72 cfs @ 12.29 hrs, Volume= 8.558 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 22L: POI - B

Inflow Area = 57.525 ac, 3.12% Impervious, Inflow Depth = 2.57" for 10-Year event
Inflow = 74.75 cfs @ 12.65 hrs, Volume= 12.306 af
Primary = 74.75 cfs @ 12.65 hrs, Volume= 12.306 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 28L: POI - F

Inflow Area = 5.040 ac, 0.00% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 7.01 cfs @ 12.61 hrs, Volume= 1.067 af
Primary = 7.01 cfs @ 12.61 hrs, Volume= 1.067 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 29L: POI - E

Inflow Area = 468.979 ac, 4.45% Impervious, Inflow Depth > 2.61" for 10-Year event
Inflow = 119.16 cfs @ 17.72 hrs, Volume= 102.171 af
Primary = 119.16 cfs @ 17.72 hrs, Volume= 102.171 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment 1S: Main Site

Runoff = 134.52 cfs @ 12.10 hrs, Volume= 11.636 af, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
16.505	98	Paved parking, HSG D
16.505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	158	0.0100	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.5	135	0.0025	4.18	20.51	**Pipe Channel, 130-131** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
0.4	110	0.0025	4.72	33.35	**Pipe Channel, 131-132** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.3	79	0.0025	4.72	33.35	**Pipe Channel, 132-133** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
0.8	246	0.0025	5.23	50.30	**Pipe Channel, 133-134** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.4	133	0.0025	5.23	50.30	**Pipe Channel, 134-135** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.6	182	0.0025	5.23	50.30	**Pipe Channel, 135-136** 42.0" Round Area= 9.6 sf Perim= 11.0' r= 0.88' n= 0.013
0.7	256	0.0025	5.72	71.82	**Pipe Channel, 136-137** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.7	233	0.0025	5.72	71.82	**Pipe Channel, 137-138** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.4	130	0.0025	5.72	71.82	**Pipe Channel, 138-139** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
0.3	113	0.0025	5.72	71.82	**Pipe Channel, 139-Outlet** 48.0" Round Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.013
7.4	1,775	Total			

Summary for Subcatchment 9S: DA to POI - E

Runoff = 259.51 cfs @ 17.71 hrs, Volume= 184.858 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
374.703	77	Woods, Good, HSG D
374.703		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	80	0.0480	0.26		**Sheet Flow,** Range n= 0.130 P2= 3.30"
391.3	7,875	0.0180	0.34		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
34.5	3,919	0.0130	1.90	182.01	**Channel Flow,** Area= 96.0 sf Perim= 81.1' r= 1.18' n= 0.100 Very weedy reaches w/pools
430.9	11,874	Total			

Summary for Subcatchment 10S: Forebay DA

Runoff = 2.81 cfs @ 12.07 hrs, Volume= 0.200 af, Depth= 6.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.268	80	>75% Grass cover, Good, HSG D
0.086	98	Water Surface, HSG D
0.354	84	Weighted Average
0.268		75.71% Pervious Area
0.086		24.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 11S: Gravel WVTS DA

Runoff = 9.47 cfs @ 12.07 hrs, Volume= 0.694 af, Depth= 7.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.605	98	Water Surface, HSG D
0.296	80	>75% Grass cover, Good, HSG D
0.228	77	Woods, Good, HSG D
1.129	89	Weighted Average
0.524		46.41% Pervious Area
0.605		53.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 12S: Subcat for Swale - 1

Runoff = 7.56 cfs @ 12.08 hrs, Volume= 0.583 af, Depth= 7.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (ac)	CN	Description
	0.253	74	>75% Grass cover, Good, HSG C
*	0.665	98	Paved parking, HSG C
	0.918	91	Weighted Average
	0.253		27.56% Pervious Area
	0.665		72.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	993	0.1266	2.77		**Lag/CN Method,**

Summary for Subcatchment 13S: Pond DA

Runoff = 16.77 cfs @ 12.07 hrs, Volume= 1.257 af, Depth= 7.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
1.261	98	Water Surface, HSG C
0.624	80	>75% Grass cover, Good, HSG D
0.064	77	Woods, Good, HSG D
1.949	92	Weighted Average
0.688		35.30% Pervious Area
1.261		64.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment 16S: DA to Entr. Culvert

Runoff = 15.19 cfs @ 12.25 hrs, Volume= 1.577 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
3.168	77	Woods, Good, HSG D
0.028	98	Paved parking, HSG D
3.196	77	Weighted Average
3.168		99.12% Pervious Area
0.028		0.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	1,034	0.0359	0.91		**Lag/CN Method,**

Summary for Subcatchment 18S: Subcat to POI - B

Runoff = 164.85 cfs @ 12.62 hrs, Volume= 26.198 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
52.205	77	Woods, Good, HSG D
0.898	98	Paved parking, HSG D
53.103	77	Weighted Average
52.205		98.31% Pervious Area
0.898		1.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.5	3,073	0.0324	1.08		**Lag/CN Method,**

Summary for Subcatchment 19S: Subcat for Swale - 2

Runoff = 5.16 cfs @ 12.03 hrs, Volume= 0.351 af, Depth= 7.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (ac)	CN	Description
	0.400	98	Water Surface, HSG C
*	0.144	74	>75% Grass cover, Good, HSG C
	0.544	92	Weighted Average
	0.144		26.47% Pervious Area
	0.400		73.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	313	0.1239	2.27		**Lag/CN Method,**

Summary for Subcatchment 20S: Wetlands DA to POI - A

Runoff = 35.64 cfs @ 12.28 hrs, Volume= 3.835 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
7.773	77	Woods, Good, HSG D
7.773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	1,002	0.0286	0.81		**Lag/CN Method,**

Summary for Subcatchment 23S: DA to POI - D

Runoff = 319.56 cfs @ 12.42 hrs, Volume= 41.217 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
83.546	77	Woods, Good, HSG D
83.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.3	3,135	0.0772	1.67		**Lag/CN Method,**

Summary for Subcatchment 24S: DA for 25R

Runoff = 3.27 cfs @ 12.51 hrs, Volume= 0.452 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.916	77	Woods, Good, HSG D
0.916		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
36.2	1,580	0.0192	0.73		**Lag/CN Method,**

Summary for Subcatchment 25S: Rerouted Area

Runoff = 6.87 cfs @ 12.23 hrs, Volume= 0.681 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
1.380	77	Woods, Good, HSG D
1.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	734	0.0260	0.73		**Lag/CN Method,**

Summary for Subcatchment 26S: Subcat for Swale - 2

Runoff = 3.18 cfs @ 12.03 hrs, Volume= 0.213 af, Depth= 7.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (ac)	CN	Description
*	0.234	98	Paved parking, HSG D
	0.107	74	>75% Grass cover, Good, HSG C
	0.341	90	Weighted Average
	0.107		31.38% Pervious Area
	0.234		68.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	293	0.1266	2.08		**Lag/CN Method,**

Summary for Subcatchment 27S: DA for POI - F

Runoff = 16.28 cfs @ 12.57 hrs, Volume= 2.486 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
5.040	77	Woods, Good, HSG D
5.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.0	2,185	0.0219	0.83		**Lag/CN Method,**

Summary for Subcatchment 29S: Rerouted Area B

Runoff = 4.60 cfs @ 12.19 hrs, Volume= 0.428 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.867	77	Woods, Good, HSG D
0.867		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	599	0.0260	0.70		**Lag/CN Method,**

Summary for Subcatchment 34S: Subcat for Swale - 4

Runoff = 2.47 cfs @ 12.03 hrs, Volume= 0.166 af, Depth= 7.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (ac)	CN	Description
*	0.072	74	>75% Grass cover, Good, HSG C
*	0.189	98	Paved parking, HSG C
	0.261	91	Weighted Average
	0.072		27.59% Pervious Area
	0.189		72.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	292	0.1265	2.17		**Lag/CN Method,**

Summary for Reach 8R: Level Spreader Surface

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 7.33" for 100-Year event
Inflow = 7.62 cfs @ 14.64 hrs, Volume= 12.178 af
Outflow = 7.62 cfs @ 14.65 hrs, Volume= 12.174 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.02 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.69 fps, Avg. Travel Time= 1.2 min

Peak Storage= 360 cf @ 14.65 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 105.0 sf, Capacity= 439.80 cfs

75.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 30.0 '/' Top Width= 135.00'
Length= 48.0' Slope= 0.0100 '/'
Inlet Invert= 558.00', Outlet Invert= 557.52'

‡

Summary for Reach 15R: Dry Swale - 1

Inflow Area =	0.918 ac, 72.44% Impervious, Inflow Depth =	7.62"	for 100-Year event	
Inflow =	7.56 cfs @	12.08 hrs, Volume=	0.583 af	
Outflow =	6.75 cfs @	12.12 hrs, Volume=	0.583 af,	Atten= 11%, Lag= 2.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.69 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 1.06 fps, Avg. Travel Time= 14.2 min

Peak Storage= 1,651 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.58'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 87.10 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 904.0' Slope= 0.0190 '/'
Inlet Invert= 572.17', Outlet Invert= 555.00'

Summary for Reach 18R: Dry Swale - 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 7.74" for 100-Year event
Inflow = 5.16 cfs @ 12.03 hrs, Volume= 0.351 af
Outflow = 4.65 cfs @ 12.06 hrs, Volume= 0.351 af, Atten= 10%, Lag= 1.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.99 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 0.69 fps, Avg. Travel Time= 13.2 min

Peak Storage= 857 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 54.76 cfs

6.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 550.0' Slope= 0.0273 '/'
Inlet Invert= 548.05', Outlet Invert= 533.01'

‡

Summary for Reach 20R: Dry Swale - 4

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 7.70" for 100-Year event
Inflow = 6.94 cfs @ 12.05 hrs, Volume= 0.516 af
Outflow = 6.82 cfs @ 12.06 hrs, Volume= 0.516 af, Atten= 2%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.03 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 3.9 min

Peak Storage= 445 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 66.01 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 198.0' Slope= 0.0109 '/'
Inlet Invert= 532.35', Outlet Invert= 530.19'

Summary for Reach 21R: POI - C

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 6.28" for 100-Year event
Inflow = 18.29 cfs @ 12.24 hrs, Volume= 2.093 af
Outflow = 18.29 cfs @ 12.24 hrs, Volume= 2.093 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.00 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 1.2 min

Peak Storage= 354 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 240.09 cfs

9.00' x 2.00' deep channel, n= 0.024
Side Slope Z-value= 2.0 '/' Top Width= 17.00'
Length= 77.4' Slope= 0.0136 '/'
Inlet Invert= 526.65', Outlet Invert= 525.60'

‡

Summary for Reach 23R: Rerouting Ditch 1

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 5.92" for 100-Year event
Inflow = 6.87 cfs @ 12.23 hrs, Volume= 0.681 af
Outflow = 6.85 cfs @ 12.24 hrs, Volume= 0.681 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.76 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.23 fps, Avg. Travel Time= 2.3 min

Peak Storage= 312 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.58'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 20.18 cfs

2.00' x 1.00' deep channel, n= 0.025 Earth, clean & winding
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 171.0' Slope= 0.0137 '/'
Inlet Invert= 536.00', Outlet Invert= 533.66'

Summary for Reach 25R: Ditch

Inflow Area = 0.916 ac, 0.00% Impervious, Inflow Depth = 5.92" for 100-Year event
Inflow = 3.27 cfs @ 12.51 hrs, Volume= 0.452 af
Outflow = 3.26 cfs @ 12.52 hrs, Volume= 0.452 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.31 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.83 fps, Avg. Travel Time= 5.3 min

Peak Storage= 369 cf @ 12.52 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 60.53 cfs

2.00' x 2.00' deep channel, n= 0.025
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 262.2' Slope= 0.0064 '/'
Inlet Invert= 540.67', Outlet Invert= 539.00'

Summary for Reach 29R: Dry Swale - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 7.58" for 100-Year event
Inflow = 8.43 cfs @ 12.10 hrs, Volume= 0.795 af
Outflow = 8.38 cfs @ 12.12 hrs, Volume= 0.795 af, Atten= 1%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.02 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.19 fps, Avg. Travel Time= 3.8 min

Peak Storage= 569 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 2.00' Flow Area= 12.0 sf, Capacity= 90.04 cfs

2.00' x 2.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 273.0' Slope= 0.0203 '/'
Inlet Invert= 553.62', Outlet Invert= 548.08'

Summary for Reach 30R: Rerouted Ditch below Culvert

Inflow Area = 2.247 ac, 0.00% Impervious, Inflow Depth = 5.92" for 100-Year event
Inflow = 11.33 cfs @ 12.22 hrs, Volume= 1.109 af
Outflow = 11.31 cfs @ 12.23 hrs, Volume= 1.109 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.07 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.67 fps, Avg. Travel Time= 2.1 min

Peak Storage= 473 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 25.17 cfs

2.00' x 1.00' deep channel, n= 0.013
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 212.0' Slope= 0.0058 '/'
Inlet Invert= 533.54', Outlet Invert= 532.32'

Summary for Pond 2P: Forebay

Inflow Area = 16.859 ac, 98.41% Impervious, Inflow Depth = 6.30" for 100-Year event
Inflow = 36.64 cfs @ 12.10 hrs, Volume= 8.855 af
Outflow = 36.51 cfs @ 12.11 hrs, Volume= 8.850 af, Atten= 0%, Lag= 0.6 min
Primary = 5.22 cfs @ 10.36 hrs, Volume= 5.271 af
Secondary = 32.14 cfs @ 12.11 hrs, Volume= 3.579 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 3,802 sf Storage= 3,789 cf
Peak Elev= 565.30' @ 12.11 hrs Surf.Area= 5,835 sf Storage= 24,399 cf (20,611 cf above start)
Flood Elev= 568.00' Surf.Area= 7,249 sf Storage= 42,057 cf (38,268 cf above start)

Plug-Flow detention time= 62.9 min calculated for 8.761 af (99% of inflow)
Center-of-Mass det. time= 49.3 min (796.8 - 747.5)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	49,579 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	2,536	269.1	0.0	0	0	2,536
559.00	2,944	279.8	40.0	1,095	1,095	3,078
560.00	3,366	290.5	40.0	1,261	2,356	3,641
561.00	3,802	301.2	40.0	1,433	3,789	4,225
562.00	4,252	312.0	100.0	4,025	7,814	4,835
563.00	4,716	322.7	100.0	4,482	12,296	5,462
564.00	5,194	333.4	100.0	4,953	17,249	6,110
565.00	5,687	344.1	100.0	5,439	22,687	6,779
566.00	6,193	354.8	100.0	5,938	28,626	7,469
567.00	6,714	365.5	100.0	6,452	35,077	8,180
568.00	7,249	376.2	100.0	6,980	42,057	8,912
569.00	7,798	386.9	100.0	7,522	49,579	9,666

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	565.00'	**60.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 3.0' Crest Height

Primary OutFlow Max=5.21 cfs @ 10.36 hrs HW=565.05' TW=562.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 5.21 cfs @ 6.64 fps)

Secondary OutFlow Max=32.11 cfs @ 12.11 hrs HW=565.30' TW=563.16' (Dynamic Tailwater)
└─**2=Sharp-Crested Rectangular Weir** (Weir Controls 32.11 cfs @ 1.80 fps)

Summary for Pond 3P: Gravel WVTS

Inflow Area = 17.988 ac, 95.60% Impervious, Inflow Depth = 6.37" for 100-Year event
Inflow = 45.42 cfs @ 12.09 hrs, Volume= 9.544 af
Outflow = 37.08 cfs @ 12.14 hrs, Volume= 9.514 af, Atten= 18%, Lag= 2.8 min
Primary = 37.08 cfs @ 12.14 hrs, Volume= 9.514 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 561.00' Surf.Area= 22,959 sf Storage= 27,438 cf
Peak Elev= 563.97' @ 14.47 hrs Surf.Area= 25,900 sf Storage= 100,017 cf (72,579 cf above start)
Flood Elev= 568.00' Surf.Area= 30,084 sf Storage= 212,684 cf (185,246 cf above start)

Plug-Flow detention time= 263.0 min calculated for 8.884 af (93% of inflow)
Center-of-Mass det. time= 169.2 min (964.4 - 795.2)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	243,305 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	22,771	626.2	0.0	0	0	22,771
559.00	22,834	626.9	40.0	9,121	9,121	23,401
560.00	22,897	627.7	40.0	9,146	18,267	24,034
561.00	22,959	628.5	40.0	9,171	27,438	24,667
562.00	23,935	639.2	100.0	23,445	50,884	25,919
563.00	24,924	649.9	100.0	24,428	75,312	27,192
564.00	25,928	660.6	100.0	25,424	100,736	28,486
565.00	26,947	671.3	100.0	26,436	127,172	29,801
566.00	27,978	682.1	100.0	27,461	154,633	31,146
567.00	29,024	692.8	100.0	28,499	183,132	32,504
568.00	30,084	703.5	100.0	29,552	212,684	33,883
569.00	31,161	714.3	100.0	30,621	243,305	35,293

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**36.0" Round Culvert** L= 20.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 558.00' / 558.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	561.00'	**12.0" Vert. Orifice/Grate X 2.00** C= 0.600
#3	Device 2	558.00'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	562.50'	**60.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Secondary	564.00'	**100.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 5.0' Crest Height

Primary OutFlow Max=36.74 cfs @ 12.14 hrs HW=563.20' TW=562.03' (Dynamic Tailwater)
1=Culvert (Passes 36.74 cfs of 36.76 cfs potential flow)
2=Orifice/Grate (Orifice Controls 8.17 cfs @ 5.20 fps)
3=Orifice/Grate (Passes < 4.08 cfs potential flow)
5=Orifice/Grate (Passes < 28.57 cfs potential flow)
4=Orifice/Grate (Weir Controls 28.57 cfs @ 2.73 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=561.00' TW=558.00' (Dynamic Tailwater)
6=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 4P: DP-1

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 8.28" for 100-Year event
Inflow = 151.64 cfs @ 12.10 hrs, Volume= 13.750 af
Outflow = 7.62 cfs @ 14.63 hrs, Volume= 12.180 af, Atten= 95%, Lag= 151.8 min
Primary = 7.62 cfs @ 14.63 hrs, Volume= 12.180 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 563.93' @ 14.63 hrs Surf.Area= 60,062 sf Storage= 318,983 cf
Flood Elev= 565.00' Surf.Area= 62,400 sf Storage= 384,495 cf

Plug-Flow detention time= 709.2 min calculated for 12.178 af (89% of inflow)
Center-of-Mass det. time= 600.7 min (1,495.5 - 894.8)

Volume	Invert	Avail.Storage	Storage Description
#1	558.00'	651,999 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
558.00	47,688	883.6	0	0	47,688
559.00	49,705	899.0	48,693	48,693	50,047
560.00	51,750	914.4	50,724	99,417	52,448
561.00	53,824	929.8	52,784	152,201	54,888
562.00	55,926	945.2	54,872	207,072	57,370
563.00	58,056	960.6	56,988	264,060	59,893
564.00	60,214	976.1	59,132	323,192	62,470
565.00	62,400	991.5	61,304	384,495	65,075
566.00	64,615	1,006.9	63,504	448,000	67,720
567.00	66,858	1,022.3	65,733	513,733	70,405
568.00	69,129	1,037.7	67,990	581,723	73,132
569.00	71,429	1,053.2	70,276	651,999	75,915

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**48.0" Round Culvert** L= 663.9' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 558.00' / 551.36' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#2	Device 1	558.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	562.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	566.00'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	567.00'	**45.0 deg x 100.0' long x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)

Primary OutFlow Max=7.62 cfs @ 14.63 hrs HW=563.93' TW=558.27' (Dynamic Tailwater)
└─**1=Culvert** (Passes 7.62 cfs of 94.70 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.98 cfs @ 11.39 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 3.65 cfs @ 4.64 fps)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=558.00' TW=0.00' (Dynamic Tailwater)
└─**5=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 13P: Det. Pond - 2

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 7.58" for 100-Year event
Inflow = 8.38 cfs @ 12.12 hrs, Volume= 0.795 af
Outflow = 6.50 cfs @ 12.23 hrs, Volume= 0.789 af, Atten= 22%, Lag= 6.7 min
Primary = 6.50 cfs @ 12.23 hrs, Volume= 0.789 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 539.94' @ 12.23 hrs Surf.Area= 7,405 sf Storage= 12,015 cf
Flood Elev= 541.00' Surf.Area= 8,791 sf Storage= 20,626 cf

Plug-Flow detention time= 249.7 min calculated for 0.789 af (99% of inflow)
Center-of-Mass det. time= 244.2 min (1,023.9 - 779.7)

Volume	Invert	Avail.Storage	Storage Description
#1	538.00'	20,626 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
538.00	5,054	387.0	0	0	5,054
539.00	6,243	405.8	5,638	5,638	6,305
540.00	7,489	424.7	6,857	12,495	7,621
541.00	8,791	423.9	8,131	20,626	8,049

Device	Routing	Invert	Outlet Devices
#1	Primary	538.00'	**15.0" Round Culvert** L= 94.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.00' / 537.00' S= 0.0106 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	538.00'	**2.4" Vert. Orifice/Grate** C= 0.600
#3	Device 1	538.90'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	539.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.50 cfs @ 12.23 hrs HW=539.94' TW=534.02' (Dynamic Tailwater)
└─**1=Culvert** (Passes 6.50 cfs of 6.65 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.20 cfs @ 6.52 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.39 cfs @ 4.49 fps)
  └─**4=Orifice/Grate** (Weir Controls 5.91 cfs @ 2.16 fps)

Summary for Pond 15P: Culvert at Entr.

Inflow Area = 4.001 ac, 15.42% Impervious, Inflow Depth = 6.28" for 100-Year event
Inflow = 18.30 cfs @ 12.24 hrs, Volume= 2.093 af
Outflow = 18.29 cfs @ 12.24 hrs, Volume= 2.093 af, Atten= 0%, Lag= 0.0 min
Primary = 18.29 cfs @ 12.24 hrs, Volume= 2.093 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 530.33' @ 12.24 hrs Surf.Area= 351 sf Storage= 389 cf

Plug-Flow detention time= 0.4 min calculated for 2.093 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (809.7 - 809.2)

Volume	Invert	Avail.Storage	Storage Description
#1	527.17'	1,407 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.17	6	14.0	0	0	6
528.00	44	35.0	18	18	90
529.00	121	58.1	79	98	268
530.00	266	92.9	189	286	693
531.00	555	117.6	402	688	1,120
532.00	897	157.4	719	1,407	2,001

Device	Routing	Invert	Outlet Devices
#1	Primary	527.17'	**18.0" Round Culvert X 2.00** L= 52.8' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 527.17' / 526.65' S= 0.0098 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	527.17'	**18.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	530.00'	**72.0" x 72.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=18.29 cfs @ 12.24 hrs HW=530.33' TW=527.11' (Dynamic Tailwater)
└─**1=Culvert** (Passes 18.29 cfs of 28.48 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 3.15 cfs @ 8.39 fps)
  └─**3=Orifice/Grate** (Weir Controls 15.14 cfs @ 1.89 fps)

Summary for Pond 17P: Box Culvert for stream

Inflow Area = 57.525 ac, 3.12% Impervious, Inflow Depth = 5.96" for 100-Year event
Inflow = 175.13 cfs @ 12.61 hrs, Volume= 28.547 af
Outflow = 174.13 cfs @ 12.64 hrs, Volume= 28.547 af, Atten= 1%, Lag= 1.8 min
Primary = 174.13 cfs @ 12.64 hrs, Volume= 28.547 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 534.93' @ 12.64 hrs Surf.Area= 11,204 sf Storage= 9,851 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.3 min (849.1 - 848.7)

Volume	Invert	Avail.Storage	Storage Description
#1	533.00'	25,714 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
533.00	412	159.8	0	0	412
534.00	5,210	513.7	2,362	2,362	19,382
535.00	11,714	795.5	8,245	10,608	48,748
536.00	18,774	996.6	15,106	25,714	77,441

Device	Routing	Invert	Outlet Devices
#1	Primary	532.20'	**144.0" W x 60.0" H Box Culvert** L= 51.5' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 532.20' / 530.66' S= 0.0299 '/' Cc= 0.900

n= 0.024, Flow Area= 60.00 sf

Primary OutFlow Max=174.11 cfs @ 12.64 hrs HW=534.93' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 174.11 cfs @ 5.31 fps)

Summary for Pond 18P: Level Spreader Underground

Inflow Area = 19.937 ac, 92.58% Impervious, Inflow Depth > 7.33" for 100-Year event
Inflow = 7.62 cfs @ 14.63 hrs, Volume= 12.180 af
Outflow = 7.62 cfs @ 14.64 hrs, Volume= 12.178 af, Atten= 0%, Lag= 0.4 min
Primary = 7.62 cfs @ 14.64 hrs, Volume= 12.178 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 558.00' Surf.Area= 2,625 sf Storage= 7,350 cf
Peak Elev= 558.27' @ 14.64 hrs Surf.Area= 2,625 sf Storage= 7,632 cf (282 cf above start)

Plug-Flow detention time= 34.0 min calculated for 12.007 af (99% of inflow)
Center-of-Mass det. time= 0.5 min (1,496.0 - 1,495.5)

Volume	Invert	Avail.Storage	Storage Description
#1	551.00'	8,400 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 21,000 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
551.00	2,625	0	0
556.00	2,625	13,125	13,125
557.00	2,625	2,625	15,750
558.00	2,625	2,625	18,375
559.00	2,625	2,625	21,000

Device	Routing	Invert	Outlet Devices
#1	Primary	558.00'	**75.0" x 35.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=7.62 cfs @ 14.64 hrs HW=558.27' TW=558.10' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Weir Controls 7.62 cfs @ 1.55 fps)

Summary for Pond 23P:

Inflow Area = 0.805 ac, 73.17% Impervious, Inflow Depth = 7.70" for 100-Year event
Inflow = 6.82 cfs @ 12.06 hrs, Volume= 0.516 af
Outflow = 6.73 cfs @ 12.08 hrs, Volume= 0.516 af, Atten= 1%, Lag= 0.8 min
Primary = 0.23 cfs @ 15.93 hrs, Volume= 0.231 af
Secondary = 6.58 cfs @ 12.08 hrs, Volume= 0.286 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 532.01' @ 12.08 hrs Surf.Area= 1,041 sf Storage= 790 cf

Plug-Flow detention time= 8.6 min calculated for 0.516 af (100% of inflow)

Center-of-Mass det. time= 8.6 min (781.2 - 772.6)

Volume	Invert	Avail.Storage	Storage Description
#1	527.33'	793 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
527.33	4	8.0	0.0	0	0	4
527.34	4	8.0	35.0	0	0	4
530.16	4	8.0	35.0	4	4	27
530.19	56	110.4	100.0	1	5	991
531.00	317	180.9	100.0	137	141	2,630
532.01	1,044	364.9	100.0	652	793	10,626

Device	Routing	Invert	Outlet Devices
#1	Primary	527.33'	**2.5" Round Culvert** L= 16.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 527.33' / 527.17' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.03 sf
#2	Secondary	531.60'	**30.0 deg x 7.7' long x 0.40' rise Sharp-Crested Vee/Trap Weir** Cv= 2.61 (C= 3.26)

Primary OutFlow Max=0.23 cfs @ 15.93 hrs HW=531.57' TW=527.61' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.23 cfs @ 6.77 fps)

Secondary OutFlow Max=6.57 cfs @ 12.08 hrs HW=532.01' TW=530.29' (Dynamic Tailwater)
└─**2=Sharp-Crested Vee/Trap Weir** (Orifice Controls 6.57 cfs @ 2.10 fps)

Summary for Pond 24P: Flow Splitter

Inflow Area = 16.505 ac,100.00% Impervious, Inflow Depth = 8.46" for 100-Year event
Inflow = 134.52 cfs @ 12.10 hrs, Volume= 11.636 af
Outflow = 134.52 cfs @ 12.10 hrs, Volume= 11.636 af, Atten= 0%, Lag= 0.0 min
Primary = 33.99 cfs @ 12.10 hrs, Volume= 8.655 af
Secondary = 100.53 cfs @ 12.10 hrs, Volume= 2.980 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 570.34' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	562.96'	**24.0" Round Culvert** L= 44.7' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.00' S= 0.0215 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Secondary	562.96'	**48.0" Round Culvert** L= 106.2' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 562.96' / 562.43' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf
#3	Device 2	565.70'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=33.98 cfs @ 12.10 hrs HW=570.34' TW=565.30' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 33.98 cfs @ 10.82 fps)

Secondary OutFlow Max=100.46 cfs @ 12.10 hrs HW=570.34' TW=561.68' (Dynamic Tailwater)
└─**2=Culvert** (Passes 100.46 cfs of 140.16 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 100.46 cfs @ 7.05 fps)

Summary for Pond 28P: Ramp Culvert

Inflow Area = 0.918 ac, 72.44% Impervious, Inflow Depth = 7.62" for 100-Year event
Inflow = 6.75 cfs @ 12.12 hrs, Volume= 0.583 af
Outflow = 6.71 cfs @ 12.13 hrs, Volume= 0.582 af, Atten= 0%, Lag= 0.6 min
Primary = 6.71 cfs @ 12.13 hrs, Volume= 0.582 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 556.03' @ 12.13 hrs Surf.Area= 350 sf Storage= 196 cf
Flood Elev= 557.00' Surf.Area= 534 sf Storage= 342 cf

Plug-Flow detention time= 1.2 min calculated for 0.582 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (780.0 - 779.1)

Volume	Invert	Avail.Storage	Storage Description
#1	554.61'	342 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
554.61	4	8.0	0	0	4
555.00	56	45.8	10	10	166
556.00	337	150.1	177	187	1,795
556.36	534	184.0	155	342	2,698

Device	Routing	Invert	Outlet Devices
#1	Primary	555.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 30.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 555.00' / 553.62' S= 0.0460 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=6.71 cfs @ 12.13 hrs HW=556.03' TW=554.25' (Dynamic Tailwater)
└─**1=RCP_Elliptical 23x14** (Inlet Controls 6.71 cfs @ 3.96 fps)

Summary for Pond 29P: Gravel Inlet Trench

Inflow Area = 1.259 ac, 71.41% Impervious, Inflow Depth = 7.58" for 100-Year event
Inflow = 8.38 cfs @ 12.12 hrs, Volume= 0.795 af
Outflow = 8.38 cfs @ 12.12 hrs, Volume= 0.795 af, Atten= 0%, Lag= 0.0 min
Primary = 8.38 cfs @ 12.12 hrs, Volume= 0.795 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 541.84' @ 12.13 hrs Surf.Area= 4 sf Storage= 5 cf

Plug-Flow detention time= 0.2 min calculated for 0.795 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (779.7 - 779.7)

Volume	Invert	Avail.Storage	Storage Description
#1	538.25'	14 cf	**2.00'W x 2.00'L x 9.75'H Prismatoid** 39 cf Overall x 35.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	538.25'	**15.0" Round Culvert** L= 25.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 538.25' / 538.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=8.33 cfs @ 12.12 hrs HW=541.83' TW=539.84' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 8.33 cfs @ 6.79 fps)

Summary for Pond 30P: Culvert 2

Inflow Area = 1.380 ac, 0.00% Impervious, Inflow Depth = 5.92" for 100-Year event
Inflow = 6.85 cfs @ 12.24 hrs, Volume= 0.681 af
Outflow = 6.85 cfs @ 12.24 hrs, Volume= 0.681 af, Atten= 0%, Lag= 0.0 min
Primary = 6.85 cfs @ 12.24 hrs, Volume= 0.681 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 535.14' @ 12.24 hrs
Flood Elev= 534.87'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.66'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.66' / 533.54' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=6.85 cfs @ 12.24 hrs HW=535.14' TW=534.21' (Dynamic Tailwater)
↑—**1=RCP_Elliptical 23x14** (Inlet Controls 6.85 cfs @ 3.75 fps)

Summary for Pond 31P: Culvert 3

Inflow Area = 0.544 ac, 73.53% Impervious, Inflow Depth = 7.74" for 100-Year event
Inflow = 4.65 cfs @ 12.06 hrs, Volume= 0.351 af
Outflow = 4.65 cfs @ 12.06 hrs, Volume= 0.351 af, Atten= 0%, Lag= 0.0 min
Primary = 4.65 cfs @ 12.06 hrs, Volume= 0.351 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 534.01' @ 12.06 hrs
Flood Elev= 538.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	533.00'	**23.0" W x 14.0" H, R=22.0" Elliptical RCP_Elliptical 23x14** L= 24.0' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 533.00' / 532.35' S= 0.0271 '/' Cc= 0.900 n= 0.013, Flow Area= 1.83 sf

Primary OutFlow Max=4.65 cfs @ 12.06 hrs HW=534.01' TW=533.02' (Dynamic Tailwater)
└─**1=RCP_Elliptical 23x14** (Inlet Controls 4.65 cfs @ 2.77 fps)

Summary for Link 21L: POI - A

Inflow Area = 27.710 ac, 66.61% Impervious, Inflow Depth > 6.93" for 100-Year event
Inflow = 39.67 cfs @ 12.29 hrs, Volume= 16.009 af
Primary = 39.67 cfs @ 12.29 hrs, Volume= 16.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 22L: POI - B

Inflow Area = 57.525 ac, 3.12% Impervious, Inflow Depth = 5.96" for 100-Year event
Inflow = 174.13 cfs @ 12.64 hrs, Volume= 28.547 af
Primary = 174.13 cfs @ 12.64 hrs, Volume= 28.547 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 28L: POI - F

Inflow Area = 5.040 ac, 0.00% Impervious, Inflow Depth = 5.92" for 100-Year event
Inflow = 16.28 cfs @ 12.57 hrs, Volume= 2.486 af
Primary = 16.28 cfs @ 12.57 hrs, Volume= 2.486 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 29L: POI - E

Inflow Area = 468.979 ac, 4.45% Impervious, Inflow Depth > 5.99" for 100-Year event
Inflow = 279.00 cfs @ 17.71 hrs, Volume= 233.994 af
Primary = 279.00 cfs @ 17.71 hrs, Volume= 233.994 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Section 9.0

Drainage Analysis
HEC-RAS Tail-Water Calculations

Technical Memorandum

Date:	Friday, January 20, 2017
Project:	Clear River Energy Center Town of Burrillville, Providence County, Rhode Island
To:	Type recipient(s) here
From:	Type sender(s) here
Subject:	Revised HEC-RAS Model of Dry Arm Brook and Iron Mine Brook

1.0 INTRODUCTION

The purpose of this technical memorandum is to describe the updated modeling completed by HDR in support of the determination of the base flood elevations (BFEs) for Dry Arm Brook and Iron Mine Brook in Burrillville, Rhode Island. Hodge WaterResources (HWR) determined the BFEs for these two brooks upstream of Wallum Lake Road in a Technical Memorandum dated October 11, 2016. HDR was to update the model to show the effects of the culverts under Algonquin Road which allow water to flow from the Dry Arm Brook Basin into the Iron Mine Branch Basin. HDR completed the modeling using the Hydrologic Engineering Center's River Analysis System (HEC-RAS), which is developed and maintained by the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC).

2.0 MODEL SETUP

The process of setting up a steady-flow HEC-RAS model includes four components.

- Development of Model Geometry
- Inclusion of Structures
- Determination of Upstream Flow Boundary Condition
- Determination of Downstream Water Level Boundary Condition

<u>Model Geometry</u>

HDR developed the channel geometry by digitizing the stream centerline; stream bank lines and cross-section locations for each brook based on Figure 3 in HWR's October 11, 2016 Technical Memorandum. In addition, HDR added a stream from Algoquin Road to Iron Mine Branch to help model any spillover from Dry Arm Brook to Iron Mine Branch and a stream was added parallel to Wallum Lake Road to help model the spillover from Iron Mine Branch south to another road crossing. The HEC-RAS geometric model was developed from the stream centerlines, edge of banks, and cross-sections that were mapped by Lidar furnished by the ESS Group, Inc. (ESS). Modifications were made to the cross-sections just above and below the culvert crossings to ensure the ground matched the entrance and exit of the culverts. The attached drawing "HEC-RAS Model Geometry and Floodplain Delineation" shows the locations of the cross-sections. For clarity, not all of the model is shown.

Inclusion of Structures

Both Dry Arm Brook and Iron Mine Branch cross under Wallum Lake Road through culverts. The culvert for Dry Arm Brook is a box culvert with a height of 2.42 ft, a width of 5.76 ft, and an upstream invert of 537.33 ft relative to the North American Vertical Datum of 1988 (NAVD88). The culvert for Iron Mine Brook is a double-barreled circular pipe culvert. Each pipe has a diameter of 2.5 ft and an upstream invert of 513.56 ft NAVD88. These dimensions were measured by ESS during a site survey conducted in August and October 2015. HDR used these measurements to incorporate the culverts into the HEC-RAS model. The culvert survey information was provided to HDR by ESS.

In addition to the culverts, HDR used a lateral structure in the modeling of Algonquin Road. The lateral structure allows water to flow under Algonquin Road when the flood waters back up high enough from the Dry Arm Brook culvert and flows into the Iron Mine Branch basin. Also, at the location where Iron Mine Brook enters the culvert under Wallum Lake Road, the topography of the surrounding area is such that if a surcharge were to occur at the upstream end of the culvert, water would flow east, parallel to Wallum Lake Road and away from the culvert. HDR modeled the potential for water to flow away from the culvert by including another stream adjacent to where Iron Mine Brook meets Wallum Lake Road.

Determination of Upstream Flow Boundary Conditions

In order to determine the BFE for a stretch of either brook, it is necessary to make a determination of the flow in the brook during a 1% annual chance storm event (commonly called a 100-year storm event). The original model used StreamStats to determine the flow in each stream. StreamStats estimates flows in Rhode Island based on studies completed by the USGS (Zarriello et al., 2012; Bent et al., 2014). The prediction of flow from StreamStats depends on the size of the watershed upstream of the requested point. StreamStats has a recommended minimum drainage area limit of 4 sq. miles. Both the Dry Arm Basin and the Iron Mine Basin are below this limit and therefore StreamStats was not used.

Dry Arm Brook has a stream gage on it by Wallum Lake Road so this data was used for the Dry Arm Book flows. In order to provide an appropriately conservative upstream steady-flow boundary for the model, HDR distributed the flow between the flow from the stream gage of Dry Arm Brook based on the relative sizes of their contributing watersheds. HDR drew the drainage areas based on the provided Lidar and calculated the flows for Iron Mine Branch using HydroCAD version 10.0. The subsequent flow values were applied to the boundary of Iron Mine Brook.

Determination of Downstream Water Level Boundary Condition

Dry Arm Brook and Iron Mine Brook drain to the western end of Wilson Reservoir, which in turn drains to the Clear River. The effective Flood Insurance Study (FIS) for Providence County (FEMA, 2015) provides a 1% annual chance flood profile of the Clear River, and the upstream limit is the outfall of Wilson Reservoir under East Wallum Lake Road. The 1% annual chance flood elevation at Wilson Reservoir at the location where Clear River flows from the Reservoir is 444 ft NAVD88. HDR used this water level as the downstream water level boundary condition in the HEC-RAS model.

After developing the model geometry, including all relevant structures, and specifying boundary conditions, HDR ran the HEC-RAS model in the steady flow condition in order to determine the BFEs for Dry Arm Brook and Iron Mine Brook.

3.0 MODEL RESULTS

The HEC-RAS model shows that 4.64 cfs during the 100 year storm flows from the Dry Arm Brook to the Iron Mine Branch. This additional water has no appreciable effect on the Iron Mine Branch Basin.

HEC-RAS Plan: Exist Profile: 100 yr

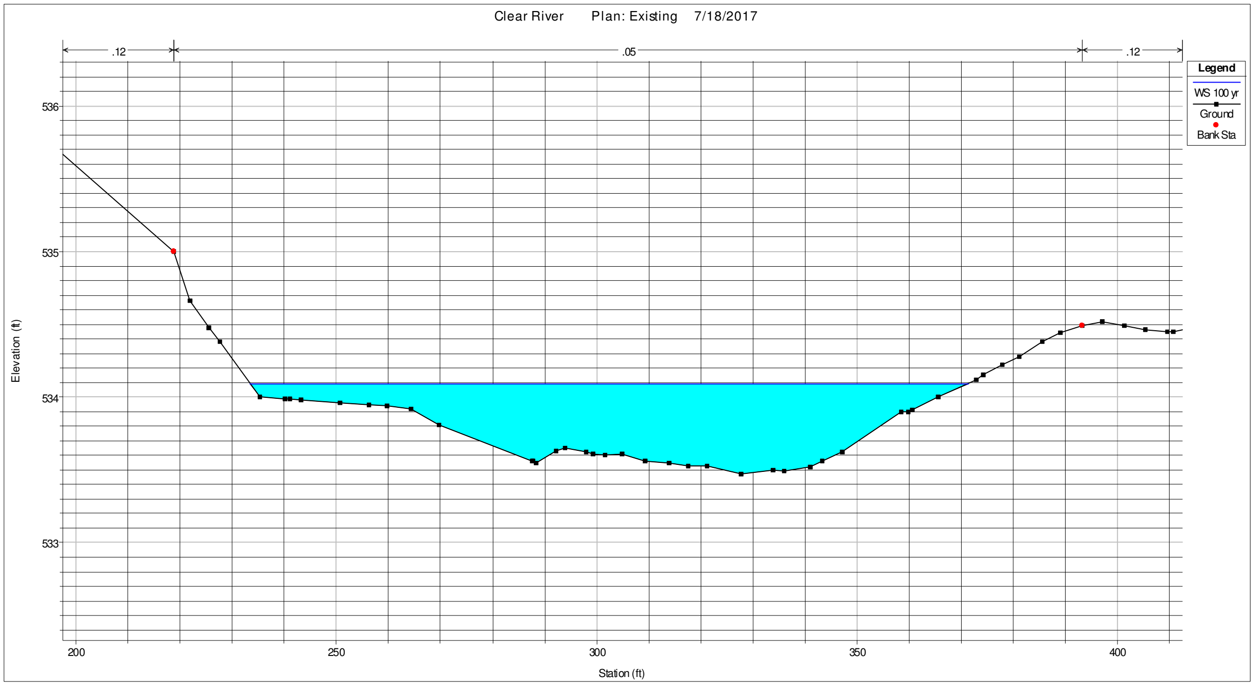
River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
IRON MINE BR	Upper	5582.71	100 yr	428.76	549.00	550.01		550.16	0.014332	3.10	138.23	172.06	0.61
IRON MINE BR	Upper	5357.25	100 yr	428.76	545.59	547.60	547.12	547.76	0.008250	3.30	151.32	134.77	0.50
IRON MINE BR	Upper	5174.02	100 yr	428.76	544.00	545.36		545.60	0.018148	3.99	117.51	138.90	0.70
IRON MINE BR	Upper	4856.72	100 yr	428.76	540.61	542.43		542.58	0.005828	3.24	169.80	128.25	0.44
IRON MINE BR	Upper	4654.34	100 yr	428.76	538.97	540.51		540.71	0.017182	3.60	120.31	142.89	0.67
IRON MINE BR	Upper	4528.85	100 yr	428.76	537.68	539.17		539.26	0.008041	2.37	193.40	299.15	0.46
IRON MINE BR	Upper	4390.26	100 yr	428.76	536.06	537.73		537.92	0.011703	3.60	143.77	167.49	0.58
IRON MINE BR	Upper	4339.74	100 yr	428.76	535.53	537.23		537.39	0.009050	3.31	154.73	182.34	0.52
IRON MINE BR	Upper	4238.33	100 yr	428.76	534.52	535.76	535.59	536.03	0.021854	4.34	121.63	157.16	0.77
IRON MINE BR	Upper	4134.29	100 yr	428.76	531.54	533.36	533.23	533.66	0.023660	4.58	114.21	211.42	0.81
IRON MINE BR	Upper	4046.46	100 yr	428.76	530.00	531.57	531.41	531.84	0.018667	4.42	127.90	240.77	0.73
IRON MINE BR	Upper	3900.5	100 yr	428.76	526.02	527.68	527.68	528.08	0.037534	5.12	87.95	227.31	0.98
IRON MINE BR	Upper	3806.38	100 yr	428.76	524.19	526.37		526.49	0.006722	2.82	165.57	216.49	0.44
IRON MINE BR	Upper	3611.18	100 yr	428.76	523.99	525.34		525.41	0.004566	2.16	215.37	332.73	0.36
IRON MINE BR	Upper	3456.73	100 yr	428.76	522.64	524.77		524.85	0.003137	2.25	225.56	533.72	0.32
IRON MINE BR	North	2139.54	100 yr	152.44	552.00	554.65		554.68	0.001283	1.54	120.32	157.71	0.21
IRON MINE BR	North	1974.29	100 yr	152.44	551.59	553.99		554.21	0.009541	3.77	40.46	26.81	0.54
IRON MINE BR	North	1770.63	100 yr	152.44	548.24	550.19	550.19	550.79	0.035807	6.22	24.52	20.66	1.01
IRON MINE BR	North	1467.1	100 yr	152.44	540.99	543.46		543.50	0.001602	1.63	93.74	58.33	0.23
IRON MINE BR	North	1154.81	100 yr	152.44	539.99	542.66		542.76	0.003755	2.59	58.96	34.25	0.35
IRON MINE BR	North	838.67	100 yr	152.44	538.35	540.52		540.77	0.012188	4.06	37.55	26.78	0.60
IRON MINE BR	North	636.25	100 yr	152.44	536.00	538.08		538.31	0.012088	3.86	39.47	30.35	0.60
IRON MINE BR	North	427.85	100 yr	152.44	533.99	535.59		535.75	0.012314	3.18	47.92	50.10	0.57
IRON MINE BR	North	354.85	100 yr	152.44	533.47	534.09	534.07	534.24	0.041458	3.07	49.73	137.93	0.90
IRON MINE BR	North	282.1	100 yr	152.44	531.85	532.78	532.76	533.01	0.042347	3.85	39.83	83.35	0.96
IRON MINE BR	North	264.10	100 yr	152.44	530.99	532.05	532.05	532.31	0.039736	4.22	41.53	97.70	0.96
IRON MINE BR	Middle	3386	100 yr	581.20	522.64	524.48		524.55	0.005382	2.50	426.87	518.59	0.40
IRON MINE BR	Middle	3346.58	100 yr	581.20	521.99	524.09		524.14	0.003945	2.43	527.27	582.89	0.35
IRON MINE BR	Middle	3264.08	100 yr	581.20	519.56	523.32		523.43	0.004341	2.82	251.45	185.44	0.38
IRON MINE BR	Middle	3154.54	100 yr	581.20	519.67	521.73	521.73	522.38	0.030307	6.48	95.17	92.28	0.96
IRON MINE BR	Lower West	3014.35	100 yr	122.52	513.49	519.96		519.97	0.000787	0.96	129.18	105.70	0.15
IRON MINE BR	Lower West	2988.35	100 yr	122.52	513.37	519.91	515.55	519.95	0.000605	1.72	91.39	209.71	0.13
IRON MINE BR	Lower West	2961		Culvert									
IRON MINE BR	Lower West	2872.42	100 yr	122.52	513.10	515.21		515.52	0.017332	4.45	27.56	21.89	0.70
IRON MINE BR	Lower West	2576.99	100 yr	122.52	508.87	510.21		510.34	0.017168	2.88	45.39	107.26	0.64
IRON MINE BR	Lower West	2283.58	100 yr	122.52	501.48	502.52	502.52	502.83	0.041936	4.46	27.49	132.04	0.99
IRON MINE BR	Lower West	2033.89	100 yr	122.52	491.99	493.24	493.13	493.53	0.026249	4.33	28.92	122.74	0.83
IRON MINE BR	Lower West	1786.16	100 yr	122.52	483.68	485.20	485.20	485.66	0.039027	5.45	22.46	24.87	1.01
IRON MINE BR	Lower West	1548.29	100 yr	122.52	473.00	474.53	474.30	474.76	0.018246	3.83	32.02	34.18	0.70
IRON MINE BR	Lower West	1289.63	100 yr	122.52	466.27	467.53	467.53	467.87	0.042384	4.71	26.01	145.35	1.01
IRON MINE BR	Lower West	974.67	100 yr	122.52	452.00	453.02	453.02	453.36	0.041871	4.66	26.28	55.69	1.00
IRON MINE BR	Lower West	707.55	100 yr	122.52	446.62	448.04		448.07	0.003960	1.49	82.41	116.17	0.31
IRON MINE BR	Lower West	438.89	100 yr	122.52	444.00	445.21	445.21	445.47	0.048379	4.11	29.81	59.71	1.02
IRON MINE BR	Lower West	152.26	100 yr	122.52	442.00	444.38		444.39	0.000166	0.51	239.32	154.65	0.07
IRON MINE BR	Lower East	2851.75	100 yr	458.68	517.97	519.52	519.52	519.98	0.031441	5.62	102.27	131.36	0.94
IRON MINE BR	Lower East	2664.45	100 yr	458.68	516.00	518.31		518.35	0.001641	1.55	310.05	258.92	0.23
IRON MINE BR	Lower East	2455.3	100 yr	458.68	515.98	517.91		517.96	0.001992	1.74	263.14	173.45	0.25
IRON MINE BR	Lower East	2203.36	100 yr	458.68	515.96	516.79		516.92	0.012487	2.84	165.56	217.82	0.56
IRON MINE BR	Lower East	2056.72	100 yr	458.68	514.06	516.40		516.44	0.001368	1.55	301.82	188.28	0.21
IRON MINE BR	Lower East	1817.17	100 yr	458.68	513.76	514.99	514.99	515.48	0.040963	6.42	107.85	117.15	1.08
IRON MINE BR	Lower East	1610.83	100 yr	458.68	505.05	506.89	506.89	507.53	0.030641	6.62	81.96	72.13	0.97
IRON MINE BR	Lower East	1505.77	100 yr	458.68	496.22	497.77	497.77	498.36	0.033639	6.20	78.33	73.06	0.99
IRON MINE BR	Lower East	1403.85	100 yr	458.68	490.23	491.68	491.64	492.17	0.028793	5.90	102.04	112.61	0.92
IRON MINE BR	Lower East	1265.67	100 yr	458.68	485.87	487.39	487.39	487.90	0.036837	5.77	79.48	78.00	1.01
IRON MINE BR	Lower East	1141.44	100 yr	458.68	479.43	480.99	480.99	481.53	0.034269	5.93	83.52	88.54	0.99
IRON MINE BR	Lower East	1017.25	100 yr	458.68	473.73	475.11	475.11	475.64	0.033581	5.91	85.80	93.11	0.98
IRON MINE BR	Lower East	889.8	100 yr	458.68	468.64	469.69	469.68	470.12	0.037593	5.53	103.15	131.61	1.00
IRON MINE BR	Lower East	667.81	100 yr	458.68	460.46	461.49	461.49	461.92	0.036308	5.34	93.54	121.21	0.98
IRON MINE BR	Lower East	466.67	100 yr	458.68	452.00	453.44		453.63	0.013205	3.55	137.79	153.92	0.61
IRON MINE BR	Lower East	229.03	100 yr	458.68	446.67	448.22	448.22	448.76	0.035353	5.93	78.77	79.84	1.00
IRON MINE BR	Lower East	22.38	100 yr	458.68	440.50	444.00	441.56	444.01	0.000190	0.85	658.28	287.79	0.09
DRY ARM BRANCH	Upper	10503.76	100 yr	123.21	590.09	590.82	590.82	591.08	0.046185	4.05	30.57	62.14	1.00
DRY ARM BRANCH	Upper	10301.42	100 yr	123.21	585.00	585.76		585.85	0.013763	2.43	50.92	89.52	0.56
DRY ARM BRANCH	Upper	10056.52	100 yr	123.21	583.00	583.76		583.80	0.005534	1.67	77.64	135.59	0.36
DRY ARM BRANCH	Upper	9858.27	100 yr	123.21	580.50	581.30	581.28	581.49	0.038532	3.54	38.34	97.39	0.91
DRY ARM BRANCH	Upper	9700.24	100 yr	123.21	576.22	577.33	577.13	577.51	0.017679	3.44	36.77	50.46	0.67
DRY ARM BRANCH	Upper	9597.79	100 yr	123.21	573.83	574.47	574.47	574.71	0.047174	3.92	31.82	70.59	1.00
DRY ARM BRANCH	Upper	9270.37	100 yr	123.21	562.25	563.90	563.62	564.14	0.016169	3.90	31.76	31.54	0.67
DRY ARM BRANCH	Upper	9167.45	100 yr	123.21	560.25	561.23	561.23	561.47	0.047834	3.93	32.49	77.10	1.01
DRY ARM BRANCH	Upper	8973.86	100 yr	123.21	558.00	558.65		558.68	0.003904	1.32	93.73	161.01	0.30
DRY ARM BRANCH	Upper	8769.13	100 yr	123.21	557.18	558.19		558.21	0.001523	0.90	139.03	222.72	0.19
DRY ARM BRANCH	Upper	8602.56	100 yr	123.21	557.00	558.05		558.05	0.000618	0.71	227.28	322.50	0.13
DRY ARM BRANCH	Upper	8384.03	100 yr	123.21	557.00	557.95		557.95	0.000353	0.51	246.74	552.47	0.10
DRY ARM BRANCH	Upper	8173.76	100 yr	123.21	557.00	557.90		557.90	0.000168	0.33	377.83	787.30	0.07
DRY ARM BRANCH	Upper	7892.03	100 yr	123.21	557.00	557.86		557.86	0.000117	0.28	432.92	518.22	0.05
DRY ARM BRANCH	Upper	7674.11	100 yr	123.21	557.00	557.83		557.83	0.000223	0.38	325.49	413.80	0.08
DRY ARM BRANCH	Upper	7550.93	100 yr	123.21	557.00	557.79		557.79	0.000461	0.52	236.85	321.52	0.11
DRY ARM BRANCH	Upper	7464.25	100 yr	123.21	556.58	557.73		557.74	0.000929	0.86	251.99	309.57	0.16
DRY ARM BRANCH	Upper	7403.34	100 yr	123.21	556.02	557.67		557.68	0.000908	1.06	232.04	302.31	0.16
DRY ARM BRANCH	Upper	7282.66	100 yr	123.21	556.28	557.52		557.53	0.001653	1.17	144.70	297.68	0.21
DRY ARM BRANCH	Upper	7206.12	100 yr	123.21	556.08	557.33		557.35	0.003682	1.28	101.16	297.92	0.29
DRY ARM BRANCH	Upper	7167.26	100 yr	123.21	556.00	557.28		557.29	0.000844	0.80	156.01	312.53	0.15
DRY ARM BRANCH	Upper	7086.28	100 yr	123.21	556.00	557.22		557.23	0.000670	0.74	178.50	330.95	0.13
DRY ARM BRANCH	Upper	7015.17	100 yr	123.21	556.00	557.13		557.15	0.001842	1.12	117.89	329.93	0.22
DRY ARM BRANCH	Upper	6919.96	100 yr	123.21	556.00	556.81		556.85	0.006120	1.72	78.59	290.78	0.38
DRY ARM BRANCH	Upper	6841.16	100 yr	123.21	556.00	556.66		556.67	0.001090	0.72	172.14	284.86	0.16
DRY ARM BRANCH	Upper	6743.15	100 yr	123.21	556.00	556.50		556.51	0.002668	0.93	131.99	278.32	0.24

HEC-RAS Plan: Exist Profile: 100 yr (Continued)

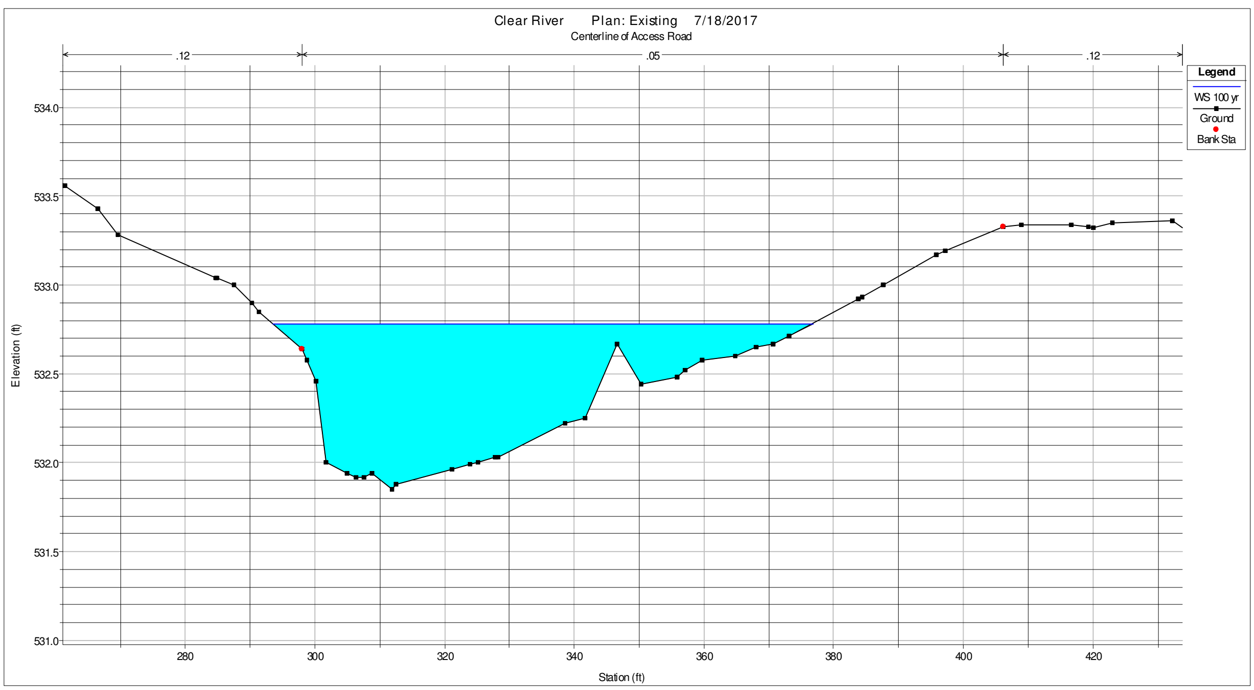
River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
DRY ARM BRANCH	Upper	6634.85	100 yr	123.21	555.01	556.31		556.32	0.001171	0.89	166.26	298.69	0.17
DRY ARM BRANCH	Upper	6485.16	100 yr	123.21	555.00	556.01		556.04	0.003821	1.37	94.32	326.79	0.30
DRY ARM BRANCH	Upper	6349.19	100 yr	123.21	555.00	555.63		555.65	0.002192	0.92	134.00	382.96	0.22
DRY ARM BRANCH	Upper	6280.52	100 yr	123.21	555.00	555.55		555.56	0.000827	0.54	232.63	488.83	0.13
DRY ARM BRANCH	Upper	6178.94	100 yr	123.21	555.00	555.48		555.48	0.000645	0.45	274.62	599.00	0.12
DRY ARM BRANCH	Upper	6057.85	100 yr	123.21	554.71	555.40		555.40	0.000720	0.43	287.47	734.33	0.12
DRY ARM BRANCH	North	1674	100 yr	76.79	555.01	556.13		556.14	0.000518	0.55	141.96	980.60	0.11
DRY ARM BRANCH	North	1300.2	100 yr	76.79	555.00	555.99		555.99	0.000312	0.42	184.47	1422.92	0.09
DRY ARM BRANCH	North	720.12	100 yr	76.79	555.00	555.75		555.75	0.000557	0.46	175.74	1035.21	0.11
DRY ARM BRANCH	North	597.35	100 yr	76.79	555.00	555.67		555.67	0.000825	0.55	138.45	714.45	0.14
DRY ARM BRANCH	North	506.65	100 yr	76.79	555.00	555.60		555.60	0.000734	0.50	154.87	650.97	0.13
DRY ARM BRANCH	North	429.49	100 yr	76.79	555.00	555.56		555.56	0.000305	0.34	230.26	720.81	0.08
DRY ARM BRANCH	North	344.15	100 yr	76.79	555.00	555.53		555.53	0.000622	0.46	167.09	695.26	0.12
DRY ARM BRANCH	North	253.41	100 yr	76.79	555.00	555.49		555.49	0.000315	0.32	239.29	750.92	0.08
DRY ARM BRANCH	North	191.93	100 yr	76.79	555.00	555.47		555.47	0.000263	0.28	270.28	728.27	0.07
DRY ARM BRANCH	North	89.36	100 yr	76.79	555.00	555.43		555.43	0.000612	0.41	187.06	764.50	0.11
DRY ARM BRANCH	Middle	5763.87	100 yr	200.00	554.19	554.96		554.98	0.002946	1.13	186.61	442.14	0.26
DRY ARM BRANCH	Middle	5670.22	100 yr	200.00	554.00	554.79		554.80	0.001271	0.79	255.45	422.90	0.17
DRY ARM BRANCH	Middle	5556.5	100 yr	200.00	554.00	554.64		554.65	0.001428	0.83	248.90	424.24	0.18
DRY ARM BRANCH	Middle	5495.35	100 yr	200.00	554.00	554.51		554.53	0.003053	1.02	201.74	443.81	0.26
DRY ARM BRANCH	Middle	5322.02	100 yr	200.00	552.88	553.79		553.82	0.005714	1.42	140.46	278.33	0.35
DRY ARM BRANCH	Middle	5201.33	100 yr	200.00	552.19	553.17		553.20	0.004806	1.34	149.37	285.10	0.33
DRY ARM BRANCH	Middle	5048.1	100 yr	200.00	551.99	552.85		552.86	0.001240	0.80	250.62	376.30	0.17
DRY ARM BRANCH	Middle	4784.92	100 yr	200.00	551.18	552.22		552.24	0.005942	1.23	163.11	416.46	0.35
DRY ARM BRANCH	Middle	4623	100 yr	200.00	549.99	551.42		551.46	0.003935	1.49	134.32	188.07	0.31
DRY ARM BRANCH	Middle	4620		Lat Struct									
DRY ARM BRANCH	Middle	4583.01	100 yr	200.00	549.97	551.16		551.24	0.007593	2.24	89.14	110.38	0.44
DRY ARM BRANCH	Middle	4507.85	100 yr	200.00	549.40	550.64		550.70	0.006784	1.90	105.28	153.92	0.40
DRY ARM BRANCH	Middle	4389.74	100 yr	200.00	547.80	549.13	549.06	549.25	0.027992	2.82	70.88	165.71	0.76
DRY ARM BRANCH	Middle	4351.23	100 yr	200.00	546.93	548.13		548.28	0.022872	3.05	65.57	117.12	0.72
DRY ARM BRANCH	Middle	4286.52	100 yr	200.00	546.34	547.84		547.86	0.002666	1.18	201.24	774.94	0.25
DRY ARM BRANCH	Middle	4254.94	100 yr	200.00	545.98	547.72		547.75	0.004731	1.54	162.92	858.37	0.34
DRY ARM BRANCH	Middle	4223.41	100 yr	200.00	545.96	547.54		547.58	0.005792	1.59	126.09	880.66	0.36
DRY ARM BRANCH	Middle	4162.36	100 yr	200.00	546.00	546.61	546.60	546.80	0.047619	3.48	57.44	388.91	0.98
DRY ARM BRANCH	Middle	4106.16	100 yr	200.00	545.00	546.51		546.52	0.001388	0.81	248.10	419.53	0.18
DRY ARM BRANCH	Middle	3944.82	100 yr	200.00	545.00	546.38		546.39	0.000539	0.65	328.32	403.12	0.12
DRY ARM BRANCH	Middle	3858.74	100 yr	200.00	545.45	546.21		546.26	0.012759	2.06	141.67	362.93	0.52
DRY ARM BRANCH	Middle	3770.09	100 yr	200.00	544.46	545.71		545.73	0.003445	1.33	150.27	225.44	0.29
DRY ARM BRANCH	Middle	3694.39	100 yr	200.00	543.98	545.58		545.59	0.001080	0.91	220.95	247.57	0.17
DRY ARM BRANCH	Middle	3542.79	100 yr	200.00	542.27	545.57		545.57	0.000049	0.38	636.47	341.77	0.04
DRY ARM BRANCH	Middle	3296.69	100 yr	200.00	537.20	545.56	539.43	545.56	0.000022	0.34	966.27	316.64	0.03
DRY ARM BRANCH	Middle	3250		Culvert									
DRY ARM BRANCH	Middle	3211.67	100 yr	200.00	536.55	538.64	538.64	539.40	0.034397	6.98	28.66	19.23	1.01
DRY ARM BRANCH	Middle	3026.39	100 yr	200.00	529.68	530.74	530.65	531.01	0.029257	4.20	47.57	63.18	0.85
DRY ARM BRANCH	Middle	2851.21	100 yr	200.00	523.70	524.72	524.71	525.06	0.039802	4.69	42.65	60.55	0.98
DRY ARM BRANCH	Middle	2651.4	100 yr	200.00	515.50	516.61	516.61	517.00	0.040909	4.96	40.33	53.76	1.01
DRY ARM BRANCH	Middle	2444.26	100 yr	200.00	506.24	507.54	507.53	507.91	0.039770	4.90	40.81	54.20	1.00
DRY ARM BRANCH	Middle	2328.41	100 yr	200.00	501.41	502.90	502.90	503.36	0.038629	5.48	36.52	40.04	1.01
DRY ARM BRANCH	Middle	2207.75	100 yr	200.00	496.15	497.86	497.83	498.26	0.035927	5.10	39.19	45.26	0.97
DRY ARM BRANCH	Middle	2081.27	100 yr	200.00	492.01	493.59	493.53	493.96	0.032179	4.87	41.10	47.01	0.92
DRY ARM BRANCH	Middle	1983.2	100 yr	200.00	488.56	490.06	490.06	490.53	0.038088	5.45	36.67	40.04	1.00
DRY ARM BRANCH	Middle	1883.54	100 yr	200.00	483.39	484.48	484.48	484.86	0.041002	4.96	40.33	53.81	1.01
DRY ARM BRANCH	Middle	1698.02	100 yr	200.00	476.43	477.54	477.49	477.88	0.033293	4.68	42.75	53.26	0.92
DRY ARM BRANCH	Middle	1607.13	100 yr	200.00	472.95	474.17	474.17	474.60	0.039370	5.25	38.10	45.26	1.01
DRY ARM BRANCH	Middle	1459.98	100 yr	200.00	467.66	468.74	468.71	469.09	0.035378	4.69	42.64	55.39	0.94
DRY ARM BRANCH	Middle	1357.47	100 yr	200.00	463.68	464.82	464.82	465.20	0.040567	5.00	40.01	52.34	1.01
DRY ARM BRANCH	Middle	1246.32	100 yr	200.00	460.11	461.14	460.97	461.31	0.019508	3.34	59.89	82.92	0.69
DRY ARM BRANCH	Middle	1085.08	100 yr	200.00	455.39	456.45	456.45	456.73	0.044879	4.22	47.39	86.32	1.00
DRY ARM BRANCH	Middle	861.63	100 yr	200.00	449.29	450.39	450.13	450.50	0.012603	2.58	77.37	113.42	0.55
DRY ARM BRANCH	Middle	698.48	100 yr	200.00	445.90	446.67	446.67	446.94	0.045369	4.19	47.73	88.57	1.01
DRY ARM BRANCH	Middle	577.6	100 yr	200.00	443.25	444.71		444.77	0.005524	2.02	116.55	175.61	0.38
DRY ARM BRANCH	Middle	340.79	100 yr	200.00	442.00	444.35		444.37	0.000516	0.97	256.34	240.85	0.13
DRY ARM BRANCH	Middle	95.96	100 yr	200.00	441.98	444.34		444.34	0.000039	0.28	735.36	449.43	0.04
DRY ARM BRANCH	Lower	357.61	100 yr	1814.03	439.00	444.10		444.17	0.001131	2.48	1307.14	517.43	0.22
DRY ARM BRANCH	Lower	162.94	100 yr	1814.03	439.00	444.00	440.80	444.03	0.000484	1.70	2272.54	884.74	0.15

Calculations for the Flood Volume Encroachment

IRON BRANCH – NORTH – STA. 3+54.85 (Elev. 534.09)

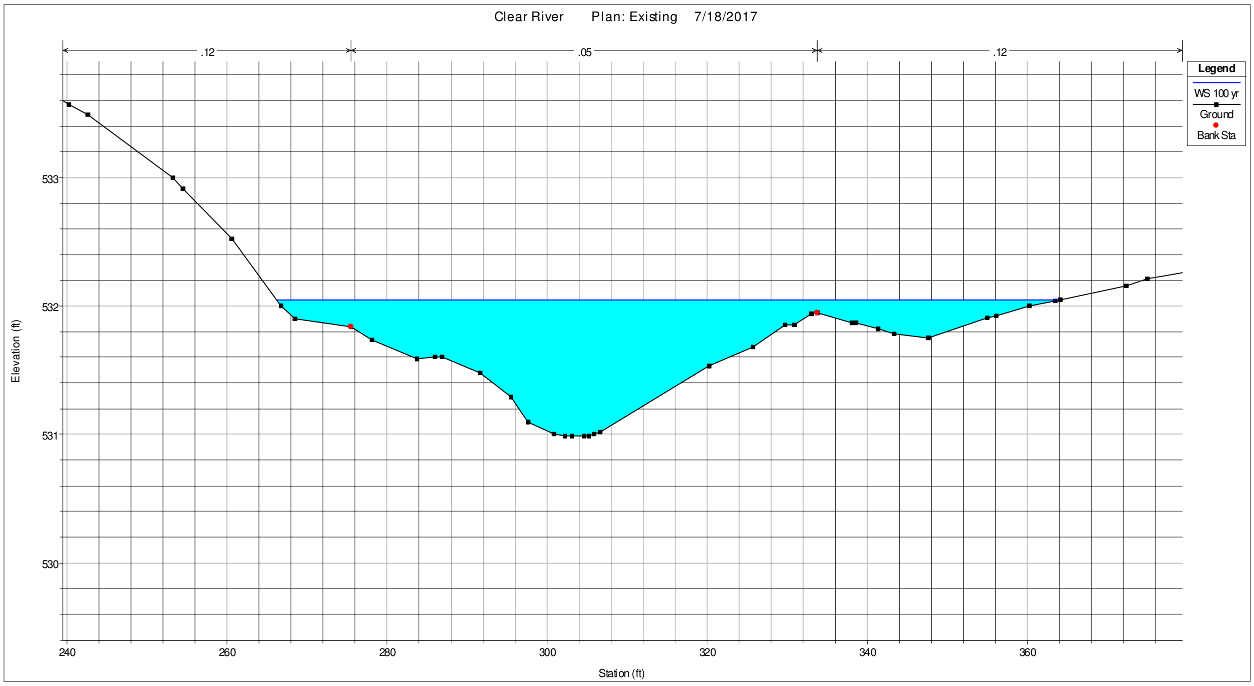


IRON BRANCH – NORTH – STA. 2+82.10 (Elev. 532.78)

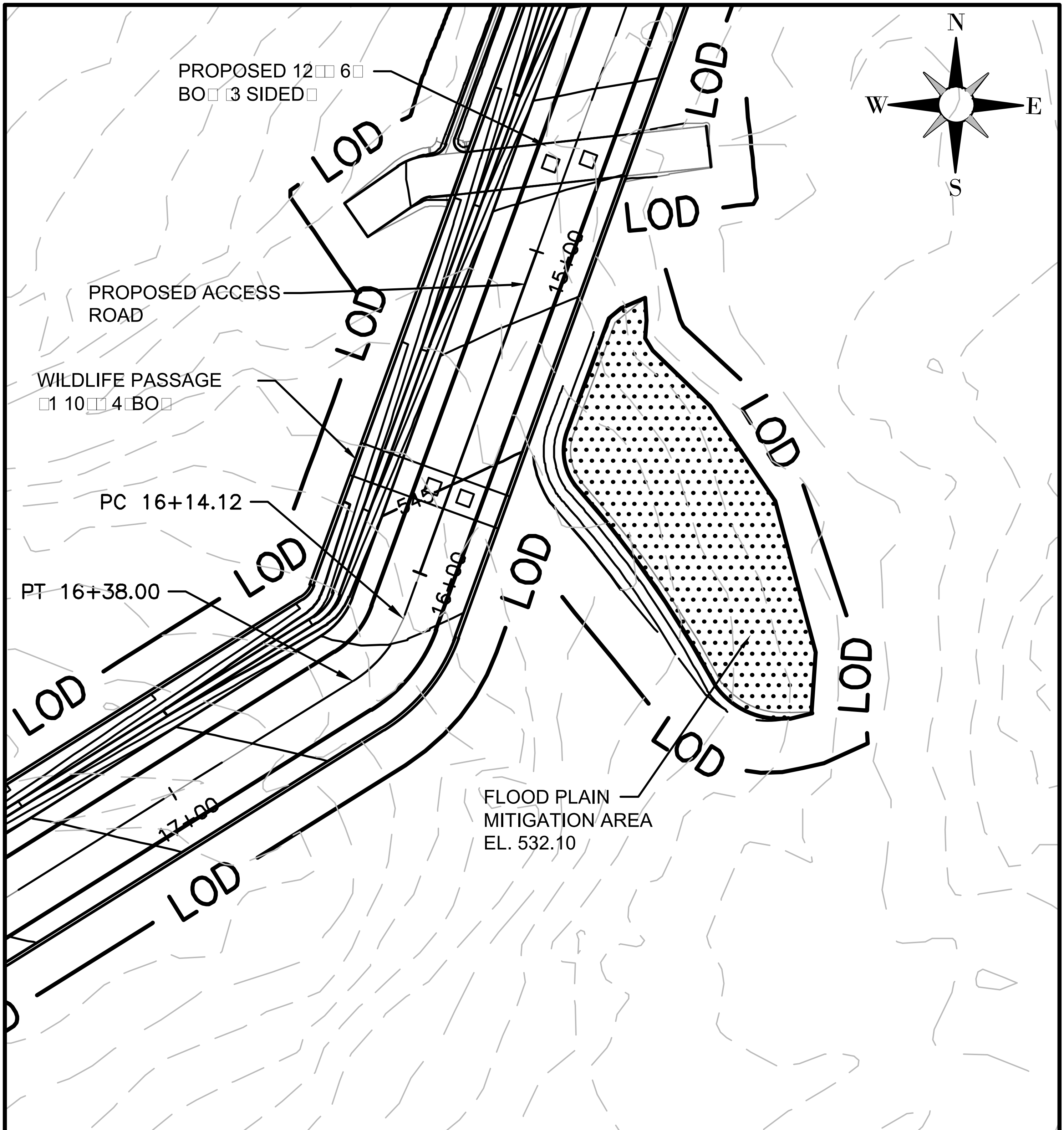


Calculations for the Flood Volume Encroachment

IRON BRANCH – NORTH – STA. 2+64.10 (Elev. 532.05)



FLOOD VOLUME CALCULATIONS				
Station	Area (sf)	Avg Area (sf)	Distance (ft)	Area (cf)
3+54.85	49.67			
		44.75	28	1,253.00
2+82.10	39.83			
2+82.10	39.83			
		40.66	16	650.56
2+64.10	41.49			
			44	1,903.56 cf
				70.50 cy



THE CUBIC YARDAGE WAS CALCULATED BY CIVIL 3D TIN MODELING. THE DIFFERENCE BETWEEN THE E□ISTING SURFACE AND THE FLOOD PLAIN MITIGATION SURFACE. THE FLOOD PLAIN MITIGATION SURFACE WAS 80.1 CU. YD. E□CESS CUT.

SCALE□1"□40□

HDR

FLOOD PLAIN MITIGATION AREA

DATE
07/17/2017

FIGURE

Exhibit 7

Drainage Report - Section 1.0 Pre- and Post-development Drainage Area Maps (Bound Separately - 24”x36”)

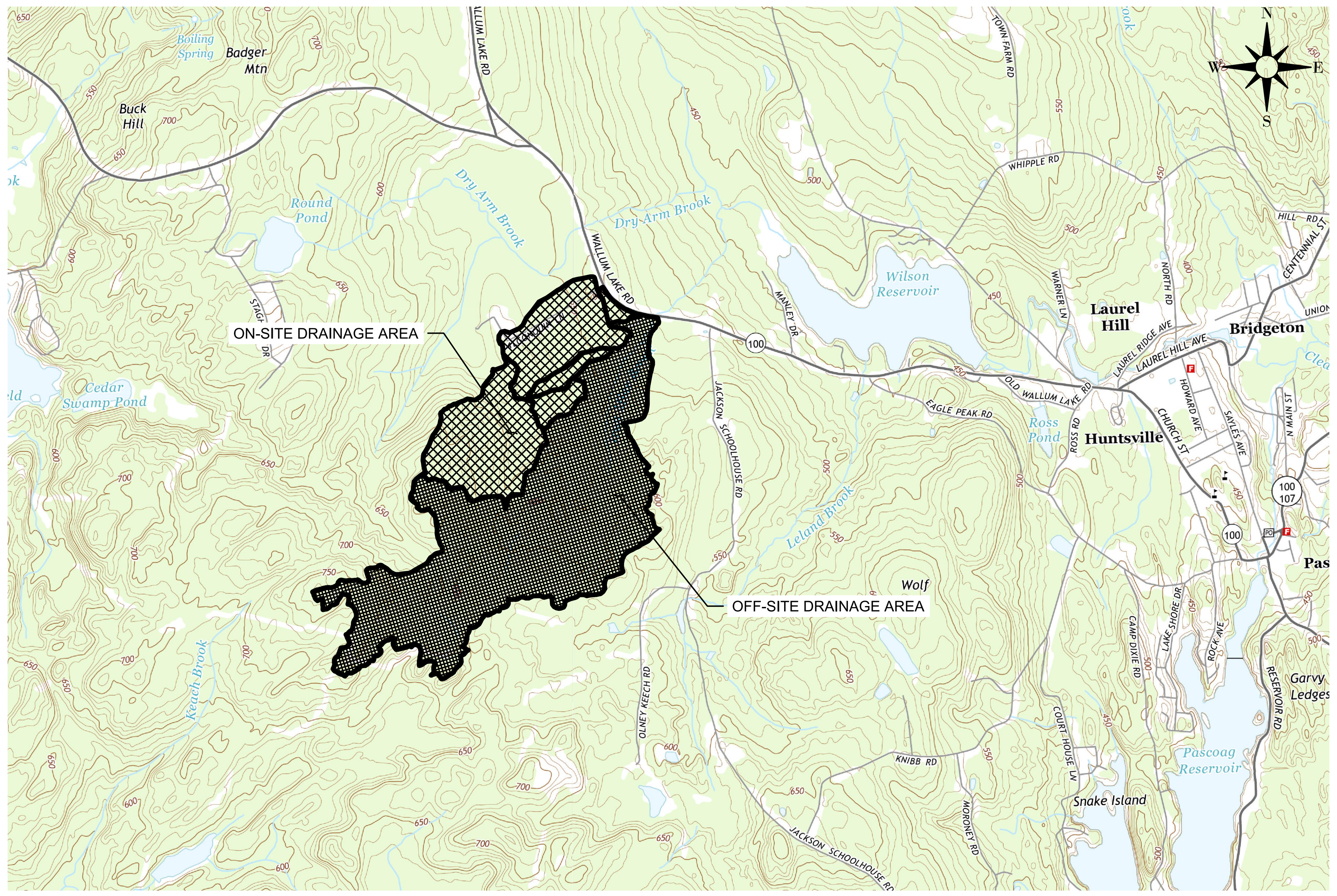
EXHIBITS FOR:

CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER

TOWN OF BURRILLVILLE, PROVIDENCE COUNTY
RHODE ISLAND

DRAINAGE AREA MAPS
DECEMBER 2017



VICINITY MAP
1"=2,000'.
USGS QUADRANGLES
CHEPACHET, RI (2015) AND
THOMPSON, CT (2015)

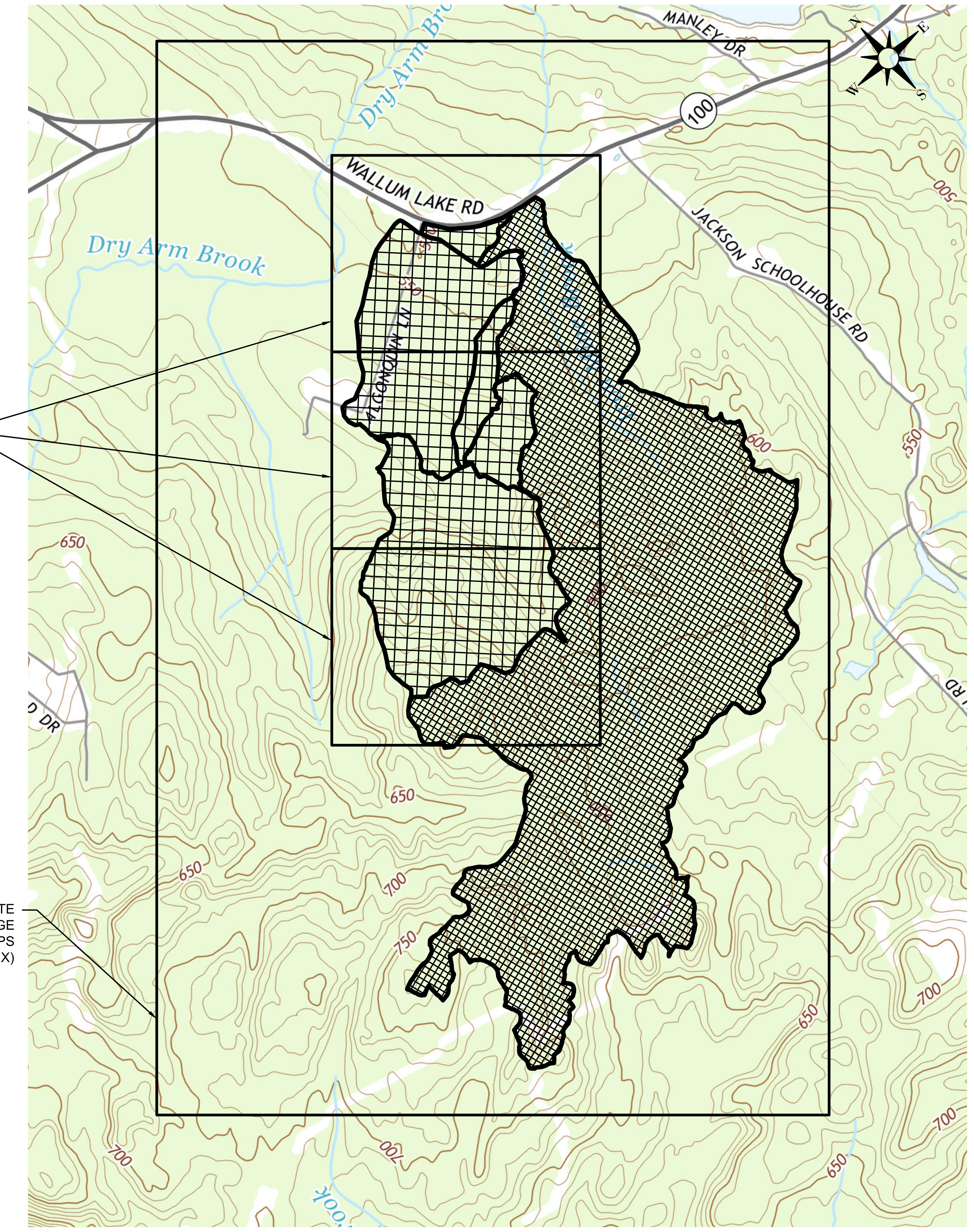
SCALE IN FEET
0 2000 4000

SHEET INDEX

SHEET	DESCRIPTION
1.0	INDEX
2.0	OFF-SITE PRE-DEVELOPMENT COVER TYPE MAP
2.1	OFF-SITE PRE-DEVELOPMENT SOILS MAP
2.2	OFF-SITE PRE-DEVELOPMENT DRAINAGE AREA MAP
2.3	OFF-SITE POST-DEVELOPMENT COVER TYPE MAP
2.4	OFF-SITE POST-DEVELOPMENT SOILS MAP
2.5	OFF-SITE POST-DEVELOPMENT DRAINAGE AREA MAP
3.0A	ON-SITE PRE-DEVELOPMENT COVER TYPE MAP
3.0B	ON-SITE PRE-DEVELOPMENT COVER TYPE MAP
3.0C	ON-SITE PRE-DEVELOPMENT COVER TYPE MAP
3.1A	ON-SITE PRE-DEVELOPMENT SOILS MAP
3.1B	ON-SITE PRE-DEVELOPMENT SOILS MAP
3.1C	ON-SITE PRE-DEVELOPMENT SOILS MAP
3.2A	ON-SITE PRE-DEVELOPMENT DRAINAGE AREA MAP
3.2B	ON-SITE PRE-DEVELOPMENT DRAINAGE AREA MAP
3.2C	ON-SITE PRE-DEVELOPMENT DRAINAGE AREA MAP
3.3A	ON-SITE POST-DEVELOPMENT COVER TYPE MAP
3.3B	ON-SITE POST-DEVELOPMENT COVER TYPE MAP
3.3C	ON-SITE POST-DEVELOPMENT COVER TYPE MAP
3.4A	ON-SITE POST-DEVELOPMENT SOILS MAP
3.4B	ON-SITE POST-DEVELOPMENT SOILS MAP
3.4C	ON-SITE POST-DEVELOPMENT SOILS MAP
3.5A	ON-SITE POST-DEVELOPMENT DRAINAGE AREA MAP
3.5B	ON-SITE POST-DEVELOPMENT DRAINAGE AREA MAP
3.5C	ON-SITE POST-DEVELOPMENT DRAINAGE AREA MAP

ON-SITE DRAINAGE MAPS (3.X)

OFF-SITE DRAINAGE MAPS (2.X)



INDEX MAP
1"=1,000'.

SCALE IN FEET
0 1000 2000

PROJECT MANAGER	D.MITAS, PE
CIVIL	M. JACOBS, PE
PROJECT NUMBER	238926

ISSUE	DATE	DESCRIPTION
A	12/08/17	ISSUED FOR PERMIT

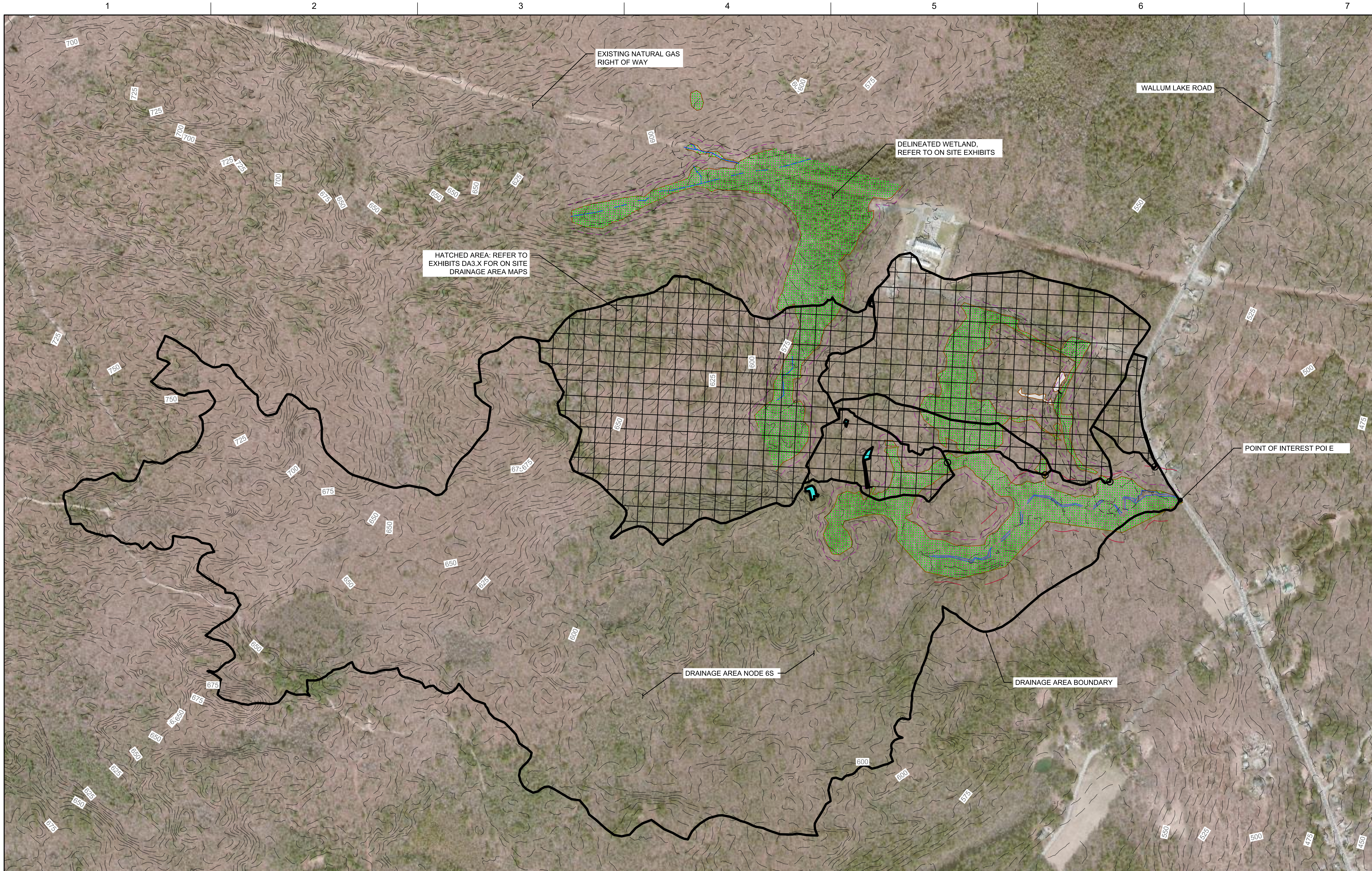
HDR

CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

DRAINAGE AREA MAPS
INDEX

FILENAME 238926-DA1.0.DWG
SCALE AS SHOWN
EXHIBIT **1.0**



REFERENCES

1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
2. AERIAL IMAGERY OBTAINED FROM BING AERIAL, 2017.
3. NRCS SOILS DATA OBTAINED FROM SPATIAL DATA GATEWAY, PROVIDENCE COUNTY RHODE ISLAND, 2017.
4. PROPERTY DATA OBTAINED FROM FIELD SURVEY BY OTHERS, 2016.

HDR

ISSUE	DATE	DESCRIPTION
A	12/08/17	ISSUED FOR PERMIT

PROJECT MANAGER D.MITAS, PE
CIVIL M. JACOBS, PE
PROJECT NUMBER 238926

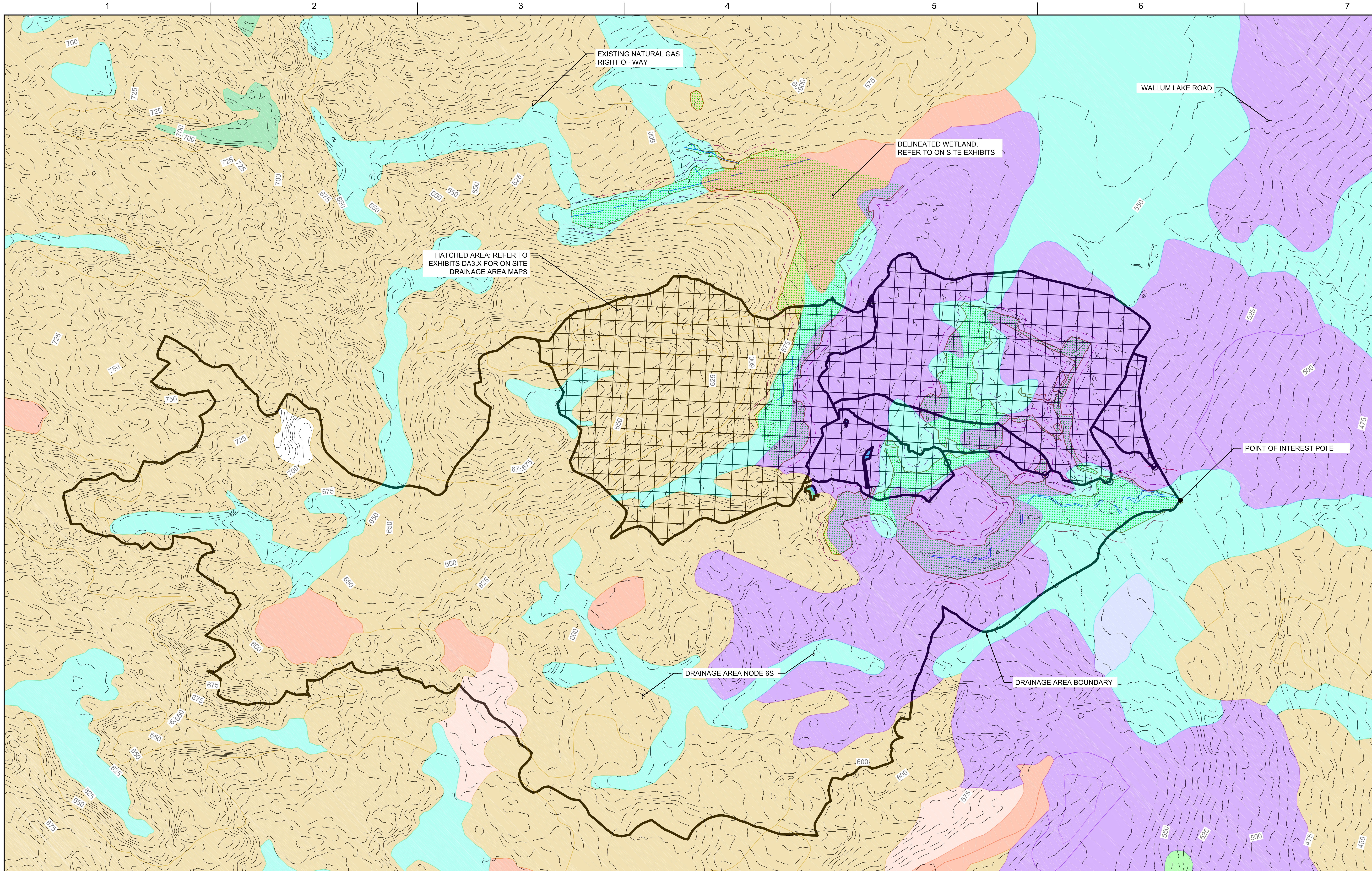
CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

OFF-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
COVER TYPE MAP

SCALE IN FEET 0 400 800

FILENAME 238926-DA2.X.DWG
SCALE AS SHOWN
EXHIBIT 2.0



REFERENCES

1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
2. AERIAL IMAGERY OBTAINED FROM BING AERIAL, 2017.
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TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

OFF-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
HYDROLOGIC SOIL GROUP (HSG) MAP

SCALE IN FEET 0 400 800

FILENAME 238926-DA2.X.DWG
SCALE AS SHOWN

EXHIBIT **2.1**

REFERENCES

1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
2. AERIAL IMAGERY OBTAINED FROM BING AERIAL, 2017.
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PROJECT MANAGER	D.MITAS, PE
CIVIL	M. JACOBS, PE
PROJECT NUMBER	238926

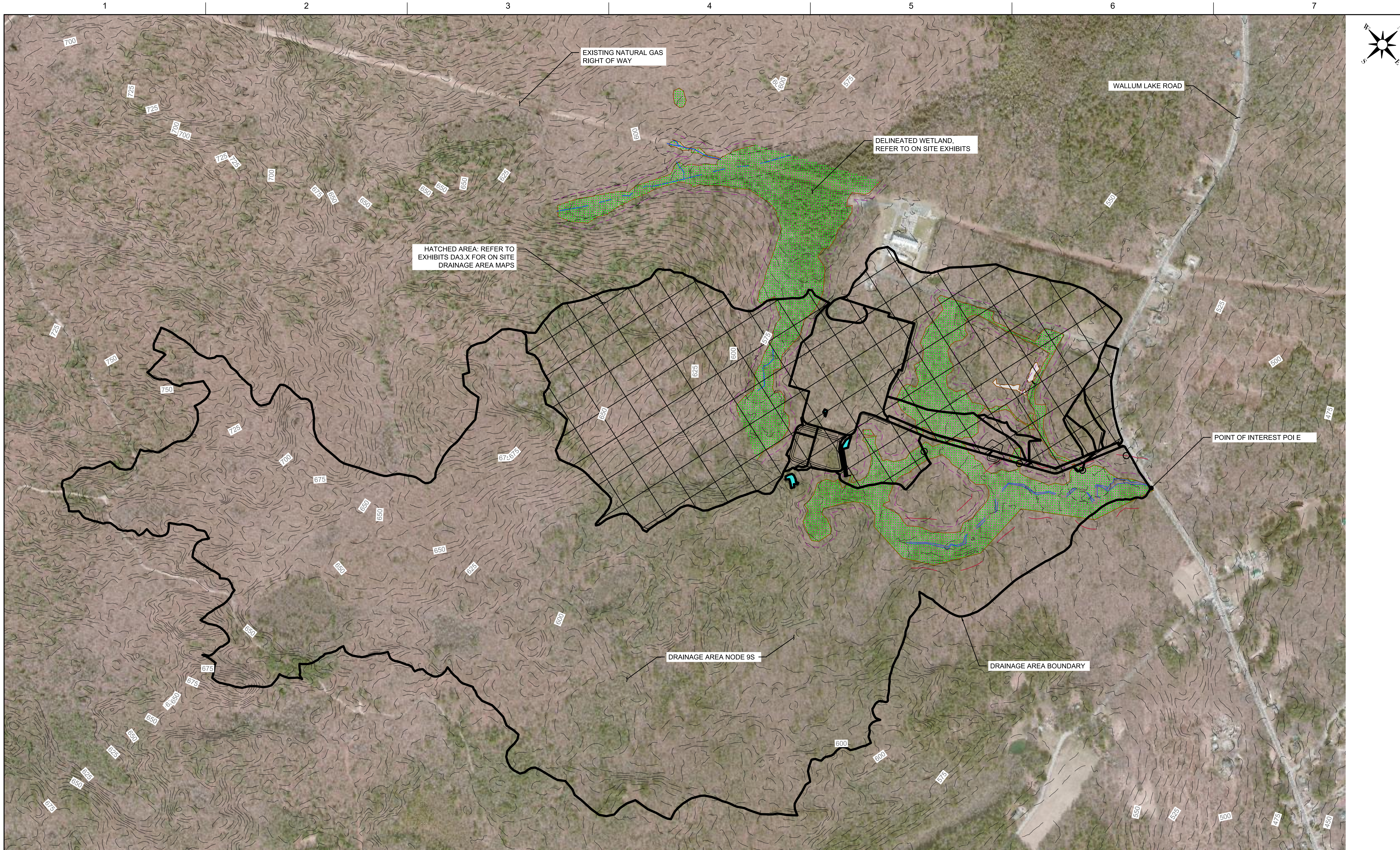
CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

OFF-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
DRAINAGE MAP

SCALE IN FEET
0 400 800

FILENAME 238926-DA2.X.DWG
SCALE AS SHOWN
EXHIBIT 2.2



REFERENCES

1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
2. AERIAL IMAGERY OBTAINED FROM BING AERIAL, 2017.
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ISSUE	DATE	DESCRIPTION
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PROJECT MANAGER: D.MITAS, PE
CIVIL: M. JACOBS, PE
PROJECT NUMBER: 238926

CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

OFF-SITE DRAINAGE AREA MAPS
POST-DEVELOPMENT CONDITION
COVER TYPE MAP

SCALE IN FEET: 0 400 800

FILENAME: 238926-DA2.X.DWG
SCALE: AS SHOWN

EXHIBIT **2.3**

REFERENCES

1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
2. AERIAL IMAGERY OBTAINED FROM BING AERIAL, 2017.
3. NRCS SOILS DATA OBTAINED FROM SPATIAL DATA GATEWAY, PROVIDENCE COUNTY RHODE ISLAND, 2017.
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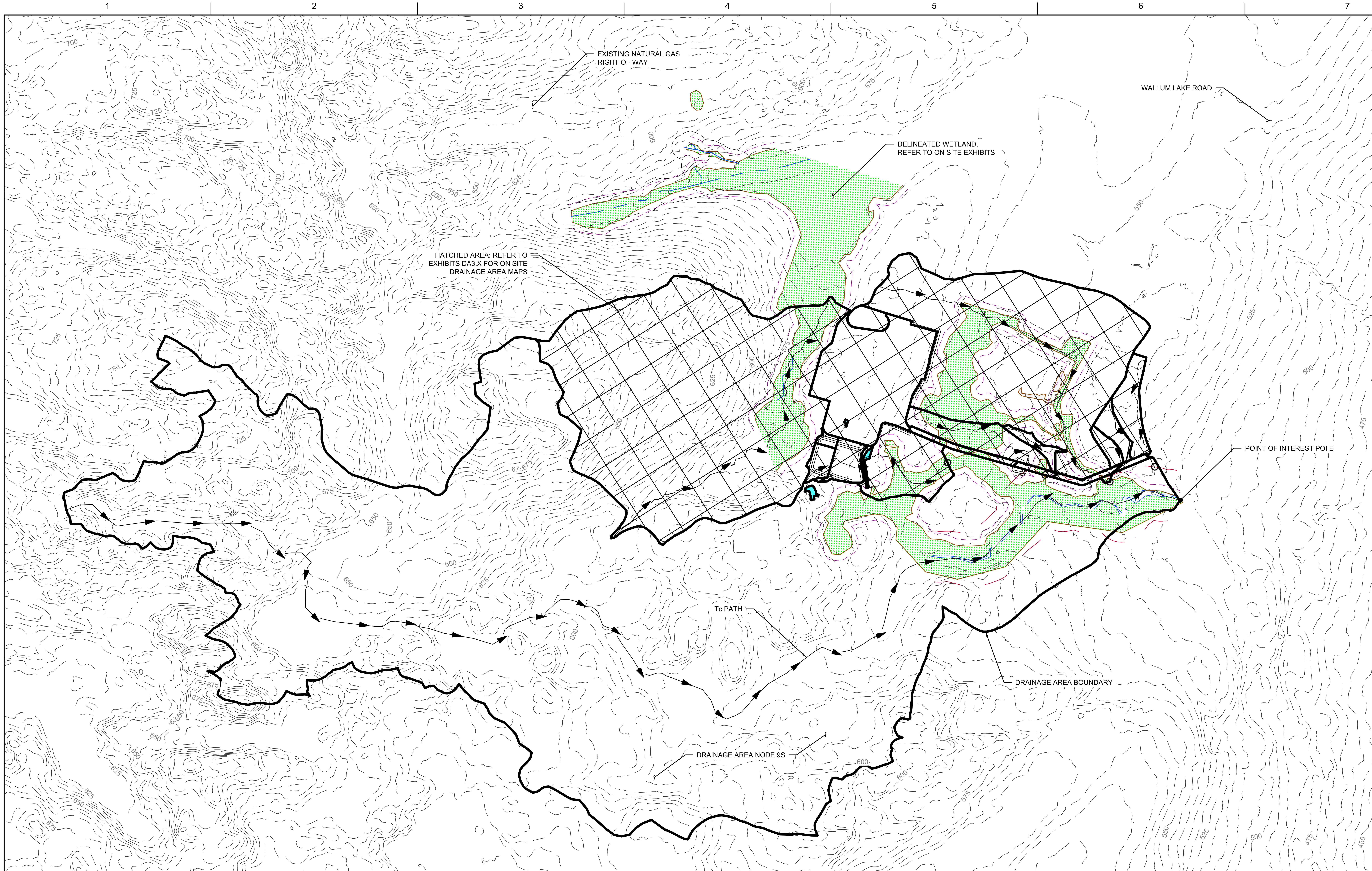
CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

OFF-SITE DRAINAGE AREA MAPS
POST-DEVELOPMENT CONDITION
HYDROLOGIC SOIL GROUP (HSG) MAP

SCALE IN FEET 0 400 800

FILENAME 238926-DA2.X.DWG
SCALE AS SHOWN
EXHIBIT 2.4



REFERENCES

1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
2. AERIAL IMAGERY OBTAINED FROM BING AERIAL, 2017.
3. NRCS SOILS DATA OBTAINED FROM SPATIAL DATA GATEWAY, PROVIDENCE COUNTY RHODE ISLAND, 2017.
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CIVIL	M. JACOBS, PE
PROJECT NUMBER	238926

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CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

OFF-SITE DRAINAGE AREA MAPS
POST-DEVELOPMENT CONDITION
DRAINAGE MAP

SCALE IN FEET 0 400 800

FILENAME 238926-DA2.X.DWG

SCALE AS SHOWN

EXHIBIT **2.5**

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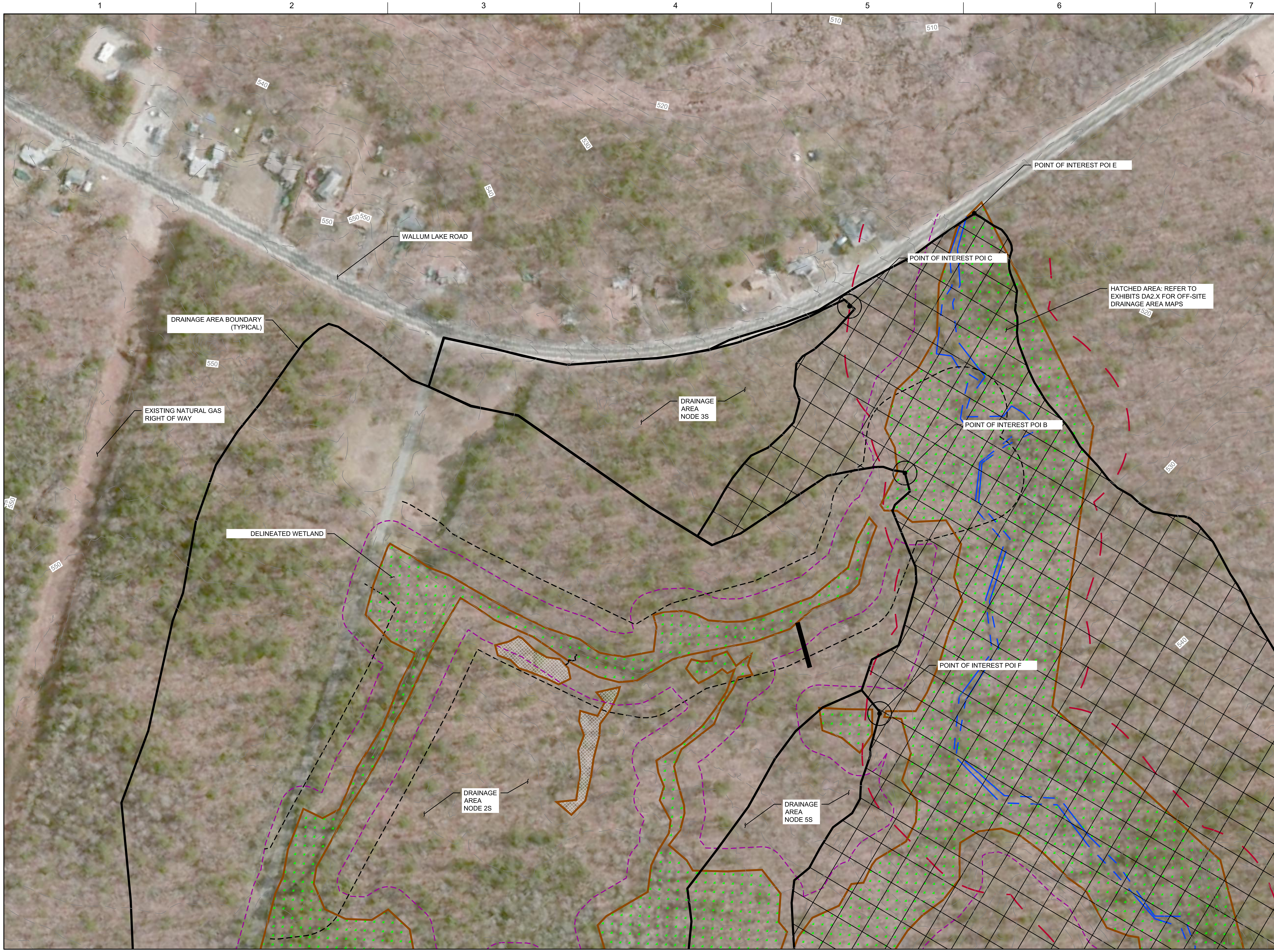

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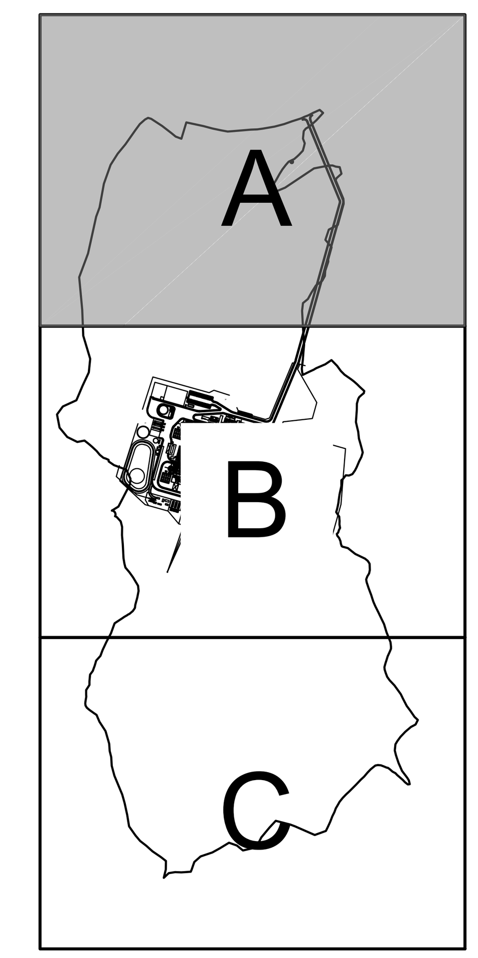

INDEX PLAN
1" = 1,000'

REFERENCES

1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
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CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
COVER TYPE MAP

SCALE IN FEET
0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN
EXHIBIT **3.0A**

REFERENCES

1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
2. AERIAL IMAGERY OBTAINED FROM BING AERIAL, 2017.
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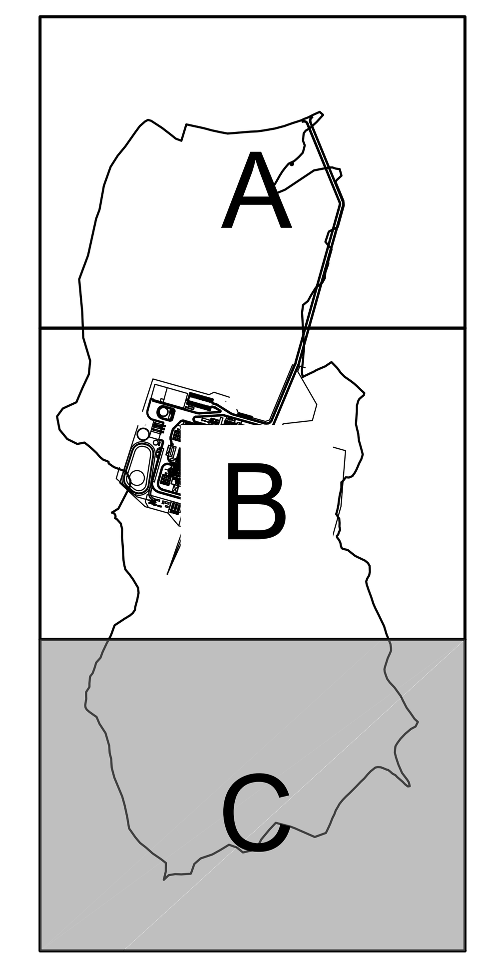
ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
COVER TYPE MAP

SCALE IN FEET 0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN

EXHIBIT **3.0B**



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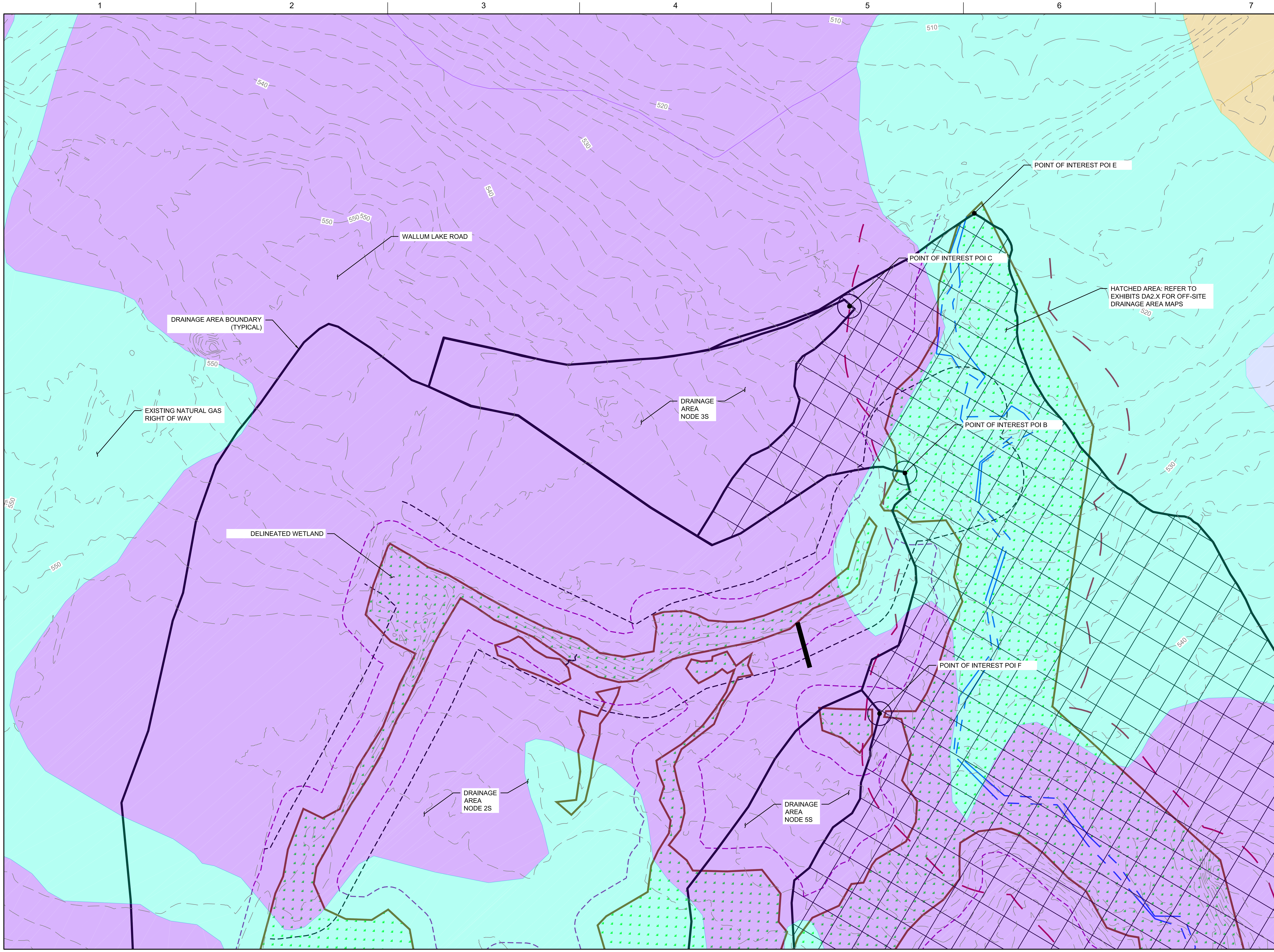
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
COVER TYPE MAP

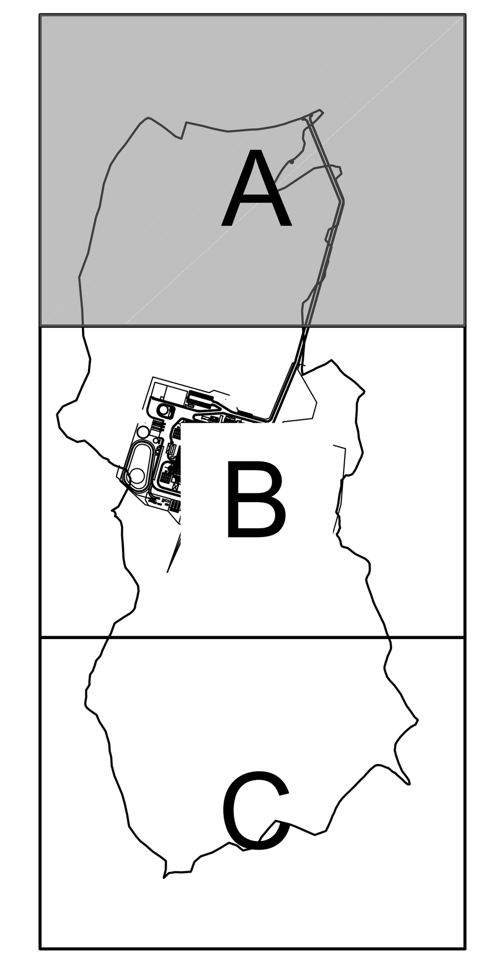
SCALE IN FEET
0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN
EXHIBIT **3.0C**



LEGEND

- HSG A
- HSG A/D
- HSG B
- HSG B/D
- HSG C
- HSG C/D
- HSG D



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PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
HYDROLOGIC SOIL GROUP (HSG) MAP

SCALE IN FEET
0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN

EXHIBIT **3.1A**

REFERENCES

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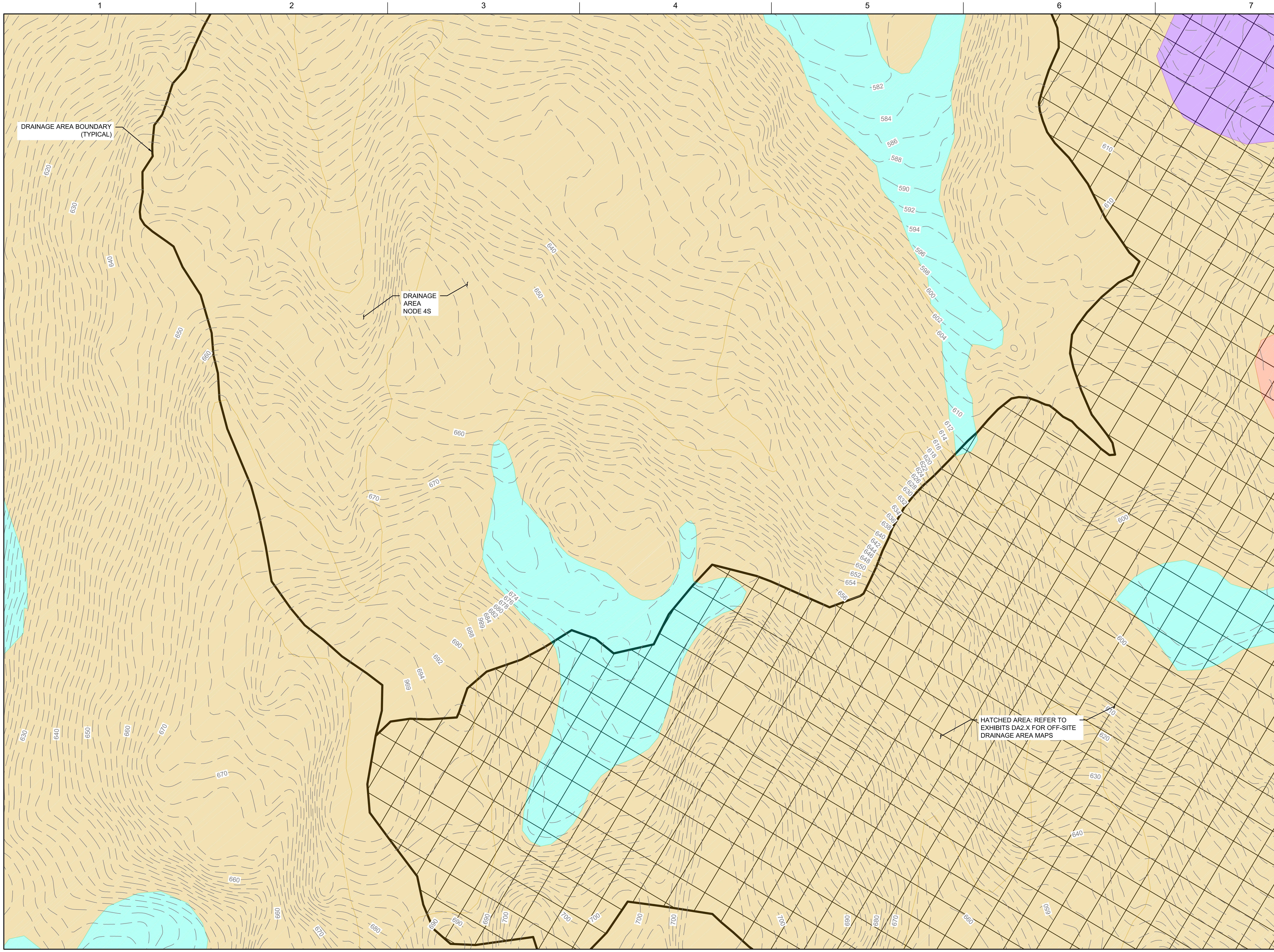
PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
HYDROLOGIC SOIL GROUP (HSG) MAP

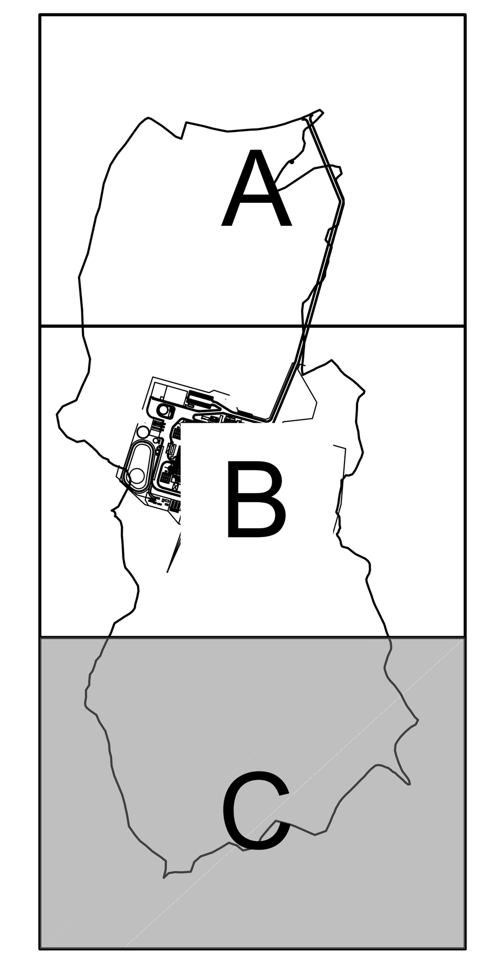
SCALE IN FEET 0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN
EXHIBIT **3.1B**



LEGEND

- HSG A
- HSG A/D
- HSG B
- HSG B/D
- HSG C
- HSG C/D
- HSG D



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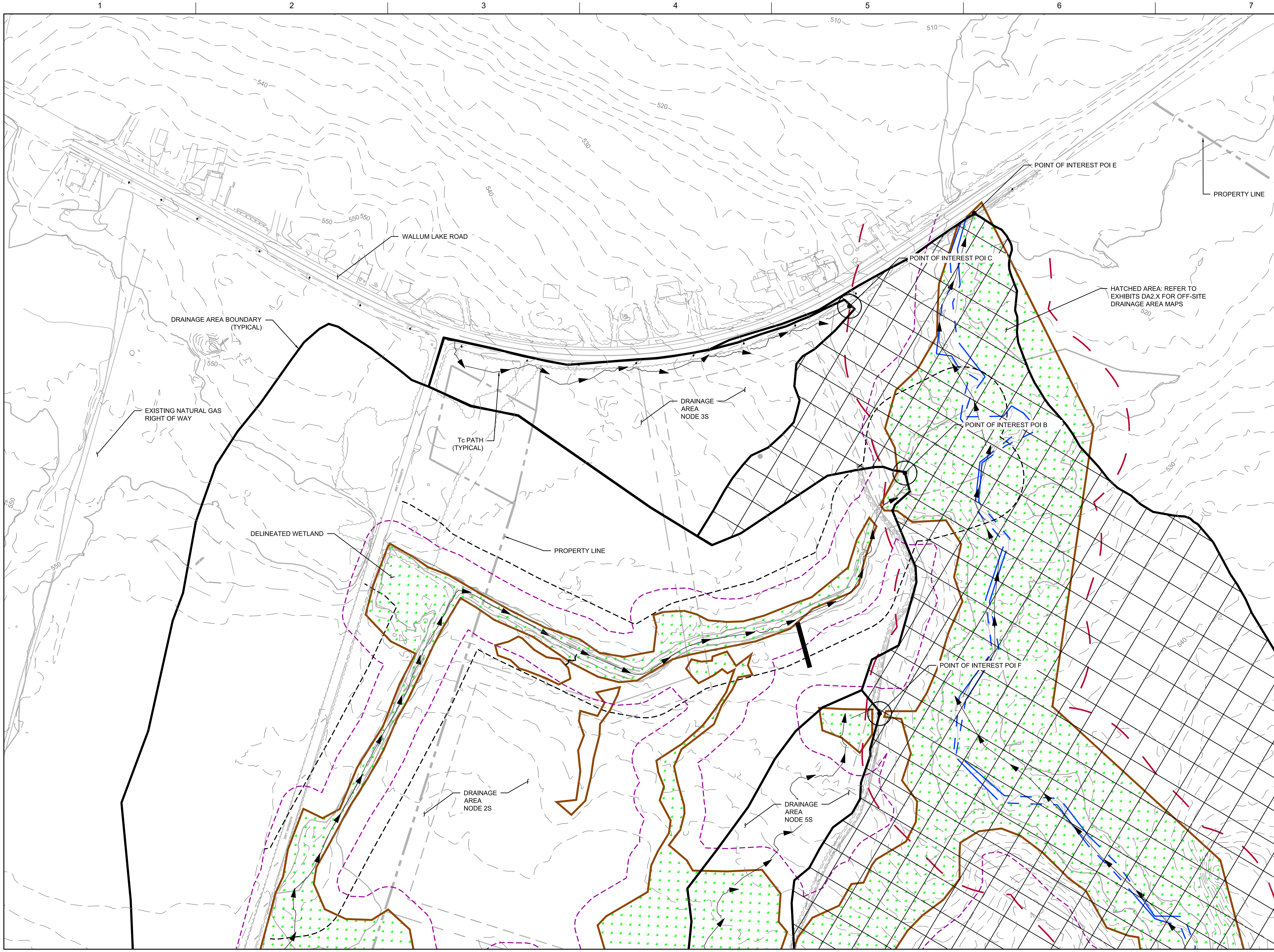
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

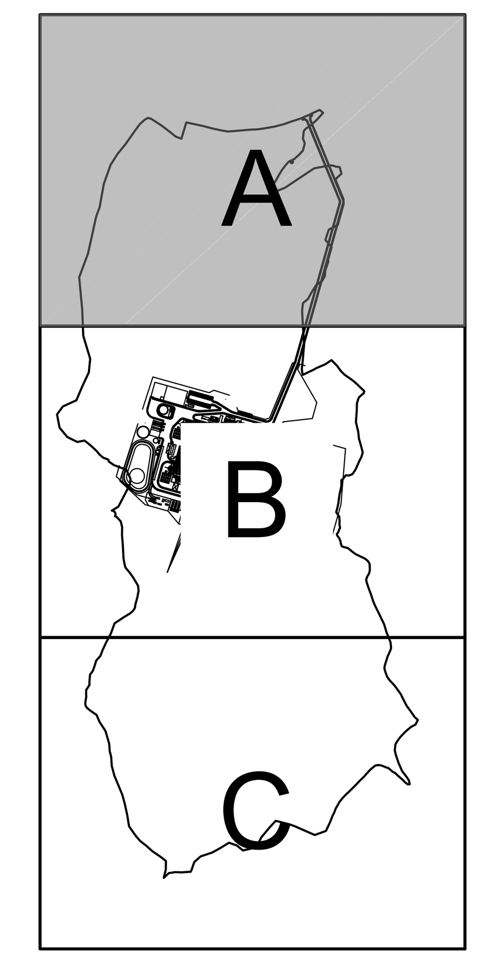
ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
HYDROLOGIC SOIL GROUP (HSG) MAP

SCALE IN FEET 0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN

EXHIBIT **3.1C**





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1" = 1,000'

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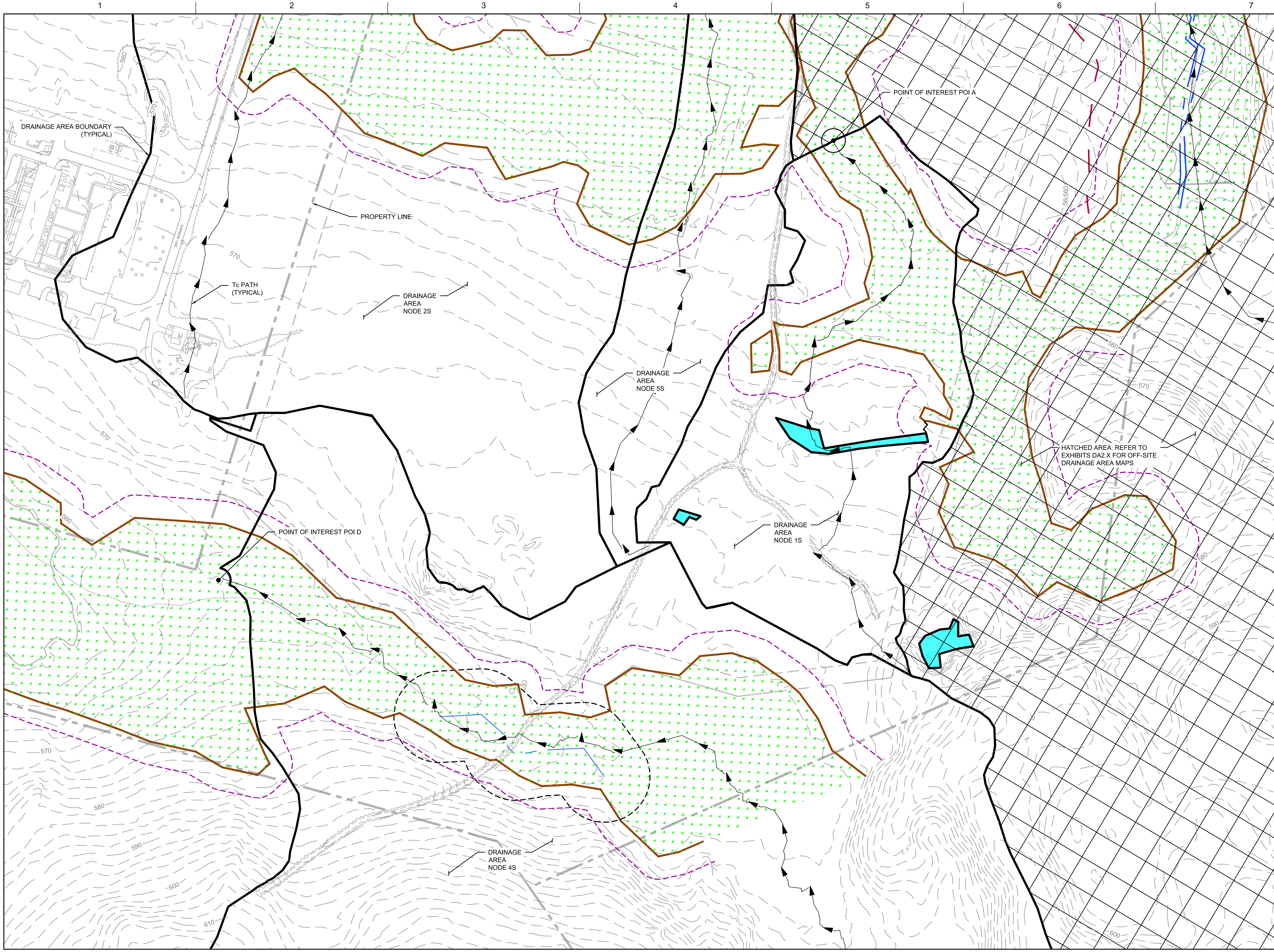
CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

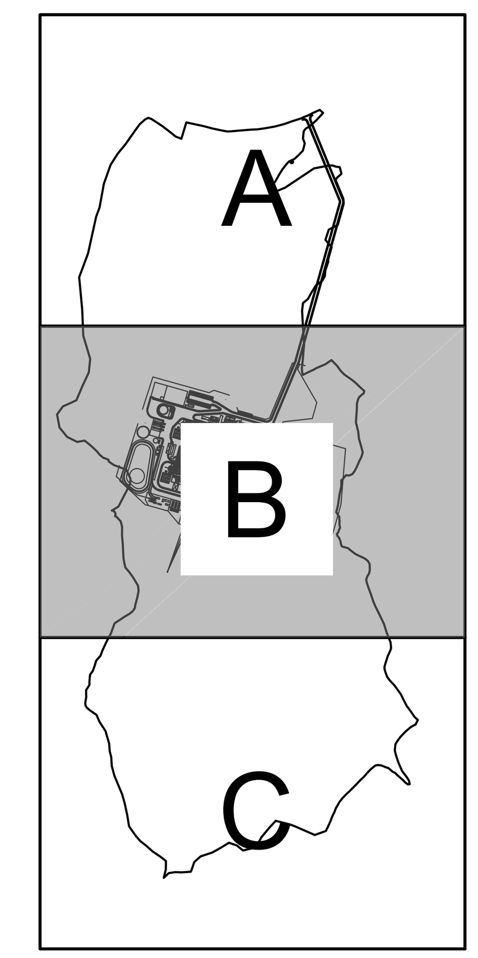
ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
DRAINAGE MAP

SCALE IN FEET 0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN

EXHIBIT **3.2A**





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1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
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PROJECT NUMBER 238926

CLEAR RIVER ENERGY CENTER, LLC

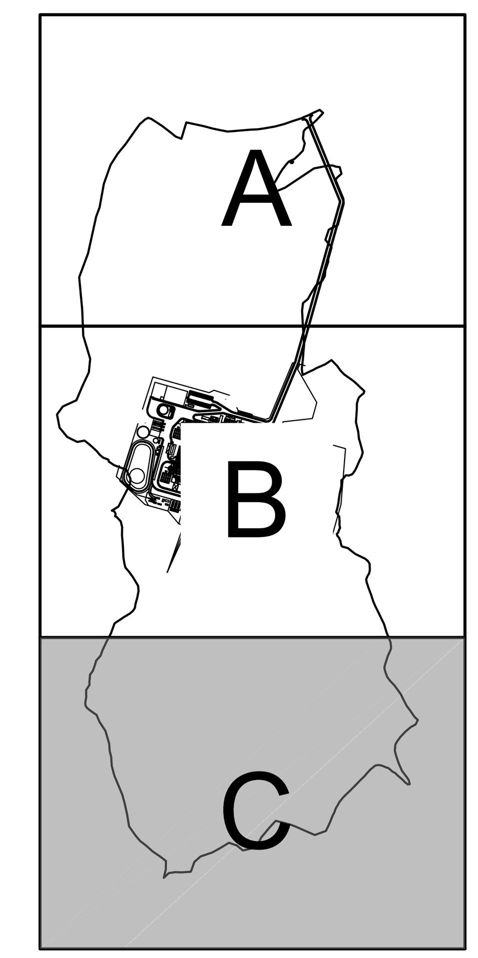
CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
DRAINAGE MAP

SCALE IN FEET
0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN

EXHIBIT
3.2B



INDEX PLAN
1" = 1,000'

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CIVIL: M. JACOBS, PE
PROJECT NUMBER: 238926

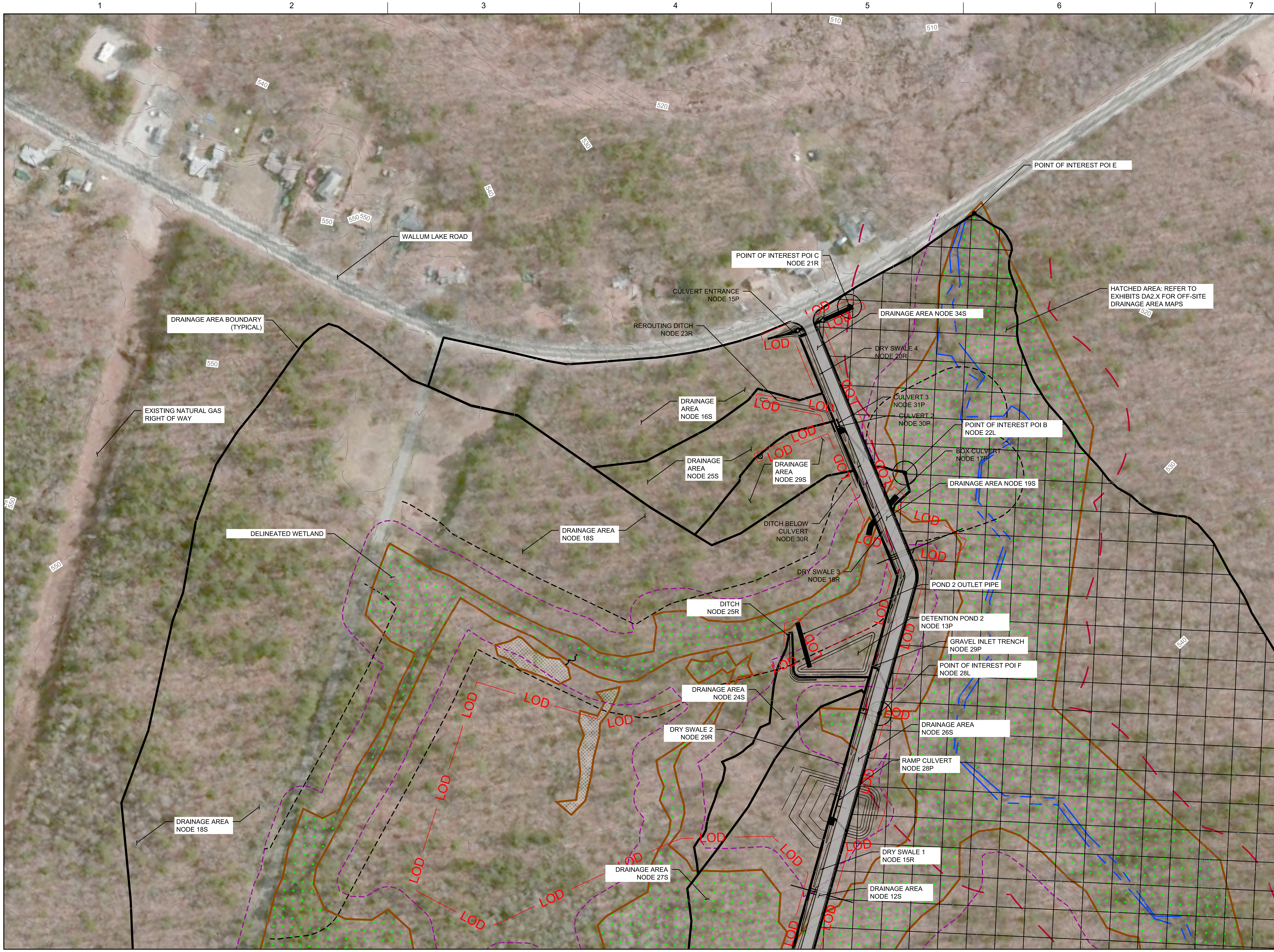
CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
DRAINAGE MAP

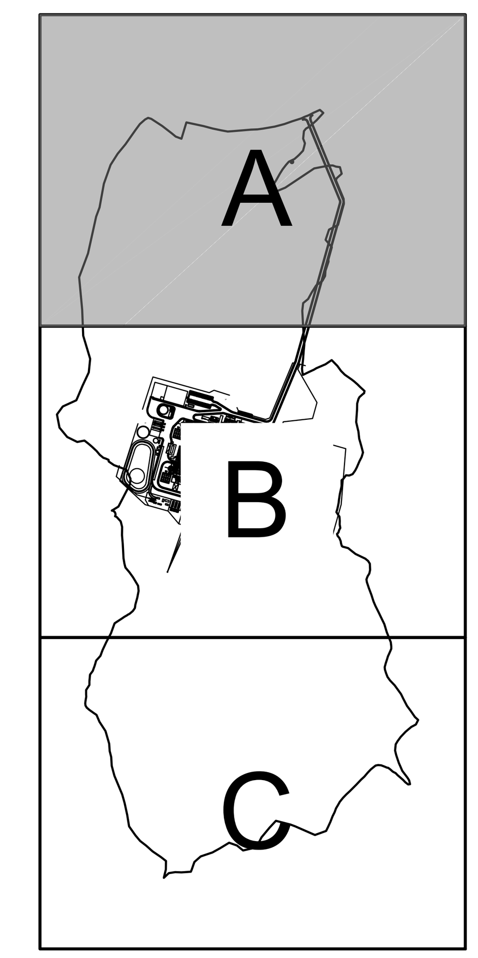
SCALE IN FEET
0 100 200

FILENAME: 238926-DA3.X.DWG
SCALE: AS SHOWN
EXHIBIT: 3.2C



LEGEND

PROPOSED IMPERVIOUS AREA



INDEX PLAN

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CIVIL M. JACOBS, PE

PROJECT NUMBER 238926

CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

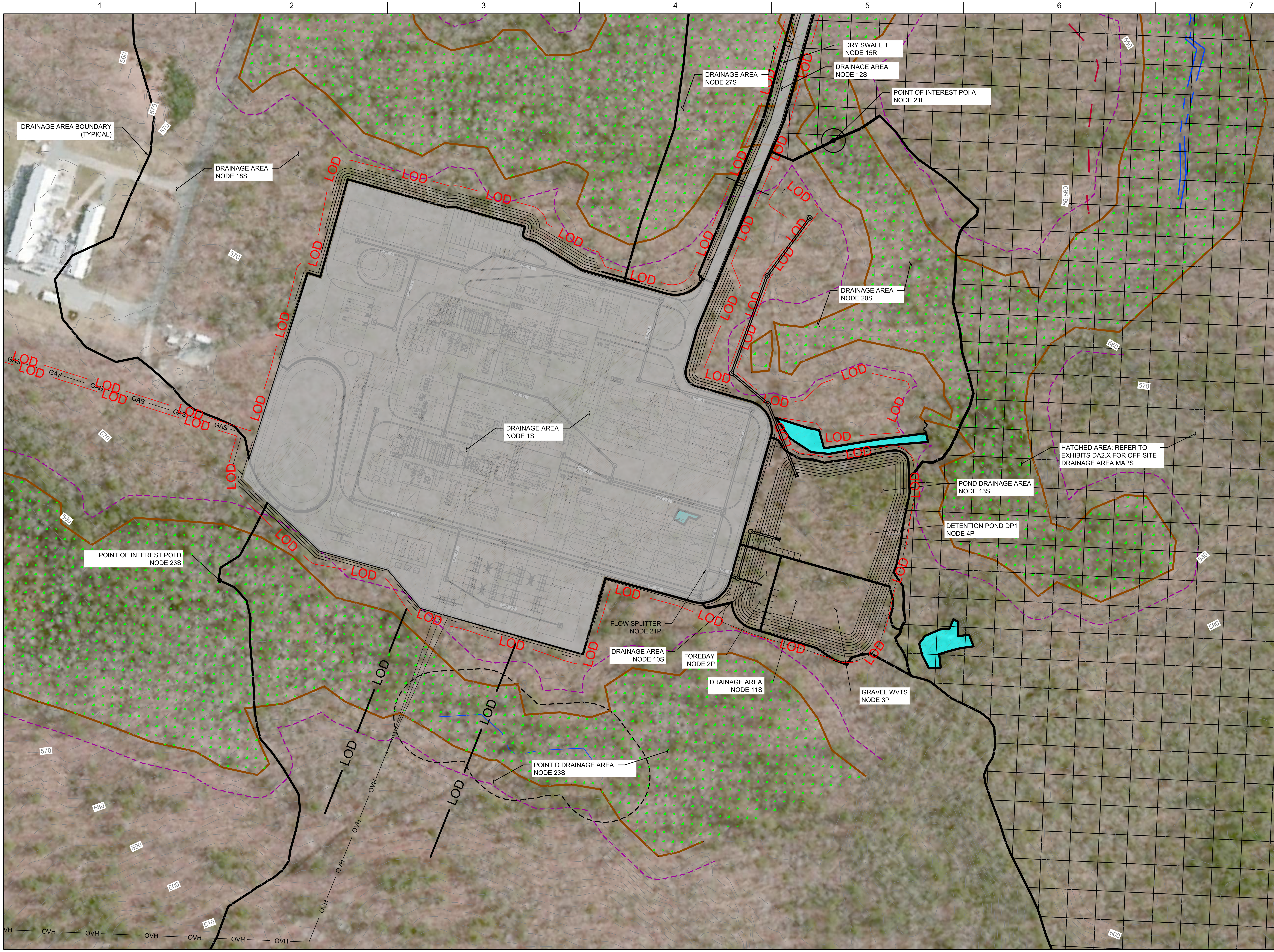
ON-SITE DRAINAGE AREA MAPS POST-DEVELOPMENT CONDITION COVER TYPE MAP

SCALE IN FEET 0 100 200

FILENAME 238926-DA3.X.DWG

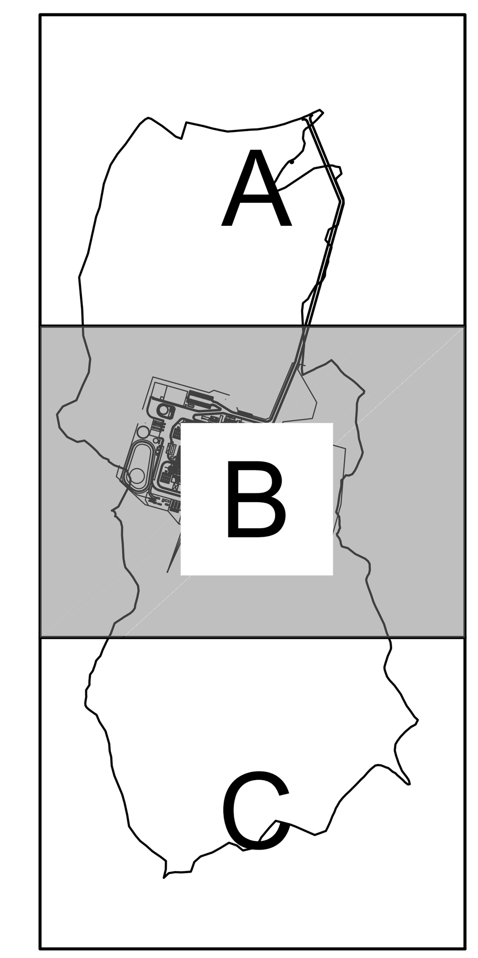
SCALE AS SHOWN

EXHIBIT 3.3A



LEGEND

PROPOSED IMPERVIOUS AREA



INDEX PLAN
1" = 1,000'

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CIVIL	M. JACOBS, PE
PROJECT NUMBER	238926

CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
POST-DEVELOPMENT CONDITION
COVER TYPE MAP

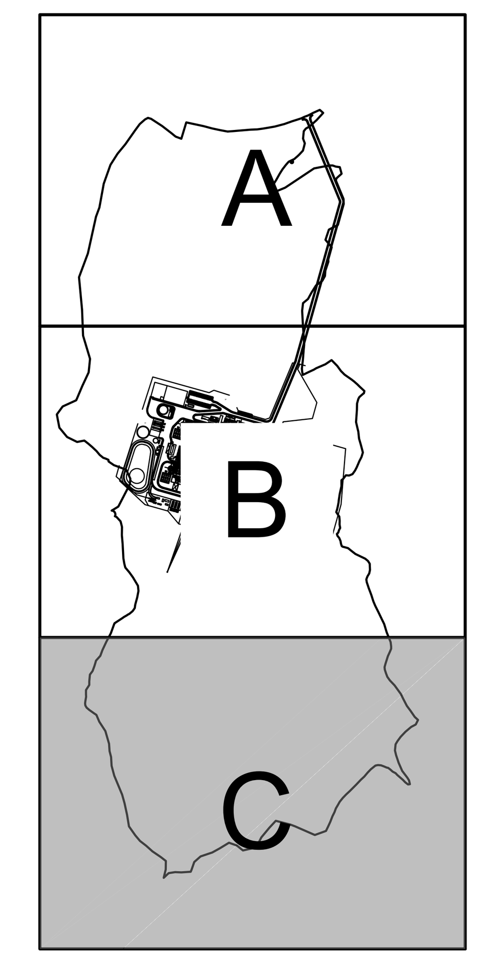
SCALE IN FEET
0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN

EXHIBIT
3.3B

LEGEND

PROPOSED IMPERVIOUS AREA



INDEX PLAN

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CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

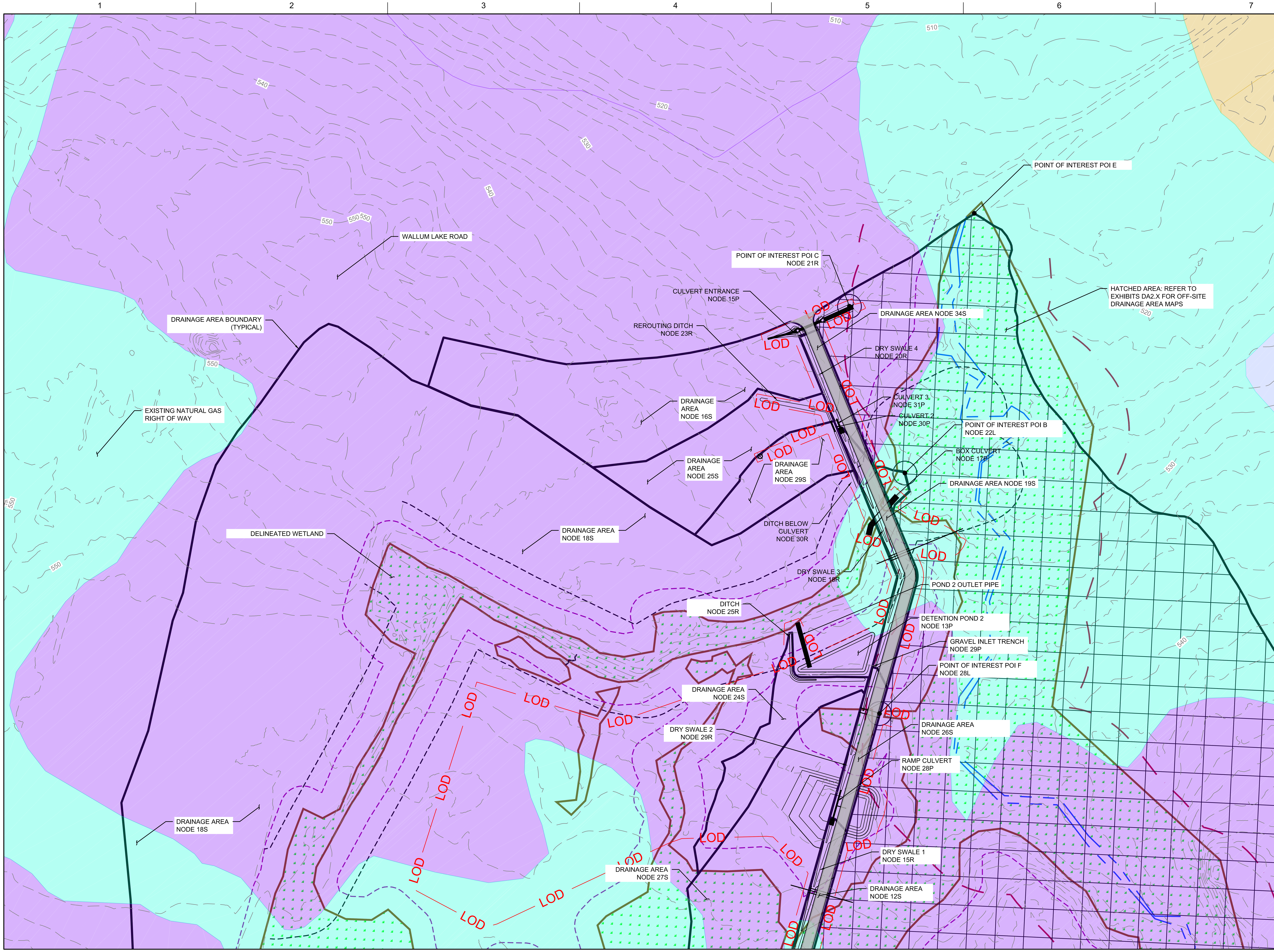
ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
COVER TYPE MAP

SCALE IN FEET 0 100 200

FILENAME 238926-DA3.X.DWG

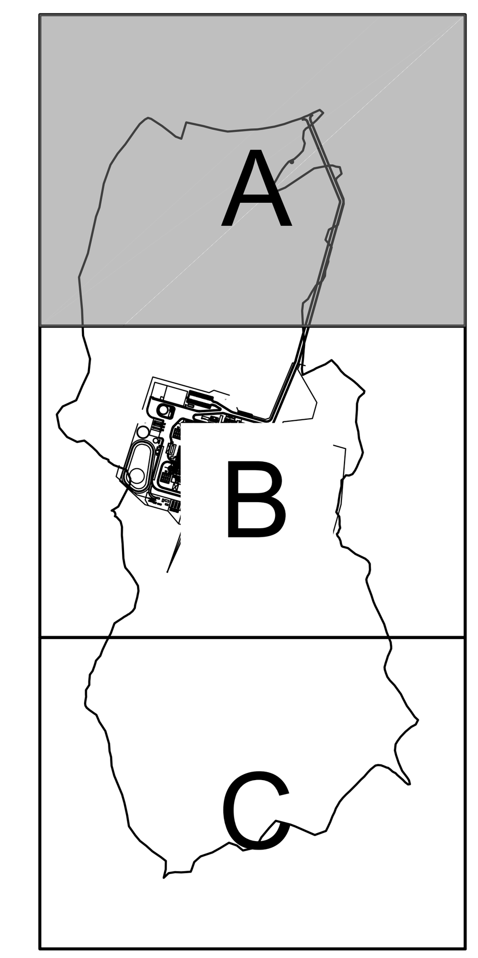
SCALE AS SHOWN

EXHIBIT **3.3C**



LEGEND

- HSG A
- HSG A/D
- HSG B
- HSG B/D
- HSG C
- HSG C/D
- HSG D



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3. NRCS SOILS DATA OBTAINED FROM SPATIAL DATA GATEWAY, PROVIDENCE COUNTY RHODE ISLAND, 2017.
4. PROPERTY DATA OBTAINED FROM FIELD SURVEY BY OTHERS, 2016.

HDR

ISSUE	DATE	DESCRIPTION
A	12/08/17	ISSUED FOR PERMIT

PROJECT MANAGER	D.MITAS, PE
CIVIL	M. JACOBS, PE
PROJECT NUMBER	238926

CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
POST-DEVELOPMENT CONDITION
HYDROLOGIC SOIL GROUP (HSG) MAP

SCALE IN FEET
0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN
EXHIBIT **3.4A**

LEGEND

- HSG A
- HSG A/D
- HSG B
- HSG B/D
- HSG C
- HSG C/D
- HSG D

REFERENCES

1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
2. AERIAL IMAGERY OBTAINED FROM BING AERIAL, 2017.
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4. PROPERTY DATA OBTAINED FROM FIELD SURVEY BY OTHERS, 2016.

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CIVIL M. JACOBS, PE
PROJECT NUMBER 238926

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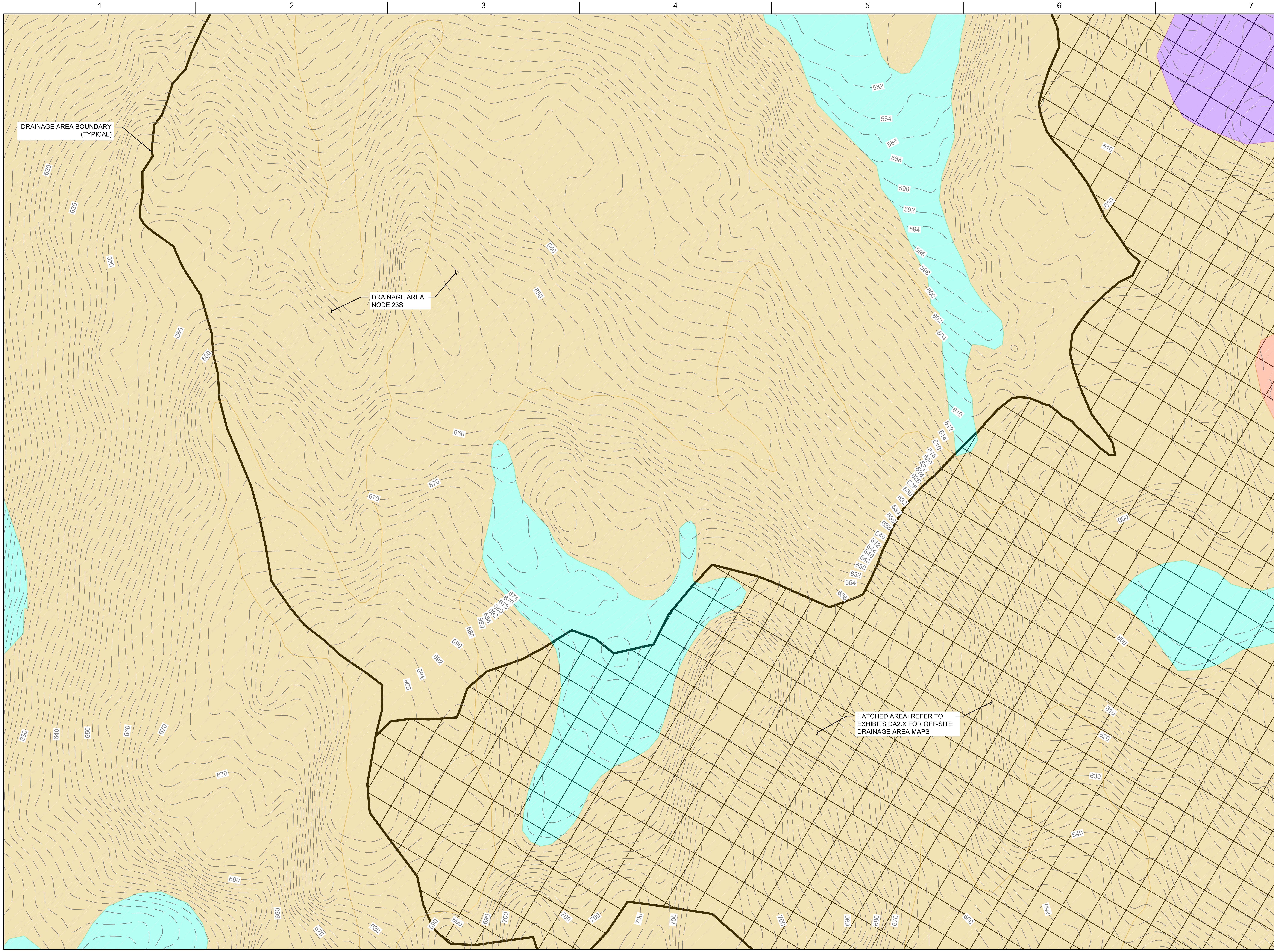
CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

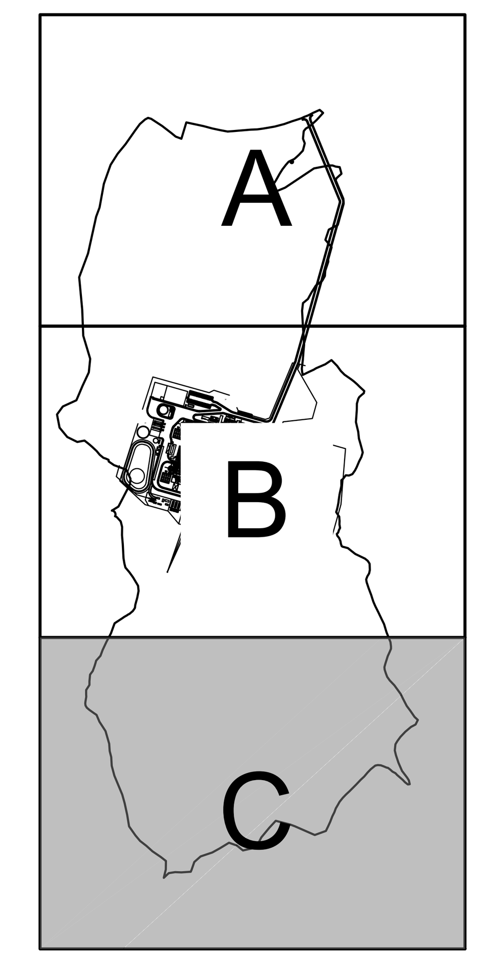
ON-SITE DRAINAGE AREA MAPS
POST-DEVELOPMENT CONDITION
HYDROLOGIC SOIL GROUP (HSG) MAP

SCALE IN FEET 0 100 200
FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN
EXHIBIT **3.4B**



LEGEND

- HSG A
- HSG A/D
- HSG B
- HSG B/D
- HSG C
- HSG C/D
- HSG D



INDEX PLAN

1" = 1,000'

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2. AERIAL IMAGERY OBTAINED FROM BING AERIAL, 2017.
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CIVIL	M. JACOBS, PE
PROJECT NUMBER	238926

CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

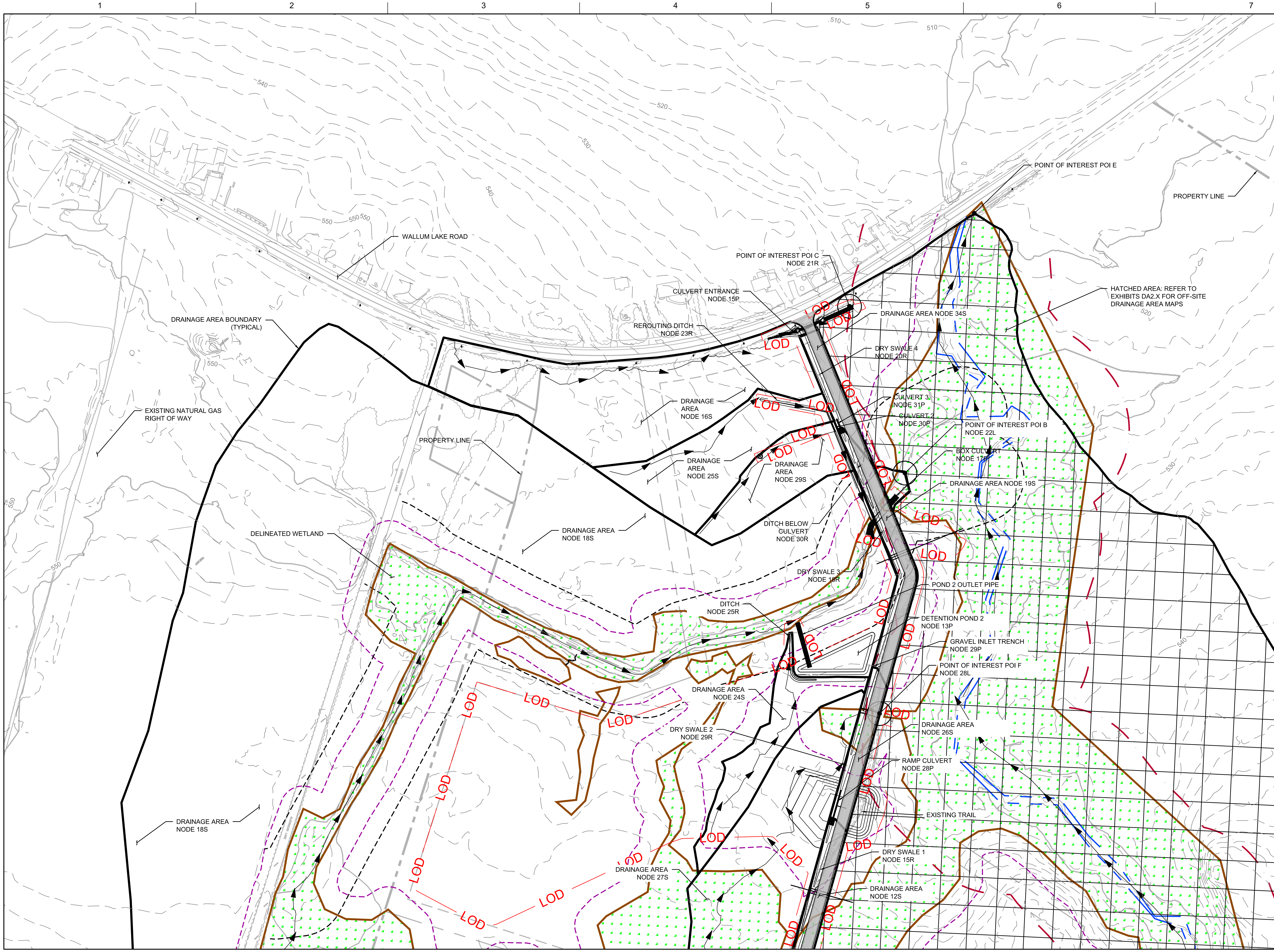
ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
HYDROLOGIC SOIL GROUP (HSG) MAP

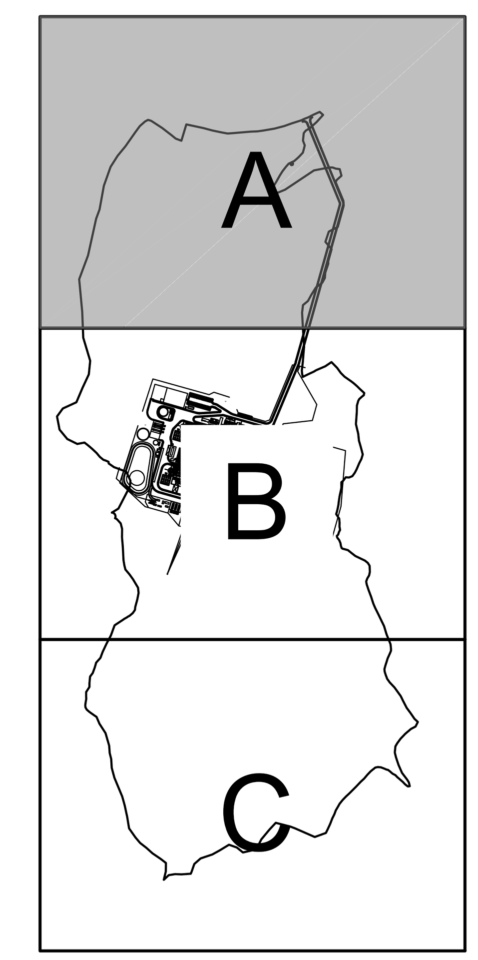
SCALE IN FEET: 0, 100, 200

FILENAME: 238926-DA3.X.DWG

SCALE: AS SHOWN

EXHIBIT: 3.4C





INDEX PLAN
1" = 1,000'

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CIVIL M. JACOBS, PE
PROJECT NUMBER 238926

CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
POST-DEVELOPMENT CONDITION
DRAINAGE AREA MAP

SCALE IN FEET
0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN

EXHIBIT
3.5A

REFERENCES

1. CONTOUR DATA OBTAINED FROM RIGIS, 2017. DATA VINTAGE OF 2013.
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CIVIL M. JACOBS, PE
PROJECT NUMBER 238926

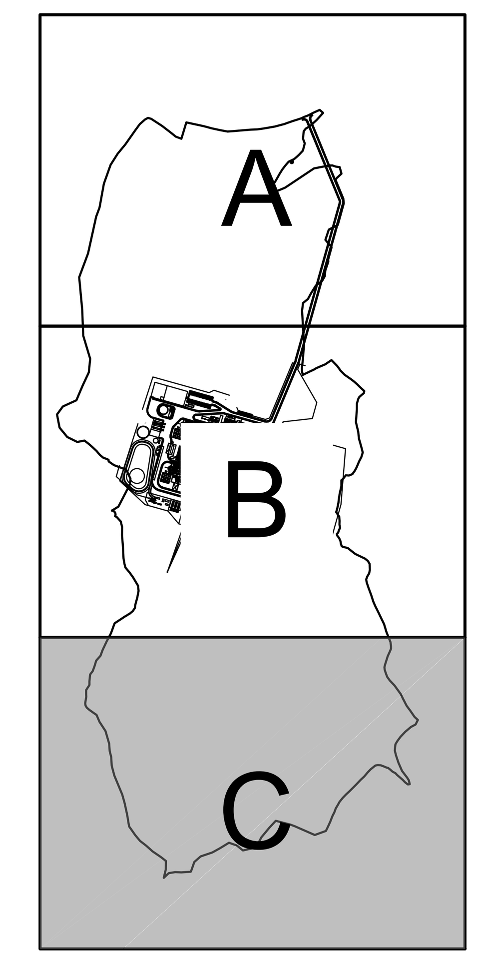
CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
POST-DEVELOPMENT CONDITION
DRAINAGE AREA MAP

SCALE IN FEET 0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN
EXHIBIT **3.5B**



INDEX PLAN
1" = 1,000'

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PROJECT NUMBER 238926

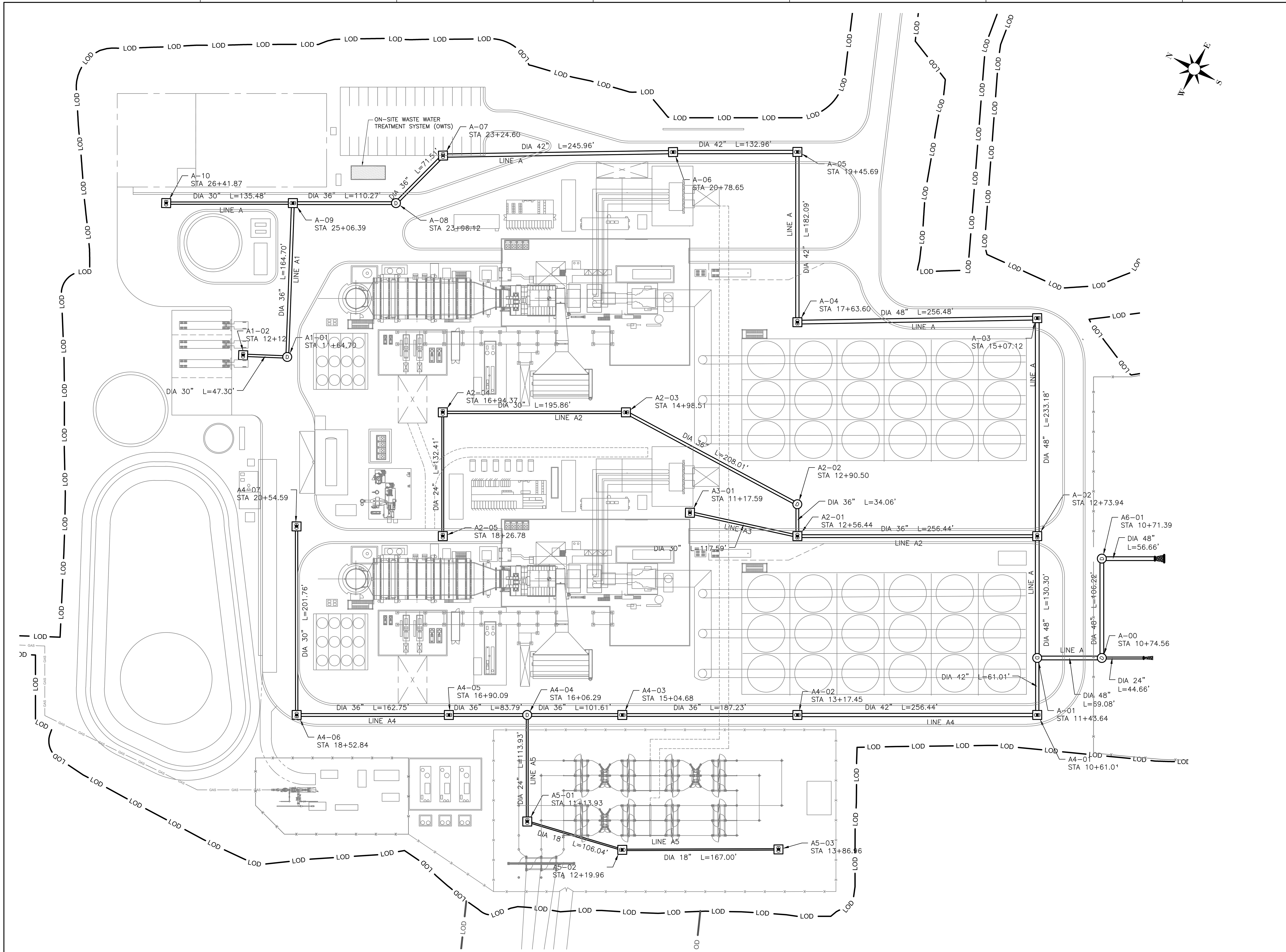
CLEAR RIVER ENERGY CENTER, LLC

CLEAR RIVER ENERGY CENTER
TOWN OF BURRILLVILLE
PROVIDENCE COUNTY, RHODE ISLAND

ON-SITE DRAINAGE AREA MAPS
PRE-DEVELOPMENT CONDITION
DRAINAGE AREA MAP

SCALE IN FEET 0 100 200

FILENAME 238926-DA3.X.DWG
SCALE AS SHOWN
EXHIBIT **3.5C**



STRUCTURE TABLE

NAME	TYPE	LAYOUT COORDINATES	LID	SUMP ELEVATION
A–00	FLOW SPLITTER	N:320779.39 E:259167.35	575.96	562.96
A–01	MANHOLE	N:320837.98 E:259130.75	573.78	563.12
A–02	DROP BOX INLET	N:320907.01 E:259241.27	572.62	563.43
A–03	DROP BOX INLET	N:321030.54 E:259439.04	572.38	564.02
A–04	DROP BOX INLET	N:321245.76 E:259299.53	572.69	564.66
A–05	DROP BOX INLET	N:321342.22 E:259453.97	572.94	565.11
A–06	DROP BOX INLET	N:321454.91 E:259383.40	572.57	565.43
A–07	DROP BOX INLET	N:321661.52 E:259249.96	573.02	566.05
A–08	MANHOLE	N:321677.22 E:259180.19	573.50	566.25
A–09	DROP BOX INLET	N:321770.75 E:259121.77	573.00	566.52
A–10	DROP BOX INLET	N:321885.65 E:259050.00	573.00	566.86
A1–01	MANHOLE	N:321688.60 E:258979.02	573.36	566.89
A1–02	DROP BOX INLET	N:321729.69 E:258955.59	572.77	567.01
A2–01	DROP BOX INLET	N:321124.51 E:259105.41	573.16	564.09
A2–02	MANHOLE	N:321142.55 E:259134.30	573.59	564.18
A2–03	DROP BOX INLET	N:321350.11 E:259120.61	572.95	564.70
A2–04	DROP BOX INLET	N:321516.23 E:259016.85	572.95	565.19
A2–05	DROP BOX INLET	N:321446.08 E:258904.55	573.17	565.52
A3–01	DROP BOX INLET	N:321235.22 E:259065.79	573.16	564.88
A4–01	DROP BOX INLET	N:320805.65 E:259079.00	572.62	563.27

STRUCTURE TABLE

NAME	TYPE	LAYOUT COORDINATES	LID	SUMP ELEVATION
A4–02	DROP BOX INLET	N:321023.15 E:258943.15	573.16	563.91
A4–03	DROP BOX INLET	N:321181.95 E:258843.96	573.16	564.38
A4–04	MANHOLE	N:321268.12 E:258790.13	574.34	564.63
A4–05	DROP BOX INLET	N:321339.19 E:258745.74	572.89	564.84
A4–06	DROP BOX INLET	N:321477.23 E:258659.52	573.50	565.29
A4–07	DROP BOX INLET	N:321584.23 E:258830.56	573.50	565.77
A5–01	DROP BOX INLET	N:321207.77 E:258693.50	574.34	564.91
A5–02	DROP BOX INLET	N:321105.53 E:258721.62	573.45	565.18
A5–03	DROP BOX INLET	N:320964.15 E:258810.50	573.26	565.60
A6–01	MANHOLE	N:320835.66 E:259257.44	574.84	562.43

STRUCTURE TABLE

NAME	TYPE	LAYOUT COORDINATES	LID	SUMP ELEVATION
B–01	MANHOLE	N:321256.01 E:259815.13	558.92	551.20
B–02	MANHOLE	N:321225.30 E:259660.67	561.99	553.00
B–03	MANHOLE	N:321120.14 E:259459.76	565.53	555.27
B–04	MANHOLE	N:321016.43 E:259473.41	566.17	556.32

SEE LINE B, DETAIL 2/01C802

PROJECT MANAGER C. JACOBS

ISSUE	DATE	DESCRIPTION
5	12/06/2017	REV. TECH. REVIEW 11/10/2017
4	7/19/2017	REVISED PER TECHNICAL REVIEW COMMENTS BY RI DEM OF JUNE 19, 2017
3	3/27/2017	REVISION
2	2/17/2017	REVISION
1	8/17/2016	SOIL EROSION SEDIMENT CONTROL PLAN

PROJECT NUMBER 10021318

ALEXANDER DEUSON
No. 0011618
REGISTERED PROFESSIONAL ENGINEER CIVIL

CLEAR RIVER ENERGY LLC
CLEAR RIVER ENERGY CENTER
WALLUM LAKE ROAD LOT NO.
135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

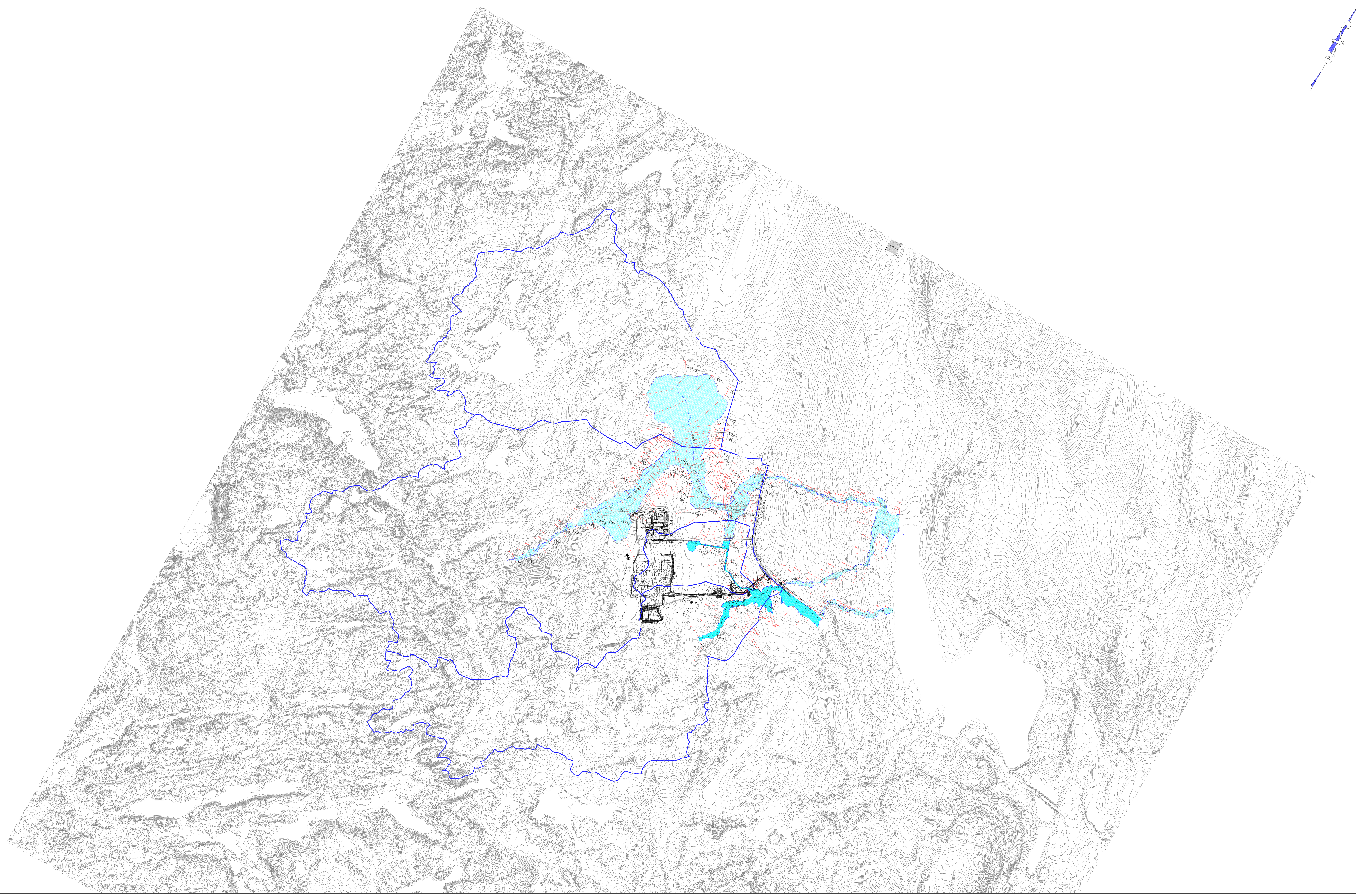
PROPOSED DRAINAGE PLAN

FILENAME 01C400.dwg
SCALE 1" = 50'

SHEET 01C400

Exhibit 8

Drainage Report - Section 9.0 Drainage Analysis Flood Impact Study Mapping (Bound Separately - 24”x36”)



LEGEND

CENTERLINE	
CROSS-SECTIONS	
FLOODPLAIN	
WATERSHED BOUNDARY	
FLOOD ELEVATION	550.20

HDR

ISSUE	DATE	DESCRIPTION
5	12/01/2017	REV. TECH. REVIEW 11/10/2017
4	7/19/2017	REVISED PER TECHNICAL REVIEW COMMENTS BY RI DEM OF JUNE 19, 2017
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1	8/17/2016	SOIL EROSION SEDIMENT CONTROL PLAN

PROJECT MANAGER C. JACOBS

PROJECT NUMBER 10021318

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CLEAR RIVER ENERGY CENTER
WALLUM LAKE ROAD LOT NO.
135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

FLOOD IMPACT STUDY MAPPING
OVERALL WATERSHED MAP

FILENAME HEC-RAS MAP.DWG

SCALE 1" = 1000'

SHEET 1 of 6

LEGEND

CENTERLINE	
CROSS-SECTIONS	
FLOODPLAIN	
WATERSHED BOUNDARY	
FLOOD ELEVATION	550.20

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PROJECT MANAGER C. JACOBS

PROJECT NUMBER 10021318

CLEAR RIVER ENERGY LLC
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WALLUM LAKE ROAD LOT NO.
135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

FLOOD IMPACT STUDY MAPPING
NORTH DRY ARM BRANCH WATERSHED

FILENAME HEC-RAS MAP.DWG

SCALE 1" = 300'

SHEET 2 of 6

LEGEND

CENTERLINE

CROSS-SECTIONS

FLOODPLAIN

WATERSHED BOUNDARY

FLOOD ELEVATION 550.20

HDR

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PROJECT MANAGER C. JACOBS

PROJECT NUMBER 10021318

CLEAR RIVER ENERGY LLC
CLEAR RIVER ENERGY CENTER
WALLUM LAKE ROAD LOT NO.
135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

FLOOD IMPACT STUDY MAPPING
DRY ARM BRANCH WATERSHED

FILENAME HEC-RAS MAP.DWG

SCALE 1" = 300'

SHEET 3 of 6

LEGEND

CENTERLINE

CROSS-SECTIONS

FLOODPLAIN

WATERSHED BOUNDARY

FLOOD ELEVATION 550.20

HDR

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PROJECT MANAGER C. JACOBS

PROJECT NUMBER 10021318

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135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

FLOOD IMPACT STUDY MAPPING
IRON MINE BRANCH WATERSHED

FILENAME HEC-RAS MAP.DWG

SCALE 1" = 300'

SHEET 4 of 6

LEGEND

CENTERLINE

CROSS-SECTIONS

FLOODPLAIN

WATERSHED BOUNDARY

FLOOD ELEVATION 550.20

HDR

PROJECT MANAGER C. JACOBS

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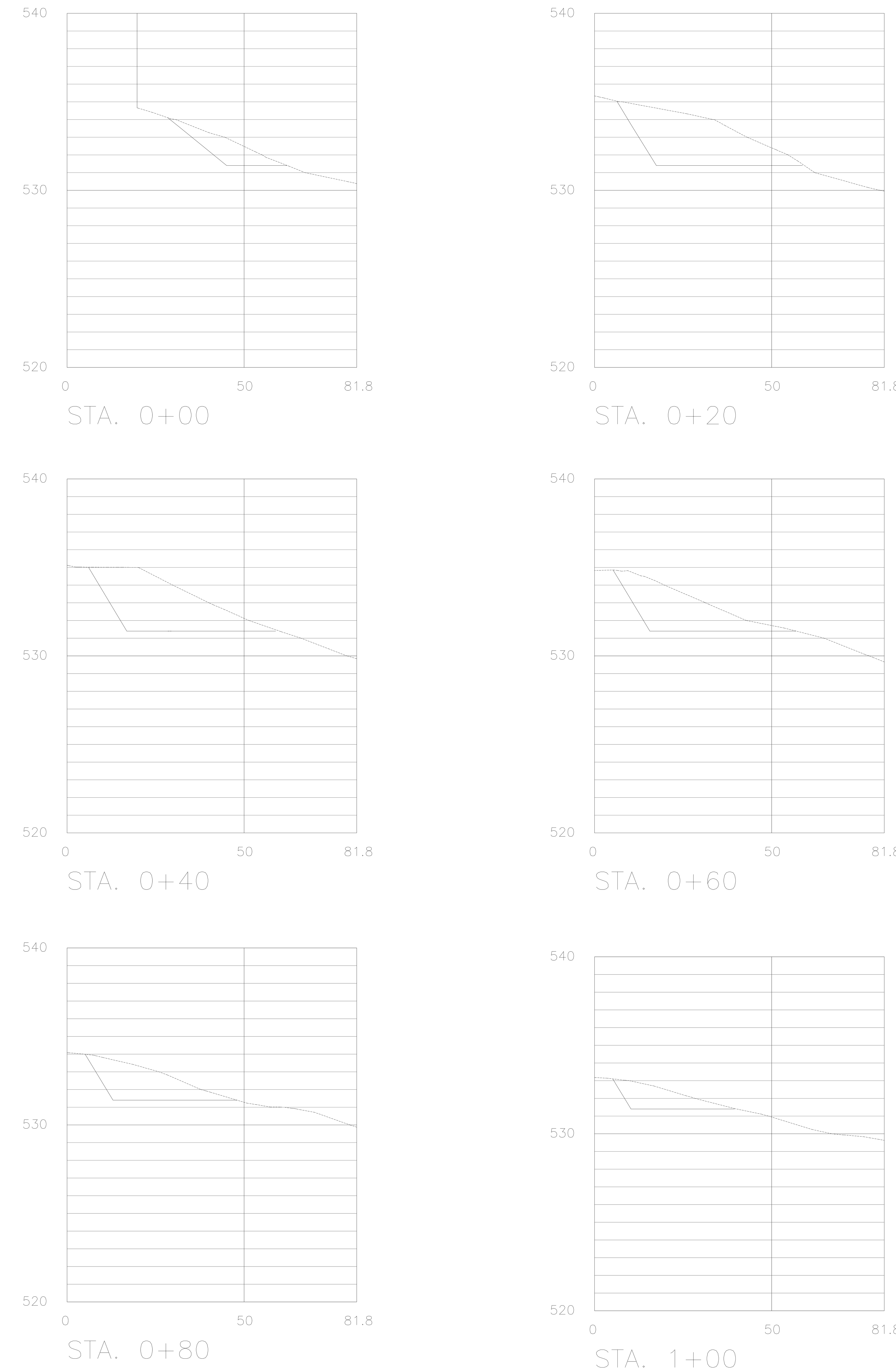
135-002, 137-002, 137-003, 137-021,
153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

FLOOD IMPACT STUDY MAPPING
FLOODPLAIN ENCROACHMENT AREA

FILENAME HEC-RAS MAP.DWG

SCALE 1" = 50'

SHEET 5 of 6



LEGEND

CENTERLINE

CROSS-SECTIONS

FLOODPLAIN

WATERSHED BOUNDARY

FLOOD ELEVATION 550.20

HDR

ISSUE	DATE	DESCRIPTION
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PROJECT MANAGER C. JACOBS

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153-001, 153-002
TOWN OF BURRILLVILLE,
PROVIDENCE COUNTY, RHODE ISLAND

FLOOD IMPACT STUDY MAPPING
FLOODPLAIN COMPENSATION AREA

FILENAME HEC-RAS MAP.DWG

SCALE 1" = 20'

SHEET 6 of 6