ATTACHMENT M

TARMAC KING ROAD
LIMESTONE MINE
LEVY COUNTY, FLORIDA

SUBMITTED BY DAN HILLIARD

Tarmac King Road Limestone Mine

Levy County, Florida

Second Request for Additional Information Response

File Number 0244771-002

November 2009

Tarmac
A Titan America Business

AL ANDREANSKY, P.E.
PALM HARBOR, FLORIDA

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

ENTRIX

Tarmac
A Titan America Business

November 4, 2009

Mr. David Adams
Environmental Specialist III - Soil Scientist
Bureau of Mining & Minerals Regulation
Florida Department of Environmental Protection
2051 East Dirac Drive
Tallahassee, Florida 32310-3760

Re: **Request for Additional Information 2**
Tarmac America – Titan King Road Mine
File No. 0244771-002, Levy County

Dear Mr. Adams:

We are providing the following responses and information in response to the Bureau of Mining and Minerals Regulation's *Request for Additional Information, Environmental Resource Permit Application, Re: Tarmac America – King Road Mine, File No. 0244771-002*, dated August 5, 2009, and the Division of Recreation and Parks' *Request for Additional Information # 2, Supplemental* for File No. 0244771-002, Tarmac King Road Mine, of September 17, 2009.

As was true of the questions posed by the Division of Recreation and Parks in November 2008, many of the Division's new questions do not fall within the applicable permitting criteria under Chapter 373, Part IV, Florida Statutes (F.S.) or applicable reclamation criteria, nor do they reflect appropriate reasonable assurance standards. This inappropriate scope and detail are reflected in repeated requests for "peer reviewed scientific publications or documents" and an exhaustive "cumulative impacts" analysis, which is not required because all of Tarmac's proposed mitigation is within the same drainage basin as the proposed impacts. Likewise, not all of the questions posed relate specifically to the additional information previously supplied as is required by Section 373.4141, F.S., and none of the questions posed contain a rule citation, as is required by Section 373.417, F.S.

The Division appears to misunderstand the ERP process, which does not impose upon an applicant the obligation to obtain or respond to "unpublished data" and communications with federal employees. Tarmac, the applicant, must provide reasonable assurances to the Department that there is a substantial likelihood that it will successfully implement the project in accordance with the applicable rules. Tarmac is not, however, required to disprove all worst case scenarios, address all theoretical impacts raised, or provide absolute guarantees. Nevertheless, the applicant is willing to supply responses to most inquiries without waiving any arguments that these questions are not relevant to the completeness of the application or the permittability of the proposed activities. It is noteworthy that completion of a federally-initiated Environmental Impact Statement ("EIS") and USGS Thermal Infrared Imaging is not in any way a prerequisite to ERP review or DEP decision making. The same is true of many of the Division's requests. The applicant does not want its willingness to entertain some of the subject areas to imply acquiescence to the propriety of the questions. The applicant wishes to clarify that the submission of responses to these unwarranted and statutorily unsupported questions cannot properly form the basis for yet more questions of this nature. The applicant would also like to point out that the Governor and Cabinet issued its certification order for the

Progress Energy nuclear facility on August 1, 2009, authorizing that project and addressing many of the issues that are raised as concerns that project in the context of this application.

Keeping all of the above in mind, responses to both the Bureau of Mining and Minerals Regulation the Division of Recreation and Parks' requests and comments are set forth below. For ease of reference, Bureau and Division requests are included below and each comment is numbered and addressed individually. The Department's comments are in italics and Tarmac's responses are in bold.

I. RESPONSES TO BUREAU OF MINING AND MINERALS REGULATION'S REQUEST FOR ADDITIONAL INFORMATION DATED AUGUST 5, 2009

Section E

Part I. Site Information

DEP 1. *The application requires aerials, legible for photo interpretation with a scale of 1 inch equals 400 feet, or more detailed, with the project boundaries. The application does not include aerials at the required scale. The aerials provided with the last submittal were at a scale of 1 inch equals 900 feet. Aerials at the correct scale were requested in the November 2008 request for additional information (RAI).*

Response: **Aerial photographs of the site scaled to 1 inch equals 400 feet have been provided as Item 1 of the Supplemental Information Package. In addition, 11x17 drawings are included as Attachment 1 of this submittal.**

Part II. Environmental Considerations

DEP 2. *The application did not provide an estimate of the wetland mitigation costs for the financial assurance mechanism. This information was requested in the November 2008 RAI.*

Response: **An estimate of the wetland mitigation costs is provided as Attachment 2 of this submittal.**

DEP 3. *A substantial part of the wetland mitigation will be provided through the preservation of the mitigation parcel through fee simple transfer of ownership to the State. The application did not provide title search information that would show whether previously granted easements or other title records would conflict with the requirements for preservation. There has been no identification of access easements through the mitigation area for offsite property owners. There was no clear time table for the* *transfer of ownership in relation to the expansion of mining operations. This information was requested November 2008.*

Response: **Two sets of title search documents are provided as Item 2 of the Supplemental Information Package.**

The title search reveals two oil, gas, and mineral reservations and fifteen easements encumbering the mitigation property. The oil, gas, and mineral reservations existing on the mitigation property will not conflict with the requirements for preservation because state and federal oil, gas, mining, and wetland regulations would make such mining or exploration difficult or impossible; there is little probability that resources exist on the mitigation property to be mined because a general reservation of "mineral" interests as exists on the deeds reserving them does not include sand or limestone which are the only known material mined or excavated in the area (see Florida Audubon Society v. Ratner, 497 So. 2d 672 (Fla. 3d DCA 1986); see also ftp://ftp.dep.state.fl.us/pub/geo/web/oilngas/gainesville.pdf, which reflects that there are only dry oil and gas test borings in Levy County); and other areas set aside for preservation or conservation purposes containing similar mineral reservations, such as mitigation banks throughout the state of Florida, have been permitted by the FDEP. Additionally, the fifteen easements consist of only non-exclusive ingress, egress, and public utilities easements for single family property owners and utilities. None of these interests conflict with the state's goal of preserving the mitigation property.

Within 6 months of receipt of all necessary local, state and federal construction permits and authorizations for all of the impacts and the full life of mine duration identified in the ERP permit application, and prior to any wetland construction occurring, the applicant will secure and convey a sufficient interest in the mitigation property to the State of Florida.

DEP 4. *The application states that there will be no preservation of the steam channels within the mining parcel. The May 26, 2009, meeting included figures showing preservation of the stream channels, the meeting included a conceptual discussion of the timing of timber harvests within the proposed conservation easement. The meeting included a conceptual discussion of including uplands within the conservation easement that include harvestable timber. The meeting included a conceptual discussion of post timber harvest enhancements of habitats. At this time, the details of the proposed wetland mitigation within the mining parcel are unclear. The application did not provide title search information that would show whether previously granted easements or other title records would conflict with the requirements for preservation. There was no clear time table for the transfer of ownership in relation to the expansion of mining operations. This information was requested November 2008.*

Response: **As discussed with DEP staff, a conservation easement for the Mine Parcel "No Mine" areas, including the stream channels has been incorporated into the mitigation plan as preservation. See also response to DEP 3, above. The Mitigation Plan has been revised to reflect the stream channel preservation and enhancement and is included as Attachment 4 of this submittal.**

DEP 5. *The April 2009 submittal for the application provided revised figures and UMAM scores for the existing and proposed conditions over a 9,277-acre project area. Department staff will not have sufficient time to verify this information in the field and apply the assessment method to determine the amount of mitigation necessary to offset the proposed impacts, as provided by rule 62-345.300(1), F.A.C. The details of potential wetland mitigation within the mining parcel are unclear. The post project conditions and UMAM scores within the proposed conservation easement are not provided by the application and cannot be verified in the field.*

Response: **The UMAM scores were included in both the original October 2008 application submittal and in the April 2009 response to DEP's first request for additional information. Since that time, David Adams of the DEP has conducted site visits to review UMAM scores on July 14-16 and October 8-9, 2009. Mr. Adams' feedback was used to revise the previously submitted UMAM data, and the updated information is provided as Attachment 3.**[1]

DEP 6. *The application states that 45.9 acres of streams and waterways will be preserved. In a October 28, 2008, title review, the Division of State Lands determined that submerged lands laying below that mean high water line of the Gulf of Mexico, and its tidal tributaries, are state owned. Preservation for wetland mitigation cannot be provided on state owned submerged lands. The application does not include a figure of the wetland mitigation parcel showing the mean high water line for the Gulf of Mexico and its tidal tributaries, or a statement that the mean high water line does not extend into the wetland mitigation parcel.*

Response: **The mean high water line does not extend onto the Mine Parcel. The applicant is in the process of confirming the extent of any state-owned submerged lands on the Mitigation Parcel, and this determination shall be completed and approved by the Department prior to recordation of the conservation easement. To the extent any of the streams and waterways designated for preservation are determined to be state-owned as a result, those areas will be excluded from the legal description of the preservation lands prior to recordation of the conservation easement over the lands, and the applicant's UMAM analysis will be revised accordingly. Should a deficit in UMAM credits result from such a revision,**

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[1] An oversized version of Attachment 3 has also been provided as Item 6 of the Supplemental Information Package.

the applicant will place under conservation easement a sufficient amount of additional lands to provide equivalent UMAM credit. In no event will the applicant attempt to place a conservation easement over or conduct mitigation activities upon any lands located waterward of the mean high water line."

E.1.

DEP 7. *Tables 1, 2 and 3 of the application must be submitted and labeled as such.*

Response: ERP Tables One (Project Wetland and Other Surface Water Summary) and Two (Project On-Site Mitigation Summary) were provided in the October 2008 submittal along with an explanation that Table Three (Project Off-Site Mitigation Summary) was not provided because the proposed project does not involve off-site mitigation. Updated Tables One and Two and a blank Table Three are provided as part of this submittal.

Part III. Plans

DEP 8. *The applicant applied for formal wetland jurisdictional determinations for the mining parcel. The completed determinations were not provided in the application. This information was requested November 2008.*

Response: The DEP Notices of Proposed Agency Action (PAA) for a Formal Determination of Landward Extent of Wetlands and Other Surface Waters (file numbers FD-38-0276624-001, FD-38-0276628-001, FD-0276629-001, and FD-0276630-001) were published on September 17, 2009 and notarized proof of publication has been provided to DEP. Upon final issuance, the applicant will forward copies of the jurisdictional determinations to Mr. Adams.

DEP 9. *The project proposes to remove or alter surface water management structures within the wetland mitigation parcel. The application did not identify the location of each structure to be removed or modified. The application does not have the required plans showing existing and proposed conditions for each structure. The application did not identify how the removal or alteration of each structure will impact surface water flows from the existing conditions. This information was requested in the November 2008 RAI.*

Response: The applicant is no longer proposing surface water management structures or road removal as mitigation. No structures will be modified or removed.

Engineering Comments

DEP 10. *The applicant has not demonstrated the ability to contain the 25-year 24-hour storm event. All areas to be mined or disturbed by mining operations should be contained within a protective perimeter berm. These protective berms should be meet accepted minimum construction standards for non engineered structures, unless proven that these standards are excessive. The crest of these berms shall be level throughout the entire project area and shall have a crest width of at least 10 feet. The crest shall be sloped to the interior of the project to reduce the occurrence of erosion of the exterior slope (2 to 3 percent). This sloping of the crest shall be illustrated on all appropriate cross section drawings. The exterior and interior slopes of these structures shall be 3H:1V or flatter. These slopes shall be grassed sufficiently to prevent erosion and periodically mowed to reduce the occurrence of woody stem vegetation and so that they can be inspected. The crest elevation shall be determined by applying a minimum of a 3-foot freeboard. This freeboard is calculated from the surface water elevation of the staging of the 25-year 24-hour storm event vertically to the interior edge of the crest. The surface water elevation of the 25-year event and the freeboard shall be illustrated and labeled on the drawings.*

Response: The stormwater calculations demonstrating ability to contain 25-year 24-hour storm event were provided in Exhibit 3 of response to November 2008 FDEP RAI. The crest of berms is 10 ft as indicated on sections found on sheets D1-D3 of Attachment 5, Engineering Drawings.[2] The crest of the berms will be modified to slope of 3%. The exterior and interior slopes of the berms are 3H:1V. The water surface elevation is indicated on revised drawings.

The 25-year 24-hour peak levels are as follows:

Mining Area 1,2,3:
Peak HWL elevation is 17.65 ft while top of berm is 21.00 ft resulting in 3.35 ft freeboard. Sheet D5 of Attachment 5, Engineering Drawings, with sections I-I and J-J has been added to clarify this area.

Mining Area 5:
Peak HWL elevation is 16.73 ft while top of berm is 19.00 ft resulting in 2.27 ft freeboard. The berm will be raised to 20.00 ft in order to achieve 3.27 ft freeboard. Please see sections A-A and B-B on sheet D1 of Attachment 5, Engineering Drawings.

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[2] An oversized, signed and sealed version of Attachment 5 has also been provided as Item 7 of the Supplemental Information Package.

Mining Area 4:
Peak HWL elevation is 8.67 ft while top of berm is 19.00 ft resulting in 10.33 ft freeboard. Please see section C-C on sheet D1 and sections D-D and E-E on sheet D2 of Attachment 5, Engineering Drawings.

DEP 11. *The location and type of all best management practices to be employed shall be illustrated and labeled on the section drawings. The location of all berms and best management practices shall be illustrated on at least one plan view drawing. These items should be identified using separate symbols and labeled.*

Response: **Please see notes on Erosion Control Plan, Sheet E1, and erosion control details on sheets E2 through E4 of Attachment 5, Engineering Drawings.**

DEP 12. *The protective berm that is provided around the processing area appears to sufficient; however, it is recommended that the crest width of this structure be 5 feet or greater. This will allow periodic mowing of the crest and inspections of the structure by vehicle.*

Response: **Please see revised section G-G on sheet D3 of Attachment 5, Engineering Drawings.**

DEP 13. *All cross sections and plan view drawings shall contain a legend of all lines and symbols used for that drawing.*

Response: **The drawings have been revised as requested.**

DEP 14. *The applicant has not provided a management plan that addresses the disposal of tailings from the processing area. This management plan shall address separately this disposal in the initiation of mining operations through the end of mine life.*

Response: **Tailings (limestone too fine for commercial use) will be disposed of by pumping fines in slurry form to lakes where excavation has been completed. The fines will be allowed to settle and consolidate by gravity only, and no chemical additives will be used. Fines will continue to be placed in the lake until the desired level of fill has been achieved. In some cases, the lakes will be completely filled to the original land contour, but in some cases, only a small amount of fines will be placed.**

Pumping slurry into the lake will cause the lake level to rise. Clear, decanted water will be pumped from the lake being filled to the lake being excavated and/or to the plant pond for recirculation through the processing plant. Water levels will

be monitored to ensure that they remain within established levels at all times, and will be adjusted by pumping only while tailings disposal is being conducted.

DEP 15. *The applicant has not provided a plan for the management of overburden during the life of the mine. This plan should include but not be limited to the utilization of overburden for reclamation and its final disposition.*

Response: **Overburden removed at the King Road Mine site will consist of topsoil and a portion of the top layer of limestone. Plant material, including stumps, will be removed and separated from the overburden.**

Overburden will be used in the construction of the berms around the perimeter of lakes and will also be stockpiled for future use in reclamation. These stockpiles will be maintained in areas that have been cleared of vegetative material and will be encircled by two rows of silt fence.

Due to the amount of lake area created by the mining process, some overburden will be placed in the mine lakes along with tailings. This material will be transported to the lake's edge and pushed in until it meets the desired contour.

DEP 16. *The location of the haul road and all proposed interior roads used for mining operations were not illustrated on the engineering drawings. The construction of haul roads and interior access/service roads are considered part of mining operations and should be included within the application and made part of the project site. Detail cross sections should be provided for all culverts and other structures that will be used for these roads. The location and description of these structures shall be located and identified on the plan view drawings.*

Response: **Please see revised Sheet S6 of Attachment 5, Engineering Drawings.**

DEP 17. *There are numerous "wetland crossings" that are identified on the engineering drawings. The use or need for these crossings has not been provided. Of particular concern is the hydrological and functional impacts of these wetlands as a result of these crossings. If these wetland crossings are for interior roads as indicated in cross section F, it is not understood why these wetland crossing are in excess of 160 feet wide.*

Response: **See Section F on Sheet D2 of Attachment 5, Engineering Drawings. The crossings include a 12 foot (12') access road, 8 foot (8') wide drainage swales on both sides of the crossing, 100 foot (100') work area for movement of drag line with a seventy-eight foot (78') footprint, and a twenty foot (20') section for conveyors and piping. Thus, the approximately one hundred and sixty-foot (160') width is necessary to support mining operations. Impacts associated with the**

wetland crossings are addressed in the UMAM analysis provided as Attachment 3 of this submittal.

DEP 18. *It is not understood the purpose of the 100-foot Work Area as identified on cross sections A-E.*

Has the applicant considered the use of any infiltration/hydration ditches for those areas to be mined adjacent to offsite wetlands?

Response: **The dragline has a seventy-eight foot (78') footprint and requires at least eleven feet (11') on either side to safely maneuver.**

The mine pits at the King Road mine will not be dewatered. Therefore infiltration/hydraulic ditches, i.e., recharge ditches, will not be required since their primary purpose is to minimize drawdown of the water table beneath areas adjacent to a dewatered or partially dewatered mine pit. The water level in the mine pits at the King Road mine will be maintained at the same elevation as the groundwater level in the middle of the mine pit would be in the absence of mining. Water level monitors installed on adjacent property far enough away from the mine pit to be unaffected by mining activities will be used to determine this elevation on a daily basis. The locations of the water level monitors are provided in the Groundwater Monitoring Plan that was submitted to FDEP as part of the industrial wastewater permit application and to SWFWMD as part of the water use permit application. A copy of the Groundwater Monitoring Plan is included as Attachment 6 of this submittal.

DEP 19. *The section H, "Typical Final Mineout Section", sheet D4 of 4 does not meet the reclamation performance standards of Chapter 62C-36, F.A.C.*

Response: **Please see revised Sheet D4 of Attachment 5, Engineering Drawings.**

DEP 20. *The scale that is provided for the plan view drawings is identified as "1=10000". It is not clear the meaning of the scale. Is this a ratio meaning "1:10000" or is this 1"=10,000 feet or yards?*

Response: **The scale is 1=10000 which means 1"=10000".**

DEP 21. *Without a proper scale it cannot be determined the approximate dimensions of the proposed lakes. Based on relative distances it appears that the perimeter berms around ponds 16 and 18 could be subject to overtopping as a result of wave run up. A wave run up analysis should be performed as a minimum for these two water bodies. In* *performing this analysis the effects of surge from the wind action should be included. The acres of each water body should be provided on the plan view drawings.*

Response: **Please see revised Sheet S4 of Attachment 5, Engineering Drawings for the area of each of the proposed lakes. The maximum operating level for Pond 16 is 6 feet, NGVD. The maximum operating level for Pond 18 is 8 feet, NGVD. The top of berm elevation is 19 feet, NGVD. The computed wave runup for a 110 mph wind on Pond 16 is 6.9 feet, which is well below the available freeboard of 13 feet. The computed wave runup for a 110 mph wind on Pond 18 is 6.48 feet, which is well below the available freeboard of 11 feet.**

Hydrogeologic Comments

DEP 22. ***Response #15 (DEP):*** *Paragraph 3 of this response noted "Seepage from the pits will disperse into the groundwater downgradient from the pits potentially increasing the sulfate concentrations in the uppermost portion of the aquifer west of the proposed mining. Recharge to the aquifer beyond the mine pits will act to lower sulfate concentrations within the upper portion of the aquifer with distance from the mine pits." Paragraph 1 of this response noted "...Sulfate concentrations in the Floridan aquifer beneath the Mine Parcel vary from about 20 mg/L at the surface to approximately the equilibrium concentration of dissolved gypsum or anhydrite (SO_4 = 1300 mg/L) at a depth of 145 feet. The concentration remains at or above 1300 mg/L to the base of the aquifer at a depth of approximately 700 feet, where the water is expected to become saline." Paragraph 2 of this response noted "...The sulfate concentrations in the ponds and pits are expected to increase to between 300 mg/L and 700 mg/L." Table 4 (Summary of Water Quality Analyses) verified sulfate concentrations ranged from 8.3-150 mg/L in the upper 20 feet of the aquifer. Table 4 verified sulfate concentrations ranged from 1100-1200 mg/L at the depths of 140-150 feet below land surface. Table 4 verified sulfate concentrations ranged from 1000-1800 mg/L at depths greater than 278 feet below land surface. Please provide a groundwater mixing or solute transport modeling which demonstrates ambient groundwater quality (sulfate concentrations) outside the "zone of discharge" will not be significantly altered by the proposed mining.*

Response: **Sulfate is known to occur naturally in the upper part of the Floridan aquifer throughout Levy, Citrus, Sumter and Marion counties without adverse environmental effects at concentrations in excess of the secondary drinking water standard (Sacks & Tihansky, 1996[3], Shampine, 1965[4]). EPA estimates that**

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[3] Sacks, L.A., and Tihansky, A.B., 1996, Geochemical and Isotopic Composition of Ground Water, with Emphasis on Sources of Sulfate, in the Upper Floridan Aquifer and Intermediate Aquifer System in Southwest Florida: U.S. Geological Survey Water-Resources Investigations Report 96-4146, 67 p.

[4] Shampine, W.J., 1965, "Sulfate Concentration in Water from the Upper Part of the Floridan Aquifer in Florida", United States Geological Survey in cooperation with the Bureau of Geology, Florida Department of Natural Resources

over 3% of public drinking water systems in the U.S. have sulfate concentrations above the 250 mg/l secondary drinking water standard (SMCL). Recent EPA studies have indicated that there are no known adverse health effects from drinking water with elevated levels of sulfate (up to 1,200 mg/l)[5]. The SMCL for sulfate was established for aesthetic reasons (i.e., taste, excessive hardness, boiler and pipe scaling, etc.).

Natural background concentrations of sulfate in the Floridan aquifer beneath the proposed mine area vary from 20 mg/l near the ground surface to 1,300 mg/l at a depth of about 145 feet. The increase in sulfate concentrations with depth results from the dissolution of naturally occurring evaporate minerals, e.g., gypsum or anhydrite, inter-bedded with the limestone deposits in the lower Floridan aquifer, primarily the Lake City Limestone, as described by Sacks & Tihansky (1996)[6].

Average sulfate concentration in the surface water present in the tailing ponds and open mine pits is expected to increase above ambient concentrations in the surrounding shallow (< 100 feet) groundwater due to dissolution of gypsum nodules during crushing and washing of the Avon Park Limestone and due to upward seepage of mineralized water from deeper portion of the aquifer (>100 feet) into the active mine pit. The sulfate concentrations in the ponds and pits is expected to increase to between 300 and 700 mg/l (best estimate about 350 mg/l). The calculations used to estimate the increase in sulfate concentration are provided Table 4.

Seepage from the pits will disperse into the groundwater downgradient from the pits potentially increasing the sulfate concentrations in the uppermost portion of the aquifer west of the proposed mining. Groundwater on the mine site flows from east to west toward Withlacoochee Bay. There are no known permitted or proposed drinking water wells located downgradient from the proposed mine pits that could be affected by any increase in sulfate concentrations.

The depth to which sulfates seeping out of the pits can influence water quality in the shallow Floridan aquifer at the site can be estimated using a simple groundwater mixing model as described below. Attachment 7 illustrates the typical path of flow lines at the King Road mine based on the predominant boundary conditions at the site. As shown, groundwater on the mine site flows from east to west toward Withlacoochee Bay. Recharge water comes from rainfall

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[5] U.S. Environmental Protection Agency, 1999, Heath effects from exposure to high levels of sulfate in drinking water workshop. Washington, DC, US Environmental Protection Agency, Office of Water, EPA 815-R-99-002

[6] Sacks, L.A., and Tihansky, A.B., 1996, Geochemical and Isotopic Composition of Ground Water, with Emphasis on Sources of Sulfate, in the Upper Floridan Aquifer and Intermediate Aquifer System in Southwest Florida: U.S. Geological Survey Water-Resources Investigations Report 96-4146, 67 p.

precipitation. The magnitude of the recharge and hydrogeological properties of the aquifer determine the flow paths followed by the groundwater but, in general, the water enters the ground at the recharge points and travels through the aquifer at various depths depending on the distance between the recharge point and the main outflow location along the Gulf coastline.

According to Darcy's law the flow through a saturated porous medium may be expressed as:

$$Q = k \cdot i \cdot A$$

Where:

Q= flow rate
i= hydraulic gradient
k= hydraulic conductivity
A = flow area

The flow rate at a given location is the product of the recharge rate times the surface area (or the length, L, if calculated per unit width) over which the recharge occurs upgradient of the given location. As depicted in Attachment 7, the net average recharge near the westernmost pit in the 10-yr plan is estimated to be between 4 and 8 inches per year. The hydraulic gradient from the potentiometric lines is calculated to be about 4 ft per mile. The flow area, A, is the product of the depth of flow at the selected location and the width (which may be taken as 1ft). The hydraulic conductivity varies throughout the site (increasing towards the coastline) but is close to 70 ft/d near the westernmost pit shown in the figure.

To make an estimate of the depth above which there would be little or no increase in sulfate concentration resulting from pit seepage, the Darcy equation can be rewritten so that (see also the figure in Attachment 7):

$$d = \frac{R \cdot L}{k \cdot i}$$

Where R is the recharge rate, L is the distance from the pit edge and d is the depth of the flow channel in which there is little or no increase in sulfate concentration.

For a distance, L, of about 5,000 ft between the active pit and the property boundary on the west side, the depth, d, would be between about 80 ft and 160 ft, for recharge rates of 4 to 8 inches per year. Water flowing above this depth is unlikely to be impacted by the elevated sulfate concentrations in the water seeping out of the pit. However, and as mentioned before, the sulfate

concentration in the aquifer increases naturally to about 1,300 mg/l at a depth close to 145 ft and, therefore, any groundwater flowing close to this depth will have a natural sulfate concentration caused by the dissolution of the gypsum or anhydrite present in the deeper portions of the aquifer.

Most domestic and public supply wells near the King Road mine are installed to a depth of no more than about 50 feet. Using the same mixing model described above, a well at this depth would have to be installed within a distance, L, from the mine pit of 1,500 ft to 3,000 ft to see any increase in sulfate concentration as a direct result of the water seeping from the active Quarry. Wells installed to depths less than 50 feet at distances greater than 1,500 ft to 3,000 ft from the mine pit will not encounter water with increased sulfate concentrations caused by seepage from the mine pit, i.e., ambient groundwater is not expected to be adversely impacted outside the zone of discharge.

As described in the Groundwater Monitoring Plan, Tarmac is proposing to monitor the concentrations of sulfates in surface water bodies, in the groundwater within the zone of discharge, and at the property boundary, and in the unlikely event that a potable well on a neighboring property is impacted by the mining operations, it will be fitted with an appropriate treatment system to reduce sulfate concentrations to below the SMCL.

DEP 23. *Paragraph 5 of this response noted "Concentrations of sulfates in Withlacoochee Bay exceed 1,200 mg/L. The concentration of sulfate in saltwater in the Gulf of Mexico is in excess of 2500 mg/L." Please provide a copy of the source materials for these statements, for verification purposes.*

Response: **The concentration of sulfate in seawater (Salinity = 35‰) is 2,712 mg/l (Stumm and Morgan (1981))[7]. The sulfate concentration in Withlacoochee and Waccasassa Bay is lower than that in sea water as a result of dilution from fresh water input from the Withlacoochee and Waccasassa River. Assuming negligible sulfate in the freshwater input from the two Rivers, the sulfate concentration in Waccasassa Bay can be computed from the measured salinity based on the sulfate:salinity ratio for seawater, i.e., 2.7:35. Salinity measurements made by Todd Kincaid and reported in the HH Associates, LLC, report entitled "Survey of Groundwater Discharges in the Waccasassa Bay Area between Dowry Creek and Beetree Slough," dated February 5, 2009 and submitted to FDEP with the 1st RAI range from 20.3‰ to 29‰ and average 27.5‰. The average existing sulfate concentration in Withlacoochee Bay computed from the average measured salinity is 2,130 mg/l.**

[7] Stumm, W., and J. J. Morgan (1970) *Aquatic Chemistry,* John Wiley & Sons, New York.

DEP 24. *Paragraph 6 of this response noted "…Tarmac has proposed a groundwater monitoring plan to monitor the concentrations of sulfates in surface waterbodies, in the groundwater within the zone of discharge, and at the property boundary. Please provide a copy of this groundwater monitoring plan OR provide the exact reference, in regard to monitoring stations' locations and/or depths, as well as all water quality parameters being monitored.*

Response: A copy of the Groundwater Monitoring Plan is included as Attachment 6 of this submittal.

DEP 25. ***Response #1 (TSS):*** *The referenced Exhibit 3 (Stormwater Calculations) was not P.E.-certified (signed, dated & sealed). Please provide.*

Response: Signed/sealed stormwater calculations are provided as Item 3 of the Supplemental Information Package.

DEP 26. ***Response #7 (DRP):*** *The referenced Exhibit 5 (H2H Associates Response #7) was not P.G./P.E.-certified on its Title Page. Please provide.*

Response: H2H Associates certified FDEP Response report is provided as Item 4 of the Supplemental Information Package.

DEP 27. ***Response #8d (DRP):*** *The referenced Table 4 (Summary of Water Quality Analyses) indicated sampled pH values ranged from 6.5-7.95 on the proposed minesite. As shellfish (oysters and clams) have a narrow range of pH tolerances, the applicant may wish to include pH as a groundwater quality value to be calculated in the previously-requested groundwater mixing or solute transport modeling (Hydro Question #2).*

Response: The pH of the groundwater in a calcium carbonate groundwater system, like the shallow Floridan aquifer at the site, is primarily a function of the partial pressure of CO_2 and the concentration of calcium in the groundwater (See, for example Freeze & Cherry (1979))[8]. The groundwater in the Floridan aquifer below a depth of 145 feet is in equilibrium with both calcite and gypsum. Neither the partial pressure of CO_2 nor the concentration of calcium below this depth is expected to change as a result of mining. In the upper part of the aquifer where recharge is occurring, the partial pressure of CO_2 is decreasing, the concentration of calcium is increasing as a result of dissolution of calcite, and the pH is increasing. The pH of the groundwater in this zone during mining and reclamation at the King Road mine will be the same as the pH of the groundwater within this zone under

[8] Freeze, R. Allan and John A. Cherry (1979) *Groundwater,* Prentice-Hall, Inc. Englewood Cliffs, N.J.

existing conditions, i.e., increasing from approximately 5.5 in the rainfall to approximately 6.8 in the groundwater. The pH in the zone of mixing between the upper and lower portions of the aquifer is expected to be between 6.8 and 7.0.

The pH of the water in the Bay is also a function of the partial pressure of CO_2 and the concentration of calcium and other cations and anions in the seawater in the Bay. It is also affected by coastal plankton blooms and other biological activity. The contribution of the calcium and CO_2 in the groundwater outflow from the King Road mine site to the coastal system is too small to have a significant effect on the pH of the seawater in the Bay. The CO_2 in surface water is controlled more by atmospheric CO_2 and biological activity than from the small amount of CO_2 in groundwater seepage from a calcium carbonate system. The calcium concentration in sea water, at about 400 mg/l, is typically at equilibrium with the mineral calcite, which is more soluble in sea water because of the increased salinity (activity). The groundwater entering Waccasassa and Withlacoochee Bay is somewhat enriched with calcium because of the higher natural sulfate concentration in the groundwater discharge along this area of the coast. Therefore, it was unnecessary to include pH in the transport modeling.

DEP 28. ***Response #17 (DRP):*** *The referenced Exhibit 5 (H2H Associates Response #17) was not P.G./P.E.-certified on its Title Page. Please provide.*

Response: H2H Associates certified FDEP Response report is provided as Item 4 of the Supplemental Information Package.

DEP 29. ***Response #5 (SAP):*** *The referenced Exhibit 5 (H2H Associates Response #17) was not P.G./P.E.-certified on its Title Page. Please provide.*

Response: H2H Associates certified FDEP Response report is provided as Item 4 of the Supplemental Information Package.

DEP 30. *Appendix II (Field Data Table) in Exhibit 6 (Survey of Groundwater Discharges in Waccasassa Bay Area between Dowry Creek & Beetree Slough by H2H Associates) indicated sampled salinity values ranged from 14-29 0/00 in nearby estuary waters. As shellfish (oysters and clams) have a moderate range of salinity tolerances, the applicant may wish to include salinity as a groundwater quality value to be calculated in the previously-requested groundwater mixing or solute transport modeling (Hydro Question #2).*

Response: The salinity of the groundwater in the zone of recharge will remain at approximately 0.45‰. The salinity of the groundwater in the zone in equilibrium

with gypsum will remain at approximately 2.2‰. The salinity at the interface of the tow zones will vary between 0.45‰ and 2.2‰.

The salinity in the groundwater beneath the King Road mine site will have no measurable effect on the salinity in Withlacoochee or Waccasassa Bay because the contribution of groundwater outflow to the Bay is very small relative to the contributions of the Withlacoochee and Waccasassa Rivers and the salinity of the groundwater when it enters the Bay during and after mining will be essentially identical to the salinity of the water currently entering the Bay. The average groundwater outflow from the 4,800-acre mine site is estimated at less than 3 cfs. The average flow of the Withlacoochee River is approximately 450 cfs. The average flow of the Waccasassa River is approximately 265 cfs. Tidal flow is larger than the surface water outflow from both Rivers combined. Therefore, it was unnecessary to include salinity in the transport modeling.

DEP 31. ***Response #9 (SAP):*** *A baseline sediment evaluation should be conducted in adjacent coastal waters, tidal marshes or estuary waters receiving the major stormwater contributions from the upgradient minesite, especially in regard to existing sulfide concentrations. As shellfish (oysters and clams) have a very narrow range of sulfide tolerances, the applicant may be required to conduct periodic sediment evaluations at one or more estuary locations to assure no significant offsite water quality impacts are occurring due to mining.*

Response: There will be no surface water discharge from the active portions of the King Road mine site. Consequently, there will be no changes in the water quality of the stormwater flowing from and through the property. Therefore the proposed project will not affect sediments in coastal waters, marshes or estuaries. Accordingly, it is thus unnecessary for Tarmac to perform sediment evaluations in adjacent coastal waters, tidal marshes and estuaries receiving stormwater contributions from the mine site as there is no reason to believe mining will impact the sediments in these areas.

DEP 32. *The referenced Exhibit 6 (Survey of Groundwater Discharges in Waccasassa Bay Area between Dowry Creek & Beetree Slough by H2H Associates) was not P.G./P.E.-certified on its Title Page. Please provide.*

Response: H2H Associates springs report is provided as Item 5 of the Supplemental Information Package.

Project Manager's Comments:

DEP 33. *Financial Assurance documentation must be included for all mitigation activities. This documentation must meet the SWFWMD BOR requirements. Financial assurance third party documentation must be reviewed and approved before issuance of a permit. Financial mechanism must be chosen and executed, along with a standby trust, before issuance of a permit.*

Response: **Tarmac expects to utilize a Performance Bond meeting the requirements of the wetland mitigation costs provided as Attachment 2 of this submittal.**

DEP 34. *Reclamation on the mine site must meet the requirements of 62C-36 FAC such as proper slopes to an appropriate depth on all post reclamation drawings. This also includes the submittal of a Conceptual Reclamation Plan (CRP) and approval of said plan before any mining activities can commence. The CRP is normally based on the approved ERP drawings and as such is not submitted until after the intent to issue has been noticed and the 21 day comment period has elapsed with no call for an administrative hearing. These drawings do not need to be signed and sealed.*

Response: **Comment noted.**

DEP 35. *Although the Division of Historical Resources (DHR) concurred with PCI's recommendation on the mine site, DHR expressed concern about the stated lack of local informants since the area had been managed by the FFWCC since 1948 and they question that the FFWCC field staff could not provide pertinent field data. Please respond to this concern.*

Response: **The Florida Fish and Wildlife Conservation Commission (FFWCC) is an agency responsible for governing state wildlife resources, not historic and archeological resources and as such, should not be expected to provide pertinent field data.**

Professional archeologists from Pan American Consultants, Inc (PCI) surveyed the Mine Parcel and found no significant historic or archeological resources onsite. Paul Jones, registered professional archeologist, participated in the PCI survey and has been conducting archeological research in the Gulf Hammock region through State grants since the 1980s. During that time, he conducted both archeological surveys and personal interviews of landowners and found that archeological and historical resources are limited in that area of the state to areas immediately adjacent to the coast or rivers, or environmental settings similar to upland areas with well drained soils and access to fresh water.

DEP 36. *The applicant still has not supplied an archeological field study of the mitigation area to the department and DHR for review. Please provide.*

Response: **Florida History's June 2008 "Cultural Resource Management Plan for the Tarmac Mine Mitigation Area" report and DHR's August 20, 2009 response letter are provided as Attachment 8.**

DEP 37. *Any and all Conservation Easements (CEs) or fee simple transfers associated with this project must be completed, approved and recorded, with the appropriate county, before the issuance of this permit.*

Response: **Prior to the initiation of mining (but not before issuance of the permit), and within 6 months of receipt of all necessary local, state and federal construction permits and authorizations for all of the impacts and the full life of mine duration identified in the ERP permit application, and prior to any wetland construction occurring, the applicant will secure and convey a sufficient interest in the mitigation property to the State of Florida.**

DEP 38. *The review of the UMAM maps for both the mine site and mitigation area has revealed a number of discrepancies, errors and oversights. Examples include roads classified as streams, forest regeneration areas with existing trees, superfluous lines separating like polygons and misidentified forest types on the mitigation site. Please clarify and rectify.*

Response: **ENTRIX has carefully reviewed the applicable maps and has revised the apparent discrepancies. ENTRIX continues to coordinate with DEP regarding the UMAM maps and definitions of community designations. The road classified as a stream was a database error that has been corrected. Forest regeneration areas frequently have some mature trees remaining but were classified as regeneration communities because the majority of the area has been cleared. In some cases, like polygons must be separated for GIS data management reasons. For example, areas that appear to be the same in their current condition may have differing proposed future conditions and must be maintained as individual polygons.**

II. RESPONSES TO DIVISION OF RECREATION AND PARKS' REQUEST FOR ADDITIONAL INFORMATION OF SEPTEMBER 17, 2009

DRP 1. *Some of the implications of altering natural hydroperiods within Waccasassa Bay Preserve remain unaddressed, specifically in regards to possible impacts on native species, natural communities and ecosystems. It would be helpful if the applicant would provide additional documentation or analysis of how mining-caused alterations of natural hydroperiods just outside the preserve might affect natural communities within the preserve. The applicant should also address potential cumulative impacts from other projects, both existing and proposed, which are located near the proposed TKR Mine.*

Response: **There will be no mining-related alterations to natural hydroperiods outside the preserve, therefore, no additional documentation or analysis is required. All of Tarmac's proposed mitigation is within the same drainage basin as the proposed impacts. Therefore, pursuant to state law (in particular, section 373.414(8)(b), F.S., SWFWMD BOR § 3.2.8, and the Second District Court of Appeal's decision in Peace River/Manasota Regional Water Supply Authority v. IMC Phosphates Company, 2009 WL 331660, at *6-*7, 34 Fla. L. Weekly D348 (Fla. 2d DCA 2009)), no further cumulative impacts analysis considering other existing or proposed projects is necessary.**

DRP 1a. *Page 15 of Document A....states, "Deviations from those conditions, such as the probable NE-SW low permeability ridge indicated by the groundwater mound in the potentiometric surface maps (Figures 3-9), will distort that conical shape by extending it in the direction of higher permeability and contracting it in regions of lower permeability." That statement confirms that the drawdown associated with the mine will not be a "cone" of depression characteristic of homogeneous, isotropic aquifers. Instead, the drawdown will be concentrated in secondary flow-paths in the matrix of the aquifer system, including fractures and dissolution channels. Additional information is needed to show how the locations of those secondary flow-paths will be identified and how this concentrated drawdown will affect the natural hydroperiod in vicinity of the proposed mine.*

Response: **First, the available data do not indicate the presence of any significant preferential flow paths (high permeability zones). Therefore, no additional information is needed in this regard. Further, the current model accounts for the increase in hydraulic conductivity (transmissivity) from east to west across the model area and the variability in the hydraulic conductivity in the north-south direction. Although the drawdown from the withdrawal at the King Road mine is centered on the plant pond, the predicted drawdown contours correctly reflect the spatial variability of the hydraulic conductivity (transmissivity) described above.**

DRP 1b. *The United States Geological Survey (USGS) Open-File Report 2007- 13 11 entitled, Temperature Anomalies in the Lower Suwannee River and Tidal Creeks, Florida, 2005, used thermal infrared imagery (TIR) to demonstrate how this part of the Gulf-Coast receives groundwater discharge from a wide array of karst features that are not confined to flowing stream channels. This report also shows that wetlands, hammocks and specific species of plants are associated with those discharge points. At a minimum, comparable data are essential to evaluate the potential impacts of the proposed TKR Mine. Fortunately, a similar study has already been funded (in 2008) under the Department of Environmental Protection's Springs Initiative program (Ellen Raabe, unpublished data). The results of this TIR study are necessary to achieve a more thorough evaluation of existing conditions and to determine possible cumulative impacts of the proposed project on the natural hydroperiod in the project vicinity, but they are not available yet (Ellen Raabe, personal communication). However, these results should be available by the time the U.S. Army Corps of Engineers' (ACOE) draft Environmental Impact Statement (EIS) for the proposed mine is released for public comment.*

Response: **Raabe's thermal anomaly study revealed numerous regions in the coastal zone with high temperature anomalies in winter. However, as she pointed out, those anomalies could be caused by day-time warming of shallow tidal water bodies as well, not necessarily by groundwater discharge. Her identification of groundwater discharges relied on field verification of the thermal anomalies. In contrast, our field work in the Waccasassa Bay area did not reveal any large springs, but we did observe numerous shallow tidal ponds that will likely yield high daytime temperatures and account for any anomalies in the Raabe thermal survey. As noted above, a cumulative impacts analysis is unnecessary.**

DRP 1c. *Top of page 16 of Document A...states, "...because the magnitude of the depression is small." Small is a relative term. Park managers can expect a predicted drawdown in groundwater levels of up to 0.5 R (6") at a distance of only two miles from the mine boundaries (Document A, Page 15). The fact that a topographic difference of only 0.2-0.3 ft. in coastal lowlands can mean the difference between salt marsh and coastal forest (i.e. hydric hammock) implies that a 0.5 ft. (6") drawdown will cause significant environmental impacts to natural communities in Waccasassa Bay Preserve. Please submit peer-reviewed scientific publications or other scientific support to document the implications for native species, habitats, natural communities and ecosystems if the proposed alterations of groundwater level and associated natural hydroperiod do occur at the proposed TKR mining site.*

Response: **The drawdown estimates reported by Kincaid in Document A are conservative, meaning they represent the likely maximum possible drawdown under a worst-case scenario. Even assuming these conservative drawdown estimates, the gradient will still flow from the proposed mine to the Gulf of Mexico. Moreover, the reduction in groundwater levels of 0.07 to 0.5 feet two miles from the**

proposed mine should not adversely impact vegetation and has no relationship to the surface topographic differences mentioned in the question.

For the Theis analysis Kincaid performed, the worst case scenario is one in which the transmissivity of the aquifer is the lowest value of the range tested, i.e. 87,500 ft3/day/ft (see Appendix I, page 3 of Document A). The effective groundwater withdrawal is the highest value of the range tested, 812 gallons per minute (gpm), calculated using 727 gpm as the predicted rock removal and adding 85 gpm for direct consumption (see Appendix I-page 3 of Document A).

DRP 1d. *Williams et al., 1999, published an account of the role of tidal flooding in coastal forest morbidity in the Waccasassa Bay/Turtle Creek area. A leading mortality factor was the increased frequency of tidal flooding. It is logical to expect there would be an even higher frequency and height of tidal flow converging on the wetlands and coastal forest that adjoin the western boundaries of the mining operation, based on the predicted 0.5 ft. (6") drawdown and that "... further demand for water will be supplied by drainage from the bay..." Any further increase in the extent or height of tidal flow could exceed the salinity tolerance threshold for hammocks, coastal forest, and oligohaline marshes in the area. Please provide supporting documentation to show that this increased tidal flow would not occur.*

Response: There is not a significant likelihood of increased tidal flow, due to the relatively steep hydraulic gradient between the quarry and the coast. Kincaid's analysis indicated that in a worst case scenario, drawdown in the aquifer associated with the construction of the quarry could be as much as 0.5 feet two miles from the quarry. The potentiometric surface maps indicate that current groundwater levels in the region about two miles down gradient from the quarry are approximately two to four feet. Predicted tide at the Withlacoochee River reveals a maximum tide of approximately four feet above mean low water. It is therefore highly unlikely that at any point other than a worst-case scenario at the highest tides would there be a landward hydraulic gradient between the bay and the inland forests. As noted above, the worst-case scenario is unlikely. Because this documentation, which has already been provided, sufficiently addressed these concerns, no more documentation is necessary.

DRP 2. *There are still unanswered questions about the possible impacts of the TKR Mine on Waccasassa Bay Preserve since the applicant's most recent environmental impact assessment occurred during drought conditions. For example, what is the susceptibility of Waccasassa Bay Preserve State Park and state resources in Waccasassa Bay to increased contamination of surface and ground water from salt-water intrusion, groundwater mineralization and aerial deposition from salt spray? Using data gathered during drought conditions as a stand-alone ecosystem/natural community assessment* *for predicting impacts of the TKR mine is impractical and does not follow sound scientific logic.*

Response: **First, it is unnecessary to evaluate the potential impacts from aerial deposition of salt spray emissions on the Waccasassa Bay Preserve State Park or other state resources in Waccasassa Bay. Aerial deposition resulting from mine operations is not reasonably likely given the proposed operations to be conducted on site. Furthermore, aerial deposition of saline plumes or other air emissions is not legally relevant to an ERP. See, e.g., In re Florida Power and Light Company, Manatee Orimulsion Project, 21 F.A.L.R. 2569, 2587-88 (Siting Board 1998) (holding, with emphasis added, that held that "[t]he cumulative impacts doctrine ..., as with the secondary impacts doctrine, does not extend beyond the subject of dredge and fill permitting to point source discharges of wastewater, let alone indirect water pollution discharges from air emissions"); see also Florida Chapter of the Sierra Club and Save Our Suwannee, Inc. v. Suwannee American Cement Company, Inc. and Department of Environmental Protection, DOAH Case No. 99-3096, Final Order, ER F.A.L.R. 00:154, ¶ 4, at 7 (concurring with the ALJ's conclusions that "emissions of mercury from the Plant into the air do not constitute "discharges" into the waters of the [state]," and specifically rejecting the petitioners' "indirect discharge" rationale).**

Second, groundwater mineralization or saltwater intrusion due to mine operations is also unlikely because mining will not reduce groundwater outflow from the property or lower the groundwater levels near the westernmost property boundary.

Third, the intent of the H2H study was to assess the karstic groundwater component of flow to the Bay (spring flow), which is best characterized during dry or "baseflow" conditions when surface water flows are minimized and groundwater is the primary component of flow. Any potential impacts of the proposed mine to groundwater levels will be most evident during dry periods, when the only freshwater flow to the Bay is groundwater. The H2H study did not reveal any significant karstic groundwater discharge to the bay. On the contrary, the results and observations indicate that the karstic features down-gradient of the proposed mine have been filled with clay and mud and are thus now contributing to a reduction in aquifer permeability in the area rather than an increase. These conditions have reduced the permeability in the upper part of the aquifer causing an increase in the relative contribution of surface water flow to the Bay at the expense of the groundwater component. The predicted inland reductions in the water table elevation should not therefore significantly impact the total freshwater flow to the Bay.

Fourth, continuous water level data within and adjacent to the King Road mine have been collected from April 2006 to the present. The measured groundwater

levels have varied from at or above ground surface elevations to approximately six feet below the ground surface elevations. These data reflect a range in hydrological conditions, from wet to dry. The hydrological modeling was performed using daily rainfall over a ten-year period that included both dry and wet conditions. The conclusions reached concerning potential impacts considered the entire range of hydrological conditions, not just drought conditions. Accordingly, our assessment is logically and scientifically sound and further analysis is not required.

DRP 2a. *Table 1 from Document A includes midmax rainfall information but does not discuss where the current year's or the last few years' data fall within the range of rainfall data. Please provide that information.*

Response: Table 1 of Document A reported 49.76 inches at Rosewood Tower and 53.31 inches at Goethe Forest. The average from Table 1 is 52.03 inches. The overall average annual rainfall for Levy County as reported by SWFWMD was 46.93 inches in 2006, 49.48 inches in 2007, and 56.25 inches in 2008. The information from Table 1 of Document A is therefore consistent with these county-wide data.

DRP 2b. *DRP does not consider it reasonable to assume that higher-salinity measurements obtained during a prolonged drought in a coastal karst system indicate that little or no karst flow occurs, and that consequently, few or no cumulative impacts to water quality or quantity would result from the proposed TKR mining activity. Please address this issue now, or indicate whether you would prefer to wait until the results of the ongoing USGS TIR study are available for review.*

Response: Please see our response to 2, above. Any significant groundwater flow to the bay should result in depressed salinities in the streams to which the discharge occurs under low flow conditions, which are commonly regarded as baseflow conditions where groundwater is the only component of flow. If flow only occurs under rainy or high water conditions it is likely attributable to local rainfall, not groundwater discharge. Therefore, the higher salinity measurements are not indicative of prolonged drought, but rather reflect the normal salinity regime for a system that receives very little groundwater discharge. As noted above, a cumulative impact analysis is not required, nor is the applicant required to wait on a pending draft study.

DRP 2b(i). *Surface tidal flow may play a role in the increased salinities. High salinities inland during a drought can also indicate karst flow - in this case landward – through dissolution channels toward inland exit points.*

Response: **Please see our response to DRP 2, above. No data or observations in the field suggest that salt water is being transported inland through karst conduits. On the contrary, all of the karst features observed were filled with clay or mud, which are more likely impediments to flow rather than avenues for flow (Document A – H2H Associates, 2009). The high salinities observed were likely caused by evaporation and reduced circulation with the outer bay water which had lower salinity than the nearshore waters.**

DRP 2c. *We request a thorough assessment of the current degree of salt-water intrusion in the region, and an estimate of any additional saltwater intrusion that may be expected to derive from the proposed TKR mining activity.*

Response: **There is no regional salt water intrusion north of the Withlacoochee River. The modeling shows that the depth to the salt water interface at the western mine boundary is greater than 500 feet and is likely to be greater than 700 feet. Mining and reclamation will not result in an inward movement of the salt water interface. Field observations are consistent with the modeling. Therefore, no additional assessment is necessary.**

DRP 2d. *What measures or monitoring does the applicant have in place to show that tidal intrusion has not already occurred, or currently occurs, or may occur in the future because of existing mining operations or similar activities in the vicinity?*

Response: **Tarmac's monitoring well data does not indicate any tidal influence. Unlike wells in known karst areas such as the Woodville Karst Plain, groundwater levels recorded in the monitoring wells do not display a tidal signal. Please see figures 10-12 of Document A.**

DRP 2e. *H2H Associates (Document A) may have posed a circular argument and made a potentially inaccurate assumption in the following statement ... Because of "...the lack of observable freshwater flow ... during dry periods" the assumption generated is "...the ecosystem in the bay ... is not dependent on freshwater discharge". It is a well established fact that coastal ecosystems in Florida are adapted to and dependent on natural pulses of freshwater that increase during the rainy season. Please provide the peer-reviewed scientific publications or other documentation that support the referenced statement that the ecosystem in the bay is not dependent on freshwater discharge.*

i. Note that the conditions referenced in the statement above may simply represent a period of extreme low flow to the ecosystem due to limited regional regional precipitation.

Response: **Kincaid did not observe any significant groundwater discharge in the nearshore waters. Moreover, field observations indicated that the region is characterized by**

very low aquifer permeability and very little coastal discharge. The references cited in Kincaid's report indicated that the biota in the region is characteristic of a salt marsh. Kincaid contrasted these observations with ones made in the Woodville Karst Plain, where observable persistent groundwater flow has given rise to freshwater biota. Please note also that modeling reflects a 10-year rainfall record. These observations and documentation support the referenced statement.

DRP 2f. *Drawdowns associated with the proposed TKR Mine and with other groundwater alterations in the region, i.e. the recently proposed nuclear facility (NF) to be located east of this mine, may cause or exacerbate contamination of surface water and groundwater in Waccasassa Bay Preserve. Please provide evidence that drawdowns (individual or cumulative) will not increase the effects of: 1) salt-water intrusion; 2) groundwater mineralization from underlying aquifer zones and 3) aerial deposition and saline plumes expected to originate from the NF cooling tower salt-spray.*

Response: **Drawdown from mining will not result in salt-water intrusion (please see response to DRP 3, below) or mineralization of the surface water/surficial groundwater regime in the Waccasassa Bay preserve (please see response to DRP 2, above). Any potential upward movement of the salt water interface beneath the King Road Mine site as a result of groundwater withdrawals during mining would occur below a depth of 500 feet. There will be no effect from this potential up-coning beneath the mine site in the Waccasassa Bay Preserve.**

With respect to determining possible cumulative impacts on the natural hydroperiod in the vicinity, as indicated earlier, all of Tarmac's proposed mitigation is within the same drainage basin as the proposed impacts. Therefore, pursuant to state law, no further cumulative impacts analysis considering other existing or proposed projects is necessary. Please see also response to DRP 1, above.

DRP 2g. *Please provide details describing how the applicant would reverse any impacts to Waccasassa Bay Preserve that may result from the proposed mining activities and from cumulative groundwater alterations as described above.*

Response: **The applicant has provided reasonable assurances that unmitigated adverse impacts resulting from mining operations will not occur. Further, proposed monitoring will further protect against adverse impacts. The "reversal" of existing cumulative impacts is not required by the applicable statutes or rules.**

DRP 3. *Key hydrological questions remain unanswered about the potential implications for Waccasassa Bay Preserve (and other state resources) of further flow reduction during droughts or periods of already low flow.*

a. We do not believe the applicant has adequately addressed the possibility of a hydrological scenario in which increased recharge occurs during wet conditions (as suggested in Document C) and decreased recharge occurs during dry conditions. This scenario bears a strong resemblance to the conditions that have led to the demise of wetland systems in the Florida Everglades. Specifically, during drought periods, this scenario would result in reductions in the surficial aquifer and subsequent increases in salt-water intrusion and related problems as described above. Given the conditions of the current drought in the coastal lowlands of the Waccasassa region, this scenario could lead to negative impacts on the resources of Waccasassa Bay Preserve. Please provide peer-reviewed scientific publications or other documentation in support of your apparent position that the problems as described above do not apply to the Waccasassa region.

Response: **There is no surface runoff from the King Road mine site under existing conditions during periods of little or no rainfall. The water table drops by as much as 6 feet under most of the property and by as much as 4 feet beneath the stream channels that pass through the property. Consequently, mining and reclamation will not have an effect on streamflow during dry periods. During rainy periods, after the water table rises to the ground surface, surface runoff occurs on the property and groundwater outflow occurs to the stream channels.**

Approximately half of the proposed mine pits will be reclaimed as lakes and half will be reclaimed as uplands. The lakes will be surrounded by perimeter berms to prevent tidal water from entering the lakes during hurricanes. There will be no runoff from the lakes. Discharge from the lakes will occur as groundwater outflow to adjacent streams or to the Bay. The uplands will be reclaimed to perform hydraulically the same as the existing uplands with surface runoff and groundwater outflow simulating existing conditions. Any change in surface water runoff will occur during wet periods only.

As demonstrated by the Ardaman Transient Analyses, groundwater outflow from the mine site (recharge) is not expected to change relative to existing conditions either during wet or dry periods. Groundwater levels along the western boundary of the site after mining and reclamation are expected to be slightly above existing groundwater levels for 90% of the time. Only during very wet conditions when the groundwater level is at or near ground surface elevations will the post reclamation water level in the westernmost lakes be lower than pre-mining conditions. Water outside the pits will still be at or near ground surface elevation. Groundwater outflow is currently greater during wet weather periods than dry weather periods. This will not change as a result of mining and reclamation.

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Consequently, salt water intrusion, which is related to long-term average groundwater outflow, will not change as a result of the project.

DRP 3b. *What evidence does the applicant have to show that surface water flow, a source of freshening for coastal forest and marsh, will continue uninterrupted at the same current rates from the TKR Mine site and across Waccasassa Bay Preserve during, and subsequent to, the extraction process?*

Response: The evidence is the modeling information and other data submitted in the application, reports, and responses to RAIs, including this one.

Because approximately half of the mined area will be reclaimed as lakes, evapotranspiration from the King Road mine site will be higher post reclamation than prior to mining. However, groundwater outflow after reclamation will remain essentially the same as prior to mining. Consequently, surface water runoff from the property after reclamation will be lower than prior to mining. Runoff from the property occurs only during the rainy season after the water table is at or near ground surface. Peak flows in the streams leaving the property will be lower after mining and reclamation than currently. The decreased peak flows will not affect the water levels in the coastal forests and marshes during the rainy season because these areas will be inundated during these periods and will be contributing to the peak flows in the surface streams. The only effect will be to reduce the total amount of freshwater entering Withlacoochee Bay. The average discharge to Withlacoochee Bay under current conditions is greater than 450 ft3/sec. The expected decrease in surface water runoff from the King Road mine after approximately 100 years of mining and reclamation will reduce this volume by less than 0.5%.

DRP 3c. *Page 11 of Document A "... no discharge comparable to Big and Little Springs" is the extent of the evaluation of spring discharge in the area - in other words, the presence of Big and Little Springs seems to trivialize the importance of any smaller seeps or springs in this coastal region. From a scientific perspective, this approach is not valid. Please address this issue now, or indicate whether you would prefer to wait until the results of the ongoing USGS TIR study are available for review.*

Response: Our approach was valid (and it is therefore unnecessary to wait until the results of the ongoing USGS TIR study are available) because it was specifically designed to document karstic groundwater discharge to the Bay. Big and Little Springs were evaluated and determined to be the largest and therefore most significant karstic features in the groundwater basin containing the proposed mine that discharge groundwater. From our observations, we concluded that these springs likely represent the most down-gradient expression of the karstic

component of groundwater flow in the basin. What groundwater flow there is to the bay is therefore most likely conveyed through the matrix component of the aquifer and into the bay through seepage. This component of groundwater flow and an estimate of the magnitude of this flow were described by the Ardaman and Associates groundwater flow model. The absence of observable karstic groundwater discharge in the Bay supports the validity of that model.

DRP 3d. *The following statement is included in the first paragraph of 3.2.6 (Document A) – "H2H conducted a survey of the Waccasassa ... to look for groundwater discharges or karst features that showed evidence of groundwater discharge at higher level conditions"; yet there is no mention of additional evaluations or observations that would confirm or deny that such evidence actually existed. Resolution of this issue would probably require an evaluation during high flow periods as well as low, but the applicant has apparently not conducted such an evaluation.*

i. We request additional research to enable development of a more accurate environmental impact assessment for this region. Analysis of a completed ACOE EIS should be required before BMR makes a final determination about issuing a permit.

Response: Please see the response to DRP 3a, above. Kincaid did not observe any significant groundwater discharge to the bay down-gradient of the quarry region. Further, there were no observations of significant groundwater discharge in nearshore waters. Moreover, all observations indicated that the region is characterized by very low aquifer permeability and very little coastal discharge (H2H Associates, 2009). Kincaid's observations sufficiently address the issue, and no additional research is necessary. Moreover, a BMR analysis of a "completed ACOE EIS" before making a final determination about issuing a permit is not a requirement under the applicable statutes and rules.

DRP 3e. *We request that the applicant obtain more complete hydrological information, including calibration of a flow model based on site-specific field data, in order to address and evaluate potential impacts of the TKR Mine. To that end, the applicant should collect groundwater flow data and conduct a dye-trace analysis of groundwater flow similar to analyses done by Dr. Todd Kincaid and his associates in the Woodville Karst Plain and by the USGS (Renkin et al., 2008) for mines in Miami-Dade County.*

i. In numerous instances throughout Documents A through C, surface water, groundwater, and permeability data and/or model values were only estimates because of a lack of real data for the Waccasassa region (see examples below).

(1) Surface water: On page 6 (Document A), "These analyses have not been performed directly due to the lack of stream flow data."

(2) Groundwater: On page 12 (Document A), "The modeled values were derived from a groundwater flow model that was not calibrated to

discharge into the Waccasassa and Withlacoochee Bays because there is no flow data with which to perform such a calibration."

Response: **As noted in Kincaid's report, a dye trace is not warranted or practicable because no significant groundwater discharges were observed which could carry the dye. In contrast, the Woodville Karst Plain traces and the Renkin trace were both done by sampling at large groundwater discharges (springs in the Woodville Karst Plain and wells in the Renkin study).**

The groundwater flow model developed by Ardaman & Associates for the project area was calibrated based on more than 2 years of continuous water level data from monitoring wells installed at the site and seasonal water levels measured at several monitoring wells installed on surrounding properties. The transmissivities used for the Floridan aquifer are reasonable and consistent with those used by SWFWMD and USGS. Groundwater recharge in the modeled area was also consistent with values used by both SWFWMD and USGS for the site area and for surrounding watersheds. Both the surface water runoff and groundwater outflow to Withlacoochee and Waccasassa Bays predicted by the calibrated groundwater model are reasonable and consistent with annual water balance analyses performed for the area. The values predicted by the model provide the best available information on both surface runoff and groundwater outflow in the project area. The values are consistent with Kincaid's observations.

Therefore, all of the hydrological data provided are sufficiently "complete" for purposes of providing reasonable assurances, which the applicant has done.

DRP 3f. *It appears that no tracer work has occurred in the region. We request that tracer testing be conducted during the rainy season/hurricane season to illustrate the permeability of the underlying karst and provide information on the potential for salt-water intrusion. Please address this request.*

Response: **This was addressed in Kincaid's report. Please see response to DRP 3e, above and page 3 of document A.**

DRP 3g. *Please provide the groundwater flow/discharge data for the Titan King Road "test pits" (#44029159.000 permitted by SWFWMD). These borrow pits show up clearly in recent USGS thermal imagery (Ellen Raabe unpublished data, personal communication). If the borrow pits have already "tapped" the aquifer, how accurate is an evaluation of this system without an evaluation of the re-direction of aquifer flow into the existing pits and an assessment of associated inpact(s) on the ecosystem? Please address this issue.*

Response: **Evaluation of this system is sufficiently accurate without further analysis. The test pits at the King Road mine were excavated to a depth of approximately sixty feet (60') into the Floridan aquifer. The water level in the pit, while only measured on one occasion, was consistent with the measured water levels in the surrounding monitor wells. The test pit did not re-direct groundwater flow on the property. The direction of groundwater flow is from east to west across the property as documented by the potentiometric maps developed from the monitor well data. Groundwater flows into the east side of the pit and flows out the west side. The drop in water level on the east side of the pit and the rise in water level on the west side of the pit was less than four inches (4"). The water level in the pit moves up and down with time mimicking the water level in Monitoring Well MW-5, which had a range from high to low of approximately six feet (6'). There is no evidence of ecological impacts in the nearest wetlands.**

DRP 4. *The applicant has yet to provide adequate analysis and evaluation of potential effects of the proposed TKR Mine on species and natural communities in Waccasassa Bay Preserve, some of which are unique and may be vulnerable to alterations of topography, freshwater flow, and water quality. The analysis done by H2H Associates and the applicant appears to focus on the flow of freshwater to Waccasassa Bay, with little or no consideration given to freshwater habitats in between. Although this aspect (i.e. flow of freshwater to the bay) is of great concern to DRP, it is only a one facet of a larger issue that needs to be addressed by the applicant.*

a. Please address the role of freshwater surface flow and groundwater discharge in supporting the hammocks, coastal forest and brackish/oligohaline wetlands of the region.

i. Fieldwork conducted in spring 2009 by park staff and USGS scientists indicated that karst features located a substantial distance from the coast and surrounded by coastal forest had experienced salt-stress during the ongoing drought (Ellen Raabe, personal communication). Salinities of 20-28 ppt were common in the karst ponds. Downed or stressed trees were frequent. The presence of coastal forest species revealed a local dependence on freshwater, yet drought-induced high salinities suggested there were salt-water impacts.

Response: **This question does not elicit information relevant to the applicable permitting criteria under Chapter 373, Part IV, Florida Statutes (F.S.), the applicable reclamation criteria, or any other appropriate reasonable assurance standard. Accordingly, there is no justification for this question and Tarmac therefore respectfully declines to respond to it.**

DRP 4b. *H2H Associates and the applicant (especially in the Document C, Page 35 response to DRP16) appeared to do little to investigate potential impacts to creeks, hammocks, swamps, and other natural communities west of the proposed mining activity.*

Information submitted by the applicant primarily addressed groundwater flow to the bay. Please address this issue.

i. Extensive conversion of coastal forest to marsh (Raabe et al, 2004) has occurred in this region since the mid-1800s. To what degree will the proposed TKR Mine activities accelerate the loss of coastal forest?

Response: **In fact, investigations of nearly all stream beds between the mine and the coast were conducted and no springs were observed. Therefore, H2H Associates sufficiently investigated the potential for impacts.**

The proposed mining activities will not accelerate the loss of coastal forest because it will have no measurable affect on either the quality or quantity of water in the Withlacoochee and Waccasassa Bays.

DRP 4c. *Supporting documents did not address research conducted by the SRWMD in developing the Waccasassa River MFL 2006* **(http://www.srwmd.state.fl.us/index.aspx?NID=I17).**

i. The SRWMD report describes unique nekton and benthic assemblages in the region of Turtle Creek and Lows Creek. The report also discusses the role of low salinity (page 5-2) and the "priority habitat target" of oligohaline marsh. This type of marsh is still present in Waccasassa Bay Preserve south of the Waccasassa River. We request that the applicant conduct a full evaluation of the above-described natural community-assemblages in the part of Waccasassa Bay Preserve west of the proposed mine site and provide exact locations and extents of the rare or vulnerable habitats there.

ii. We ask that the applicant document species distributions that may be indicative of the presence of regular or frequent freshwater surface flow or discharge, such as upland species or wetland plant species that typically thrive only in fresh or oligohaline waters.

Response: **Please see our response to DRP 2c, above. The applicant has provided reasonable assurances, through modeling and field observations, that mining and reclamation will not result in an inward movement of the salt water interface. Accordingly, it is unnecessary for the applicant to further "address" the SRWMD report cited or document species distributions indicative of regular or frequent freshwater flow or discharge.**

DRP 5. *DRP is concerned that the unavoidable topographic alterations from the proposed mining activities will result in significant changes in the flow of surface waters and storm surges across the lowland landscape. To that extent, there is a genuine need for the applicant to gather more detailed, topographic information and to assess how mine-*

related topographic changes might influence nearby state lands. At a minimum, LIDAR (Light Detection and Ranging) data are recommended. Please address these concerns.

a. *Please provide peer-reviewed scientific publications or other documents that support the applicant's position that the proposed TKR Mine "terracing" structures will not act as a backdrop for storm surges to inundate and erode lands of Waccasassa Bay Preserve lying between the structures and the Gulf of Mexico.*

b. *Please address how development of the proposed "terraced" system will alter surface flow to coastal habitats within Waccasassa Bay Preserve. Please note that USGS researchers and the United States Fish and Wildlife Service (USFWS) have already identified loss or degradation of forests on the Gulf side of elevated coastal roads (Raabe et al., 2004; Brian Pridgeon, US FWS, personal communication).*

c. *High quality LIDAR mapping is necessary for developing a detailed topographic assessment that would improve the accuracy of the hydrologic model for this area.*

Response: **First, with respect to whether the proposed TKR Mine "terracing" structures will act as a backdrop for storm surges to inundate and erode lands of the Waccasassa Bay Preserve lying between the structures and the Gulf of Mexico, the air space occupied by the bermed quarries on the TKR mine is so small relative to the volume of water involved in a tidal surge along the Levy County coast that its effect on water level and velocity in Waccasassa Bay preserve during a tidal surge would be insignificant and well within the ± 20% accuracy of the NOAA surge height predictions.**

Second, with respect to how development of the proposed "terraced" system will alter surface flow to coastal habitats within the Preserve, please see the response to DRP 3, above.

Finally, please note that LIDAR is not required to provide reasonable assurances that the project will comport with applicable rules and statutes; neither are "peer-reviewed" reports. The application, reports, and RAI responses already submitted provide reasonable assurances that flow of surface and stormwater across the site will not be adversely affected by the project.

DRP 6. *DRP requests further clarification concerning specific data collected by the applicant's consultant, H2H Associates. In addition, since "... aquifer permeability has not been measured directly in the proposed mining area..." (as mentioned in Document A, page12), we recommend that the applicant improve their aquifer permeability analysis by incorporating unpublished USGS data collected at two important reference sites within Waccasassa Bay Preserve (i.e. Lancaster Spring and Yulee Well). We request that the applicant obtain and use unpublished USGS water level data (Ellen Raabe,* *unpublished data) to achieve a more detailed, site-specific assessment of potential impacts from the proposed TKR mining activities.*

Response: The hydraulic conductivity values reported by John Garlanger September 2009 derived from site-specific studies are less than or equal to the lowest values used in the Kincaid analysis. Lancaster Spring is not in either the surface watershed or the groundwater basin in which the proposed mine is located (please see the attached figure). Also, the use of unpublished data is neither required nor necessary.

DRP 6a. We are interested in locating specific features described by H2H Associates, but the H2H document is either unclear or provides erroneous information. Please clarify the following information submitted by this consultant.

i. The locations of two sites (Document A, Page 3) were provided as latitude/longitude (latllong), but the document did not provide the projection, datum or ellipsoid (if any). We request a clarification with specifics of the settings on the GPS (State Plane, UTM, or Albers?, NAD83? WGS84?).

ii. The second lat~long (Document A, Page 3) that was provided appears to be erroneous and we request a correction of that datum.

iii. Multiple salinity readings and descriptions of karst features are discussed in H2H Associates reports (Documents A and C). We request a detailed list of all sites visited, including lat/long and site descriptions.

Response: The GPS values are in WGS84. Also, the Lat/Lon values are provided for every observation point in Appendix II of that report.

DRP 6b. H2H Associates provides an analysis of potentiometric surface maps to suggest "...interconnected karst features do not provide a significant component of the aquifer permeability in this region". Again, according to H2H, "Another indicator of low karstic influence on permeability is the lack of significant correlations in daily groundwater fluctuations to tide".

i. The USGS has well data (Yulee Well; Ellen Raabe, unpublished data) that illustrate strong changes in response to rainfall with subsequently quick return levels. These data seem to contradict the statement that ". . .aquifer permeability in the western part of the basin is not dominated by karstic features (Document A, page 17, last paragraph).

ii. The USGS has historic water level data from Lancaster Spring (also known as LEV97991; Hornsby and Ceryak, 1998) that illustrate a strong tidal influence occurs at the springhead (1.2 km from the coast). Data gathered from this spring seem to conflict with groundwater fluctuation data collected from a similar area in the region, suggesting that a larger karstic influence on aquifer permeability potentially exists than has been indicated by H2H Associates (Document A, page 12, paragraph 4).

Response: **We were only able to obtain daily data for the USGS wells and were therefore unable to analyze regional water levels with respect to tide. Continuous data was available for the Tarmac monitoring wells and we did conduct an analysis of it with respect to tide (please see Figures 10-12 and the relevant discussion on page 12 of Document A). The attached map and charts show the locations of the USGS and monitoring wells with respect to the Bay and the proposed mine, the water level records for October 2008, and the predicted tide at the mouth of the Withlacoochee River during that period. The data show no correlation to tide at MW-3 or MW-5 and only a weak correlation at MW-1 in which the maximum magnitude of the potentially diurnal water level fluctuations is less than 0.05 feet and is not consistent. By comparison to wells in known karst basins in Florida such as the Woodville Karst Plain (please see Figure 12 of Document A), these data do not support the presence of significant karst features in the proposed mine area that could convey groundwater to the Bay.**

Lancaster Spring is not in either the surface watershed or the groundwater basin in which the proposed mine is located (please see the attached figure). The record of flows from that spring are therefore not relevant to an assessment of groundwater flow patterns in the proposed mine area.

It is our belief that the above responses, along with the attached supporting documents, address the concerns raised in both the Bureaus' and the Divisions' Requests for Additional Information. Should you have any questions or concerns regarding the information provided, please do not hesitate to contact me.

Sincerely,

Albert W. Townsend
Director of Real Estate and Environmental Services
Tarmac America LLC

T. E ONE: **PROJECT WETLAND AND OT R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
02-2	616	0.174	0.0	0.120	F			MITIGATION AREA 1
-	-	-	-	0.054	D			MITIGATION AREA 1
02-6	630	3.007	0.0	1.056	F			MITIGATION AREA 1
-	-	-	-	0.041	D			MITIGATION AREA 1
-	-	-	-	1.911	D			MITIGATION AREA 1
02-7	616	0.926	0.0	0.926	D			MITIGATION AREA 1
02-8	616	0.090	0.0	0.082	F			MITIGATION AREA 1
-	-	-	-	0.008	D			MITIGATION AREA 1
02-87	616	0.195	0.0	0.195	D			MITIGATION AREA 1
02-88	616	0.084	0.0	0.084	D			MITIGATION AREA 1
02-89	630	0.145	0.0	0.087	F			MITIGATION AREA 1
-	-	-	-	0.058	D			MITIGATION AREA 1
02-9	6291	0.970	0.0	0.058	F			MITIGATION AREA 1
-	-	-	-	0.911	D			MITIGATION AREA 1
02-90	630	0.051	0.0	0.051	D			MITIGATION AREA 1
03-1	616	0.310	0.0	0.248	F			MITIGATION AREA 1
-	-	-	-	0.063	D			MITIGATION AREA 1
03-2	616	0.180	0.0	0.162	F			MITIGATION AREA 1
-	-	-	-	0.018	D			MITIGATION AREA 1
03-3	616	0.604	0.0	0.432	F			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	0.172	D			MITIGATION AREA 1
03-4	616	0.220	0.0	0.220	D			MITIGATION AREA 1
07-1	6292	8.060	0.0	2.882	F			MITIGATION AREA 1
-	-		-	5.178	D			MITIGATION AREA 1
08-1	530	0.441	0.0	0.441	D			MITIGATION AREA 1
08-100	6292	90.582	0.0	5.548	F			MITIGATION AREA 1
-	-		-	85.034	D			MITIGATION AREA 1
08-102	6291	206.697	0.0	15.690	F			MITIGATION AREA 1
-	-	-	-	49.939	D			MITIGATION AREA 1
-	-	-	-	69.748	D			MITIGATION AREA 1
-	-	-	-	71.319	D			MITIGATION AREA 1
08-103	6303	13.273	0.0	13.273	D			MITIGATION AREA 1
08-104	617	10.932	0.0	1.289	F			MITIGATION AREA 1
-	-	-	-	5.648	D			MITIGATION AREA 1
-	-	-	-	3.994	D			MITIGATION AREA 1
08-105	617	1.035	0.0	1.035	D			MITIGATION AREA 1
08-106	617	0.596	0.0	0.555	F			MITIGATION AREA 1
-	-	-	-	0.041	D			MITIGATION AREA 1
08-107	617	0.889	0.0	0.889	D			MITIGATION AREA 1
08-108	630	12.587	0.0	12.587	D			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
08-110	630	4.482	0.0	4.482	D			MITIGATION AREA 1
08-111	630	2.580	0.0	1.101	F			MITIGATION AREA 1
-	-	-	-	0.097	D			MITIGATION AREA 1
-	-	-	-	1.382	D			MITIGATION AREA 1
08-112	6292	53.491	0.0	5.983	F			MITIGATION AREA 1
-	-	-	-	47.508	D			MITIGATION AREA 1
08-113	6291	70.608	0.0	5.223	F			MITIGATION AREA 1
-	-	-	-	24.645	D			MITIGATION AREA 1
-	-	-	-	0.349	D			MITIGATION AREA 1
-	-	-	-	39.929	D			MITIGATION AREA 1
-	-	-	-	0.462	D			MITIGATION AREA 1
08-12	630	13.879	0.0	1.588	F			MITIGATION AREA 1
-	-	-	-	12.290	D			MITIGATION AREA 1
08-13	617	2.649	0.0	0.554	F			MITIGATION AREA 1
-	-	-	-	2.095	D			MITIGATION AREA 1
08-14	630	0.636	0.0	0.164	F			MITIGATION AREA 1
-	-	-	-	0.472	D			MITIGATION AREA 1
08-15	630	0.541	0.0	0.541	D			MITIGATION AREA 1
08-16	616	0.142	0.0	0.111	F			MITIGATION AREA 1
-	-	-	-	0.031	D			MITIGATION AREA 1

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				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
08-17	616	0.108	0.0	0.108	D			MITIGATION AREA 1
08-18	616	0.167	0.0	0.167	D			MITIGATION AREA 1
08-19	616	0.086	-	0.086	D			MITIGATION AREA 1
08-2	530	1.131	0.0	0.152	F			MITIGATION AREA 1
-	-	-	-	0.979	D			MITIGATION AREA 1
08-20	616	0.533	0.0	0.533	D			MITIGATION AREA 1
08-21	616	0.849	0.0	0.095	F			MITIGATION AREA 1
-	-	-	-	0.755	D			MITIGATION AREA 1
08-23	630	4.049	0.0	1.731	F			MITIGATION AREA 1
-	-	-	-	0.550	D			MITIGATION AREA 1
-	-	-	-	1.768	D			MITIGATION AREA 1
08-24	616	0.297	0.0	0.297	D			MITIGATION AREA 1
08-25	616	0.146	0.0	0.146	D			MITIGATION AREA 1
08-26	616	0.199	0.0	0.199	D			MITIGATION AREA 1
08-27	616	1.261	0.0	1.261	D			MITIGATION AREA 1
08-28	616	0.214	0.0	0.214	D			MITIGATION AREA 1
08-29	616	0.121	0.0	0.121	F			MITIGATION AREA 1
08-3	530	0.887	0.0	0.887	D			MITIGATION AREA 1
08-32	616	0.279	0.0	0.279	D			MITIGATION AREA 1
08-33	616	0.908	0.0	0.908	D			MITIGATION AREA 1

T, E ONE: **PROJECT WETLAND AND OT R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
08-34	630	0.058	0.0	0.058	D			MITIGATION AREA 1
08-35	616	0.118	0.0	0.118	D			MITIGATION AREA 1
08-36	630	1.120	0.0	1.120	D			MITIGATION AREA 1
08-38	616	0.270	0.0	0.270	D			MITIGATION AREA 1
08-39	616	0.357	0.0	0.357	D			MITIGATION AREA 1
08-4	530	2.044	0.0	1.058	F			MITIGATION AREA 1
-	-	-	-	0.986	D			MITIGATION AREA 1
08-40	616	0.180	0.0	0.180	D			MITIGATION AREA 1
08-42	616	0.401	0.0	0.401	D			MITIGATION AREA 1
08-43	616	0.473	0.0	0.473	D			MITIGATION AREA 1
08-44	616	0.511	0.0	0.511	D			MITIGATION AREA 1
08-45	630	0.392	0.0	0.392	D			MITIGATION AREA 1
08-47	616	0.146	0.0	0.146	D			MITIGATION AREA 1
08-48	616	0.113	0.0	0.113	D			MITIGATION AREA 1
08-49	616	0.139	0.0	0.139	D			MITIGATION AREA 1
08-5	6292	3.137	0.0	3.137	D			MITIGATION AREA 1
08-50	6292	4.093	0.0	4.093	D			MITIGATION AREA 1
08-51	616	0.179	0.0	0.179	D			MITIGATION AREA 1
08-52	616	0.155	0.0	0.155	D			MITIGATION AREA 1
08-53	630	1.165	0.0	1.165	D			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
08-54	616	0.192	0.0	0.192	D			MITIGATION AREA 1
08-55	616	0.419	·0.0	0.419	D			MITIGATION AREA 1
08-56	616	0.104	0.0	0.104	D			MITIGATION AREA 1
08-57	616	0.604	0.0	0.604	D			MITIGATION AREA 1
08-58	616	0.332	0.0	0.332	D			MITIGATION AREA 1
08-59	616	0.182	0.0	0.182	D			MITIGATION AREA 1
08-6	6291	0.721	0.0	0.028	F			MITIGATION AREA 1
-	-	-	-	0.693	D			MITIGATION AREA 1
08-60	616	0.142	0.0	0.142	D			MITIGATION AREA 1
08-61	616	0.356	0.0	0.356	D			MITIGATION AREA 1
08-62	616	0.196	0.0	0.196	D			MITIGATION AREA 1
08-63	616	0.251	0.0	0.251	D			MITIGATION AREA 1
08-64	616	0.232	0.0	0.232	D			MITIGATION AREA 1
08-65	616	0.362	0.0	0.362	D			MITIGATION AREA 1
08-66	616	0.095	0.0	0.095	D			MITIGATION AREA 1
08-68	616	0.114	0.0	0.114	D			MITIGATION AREA 1
08-69	616	0.261	0.0	0.251	F			MITIGATION AREA 1
-	-	-	-	0.010	D			MITIGATION AREA 1
08-70	616	0.055	0.0	0.055	D			MITIGATION AREA 1
08-71	616	0.193	0.0	0.193	D			MITIGATION AREA 1

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
08-72	616	0.089	0.0	0.089	D			MITIGATION AREA 1
08-73	616	0.325	0.0	0.325	D			MITIGATION AREA 1
08-74	616	1.286	0.0	1.286	D			MITIGATION AREA 1
08-75	530	4.595	0.0	4.595	D			MITIGATION AREA 1
08-78	6292	1.304	0.0	1.304	D			MITIGATION AREA 1
08-79	616	0.257	0.0	0.257	D			MITIGATION AREA 1
08-81	6292	7.195	0.0	2.674	F			MITIGATION AREA 1
-	-	-	-	4.521	D			MITIGATION AREA 1
08-82	6291	1.950	0.0	1.950	D			MITIGATION AREA 1
08-83	616	0.415	0.0	0.415	D			MITIGATION AREA 1
08-84	617	1.701	0.0	1.701	D			MITIGATION AREA 1
08-86	6292	1.688	0.0	1.688	D			MITIGATION AREA 1
08-89	616	0.473	0.0	0.473	D			MITIGATION AREA 1
08-9	630	0.515	0.0	0.091	F			MITIGATION AREA 1
-	-	-	-	0.424	D			MITIGATION AREA 1
08-91	616	0.456	0.0	0.456	D			MITIGATION AREA 1
08-92	617	0.683	0.0	0.683	D			MITIGATION AREA 1
08-93	616	0.244	0.0	0.244	D			MITIGATION AREA 1
08-95	616	0.144	0.0	0.144	D			MITIGATION AREA 1
08-96	6292	6.670	0.0	0.411	F			MITIGATION AREA 1

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				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	4.225	D			MITIGATION AREA 1
-	-	-	-	2.033	D			MITIGATION AREA 1
08-97	6292	71.611	0.0	10.280	F			MITIGATION AREA 1
-	-	-	-	29.408	D			MITIGATION AREA 1
-	-	-	-	31.923	D			MITIGATION AREA 1
08-98	6292	102.037	0.0	17.111	F			MITIGATION AREA 1
-	-	-	-	17.961	D			MITIGATION AREA 1
-	-	-	-	0.752	D			MITIGATION AREA 1
-	-	-	-	36.514	D			MITIGATION AREA 1
-	-	-	-	29.698	D			MITIGATION AREA 1
08-99	6291	18.724	0.0	1.573	F			MITIGATION AREA 1
-	-	-	-	17.151	D			MITIGATION AREA 1
09-1	6291	3.148	0.0	0.094	F			MITIGATION AREA 1
-	-	-	-	3.054	D			MITIGATION AREA 1
09-10	630	1.150	0.0	0.075	F			MITIGATION AREA 1
-	-	-	-	1.075	D			MITIGATION AREA 1
09-11	616	0.249	0.0	0.249	D			MITIGATION AREA 1
09-13	630	0.508	0.0	0.000	F			MITIGATION AREA 1
-	-	-	-	0.508	D			MITIGATION AREA 1
09-14	616	0.316	0.0	0.316	D			MITIGATION AREA 1

T. E ONE: **PROJECT WETLAND AND OT R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
09-15	616	0.350	0.0	0.350	D			MITIGATION AREA 1
09-17	616	1.367	0.0	1.367	D			MITIGATION AREA 1
09-19	616	0.699	0.0	0.699	D			MITIGATION AREA 1
09-20	616	0.279	0.0	0.279	D			MITIGATION AREA 1
09-21	616	0.776	0.0	0.776	D			MITIGATION AREA 1
09-23	616	0.239	0.0	0.101	D			MITIGATION AREA 1
-	-	-	-	0.138	D			MITIGATION AREA 1
09-27	616	0.275	0.0	0.275	D			MITIGATION AREA 1
02-29	616	0.700	0.0	0.700	D			MITIGATION AREA 1
09-3	6291	4.820	0.0	4.820	D			MITIGATION AREA 1
09-31	616	0.504	0.0	0.112	F			MITIGATION AREA 1
-	-	-	-	0.392	D			MITIGATION AREA 1
09-32	616	0.276	0.0	0.276	D			MITIGATION AREA 1
09-33	616	0.157	0.0	0.110	D			MITIGATION AREA 1
-	-	-	-	0.048	D			MITIGATION AREA 1
09-35	616	0.347	0.0	0.347	D			MITIGATION AREA 1
09-36	616	0.186	0.0	0.020	F			MITIGATION AREA 1
-	-	-	-	0.166	D			MITIGATION AREA 1
09-37	616	0.262	0.0	0.262	D			MITIGATION AREA 1
09-38	628	0.371	0.0	0.371	F			MITIGATION AREA 1

T. .E ONE: PROJECT WETLAND AND OT R SURFACE WATER SUMMARY

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
09-39	6291	0.375	0.0	0.375	F			MITIGATION AREA 1
-	-	-	-	0.000	D			MITIGATION AREA 1
09-40	630	0.521	0.0	0.089	F			MITIGATION AREA 1
-	-	-	-	0.432	D			MITIGATION AREA 1
09-42	616	0.404	0.0	0.274	F			MITIGATION AREA 1
-	-	-	-	0.107	D			MITIGATION AREA 1
-	-	-	-	0.023	D			MITIGATION AREA 1
09-44	616	1.434	0.0	1.262	F			MITIGATION AREA 1
-	-	-	-	0.172	D			MITIGATION AREA 1
09-47	616	0.010	0.0	0.010	F			MITIGATION AREA 1
09-48	616	0.285	0.0	0.285	F			MITIGATION AREA 1
09-49	616	1.417	0.0	1.171	F			MITIGATION AREA 1
-	-	-	-	0.246	D			MITIGATION AREA 1
09-5	616	0.008	0.0	0.008	F			MITIGATION AREA 1
09-51	616	0.403	0.0	0.130	F			MITIGATION AREA 1
-	-	-	-	0.273	D			MITIGATION AREA 1
09-52	616	0.744	0.0	0.744	D			MITIGATION AREA 1
09-53	630	0.246	0.0	0.246	F			MITIGATION AREA 1
09-55	616	0.107	0.0	0.107	D			MITIGATION AREA 1
09-59	616	0.099	0.0	0.019	F			MITIGATION AREA 1

T… E ONE: PROJECT WETLAND AND OT… R SURFACE WATER SUMMARY

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	0.080	D			MITIGATION AREA 1
09-62	616	0.056	0.0	0.056	F			MITIGATION AREA 1
-	-	-	-	0.001	D			MITIGATION AREA 1
09-65	616	0.509	0.0	0.509	D			MITIGATION AREA 1
09-68	6291	4.413	0.0	3.363	F			MITIGATION AREA 1
-	-	-	-	1.050	D			MITIGATION AREA 1
09-69	6291	49.871	0.0	7.885	F			MITIGATION AREA 1
-	-	-	-	29.032	D			MITIGATION AREA 1
-	-	-	-	0.203	D			MITIGATION AREA 1
-	-	-	-	3.121	D			MITIGATION AREA 1
-	-	-	-	9.630	D			MITIGATION AREA 1
09-75	630	57.388	0.0	2.870	F			MITIGATION AREA 1
-	-	-	-	11.937	D			MITIGATION AREA 1
-	-	-	-	20.781	D			MITIGATION AREA 1
-	-	-	-	7.307	D			MITIGATION AREA 1
-	-	-	-	14.492	D			MITIGATION AREA 1
09-78	617	5.124	0.0	1.008	F			MITIGATION AREA 1
-	-	-	-	3.875	D			MITIGATION AREA 1
-	-	-	-	0.242	D			MITIGATION AREA 1
09-79	6291	87.468	0.0	20.989	F			MITIGATION AREA 1

T/ E ONE: **PROJECT WETLAND AND OT R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	17.187	D			MITIGATION AREA 1
-	-	-	-	47.786	D			MITIGATION AREA 1
-	-	-	-	1.506	D			MITIGATION AREA 1
09-82	617	1.263	0.0	0.362	F			MITIGATION AREA 1
-	-	-	-	0.901	D			MITIGATION AREA 1
09-9	616	0.313	0.0	0.286	F			MITIGATION AREA 1
-	-	-	-	0.027	D			MITIGATION AREA 1
10-10	616	0.505	0.0	0.242	F			MITIGATION AREA 1
-	-	-	-	0.263	D			MITIGATION AREA 1
10-12	616	0.170	0.0	0.170	D			MITIGATION AREA 1
10-13	6291	0.100	0.0	0.100	D			MITIGATION AREA 1
10-15	616	0.155	0.0	0.143	F			MITIGATION AREA 1
-	-	-	-	0.002	D			MITIGATION AREA 1
-	-	-	-	0.009	D			MITIGATION AREA 1
10-16	616	0.312	0.0	0.312	D			MITIGATION AREA 1
10-17	616	0.466	0.0	0.466	D			MITIGATION AREA 1
10-18	616	0.181	0.0	0.181	D			MITIGATION AREA 1
10-19	616	1.084	0.0	0.156	F			MITIGATION AREA 1
-	-	-	-	0.007	D			MITIGATION AREA 1
-	-	-	-	0.921	D			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
10-2	616	0.048	0.0	0.048	F			MITIGATION AREA 1
10-20	616	0.086	0.0	0.086	D			MITIGATION AREA 1
10-21	616	0.395	0.0	0.395	D			MITIGATION AREA 1
10-24	617	0.116	0.0	0.077	F			MITIGATION AREA 1
-	-	-	-	0.039	D			MITIGATION AREA 1
10-24	617	0.116	0.0	0.077	F			MITIGATION AREA 1
-	-	-	-	0.039	D			MITIGATION AREA 1
10-25	6291	4.755	0.0	4.755	D			MITIGATION AREA 1
10-26	616	0.491	0.0	0.491	D			MITIGATION AREA 1
10-27	616	0.193	0.0	0.193	D			MITIGATION AREA 1
10-28	616	0.606	0.0	0.606	D			MITIGATION AREA 1
10-29	630	0.433	0.0	0.433	D			MITIGATION AREA 1
10-30	616	2.735	0.0	0.833	F			MITIGATION AREA 1
-	-	-	-	0.309	D			MITIGATION AREA 1
-	-	-	-	1.593	D			MITIGATION AREA 1
10-31	616	1.725	0,0	1.725	D			MITIGATION AREA 1
10-32	616	0.229	0.0	0.229	D			MITIGATION AREA 1
10-33	6291	5.564	0.0	0.677	F			MITIGATION AREA 1
-	-	-	-	3.983	D			MITIGATION AREA 1
-	-	-	-	0.904	D			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
10-34	616	0.413	0.0	0.413	D			MITIGATION AREA 1
10-35	616	0.458	0.0	0.458	D			MITIGATION AREA 1
10-36	616	0.309	0.0	0.309	D			MITIGATION AREA 1
10-38	616	0.232	0.0	0.232	D			MITIGATION AREA 1
10-39	6291	1.193	0.0	1.193	D			MITIGATION AREA 1
10-4	616	0.482	0.0	0.482	D			MITIGATION AREA 1
10-41	616	2.267	0.0	2.130	F			MITIGATION AREA 1
-	-	-	-	0.138	D			MITIGATION AREA 1
10-42	616	0.060	0.0	0.060	D			MITIGATION AREA 1
10-43	616	1.004	0.0	1.004	D			MITIGATION AREA 1
10-44	616	0.763	0.0	0.350	F			MITIGATION AREA 1
-	-	-	-	0.215	D			MITIGATION AREA 1
-	-	-	-	0.198	D			MITIGATION AREA 1
10-45	616	0.794	0.0	0.794	D			MITIGATION AREA 1
10-47	616	0.409	0.0	0.409	D			MITIGATION AREA 1
10-48	616	0.567	0.0	0.567	D			MITIGATION AREA 1
10-50	616	0.261	0.0	0.261	D			MITIGATION AREA 1
10-51	616	0.659	0.0	0.659	D			MITIGATION AREA 1
10-52	616	0.431	0.0	0.033	F			MITIGATION AREA 1
-	-	-	-	0.398	D			MITIGATION AREA 1

TABLE ONE: PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
10-53	616	0.101	0.0	0.101	F			MITIGATION AREA 1
10-54	630	0.361	0.0	0.361	D			MITIGATION AREA 1
10-55	6291	6.366	0.0	3.724	F			MITIGATION AREA 1
-	-	-	-	2.642	D			MITIGATION AREA 1
10-59	616	0.356	0.0	0.356	D			MITIGATION AREA 1
10-6	616	0.439	0.0	0.200	F			MITIGATION AREA 1
-	-	-	-	0.239	D			MITIGATION AREA 1
10-62	616	0.190	0.0	0.190	D			MITIGATION AREA 1
10-7	616	0.491	0.0	0.260	F			MITIGATION AREA 1
-	-	-	-	0.231	D			MITIGATION AREA 1
10-71	616	0.029	0.0	0.029	F			MITIGATION AREA 1
10-73	6291	3.022	0.0	3.022	F			MITIGATION AREA 1
10-75	616	0.513	0.0	0.513	F			MITIGATION AREA 1
10-77	616	2.385	0.0	2.385	F			MITIGATION AREA 1
10-79	616	2.606	0.0	2.606	D			MITIGATION AREA 1
10-8	616	1.044	0.0	1.044	D			MITIGATION AREA 1
10-80	628	8.058	0.0	8.058	F			MITIGATION AREA 1
10-83	6291	113.899	0.0	17.097	F			MITIGATION AREA 1
-	-	-	-	18.750	D			MITIGATION AREA 1
-	-	-	-	40.374	D			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	7.749	D			MITIGATION AREA 1
-	-	-	-	0.075	D			MITIGATION AREA 1
-	-	-	-	17.173	D			MITIGATION AREA 1
-	-	-	-	12.680	D			MITIGATION AREA 1
10-85	6291	1.170	0.0	0.425	F			MITIGATION AREA 1
-	-	-	-	0.745	D			MITIGATION AREA 1
10-87	6291	53.629	0.0	9.775	F			MITIGATION AREA 1
-	-	-	-	2.676	D			MITIGATION AREA 1
-	-	-	-	13.376	D			MITIGATION AREA 1
-	-	-	-	27.803	D			MITIGATION AREA 1
10-88	6291	0.225	0.0	0.147	F			MITIGATION AREA 1
-	-	-	-	0.036	D			MITIGATION AREA 1
-	-	-	-	0.042	D			MITIGATION AREA 1
10-90	6291	0.431	0.0	0.431	D			MITIGATION AREA 1
10-91	6291	0.357	0.0	0.211	F			MITIGATION AREA 1
-	-	-	-	0.123	D			MITIGATION AREA 1
-	-	-	-	0.022	D			MITIGATION AREA 1
10-94	6291	1.205	0.0	1.205	D			MITIGATION AREA 1
10-95	6291	7.301	0.0	4.699	F			MITIGATION AREA 1
-	-	-	-	0.932	D			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	0.001	D			MITIGATION AREA 1
-	-	-	-	1.669	D			MITIGATION AREA 1
10-96	6291	14.009	0.0	3.357	F			MITIGATION AREA 1
-	-	-	-	10.652	D			MITIGATION AREA 1
10-97	6291	0.490	0.0	0.490	F			MITIGATION AREA 1
10-99	6291	53.006	0.0	26.441	F			MITIGATION AREA 1
-	-	-	-	5.319	D			MITIGATION AREA 1
-	-	-	-	21.246	D			MITIGATION AREA 1
11-1	6292	3.253	0.0	0.784	F			MITIGATION AREA 1
-	-	-	-	2.470	D			MITIGATION AREA 1
11-10	616	0.226	0.0	0.222	F			MITIGATION AREA 1
-	-	-	-	0.005	D			MITIGATION AREA 1
11-100	6291	0.496	0.0	0.496	D			MITIGATION AREA 1
11-101	6291	0.547	0.0	0.538	F			MITIGATION AREA 1
-	-	-	-	0.009	D			MITIGATION AREA 1
11-103	616	0.318	0.0	0.318	D			MITIGATION AREA 1
11-110	6292	1.232	0.0	0.391	F			MITIGATION AREA 1
-	-	-	-	0.842	D			MITIGATION AREA 1
11-111	616	0.272	0.0	0.272	F			MITIGATION AREA 1
11-112	6291	0.001	0.0	0.001	F			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
11-114	6291	0.003	0.0	0.003	F			MITIGATION AREA 1
11-115	616	1.065	0.0	1.065	F			MITIGATION AREA 1
11-116	6292	0.915	0.0	0.910	F			MITIGATION AREA 1
-	-	-	-	0.005	D			MITIGATION AREA 1
11-119	616	0.459	0.0	0.459	D			MITIGATION AREA 1
11-12	616	0.107	0.0	0.107	D			MITIGATION AREA 1
11-120	6291	1.073	0.0	1.073	F			MITIGATION AREA 1
11-124	617	10.523	0.0	2.574	F			MITIGATION AREA 1
-	-	-	-	7.949	D			MITIGATION AREA 1
11-127	6291	0.305	0.0	0.090	F			MITIGATION AREA 1
-	-	-	-	0.214	D			MITIGATION AREA 1
11-128	6291	0.885	0.0	0.885	D			MITIGATION AREA 1
11-129	6292	16.659	0.0	1.863	F			MITIGATION AREA 1
-	-	-	-	2.280	D			MITIGATION AREA 1
-	-	-	-	6.554	D			MITIGATION AREA 1
-	-	-	-	5.961	D			MITIGATION AREA 1
11-13	616	0.094	0.0	0.094	D			MITIGATION AREA 1
11-130	6292	63.578	0.0	8.442	F			MITIGATION AREA 1
-	-	-	-	3.442	D			MITIGATION AREA 1
-	-	-	-	21.492	D			MITIGATION AREA 1

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	30.202	D			MITIGATION AREA 1
11-131	617	0.558	0.0	0.558	D			MITIGATION AREA 1
11-133	6292	1.334	0.0	0.288	F			MITIGATION AREA 1
-	-	-	-	0.256	D			MITIGATION AREA 1
-	-	-	-	0.790	D			MITIGATION AREA 1
11-134	6291	1.506	0.0	1.506	D			MITIGATION AREA 1
11-135	617	2.315	0.0	0.342	F			MITIGATION AREA 1
-	-	-	-	0.032	D			MITIGATION AREA 1
-	-	-	-	1.941	D			MITIGATION AREA 1
11-137	630	3.433	0.0	0.170	F			MITIGATION AREA 1
-	-	-	-	3.264	D			MITIGATION AREA 1
11-138	630	3.196	0.0	1.111	F			MITIGATION AREA 1
-	-	-	-	1.372	D			MITIGATION AREA 1
-	-	-	-	0.713	D			MITIGATION AREA 1
11-14	616	0.760	0.0	0.029	F			MITIGATION AREA 1
-	-	-	-	0.731	D			MITIGATION AREA 1
11-15	616	0.502	0.0	0.502	D			MITIGATION AREA 1
11-16	630	1.935	0.0	0.637	F			MITIGATION AREA 1
-	-	-	-	1.289	D			MITIGATION AREA 1
-	-	-	-	0.009	D			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
11-17	616	0.555	0.0	0.555	D			MITIGATION AREA 1
11-18	616	0.102	0.0	0.102	D			MITIGATION AREA 1
11-20	616	0.168	0.0	0.102	F			MITIGATION AREA 1
-	-	-	-	0.066	D			MITIGATION AREA 1
11-22	616	0.144	0.0	0.144	D			MITIGATION AREA 1
11-23	616	0.236	0.0	0.236	D			MITIGATION AREA 1
11-24	616	0.074	0.0	0.035	F			MITIGATION AREA 1
-	-	-	-	0.039	D			MITIGATION AREA 1
11-25	616	0.213	0.0	0.213	D			MITIGATION AREA 1
11-26	630	0.386	0.0	0.386	D			MITIGATION AREA 1
11-27	616	0.458	0.0	0.458	D			MITIGATION AREA 1
11-29	616	0.124	0.0	0.124	D			MITIGATION AREA 1
11-30	630	5.458	0.0	1.101	F			MITIGATION AREA 1
-	-	-	-	2.257	D			MITIGATION AREA 1
-	-	-	-	2.101	D			MITIGATION AREA 1
11-32	616	0.161	0.0	0.161	D			MITIGATION AREA 1
11-33	6291	0.802	0.0	0.802	D			MITIGATION AREA 1
11-34	616	1.359	0.0	0.063	F			MITIGATION AREA 1
-	-	-	-	1.295	D			MITIGATION AREA 1
11-35	616	0.160	0.0	0.160	D			MITIGATION AREA 1

T/ E ONE: **PROJECT WETLAND AND OT R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
11-38	617	1.236	0.0	1.236	D			MITIGATION AREA 1
11-39	616	0.125	0.0	0.125	D			MITIGATION AREA 1
11-40	6291	1.581	0.0	0.036	F			MITIGATION AREA 1
-	-	-	-	1.545	D			MITIGATION AREA 1
11-42	616	0.080	0.0	0.080	D			MITIGATION AREA 1
11-47	616	0.238	0.0	0.007	F			MITIGATION AREA 1
-	-	-	-	0.230	D			MITIGATION AREA 1
11-48	616	0.752	0.0	0.752	D			MITIGATION AREA 1
11-49	616	0.520	0.0	0.330	F			MITIGATION AREA 1
-	-	-	-	0.165	D			MITIGATION AREA 1
-	-	-	-	0.025	D			MITIGATION AREA 1
11-50	616	0.852	0.0	0.852	D			MITIGATION AREA 1
11-51	617	0.726	0.0	0.726	D			MITIGATION AREA 1
11-52	616	0.131	0.0	0.131	D			MITIGATION AREA 1
11-53	616	0.336	0.0	0.336	D			MITIGATION AREA 1
11-54	616	0.370	0.0	0.370	D			MITIGATION AREA 1
11-57	616	0.318	0.0	0.318	D			MITIGATION AREA 1
11-58	617	0.541	0.0	0.169	F			MITIGATION AREA 1
-	-	-	-	0.150	D			MITIGATION AREA 1
-	-	-	-	0.222	D			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
11-59	616	0.535	0.0	0.321	F			MITIGATION AREA 1
-	-	-	-	0.021	D			MITIGATION AREA 1
-	-	-	-	0.193	D			MITIGATION AREA 1
11-61	6291	1.986	0.0	0.141	F			MITIGATION AREA 1
-	-	-	-	0.027	D			MITIGATION AREA 1
-	-	-	-	1.818	D			MITIGATION AREA 1
11-62	6291	0.982	0.0	0.982	D			MITIGATION AREA 1
11-63	616	0.334	0.0	0.334	D			MITIGATION AREA 1
11-65	616	0.289	0.0	0.289	D			MITIGATION AREA 1
11-66	617	1.273	0.0	1.273	D			MITIGATION AREA 1
11-67	616	1.402	0.0	1.402	D			MITIGATION AREA 1
11-70	616	0.768	0.0	0.768	D			MITIGATION AREA 1
11-71	616	0.052	0.0	0.052	D			MITIGATION AREA 1
11-72	616	0.442	0.0	0.442	D			MITIGATION AREA 1
11-73	6292	0.271	0.0	0.271	D			MITIGATION AREA 1
11-74	616	0.050	0.0	0.050	D			MITIGATION AREA 1
11-75	616	0.314	0.0	0.314	D			MITIGATION AREA 1
11-76	616	0.035	0.0	0.035	F			MITIGATION AREA 1
11-77	616	0.020	0.0	0.020	D			MITIGATION AREA 1
11-79	616	0.116	0.0	0.116	F			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
11-8	616	0.159	0.0	0.159	D			MITIGATION AREA 1
11-81	616	1.224	0.0	0.020	F			MITIGATION AREA 1
-	-	-	-	1.204	D			MITIGATION AREA 1
11-83	616	0.230	0.0	0.230	D			MITIGATION AREA 1
11-84	6291	0.482	0.0	0.237	F			MITIGATION AREA 1
-	-	-	-	0.029	D			MITIGATION AREA 1
-	-	-	-	0.217	D			MITIGATION AREA 1
11-85	616	0.212	0.0	0.022	F			MITIGATION AREA 1
-	-	-	-	0.190	D			MITIGATION AREA 1
11-86	616	0.209	0.0	0.209	F			MITIGATION AREA 1
11-88	616	0.071	0.0	0.071	F			MITIGATION AREA 1
11-89	616	0.237	0.0	0.060	F			MITIGATION AREA 1
-	-	-	-	0.177	D			MITIGATION AREA 1
11-9	616	0.106	0.0	0.106	F			MITIGATION AREA 1
11-91	617	1.901	0.0	1.901	D			MITIGATION AREA 1
11-92	616	1.635	0.0	1.635	D			MITIGATION AREA 1
11-93	6291	0.711	0.0	0.161	F			MITIGATION AREA 1
-	-	-	-	0.550	D			MITIGATION AREA 1
11-94	6292	0.834	0.0	0.834	D			MITIGATION AREA 1
11-95	616	0.369	0.0	0.279	F			MITIGATION AREA 1

T E ONE: **PROJECT WETLAND AND OT R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	0.090	D			MITIGATION AREA 1
11-98	6292	0.225	0.0	0.051	F			MITIGATION AREA 1
-	-	-	-	0.175	D			MITIGATION AREA 1
11-99	616	1.477	0.0	0.411	F			MITIGATION AREA 1
-	-	-	-	1.051	D			MITIGATION AREA 1
-	-	-	-	0.015	D			MITIGATION AREA 1
14-10	6291	0.176	0.0	0.176	F			MITIGATION AREA 1
14-12	616	1.216	0.0	1.216	F			MITIGATION AREA 1
14-13	616	0.170	0.0	0.170	F			MITIGATION AREA 1
14-15	6291	0.511	0.0	0.440	F			MITIGATION AREA 1
-	-	-	-	0.072	D			MITIGATION AREA 1
14-16	6291	0.246	0.0	0.246	F			MITIGATION AREA 1
14-18	616	0.176	0.0	0.176	F			MITIGATION AREA 1
14-19	616	0.524	0.0	0.524	F			MITIGATION AREA 1
14-20	616	0.782	0.0	0.782	F			MITIGATION AREA 1
14-21	617	0.301	0.0	0.301	F			MITIGATION AREA 1
14-24	616	0.759	0.0	0.759	F			MITIGATION AREA 1
14-25	616	0.989	0.0	0.989	F			MITIGATION AREA 1
14-25	616	0.007	0.0	0.007	F			MITIGATION AREA 1
14-27	616	0.356	0.0	0.356	F			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
14-28	6291	1.024	0.0	0.764	F			MITIGATION AREA 1
-	-	-	-	0.055	D			MITIGATION AREA 1
-	-	-	-	0.204	D			MITIGATION AREA 1
14-29	616	1.640	0.0	1.416	F			MITIGATION AREA 1
-	-	-	-	0.225	D			MITIGATION AREA 1
14-30	6291	0.380	0.0	0.380	F			MITIGATION AREA 1
14-31	616	0.906	0.0	0.906	F			MITIGATION AREA 1
14-32	616	0.545	0.0	0.545	F			MITIGATION AREA 1
14-33	6291	0.786	0.0	0.786	F			MITIGATION AREA 1
14-34	617	0.351	0.0	0.351	D			MITIGATION AREA 1
14-35	616	1.191	0.0	0.497	F			MITIGATION AREA 1
-	-	-	-	0.652	D			MITIGATION AREA 1
-	-	-	-	0.042	D			MITIGATION AREA 1
14-36	616	0.826	0.0	0.826	F			MITIGATION AREA 1
14-37	616	0.581	0.0	0.010	F			MITIGATION AREA 1
-	-	-	-	0.571	D			MITIGATION AREA 1
14-38	616	0.148	0.0	0.148	F			MITIGATION AREA 1
14-4	617	0.014	0.0	0.014	F			MITIGATION AREA 1
14-40	617	0.608	0.0	0.192	F			MITIGATION AREA 1
-	-	-	-	0.023	D			MITIGATION AREA 1

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	0.393	D			MITIGATION AREA 1
14-41	616	0.097	0.0	0.097	D			MITIGATION AREA 1
14-42	6291	0.063	0.0	0.063	F			MITIGATION AREA 1
14-43	616	0.288	0.0	0.288	D			MITIGATION AREA 1
14-47	616	0.420	0.0	0.420	D			MITIGATION AREA 1
14-48	616	0.391	0.0	0.391	F			MITIGATION AREA 1
14-5	617	0.000	0.0	0.000	F			MITIGATION AREA 1
14-50	616	0.027	0.0	0.027	F			MITIGATION AREA 1
14-51	6291	0.218	0.0	0.218	F			MITIGATION AREA 1
14-53	6291	0.042	0.0	0.042	F			MITIGATION AREA 1
14-54	6291	0.009	0.0	0.009	F			MITIGATION AREA 1
14-56	616	0.023	0.0	0.023	F			MITIGATION AREA 1
14-57	6291	0.012	0.0	0.012	F			MITIGATION AREA 1
14-59	616	0.298	0.0	0.298	F			MITIGATION AREA 1
14-6	617	0.376	0.0	0.224	F			MITIGATION AREA 1
-	-	-	-	0.152	D			MITIGATION AREA 1
14-60	617	0.269	0.0	0.269	D			MITIGATION AREA 1
14-62	616	1.066	0.0	1.066	D			MITIGATION AREA 1
14-63	616	0.662	0.0	0.662	D			MITIGATION AREA 1
14-64	617	0.032	0.0	0.032	F			MITIGATION AREA 1

T E ONE: **PROJECT WETLAND AND OT R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW IMPACT SIZE (acres)	IMPACT CODE	TEMPORARY IMPACTS TO WL & SW IMPACT SIZE (acres)	IMPACT CODE	MITIGATION AREA ID
14-66	616	0.889	0.0	0.889	D			MITIGATION AREA 1
14-67	616	1.028	0.0	1.028	D			MITIGATION AREA 1
14-69	6291	0.009	0.0	0.009	F			MITIGATION AREA 1
14-70	616	0.772	0.0	0.040	F			MITIGATION AREA 1
-	-	-	-	0.732	D			MITIGATION AREA 1
14-71	6291	0.284	0.0	0.284	D			MITIGATION AREA 1
14-72	616	0.128	0.0	0.128	D			MITIGATION AREA 1
14-73	616	1.213	0.0	0.425	F			MITIGATION AREA 1
-	-	-	-	0.587	D			MITIGATION AREA 1
-	-	-	-	0.201	D			MITIGATION AREA 1
14-74	616	0.129	0.0	0.129	D			MITIGATION AREA 1
14-76	616	0.378	0.0	0.378	D			MITIGATION AREA 1
14-8	6291	1.372	0.0	0.954	F			MITIGATION AREA 1
-	-	-	-	0.418	D			MITIGATION AREA 1
14-82	630	4.940	0.0	3.543	F			MITIGATION AREA 1
-	-	-	-	1.397	D			MITIGATION AREA 1
14-83	6291	11.106	0.0	11.106	F			MITIGATION AREA 1
14-84	6291	6.002	0.0	6.002	F			MITIGATION AREA 1
14-85	617	5.285	0.0	1.986	F			MITIGATION AREA 1
-	-	-	-	3.299	D			MITIGATION AREA 1

T. E ONE: **PROJECT WETLAND AND O R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
14-86	630	1.077	0.0	1.077	F			MITIGATION AREA 1
14-87	6291	25.929	0.0	24.162	F			MITIGATION AREA 1
-	-	-	-	1.767	D			MITIGATION AREA 1
14-88	617	0.775	0.0	0.775	F			MITIGATION AREA 1
14-89	617	3.108	0.0	3.108	F			MITIGATION AREA 1
14-90	6291	0.966	0.0	0.966	D			MITIGATION AREA 1
14-91	6291	27.967	0.0	22.080	F			MITIGATION AREA 1
-	-	-	-	5.384	D			MITIGATION AREA 1
-	-	-	-	0.504	D			MITIGATION AREA 1
14-92	617	1.043	0.0	0.245	F			MITIGATION AREA 1
-	-	-	-	0.798	D			MITIGATION AREA 1
14-93	6291	10.718	0.0	2.362	F			MITIGATION AREA 1
-	-	-	-	3.465	D			MITIGATION AREA 1
-	-	-	-	1.133	D			MITIGATION AREA 1
-	-	-	-	3.758	D			MITIGATION AREA 1
14-94	6291	0.021	0.0	0.021	F			MITIGATION AREA 1
14-96	617	1.097	0.0	0.274	F			MITIGATION AREA 1
-	-	-	-	0.823	D			MITIGATION AREA 1
14-97	6291	0.985	0.0	0.985	F			MITIGATION AREA 1
15-104	6292	0.003	0.0	0.003	F			MITIGATION AREA 1

T, E ONE: **PROJECT WETLAND AND OT R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
15-106	617	10.729	0.0	1.067	F			MITIGATION AREA 1
-	-	-	-	7.511	D			MITIGATION AREA 1
-	-	-	-	2.151	D			MITIGATION AREA 1
15-11	616	2.844	0.0	0.299	F			MITIGATION AREA 1
-	-	-	-	2.187	D			MITIGATION AREA 1
-	-	-	-	0.358	D			MITIGATION AREA 1
15-112	617	1.609	0.0	1.609	F			MITIGATION AREA 1
15-113	617	1.972	0.0	0.359	F			MITIGATION AREA 1
-	-	-	-	1.612	D			MITIGATION AREA 1
15-114	6291	1.865	0.0	1.865	F			MITIGATION AREA 1
15-116	617	9.304	0.0	0.237	F			MITIGATION AREA 1
-	-	-	-	2.485	D			MITIGATION AREA 1
-	-	-	-	6.582	D			MITIGATION AREA 1
15-118	617	0.400	0.0	0.209	F			MITIGATION AREA 1
-	-	-	-	0.190	D			MITIGATION AREA 1
15-12	616	0.006	0.0	0.006	F			MITIGATION AREA 1
15-121	6292	25.216	0.0	4.784	F			MITIGATION AREA 1
-	-	-	-	13.546	D			MITIGATION AREA 1
-	-	-	-	6.628	D			MITIGATION AREA 1
-	-	-	-	0.257	D			MITIGATION AREA 1

T/ E ONE: **PROJECT WETLAND AND OT R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
15-123	617	0.663	0.0	0.663	D			MITIGATION AREA 1
15-127	617	0.553	0.0	0.553	D			MITIGATION AREA 1
15-128	530	0.293	0.0	0.080	F			MITIGATION AREA 1
-	-	-	-	0.213	D			MITIGATION AREA 1
15-13	616	0.605	0.0	0.605	F			MITIGATION AREA 1
15-14	616	0.065	0.0	0.065	F			MITIGATION AREA 1
15-15	616	0.425	0.0	0.425	F			MITIGATION AREA 1
15-16	616	0.030	0.0	0.030	F			MITIGATION AREA 1
15-17	616	0.774	0.0	0.774	D			MITIGATION AREA 1
15-18	617	0.652	0.0	0.652	D			MITIGATION AREA 1
15-19	616	0.336	0.0	0.336	D			MITIGATION AREA 1
15-21	616	0.144	0.0	0.113	F			MITIGATION AREA 1
-	-	-	-	0.021	D			MITIGATION AREA 1
-	-	-	-	0.011	D			MITIGATION AREA 1
15-22	6291	2.584	0.0	2.584	F			MITIGATION AREA 1
15-23	616	0.315	0.0	0.315	D			MITIGATION AREA 1
15-24	617	1.616	0.0	0.617	F			MITIGATION AREA 1
-	-	-	-	0.232	D			MITIGATION AREA 1
-	-	-	-	0.766	D			MITIGATION AREA 1
15-25	616	0.384	0.0	0.384	F			MITIGATION AREA 1

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
15-26	616	1.294	0.0	1.294	F			MITIGATION AREA 1
15-27	616	0.202	0.0	0.202	F			MITIGATION AREA 1
15-28	616	0.472	0.0	0.472	D			MITIGATION AREA 1
15-29	617	0.879	0.0	0.768	F			MITIGATION AREA 1
-	-	-	-	0.112	D			MITIGATION AREA 1
15-3	530	1.307	0.0	1.307	F			MITIGATION AREA 1
15-31	616	0.161	0.0	0.008	F			MITIGATION AREA 1
-	-	-	-	0.152	D			MITIGATION AREA 1
15-32	6291	0.278	0.0	0.237	F			MITIGATION AREA 1
-	-	-	-	0.041	D			MITIGATION AREA 1
15-33	616	0.246	0.0	0.246	F			MITIGATION AREA 1
15-34	616	0.151	0.0	0.151	F			MITIGATION AREA 1
15-36	6291	0.043	0.0	0.043	F			MITIGATION AREA 1
15-37	6292	0.117	0.0	0.117	D			MITIGATION AREA 1
15-39	616	1.764	0.0	0.777	F			MITIGATION AREA 1
-	-	-	-	0.987	D			MITIGATION AREA 1
15-40	616	0.017	0.0	0.017	F			MITIGATION AREA 1
15-41	616	0.255	0.0	0.195	F			MITIGATION AREA 1
-	-	-	-	0.060	D			MITIGATION AREA 1
15-43	6291	0.136	0.0	0.136	F			MITIGATION AREA 1

T. .E ONE: **PROJECT WETLAND AND O R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
15-46	617	3.325	0.0	2.051	F			MITIGATION AREA 1
-	-	-	-	1.274	D			MITIGATION AREA 1
15-47	6291	0.175	0.0	0.175	F			MITIGATION AREA 1
15-49	616	0.008	0.0	0.008	F			MITIGATION AREA 1
15-50	6291	4.987	0.0	4.297	F			MITIGATION AREA 1
-	-	-	-	0.690	D			MITIGATION AREA 1
15-51	617	4.059	0.0	3.626	F			MITIGATION AREA 1
-	-	-	-	0.101	D			MITIGATION AREA 1
-	-	-	-	0.332	D			MITIGATION AREA 1
15-52	6292	8.168	0.0	4.001	F			MITIGATION AREA 1
-	-	-	-	3.269	D			MITIGATION AREA 1
-	-	-	-	0.898	D			MITIGATION AREA 1
15-54	616	0.711	0.0	0.711	D			MITIGATION AREA 1
15-55	616	0.140	0.0	0.002	F			MITIGATION AREA 1
-	-	-	-	0.138	D			MITIGATION AREA 1
15-57	616	0.105	0.0	0.105	D			MITIGATION AREA 1
15-58	617	4.947	0.0	4.947	D			MITIGATION AREA 1
15-59	6292	0.977	0.0	0.977	D			MITIGATION AREA 1
15-60	616	1.995	0.0	1.995	D			MITIGATION AREA 1
15-62	616	0.387	0.0	0.114	F			MITIGATION AREA 1

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	0.273	D			MITIGATION AREA 1
15-65	616	0.698	0.0	0.698	D			MITIGATION AREA 1
15-67	6292	0.085	0.0	0.085	D			MITIGATION AREA 1
15-68	6292	0.330	0.0	0.330	D			MITIGATION AREA 1
15-69	616	0.462	0.0	0.462	D			MITIGATION AREA 1
15-70	617	1.738	0.0	1.738	D			MITIGATION AREA 1
15-71	616	0.313	0.0	0.313	D			MITIGATION AREA 1
15-72	616	1.234	0.0	1.234	D			MITIGATION AREA 1
15-74	6292	0.390	0.0	0.390	D			MITIGATION AREA 1
15-75	616	0.320	0.0	0.320	D			MITIGATION AREA 1
15-77	617	1.507	0.0	1.507	D			MITIGATION AREA 1
15-78	616	0.188	0.0	0.188	D			MITIGATION AREA 1
15-79	616	0.107	0.0	0.107	D			MITIGATION AREA 1
15-80	617	0.458	0.0	0.121	F			MITIGATION AREA 1
-	-	-	-	0.337	D			MITIGATION AREA 1
15--81	616	1.215	0.0	1.215	D			MITIGATION AREA 1
15-82	6292	0.071	0.0	0.019	F			MITIGATION AREA 1
-	-	-	-	0.052	D			MITIGATION AREA 1
15-84	616	0.642	0.0	0.642	D			MITIGATION AREA 1
15-86	616	0.132	0.0	0.132	D			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
15-88	6291	0.455	0.0	0.455	D			MITIGATION AREA 1
15-89	621	1.204	0.0	1.204	D			MITIGATION AREA 1
15-90	616	0.502	0.0	0.502	D			MITIGATION AREA 1
15-91	6291	1.048	0.0	1.048	D			MITIGATION AREA 1
15-94	6291	0.232	0.0	0.183	F			MITIGATION AREA 1
-	-	-	-	0.036	D			MITIGATION AREA 1
-	-	-	-	0.013	D			MITIGATION AREA 1
15-96	616	0.744	0.0	0.744	D			MITIGATION AREA 1
15-98	616	0.234	0.0	0.234	D			MITIGATION AREA 1
15-99	616	0.257	0.0	0.257	D			MITIGATION AREA 1
16-1	6291	6.373	0.0	0.278	F			MITIGATION AREA 1
-	-	-	-	1.107	D			MITIGATION AREA 1
-	-	-	-	4.988	D			MITIGATION AREA 1
16-10	6292	2.761	0.0	2.537	F			MITIGATION AREA 1
-	-	-	-	0.224	D			MITIGATION AREA 1
16-102	630	44.874	0.0	29.899	F			MITIGATION AREA 1
-	-	-	-	8.281	D			MITIGATION AREA 1
-	-	-	-	0.077	D			MITIGATION AREA 1
-	-	-	-	2.469	D			MITIGATION AREA 1
-	-	-	-	0.091	D			MITIGATION AREA 1

TABLE ONE: **PROJECT WETLAND AND OTHER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	4.057	D			MITIGATION AREA 1
16-103	6291	158.316	0.0	29.757	F			MITIGATION AREA 1
-	-	-	-	47.858	D			MITIGATION AREA 1
-	-	-	-	27.663	D			MITIGATION AREA 1
-	-	-	-	5.645	D			MITIGATION AREA 1
-	-	-	-	47.394	D			MITIGATION AREA 1
16-105	628	46.725	0.0	1.320	F			MITIGATION AREA 1
-	-	-	-	0.603	D			MITIGATION AREA 1
-	-	-	-	44.802	D			MITIGATION AREA 1
16-106	630	14.672	0.0	0.638	F			MITIGATION AREA 1
-	-	-	-	14.035	D			MITIGATION AREA 1
16-107	6291	33.293	0.0	5.258	F			MITIGATION AREA 1
-	-	-	-	21.355	D			MITIGATION AREA 1
-	-	-	-	6.149	D			MITIGATION AREA 1
-	-	-	-	0.531	D			MITIGATION AREA 1
16-11	6291	0.510	0.0	0.510	F			MITIGATION AREA 1
16-110	617	1.398	0.0	0.578	F			MITIGATION AREA 1
-	-	-	-	0.116	D			MITIGATION AREA 1
-	-	-	-	0.705	D			MITIGATION AREA 1
16-112	6291	2.044	0.0	2.044	D			MITIGATION AREA 1

T. .E ONE: **PROJECT WETLAND AND O\ R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
16-114	617	0.367	0.0	0.367	F			MITIGATION AREA 1
16-117	617	1.086	0.0	1.086	D			MITIGATION AREA 1
06-12	628	28.707	0.0	14.195	F			MITIGATION AREA 1
-	-	-	-	14.512	D			MITIGATION AREA 1
06-14	616	1.042	0.0	0.307	F			MITIGATION AREA 1
-	-	-	-	0.506	D			MITIGATION AREA 1
-	-	-	-	0.228	D			MITIGATION AREA 1
16-16	616	1.080	0.0	0.121	F			MITIGATION AREA 1
-	-	-	-	0.959	D			MITIGATION AREA 1
16-18	616	0.597	0.0	0.597	D			MITIGATION AREA 1
16-2	6291	0.852	0.0	0.852	D			MITIGATION AREA 1
16-23	616	0.524	0.0	0.524	D			MITIGATION AREA 1
16-24	616	0.047	0.0	0.047	F			MITIGATION AREA 1
16-25	6292	2.505	0.0	0.410	F			MITIGATION AREA 1
-	-	-	-	2.094	D			MITIGATION AREA 1
16-27	616	0.168	0.0	0.168	D			MITIGATION AREA 1
16-28	616	0.108	0.0	0.035	F			MITIGATION AREA 1
-	-	-	-	0.074	D			MITIGATION AREA 1
16-29	616	0.126	0.0	0.126	D			MITIGATION AREA 1
16-3	6291	0.466	0.0	0.466	D			MITIGATION AREA 1

T. E ONE: **PROJECT WETLAND AND O R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
16-31	6292	0.445	0.0	0.445	D			MITIGATION AREA 1
16-33	616	0.472	0.0	0.445	F			MITIGATION AREA 1
-	-	-	-	0.027	D			MITIGATION AREA 1
16-34	616	0.272	0.0	0.272	D			MITIGATION AREA 1
16-35	6292	0.797	0.0	0.797	D			MITIGATION AREA 1
16-36	6292	0.091	0.0	0.091	D			MITIGATION AREA 1
16-37	616	0.718	0.0	0.047	F			MITIGATION AREA 1
-	-	-	-	0.671	D			MITIGATION AREA 1
16-38	616	0.003	0.0	0.003	F			MITIGATION AREA 1
16-4	6292	1.884	0.0	0.001	F			MITIGATION AREA 1
-	-	-	-	1.882	D			MITIGATION AREA 1
16-40	616	1.077	0.0	0.689	F			MITIGATION AREA 1
-	-	-	-	0.214	D			MITIGATION AREA 1
-	-	-	-	0.174	D			MITIGATION AREA 1
16-41	616	0.263	0.0	0.210	F			MITIGATION AREA 1
-	-	-	-	0.052	D			MITIGATION AREA 1
16-42	616	0.098	0.0	0.098	D			MITIGATION AREA 1
16-44	617	0.001	0.0	0.001	F			MITIGATION AREA 1
16-45	630	11.188	0.0	0.852	F			MITIGATION AREA 1
-	-	-	-	10.335	D			MITIGATION AREA 1

T E ONE: **PROJECT WETLAND AND OT R SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
16-47	616	0.185	0.0	0.185	D			MITIGATION AREA 1
16-49	616	0.141	0.0	0.141	F			MITIGATION AREA 1
16-5	6292	0.935	0.0	0.669	F			MITIGATION AREA 1
-	-	-	-	0.000	D			MITIGATION AREA 1
-	-	-	-	0.266	D			MITIGATION AREA 1
16-51	616	1.208	0.0	1.208	D			MITIGATION AREA 1
16-52	6292	0.116	0.0	0.116	F			MITIGATION AREA 1
16-55	6291	0.588	0.0	0.588	F			MITIGATION AREA 1
-	-	-	-	0.000	D			MITIGATION AREA 1
16-57	6292	5.476	0.0	3.128	F			MITIGATION AREA 1
-	-	-	-	2.348	D			MITIGATION AREA 1
16-59	6291	0.679	0.0	0.532	F			MITIGATION AREA 1
-	-	-	-	0.147	D			MITIGATION AREA 1
16-61	617	0.019	0.0	0.019	F			MITIGATION AREA 1
16-62	6292	1.124	0.0	1.088	F			MITIGATION AREA 1
-	-	-	-	0.036	D			MITIGATION AREA 1
16-63	616	0.013	0.0	0.013	F			MITIGATION AREA 1
16-64	616	0.040	0.0	0.040	F			MITIGATION AREA 1
16-65	617	0.037	0.0	0.037	F			MITIGATION AREA 1
16-67	6292	6.356	0.0	1.331	F			MITIGATION AREA 1

LE ONE: **PROJECT WETLAND AND C ER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	5.025	D			MITIGATION AREA 1
16-68	6292	0.280	0.0	0.257	F			MITIGATION AREA 1
-	-	-	-	0.022	D			MITIGATION AREA 1
16-69	617	0.652	0.0	0.498	F			MITIGATION AREA 1
-	-	-	-	0.154	D			MITIGATION AREA 1
16-70	6292	0.341	0.0	0.298	F			MITIGATION AREA 1
-	-	-	-	0.042	D			MITIGATION AREA 1
16-71	6292	0.172	0.0	0.172	F			MITIGATION AREA 1
16-79	616	0.704	0.0	0.704	D			MITIGATION AREA 1
16-8	6292	0.016	0.0	0.016	F			MITIGATION AREA 1
16-81	6292	0.308	0.0	0.308	D			MITIGATION AREA 1
16-84	617	2.311	0.0	0.134	F			MITIGATION AREA 1
-	-	-	-	2.176	D			MITIGATION AREA 1
16-86	6292	0.168	0.0	0.168	F			MITIGATION AREA 1
16-88	617	0.793	0.0	0.157	F			MITIGATION AREA 1
-	-	-	-	0.636	D			MITIGATION AREA 1
16-9	628	13.830	0.0	13.830	D			MITIGATION AREA 1
16-92	630	0.020	0.0	0.020	F			MITIGATION AREA 1
16-95	616	0.002	0.0	0.002	F			MITIGATION AREA 1
16-99	6292	82.968	0.0	25.321	F			MITIGATION AREA 1

LE ONE: **PROJECT WETLAND AND (ER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	21.023	D			MITIGATION AREA 1
-	-	-	-	31.512	D			MITIGATION AREA 1
-	-	-	-	5.112	D			MITIGATION AREA 1
17-14	6291	2.162	0.0	2.162	D			MITIGATION AREA 1
17-16	616	0.150	0.0	0.150	D			MITIGATION AREA 1
17-17	616	0.471	0.0	0.471	D			MITIGATION AREA 1
17-18	616	0.092	0.0	0.092	D			MITIGATION AREA 1
17-19	616	0.531	0.0	0.235	F			MITIGATION AREA 1
-	-	-	-	0.296	D			MITIGATION AREA 1
17-20	616	0.419	0.0	0.419	D			MITIGATION AREA 1
17-21	628	14.970	0.0	14.970	D			MITIGATION AREA 1
17-22	616	0.564	0.0	0.564	D			MITIGATION AREA 1
17-23	617	0.275	0.0	0.275	D			MITIGATION AREA 1
17-24	616	0.122	0.0	0.122	D			MITIGATION AREA 1
17-25	630	6.639	0.0	1.715	F			MITIGATION AREA 1
-	-	-	-	4.239	D			MITIGATION AREA 1
-	-	-	-	0.685	D			MITIGATION AREA 1
17-26	616	2.496	0.0	0.316	F			MITIGATION AREA 1
-	-	-	-	2.180	D			MITIGATION AREA 1
17-27	606	0.210	0.0	0.210	D			MITIGATION AREA 1

PROJECT WETLAND AND C ER SURFACE WATER SUMMARY

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
17-28	616	0.537	0.0	0.537	D			MITIGATION AREA 1
17-29	6292	5.461	0.0	5.461	D			MITIGATION AREA 1
17-30	616	0.103	0.0	0.103	D			MITIGATION AREA 1
17-31	616	0.102	0.0	0.102	D			MITIGATION AREA 1
17-33	616	0.069	0.0	0.069	D			MITIGATION AREA 1
17-34	616	0.226	0.0	0.226	D			MITIGATION AREA 1
17-37	6292	4.292	0.0	0.144	F			MITIGATION AREA 1
-	-	-	-	4.002	D			MITIGATION AREA 1
-	-	-	-	0.146	D			MITIGATION AREA 1
17-38	616	0.771	0.0	0.771	D			MITIGATION AREA 1
17-39	616	0.311	0.0	0.311	D			MITIGATION AREA 1
17-40	616	0.365	0.0	0.365	D			MITIGATION AREA 1
17-41	6291	0.650	0.0	0.650	D			MITIGATION AREA 1
17-42	6291	1.124	0.0	1.045	F			MITIGATION AREA 1
-	-	-	-	0.078	D			MITIGATION AREA 1
17-43	616	0.132	0.0	0.132	D			MITIGATION AREA 1
17-44	630	0.179	0.0	0.179	D			MITIGATION AREA 1
17-45	616	0.170	0.0	0.084	F			MITIGATION AREA 1
-	-	-	-	0.004	D			MITIGATION AREA 1
-	-	-	-	0.082	D			MITIGATION AREA 1

LE ONE: **PROJECT WETLAND AND C ER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
17-46	616	0.281	0.0	0.035	F			MITIGATION AREA 1
-	-	-	-	0.246	D			MITIGATION AREA 1
17-47	616	0.276	0.0	0.276	D			MITIGATION AREA 1
17-48	6292	0.123	0.0	0.123	D			MITIGATION AREA 1
17-49	616	0.262	0.0	0.262	F			MITIGATION AREA 1
17-50	6291	0.974	0.0	0.974	F			MITIGATION AREA 1
-	-	-	-	0.000	D			MITIGATION AREA 1
17-51	6292	0.212	0.0	0.212	D			MITIGATION AREA 1
17-53	630	0.021	0.0	0.021	F			MITIGATION AREA 1
17-54	616	0.187	0.0	0.187	D			MITIGATION AREA 1
17-55	6292	0.289	0.0	0.289	D			MITIGATION AREA 1
17-57	616	0.412	0.0	0.411	F			MITIGATION AREA 1
-	-	-	-	0.000	D			MITIGATION AREA 1
17-58	6291	0.969	0.0	0.851	F			MITIGATION AREA 1
-	-	-	-	0.118	D			MITIGATION AREA 1
17-59	6291	5.939	0.0	5.485	F			MITIGATION AREA 1
-	-	-	-	0.454	D			MITIGATION AREA 1
17-60	616	0.122	0.0	0.122	D			MITIGATION AREA 1
17-62	6291	0.841	0.0	0.007	F			MITIGATION AREA 1
-	-	-	-	0.834	D			MITIGATION AREA 1

PROJECT WETLAND AND C ER SURFACE WATER SUMMARY

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
17-63	6292	0.041	0.0	0.041	F			MITIGATION AREA 1
17-69	6291	0.076	0.0	0.076	F			MITIGATION AREA 1
17-91	628	4.855	0.0	3.551	F			MITIGATION AREA 1
-	-	-	-	1.304	D			MITIGATION AREA 1
17-93	6291	1.203	0.0	1.203	D			MITIGATION AREA 1
17-95	6291	0.877	0.0	0.101	F			MITIGATION AREA 1
-	-	-	-	0.716	D			MITIGATION AREA 1
-	-	-	-	0.060	D			MITIGATION AREA 1
17-96	616	3.558	0.0	2.133	F			MITIGATION AREA 1
-	-	-	-	1.425	D			MITIGATION AREA 1
22-1	630	0.002	0.0	0.002	F			MITIGATION AREA 1
22-10	616	1.518	0.0	0.541	F			MITIGATION AREA 1
-	-	-	-	0.099	D			MITIGATION AREA 1
-	-	-	-	0.878	D			MITIGATION AREA 1
22-12	6292	1.428	0.0	1.285	F			MITIGATION AREA 1
-	-	-	-	0.144	D			MITIGATION AREA 1
22-13	6292	0.019	0.0	0.019	F			MITIGATION AREA 1
22-23	616	0.095	0.0	0.095	F			MITIGATION AREA 1
22-3	617	3.197	0.0	1.835	F			MITIGATION AREA 1
-	-	-	-	1.363	D			MITIGATION AREA 1

LE ONE: **PROJECT WETLAND AND C ER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
22-32	6291	36.451	0.0	3.730	F			MITIGATION AREA 1
-	-	-	-	0.428	D			MITIGATION AREA 1
-	-	-	-	6.239	D			MITIGATION AREA 1
-	-	-	-	5.909	D			MITIGATION AREA 1
-	-	-	-	20.145	D			MITIGATION AREA 1
22-33	6291	1.985	0.0	1.815	D			MITIGATION AREA 1
-	-	-	-	0.170	D			MITIGATION AREA 1
22-34	6292	4.959	0.0	1.418	F			MITIGATION AREA 1
-	-	-	-	3.541	D			MITIGATION AREA 1
22-37	617	0.002	0.0	0.002	F			MITIGATION AREA 1
22-4	616	0.884	0.0	0.392	F			MITIGATION AREA 1
-	-	-	-	0.491	D			MITIGATION AREA 1
22-42	530	1.340	0.0	0.125	F			MITIGATION AREA 1
-	-	-	-	1.215	D			MITIGATION AREA 1
22-5	616	0.302	0.0	0.302	D			MITIGATION AREA 1
22-54	6291	2.783	0.0	2.665	F			MITIGATION AREA 1
-	-	-	-	0.016	D			MITIGATION AREA 1
-	-	-	-	0.102	D			MITIGATION AREA 1
22-55	628	2.222	0.0	0.492	F			MITIGATION AREA 1
-	-	-	-	0.809	D			MITIGATION AREA 1

LE ONE: **PROJECT WETLAND AND C ER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
-	-	-	-	0.921	D			MITIGATION AREA 1
22-56	628	14.978	0.0	5.909	F			MITIGATION AREA 1
-	-	-	-	2.504	D			MITIGATION AREA 1
-	-	-	-	0.057	D			MITIGATION AREA 1
-	-	-	-	6.508	D			MITIGATION AREA 1
22-8	616	0.141	0.0	0.004	F			MITIGATION AREA 1
-	-	-	-	0.137	D			MITIGATION AREA 1
23-10	616	0.596	0.0	0.596	D			MITIGATION AREA 1
23-11	616	0.134	0.0	0.019	F			MITIGATION AREA 1
-	-	-	-	0.115	D			MITIGATION AREA 1
23-12	616	0.018	0.0	0.018	F			MITIGATION AREA 1
23-19	6291	29.125	0.0	2.038	F			MITIGATION AREA 1
-	-	-	-	4.387	D			MITIGATION AREA 1
-	-	-	-	18.131	D			MITIGATION AREA 1
-	-	-	-	4.569	D			MITIGATION AREA 1
23-2	616	0.045	0.0	0.045	F			MITIGATION AREA 1
23-20	617	0.941	0.0	0.941	D			MITIGATION AREA 1
23-21	617	0.960	0.0	0.115	F			MITIGATION AREA 1
-	-	-	-	0.845	D			MITIGATION AREA 1
23-22	617	1.365	0.0	1.365	D			MITIGATION AREA 1

LE ONE: **PROJECT WETLAND AND O ER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
23-3	617	0.987	0.0	0.033	F			MITIGATION AREA 1
-	-	-	-	0.954	D			MITIGATION AREA 1
23-4	616	2.314	0.0	0.868	F			MITIGATION AREA 1
-	-	-	-	0.789	D			MITIGATION AREA 1
-	-	-	-	0.657	D			MITIGATION AREA 1
23-5	6291	0.122	0.0	0.122	F			MITIGATION AREA 1
23-6	616	0.565	0.0	0.565	D			MITIGATION AREA 1
23-7	6291	0.069	0.0	0.069	D			MITIGATION AREA 1
23-8	6291	2.113	0.0	0.531	F			MITIGATION AREA 1
-	-	-	-	1.518	D			MITIGATION AREA 1
-	-	-	-	0.064	D			MITIGATION AREA 1
23-9	6291	1.462	0.0	1.462	F			MITIGATION AREA 1
-	-	-	-	0.001	D			MITIGATION AREA 1
16-10-P	6292	0.418	0.0	0.418	F			MITIGATION AREA 1
16-12-P	628	1.376	0.0	1.376	F			MITIGATION AREA 1
10-55-P	6291	0.096	0.0	0.096	F			MITIGATION AREA 1
10-61-P	616	0.066	0.0	0.066	F			MITIGATION AREA 1
10-63-P	616	0.549	0.0	0.549	F			MITIGATION AREA 1
16-24-P	616	1.332	0.0	1.332	F			MITIGATION AREA 1
15-29-P	617	0.673	0.0	0.673	F			MITIGATION AREA 1

LE ONE: **PROJECT WETLAND AND O ER SURFACE WATER SUMMARY**

WL & SW ID	WL & SW TYPE	WL & SW SIZE (ac.) ON SITE	WL & SW ACRES NOT IMPACTED	PERMANENT IMPACTS TO WL & SW		TEMPORARY IMPACTS TO WL & SW		MITIGATION AREA ID
				IMPACT SIZE (acres)	IMPACT CODE	IMPACT SIZE (acres)	IMPACT CODE	
16-38-P	616	0.000	0.0	0.000	F			MITIGATION AREA 1
15-49-P	616	0.056	0.0	0.056	F			MITIGATION AREA 1
15-50-P	6291	0.011	0.0	0.011	F			MITIGATION AREA 1
10-80-P	628	0.897	0.0	0.897	F			MITIGATION AREA 1
09-68-P	6291	2.176	0.0	2.176	F			MITIGATION AREA 1
16-102-P	630	0.387	0.0	0.387	F			MITIGATION AREA 1
15-114-P	6291	0.437	0.0	0.437	F			MITIGATION AREA 1
PROJECT TOTALS:		2355.218	0.0	2355.218				

Comments:

Note:

WL=Wetland SW=Other Surface Water ID=Identification number, letter, etc.

Wetland Type: from an established wetland classification system

Impact Type: D=dredge; F=fill; H=change hydrology; S=shading; C=clearing; O=other

Multiple entries per cell not allowed, except in the "Mitigation ID" column. If more than one impact is proposed in a given area, indicate the final impact.

T. .E TWO: **PROJECT ONSITE .IGATION SUMMARY**

MITIGATION ID	CREATION		RESTORATION		ENHANCEMENT		WETLAND PRESERVE		UPLAND PRESERVE		OTHER	
Assessment Area	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE
U1					171.5	425						
U2					33.2	425						
U3					126.4	425						
W-1					345.0	617						
W-2					1314.6	617						
W-3 (530)					11.2	530						
W-3 (615)					22.5	615						
W-3 (616)					101.4	616						
W-3 (617)					124.7	617						
W-3 (621)					20.5	621						
W-3 (628)					20.7	628						
W-3 (630)					1601.2	630						
W-3 (633)					382.9	633						
W-3 (641)					13.1	641						
W-3 (642)					36.5	642						
W-3 (651)					71.3	651						
W-4					43.1	617						
No Mine 425									54.2	425		
No Mine 427									0.1	427		

T. E TWO: **PROJECT ONSITE .IGATION SUMMARY**

MITIGATION ID	CREATION		RESTORATION		ENHANCEMENT		WETLAND PRESERVE		UPLAND PRESERVE		OTHER	
Assessment Area	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE
No Mine 441									42.8	441		
No Mine 443									25.4	443		
No Mine 530							0.1	530				
No Mine 616							149.0	616				
No Mine 617							41.4	617				
No Mine 628							79.7	628				
No Mine 6291							97.2	6291				
No Mine 6292							43.7	9292				
No Mine 630							108.6	630				
PROJECT TOTALS:					4439.7		519.6		122.5			

TABLE 3
OFF-SITE MITIGATION SUMMARY

MITIGATION ID	CREATION		RESTORATION		ENHANCEMENT		WETLAND PRESERVE		UPLAND PRESERVE		OTHER	
	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE	AREA	TARGET TYPE
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PROJECT TOTALS:	N/A		N/A		N/A		N/A		N/A		N/A	

CODES (multiple entries per cell not allowed):

Target Type=target or existing habitat type from an established wetland classification system or land use classification for non-wetland mitigation

Table 4
Calculate Sulfate Concentration in Reclaimed Lakes

Assumptions		
Production Rate	3.00	MTY
Mining Rate:	5.2	MTY
Average Sulfate Concentration in Rock:	0.07%	
Average Sulfate Concentration in GW:	0.0148%	
Average Sulfate In Captured Runoff	0.0000%	
Average Sulfate In in Pore Water	0.0020%	
Density of In situ Rock	1.375	tons/yd^3
Product Water Content	6%	
Apparent Specific Gravity of Aggregate Particles	2.75	
Water content of Rock Formation	24.9%	
Percentage of Sulfate in Tailings that Dissolves	10.0%	
Percentage of High Sulfate Groundwater that enters Pit	10%	
High sulfate Concentration	1,300	ppm
Captured Surface Water Runoff	0.48	mgd
Change in ET	0.02	mgd
Calculations		
Tons of Dissolved Sulfate from Tailings	0.42	tons
Tons of Water in Rock	3545	tons
Tons of Makeup Water Required	3,563	tons
Tons of Groundwater Required	1,564	tons
Tons of Surface Water Runoff	1,999	tons
Tons of Sulfate in Pore Water	0.07	tons
Tons of sulfate in Makeup Water	0.23	tons
Concentration of Sulfate in Pond Water	83	ppm

Assumptions		
Production Rate	3.00	MTY
Mining Rate:	5.2	MTY
Average Sulfate Concentration in Rock:	0.07%	
Average Sulfate Concentration in GW:	0.0340%	
Average Sulfate In Captured Runoff	0.0000%	
Average Sulfate In in Pore Water	0.0020%	
Density of In situ Rock	1.375	tons/yd^3
Product Water Content	6%	
Apparent Specific Gravity of Aggregate Particles	2.75	
Water content of Rock Formation	24.9%	
Percentage of Sulfate in Tailings that Dissolves	50%	
Percentage of High Sulfate Groundwater that enters Pit	25%	
High sulfate Concentration	1,300	ppm
Captured Surface Water Runoff	0.48	mgd
Calculations		
Tons of Dissolved Sulfate from Tailings	2.11	tons
Tons of Water in Rock	3545	tons
Tons of Makeup Water Required	3,480	tons
Tons of Groundwater Required	1,480	tons
Tons of Surface Water Runoff	1,999	tons
Tons of Sulfate in Pore Water	0.07	tons
Tons of sulfate in Makeup Water	0.50	tons
Concentration of Sulfate in Pond Water	315	ppm

Assumptions		
Production Rate	3.00	MTY
Mining Rate:	5.2	MTY
Average Sulfate Concentration in Rock:	0.07%	
Average Sulfate Concentration in GW:	0.0442%	
Average Sulfate In Captured Runoff	0.0000%	
Average Sulfate In in Pore Water	0.0020%	
Density of In situ Rock	1.375	tons/yd^3
Product Water Content	6%	
Apparent Specific Gravity of Aggregate Particles	2.75	
Water content of Rock Formation	24.9%	
Percentage of Sulfate in Tailings that Dissolves	67.0%	
Percentage of High Sulfate Groundwater that enters Pit	33%	
High sulfate Concentration	1,300	ppm
Captured Surface Water Runoff	0.48	mgd
Calculations		
Tons of Dissolved Sulfate from Tailings	6.68	tons
Tons of Water in Rock	3545	tons
Tons of Makeup Water Required	-	tons
Tons of Groundwater Required	(1,999)	tons
Tons of Surface Water Runoff	1,999	tons
Tons of Sulfate in Pore Water	0.07	tons
Tons of sulfate in Makeup Water	-0.88	tons
Concentration of Sulfate in Pond Water	1100	ppm

Assumptions		
Production Rate	3.00	MTY
Mining Rate:	5.2	MTY
Average Sulfate Concentration in Rock:	0.07%	
Average Sulfate Concentration in GW:	0.0878%	
Average Sulfate In Captured Runoff	0.0000%	
Average Sulfate In in Pore Water	0.0020%	
Density of In situ Rock	1.375	tons/yd^3
Product Water Content	6%	
Apparent Specific Gravity of Aggregate Particles	2.75	
Water content of Rock Formation	24.9%	
Percentage of Sulfate in Tailings that Dissolves	90.0%	
Percentage of High Sulfate Groundwater that enters Pit	67%	
High sulfate Concentration	1,300	ppm
Captured Surface Water Runoff	0.48	mgd
Calculations		
Tons of Dissolved Sulfate from Tailings	8.97	tons
Tons of Water in Rock	3545	tons
Tons of Makeup Water Required	-	tons
Tons of Groundwater Required	(1,999)	tons
Tons of Surface Water Runoff	1,999	tons
Tons of Sulfate in Pore Water	0.07	tons
Tons of sulfate in Makeup Water	-1.75	tons
Concentration of Sulfate in Pond Water	1100	ppm

CONTENTS

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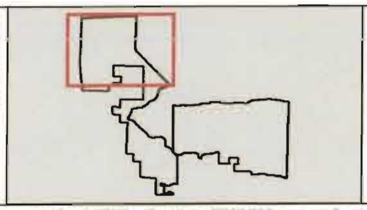

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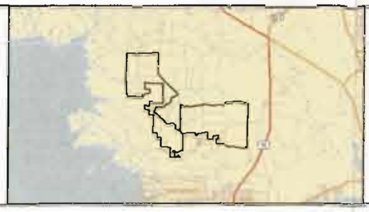
Tarmac King Road Limestone Mine
Levy County, Florida



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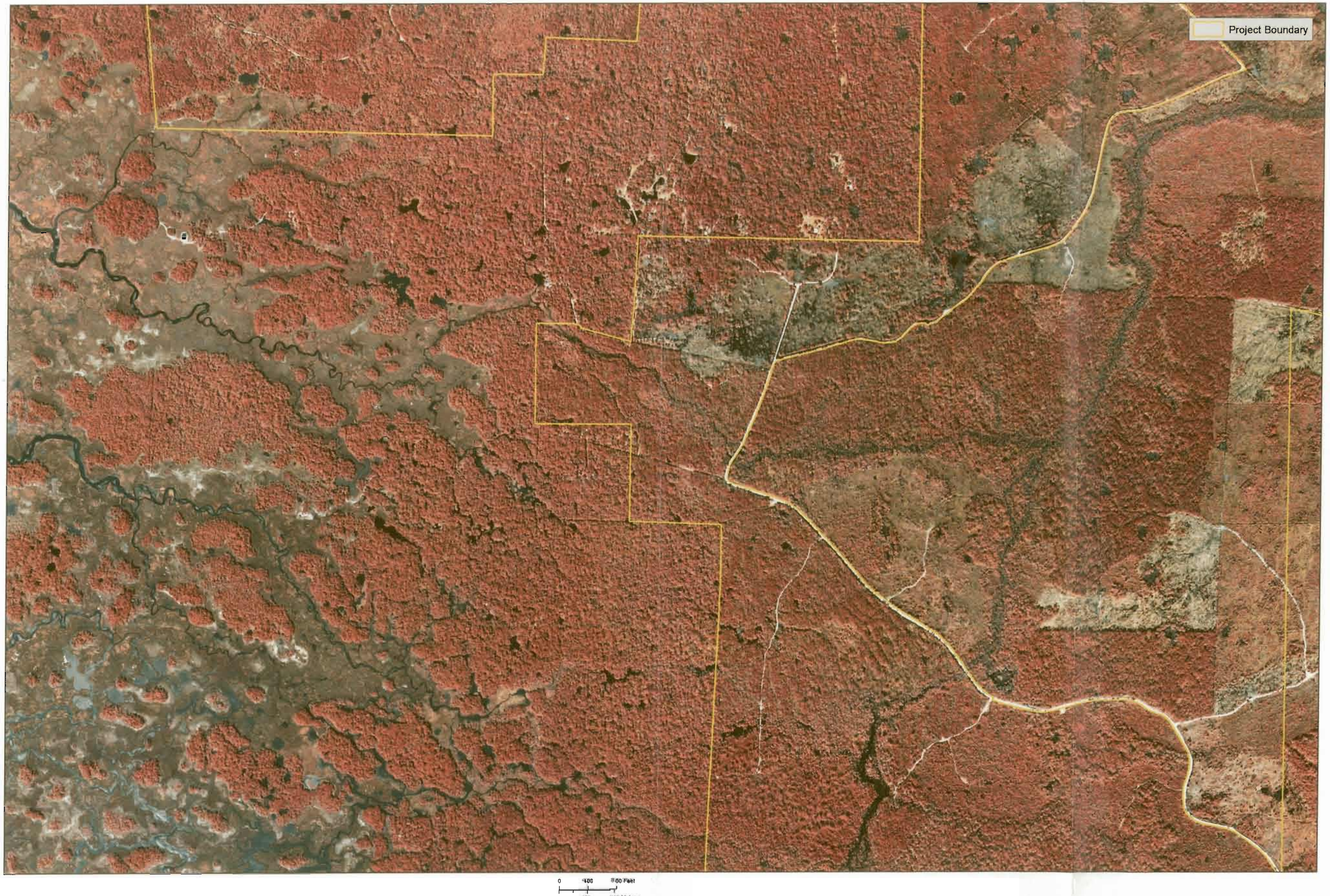

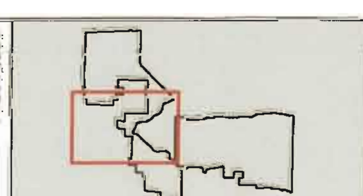

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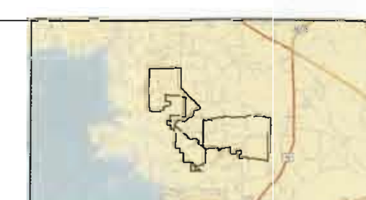

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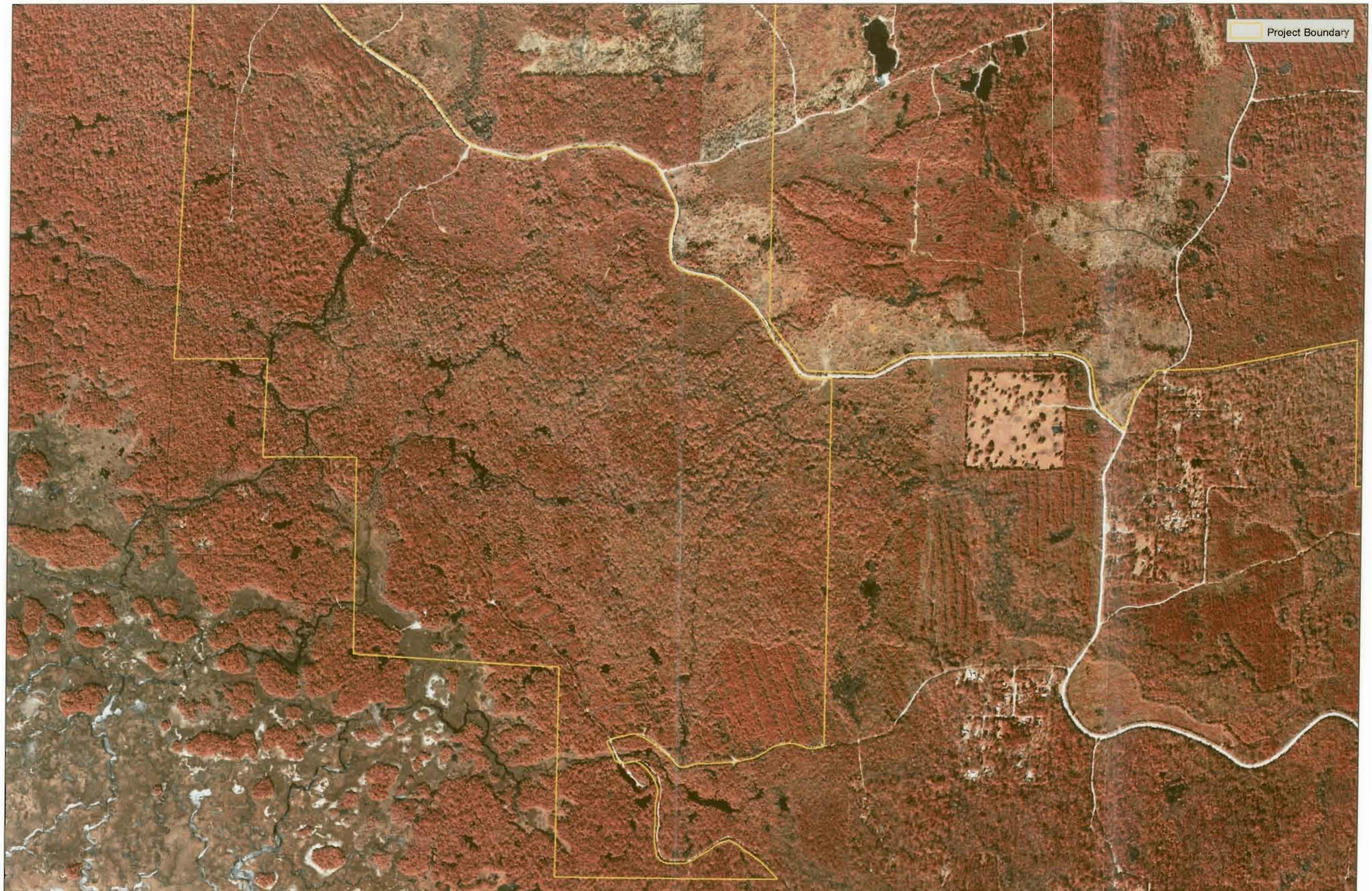

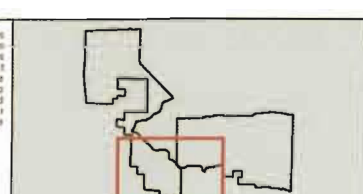

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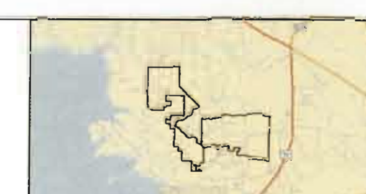

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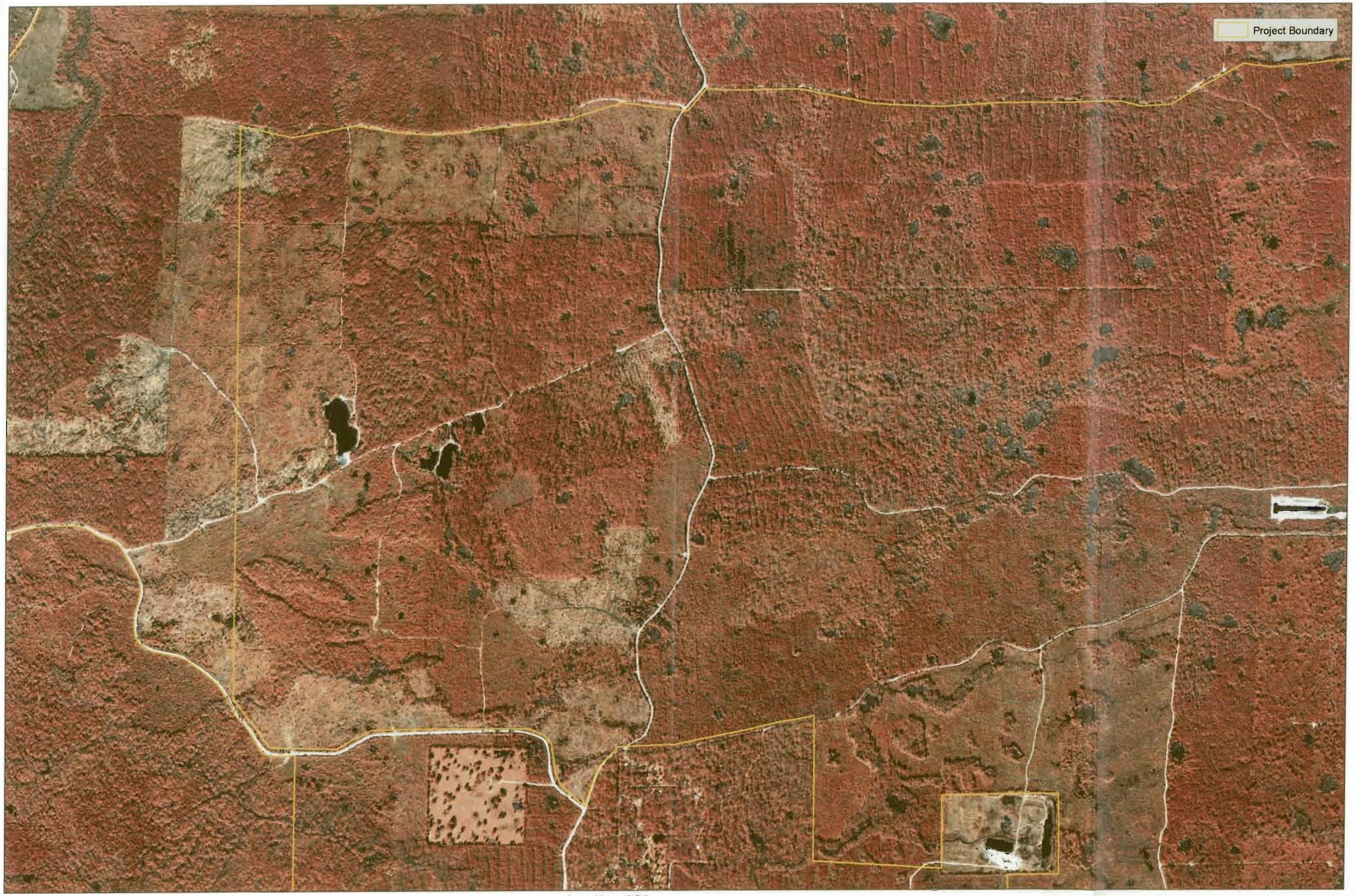

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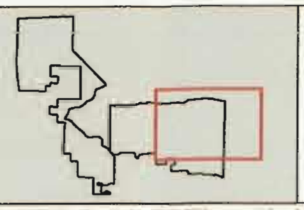

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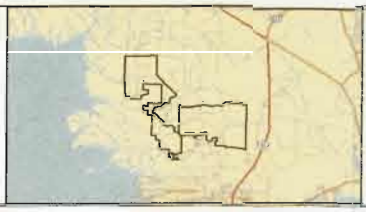

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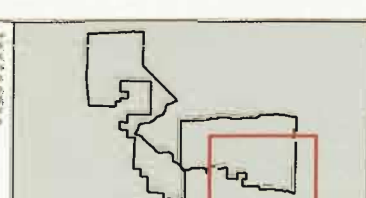

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EXHIBIT "A"

TARMAC
KING ROAD LIMESTONE MINE
MITIGATION SERVICES

SCOPE OF SERVICES

1.0 Restoration to Natural Plant Communities – Year Five

Reversing the Effects of Silviculture

In the fifth year of the mitigation effort, all natural plant communities will be enhanced through the elimination of selective harvest of naturally occurring wood-producing species and pine plantation activities. Where planted pines exist, selective thinning will be used to reduce the number of pines to 100 stems per acre or less. Loblolly pine will be preferred over slash pine as local forested communities are characterized by a greater dominance by loblolly. Tree-sized hardwoods will not be cleared. Care will be taken to minimize damage to any recruited hardwood species. Where the planted pines are mature, they will be cut and removed. Where pines are small enough, mulching in place (hydro-axe) will be the preferred method, although girdling in place may also be used. Care will be taken during removal to limit damage to recruiting hardwood species.

Selective Burning

If warranted, localized burning may be used to remove piles of debris or mulch layers. To minimize hardwood mortality, winter burning will be used to remove mulch/debris.

Supplemental Planting

Individual restoration areas will be assessed to determine if seedlings and saplings of target desirable species are present in adequate variety and abundance to establish the target forested habitat type. If not, then the existing vegetation will be supplemented with one-gallon nursery material. If supplementation occurs, the species chosen will be appropriate to the target mature natural community.

2.0 Nuisance Plant Treatments

ENTRIX will complete and intensive initial maintenance event at the King Road Limestone Mine mitigation site. The task will consist of herbicide treatments of nuisance vegetation located within the adjacent to the mitigation site. Target species will be those listed as invasive by the Florida Exotic Pest Plant Council including cogon grass (*Imperata cylindrica*), air potato (*Dioscorea bulbifera*), and Japanese climbing fern (*Lygodium japonicum*). However, based on current cover by exotic species, treatments will primarily target cogon grass along most roadways through and adjacent to the site.

All treatments will be performed by State certified applicators using Environmental Protection Agency approved herbicides. All treated vegetation will be left in place to decompose naturally. The initial treatment will take place prior to any other work on the mitigation site to prevent the inadvertent spread of nuisance plants. In the first three years following the initial event, treatments will be conducted monthly for a three-year total of 36 events. In years four and five treatments will be conducted quarterly for a two-year total of eight events.

3.0 Monitoring

At least five monitoring transects will be established in each defined mitigation activity area. The locations will be chosen to be representative of each category of mitigation. Conditions will be documented through photographs taken at fixed photopoints and a narrative description of each location. Meandering transects will be used to document changes in vegetation composition. A permanent photopoint will be established at a predetermined strategic position on the transects. The locations will be marked in the field with metal stakes and coordinates will be recorded with a sub meter GPS unit. Photos will be taken once a year at each point, after completion of any major management activity such as thinning, planting, nuisance species removal, or hydrologic restoration; or after natural disturbances such as wildfire, severe windstorms, or saltwater inundation due to storm surges. At each location, a camera will be set up on a fixed elevation and a 360 ° panoramic picture will be taken. The locations of the photopoints will be indicated on an aerial photograph and included in the annual report. Panoramas will be included in the annual report. Monitoring will be conducted in September or October, annually for years one through five.

Data gathered along the transects will be summarized in each annual report and will consist of the following:

3.1 A qualitative description of the vegetation,
3.2 Date of supplemental planting (if necessary) and number of each species installed,
3.3 Color photographic prints taken from fixed reference points,
3.4 Total percent cover by desirable vegetation in the canopy, shrub and ground cover strata,
3.5 Percent cover of nuisance species,
3.6 An estimate of pine tree density in wetlands previously planted with pines,
3.7 Indications of natural recruitment of target habitat species,
3.8 A total estimate of species classified as FAC, FACW or OBL.
3.9 Water depths and/or a description of soil moisture,
3.10 Lists of dominant target plant species and an estimate of the cover of each,
3.11 Observations of wildlife use,
3.12 Overall ecological evaluation, and
3.13 A description of management activities completed since the previous reporting period.

Reports shall be prepared for submittal to the agencies, after review by the Client.

4.0 Cost

The compensation for services of principals and employees of ENTRIX rendered pursuant to the Scope of Services of this agreement is as follows:

Task 1.0	Restoration to Natural Plant Communities in Year Five	
	Selective Pine Harvest and Debris Removal	$ 1,580,480.00
	Selective Burning	$ 51,950.00
	Supplemental Planting	$ 48,200.00

Task 2.0	Nuisance Plant Treatments		
	Initial Event	$	75,000.00
	Years 1-3 (36 events @ $14,550.00/event)	$	523,800.00
	Years 4-5 (8 events @ $10,000.00/event)	$	80,000.00
Task 3.0	Monitoring		
	Set-up Event	$	37,300.00
	Years 2-4 (4 events @ $34,300.00 event)	$	137,200.00
Years 1 – 5 Total		$	2,533,930.00

For Task 1.0 invoices will be submitted on a percent completion basis of a specific restoration area. For Tasks 2.0 and 3.0 invoices will be submitted on completion of each task or event.

All rates and fees shall be subject to renegotiation after a one (1) month period from the date of this Agreement if it has not been accepted. In the event new or additional regulations are adopted or implemented after the date of this Agreement, any additional work effort will be extra to this Agreement.

5.0 Mitigation Compliance

Please note that these costs do not include extensive coordination or negotiation with regulatory agencies (e.g., unscheduled field or office meetings) regarding permit compliance deficiencies outside the control of ENTRIX.

6.0 Proposal Assumptions

General

- The Client will make provision for ENTRIX to enter upon public and private property as required to perform services under this agreement.
- This Scope of Services does not include permit modifications, including negotiations with regulatory agencies or necessary corrective actions.
- Any work or items not specifically included are excluded.
- These notes become part of any contract or agreement entered into, unless specific exceptions are made in writing stating otherwise, adding to or deleting from the scope of work.

Selective Clearing

- Costs do not include the sale of merchantable timber.

Supplemental Planting

- The planting areas will be readily accessible to vehicular traffic during the initial planting activities. Should vehicular access be restricted, the additional time required to deliver the plant material to the planting area will be billed as additional services.
- All plants, trees, sod, etc. required for this job are subject to market availability.
- Clean up of site is limited to debris and waste generated by our operations.
- Costs assume the need to plant 1% of mitigation activity types W1, W2, U1 and U2, 20% of mitigation activity type W4, 5% of mitigation activity type U3, and that no supplemental planting will be needed in mitigation activity type W3.

Monitoring

These costs assume that the monitoring methods, as briefly outlined in this scope, are accepted by the agencies. The methods, as outlined, are designed for the qualitative collection of monitoring data on which to base subsequent monitoring reports. If more quantitative sampling methods are required by the regulating agencies, this contract will need to be amended to allow for new methods approval and implementation.

Maintenance

- The proposed maintenance schedule and cost estimate are based on existing conditions of the project area at the time of this proposal. Certain situations such as the introduction of seeds or propagules of exotic plants by the movement of contaminated machinery may increase the cover by nuisance species and therefore the cost of maintenance. ENTRIX will contact the client immediately if any conditions are noted on the site that will make more frequent maintenance necessary and provide an estimate of remedial measures.
- Costs for maintenance assume that there will be water (well) available to use for mixing herbicides.
- Costs for maintenance also assume that all equipment will be free of exotic plant parts prior to entering the site.

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
02-2	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.17	-0.11
02-6	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	3.01	-1.70
02-7	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.93	-0.59
02-8	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.09	-0.06
02-87	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.20	-0.12
02-88	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.08	-0.05
02-89	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	0.14	-0.08
02-9	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.97	-0.45
02-90	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	0.05	-0.03
03-1	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.31	-0.20
03-2	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.18	-0.11
03-3	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.60	-0.38
03-4	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.22	-0.14
07-1	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	8.06	-4.03
08-1	530 - Borrow Pits	0	0	0	0	6	4	3	0.43	0.44	-0.19
08-100	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	90.58	-45.29
08-102	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	206.70	-103.35
08-103	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	13.27	-7.96
08-104	617 - Mixed Wetland Hardwoods	0	0	0	0	6	6	6	0.60	10.93	-6.56
08-105	617 - Mixed Wetland Hardwoods	0	0	0	0	6	6	6	0.60	1.04	-0.62
08-106	617 - Mixed Wetland Hardwoods	0	0	0	0	6	6	6	0.60	0.60	-0.36
08-107	617 - Mixed Wetland Hardwoods	0	0	0	0	6	6	6	0.60	0.89	-0.53
08-108	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	12.59	-7.55
08-110	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	4.48	-2.69
08-111	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	2.58	-1.55
08-112	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	53.49	-26.75
08-113	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	70.61	-35.30
08-12	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	13.88	-8.33
08-13	617 - Mixed Wetland Hardwoods	0	0	0	0	6	6	6	0.60	2.65	-1.59
08-14	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	0.64	-0.38
08-15	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	0.54	-0.32
08-16	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.14	-0.09
08-17	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.11	-0.07
08-18	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.17	-0.11
08-19	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.09	-0.06

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
08-2	530 - Borrow Pits	0	0	0	0	6	4	3	0.43	1.13	-0.49
08-20	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.53	-0.37
08-21	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.85	-0.59
08-23	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	4.05	-2.43
08-24	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.30	-0.20
08-25	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.15	-0.10
08-26	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.20	-0.13
08-27	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	1.26	-0.88
08-28	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.21	-0.14
08-29	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.12	-0.08
08-3	530 - Borrow Pits	0	0	0	0	6	4	3	0.43	0.89	-0.38
08-32	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.28	-0.20
08-33	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.91	-0.64
08-34	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	0.06	-0.03
08-35	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.12	-0.08
08-36	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	1.12	-0.67
08-38	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.27	-0.18
08-39	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.36	-0.24
08-4	530 - Borrow Pits	0	0	0	0	6	4	3	0.43	2.04	-0.89
08-40	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.18	-0.12
08-42	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.40	-0.27
08-43	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.47	-0.32
08-44	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.51	-0.36
08-45	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	0.39	-0.24
08-47	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.15	-0.10
08-48	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.11	-0.08
08-49	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.14	-0.09
08-5	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	3.14	-1.57
08-50	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	4.09	-2.05
08-51	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.18	-0.13
08-52	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.16	-0.11
08-53	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	1.16	-0.70
08-54	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.19	-0.13
08-55	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.42	-0.28
08-56	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.10	-0.07
08-57	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.60	-0.40

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
08-58	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.33	-0.22
08-59	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.18	-0.13
08-6	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	0.72	-0.36
08-60	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.14	-0.09
08-61	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.36	-0.24
08-62	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.20	-0.13
08-63	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.25	-0.17
08-64	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.23	-0.15
08-65	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.36	-0.25
08-66	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.09	-0.06
08-68	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.11	-0.08
08-69	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.26	-0.17
08-70	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.06	-0.04
08-71	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.19	-0.13
08-72	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.09	-0.06
08-73	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.32	-0.22
08-74	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	1.29	-0.86
08-75	530 - Borrow Pits	0	0	0	0	6	4	3	0.43	4.60	-1.99
08-78	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	1.30	-0.65
08-79	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.26	-0.17
08-81	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	7.19	-3.60
08-82	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	1.95	-0.98
08-83	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.42	-0.29
08-84	617 - Mixed Wetland Hardwoods	0	0	0	0	6	6	6	0.60	1.70	-1.02
08-86	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	1.17	-0.58
08-89	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.47	-0.33
08-9	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	0.52	-0.31
08-91	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.46	-0.30
08-92	617 - Mixed Wetland Hardwoods	0	0	0	0	6	6	6	0.60	0.68	-0.41
08-93	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.24	-0.17
08-95	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.14	-0.10
08-96	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	6.67	-3.33
08-97	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	71.61	-35.81
08-98	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	102.04	-51.02
08-99	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	18.72	-9.36
09-1	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	3.15	-1.47

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
09-10	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	1.15	-0.69
09-11	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.25	-0.16
09-13	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	0.51	-0.30
09-14	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.32	-0.22
09-15	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.35	-0.22
09-17	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.37	-0.87
09-19	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.70	-0.47
09-20	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.28	-0.18
09-21	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.78	-0.49
09-23	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.24	-0.16
09-27	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.27	-0.18
09-29	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.70	-0.47
09-3	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	4.82	-2.41
09-31	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.50	-0.34
09-32	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.28	-0.18
09-33	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.16	-0.10
09-35	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.35	-0.22
09-36	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.19	-0.12
09-37	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.26	-0.17
09-38	628 - Pine - Mesic - Oak	0	0	0	0	5	5	6	0.53	0.37	-0.20
09-39	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.37	-0.17
09-40	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	0.52	-0.30
09-42	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.40	-0.27
09-44	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	1.43	-0.96
09-47	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.01	-0.01
09-48	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.28	-0.18
09-49	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.42	-0.90
09-5	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.01	-0.01
09-51	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.40	-0.28
09-52	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.74	-0.47
09-53	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	0.25	-0.14
09-55	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.11	-0.07
09-59	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.10	-0.06
09-62	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.06	-0.04
09-65	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.51	-0.32
09-68	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	6.59	-3.07

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
09-69	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	49.87	-23.27
09-75	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	57.39	-32.52
09-78	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	5.12	-2.90
09-79	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	87.47	-40.82
09-82	617 - Mixed Wetland Hardwoods	0	0	0	0	6	6	6	0.60	1.26	-0.76
09-9	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.31	-0.20
10-10	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.50	-0.32
10-12	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.17	-0.11
10-13	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.10	-0.05
10-15	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.16	-0.10
10-16	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.31	-0.20
10-17	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.47	-0.30
10-18	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.18	-0.11
10-19	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.08	-0.69
10-2	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.05	-0.03
10-20	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.09	-0.05
10-21	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.39	-0.25
10-24	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.12	-0.07
10-25	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	4.75	-2.22
10-26	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.49	-0.31
10-27	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.19	-0.12
10-28	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.61	-0.38
10-29	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	0.43	-0.25
10-30	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	2.73	-1.73
10-31	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.73	-1.09
10-32	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.23	-0.14
10-33	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	5.56	-2.60
10-34	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.41	-0.26
10-35	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.46	-0.29
10-36	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.31	-0.20
10-38	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.23	-0.15
10-39	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.19	-0.56
10-4	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.48	-0.31
10-40	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.46	-0.29
10-41	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	2.27	-1.44
10-42	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.06	-0.04

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
10-43	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.00	-0.64
10-44	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.76	-0.48
10-45	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.79	-0.50
10-47	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.41	-0.26
10-48	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.57	-0.36
10-50	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.26	-0.17
10-51	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.66	-0.42
10-52	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.43	-0.27
10-53	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.10	-0.06
10-54	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	0.36	-0.20
10-55	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	6.46	-3.02
10-59	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.36	-0.23
10-6	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.44	-0.28
10-61	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.07	-0.04
10-62	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.19	-0.12
10-63	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.55	-0.37
10-7	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.49	-0.31
10-71	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.03	-0.02
10-73	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	3.02	-1.41
10-75	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.51	-0.33
10-77	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	2.38	-1.59
10-79	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	2.61	-1.65
10-8	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.04	-0.66
10-80	628 - Pine - Mesic - Oak	0	0	0	0	5	5	6	0.53	8.95	-4.78
10-83	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	113.90	-53.15
10-85	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.17	-0.55
10-87	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	53.63	-25.03
10-88	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.23	-0.11
10-90	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.43	-0.20
10-91	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.36	-0.17
10-94	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.20	-0.56
10-95	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	7.30	-3.41
10-96	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	14.01	-6.54
10-97	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.49	-0.23
10-99	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	53.01	-24.74
11-1	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	3.25	-1.52

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
11-10	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.23	-0.15
11-100	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.50	-0.23
11-101	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.55	-0.26
11-103	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.32	-0.21
11-110	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	1.23	-0.58
11-111	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.27	-0.17
11-112	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.0007	-0.0003
11-114	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.0033	-0.0015
11-115	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.06	-0.71
11-116	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.92	-0.43
11-119	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.46	-0.31
11-12	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.11	-0.07
11-120	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.07	-0.50
11-124	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	10.52	-5.96
11-127	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.30	-0.14
11-128	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.88	-0.41
11-129	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	16.66	-7.77
11-13	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.09	-0.06
11-130	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	63.58	-29.67
11-131	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.56	-0.32
11-133	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	1.33	-0.62
11-134	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.51	-0.70
11-135	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	2.31	-1.31
11-137	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	3.43	-1.95
11-138	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	3.20	-1.81
11-14	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.76	-0.48
11-15	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.50	-0.32
11-16	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	1.94	-1.10
11-17	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.55	-0.37
11-18	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.10	-0.06
11-20	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.17	-0.11
11-22	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.14	-0.10
11-23	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.24	-0.15
11-24	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.07	-0.05
11-25	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.21	-0.14
11-26	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	0.39	-0.22

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AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
11-27	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.46	-0.29
11-29	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.12	-0.08
11-30	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	5.46	-3.09
11-32	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.16	-0.10
11-33	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.80	-0.37
11-34	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.36	-0.86
11-35	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.16	-0.10
11-38	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.24	-0.70
11-39	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.13	-0.08
11-40	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.58	-0.74
11-42	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.08	-0.05
11-47	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.24	-0.15
11-48	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.75	-0.50
11-49	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.52	-0.33
11-50	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.85	-0.57
11-51	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.73	-0.41
11-52	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.13	-0.08
11-53	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.34	-0.21
11-54	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.37	-0.23
11-57	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.32	-0.20
11-58	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.54	-0.31
11-59	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.53	-0.36
11-61	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.99	-0.93
11-62	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.98	-0.46
11-63	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.33	-0.22
11-65	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.29	-0.18
11-66	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.27	-0.72
11-67	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.40	-0.93
11-70	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.77	-0.49
11-71	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.05	-0.03
11-72	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.44	-0.28
11-73	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.27	-0.13
11-74	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.05	-0.03
11-75	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.31	-0.20
11-76	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.03	-0.02
11-77	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.02	-0.01

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11-79	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.12	-0.07
11-8	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.16	-0.10
11-81	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.22	-0.82
11-83	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.23	-0.15
11-84	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.48	-0.22
11-85	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.21	-0.13
11-86	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.21	-0.13
11-88	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.07	-0.05
11-89	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.24	-0.15
11-9	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.11	-0.07
11-91	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.90	-1.08
11-92	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.63	-1.09
11-93	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.71	-0.33
11-94	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.83	-0.39
11-95	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.37	-0.25
11-98	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.23	-0.11
11-99	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.48	-0.98
14-10	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.18	-0.08
14-12	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.22	-0.81
14-13	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.17	-0.11
14-15	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.51	-0.24
14-16	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.25	-0.11
14-18	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.18	-0.11
14-19	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.52	-0.35
14-20	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.78	-0.50
14-21	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.30	-0.17
14-24	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.76	-0.48
14-25	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.00	-0.63
14-27	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.36	-0.24
14-28	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.02	-0.48
14-29	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.64	-1.04
14-30	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.38	-0.18
14-31	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.91	-0.60
14-32	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.55	-0.36
14-33	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.79	-0.37
14-34	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.35	-0.20

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14-35	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.19	-0.79
14-36	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.83	-0.52
14-37	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.58	-0.37
14-38	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.15	-0.09
14-4	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.01	-0.01
14-40	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.61	-0.34
14-41	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.10	-0.06
14-42	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.06	-0.03
14-43	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.29	-0.19
14-47	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.42	-0.27
14-48	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.39	-0.25
14-5	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.0004	-0.0002
14-50	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.03	-0.02
14-51	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.22	-0.10
14-53	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.04	-0.02
14-54	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.01	0.00
14-56	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.02	-0.01
14-57	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.01	-0.01
14-59	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.03	-0.02
14-6	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.38	-0.21
14-60	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.27	-0.15
14-62	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.07	-0.68
14-63	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.66	-0.42
14-64	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.03	-0.02
14-66	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.89	-0.56
14-67	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.03	-0.65
14-69	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.01	0.00
14-70	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.77	-0.51
14-71	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.28	-0.13
14-72	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.13	-0.09
14-73	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.21	-0.81
14-74	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.13	-0.09
14-76	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.38	-0.25
14-8	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.37	-0.64
14-82	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	4.94	-2.80
14-83	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	11.11	-5.18

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14-84	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	6.00	-2.80
14-85	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	5.28	-2.99
14-86	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	1.08	-0.61
14-87	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	25.93	-12.10
14-88	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.77	-0.44
14-89	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	3.11	-1.76
14-90	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.97	-0.45
14-91	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	27.97	-13.05
14-92	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.04	-0.59
14-93	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	10.72	-5.00
14-94	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.02	-0.01
14-96	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.10	-0.62
14-97	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.98	-0.46
15-104	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.0035	-0.0016
15-106	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	10.73	-6.08
15-11	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	2.84	-1.90
15-112	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.61	-0.91
15-113	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.97	-1.12
15-114	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	2.30	-1.07
15-116	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	9.30	-5.27
15-118	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.40	-0.23
15-12	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.01	0.00
15-121	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	25.22	-11.77
15-123	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.66	-0.38
15-127	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.55	-0.31
15-128	530 - Borrow Pits	0	0	0	0	5	4	1	0.33	0.29	-0.10
15-13	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.60	-0.40
15-14	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.06	-0.04
15-15	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.43	-0.28
15-16	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.03	-0.02
15-17	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.77	-0.52
15-18	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.65	-0.37
15-19	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.34	-0.22
15-21	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.14	-0.10
15-22	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	2.58	-1.21
15-23	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.31	-0.21

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
15-24	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.62	-0.92
15-25	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.38	-0.24
15-26	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.29	-0.86
15-27	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.20	-0.13
15-28	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.47	-0.30
15-29	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.55	-0.88
15-3	530 - Borrow Pits	0	0	0	0	5	4	1	0.33	1.31	-0.44
15-31	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.16	-0.11
15-32	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.28	-0.13
15-33	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.25	-0.16
15-34	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.15	-0.10
15-36	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.04	-0.02
15-37	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.12	-0.05
15-39	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.76	-1.18
15-40	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.02	-0.01
15-41	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.25	-0.17
15-43	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.14	-0.06
15-46	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	3.33	-1.88
15-47	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.17	-0.08
15-49	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.06	-0.04
15-50	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	5.00	-2.33
15-51	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	4.06	-2.30
15-52	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	8.17	-3.81
15-54	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.71	-0.47
15-55	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.14	-0.09
15-57	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.10	-0.07
15-58	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	4.95	-2.80
15-59	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.98	-0.46
15-60	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	2.00	-1.33
15-62	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.39	-0.25
15-65	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.70	-0.44
15-67	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.09	-0.04
15-68	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.33	-0.15
15-69	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.46	-0.29
15-70	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.74	-0.98
15-71	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.31	-0.21

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
15-72	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.23	-0.82
15-74	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.39	-0.18
15-75	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.32	-0.21
15-77	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.51	-0.85
15-78	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.19	-0.12
15-79	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.11	-0.07
15-80	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.46	-0.26
15-81	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.21	-0.77
15-82	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.07	-0.03
15-84	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.64	-0.41
15-86	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.13	-0.09
15-88	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.45	-0.21
15-89	621 - Cypress	0	0	0	0	5	8	6	0.63	1.20	-0.76
15-90	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.50	-0.33
15-91	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.05	-0.49
15-94	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.23	-0.11
15-96	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.74	-0.47
15-98	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.23	-0.16
15-99	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.26	-0.16
16-1	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	6.37	-2.97
16-10	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	3.18	-1.48
16-102	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	45.26	-25.65
16-103	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	158.32	-73.88
16-105	628 - Pine - Mesic - Oak	0	0	0	0	6	5	6	0.57	46.72	-26.48
16-106	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	14.67	-8.31
16-107	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	33.29	-15.54
16-11	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.51	-0.24
16-110	617 - Mixed Wetland Hardwoods	0	0	0	0	6	6	6	0.60	1.40	-0.84
16-112	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	2.04	-0.95
16-114	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.37	-0.21
16-117	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.09	-0.62
16-12	628 - Pine - Mesic - Oak	0	0	0	0	5	5	6	0.53	30.09	-16.05
16-14	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.04	-0.66
16-16	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.08	-0.68
16-18	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.60	-0.40
16-2	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.85	-0.40

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

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16-23	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.52	-0.33
16-24	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.38	-0.92
16-25	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	2.50	-1.17
16-27	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.17	-0.11
16-28	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.11	-0.07
16-29	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.13	-0.08
16-3	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.47	-0.22
16-31	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.45	-0.21
16-33	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.47	-0.33
16-34	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.27	-0.18
16-35	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.80	-0.37
16-36	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.09	-0.04
16-37	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.72	-0.46
16-38	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.0027	-0.0018
16-4	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	1.88	-0.88
16-40	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.08	-0.68
16-41	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.26	-0.18
16-42	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.10	-0.06
16-44	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.0006	-0.0004
16-45	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	11.19	-6.71
16-47	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.18	-0.12
16-49	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.14	-0.09
16-5	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.94	-0.44
16-51	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	1.21	-0.77
16-52	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.12	-0.05
16-55	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.59	-0.27
16-57	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	5.48	-2.74
16-59	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.68	-0.32
16-61	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.02	-0.01
16-62	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	1.12	-0.52
16-63	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.01	-0.01
16-64	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.04	-0.03
16-65	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.04	-0.02
16-67	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	6.36	-2.97
16-68	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.28	-0.13
16-69	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.65	-0.37

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16-70	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.34	-0.16
16-71	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.17	-0.08
16-79	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.70	-0.45
16-8	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.02	-0.01
16-81	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.31	-0.14
16-84	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	2.31	-1.31
16-86	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.17	-0.08
16-88	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.79	-0.45
16-9	628 - Pine - Mesic - Oak	0	0	0	0	5	5	6	0.53	13.83	-7.38
16-92	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	0.02	-0.01
16-94	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.0000003	-0.0000002
16-95	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.0016	-0.0011
16-99	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	82.97	-38.72
17-14	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	2.16	-1.08
17-16	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.15	-0.10
17-17	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.47	-0.31
17-18	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.09	-0.06
17-19	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.53	-0.35
17-20	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.42	-0.28
17-21	628 - Pine - Mesic - Oak	0	0	0	0	6	5	6	0.57	14.97	-8.48
17-22	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.56	-0.39
17-23	617 - Mixed Wetland Hardwoods	0	0	0	0	6	6	6	0.60	0.27	-0.16
17-24	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.12	-0.09
17-25	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	6.64	-3.98
17-26	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	2.50	-1.75
17-27	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.21	-0.15
17-28	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	0.54	-0.38
17-29	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	5.46	-2.73
17-30	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.10	-0.07
17-31	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.10	-0.07
17-33	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.07	-0.05
17-34	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.23	-0.15
17-37	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	4.29	-2.15
17-38	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.77	-0.51
17-39	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.31	-0.21
17-40	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.37	-0.24

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17-41	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	0.65	-0.32
17-42	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	1.12	-0.56
17-43	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.13	-0.09
17-44	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	0.18	-0.11
17-45	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.17	-0.11
17-46	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.28	-0.19
17-47	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.28	-0.18
17-48	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	0.12	-0.06
17-49	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.26	-0.17
17-50	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	0.97	-0.49
17-51	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	0.21	-0.11
17-53	630 - Wetland Forested Mixed	0	0	0	0	6	6	6	0.60	0.02	-0.01
17-54	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.19	-0.12
17-55	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	0.29	-0.14
17-57	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.41	-0.27
17-58	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	0.97	-0.48
17-59	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	5.94	-2.97
17-60	616 - Deep Water Ponds	0	0	0	0	6	6	8	0.67	0.12	-0.08
17-62	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	0.84	-0.42
17-63	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	6	4	5	0.50	0.04	-0.02
17-69	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	0.08	-0.04
17-91	628 - Pine - Mesic - Oak	0	0	0	0	6	5	6	0.57	4.85	-2.75
17-93	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	1.20	-0.60
17-95	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	6	4	5	0.50	0.88	-0.44
17-96	616 - Deep Water Ponds	0	0	0	0	6	7	8	0.70	3.56	-2.49
22-1	630 - Wetland Forested Mixed	0	0	0	0	5	6	6	0.57	0.0022	-0.0013
22-10	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	1.52	-1.01
22-12	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	1.43	-0.67
22-13	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	0.02	-0.01
22-23	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.09	-0.06
22-3	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	3.20	-1.81
22-32	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	36.45	-17.01
22-33	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.99	-0.93
22-34	6292 - Hydric Coniferous Plantation < 8	0	0	0	0	5	4	5	0.47	4.96	-2.31
22-37	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.0016	-0.0009
22-4	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.88	-0.59

Tarmac King Road Limestone Mine Parcel Impact Areas – FDEP UMAM Scores

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Functional Lift/Loss
22-42	530 - Borrow Pits	0	0	0	0	5	4	1	0.33	1.34	-0.45
22-5	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.30	-0.19
22-54	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	2.78	-1.30
22-55	628 - Pine - Mesic - Oak	0	0	0	0	5	5	6	0.53	2.22	-1.19
22-56	628 - Pine - Mesic - Oak	0	0	0	0	5	5	6	0.53	14.98	-7.99
22-8	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.14	-0.09
23-10	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.60	-0.40
23-11	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.13	-0.09
23-12	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	0.02	-0.01
23-19	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	29.12	-13.59
23-2	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.04	-0.03
23-20	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.94	-0.53
23-21	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.96	-0.54
23-22	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	1.36	-0.77
23-3	617 - Mixed Wetland Hardwoods	0	0	0	0	5	6	6	0.57	0.99	-0.56
23-4	616 - Deep Water Ponds	0	0	0	0	5	6	8	0.63	2.31	-1.47
23-5	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.12	-0.06
23-6	616 - Deep Water Ponds	0	0	0	0	5	7	8	0.67	0.56	-0.38
23-7	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	0.07	-0.03
23-8	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	2.11	-0.99
23-9	6291 - Hydric Coniferous Plantation > 8	0	0	0	0	5	4	5	0.47	1.46	-0.68
									TOTALS	**2354.78**	**-1197.35**

Tarmac King Road Limestone Mine Parcel Preservation Areas – FDEP UMAM Scores

UPLANDS – No Mine

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
P-P-E	425 - Temperate Hardwood	5	0	8	0.65	5	0	4	0.45	45.29	1	1	9.06
P-P-W	425 - Temperate Hardwood	6	0	8	0.70	6	0	4	0.50	8.86	1	1	1.77
Q-P-E	441 - Coniferous Plantation	5	0	8	0.65	5	0	6	0.55	38.60	1	1	3.86
Q-P-W	441 - Coniferous Plantation	6	0	8	0.70	6	0	6	0.60	4.24	1	1	0.42
R-P-E	443 - Forest Regeneration	5	0	8	0.65	5	0	4	0.45	17.48	1	1	3.50
R-P-W	443 - Forest Regeneration	6	0	8	0.70	6	0	4	0.50	7.94	1	1	1.59
T-P-E	427 - Live Oak	5	0	8	0.65	5	0	6	0.55	0.14	1	1	0.01
									TOTALS	**122.55**			**20.21**

Tarmac King Road Limestone Mine Parcel Preservation Areas – FDEP UMAM Scores

WETLANDS– No Mine

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
08-112-P	6292 - Hydric Coniferous Plantation < 8	6	4	7	0.57	6	4	5	0.50	13.95	1	1	0.93
09-38-P	628 - Pine - Mesic - Oak	5	5	8	0.60	5	5	6	0.53	18.28	1	1	1.22
09-39-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.01	1	1	0.0004
09-44-P	616 - Deep Water Ponds	6	7	8	0.70	6	7	8	0.70	0.07	1	1	0
09-47-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	1.51	1	1	0
09-48-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	0.00081	1	1	0
09-54-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.60	1	1	0
09-57-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	1.78	1	1	0
09-58-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.25	1	1	0
09-60-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.45	1	1	0
09-61-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.33	1	1	0
09-63-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.84	1	1	0
09-67-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	4.27	1	1	0
09-68-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	9.97	1	1	0.66
09-79-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	2.78	1	1	0.19
10-2-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	19.73	1	1	0
10-3-P	630 - Wetland Forested Mixed	5	6	8	0.63	5	6	6	0.57	0.00004	1	1	0.000003
10-55-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	1.55	1	1	0.10
10-58-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	0.71	1	1	0
10-61-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	0.25	1	1	0
10-63-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	5.78	1	1	0
10-64-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	0.53	1	1	0
10-67-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	0.63	1	1	0
10-70-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.43	1	1	0
10-71-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	6.72	1	1	0
10-73-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	2.32	1	1	0.15
10-80-P	628 - Pine - Mesic - Oak	5	5	8	0.60	5	5	6	0.53	15.31	1	1	1.02
10-95-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	7.41	1	1	0.49
10-96-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.75	1	1	0.05
10-97-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	5.54	1	1	0.37
10-99-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	1.51	1	1	0.10
11-104-P	630 - Wetland Forested Mixed	5	6	8	0.63	5	6	6	0.57	0.85	1	1	0.06
11-107-P	630 - Wetland Forested Mixed	5	6	8	0.63	5	6	6	0.57	0.21	1	1	0.01
11-112-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.39	1	1	0.03
11-114-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.80	1	1	0.05

Tarmac King Road Limestone Mine Parcel Preservation Areas – FDEP UMAM Scores

WETLANDS– No Mine

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
11-88-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	0.08	1	1	0
11-97-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.33	1	1	0
14-10-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	2.62	1	1	0.17
14-15-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	2.39	1	1	0.16
14-20-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.11	1	1	0
14-21-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	1.01	1	1	0.07
14-25-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	2.11	1	1	0
14-28-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.15	1	1	0.01
14-29-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	3.83	1	1	0
14-2-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	0.17	1	1	0.01
14-30-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.15	1	1	0.01
14-3-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	0.36	1	1	0.02
14-42-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	4.25	1	1	0.28
14-4-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	0.29	1	1	0.02
14-50-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	8.50	1	1	0
14-53-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	1.98	1	1	0.13
14-54-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.99	1	1	0.07
14-55-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	0.20	1	1	0
14-56-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	2.48	1	1	0
14-57-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.43	1	1	0.03
14-58-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	0.32	1	1	0.02
14-59-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	2.73	1	1	0
14-5-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	0.27	1	1	0.02
14-61-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	0.42	1	1	0.03
14-64-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	1.63	1	1	0.11
14-69-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.75	1	1	0.05
14-83-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	2.09	1	1	0.14
14-84-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	2.07	1	1	0.14
14-91-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	5.67	1	1	0.38
14-94-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	5.05	1	1	0.34
14-97-P	6291 - Hydric Coniferous Plantation > 8	5	6	8	0.63	5	6	6	0.57	1.89	1	1	0.13
15-104-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	7.61	1	1	0.51
15-114-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	1.27	1	1	0.08
15-128-P	530 - Borrow Pits	5	8	1	0.47	5	8	1	0.47	0.02	1	1	0
15-12-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	1.68	1	1	0
15-1-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	0.24	1	1	0.02

Tarmac King Road Limestone Mine Parcel Preservation Areas – FDEP UMAM Scores

WETLANDS– No Mine

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
15-29-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	4.64	1	1	0.31
15-32-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.74	1	1	0.05
15-36-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.17	1	1	0.01
15-38-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	1.40	1	1	0
15-39-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	3.04	1	1	0
15-40-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.71	1	1	0
15-43-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.15	1	1	0.01
15-46-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	0.58	1	1	0.04
15-47-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.26	1	1	0.02
15-49-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.17	1	1	0
15-50-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.00134	1	1	0.000
15-51-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	1.15	1	1	0.08
15-52-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	1.27	1	1	0.08
16-102-P	630 - Wetland Forested Mixed	5	6	8	0.63	5	6	6	0.57	99.92	1	1	6.66
16-103-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	3.38	1	1	0.23
16-107-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.87	1	1	0.06
16-10-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	5.77	1	1	0.38
16-114-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	3.35	1	1	0.22
16-11-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	2.58	1	1	0.17
16-12-P	628 - Pine - Mesic - Oak	5	5	8	0.60	5	5	6	0.53	9.91	1	1	0.66
16-17-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.43	1	1	0
16-19-P	630 - Wetland Forested Mixed	5	6	8	0.63	5	6	6	0.57	3.03	1	1	0.20
16-20-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.58	1	1	0
16-21-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.28	1	1	0
16-22-P	630 - Wetland Forested Mixed	5	6	8	0.63	5	6	6	0.57	2.22	1	1	0.15
16-24-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	9.73	1	1	0
16-26-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.35	1	1	0
16-30-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.29	1	1	0
16-38-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	1.32	1	1	0
16-44-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	4.23	1	1	0.28
16-45-P	630 - Wetland Forested Mixed	6	6	8	0.67	6	6	6	0.60	0.50	1	1	0.03
16-48-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	8.83	1	1	0
16-52-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	1.63	1	1	0.11
16-56-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	0.40	1	1	0.03
16-57-P	6292 - Hydric Coniferous Plantation < 8	6	4	7	0.57	6	4	5	0.50	1.15	1	1	0.08
16-58-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	0.77	1	1	0.05

Tarmac King Road Limestone Mine Parcel Preservation Areas – FDEP UMAM Scores

WETLANDS– No Mine

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
16-5-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	1.07	1	1	0.07
16-61-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	5.63	1	1	0.38
16-63-P	616 - Deep Water Ponds	6	6	8	0.67	6	6	8	0.67	5.25	1	1	0
16-65-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	6.97	1	1	0.46
16-66-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.04	1	1	0
16-7-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	0.13	1	1	0.01
16-8-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	2.58	1	1	0.17
16-94-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	5.31	1	1	0.35
16-95-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	1.49	1	1	0
16-99-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	1.23	1	1	0.08
17-2-P	616 - Deep Water Ponds	6	7	8	0.70	6	7	8	0.70	0.17	1	1	0
17-49-P	616 - Deep Water Ponds	6	6	8	0.67	6	6	8	0.67	0.08	1	1	0
17-50-P	6291 - Hydric Coniferous Plantation > 8	6	4	7	0.57	6	4	5	0.50	1.06	1	1	0.07
17-53-P	630 - Wetland Forested Mixed	6	6	8	0.67	6	6	6	0.60	0.18	1	1	0.01
17-56-P	616 - Deep Water Ponds	6	7	8	0.70	6	7	8	0.70	0.07	1	1	0
17-58-P	6291 - Hydric Coniferous Plantation > 8	6	4	7	0.57	6	4	5	0.50	0.12	1	1	0.01
17-59-P	6291 - Hydric Coniferous Plantation > 8	6	4	7	0.57	6	4	5	0.50	1.51	1	1	0.10
17-63-P	6292 - Hydric Coniferous Plantation < 8	6	4	7	0.57	6	4	5	0.50	1.86	1	1	0.12
17-91-P	628 - Pine - Mesic - Oak	6	5	8	0.63	6	5	6	0.57	19.49	1	1	1.30
17-96-P	616 - Deep Water Ponds	6	6	8	0.67	6	6	8	0.67	24.94	1	1	0
17-97-P	6292 - Hydric Coniferous Plantation < 8	6	4	7	0.57	6	4	5	0.50	0.47	1	1	0.03
22-12-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	0.64	1	1	0.04
22-13-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	1.27	1	1	0.08
22-14-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	2.84	1	1	0
22-16-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	0.23	1	1	0.02
22-1-P	630 - Wetland Forested Mixed	5	6	8	0.63	5	6	6	0.57	1.72	1	1	0.11
22-20-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	0.78	1	1	0
22-22-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	0.73	1	1	0.05
22-23-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	4.62	1	1	0
22-26-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	1.27	1	1	0.08
22-29-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	0.81	1	1	0
22-32-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	0.66	1	1	0.04
22-34-P	6292 - Hydric Coniferous Plantation < 8	5	4	7	0.53	5	4	5	0.47	1.67	1	1	0.11
22-37-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	2.75	1	1	0.18
22-38-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	1.23	1	1	0.08
22-3-P	617 - Mixed Wetland Hardwoods	5	6	8	0.63	5	6	6	0.57	0.06	1	1	0.004

Tarmac King Road Limestone Mine Parcel Preservation Areas – FDEP UMAM Scores

WETLANDS– No Mine

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
22-42-P	530 - Borrow Pits	5	8	1	0.47	5	8	1	0.47	0.07	1	1	0
22-4-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	2.45	1	1	0
22-54-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	10.70	1	1	0.71
22-56-P	628 - Pine - Mesic - Oak	5	5	8	0.60	5	5	6	0.53	16.69	1	1	1.11
23-12-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	8.73	1	1	0
23-14-P	616 - Deep Water Ponds	5	6	8	0.63	5	6	8	0.63	0.21	1	1	0
23-1-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	2.22	1	1	0.15
23-23-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	3.86	1	1	0.26
23-2-P	616 - Deep Water Ponds	5	7	8	0.67	5	7	8	0.67	2.44	1	1	0
23-5-P	6291 - Hydric Coniferous Plantation > 8	5	4	7	0.53	5	4	5	0.47	2.88	1	1	0.19
									TOTALS	**519.62**			**24.70**

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

UPLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
U-1A	443 - Forest Regeneration	10	0	9	0.95	7	0	4	0.55	1.38	1	1	0.55
U-1B	443 - Forest Regeneration	9	0	9	0.90	6	0	4	0.50	10.19	1	1	4.07
U-1B-I	443 - Forest Regeneration	8	0	9	0.85	6	0	4	0.50	2.19	1	1	0.77
U-1C	443 - Forest Regeneration	8	0	9	0.85	6	0	4	0.50	7.60	1	1	2.66
U-1D	443 - Forest Regeneration	10	0	9	0.95	7	0	4	0.55	2.65	1	1	1.06
U-1D-I	443 - Forest Regeneration	9	0	9	0.90	7	0	4	0.55	9.54	1	1	3.34
U-2A	425/434 - Temperate Hardwood /Hardwood Coniferous Mixed	10	0	9	0.95	7	0	4	0.55	39.25	1	1	15.70
U-2C	425/434 - Temperate Hardwood /Hardwood Coniferous Mixed	8	0	9	0.85	6	0	4	0.50	6.62	1	1	2.32
U-2D	425/434 - Temperate Hardwood /Hardwood Coniferous Mixed	10	0	9	0.95	7	0	4	0.55	80.48	1	1	32.19
U-2D-I	425/434 - Temperate Hardwood /Hardwood Coniferous Mixed	9	0	9	0.90	7	0	4	0.55	6.75	1	1	2.36
U-3A	441 - Coniferous Plantation	10	0	10	1.00	7	0	4	0.55	37.23	1	1	16.75
U-3B	441 - Coniferous Plantation	9	0	10	0.95	6	0	4	0.50	28.13	1	1	12.66
U-3D	441 - Coniferous Plantation	10	0	10	1.00	7	0	4	0.55	53.32	1	1	24.00
U-3D-I	441 - Coniferous Plantation	9	0	10	0.95	7	0	4	0.55	2.57	1	1	1.03
U-3E	441 - Coniferous Plantation	10	0	10	1.00	7	0	4	0.55	39.08	1	1	17.59
U-3E-I	441 - Coniferous Plantation	9	0	10	0.95	7	0	4	0.55	4.21	1	1	1.68
									TOTALS	**331.19**			**138.73**

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
01-1	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	19.92	1	1	5.98
01-10	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	9.05	1	1	3.32
01-11	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	1.29	1	1	0.39
01-12	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.13	1	1	0.04
01-13	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.08	1	1	0.02
01-2	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	1.04	1	1	0.38
01-3	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	0.88	1	1	0.32
01-4	6291 - Hydric Coniferous Plantation > 8	8	8	9	0.83	6	4	5	0.50	2.42	1	1	0.81
01-5	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.09	1	1	0.03
01-6	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.23	1	1	0.06
01-7	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.48	1	1	0.11
01-8	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	11.35	1	1	4.16
01-9	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	2.32	1	1	0.70
02-1	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	2.30	1	1	0.46
02-10	642 - Saltwater Marsh	10	10	10	1.00	7	9	7	0.77	0.06	1	1	0.01
02-11	642 - Saltwater Marsh	10	10	10	1.00	7	9	7	0.77	0.12	1	1	0.03
02-12	642 - Saltwater Marsh	9	10	10	0.97	6	9	7	0.73	0.38	1	1	0.09
02-13	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.14	1	1	0.03
02-14	642 - Saltwater Marsh	10	10	10	1.00	7	9	7	0.77	0.25	1	1	0.06
02-15	642 - Saltwater Marsh	10	10	10	1.00	7	9	7	0.77	0.66	1	1	0.15
02-16	642 - Saltwater Marsh	10	10	10	1.00	7	9	7	0.77	0.28	1	1	0.06
02-17	642 - Saltwater Marsh	10	10	10	1.00	7	9	7	0.77	0.11	1	1	0.03
02-18	621 - Cypress	10	9	9	0.93	7	7	6	0.67	0.38	1	1	0.10
02-19	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.29	1	1	0.07
02-2	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.51	1	1	0.10
02-20	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.05	1	1	0.01
02-21	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.37	1	1	0.09
02-22	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.86	1	1	0.20
02-23	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.23	1	1	0.05
02-24	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.36	1	1	0.08
02-25	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.56	1	1	0.13
02-26	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.11	1	1	0.03
02-27	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.10	1	1	0.02
02-28	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.08	1	1	0.02

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
02-29	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.21	1	1	0.05
02-3	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.48	1	1	0.10
02-30	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.43	1	1	0.10
02-31	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.25	1	1	0.06
02-32	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	2.83	1	1	0.66
02-33	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.07	1	1	0.02
02-34	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.26	1	1	0.06
02-35	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.73	1	1	0.20
02-36	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	1.12	1	1	0.26
02-37	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.13	1	1	0.04
02-38	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.04	1	1	0.01
02-39	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.04	1	1	0.01
02-4	642 - Saltwater Marsh	10	10	10	1.00	7	9	7	0.77	0.23	1	1	0.05
02-40	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.03	1	1	0.01
02-41	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.05	1	1	0.01
02-42	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.19	1	1	0.04
02-43	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	1.10	1	1	0.26
02-44	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.14	1	1	0.03
02-45	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.34	1	1	0.08
02-46	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.26	1	1	0.07
02-47	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.21	1	1	0.05
02-48	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.29	1	1	0.07
02-49	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.22	1	1	0.06
02-5	642 - Saltwater Marsh	9	10	10	0.97	6	9	7	0.73	0.14	1	1	0.03
02-50	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.13	1	1	0.03
02-51	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.92	1	1	0.22
02-52	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.24	1	1	0.06
02-53	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.28	1	1	0.06
02-54	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.07	1	1	0.02
02-55	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.23	1	1	0.05
02-56	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	1.09	1	1	0.25
02-57	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.33	1	1	0.08
02-58	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.24	1	1	0.06
02-59	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.15	1	1	0.04
02-6	642 - Saltwater Marsh	9	10	10	0.97	6	9	7	0.73	0.11	1	1	0.03

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
02-60	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	12.85	1	1	2.57
02-61	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	1.48	1	1	0.30
02-62	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.55	1	1	0.11
02-63	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.17	1	1	0.03
02-64	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	4.88	1	1	0.98
02-65	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.67	1	1	0.13
02-66	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	37.50	1	1	11.25
02-67	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	10.83	1	1	3.25
02-68	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	37.73	1	1	11.32
02-69	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	49.06	1	1	13.08
02-7	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.31	1	1	0.06
02-70	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	16.39	1	1	6.01
02-71	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	2.61	1	1	0.96
02-72	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	20.42	1	1	7.49
02-73	621 - Cypress	10	10	9	0.97	7	9	6	0.73	7.97	1	1	1.86
02-74	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	3.60	1	1	0.72
02-75	642 - Saltwater Marsh	10	10	10	1.00	7	9	10	0.87	28.33	1	1	3.78
02-76	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	83.80	1	1	25.14
02-77	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	22.50	1	1	6.75
02-78	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	25.23	1	1	7.57
02-79	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	68.92	1	1	20.68
02-8	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.16	1	1	0.03
02-80	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	45.67	1	1	9.13
02-81	530 - Borrow Pits	10	8	3	0.70	7	4	3	0.47	1.29	1	1	0.30
02-82	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	7.52	1	1	1.50
02-83	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.37	1	1	0.07
02-84	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	1.21	1	1	0.24
02-85	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.95	1	1	0.19
02-86	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	1.22	1	1	0.33
02-9	642 - Saltwater Marsh	10	10	10	1.00	7	9	7	0.77	0.05	1	1	0.01
06-1	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	0.06	5	1.14	0.02
06-10	630 - Wetland Forested Mixed	7	9	10	0.87	6	7	6	0.63	1.57	1	1	0.37
06-11	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	1.32	1	1	0.35
06-12	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.96	1	1	0.25
06-13	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	1.10	1	1	0.29

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
06-14	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.61	1	1	0.16
06-15	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	2.60	1	1	0.69
06-16	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	2.53	1	1	0.67
06-17	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.59	1	1	0.16
06-18	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.53	1	1	0.11
06-19	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	3.85	1	1	0.77
06-2	6292 - Hydric Coniferous Plantation < 8	7	8	9	0.80	6	4	5	0.50	1.46	5	1.14	0.38
06-20	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	0.36	1	1	0.08
06-21	616 - Deep Water Ponds	7	9	10	0.87	6	7	8	0.70	0.43	1	1	0.07
06-22	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	1.13	1	1	0.23
06-23	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	0.32	1	1	0.07
06-24	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.33	1	1	0.07
06-25	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	1.08	1	1	0.22
06-26	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.87	1	1	0.17
06-27	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	0.07	1	1	0.02
06-28	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.10	1	1	0.02
06-29	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	0.05	1	1	0.01
06-3	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.46	1	1	0.12
06-30	616 - Deep Water Ponds	7	9	10	0.87	6	7	8	0.70	0.59	1	1	0.10
06-31	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	0.04	1	1	0.01
06-32	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.12	1	1	0.02
06-33	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.60	1	1	0.12
06-34	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	1.10	1	1	0.26
06-35	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	1.51	1	1	0.30
06-36	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	0.05	1	1	0.01
06-37	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	0.12	1	1	0.03
06-38	616 - Deep Water Ponds	7	9	10	0.87	6	7	8	0.70	0.28	1	1	0.05
06-39	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.66	1	1	0.17
06-4	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.28	1	1	0.07
06-40	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.25	1	1	0.05
06-41	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.44	1	1	0.12
06-42	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.67	1	1	0.18
06-43	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.51	1	1	0.14
06-44	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	0.04	1	1	0.01
06-45	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	1.57	5	1.14	0.46

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AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
06-46	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	1.46	1	1	0.39
06-47	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	2.09	1	1	0.56
06-48	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	5.07	1	1	1.35
06-49	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	9.19	1	1	2.45
06-5	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.68	1	1	0.18
06-50	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	1.43	1	1	0.38
06-51	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	1.44	1	1	0.38
06-52	630 - Wetland Forested Mixed	7	9	10	0.87	6	7	6	0.63	2.15	1	1	0.50
06-53	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.47	1	1	0.13
06-58	630 - Wetland Forested Mixed	7	9	10	0.87	6	7	6	0.63	1.57	1	1	0.37
06-59	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	164.42	5	1.14	48.08
06-59-I	6292 - Hydric Coniferous Plantation < 8	7	8	9	0.80	6	4	5	0.50	38.10	5	1.14	10.03
06-6	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.12	1	1	0.02
06-60	6291 - Hydric Coniferous Plantation > 8	8	8	9	0.83	6	4	5	0.50	66.13	1	1	22.04
06-60-I	6291 - Hydric Coniferous Plantation > 8	7	8	9	0.80	6	4	5	0.50	9.96	1	1	2.99
06-61	641 - Freshwater Marsh	8	9	10	0.90	6	7	9	0.73	0.38	1	1	0.06
06-7	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	1.41	1	1	0.38
06-8	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.34	1	1	0.09
06-9	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.51	1	1	0.14
07-1	6292 - Hydric Coniferous Plantation < 8	7	8	9	0.80	6	4	5	0.50	0.93	5	1.14	0.25
07-2	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	3.02	1	1	0.60
07-3	616 - Deep Water Ponds	7	9	10	0.87	6	7	8	0.70	0.56	1	1	0.09
07-4	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	18.38	1	1	4.90
07-4-I	630 - Wetland Forested Mixed	7	9	10	0.87	6	7	6	0.63	11.02	1	1	2.57
12-1	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	2.50	1	1	0.67
12-10	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	34.48	1	1	11.49
12-11	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	3.14	1	1	1.05
12-12	6291 - Hydric Coniferous Plantation > 8	8	8	9	0.83	6	4	5	0.50	1.26	1	1	0.42
12-13	6291 - Hydric Coniferous Plantation > 8	8	8	9	0.83	6	4	5	0.50	10.26	1	1	3.42
12-14	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	6.11	1	1	1.63
12-15	6291 - Hydric Coniferous Plantation > 8	8	8	9	0.83	6	4	5	0.50	4.49	1	1	1.50
12-16	6291 - Hydric Coniferous Plantation > 8	7	8	9	0.80	6	4	5	0.50	3.50	1	1	1.05
12-17	621 - Cypress	8	9	9	0.87	6	8	6	0.67	2.70	1	1	0.54
12-18	621 - Cypress	8	9	9	0.87	6	8	6	0.67	0.15	1	1	0.03
12-19	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.29	1	1	0.08

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12-2	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	2.65	1	1	0.71
12-20	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.28	1	1	0.07
12-21	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.58	1	1	0.15
12-22	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.10	1	1	0.03
12-23	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.09	1	1	0.02
12-24	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.39	1	1	0.08
12-25	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.20	1	1	0.04
12-26	616 - Deep Water Ponds	7	9	10	0.87	6	7	8	0.70	0.20	1	1	0.03
12-27	642 - Saltwater Marsh	8	10	10	0.93	6	9	7	0.73	0.19	1	1	0.04
12-28	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.17	1	1	0.03
12-29	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.33	1	1	0.07
12-3	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	1.13	1	1	0.30
12-30	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.16	1	1	0.03
12-31	633 - Coastal Maritime Hammock	7	9	10	0.87	6	7	7	0.67	3.30	1	1	0.66
12-32	633 - Coastal Maritime Hammock	8	9	10	0.90	6	7	7	0.67	0.00202	1	1	0.0005
12-33	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	12.67	1	1	3.38
12-34	651 - Tidal Flats	8	10	10	0.93	6	9	7	0.73	3.84	1	1	0.77
12-35	642 - Saltwater Marsh	8	10	10	0.93	6	9	7	0.73	0.44	1	1	0.09
12-36	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	22.74	1	1	6.06
12-37	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	7.41	1	1	2.47
12-38	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.31	1	1	0.06
12-39	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	17.05	1	1	4.55
12-4	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	1.42	1	1	0.47
12-40	633 - Coastal Maritime Hammock	8	9	10	0.90	6	7	7	0.67	6.27	1	1	1.46
12-41	633 - Coastal Maritime Hammock	8	9	10	0.90	6	7	7	0.67	14.85	1	1	3.46
12-42	633 - Coastal Maritime Hammock	8	9	10	0.90	6	7	7	0.67	12.97	1	1	3.03
12-43	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	40.40	1	1	10.77
12-44	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	34.22	1	1	11.41
12-44-I	6292 - Hydric Coniferous Plantation < 8	7	8	9	0.80	6	4	5	0.50	8.13	1	1	2.44
12-45	6291 - Hydric Coniferous Plantation > 8	10	8	9	0.90	7	4	5	0.53	38.37	1	1	14.07
12-45-I	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	7	4	5	0.53	11.30	1	1	3.77
12-46	633 - Coastal Maritime Hammock	8	9	10	0.90	6	7	7	0.67	3.85	1	1	0.90
12-47	616 - Deep Water Ponds	7	9	10	0.87	6	6	8	0.67	0.10	1	1	0.02
12-48	616 - Deep Water Ponds	7	9	10	0.87	6	7	8	0.70	0.59	1	1	0.10
12-5	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.68	1	1	0.18

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12-6	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	2.89	1	1	0.77
12-7	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	11.48	1	1	3.06
12-8	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	2.03	1	1	0.54
12-9	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	7.04	1	1	1.88
13-1	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	5.73	1	1	1.15
13-10	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.10	1	1	0.02
13-11	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.14	1	1	0.03
13-12	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.14	1	1	0.03
13-13	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.08	1	1	0.02
13-14	633 - Coastal Maritime Hammock	8	9	10	0.90	6	7	7	0.67	0.55	1	1	0.13
13-15	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	1.10	1	1	0.22
13-16	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	1.15	1	1	0.23
13-17	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.71	1	1	0.14
13-18	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.70	1	1	0.14
13-19	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.17	1	1	0.03
13-2	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	12.11	1	1	2.42
13-20	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.76	1	1	0.15
13-21	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.24	1	1	0.05
13-22	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	17.24	1	1	5.17
13-23	633 - Coastal Maritime Hammock	8	9	10	0.90	6	7	7	0.67	2.47	1	1	0.58
13-24	6291 - Hydric Coniferous Plantation > 8	8	8	9	0.83	6	4	5	0.50	5.34	1	1	1.78
13-25	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	0.00034	1	1	0.0001
13-26	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	5.50	1	1	1.10
13-27	633 - Coastal Maritime Hammock	8	9	10	0.90	6	7	7	0.67	5.19	1	1	1.21
13-28	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	17.33	1	1	4.62
13-29	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	5.32	1	1	1.42
13-3	6291 - Hydric Coniferous Plantation > 8	8	8	9	0.83	6	4	5	0.50	6.87	1	1	2.29
13-30	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.60	1	1	0.12
13-31	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	0.68	1	1	0.21
13-32	617 - Mixed Wetland Hardwoods	10	9	9	0.93	7	7	6	0.67	3.61	1	1	0.96
13-33	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	50.09	1	1	15.03
13-34	651 - Tidal Flats	10	10	10	1.00	7	9	10	0.87	21.38	1	1	2.85
13-35	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.69	1	1	0.19
13-36	615 - Streams and Lake Swamps (Bottomlands)	10	9	9	0.93	7	7	9	0.77	0.78	1	1	0.13

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13-37	530 - Borrow Pits	10	8	3	0.70	7	4	3	0.47	0.09	1	1	0.02
13-4	6291 - Hydric Coniferous Plantation > 8	10	8	9	0.90	7	4	5	0.53	10.30	1	1	3.78
13-5	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.13	1	1	0.03
13-6	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.32	1	1	0.06
13-7	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.28	1	1	0.06
13-8	621 - Cypress	8	9	9	0.87	6	6	6	0.60	1.16	1	1	0.31
13-9	621 - Cypress	10	9	9	0.93	7	6	6	0.63	0.05	1	1	0.01
17-1	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	4.39	1	1	1.32
17-1-I	630 - Wetland Forested Mixed	9	9	10	0.93	7	7	6	0.67	3.50	1	1	0.93
17-2	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	7	4	5	0.53	4.19	1	1	1.40
17-3	616 - Deep Water Ponds	9	9	10	0.93	7	7	8	0.73	0.18	1	1	0.04
18-1	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.49	1	1	0.08
18-10	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.14	1	1	0.02
18-11	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	0.17	1	1	0.05
18-12	651 - Tidal Flats	10	10	10	1.00	7	9	8	0.80	1.24	1	1	0.25
18-13	651 - Tidal Flats	10	10	10	1.00	7	9	8	0.80	0.38	1	1	0.08
18-14	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	0.72	1	1	0.22
18-15	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.17	1	1	0.05
18-16	615 - Streams and Lake Swamps (Bottomlands)	10	10	9	0.97	7	9	9	0.83	0.75	1	1	0.10
18-17	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.12	1	1	0.03
18-18	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.07	1	1	0.02
18-19	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.08	1	1	0.02
18-2	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.15	1	1	0.02
18-20	530 - Borrow Pits	10	8	3	0.70	7	4	3	0.47	0.13	1	1	0.03
18-21	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	1.37	1	1	0.41
18-22	6292 - Hydric Coniferous Plantation < 8	10	8	9	0.90	7	4	5	0.53	13.22	1	1	4.85
18-22-I	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	7	4	5	0.53	12.38	1	1	4.13
18-23	615 - Streams and Lake Swamps (Bottomlands)	10	10	9	0.97	7	9	9	0.83	11.01	1	1	1.47
18-24	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.09	1	1	0.02
18-25	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	168.48	1	1	50.54
18-25-I	630 - Wetland Forested Mixed	9	9	10	0.93	7	7	6	0.67	10.75	1	1	2.87
18-26	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	146.14	1	1	43.84
18-26-I	630 - Wetland Forested Mixed	9	9	10	0.93	7	7	6	0.67	4.05	1	1	1.08

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Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
18-27	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	30.75	1	1	6.15
18-28	651 - Tidal Flats	10	10	10	1.00	7	9	7	0.77	3.66	1	1	0.85
18-29	651 - Tidal Flats	10	10	10	1.00	7	9	8	0.80	5.25	1	1	1.05
18-3	641 - Freshwater Marsh	10	9	10	0.97	7	5	9	0.70	0.09	1	1	0.02
18-30	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	2.54	1	1	0.76
18-30-I	630 - Wetland Forested Mixed	9	9	10	0.93	7	7	6	0.67	1.34	1	1	0.36
18-31	6291 - Hydric Coniferous Plantation > 8	10	8	9	0.90	7	4	5	0.53	4.63	1	1	1.70
18-31-I	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	7	4	5	0.53	5.02	1	1	1.67
18-32	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	2.53	1	1	0.67
18-33	615 - Streams and Lake Swamps (Bottomlands)	10	10	9	0.97	7	9	9	0.83	1.38	1	1	0.18
18-4	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.20	1	1	0.03
18-5	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.06	1	1	0.01
18-6	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.16	1	1	0.03
18-7	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.11	1	1	0.02
18-8	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.34	1	1	0.06
18-9	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.39	1	1	0.06
19-1	651 - Tidal Flats	10	10	10	1.00	7	9	10	0.87	2.43	1	1	0.32
19-10	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.09	1	1	0.02
19-11	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.23	1	1	0.05
19-12	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.10	1	1	0.02
19-13	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.04	1	1	0.01
19-14	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.07	1	1	0.01
19-15	530 - Borrow Pits	10	8	3	0.70	7	4	3	0.47	0.79	1	1	0.18
19-17	642 - Saltwater Marsh	10	10	10	1.00	7	9	7	0.77	0.15	1	1	0.03
19-19	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.67	1	1	0.16
19-2	651 - Tidal Flats	10	10	10	1.00	7	9	10	0.87	1.77	1	1	0.24
19-20	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.25	1	1	0.06
19-23	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.12	1	1	0.03
19-24	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.56	1	1	0.13
19-25	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.23	1	1	0.05
19-26	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	0.00068	1	1	0.0002
19-27	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	0.61	1	1	0.18
19-3	651 - Tidal Flats	10	10	10	1.00	7	9	7	0.77	0.21	1	1	0.05
19-31	6291 - Hydric Coniferous Plantation > 8	10	8	9	0.90	7	4	5	0.53	13.76	1	1	5.04

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
19-32	6291 - Hydric Coniferous Plantation > 8	10	8	9	0.90	7	4	5	0.53	8.28	1	1	3.03
19-33	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.19	1	1	0.04
19-34	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.21	1	1	0.05
19-35	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.12	1	1	0.03
19-36	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.09	1	1	0.02
19-37	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.25	1	1	0.06
19-38	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.15	1	1	0.03
19-39	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.20	1	1	0.05
19-4	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.38	1	1	0.09
19-40	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.07	1	1	0.02
19-41	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.32	1	1	0.07
19-43	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.33	1	1	0.07
19-44	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.49	1	1	0.10
19-45	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	3.91	1	1	1.04
19-47	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	6.55	1	1	1.75
19-49	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	0.58	1	1	0.15
19-5	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.14	1	1	0.03
19-50	651 - Tidal Flats	10	10	10	1.00	7	9	10	0.87	9.62	1	1	1.28
19-51	651 - Tidal Flats	10	10	10	1.00	7	9	7	0.77	0.12	1	1	0.03
19-52	651 - Tidal Flats	10	10	10	1.00	7	9	10	0.87	0.84	1	1	0.11
19-53	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	142.66	1	1	42.80
19-54	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	15.12	1	1	4.03
19-55	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	1.32	1	1	0.40
19-57	641 - Freshwater Marsh	10	9	10	0.97	7	7	9	0.77	0.56	1	1	0.11
19-58	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.54	1	1	0.09
19-59	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.22	1	1	0.04
19-6	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.24	1	1	0.06
19-60	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.20	1	1	0.03
19-61	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.12	1	1	0.02
19-62	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	9.86	1	1	2.63
19-63	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	4.71	1	1	1.26
19-64	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	0.20	1	1	0.05
19-69	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	1.96	1	1	0.46
19-7	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.23	1	1	0.05
19-70	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.79	1	1	0.18

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
19-71	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.41	1	1	0.09
19-72	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	5.15	1	1	1.55
19-73	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	6.38	1	1	1.28
19-74	651 - Tidal Flats	10	10	10	1.00	7	9	10	0.87	20.57	1	1	2.74
19-75	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	92.18	1	1	27.66
19-75-I	630 - Wetland Forested Mixed	9	9	10	0.93	7	7	6	0.67	20.39	1	1	5.44
19-77	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	17.54	1	1	5.26
19-78	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	7.87	1	1	2.36
19-79	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	6.93	1	1	2.08
19-8	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.03	1	1	0.01
19-81	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	6.74	1	1	1.80
19-82	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	7	0.70	44.71	1	1	11.92
19-83	615 - Streams and Lake Swamps (Bottomlands)	10	10	9	0.97	7	9	9	0.83	8.54	1	1	1.14
19-84	530 - Borrow Pits	10	8	3	0.70	7	4	3	0.47	0.25	1	1	0.06
19-9	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.14	1	1	0.03
20-2	616 - Deep Water Ponds	9	9	10	0.93	7	7	8	0.73	0.18	1	1	0.04
20-3	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.21	1	1	0.05
20-4	616 - Deep Water Ponds	9	9	10	0.93	7	6	8	0.70	0.11	1	1	0.02
20-6	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.21	1	1	0.05
20-7	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.24	1	1	0.06
24-1	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	0.58	1	1	0.12
24-2	642 - Saltwater Marsh	10	10	10	1.00	7	9	8	0.80	0.17	1	1	0.03
25-1	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.73	1	1	0.12
25-10	617 - Mixed Wetland Hardwoods	8	9	9	0.87	6	6	6	0.60	1.72	1	1	0.46
25-11	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	0.99	1	1	0.30
25-12	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.28	1	1	0.06
25-13	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.60	1	1	0.12
25-14	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.13	1	1	0.03
25-15	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.28	1	1	0.06
25-16	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.07	1	1	0.02
25-17	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.85	1	1	0.20
25-18	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.23	1	1	0.05
25-19	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.63	1	1	0.15
25-2	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	1.24	1	1	0.21

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
25-20	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.48	1	1	0.11
25-21	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.65	1	1	0.15
25-22	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.25	1	1	0.07
25-23	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.13	1	1	0.03
25-24	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.14	1	1	0.03
25-25	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.09	1	1	0.02
25-26	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.82	1	1	0.19
25-27	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.38	1	1	0.09
25-28	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.20	1	1	0.05
25-29	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.15	1	1	0.04
25-3	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.57	1	1	0.09
25-30	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.34	1	1	0.09
25-31	530 - Borrow Pits	9	8	3	0.67	6	4	3	0.43	0.30	1	1	0.07
25-32	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	3.74	1	1	1.12
25-32-I	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	2.85	1	1	0.76
25-33	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	13.93	1	1	4.18
25-34	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	1.70	1	1	0.51
25-35	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	6.91	1	1	2.07
25-36	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	25.51	1	1	7.65
25-36-I	617 - Mixed Wetland Hardwoods	8	9	9	0.87	6	6	6	0.60	17.30	1	1	4.61
25-37	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	4.48	1	1	1.34
25-37-I	617 - Mixed Wetland Hardwoods	8	9	9	0.87	6	6	6	0.60	5.04	1	1	1.34
25-38	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	2.90	1	1	0.87
25-39	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	1.20	1	1	0.36
25-4	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.43	1	1	0.07
25-40	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.52	1	1	0.16
25-41	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	28.49	8	1.25	8.36
25-42	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	2.65	1	1	0.97
25-42-I	6291 - Hydric Coniferous Plantation > 8	8	8	9	0.83	6	4	5	0.50	2.07	1	1	0.69
25-43	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	0.78	1	1	0.24
25-44	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.50	1	1	0.12
25-45	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	78.71	8	1.25	23.09
25-45-I	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	9.45	8	1.25	2.52
25-46	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	30.65	1	1	9.19
25-47	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.13	1	1	0.02

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
25-5	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	8.23	1	1	2.47
25-6	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	0.20	1	1	0.06
25-7	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	2.67	1	1	0.80
25-8	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	2.16	1	1	0.65
25-9	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	0.90	1	1	0.27
26-1	6291 - Hydric Coniferous Plantation > 8	10	8	9	0.90	7	4	5	0.53	1.52	1	1	0.56
26-10	616 - Deep Water Ponds	9	9	10	0.93	7	6	8	0.70	0.09	1	1	0.02
26-11	616 - Deep Water Ponds	9	9	10	0.93	7	6	8	0.70	0.09	1	1	0.02
26-12	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.22	1	1	0.06
26-13	616 - Deep Water Ponds	9	9	10	0.93	7	6	8	0.70	0.07	1	1	0.02
26-14	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.12	1	1	0.03
26-15	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.15	1	1	0.04
26-16	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.22	1	1	0.06
26-17	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.19	1	1	0.05
26-18	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.23	1	1	0.06
26-19	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.87	1	1	0.20
26-2	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	4.90	1	1	1.47
26-20	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.25	1	1	0.07
26-21	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.30	1	1	0.08
26-22	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.24	1	1	0.06
26-23	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.16	1	1	0.04
26-24	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.55	1	1	0.15
26-25	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.31	1	1	0.08
26-26	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.24	1	1	0.06
26-27	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.45	1	1	0.12
26-28	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.05	1	1	0.01
26-29	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.07	1	1	0.02
26-3	6291 - Hydric Coniferous Plantation > 8	10	8	9	0.90	7	4	5	0.53	2.18	1	1	0.80
26-30	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.07	1	1	0.02
26-31	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.21	1	1	0.06
26-32	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.29	1	1	0.08
26-33	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.21	1	1	0.06
26-34	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.15	1	1	0.03
26-35	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	1.62	1	1	0.43
26-36	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.15	1	1	0.04

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
26-37	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.16	1	1	0.04
26-38	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.04	1	1	0.01
26-39	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.05	1	1	0.01
26-4	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	1.55	1	1	0.47
26-40	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.15	1	1	0.04
26-41	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.09	1	1	0.02
26-42	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.45	1	1	0.12
26-43	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.52	1	1	0.14
26-44	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.36	1	1	0.10
26-45	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.42	1	1	0.11
26-46	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.03	1	1	0.01
26-47	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.17	1	1	0.04
26-48	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.41	1	1	0.11
26-49	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.09	1	1	0.02
26-5	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	0.66	1	1	0.20
26-50	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.08	1	1	0.02
26-51	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	1.30	1	1	0.39
26-52	628 - Pine - Mesic - Oak	9	9	9	0.90	6	7	6	0.63	0.78	1	1	0.21
26-53	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	0.41	1	1	0.12
26-54	630 - Wetland Forested Mixed	9	9	10	0.93	7	7	6	0.67	0.10	1	1	0.03
26-55	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	8.03	1	1	2.41
26-56	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.30	1	1	0.08
26-57	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	4.14	1	1	1.10
26-58	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.89	1	1	0.24
26-59	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.22	1	1	0.06
26-6	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	0.22	1	1	0.07
26-60	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	116.51	10	1.25	34.18
26-60-I	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	13.05	10	1.25	3.48
26-61	6292 - Hydric Coniferous Plantation < 8	10	8	9	0.90	7	4	5	0.53	227.15	11	1.46	57.05
26-61-I	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	7	4	5	0.53	17.69	11	1.46	4.04
26-62	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	7.74	1	1	1.55
26-7	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	0.19	1	1	0.04
26-8	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.28	1	1	0.08
26-9	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	1.21	1	1	0.32
30-1	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.17	1	1	0.04

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
30-2	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	0.30	1	1	0.09
31-1	616 - Deep Water Ponds	7	9	10	0.87	6	7	8	0.70	0.76	1	1	0.13
31-2	6292 - Hydric Coniferous Plantation < 8	7	8	9	0.80	6	4	5	0.50	1.53	5	1.14	0.40
31-3	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	1.01	1	1	0.20
31-4	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	31.31	5	1.14	9.16
31-4-I	6292 - Hydric Coniferous Plantation < 8	7	8	9	0.80	6	4	5	0.50	5.33	5	1.14	1.40
31-5	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	1.77	1	1	0.47
31-5-I	630 - Wetland Forested Mixed	7	9	10	0.87	6	7	6	0.63	2.13	1	1	0.50
34-1	633 - Coastal Maritime Hammock	10	9	10	0.97	7	7	9	0.77	11.30	1	1	2.26
35-1	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.07	1	1	0.02
35-10	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	12.09	1	1	4.03
35-11	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	0.26	1	1	0.09
35-12	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.71	1	1	0.21
35-13	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	3.02	1	1	0.91
35-14	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.19	1	1	0.06
35-15	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.46	1	1	0.14
35-16	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.22	1	1	0.07
35-17	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.45	1	1	0.13
35-18	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.35	1	1	0.10
35-19	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	2.78	1	1	0.83
35-2	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.08	1	1	0.01
35-20	6292 - Hydric Coniferous Plantation < 8	10	8	9	0.90	7	4	5	0.53	4.56	1	1	1.67
35-21	6291 - Hydric Coniferous Plantation > 8	10	8	9	0.90	7	4	5	0.53	0.16	1	1	0.06
35-22	6291 - Hydric Coniferous Plantation > 8	10	8	9	0.90	7	4	5	0.53	14.85	1	1	5.45
35-23	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	2.44	1	1	0.73
35-24	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.07	1	1	0.02
35-25	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.21	1	1	0.06
35-26	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.23	1	1	0.06
35-27	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.08	1	1	0.02
35-28	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.11	1	1	0.03
35-29	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.31	1	1	0.07
35-3	641 - Freshwater Marsh	10	9	10	0.97	7	8	9	0.80	0.08	1	1	0.01
35-30	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.17	1	1	0.05
35-31	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.24	1	1	0.07
35-32	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.19	1	1	0.04

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
35-33	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.22	1	1	0.06
35-34	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.16	1	1	0.04
35-35	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.37	1	1	0.09
35-36	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.14	1	1	0.03
35-37	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.47	1	1	0.13
35-38	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.66	1	1	0.15
35-39	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.07	1	1	0.02
35-4	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.14	1	1	0.04
35-40	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.26	1	1	0.06
35-41	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.16	1	1	0.04
35-42	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.33	1	1	0.08
35-43	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.24	1	1	0.06
35-44	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.12	1	1	0.03
35-45	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.14	1	1	0.03
35-46	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.18	1	1	0.04
35-47	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.26	1	1	0.06
35-48	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.13	1	1	0.03
35-49	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.14	1	1	0.03
35-5	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.10	1	1	0.03
35-50	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.06	1	1	0.02
35-51	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.18	1	1	0.04
35-52	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	1.29	1	1	0.30
35-53	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.17	1	1	0.04
35-54	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.10	1	1	0.02
35-55	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.03	1	1	0.01
35-56	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.11	1	1	0.02
35-57	530 - Borrow Pits	10	8	3	0.70	7	4	3	0.47	0.22	1	1	0.05
35-58	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.15	1	1	0.04
35-59	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.19	1	1	0.05
35-6	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.14	1	1	0.04
35-60	530 - Borrow Pits	10	8	3	0.70	7	4	3	0.47	0.15	1	1	0.04
35-61	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.23	1	1	0.05
35-62	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.59	1	1	0.14
35-63	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.36	1	1	0.08
35-64	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.16	1	1	0.04

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
35-65	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.16	1	1	0.04
35-66	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.11	1	1	0.03
35-67	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.13	1	1	0.03
35-68	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	1.05	1	1	0.35
35-69	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	1.03	1	1	0.31
35-7	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.50	1	1	0.13
35-70	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	17.39	1	1	6.37
35-71	530 - Borrow Pits	9	8	3	0.67	6	4	3	0.43	1.22	1	1	0.29
35-72	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	3.59	1	1	1.08
35-73	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	0.23	1	1	0.08
35-74	616 - Deep Water Ponds	10	9	10	0.97	7	6	8	0.70	0.60	1	1	0.16
35-75	621 - Cypress	9	9	9	0.90	6	7	6	0.63	5.47	1	1	1.46
35-76	616 - Deep Water Ponds	10	9	10	0.97	7	7	8	0.73	0.13	1	1	0.03
35-77	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	6.68	1	1	2.23
35-78	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	106.58	1	1	31.97
35-79	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	124.27	1	1	37.28
35-8	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.25	1	1	0.07
35-80	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	33.66	1	1	10.10
35-81	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	155.40	10	1.25	45.58
35-82	530 - Borrow Pits	9	8	3	0.67	6	4	3	0.43	0.21	1	1	0.05
35-83	630 - Wetland Forested Mixed	10	9	10	0.97	7	7	6	0.67	0.08	1	1	0.02
35-9	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	1.06	1	1	0.28
36-1	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.37	1	1	0.06
36-10	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.29	1	1	0.08
36-100	628 - Pine - Mesic - Oak	9	9	9	0.90	6	7	6	0.63	8.15	1	1	2.17
36-101	530 - Borrow Pits	9	8	3	0.67	6	4	3	0.43	0.12	1	1	0.03
36-102	621 - Cypress	9	9	9	0.90	6	7	6	0.63	0.20	1	1	0.05
36-11	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.19	1	1	0.05
36-12	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.48	1	1	0.13
36-13	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.28	1	1	0.07
36-14	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.12	1	1	0.03
36-15	641 - Freshwater Marsh	9	9	10	0.93	6	7	9	0.73	0.35	1	1	0.07
36-16	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	4.37	1	1	1.46
36-17	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	0.26	1	1	0.09
36-18	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	2.47	1	1	0.82

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WETLANDS - Mitigation

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36-19	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	1.61	1	1	0.54
36-2	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.09	1	1	0.01
36-20	6301 - Wetland Forested Mixed - Cleared	8	8	10	0.87	6	4	6	0.53	2.43	1	1	0.81
36-21	6301 - Wetland Forested Mixed - Cleared	9	8	10	0.90	6	4	6	0.53	0.44	1	1	0.16
36-22	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	0.05	1	1	0.01
36-23	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.37	1	1	0.11
36-24	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.22	1	1	0.07
36-25	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	1.18	1	1	0.35
36-26	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.44	1	1	0.13
36-27	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.09	1	1	0.03
36-28	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	1.56	1	1	0.36
36-29	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	8.19	1	1	2.46
36-3	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.22	1	1	0.04
36-30	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	1.29	1	1	0.39
36-31	530 - Borrow Pits	9	8	3	0.67	6	4	3	0.43	1.73	1	1	0.40
36-32	530 - Borrow Pits	9	8	3	0.67	6	4	3	0.43	0.46	1	1	0.11
36-33	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	1.20	4	1.1	0.40
36-34	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	1.67	1	1	0.61
36-35	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	0.05	2	1.03	0.02
36-36	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	0.21	2	1.03	0.08
36-37	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	6.67	1	1	2.44
36-38	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	0.14	1	1	0.05
36-39	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	1.09	1	1	0.40
36-4	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.07	1	1	0.01
36-40	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	3.15	1	1	1.15
36-41	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	1.42	1	1	0.52
36-42	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	0.45	1	1	0.13
36-43	617 - Mixed Wetland Hardwoods	9	9	9	0.90	6	6	6	0.60	0.51	1	1	0.15
36-44	628 - Pine - Mesic - Oak	9	9	9	0.90	6	7	6	0.63	0.47	1	1	0.13
36-45	621 - Cypress	9	9	9	0.90	6	7	6	0.63	0.96	1	1	0.26
36-46	621 - Cypress	9	9	9	0.90	6	7	6	0.63	1.05	1	1	0.28
36-47	621 - Cypress	9	9	9	0.90	6	7	6	0.63	0.15	1	1	0.04
36-48	621 - Cypress	9	9	9	0.90	6	7	6	0.63	0.29	1	1	0.08
36-49	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.24	1	1	0.06
36-5	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.13	1	1	0.02

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
36-50	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.48	1	1	0.11
36-51	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.47	1	1	0.11
36-52	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	1.29	1	1	0.30
36-53	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.48	1	1	0.11
36-54	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.38	1	1	0.09
36-55	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.12	1	1	0.03
36-56	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.10	1	1	0.03
36-57	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.31	1	1	0.08
36-58	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.55	1	1	0.15
36-59	616 - Deep Water Ponds	8	9	10	0.90	6	6	8	0.67	0.34	1	1	0.08
36-6	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.19	1	1	0.03
36-60	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	1.90	1	1	0.44
36-61	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.15	1	1	0.04
36-62	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	1.00	1	1	0.27
36-63	530 - Borrow Pits	9	8	3	0.67	6	4	3	0.43	0.14	1	1	0.03
36-64	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.18	1	1	0.05
36-65	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.09	1	1	0.02
36-66	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.41	1	1	0.11
36-67	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	5.04	1	1	1.34
36-68	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.54	1	1	0.14
36-69	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.11	1	1	0.03
36-7	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.09	1	1	0.01
36-70	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.14	1	1	0.04
36-71	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.37	1	1	0.10
36-72	616 - Deep Water Ponds	8	9	10	0.90	6	7	8	0.70	0.48	1	1	0.10
36-73	616 - Deep Water Ponds	9	9	10	0.93	6	6	8	0.67	0.06	1	1	0.02
36-74	616 - Deep Water Ponds	9	9	10	0.93	6	7	8	0.70	0.24	1	1	0.05
36-75	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.28	1	1	0.08
36-76	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.17	1	1	0.05
36-77	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.05	1	1	0.01
36-78	530 - Borrow Pits	9	8	3	0.67	6	4	3	0.43	1.87	1	1	0.44
36-79	530 - Borrow Pits	9	8	3	0.67	6	4	3	0.43	1.20	1	1	0.28
36-8	641 - Freshwater Marsh	9	9	10	0.93	6	8	9	0.77	0.19	1	1	0.03
36-80	530 - Borrow Pits	9	8	3	0.67	6	4	3	0.43	1.02	1	1	0.24
36-81	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	3.87	1	1	1.29

Tarmac King Road Limestone Mine Parcel Mitigation Areas – FDEP UMAM Scores

WETLANDS - Mitigation

AA ID	FLUCFCS	With Project Location Score	With Project Water Score	With Project Community Score	With Project Sum	Without Project Location Score	Without Project Water Score	Without Project Community Score	Without Project Sum	Acres	Timelag - Years	Timelag - tfactor	Functional Lift/Loss
36-82	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	2.37	1	1	0.79
36-83	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	4.43	1	1	1.48
36-84	6301 - Wetland Forested Mixed - Cleared	9	9	10	0.93	6	6	6	0.60	0.79	1	1	0.26
36-85	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	6.27	1	1	1.88
36-86	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	7.16	1	1	2.15
36-87	630 - Wetland Forested Mixed	8	9	10	0.90	6	7	6	0.63	1.43	1	1	0.38
36-88	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	0.75	1	1	0.23
36-89	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	89.24	7	1.25	26.18
36-89-I	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	12.35	7	1.25	3.29
36-9	641 - Freshwater Marsh	9	9	10	0.93	6	5	9	0.67	0.25	1	1	0.07
36-90	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	84.65	4	1.1	28.22
36-90-I	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	6.54	4	1.1	1.98
36-91	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	36.08	1	1	13.23
36-92	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	30.10	1	1	11.04
36-93	617 - Mixed Wetland Hardwoods	8	9	9	0.87	6	6	6	0.60	0.74	1	1	0.20
36-94	628 - Pine - Mesic - Oak	9	9	9	0.90	6	7	6	0.63	11.30	1	1	3.01
36-95	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	2.73	1	1	0.82
36-96	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	0.56	1	1	0.21
36-97	630 - Wetland Forested Mixed	9	9	10	0.93	6	7	6	0.63	34.85	1	1	10.46
36-98	6292 - Hydric Coniferous Plantation < 8	9	8	9	0.87	6	4	5	0.50	12.93	2	1.03	4.60
36-98-I	6292 - Hydric Coniferous Plantation < 8	8	8	9	0.83	6	4	5	0.50	4.81	2	1.03	1.56
36-99	6291 - Hydric Coniferous Plantation > 8	9	8	9	0.87	6	4	5	0.50	47.75	1	1	17.51
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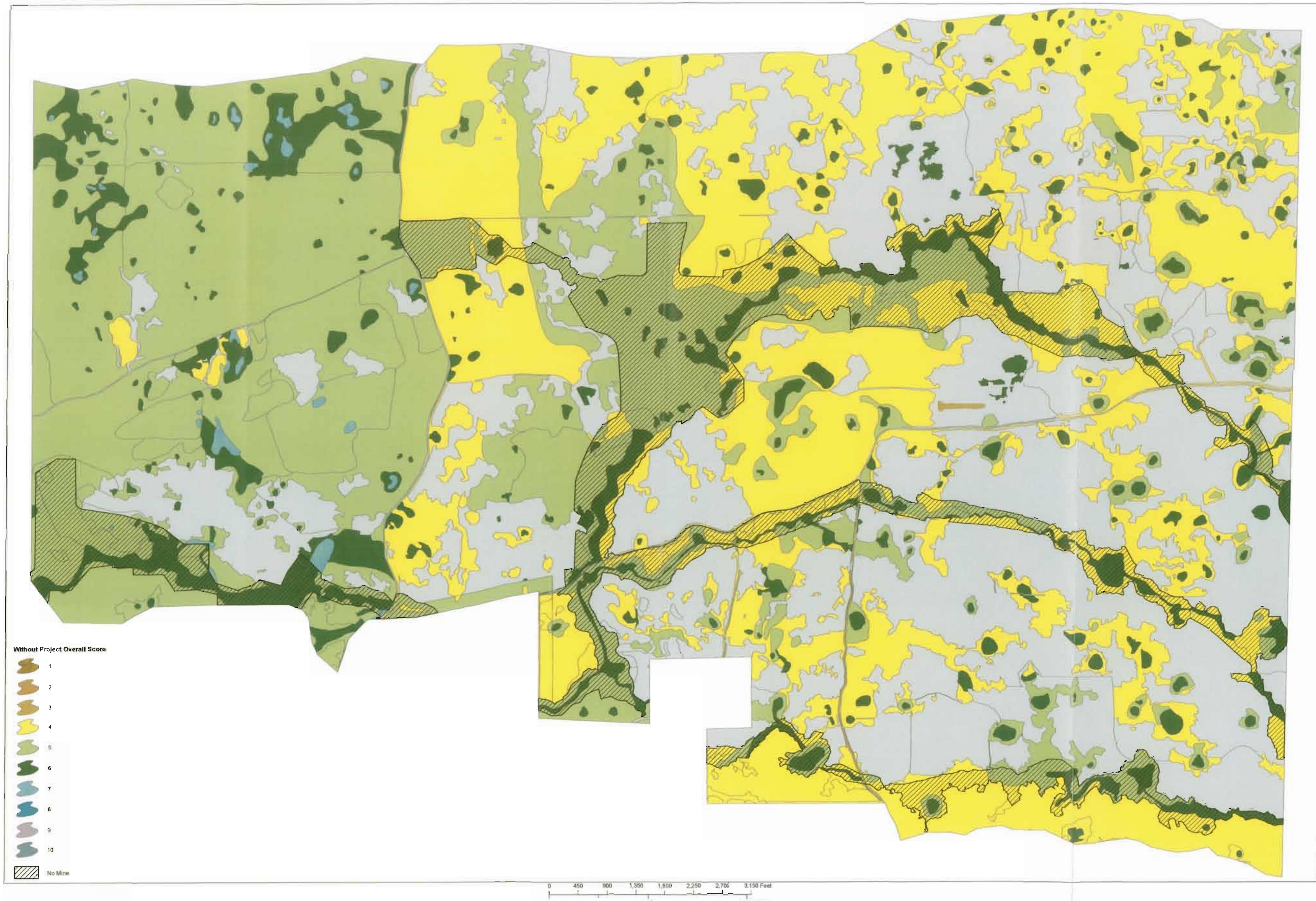

Without Project Overall Score

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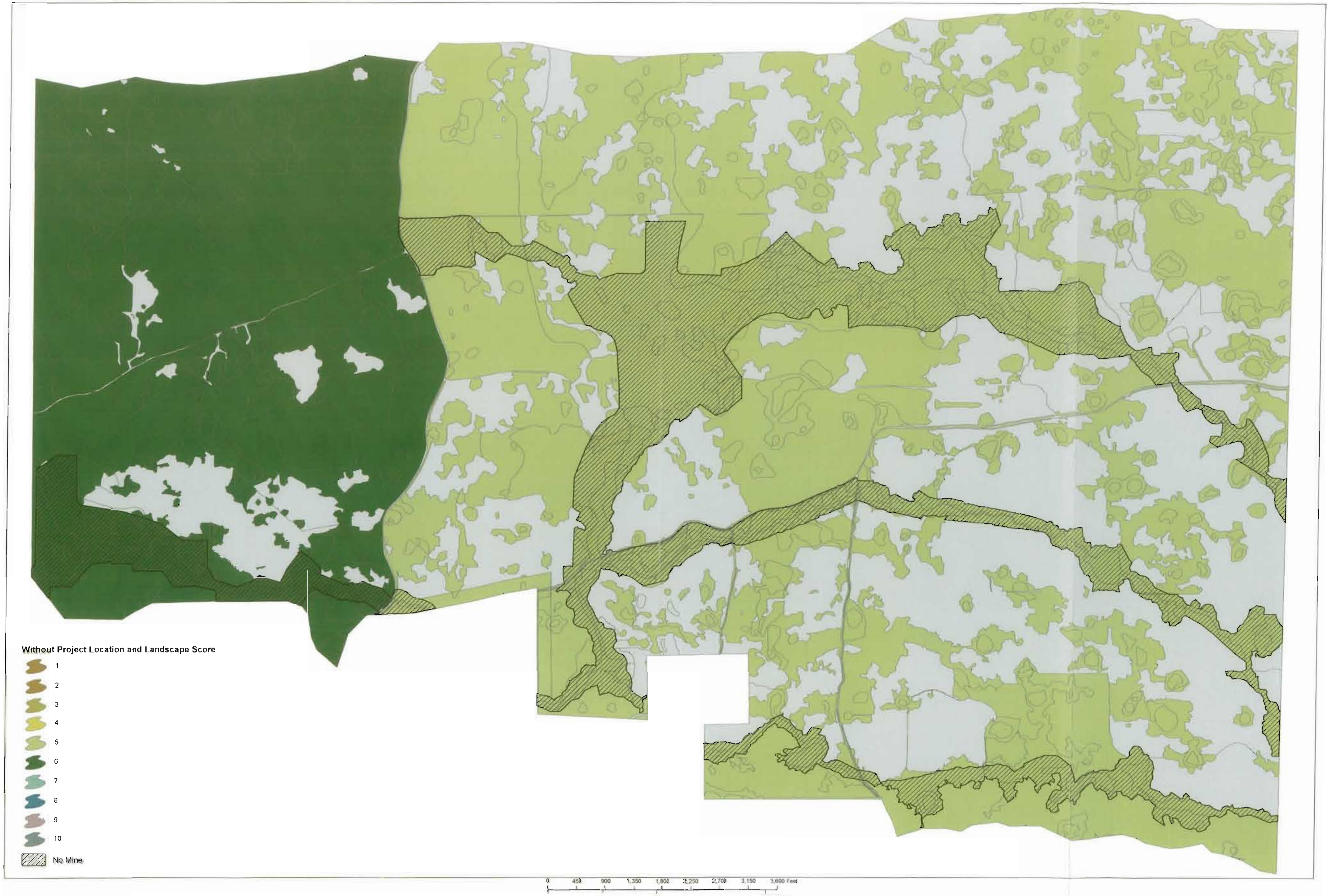

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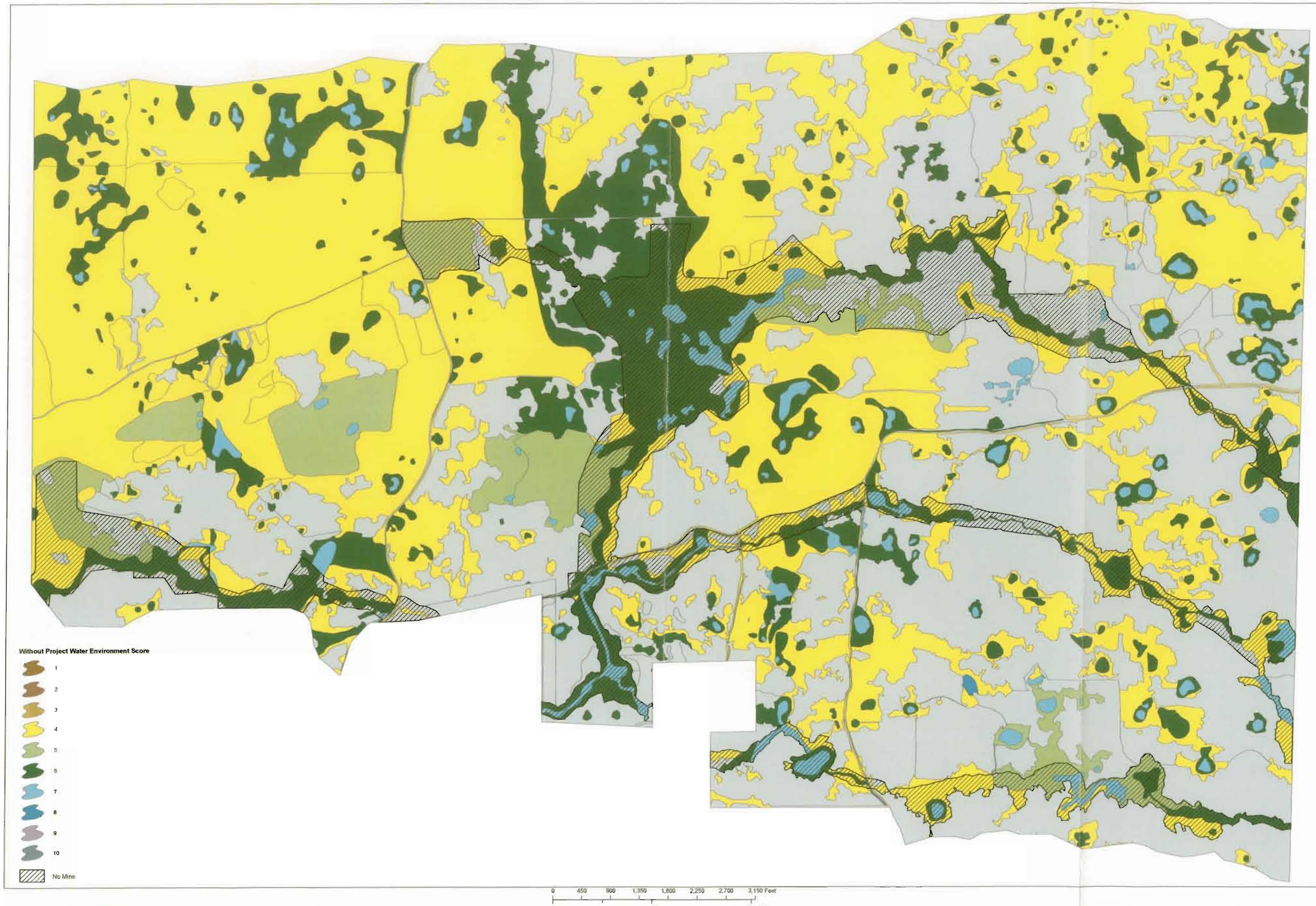

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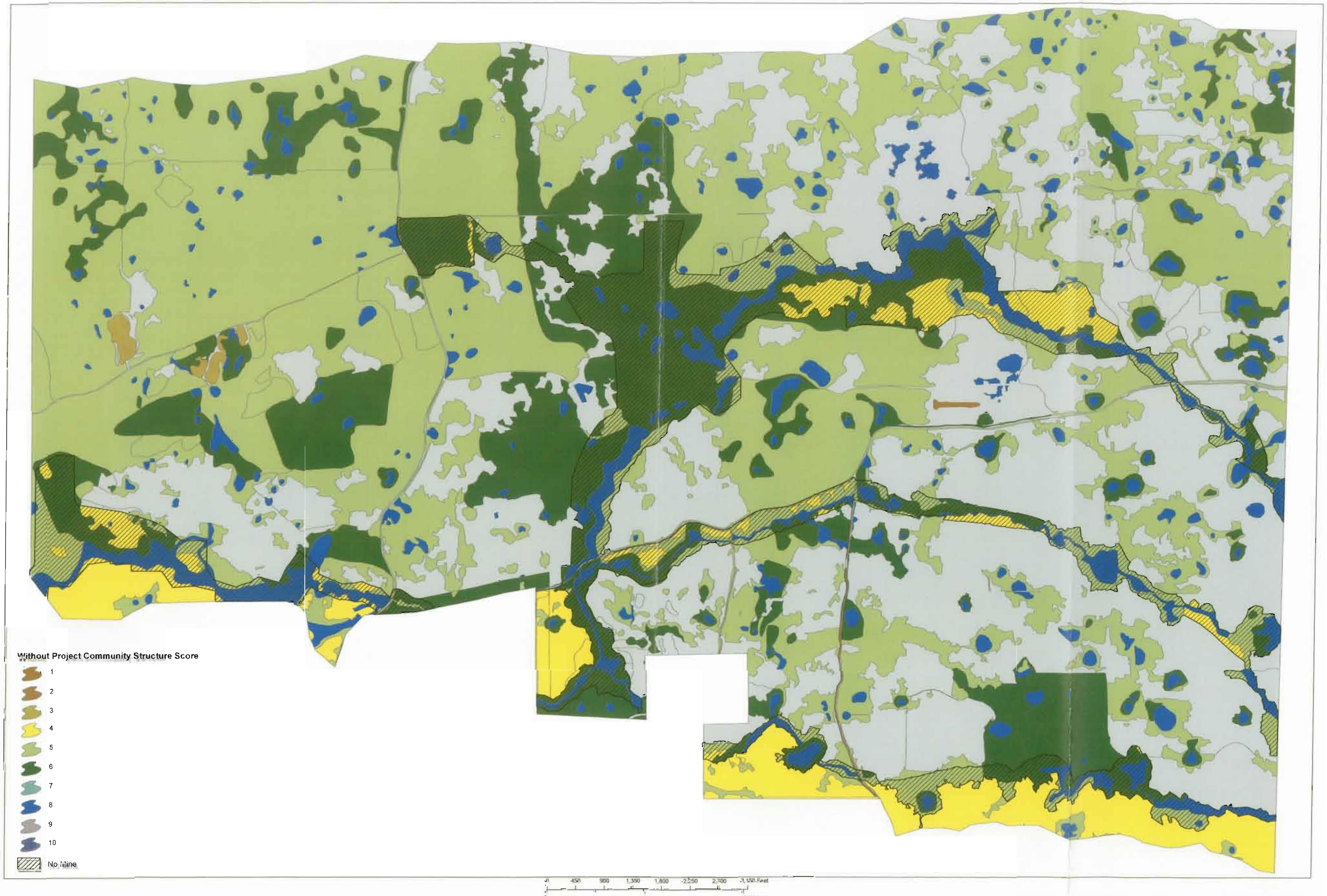

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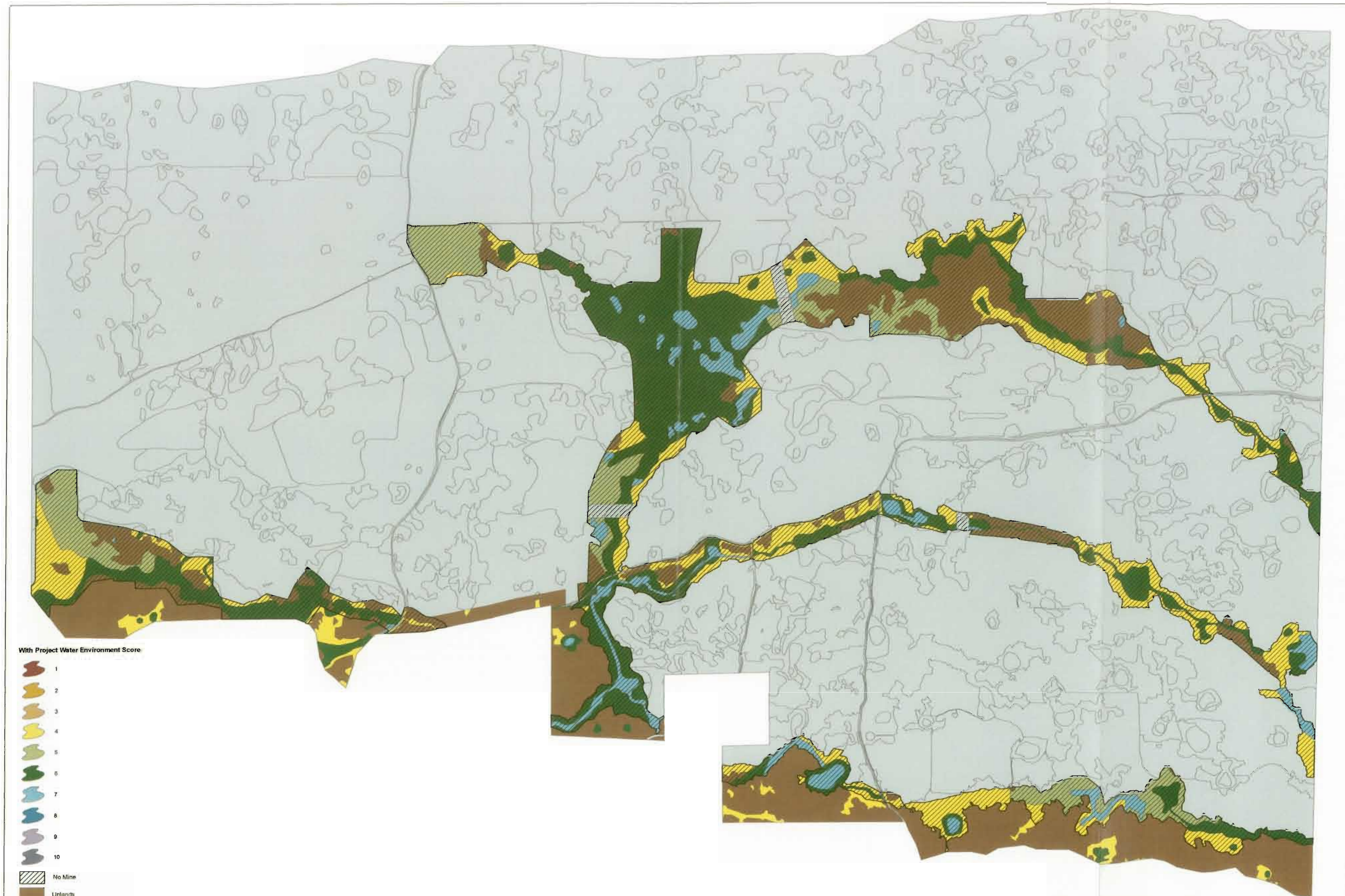

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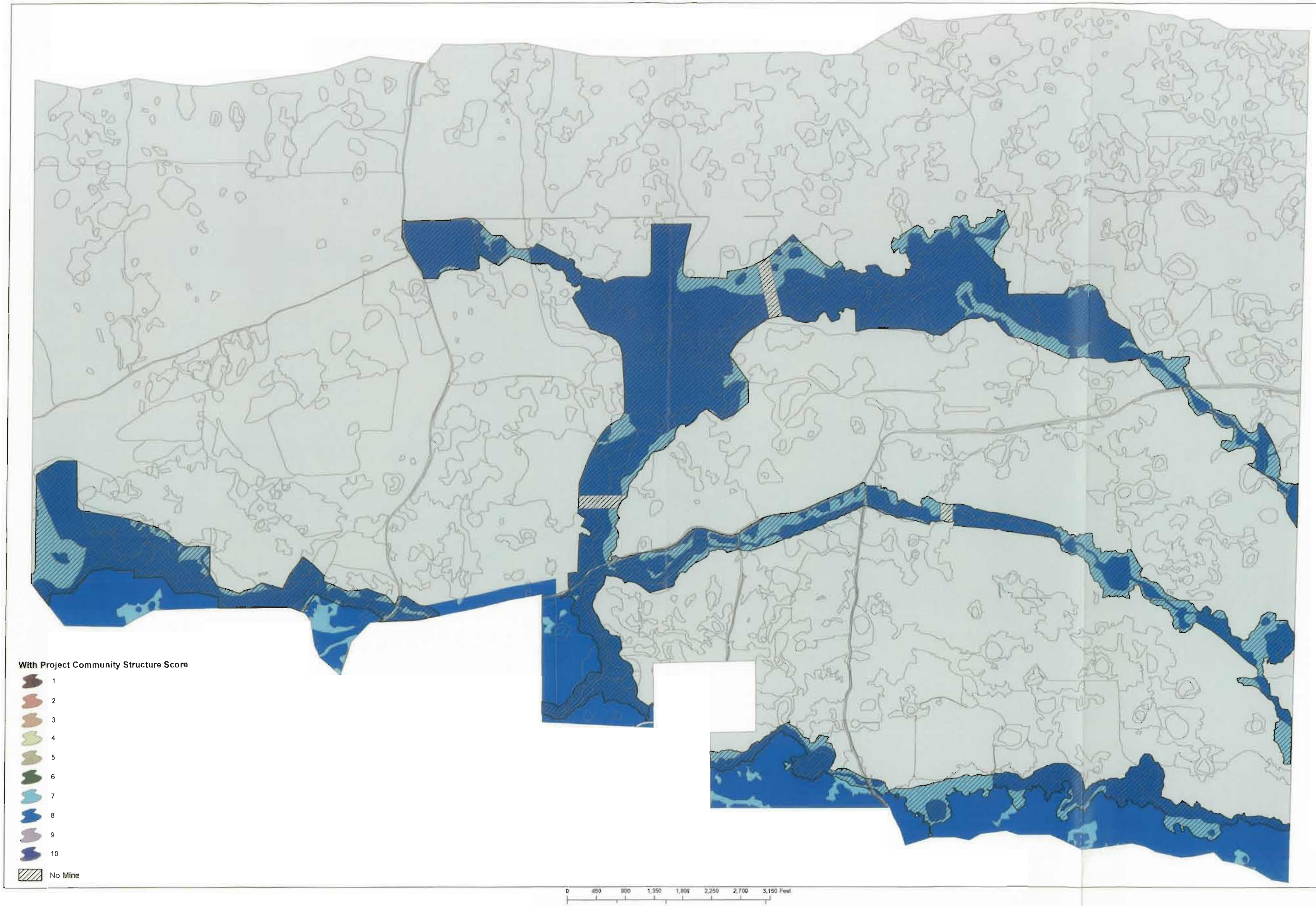

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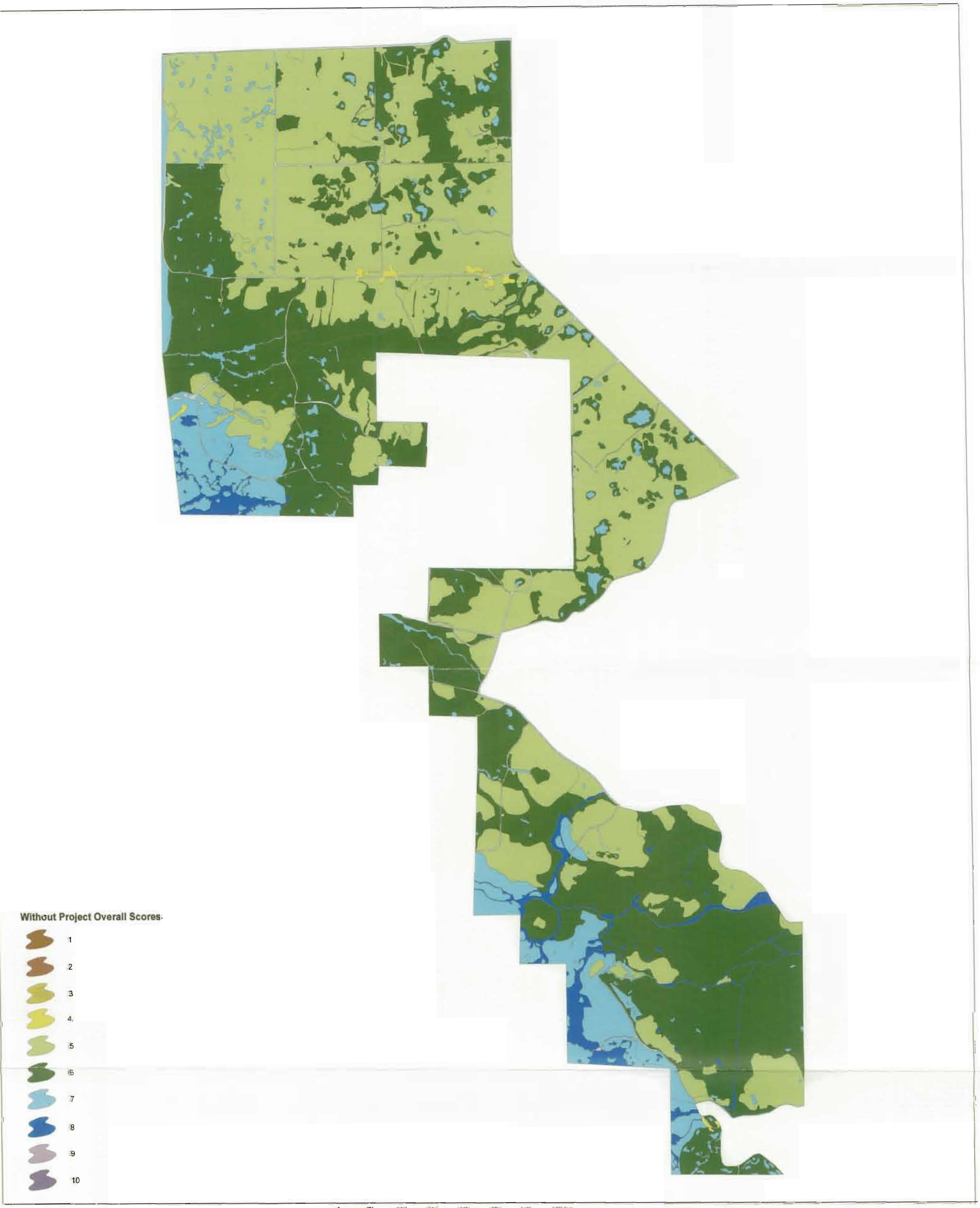

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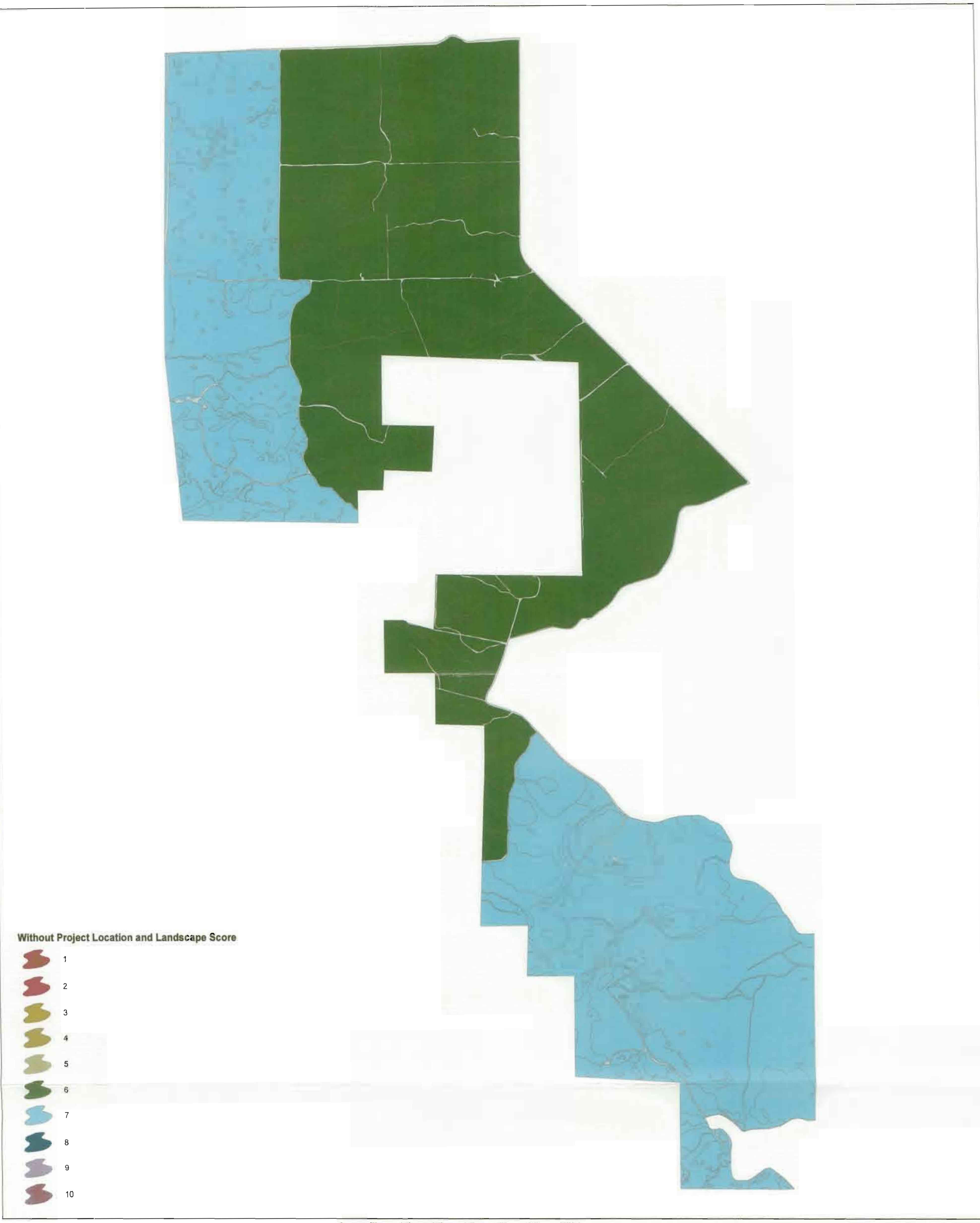

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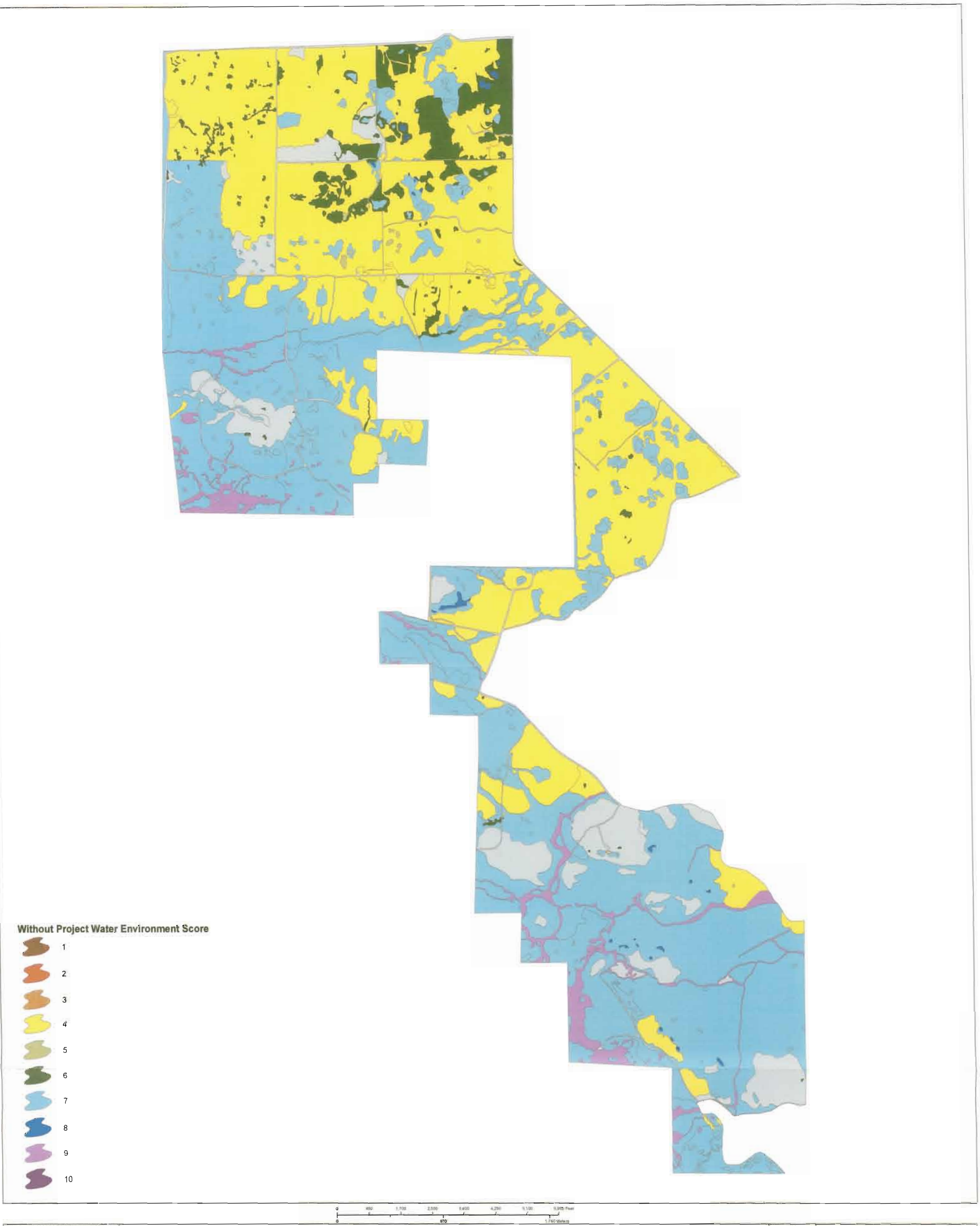

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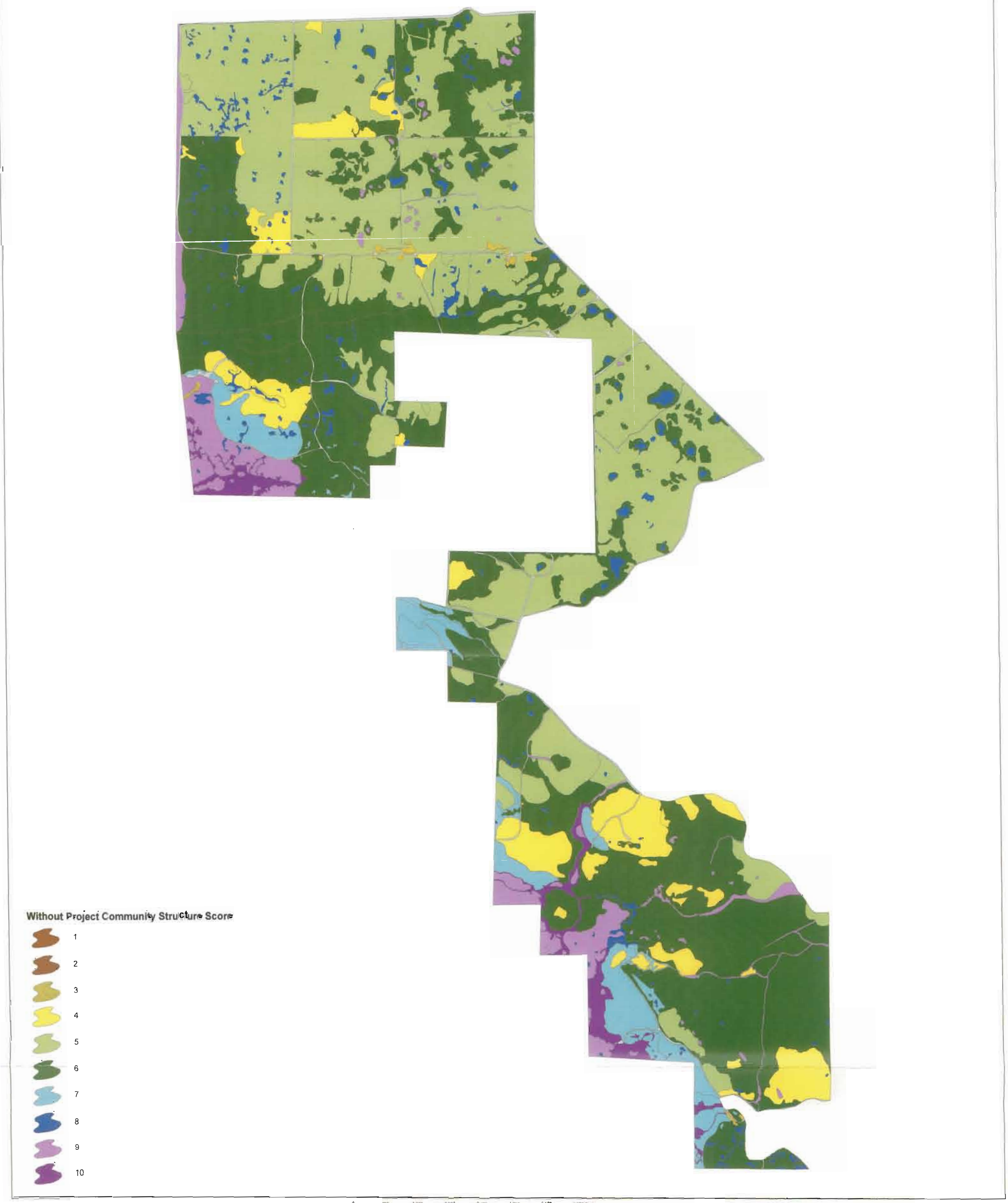

Without Project Community Structure Score

Tarmac King Road Mine
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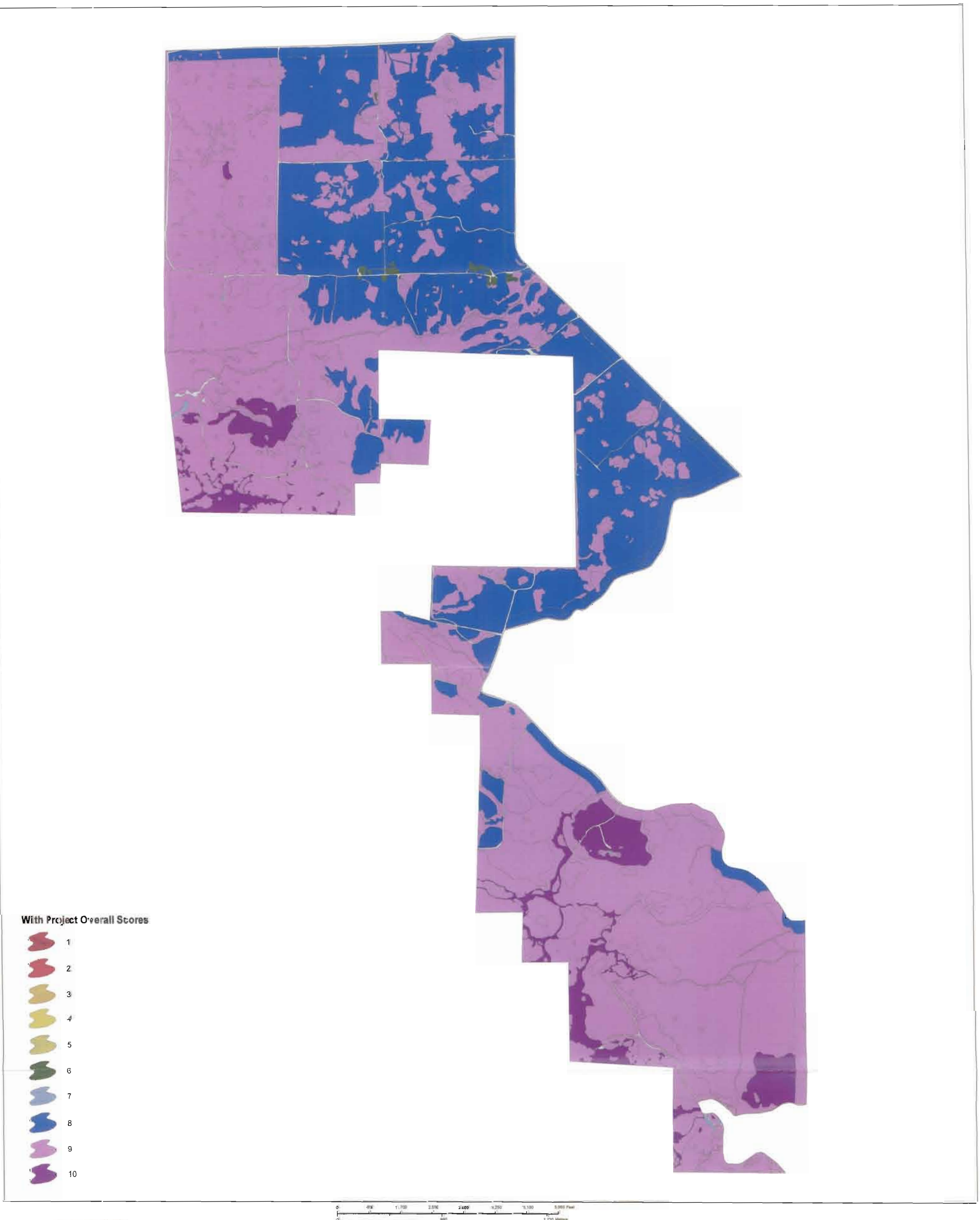

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Levy County, Florida

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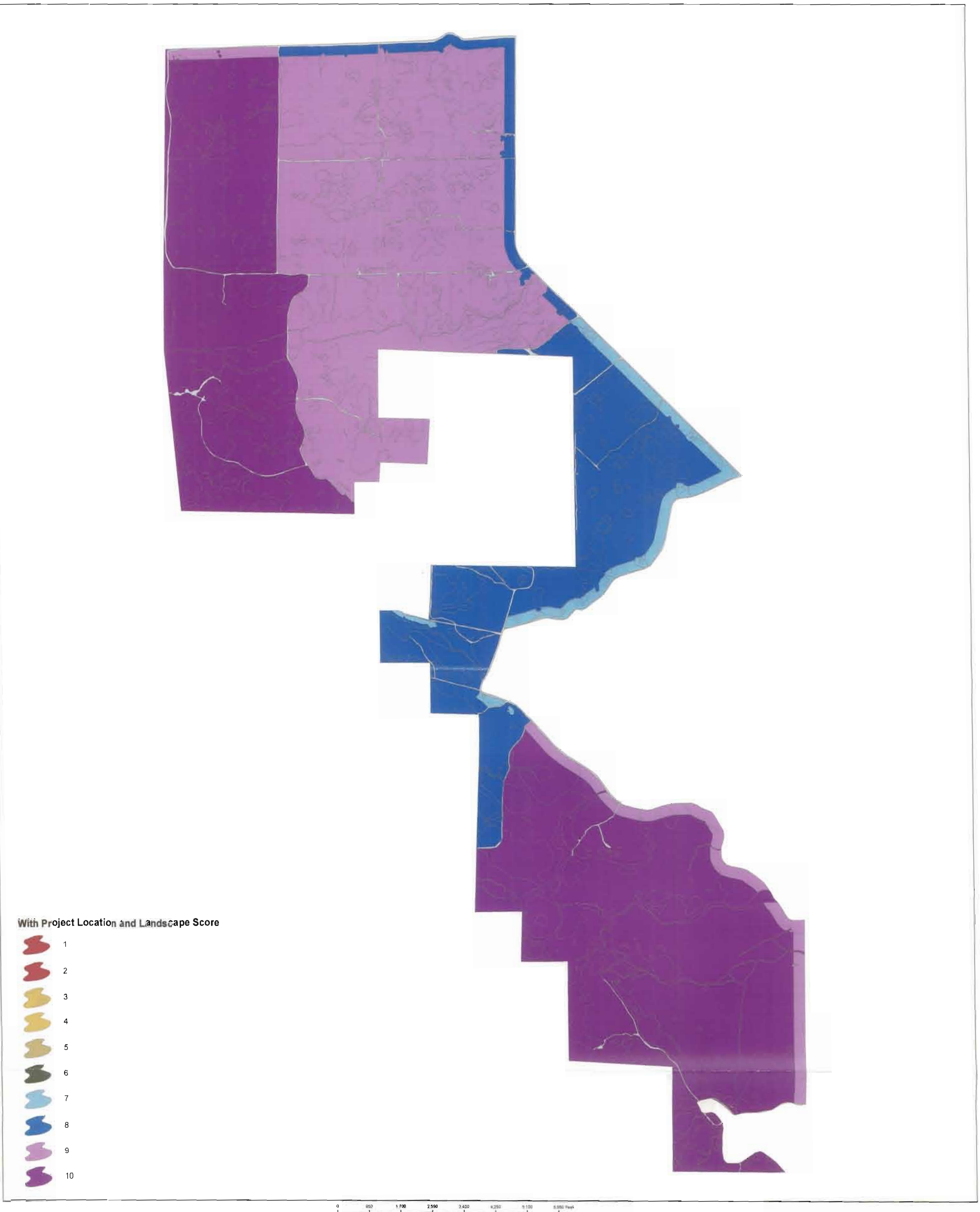

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With Project Location and Landscape Score

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Mitigation Parcel
Levy County, Florida

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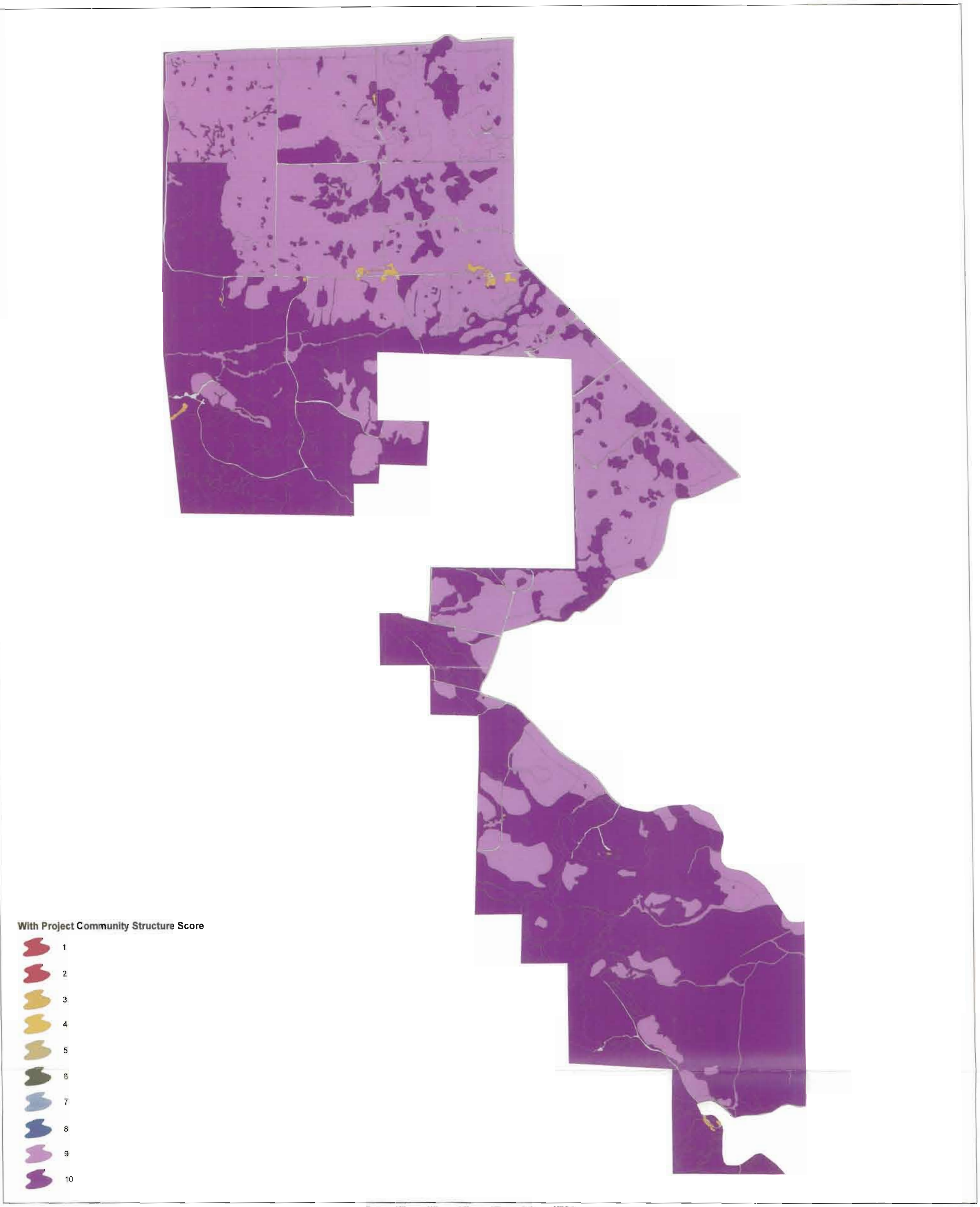

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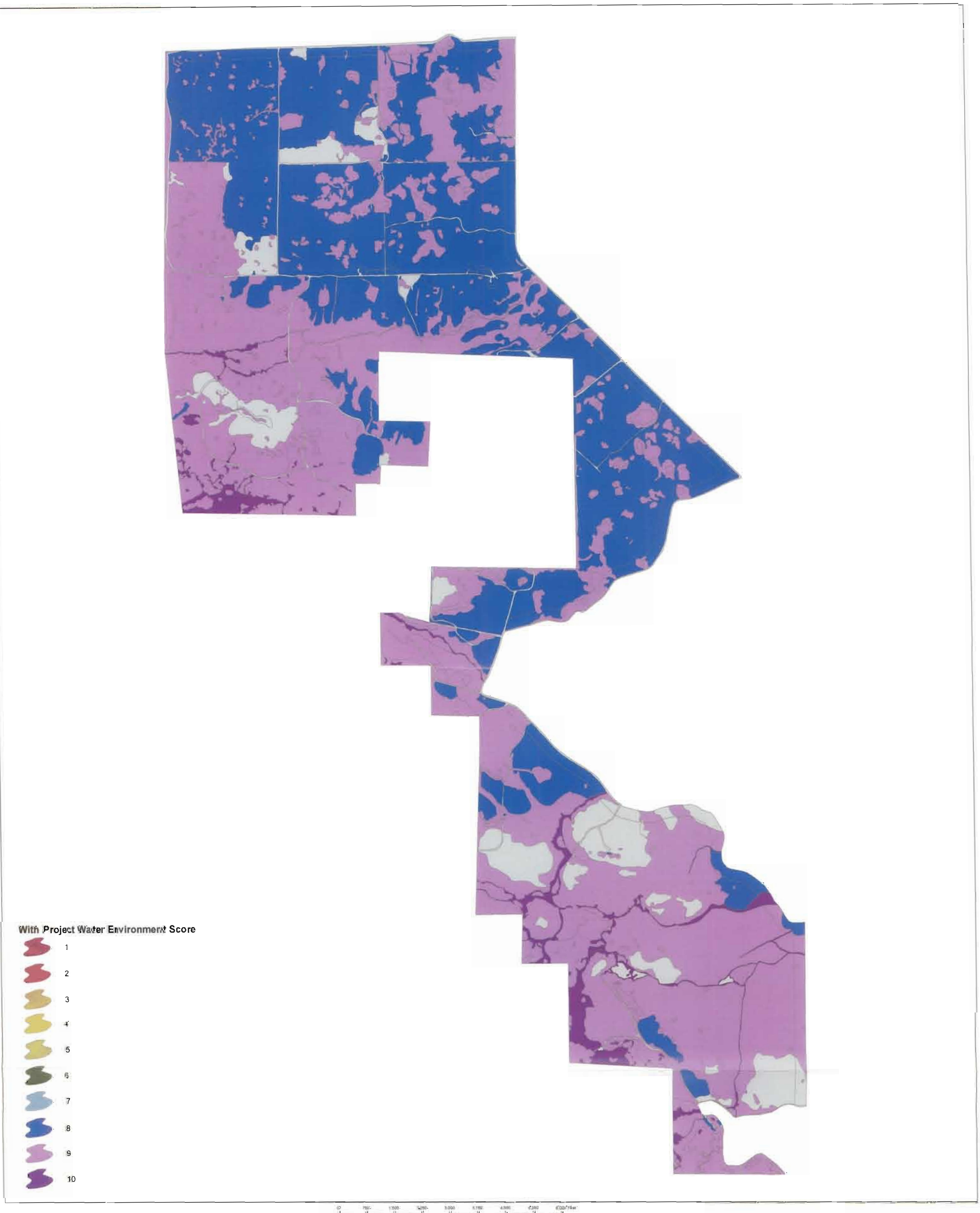

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With Project Water Environment Score

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Mitigation Parcel
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Tarmac King Road Limestone Mine
Mitigation Plan
Levy County, Florida

SUBMITTED TO:

Florida Department of Environmental Protection
Bureau of Mine Reclamation
2051 East Dirac Street
Tallahassee, FL 32310

PREPARED BY

McLane E. Evans
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SECTION 1

Introduction

The Tarmac King Road Limestone Mine Project (Tarmac) is proposing the establishment of an onsite mitigation area to be known as the Tarmac Mitigation Site (TMS) located in the Gulf Hammock Wildlife Management Area (GHWMA) in Levy County, Florida.

The mitigation site is part of the historic Gulf Hammock, once the largest area of hydric hammock in Florida (Wolfe 1990). The hammock once covered nearly 100,000 acres and stretched from the Withlacoochee River north to State Road 24 in a relatively narrow band inland from the coastal salt marshes and west of US 19. It was known for flora and faunal diversity. However, since the early 1800s, the hammock has been disturbed repeatedly beginning with selective harvesting of specific tree species (such as harvesting of eastern red cedar for pencil), and more recently, has been extensively converted to pine plantations (Wolfe 1990).

The proposed TMS will consist of approximately 4,526 acres (subject to a final survey) that are currently owned by Plum Creek Timber Company and will be obtained by Tarmac America, LLC. Tarmac America LLC will assume management and financial responsibility to ensure that the proposed mitigation plan is fully implemented. Both wetlands and uplands have been altered, and there is substantial opportunity to restore and enhance hydric hammocks, swamp forests, and supporting embedded upland islands. The proposed mitigation plan is intended to enhance degraded areas, restore hydric hammocks that have been converted to pine plantation and provide buffer to publicly owned areas (Waccasassa Bay State Preserve).

The objective of this mitigation plan is to provide guidelines for the restoration and enhancement of natural ecosystems in order to provide a mosaic of varied wildlife habitats. Mitigation credits will be obtained through habitat restoration and enhancement. A conservation easement will be recorded upon establishment of the TMS and this, combined with mitigation actions, financial assurances, and long-term management, will ensure that the TMS is preserved in perpetuity.

1.1 LOCATION

The proposed TMS is located in Sections 6, 7, 11,12,13,17 thru 20 and 29, Township 16 South, Range 16 East; Sections 1, 2 and 31, Township 16 South, Range 15 East; and Sections 25, 26, 35 and 36, Township 15 South, Range 15 East in Levy County, Florida (Figure 1). More specifically, it is located north of Inglis, between US19 and the Gulf of Mexico (Figure 2). It is contiguous to the Waccasassa Bay State Preserve and lies entirely within the 25,655-acre GHWMA, which is favored for conservation by the Florida Forever Project. Other conservation lands that are located nearby include Goethe State Forest to the east, Cedar Key Scrub State Reserve and the Lower Suwannee National Wildlife Refuge to the north, and the Waccasassa Bay State Preserve to the west (Figure 3).

SECTION 2

Current Condition

According to the *Levy County Soil Survey* (USDA Natural Resources Conservation Service [NRCS], 1996), four natural soil-mapping units occur on the property (Figure 4). In their undisturbed state, the soils found on site are described as poorly drained, nearly level, sandy, clay loams covering a coastal limestone bedrock layer. Two mapping units, Demory sandy clay loam, occasionally flooded (41) and Waccasassa-Demory complex, flooded (39) cover more than 90 percent of the mitigation site. Demory sandy clay loam is described as flooding occasionally while Waccasassa sandy clay loam occurs on low ridges and is described as flooding only rarely. Both soil types are generally considered hydric by both state and federal regulatory agencies and field observations verify this assumption. These soil types are primarily found within jurisdictional areas, however upland inclusions do occur.

The vegetation on site includes both relatively natural and altered plant communities. For purposes of this mitigation plan, the vegetative cover types on-site (Figure 5) have been assigned a land use code based on the Florida Land Use, Cover and Forms Classification System [FLUCFCS: Florida Department of Transportation (FDOT), 1999, the Southwest Florida Water Management District (SWFWMD) GIS database]. The SWFWMD data were refined using information gathered during field visits to more accurately reflect the existing conditions on the site. Pedestrian transects were conducted by professional biologists to identify relic plant communities and plant regeneration and to determine the dominant plant species occurring within each cover type. The majority of the tract has been converted to pine plantation or otherwise highly altered by silvicultural activities.

Most remnant natural areas may be described as either mesic hardwood hammock or hydric hammock. Restoring the site to its historic Gulf Hammock habitat quality requires restoring the existing mosaic of remnant mesic hardwood and hydric hammocks to their optimal condition. The hydric hammock is subdivided into two types based on proximity to the coast. The inland version of remnant hydric hammock is the most common and occurs on the majority of the site, while coastal areas that are likely to be inundated with salty or brackish water by tropical storms are considered coastal hydric hammock. The coastal hydric hammock communities generally contain the same plant species found in the inland hydric hammocks, however the species distribution is slightly different. For example, eastern red cedar (*Juniperus virginiana*) and cabbage palm (*Sabal palmetto*) occur in both types of hydric hammock, but are much more prominent in the coastal community.

2.1 UPLAND VEGETATIVE COVER TYPES

The TMS is part of the Gulf Hammock that stretched from the Withlacoochee River northward along the coast to SR 24. The Gulf Hammock was the largest example of hydric hammock in Florida prior to the early 1900s. Since that time, much of the TMS has been altered, primarily by timbering and conversion to pine plantation. Historic references also note that the scale of variation is very fine – upland and wetland conditions may occur within the same forest type merely due to minor variations in the subsurface limestone. Distance from the coast, especially when combined with elevation, is also critical as low hammocks along the coast and low drainage ways leading to the coast are subject to salt water inundation during major storm events, and vegetation incapable of handling occasional saline conditions is eliminated from those areas.

The descriptions that follow use the FLUCFCS terminology, but use it in combination with the terminology of (Florida Natural Areas Inventory) FNAI and the NRCS to clearly distinguish between the major types of existing and historic vegetation and to provide a basis from which to develop an effective mitigation plan.

Temperate Hardwoods (FLUCFCS 425, 104.1 acres)

FLUCFCS 425 was used to describe the temperate hardwood forests also known as coastal mesic hammocks. On this site, they are found on shallow loamy soils over limerock and are scattered mainly along the western edge. Fire frequency is low although fire scars were noted in most areas. There is a large variety of canopy trees and a diverse flora in the understory. On the TMS, the temperate hardwood forests have an overstory characterized by cabbage palm (*Sabal palmetto*), live oak (*Quercus virginiana*), eastern red cedar, laurel oak (*Q. laurifolia*), sweetgum (*Liquidambar styraciflua*), basswood (*Tilia americana*), and sugarberry (*Celtis laevigata*). Associates and understory trees include Florida maple (*Acer saccharum* subsp. *floridanum*), Hercules club (*Zanthoxylum clava-herculis*), hophornbeam (*Ostrya virginiana*), magnolia (*Magnolia grandiflora*), yaupon holly (*Ilex vomitoria*), and winged elm (*Ulmus alata*). The ground cover consists of saplings of trees, vines including poison ivy (*Toxicodendron radicans*), green briar (*Smilax bona-nox*), and pepper (*Ampelopsis artemisiifolia*), and rattan vine (*Berschemia scandens*), ferns (*Thelypteris* spp.), coontie (*Zamia pumila*), grasses (*Dichanthelium commutatum, Oplismenus hirtellus*), and a variety of other herbs and small shrubs.

Hardwood-Conifer Mixed (FLUCFCS 434, 22.3 acres)

These communities occur on the northwestern portion of the site surrounded by Wetland Forested Mixed (FLUCFCS 630) and Hydric Coniferous Plantation (FLUCFCS 6291) communities. Canopy cover in these areas consists of an even distribution of mature hardwood species including live oak and laurel oak as well as mature conifer species including slash pine (*Pinus elliottii*) and loblolly pine (*Pinus taeda*). Cabbage palm and eastern red cedar are also common in these communities. The subcanopy is predominantly composed of cabbage palm and the shrub layer is dominated by saw palmetto. Herbs are prevalent where sufficient light reaches the ground and consist of ferns (*Thelypteris* spp.), torpedo grass (*Panicum repens*), and slender woodoats (*Chasmanthium laxum*). Density of palmetto and grassy forbs varies within each forested area. Common vines include saw greenbrier and muscadine grape (*Vitis rotundifolia*).

Coniferous Plantation, > 8 years (FLUCFCS 441, 171.5 acres)

The pine plantations are located in areas that were historically temperate hardwoods (FLUCFCS 425). They are currently dominated either by slash pine or by loblolly pine greater than eight years old. The understory is typically dominated by persimmon (*Diospyros virginiana*), live oak, eastern red cedar (*Juniperus virginiana*), and blackberry (*Rubus argutus*).

Forest Regeneration (FLUCFCS 443, 33.2 acres)

This categorization includes a diversity of areas that were once temperate hardwoods (FLUCFCS 425) and that are currently either recently cleared or planted with young pines that are less than 8-years-old. The canopy is either non-existent or sparse. The overstory consisted of slash pines that were too young to form a closed canopy with small numbers of sweetgum, redbud, sugarberry, American elm, cabbage palms, live oaks, basswood, Hercules club, and eastern red cedar. These species were also found as shrubs. The groundcover was dominated by vines, especially greenbriar, ruderal species such as blackberry, and grasses.

Disturbed Land (FLUCFCS 740, 86.7 acres)

A network of lime-rock and dirt roads occur throughout the TMS. Most of these roads are elevated with ditches, swales and small borrow pits occurring adjacent to the roads. Disturbed lands also include scraped areas around the borrow pits that are either bare or occupied by ruderal vegetation.

2.2 WETLAND HABITAT TYPES

Borrow Pits (FLUCFCS 530, 11.2 acres)

These are areas occur where material (soil, gravel, sand, etc.) has been dug for use at another location, usually the adjacent roadways. In some cases, the borrow pits fill with ground water, depending on the depth of excavation and the water table depth. They are often adjacent to a timber roads and pine plantations and may have a narrow fringe of hammock at the top of slope. These pits are often populated with nuisance species such as cattails (*Typha* sp.) in the shallow edges.

Streams and Lake Swamps (Bottomland) (FLUCFCS 615, 22.5 acres)

These are areas occur where the freshwater flow-ways from the east enter the TMS and flow to meet the saline, tidally-influenced salt marshes and tidal flats along the western edge of the parcel. Typically, these habitats have an exposed limerock bed in the center of the flow-way. Sediment build up along the edges supports some cypress and a variety of water-tolerant hardwood species.

Deep Water Ponds (FLUCFCS 616a, 101.4 acres)

Many of the deep-water ponds remain inundated throughout much of the year. They are isolated during the dry season and are hydrologically connected via a slough system during the wet season. Nearly all of these areas are dominated by pop ash (*Fraxinus caroliniana*). Because these areas are inundated with deep water for extended time periods, understory vegetation is often times greatly reduced. Cover in these areas when present consists of species tolerant of prolonged deep inundation such as buttonbush (*Cephalanthus occidentalis*), pickerelweed (*Pontederia cordata*) and fireflag (*Thalia geniculata*). At the wetland perimeters, species diversity increases and various oaks are sometimes present.

Mixed Wetland Hardwoods (FLUCFCS 617, 124.7 acres)

This plant community type contains a mixture of the hardwood tree species mentioned in the other wetland categories such as water oak (*Quercus nigra*), American elm (*Ulmus Americana*), sweet-bay (*Magnolia virginiana*), red maple (*Acer rubrum*), and sweetgum. It is not dominated by a particular species, but rather exhibits and ill-defined and diverse mixture of species.

Cypress (FLUCFCS 621, 20.5 acres)

This habitat type is dominated by bald cypress (*Taxodium distichum*) in the canopy with Carolina willow (*Salix caroliniana*), lance-leaved arrowhead, and sawgrass (*Cladium jamaicense*) dominating the understory.

Pine – Mesic - Oak (FLUCFCS 628, 20.7 acres)

This land cover type represents remnants of the hydric hammock that once dominated most of the more inland areas on this site. It contains a mixture of pines, predominantly loblolly pine, oaks (live, laurel, water, Shumard), elms, maples (red, Florida), American hornbeam (*Carpinus caroliniana*), magnolias, etc. It is variable in character depending on minor changes in topography and depth to bedrock. Better drained areas include species usually associated with uplands, such as saw palmetto (*Serenoa repens*), pignut hickory (*Carya glabra*) and redbud (*Cercis canadensis*). Inclusions of more poorly drained areas lack these species but have characteristic wetland species such as American elm and pop ash.

Hydric Coniferous Plantation > 8 years (FLUCFCS 6291, 345.0 acres)

The hydric coniferous plantations are dominated by densely planted loblolly or slash pine, often bedded in shallow rows. They are typically located in areas that were historically hydric hammock. Hardwood species scattered through these plantations include red\maple, laurel oak, yaupon holly, and sweetgum. The shrub stratum consists mostly of saltbush (*Baccharis halimifolia*) and the herbaceous cover consists almost entirely of weedy ruderal species.

Hydric Coniferous Plantation <8 years (FLUCFCS 6292, 1314.6 acres)

These plantations were harvested within the last 8 years. Some have been replanted with slash pine and loblolly pine; some have not yet been replanted. In areas that were not replanted, a diverse herbaceous ruderal species cover has emerged. Remaining canopy trees are few and consist mainly of laurel oak and cabbage palm. Ground cover is gradually increasing and includes dog fennel (*Eupatorium capillifolium*) and hardwood seedlings. In areas that have been replanted, the species composition is similar, but includes a densely planted immature overstory of loblolly or slash pine.

Wetland Forested Mixed (FLUCFCS 630, 1,601.2 acres)

Wetland Forested Mixed communities are the most prevalent natural wetland community on the parcel. It consists of areas in which include pines and no individual hardwood species achieves dominance. Most any hardwood species typical of Mixed Wetland Hardwood Forests (FLUCFCS code 617) may occur. Mid-story trees and shrubs may be prevalent, limited to isolated colonies, or nearly absent. They may consist of young trees typical of the canopy or of larger shrubs such as wax myrtle. The ground cover is generally herbaceous and quite variable both in its abundance and in its species composition, forming a continuous cover where the tree canopy is discontinuous allowing ample light to reach the ground. Some vine species including muscadine grape, saw greenbrier (*Smilax bona-nox*) and blackberry are present in these areas.

Wetland Forested Mixed, Cleared (FLUCFCS 6301, 43.1 acres)

These wetlands are concentrated in the northern portion of the parcel. They contain relics of a mix of hardwoods and conifers, but have been harvested. Vegetation exists mainly of emerging hardwood seedlings, dog fennel, yaupon holly, wax myrtle and coinwort.

Coastal Maritime Hammock (FLUCFCS 633, 382.9 acres)

Coastal hydric hammocks are adjacent to the salt marshes and tidal flats along the western side of the parcel. They are similar to the hydric hammocks that are more inland but are distinguished from them by vegetation with a higher dominance by cabbage palms, live oaks, and eastern red cedar (*Juniperus virginiana*). Associates include winged elm, laurel oak, American hornbeam, yaupon holly, coontie and Hercules club. St. Augustine grass (*Stenotaphrum secundatum*) is abundant in the groundcover. Included within this mapping unit are small areas of Coastal Mesic Hammock (Temperate Hardwoods 425). The Coastal Maritime Hammock has been delimited from the various historic hydric hammock communities based on the eastern limit of soil mapping unit 41 in combination with signatures on recent aerial photographs. On the ground, these systems are "diffuse" in the sense that the change is gradual.

Freshwater Marsh (FLUCFCS 641, 13.1 acres)

Many of the marshes on TMS are associated with forested swamps, hammocks, or embedded within hydric pine plantations. Most of the freshwater marshes on the TMS are dominated by sawgrass.

Saltwater Marsh (FLUCFCS 642, 36.5 acres)

The majority of saltwater marshes, including tidal creek systems, are found in the southern and western portions of the TMS. They are connected to the Waccasassa Bay State Preserve, Demory Creek, and the Gulf of Mexico through the TMS. Salt marshes are tidal coastal ecosystems that contain dominated by non-woody salt-tolerant plants such as saltmarsh cordgrass (*Spartina alterniflora*), black rush (*Juncus romarianus*), and saltgrass (*Distichlis spicata*). Salt-tolerant shrubs including Christmas berry (*Lycium carolinianum*) and saltwater false willow (*Baccharis angustifolia*) occur along the transitional areas.

Tidal Flats (FLUCFCS 651, 71.3 acres)

Tidal flats occur along the western half of the site, bordering Waccasassa Bay and the Gulf of Mexico. These areas are estuaries, generally protected from wave action, and composed of silt and mud transported along tidal channels. These mud flat communities are largely unvegetated. They are associated with the tide, and thus are alternately submerged and then exposed to the atmosphere.

2.3 HYDROLOGY

Overall elevation on the TMS decreases from east to west and sheet flow generally occurs toward the west and south-southwest. The TMS has significant hydrologic connectivity with Waccasassa Bay and the Gulf of Mexico, as well as a hydrologic corridor through the eastern end of the Spring Run system.

The hydrology on the site has been affected by both the system of elevated roads, ditches, and culverts and the ongoing clearing activities. These have, respectively, altered sheet flow in the hammock, drained wetlands, and impounded water upstream of crossings.

2.4 FORESTRY

Approximately 1,660 acres of pine plantations occur on the TMS with ages of the stands varying from 1 to 30 years. Additional acres of "natural" forest that has been timbered or high-graded is present, especially in the western and southern parts of the site. In plantations, trees were typically planted at a density of between 425 to 725 trees per acre. Individual tree heights vary from less than 8-ft to more than 50-ft high. According to 1943 aerial photographs and soil data found in the Levy County Soil Survey, most of the pine plantation acreage is are located in areas that were historically coastal mesic and hydric hammocks. However, it also occurs within habitats that were forested wetlands and even in areas that have somewhat saline soils and vegetation. Without implementation of this mitigation plan, the TMS is slated for continued pine production and harvesting.

2.5 WILDLIFE

Wildlife biologists from ENTRIX visited the site regularly during 2005, 2006, 2007 and 2008 and any wildlife observed during this period was recorded. Efforts were concentrated on establishing a list of wildlife currently occurring on the site and on determining suitable habitat for listed species. Listed species observed on the site include little blue heron (*Egretta caerulea*), white ibis (*Eudocimus albus*), American alligator (*Alligator mississippiensis*), bald eagle (*Haliaeetus leucocephalus*), wood stork (*Mycteria americana*), limpkin (*Aramus guarauna*), and snowy egret (*Egretta thula*). A little blue heron rookery and a white ibis roost were also observed on the site. Pairs of swallow-tailed kites (*Elanoides forficatus*) were observed, and they may be breeding on the site though nests were never located. Table 1 contains a list of all the wildlife species that were observed on the TMS.

More formal wildlife surveys were conducted from August 2007 through June 2008 to identify the presence and abundance of a variety of species. A detailed accounting of sampling methodology and results is provided in the Tarmac King Road Limestone Mine Wildlife Survey Results May 2009 report.

2.6 LISTED PLANT SPECIES

State listed rare plant species have been observed on the mitigation site. These include corkwood (*Leitneria cordifolia*), which occurs in moderately deep ponds, mostly near the coast; brown-eyed susan (*Rudbeckia triloba*), which is abundant in recently clear areas with clayey soils; pinewoods dainties (*Phyllanthus liebmannianus subsp. platylepis*); and anglepod (*Matelea gonocarpus*), which was seen in several areas of older pine plantation and natural hammock.

SECTION 3

Mitigation

3.1 OBJECTIVE

The objective of this mitigation plan is to provide guidelines for the restoration and enhancement of natural ecosystems in order to provide a mosaic of varied wildlife habitats. Mitigation credits will be obtained through habitat restoration and enhancement. A conservation easement will be recorded upon establishment of the TMS and this, combined with mitigation actions, financial assurances, and long-term management, will ensure that the TMS is preserved in perpetuity.

The TMS is proposed to provide mitigation that will offset the effects of the proposed Tarmac King Road Limestone Mine. The project goal is to enhance, restore, and protect native wetlands and uplands, thereby restoring the site to its natural condition. Habitat management to benefit wildlife, particularly species listed as endangered, threatened or species of special concern by the Florida Fish and Wildlife Conservation Commission (FFWCC) or the U.S. Fish and Wildlife Service (FWS), will be a high priority.

The mitigation plan for the TMS proposes mitigation actions that will improve and protect the ecological value of approximately 4,440 acres located within the TMS. Approximately 4,108 acres of wetlands and 331 acres of uplands will be restored and enhanced through hydrologic and vegetative improvements detailed below (Table 2 and Figure 6).

Placing the TMS under a conservation easement will ensure the protection of these preserved and enhanced habitats in perpetuity.

3.2 PROPOSED MITIGATION ACTIVITIES

The proposed mitigation activities include the following:

- Thinning of planted pines to approximate densities that would occur naturally
- Planting of appropriate native species if natural recruitment is not occurring
- Assessment of bedded areas to determine if bed removal would be beneficial; removal if there will be a net improvement
- Prevention of further silviculture impacts through establishment of a conservation easement
- Protection of wildlife through habitat enhancement and preservation of wildlife corridors
- Preservation of archaeological resources
- Nuisance species removal
- Implementation of a monitoring program to ensure mitigation success

3.3 WILDLIFE MANAGEMENT

The mitigation activities proposed for the TMS will result in a mosaic of habitats that will benefit wildlife on the site. According to the recent wildlife survey, the site currently does not support a wide range of listed species or wildlife in general. Creating a habitat mosaic and restoring the site to more natural conditions will encourage increased wildlife utilization and increase the habitat availability for listed species. Because the site is contiguous and in close proximity to several publicly-owned conservation areas, wildlife should move onto the site as the habitat becomes suitable.

3.4 MITIGATION TECHNIQUES

Specific mitigation activities will be implemented based on the historic habitat and the existing conditions. The natural structure of hydric hammocks consist of a closed canopy of mixed deciduous and evergreen hardwood tree species, including laurel oak, sweetbay, sweetgum, live oak, water oak, red maple, and loblolly pine; a sparse to dense subcanopy of cabbage palm, musclewood (*Carpinus caroliniana*), swamp dogwood (*Cornus foemina*), and swamp bay; and a ground layer of spikegrass (*Chasmanthium nitidum*), millet beakrush (*Rhynchospora miliacea*), and blue palmetto (*Sabal minor*) (FNAI 1990). The proposed activities have been designed to restore the historic character to the systems while minimizing potential short-term disturbance. Activity areas are discussed in detail below and are separated into the following categories.

W1 Restoration of hydric hammock from mature pine plantations
W2 Restoration of hydric hammocks from pine plantations < 8 years
W3 Enhancing existing wetlands
W4 Restoration of coastal hydric and hydric hammocks from cleared natural hammock
U1 Restoration of coastal mesic hammock from mature pine plantations
U2 Restoration of coastal mesic hammock from harvested pine plantations
U3 Enhancing existing coastal mesic hammock

3.4.1 W1 – Restoration of hydric hammock and coastal hydric hammock from mature pine plantations

A prescription of site-specific enhancements will be used restore mature pine plantations to hydric hammocks and coastal hydric hammocks. Specific techniques will include the following:

- Selective thinning will be used in dense plantation areas to reduce mature pines to 100 stems per acre or less in both community types, loblolly pine will be preferred over slash pine as both natural communities are characterized by a greater dominance by loblolly. Tree-sized hardwoods will not be cleared.
- After thinning, the areas will be assessed relative to remaining vegetation with the intent that any species present in the canopy for the community as noted in Table 3 will be present in one or more strata as those will provide a basis from which recruitment into the canopy can occur.
- If species noted as key species in Table 3 are not present and do not recruit into the area after 5 years, selected supplemental planting will be conducted. The areas will also be assessed for small trees, shrubs, and herbaceous species. If the species noted as key species in Table 3 are not present, those species will be planted.
- Nuisance species will be removed either individually or by use of herbicide, as appropriate.

3.4.2 W2 - Restoration of hydric hammocks and coastal hydric hammocks from pine plantations < 8 years

A prescription of site-specific restoration techniques will be used to restore young pine plantations and cleared areas to hydric hammock and coastal hydric hammock. Specific techniques will include the following:

- All slash pine will be removed from this area and loblolly pine will be thinned to a density of no more than 100 trees per acre.
- If warranted, localized burning may be used to remove piles of logging debris. As hydric hammocks are believed to burn only rarely, fire will not be used on the site as a whole.
- After harvesting and timber removal, these areas will be inspected to determine if soil remediation (removal of bedding, leveling of ruts) is warranted. Such action will be considered warranted if bedding or rutting appears to be causing severe harm to the natural hydrology. They will not be removed the remedial action is likely to cause more harm to recruitment than the expected improvement due to hydrological improvement. Species composition and distribution will be used in this determination.
- Individual restoration areas will be assessed to determine the likelihood of seedlings and saplings of desirable hydric hammock species present in adequate variety and abundance to establish a closed overstory within 20 years. If not, then the existing vegetation will be supplemented with local vegetation as listed in Table 3. If supplementation occurs, coastal hydric hammocks and hydric hammocks will be distinguished such that the supplemental vegetation is appropriate to the target mature natural community.
- Nuisance species will be removed by either mechanical or chemical methods, as appropriate.
- Hydric hammocks will not be burned. If wildfire occurs, current weather conditions and hydration of the substrate will be used to determine if active fire suppression is needed.

3.4.3 W3 – Enhancing existing wetlands

Existing native wetland communities within the mitigation parcel have been affected by silviculture management activities occurring in and around the wetlands. Wetland enhancement will occur through a variety of active and passive methods including:

- Eliminating pine silviculture activities
- Reducing the evapotranspiration rate by eliminating the planted pine beds throughout the mitigation parcel
- Preventing further restrictions on sheet flow by eliminating ditching and bedding practices
- Prevent future potential water quality degradation that results from sediment loading during clearing activities
- Eliminating selective harvesting of cypress, cedar and other merchantable wood-producing species
- Removing and preventing the spread of exotic species throughout these wetlands
- Improving wildlife corridors and connectivity between wetlands through enhancements to adjacent planted pine and upland areas

3.4.4 W4 – Restoration of coastal hydric and hydric hammocks from cleared natural hammock

Several areas of cleared natural hammock exist on site. The goal is to restore these to natural conditions. These areas differ from harvested pine plantations in that they are not bedded or planted with pines. Various conditions exist within these areas, including some dominated by vines and other ruderal vegetation.

A prescription of site-specific restoration techniques will be used to restore cleared areas to hydric hammock and coastal hydric hammock.

- If warranted, localized burning may be used to remove piles of logging debris. As hydric hammocks are believed to burn only rarely, fire will not be used on the site as a whole.
- Sites will be inspected for dense occurrence of vines, ruderal vegetation, and nuisance species. Nuisance species will be removed, and any over-abundance of vines or ruderal vegetation will be eliminated through mechanical or chemical methods.
- Individual restoration areas will be assessed to determine if seedlings and saplings of desirable hydric hammock species are present in adequate variety and abundance to establish a closed overstory within 20 years. If not, then the existing vegetation will be supplemented with characteristic vegetation as listed in Table 3. If supplementation occurs, coastal hydric hammocks and hydric hammocks will be distinguished such that the supplemental vegetation is appropriate to the target mature natural community.
- Hydric hammocks will not be burned. If wildfire occurs, current weather conditions and hydration of the substrate will be used to determine if active fire suppression is needed.

3.4.5 U1 - Restoration of coastal mesic hammocks from mature pine plantations

Coastal mesic hammocks are dominated by a diverse assortment of species including live oak, eastern red cedar, cabbage palm, basswood, winged elm, and a wide variety of other species as listed in Table 3. The primary restoration goals are to encourage re-growth of a characteristic plant community and to enhance hydrological conditions in the hammocks such that they provide appropriate hydrological, water quality, and buffer support for adjacent wetlands. Support of wildlife that utilizes both uplands and wetlands is an additional goal.

A prescription of site-specific enhancements will be used to restore mature pine plantations to coastal mesic hammock. Specific techniques include the following:

- Selective thinning will be used in dense plantation areas to reduce mature pines 100 stems per acre or less. Loblolly pine will be preferred over slash pine as this natural community is characterized by a greater dominance by loblolly than slash. Tree-sized hardwoods will not be cleared. After thinning, the areas will be assessed relative to remaining vegetation with the intent that any species present in the canopy for the community as noted in Table 3 will be present in one or more strata as those will provide a basis from which recruitment into the canopy can occur.
- If species noted as key species in Table 3 are not present or do not recruit into the area within 5 years, selected supplemental planting will be conducted. The areas will also be assessed for small trees, shrubs, and herbaceous species and compared to the table for similarity. If the species noted as key species in Table 3 are not present, those species will be planted.
- Nuisance species will be removed by either chemical or mechanical methods.

3.4.6 U2 - Restoration of coastal mesic hammocks from harvested pine plantations

A prescription of site-specific enhancements will be used to restore harvested pine plantations to coastal hammocks. Specific techniques include the following:

- Each area will be inspected to determine if soil disturbance has occurred to such a degree that selected leveling may be needed prior to other restoration activities.
- Each area will be inspected for a high abundance of logging debris. If needed, localized fire may be used to remove large piles of debris.
- Nuisance species will be removed either individually or by use of herbicide, as appropriate.

- If species noted as key species in Table 3 are not present and do not recruit into the area within 5 years, selected supplemental planting will be conducted. The areas will also be assessed for small trees, shrubs, and herbaceous species. If the species noted as key species Table 3 are not present, those species will be planted.

3.4.7 U3 - Enhancing existing coastal mesic hammocks

Generally, the coastal hammocks on the TMS have not been cleared, but selected logging (high grading) has been conducted in some areas. In addition, other activities (e.g. road construction, disturbance, exotic species introduction, etc.) have altered both overstory and understory in other areas. The primary restoration goals are to encourage re-growth of a characteristic plant community and to enhance hydrological conditions in the hammocks such that they provide appropriate hydrological, water quality, and buffer support for adjacent wetlands. Support of wildlife that utilizes both uplands and wetlands is an additional goal. Existing areas will be examined to determine if the existing mix of species has been greatly altered from that presented in Table 3.

- Each enhancement area will be inspected for alterations that have shifted the existing plant community from that of characteristic coastal mesic hammocks.
- If necessary, supplemental plantings of these species will take place with the goal that both overstory and understory approach a species composition similar to that in Table 3.
- No prescribed burns will be administered in this natural plant community. If wildfire occurs, existing conditions (rainfall, hydration of soil and vegetation) will be assessed to determine if suppression is necessary.
- Nuisance species will be removed by either mechanical or chemical methods.
- Natural disturbance events such as hurricanes and death of individual trees is anticipated and considered normal and important to the community. Snags will be allowed to remain to provide habitat for cavity nesting species.

SECTION 4

Archaeological Preservation

In June 2008, Florida History, LLC completed the *Cultural Resource Management Plan for the Tarmac Mine Mitigation Area.* It states that there are three known archeological sites within the boundaries of the mitigation area. It proposes management measures to insure these sites are not disturbed. The Florida State Historic Preservation Officer issued a letter approving the plan on 20 August 2008.

SECTION 5

Proposed Mitigation Credits

Mitigation credits are produced through seven different mitigation categories on the Mitigation Parcel (Table 2 and Figure 6) and preservation of 642.1 acres of "No Mine" area on the Mine Parcel. The Uniform Mitigation Assessment Method (UMAM) was used to calculate the Relative Functional Gain (RFG) and number of credits for each mitigation type. Based on the work proposed herein, it is anticipated that the TMS will yield 1319.25 credits and the "No Mine" preservation will yield 44.91 credits to be released according to the following schedule:

	Credits
Year 1 - Achieve Success on No Mine Preservation, W3, U1, U2 & U3	839.47
Year 20 - Achieve Success on Area W1	121.77
Year 24 - Achieve Success on 244.85 acres of W2 (with 11 years of time lag applied)	61.09
Year 25 - Achieve Success on 284.95 acres of W2 (with 10 years of time lag applied)	83.24
Year 27 - Achieve Success on 116.65 of W2 (with 8 years of time lag applied)	33.96
Year 28 - Achieve Success on 101.60 of W2 (with 7 years of time lag applied)	29.47
Year 30 - Success on 244.73 of W2 (with 5 years of time lag applied)	70.17
Year 30 - Success on 244.73 of W2 (with 5 years of time lag applied)	70.17
Year 31 - Success on 92.40of W2 (with 4 years of time lag applied)	30.60
Year 33 - Success on 18.01 of W2 (with 2 years of time lag applied)	6.26
Year 34 - Success on 211.43 of W2 (with 1 year of time lag applied)	73.74
Year 35 - Achieve Success on W4	14.39

Figure 7 depicts the release schedule by year.

SECTION 6

Ecological Benefits

The current ecological value of the proposed TMS to the regional watershed is moderate, but can be significantly improved (Figures 8 and 9). The TMS is part of the Gulf Hammock Wildlife Management Area and directly adjacent to the Waccasassa Bay State Preserve. It is hydrologically connected to Waccasassa Bay, the Gulf of Mexico, Spring Run, Demory Creek, Turtle Creek, Smith Creek, and BeeTree Slough. While the landscape setting and connectivity to other large tracts of undeveloped forested wetlands benefit the ecological value of the current TMS, these benefits are partially negated by the intensive silvicultural disturbances that have occurred for nearly 50 years.

Size and relative isolation from human development also make the TMS an important area for wildlife habitats in Levy County. However, its importance is believed to be greatly reduced relative to historic conditions due to the habitat alterations that have occurred. Historically, the hydric hammocks are believed to have supported a greater diversity of wildlife species than most adjacent habitat (Vince et al. 1989) for a variety of reasons including production of nuts, berries, and dry fruits; presence of large numbers of live cavity trees; proximity to water; and remoteness. Habitat alteration, especially the conversion of natural, species-diverse stands to pine monocultures and the elimination of live cavity trees, are believed to have substantially reduced both species diversity and abundance of wildlife populations (Vince et al. 1989). Hence, preservation, restoration, and enhancement have high potential to improve habitat quality.

The staff of the FFWCC has identified the TMS area as a proposed Strategic Habitat Conservation Area for the Gulf salt marsh mink (*Mustela vison lutensis*), bald eagle, little blue heron, one-toed amphiuma (*Amphiuma pholeter*), limpkin, Florida pine snake (*Pituophis melanoleucus mugitus*), swallow-tailed kite, and eastern indigo snake (*Drymarcon corais couperi*). In addition, the TMS has the potential to provide a protected area for rookeries of the snowy egret, great egret, as well as the little blue heron. With enhancement and time, the number of live cavity trees and the variety of food-bearing trees will increase. Further, the TMS will expand the existing habitat preserved in or adjacent to the Waccasassa Bay Preserve State Park and GHWMA. There is at least the potential that the combined area of natural and restored habitat could support species, such as the Florida black bear that were once present (Vince et al. 1989) but which have been locally eliminated or greatly reduced in abundance. At the TMS, emphasis will be placed upon maximizing species diversity and increasing carrying capacity by improving the habitat quality. The combination of habitat quality improvement and protection will increase the effective width and diversity within the existing wildlife corridor through the Waccasassa Bay Preserve State park and GHWMA. By doing so, it also increases the number of species for which the combined area can serve as a corridor and the number of individuals that use the area for shelter during movement or refugia.

In addition to the benefits to wildlife, protection and enhancement of the TMS are expected to preserve populations of plants that are listed as Threatened or Endangered by the State of Florida. One of these (pinkroot) is endemic to hydric hammocks, and two others (pinewoods dainties and corkwood) are endemic to the Big Bend region.

Finally, by establishing the TMS, further loss of hydric hammock and degradation of remaining hammocks will be avoided. Placing this land under a conservation easement will ensure that this ecologically valuable corridor, unique to this region of Florida, is restored and preserved in perpetuity as an addition to the conservation land in Levy County.

SECTION 7

Monitoring

7.1 SHORT-TERM MONITORING

This section relates to monitoring activities during the first five years after the establishment of the TMS. Baseline data will be recorded before the commencement of any management activities. Beginning at the time of initial implementation, an annual report will be prepared. Reports will address the baseline and current condition of the TMS, and will list specific management activities that have been implemented during the monitoring period. Annual reports will be submitted in December of each year. Specific activities, techniques and objectives will be discussed as well as achievements of prior activities.

7.1.1 Selection of Monitoring Locations

Monitoring locations will be selected within the major areas of restoration and enhancement. At least one location will occur in each defined management area. The locations will be chosen to be representative. Conditions will be documented through photographs taken at fixed photopoints and a narrative description of each location.

7.1.2 Photopoints

Vegetative conditions will be documented with photographs. Photopoints will be established at predetermined strategic positions. The locations will be marked in the field with metal stakes and coordinates will be recorded with a submeter GPS unit. Photos will be taken once a year at each point, after completion of any major management activity such as thinning, planting, nuisance species removal, or hydrologic restoration; or after natural disturbances such as wildfire, severe windstorms, or saltwater inundation due to storm surges. At each location, a camera will be set up on a tripod and a 360 ° panoramic picture will be taken. The locations of the photopoints will be indicated on an aerial photograph and included in the annual report. Panoramas will be included in the annual report.

7.1.3 Vegetation

Meandering transects will be used to permanently document changes in vegetation composition. At least one transect will be established in each defined management area and will intersect at the established photopoint. Data gathered along the transect will consist of a qualitative description of the vegetation, a list of nuisance species (if any) and their abundance, suggested management needs, as well as a list of species characteristic of the target plant community, their general abundance, and size, and canopy closure. Monitoring will be conducted in September or October, annually. Target plant community composition will be that described in Tables 4 and 5.

7.2 LONG-TERM MONITORING

After the initial five-year monitoring period, a monitoring report will be prepared and submitted every five years in December. This report will include photographs and a general narrative discussion. The emphasis will be on describing whether or not the TMS continues to meet the success criteria. Monitoring will include photopoints, meandering transects and a qualitative description of each area. Photographs will continue to be taken at established photopoints once every five years or after management activities have been conducted. Vegetation and wildlife data will also be collected once every five years and included in the report. Wildlife data will be based on a meandering transect at each site.

A description of management activities completed since the previous reporting period will also be included in the report. If additional credits are scheduled for release, more detailed information will be included to document the progress of the TMS toward the credit release milestone.

SECTION 8

Success Criteria

8.1 VEGETATION

Habitat and vegetation improvements shall be successful when the following criteria are met:

- The density of pine trees in areas being restored or enhanced from wetland pine plantations (W1, W2) is less than 100 trees per acre, species richness (number of species present) of desirable tree species is at least 4 in each enhancement area, and 95% of observed species are appropriate to coastal hardwood hammocks as listed in Table 3.
- Obvious recruitment of wetland vegetation within wetlands (mitigation units W1, W2, W3 and W4).
- Less than 5% non-native nuisance species coverage per acre in any restoration, enhancement, or preservation area.
- Improved function in wetlands (mitigation units W1, W2, W3 and W4) as indicated by a minimum of 50% cover by species classified as FAC, FACW, or OBL.

8.2 PROTECTION

Protective measures will be considered successful when a conservation easement has been recorded and the proposed management actions have been completed.

SECTION 9

Financial Assurance

The TMS will be managed by Tarmac according to the approved Mitigation Plan, developed in conjunction with the Florida Department of Environmental Protection and the U.S. Army Corps of Engineers and included in the state ERP and the federal IP. Tarmac will provide sufficient financial assurance instruments, formatted to follow state and federal guidelines, to manage the TMS in perpetuity.

SECTION 10

Literature Cited

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Table 1 Results of Wildlife Surveys Conducted at Tarmac Mitigation Parcel

Class	Scientific Name	Common Name
AMPHIBIA	*Acris gryllus dorsalis*	Florida cricket frog
AMPHIBIA	*Amphiuma means*	Two-toed amphiuma
AMPHIBIA	*Bufo quercicus*	Oak toad
AMPHIBIA	*Bufo terrestris*	Southern toad
AMPHIBIA	*Hyla cinerea*	Green treefrog
AMPHIBIA	*Hyla squirella*	Squirrel treefrog
AMPHIBIA	*Pseudacris nigrita verrucosa*	Florida chorus frog
AMPHIBIA	*Pseudacris ocularis*	Little grass frog
AMPHIBIA	*Rana catesbeiana*	Bullfrog
AMPHIBIA	*Rana grylio*	Pig frog
AMPHIBIA	*Rana utricularia*	Southern leopard frog
AVES	*Agelaius phoeniceus*	Red-winged blackbird
AVES	*Ajaia ajaja*	Roseate spoonbill
AVES	*Anhinga anhinga*	Anhinga
AVES	*Aramus guarauna*	Limpkin
AVES	*Ardea alba*	Great egret
AVES	*Ardea herodia*	Great blue heron
AVES	*Baeolophus bicolor*	Tufted titmouse
AVES	*Botaurus lentiginosus*	American bittern
AVES	*Buteo lineatus*	Red-shouldered hawk
AVES	*Caprimulgus carolinensis*	Chuck-Will's Widow
AVES	*Cardinalis cardinalis*	Northern cardinal
AVES	*Cathartes aura*	Turkey vulture
AVES	*Catharus guttatus*	Hermit thrush

Class	Scientific Name	Common Name
AVES	*Catharus minimus*	Gray-cheeked thrush
AVES	*Certhia americana*	Brown creeper
AVES	*Ceryle alcyon*	Belted kingfisher
AVES	*Chaetura pelagica*	Chimney swift
AVES	*Cistothorus palustris*	Marsh wren
AVES	*Columbia passerina*	Common ground dove
AVES	*Contopus virens*	Eastern wood-pewee
AVES	*Coragyps atratus*	Black vulture
AVES	*Corvus brachyrhynchos*	American crow
AVES	*Corvus ossifragus*	Fish crow
AVES	*Cyanocitta cristata*	Blue jay
AVES	*Dendroica coronata*	Yellow-rumped warbler
AVES	*Dendroica discolor*	Prairie warbler
AVES	*Dendroica palmarum*	Palm warbler
AVES	*Dendroica pinus*	Pine warbler
AVES	*Dryocopus pileatus*	Pileated woodpecker
AVES	*Dumetella carolinensis*	Gray catbird
AVES	*Egretta caerulea*	Little blue heron
AVES	*Egretta rufescens*	Reddish egret
AVES	*Egretta thula*	Snowy egret
AVES	*Egretta tricolor*	Tricolored heron
AVES	*Elanoides forficatus*	Swallow-tailed kite
AVES	*Eudocimus albus*	White ibis
AVES	*Gallinula chloropus*	Common moorhen
AVES	*Geothlypis trichas*	Common yellowthroat

Class	Scientific Name	Common Name
AVES	*Haliaeetus leucocephalus*	Bald eagle
AVES	*Hirundo rustica*	Barn swallow
AVES	*Ictinia mississippiensis*	Mississippi kite
AVES	*Lanius ludovicianus*	Loggerhead shrike
AVES	*Lophodytes cucullatus*	Hooded merganser
AVES	*Melanerpes carolinus*	Red-bellied woodpecker
AVES	*Meleagris gallopavo*	Wild turkey
AVES	*Mimus polyglottos*	Northern mockingbird
AVES	*Mniotilta varia*	Black-and-white warbler
AVES	*Mycteria americana*	Wood stork
AVES	*Myiarchus crinitus*	Great crested flycatcher
AVES	*Nyctanassa violacea*	Yellow-crowned night-heron
AVES	*Nycticorax nycticorax*	Black-crowned night-heron
AVES	*Pandion haliaetus*	Osprey
AVES	*Parula americana*	Northern parula
AVES	*Pelecanus erythrorhynchos*	American white pelican
AVES	*Picoides pubescens*	Downy woodpecker
AVES	*Picoides villosus*	Hairy woodpecker
AVES	*Pipilo erythrophthalmus*	Eastern towhee
AVES	*Plegadis falcinellus*	Glossy ibis
AVES	*Poecile carolinensis*	Carolina chickadee
AVES	*Polioptila caerulea*	Blue-gray gnatcatcher
AVES	*Progne subis*	Purple martin
AVES	*Quiscalus quiscula*	Common grackle
AVES	*Rallus longirostris*	Clapper rail

Class	Scientific Name	Common Name
AVES	*Seiurus aurocapillus*	Ovenbird
AVES	*Setophaga ruticella*	American redstart
AVES	*Sitta pusilla*	Brown-headed nuthatch
AVES	*Sphyrapicus varius*	Yellow-bellied sapsucker
AVES	*Strix varia*	Barred owl
AVES	*Tachycineta bicolor*	Tree swallow
AVES	*Thryothorus ludovicianus*	Carolina wren
AVES	*Toxostoma rufum*	Brown thrasher
AVES	*Troglodytes aedon*	House wren
AVES	*Turdus migratorius*	American robin
AVES	*Tyrannus dominicensis*	Gray Kingbird
AVES	*Vireo griseus*	White-eyed vireo
AVES	*Vireo olivaceus*	Red-eyed vireo
AVES	*Vireo solitarius*	Blue-headed vireo
AVES	*Wilsonia citrina*	Hooded warbler
AVES	*Zenaida macroura*	Mourning dove
MAMMALIA	*Canis latrans*	Coyote
MAMMALIA	*Dasypus novemcinctus*	Nine-banded armadillo
MAMMALIA	*Didelphis virginiana*	Opossum
MAMMALIA	*Lutra canadensis*	River otter
MAMMALIA	*Lynx rufus*	Bobcat
MAMMALIA	*Neotoma floridana*	Eastern woodrat
MAMMALIA	*Odocoileus virginianus*	White-tailed deer
MAMMALIA	*oryzomys palustris*	Rice rat
MAMMALIA	*Peromyscus gossypinus*	Cotton mouse

Class	Scientific Name	Common Name
MAMMALIA	*Procyon lotor*	Raccoon
MAMMALIA	*Sciurus carolinensis*	Gray squirrel
MAMMALIA	*Sigmodon hispidus*	Hispid cotton rat
MAMMALIA	*Sus scrofa*	Feral hog
MAMMALIA	*Sylvilagus palustris*	Marsh rabbit
MAMMALIA	*Vulpes fulva*	Red fox (New World)
OSTEICHTHYES	*Aphredoderus sayanus*	Pirate perch
OSTEICHTHYES	*Cyprinodon variegatus*	Sheepshead
OSTEICHTHYES	*Fundulus chrysotus*	Golden topminnow
OSTEICHTHYES	*Fundulus confluentus*	Marsh killifish
OSTEICHTHYES	*Fundulus seminolis*	Seminole killifish
OSTEICHTHYES	*Gambusia holbrooki*	Eastern mosquitofish
OSTEICHTHYES	*Heterandria formosa*	Least killifish
OSTEICHTHYES	*Jordanella floridae*	Flagfish
OSTEICHTHYES	*Lepisosteus osseus*	Longnose gar
OSTEICHTHYES	*Lepomis gulosus*	Warmouth
OSTEICHTHYES	*Lepomis macrochirus*	Bluegill
OSTEICHTHYES	*Lepomis marginatus*	Dollar sunfish
OSTEICHTHYES	*Lepomis microlophus*	Red-ear sunfish
OSTEICHTHYES	*Lepomis punctatus*	Spotted sunfish
OSTEICHTHYES	*Lucania goodei*	Blue killifish
OSTEICHTHYES	*Mugil curema*	White mullet (Silver mullet)
OSTEICHTHYES	*Notemigonus crysoleucas*	Golden shiner
OSTEICHTHYES	*Poecilia latipinna*	Sailfin molly
OSTEICHTHYES	*Sciaenops ocellatus*	Redfish

Class	Scientific Name	Common Name
OSTEICHTHYES	*Strongylura marina*	Atlantic needlefish
REPTILIA	*Agkistrodon piscivorus conanti*	Florida cottonmouth
REPTILIA	*Alligator mississippiensis*	American alligator
REPTILIA	*Anolis carolinensis*	Green anole
REPTILIA	*Anolis sagrei*	Brown anole
REPTILIA	*Coluber constrictor priapus*	Southern black racer
REPTILIA	*Deirochelys reticularia*	Chicken turtle
REPTILIA	*Diadophis punctatus punctatus*	Southern ringneck snake
REPTILIA	*Kinosternon subrubrum steindachneri*	Florida mud turtle
REPTILIA	*Lampropeltis triangulum elapsoides*	Scarlet kingsnake
REPTILIA	*Nerodia clarkii*	Gulf salt marsh snake
REPTILIA	*Plestiodon fasciatus*	Five-lined skink
REPTILIA	*Pseudemys concinna*	River cooter
REPTILIA	*Scincella lateralis*	Ground skink
REPTILIA	*Sistrurus miliarius barbouri*	Dusky pigmy rattlesnake
REPTILIA	*Sternotherus odoratus*	Common musk turtle
REPTILIA	*Terrapene carolina bauri*	Florida box turtle
REPTILIA	*Thamnophis sauritus nitae*	Blue stripe ribbon snake
REPTILIA	*Thamnophis sirtalis similis*	Bluestripe garter snake
REPTILIA	*Trachemys scripta scripta*	Yellow-bellied slider

Table 2 Mitigation Categories, Acres and Credits

Mitigation Category	Acres	Credits
U-1	171.5	73.71
U-2	33.2	12.45
U-3	126.4	52.57
W-1	345.0	121.77
W-2	1314.6	388.54
W-3	2405.9	655.82
W-4	43.1	14.39
No Mine Uplands	122.5	20.21
No Mine Wetlands	519.6	24.70
TOTAL	5,081.8	1364.16

Table 3 Key Species in Reference Communities

Species – Hydric Hammocks & Coastal Hydric Hammocks	Species – Coastal Mesic Hammocks
Acer negundo	*Acer saccharum* subsp. *Floridanum*
Acer rubrum	*Carpinus caroliniana*
Carpinus caroliniana	*Carya glabra*
Carya aquatica	*Celtis laevigata*
Carya glabra	*Juniperus virginiana*
Cornus foemina	*Liquidambar styraciflua*
Fraxinus caroliniana	*Pinus elliottii*
Gleditsia aquatica	*Quercus laurifolia*
Juniperus virginiana	*Quercus nigra*
Liquidambar styraciflua	*Quercus virginiana*
Persea borbonia	*Sabal palmetto*
Pinus taeda	*Tilia americana* var. *caroliniana*
Quercus laurifolia	*Ulmus alata*
Quercus nigra	
Quercus shumardii	
Quercus virginiana	
Sabal palmetto	
Tilia Americana	
Ulmus alata	
Ulmus americana	

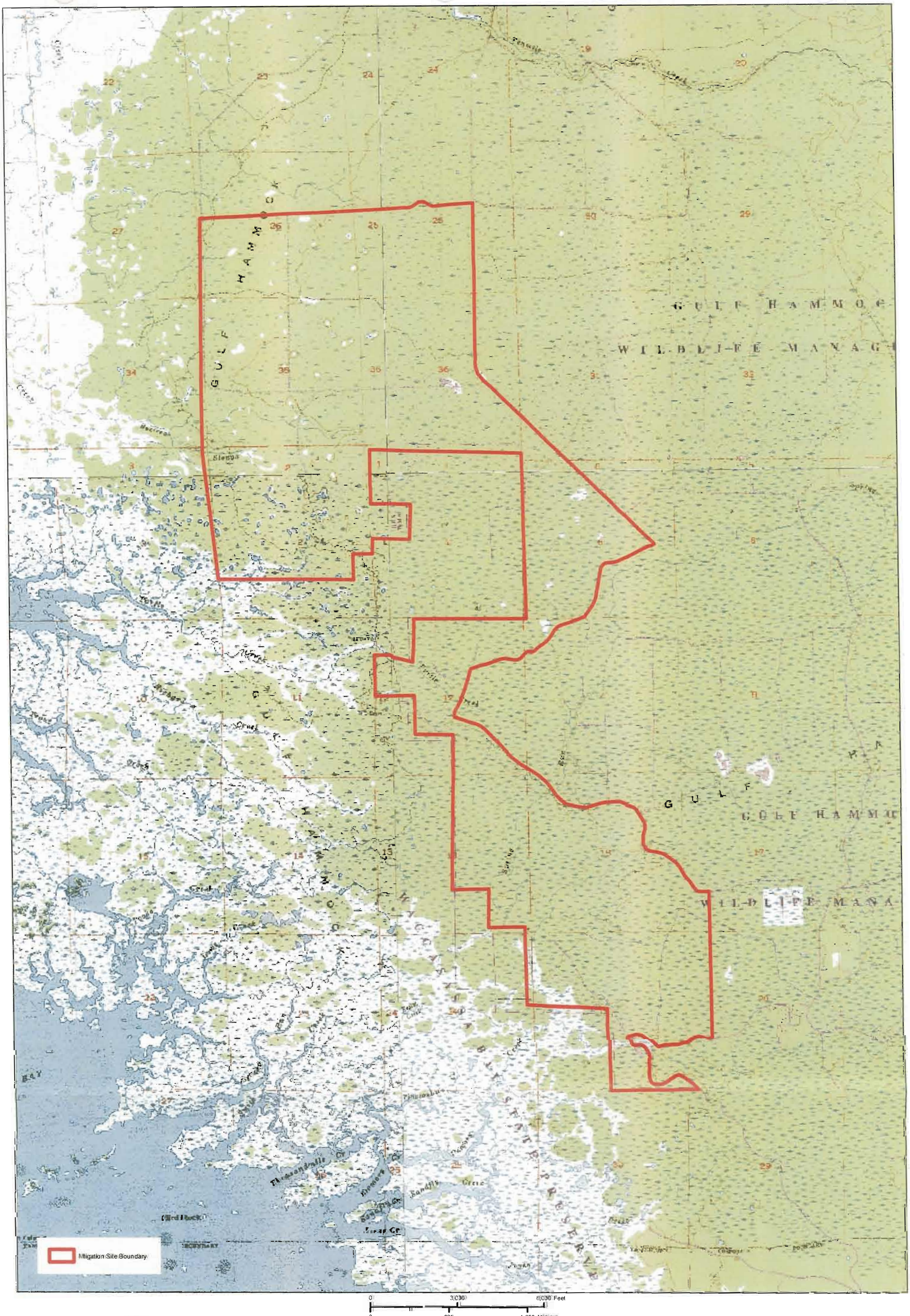

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Figure 1 - USGS Quadrangle Map

Tarmac King Road Limestone Mine
Mitigation Site
Levy County, Florida

Image: USGS

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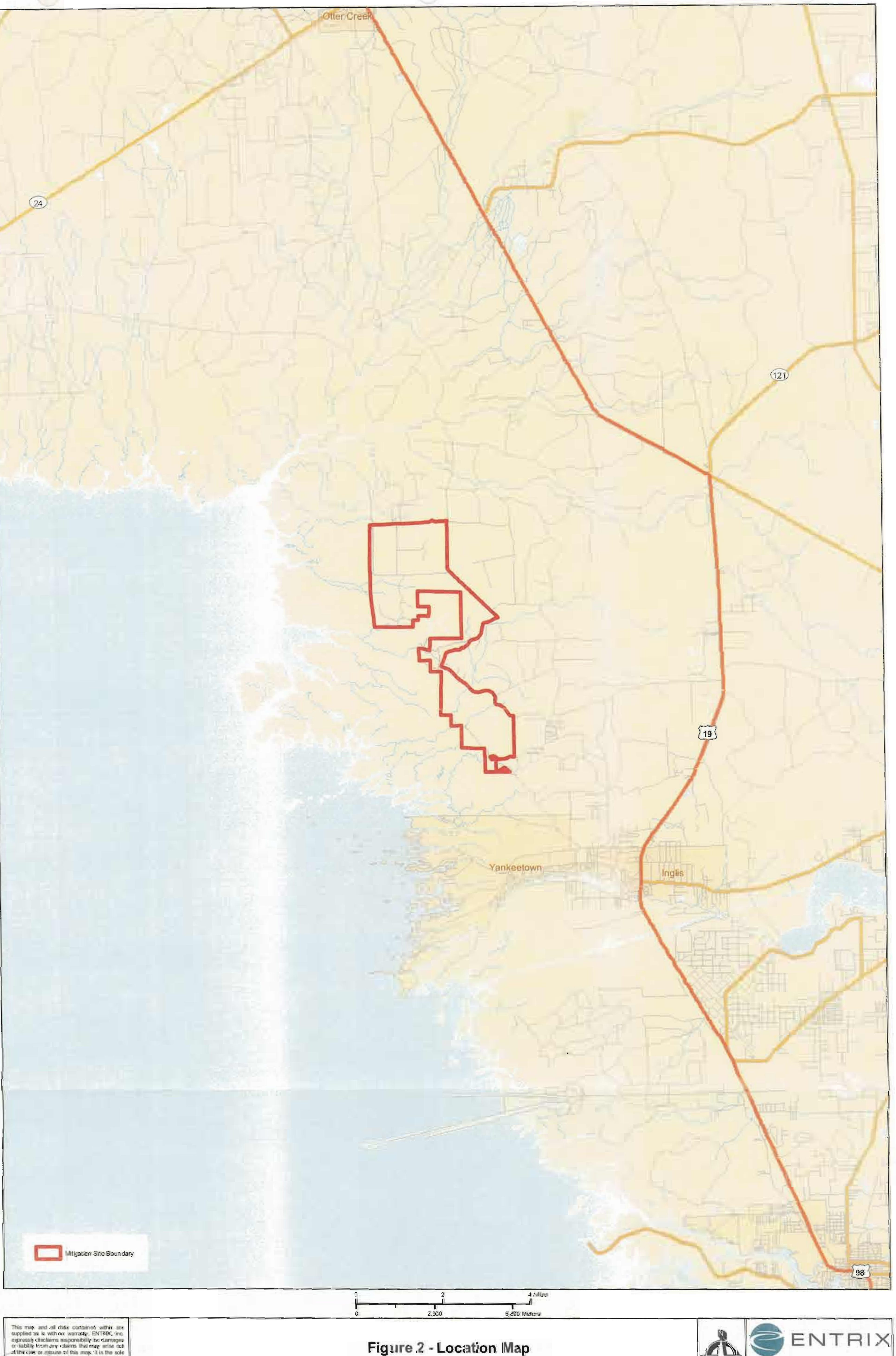

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Figure 2 - Location Map

Tarmac King Road Limestone Mine
Mitigation Site
Levy County, Florida

Image: ESRI

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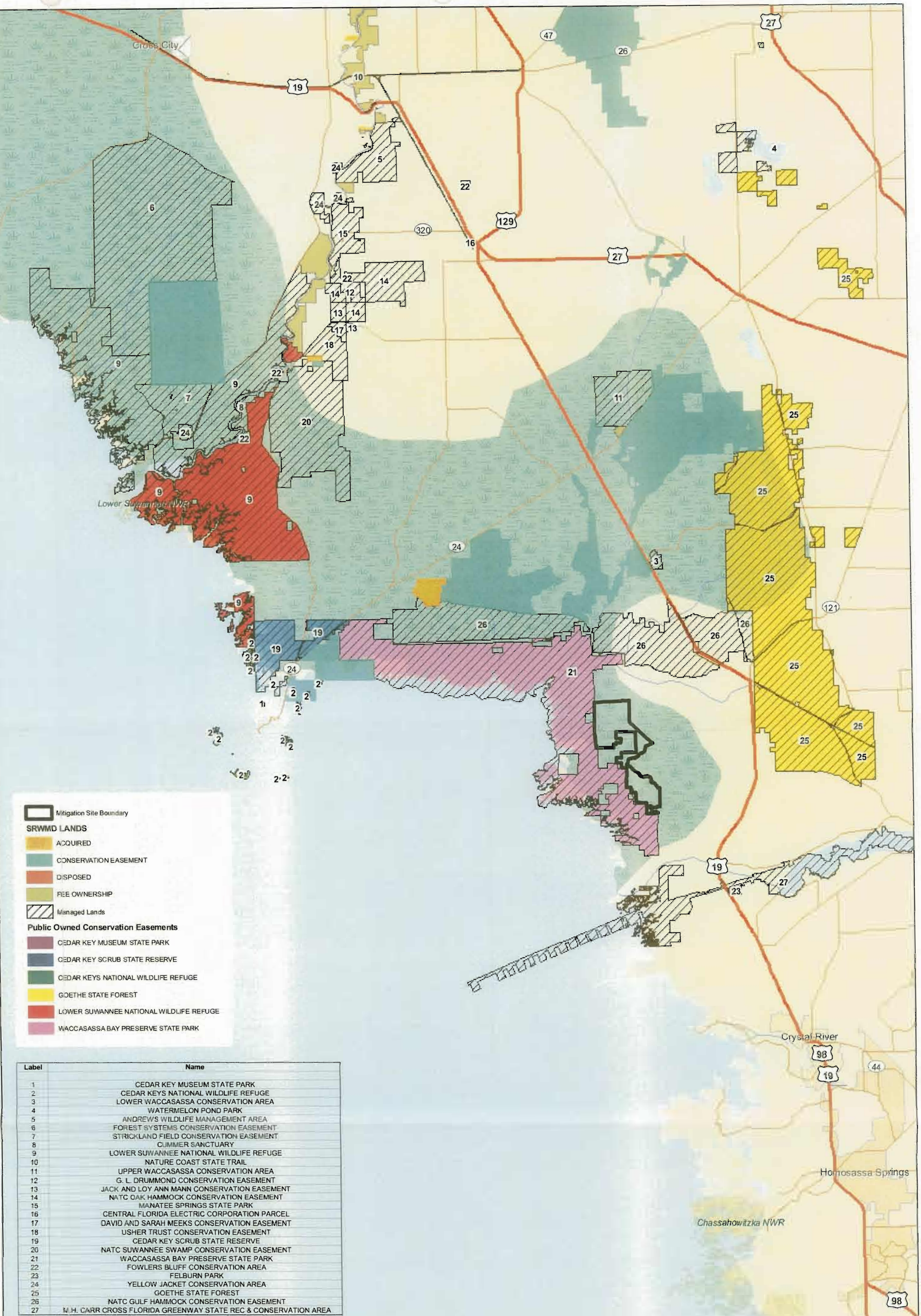

Label	Name
1	CEDAR KEY MUSEUM STATE PARK
2	CEDAR KEYS NATIONAL WILDLIFE REFUGE
3	LOWER WACCASASSA CONSERVATION AREA
4	WATERMELON POND PARK
5	ANDREWS WILDLIFE MANAGEMENT AREA
6	FOREST SYSTEMS CONSERVATION EASEMENT
7	STRICKLAND FIELD CONSERVATION EASEMENT
8	CUMMER SANCTUARY
9	LOWER SUWANNEE NATIONAL WILDLIFE REFUGE
10	NATURE COAST STATE TRAIL
11	UPPER WACCASASSA CONSERVATION AREA
12	G. L. DRUMMOND CONSERVATION EASEMENT
13	JACK AND LOY ANN MANN CONSERVATION EASEMENT
14	NATC OAK HAMMOCK CONSERVATION EASEMENT
15	MANATEE SPRINGS STATE PARK
16	CENTRAL FLORIDA ELECTRIC CORPORATION PARCEL
17	DAVID AND SARAH MEEKS CONSERVATION EASEMENT
18	USHER TRUST CONSERVATION EASEMENT
19	CEDAR KEY SCRUB STATE RESERVE
20	NATC SUWANNEE SWAMP CONSERVATION EASEMENT
21	WACCASASSA BAY PRESERVE STATE PARK
22	FOWLERS BLUFF CONSERVATION AREA
23	FELBURN PARK
24	YELLOW JACKET CONSERVATION AREA
25	GOETHE STATE FOREST
26	NATC GULF HAMMOCK CONSERVATION EASEMENT
27	M.H. CARR CROSS FLORIDA GREENWAY STATE REC & CONSERVATION AREA

Figure 3 - Conservation Lands Map

Tarmac King Road Limestone Mine
Mitigation Site
Levy County, Florida

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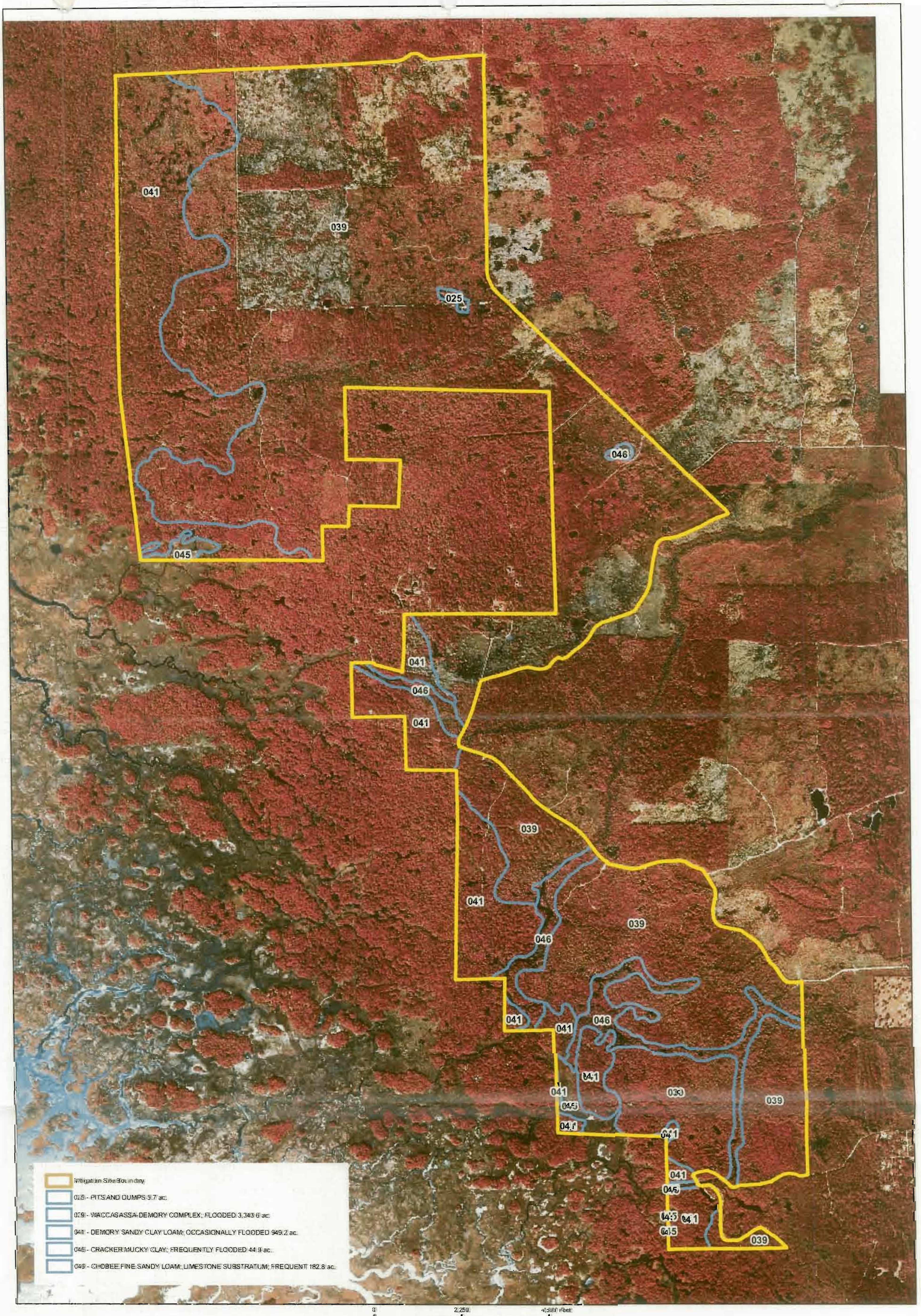

Figure 4 - NRCS Soils Map

Tarmac King Road Limestone Mine
Mitigation Site
Levy County, Florida

Image: 2007

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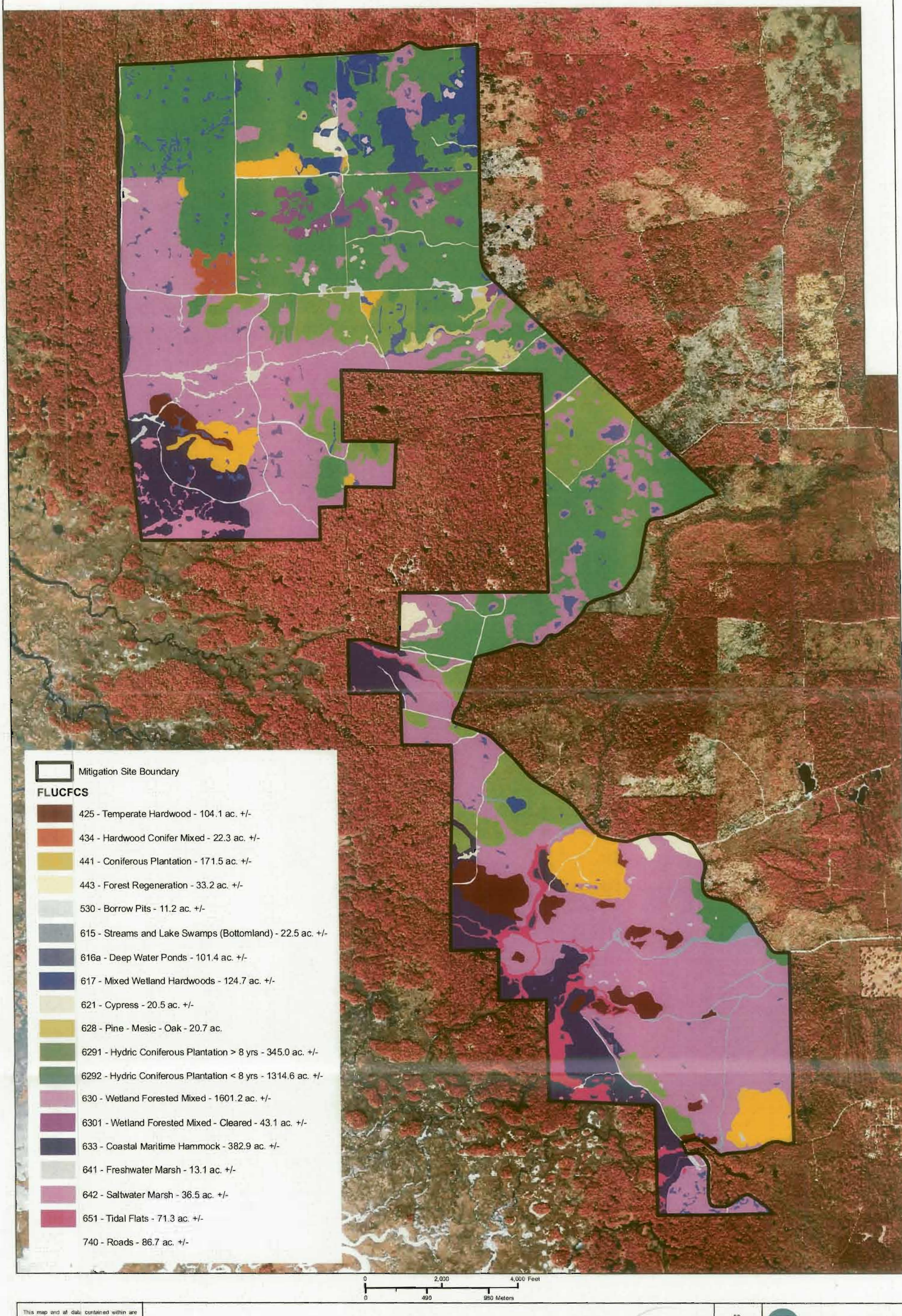

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Figure 5 - FLUCFCS Map

Tarmac King Road Limestone Mine
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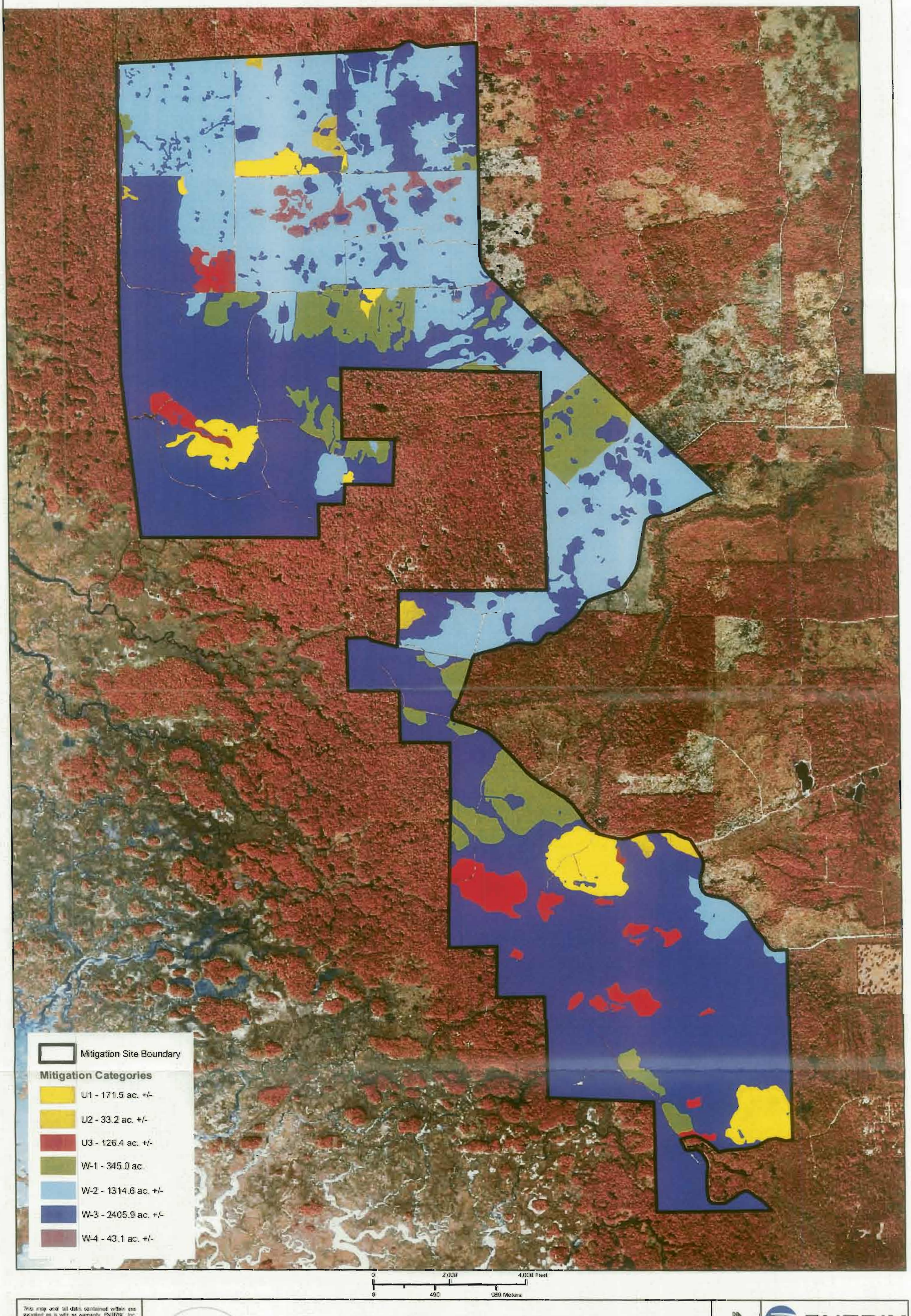

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Figure 6 - Mitigation Categories

Tarmac King Road Limestone Mine
Mitigation Site
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Image 2007 IR

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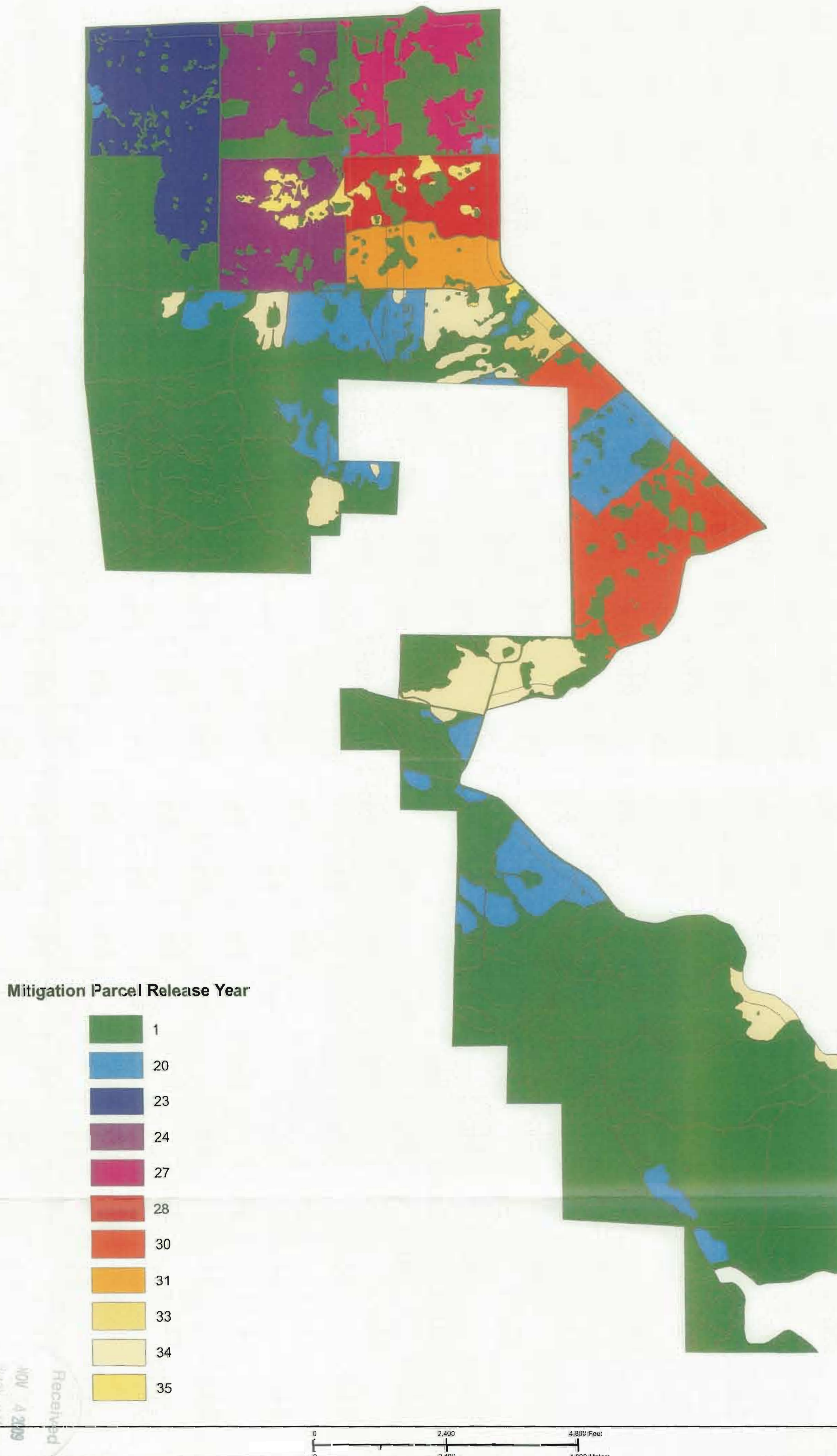

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Figure 7 - Mitigation Parcel Release Year Map

Tarmac King Road Limestone Mine
Levy County, Florida

Image: N/A

ENTRIX
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Riverview, FL 33578-3625
ph. (813) 664-4500
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Coordinate System:
NAD 1983 UTM Zone 10N feet

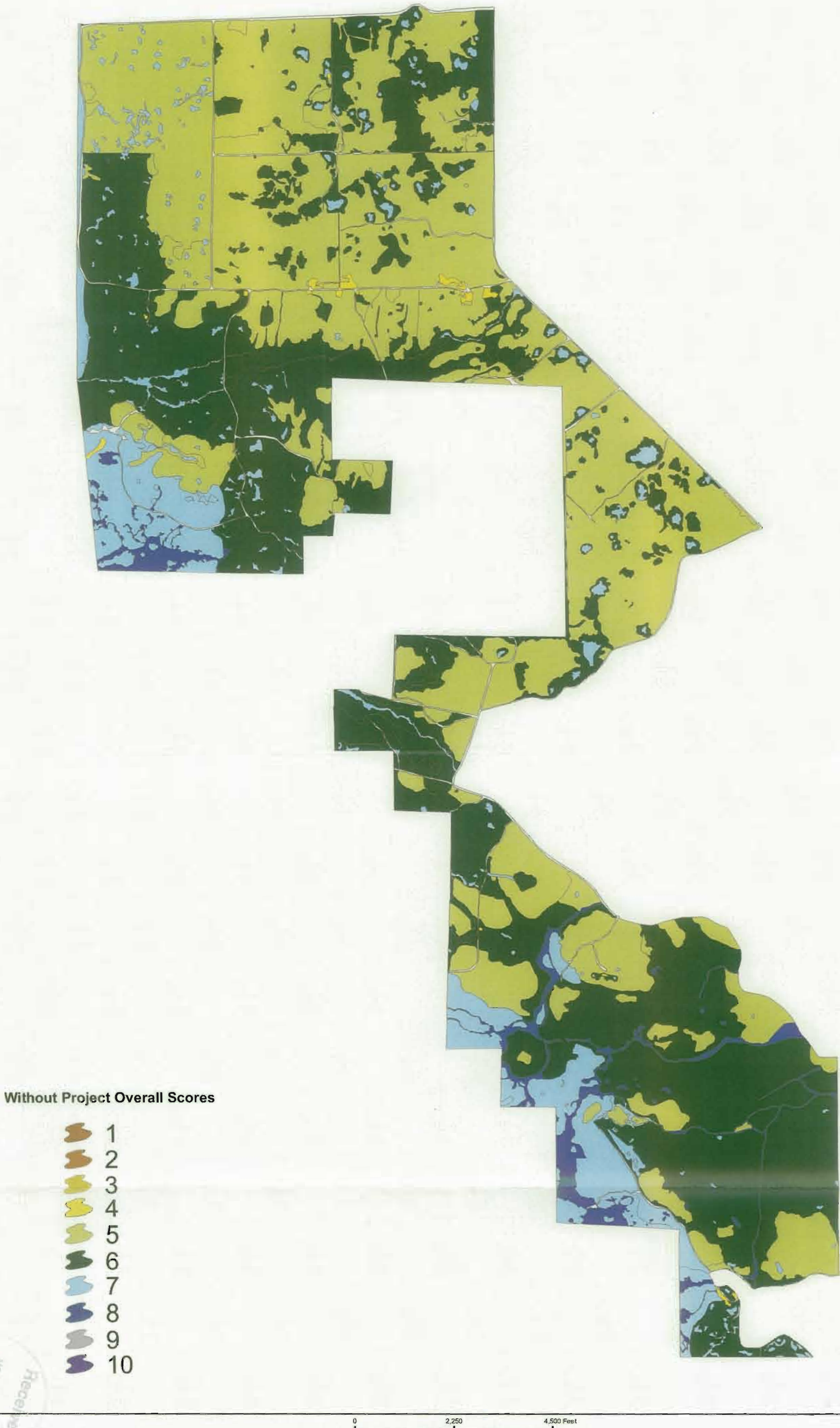

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Figure 8 - Without Project Overall Score

Tarmac King Road Mine
Mitigation Parcel
Levy County, Florida

ENTRIX

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Riverview, FL 33578-3625

ph. (813) 664-4500
fx (813) 664-0440

www.entrix.com

Coordinate System:
NAD 1983 Florida State Plane West Feet

Date: 07/31/2009 Rev. Date: 11/04/09 PM MEF GIS Analyst: GDA Map Document: mitigation_without_proj_scores_B_20091104.mxd Project Number: 7856-001 PDF Document: mitigation_without_proj_scores_B_20091104.pdf Plot Size: 11 x 17

Figure 9 - With Project Overall Score

Tarmac King Road Mine
Mitigation Parcel
Levy County, Florida

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fx (813) 664-0440
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Coordinate System:
NAD 1983 Florida State Plane West Feet

Date: 07/31/2009 Rev. Date: 11/04/09 PM: MEF GIS Analyst: GDA Map Document: mitigation_with_proj_scores_B_20091104.mxd Project Number: 7856-001 PDF Document: mitigation_with_proj_scores_B_20091104.pdf Plot Size: 11 x 17

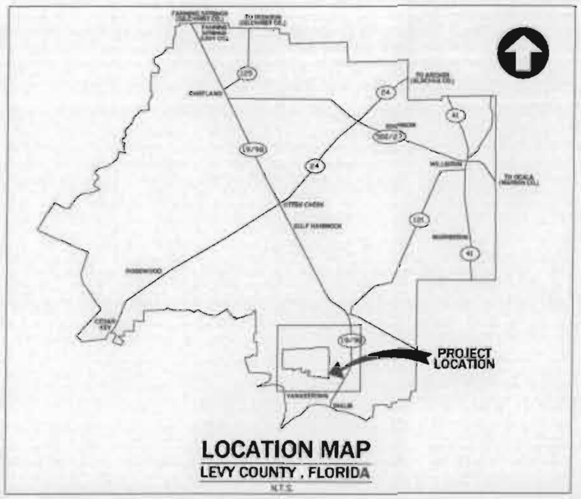
ENGINEERING DRAWINGS OF MINE P

TARMAC AMERICA LLC
6501 KING ROAD
LEVY COUNTY , FLORIDA

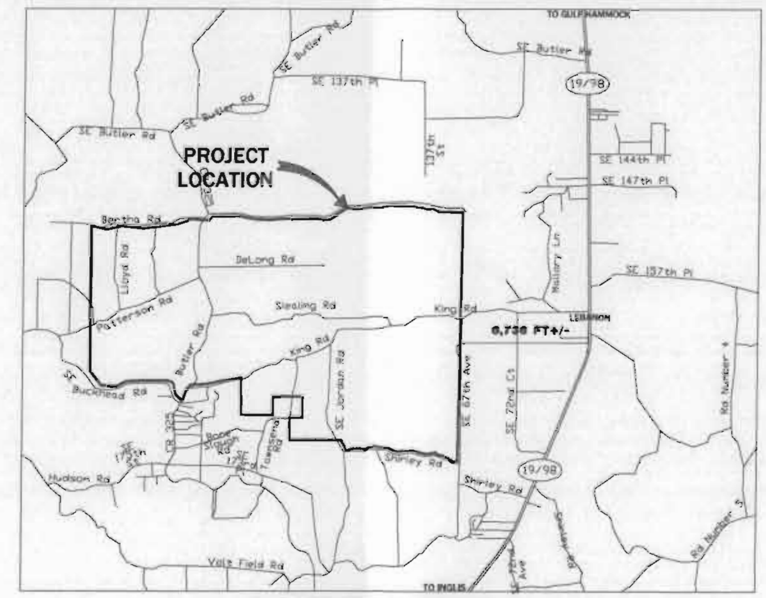
08112001.001

SECTION 8, 9, 10, 11, 14, 15,16, 17, 22 & 23 TOWNSHIP 16 SOUTH, RANGE 16 EAST

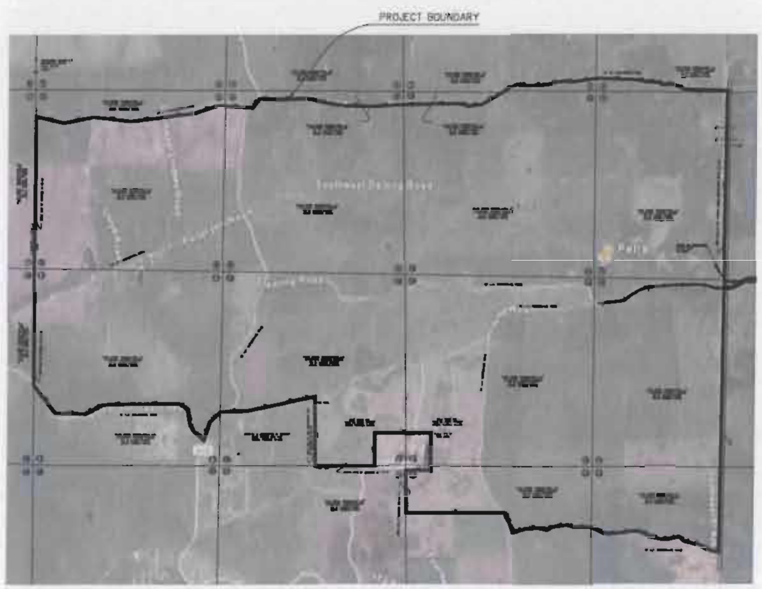
LEVY COUNTY



LOCATION MAP
LEVY COUNTY , FLORIDA
N.T.S.



VICINITY MAP
N.T.S.



PROJECT AERIAL MAP N.T.S.

LAST REVISION: 08/28/09
LAST PLOTTED: 10/31/09
DRAWING SCALE: 1=1
PLOT SCALE: 1=1

ENGINEER:

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TELEPHONE [727] 441-4149
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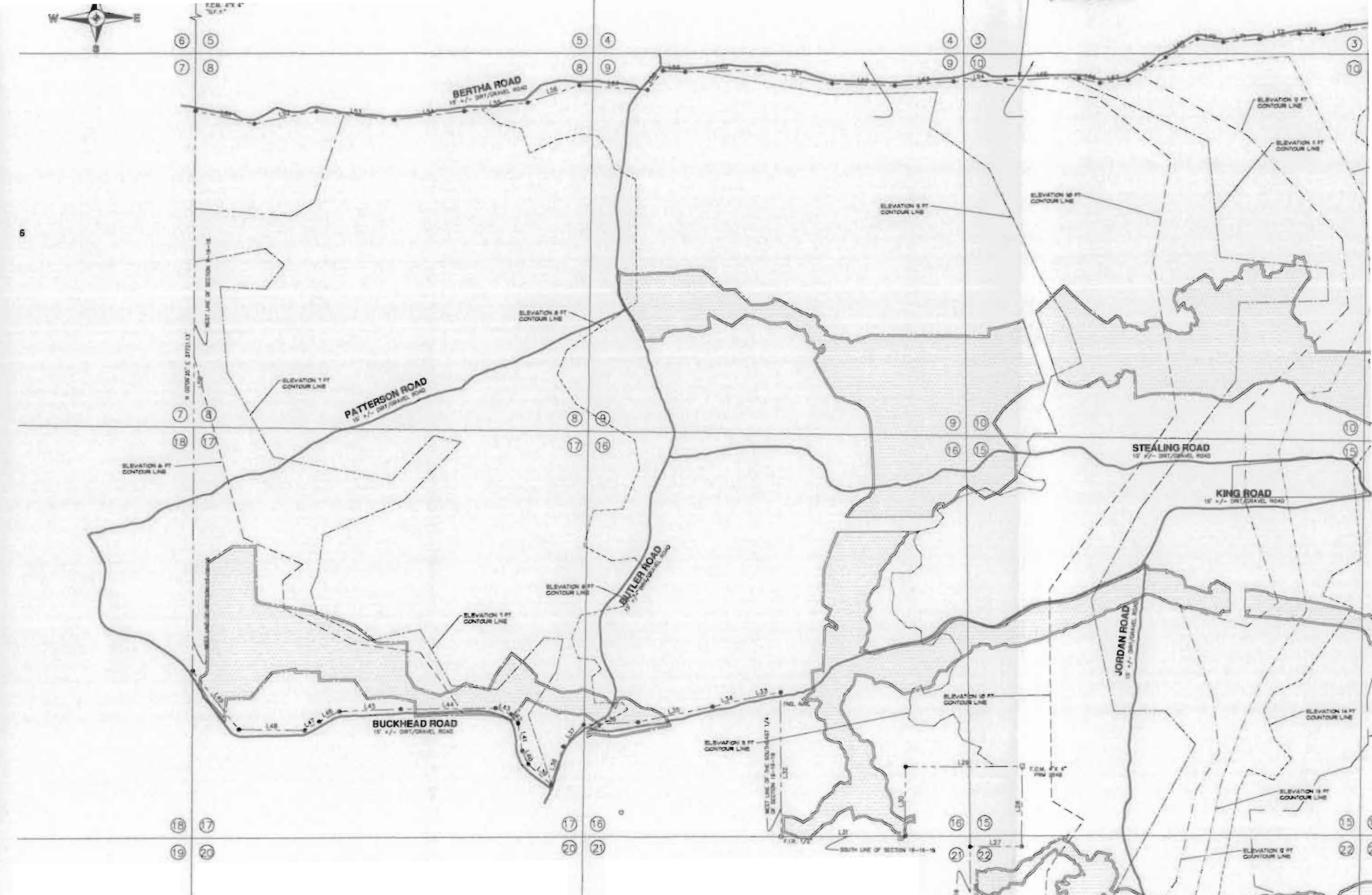
email: envirosy@gate.net



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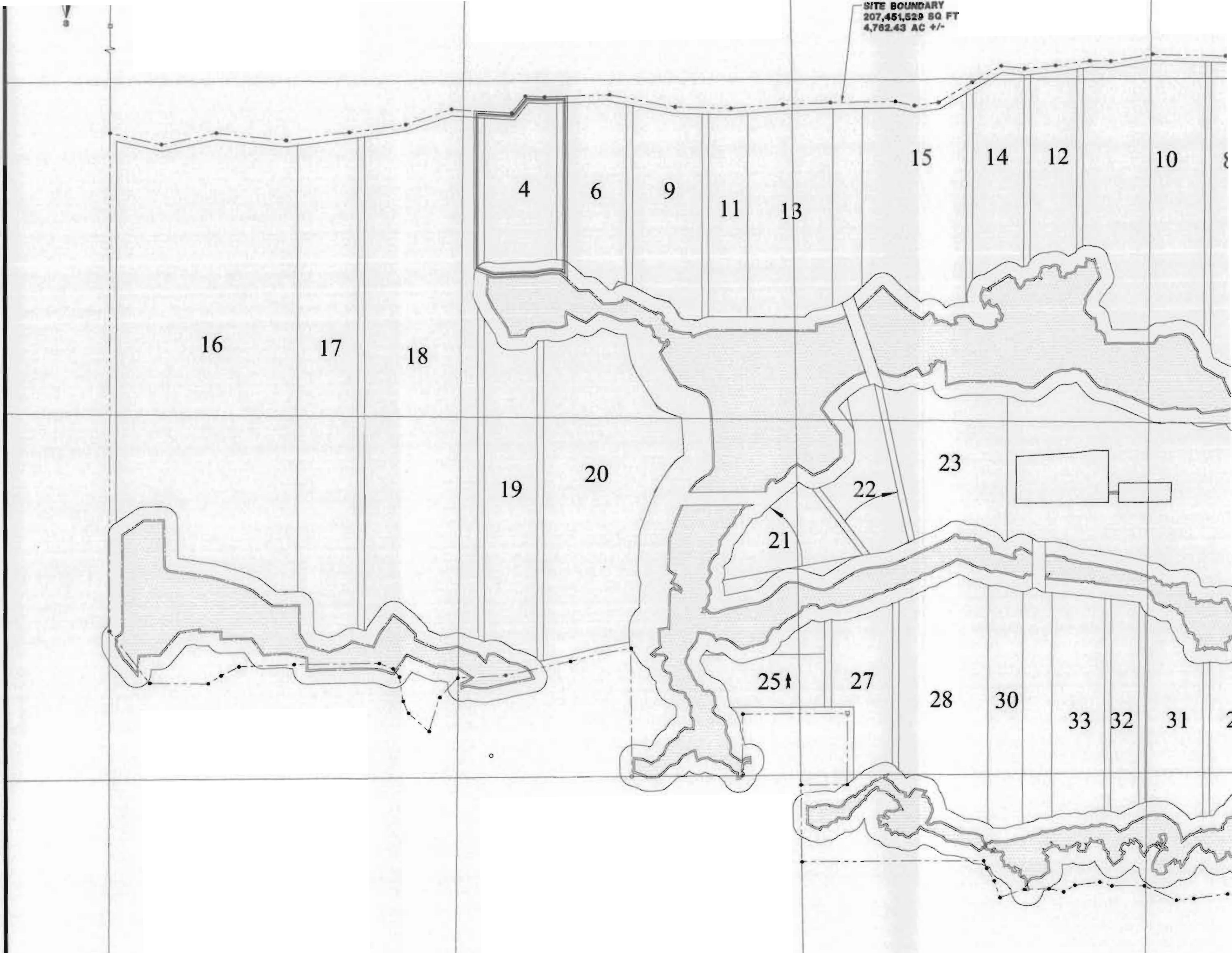

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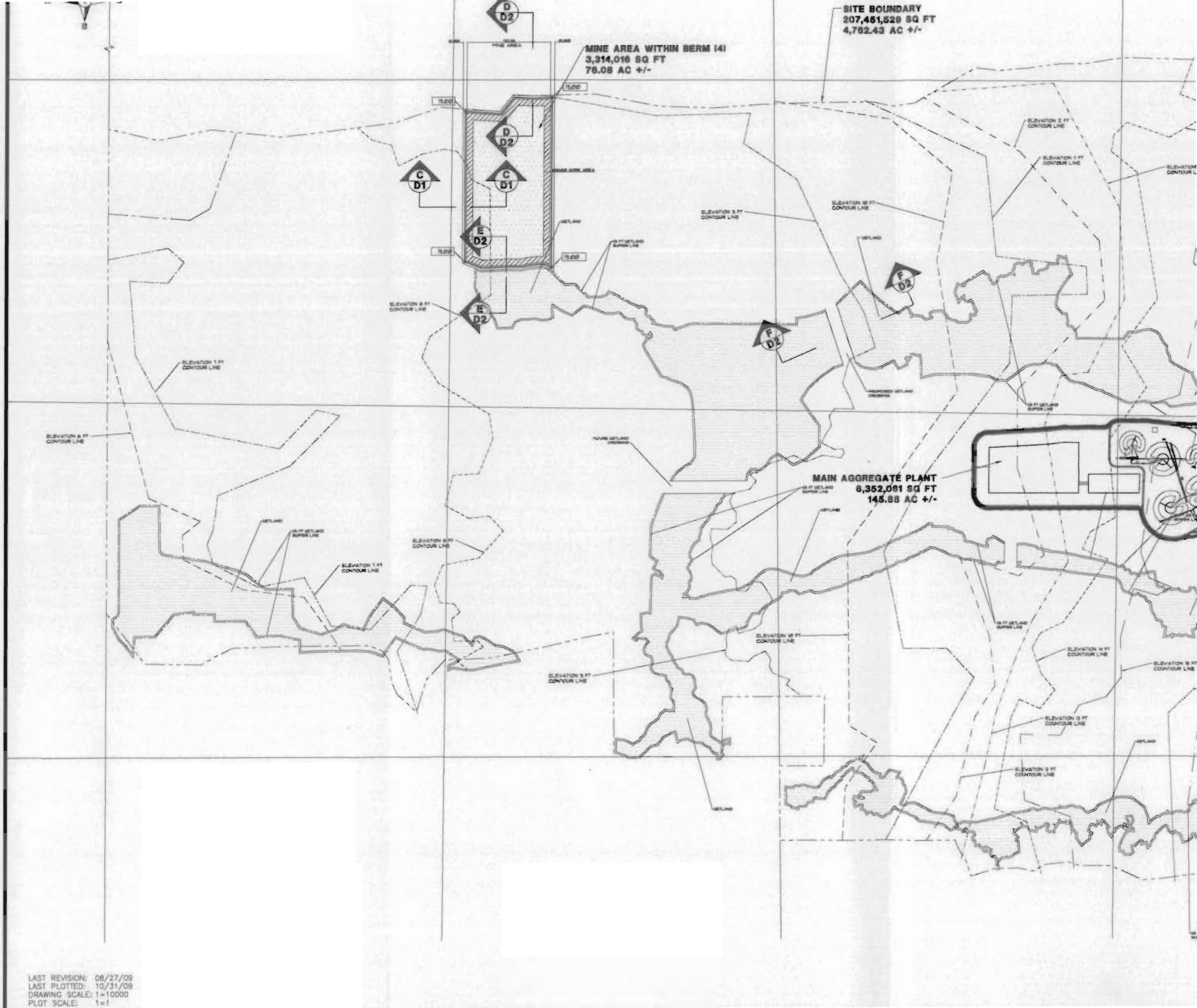

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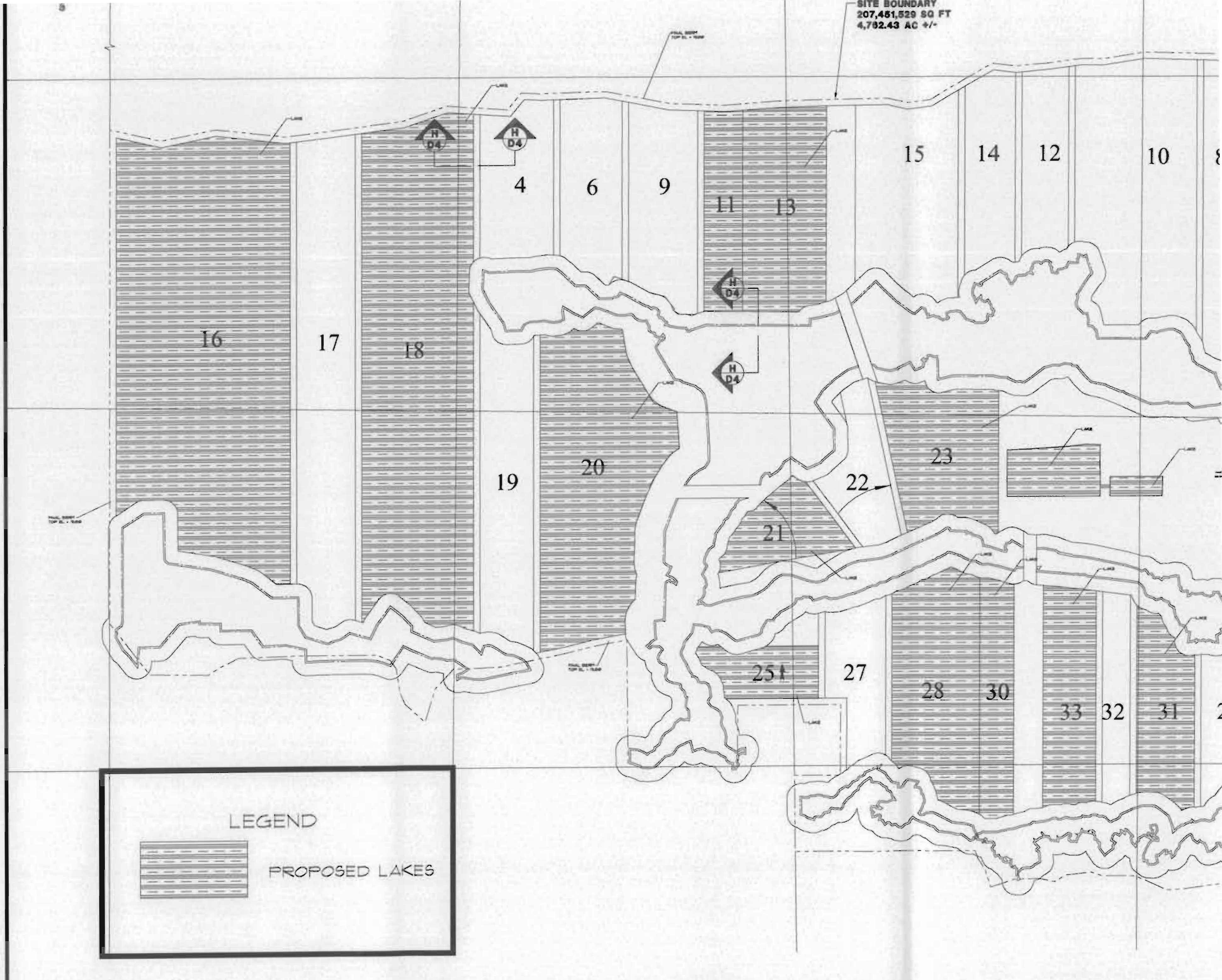

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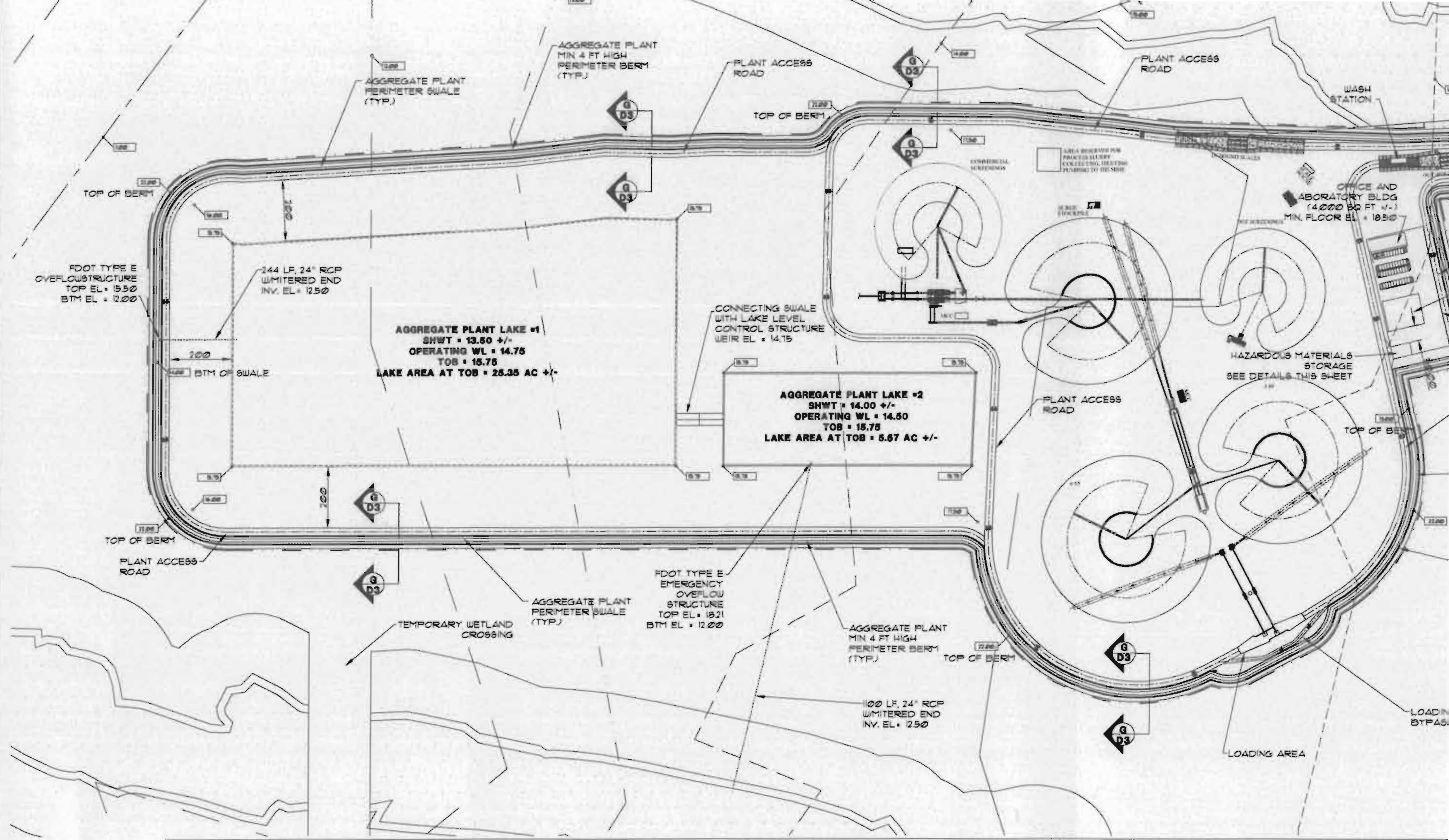

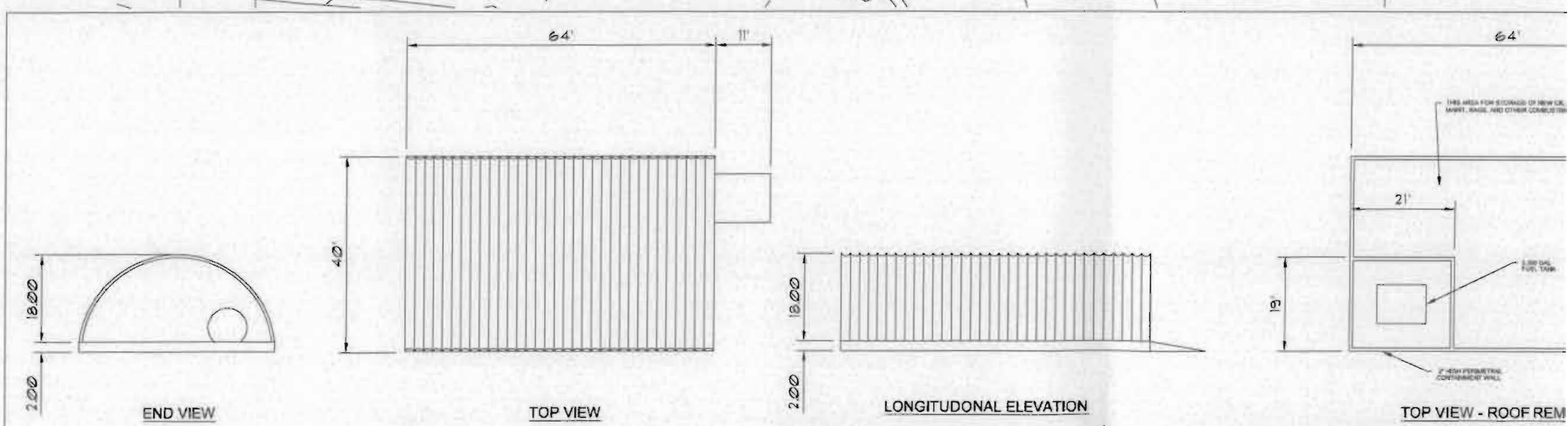

LAST REVISION: 08/28/09
LAST PLOTTED: 10/31/09
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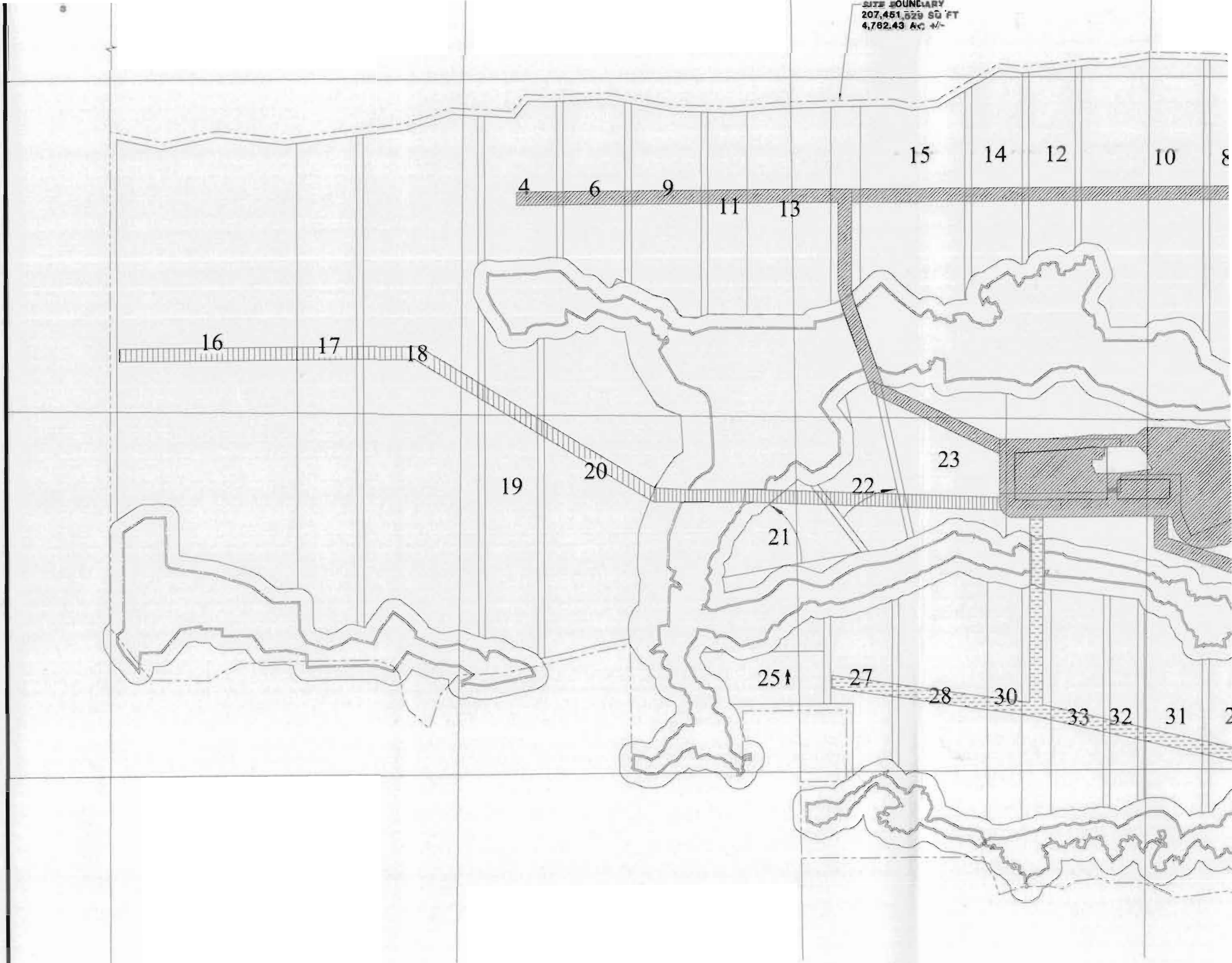
HAZARDOUS MATERIALS STORAGE DETAILS



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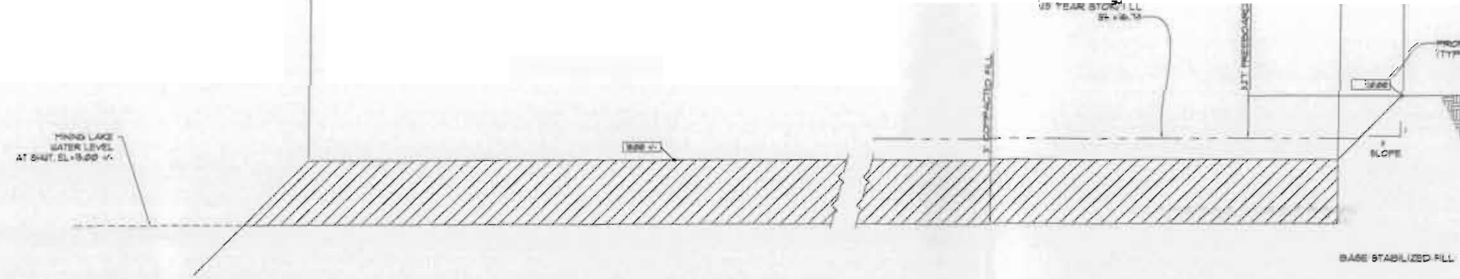
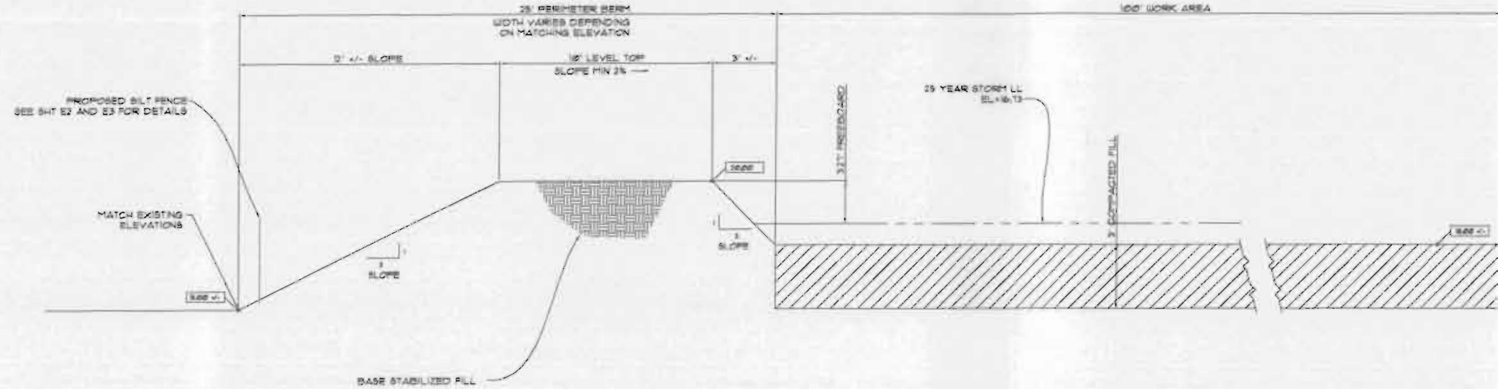


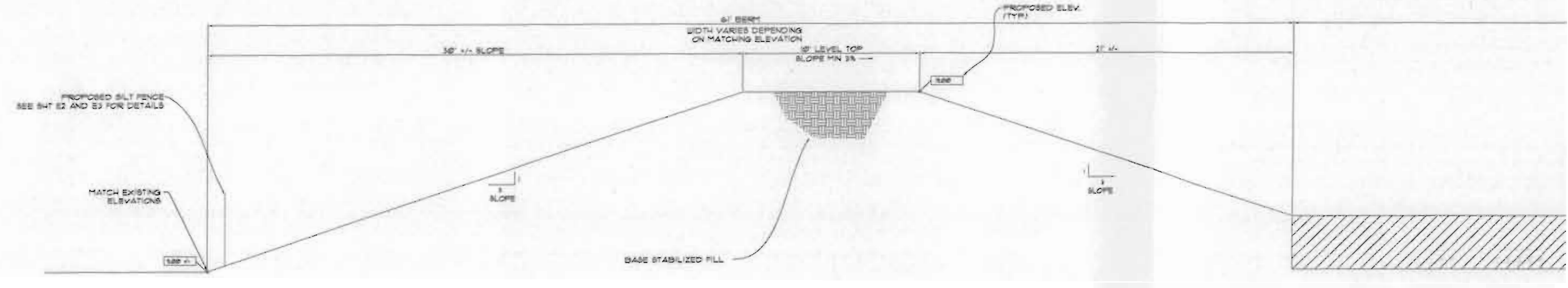
(A / S3) TYPICAL SECTION AT PROPERTY BOUNDARY (

SCALE: NTS



(B / S3) TYPICAL SECTION AT MINING BOUNDARY (5)

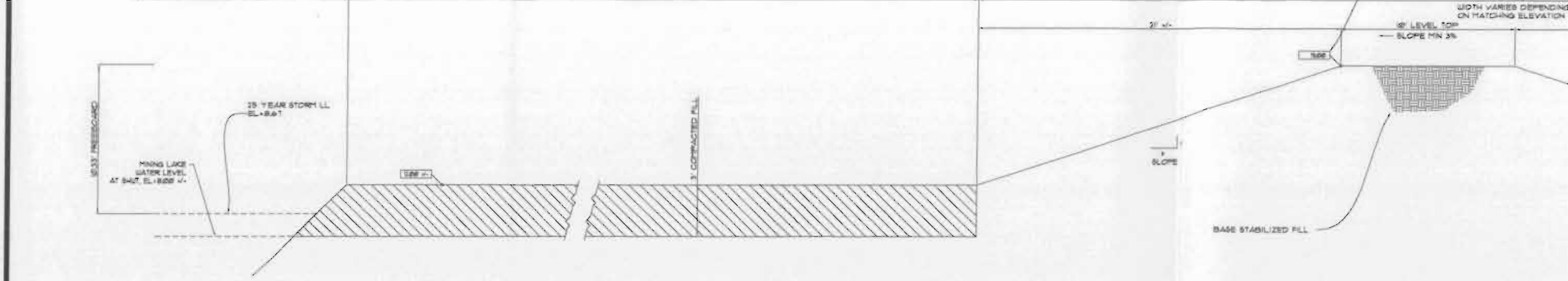
SCALE: NTS



LAST REVISION: 08/27/09
LAST PLOTTED: 10/31/09
DRAWING SCALE: NOTED
PLOT SCALE: 1=1

(C / S3) TYPICAL SECTION AT MINING BOUNDARY (4)

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



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TYPICAL SECTION AT PROPERTY BOUNDARY

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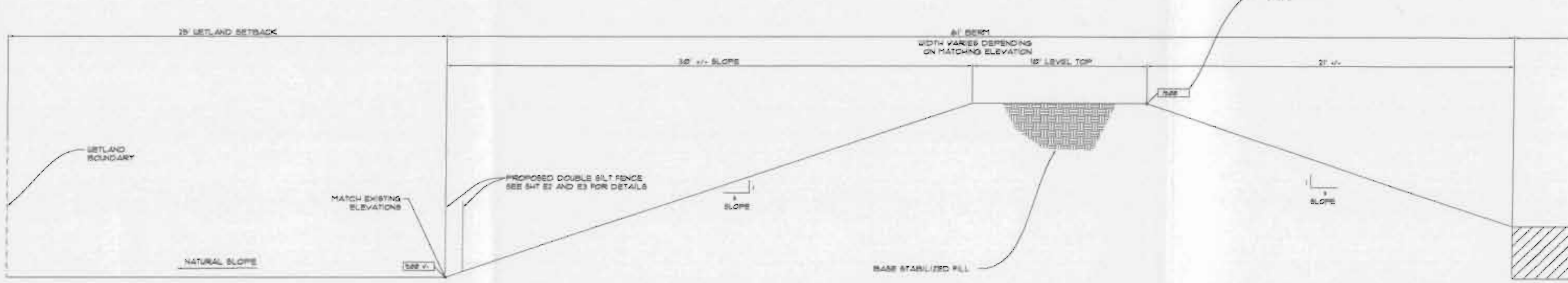

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TYPICAL SECTION AT WETLAND BOUNDARY

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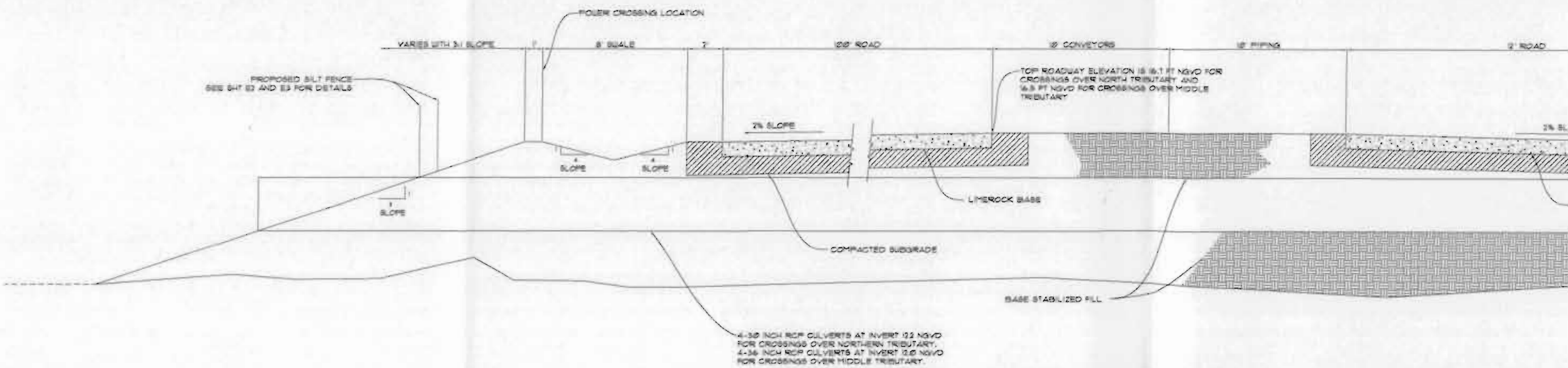

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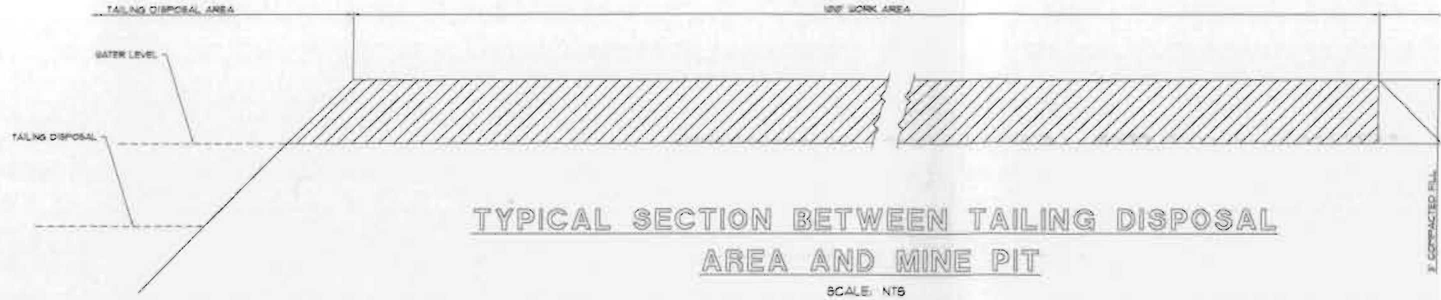
TYPICAL SECTION OF WETLAND CROSSIN

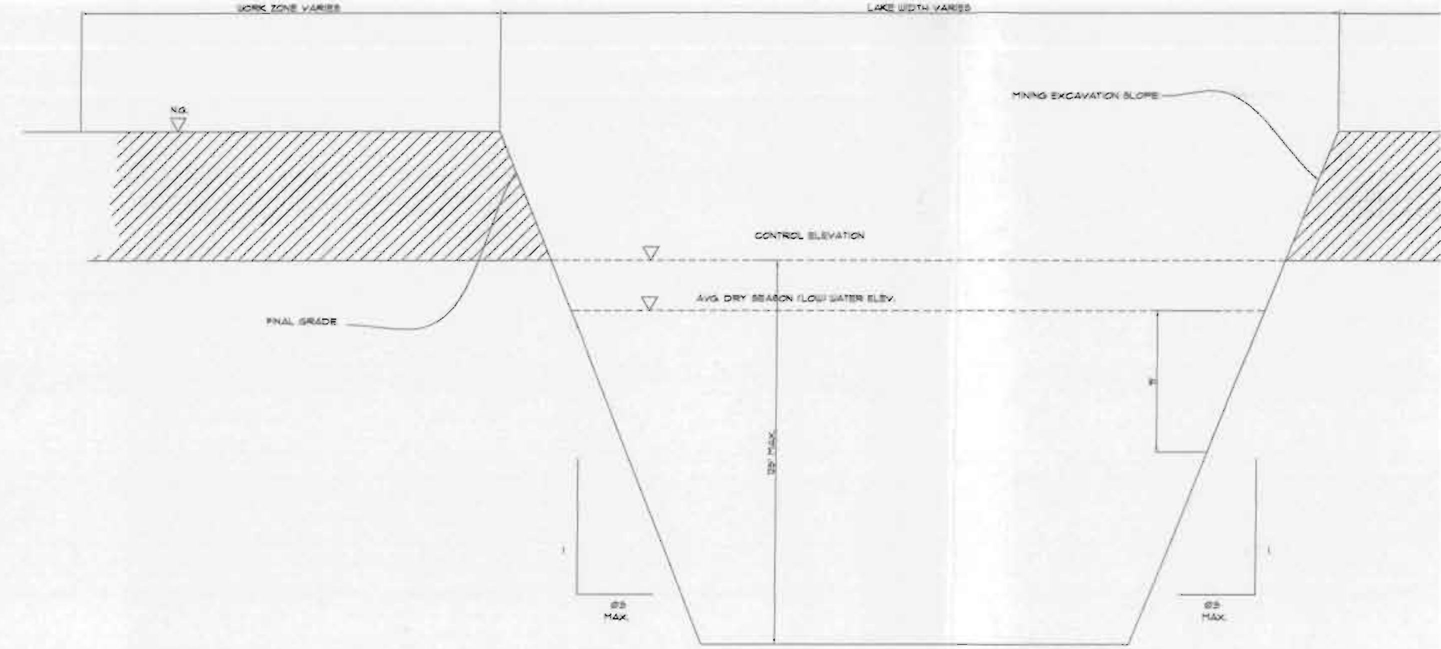
SCALE: 1/4"=1'-0"

LAST REVISION: 08/27/09
LAST PLOTTED: 10/31/09
DRAWING SCALE: NOTED
PLOT SCALE: 1=1



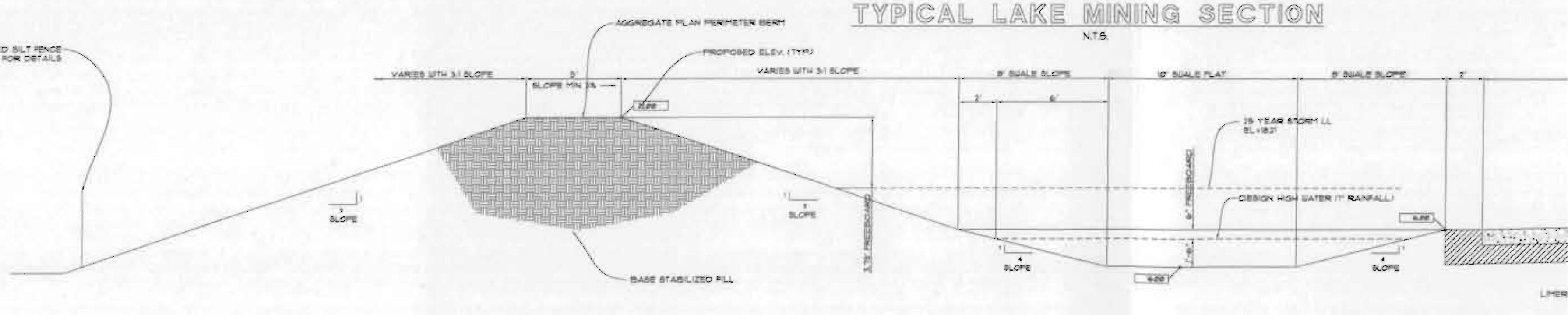
TYPICAL SECTION BETWEEN TAILING DISPOSAL AREA AND MINE PIT

SCALE: NTS



TYPICAL LAKE MINING SECTION

N.T.S.



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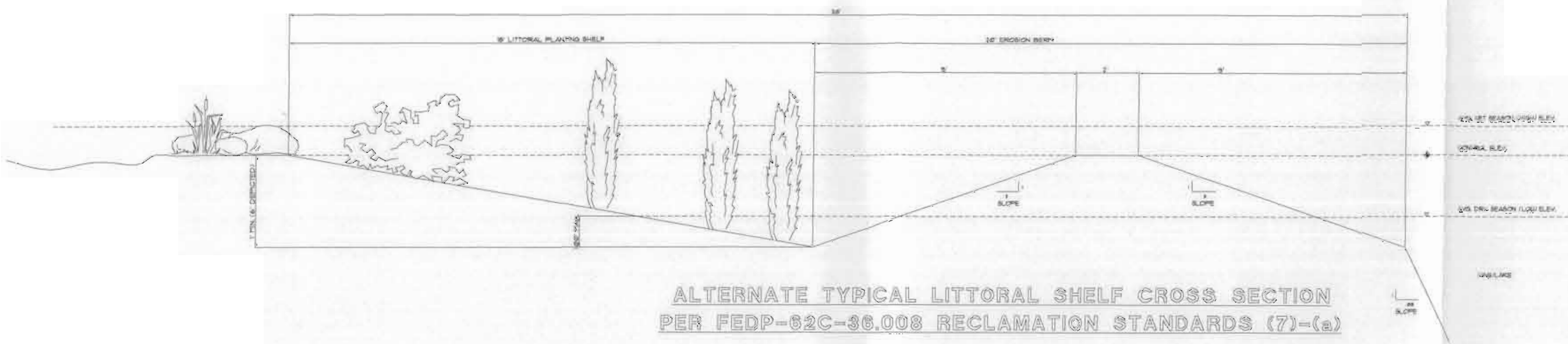
S5

TYPICAL AGGREGATE PLANT BOUNDARY

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

LAST REVISION: 08/27/09
LAST PLOTTED: 10/31/09
DRAWING SCALE: NOTED
PLOT SCALE: 1=1



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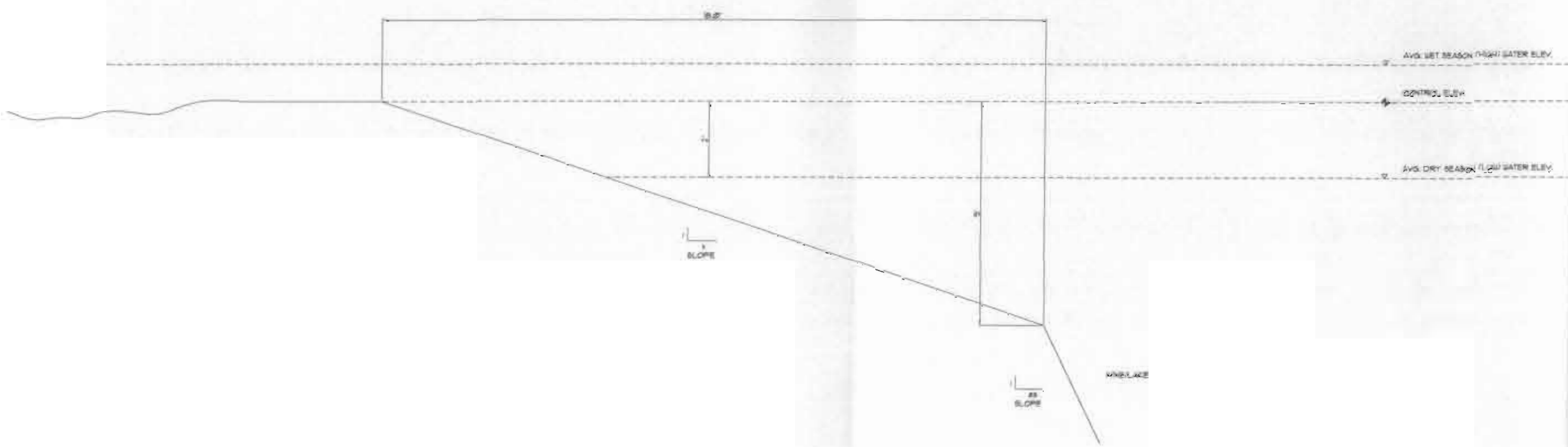

ALTERNATE TYPICAL RECLAMATION SHORELINE TREATMENT CROSS SECTION PER FEDP-62C-36.008 RECLAMATION STANDARDS (7)-(b)

H/04 TYPICAL FINAL MINEOUT SECTION

SCALE: NTS

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DRAWING SCALE: NOTED
PLOT SCALE: 1=1

SCALE VERIFICATION
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USE TO VERIFY FIGURE

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CAD FILE: 0811200100	SCALE: NOTED
DRAWN BY: A.A.	DATE: 02-12-09
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APPROVED BY:	DATE:

AL ANDREANSKY, P.E.
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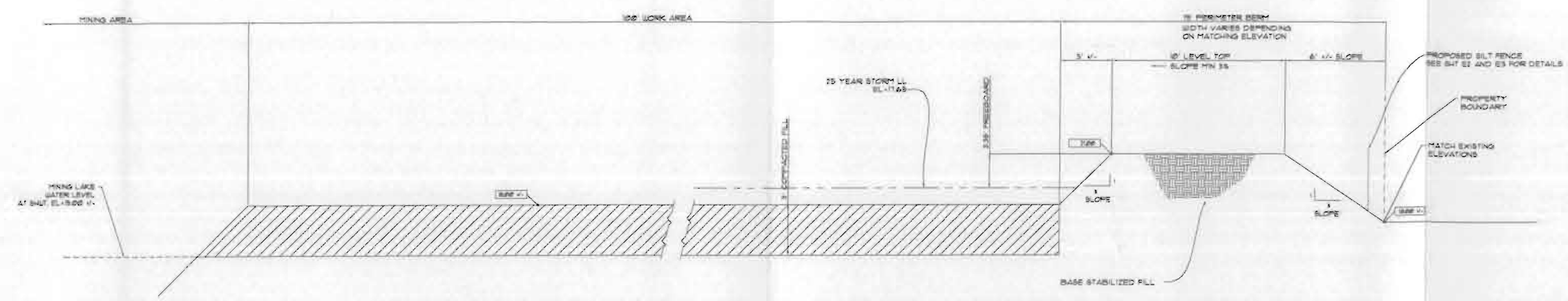
PALM HARBOR, FLORIDA 34682-0456
PHONE: (727) 441-4149, FAX: (727) 789-9565

PROPOSED MINING & RECLAMATION SECTIONS
6051 KING ROAD
LEVY COUNTY, FLORIDA

PROJECT No. 0911200.001
SHEET 04 of 6

TARMAC KING ROAD LIMESTONE MINE, TARMAC AMERICA LLC, DEERFILED BEACH, FLORIDA



TYPICAL SECTION AT PROPERTY BOUNDARY (1,2,3)

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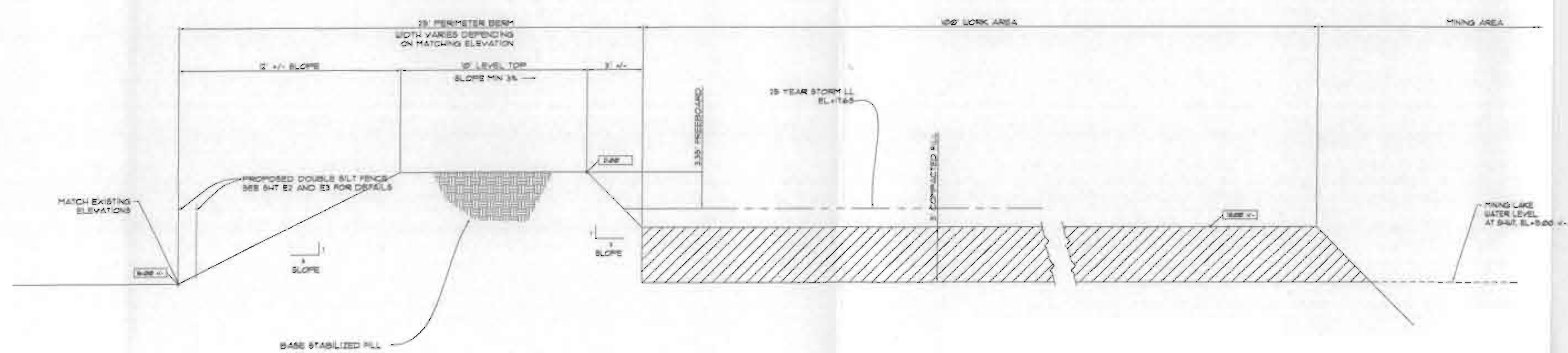

TYPICAL SECTION AT MINING BOUNDARY (1,2,3)

SCALE: NTS

LAST REVISION: 08/28/09
LAST PLOTTED: 10/31/09
DRAWING SCALE: NOTED
PLOT SCALE: 1=1

SCALE VERIFICATION: THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING. USE TO VERIFY FIGURE

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APPROVED BY:	DATE:

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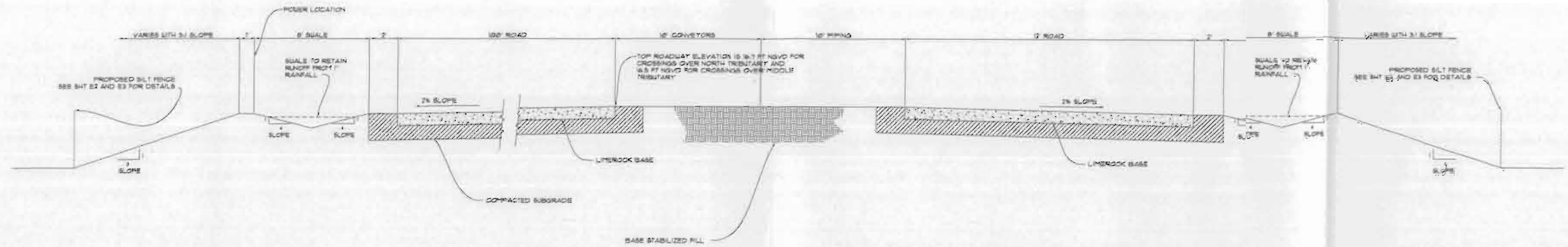
PALM HARBOR, FLORIDA 34682-0456
PHONE: (727) 441-4149, FAX: (727) 789-9565

PROPOSED MINING & CONSTRUCTION SECTIONS
6051 KING ROAD
LEVY COUNTY, FLORIDA

PROJECT No. 08112001.001
SHEET D5 of 8

TARMAC KING ROAD LIMESTONE MINE, TARMAC AMERICA LLC, DEERFILED BEACH, FLORIDA



ACCESS ROAD TYPICAL SECTION

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

LAST REVISION: 08/28/09
LAST PLOTTED: 10/31/09
DRAWING SCALE: NOTED
PLOT SCALE: 1=1

SCALE VERIFICATION: THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING. 0 1". USE TO VERIFY FIGURE

REVISION	DATE	DESCRIPTION	BY	APPROVED
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ENGINEER OF RECORD:
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CAD FILE: 08112001CD	SCALE: NOTED
DRAWN BY: A.A.	DATE: 08-21-09
CHECKED BY:	DATE:
APPROVED BY:	DATE:

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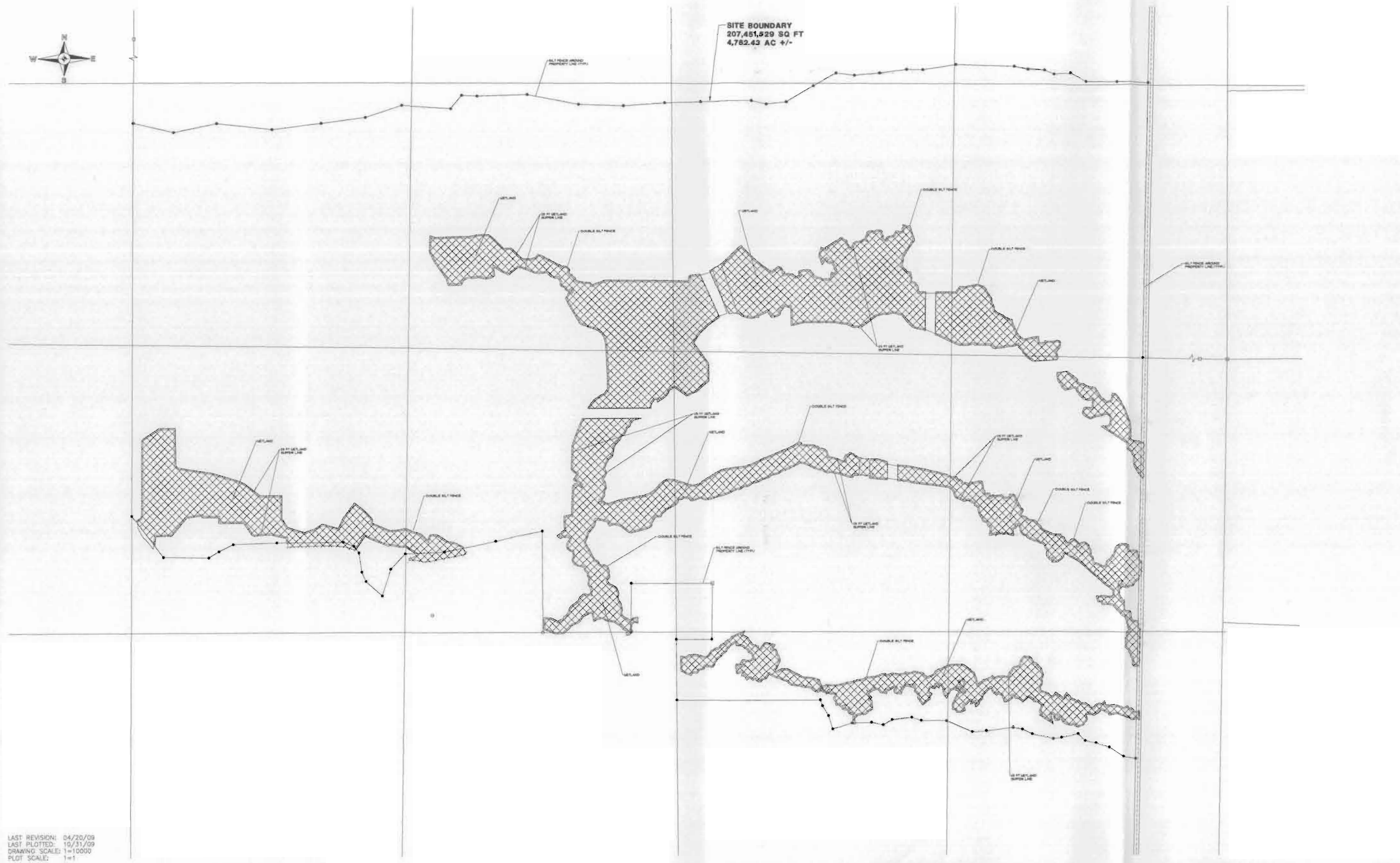
PALM HARBOR, FLORIDA 34682-0456
PHONE: (727) 441-4149, FAX: (727) 789-9566

PROPOSED MINING & CONSTRUCTION SECTIONS
6051 KING ROAD
LEVY COUNTY, FLORIDA

PROJECT No. 09112001.001
SHEET D6 of 8



LAST REVISION: 04/20/09
LAST PLOTTED: 10/31/09
DRAWING SCALE: 1=10000
PLOT SCALE: 1=1

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P.O. BOX 456
PALM HARBOR, FLORIDA 34682-0456
PHONE: (727) 441-4149, FAX: (727) 789-9585

EROSION CONTROL PLAN
6501 KING ROAD
LEVY COUNTY, FLORIDA

PROJECT No. 08112001.001
SHEET E1 of 4

TARMAC KING ROAD LIMESTONE MINE, TARMAC AMERICA LLC, DEERFIELD NBEACH, FLORIDA

EROSION AND SEDIMENT CONTROL PLAN

SITE DESCRIPTION

PROJECT NAME AND LOCATION

TARMAC KING ROAD LIMESTONE MINE
6051 KING ROAD
LEVY COUNTY, FLORIDA

OWNER NAME AND ADDRESS

TARMAC AMERICA LLC
455 FAIRWAY DRIVE
DEERFIELD BEACH, FLORIDA 33441

PROJECT DESCRIPTION

THE PROJECT WILL CONSIST OF CONSTRUCTION OF BUILDINGS, CONVEYORS, SILOS, STORMWATER, AND DRAINAGE SYSTEMS FOR MINE.

ACTIVITIES THAT REQUIRE EROSION CONTROL

SITE CLEARING AND GRUBBING; PROVIDING A STABILIZED CONSTRUCTION ENTRANCE, PERIMETER, AND OTHER EROSION AND SEDIMENT CONTROLS; EXCAVATION FOR THE RETENTION POND; SITE GRADING; INSTALLATION OF STORM WATER, SANITARY SEWER, AND WATER STRUCTURES; CONSTRUCTION OF THE BUILDING FOUNDATION, CURB AND GUTTER, ROADWAYS, SIDEWALKS, AND PARKING FACILITIES; LANDSCAPING.

SEE SHEETS E1, E3 AND E4 FOR DETAILS OF TEMPORARY SEDIMENT BARRIERS AND OTHER EROSION

SEQUENCE OF MAJOR ACTIVITIES

THE ORDER OF CONSTRUCTION IS AS FOLLOWS:

1. PROVIDE STABILIZED CONSTRUCTION ENTRANCE
2. INSTALL SILT FENCES AND OTHER EROSION CONTROL METHODS
3. CLEAR AND GRUB FOR SEDIMENT BASIN AND EARTH DIKE
4. CONSTRUCT EARTH DIKE AND SEDIMENT BASIN
5. FINISH CLEARING AND GRUBBING
6. REMOVE AND STORE TOPSOIL
7. PROVIDE INITIAL GRADING AS REQUIRED
8. STABILIZE ALL DISTURBED AREAS AS SOON AS POSSIBLE
9. INSTALL UTILITIES, STORM SEWER, CURB AND GUTTER
10. INSTALL BASE TO ROAD AND PARKING AREA
11. FINISH GRADING ENTIRE SITE
12. PROVIDE REQUIRED LANDSCAPING
13. CONSTRUCT FINAL PAVING
14. REMOVE ACCUMULATED SEDIMENT
15. REMOVE ANY ITEMS THAT ARE NOT REQUIRED

TIMING OF CONTROL MEASURES

THE INSTALLATION OF SILT FENCE (AND OTHER EROSION CONTROL MEASURES), A STABILIZED ENTRANCE AND SEDIMENT BASIN SHALL OCCUR PRIOR TO CLEARING AND GRUBBING ACTIVITY. AFTER CONSTRUCTION IS COMPLETE, THE ACCUMULATED SEDIMENT SHALL BE REMOVED AND THE AREAS SHALL BE REGRADED AND PERMANENTLY STABILIZED AS SHOWN ON THE PLANS.

GENERAL NOTES FOR

DRAINAGE STRUCTURES:

1. ALL STRUCTURES SHALL BE MADE OF PRECAST CONCRETE 3000 PSI @ 28 DAYS.
2. WALL REINFORCEMENT AND THICKNESS ARE FOR EITHER CAST-IN-PLACE OR PRECAST CONCRETE EXCEPT THAT FOR PRECAST CIRCULAR UNITS ASTM SPECIFICATION C-76, TABLE III, FOR B WALL REINFORCED CONCRETE PIPE OR PRECAST CIRCULAR UNITS IN ACCORDANCE WITH ASTM SPECIFICATION C-478 WILL BE ACCEPTABLE. TOP AND FLOOR SLAB THICKNESS AND REINFORCEMENT ARE FOR ALL TYPES OF CONSTRUCTION.
3. PRECAST TOP AND/OR FLOOR SLABS MAY BE OF THE SAME CONCRETE AS SPECIFIED IN ASTM SPECIFICATION C-478 FOR PRECAST CIRCULAR UNITS.
4. CORNERS FILLETS SHOWN FOR RECTANGULAR STRUCTURES ARE NECESSARY ONLY
5. STRUCTURES SHALL BE SECURED TO INLETS THROATS, RISERS OR MANHOLE TOPS WITH A MINIMUM OF 6 No. 4 BARS LONG OR AS SHOWN ON SHEET 2.
6. ANY INLET, MANHOLE OR JUNCTION BOX MAY BE USED IN CONJUCTION WITH ANY INLET THROAT OR MANHOLE TOP.
7. MORTAR USED TO SEAL THE PIPE IN THE WALLS OF THE PRECAST UNITS SHALL BE OF SUCH A MIX THAT SHRINKAGE WILL NOT CAUSE LEAKAGE INTO OR OUT OF THE UNITS. MAXIMUM OPENING FOR PIPE SHALL BE MAX. REQUIRED O.D. + 6".
8. BRICK MASONRY CONSTRUCTION SHALL BE PLASTERED WITH 1/2" THICK MORTAR INSIDE AND OUTSIDE.
9. CONCRETE PROTECTION FOR REINFORCEMENT IN CAST-IN-PLACE OR PRECAST CONCRETE SHALL BE IN ACCORDANCE WITH CHAPTER 7 "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318-71)".

EROSION AND SEDIMENT CONTROLS

BEST MANAGEMENT PRACTICES SHALL BE USED FOR THIS PROJECT TO CONTROL EROSION AND TURBIDITY CAUSED BY STORM WATER RUN-OFF. THE LOCATION AND DETAILS OF EROSION CONTROL METHODS ARE SHOWN ON THE PLANS. THE CONTRACTOR IS RESPONSIBLE FOR PLACING AND MAINTAINING THESE CONTROL METHODS AS SHOWN ON THE PLANS OR AS REQUIRED. HE/SHE SHALL ALSO PROVIDE THE REQUIRED EROSION PROTECTION AS REQUIRED BY LOCAL, STATE AND FEDERAL LAW.

STORM WATER MANAGEMENT

STORM WATER COLLECTION SHALL BE PROVIDED BY CURB AND GUTTER AND DRAINAGE INLETS FOR THE DEVELOPED AREAS. THE AREAS THAT ARE REGRADED BUT NOT DEVELOPED SHALL BE STABILIZED IMMEDIATELY AFTER REGRADING. AT THE END OF CONSTRUCTION, A TOTAL OF 1.05 ACRES SHALL HAVE BEEN REGRADED, AND THERE SHALL BE 0.14 ACRES OF RETENTION. THE ENTIRE SITE SHALL DRAIN TO DRY SWMF. THE SWMF SHALL BE IN THE AREA OF THE TEMPORARY SEDIMENT BASINS. WHEN SLOPES HAVE BEEN STABILIZED, THE SEDIMENT THAT HAS ACCUMULATED SHALL BE REMOVED FROM THE BASIN AND THE APPROPRIATE VEGETATION SHALL BE PLANTED. THE OUTLET OF THE SWMF'S SHALL BE AN EXISTING STORMWATER CONVEYANCE SYSTEM.

STABILIZATION PRACTICES:

TEMPORARY STABILIZATION – TOPSOIL STOCK PILES AND DISTURBED PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITY TEMPORARILY CEASE FOR AT LEAST 21 DAYS, SHALL BE STABILIZED WITH TEMPORARY SEED AND MULCH WITHIN 14 DAYS OF THE LAST CONSTRUCTION ACTIVITY IN THAT AREA. THE TEMPORARY SEED REQUIRED CAN BE FOUND IN TABLE 1.65 A OF THE FLORIDA DEVELOPMENT MANUAL. PRIOR TO SEEDING, WHERE SOILS ARE ACIDIC 2 TONS OF PULVERIZED AGRICULTURAL LIMESTONE SHOULD BE ADDED PER ACRE AND 450 POUNDS OF 10-20-20 FERTILIZER SHALL BE APPLIED TO EACH ACRE. AFTER SEEDING, EACH AREA SHALL BE IMMEDIATELY MULCHED WITH STRAW OR EQUIVALENT EQUAL. AREAS OF THE SITE WHICH ARE TO BE PAVED SHALL BE TEMPORARILY STABILIZED BY APPLYING GEOTEXTILE AND STONE SUB-BASE UNTIL BITUMINOUS PAVEMENT CAN BE APPLIED.

PERMANENT STABILIZATION – DISTURBED PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES PERMANENTLY CEASES SHALL BE STABILIZED WITH PERMANENT SEED NO LATER THAN 14 DAYS AFTER THE LAST CONSTRUCTION ACTIVITY. THE APPROPRIATE PERMANENT SEED MIX CAN BE FOUND IN TABLES 1.66A, 1.66B AND 1.66C OF THE FLORIDA DEVELOPMENT MANUAL. PRIOR TO SEEDING, 2 TONS/ACRE OF FINELY GROUND AGRICULTURAL LIMESTONE AND THE PROPER FERTILIZER BASED ON THE TYPE OF SEEDING SHALL BE APPLIED TO EACH ACRE TO PROVIDE PLANT NUTRIENTS. AFTER SEEDING, EACH AREA SHALL BE MULCHED IMMEDIATELY.

STRUCTURAL PRACTICES:

EARTH DIKE – IF REQUIRED, AN EARTH DIKE SHALL BE CONSTRUCTED ALONG THE SITE PERIMETER. A PORTION OF THE DIKE SHALL DIVERT RUN-ON AROUND THE CONSTRUCTION SITE. THE REMAINING PORTION OF THE DIKE SHALL COLLECT RUNOFF FROM THE DISTURBED AREA AND DIRECT THE RUNOFF TO THE SEDIMENT BASIN.

SEDIMENT BASIN – A SEDIMENT BASIN SHALL BE CONSTRUCTED IN THE COMMON DRAINAGE AREA FOR THE SITE. THIS STORAGE POND SHALL HAVE A VOLUME OF   CUBIC FEET OF STORAGE FOR EACH ACRE. ALL SEDIMENT COLLECTED IN THE BASIN MUST BE REMOVED FROM THE BASIN UPON COMPLETION OF CONSTRUCTION. SEDIMENT FROM THE BASIN MAY BE USED AS FILL ON THE SITE IF IT IS SUITABLE SOIL.

WASTE DISPOSAL

WASTE MATERIALS – ALL WASTE MATERIALS SHALL BE COLLECTED AND STORED IN A METAL DUMPSTER WITH A SECURE LID IN ACCORDANCE WITH ALL LOCAL AND STATE LAWS. ALL TRASH AND CONSTRUCTION DEBRIS FROM THE SITE SHALL BE DEPOSITED IN THE DUMPSTER. THE SUPERINTENDENT SHALL COORDINATE WITH THE LOCAL UTILITIES TO HAVE THE DUMPSTER EMPTIED AT LEAST TWICE A WEEK AND THE WASTE TAKEN TO AN APPROPRIATE LANDFILL. NO CONSTRUCTION WASTE MATERIALS SHALL BE BURIED ON SITE. THE SUPERINTENDENT SHALL ORGANIZE TRAINING FOR THE EMPLOYEES IN THE PROPER PRACTICES WHEN DEALING WITH WASTE MATERIALS. THE SUPERINTENDENT SHALL BE RESPONSIBLE FOR POSTING AND ENFORCING WASTE MATERIAL PROCEDURES.

HAZARDOUS WASTE – HAZARDOUS WASTE MATERIALS SHALL BE DISPOSED OF IN ACCORDANCE WITH ALL LOCAL AND STATE LAWS OR AS DIRECTED BY THE MANUFACTURER. THE SUPERINTENDENT SHALL ORGANIZE THE PROPER TRAINING FOR EMPLOYEES IN THE PROPER PRACTICES WHEN DEALING WITH HAZARDOUS WASTE MATERIALS. THESE PROCEDURES SHALL BE POSTED ON THE SITE. THE PERSON WHO MANAGES THE SITE SHALL BE RESPONSIBLE FOR ENFORCING THE PROCEDURES.

SANITARY WASTE – SANITARY WASTE SHALL BE COLLECTED AND DISPOSED OF IN ACCORDANCE WITH ALL LOCAL AND STATE LAWS. THE SUPERINTENDENT SHALL COORDINATE WITH THE LOCAL UTILITY FOR COLLECTION OF THE SANITARY WASTE AT LEAST THREE TIMES A WEEK TO PREVENT SPILLAGE ONTO THE SITE.

OFFSITE TRACKING

A STABILIZED CONSTRUCTION ENTRANCE SHALL BE PROVIDED TO REDUCE SEDIMENT TRACKING OFFSITE. THE MAJOR ROAD CONNECTED TO THE PROJECT SHALL BE CLEANED ONCE A DAY TO REMOVE ANY EXCESS MUD, DIRT OR ROCK RESULTING FROM CONSTRUCTION TRAFFIC. ALL TRUCKS HAULING MATERIALS OFFSITE SHALL BE COVERED WITH A TARPAULIN.

ITEMS REQUIRING POLLUTION PREVENTION

THE FOLLOWING ITEMS ARE EXPECTED TO BE PRESENT ON THE PROJECT SITE:

-ASPHALT	-CLEANING SUPPLIES
-CONCRETE	-DETERGENTS
-FERTILIZERS	-MASONARY BLOCK/BRICKS
-METAL PIECES	-PAINT
-PETROLEUM BASED PRODUCTS	-ROOFING SUPPLIES
-TAR	-WOOD

THE FOLLOWING ARE NON-STORM WATER SOURCES THAT WILL BE ENCOUNTERED AT THE SITE AND SHOULD BE DIRECTED TO THE SEDIMENT BASIN PRIOR TO DISCHARGE:

-UNCONTAMINATED GROUNDWATER EXPOSED DURING EXCAVATION
-WATER FROM WATER LINE FLUSHING
-PAVEMENT WASH WATERS (WHERE NO SPILLS OR LEAKS OF TOXIC OR HAZARDOUS MATERIALS HAVE OCCURRED).

SPILL PREVENTION AND CONTROL

THE FOLLOWING ARE THE MATERIAL MANAGEMENT PRACTICES THAT WILL BE USED TO REDUCE THE RISK OF SPILLS OR OTHER ACCIDENTAL EXPOSURE OF MATERIALS AND SUBSTANCES TO STORM WATER RUNOFF.

GOOD HOUSEKEEPING

-SUPERINTENDENT SHALL INSPECT PROJECT AREA DAILY FOR PROPER STORAGE, USE, AND DISPOSAL OF CONSTRUCTION MATERIALS.

-STORE ONLY ENOUGH MATERIAL ON SITE FOR PROJECT COMPLETION.

-ALL SUBSTANCES SHOULD BE USED BEFORE DISPOSAL OF CONTAINER.

-ALL CONSTRUCTION MATERIALS STORED SHALL BE ORGANIZED AND IN THE PROPER CONTAINER AND IF POSSIBLE, STORED UNDER A ROOF OR PROTECTIVE COVER.

-PRODUCTS SHALL NOT BE MIXED UNLESS DIRECTED BY THE MANUFACTURER.

-ALL PRODUCTS SHALL BE USED AND DISPOSED OF ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.

HAZARDOUS PRODUCTS

-MATERIALS SHOULD BE KEPT IN ORIGINAL CONTAINER WITH LABELS UNLESS THE ORIGINAL CONTAINERS CANNOT BE RESEALED. IF ORIGINAL CONTAINERS CANNOT BE USED, LABELS AND PRODUCT INFORMATION SHALL BE SAVED.

-PROPER DISPOSAL PRACTICES SHALL ALWAYS BE FOLLOWED IN ACCORDANCE WITH MANUFACTURER AND LOCAL/STATE REGULATIONS.

PRODUCT SPECIFIC PRACTICES

-PETROLEUM PRODUCTS MUST BE STORED IN PROPER CONTAINERS AND CLEARLY LABELED. VEHICLES CONTAINING PETROLEUM PRODUCTS SHALL BE PERIODICALLY INSPECTED FOR LEAKS. PRECAUTIONS SHALL BE TAKEN TO AVOID LEAKAGE OF PETROLEUM PRODUCTS ON SITE.

-THE MINIMUM AMOUNT OF FERTILIZER SHALL BE USED AND MIXED INTO THE SOIL IN ORDER TO LIMIT EXPOSURE TO STORM WATER. FERTILIZERS SHALL BE STORED IN A COVERED SHED. THE CONTENTS OF ANY PARTIALLY USED BAGS OF FERTILIZER SHALL BE TRANSFERRED TO A SEALABLE PLASTIC BIN TO AVOID SPILLS.

-PAINT CONTAINERS SHALL BE SEALED AND STORED WHEN NOT IN USE. EXCESS PAINT MUST BE DISPOSED OF IN AN APPROVED MANNER.

-CONCRETE TRUCKS SHALL NOT BE ALLOWED TO WASH OUT OR DISCHARGE SURPLUS CONCRETE OR DRUM WASH WATER ON THE SITE.

SPILL CONTROL PRACTICES

IN ADDITION TO THE GOOD HOUSEKEEPING AND MATERIAL MANAGEMENT PRACTICES DISCUSSED IN THE PREVIOUS SECTIONS OF THIS PLAN, THE FOLLOWING PRACTICES SHALL BE FOLLOWED FOR SPILL PREVENTION AND CLEANUP:

-SPILL CLEANUP INFORMATION SHALL BE POSTED ON SITE TO INFORM EMPLOYEES ABOUT CLEANUP PROCEDURES AND RESOURCES.

-THE FOLLOWING CLEAN-UP EQUIPMENT MUST BE KEPT ON-SITE NEAR THE MATERIAL STORAGE AREA: GLOVES, MOPS, RAGS, BROOMS, DUST PANS, SAND, SAWDUST, LIQUID ABSORBER, GOGGLES, AND TRASH CONTAINERS.

-ALL SPILLS SHALL BE CLEANED UP AS SOON AS POSSIBLE.

-WHEN CLEANING A SPILL, THE AREA SHOULD BE WELL VENTILATED AND THE EMPLOYEE SHALL WEAR PROPER PROTECTIVE COVERING TO PREVENT INJURY.

-TOXIC SPILLS MUST BE REPORTED TO THE PROPER AUTHORITY REGARDLESS OF THE SIZE OF THE SPILL.

-AFTER A SPILL, THE PREVENTION PLAN SHALL BE REVIEWED AND CHANGED TO PREVENT FURTHER SIMILAR SPILLS FROM OCCURRING. THE CAUSE OF THE SPILL, MEASURES TO PREVENT IT, AND HOW TO CLEAN THE SPILL UP SHALL BE RECORDED.

-THE SUPERINTENDENT SHALL BE THE SPILL PREVENTION AND CLEANUP COORDINATOR AND IS RESPONSIBLE FOR THE DAY TO DAY SITE OPERATIONS. THE SUPERINTENDENT ALSO OVERSEES THE SPILL PREVENTION PLAN AND SHALL BE RESPONSIBLE FOR EDUCATING THE EMPLOYEES ABOUT SPILL PREVENTION AND CLEANUP PROCEDURES.

MAINTENANCE AND INSPECTION PRACTICES

THE FOLLOWING ARE MAINTENANCE AND INSPECTION PRACTICES THAT SHALL BE COMPLETED BY THE CONTRACTOR:

-ALL SEDIMENT AND EROSION CONTROL METHODS SHALL BE CHECKED DAILY AND AFTER EACH SIGNIFICANT RAINFALL BY THE SUPERINTENDENT OR SOMEONE UNDER HIS/HER DIRECT SUPERVISION.

-ALL SEDIMENT AND EROSION CONTROL METHODS SHALL BE KEPT IN GOOD CONDITION. REPAIRS MUST BE MADE WITHIN 24 HOURS OF REPORT.

-THE SILT FENCE SHALL BE CLEARED OF SEDIMENT WHEN SEDIMENT MEASURES ONE-THIRD THE HEIGHT OF THE FENCE.

-THE SILT FENCE SHALL BE INSPECTED PERIODICALLY FOR HEIGHT OF SEDIMENT AND CONDITION OF FENCE.

-THE SEDIMENT BASINS/DITCHES SHALL BE CHECKED MONTHLY FOR DEPTH OF SEDIMENT. THEY SHALL BE CLEANED WHEN SEDIMENT REACHES 10% OF TOTAL CAPACITY AND AFTER CONSTRUCTION IS COMPLETE.

-THE DIVERSION DIKE SHALL BE INSPECTED MONTHLY. ANY BREACHES SHALL BE PROMPTLY REPAIRED.

-ALL SEEDING SHALL BE CHECKED FOR PROPER GROWTH AND UNIFORMITY. UNSTABALIZED AREAS SHALL BE RE-SODDED.

-A MAINTENANCE REPORT SHALL BE COMPLETED DAILY AFTER EACH INSPECTION OF THE SEDIMENT AND EROSION CONTROL METHODS. THE REPORTS SHALL BE FILED IN AN ORGANIZED MANNER AND RETAINED ON-SITE DURING CONSTRUCTION. AFTER CONSTRUCTION IS COMPLETED, THE REPORTS SHALL BE SAVED FOR AT LEAST THREE YEARS. THE REPORTS SHALL BE AVAILABLE FOR ANY AGENCY THAT HAS JURISDICTION OVER EROSION CONTROL.

-THE SUPERINTENDENT SHALL ORGANIZE THE TRAINING FOR INSPECTION PROCEDURES AND PROPER EROSION CONTROL METHODS FOR EMPLOYEES THAT COMPLETE INSPECTIONS AND REPORTS.

ENGINEERING NOTES:

1. ANY APPARENT DISCREPANCIES BETWEEN THESE PLANS AND ACTUAL FIELD CONDITIONS SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION IN WRITING PRIOR TO THE START OF CONSTRUCTION.
2. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES IN THE FIELD. CONTRACTOR SHALL EXERCISE CARE AND CAUTION IN PROTECTING ALL UTILITIES DURING THE COMPLETION OF THIS WORK. IN THE EVENT OF DAMAGE, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE APPROPRIATE UTILITY COMPANY. ANY AND ALL COSTS INCURRED DUE TO DAMAGE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. FORTY-EIGHT (48) HOURS BEFORE DIGGING, CALL SUNSHINE, TOLL FREE 1-800-432-4770.
3. ALL WORK SHALL MEET MIAMI-DADE COUNTY PUBLIC WORKS DEPT. REGULATIONS AND STANDARDS.
4. ELEVATIONS SHOWN REFER TO N.G.V.D. (NATIONAL GEODETIC VERTICAL DATUM 1929.)
5. ALL DRIVING SURFACES MUST BE CONSTRUCTED ON A 12 INCHES (SEE DETAIL) LIMEROCK BASE (LBR 100) THAT WILL PRODUCE A C.B.R. VALUE OF NO LESS THAN 25 WHEN COMPACTED TO A MINIMUM FIELD DENSITY OF 95% OF MAX. DENSITY AS DETERMINED BY AASTHO T-180. SUBGRADE MATERIAL SHALL BE BE GRANULAR AND ANGULAR AND SHALL HAVE A MINIMUM LBR OF 100. PROPOSED 8" REINFORCED CONCRETE W/#15-12" O.C. E.W. FC=4000 PSI.
6. BEFORE STARTING ANY FILL OPERATIONS, THE CONTRACTOR SHALL REMOVE ALL EXISTING VEGETATION. ALL AREAS TO BE FILLED SHALL BE FILLED, ROLLED AND COMPACTED PRIOR TO STARTING FILL OPERATIONS. SHALL BE PLACED IN 6" LAYERS NOT TO EXCEED 12" LOOSE MEASURE, AND COMPACTED TO 95% OF MAX. DENSITY AS DETERMINED BY AASTHO T-180. FILL SHALL BE LOCALLY ACCEPTABLE AND SUITABLE FOR FILL PURPOSES. THE TOP 12" OF FILL OR CUT UNDER THE PAVEMENT BASE SHALL BE COMPACTED TO 95% OF MAX. DENSITY AS DETERMINED BY AASHTO T-180.
7. FLOOD CRITERIA ELEVATION: 6.90 (SOURCE M-D CO. P.W.D. FLOOD CRITERIA MAPS)
8. MONUMENT OR PROPERTY LINE MARKS LOCATED WITHIN THE LIMITS OF CONSTRUCTION SHALL NOT BE DISTURBED.
9. IT IS THE INTENT OF THESE PLANS TO BE IN ACCORDANCE WITH THE APPLICABLE CODES AND AUTHORITIES HAVING JURISDICTION. ANY DISCREPANCIES BETWEEN THESE PLANS AND APPLICABLE CODES SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE ENGINEER.
10. THE CONTRACTOR SHALL PREPARE AND SUBMIT SHOP DRAWINGS FOR ALL ITEMS SHOWN IN PROJECT PLANS AND LISTED IN PROJECT SPECIFICATIONS.
11. ALL PAVEMENT MARKINGS SHALL BE IN ACCORDANCE WITH THE M-D CO. P.W.D. STANDARDS.
12. THE RETENTION/DETENTION PONDS/SWALES ARE INTENDED TO DRAIN AS RAPIDLY AS POSSIBLE, THUS, THE QUALITY OF SOIL IN THE SIDES AND BOTTOM OF THE PONDS/SWALES IS CRITICAL. SILT, MUCK, CLAY OR QUESTIONABLE FINES UNCOVERED IN THE BOTTOM OF THE DETENTION PONDS/SWALES MUST BE REMOVED AND BACKFILLED WITH SAND TO A DEPTH OF 2 FEET.

LAST REVISION: 04/20/09
LAST PLOTTED: 10/31/09
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PLOT SCALE: 1=1

SCALE VERIFICATION
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REVISION	DATE	DESCRIPTION	BY	APPROVED

ENGINEER OF RECORD:
AL ANDREANSKY, P.E. FLA. REG. #39387 — DATE SIGNED:

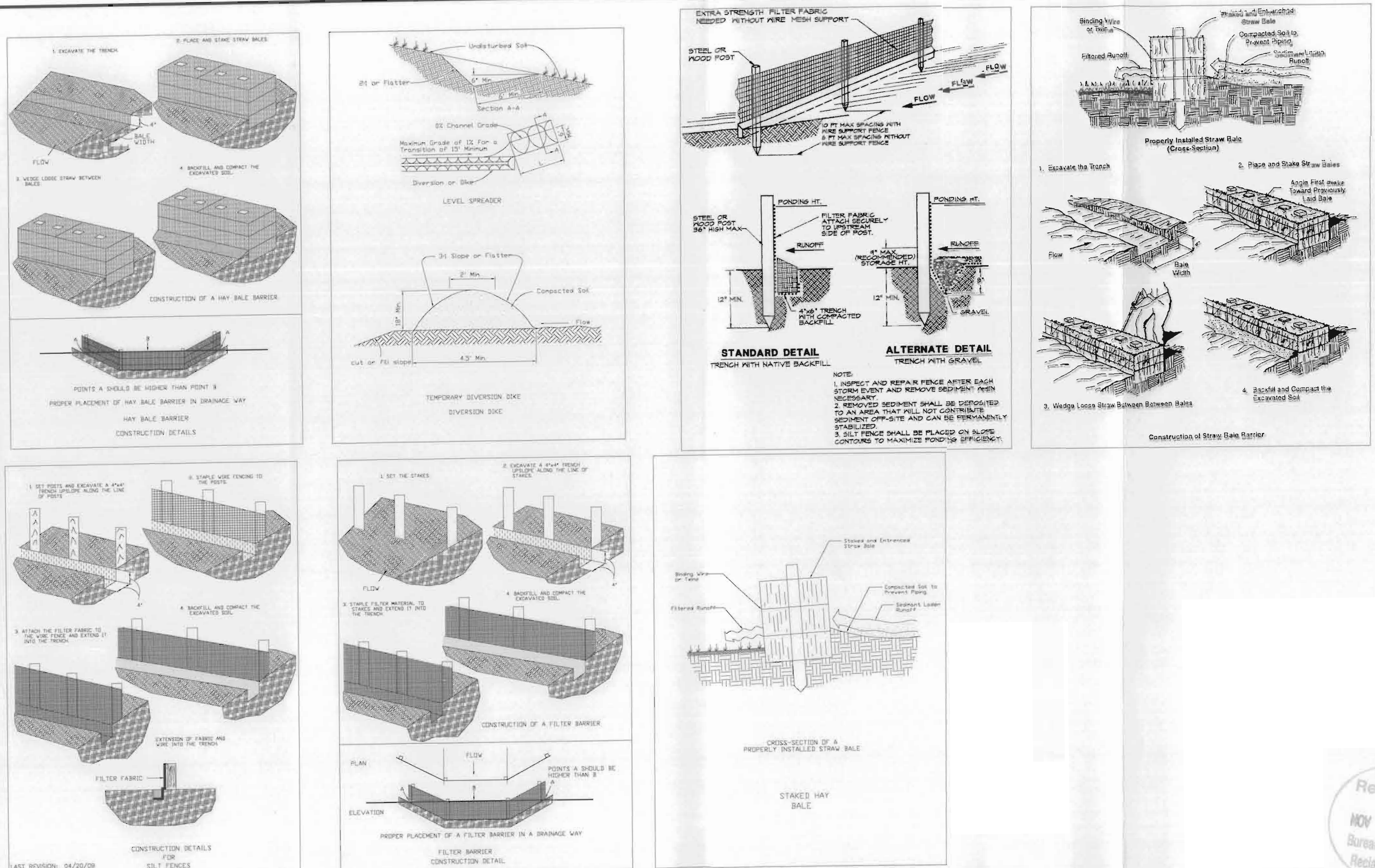
CAD FILE: 08112001CD	SCALE: N/A
DRAWN BY: A.A.	DATE: 02-12-09
CHECKED BY:	DATE:
APPROVED BY:	DATE:

AL ANDREANSKY, P.E.
P.O. BOX 456
PALM HARBOR, FLORIDA 34682-0456
PHONE: (727) 441-4149, FAX: (727) 789-9565

EROSION AND CONTROL NOTES
6051 KING ROAD
LEVY COUNTY, FLORIDA

PROJECT No. 08112001.001
SHEET E2 of 4

TARMAC KING ROAD LIMESTONE MINE, TARMAC AMERICA LLC, DEERFIELD BEACH, FLORIDA



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SCALE: N/A	
DATE: 02-12-09	
DATE:	
DATE:	

AL ANDREANSKY, P.E.
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PALM HARBOR, FLORIDA 34682-0456
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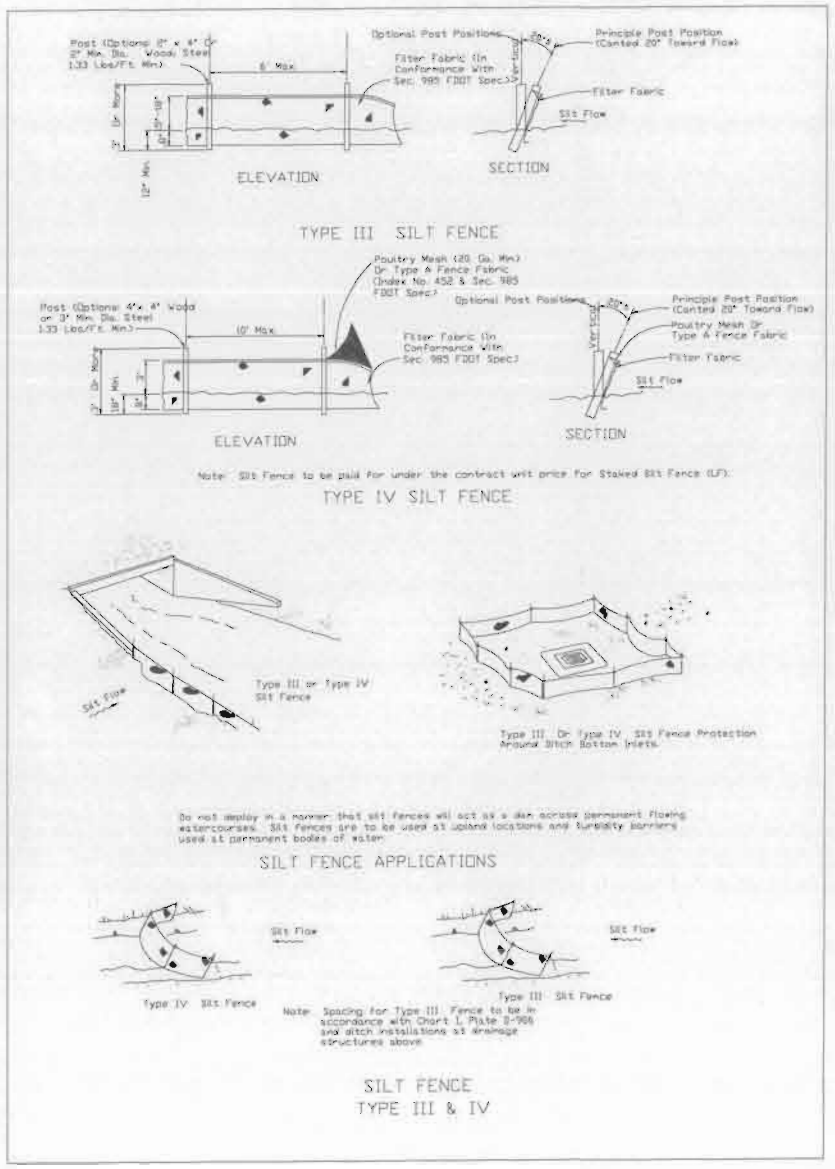
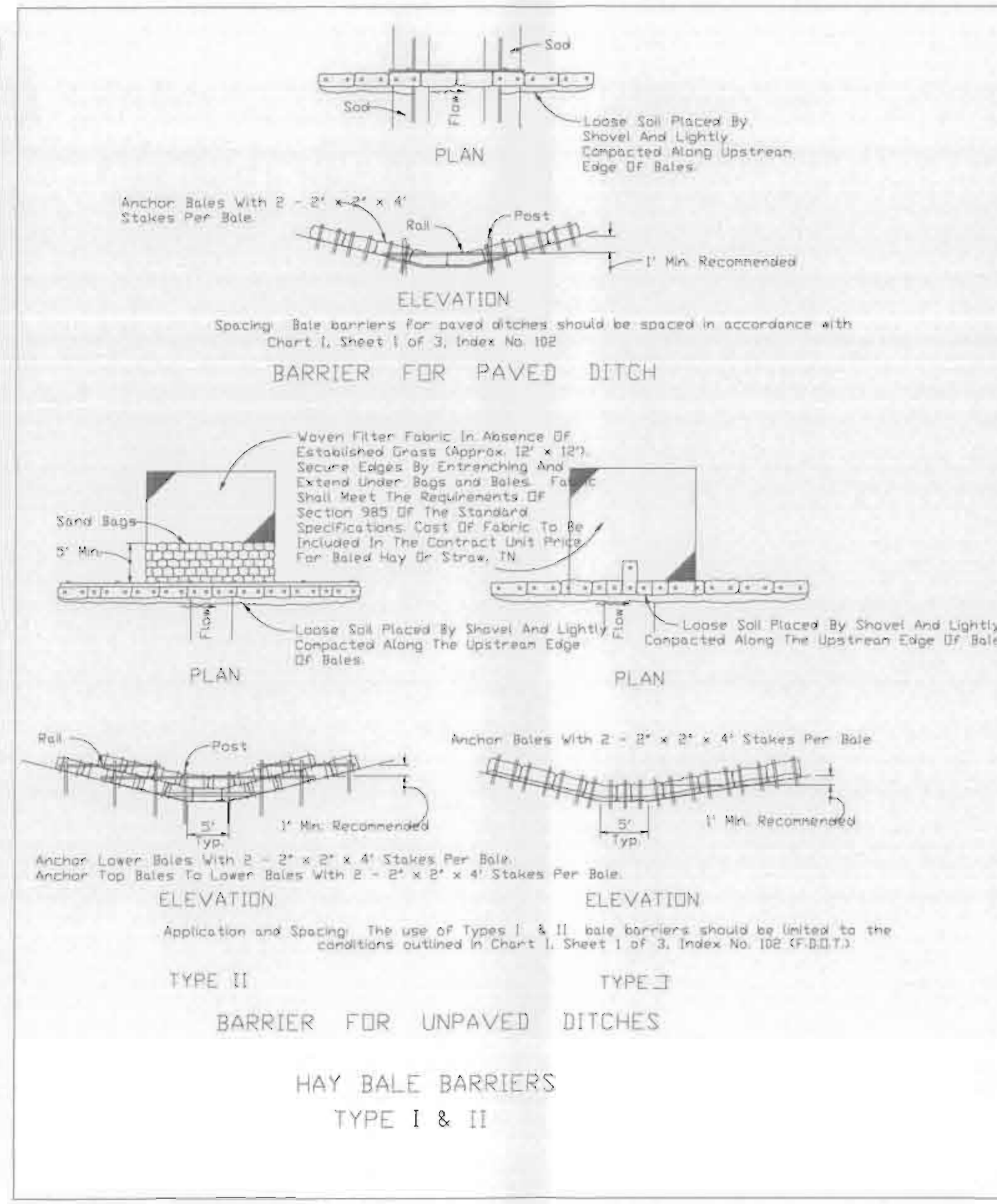
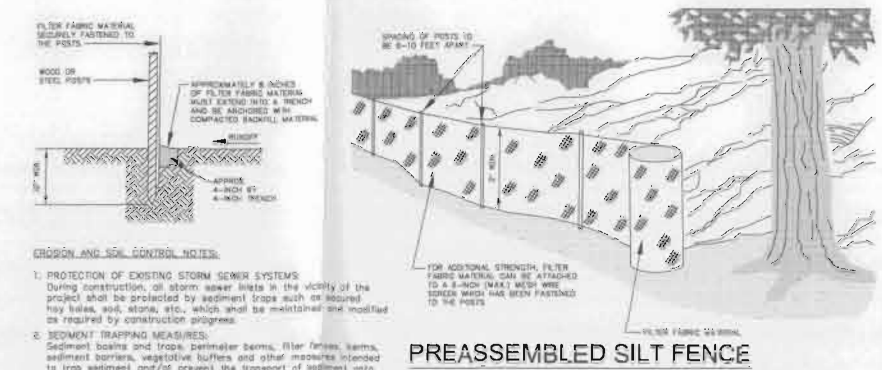
EROSION CONTROL DETAILS 1
6051 KING ROAD
LEVY COUNTY, FLORIDA

PROJECT No. 08112001.001
SHEET E3 of 4

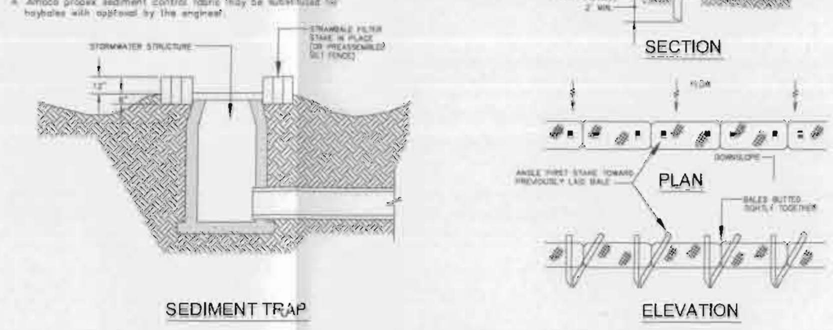






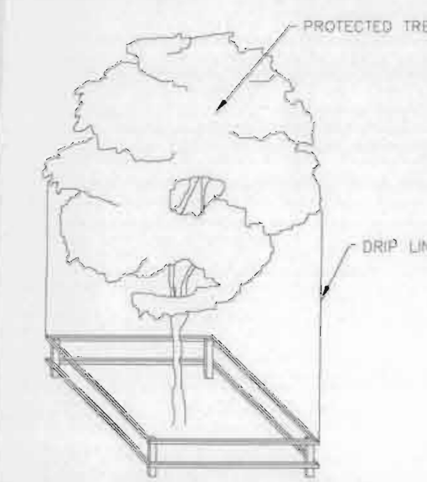
EROSION AND SOIL CONTROL NOTES:

1. PROTECTION OF EXISTING STORM SEWER SYSTEMS: During construction, all storm sewer inlets in the vicinity of the project shall be protected by sediment traps such as secured hay bales, sod, stone, etc., which shall be maintained and modified as required by construction progress.
2. SEDIMENT TRAPPING MEASURES: Sediment basins and traps, perimeter berms, filter fences, berms, sediment barriers, vegetative buffers and other measures intended to trap sediment and/or prevent the transport of sediment onto adjacent properties, or into existing water bodies, must be installed, constructed or, in the case of vegetative buffers, protected from disturbance, as a first step in the land alteration process.
3. MAINTENANCE: All erosion and siltation control devices shall be checked regularly, especially after each rainfall and will be cleaned out and/or repaired as required.
4. Amoco ProPex sediment control fabric may be substituted for haybales with approval by the engineer.



EROSION AND SEDIMENT CONTROLS DETAIL

N.T.S.



PROTECTIVE BARRIER REQUIREMENTS AND SPECIFICATIONS:

1. PROTECTIVE BARRIERS ARE USED DURING LAND ALTERATION AND CONSTRUCTION ACTIVITIES TO PROTECT TREES AND NATURAL AREAS TO BE RETAINED ON A SITE.
2. PROTECTIVE BARRIERS MUST BE ERECTED AROUND TREES TO BE RETAINED WITHIN AN AREA WHERE LAND ALTERATION AND CONSTRUCTION ACTIVITIES WILL OCCUR AS WELL AS ALONG NATURAL AREAS WHERE SUCH AREAS ARE ADJACENT TO PERMITTED LAND ALTERATION AND CONSTRUCTION ACTIVITIES. A PROTECTIVE BARRIER MUST REMAIN IN PLACE UNTIL THE LAND ALTERATION AND CONSTRUCTION ACTIVITIES ARE COMPLETED OR UNTIL COMMENCEMENT OF GRADE FINISHING AND SODDING. NO GROUND DISTURBANCE MUST OCCUR WITHIN THE BARRICADED AREA.
3. TO RESTRICT ACCESS INTO THE AREA WITHIN THE DRIPLINE OF A TREE, A PHYSICAL STRUCTURE NOT LESS THAN FOUR (4) FEET IN HEIGHT, COMPRISED OF WOOD OR OTHER SUITABLE MATERIAL, IS PLACED AROUND THE TREE AT THE DRIP LINE, EXCEPT WHERE LAND ALTERATION OR CONSTRUCTION ACTIVITIES AREA APPROVED WITHIN THE DRIPLINE.
4. UPRIGHT STAKES OF NO LESS THAN 2"x4" @ MAX. 5' O.C. LUMBER, CONNECTED BY HORIZONTAL MEMBERS OF NO LESS THAN 2"x4" LUMBER.

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ENGINEER OF RECORD: AL ANDREANSKY, P.E. FLA. REG. #39387 — DATE SIGNED:

CAD FILE: 08112001CD	SCALE: N/A
DRAWN BY: A.A.	DATE: 02-12-09
CHECKED BY:	DATE:
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EROSION CONTROL DETAILS 2
6502 KING ROAD
LEVY COUNTY, FLORIDA

PROJECT No. 08112001.001
SHEET E4 of 4

TARMAC KING ROAD LIMESTONE MINE, TARMAC AMERICA LLC, DEERFIELD BEACH, FLORIDA

Groundwater Monitoring Plan for Proposed King Road Mine

Prepared for

Tarmac America, LLC,
Levy County, Florida.

Prepared by

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

June 22, 2009

Reinaldo Rolo, Ph.D., P.E.

John E. Garlanger, Ph.D., P.E.
Florida License No. 19782

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

June 22, 2009

GROUNDWATER MONITORING PLAN
King Road Mine
Tarmac America, LLC

1. Objective

The objectives of the proposed groundwater monitoring plan (GWMP) are to ensure compliance with permit conditions related to water quality and water quantity. With respect to water quality, the GWMP describes the tasks that will be performed to document the chemical and physical characteristics of the surface water within the active mine pits, tailings disposal areas, and plant pond; determine the rate, direction of movement, and chemical characteristics of the water seeping away from the mine pits; document the natural background quality of the groundwater, and ensure compliance with permit conditions. With respect to water quantity, the GWMP describes the tasks that will be performed to determine the regional potentiometric surface on a daily basis; map the regional potentiometric surface and establish the target water level in the mine pits on a daily basis, and develop pre-mining and during-mining stage-duration curves for preserved wetlands located within 500 feet of the active mine cut and tailings disposal area. The following plan describes the number, location and depth of the proposed wells, the number, location, and depth of the proposed wetland piezometers/staff gages, the construction details of the proposed wells and piezometers, and the sampling and chemical analysis protocol used to assure accurate water quality results.

This GWMP was been prepared following the guidance for ground water monitoring plan design from the Florida Department of Environmental Protection (2008) and Rule 62-520.600, F.A.C.

2. Location

The proposed mine site is located within Sections 8, 9, 10, 11, 14, 15, 16, 17, 22 and 23 of Township 16 South, Range 16 East in Levy County, Florida. The eastern boundary of the site is approximately 1.2 miles west of US Highway 19 and the southern boundary is approximately 3 miles north of County Road 40. Entrance to the proposed mine site will be through King Road, which intersects US 19 approximately 5.1 miles north of the intersection of US 19 with County Road 40 in Inglis. The location of the proposed mine site is shown in Figure MP-1.

3. Physical and Hydrogeologic Characteristics around the Site

3.1. Topography

The ground surface elevations in the vicinity of the proposed mine vary from a high of approximately 23 feet (NGVD) near the southeast corner of the site to a low of approximately 6 feet (NGVD) near the southwest corner of the project area. The average slope across the site from east to west is approximately 4 feet per mile. The slope from north to south is negligible. A topographic map of the site and surrounding area is provided as Figure MP-2.

3.2. Stratigraphy

The oldest rock formation outcropping at the proposed mine site is the Avon Park Limestone (Vernon, 1951). The Avon Park limestone is Late Middle Eocene in age and was deposited in a marine environment more than 35 million years ago. The upper portion of the Avon Park limestone is a cream to brown, highly fossiliferous, fragmental to pasty limestone that weathers cream to white. Numerous exposures are visible, particularly along the primary stream channels and roadside ditches that pass through the property. The limestone grades to dolomite with increasing depth and the entire formation has been dolomitized since deposition. The Avon Park formation is over 300 feet deep at the proposed mine site.

Underlying the Avon Park limestone is the Lake City limestone of Early Middle Eocene age. The Lake City Limestone is a chalky to granular limestone, containing chert and gypsum in some areas. The Lake City limestone has also been dolomitized throughout its depth. It occurs from about 350 feet to over 1000 feet below land surface at the proposed mine site. However, gypsum and anhydrite deposits within the lower 300 feet of the formation make the lower portion of the Lake City limestone relatively impermeable. The Avon park limestone and the Lake City limestone make up the Avon Park formation. Deeper limestone deposits at the site include the Oldsmar limestone of Lower Eocene age and the Cedar Keys limestone of Paleocene age. These older deposits and the lower portion of the Lake City limestone are not part of the upper Floridan aquifer system. Younger formations, including the Ocala Group limestones of Late Eocene age and the Suwannee limestone of Oligocene age that are typically included in the Floridan aquifer system in central Florida, are not present at the site.

Figure MP-3 is a cross section drawn through the mine site summarizing the topography, physiography and geology described above.

3.3. Drainage

Surface drainage is through intermittent streams that run approximately east-west through the property. These unnamed streams intercept the Floridan aquifer during wet weather periods and act as shallow relief points for groundwater outflow. The streams dry up after the water table drops below the bottom of the stream channel. Drainage divides (watershed boundaries) for the three primary stream channels on the property are shown in Figure MP-4. As shown, most of the surface runoff from the site drains out midway along the south boundary of the site into Section 21, T16S, R16E. Smaller tributaries flow north along the northern site boundary and west along the western site boundary. Surface runoff from the site eventually flows into Withlacoochee Bay primarily through Smith Creek and Demory Creek. A small portion of the site drains to Spring Run which flows north and west of the proposed mine site. The head waters of Spring Run include Little King and Big King Springs[1], both of which are located in Section 6, T16S, R16E northeast of the proposed mine.

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1 Scott, T. M., Guy H. Means, Rebecca P. Meegan, Ryan C. Means, Sam B. Upchurch, R.E. Copeland, James Jones, Tina Roberts and Alan Willet (2004) "Springs of Florida", Bulletin 66, Florida Geological Survey, Tallahassee.

Little King Spring forms a circular spring pool about 35 feet in diameter. There is a limestone opening in the southeast end of the pool at a depth of about 4 feet. This opening is about a foot in length. Big King Spring forms an elliptical spring pool that measures 75 feet north to south and 45 feet east to west and is about 8 feet deep.

Little King or Big King Spring are probably third magnitude springs with flows in the range of 1 to 10 cubic feet per second (cfs). For comparison, the flow of Wekiva Springs, which is a nearby second order spring, has a flow in the range of 20 to 70 cfs. The flow from Rainbow Springs, which is a nearby first magnitude spring, is between 600 and 800 cfs. Two other smaller springs labeled SP-5 and SP-6 in the Figure MP-4) are located in Spring Run and near Demory Creek.

Annual outflow from Lake Rousseau to Withlacoochee Bay is estimated to be 450 cfs.

3.4. Soil Characteristics

The characteristics of the surficial soil on the site influence the quantity of daily evapotranspiration and direct surface runoff. Infiltration during storm events depends upon both soil permeability and available storage. Annual evapotranspiration is higher in soils with higher field capacities and lower wilting points (higher available moisture).

There are two soil types on the proposed mine site: Wekiva fine sand and Waccasassa-Demory complex, flooded[2]. Both of these soil types are within the wetland Hardwood Hammock ecological community. The Wekiva fine sand is a poorly drained, shallow, nearly level soil found primarily on low ridges. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray fine sand about 4 inches thick. The subsurface layer, to a depth of about 9 inches, is grayish brown fine sand. The subsoil, to a depth of about 18 inches, is yellowish brown sandy clay loam overlying limestone bedrock. In most years the seasonal high water table is within 12 inches of the ground surface for 2 to 6 months. The water table is above the surface for 1 to 2 weeks following heavy rains. The water table recedes into joints and cracks in the bedrock during dry periods. Permeability (hydraulic conductivity) is moderately low. Available water capacity is very low. Vegetation is primarily planted pine trees.

The Waccasassa-Demory complex consists of poorly drained, nearly level soils on low ridges. They are rarely to occasionally flooded. The surface soil is a very dark grayish brown sandy clay loam about 2 inches thick. The subsoil is dark yellowish brown sandy clay loam to a depth of 12 inches and overlies limestone bedrock. The seasonal high water table is within a depth of 12 inches for 2 to 6 months in most years and the surface is flooded for 2 to 7 days after heavy rainstorms. Permeability is moderately low and available water capacity is very low. Vegetation on this soil is also primarily planted pine.

A soil map of the proposed mine site and its drainage basin is provided in Figure MP-5.

3.5. Aquifer Properties

The uppermost aquifer at the proposed mine site is the Floridan aquifer. The potentiometric surface of the Floridan aquifer at the mine site is the water table, which varies from at or slightly above the ground surface to about 6 feet below the ground surface. The Floridan aquifer at the

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[2] Slabaugh, J. D., A. O. Jones, W. E. Puckett, & J. N. Schuster (1991) "Soil Survey of Levy County, Florida, USDA NRCS, Washington, D.C.

mine site is comprised of the Avon Park limestone and the upper portions of the Lake City limestone. The thickness of the aquifer at the mine site is approximately 700 feet[3]. The transmissivity of the Floridan aquifer in the vicinity of the mine site is quite variable with reported values between 12,000 ft^2/day and 1,500,000 ft^2/day Seepage in the Floridan aquifer is along joints and bedding planes that have been enlarged through solution weathering (corrosion). Because the quantity of flow increases with distance from the groundwater divide, solution openings get larger and transmissivity increases as the flow approaches a discharge point, e.g., a spring or the coast.

The primary porosity of the upper portion of the Avon Park formation based on the measured dry density of cores is approximately 0.3. Solutioning along discontinuities in the rock, e.g., joints and bedding planes, results in a secondary porosity that controls the seepage velocity in the formation. A secondary porosity of 0.05 to 0.10 was reported by Davis & Katz (2007)[4]. for the Floridan aquifer around the City of Tallahassee well field. The secondary porosity will not affect the mining operations or the requested water quantities. The principal effect of the secondary porosity is to increase the seepage velocity, $v_s = ki/n_e$, where "k" is the hydraulic conductivity, "i" is the hydraulic gradient, and "n_e" is the effective (secondary) porosity. Potential changes in water quality associated with the mining will be detected in the proposed monitoring wells sooner as a result of the secondary porosity

4. Background Groundwater Data

4.1. Water Level Data

Data on the elevation of the potentiometric surface of the Floridan aquifer is available from USGS and SWFWMD maps and wells in the site vicinity. This public data has been combined with site-specific water levels measured by Tarmac in a number of monitoring wells already installed within the mine area, to develop a potentiometric surface map for the proposed mine site and surrounding area during wet and dry periods. These maps are presented in Figures MP-6 and MP-7. The figures show how the water in the Floridan aquifer flows naturally from east to west across the property. It flows from a high point in the water table located northeast of the property to the lowest point in the water table at the Gulf shore west of the property. The slope of the water table across the mine site is approximately 4 feet per mile.

Three of the wells already installed as part of this GWMP (see location in Figures MP-6 and MP-11) are equipped with continuous recorders that measure the water level every four hours. The hydrographs of the data available to date is presented in Figure MP-8.

The water table fluctuates from at or slightly above the ground surface to approximately 6 feet below ground surface, i.e., the seasonal high groundwater level is at the ground surface and the seasonal low is about 5 to 6 feet below the ground surface.

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[3] Grubbs, J. W., and Crandall, C. A. (2007) "Exchanges of Water between the Upper Floridan Aquifer and the Lower Suwannee and Lower Santa Fe Rivers", Florida: U.S. Geological Survey Professional Paper 1656-C.

[4] Davis, J. H., & B. G. Katz (2007) "Hydrogeologic Investigation, Water Chemistry Analysis, and Model Delineation of Contributing Areas for City of Tallahassee Public-Supply Wells, Tallahassee, Florida", U.S. Geological Survey Scientific Investigations Report 2007-5070.

4.2. Springs Groundwater Outflow

A recent survey of groundwater discharges in the proximity of the proposed mine site revealed the presence of a total of six springs (defined as features from which water could be clearly seen to be discharging from the ground). These are depicted in Figure MP-4.

Four of the six (SP-1 through SP-4 in Figure MP-4) were the spring vents comprising Big Spring and Little Springs located approximately ½ to ¾ of a mile to the northeast of the northeastern corner of the proposed Quarry. During the field survey, the observed discharge from the springs was approximately 0.5 cfs from the group of vents comprising Little Springs and approximately 1.2 to 1.5 cfs from Big Spring. Only the largest of the three Little Springs vents was discharging at the time of the survey. These estimates classify the springs as third and fourth magnitude (1 to 10 cfs and 0.2 to 1 cfs) for Big Springs and Little Springs respectively.

The fifth spring (SP-5) was located in Spring Run approximately ¾ of a mile downstream of the upstream most point in the tidal range. An estimated flow of 45 gpm (0.1 cfs) was emanating from this spring, through a small karstified limestone cavity. The sixth one (SP-6) was a rise in Demory Creek approximately 200 feet downstream of a swallet where the entire creek disappeared. The flow could not be estimated but low salinity levels measured in the rise compared to the swallet indicated that the rise was receiving groundwater in addition to the lost stream flow.

More data will start to be collected within 30 days after all permits and approvals for the project are received.

4.3. Groundwater Quality Information

All of the ground water quality data available for the site is provided in Table MP- 1.

Prior to the commencement of mining activities Tarmac will sample the natural groundwater at each well location and provide an updated report showing chronological measurements of the chemical composition of the background water.

4.4. Neighboring wells

The Floridan aquifer is the primary source of potable water in Levy and Citrus counties. Potable wells located in the small community located near the southwest corner of the site are typically about 35 to 40 feet deep with 15-ft to 20-ft deep drop pipes. The public water supply wells for Yankeetown are approximately 80 feet deep and those for Inglis are approximately 230 feet deep. Both the Inglis and Yankeetown public supply wells are approximately 15,500 feet from the southern boundary of the mine site (see Figure MP-9).

Figure MP-9 also shows the location of domestic and public supply wells as recorded in the well construction permits filed at SWFWMD. However, many historical sites do not have actual coordinates recorded in the permit. For these sites, address matching, quarter STR centroids, STR centroids, or county centroids were used by the District as the location.

4.5. Potential mine effects on groundwater levels

Figures MP-10 depicts the drawdown contours corresponding to 0.38 mgd steady-state withdrawals from the plant pond. Also shown are the neighboring wells as described above. The figures show that the drawdown outside of the property boundary limit is expected to be less than 3.5 inches, and that the maximum drawdowns that may be potentially measured at the properties nearest to the mine site are close to 2.5 inches or lower. However, any drawdown effects rapidly dissipate and are predicted to be 1.2 inches or lower at a distance of about 3 miles.

5. Proposed Monitoring Wells

Figure MP-11 shows the location of the proposed monitoring well network for the first ten years of mining. Two monitor wells will be provided at each water quality sampling location; one screened from 15 feet to 35 feet below existing grade (S well) and one screened from 50 to 70 feet below existing grade (D well). Monitor Wells MW-15S and MW-15D will serve as the *Background Wells.* Wells MW-4, MW-6, MW-7, MW-11, MW-12, MW-13 and MW-14 will serve as *Regional Wells*, since according to the predicted drawdown contours, they are sufficiently far from the withdrawal points to ensure minimum drawdown effects (i.e. lower than 2 inches) from the mining operations (see Figure MP-10). Wells MW-17S, MW-17D, MW-18S, MW-18D MW-19S, MW-19D, MW-20S and MW-20D will serve as *Intermediate Wells* (interceptor wells) located within the zone of discharge, and monitor wells MW-2S, MW-2D, MW-7S, MW-7D, MW-16S and 16D will serve as *Compliance Wells.* MW-8, MW-9 and MW-10 are existing salt water monitors screened below 300 feet. MW-1, MW-2, MW-3, and MW-5 are existing monitor wells used to obtain water levels and water quality during permitting.

Tarmac also proposes to install staff gauges in the active mine pit, tailings disposal area and in the plant pond and to install piezometer/staff gauges in preserved wetlands located within 500 feet of the active mine cut and tailings disposal area.

Monitor wells will be constructed in accordance with the FDEP Monitoring Well Design and Construction Guidance Manual, 2008 (included in Appendix 1), using 2-inch diameter, Schedule 40 PVC pipe. The wells will be properly logged and developed under the direct supervision of an engineer or geologist using one of the methods described in the above-referenced Guidance Manual. Each well will have a unique label that distinguishes it from all other wells located at the site. Piezometer/staff gages will also be constructed using 2-inch diameter PVC pipe but will only be installed to a depth of ten to fifteen feet.

All monitoring wells will be installed within 90 days after all permits and approvals for the project are received. Well completion reports will be submitted to the FDEP and SWFWMD within 30 days after all of the proposed wells have been installed. These will include construction details and information about well development following the guidelines in the aforementioned Monitoring Well Manual. Construction details of the wells already installed are included in Appendix 2. All wells will be surveyed by a licensed surveyor to obtain State Plane Coordinates and elevation.

6. Sampling Parameters

The following parameters will be monitored quarterly in the background well, the intermediate wells and the compliance wells once mining operations start.

Field Parameters	Laboratory Parameters
pH	TDS
Conductivity	Sulfate
Temperature	Total Nitrogen
Turbidity	Arsenic
Water level	

The chloride monitors will be sampled and tested annually for the field parameters, TDS, sodium and chloride. Other chemical analyses may be performed if required by FDEP or the Water Management District.

7. Sampling/Monitoring Protocol and Schedule

All samples will be obtained using the procedures described in the FDEP SOP for groundwater samples (FS2200), to ensure that that all samples are representative of water in the aquifer and that they have not been altered or contaminated by the sampling and handling procedures (a copy of the FS2200 SOP is included in Appendix 3).

Laboratory analyses will be performed using an analytical laboratory accredited by the National Environmental Laboratory Accreditation Program (NELAP) and certified by the Florida Department of Health. Sampling will be conducted quarterly.

Groundwater elevations in the regional wells will be monitored and recorded electronically up to six times a day. The wetland staff gauges will be monitored weekly. This data will be analyzed and plotted as a cumulative frequency diagram (stage-duration curve) for each wetland. The stage-duration curve established from the pre-mining data will be used as a baseline for the stage-duration curves developed during mining. Groundwater outflows will be measured monthly in both Little King and Big King Springs.

Groundwater level readings will be taken or downloaded daily at the regional wells (i.e., MW-4, MW-6, MW-7, MW-11, MW-12, MW-13 and MW-14), where the mining effects are predicted to be negligible, and at the active mine pit and tailings disposal area. The data will be taken to the plant offices, reduced, processed and inserted in a computer contouring and 3D surface mapping program (Surfer® or similar) to produce potentiometric maps of background groundwater levels. This information will be used to determine the target water level at the center of the active mine pit and tailings area. Tarmac will adjust the water flow to and from the pit to maintain the water level in the active quarry at or near the target level determined for that day from the regional potentiometric map.

The proposed mine operation is not expected to cause violations of applicable groundwater standards outside of a permitted zone of discharge or surface water standards, i.e., no adverse impacts are expected. Nevertheless, in the unlikely event that a potable well on a neighboring property is impacted by the mining operations, Tarmac will follow a "Good-Neighbor" policy for such wells located within a half mile radius from the property boundary. Under previous agreement with the well owner, Tarmac will record the owner's concern and promptly carry out an investigation to assess the well, the water level and the quality of the groundwater. The results of the assessment will be compared with any available background information to help determine the causes of any impact to the groundwater at the location of concern. Tarmac will volunteer to solve the problems associated with the complaint (e.g. install an adequate water treatment system) if it is determined that the mining operations are the legitimate source of the problem.

8. Reporting

The results of the groundwater monitoring program will be **reported quarterly** and will include a tabulation of the analytical results, chemical composition of the water in the active mine pit and tailings pond, chemical composition of water samples taken from the Background, Interceptor, and Compliance Wells (see sampling parameters described earlier in this document), groundwater elevations, springs outflows, graphical displays of the indicator parameters (e.g., TDS, conductivity, and sulfate) as a function of time, and a discussion of the results. The report will also include a description of the controls established to maintain the background water levels in the active pits and a detailed description of neighboring wells complaints and agreed or established resolution to each of them.

The groundwater chemical composition will be compared with the pre-mining values and the primary and secondary groundwater standards, so as to determine any potential impacts from the mining activities. Deviations in the quality of the groundwater will be investigated (including an assessment of potential causes of the deviation and comparison with previous reports regarding the size, direction and rate of movement) and reported to the district. The report will also include any corrective measures that are proposed to mitigate impacts to groundwater quality.

The chronologic water level measurements from the site wells will be processed, interpreted and combined with any other public data, if available (USGS and SWFWMD), to prepare potentiometric maps that depict changes in the groundwater elevations and potential drawdowns contours. Potentiometric contours will be produced with the aid of a computer contouring and 3D surface mapping program (Surfer® or similar). The results will be discussed in detail, including any remedial measures proposed to mitigate mining impacts.

****

TABLES

Table MP-1
Summary of Water Quality Analyses

Parameter	Units	MCL	Sample I.D.															
			MW-1		MW-2			MW-3			MW-4		MW-5			MW-6	
			10'-20'		10'-20'			9'-19'			10'-20'		10'-20'			10'-20'	
			3/24/2008	11/4/2008	3/22/2007	3/24/2008	11/4/2008	3/22/2007	3/24/2008	11/3/2008	3/24/2008	11/3/2008	3/22/2007	3/24/2008	11/3/2008	3/24/2008	11/3/2008
pH (field)	s.u.	--	6.96	6.60	7.05	6.90	6.90	7.18	6.73	6.50	6.76	6.50	7.06	6.80	6.60	6.72	6.50
pH (lab)	s.u.	--	7.40	--	--	7.20	--	--	7.00	--	--	--	--	7.10	--	7.10	--
Conductivity (field)	µmhos/cm	--	991	980	732	796	618	748	814	778	1025	880	886	923	727	1013	1043
Temperature	°C	--	20.3	22	18.5	20.5	22	18.8	21	23.1	20.2	23.4	18.7	20.3	22.6	20.4	21.9
Turbidity	NTU	--	1.0	1.5	24.0	0.0	2.2	6.8	0.4	1.8	6.5	4.1	7.0	0.2	0.9	0.3	0.6
Calcium	mg/l	--	126	132	164	93	85	128	123	130	97	97	122	119	93	103	105
Magnesium	mg/l	--	38	41	55	23	21	13	12	13	31	32	37	37	28	58	58
Sodium	mg/l	160	11	12	12	11	9	9	9	10	10	10	11	11	7	20	20
Potassium	mg/l	--	0.5	0.7	0.5	0.2	0.5	0.1	0.1	*0.3*	0.1	*0.3*	0.2	0.2	0.5	0.2	*0.3*
Iron	mg/l	0.3	0.05	0.04	1.97	0.99	0.78	1.15	0.86	1.62	2.19	2.45	0.83	0.95	1.05	0.60	0.64
Alkalinity as $CaCO_3$	mg/l	--	360	340	330	350	280	340	360	340	370	340	410	420	310	480	460
Chloride	mg/l	250	20	21	16	21	16	15	19	19	23	32	18	22	12	42	42
Sulfate	mg/l	250	120	150	23	22	16	20	24	27	8.3	12	28	29	33	19	18
Fluoride	mg/l	4	0.4	0.4	0.1	0.3	0.2	0.1	0.2	0.2	0.4	0.3	0.3	0.6	0.6	0.8	0.7
Total Nitrogen	mg/l	10	0.7	0.7	0.7	0.0	0.9	0.8	0.4	0.4	0.3	0.3	0.7	0.3	0.3	0.0	0.3
Total Phosphorous	mg/l	--	0.02	0.02	0.19	0.02	0.04	0.05	0.03	0.04	0.05	0.05	0.02	0.03	0.04	0.02	*0.01*
Silica	mg/l	--	5.2	--	10.0	5.3	--	6.0	6.1	--	3.9	--	10.0	11.0	--	5.8	--
TDS	mg/l	500	610	630	--	400	370	--	460	460	400	430	--	470	410	500	570
Arsenic	µg/l	10	10.3	*4.0*	--	11.6	*4.0*	--	8.5	*4.0*	8.0	*4.0*	--	16.0	7.2	14.9	7.7
Barium	µg/l	2000	15.9	16.6	--	9.7	*11.0*	--	40.7	51.1	17.9	20.0	--	14.9	14.8	22.0	25.0
Cadmium	µg/l	5	*<0.2*	*1.1*	--	*<0.2*	*1.1*	--	*<0.2*	*1.1*	*<0.2*	*1.1*	--	*<0.2*	*1.1*	*<0.2*	*1.1*
Chromium	µg/l	100	*<1.2*	*4.5*	--	*<1.2*	*4.5*	--	*<1.2*	*4.5*	*<1.2*	*4.5*	--	*<1.2*	*4.5*	*<1.2*	*4.5*
Copper	µg/l	1000	--	*2.2*	--	--	*2.2*	--	--	*2.2*	--	*2.2*	--	--	*2.2*		*2.2*
Lead	µg/l	15	*<2.2*	*1.2*	--	*<2.2*	*1.2*	--	*<2.2*	*1.2*	*<2.2*	*1.2*	--	*<2.2*	*1.2*	*<2.2*	*1.2*
Mercury	µg/l	2	*<0.01*	*0.02*	--	*<0.01*	*0.02*	--	*<0.01*	*0.02*	*<0.01*	*0.02*	--	*<0.01*	*0.02*	*<0.01*	*0.02*
Selenium	µg/l	50	3.5	*5.2*	--	4.5	*5.2*	--	3.5	*5.2*	3.5	*5.2*	--	3.5	*5.2*	6.4	*5.2*
Silver	µg/l	100	*<0.4*	*0.2*	--	*<0.4*	*0.2*	--	*<0.4*	*0.2*	*<0.4*	*0.2*	--	*<0.4*	*0.2*	*<0.4*	*0.2*
Zinc	µg/l	5000	*16.0*	*16.0*	--	--	*16.0*	--	--	24.5	--	35.9	--	--	*16.0*	--	*16.0*
Gross Alpha	pCi/l	15	--	4.4	--	*1.9*	2.0	--	2.8	3.3	--	2.8	--	5.3	2.9	--	4.1
Radium 226	pCi/l	5	--	1.3	--	1.8	1.4	--	1.8	1.9	--	1.7	--	1.6	1.4	--	1.7
Radium 228	pCi/l		--	*0.8*	--	*1.0*	*0.7*	--	*1.0*	*0.9*	--	*0.9*	--	*1.0*	*0.9*	--	*0.8*

(cont...)

Table MP-1
Summary of Water Quality Analyses

Parameter	Units	MCL	Sample ID												
			MW-7		MW-8		MW-9		MW-10		Test Pit	Test Pit		Test Pit	Little King Spring
			140'-150'		353'-373'		278'-298'		286'-306'		1.5'	25'		50'	Surface
			3/24/2008	11/4/2008	3/24/2008	11/4/2008	3/24/2008	11/4/2008	3/24/2008	11/3/2008	3/22/2007	3/22/2007	3/24/2008	3/22/2007	3/22/2007
pH (field)	s.u.	--	6.72	6.90	7.07	6.80	7.00	6.90	7.29	6.90	7.95	7.48	6.83	7.49	7.35
pH (lab)	s.u.	--	7.40	--	7.30	--	7.30	--	7.10	--	--	--	8.00	--	--
Conductivity (field)	μmhos/cm	--	2180	2280	2720	2940	2550	2816	2030	2034	568	585	783	578	479
Temperature	°C	--	21.5	21.1	21.6	21.4	21.7	21.5	21.6	22	--	--	20.2	--	--
Turbidity	NTU	--	1.1	1.2	0.2	1.3	2.3	1.1	0.6	0.3	0.9	21.5	0.0	1.6	0.5
Calcium	mg/l	--	388	414	497	554	419	531	386	392	68	83	71	70	66
Magnesium	mg/l	--	92	96	127	141	90	115	69	66	27	34	24	28	18
Sodium	mg/l	160	20	20	30	30	27	25	10	10	7	7	6	7	6
Potassium	mg/l	--	2.6	2.6	6.1	6.7	2.3	2.7	1.9	1.8	0.6	0.8	0.6	0.7	0.4
Iron	mg/l	0.3	--	0.57	--	0.18	--	0.04	--	0.07	0.04	0.14	0.01	0.04	0.09
Alkalinity as $CaCO_3$	mg/l	--	170	170	150	140	170	160	190	180	190	200	220	200	200
Chloride	mg/l	250	34	35	51	53	40	41	15	13	8	8	10	8	9
Sulfate	mg/l	250	1100	1200	1600	1800	1500	1700	1000	1100	86	86	99	86	11
Fluoride	mg/l	4	--	0.8	--	1.6	--	1.0	--	0.7	0.1	0.1	0.3	0.1	0.1
Total Nitrogen	mg/l	10	--	0.3	--	0.8	--	0.5	--	0.4	0.8	1.1	0.0	1.0	1.4
Total Phosphorous	mg/l	--	--	0.04	--	*0.01*	--	*0.01*	--	0.01	0.02	0.04	0.02	0.02	0.05
Silica	mg/l	--	--	--	--	--	--	--	--	--	3.4	5.0	2.4	4.5	4.0
TDS	mg/l	500	2000	2000	2500	2800	2500	2600	1800	1800	--	--	380	--	--
Arsenic	μg/l	10	--	*4.0*	--	*4.0*	--	*4.0*	--	*4.0*	--	--	4.2	--	--
Barium	μg/l	2000	--	*11.0*	--	*11.0*	--	12.8	--	24.5	--	--	8.0	--	--
Cadmium	μg/l	5	--	*1.1*	--	*1.1*	--	*1.1*	--	*1.1*	--	--	*<0.2*	--	--
Chromium	μg/l	100	--	*4.5*	--	*4.5*	--	*4.5*	--	*4.5*	--	--	*<1.2*	--	--
Copper	μg/l	1000	--	2.3	--	3.3	--	2.8	--	*2.2*	--	--	--	--	--
Lead	μg/l	15	--	*1.2*	--	*1.2*	--	*1.2*	--	*1.2*	--	--	*<2.2*	--	--
Mercury	μg/l	2	--	*0.02*	--	*0.02*	--	*0.02*	--	*0.02*	--	--	*<0.01*	--	--
Selenium	μg/l	50	--	*5.2*	--	*5.2*	--	*5.2*	--	*5.2*	--	--	5.4	--	--
Silver	μg/l	100	--	*0.2*	--	*0.2*	--	*0.2*	--	*0.2*	--	--	*<0.4*	--	--
Zinc	μg/l	5000	--	*16.0*	--	20.2	--	*16.0*	--	21.4	--	--	--	--	--
Gross Alpha	pCi/l	15	--	7.7	--	*5.0*	--	*5.4*	--	*4.3*	--	--	3.5	--	--
Radium 226	pCi/l	5	--	1.2	--	0.5	--	2.0	--	1.7	--	--	0.4	--	--
Radium 228	pCi/l		--	*0.8*	--	*0.8*	--	*0.8*	--	*0.8*	--	--	*0.9*	--	--

FIGURES

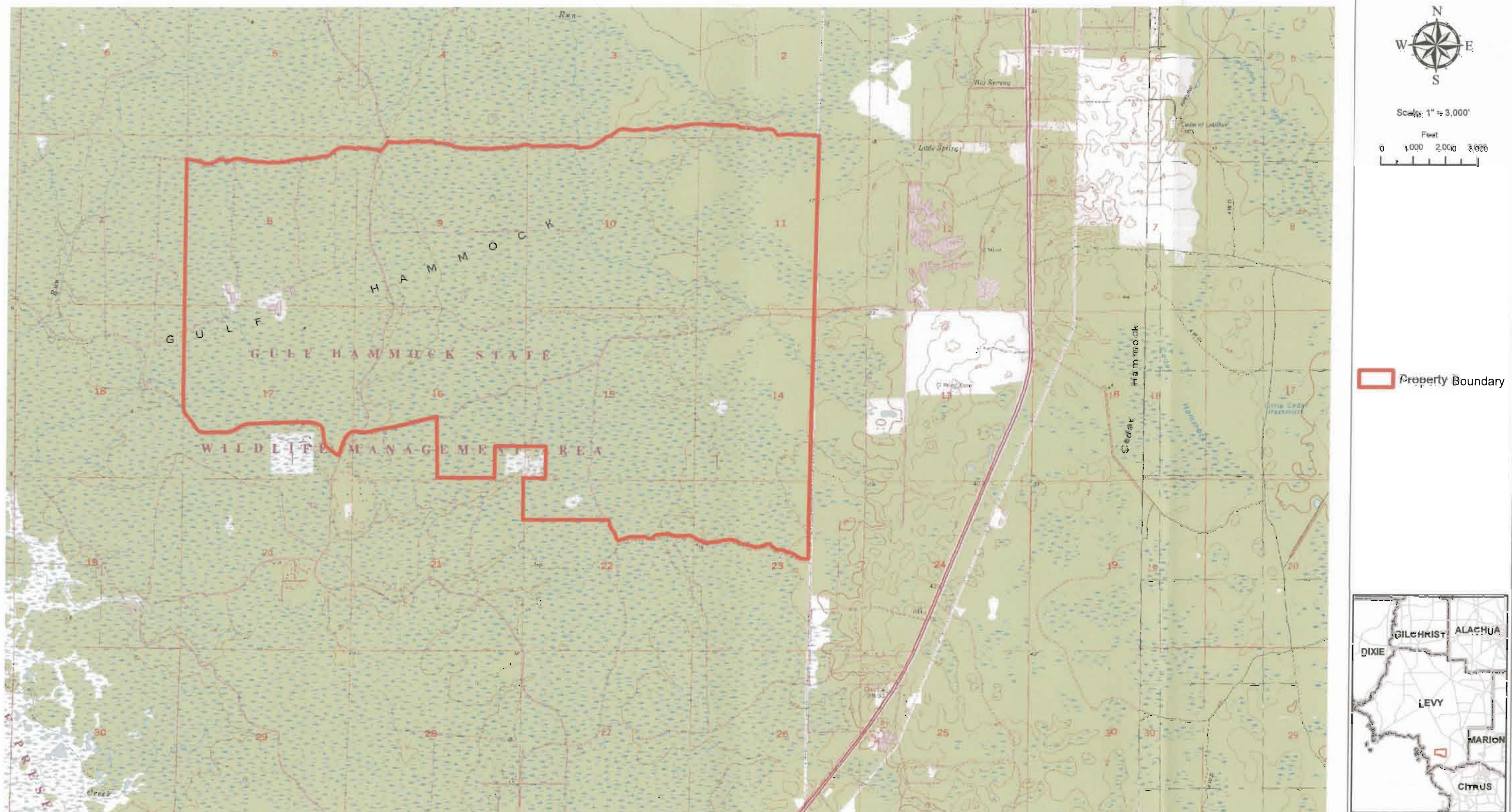

FIGURE MP-1

SITE LOCATION MAP

KING ROAD MINE
TARMAC AMERICA LLC
LEVY COUNTY, FLORIDA

Project: 05-086	Projection: State Plane Florida West	
Prepared: 05-07-09	Horizontal Datum: NAD83	Vertical Datum: N/A
Prepared by: RMC	Modified by:	Modified:
File: \\2005\05-086\ArcGIS_ArcLayouts\20090507\Figure1 Site Location.mxd		

Ardaman & Associates, Inc.
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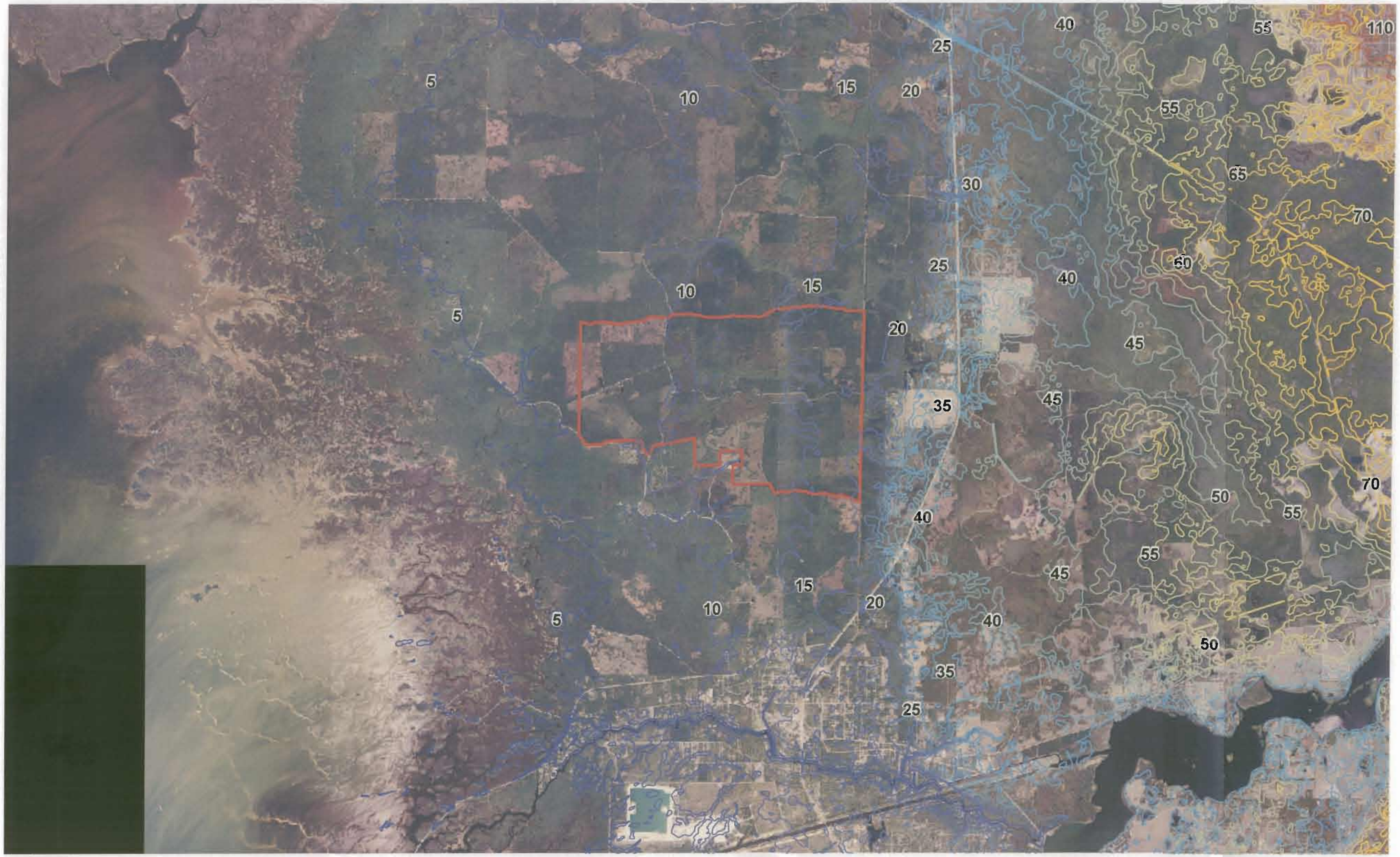
8008 South Orange Avenue
Orlando, Florida 32809



N
W E
S

Scale: 1" = 6,000'
0 3,000 6,000
Feet

Property Boundary

35 Ground Surface Elevation (NGVD)

FIGURE MP-2

USGS TOPOGRAPHIC MAP

KING ROAD MINE
TARMAC AMERICA LLC
LEVY COUNTY, FLORIDA

Project: 05-086	Projection: Florida West Stateplane	
Prepared: 05-07-09	Horizontal Datum: NAD83	Vertical Datum: NGVD29
Prepared by: RMC	Modified by:	Modified:
File: W:\Projects\2005\05-086\ArcGIS_ArcLayouts\20090507\Figure2 Topo Map.mxd		

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Geotechnical, Environmental and Materials Consultants
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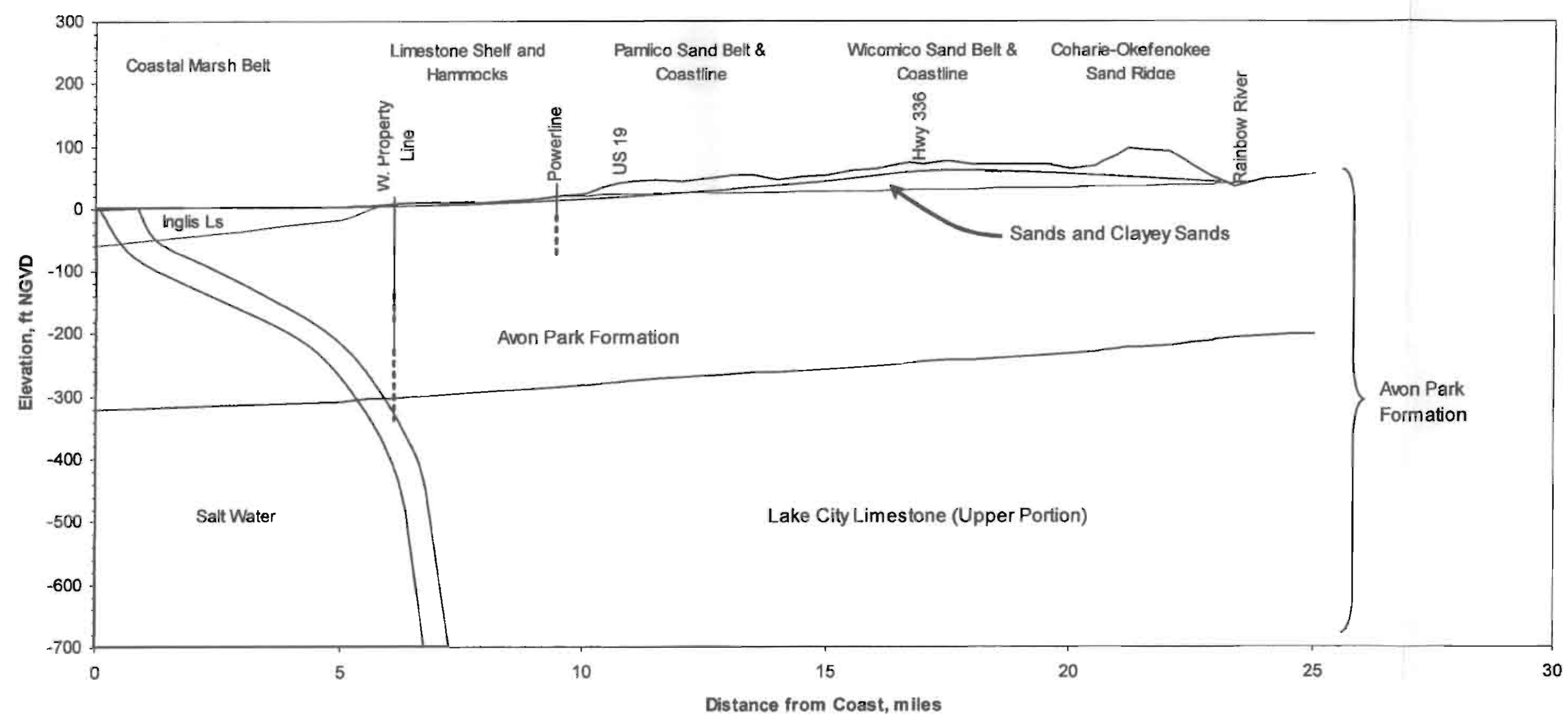
8008 South Orange Avenue
Orlando, Florida 32809

T:\Corporate\05\05-086\Report\Monitoring Plan\FIGURE MP3.dwg 5/18/2009 12:57:22 PM, scott.stevenson



GEOLOGIC CROSS SECTION		
Ardaman & Associates, Inc. Geotechnical, Environmental and Materials Consultants		
KING ROAD MINE TARMAC AMERICA, LLC LEVY COUNTY, FLORIDA		
DRAWN BY: AAD	CHECKED BY:	DATE: 05/13/08
FILE NO. 05-086	APPROVED BY:	FIGURE: MP-3

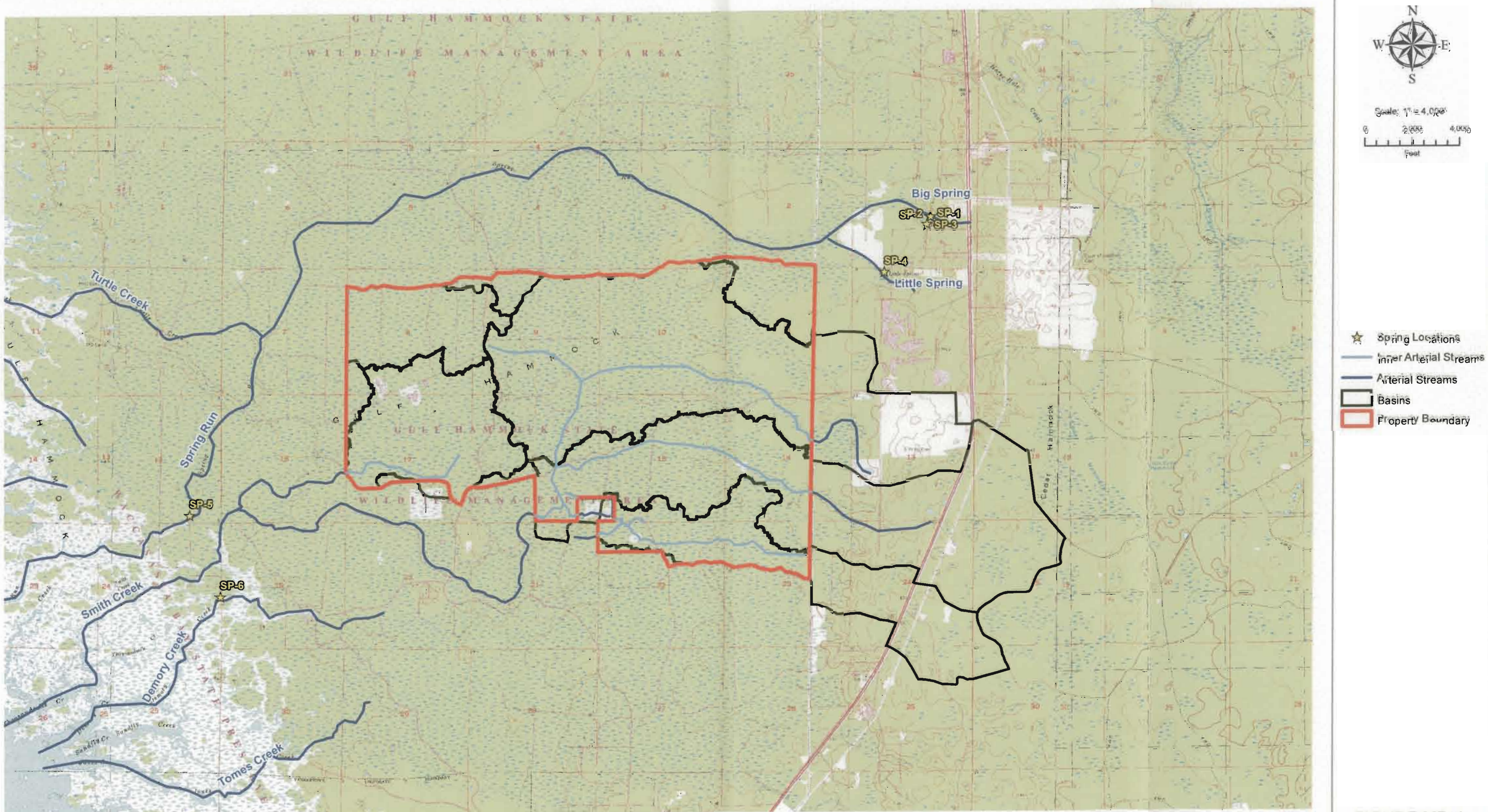


FIGURE MP-4

DRAINAGE BASIN AND SPRINGS LOCATION MAP

KING ROAD MINE
TARMAC AMERICA LLC
LEVY COUNTY, FLORIDA

Project: 05-086	Projection: Florida West Stateplane	
Prepared: 05-07-09	Horizontal Datum: NAD83	Vertical Datum: N/A
Prepared by: RMC	Modified by:	Modified:

File: W:\Projects\2005\05-086\ArcGIS_ArcLayouts\20090507\Figure4 Drainage Map.mxd

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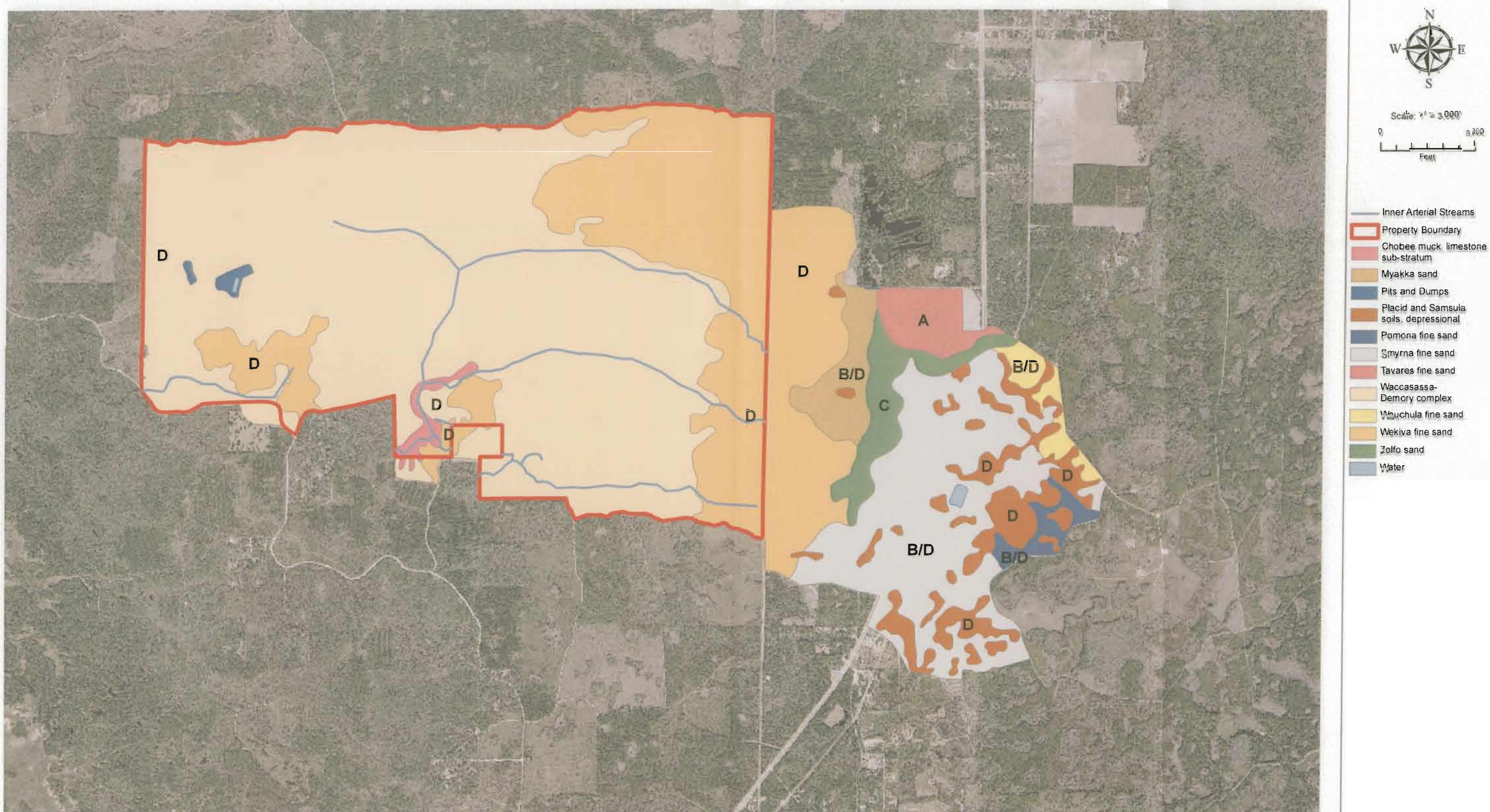

FIGURE MP-5

SOILS MAP

KING ROAD MINE
TARMAC AMERICA LLC
LEVY COUNTY, FLORIDA

Project: 05-086	Projection: Florida West Stateplane	
Prepared: 05-07-09	Horizontal Datum: NAD83	Vertical Datum: N/A
Prepared by: RMC	Modified by:	Modified:
File: W:\Projects\2005\05-086\ArcGIS_ArcLayouts\20090507\Figure5 Soil Map.mxd		

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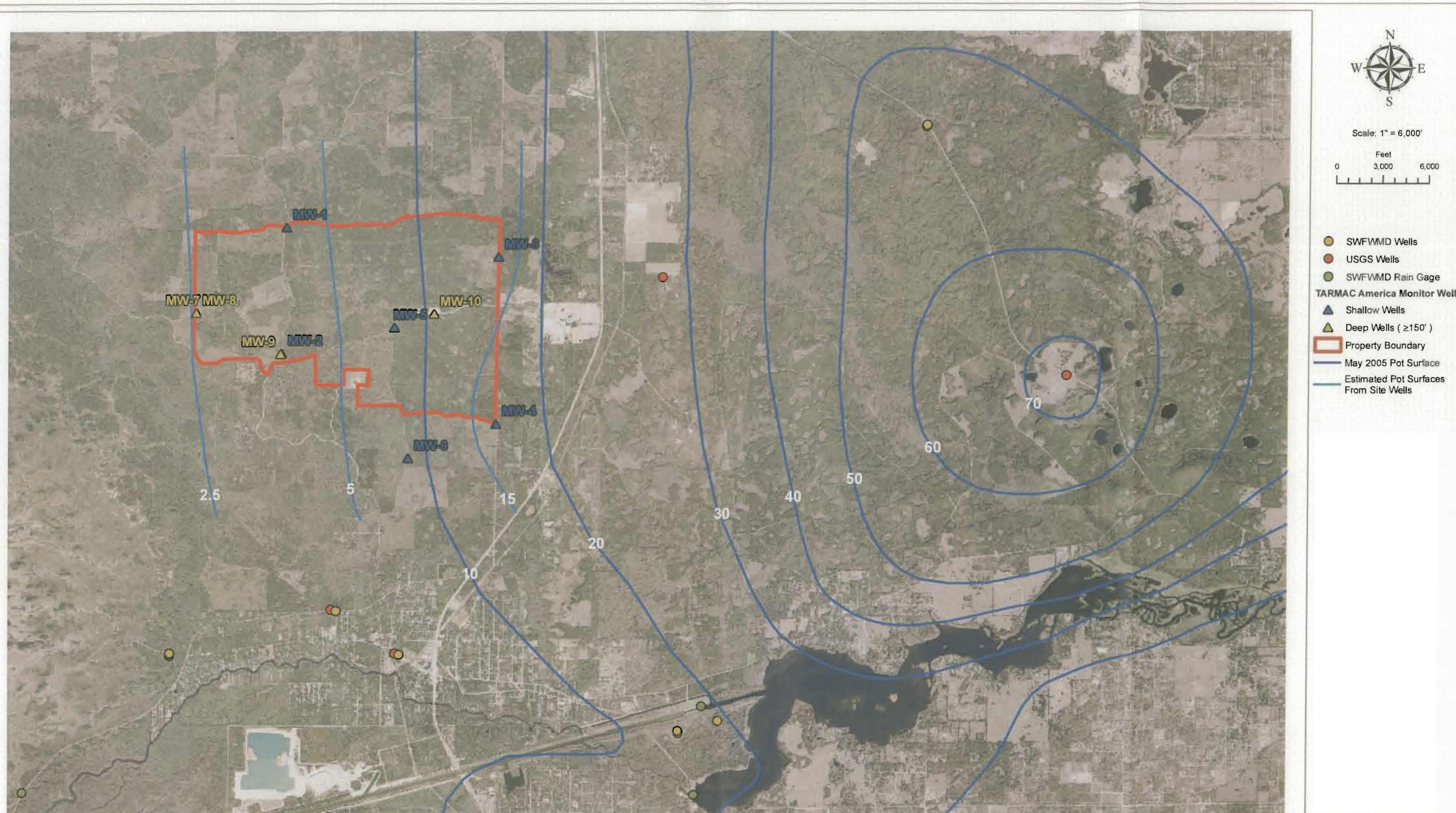

FIGURE MP-6

Disclaimer
Ardaman & Associates used the following data "as is" and makes no representation as to the accuracy of the data:

Imagery	SWFWMD	2008
Pot Surface Contours	USGS/SWFWMD	2007
Project: 05-086	Projection: State Plane Florida West	
Prepared: 06-22-09	Horizontal Datum: NAD83	Vertical Datum: N/A
Prepared by: RMC	Modified by:	Modified:
File: \2005\05-086\ArcGIS_ArcLayouts\20090622\FigureMP-6 Dry Season Pot Surface Map.mxd		

DRY SEASON POTENTIOMETRIC SURFACE

KING ROAD MINE
TARMAC AMERICA LLC
LEVY COUNTY, FLORIDA

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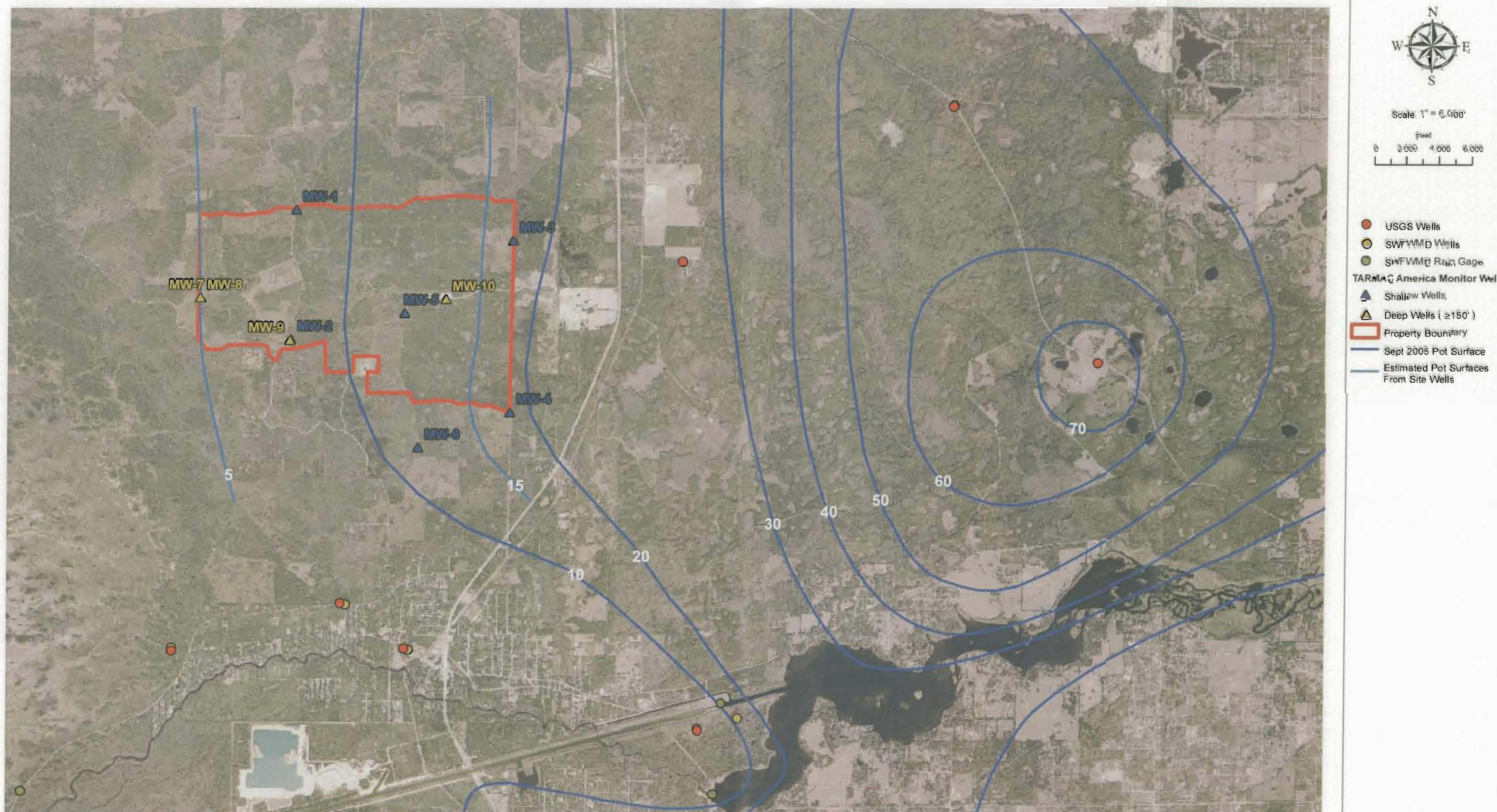

FIGURE MP-7

Disclaimer Ardaman & Associates used the following data "as is" and makes no representation as to the accuracy of the data: Imagery SWFWMD 2008 Pot Surface Contours USGS/SWFWMD 2007		
Project: 05-086	Projection: State Plane Florida West	
Prepared: 06-22-09	Horizontal Datum: NAD83	Vertical Datum: N/A
Prepared by: RMC	Modified by:	Modified:
File: \2005\05-086\ArcGIS_ArcLayouts\20090622\FigureMP-7 Wet Season Pot Surface Map.mxd		

WET SEASON POTENTIOMETRIC SURFACE

KING ROAD MINE
TARMAC AMERICA LLC
LEVY COUNTY, FLORIDA

Ardaman & Associates, Inc.
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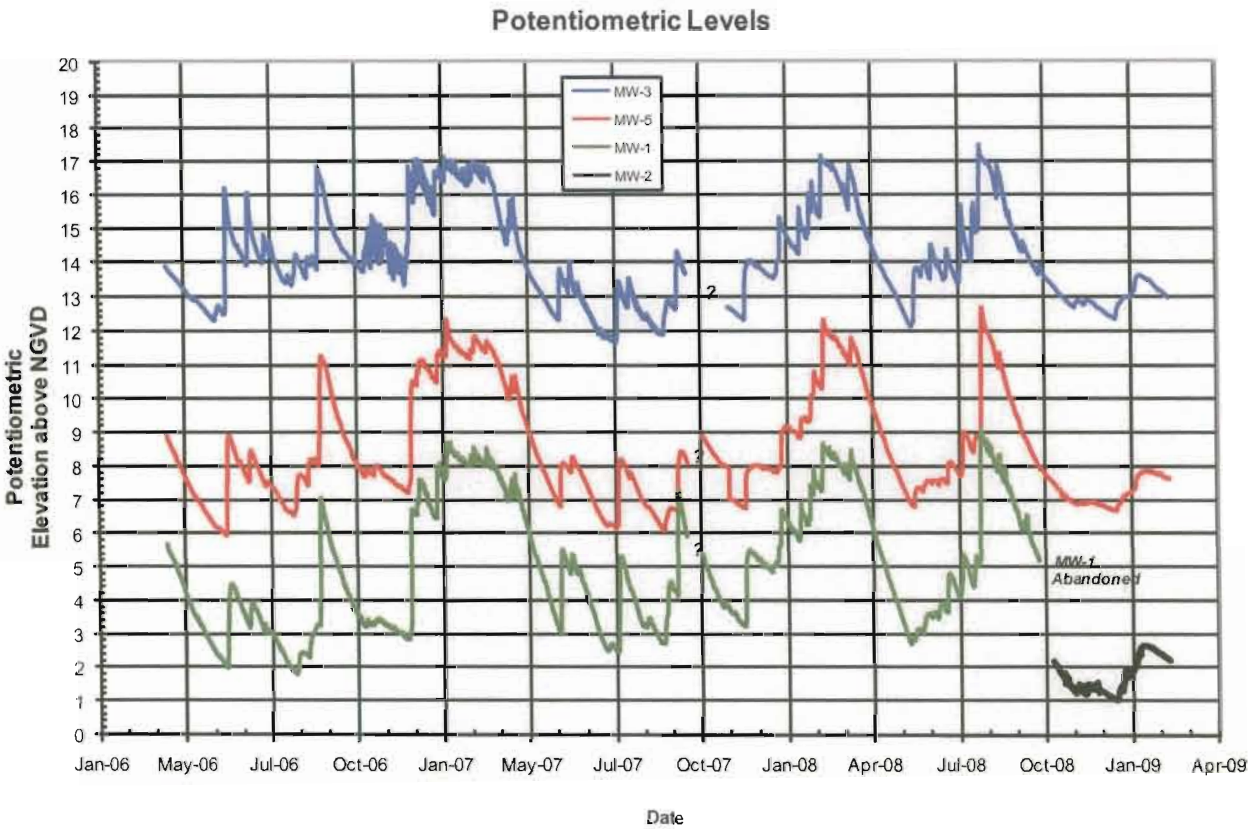
Orlando, Florida 32809



T:\Corporate\05\05-086\Report\Monitoring Plan\FIGURE MP8.dwg 5/18/2009 1:21:29 PM, reinaldo.rolo

MONITOR WELLS READINGS

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KING ROAD MINE
TARMAC AMERICA, LLC
LEVY COUNTY, FLORIDA

DRAWN BY: RRC	CHECKED BY:	DATE: 05/05/09
FILE NO. 05-086	APPROVED BY:	FIGURE: MP--8

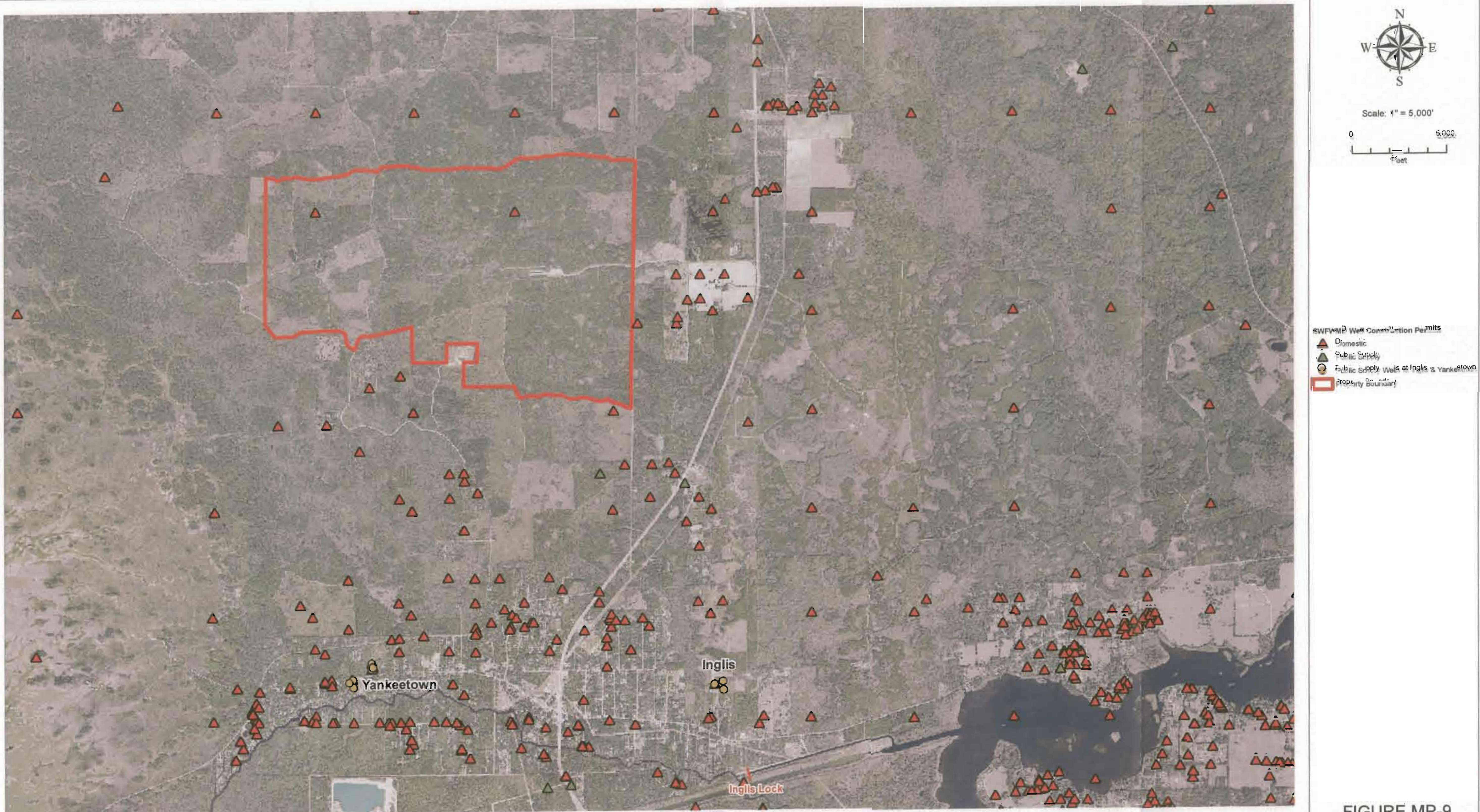

FIGURE MP-9

DOMESTIC & PUBLIC SUPPLY WELLS

KING ROAD MINE
TARMAC AMERICA LLC
LEVY COUNTY, FLORIDA

Project: 05-086	Projection: State Plane Florida West	
Prepared: 05-07-09	Horizontal Datum: NAD83	Vertical Datum: N/A
Prepared by: RMC	Modified by:	Modified:
File: \\ArcGIS_ArcLayouts\20090507\Figure9 Public Supply Wells Map.mxd		

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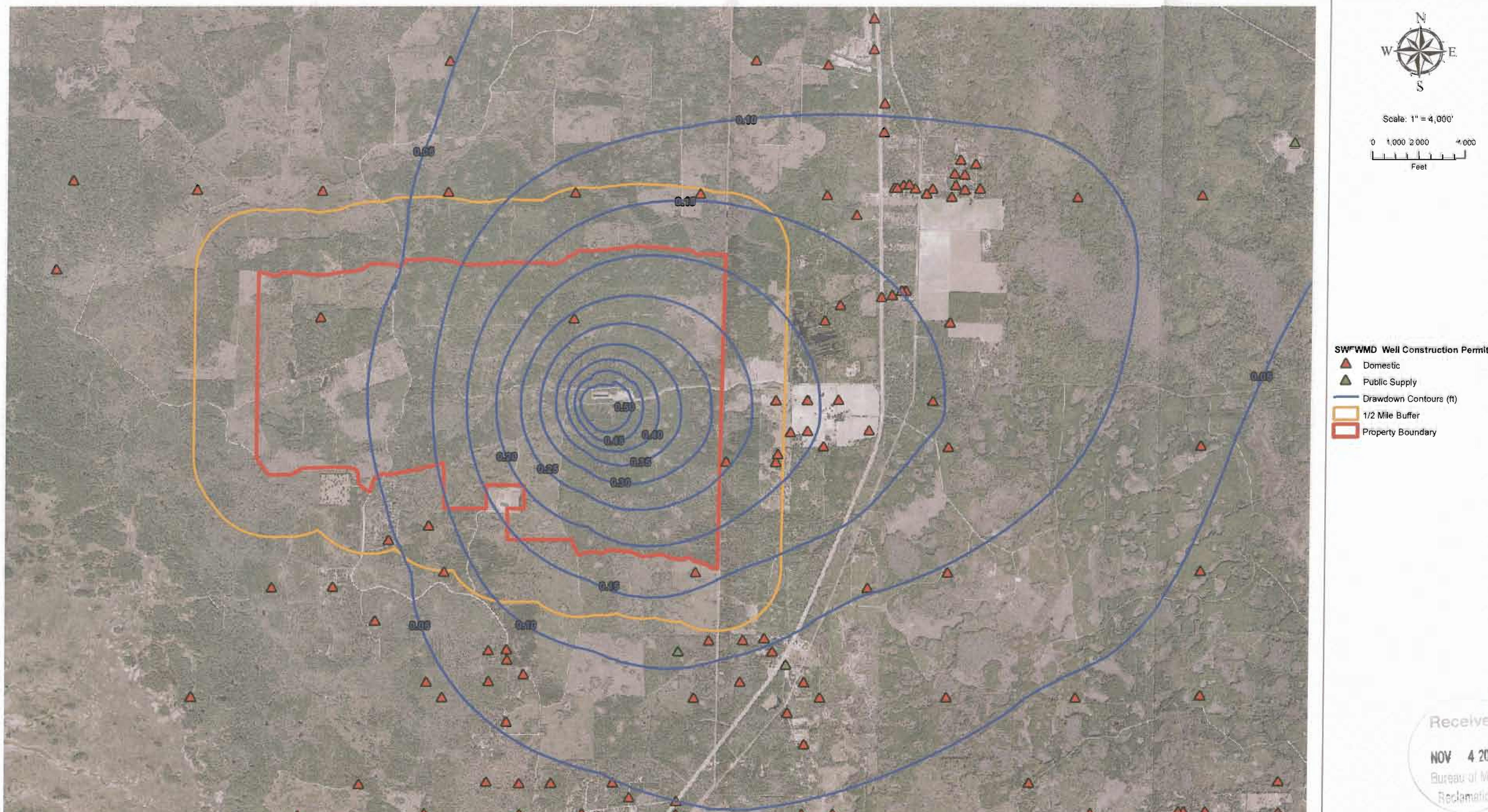

FIGURE MP-10

WELL LOCATIONS AND INCREMENTAL DRAWDOWN CONTOURS WITH 0.38 MGD WITHDRAWAL FROM PLANT POND - STEADY STATE

KING ROAD MINE, TARMAC AMERICA LLC, LEVY COUNTY, FLORIDA

Project: 05-086	Projection: State Plane Florida West	
Prepared: 05-07-09	Horizontal Datum: NAD83	Vertical Datum: N/A
Prepared by: RMC	Modified by:	Modified:
File: \\05-086\ArcGIS_ArcLayouts\20090507\Figure10 PP Drawdown Map.mxd		

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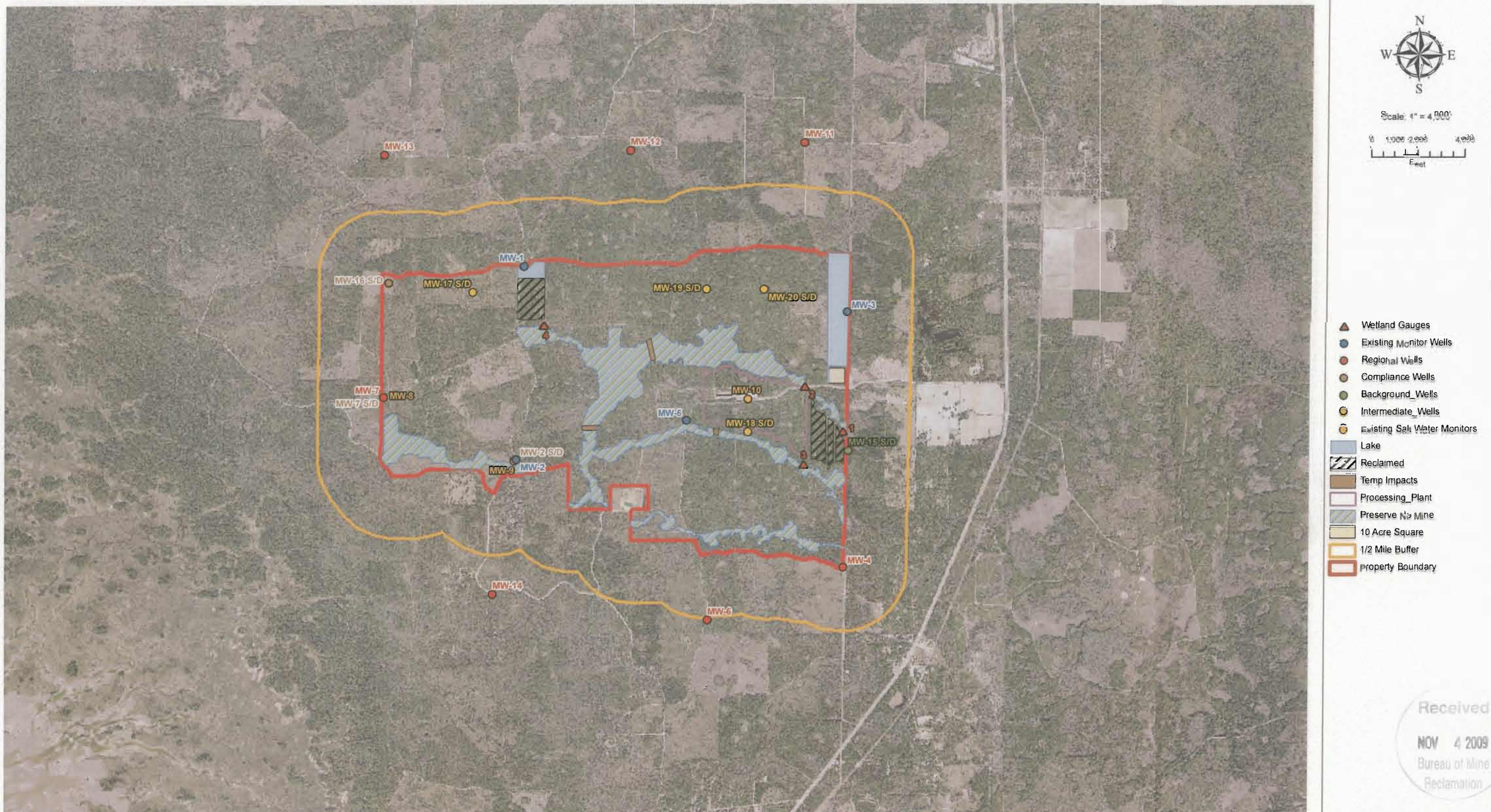

FIGURE MP-11

GROUNDWATER MONITORING PLAN

KING ROAD MINE
TARMAC AMERICA LLC
LEVY COUNTY, FLORIDA

Project: 05-086	Projection: State Plane Florida West	
Prepared: 05-07-09	Horizontal Datum: NAD83	Vertical Datum: N/A
Prepared by: RMC	Modified by: TJC	Modified: 10-2-09
File: \\20091002-June2009 10 year mine plan\Figure11 MW NetworkMap.mxd		

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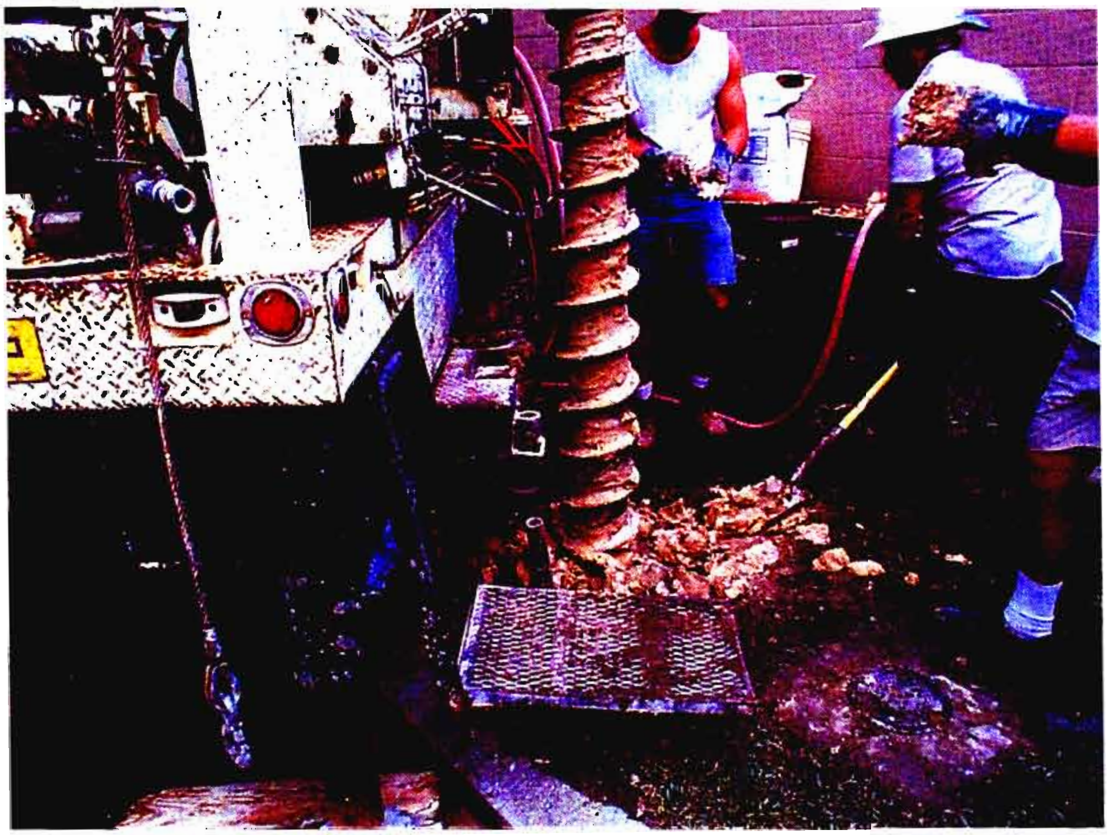
APPENDIX 1

FDEP MONITORING WELL DESIGN

Monitoring Well Design and Construction Guidance Manual



Florida Department of Environmental Protection
Bureau of Water Facilities Regulation
2008

Table of Contents

Tables, Figures and Forms

FIGURES

TABLES

FORMS

Monitoring Well Design and Construction Guidance Manual

1.0 Introduction

1.1 Purpose

This guidance manual provides the protocols and recommended procedures for the proper design and construction of monitoring wells such that quality ground water samples representative of actual conditions can be collected. A properly designed, installed and developed ground water monitoring well provides ground water samples that exhibit the physical and chemical properties of that portion of the aquifer screened by the well.

1.2 Planning

Each monitoring well within a network requires a design that considers project objective, site geology, hydrology, site history, waste site operational history (if applicable), ground water quality, and anticipated contaminants of concern. Prior to monitoring well design and installation, development of a conceptual hydrogeologic framework that identifies potential flow path and the target monitoring zone(s) is necessary. The following site characterization data elements should be utilized to form a conceptual model of the site:

1) Site geology and hydrology;
2) Potential contaminant sources, properties, and distribution;
3) Release mechanism and rates;
4) Fate and transport processes;
5) Current and potential receptors;
6) Potential remedial options; and
7) Other available site characterization data.

1.3 Design Considerations

The design and installation of monitoring wells should consider 1) permanence, 2) installation methodology, and 3) well construction requirements. Many factors must be considered when evaluating each of these three components, utilizing only the most reliable data and information. Monitoring requirements and project timeline and objectives will, in part, determine the need for temporary and/or permanent wells. Site conditions, geological and hydrological settings will influence the types of required drilling method, installation procedures and well construction characteristics. When_designing monitoring wells, the U.S. Environmental Protection Agency (USEPA) document, *Environmental Investigations Standard Operating Procedure and Quality Assurance Manual*, Section 6, (2001), recommends the following considerations:

1) Short- and long-term objectives,
2) Purpose(s) of the well(s),
3) Probable duration of the monitoring program,
4) Contaminants likely to be monitored,
5) Types of well construction materials to be used,
6) Surface and subsurface geologic conditions,
7) Properties of the aquifer(s) to be monitored,
8) Well screen placement,
9) General site conditions, and
10) Potential site health and safety hazards.

A ground water monitoring and well installation plan can be developed from these data and information. The plan should address all phases of the installation and monitoring program, including site access, health and safety, drilling techniques, decontamination protocol, well installation, well development, well abandonment, sample collection, waste management, and site surveys.

2.0 Drilling Operations

A driller, water well contractor or water well consultant should ensure that all materials and equipment for drilling and installing any given well are available and onsite prior to commencing drilling activities. For long schedules, it should be ensured that the above-mentioned materials needed for at least 2 days of operation are onsite prior to drilling. Site-specific factors that preclude the availability of needed secure storage areas should be identified and resolved in a ground water monitoring plan.

2.1 Logistics

2.1.1 Permitting, Licenses and Registration

The driller, water well contractor, and/or water well consultant is responsible for identifying all applicable permits, licenses, professional registration, rights-of-entry, and applicable State and local regulatory procedures for drilling, well installation, and well abandonment (to include any requirements for the submission of well logs, samples, etc). Acquisition and submittal of these items to State or local authorities should be coordinated between the driller, contactor, and/or consultant, with the responsibilities of each specified in a ground water monitoring plan and subcontract agreements.

2.1.2 Access and Security

The need for any rights-of-entry should be specified in a ground water monitoring plan along with the organization(s) responsible for their acquisition. The driller or water well contractor shall comply with all security policies at a project site. The driller is responsible for securing his own equipment, and should prepare for any special situations identified in a ground water monitoring plan.

2.1.3 Site Safety

Safety precautions should be implemented for any drilling operation and in particular for activities related to the investigation and monitoring of hazardous and potentially hazardous materials sites. When appropriate, a site health and safety plan should be developed and followed during all drilling activities. The driller or designated safety person should be responsible for the safety of the drilling team during all drilling activities. All personnel involved with drilling activities should be qualified in proper drilling and safety procedures. Guidance related to drilling activities is available in Occupational Safety and Health Administration (OSHA) documents, particularly 29 CFR 1910.120 and 29, CFR 1926.

2.1.4 Site Preparation, Well Installation and Restoration

2.1.4.1 Site Reconnaissance
Site visits should be made prior to drilling activities to evaluate physical conditions and equipment and logistical requirements. Particular interests include site access, proximal utilities, barriers and hindrances to movement of equipment, potential hazards, and geographical locations of support facilities (i.e., drilling supplies, drilling water, sample shipment facilities, and emergency facilities). Site modifications and adaptations to drilling plans should be made accordingly and as is practical.

2.1.4.2 Utility Clearances
Prior to drilling or excavation activities, the driller, water well contractor, water well consultant, or appropriate person must coordinate with the appropriate utility locator services to identify and locate all underground utilities and other subsurface features that could obstruct or be damaged by such activities. Digging permits may be required and a locator service given notice to allow adequate time to locate and mark utilities prior to any onsite operations. Overhead utilities and structures should also be considered with respect to clearance space required by the drilling equipment.

As appropriate, boreholes should be advanced to a minimum of two to three feet below land surface (or more as required or needed) with a hand auger or post hole digger. The diameter of the manually advanced borehole should be at least as wide as the largest auger or other equipment to be placed within the borehole.

2.1.4.3 Equipment
The driller should arrive at the site with all the necessary personnel, supplies, and equipment to complete the specified tasks described in Chapter 3.0, Well Design and Material Specifications. All equipment must have been properly inspected, serviced, maintained, and tested prior to relocation to the site to ensure that it is in proper working condition, and to minimize the potential for delays. Sufficient replacement or repair equipment and supplies shall be kept on hand or readily available in the event of mechanical failures or malfunctions.

2.1.4.4 Borehole Requirements
The borehole shall be drilled and constructed so as to 1) allow for the proper construction of the monitoring well, 2) properly monitor the parameters of interest and 3) meet the objectives of the ground water monitoring program. Generally, monitored parameters occur in ground water as aqueous (those dissolved in the ground water) non-aqueous phase liquids (NAPLS) and particulate matter (colloid-sized particles that may be inert or biologically active. The borehole must

allow for the proper placement of the well screen so as to allow for monitoring of parameters based upon chemical and physical characteristics.

The borehole shall be drilled as close to vertical as possible. Slanted boreholes are not acceptable unless specified in the design. The depth and volume of the borehole, including any overdrilling if applicable, should be calculated such that appropriate quantities of materials are procured and installed during well construction. Table A-1 Appendix A, provides several typical volume calculations for use during boring and well installation. If the well boring is drilled too deeply, it should be backfilled to the desired installation depth with pure bentonite pellets (for fine-grained aquifers) or filter sand (for coarse-grained aquifers). If bentonite pellets are used, a minimum of 1 foot of filter sand should be placed above the bentonite prior to screen installation. This will protect the bottom of the well screen from bentonite intrusion.

The selected hollow-stem augers, temporary casing, or permanent surface casing should have an inside diameter (I.D.) sufficient to allow the installation of the prescribed diameter screen and well riser plus annular space for a tremie pipe through which to place the filter pack and annular sealants. It is advantageous that the I.D. of the drill casing or hollow-stem auger be at least 4 inches greater than the outside diameter (O.D.) of the centered well riser and screen. This increased borehole size will allow placement of a wider filter pack, annular seal, and annular grout. This will also allow the use of a 1.5-inch O.D. tremie pipe for emplacing well construction materials. However, larger diameter augers will also result in additional drilling time, increased cost of well installation, and increased production of investigations-derived waste (IDW), including drill cuttings and fluids removed from the borehole and monitoring well. Depending upon the project objectives and regulatory requirements, the advantages must be weighed against the disadvantages such that the project objectives are met with the minimum cost incurred.

When telescoping outer casings (one casing within another), the specified annulus may not be practical or functional. In this case, a lesser spacing allowing for proper grout placement may be acceptable, depending on site specifics and project objectives.

A separate pilot boring should be advanced if significant drilling beyond the desired screen interval(s) is required (as for defining stratigraphy or locating a zone of interest). Upon completion of the exploration, the pilot boring should be properly abandoned and a new boring advanced for the placement of a monitoring well. ASTM Standard D5299 provides guidance for abandonment of boreholes and ground water wells.

2.1.4.5 Well Installation Schedule

Ideally, well installation should begin immediately after boring completion. Once installation has begun, no breaks in the installation process should be made until the well has been grouted and temporary drill casing removed. This includes interruptions due to the end of the driller's work shift, weekend, or holiday. This does not include the time required for proper hydration of the bentonite seal.

Unscheduled delays may occur, including personal injury, equipment breakdowns, or sudden inclement weather. Scheduled delays may also occur such as the time required for downhole geophysical surveys. In such cases, the type of delay, beginning and ending times of the delay, and the delay interval should be noted on a well construction diagram (Section 3.2). In instances where a cased hole into bedrock is to be partially developed prior to well insertion, well installation should begin within 12 hours after this initial development.

Temporary casing and hollow-stem augers may be withdrawn from the boring prior to well installation if the potential for cross-contamination is not likely and if the borehole wall will not slough during the time required for well installation. This procedure is usually successful in firm clays and in bedrock that is not intensely fractured or highly weathered.

Any materials, especially soils, blocking the bottom of the drill casing or hollow-stem auger should be dislodged and removed from the casing prior to well insertion. The use of a bottom plug, dove-tail bit, or internal drill rods during drilling may be beneficial for reducing and/or eliminating soil blocking and heaving sands. If used, the composition of any disposable bottom plug (such as stainless steel or wooden plug) must be appropriate considering the analytical parameters of interest.

2.1.4.6 Restoration

All work areas around the wells and/or borings should be restored to a condition equivalent to that prior to installation. This includes the disposal of borehole cuttings and rut repair. IDW, i.e., borehole cuttings, discarded samples, drilling fluids, equipment cleaning residue, water removed from a well during installation, development, or aquifer testing, and personal protection equipment (PPE) must be disposed of in a manner consistent with a waste management plan and all applicable Federal, State, and local regulations and ordinances. Restoration, disposal procedures, and responsibilities should be discussed in detail in a ground water monitoring plan.

2.2 Oversight

A site geologist, engineer or geotechnical engineer, suitably qualified to conduct hydrogeologic investigations should be present at each operating drill rig. The site geologist, engineer or geotechnical engineer must be familiar with all State, Federal, and local laws, regulations, and requirements pertaining to the geologist's, engineer's or geotechnical engineer's duties and responsibilities. The geologist, engineer or geotechnical engineer shall be responsible for logging, acquisition, and shipment of samples, boring logs and well construction diagrams, and recording the well installation and abandonment procedures. Ideally, each site geologist, engineer or geotechnical engineer should be responsible for only one operating rig. The geologist, engineer or geotechnical engineer should have onsite sufficient tools, forms, and professional equipment in operable condition to efficiently perform the duties as outlined in this manual or other relevant project documents.

2.3 Drilling Methodology

2.3.1 Objectives

The objectives of selecting a drilling method for monitoring well installation are to use that technique which:

1) Provides representative data and samples consistent with project objectives;

2) Eliminates or minimizes the potential for subsurface contamination and/or cross-contamination; and

3) Minimizes drilling costs.

2.3.2 Methods

There are several drilling methods that can be used for site characterization and to install acceptable monitoring wells. Additional information and details on the various drilling methods can be found in Driscoll (1986), U.S. Army Corp of Engineers (USCOE) (1998), National Ground Water Association (1998) and Section 6.3 of the EPA manual, as well as numerous other sources. In addition, ASTM International maintains standards, ASTM D6286 and ASTM D5092, for selection of drilling methods for site characterization and the design and installation of ground water monitoring wells, respectively, as well as method-specific standards for many drilling techniques. The following drilling methods are most typically used in the installation of monitoring wells:

1) Hollow-stem augers;

2) Solid-stem augers;

3) Water/mud rotary;

4) Air/pneumatic rotary;

5) Sonic;

6) Direct Push; and

7) Casing or cable

The drilling method must be specified and described in a ground water monitoring plan. The plan should also contain detailed rationale for the selection of the specified method including, but not limited to, how the anticipated drilling conditions are accounted for by the selected method and how cross-contamination would be minimized.

2.3.3 Concerns Related to Drilling Methodology

Dry methods: Dry methods advance a boring using purely mechanical means without the aid of an aqueous or pneumatic drilling "fluid" for cuttings removal, bit cooling, or borehole stabilization. In this way, the chemical interaction with the subsurface is minimized, though not eliminated. Local aeration and heating of the borehole wall, for example, may occur simply by the removal of compacted or confining soil or rock (USCOE, 1998).

Aqueous methods: Aqueous drilling methods use fluid, usually either approved water or water and bentonite slurry, for cuttings removal, bit cooling, and borehole stabilization (USCOE, 1998). For environmental work, the use of these materials increases the potential to add a new contaminant or suite of contaminants to the subsurface environment adjacent to the boring. Even the removal of one or more volumes of water equal to the volume lost during drilling will not remove all of the lost fluid. The level of effort to be expended upon well development is directly related to the amount of fluid lost during drilling: a minimum of five times the volume lost should be removed during development. Therefore, the less fluid loss, the less the development effort, time, and cost.

Air/Pneumatic Rotary methods: Air/pneumatic rotary methods involve the use of compressed air to evacuate cuttings. Potential problems with this method include the introduction of pollutants such as hydrocarbons into the subsurface from the compressed air source, volatilization/stripping of contaminants from the subsurface, and mobilization of dust and/or vapor phase components to create a potential breathing hazard. However, this method may be advantageous in materials where circulation of other fluids cannot be maintained. Appropriate dust collection/suppression equipment must be provided. Wells installed using this method must be developed until the water becomes clear and free of sediment.

Sonic methods: The fundamental difference between the sonic drilling method and other rotary-type methods is that it employs a combination of rotation and high-frequency vibration for drill bit penetration. This method is suitable for use in either consolidated or unconsolidated materials. The advantages of this technology are rapid drilling rates and relatively minimal amounts of waste generated. Disadvantages include potential disturbance to samples collected for geotechnical analyses and volatilization of chemical samples.

Direct push Technologies: Direct push technologies (DPT) utilize equipment that push or drive steel rods into the ground. They allow cost-effective, rapid sampling and data collection from unconsolidated soils and sediments. A tremendous variety of equipment is available, particularly in the type of attachments used at the end of rods to collect samples and data. These attachments may collect soil, soil gas, or ground water samples; they may conduct *in situ* analysis of contaminants; or they may collect geophysical data that are continuously logged as the DPT rods are advanced. Continuous logs of subsurface conditions are particularly valuable because they help to develop a three-dimensional conceptual site model.

Tables 1 and 2 provide a brief description and comparison of some common drilling methods.

Table 1: Drilling Methods for Monitoring Wells

Method and ASTM Standard	Drilling Principle	Depth Limitation Feet (meters)	Advantages	Disadvantages
Auger, Hollow-Stem and Solid-Stem ASTM D5784, ASTM D1452	Successive 5-foot (1.5m) flights of spiral-shaped drill stem are rotated into the ground to create a borehole. Cuttings are brought to the surface by the rotation of the auger flights	150 (45)	• May be inexpensive •Fairly simple, quick setup time and moderately fast operation • Rigs are highly mobile and can reach most drilling sites •No drilling fluid or lubricants used, eliminating contamination from additives • Can be used to avoid hole caving • Hollow-stem allows formation water to be sampled during drilling via screened auger or advancing a well point ahead of the augers • Small-diameter wells can be built inside hollow-stem flights • Hollow-stem allows the collection of split-spoon samples, continuous sampling possible •Natural gamma-ray logging can be done inside hollow-stem flights	• Limited to unconsolidated or semiconsolidated (weathered rock) materials Compact, gravelly materials may be hard to penetrate • Possible problems controlling heaving sands • Rips and smears borehole wall, creating problems with connecting to the aquifer during well development •Well points yields low rates of water • Small diameter well screen may be hard to develop. Screen may become clogged if thick clays are penetrated • May not be able to run a complete suite of geophysical logs

Method and ASTM Standard	Drilling Principle	Depth Limitation Feet (meters)	Advantages	Disadvantages
Water/Mud Rotary (Hydraulic Rotary) ASTM D5783	Rotating bit breaks formation; cuttings are brought to the surface by a circulation fluid (mud). Mud (which should be contaminant-free water and bentonite without additives) is forced down the interior of the drill stem, out the bit, and up the annulus between the drill stem and borehole wall. Cuttings are removed by settling in a mud pit at the ground surface and the mud is circulated back down the drill stem.	5,000+ (1,500+)	•Drilling is fairly rapid in all types of geologic materials, unconsolidated and consolidated •Borehole may stay open from formation of a mud wall on the sides of borehole by the circulating mud • Geologic cores can be collected • A complete suite of geophysical logs can be obtained in the open borehole • Many options for well construction. Can use casing-advancement drilling method, or casing may not be required • Smaller rigs can reach most drilling sites •Borehole can be gravel packed and easily grouted	•May be expensive, requires experienced driller and a fair amount of peripheral equipment; overburden casing required • Drilling fluids mix with formation water, may contaminate and can be difficult to remove. •Completed well may be difficult to develop, especially small diameter wells, due to mud cake invading the formation and is difficult to remove • Geological logging by visual inspection is only fair, can miss strata and composition •Location of water-bearing zones during drilling may be difficult to detect •Drilling fluid circulation is often lost and difficult to maintain in fractured rock, and gravel or cavernous zones • Difficult drilling in boulder and cobble zones • Circulation of drilling mud through a contaminated zone can create a hazard a ground surface and cross-contaminate clean zones •Organic drilling fluids can interfere with bacterial and/or organic-related analyses and are not allowed; bentonitic fluids with metal analyses, but may be necessary.

Method and ASTM Standard	Drilling Principle	Depth Limitation Feet (meters)	Advantages	Disadvantages
Reverse Rotary ASTM D5781	Similar to hydraulic rotary, except the drilling fluid is circulated down the borehole outside the drill stem and is pumped up the inside; the reverse of the usual rotary method. Water is used as the drilling fluid and the borehole is kept open by the hydrostatic pressure of the water standing in the borehole.	5,000+ (1,500+)	• Drilling is readily accomplished in most geologic materials, unconsolidated and consolidated • Drilling is relatively fast and can be used for drilling large diameter boreholes •Large borehole diameter facilitates ease of well installation • Geophysical logs can be run prior to installation of well • Creates a "clean" borehole, not contaminated by introduced fluids • Split-spoon sampling possible	• May be expensive, requires experienced driller and a fair amount of peripheral equipment; overburden casing required • May be difficult to drill in boulder, cobble or cavernous zones • The addition of drilling lubricants may be required: lubricants interfere with borehole wall composition and water chemistry • Cross-contamination from circulating water is likely • A large water supply is needed to maintain hydrostatic pressure in deep holes and when highly conductive formations are encountered •Geologic samples brought to surface are generally of poor quality; fine-grained materials are washed out
Air Rotary ASTM D5782	Similar to hydraulic rotary. Air is used as the primary drilling "fluid" as opposed to mud or water	5,000+ (1,500+)	• Can be used in all geologic formations; most successfully in highly fractured environments • Useful at almost any depth • Drilling rates are usually fast • Can use the casing-advancement method • Drilling mud or water is not required •Borehole is accessible to geophysical logging prior to well installation •Geologic sampling is excellent in hard, dry formations • First water zone easily detected • Well development is relatively easy	• Relatively expensive, requires experienced drill crew • Overburden casing usually required •Air mixes with borehole water and blown from the hole, creating potential for cross-contamination, surface contamination, health and environmental risks • Water flow between zones with different hydrostatic pressures will occur between the time that drilling is completed and the hole is properly cases and grouted • Compressor discharge to air may contain hydrocarbons • Organic foam additives to aid cuttings removals may cause cross contamination

Method and ASTM Standard	Drilling Principle	Depth Limitation Feet (meters)	Advantages	Disadvantages
Air-Percussion Rotary or Down-the-Hole Hammer (DTH) ASTM D5781	Air rotary with a reciprocating hammer connecting to the bit used to fracture rock.	600 (2,00)	• Very fast drill rates • Useful in all geologic formations • Only small amounts of water need for dust and bit temperature control • Cross-contamination potential can be reduced by driving casing • Can use casing-advancement method • Well development relatively easy	• Relatively expensive • As with most hydraulic rotary methods, the rig is large, heavy and has limited accessibility • Overburden casing usually required • Vertical mixing of water and air craters cross contamination potential • Hazard posed to surface environment if toxic compounds are encountered • DTH hammer drilling can cause hydraulic fracturing of borehole wall • The DTH hammer required lubrication during drilling • Organic foam additives for cuttings removal may contaminate samples
Sonic (Vibratory) ASTM D6914	Uses high-frequency mechanical vibration to take continuous core samples of overburden soils and most hard rocks.	500 (150)	• Can obtain large diameter, continuous and relatively undisturbed cores of almost any soil material without the use of drilling fluids • Can drill through boulders, wood, concrete and other construction debris • Can drill and sample most softer rock with a high percentage of core recovery • Drill rates are faster than most other methods • Large reduction of investigation-derived wastes	• Relatively expensive • Equipment is not readily available • Rock drilling requires the addition of water or air or both to remove drill cuttings • Extraction of casing can smear borehole wall with clays and silts • Extraction of casing can damage well screen

Method and ASTM Standard	Drilling Principle	Depth Limitation Feet (meters)	Advantages	Disadvantages
Direct Push ASTM D6724, ASTM D6725	Advances a sampling device into the subsurface by applying static pressure, impacts, or vibrations or any combination thereof to the above ground portion of the sampler extensions until the samples has been advanced its full length into the soil strata.	100 (30)	• Avoids use of drilling fluids and lubricants during drilling • Equipment is highly mobile • Disturbance of geochemical conditions during installation is minimized • Drilling and well screen installation is fast, considerably less labor intensive • Does not produce drill cuttings, reduction of investigation-derived wastes	• Limited to fairly soft materials such as clay, silt, sand and gravel •Compact, gravelly materials may be hard to penetrate • Small diameter well screen may be hard to develop. Screen may become clogged if thick clays are penetrated • The small diameter drive pipe generally precluded conventional borehole geophysical logging • The drive points yield relatively low rates of water
Cable-Tool (Percussion) ASTM D5875, ASTM D5872	Borehole is created by dropping a heavy "string" of drill tools into well bore, crushing materials at the bottom. Cuttings are removed occasionally by bailer. Generally, casing is driven just ahead of the bottom of the hole; a hole greater than 6 inches in diameter is usually made	1,000+ (300+)	• Can be used in consolidated and unconsolidated formations • Can drill boulder, cobble, fractured and cavernous zones • Fairly accurate logs can be made from cuttings if collected often enough • Core samples easily obtained • Driving casing ahead of hole minimizes cross-contamination via vertical leakage of formation waters, maintains borehole stability • Excellent method for drilling in soils and rock where loss of circulation fluids is problematic • Recovery of borehole fluid samples excellent • Excellent method for detecting thin water-bearing zones • Excellent for well development	• The potential for cross-contamination of samples is very high •Steel casing must be used • Heavy steel drive pipe and drilling "tools" can limit accessibility • Heavier wall, larger diameter casing than that used for other drilling methods normally used • Cannot run a complete suite of geophysical logs due to the presence of the drive pipe • Temporary casing can cause problems with placement of effective filter pack and grout seal • Usually a screen must be set before a water sample can be collected • Heaving of unconsolidated sediment into bottom of casing can be problematic

Adapted from U.S. Army Corps of Engineers, November 1998

Table 2: Comparison of Drilling Methods

Drilling Method	Shallow and Intermediate Boreholes	Deep Boreholes	Water Sampling	Soil Sampling	Well Installation	Boulders and other obstructions	Control of Hydrostatic Pressure	Downhole Geophysics
Hollow-Stem Auger	E	P	E	E	E	P	F	L
Solid-Stem Auger	E	P	NA	NA	F	P	P	NA
Water/ Mud Rotary	E	E	P	P	F	G	E	E
Reverse Rotary	E	E	P	P	F	P	E	E
Air Rotary	E	E	P	P	F	G	P	P
Sonic	E	G	E	E	E	E	E	E
Direct Push	E	F	E	E	G	L	E	L
Cable-Tool (Cased Boring)	E	F	E	E	E	G	E	L

Notes:
E = Excellent
G = Good
F = Fair
P = Poor
L = Limited application
NA = Not applicable

2.3.4 Special Concerns

2.3.4.1 Recirculation Tanks and Sumps

Portable recirculation tanks should be used for mud or water rotary operations and similar functions. The use of dug sumps or pits (lined or unlined) are expressly prohibited to minimize cross-contamination and to optimize both personal safety and work area restoration (USCOE, 1998).

2.3.4.2 Surface Runoff

Surface runoff, e.g., precipitation, wasted or spilled drilling fluid, and miscellaneous spills and leaks, should not enter any boring or well either during or after construction. To help avoid such entry, the use of temporary casing, recirculation tanks, berms around the borehole, or temporary surficial bentonite packs is recommended (USCOE, 1998).

2.3.4.2 Drilling Fluids

To the extent practical, the use of water during drilling, and any other water used during well installation and completion, should be held to a minimum. When use of water is deemed necessary, the source of any water used must be specified in the ground water monitoring plan and approved by the appropriate authority. The driller should have the responsibility to procure, transport, and store the approved water required for project needs in a manner that avoids the chemical contamination or degradation of the approved water once obtained.

If there is a suitable source of approved water onsite, the source should be used. If no onsite approved water is available, a potential source must be located and water quality evaluated and approved prior to the arrival of any drilling equipment onsite. It is important that the approved water be free of site-related analytes. It is advantageous that the drilling water be pretested (sampled and analyzed) for the contaminants of interest. Knowledge of the water chemistry is the most important factor for water quality approval. Surface water bodies must not be used as a water source.

Pure bentonite (no additives) is the only drilling fluid additive that is typically allowed under normal circumstances. This includes any form of bentonite (powders, granules, or pellets) intended for drilling mud or sealants. The use of any bentonite shall be adequately discussed in the ground water monitoring plan, including documentation of the manufacturer's recommendations and product constituents. Bentonite shall only be used if absolutely necessary to ensure that the borehole will not collapse or to improve cuttings removal (USCOE, 1998).

2.4 Decontamination

ASTM Standard D5088 provides guidance for decontamination of field equipment. All drilling equipment that is utilized in drilling or sampling activities must be cleaned or washed with high pressure hot water and decontaminated prior to arriving at the site or at the designated decontamination area before entering the site. This includes drilling rigs, support vehicles, water tanks (inside and out), augers, drill casings, rods, samples, tools, and recirculation tanks. The initial cleaning must be adequate to remove all rust, soil, or other material that may have been transported from another site. Any downhole auguring, drilling, and sampling equipment with paint, rust, or scale that cannot be removed by pressure washing or steam cleaning must be sandblasted prior to arrival on site. All equipment shall be inspected prior to site entry to confirm that all seals and gaskets are intact; no fluids are leaking; and all oil, grease, and other fluids have been removed. No oils or grease may be used to lubricate drill rods or any other equipment being used above or in the borehole without specific approval from the site geologist, engineer or geotechnical engineer. Such approval must be recorded on the well construction form.

All drilling, sampling, and associated downhole equipment that contacts the sample medium shall be cleaned and decontaminated by the following procedures:

1) Clean with approved water, laboratory-grade, phosphate-free detergent, and brush to remove particulate matter and surface films. Steam cleaning or high pressure hot water washing may be used in lieu of, or in addition to, brushing. Equipment that is hollow or perforated to transmit water or drilling fluids must be cleaned inside and outside. The steam cleaner or high pressure hot water washer must be capable of generating a pressure of at least 2500 PSI and producing hot water or steam of at least 200 ° F;

2) Rinse thoroughly with approved water. Approved water may be applied with a pump sprayer. All other decontamination liquids must be applied with non-interfering containers made of glass, Teflon ®, or stainless steel. Rinsing operations will be inspected by the site geologist, engineer or geotechnical engineer prior to initiation of work;

3) Rinse thoroughly with approved decontamination water;

4) Unless otherwise specified, rinse twice with pesticide-grade isopropanol;

5) Rinse thoroughly with approved decontamination water and allow to air dry;

6) Any equipment that will be stored or transported must be wrapped in aluminum foil (or clean plastic if equipment has been air dried);

7) Any printing or writing on well casing, tremie pipe, etc., arriving on site must be removed with sandpaper or emery cloth prior to initial cleaning; and

8) Well casing, tremie pipe, or other materials constructed of plastic or polyvinyl chloride (PVC) must be solvent rinsed during the cleaning and decontamination process.

After the onsite cleaning, only the equipment used or soiled at a particular boring or well should need to be cleaned between each boring or well at a given project. Paint applied by the equipment manufacturer may not have to be removed from drilling equipment, depending upon the paint composition and its contact with the environment and contaminants of concern. All equipment must be decontaminated before it is removed from the project site. If drilling requires telescoping casing because of differing levels of contamination in subsurface strata, then decontamination may be necessary before setting each string of smaller casing and before drilling beyond any casing. To the extent practical, all cleaning should be performed in a single remote area that is surficially cross gradient or downgradient and downwind from the clean equipment drying area and from any sited to be sampled. Waste solids and water from the cleaning and decontamination process shall be properly collected and disposed, as discussed in Chapter 5.0, Management of Investigation-Derived Waste. This may require that cleaning be conducted on a concrete pad or other surface from which the waste materials may be collected.

2.5 Sampling and Coring

A sufficient number of soil or rock samples should be collected and evaluated by the site and/or project geologist. The purpose of this collection is to provide a sound basis for the design of the ground water monitoring system. A "sufficient number of samples" is dependent on project-specific objectives, and should be described in the ground water monitoring plan. Soil samples should be collected according to ASTM Standards D1452, D1586, D3550, or D1587, whichever is appropriate given the anticipated characteristics of the soil samples. Rock samples should be collected using ASTM Standard D2113. Additional guidance on both soil and rock sampling can be found in ASTM Standard D6169.

2.5.1 Soil Sampling

The primary purpose of collecting soil samples, other than for chemical analysis, is the characterization of the subsurface lithology and stratigraphy. Typically, intact soil samples for physical descriptions are collected every 5 feet (1.5

meters) or at each change of material, whichever occurs first. Alternate sampling plans, with supporting information, should be detailed in the ground water monitoring plan. Additionally, a sufficient number of representative samples of the intervals significant to well design and hydrogeologic characterization should be collected for physical analyses; these results should then be used to support well design. These samples should be representative of the geographic and geologic range of materials within the project area and should specifically include the screened interval of a representative number of wells. Samples should be obtained with driven (e.g., split spoon), pushed (e.g., thin-wall Shelby tube), or rotary (e.g., Dennison) type samplers. Borehole cuttings do not usually provide the desired information and, therefore, are not usually satisfactory. Sampling procedures should be detailed in the ground water monitoring plan. Lithological logging of samples should be recorded according to the procedures listed in Section 2.9. Disposition of samples should be in accordance with Chapter 5.0

2.5.2 Rock Coring

Bedrock should be cored unless the ground water monitoring plan specifies otherwise. Coring, using a diamond- or carbide-studded bit, produces a generally intact sample of the bedrock lithology, structure, and physical condition. The use of a gear-bit, tri-cone, etc., to penetrate bedrock should only be considered for the confirmation of the "top of rock" (where penetration is limited to a few feet), enlargement of a previously cored hole, or drilling of highly fractured intervals. Lithologic logging of the core should be conducted in accordance with Section 2.9, Documentation.

Rock cores should be retrieved and stored in such a way as to reflect natural conditions and relative stratigraphic position. Gaps in the core and intervals of lost core should be noted in the core sequence. Cores should be stored in covered core boxes to preserve their relative position by depth. Boxes should be marked on the cover (both inside and outside) and on the ends to provide project name, boring number, cored interval, and box number in cases of multiple boxes. Each box shall clearly denote the top and bottom of the rock core present in that box. Any core box known or suspected to contain contaminated core should be appropriately marked on the log and on the box cover, (inside and out), and on both ends. Storage of rock cores must be in accordance with the approved ground water monitoring plan, and disposition must be in accordance with Chapter 5.0.

If photographs of the core are taken, the core surface must be cleaned or peeled, as appropriate, and wetted. Photographs should be taken in color.

2.6 Drilling through Contaminated Zones

When drilling through contaminated strata to reach lower, possibly uncontaminated, strata, the potential for "drag down" of contamination should be minimized by drilling technique. In this procedure, an outer drill casing is set and sealed within an "impermeable" layer or at a level below which the underlying environment is thought to be "cleaner" than the overlying environment. The drill fluids used to reach this point are disposed of according to Chapter 5.0 and replaced by a fresh supply. This system can be repeated, resulting in telescopic drill casing through which the final well casing is placed. These situations should be specifically addressed in the ground water monitoring plan.

2.7 Drilling Fluid Loss and Removal

When a borehole, made with or without the use of drilling fluid, contains an excessively thick, particulate-laden fluid that would preclude or hinder the specified well installation, the borehole fluid should be removed. This removal should facilitate the proper placement of casing, screen, granular filter, and seal.

Note: Unless the borehole wall has been supported by casing, the wall is likely to partially or completely collapse during fluid removal. Therefore, when no casing is present the fluid must be removed with great caution and the condition of the borehole monitored. Fluid losses in this operation must be recorded on the well diagram or boring log and later on the well development record. Any fluid removal prior to well replacement should be contingent upon the site geologist, engineer or geotechnical engineer's evaluation of hole stability (i.e. sufficient for the desired well and seal placement).

If large drilling fluid losses occur in bedrock, the drilling operator should remove some of this fluid loss prior to well insertion. The intent here is to allow the placement of a larger pump in the borehole than otherwise possible in the well casing, thereby reducing subsequent development time and removing the lost water closer to the time of the loss. Development of the completed well can then be reduced by a volume equal to that which was removed through the above procedure.

2.8 Abandonment

All soil borings not completed as wells must be abandoned in accordance with Chapter 7.0, Well and Boring Abandonment. In addition, wells that are deemed to be unnecessary for continued site monitoring or remediation system performance or to be structurally unsound should be abandoned.

2.9 Documentation

2.9.1 General

Each boring log should fully describe the subsurface environment and the procedures used to gain that description. Unless otherwise specified in the ground water monitoring plan, a log shall be produced for every boring completed. The information in subsection 2.9.3, Routine Entries, is required on boring logs although not necessarily in the format illustrated. Example soil and rock parameters for logging are included in Tables B-1 and B-2, respectively.

2.9.2 Time of Recording

Boring logs should be recorded directly in the field without transcription from a field book or other document. This technique minimizes the chance of errors of manual copying and allows the completed document to be field-reviewed closer to the time of drilling.

2.9.3 Routine Entries

In addition to specific data required by the ground water monitoring plan, the following information should be routinely entered on the boring log:

1) Each boring and well (active and abandoned) should be uniquely numbered in accordance with an established well designation plan (discussed in Subsection 3.1.1);

2) Depths and heights (and reference to the appropriated datum) should be recorded in feet and decimal fractions (tenths of feet);

3) Field soil classification must be in accordance with the Unified Soil Classification System (USCS) or Standard D2487 and D2488, and shall be recorded in the field at the time of the sampling by the geologist. Such terms as "trace," "some", "several," must be consistent with the USCS or ASTM Standard D2488;

4) Each soil sample collected should be fully described on the log. Sample colors should be described using a Munsell soil and/or rock color chart. Samples should be described when wetted;

5) When used to supplement other sampling techniques, disturbed samples (e.g., wash samples, cuttings, and auger flight samples) should be described in terms of the appropriated soil/rock parameters

6) Rock cores should be fully described on the boring log. Sample colors should be described using a Munsell rock color chart. Samples should be described when wetted;

7) For rock core the log will include, denoting by depth, the location, orientation, and nature (natural or mechanical) of all core breaks. Also mark the breaks purposely made to fit the core into the core boxes. If fractures are too numerous to be individually shown, their location may be drawn as a zone and described on the log. Also note, by depth, the intervals of all lost core and hydrologically significant details. This sketch should be prepared at the time of core logging, concurrent with drilling;

8) All special problems and their resolution should be recorded in the field logbook, with appropriated entries on the log form. Examples of problems include, hole squeezing, recurring problems at a particular depth, sudden tool drops, excessive grout takes, drilling fluid losses, unrecovered tools in hole, and lost casings;

9) The dates and times for the start and completion of borings should be recorded on the log;

10) Each sequential boundary between the various soils and individual lithologies should be noted on the log by depth and elevation;

11) The depth of the first encountered free water should be indicated. Before proceeding, the first encountered water should be allowed to partially stabilize for a minimum of 5 to 10 minutes and recorded along with the time between measurements. It is important to note if the measured water level increases or decreases over time;

12) The purpose and interval by depth for each sample collected, classified, and/or retained should be noted on the log;

13) A record of the blow counts, hammer type and weight, and length of hammer fall for driven samplers should be made when standard penetration samplers are used. For thin-wall samplers, indicate whether the sampler was pushed or driven and the pressure/blow count per drive. Blow counts should be recorded in half-foot increments when standard penetrations samplers (1-⅜ inch I.D. X 2

inch O.D.) are used. For penetration less than a half-foot, annotate the count with the distance over which the count was taken. Blow counts, in addition to their engineering significance and classification purpose, may be useful for stratigraphic correlation;

14) When drilling fluid is used, a quantitative record in the field logbook should be maintained of fluid losses and/or gains and the interval over which they occur. Adjustment should be made for fluid losses due to spillage and intentional wasting (e.g., recirculation tank cleaning) to more closely estimate the amount of fluid lost to the subsurface environment. Losses should be noted by time and depth interval;

15) Record the total depth of drilling and sampling on the log;

16) Record significant color and viscosity changes in the drilling fluid return, even when intact soil samples or rock core are being obtained. Include the color/viscosity change, depth at which change occurred, and a lithologic description of the cuttings before and after the change;

17) Soil gas and breathing zone readings, if taken, should be recorded on the log. Each notation should include interval sampled and reading. When possible, a general note on the log should indicate meter manufacturer, model, serial number, and calibration material. If several meters are used, key the individual readings to the specific meter; and

18) Special abbreviations used on the log and/or well diagram should be defined where used.

2.9.4 Soil Boring Abandonment

For each soil boring, its final status (abandoned; converted to a monitoring well, etc.) should be recorded on the boring log form. If the boring is abandoned, the date(s) of abandonment and the abandonment method should be included. The boring abandonment procedures should comply with Chapter 7.0 of the manual.

2.9.5 Well Abandonment

For each abandoned monitoring well or piezometers, a record of the abandonment must be provided on the Well Abandonment Form. An example of this form is included in Appendix B. Well abandonment procedures should comply with Chapter 7.0 of the manual.

3.0 Well Design and Material Specifications

3.1 Well Design Specifications

This section describes the design specifications for the various monitoring well components. Figure 1, Single-Cased Monitoring Well Schematic Diagram, illustrates typical single-cased well components described in the following subsections. Well construction specifications for monitoring wells installed with conventional drill rigs are outlined in Sections 6.4 through 6.6 of the USEPA guidance document (USEPA, 2001) and for direct-push micro wells in the ASTM Standard 6725. Variations from standard practices should be based upon site, geologic, and hydraulic conditions and must be approved prior to installation by the appropriate regulatory authorities and must follow appropriate regulatory procedures. Persons with authority to address and grant variances should be identified in the ground water monitoring plan. Circumstances and factors leading to variances must be properly documented.

3.1.1 Well Designation

Each well at a site should have a unique label that distinguishes it from all other wells located at the installation. Prior to assigning a well label, all wells at the site should be checked to ensure no duplication. An example of a naming convention is given below:

Site:	Johnson Bulk Tank Farm No. 2
Well Number (Name):	JBTF-N2-MW01;
Where:	JBTF = Johnson Bulk Tank Farm N2 = Farm No. 2 MW01 = monitoring well 01

It is preferred that wells be labeled with an identification tag. A metal tag containing the well designation should be attached to the protective casing of each monitoring well. Figure 2 presents a diagram of a well identification tag. The following specification can be applied to the use and installation of well tags:

Specifications:

4"X4"X0.032" stainless steel or aluminum
3/16" lettering
1/8" diameter mounting holes
black printed or stamped lettering

Printing:

A printing press can be used to complete as much information as possible before mobilizing to the site. Required information to be included in on a tag is shown in Figure 2. Information that is not available at the time of printing must be hand stamped in the field.

Figure 1: Typical Monitor Well Construction, Single-Cased Monitor Well

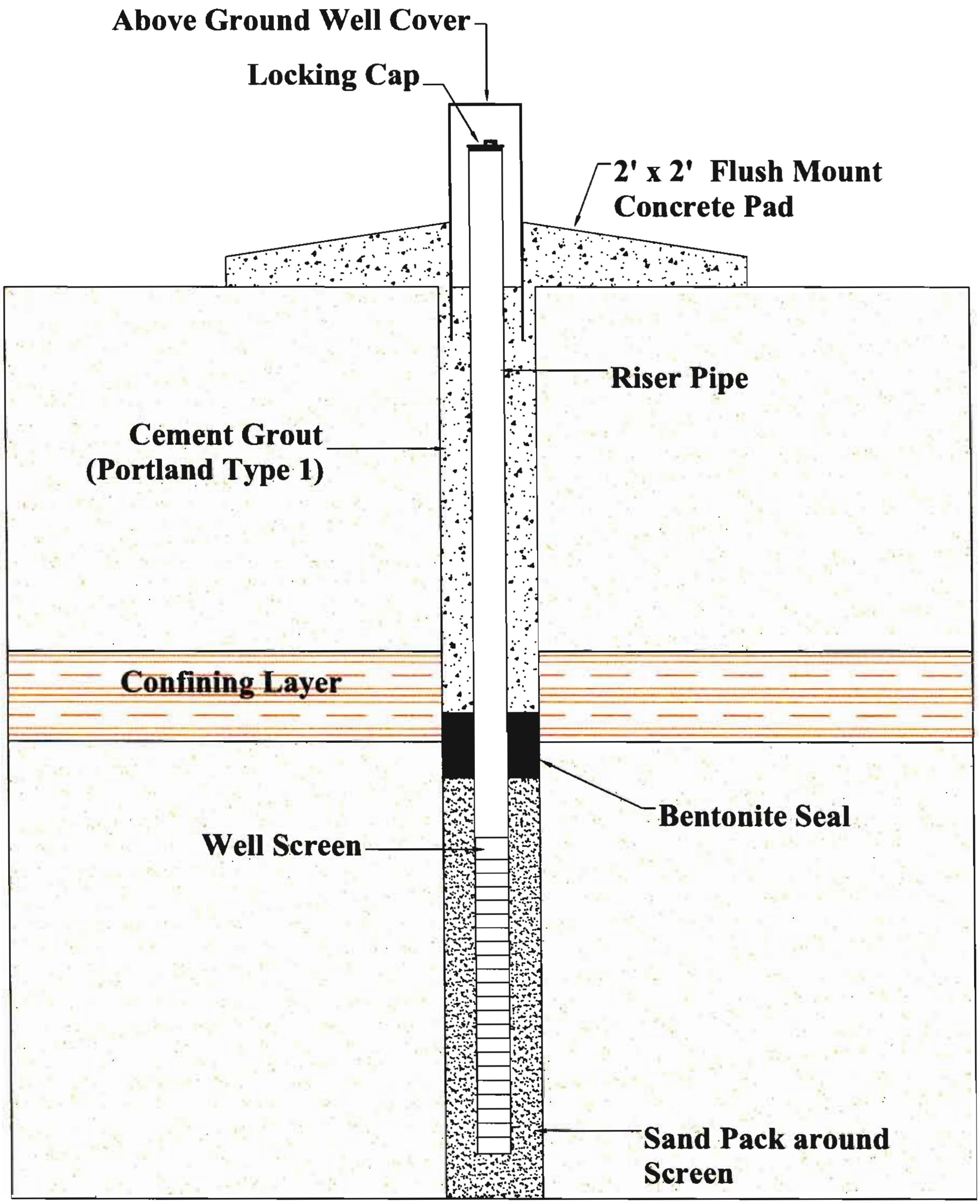


Figure 2: Monitoring Well Identification Tag

3.1.1.1 The Florida Unique Well Identification Program

The Florida Unique Well Identification (FLUWID) program provides a means to simplify the identification and exchange of water well information between state agencies and other interested parties. Under the program, water wells are assigned a unique alphanumeric code called the FLUWID identification number (example: AAA0000). The alphanumeric code is printed on a weather resistant adhesive tag/label and attached to a wellhead or pump house for identification. The FLUWID identification number serves as the primary water well identification number which enables different state agency water well databases to be cross referenced and queried. The FLUWID identification number is meant to be used in conjunction with any other numbering identification scheme such as the permit numbering system for water well construction and identification water well samples.

The naming convention in subsection 3.1.1 can still be used; however the FLUWID number can either replace the well number or be used in conjunction with the well number. For example a FLUWID number, AAB2123, queried from the database would show that this FLUWID number is associated to the original site name JBT-N2-MW01, and the FLUWID number would associate any sample identifications related to JBT-N2-MW01, as well as any other related data and information associated with that well.

The FLUWID Coordinator maintains the FLUWID Program Database (database). The database records the agency that is issued FLUWID tags, the date of issuance, differential global positioning system (DGPS) coordinates and other well information. The primary function of the database is to simplify water well data inquires by directing all request to the party issued the FLUWID tags. The database is not a repository for water well historical data.

The FLUWID Program is not mandated by law, but implemented voluntarily to facilitate water well data collection The FLUWID Program only works if all parties participate and report data associated to the FLUWID ID numbers that are issued to said parties. It is most important that all data be returned to the FLUWID coordinator in a timely fashion in order to maintain an up-to-date and accurate database.

3.1.2 Well Material Specifications

The selected well construction materials should be chosen based on site and hydrogeological conditions and the physical and chemical monitoring objectives. The prime concern when selecting well materials is that these materials will not contribute foreign constituents to the ground water quality sample or alter the surrounding environment, either by leaching or sorption. The introduction of foreign matter or alteration of ground water quality may compromise the integrity of the well and of any analytical data. Also, well materials must not absorb any of the contaminants of interest that may be present in the ground water. An additional concern is that all well materials must be durable enough to withstand installation and well development and endure for the entire designed monitoring period. ASTM Standard D5092 presents an excellent discussion of material terminology and definitions. Deviations from acceptable well material specifications should be specified the ground water monitoring plan and approved prior to installation.

PVC and stainless steel are the most commonly used monitoring well screen and riser materials. However, in some situations, other materials, such as Teflon®, or carbon steel (for riser pipe) may meet project objectives. Typically, the riser is constructed of the same material as the well screen. However, depending upon the project objectives, PVC or carbon steel riser pipe material may be used to reduce the material cost when stainless steel well screens are specified. Where a different riser material is used to produce a "hybrid" well, the materials anticipated to be in contact with the ground water must be consistent with the material of the well screen. Table A-2, Appendix A, provides a comparison of stainless steel and PVC material characteristics. Table A-3, Appendix A, provides a comparison of the relative compatibility of miscellaneous well materials to potentially reactive substances.

All PVC screens, casings, and fittings are typically Schedule 40 or 80 and shall conform to National Sanitation Foundation (NSF) Standard 14 for approved water usage or ASTM Standards F480 or D1785. If the driller uses a screen and/or casing manufacturer or supplier who removes or does not apply this logo, a written statement from the manufacturer/supplier that the screens and/or casing have been appropriately rated by NSF or ASTM should be included in the ground water monitoring plan.

Stainless steel well screen is typically Type 316 or 304. The stainless steel well screen must have flush threaded joints, sealing “O” rings of compatible material with the project objectives, and conform to ASTM Standard A312/A312M.

A Teflon® well screen must have flush threaded joins, sealing Teflon® “O” rings, and conform to ASTM Standard D4894 or D4895. Specific materials must be specified in the ground water monitoring plan. All materials should be as chemically inert as technically practical with respect to the site environment. Marking, writing, or paint strips are not allowed.

All monitoring well joints must be water tight. Couplings with the casing and between the casing and screen must be compatibly threaded. Thermal- or solvent-welded couplings on PVC pipe shall not be used. This restriction also applies to threaded or to slip-joint couplings thermally welded to the casing by the manufacturer or in the field. Gaskets, pop rivets, or screws are not normally used on monitoring wells. Exceptions are: 1) manufactured flush-joint casing requiring an o-ring to seal the joint and 2) stainless steel screws required to attach a bottom cap to a nonstandard length of screen material where the normal joint structure is missing. Exceptions should be approved prior to installation and must be recorded in the well completion report. All screen bottoms must be securely fitted with a cap or plug of the same composition as the screen. Solvents or glues are not permitted in the construction of a monitoring well.

All well screens and well casings must be free of foreign matter (e.g., adhesive tape, labels, soil, grease, etc.). Typically, well casing and screen materials are prepared, wrapped, and boxed by the manufacturer with a certificate of being “clean”. If the cleanliness of the well materials is in doubt, the casing and screen must be decontaminated using an approved protocol. Cleaned materials must be stored in appropriate containers until just prior to installation. Pipe nomenclature stamped or stenciled directly on the well screen and/or blank casing within and below the bentonite seal must be removed by means of sanding, unless removable with approved water. Solvents, except approved water, must not be used for removal of markings.

3.1.3 Well Screen Usage

Each well should be constructed with new, machine-slotted or continuously-wound screen section. The end plug should be composed of the same material as the well screen. The screen assembly must be able to withstand installation and development pressures without collapsing or rupturing.

Although many wells set into bedrock could be installed as open-hole installations, the extra cost and effort for screen installation can be more than offset by the assurance of an unobstructed opening to the required depth during repeated usage. Well integrity and consistent access to the original sample interval during prolonged monitoring is thereby maintained.

3.1.4 Well Screen Length

Well screen lengths should be selected based on the purpose of the well. Some wells are designed to determine the presence or absence of contaminants. Others are designed to monitor a discrete zone for a particular contaminant type. Design of screen length must take into account hydrostratigraphy, temporal considerations, environmental setting, analytes of concern, fate and transport of contaminants, and/or regulatory requirements.

In most situations, monitoring wells are designed to double as ground-water quality sampling points and as piezometers to monitor water levels or hydraulic head at that particular location and depth. In order to satisfy these dual roles, monitoring well screen lengths may range from as short as 2 feet to greater than 20 feet. Typically, though, well screen lengths are 5 or 10 feet, and rarely exceeding 20 feet. It is important that well screen lengths be specified in the ground water monitoring plan.

3.1.5 Well Screen Diameter

The inside diameter (I.D.) of the well screen should be chosen based on anticipated use of the well. Generally, a 2-inch I.D. well is sufficient to allow sampling with most types of sampling devices such as bailers or low-flow samplers. If the well may be used as part of a remedial system, a greater I.D. may be considered (e.g., 4-inch or 6 inch), however, the advantages of this increased diameter should be evaluated with respect to cost increases in drilling, material, and disposal of waste material.

The actual inside diameter of a nominally sized well is a function of screen construction and the wall thickness/schedule of the screen, casing, and joints. In the case of continuously-wound steel screens, their interior supporting rods may reduce the full inside diameter. Additionally, the welded couplings on 2-inch I.D. stainless steel well pipe frequently reduces the inside diameter to slightly less than 2 inches. This consideration is critical when sizing pumps, bailers, surge devices, etc.

All well screens must be commercially fabricated, slotted or continuously wound, and have an I.D. equal to or greater than the I.D. of the well casing. An exception may be warranted in the case of continuously-wound screens. No fitting should restrict the I.D. of the joined casing and/or screen.

3.1.6 Well Screen Slot Size

The grain size distribution of the screened formation and the filter pack gradation are the primary parameters that should be used when selecting a slot size for the well screen. Therefore, the grain size of the aquifer material should be the determining factor in selecting well screen slot size.

The largest practical slot size that is compatible with the aquifer and available filter material should be used. This will allow maximum intake volume per unit screen length. The slot size should retain at least 90 percent (preferably 99 percent) of the filter pack material. The method for determining the appropriate gradation of filter pack material is described in paragraph 3.1.11.2, Primary Filter Pack.

3.1.7 Well Screen Placement

The screen shall be place such that the parameters of concern can be properly monitored. Chemical constituents with a specific gravity greater than water tend to sink and may accumulate as a dense non-aqueous phase liquid (DNAPL). If the well screen is to be installed in a location known or suspected to be impacted by DNAPLs, then the borehole must not be overdrilled and the screen must be placed at the bottom of the borehole. The screen must be placed with no filter pack beneath the base of the screen as this construction may provide a sediment trap and the DNAPLs may sink and not be detected. DNAPLs may exhibit an overall vertical migration, even with a predominant horizontal ground water flow. Therefore, screens need to be place at the bottom of a saturated zone or just above a confining layer. Screen lengths should be as short as possible, at the most 10 feet and preferably 5 feet (or less), to decrease the likelihood of cross contamination of deeper portions of an aquifer.

Overdrilling of a borehole is sometimes performed for such activities as definition of stratigraphy, location of a confining unit or to creation of a sediment trap. It is preferred that exploratory activities (i.e., stratigraphic definition and strata location) are conducted in a pilot hole and then the borehole be properly abandoned. A separate borehole should be advanced for the monitoring well.

Overdrilling to create sediment traps is not encouraged. If, however, overdrilling is performed to create a sediment trap, the bottom of a well screen may be placed at a minimum of 6 inches, but no more than 3 feet above the bottom of the borehole. If bentonite pellets are used to seal the bottom of the borehole, a minimum of one foot of filter sand must be placed above the bentonite prior to screen placement. Overdrilling must be appropriate for site conditions and the monitoring parameters of concern. The use and style of sediment traps must be discussed in the ground water monitoring plan.

3.1.8 Well Riser

The I.D. of the riser should be chosen based on the anticipated use of the well. Usually a minimum of 2-inch I.D. riser is required to allow use of most sampling devices and water level indicators. In most cases, the well riser will be fabricated of the same material and be the same I.D. as the selected well screen. Couplings within casing segments and between the casing and screen must be compatibly threaded.

Each riser section should be installed as straight and level as possible. For deep installations (greater than 40 feet) centralizers should be used to ensure a constant annular spacing between the borehole and well materials. The top of the uppermost riser pipe, i.e., the top of the well, must be level. A point on the top of the well should be marked such that survey and water level measurements are collected from the same location. Traditionally, this mark is placed on the north side of the riser.

3.1.9 Surface Casing

Outer well casing used as a permanent part of the installation when multi-cased wells are installed must be composed of new material. The casing must be free of interior and exterior protective coatings and must be steam cleaned or washed with a high-pressure water device (if appropriate for the selected material) using approved water immediately before installation. The type of material and wall thickness of the casing must be adequate to withstand the installation process. Surface casing must consist of steel meeting ASTM Standard A53/A53M-06 or Schedule 40 or 80 PVC, and shall have a minimum wall thickness of 0.25 inch, unless otherwise specified. The ends of each casing section should be either flush-threaded or beveled for welding.

At sites where multiple aquifers may be penetrated or where a confined or semi-confined aquifer must remain isolated from potential surface water infiltration, surface casing is required to prevent cross-contamination between the separate zones. When used to seal a confining layer or bedrock surface, well casing is typically installed 3 feet to 5 feet into the top of the unit. This should provide a sufficient isolation of the aquifer to be protected. For thin confining layers or thin saprolite horizons, a shallower penetration depth may be appropriate.

Different casing sizes may be required depending on the types of geologic materials encountered at the drilling site and the anticipated purpose of the well. The site geologist, engineer or geotechnical engineer should anticipate these conditions and design the monitoring wells accordingly. Casing diameters for filter-packed wells should be selected so that a minimum annular space of 2 inches is maintained radially between the inside diameter of the surface casing and outside diameter of the monitoring well riser. Also, the diameter of all casings in multi-cased wells should be sized so that a minimum of 2 inches of annular space is maintained between the surface casing and the borehole. For example, a 2-inch diameter well screen will require a 6-inch diameter casing inside a 10-inch diameter boring.

3.1.10 Granular Filter Packs

3.1.10.1 Filter Pack Materials

All granular filters should be discussed in a ground water monitoring plan, including composition, source, placement, and gradation. If the actual gradation is to be determined during drilling, then more than one filter pack gradation should be available so that well installation will not be unnecessarily delayed. A 1-pint representative sample should be collected for possible future analysis.

Granular filter packs must be at least 98 percent pure silica sand, visually clean (as seen through a 10-power hand lens), free of materials that would pass through a No. 200 U.S. Standard sieve, inert, composed of rounded grains, and of appropriated size for the well screen and host environment. The filter material should be packaged in bags by the suppliers and therein delivered to the site.

Filter packs are placed in the borehole and around the well screen to prevent natural formation material from entering the well screen. The use of a tremie pipe for filter pack placement is recommended; especially when the boring contains thick drilling fluid or mud or is sufficiently deep such that bridging is likely. Exceptions to the use of a tremie pipe for filter pack placement may include vadose zone wells or surficial well with less than approximately 10 feet of standing water.

The final depth to the top of the granular filter should be directly measured (by fiberglass or stainless steel tape measure or rod) and recorded on a well construction form. Final depths must not be estimated based on volumetric measurements of placed filter sand.

When installing a monitoring well in karst or highly fractured bedrock, the borehole configuration of void spaces within the formation surrounding the borehole is often unknown. Therefore, the installation of a filter pack becomes difficult and may not be feasible.

3.1.10.2 Primary Filter Pack

The primary filter pack consists of granular, siliceous material or glass beads. These materials should be clean and free of materials that would compromise the integrity of the representative ground water quality.

The filter pack shall extend from the bottom of the boring to a minimum of 3 feet above the top of the screen unless otherwise specified in the work plan. As mentioned in Subsection 2.1.4.4, Borehole Requirements, the filter pack is not placed beneath the screen when potential contaminants with a specific gravity greater than that of water (i.e. DNAPLs) are suspected. Once the filter pack material is in place the well should be surged to break bridged filter pack materials in the borehole and to consolidate those materials around the screened interval.

As appropriate, up to 5 feet of filter pack can be placed above the top of the screen. This additional filter pack thickness will allow for settling from infiltration and compaction of the filter pack during development and repeated sampling events. The additional filter also helps to maintain a separation between the bentonite seal and well screen. The selected filter pack material should be uniformly graded and composed of siliceous particles that have been appropriately washed and screened. The filter pack grain-size is based on the smallest natural formation material. The following table presents a comparison of typical filter pack mesh sizes and appropriate screen size openings:

Table 3: Comparison of Screen Slot Size and Filter Pack

Screen Size Opening (Inches)	Screen Size Slot Number	Typical Sand Pack Mesh Size (U.S. Standard Sieve Number)
0.005	5	100
0.010	10	20 to 40
0.020	20	10 to 20
0.030	30	10 to 20

3.1.10.3 Secondary Filter Pack

As appropriate and as borehole depth and hydrogeologic conditions allow, a minimum 1- to 2-foot thick secondary filter pack should be used during well installation. A fine-grained sand (i.e. 30/65) may be used as a secondary filter pack.

The objective of a secondary filter pack is to prevent intrusion of the bentonite seal into the primary filter pack. Additionally, a secondary filter pack can also be used between the bentonite seal and the grout backfill to prevent intrusion of the grout into the bentonite seal. Finally, for wells completed with the seal located above the static ground water level, a secondary filter pack should be installed to replace the bentonite seal.

3.1.11 Annular Seal

The objective of an annular seal is to prevent intrusion of the annular grout into the primary and/or secondary filter pack. An annular seal of fine-grained, washed silica sand is recommended in situations where monitor well screen sections are designed to intercept the water table. In situations where the annular seal is assured to remain below the water table and saturated, a bentonite seal is appropriate. Bentonite has the ability to expand when completely hydrated to form a dense clay mass with very low in-place permeability, thereby providing an effective barrier to water migration. However, bentonite is not effective when 1) improperly hydrated, 2) allowed to desiccate in place or 3) placed in high or low pH environments. To allow for adequate hydration and avoid desiccation bentonite seals must be placed at a depth below the lowest anticipated static ground water level in the well.

Because bentonite has a high cation exchange capacity and high pH, it may adversely affect water-quality samples that come in contact with, or have migrated through or past the bentonite seal. Additional concerns include the use of bentonite in ground water that exhibits high total dissolved solids or high chloride content, or may contain chemicals reactive to the bentonite's cation exchange capacity and pH. For these reasons, the rationale and design specifications for bentonite seals should be detailed in a work plan. If selected for use during the design process, the bentonite seal should have a minimum 2-foot thickness.

Bentonite used in drilling slurries and as annular sealant shall be powdered, granular, chipped or pelletized. Pelletized or chipped bentonite should be used for bentonite seals, whereas powdered or granular bentonite should be used when required in preparing slurries and grout. The materials must be a 100 percent pure sodium bentonite (montmorillonite) supplied in sacks or plastic buckets. The bentonite must be free of any additives or other material that may negatively affect water quality in the resulting monitoring well. The diameter of the bentonite pellets used should be less than one fifth the width of the annular space into which they are placed. This will help reduce the possibility of the material bridging in the annular space.

The preferred method of placing bentonite pellets or chips is by positive displacement or by use of a tremie pipe. Use of the tremie method minimizes the risk of pellets or chips bridging in the borehole, but time and care must be taken to prevent plugging of the tremie pipe. Pouring of the pellets is acceptable in shallow boreholes (less than 40 feet). In order to provide accurate measurement of bentonite pellet thickness in the well boring, the pellet seal should be tamped during measurement. Bentonite pellet/chips seals should be measured during and immediately after placement, without allowance for swelling. Granular or chip bentonite may be used if the seal is set in a dry condition.

If the proposed seal location is above the anticipated static ground water level, a bentonite seal should not be used. In this case, a 1- to 2-foot layer of fine-grained sand (secondary filter pack) placed atop the primary filter pack will enhance resistance to downward grout migration.

Slurry seals should be used only as a last resort, as when the seal location is too far below water to allow for pellet or chips or containerized-bentonite placement or within a narrow well-borehole annulus. Typically, the specific gravity of cement grout placed atop the slurry seal will be greater than that of the slurry. Therefore, the intent to use a slurry seal should be detailed in the ground water monitoring plan, and details should include a discussion of how the grout will be precluded from migrating through the slurry. An option includes a secondary filter pack of fine-grained sand and the use of a side discharging tremie pipe. Slurry seals should have a thick, batter-like (high viscosity) consistency with a placement thickness of 3 feet to 5 feet.

The final depth of the top of the bentonite seal should be directly measured (by tape or rod) and recorded. Final depths should not be estimated based on volumetric measurements of placed bentonite.

In a well designed to monitor competent bedrock, the bottom of the bentonite seal should be located at 3 feet below the top of firm bedrock, as determined by drilling. "Competent bedrock" refers to that portion of solid or relative solid, moderately weathered to unweathered bedrock where the frequency of loose and fractured rock is markedly less than in the overlying, highly weathered bedrock. Special designs will be needed to monitor fractured bedrock.

3.1.12 Annular Grout

Grout used in monitoring well construction and borehole/well abandonment should be one of the five Portland cement types specified in ASTM Standard C150. Type I Portland cement is most commonly used for monitoring well construction. Bentonite-based grouts (30 percent solids) can be used when the grout needs to remain somewhat flexible. The cement-based grout should be composed of Type I Portland cement , 100 percent pure sodium bentonite (10 percent dry bentonite per 94-lb. sack of dry cement), and shall not exceed 6 gallons of water per 94 pounds of Portland cement. The amount of approved water used should be kept at a minimum. Use of 10 percent bentonite, by weight, added to a cement--based grout is advantageous when lower shrinkage, better workability, and reduced weight are important. The considerations of using bentonite include reduced set strength, increased set time, and potential incompatibility with some ground water chemistry conditions

When a sulfate-resistant grout is needed, Types II or V cement should be used instead of Type I. Quick-setting cements containing additives must not be used for monitoring well installation. These additives may leach from the cement and adversely affect the chemistry of the water samples collected from the resulting monitoring well. Generally, the use of air-entrained cements should be avoided to negate potential analytical interference in ground water samples by the entraining additives. Neither additives nor borehole cuttings shall be mixed with the grout.

3.1.13 Surface Completion

Protective casing should be installed around each monitoring well the same day as the initial grout placement. Any annulus formed between the outside of the protective casing and the borehole or between the monitoring well and protective casing should be filled to the ground surface with grout as part of the overall grouting procedure. Specific details of well protection should be detailed in the ground water monitoring plan. Details and specific elements of well protection should be included in well completion diagrams. Figures 3 and 4 present schematic diagrams for flush-mounted and stick-up protective casing, respectively. ASTM Standard D5787 provides guidance for monitoring well protection.

All protective casing should be steamed or hot-water-pressure cleaned prior to placement; free of extraneous openings; and devoid of any asphaltic, bituminous, encrusted, and/or coating materials, except the paint or primer applied by the manufacturer.

As specified in Subsection 3.1.1, Well Designation, a metal identification tag containing the well designation should be attached to the protective casing of each monitoring well or placed square on the protective concrete pad, centered on the northern or northwestern side of the pad, with the top of the tag toward the well head. For new pads, the tag shall be placed and pinned during pad construction. For existing pads, the tag should be epoxy grouted and cement screwed.

The material type of the surface completion casing should be adequate to protect the completed monitoring well. The surface completion materials need to be selected such that they provide adequate protection against physical destruction, tampering, natural degradation, and the environment.

Unless otherwise specified, surface completion materials should conform to the following specifications:

1) Locking 16-gauge steel or aluminum protective well cover, round or square and 5-feet in length, or flush-mounted 22-gauge steel, water resistant, welded box with 3/8-inch steel lid;

2) Cement consisting of one of the five Portland cement types that are specified in Standard C 150 as discussed in Paragraph 3.1.12, Annular Grout;

3) Brass, corrosion resistant, keyed-alike padlock;

4) Protective bumper posts constructed of 4-inch diameter and minimum 5-foot long steel or aluminum pipe (four per well). Each post must be set into concrete outside the corners of the concrete pad and filled with concrete;

5) Paint that matches existing monitoring wells at the installation. Where no wells exist, it is recommended to use high visibility yellow epoxy paint;

6) A well identification tag as detailed in Subsection 3.1.1, Well Designation; and

7) Cement consisting of one of the five Portland cement types that are specified in Standard C 150 as discussed in Paragraph 3.1.12, Annular Grout.

The primary purpose of a properly designed surface completion is to maintain the integrity of the well for the designed monitoring period. After the well is installed, it shall be completed at the ground surface in one of two ways:

1) Construct around the protective casing a 2-foot by 2-foot, 4-inch thick concrete pad, sloping from the casing to the perimeter such that water will drain away from the well. The bottom of the concrete pad should be installed partially or completely below grade to protect against undermining. Bentonite grout should then be placed in the annular space below ground level within the protective casing. Pea gravel should then be placed in the annular space above the bentonite to about 6 inches from the top of the well riser.

2) Where monitoring well protection must be flush-mounted with the ground, a locking security internal cap must be on top of the riser within the steel manhole or vault. This cap must be leak proof so that if the vault or manhole should fill with water, the water will not enter the well casing. A bolt-down manhole cover should be required for security. The manhole cover should be installed into a 6-inch thick, 2-foot square, concrete pad, sloped (1 inch per foot) to provide water drainage away from the well, and finished flush to existing grade. Ideally the manhole cover should also be leak-proof.

If the well is completed above ground the protective casing should extend from slightly above the well casing to below ground with a minimum of 2.5 feet below grade. The protective casing should be waterproof and held firmly in lean concrete placed around the outside of the protective casing. The casing should be placed in alignment with the well riser pipe.

Figure 3: Flush-Mounted Protective Casing

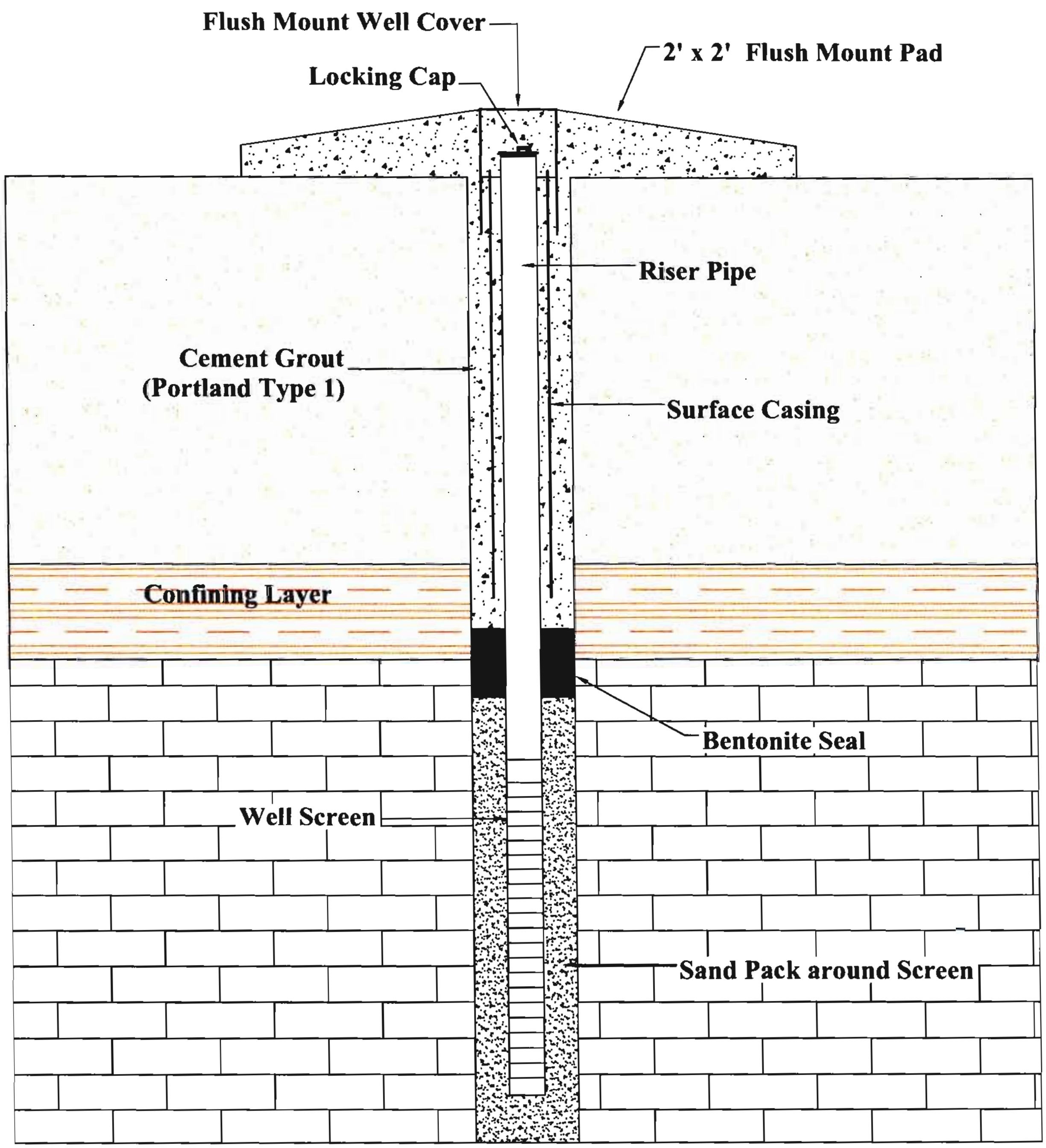
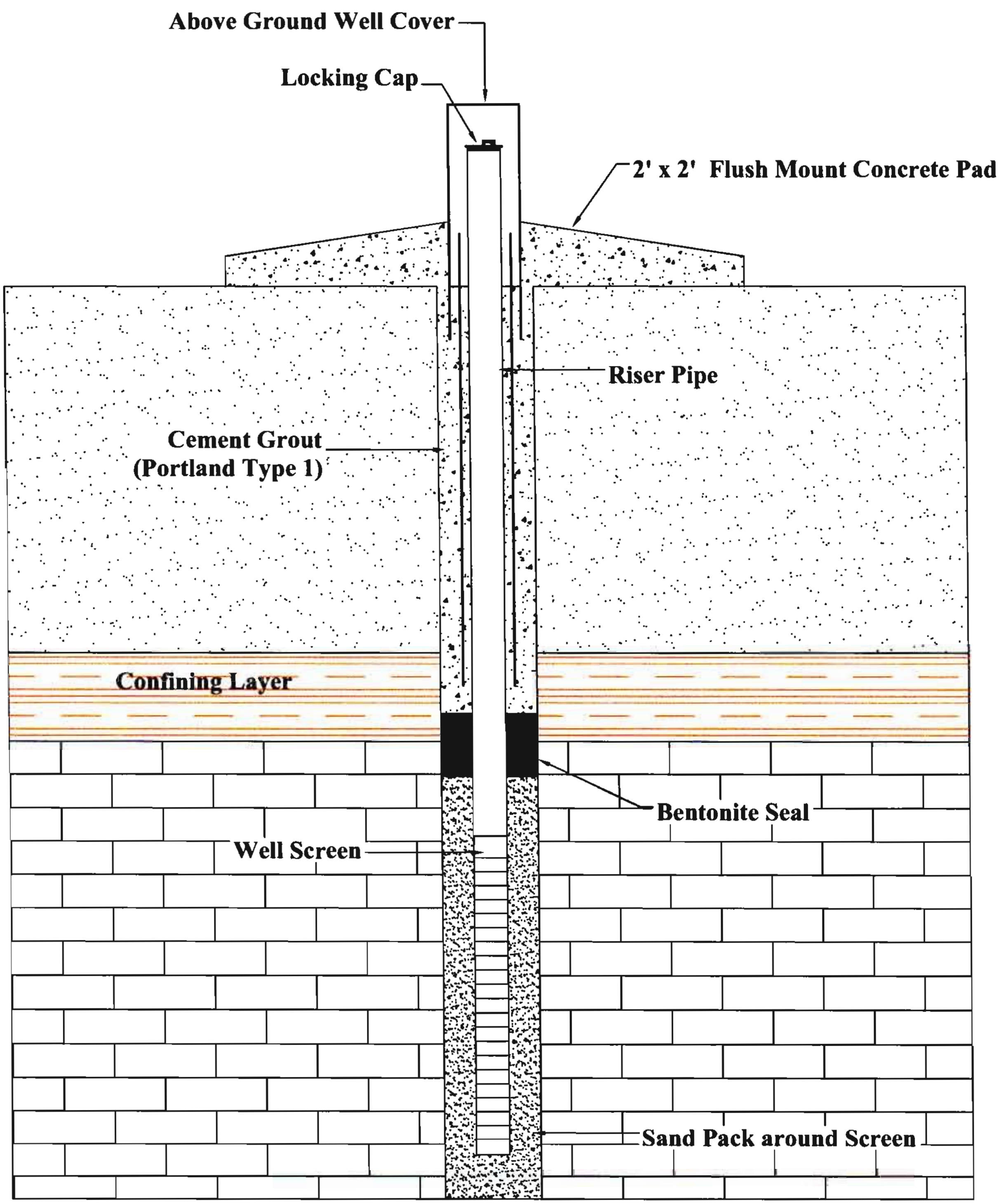


Figure 4: Above-Ground Protective Casing



Prior to protective casing installation, a ⅛-inch diameter vent hole should be drilled or slotted in the well riser approximately 6 inches below the cap to allow the well to vent. A second ¼-inch diameter hole (or weep hole), should be drilled in the surface casing immediately above the concrete pad to allow water to drain from the inside of the protective casing. Vent holes should not be used for flush-mounted well completions. Enough clearance, usually 6 inches, should be left between the lid of the protective casing and the tip of the riser to allow the introduction of sampling equipment and/or pumps. All materials chosen shall be documented.

Monitoring wells located in high traffic areas should be flush mounted whenever possible. If a well can not be flush-mounted in high traffic areas or areas where heavy equipment is operated, the well should be protected with four steel bumper posts. This type of protection may not be necessary at all monitoring well locations.

Additional design details for a typical aboveground protective casing include the following:

1) A 5-foot minimum length of steel or aluminum protective casing shall extend approximately 2.5 feet above ground surface and set into the protective apron (aluminum should be used in coastal environments due to its corrosion resistant characteristics);

2) The protective casing inside diameter shall be at least 4 inches greater than the nominal diameter of the well riser;

3) An aluminum-hinged cover or loose-fitting telescopic slip-joint-type cap should be used to keep precipitation and cap runoff out of the casing;

4) All protective casing covers/caps shall be secured to the protective casing by means of a padlock at the time the protective casing is installed;

5) If practical, all padlocks at a given site should be keyed alike;

6) No more than a 2-inch clearance should be left between the top of the protective casing and the top of the well riser. This spacing may be required for installation of monitoring and/or pumping devices. If, however, acoustical equipment will be used for water-level determinations, a smaller spacing (2 inches or less) may be necessary;

7) Only the outside of the protective casing, hinges (if present), and covers/caps must be prepainted or painted with a paintbrush (no aerosol can). Paint shall dry prior to initially sampling that well;

8) A metal identification tag should be placed on the outside of the protective casing; and

9) In high traffic areas, install four steel or aluminum bumper posts. Each post should be radially located 4 feet from the well (immediately outside each corner of the concrete pad) and placed a minimum 2 feet below ground surface, having a minimum of 3 feet above ground surface. The posts should be set into and filled with concrete. Flagging or signposts in areas of high vegetation may be helpful. The bumper posts should be prepainted or painted using a brush.

3.1.14 Quality Assurance Sampling

Certain well construction materials used during installation should be collected for quality assurance (QA) purposes. It is not always necessary to perform chemical analyses on collected materials. However, with the exception of the approved water, the materials should be archived until the chemical results are received from the environmental samples at that location in case that the results appear to be anomalous. In this case, it may be desirable to analyze some or all of the well construction materials. Such materials include drilling fluids (approved water and any additives, if used), annular filter pack, bentonite, and cement.

3.2 Documentation

Unless otherwise specified in the ground water monitoring plan, a well construction diagram and a certificate of conformance must be produced for every monitoring well constructed.

3.2.1 Well Construction Diagram

Each diagram must be attached to, or placed on the original boring log and maintained by the site geologist, engineer or geotechnical engineer until completion of the field effort. Figure 3-1 presents an example of a completed well construction diagram included on a soil boring log. The original diagram and boring log should be retained for later reference, as needed. Special abbreviations used on the well completion diagram must be defined on the diagram.

The following information should be attached to the original boring log and graphically denote, by the depth from ground surface:

1) The bottom of the boring (that part of the boring most deeply penetrated by drilling and/or sampling) and boring diameter(s);

2) Screen type and interval;

3) Joint type and depths;

4) Granular filter pack type and depth interval;

5) Seal type and depth interval;

6) Grout type and depth interval;

7) Cave-in, if any;

8) Centralizer locations;

9) Height of riser (stickup) without cap/plug above ground surface;

10) The following protective casing details; and
    a. Height of protective casing, without cap/cover, above ground surface;
    b. Base of protective casing below ground;
    c. Weep hole location and size;
    d. Concrete pad thickness, height, and extent, and;
    e. Protective post configuration.

11) Water level immediately after completion and 24 hours after completion with date and time of measurement.

In addition to the graphical presentation discussed above, the following items should be described on each diagram:

1) The actual quantity and composition of the grout, bentonite seal, and granular filter pack used for each well;

2) The screen slot-size in inches, slot configuration type, total open area per foot of screen, outside diameter, nominal inside diameter, schedule/thickness, composition, and manufacturer;

3) The material between the bottom of the boring and the bottom of the screen;

4) The outside diameter, nominal inside diameter, schedule/thickness, composition, and manufacturer of the well casing;

5) The joint design and composition;

6) Centralizer design and composition;

7) Depth and description of any permanent pump or sampling device. For pumps, include the voltage, phase requirements, and electrical plug configuration;

8) Protective casing composition, length, and nominal inside diameter;

9) Special problems and their solutions; e.g., grout in well, lost casing and/or screens, bridging, casing repairs and adjustments, etc.; and

10) Dates and times for the start and completion of well installation.

3.3 Special Concerns

3.3.1 Shallow Wells

During shallow well construction (i.e., less than approximately 15 feet) sufficient depth may not be available to install the desired thickness of typical well components (filter pack, bentonite seal, grout, etc.). Tailored well designs and deviations from standard well construction requirements should be detailed in a ground water monitoring plan. The design, if modified, should minimize the potential infiltrations of surface water.

3.3.2 Well Clusters

Unless otherwise specified in an approved work plan, each well in a cluster shall be installed in a separate boring rather than co-located within one large-diameter boring. Each monitoring well is a mechanism through which to obtain a ground water sample representative of the aquifer zone monitored and, if so designed, to measure the potentiometric surface in that well. To ensure this representation, each well in a cluster must be constructed and installed in a separate boring. Multiple well placements in a singe boring are too difficult for effective execution and evaluation to warrant single hole usage. One exception includes the intentional design and installation of well clusters such as bundled piezometers for DNAPL characterization. Such exemptions must be detailed in a ground water monitoring plan.

4.0 Well Development

4.1 General

Borehole drilling activities may retard the ability of an aquifer to transmit water to a monitoring well. Obstructions can be caused by physical alteration of the aquifer material, or by formation damage as a result of the introduction of drilling fluids or solids in the aquifer, causing reduced permeability adjacent to the borehole. Well development is necessary to correct this damage and improve hydraulic conductivity in the immediate vicinity of the monitoring well. The objective of well development is to remove all or as much as possible of the introduced drilling fluids, mud, cuttings, mobile particulates, and entrapped gases from within and adjacent to a newly installed well, thus providing an improved connection between the well screened interval and the aquifer. The resulting inflow to the well should be physically and chemically representative of that portion of the aquifer adjacent to the screened interval. The appropriate development method or procedure to use will vary according to the hydrologic characteristics of the aquifer, the drilling method used, and the type of well completion.

4.2 Development Methods

The method most appropriate for monitoring well development is dependent upon the construction material and size of the well screen and casing, design of the filter pack, characteristics of the formation material, disposal considerations of development fluids, borehole drilling method used, impact of development method on aquifer chemistry, well depth, and cost. ASTM Standard D5521 provides guidance for the development of monitoring wells in granular aquifers.

The following are some of the most commonly used methods:

<u>Mechanical Surging</u> This method involves use of a swedge (surge) block that is moved up and down the well screen and casing. Water is alternately forced in and out of the screen to loosen sediment bridges and draw fine-grained material into the well, which is then pumped out. This is the preferred method of well development. Fine-grained materials can become trapped between the swedge and the inner wall of the screen and well casing causing the swedge to freeze in the well as well as scouring the well materials.

<u>Overpumping</u> The well is pumped at a higher rate than when it will be purged and sampled. Theoretically, the high flow rates dislodge fine-grained materials, opening the flow paths between the well and the aquifer. This method is subject to sediment bridging, requires large pumps that may be difficult to fit into small

diameter wells, generates large volumes of water that must be disposed, and results in poor development of wells with long screen intervals.

Rawhiding In this method, the well is alternately pumped and stopped at intervals that draw water into the well and back out, developing the filter pack by fluid surging. The technique can cause a high rate of wear on the pump and in certain situations may not produce a sufficient surge action for development.

Jetting This method uses high velocity streams of water to loosen fine-grained material and drilling fluids from the formation. The material that enters the wells is then pumped out. This method requires an external water supply and high velocity streams can damage the well screen. Jetting may be appropriate for redevelopment of wells that have become fouled with silt and clay or other fine matter.

Air Lift Air Lift involves forcing air out through the screen and into the monitoring well to clean debris from the well. This method alters the chemistry of the aquifer, may introduce contaminants to the aquifer via the air supply, may release contaminants to the air via mists from the well, and may damage the screen and filter pack.

4.3 Timing and Record Submittal

The development of monitoring wells should not be initiated sooner than 12 hours after or longer than 7 days beyond placement of grout. Well development should be appropriately documented on a monitoring well development record and included with the boring log.

4.4 Oversight

The development of a monitoring well should be overseen and recorded by a site geologist, engineer or geotechnical engineer.

4.5 Development Criteria

Well development should continue until representative water; free of drilling fluids, cuttings, or other materials introduced during well construction is obtained. In other words, the well should be developed until the water is non-turbid. Well discharge water should be metered in the field until it can be established that development has attenuated and stabilized turbidity to the maximum degree possible. All turbidity sampling times and measurements should be recorded on a well completion form.

Suggested minimum volumes to be withdrawn from a well are:

1) For those wells where the boring was made without the use of drilling fluid, but approved water was added to the well installation, remove five times the amount of any water unrecovered from the well during installation (in addition to five times the standing volume).

2) For those wells where the boring was made or enlarged (totally or partially) with the use of drilling fluid, remove five times the measured, or estimated, amount of total fluids lost while drilling, plus five times that used for well installation (in addition to the five times the standing volume). Exceptions may be warranted during the drilling of deep well borings where significant water was lost in a previous hydrologic zone.

Note: Developing a well for too short a period is a common and major cause for poor well performance. Also, water should not be added to a well as part of the development once the initial bentonite seal atop the filter pack is placed.

If any of the following circumstances occur, the site geologist, engineer or geotechnical engineer should document the event in writing and use an alternate plan of action:

1) After extensive development, a non-turbid sample cannot be collected due to a significant fraction of fine-grained material in the surrounding aquifer;

2) Persistent water discolorations remain after the required volumetric development; and

3) Excessive sediment remains after the required volumetric removal.

4.6 Development – Sampling Break

Well development must be completed at least 24 hours before well sampling. The intent of this hiatus is to provide time for the newly installed well and backfill materials to sufficiently equilibrate to their new environment and for that environment to re-stabilize after disturbance of drilling. Applicable Federal, State, and local regulations may require up to 14 days before well sampling can begin.

4.7 Pump/Bailer Movement

During development, water should be removed throughout the entire water column in the well by periodically lowering and raising the pump intake (or bailer stopping point).

4.8 Well Washing

Well development should include the washing of the entire well cap and the interior of the well riser above the water table using only water from that well. The result of this operation will be a well casing free of extraneous materials (grout, bentonite, sand, etc.) inside the well cap and casing, between the top of the well and the water table. The washing should be conducted before and/or during development, and not after development.

4.9 Well Development Record

The following data shall be recorded on a monitoring well development record during development:

1) Name of the responsible site geologist, engineer or geotechnical engineer;

2) Well designation and location;

3) Site name and location;

4) Date(s) of well installation;

5) Date(s) and time of well development;

6) Description of surge/development technique;

7) Type, size, capacity, and pumping rate of pump and/or bailer used;

8) Depth from top of well casing to bottom of well;

9) Well and casing inside diameter;

10) Static water level (equilibrium) from top of well casing before and after development;

11) Field measurements of pH, specific conductance, temperature, and turbidity before, at least twice during, and after development;

12) Screen length and interval;

13) Physical character of removed water, to include changes during development in clarity, color, particulates, and any noted incidental odor;

14) Cumulative water volume or pumping rate;

15) Quantity of fluids/water removed and time interval for removal (present both incremental and total values); and

16) Drilling company.

4.10 Determination of Hydraulic Conductivity from Specific Capacity

Immediately following well development, estimates of hydraulic conductivity can be obtained by conducting specific capacity tests. Specific capacity of a well is the well yield per unit drop of water level in the well. Immediately after monitoring well development, the specific capacity can be measured and used to provide an estimate of the hydraulic conductivity. If the well does not sustain pumping rates of at least 0.5 gallons per minute without excessive drawdown, other aquifer tests, such as slug tests, should be conducted.

Inherent in the calculation of hydraulic conductivity from specific capacity data are certain assumptions, therefore the responsible site geologist, engineer or geotechnical engineer should account for the following potential sources of error when calculating the hydraulic conductivity from specific capacity data:

1) Effects of variable discharge;

2) Effects of partial penetration of the well;

3) Calculation of well losses;

4) Appearance of delayed yield in the aquifer; and

5) Estimates of aquifer storativity.

Appendix C presents details on the performance of specific capacity tests.

5.0 Management of Investigation-Derived Waste

Investigation-Derived Waste (IDW) is defined as waste materials generated during environmental field activities. IDW may include drilling muds, cuttings, and purge water from test pit and well installation; purge water, soil, and other materials from sample collection; residues such as ash, spent carbon, well development purge water for testing of treatment technologies; contaminated PPE; and solution used to decontaminate equipment and non-disposable PPE. An IDW management plan should be developed as part of a ground water monitoring plan.

5.1 IDW Management Requirements

The fundamental purpose of IDW management is to choose options that are:

1) Protective of human health and the environment; and

2) In compliance with regulations and applicable or relevant and appropriate requirements (ARARs).

5.2 General Objectives for IDW Management

General objectives that site managers should consider include:

1) Protectiveness;

2) Minimization of IDW generation; and

3) Management of IDW consistent with the final remedy for the site.

To the extent that the objectives can be achieved is highly dependent on site-specific conditions.

5.2.1 Protectiveness

Factors that should be considered in determining if a specific management or disposal option is protective include the following:

1) The contaminants, their concentrations, and total volume of IDW;

2) Potentially affected media under management options;

3) Location of the nearest population(s) and likelihood or degree of site access;

4) Potential exposure to workers; and

5) Potential for environmental impacts.

Generally, best professional judgment will be required to make this determination.

5.2.2 IDW Management

Site managers should attempt to minimize the generation of IDW to reduce the need for special storage or disposal requirements that may result in substantial additional costs yet provide little or no reduction in site risks relative to the final remedial action. Generation of IDW can be minimized through proper planning of all remedial activities that may generate IDW, as well as through use of screening information during the site inspection. The potential problems of managing IDW should be a factor in choosing an investigation method.

5.2.3 Consistency with Final Remedy

Most IDW generated during the course of an investigation are intrinsic elements of the site. If possible, IDW should be considered part of the site and should be managed with other wastes from the site, consistent with the final remedy. This will avoid the need for separate treatment and/or disposal arrangements. Because early planning for IDW can prevent unnecessary costs and the use of treatment and disposal capacity, IDW management should be considered as early as possible during the remedial process. A key decision to be made is whether the waste will best be treated or disposed of immediately or addressed with the final remedy. In addition, when IDW is stored on site, it should be managed as part of the first remedial action that addresses the affected media.

5.3 Selection of IDW Disposal Options

The manner of waste disposal must be consistent with applicable Federal, State, and local regulations. Actual disposal and/or treatment techniques for contaminated materials are the same as those for any hazardous substance, that is, incineration, deposition in a landfill, treatment, etc. Protocols and the parties responsible for the handling and disposal of IDW should be included in the ground water work plan.

Disposal option selection should be based on the previously discussed factors:

1) The type and quantity of IDW generated;

2) Risk posed by managing the IDW on site;

3) Compliance to regulations, standards, and ARARs;

4) IDW minimization; and

5) Whether the final remedy is anticipated to be an off site or and onsite remedy.

6.0 Topographic Survey

6.1 Licensing

When practical or if site circumstances require, topographic survey efforts should be conducted by a Florida-licensed surveyor. Exceptions may include low resolution surveys, temporary point locations, and relative location surveys performed by personnel familiar with land surveying but not state certified.

6.2 Horizontal Control

Each boring and/or well installation should be topographically surveyed to determine its location referenced to either a Universal Transverse Mercator (UTM) grid or the State Plane Coordinate System (SPCS). These surveys should be connected to the UTM or SPCS by third order, Class II control surveys in accordance with the Standards and Specifications for Geodetic Control Networks (Federal Geodetic Control Committee, 1984). If the project is an area remote from UTM or SPCS benchmarks and such horizontal control is not warranted, then locations measured from an alternate system depicted on project plans may be acceptable. An accuracy of +/- 0.10 foot is expected for monitoring well locations. Under typical conditions, all borings, temporary wells, temporary and/or permanent markers should also have an accuracy of +/- 1.0.

6.3 Vertical Control

Elevations for a designated point (marked measuring point) on the rim of the uncapped well casing (not the protective casing) for each bore/well site should be surveyed to within +/- 0.010 foot and referenced to the National Geodetic Vertical Datum (NGVD) of 1988. If elevations for the natural ground surface at the bore/well site (not the top of the concrete pad) are required, the survey should be within +/- 0.10 foot and referenced to the NGVD 1988. These surveys should be connected by third order leveling to the NGVD in accordance with the Standards and Specification for Geodetic Control Networks. If the project is in an area remote to NGVD benchmarks and such vertical control is not warranted, then elevations measured from a project datum may suffice, at least on a temporary basis.

6.4 Benchmark Placement

Temporary benchmarks may be installed to perform survey work. Ternporary benchmarks typically consist of one or more of the following:

1) Iron pin (#4 rebar minimum, 24 inches in length);

2) Railroad spike in utility pole or tree;

3) Masonry nail driven in pavement;

4) Chiseled square on a concrete structure; and

5) Painted portion of a fixed object, such as a specific part of a fire hydrant.

Permanent benchmarks may be required to provide future control at a site. Permanent benchmarks will consist of a concrete monument a minimum of 5 inches square and two feet in depth with an iron pin imbedded full depth of the concrete and set flush with the top of the concrete, or a brass marker set in a five inches square, two-foot deep concrete monument.

6.5 Field Data

The topographic survey should be completed as near to the time of the last well completion as possible. Survey field data (as corrected), should include loop closures and other statistical data in accordance with the Standards and Specifications. Closure should be within the horizontal and vertical limits referenced above. These data shall be clearly listed in tabular form; the coordinates (and system) and elevation (ground surface and top of riser) for all borings, wells, and reference marks. All permanent and semi permanent reference marks used for horizontal and vertical control (benchmarks, caps, plates, chiseled cuts, rail spikes, etc.) should be described in terms of their name, character, physical location, and reference value. These field data should become part of the project records maintained by the site geologist, engineer, geotechnical engineer, project manager, or other appropriate person.

6.6 Survey Reports

The survey report should include the following:

1) A map showing the locations of the monitoring wells, reference points, and benchmarks. Elevations must be included for all wells (ground surface and top of well riser) and benchmarks;

2) A copy of all checked field notes taken during the field work; and

3) A copy of all coordinates and elevations for the monitoring wells, soil borings, surface water/sediment locations, etc., and temporary control points (baseline and traverse points).

6.7 Geographic Positioning System

As an alternative to conventional land surveying, a Geographic Positioning System (GPS) may be used to determine the horizontal and vertical location of points in the field. GPS may provide greater convenience, reduce equipment and personnel demands, and reduce the time required to conduct a survey as opposed to more traditional methods. GPS is particularly suited for point positioning in remote locations away from established benchmarks. Adequate GPS units must be employed, though, as typical well location and elevation determinations require high resolution surveying.

7.0 Well and Boring Abandonment

7.1 General

Abandonment procedures are designed to permanently close a boring or monitoring well. As such they are designed to preclude current or subsequent fluid media from entering or migrating within the subsurface environment along the borehole vertical axis. It is therefore important that a borehole be sealed in such a manner that it cannot act as a conduit for migration of contaminants from the ground surface to the water table or between aquifers.

All soil borings not completed as monitoring wells must be abandoned in accordance with the following procedures and must be documented on the boring log as such. The date(s) of abandonment and the abandonment method must be included on the boring log.

7.2 Methodology

Each boring to be abandoned should be sealed by grouting from the bottom of the boring/well to ground surface. This should be done by placing a tremie pipe to the bottom for the boring (i.e., to the maximum depth drilled) and pumping grout through the pipe until undiluted grout flows from the boring at ground surface. The ground sealant must consist of high-solids, 100 percent-pure sodium bentonite grout. The amount of approved water used should be kept to a minimum. Neither additives nor borehole cuttings should be mixed with the grout. No borehole shall be backfilled with cuttings.

After 24 hours, the driller, site geologist, engineer, geotechnical engineer, or other field representative, should check the abandoned site for grout settlement. Any settlement depression should be immediately filled even with the ground surface and rechecked 24 hours later. Additional grout should be added using a tremie pipe inserted to the top of the firm grout, unless the depth of the unfilled portion of the hole is less than 5 feet and that portion is dry. The process should be repeated until firm grout remains at the ground surface. It may be necessary to grout the boring to a depth of 2 feet below grade and complete the backfill with lean concrete or asphalt, depending upon the composition of the original surface.

References Cited

29 CFR 1910,120, Code of Federal Regulations, 29 CFR 1910,120, Hazardous Waste Operations and Emergency Response

29 CFR 1926, Code of Federal Regulations, 29 CFR 1926, Safety and Health Regulations for Construction

ASTM A53/A53M, "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless," ASTM International

ASTM A312/A312M, "Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipe," ASTM International

ASTM C150, "Standard Specification for Portland Cement", ASTM International

ASTM, D1452, "Standard Practice for Soil Investigation and Sampling by Auger Borings," ASTM International

ASTM D1586, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils," ASTM International

ASTM D1587, "Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes," ASTM International

ASTM D1785, "Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120," ASTM International

ASTM D2113 Historical Standard, "Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation," ASTM International

ASTM D2487, "Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)," ASTM International

ASTM D2488, "Standard Practice for Description and Identification of Soils," ASTM International

ASTM D3550, "Standard Practice for Thick Wall, Ring-lined, Split Barrel, Drive Sampling of Soils," ASTM International

ASTM D4894, "Standard Specification of Polytetraflurorethylene (PTFE) Granular Molding and Ram Extrusion Materials," ASTM International

ASTM D4895, "Standard Specification for Polytetraflurorethylene (PTFE) Resin Produced From Dispersion," ASTM International

ASTM D5088, "Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites," ASTM International

ASTM D5092, "Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers," ASTM International

ASTM D5299, "Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities," ASTM International

ASTM D5521, "Standard Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers," ASTM International

ASTM D5781, "Standard Guide for Use of Dual-Wall Reverse-Circulation Drilling for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices," ASTM International

ASTM D5782, "Standard Guide for Use of Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices," ASTM International

ASTM D5783, "Standard Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices," ASTM International

ASTM D5784, "Standard Guide for Use of Hollow-Stem Augers for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices," ASTM International

ASTM D5787, "Standard Practice for Monitoring Well Protection," ASTM International

ASTM D5872, "Standard Guide for Use of Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices," ASTM International

ASTM D5875, "Standard Guide for Use of Cable-Tool Drilling and Sampling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices," ASTM International

ASTM D6169, "Standard Guide for Selection of Soil and Rock Sampling Devices Used With Drill Rigs for Environmental Investigations," ASTM International

ASTM D6286, "Standard Guide for Selection of Drilling Methods for Environmental Site Characterization," ASTM International

ASTM D6724, “Standard Guide for Installation of Direct Push Ground Water Monitoring Wells”, ASTM International

ASTM D6725, “Standard Guide for Direct Push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers,” ASTM International

ASTM D6914, “Standard Practice for Sonic Drilling for Site Characterization and the Installation of Subsurface Monitoring Devices,” ASTM International

ASTM F480, “Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80, ASTM International

Driscoll, Fletcher, Ph.D., Ground water and Wells, Johnson Division, St. Paul, MN, 1996.

National Ground Water Association, Stuart Smith, ed., Manual of Water Well Construction Practices, NGWA, Westerville, OH (1998)

U.S. Army Corps of Engineers (USCOE), Engineering and Design, Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites, EM 1110-1-4000, 1 November 1998

USCOE, EM 385-1-1, Safety and Health Requirements Manual

USCOE, ER 385-1-92, Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive (HTRW) and Ordnance and Explosive Waste (OEW) Activities

U. S. Environmental Protection Agency,_Environmental Investigations Standard Operating Procedure and Quality Assurance Manual, Section 6: Design and Installation of Monitoring Wells, November 2001

Other Suggested References

ASTM D 5876, "Standard Guide for Use of Direct Rotary Wireline Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices," ASTM International

ASTM D 5978, "Standard Guide for Maintenance and Rehabilitation of Ground-Water Monitoring Wells," ASTM International

ASTM D 5979, "Standard Guide for Conceptualization and Characterization of Ground-Water Systems," ASTM International

U.S. Environmental Protection Agency, Nonaqueous Phase Liquids Compatibility with Materials Used in Well Construction, Sampling, and Remediation, (EPA/540/S-95/503, July, 1995) http://www.epa.gov/ada/download/issue/napl.pdf

Appendix A – Tables

- Table 4: Typical Borehole and Annulus Volume Calculations
- Table 5: Comparison of Stainless Steel, PVC, and Teflon® for Monitoring Well Construction
- Table 6: Relative Compatibility of Rigid Well Casing Material (Percent)

Table 4: Typical Borehole and Annulus Volume Calculations

Inside Diameter of Borehole (inches)	Outside Diameter of Casing Within Borehole (inches)	Cubic Feet per Foot of Depth	U.S. Gallons per Foot of Depth
1.0	NA	0.005	0.04
1.5	NA	0.012	0.09
2.0	NA	0.022	0.16
2.5	NA	0.034	0.25
3.0	NA	0.049	0.37
3.5	NA	0.067	0.50
4.0	NA	0.087	0.65
4.0	2.5	0.053	0.40
4.5	NA	0.110	0.83
5.0	NA	0.136	1.02
5.5	NA	0.165	1.23
6.0	NA	0.196	1.47
6.0	2.5	0.162	1.21
6.0	4.5	0.086	0.64
6.5	NA	0.230	1.72
7.0	NA	0.267	2.00
8.0	NA	0.349	2.61
8.0	2.5	0.315	2.36
8.0	4.5	0.239	1.78
8.0	6.5	0.119	0.89
9.0	NA	0.442	3.30
10.0	NA	0.545	4.08
10.0	2.5	0.511	3.82
10.0	4.5	0.435	3.25
10.0	6.5	0.315	2.36
11.0	NA	0.660	4.94
12.0	NA	0.785	5.87
12.0	2.5	0.751	5.62
12.0	4.5	0.675	5.05
12.0	6.5	0.555	4.15
14.0	NA	1.069	8.00
14.0	4.5	0.959	7.17
14.0	6.5	0.839	6.27
16.0	NA	1.396	10.44
16.0	4.5	1.286	9.62
16.0	6.5	1.186	8.72

Table 5: Comparison of Stainless Steel, PVC, and Teflon® for Monitoring Well Construction

Characteristic	Stainless Steel	Schedule 40 PVC	Teflon
Strength	Use in deep wells to prevent compression and closing of screen and/or riser	Use when shear and compression strength are not critical	Low-strength capabilities limit deep-well construction
Weight	Relatively heavier	Light-weight	Relatively light
Cost	Relatively expensive	Relatively inexpensive	Expensive
Corrosivity	Deteriorates more rapidly in corrosive water, particularly when exposed to $H_2SO_4$4	Non-corrosive – may deteriorate in presence of high concentrations of ketones, aromatics, alkyl sulfides, or some chlorinated hydrocarbons	Nearly totally resistant to chemical and biological attack, oxidation, weathering and ultraviolet radiation
Ease of Use	Difficult to adjust size or length in the field	Easy to handle and work with in the field	Fairly easy to handle and work with in the field
Preparation for Use	Should be steam cleaned if organics will be subsequently sampled	Never use glue fillings – pipes should be threaded or pressure fitted. Should be steam cleaned when used for monitoring wells is not certified clean	Should be steam cleaned if not wrapped by manufacturer and if organics will be subsequently sampled
Interaction with contaminants	May sorb organic or inorganic substances when oxidized	May sorb or release organic substances	Almost completely chemically inert; may react to halogenated compounds, and sorption of some organic compounds, (Reynolds and Gillham, 1985). Except in the case of very low yield wells which preclude purging prior to sampling, these reactions are unlikely to cause significant sample bias.

Table 6: Relative Compatibility of Rigid Well Casing Material (Percent)

Potentially-Reactive Substance	Type of Casing Material						
	PVC 1	Galvanized Steel	Carbon Steel	Lo-Carbon Steel	Stainless Steel 304	Stainless Steel 316	Teflon®*
Buffered Weak Acid	100	56	51	59	97	100	100
Weak Acid	98	59	43	47	96	100	100
Mineral Acid/High Solids Content	100	48	57	60	80	82	100
Aqueous/ Organic Mixtures	64	69	73	73	98	100	100
Percent Overall Rating	91	58	56	59	93	96	100

Preliminary Ranking of Rigid Materials:

1. Teflon®*
2. Stainless Steel 316
3. Stainless Steel 304
4. PVC
5. Lo-Carbon Steel
6. Galvanized Steel
7. Carbon Steel

*Teflon is a registered product of DuPont

Appendix B – Forms

- Form 1: Soil Parameters for Logging
- Form 2: Rock Parameters for Logging
- Form 3: Monitoring Well Completion Report
- Form 4: Application to Construct, Repair, Modify or Abandon a Well

Form 1: Soil Parameters for Logging

Parameter	**Example**
Classification	
Depositional Environment and formation, if known	
ASTM D 2488 Group Symbol	
Secondary Components and estimated percentages	
Color: *Give both narrative and numerical description and what chart was used – Munsell Soil and/or GSA Rock Color*	
Plasticity	
Consistency (cohesive soil)	
Density (non-cohesive soil)	
Moisture content (use relative terms)	
Structure and orientation	
Grain angularity	

Source: U.S. COE, 1988

Form 2: Rock Parameters for Logging

Parameter	**Example**
Rock Type	
Formation	
Modifier denoting variety	
Bedding/banding characteristics	
Color: *Give both narrative and numerical description and what chart was used – Munsell Soil and/or GSA Rock Color*	
Hardness	
Degree of cementation	
Texture	
Structure and orientation	
Degree of Weathering	
Solution or Void Conditions	
Primary and secondary permeability, including estimates and rationale	
Rock quality designation	

Source: U.S. COE, 1988

Form 3: Monitoring Well Completion Report

DEP Form # 62-520.900(3)	
Form Title MONITORING WELL COMPLETION REPORT	
Effective Date	
DEP Application No. (Filled in by DEP)	

Florida Department of Environmental Protection

Bob Martinez Center, 2600 Blair Stone Road Tallahassee, Florida 32399-2400

MONITORING WELL COMPLETION REPORT

PART I: GENERAL INFORMATION

Well ID:	Site Name:		Well Install Date
Facility ID	Alternate ID	FLUWID #	WMD Permit #
Well Purpose ☐ Background ☐ Intermediate ☐ Compliance ☐ Other (explain)			
Latitude (to nearest 0.1 seconds)		Longitude (to nearest 0.1 seconds)	
Latitude and Longitude collection method: ☐ DGPS ☐ AGPS ☐ MAP ☐ ZIPCODE ☐ DPHO ☐ UNKNOWN ☐ OTHER			

PART II: WELL CONSTRUCTION DETAILS

Water Well Contractor Name	Contractor License #
Company Name	
Construction Method: ☐ Hollow Stem Auger ☐ Solid Stem Auger ☐ Water/Mud Rotary ☐ Air Rotary ☐ Cable Tool ☐ Direct Push ☐ Sonic ☐ Other (describe)	Aquifer Monitored
Top of Casing Elevation (NVGD or NAVD)	Ground Surface Elevation (NVGD or NAVD)

Casing

Material	Inside Diameter	Outside Diameter	Depth (ft.) From	Depth (ft.) To

Screen

Material	Inside Diameter	Outside Diameter	Depth (ft.) From	Depth (ft.) To	Slot Size

Annulus

Material including additives for sealant	Size of Material	Amount (# of bags)	Depth (ft.) From	Depth (ft.) To	Installation Method

PART III: WELL DEVELOPMENT DETAILS

Well Development Date	Well Development Method: ☐ Surge/Pump ☐ Pump ☐ Compressed Air ☐ Other (explain)		
Development Duration			
Pumping Rate	Maximum Drawdown	Well Purged Dry ☐ yes ☐ no	Pumping Condition ☐ continuous ☐ intermittent
Turbidity (if Measured): Start:	End:		Stabilized Water Level (BLS)
Water appearance (color and odor) at start of development:			
Water appearance (color and odor) at end of development:			

Report Prepared By:	Date
Title/Company	License #

PLEASE ATTACH BORING LOG

Remarks

Form 4: Application to Construct, Repair, Modify or Abandon a Well

STATE OF FLORIDA PERMIT APPLICATION TO CONSTRUCT, REPAIR, MODIFY, OR ABANDON A WELL

☐ Southwest
☐ Northwest
☐ St. Johns River
☐ South Florida
☐ Suwannee River

CHECK BOX FOR APPROPRIATE DISTRICT. ADDRESS ON BACK OF PERMIT FORM

THIS FORM MUST BE FILLED OUT COMPLETELY.

The water well contractor is responsible for completing this form and forwarding the permit to the appropriate delegated county where applicable.

Permit No. ____________
Florida Unique I.D. ____________
Permit Stipulations Required (See attached)

62-524 well ☐
CUP/WUP Application No. ____________

Fold at this line in order that address is visible through envelope window

1. ____________
Owner, Legal Name of Entity if Corporation | Address | City | Zip | Telephone Number

2. ____________
Well Location — Address, Road Name or Number, City

3. ____________
Well Drilling Contractor | License No. | Telephone No.
Address
City | State | Zip

4. ______ (smallest) 1/4 of ______ (biggest) 1/4 of Section ______
(Indicate Well on Chart)
NW | NE | SW | SE

5. Township ______ Range ______

6. ______ | ______ | ______ | ______ | ______
County | Subdivision Name | Lot | Block | Unit

7. **Number of proposed wells** ______ **Check the use of well:** (See back of permit for additional choices) ______ Domestic Monitor (type) ______
______ Irrigation (type) (See Back) Public Water Supply (type) ______ (See Back) List Other ______
Distance from septic system ______ ft. **Description of facility** ______ **Estimated start of construction date** ______

8. **Application for:** ______ New Construction ______ Repair/Modify ______ Abandonment ______ (Reason for Abandonment)

Date Stamp

9. **Estimated:** Well Depth ______ Casing Depth ______ Screen Interval from ______ to ______
Casing Material: Blk-Steel / Gal / PVC Casing Diameter ______ Seal Material ______

10. **If applicable: Proposed Grouting Interval**
From ______ to ______ Seal Material ______
From ______ to ______ Seal Material ______
From ______ to ______ Seal Material ______

Draw a map of well location and indicate well site with an "X". Identify known roads and landmarks; provide distances between well and landmarks.

North | West | East | South

11. **Telescope Casing** ______ **or Liner** ______ (check one) Diameter ______
Blk-Steel / Galvanized / PVC Other (specify: ______

12. **Method of Construction:** ______ Rotary ______ Cable Tool ______ Combination
______ Auger ______ Other (specify:) ______)

13. **Indicate total No. of wells on site** ______. **List number of unused wells on site** ______.

14. **Is this well or any other well or water withdrawal on the owner's contiguous property covered under a Consumptive/Water Use Permit (CUP/WUP) or CUP/WUP Application?** ___No ___Yes
(If yes, complete the following) CUP/WUP No. ______
District well I.D. No. ______
Latitude ______ Longitude ______
Data obtained from GPS ____ or map ____ or survey ____ (*map datum NAD 27*___ *NAD 83*___)

15. I hereby certify that I will comply with the applicable rules of Title 40, Florida Administrative Code, and that a water use permit or artificial recharge permit, if needed, has been or will be obtained prior to commencement of well construction. I further certify that all information provided on this application is accurate and that I will obtain necessary approval from other federal, state, or local governments, if applicable. I agree to provide a well completion report to the District within 30 days after drilling or the permit expiration, whichever occurs first.

I certify that I am the owner of the property, that the information provided is accurate, and that I am aware of my responsibilities under Chapter 373, Florida Statutes, to maintain or properly abandon this well; or, I certify that I am the agent for the owner, that the information provided is accurate, and that I have informed the owner of his responsibilities as stated above. Owner consents to personnel of the WMD or a representative access to the well site.

Signature of Contractor | License No. | Owner's or Agent's Signature | Date

DO NOT WRITE BELOW THIS LINE — FOR OFFICIAL USE ONLY

Approval Granted By: ______ Issue Date: ______ Hydrologist Approval ______ (Initials)

Owner Number: ______ Fee Received: $ ______ Receipt No.: ______ Check No.: ______

THIS PERMIT NOT VALID UNTIL PROPERLY SIGNED BY AN AUTHORIZED OFFICER OR REPRESENTATIVE OF THE WMD. IT SHALL BE AVAILABLE AT THE WELL SITE DURING ALL DRILLING OPERATIONS. ***This permit is valid for 90 days from date of issue.***

WHITE: ORIGINAL FILE
YELLOW: DRILLING CONTRACTOR
PINK: OWNER

SRWMD FORM 40B-3-1 REV. 12/95

Appendix C- Specific Capacity Testing

The purpose of specific capacity testing can be multi-fold, and depends on project demands. Specifically, some of the objectives of specific capacity testing include:

1) Determine the maximum pumping rate for a given well;

2) Obtain data to calculate first estimate of hydraulic conductivity and storativity; and

3) Obtain data to determine well efficiency.

Specific capacity tests can be conducted during or following development, or during purging for sampling. Specific capacity testing should be considered if the well is capable of sustaining a measurable yield, and if the test well pump is capable of sustaining a constant rate discharge. Specific capacity is defined as yield divided by drawdown, and is normally expressed as gallons per minute/feet of drawdown. Both pumping rate and drawdown are measured simultaneously in the tested well after a given amount of time has elapsed. Dividing the yield rate by the stabilized drawdown, gives the specific capacity. Specific capacity can vary with pumping duration, with specific capacity decreasing as pumping time increases. Additionally, specific capacity also generally decreases as discharge rate increases. Both of these responses are due to the dewatering of the aquifer within the domain of the cone of depression; for a given amount of drawdown, the yield progressively becomes less as the saturated thickness of the aquifer is reduced. Specific capacity may also vary with yield as function of the system efficiency, including the pump, well, discharge piping, well efficiency, etc., which all add an element of friction to the process.

The analysis of specific capacity test data is relatively straightforward, and based on equations presented in Jacob (1946) and Lohman (1972). Bradbury and Rothschild (1985) compiled a computer program to accept specific capacity data and output aquifer transmissivity. This program accounts for well loss and partial penetration, and is easily compiled from the reference. The treatment of partial penetration in the program is straightforward, and is treated mathematically in the reference. Well loss is less apparent, and is discussed further.

Well loss in an important factor in the analysis of specific capacity data when yield rate is substantially high. Well loss, or head loss due to well inefficiency, is due to turbulent flow of water through the well bore, into the well, and into the pump. Well loss is expressed as a percentage, or as a coefficient.

The equation representing general well loss (Walton, 1987) is expressed as:

Equation 1 $S_\omega = CQ^2$

Where:

S_ω = drawdown component due to well loss, in feet
C = well coefficient, in sec^2/ft^5
Q = production well discharge rate, in cubic feet per second (cfs) (1 cfs = 449 gallons per minute [gpm])

Values of the well loss coefficient as used in the Bradbury and Rothschild program for production wells are generally less than 10 and are more often than not less than 2 (Walton, 1987). Typically, well loss is calculated using step drawdown test data. During a step drawdown test, yield rate and drawdown are measured synoptically while the pump is operated at successive stages at some fraction of full capacity. Using a step test data, the well loss coefficient may be estimated by the following equation (Walton, 1987):

Equation 2

$$C = \frac{(\Delta S_n/\Delta Q_n) - (\Delta S_{n-1}/\Delta Q_{n-1})}{(\Delta Q_{n-1} + \Delta Q_n)}$$

The following example illustrates a typical well loss coefficient calculation: A step drawdown test was performed. The pumping rates and times are shown below:

Start Time	End Time	Pumping Rate (gpm)
10:30	12:40	13.3
12:40	14:00	25.0
14.00	14.20	42.0

During the pumping periods, the water levels in the pumping well were recorded using an electronic water/level indicator. Data required to calculate the well loss coefficient are shown below:

Step # (n)	Q (gpm)	Q (cfs)	ΔQ (cfs)	s (ft)	Δ s (ft)
1	13.3	0.0296	0.0296	5.6	5/.6
2	25.0	0.0557	0.0261	11.6	6.0
3	42.0	0.0935	0.0378	21.2	9.6

Where:

Q = Actual discharge for the time step
ΔQ = Increase in discharge for the time step
S = Drawdown at the time step pumping rate
ΔQ = Increase in drawdown from the previous time step

Using Equation 2, the well loss coefficients are:

C 1.2 = 730.7 sec^2 / ft^5
C 2.3 = 377.1 sec^2 / ft^5

Therefore, the average well loss coefficient is 553.9 sec^2 / ft^5. Using Equation 1, the well loss at 42 gpm is theoretically calculated to be 4.8 feet.

The importance of determining the well loss coefficient will depend on the yield rate of the test. Because of the association with turbulent flow, calculation of the well loss coefficient may be impractical and unnecessary for a yield rate of a few gallons per minute or less.

The procedure for conducting a specific capacity test is quite simple, and consists of the following general steps:

1) Open the well to vent;

2) Measure the static water level;

3) Insert pump into well and allow to equilibrate;

4) Remeasure water level to ensure equilibration following pump insertion;

5) Initiate pumping;

6) Measure yield rate and drawdown synoptically at regular and frequent intervals, and record on the specific capacity test form;

7) Pump until drawdown stabilized (subjective determination; generally measurements within 0.03 feet over a ten minute interval can be considered stable);

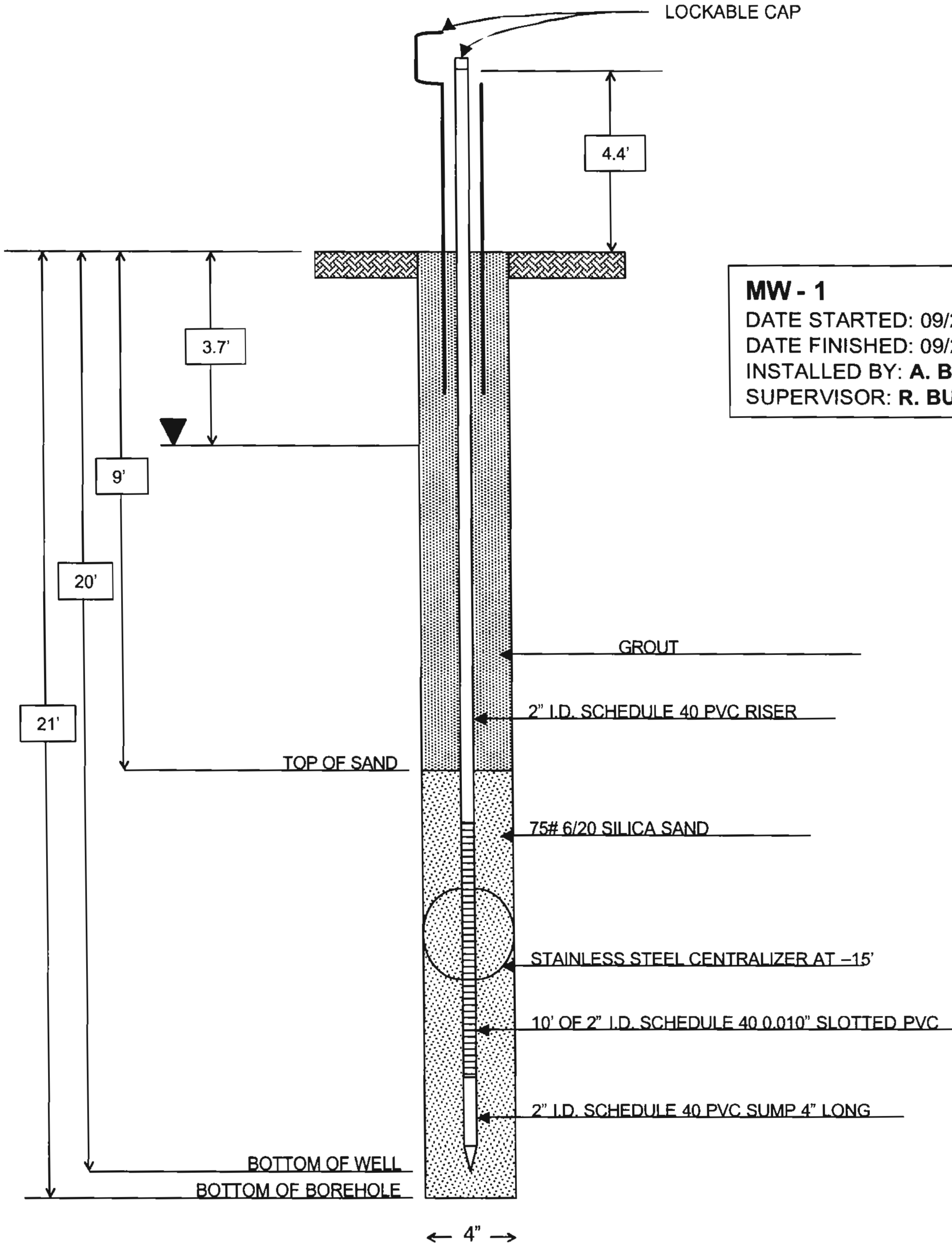
8) Terminate pumping; and

9) Measure water levels at frequent intervals during recovery to ensure original static water level is reached; the water level measured when residual drawdown stabilized should be used as the static water level.

APPENDIX 2

WELL CONSTRUCTION DETAILS

MONITORING WELL INSTALLATION
TITAN – KING'S ROAD MINE
FILE NO.: 05-086



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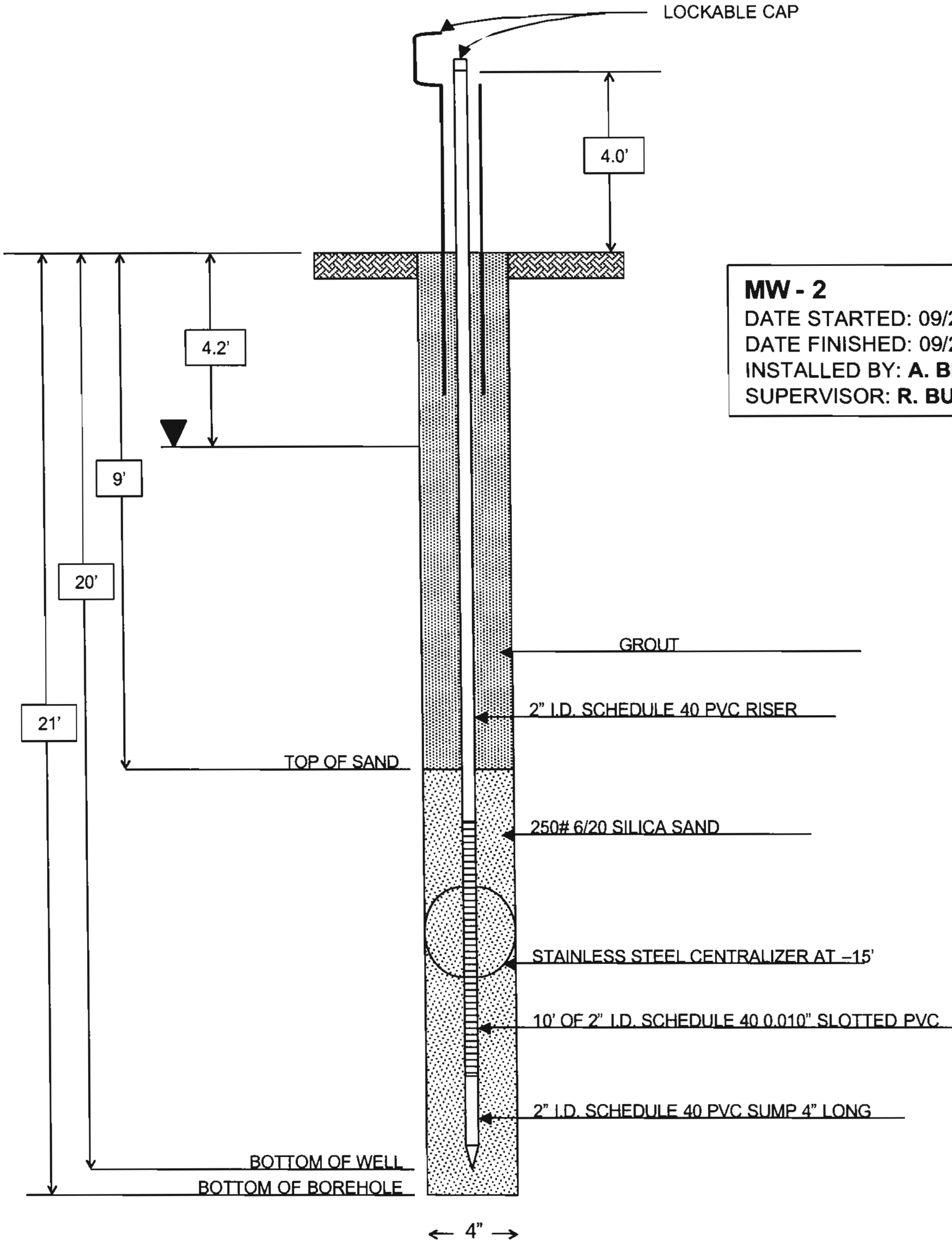
DATE STARTED: 09/29/05
DATE FINISHED: 09/29/05
INSTALLED BY: **A. BRACKINS**
SUPERVISOR: **R. BURR, P.G.**

MONITORING WELL INSTALLATION
TITAN – KING'S ROAD MINE
FILE NO.: 05-086



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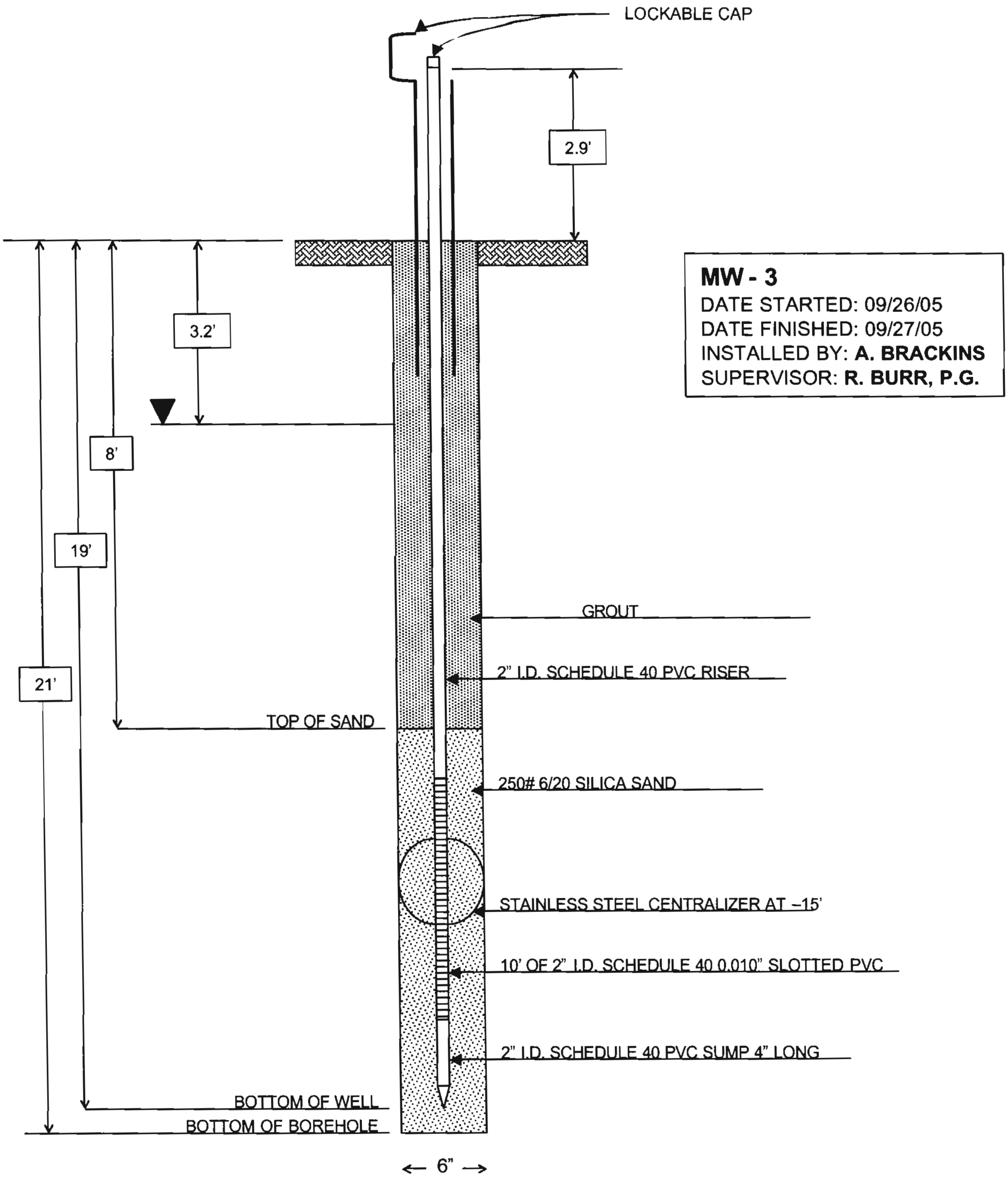
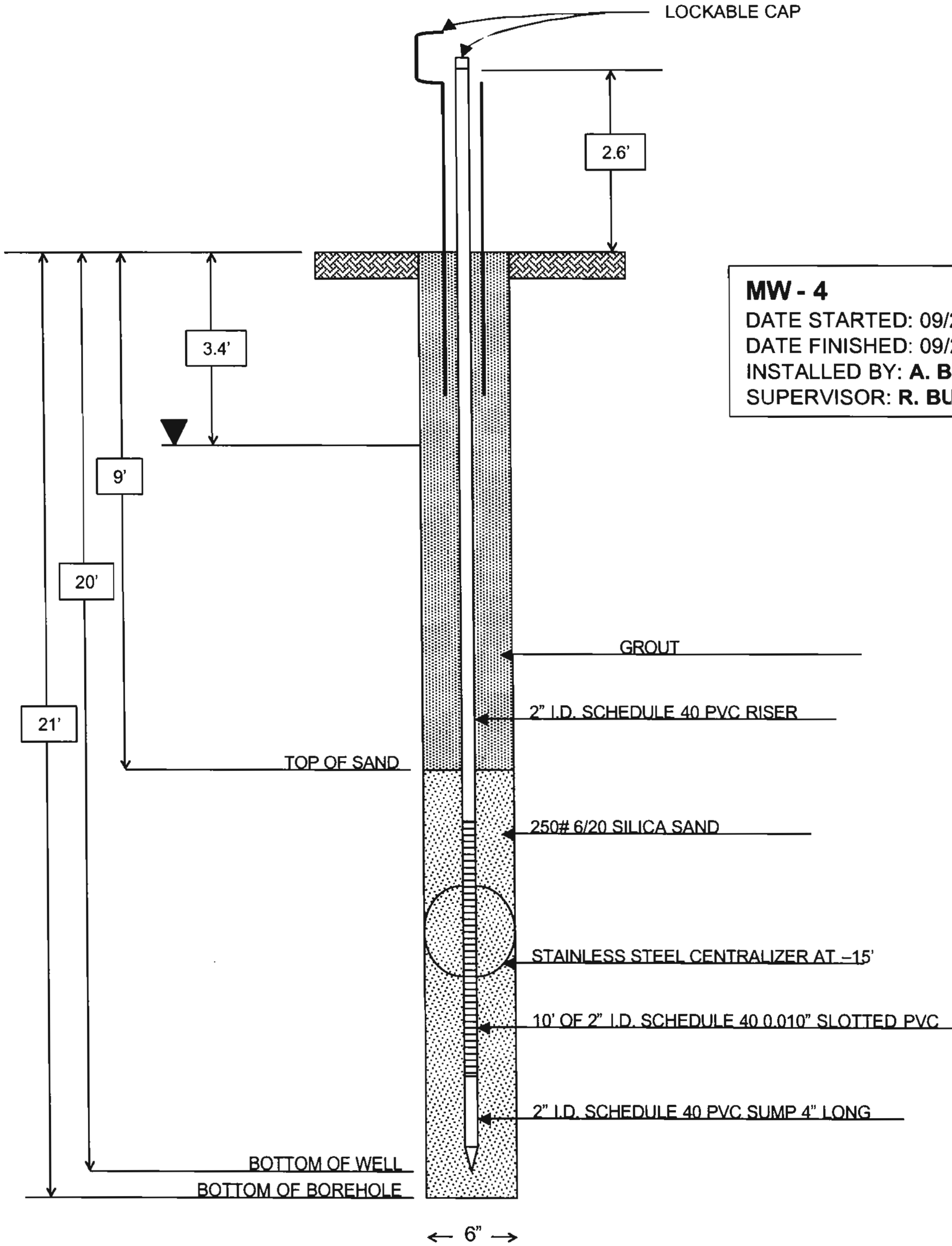
DATE FINISHED: 09/29/05
INSTALLED BY: **A. BRACKINS**
SUPERVISOR: **R. BURR, P.G.**

MONITORING WELL INSTALLATION
TITAN – KING'S ROAD MINE
FILE NO.: 05-086

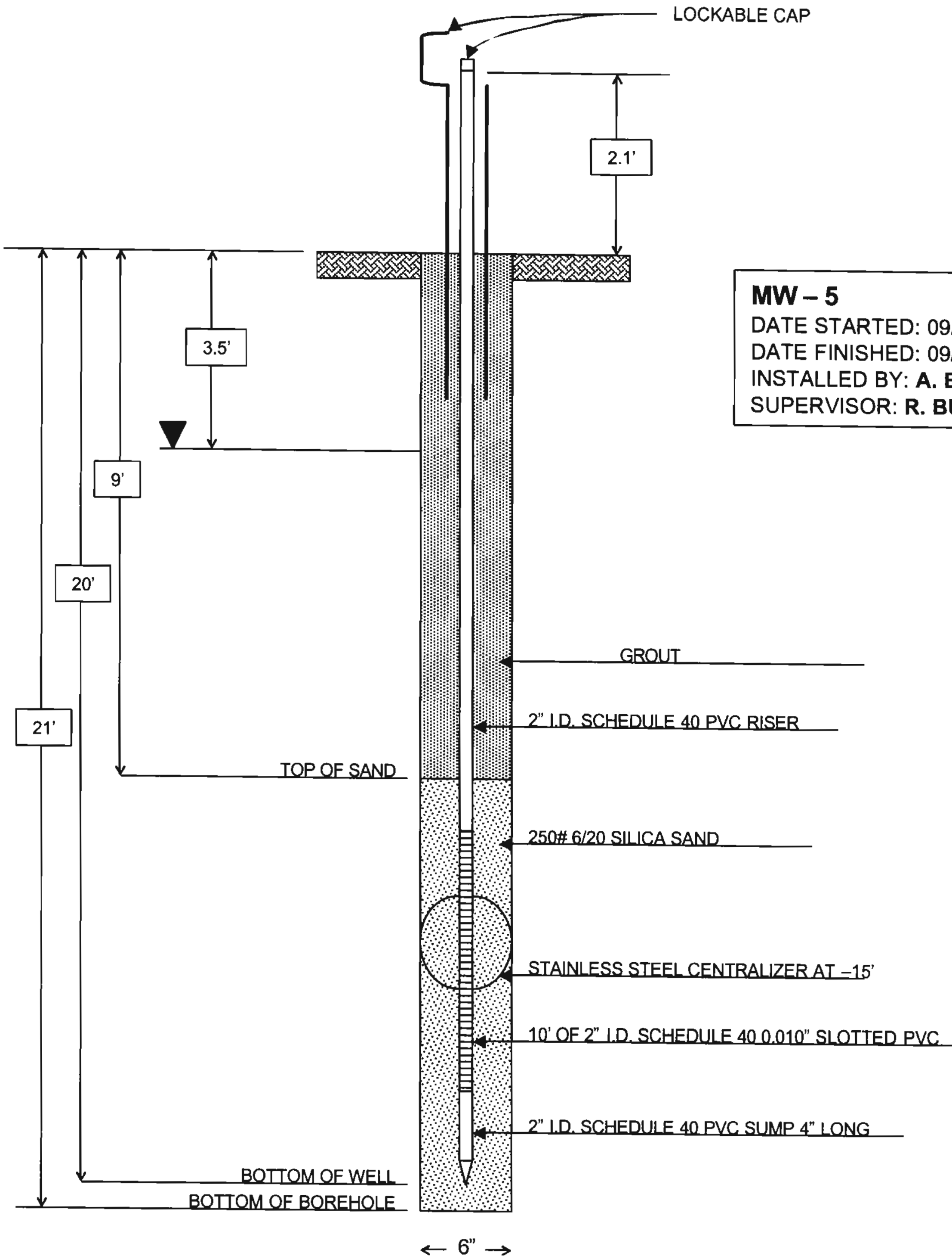


MONITORING WELL INSTALLATION
TITAN – KING'S ROAD MINE
FILE NO.: 05-086



MW - 4
DATE STARTED: 09/28/05
DATE FINISHED: 09/28/05
INSTALLED BY: **A. BRACKINS**
SUPERVISOR: **R. BURR, P.G.**

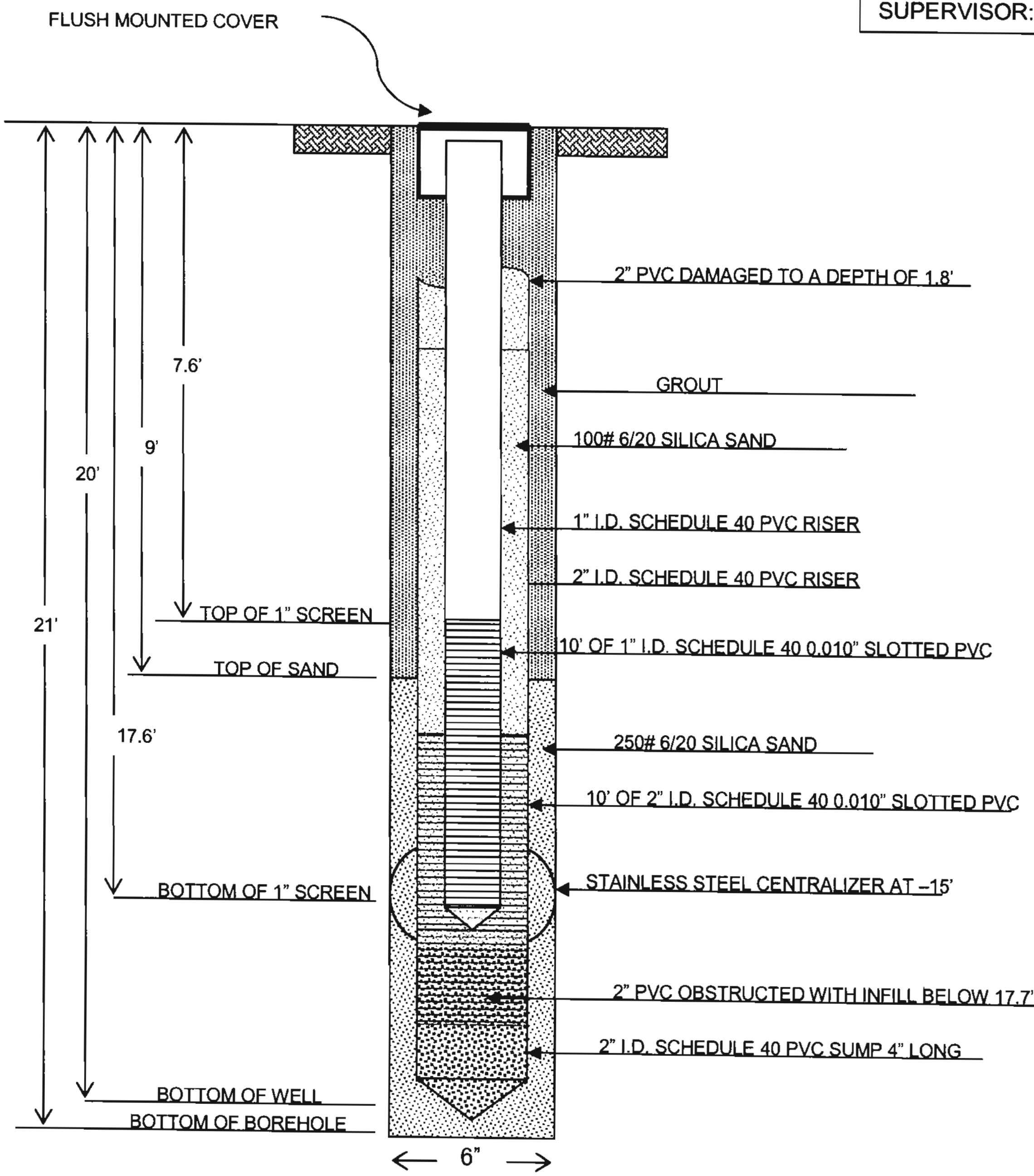
MONITORING WELL INSTALLATION
TITAN – KING'S ROAD MINE
FILE NO.: 05-086



MW – 5
DATE STARTED: 09/28/05
DATE FINISHED: 09/28/05
INSTALLED BY: **A. BRACKINS**
SUPERVISOR: **R. BURR, P.G.**

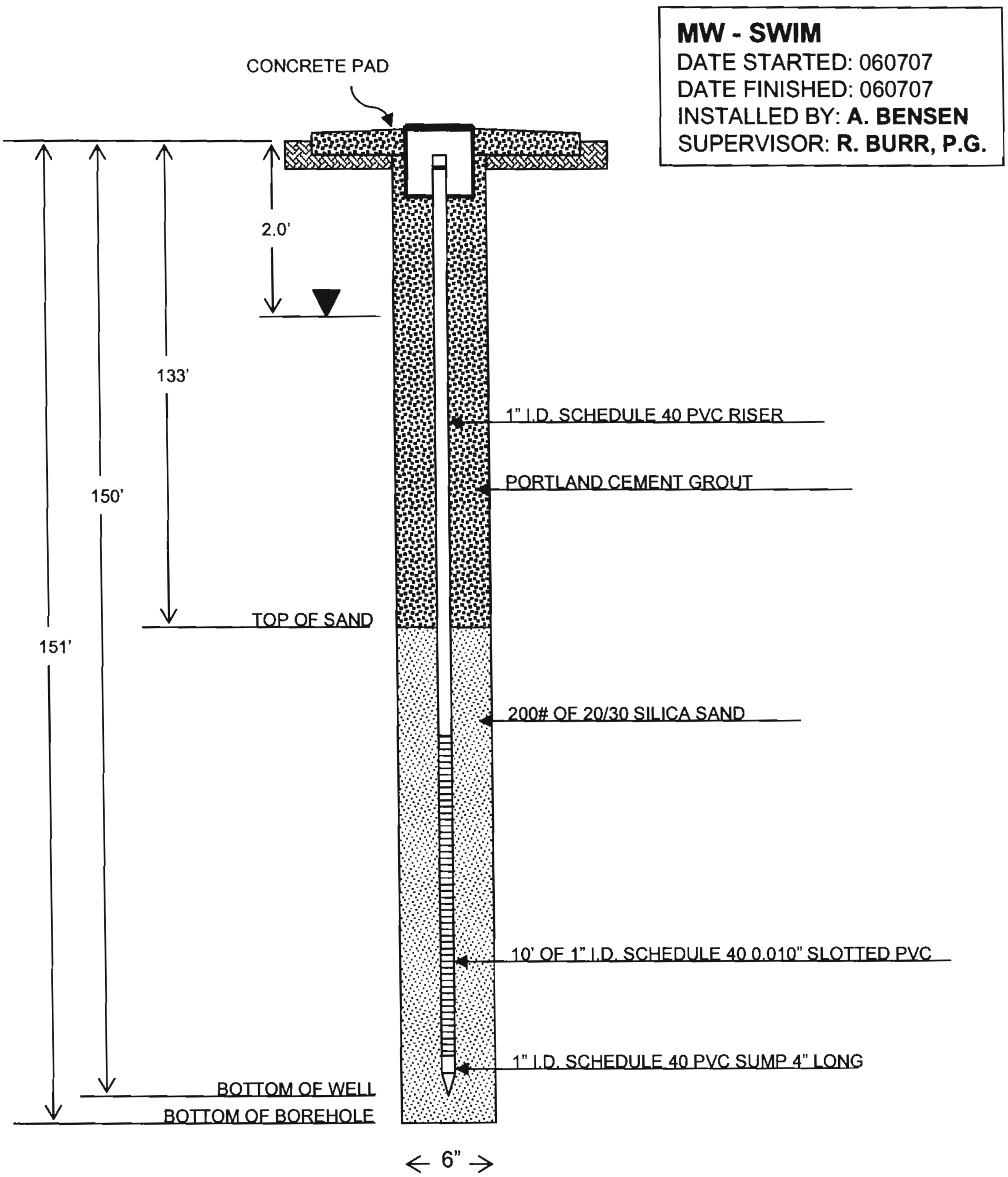
MONITORING WELL REPAIR
TITAN – KING'S ROAD MINE
FILE NO.: 05-086

MW – 6 REPAIR
DATE STARTED: 12/11/06
DATE FINISHED: 12/11/06
INSTALLED BY: R. BURR, P.G
SUPERVISOR: R. BURR, P.G.



NOT TO SCALE

TITAN – KINGS ROAD MINE
Saltwater Monitoring Well



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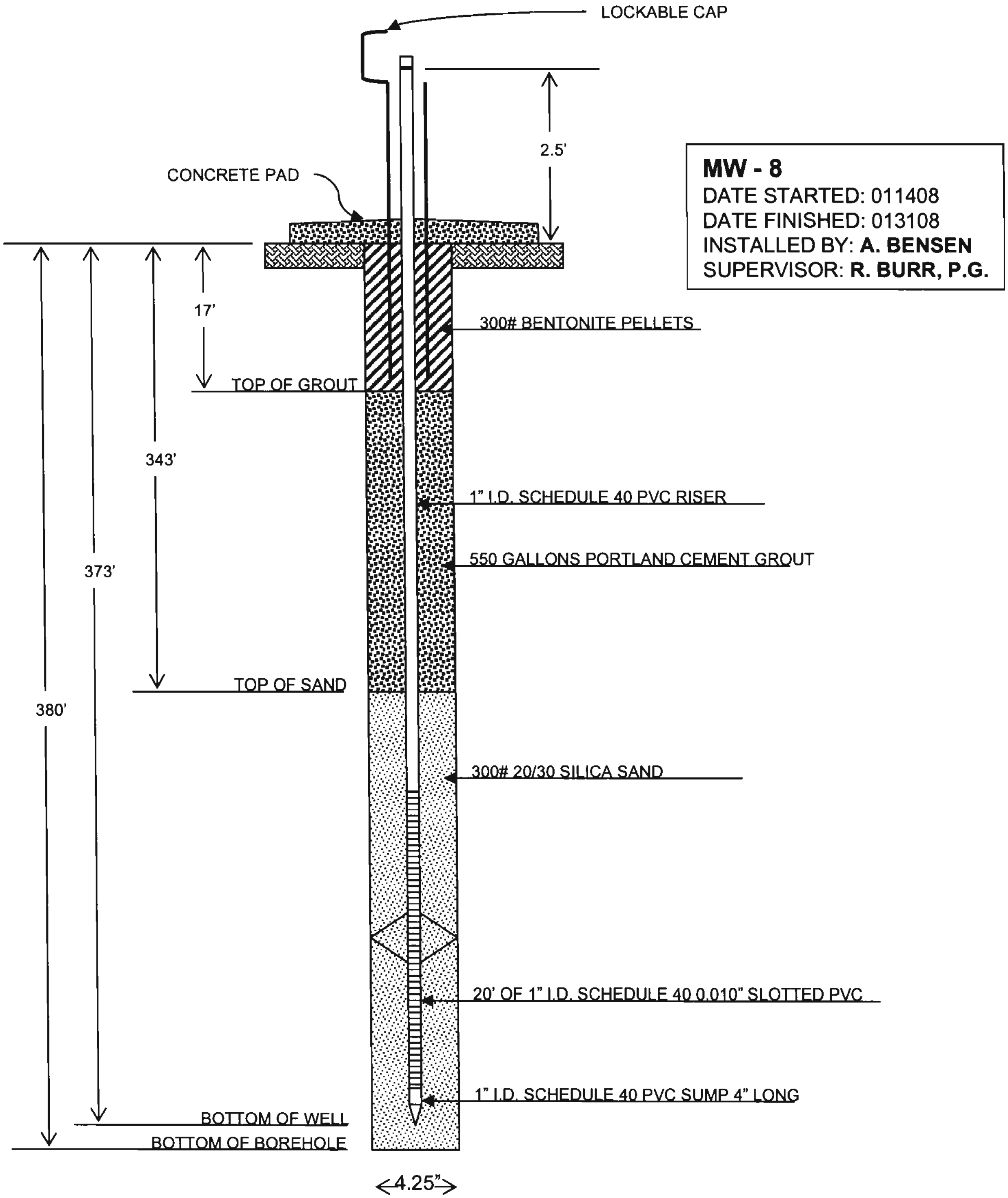
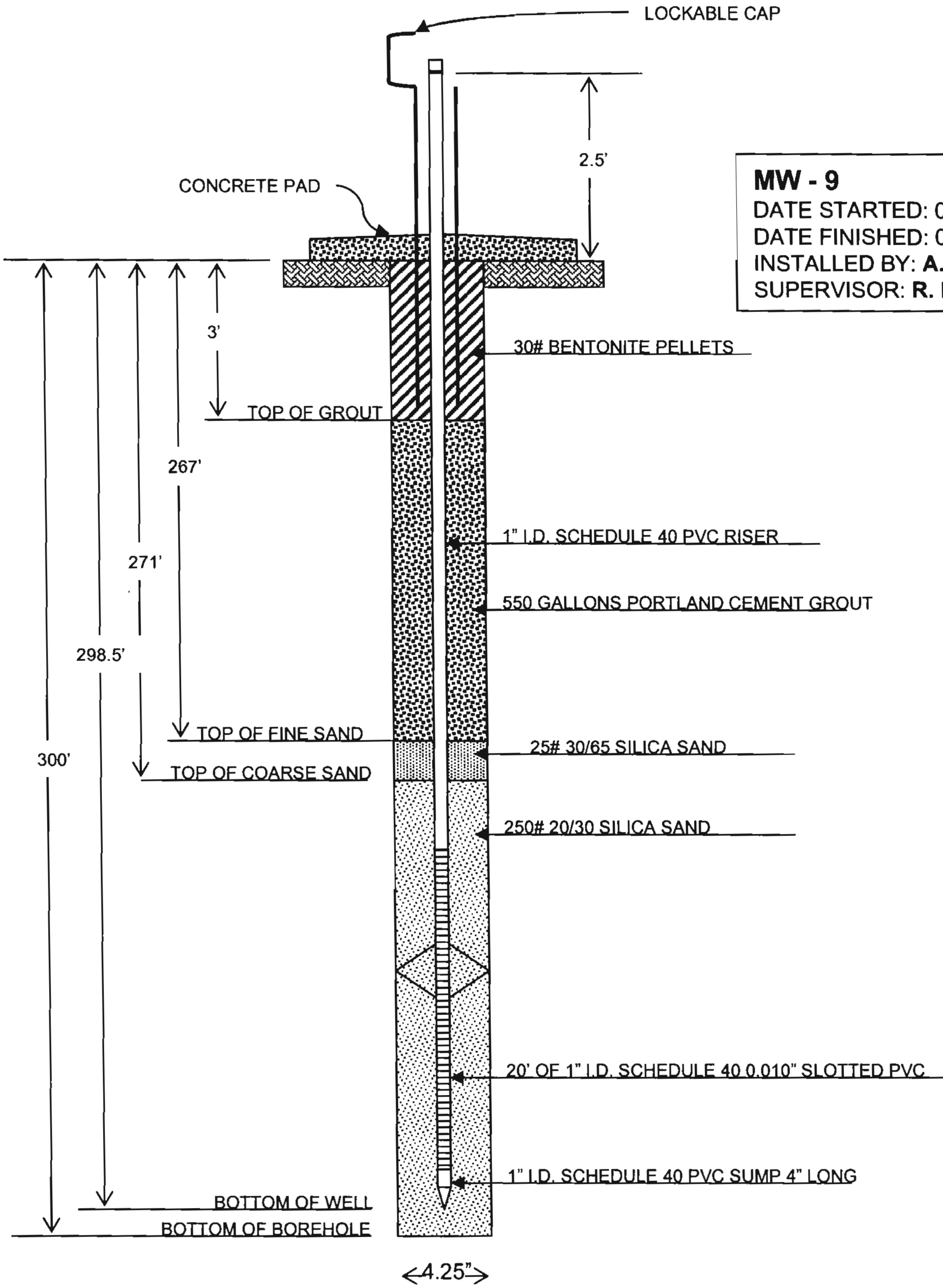
TITAN – KINGS ROAD MINE
Saltwater Monitoring Well



File No.: 05-086

TITAN – KINGS ROAD MINE
Saltwater Monitoring Well



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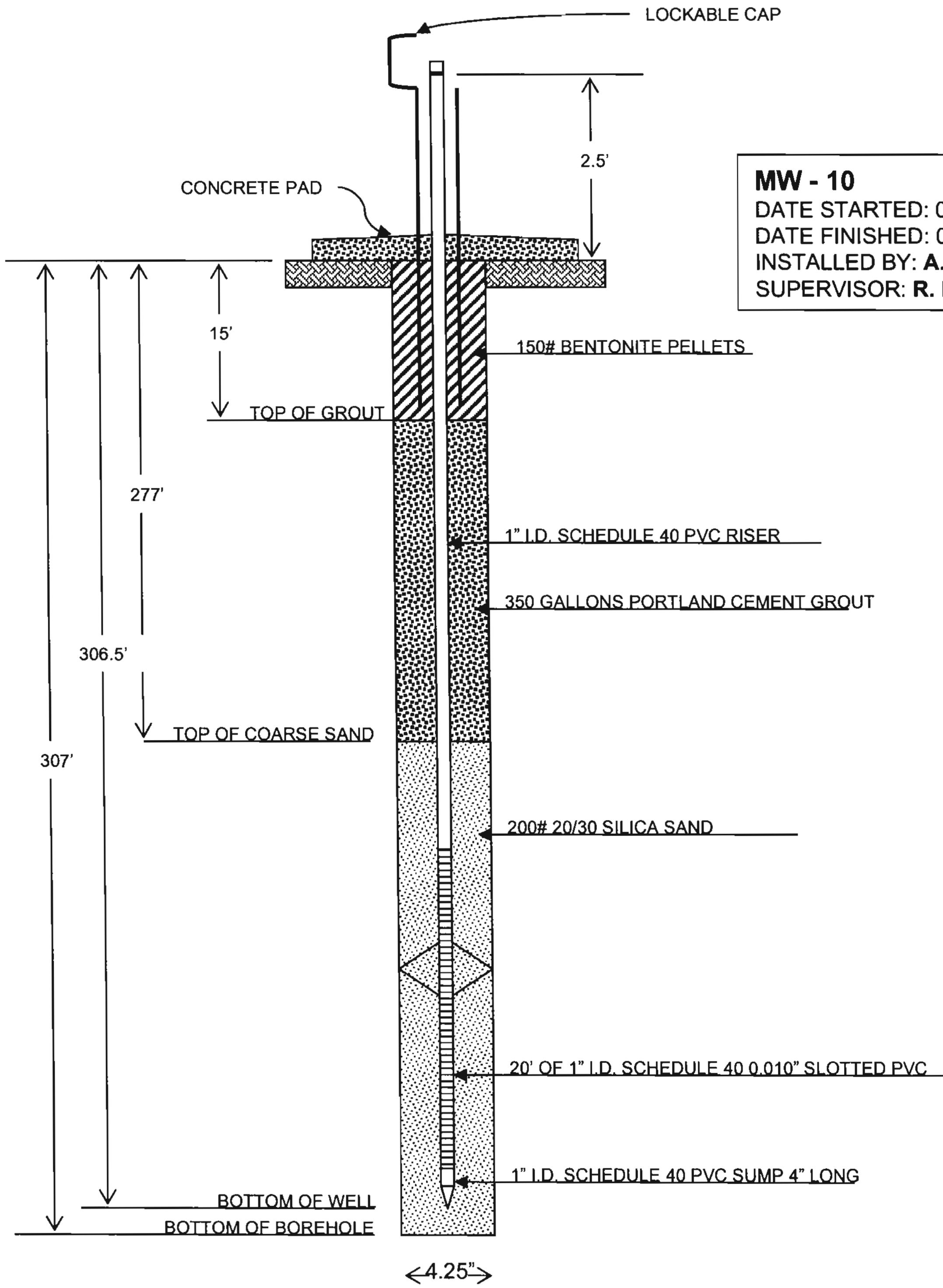
DATE STARTED: 011408
DATE FINISHED: 020808
INSTALLED BY: **A. BENSEN**
SUPERVISOR: **R. BURR, P.G.**

File No.: 05-086

TITAN – KINGS ROAD MINE
Saltwater Monitoring Well



MW - 10
DATE STARTED: 021208
DATE FINISHED: 022008
INSTALLED BY: **A. BENSEN**
SUPERVISOR: **R. BURR, P.G.**

File No.: 05-086

APPENDIX 3

FDEP SOP FOR GROUNDWATER SAMPLES (FS2200)

FS 2200. Groundwater Sampling

1. INTRODUCTION AND SCOPE

1.1 Use these Standard Operating Procedures to collect groundwater samples. They are designed to ensure that the collected samples will be representative of water in the aquifer or target formation and that the samples have not been altered or contaminated by the sampling and handling procedures. These procedures apply to permanently and temporarily installed monitoring wells, wells constructed using "direct-push" techniques, wells with installed plumbing, remedial groundwater treatment systems and excavations where groundwater is present. Use of alternative, DEP-approved and properly documented procedures (e.g., Corporate SOP, ASTM Standards, alternative equipment, etc.) is acceptable if they meet the intent (e.g., sample representativeness and integrity) of this standard (see FA 1000).

1.2 The topics in this SOP include equipment and supply selection, equipment construction materials, and purging and sampling techniques.

1.3 Use the following DEP SOPs in conjunction with FS 2200:

- FA 1000 Regulatory Scope and Administrative Procedures for Use of DEP SOPs
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000 Documentation Procedures
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FS 2000 General Aqueous Sampling
- FT 1000 Field Testing and Measurement
- FT 1100 Field pH
- FT 1200 Field Specific Conductance
- FT 1400 Field Temperature
- FT 1500 Field Dissolved Oxygen
- FT 1600 Field Turbidity

2. Groundwater samples may be collected from a number of different configurations. Each configuration is associated with a unique set of sampling equipment requirements and techniques:

3. Wells without Plumbing: These wells require that equipment be brought to the well to purge and sample unless dedicated equipment is placed in the well.

4. Wells with In-Place Plumbing: Wells with in-place plumbing do not require that equipment be brought to the well to purge and sample. In-place plumbing is generally considered permanent equipment routinely used for purposes other than purging and sampling, such as for water supply. They are generally found at wellfields, industrial facilities, and private residences. See FS 2300 for procedures to sample potable water wells. Air Strippers or Remedial Systems: These types of systems are installed as remediation devices. Sample these wells like drinking water wells (see FS 2300).

FS 2201 *Equipment and Supplies*

Use groundwater purging and sampling equipment constructed of only non-reactive, non-leachable materials that are compatible with the environment and the selected analytes. In selecting groundwater purging and sampling equipment, give consideration to the depth of the well, the depth to groundwater, the volume of water to be evacuated, the sampling and purging technique, and the analytes of interest. Refer to Tables FS 1000-1, FS 1000-2, FS 1000-3 and FS 2200-1 for selection of appropriate equipment.

Additional supplies such as reagents, preservatives, and field measurement equipment are often necessary.

1. FLOW CONTAINER: DEP recommends using a flow-through cell or container when collecting measurements for purging stabilization. The design must ensure that fresh formation water continuously contacts the measuring devices and does not aerate the sample or otherwise affect the groundwater properties.

2. PUMPS: All pumps or pump tubing must be lowered and retrieved from the well slowly and carefully to minimize disturbance to the formation water. This is especially critical at the air/water interface. Avoid the resuspension of sediment particles (turbidity) at the bottom of the well or adhered to the well casing during positioning of the pump or tubing.

2.1 Above-Ground Pumps

2.1.1 Variable Speed Peristaltic Pump: Use a variable speed peristaltic pump to purge groundwater from wells when the static water level in the well is no greater than 20-25 feet below land surface (BLS). If the water levels are deeper than 18-20 feet BLS, the pumping velocity will decrease.

2.1.1.1 A variable speed peristaltic pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.1.1.2 Most analyte groups can be sampled with a peristaltic pump if the tubing and pump configurations are appropriate. See Table FS 1000-3 for proper tubing selection and pump configurations.

2.1.2 Variable Speed Centrifugal Pump: A variable speed centrifugal pump can be used to purge groundwater from 2-inch and larger internal diameter wells. Do not use this type of pump to collect groundwater samples.

2.1.2.1 When purging is complete, do not allow the water that remains in the tubing to fall back into the well. Install a check valve at the end of the purge tubing, and withdraw the tubing slowly from the well while the pump is still running.

2.1.2.2 See Table FS 1000-3 for proper tubing selection and allowable analyte groups.

2.2 Submersible Pumps

2.2.1 Variable Speed Electric Submersible Pump: A variable speed submersible pump can be used to purge and sample groundwater from 2-inch and larger internal diameter wells.

2.2.1.1 A variable speed submersible pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.2.1.2 Make sure that the pump housing, fittings, check valves and associated hardware are constructed of stainless steel. Make sure that any other materials are compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

2.2.1.3 Install a check valve at the output side of the pump to prevent backflow.

2.2.1.4 If purging and sampling for organics:

- The entire length of the delivery tube must be Teflon, Polyethylene or Polypropylene (PP) tubing.
- The electrical cord must be sealed in Teflon, Polyethylene or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or be constructed of stainless steel.
- All interior components that contact the sample water (impeller, seals, gaskets, etc.) must be constructed of stainless steel or Teflon.

2.2.2 Variable Speed Bladder Pump: A variable speed positive displacement bladder pump (no-gas contact) can be used to purge and sample groundwater from 3/4-inch and larger internal diameter wells.

2.2.2.1 A variable speed bladder pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.2.2.2 The bladder pump system is composed of the pump, the compressed air tubing, the water discharge tubing, the controller and a compressor or compressed gas supply.

2.2.2.3 The pump consists of a bladder and an exterior casing or pump body that surrounds the bladder and two (2) check valves. These parts can be composed of various materials, usually combinations of polyvinyl chloride (PVC), Teflon, Polyethylene, PP and stainless steel. Other materials must be compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

2.2.2.4 If purging and sampling for organics:

- The pump body must be constructed of stainless steel and the valves and bladder must be Teflon, Polyethylene or PP
- The entire length of the delivery tube must be Teflon, Polyethylene or PP.
- Any cabling must be sealed in Teflon Polyethylene or PP, or be constructed of stainless steel.
- Permanently installed pumps may have a PVC pump body as long as the pump remains in contact with the water in the well.

3. BAILERS:

3.1 Purging: DEP does not recommend using bailers for purging unless no other equipment can be used or purging with a bailer has been specifically authorized by a DEP program, permit, contract or order (see Table FS 2200-3). Use a bailer if there is non-aqueous phase liquid (free product) in the well or non-aqueous phase liquid is suspected to be in the well. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager. If a bailer is used, follow FS 2213, section 4, with no deviations.

3.2 Sampling: Bailers may be used to routinely collect some analyte groups or under specific circumstances for other analyte groups (see Table FS 2200-3).

3.3 Construction and Type:

3.3.1 Bailers must be constructed of materials compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

3.3.2 Stainless steel, Teflon, Polyethylene and PP bailers may be used to sample all analytes.

3.3.3 Use disposable bailers when sampling grossly contaminated sample sources.

3.3.4 DEP recommends using dual check valve bailers when collecting samples.

3.3.5 Use bailers with a controlled flow bottom when collecting volatile organic samples.

3.3.6 Use bailers that can be pressurized when collecting filtered samples for metals.

3.4 Contamination Prevention:

3.4.1 Keep the bailer wrapped (foil, butcher paper, etc.) until just before use.

3.4.2 Use protective gloves to handle the bailer once it is removed from its wrapping.

3.4.3 Handle the bailer by the lanyard to minimize contact with the bailer surface.

4. LANYARDS

4.1 Lanyards must be made of non-reactive, non-leachable material such as cotton twine, nylon, or stainless steel; or, coated with Teflon, Polyethylene or PP.

4.1.1 Evaluate the appropriateness of the lanyard material with analyses of equipment blanks for the analytes of interest, as necessary.

4.2 Discard cotton twine, nylon, and non-stainless steel braided lanyards after sampling each monitoring well.

4.3 Decontaminate stainless steel, coated Teflon, Polyethylene and PP lanyards between monitoring wells (see FC 1003). They do not need to be decontaminated between purging and sampling operations.

4.4 Securely fasten lanyards to downhole equipment (bailers, pumps, etc.).

4.5 Do not allow lanyards used for downhole equipment to touch the ground surface.

FS 2210. GROUNDWATER PURGING

Perform procedures in the following sections to calculate purging parameters and to purge groundwater from monitoring wells, wells with installed plumbing, high-volume wells, air stripper systems and other remedial treatment systems.

FS 2211 *Water Level and Purge Volume Determination*

Collect representative groundwater samples from the aquifer. The amount of water that must be purged from a well is determined by the volume of water and/or field parameter stabilization.

1. GENERAL EQUIPMENT CONSIDERATIONS

1.1 Selection of appropriate purging equipment depends on the analytes of interest, the well diameter, transmissivity of the aquifer, the depth to groundwater and other site conditions.

1.2 Use a pump to purge the well.

1.3 Use a bailer if there is non-aqueous phase liquid in the well or non-aqueous phase liquid is suspected to be in the well.

1.4 Bailers may be used if approved by a DEP program, or if bailer use is specified in a permit, contract or DEP order (see Table FS 2200-3). If used, bailers must be of appropriate type and construction, and the user must follow the procedure outlined in FS 2213, section 4, with no deviations. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager. DEP does not recommend using bailers because improper bailing:

1.4.1 Introduces atmospheric oxygen which precipitates metals (i.e., iron) or causes other changes in the chemistry of the water in the sample (i.e., pH)

1.4.2 Agitates groundwater which biases volatile and semi-volatile organic analyses due to volatilization

1.4.3 Agitates the water in the aquifer and resuspends fine particulate matter

1.4.4 Surges the well, loosening particulate matter in the annular space around the well screen

1.4.5 Introduces dirt into the water column if the sides of the casing wall are scraped

2. INITIAL INSPECTION

2.1 Verify the identification of the monitoring well by examining markings, sign plates, placards or other designations.

2.2 Remove the well cover and remove all standing water around the top of the well casing (manhole) before opening the well cap.

2.3 Inspect the exterior protective casing of the monitoring well for damage and document the results of the inspection if there is a problem.

2.4 It is recommended that you place a protective covering around the well head. Replace the covering if it becomes soiled or ripped.

2.5 Inspect the well lock and determine whether the cap fits tightly. Replace the cap if necessary.

3. WATER LEVEL MEASUREMENTS: Use an electronic probe or chalked tape to determine the water level.

3.1 General Procedures

Perform these steps using either the electronic probe or chalked tape method.

3.1.1 Decontaminate all equipment that will contact the groundwater in the well before use.

3.1.2 Measure the depth to groundwater from the top of well casing to the nearest 0.01 foot and always measure from the same reference point or survey mark on the well casing. If there is no reference mark, measure from the north side of the casing.

3.1.3 Record the measurement and the reference point.

3.2 Electronic Probe

3.2.1 Follow the manufacturer's instructions for use.

3.2.2 Record the measurement.

3.3 Chalked Line Method: This method is not recommended if collecting samples for organic or inorganic parameters.

3.3.1 Lower chalked tape into the well until the lower end is in the water (usually determined by the sound of the weight hitting the water).

3.3.2 Record the length of the tape relative to the reference point (see section 3.2 above).

3.3.3 Quickly remove the tape from the well.

3.3.4 Record the length of the wetted portion to the nearest 0.01 foot.

3.3.5 Determine the depth to water by subtracting the length of the wetted portion (see section 3.5.3 above) from the total length (see section 3.5.2 above). Record the result.

4. WATER COLUMN DETERMINATION

4.1 Do not determine the total depth of the well by lowering the probe to the bottom of the well immediately before purging and sampling. If the well must be sounded, delay purging and sampling activities for at least 24 hours after the well was sounded or for a time sufficient to meet the purge stabilization criterion for turbidity. Alternatively, collect samples before sounding the well.

4.2 Subtract the depth to the top of the water column from the total well depth to determine the length of the water column.

4.3 The total well depth depends on the well construction. Some wells may be drilled in areas of sinkhole or karst formations or rock leaving an open borehole. Attempt to find the total borehole depth in cases where there is an open borehole below the cased portion.

5. WELL WATER VOLUME

5.1 Calculate the total volume of water in gallons in the well using the following equation:

V = (0.041)d x d x h

Where: V = volume in gallons

d = well diameter in inches

h = height of the water column in feet

5.2 The total volume of water in the well may also be determined with the following equation by using a casing volume per foot factor (Gallons per Foot of Water) for the appropriate diameter well:

V = [Gallons per Foot of Water] x h

Where: V = volume in gallons

h = height of the water column in feet

Casing Internal Diameter	Approximate Gallons per Foot of Water
0.75"	0.02
1"	0.04
1.25"	0.06
2"	0.16
3"	0.37
4"	0.65
5"	1.02
6"	1.47
12"	5.88

5.3 Record all measurements and calculations in the field records.

6. Purging Equipment Volume

Calculate the total volume of the pump, associated tubing and container that is used for in situ measurements (flow container), if used, using the following equation:

$$V = p + ((0.041)d \times d \times l) + fc$$

Where: V = volume in gallons

p = volume of pump in gallons

d = tubing diameter in inches

l = length of tubing in feet

fc = volume of flow cell in gallons

7. When collecting samples from multiple wells on a site, if the groundwater elevation data are to be used to construct groundwater elevation contour maps, all water level measurements must be taken within the same 24-hour time interval unless a shorter time period is required by a DEP program. If the site is tidally influenced, complete the water level measurements within the time frame of an incoming or outgoing tide.

FS 2212 *Well Purging Techniques*

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. The intent of proper purging is to stabilize the water level in the well and minimize the hydraulic stress to the hydrogeologic formation.

Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging completion criteria.

A flowchart which summarizes purging procedure options is presented in Figure FS 2200-2.

Select equipment using the construction and configuration requirements specified in Table FS 2200-1. See the discussions in FS 2201.

1. MEASURING THE PURGE VOLUME: The volume of water that is removed during purging must be recorded. Measure the volume during the purging operation.

1.1 Collect the water in a graduated container and multiply the number of times the container was emptied by the volume of the container, or

1.2 Estimate the volume based on pumping rate. Use this technique only if the pumping rate is constant. Determine the pumping rate by measuring the amount of water that is pumped for a fixed period of time or use a flow meter.

1.2.1 Calculate the amount of water that is discharged per minute:

$$D = \frac{\text{Measured amount}}{\text{Total time in minutes}}$$

1.2.2 Calculate the time needed to purge one (1) well volume or one (1) purging equipment volume:

$$\text{Time} = \frac{V}{D}$$

Where: V = well volume determined from FS 2211, section 5, or purging equipment volume

D = discharge rate calculated in section 1.2.1. above

1.2.3 Make new measurements (see section 1.2.1 above) each time the pumping rate is changed, or

1.3 Use a totalizing flow meter.

1.3.1 Record the reading on the totalizer prior to purging.

1.3.2 Record the reading on the totalizer at the end of purging.

1.3.3 Subtract the reading on the totalizer prior to purging from the reading on the totalizer at the end of purging to obtain the volume purged.

1.4 Record in the field records the times that purging begins and ends.

2. Stabilization Measurement Frequency

2.1 Begin to record stabilization measurements after pumping the minimum volume as prescribed in options 2.3 – 2.5 below. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging criteria.

2.2 If the well screened interval is not known, use option 2.3, below.

2.3 <u>Wells with Fully Submerged Screen and Pump or Intake Tubing Placed at the Top of the Water Column (conventional purge):</u> Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) well volume prior to collecting measurements of the stabilization parameters. Allow at least one quarter (1/4) well volume to purge between subsequent measurements.

2.4 <u>Wells with Fully Submerged Screen and Pump or Intake Tubing Placed Within the Screened Interval (minimizing purge volume):</u> Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) volume of the pump, associated tubing and flow container (if used) prior to collecting measurements of the stabilization parameters. Take measurements of the stabilization parameters no sooner than two (2) minutes apart. Purge at least three (3) volumes of the pump, associated tubing and flow container, if used, prior to collecting a sample.

If the water level drops into the screened interval during purging, lower the pump or tubing intake as in FS 2213, section 1.3 below and follow purging procedures for partially submerged well screens (2.5 below).

2.5 Wells with a Partially Submerged Well Screen: Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) well volume prior to collecting measurements of the stabilization parameters. Take measurements of the stabilization parameters no sooner than two (2) minutes apart.

3. PURGING COMPLETION: DEP recommends the use of a flow-through container to measure the stabilization parameters discussed below. Alternatively, measure all parameters *in situ* by inserting measurement probes into the well at the depth appropriate for the purging option. Purging is considered complete if the criteria in section 3.1, 3.2 or 3.3 below are satisfied. Make every attempt to satisfy the criteria in section 3.1. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging criteria.

3.1 Three (3) consecutive measurements of the five (5) parameters listed below must be within the stated limits. The measurements evaluated must be the last three consecutive measurements taken before purging is stopped. The range between the highest and the lowest values for the last three measurements of temperature, pH and specific conductance cannot exceed the stated limits. The last three consecutive measurements of dissolved oxygen and turbidity must all be at or below the listed thresholds.

- Temperature: ± 0.2° C
- pH: ± 0.2 Standard Units
- Specific Conductance: ± 5.0% of reading
- Dissolved Oxygen: ≤20% Saturation
- Turbidity: ≤20 NTU

3.2 Naturally occurring conditions may prevent attaining the ≤20% saturation criterion for dissolved oxygen, typically in surficial aquifers. See section 3.5, below.

3.3 Naturally occurring conditions may prevent attaining the ≤20 NTU criterion for turbidity. However, when collecting groundwater samples for metals or certain inorganic (e.g., phosphorus forms) or extractable organic (e.g. polynuclear aromatic hydrocarbons) chemicals, make every attempt to reduce turbidity to ≤20 NTU to avoid a potential turbidity-associated bias for these analytes. See section 3.5, below.

3.4 Document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.

- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.5 If the criteria in section 3.1 above for dissolved oxygen and/or turbidity cannot be met, then three (3) consecutive measurements of the five (5) parameters listed below must be within the stated limits.

3.5.1 The measurements evaluated must be the last three consecutive measurements taken before purging is stopped. The range between the highest and the lowest values for the last three measurements cannot exceed the stated limits.

- Temperature: ± 0.2° C
- pH: ± 0.2 Standard Units
- Specific Conductance: ± 5.0% of reading
- Dissolved Oxygen: ± 0.2 mg/L or 10%, whichever is greater
- Turbidity: ± 5 NTUs or 10%, whichever is greater

3.5.2 Additionally, document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- A description of conditions at the site that cause the dissolved oxygen to be high and/or dissolved oxygen measurements made within the screened or open borehole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that cause the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.5.3 If from review of the submitted data the Department determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first four (4) items are required to be submitted in future reports. However, if the Department cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first four (4) items, a description of the conditions at the site that caused the affected parameter(s) to be high is required to be submitted in future reports.

3.6 If the stabilization parameters in either section 3.1 or 3.2 cannot be met, and all attempts have been made to minimize the drawdown, check the instrument condition and calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. All measurements that were made during the attempt must be documented. The sampling team leader may decide whether or not to collect a sample or to continue purging after five (5) well volumes (conventional purge section 2.1 or 2.3 above) or five (5) volumes of the screened interval (minimizing purge volumes in section 2.2 above).

Further, the report in which the data are submitted must include the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- Drawdown in the well, if any.
- A description of conditions at the site that caused the dissolved oxygen to be high and/or dissolved oxygen measurements made within the screened or open borehole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that caused the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If from review of the submitted data the DEP determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first four (4) items are required to be submitted in future reports. However, if the DEP cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first four (4) items, a description of the conditions at the site that caused the affected parameter(s) to be high is required to be submitted in future reports.

3.7 One fully dry purge (not recommended). This criterion applies only if purging was attempted per FS 2212, FS 2213, and section 3.4.1 below, and if it is impossible to balance the pumping rate with the rate of recharge at very low pumping rates (< 100 mL/minute).

3.7.1 If wells have previously and consistently purged dry, when purged according to FS 2212 and FS 2213, and the current depth to groundwater indicates that the well will purge dry during the current sampling event, minimize the amount of water removed from the well by using the same pump to purge and collect the sample:

3.7.1.1 Place the pump or tubing intake within the well screened interval.

3.7.1.2 Use very small diameter Teflon, Polyethylene or PP tubing and the smallest possible pump chamber volume to minimize the total volume of water pumped from the well and to reduce drawdown.

3.7.1.3 Select tubing that is thick enough to minimize oxygen transfer through the tubing walls while pumping.

3.7.1.4 Pump at the lowest possible rate (100 mL/minute or less) to reduce drawdown to a minimum.

3.7.1.5 Purge at least two (2) volumes of the pumping system (pump, tubing and flow cell, if used).

3.7.1.6 Measure pH, Specific Conductance, Temperature, Dissolved Oxygen and Turbidity and begin to collect the samples (see FS 2222).

4. Collect samples immediately after purging is complete.

4.1 The time period between completing the purge and sampling cannot exceed six (6) hours.

4.2 If sample collection does not occur within one (1) hour of purging completion, re-measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity just prior to collecting the sample.

4.2.1 If the measured values are not within 10 percent of the previous measurements, re-purge the well.

4.2.2 See section 3.4 above when collecting samples from wells that have purged dry.

FS 2213 *Purging Wells Without Plumbing (Monitoring Wells)*

1. TUBING/PUMP PLACEMENT

1.1 Do not lower the pump or intake hose (tubing) to the bottom of the well. Pump or tubing placement procedures will be determined by the purging option selected in FS 2212, section 2 above or FS 2214 below.

1.1.1 Minimizing Purge Volume: If the following conditions can be met, position the intake hose (tubing) or pump in the screened or open borehole interval.

- The same pump must be used for both purging and sampling,
- The well screen or borehole interval must be less than or equal to 10 feet, and
- The well screen or borehole must be fully submerged.

1.1.2 If the position or length of the screened interval or open borehole is unknown or estimated, place the intake hose (tubing) or pump to perform conventional purging in 1.2 below.

1.1.3 Position the pump or intake hose when purging large-diameter deep wells with open boreholes using the procedure in FS 2214 below.

1.2 Conventional Purging: Position the pump or intake tubing in the top one foot of the water column or no deeper than necessary for the type of pump.

1.2.1 If purging with a bailer, see section 4 below.

1.3 Partially Submerged Screened Interval: If the well screen or open borehole is partially submerged, and the pump will be used for both purging and sampling, position the pump or intake hose (tubing) in the portion of the water column within the submerged screened or open borehole interval.

1.3.1 If the position or length of the screened interval or open borehole is unknown or estimated, place the intake hose (tubing) or pump to perform conventional purging in 1.2 above.

1.3.2 Purge large-volume, high-recharge wells as in FS 2214 below.

1.3.3 If purging with a bailer, see section 4 below.

2. NON-DEDICATED (PORTABLE) PUMPS

2.1 Variable Speed Peristaltic Pump

2.1.1 Install a new, 1-foot maximum length of silicone tubing in the peristaltic pump head.

2.1.2 Attach a short section of tubing to the discharge side of the pump-head silicone tubing and into a graduated container.

2.1.3 Attach one end of a length of new or precleaned transport tubing to the intake side of the pump head silicone tubing.

2.1.4 Place the transport tubing in the monitoring well per one of the options in FS 2213, section 1 above.

2.1.5 Measure the depth to groundwater at frequent intervals.

2.1.6 Record these measurements.

2.1.7 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.1.8 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.1.9 If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.1.10 Record the purging rate each time the rate changes.

2.1.11 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.1.12 Record this measurement.

2.1.13 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.2 Variable Speed Centrifugal Pump

2.2.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.2.2 Place the decontaminated suction hose so that water is always pumped from the top of the water column.

2.2.3 Equip the suction hose with a foot valve to prevent purge water from re-entering the well.

2.2.4 Measure the depth to groundwater at frequent intervals.

2.2.5 Record these measurements.

2.2.6 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.2.7 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.2.8 If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.2.9 Record the purging rate each time the rate changes.

2.2.10 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.2.11 Record this measurement.

2.2.12 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.3 Variable Speed Electric Submersible Pump

2.3.1 Position fuel powered equipment downwind and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.3.2 Carefully position the decontaminated pump per one of the options in FS 2213, section 1 above.

2.3.3 Measure the depth to groundwater at frequent intervals.

2.3.4 Record these measurements.

2.3.5 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.3.6 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.3.7 If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.3.8 Record the purging rate each time the rate changes.

2.3.9 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.3.10 Record this measurement.

2.3.11 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.4 Variable Speed Bladder Pump

2.4.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.4.2 Attach the tubing and carefully position the pump per one of the options in FS 2213, section 1 above.

2.4.3 Measure the depth to groundwater at frequent intervals.

2.4.4 Record these measurements.

2.4.5 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.4.6 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.4.7 If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.4.8 Record the purging rate each time the rate changes.

2.4.9 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.4.10 Record this measurement.

2.4.11 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

3. DEDICATED PORTABLE PUMPS: Place dedicated pumps per one of the options in FS 2213, section 1 above.

3.1 Variable Speed Electric Submersible Pump

3.1.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.1.2 Measure the depth to groundwater at frequent intervals.

3.1.3 Record these measurements.

3.1.4 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.1.5 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal with the recharge rate.

3.1.6 Record the purging rate each time the rate changes.

3.1.7 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.1.8 Record this measurement.

3.2 Variable Speed Bladder Pump

3.2.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.2.2 Measure the depth to groundwater at frequent intervals.

3.2.3 Record these measurements.

3.2.4 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.2.5 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal with the recharge rate.

3.2.6 Record the purging rate each time the rate changes.

3.2.7 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.2.8 Record this measurement.

4. BAILERS: DEP recommends against using bailers for purging except as a last contingency, or if free product is present in the well or suspected to be in the well. However, they may be used if approved by a DEP program, or specified in a permit, contract or DEP order (see Table FS 2200-3 and FS 2211, section 1.3). If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager.

4.1 Minimize handling the bailer as much as possible.

4.1.1 Remove the bailer from its protective wrapping just before use.

4.1.2 Attach a lanyard of appropriate material (see FS 2201, section 4).

4.1.3 Use the lanyard to move and position the bailer.

4.2 Lower and retrieve the bailer slowly and smoothly.

4.3 Lower the bailer carefully into the well to a depth approximately a foot above the water column.

4.3.1 Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column. Ensure that the length of the bailer does not exceed the length of the water column.

4.3.2 Allow time for the bailer to fill with aquifer water as it descends into the water column.

4.4 Carefully raise the bailer.

4.4.1 Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.

4.5 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

4.5.1 Record the volume of the bailer.

4.6 Continue to carefully lower and retrieve the bailer as described above until the purging completion conditions specified in FS 2212, section 3, have been satisfied.

4.6.1 Remove at least one (1) well volume before collecting measurements of the field parameters. Take each subsequent set of measurements after removing at least one quarter (1/4) well volume between measurements.

FS 2214 *Purging Large-Volume, High-Recharge Wells With Portable Pumps*

If a well originally constructed for high-flow-rate pumping will be sampled as a monitoring well, use these guidelines to develop a purging procedure applicable to the specific details of the well construction. Typical wells constructed for this purpose may be deep, large-diameter wells with a section of open borehole. Evaluate each well on a case-by-case basis and consider any available information on the construction and hydraulic performance of the well.

1. PURGING PROCEDURE

1.1 Place the pump at the top of the open borehole segment of the well.

1.2 Start purging while monitoring stabilization parameters as in FS 2212, section 3 above.

1.3 Purge at least one equipment volume before measuring stabilization parameters.

1.4 If the well is being purged for the first time using these guidelines, monitor stabilization parameters for an extended period until confident that sufficient volume has been pumped from the open borehole to draw fresh formation water into the pump tubing and flow-through container. Use the information obtained from the first-time purging of the well to determine the pumping rate and duration of purging required for future sampling events at the well.

1.5 Purge at least three equipment volumes before evaluating purging completion.

2. PURGING COMPLETION

2.1 Complete the purging of the well when the last three consecutive measurements of the purge stabilization parameters have met the applicable criteria specified in FS 2212, section 3 above.

3. Collect samples from the well using the procedures in FS 2221, section 1 below.

FS 2215. *Purging Wells With Plumbing (production wells or permanently installed pumps equipped with sampling ports or sampling spigots)*

Wells with in-place plumbing are commonly found at municipal water treatment plants, industrial water supplies, private residences, etc. Depending on the sampling objective for collecting samples using installed plumbing, purge the system and collect samples closest to the point of consumption, or, as close to the source well as possible. When purging is required and the purge volume of the plumbing system is not known, purge the system until the purging completion criteria in FS 2212, section 3, have been met.

1. CONTINUOUSLY RUNNING PUMPS

1.1 Select the spigot that is closest to the pump and before any storage tanks (if possible).

1.2 Remove all hoses, aerators and filters (if possible).

1.3 Open the spigot and purge at maximum flow.

1.4 If a storage tank is located between the pump and the spigot, purge the volume of the tank, lines and spigot.

1.5 If the spigot is before any storage tank, purge until sufficient volume is removed to flush the stagnant water from the spigot and the tap line to the spigot.

1.6 Reduce the flow rate to ≤ 500 mL/minute (a 1/8" stream) or approximately 0.1 gal/minute before collecting samples. When sampling for volatile organic compounds, reduce the flow to ≤100 mL/minute before collecting the samples.

2. INTERMITTENTLY RUNNING PUMPS

2.1 Select the spigot that is closest to the pump and before any storage tanks (if possible).

2.2 Remove all hoses, aerators and filters (if possible).

2.3 Open the spigot and purge sufficient volume at a maximum, practical flow rate to flush the spigot and lines and until the purging completion criteria in FS 2212, section 3, have been met.

2.4 If a storage tank is located between the pump and the spigot, purge the volume of the tank, lines and spigot.

2.5 Ensure that the purge stabilization measurement of dissolved oxygen is not biased with aeration of the sample by a high flow rate in the flow-through container.

2.6 Reduce the flow rate to ≤ 500 mL/minute (a 1/8" stream) or approximately 0.1 gal/minute before collecting samples. When sampling for volatile organic compounds, reduce the flow to ≤ 100 mL/minute before collecting the samples.

FS 2216. *Purging Airstrippers and Remedial Treatment Systems*

If collecting samples for groundwater contamination monitoring, follow FS 2215above.

FS 2220. GROUNDWATER SAMPLING TECHNIQUES

1. Purge wells using the techniques outlined in FS 2210.

2. Replace the protective covering around the well if it is soiled or torn after completing the purging operations.

3. EQUIPMENT CONSIDERATIONS

Follow all notes and restrictions as indicated in Table FS 2200-1 and as discussed in FS 2201.

NOTE: The only pumps that are currently approved for use in collecting volatile organic samples through the pump are stainless steel and Teflon variable speed submersible pumps, stainless steel and Teflon or Polyethylene variable speed bladder pumps, and permanently installed PVC bodied pumps (variable speed bladder or submersible pumps) as long as the pump remains in contact with the water in the well at all times.

3.1 Collect the sample into the sample container from the sampling device. **Do not** use intermediate containers.

3.2 In order to avoid contaminating the sample or loss of analytes from the sample:

3.3 Handle the sampling equipment as little as possible.

3.3.1 Minimize the equipment that is exposed to the sample.

3.3.2 Minimize aeration of samples collected for VOC analysis.

3.3.3 Reduce sampling pump flow rates to ≤ 100 mL/minute when collecting VOC samples.

3.4 <u>Dedicated Sampling Equipment</u>

3.4.1 Whenever possible, use dedicated equipment because it significantly reduces the chance of cross-contamination.

3.4.2 Dedicated is defined as equipment that is to be used solely for one location for the life of that equipment (e.g., permanently mounted pump).

3.4.3 All material construction and restrictions from Table FS 2200-1 also apply to dedicated equipment. Purchase equipment with the most sensitive analyte of interest in mind.

3.5 <u>Cleaning/Decontamination</u>

3.5.1 Clean or ensure dedicated pumps are clean before installation. They do not need to be cleaned prior to each use but must be cleaned if they are withdrawn for repair or servicing.

3.5.2 Clean or make sure any permanently mounted tubing is clean before installation.

3.5.3 Change or clean tubing when the pump is withdrawn for servicing.

3.5.4 Clean any replaceable or temporary parts as specified in FC 1000.

3.5.5 Collect equipment blanks on dedicated pumping systems when the tubing is cleaned or replaced.

3.5.6 Clean or ensure dedicated bailers are clean before placing them into the well.

3.5.7 Collect an equipment blank on dedicated bailers before introducing them into the water column.

3.5.8 Suspend dedicated bailers above the water column if they are stored in the well.

FS 2221. *Sampling Wells Without Plumbing*

1. SAMPLING WITH PUMPS: Variable speed stainless steel and Teflon submersible pumps and stainless steel, Teflon or Polyethylene bladder pumps, and permanently installed PVC-bodied variable speed submersible or bladder pumps, as long as the pump remains in contact with the water in the well at all times, may be used to sample for all organics. The delivery tubing must be Teflon, Polyethylene or PP. **Extractable organics** may be collected through a peristaltic pump if $\leq$ 1 foot of silicone tubing is used in the pump head or a vacuum trap is used (see Figure FS 2200-1 for specific configuration). Follow all notes and restrictions as defined in Table FS 2200-1 and discussed in Equipment and Supplies (FS 2201) when using pumps to collect samples.

Do not lower the pump or tubing to the bottom of the well.

1.1 <u>Peristaltic Pump</u>

1.1.1 <u>Volatile Organics Using Manual Fill and Drain Method</u>: Collect volatile organics last. If the pump tubing is placed within the screened interval, the tubing cannot be reinserted into the well, and steps 1.1.1.3 through 1.1.1.6 below are prohibited.

1.1.1.1 Ensure that there is sufficient tubing volume to fill the requisite number of VOC vials.

1.1.1.2 Remove the drop tubing from the inlet side of the pump.

1.1.1.3 Submerse the drop tubing into the water column and allow it fill.

1.1.1.4 Remove the drop tubing from the well.

1.1.1.5 Prevent the water in the tubing from flowing back into the well.

1.1.1.6 Carefully allow the groundwater to drain by gravity into the sample vials. Avoid turbulence. Do not aerate the sample. The flow rate must be $\leq$ 100 mL/minute.

1.1.1.7 Repeat steps 1.1.1.3 - 1.1.1.6 until enough vials are filled.

1.1.2 <u>Volatile Organics Using the Pump to Fill and Drain the Tubing:</u> Collect volatile organics last. If the pump tubing is placed within the screened interval, the tubing cannot be reinserted into the well, and steps 1.1.2.2 through 1.1.2.8 below are prohibited.

1.1.2.1 Ensure that there is sufficient tubing volume to fill the requisite number of VOC vials.

1.1.2.2 Submerse the drop tubing into the water column.

1.1.2.3 Use the pump to fill the drop tubing.

1.1.2.4 Quickly remove the tubing from the pump.

1.1.2.5 Prevent the water in the tubing from flowing back into the well.

1.1.2.6 Remove the drop tubing from the well and fill the vials using the pump or gravity-drain methods in steps 1.1.2.7 or 1.1.2.8 below.

1.1.2.7 Reverse the flow on the peristaltic pump to deliver the sample into the vials at a slow, steady rate. The flow rate must be $\leq$ 100 mL/minute.

1.1.2.8 Or, remove the drop tubing from the inlet side of the pump and carefully allow the groundwater to drain into the sample vials. Avoid turbulence. Do not aerate the sample. The flow rate must be $\leq$ 100 mL/minute.

1.1.2.9 Repeat steps 1.1.2.2 through 1.1.2.8 until enough vials are filled.

1.1.3 Extractable Organics Collected Through Silicone Pump-Head Tubing:

1.1.3.1 Ensure that a 1-foot maximum length of new silicone tubing was installed in the peristaltic pump head assembly before the well was purged if the same pump is being used to purge and sample the well. Otherwise, install a new length of tubing as described above.

1.1.3.2 Collect extractable organic samples directly from the effluent delivery tubing (attached to discharge side of the silicone pump head tubing) into the sample container.

1.1.3.3 If there is a concern that sample analytes are absorbed, adsorbed, leached or otherwise affected or lost by pumping through the silicone pump-head tubing, sample the well using the organic trap assembly in 1.1.4 below.

1.1.4 Extractable Organics Using an Optional Organic Trap Assembly

1.1.4.1 Assemble the components of the pump and trap according to Figure FS 2200-1.

1.1.4.2 The sample container should be the trap bottle.

1.1.4.3 All equipment that contacts the groundwater **before** the sample container must be constructed of Teflon, Polyethylene, PP, stainless steel or glass, including the transport tubing to and from the sample container, the interior liner of the container cap and all fittings. **Do not use a rubber stopper as a cap.**

1.1.4.4 Connect the outflow tubing from the container to the influent side of the peristaltic pump.

1.1.4.5 Prevent the water in the down-hole delivery tubing from flowing back into the well while performing this connection.

1.1.4.6 Turn the pump on and reduce the flow rate to a smooth and even flow.

1.1.4.7 Discard a small portion of the sample to allow an air space.

1.1.4.8 Preserve (if required), label and complete the field notes.

1.1.5 Inorganics

1.1.5.1 Inorganic samples may be collected from the effluent tubing.

1.1.5.2 If samples are collected from the pump, decontaminate all tubing (including the tubing in the head) or change it between wells.

1.1.5.3 Preserve (if required), label and complete field notes.

1.2 Variable Speed Bladder Pump

1.2.1 If sampling for organics the pump body must be constructed of stainless steel and the valves and bladder must be Teflon. All tubing must be Teflon, Polyethylene, or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or made of stainless steel.

1.2.2 After purging to a smooth even flow, reduce the flow rate.

1.2.3 When sampling for volatile organic compounds, reduce the flow rate to 100 mL/minute or less, if possible.

1.3 Variable Speed Submersible Pump

1.3.1 The housing must be stainless steel.

1.3.2 If sampling for organics, the internal impellers, seals and gaskets must be constructed of stainless steel, Teflon, Polyethylene or PP. The delivery tubing must be Teflon, Polyethylene or PP and the electrical cord must be sealed in Teflon and any cabling must be sealed in Teflon or constructed of stainless steel.

1.3.3 After purging to a smooth even flow, reduce the flow rate.

1.3.4 When sampling for volatile organic compounds, reduce the flow rate to 100 mL/minute or less, if possible.

2. SAMPLING WITH BAILERS: A high degree of skill and coordination are necessary to collect representative samples with a bailer. When properly used, bailers may be used to collect samples for certain analyte groups and under specific conditions (see Table FS 2200-3). They must be of an appropriate type and construction (see FS 2201, section 3), and must be used as outlined below. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager.

2.1 General Considerations

2.1.1 Minimize handling the bailer as much as possible.

2.1.1.1 Wear sampling gloves.

2.1.1.2 Remove the bailer from its protective wrapping just before use.

2.1.1.3 Attach a lanyard of appropriate material (see FS 2201, section 4).

2.1.1.4 Use the lanyard to move and position the bailers.

2.1.2 Do not allow the bailer or lanyard to touch the ground.

2.1.3 Rinsing

2.1.3.1 If the bailer is certified precleaned, no rinsing is necessary.

2.1.3.2 If both a pump and a bailer are to be used to collect samples, rinse the exterior and interior of the bailer with sample water from the pump before removing the pump.

2.1.3.3 If the purge pump is not appropriate for collecting samples (e.g., non-inert components), rinse the bailer with by collecting a single bailer of the groundwater to be sampled. Use the technique described in section 2.2, Bailing Technique, below.

2.1.3.4 Discard the water appropriately.

2.1.3.5 **Do not** rinse the bailer if Oil & Grease, TRPHs, etc., (see FS 2006) are to be collected.

2.2 Bailing Technique

2.2.1 Collect all samples that are required to be collected with a pump before collecting samples with the bailer.

2.2.2 Raise and lower the bailer gently to minimize stirring up particulate matter in the well and the water column which can increase sample turbidity.

2.2.3 Lower the bailer carefully into the well to a depth approximately a foot above the water column. Ensure that the length of the bailer does not exceed the length of the water column.

2.2.3.1 When the bailer is in position, lower the bailer into the water column at a rate of 2 cm/sec until the desired depth is reached (see section 2.2.3 above).

2.2.4 Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column.

2.2.5 Allow time for the bailer to fill with aquifer water as it descends into the water column.

2.2.6 Do not allow the bailer to touch the bottom of the well or particulate matter will be incorporated into the sample.

2.2.6.1 Carefully raise the bailer (see section 2.2.2 above). Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.

2.2.7 Lower the bailer to approximately the same depth each time.

2.2.8 Collect the sample.

2.2.8.1 Install a device to control the flow from the bottom of the bailer and discard the first few inches of water. Reduce the flow to $\leq$ 100 mL/minute when collecting VOC samples.

2.2.8.2 Fill the appropriate sample containers by allowing the sample to slowly flow down the side of the container. Minimize aeration of VOC samples.

2.2.8.3 Discard the last few inches of water in the bailer.

2.2.9 Repeat steps 2.2.1 through 2.2.8.3 for additional samples.

2.2.10 Measure the DO, pH, temperature, turbidity and specific conductance after the final sample has been collected.

2.2.10.1 Record all measurements and note the time that sampling was completed.

3. SAMPLING WELLS WITH FLOATING NON-AQUEOUS PHASE LIQUID: DEP does not recommend the sampling of wells with floating non-aqueous phase liquid for trace contaminants. This concerns primarily petroleum related sites, but includes any chemical product (e.g., solvent) that floats on the water table. Sampling is acceptable if the information is to be used for the purpose of remedial design.

Sample data from such wells cannot provide useful information regarding the level of contamination. Furthermore, these wells typically do not provide legitimate data because of permanent chemical contamination from product contact with the well casing for an extended period of time.

DEP does reserve the right to require sampling of these wells, not for levels of trace contaminants, but for confirmation of an appropriate remediation technique. This type of sampling is performed **below** the non-aqueous phase layer (see section 3.2 below).

3.1 Non-Aqueous Phase Liquid Sampling: Non-aqueous phase liquid may be evident in a cased monitoring well or in an open excavation.

3.1.1 Non-aqueous phase liquid is normally sampled for two reasons:

- Documentation for its existence and thickness; and
- Determination of the type of product so that the proper analyses can be performed to determine extent. This is only feasible for relatively recent releases as it may not be possible to identify weathered product.

3.1.2 Disposable plastic (acrylic, clear PVC) bailers are recommended for sampling. Disposable Polyethylene and PP bailers are also acceptable. Other wide mouth vessels may be used for sampling non-aqueous phase liquid in an excavation.

3.1.3 Monitoring Well

3.1.3.1 If a non-aqueous phase liquid is identified in a monitoring well during the water level measurement, measure its thickness in the well. If the thickness of the non-aqueous phase liquid is greater than 0.01 foot or product globules are present, collect a sample using a precleaned disposable bailer.

3.1.3.2 Measure the product thickness to the nearest 0.01 foot after withdrawing the bailer.

3.1.3.3 Pour a portion of the product into a glass sample container.

3.1.3.4 This sample is considered a concentrated waste. Therefore, package the container in protective wrapping to prevent breakage, isolate from other samples, and ice to 4°C.

3.1.4 Excavation

3.1.4.1 If non-aqueous phase liquid is observed in an open excavation, a glass sample container or a precleaned intermediate vessel may be used to collect the sample.

3.1.4.2 Securely tie a lanyard to the container and lower it into the excavation.

3.1.4.3 Gently lower and retrieve the container so that no solid material is released or collected.

3.1.4.4 If sufficient water is available, a bailer can be used.

3.1.4.5 Although not recommended, screened casing can be placed (or augered and placed) in the bottom of the excavation and the product sampled with a bailer.

3.1.4.6 Avoid dangerous situations, such as standing too close to the edge of an excavation, riding in the backhoe bucket, or entering a trench or excavation that may collapse.

3.1.4.7 Follow all applicable OSHA regulations.

3.2 Sampling Below Product

3.2.1 This type of depth-specific sampling to attempt to sample the dissolved constituents in the water column below the product layer is performed only at the request of DEP or its designee.

3.2.2 These data provide information that helps define adequate groundwater treatment. Without these data, incorrect (and sometimes unnecessarily expensive) remediation techniques may be designed for a situation where they are not required.

3.2.3 There are some substantial logistical problems involved with sending a sampler through non-aqueous phase liquid to sample the groundwater below. Although there are some products designed specifically for this type of sampling, they are expensive and the results may not be commensurate with their cost. The use of "self-engineered" equipment or coverings may be the best option.

3.2.4 These data are only to be used for qualitative use and will aid in deciding on an appropriate remediation technique.

3.2.5 Wrapping bailers and tubing in plastic seems to be the most popular technique in getting past the product layer.

3.2.6 Although not recommended, some have wrapped submersible pumps in several layers of plastic and retrieved each layer by a separate lanyard. One suggestion would be to use a rigid piece of stainless steel tubing wrapped in plastic.

3.2.6.1 Once the covered tubing is past the layer, pull up on the plastic, piercing the plastic and exposing the (somewhat) clean tubing inlet.

3.2.6.2 Introduce the wrapped hose slowly to not entrain any more product into the dissolved layer located below.

3.2.6.3 Also, perform this procedure with a peristaltic pump or a vacuum pump linked to a trap bottle. To use this setup, the water table must be no deeper than 15-20 feet, realizing that actual sampling may be occurring several feet below the product layer.

FS 2222. *Sampling Low Permeability Aquifers or Wells That Have Purged Dry*

1. Collect the sample(s) after the well has been purged according to FS 2212, section 3.4. Minimize the amount of water removed from the well by using the same pump to purge and collect the sample. If the well has purged dry, collect samples as soon as sufficient sample water is available.

2. Measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity at the time of sample collection.

3. Advise the analytical laboratory and the client that the usual amount of sample for analysis may not be available.

FS 2223. *Sampling Wells With In-Place Plumbing*

1. If a storage tank is present, locate a cold water spigot, valve or other sampling point close to the well head between the pump and the storage tank. If there is no sampling location between the pump and the storage tank, locate the spigot, valve or other sampling point closest to the tank.

1.1 Depending on the sampling objective for collecting samples using installed plumbing, purge the system and collect samples closest to the point of consumption, or, as close to the source well as possible.

2. Remove all screens or aerators and reduce the flow rate to no more than 500 mL/minute. If collecting samples for volatile organic compounds, reduce the flow rate to 100 mL/minute or less. Collect the samples directly into the appropriate containers.

FS 2224. *Sampling Airstripper and Remedial Treatment System Sampling*

1. Reduce the flow rate to less than 500 mL/minute and begin sample collection.

2. If collecting samples for volatile organic compounds, reduce the flow rate to 100 mL/minute or less.

3. Collect the samples directly into the appropriate containers.

FS 2225. *Filtering Groundwater Samples*

Filtered groundwater samples can only be collected after approval from the DEP program or project manager. If filtering is approved, the DEP program or permit condition may require both filtered and unfiltered samples to be collected, analyzed and reported.

1. FILTERING GROUNDWATER FOR METALS:

1.1 Unless specified otherwise by the DEP program, use a new, disposable, high capacity, 1-µm in-line filter.

1.2 Use a variable speed peristaltic, bladder or submersible pump with the in-line filter fitted on the outlet end.

1.2.1 Peristaltic pumps, bladder pumps or submersible pumps can be used when water levels are no greater than 20 to 25 feet deep.

1.2.2 Bladder pumps or submersible pumps must be used when water levels are greater than 20 to 25 feet deep.

1.3 Ensure that a 1-foot maximum length of new, silicone tubing was installed in the peristaltic pump head assembly before the well was purged if the same pump is being used to purge and sample the well. Otherwise, install a new length of tubing as described above.

1.4 Ensure that new or precleaned delivery tubing was assembled with the peristaltic pump before the well was purged if the same pump is being used to purge and sample the well. Otherwise, assemble the pump with new or precleaned delivery tubing and the new filter.

1.5 Insert the filter on the high pressure side (i.e., on the delivery side) of the pump.

1.5.1 Flush the filter before attaching to the pump tubing assembly with 30-50 mL of analyte free water or an inert gas (nitrogen) to remove atmospheric oxygen;

1.5.2 Or, with the filter attached to the pump tubing assembly, hold the filter upright with the inlet and outlet in the vertical position and pump water from the aquifer through the filter until all atmospheric oxygen has been removed.

1.6 Collect the filtered samples directly into the sample container from the high-pressure (delivery) side of the pump tubing assembly.

1.6.1 Collect filtered samples by either of the methods in 1.6.1.3 or 1.6.1.4 below if the static water level in the well is too deep for a variable speed peristaltic pump and a variable speed electric submersible pump or variable speed bladder pump is not available.

1.6.1.1 Do not agitate the sample or expose it to atmospheric oxygen.

1.6.1.2 **<u>Do not</u>** pour the sample into any intermediate vessel for subsequent filtration.

1.6.1.3 Collect the sample in a Polyethylene, Teflon or PP bailer that can be pressurized. When the bailer has been retrieved, immediately connect the filter and begin to pressurize the bailer;

1.6.1.4 Or, collect the sample with a bailer and immediately place the intake tube of the peristaltic pump into the full bailer and begin pumping the water through the filter as described in section 1.2 above.

1.7 **Do not** use the following equipment for filtering groundwater samples for metals:

1.7.1 Any pump and apparatus combination in which the filter is on the vacuum (suction) side of the pump.

1.7.2 Any type of syringe or barrel filtration apparatus.

1.7.3 Any filter that is not encased in a one-piece, molded unit.

2. Filtering groundwater for non-metallic analytes

2.1 The following analytes cannot be filtered:

- Oil and Grease
- Total Recoverable Petroleum Hydrocarbons (TRPH)
- FL-PRO
- Volatile Organic Compounds (VOC)
- Microbiological Analytes
- Volatile Inorganic Compounds (e.g., Hydrogen Sulfide)

2.2 Unless specified otherwise by the regulatory program, use a new, disposable, high capacity, 0.45 µm in-line filter.

2.3 Assemble the pump, tubing and filter as in 1.2 – 1.5 above.

2.4 Flush the filter as in 1.5.1 or 1.5.2 above.

2.5 Collect the samples as in 1.6 – 1.6.1.4 above.

Appendix FS 2200

Tables, Figures and Forms

Table FS 2200-1
Equipment for Collecting Groundwater Samples

Activity	Equipment Type
Well Purging	Variable speed centrifugal pump Variable speed submersible pump Variable speed bladder pump Variable speed peristaltic pump Bailer with lanyard: Not Recommended
Well Stabilization	pH meter DO meter Conductivity meter Thermometer/Thermistor Turbidimeter Flow-through cell Multi-function meters
Sample Collection	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Bailer with lanyard (See Table FS 2200-3)
Filtration	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Pressurized bailer 1.0 µm high capacity molded filter 0.45 µm high capacity molded filter
Groundwater Level	Electronic sensor Chalked tape

Table FS 2200-2
Dissolved Oxygen Saturation

TEMP	D.O.	mg/L	TEMP	D.O.	mg/L	TEMP	D.O.	mg/L	TEMP	D.O.	mg/L
deg C	SAT.	20%	deg C	SAT.	20%	deg C	SAT.	20%	deg C	SAT.	20%
15.0	10.084	2.017	19.0	9.276	1.855	23.0	8.578	1.716	27.0	7.968	1.594
15.1	10.062	2.012	19.1	9.258	1.852	23.1	8.562	1.712	27.1	7.954	1.591
15.2	10.040	2.008	19.2	9.239	1.848	23.2	8.546	1.709	27.2	7.940	1.588
15.3	10.019	2.004	19.3	9.220	1.844	23.3	8.530	1.706	27.3	7.926	1.585
15.4	9.997	1.999	19.4	9.202	1.840	23.4	8.514	1.703	27.4	7.912	1.582
15.5	9.976	1.995	19.5	9.184	1.837	23.5	8.498	1.700	27.5	7.898	1.580
15.6	9.955	1.991	19.6	9.165	1.833	23.6	8.482	1.696	27.6	7.884	1.577
15.7	9.934	1.987	19.7	9.147	1.829	23.7	8.466	1.693	27.7	7.870	1.574
15.8	9.912	1.982	19.8	9.129	1.826	23.8	8.450	1.690	27.8	7.856	1.571
15.9	9.891	1.978	19.9	9.111	1.822	23.9	8.434	1.687	27.9	7.842	1.568
16.0	9.870	1.974	20.0	9.092	1.818	24.0	8.418	1.684	28.0	7.828	1.566
16.1	9.849	1.970	20.1	9.074	1.815	24.1	8.403	1.681	28.1	7.814	1.563
16.2	9.829	1.966	20.2	9.056	1.811	24.2	8.387	1.677	28.2	7.800	1.560
16.3	9.808	1.962	20.3	9.039	1.808	24.3	8.371	1.674	28.3	7.786	1.557
16.4	9.787	1.957	20.4	9.021	1.804	24.4	8.356	1.671	28.4	7.773	1.555
16.5	9.767	1.953	20.5	9.003	1.801	24.5	8.340	1.668	28.5	7.759	1.552
16.6	9.746	1.949	20.6	8.985	1.797	24.6	8.325	1.665	28.6	7.745	1.549
16.7	9.726	1.945	20.7	8.968	1.794	24.7	8.309	1.662	28.7	7.732	1.546
16.8	9.705	1.941	20.8	8.950	1.790	24.8	8.294	1.659	28.8	7.718	1.544
16.9	9.685	1.937	20.9	8.932	1.786	24.9	8.279	1.656	28.9	7.705	1.541
17.0	9.665	1.933	21.0	8.915	1.783	25.0	8.263	1.653	29.0	7.691	1.538
17.1	9.645	1.929	21.1	8.898	1.780	25.1	8.248	1.650	29.1	7.678	1.536
17.2	9.625	1.925	21.2	8.880	1.776	25.2	8.233	1.647	29.2	7.664	1.533
17.3	9.605	1.921	21.3	8.863	1.773	25.3	8.218	1.644	29.3	7.651	1.530
17.4	9.585	1.917	21.4	8.846	1.769	25.4	8.203	1.641	29.4	7.638	1.528
17.5	9.565	1.913	21.5	8.829	1.766	25.5	8.188	1.638	29.5	7.625	1.525
17.6	9.545	1.909	21.6	8.812	1.762	25.6	8.173	1.635	29.6	7.611	1.522
17.7	9.526	1.905	21.7	8.794	1.759	25.7	8.158	1.632	29.7	7.598	1.520
17.8	9.506	1.901	21.8	8.777	1.755	25.8	8.143	1.629	29.8	7.585	1.517
17.9	9.486	1.897	21.9	8.761	1.752	25.9	8.128	1.626	29.9	7.572	1.514
18.0	9.467	1.893	22.0	8.744	1.749	26.0	8.114	1.623	30.0	7.559	1.512
18.1	9.448	1.890	22.1	8.727	1.745	26.1	8.099	1.620	30.1	7.546	1.509
18.2	9.428	1.886	22.2	8.710	1.742	26.2	8.084	1.617	30.2	7.533	1.507
18.3	9.409	1.882	22.3	8.693	1.739	26.3	8.070	1.614	30.3	7.520	1.504
18.4	9.390	1.878	22.4	8.677	1.735	26.4	8.055	1.611	30.4	7.507	1.501
18.5	9.371	1.874	22.5	8.660	1.732	26.5	8.040	1.608	30.5	7.494	1.499
18.6	9.352	1.870	22.6	8.644	1.729	26.6	8.026	1.605	30.6	7.481	1.496
18.7	9.333	1.867	22.7	8.627	1.725	26.7	8.012	1.602	30.7	7.468	1.494
18.8	9.314	1.863	22.8	8.611	1.722	26.8	7.997	1.599	30.8	7.456	1.491
18.9	9.295	1.859	22.9	8.595	1.719	26.9	7.983	1.597	30.9	7.443	1.489

Derived using the formula in Standard Methods for the Examination of Water and Wastewater, Page 4-101, 18th Edition, 1992

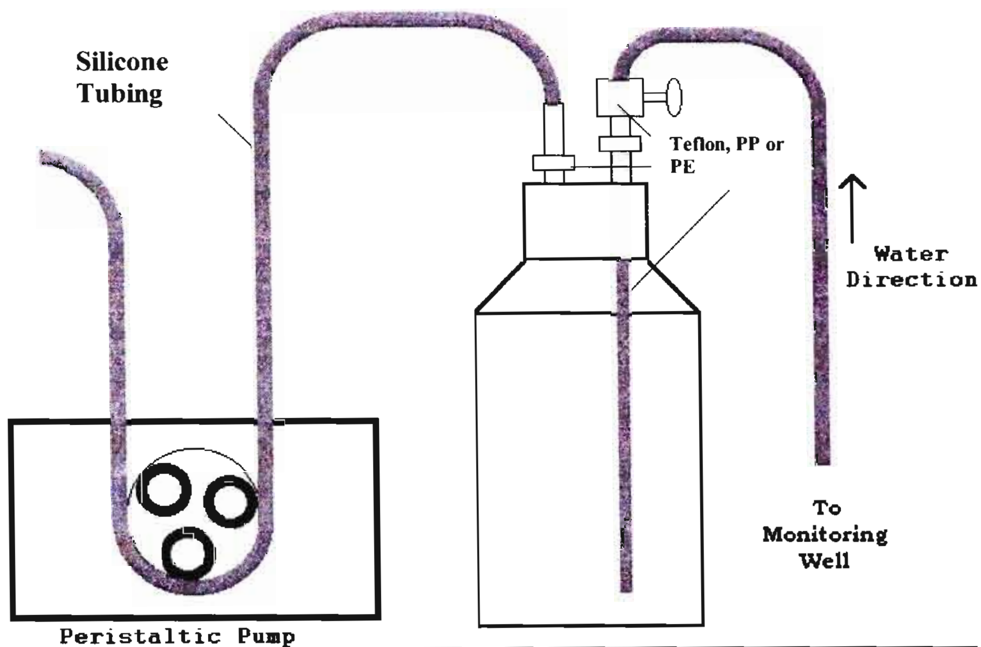
Table FS 2200-3
Allowable Uses for Bailers

• ANALYTE GROUP(S)	• PURGING (Not Recommended)	• SAMPLING	
	Use:	Use:	Not Recommended:
Volatile Organics Extractable Organics Radionuclides, including Radon Metals Volatile Sulfides	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	If concentrations exceed action levels, the purpose is to monitor effective treatment, and the DEP program allows the use of bailers; or If specified by DEP permit, program, contract or order. or If operated by a skilled individual with documented training in proper techniques and using appropriate equipment. Field documentation must demonstrate that the procedure in FS 2221, section 2 was followed without deviation.	If concentrations are near or below the stated action levels; or If a critical decision (e.g., clean closure) will be made based on the data; or If data are to demonstrate compliance with a permit or order.
Petroleum Hydrocarbons (TRPH) & Oil & Grease	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	Only if allowed by permit, program, contract or order as samples should be collected into the container without intermediate devices.	Unless allowed by permit, program, contract or order.

• ANALYTE GROUP(S)	• PURGING (Not Recommended)	• SAMPLING	
	Use:	Use:	Not Recommended:
Biologicals Inorganic Non-Metallics Aggregate Organics Microbiological Physical and Aggregate Properties	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	If all analytes collected from the well can be collected with a bailer; or If collected after collecting all analytes that require the use of a pump.	Before collecting any analytes that must be collected with a pump.
Ultra-Trace Metals	Never	Never	

Figure 2200-1

Pump and Trap for Extractable Organics



The glass sample bottle must be threaded to use a reusable sampling cap lined and installed with fittings made of Teflon, polypropylene or polyethylene, similar to the design shown.

Scenario 1: WELL SCREEN COMPLETELY SUBMERGED

Option 1a: Minimal Purge Volume: Pump or tubing is placed within the middle of the screen interval. The following conditions must be met to use this option:

1. The well screen interval is ≤ 10 feet.
2. Although drawdown may occur in the well when purging is initiated, the drawdown has to stabilize (Aquifer Recovery Rate = Purge Rate).
3. The samples will be obtained with the same equipment that was used to purge the well. Therefore, centrifugal pumps and bailers are not suitable for use in Option 1a.

If one or more of these conditions do not apply, use Option 1b.

Option 1b: Conventional Purge: Pump, tubing, or bailer [1] is placed above the screen at the top of the water column.

[1] DEP does not recommend the use of a bailer for purging; however, if a bailer is used it shall be lowered and raised at the rate of 2 cm/sec in the top of the water column.

Scenario 2: WELL SCREEN PARTIALLY SUBMERGED

Option 2a: A bailer [1] is placed at the top of the water column and is used to purge and sample the well.

Option 2b: Pump or tubing is placed within the middle of the saturated portion of the screen interval.

If the pump or tubing that was used for purging will not be used to obtain the sample, then position the pump or tubing at the top of the water column for purging.

Purging Procedure #1

1. After the drawdown in the well stabilizes, purge at least one equipment volume then collect the first set of stabilization parameters.
2. Thereafter, collect stabilization parameters ≥ 2 to 3 minutes apart.
3. Purge at least three equipment volumes before sampling.

Purging Procedure #2

1. Purge at least one well volume then collect first set of stabilization parameters.
2. Thereafter, collect stabilization parameters ≥ every 1/4 well volume.

Purging Procedure #3

1. Purge at least one well volume then collect first set of stabilization parameters.
2. Thereafter, collect stabilization parameters ≥ 2 to 3 minutes apart.

Purging Completion

If Dissolved Oxygen is ≤ 20% of saturation for the measured temperature and **Turbidity** is ≤ 20 NTUs, then purging is complete when **three** consecutive readings of the parameters listed below are within the following ranges:

Temperature ± 0.2 °C
pH ± 0.2 Standard Units
Specific Conductance ± 5.0% of reading

If Dissolved Oxygen (DO) is > 20% of saturation for the measured temperature and/or **Turbidity** is > 20 NTUs after every attempt has been made to reduce DO and/or turbidity, then purging is complete when **three** consecutive readings of the parameters listed below are within the following ranges:

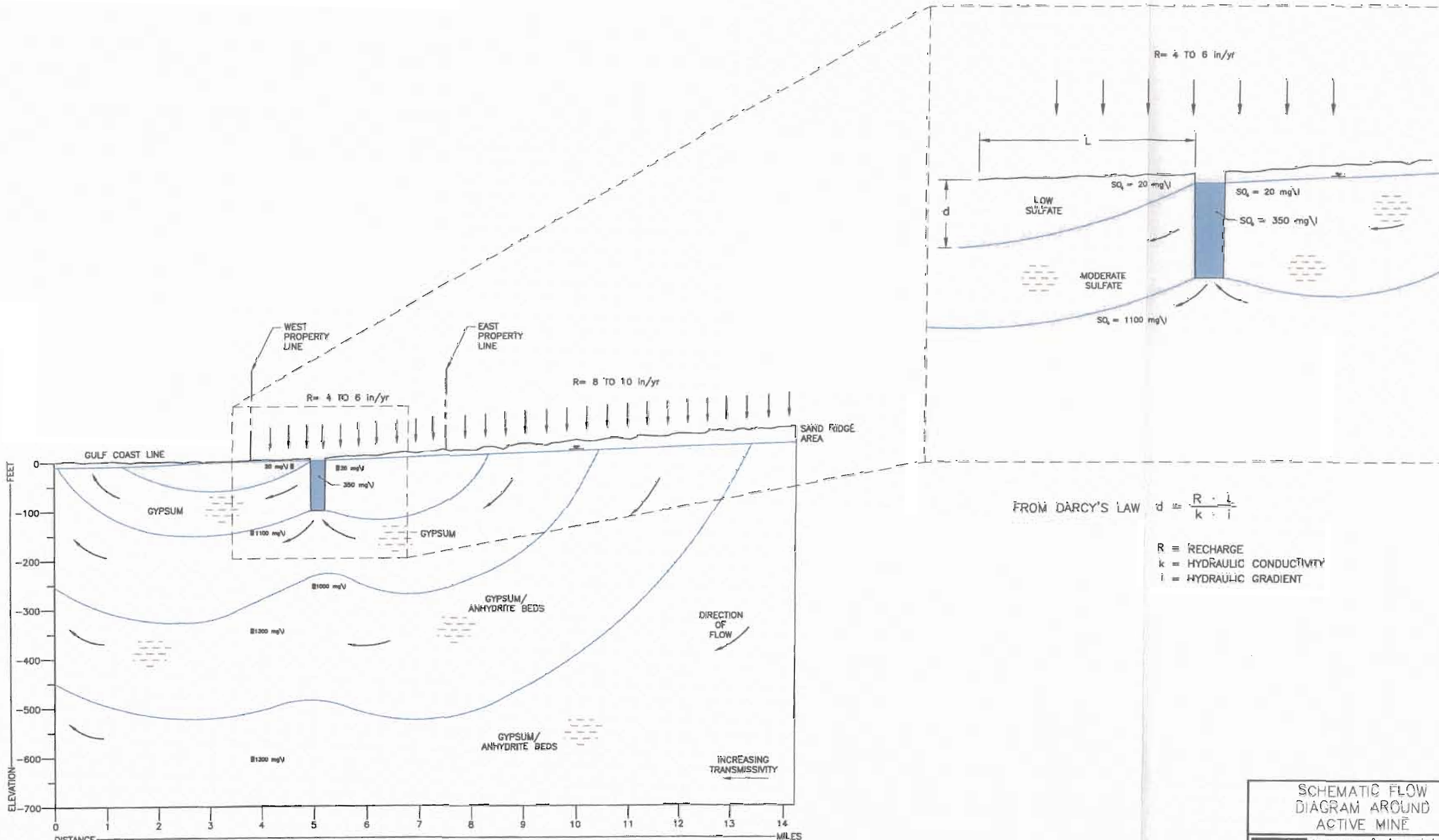
Temperature ± 0.2 °C
pH ± 0.2 Standard Units
Specific Conductance ± 5.0% of reading
Dissolved Oxygen ± 0.2 mg/L or readings are within 10% (whichever is greater).
Turbidity ± 5 NTUs or readings are within 10% (whichever is greater).

If the well is expected to purge dry, position the pump or tubing within the screened interval and purge at ≤ 100 mL/minute until two equipment volumes are removed. Use the same pump for purging and sampling.

If the **well purges dry** at the lowest achievable flow rate (pumping at 100 mL/minute or less), then after a sufficient amount of water recharges in the well, collect the samples.

In either case listed above, before samples are collected, measure (once) **pH, temperature, specific conductance, dissolved oxygen, and turbidity**.

If one or more parameters do not stabilize **after 5 volumes of the screened interval (purging procedure #1) or 5 well volumes (purging procedure #s 2 & 3)** are removed, purging may be discontinued at the discretion of the sampling team leader.



NOTE: FLOW LINES NOT TO SCALE

FROM DARCY'S LAW $d = \frac{R \cdot L}{k \cdot i}$

R = RECHARGE
k = HYDRAULIC CONDUCTIVITY
i = HYDRAULIC GRADIENT

SCHEMATIC FLOW DIAGRAM AROUND ACTIVE MINE

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

KING ROAD MINE
TARMAC AMERICA, LLC
LEVY COUNTY, FL

DRAWN BY: SDS	CHECKED BY:	DATE: 09/18/09
FILE NO: 08-086	APPROVED BY:	FIGURE: C2-8

CULTURAL RESOURCE MANAGEMENT PLAN FOR THE TARMAC MINE MITIGATION AREA LEVY COUNTY, FLORIDA:

PRELIMINARY PLAN

Prepared by

Florida History, LLC
12157 W. Linebaugh Avenue # 167
Tampa, Florida 33626

June 2008

Contains Sensitive Material-Not for Public Distribution
Exempt from Florida Sunshine Law under Chapter 267.135, Location of Archaeological Sites

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CULTURAL RESOURCE MANAGEMENT PLAN FOR THE TARMAC MINE MITIGATION AREA LEVY COUNTY, FLORIDA:

PRELIMINARY PLAN

PROJECT OVERVIEW

Professional archaeological and historical staff from Florida History, LLC of Tampa, Florida, provided the cultural resource management services for the Tarmac Mine in Levy County, Florida. Since portions of the proposed mitigation project area are in archaeologically sensitive areas, Florida History, LLC, will assist with planning, construction, and management measures to protect the archaeological resources of this unique property. This first stage is to determine how planned activities may impact archaeological and historic sites that may be present within the proposed mitigation area.

The 9,733-acre Tarmac Mine project area can be divided into eastern and western portions (Figure 1). The eastern portion, which is to be mined, has been subject to a Phase I cultural resource assessment survey related to its proposed use as a mine. Through this survey, the Florida Division of Historical Resources (DHR) has cleared the mine property from impacts to cultural resources, and shown that no archaeological or historical sites are present in the area to be mined. The western portion, which is the mitigation area and will not be mined, has had portions surveyed as part of a reconnaissance-level archaeological survey of the Gulf Hammock Wildlife Management Area. Activities proposed to be conducted within the western portion of the survey area include the removal of non-native vegetation, the elimination of existing roads, and the addition of drainage ways to assist in returning the area to its prior condition.

MANAGEMENT PLAN OVERVIEW

The purpose of this management plan is to detail recorded locations of known archaeological sites, delineate site concentrations for avoidance, and identify areas with low, moderate, or high probability of having recorded or unrecorded archaeological sites. The purpose of this document is to assist in the planning of reconnaissance and/or Phase I archaeological surveys of areas of major impact, especially in the proximity of known sites. The overall goal of this plan is to avoid or minimize project impacts on cultural resources while allowing environmental mitigation to proceed.

Specific recommendations of this plan include the following parts. Testing and specific location for potential avoidance [preferred alternative for three sites (8LV110, 8LV468, and 8LV532)]. Site visits for limited high probability zones to determine if sites are present, and a brief training and familiarization with archaeological site avoidance and identification for equipment operators. Additionally, Native American consultation for impacts to sites, and information on any unidentified traditional cultural properties is also recommended.

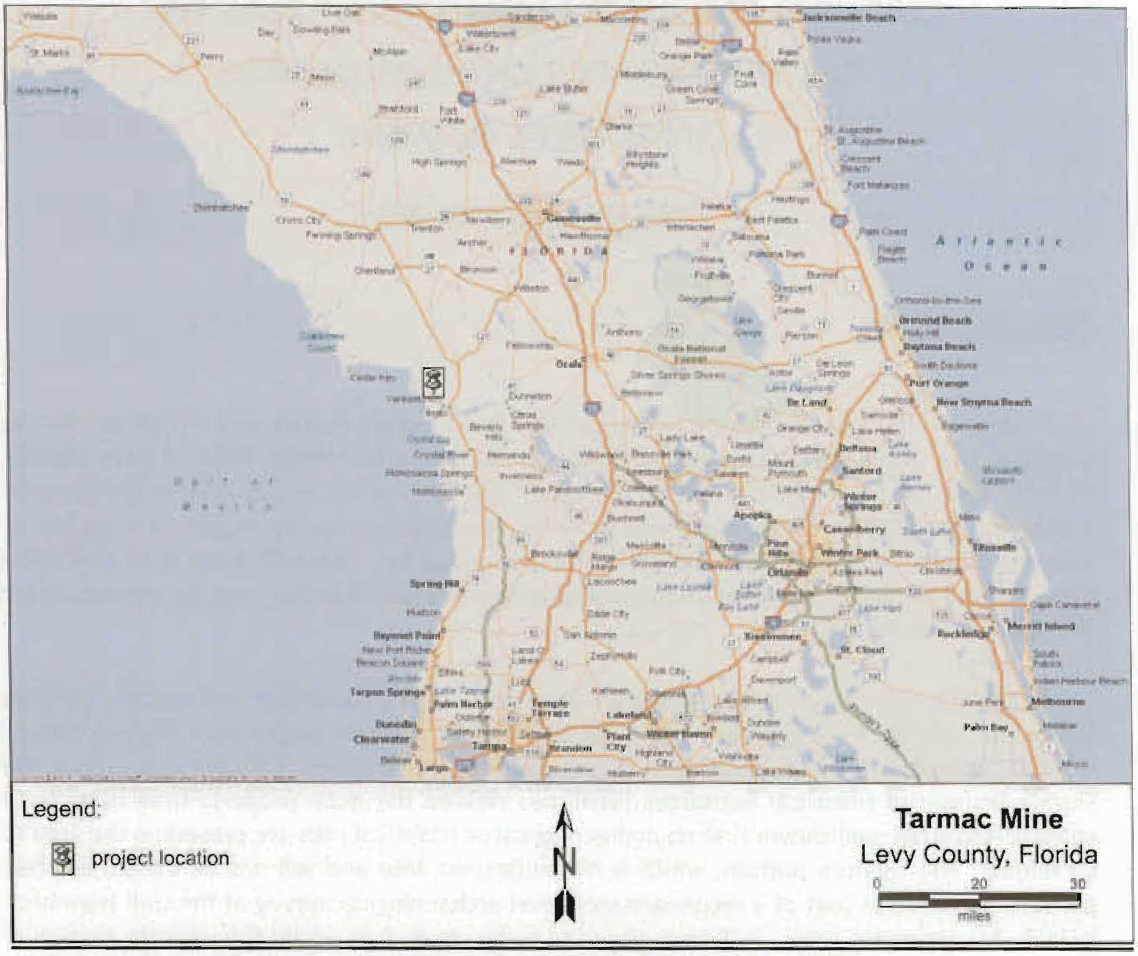

Figure 1. General location of the Tarmac Mine project area.

ARCHIVAL RESEARCH

Levy County Property Appraiser Records

An online search of the Levy County Property Appraiser Records was completed for the parcels within the project area (http://www.levypa.com, accessed May 6, 2008). These parcels are listed in Table 1. According to the property appraiser, there are no buildings within the project area. A list of current land use includes managed timber, vacant land, and stands of hardwood/cypress.

Table 1. Parcels within the Mitigation Project Area.

Parcel Number	Owner	Acreage	Township / Range / Section
02149-000-00	Plum Creek Timberlands LP	380 acres	T 15 / R 15 / Sec 25
02150-000-00	Plum Creek Timberlands LP	380 acres (all but far eastern portion in project area)	T 15 / R 15 / Sec 26
02187-000-00	Plum Creek Timberlands LP	640 acres	T 15 / R 15 / Sec 35
02188-000-00	Plum Creek Timberlands LP	640 acres	T 15 / R 15 / Sec 36
02199-000-00	Plum Creek Timberlands LP	40 acres	T 16 / R 15 / Sec 1
02201-000-00	Plum Creek Timberlands LP	528.65 acres	T 16 / R 15 / Sec 2
02214-000-00	Plum Creek Timberlands LP	474.55 acres (just the western portion is in project area)	T 16 / R 15 / Sec 12
02220-000-00	Plum Creek Timberlands LP	280 acres	T 16 / R 15 / Sec 13
02835-000-00	Plum Creek Timberlands LP	640 acres (just the SW corner of the parcel is in the project area)	T 15 / R 16 / Sec 31
02853-000-00	Plum Creek Timberlands LP	640 acres (only the western portion is in the project area)	T 16 / R 16 / Sec 6
02872-000-00	Plum Creek Timberlands LP	600 acres (only SW corner is in project area)	T 16 / R 16 / Sec 17
02874-000-00	Plum Creek Timberlands LP	640 acres (all but NE portion is in project area)	T 16 / R 16 / Sec 18
02875-000-00	Plum Creek Timberlands LP	480 acres	T 16 / R 16 / Sec 19
02879-000-00	Plum Creek Timberlands LP	520 acres (only far western portion is in project area)	T 16 / R 16 / Sec 20

Historic Aerial Photographs

Examination of 1961, 1963, and 1970 aerial photographs of the project area, available online (Florida Aerial Photography, http://www.uflib.ufl.edu/digital/collections/flap/, accessed May 6, 2008), could discern no buildings or historic features within the project area.

Previously Recorded Surveys

No previous formal surveys have been conducted within the Tarmac Mine Mitigation Area (the mitigation area of the Tarmac King Road Limestone Mine); however, two previous surveys have bordered the western project area boundary (Jones 1993; Vojnovski et al. 2000). These surveys have provided an overview of both sites and site types to be found within the mitigation area. A total of four cultural resource surveys have been conducted within one mile of the project area (Table 2).

The first intensive survey to be completed in this general area was an archaeological survey of the South Gulf Hammock, completed by Paul L. Jones, a Registered Professional Archaeologist (RPA) then with the University of Florida, Department of Anthropology, now a Senior

Archaeologist at Florida History, LLC (Jones 1993). This survey covered 16,000 acres within the Waccasassa Bay State Preserve, using a combination of survey techniques, including pedestrian survey, surface inspection, auger testing, shovel testing, and excavation of formal test units. Forty-four newly recorded sites were located during this survey, and three previously recorded sites were revisited. The report of findings also provides a discussion of prehistoric settlement patterns in the Gulf Hammock.

During the 2000 C.A.R.L. survey of Waccasassa Bay State Preserve, testing was performed by archaeologists for the Florida Department of State. Archaeological methods included a literature review, site visits to selected sites, recording sites reported by local informants, windshield survey, surface inspection, and an airboat survey along the Waccasassa River. The surveyors recorded prehistoric habitation sites, burial mounds, and historic homesteads. An interesting feature noted at the homestead sites was the use of square wells. The surveyors noted site disturbances due to vandalism, hunting, and erosion. With this survey, a total of 80 cultural resources had been identified in the Waccasassa Bay State Preserve; however, portions of the Preserve, outside of the area to be mined, remain unsurveyed to this day.

Two archaeological surveys have been completed for the portion of the Tarmac King Road Limestone Mine Site to be mined. In January 2006, Panamerican Consultants, Inc., surveyed a 16-acre parcel to be used as a mining test pit in the Tarmac King Road Limestone Mine (Hughes 2006). No cultural resources were identified. In the Fall of 2006, Panamerican Consultants, Inc., surveyed the 4,572-acre Tarmac King Road Limestone Mine Site, to the east of the mitigation area. With 494 shovel tests dug in a grid across the project area, a single chert flake, presumably prehistoric, was found. This was considered to be an isolated archaeological occurrence, and was not assigned a Florida Master Site File archaeological site number (Ambrosino 2006).

Table 2. Archaeological and Historical Surveys Previously Conducted within One Mile of the Project Area.

FMSF Survey No.	Title	Author	Survey Sponsor	Publication Year
3580	Archaeological Survey of the Gulf Hammock, Phase II	Jones, Paul L.	Florida Bureau of Historic Preservation	1993
6222	C.A.R.L. Survey of Waccasassa Bay State Preserve	Vojnovski et al.	Florida Bureau of Archaeological Research	2000
12589	Archaeological and Historical Survey of King/Titan Mine Project Area	Hughes, Skye W.	Biological Research Associates	2006
None Assigned	Archaeological and Historical Survey of the Kings Road Mine Project Area	Ambrosino, James N.	Tarmac/Titan America, LLC	2006

Previously Recorded Sites

While no archaeological sites are present within the mine parcel itself, three archaeological sites have been recorded within the Tarmac Mine mitigation area (Figure 2; Table 3), and eight archaeological sites have been recorded within one mile (Table 4). Site 8LV110 (Beetree Slough) is a prehistoric cemetery and habitation site recorded by the Florida State Museum based on an informant report and a site visit by E.T. Hemmings and Ripley Bullen in December 1971 and January 1972. Numerous Weeden Island-period ceramic sherds and human remains were reported, as was significant damage from vandalism. The recorder described the site as a "cemetery rather than [a] mound, although some addition of soil to low knoll likely; estimated 10-30 burials; 3 or more small household middens in vicinity...." The property was owned by Georgia-Pacific at the time (FMSF Archaeological Site Form 8LV110).

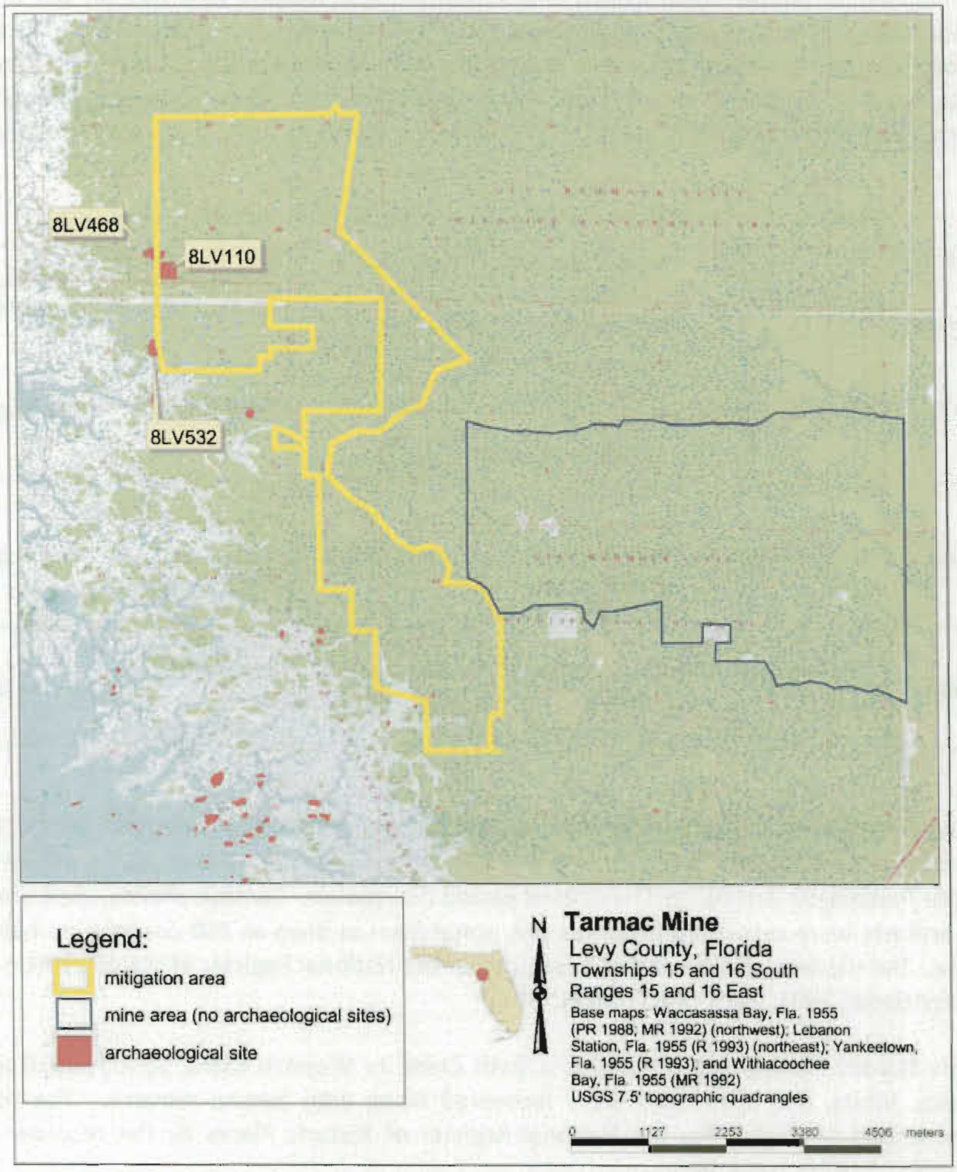

Figure 2. Location of the Tarmac Mine and Tarmac Mine Mitigation project area and the three previously recorded archaeological sites.

Just to the northwest of 8LV110, Jones (1993) recorded site 8LV468 (Crackerville) on the boundary between Waccasassa Bay State Preserve and land owned by Georgia-Pacific at that time (FMSF Archaeological Site Form 8LV468). Numerous Woodland Stage ceramic sherds, along with a Duval-style lithic projectile point and shell tools, led the recorder to conclude that this site may be transitional between the Deptford and Weeden Island periods. Although erosion, logging, and a jeep trail had disturbed the site to some extent, archaeological deposits were found at depths ranging from 0 to 80 centimeters below the ground surface, fairly deep for this area. Jones (1993) recommended further evaluation of the site to determine its significance. This additional recommended work has not been completed.

Site 8LV532 (Turtle Creek North) is a Weeden Island midden recorded on the boundary between the Waccasassa Bay State Preserve and the Tarmac Mine mitigation area. The site was recorded based on a local informant report, but was not revisited by C.A.R.L. archaeologists during the 2000 survey of the preserve. There was insufficient information available to make a determination regarding eligibility for the NRHP (Vojnovski et al, 2000; FMSF Site Form 8LV532).

Table 3. Archaeological Sites Previously Recorded within the Project Area.

FMSF Site Number	Site Name	Site Type and Cultural Affiliation	Recorder / Survey Number	Recorder's Evaluation	SHPO Evaluation
8LV110	Beetree Slough	Prehistoric Cemetery and Habitation / Weeden Island	Hemmings and Bullen / No Survey Report Completed	None given	None given
8LV468	Crackerville	Prehistoric Habitation / Transitional Deptford to Weeden Island	Jones /3580	Further Evaluation Recommended	None given
8LV532	Turtle Creek North	Weeden Island midden	Vojnovski / 6222	Insufficient Information to Make Determination	None given

Eight additional archaeological sites have been recorded within one mile of the Tarmac Mine mitigation area (Figure 3). Site 8LV467 (Opus P) is a Weeden Island-period village with a possible Preceramic Archaic to Transitional period occupation. Ceramic sherds, shell tools, and lithic artifacts were recovered from this site, some from as deep as 250 centimeters below the surface. The site was recommended as eligible for the National Register of Historic Places by the recorder (Jones 1993; FMSF Site Form 8LV467).

Site 8LV469 (Spring Run Mound) is a Swift Creek to Weeden Island period burial mound; ceramics, lithics, and shell tools were recovered along with human remains. The site was recommended as eligible for the National Register of Historic Places by the recorder (Jones 1993; FMSF Site Form 8LV469).

Site 8LV470 (Thousand Mile Creek) is a ceramic and lithic scatter with a shell midden dating to the Woodland Stage. This small and eroded site was recommended as ineligible for the National Register individually or as part of a district, but potentially important at a local level (Jones 1993; FMSF Site Form 8LV470).

Table 4. Additional Archaeological Sites Recorded within One Mile of the Project Area.

FMSF Site Number	Site Name	Site Type and Cultural Affiliation	Recorder / Survey Number	Recorder's Evaluation	SHPO Evaluation
8LV467	Opus P	Weeden Island village with poss. Archaic / Transitional occupation	Jones / 3580	Eligible	None given
8LV469	Spring Run Burial Mound	Swift Creek to early Weeden Island / burial mound	Jones / 3580	Eligible	None given
8LV470	Thousand Mile Creek	Woodland Stage shell midden	Jones /3580	Potentially significant at local level	None given
8LV476	Thousand Island	Prehistoric lithic scatter	Jones / 3580	Not eligible	None given
8LV529	Spring Run Hammock	Historic scatter and square well / mid 19 to early 20 C.	Vojnovski / 6222	Insufficient Information to Make Determination	None given
8LV540	Potlid Pinellas	Weeden Island midden	Vojnovski / 6222	Insufficient Information to Make Determination	None given
8LV542	Turtle Creek Well	Historic Well	Vojnovski / 6222	Insufficient Information to Make Determination	None given
8LV543	Trailer Dump Campsite	Weeden Island and Fort Walton / shell midden	Vojnovski / 6222	Insufficient Information to Make Determination	None given

Site 8LV476 (Thousand Island) is an isolated prehistoric lithic scatter that is not eligible for the National Register of Historic Places (Jones 1993; FMSF Site Form 8LV476).

Site 8LV529 (Spring Run Midden) is a nineteenth to twentieth-century historic scatter and square well that may be associated with a historic homestead. There was insufficient information available to make a determination regarding eligibility for the NRHP (Vojnovski et al, 2000; FMSF Site Form 8LV529).

Site 8LV532 (Turtle Creek North) is a Weeden Island midden recorded on the boundary between the Waccasassa Bay State Preserve and the Tarmac Mine mitigation area. The site was recorded based on a local informant report, and was not visited by C.A.R.L. archaeologists during the 2000 survey of the preserve. There was insufficient information available to make a determination regarding eligibility for the NRHP (Vojnovski et al, 2000; FMSF Site Form 8LV532).

Site 8LV540 (Potlid Pinellas) is a Weeden Island midden recorded based on a local informant report; the site was not visited by C.A.R.L. archaeologists during the 2000 survey of the preserve. There was insufficient information available to make a determination regarding eligibility for the NRHP (Vojnovski et al, 2000; FMSF Site Form 8LV540).

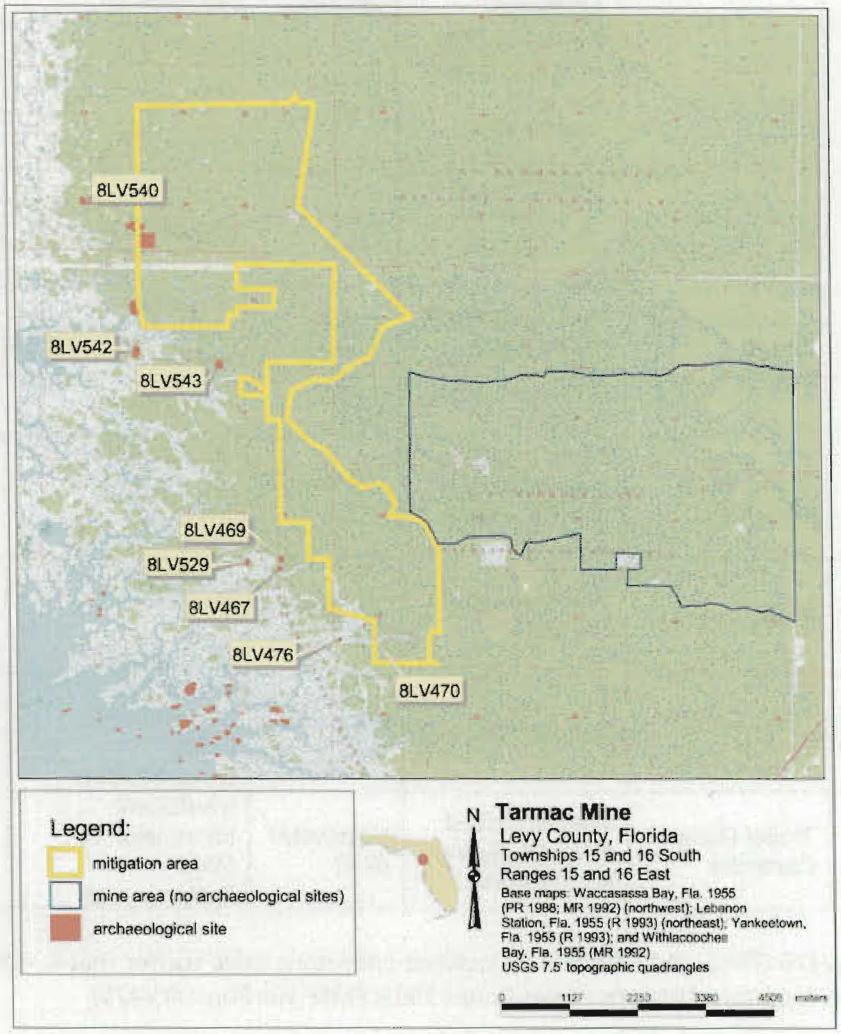

Figure 3. Location of the eight previously recorded archaeological sites located within one mile of the Tarmac Mine Mitigation project area.

Site 8LV542 (Turtle Creek Well) is a historic square well that may have an associated historic artifact scatter. No shovel testing was conducted at this site by C.A.R.L. archaeologists during their 1999 site visit. There was insufficient information available to make a determination regarding eligibility for the NRHP (Vojnovski et al, 2000; FMSF Site Form 8LV542).

Site 8LV543 (Trailer Dump Campsite) is a prehistoric shell midden dating to the Weeden Island and Fort Walton periods. The site was detected in a tree tip; however, since 8LV543 is on privately owned land, the C.A.R.L. archaeologists did not conduct any shovel testing. There was insufficient information available to make a determination regarding eligibility for the NRHP (Vojnovski et al, 2000; FMSF Site Form 8LV543).

Three cemeteries have been recorded within one mile of the project area. The King Family Cemetery (8LV659), established in 1880, the Hawthorne Cemetery (8LV675), established in 1955, and the Priest Family Cemetery (8LV660), established in 1881, are all private family cemeteries. These three cemeteries have not been evaluated by the SHPO concerning their potential eligibility for inclusion in the NRHP.

No historic structures or bridges have been recorded within one mile of the Tarmac Mine Mitigation Area.

Environmental Setting

The proposed Tarmac mitigation project area is situated in western central Florida at the interface of the physiographic provinces of the gulf coastal plain and peninsular Florida. The local geology, shallow limestone formations and a seasonally fluctuating water table near to the surface exert the strongest influence on the landforms and ecology of the site. This condition coupled with the sub-tropical precipitation regime produces the dominant ecological climax communities associated with this region, wetland hardwood hammocks and upland hardwood hammocks. These communities share many of the same dominant species including live oak, *Quercus virginiana*; laurel oak, *Q. laurifolia*; hawthorns, *Crataegeus spp.*; magnolia, *Magnolia grandiflora*; and sweetgum, *Liquidambar styraciflua*. Subordinating species include sweetbay, *Magnolia virginiana*; red bay, *Persea borbonia*; American hornbeam *Carpinus caroliniana*; and red maple *Acer rubrum* in the wetland hammocks and pignut hickory, *Carya glabra*; Eastern hophornbeam, *Ostrya virginiana*; black cherry, *Prunus serotina*; and juniper, *Juniperus virginiana* in the upland hammocks. Subordinate communities interspersed among both upland and wetland hammocks are depressional vegetative assemblages dominated by various associations of water locust, *Gleditsia aquatica*; pop ash, *Fraxinus caroliniana*; and Carolina willow, *Salix caroliniana*.

These landforms, commonly referred to as solution holes or sinks are a type of karst feature resultant of dissolution in the underlying carbonate strata. Some of the features are linear and likely originate as a result of dissolution along fractures or joints within the bedrock allowing for the often discontinuous conveyance of runoff along preferential courses during storm events. With exception of these sinks, much of the project area is currently managed for silviculture and over the last half century these practices have altered climax community development and masked many of the ecotones once present. As a result, delineation of upland hardwood hammock and wetland hardwood hammock is often extremely problematic.

The character of the soils present within the project area is also greatly influenced by the shallow underlying bedrock. Most soil horizons interfacing with the underlying strata contain a significant fraction of clay residuum present as a result of chemical weathering of carbonates. The depth of most soils range from 4- 48 inches, with often greater depths within the some of the sinks. Many are loamy with a thin surface of fine sand 4-6 inches thick while others are loamy nearly to the surface, these are again often found within sinks. Most of these soils are found on level or nearly level sites with slopes of 0-2 percent and are moderately to poorly drained. Soils maps are provided as figures 4, 5, and 6.

(13) Wekiva fine sand

This poorly drained, shallow to moderately deep, nearly level soil is on low ridges. Individual areas are generally irregular in shape and range from 2 to more than 10,000 acres in size. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray fine sand about 4 inches thick. The subsurface layer, to a depth of about 9 inches is grayish brown fine sand. The subsoil, to a depth of about 18 inches, is yellowish brown sandy clay loam. Below this is limestone bedrock. On 90 percent of the acreage mapped as Wekiva fine sand, Wekiva and similar soils make up about 75 to 100 percent of the mapped areas. Dissimilar soils make up less than 25 percent. On 10 percent of the acreage, the dissimilar soils make up more than 25 percent of the mapped areas. Included in mapping are soils that are similar to the Wekiva soil but do not have a sandy surface (Slabaugh et al. 1996)

(25) Pits and Dumps

This map unit consists of pits from which sandy or loamy soil material or limestone has been excavated and dumps in which the excavated materials have been piled (Slabaugh et al. 1996)

(39) Waccasassa Demory complex, flooded

These poorly drained, shallow or very shallow, nearly level soils are on low ridges. They are rarely flooded and occasionally flooded. Individual areas are generally irregular in shape and range from 2 to more than 10,000 acres in size. Slopes range from 0 to 2 percent. Typically, the surface layer of the Waccasassa soil is very dark grayish brown sandy clay loam about 2 inches thick. The subsoil is dark yellowish brown sandy clay loam to a depth of about 12 inches. Limestone bedrock is at a depth of about 12 inches. Typically, the surface layer of the Demory soil is very dark brown sandy clay loam to a depth of about 6 inches. The underlying material is dark yellowish brown sandy clay loam, and extends to a depth of about 11 inches. Limestone bedrock is at a depth of about 11 inches. Generally, the mapped areas average about 53 percent Waccasassa and similar soils and 37 percent Demory and similar soils. The components of this map unit are so intermingled that it is not practical to map them separately at the scale used in mapping. However, the proportions of the Waccasassa and Demory soils and of the similar soils are fairly consistent in most mapped areas. On 95 percent of the acreage mapped as Waccasassa-Demory complex, flooded, Waccasassa, Demory, and similar soils make up about 81 to 99 percent of the mapped areas. Dissimilar soils make up about 1 to 19 percent. On 5 percent of the acreage, the dissimilar soils make up more than 19 percent of the mapped areas. Included in mapping are soils that are similar to the Waccasassa and Demory soils but have a surface layer of fine sand, loamy fine sand, fine sandy loam, or muck that is more than 3 inches thick; have more than 5 percent gravel in the surface layer; are sandy throughout; or have bedrock within a depth of 4 inches. Dissimilar soils that are included with the Waccasassa and Demory soils in mapping occur as small areas of Aripeka, Boca, Bradenton, Chobee, Hicoria, Matmon, and Pineda soils and rock outcrop. Aripeka and Matmon soils are in the slightly higher landscape positions. Boca, Bradenton, and Pineda soils are in positions on the landscape similar to those of the Waccasassa and Demory soils. Chobee and Hicoria soils are in the lower landscape positions. Boca and Pineda soils are sandy to a depth of 20 inches or more and do not have bedrock within a depth of 20 inches. Bradenton soil (Slabaugh et al. 1996)

(41) Demory sandy clay loam, occasionally flooded

This poorly drained, nearly level, shallow to very shallow is on low ridges adjacent to or surrounded by areas of tidal marsh. It is occasionally flooded. Individual areas are generally irregular in shape and range from 2 to nearly 3,000 acres in size. Slopes range from 0 to 2 percent. Typically, the surface is covered with several inches of undecomposed leaf litter. The surface layer is black muck about 3 inches thick. Below this is very dark grayish brown sandy clay loam about 4 inches thick. The underlying material is dark grayish brown sandy clay loam about 2 inches thick. Limestone bedrock is at a depth of 9 inches. On 95 percent of the acreage mapped as Demory sandy clay loam, occasionally flooded, Demory and similar soils make up about 78 to 96 percent of the mapped areas. Dissimilar soils make up about 4 to 22 percent. On 5 percent of the acreage, the dissimilar soils make up more than 22 percent of the mapped areas. Included in mapping are soils that are similar to the Demory soil but do not have a dark surface layer; have a surface layer of fine sand, loamy fine sand, fine sandy loam, or muck that is more than 3 inches thick; have more than 5 percent gravel in the surface layer; have bedrock within a depth of 4 inches; or are sandy throughout (Slabaugh et al. 1996)

(45) Cracker mucky clay, frequently flooded

This very poorly drained, shallow or very shallow, nearly level soil is in areas of tidal marsh. IT is frequently flooded. Individual areas are generally irregular in shape and range from 9 to nearly 5,900 acres in size. Slopes are 0 to 1 percent. Typically, the surface layer is black mucky clay to a depth of about 4 inches and very dark gray sandy clay loam to a depth of 12 inches. Limestone bedrock is at a depth of about 12 inches. On 90 percent of the acreage mapped as Cracker mucky clay, frequently flooded, Cracker and similar soils make up about 76 to 92 percent of the mapped areas. Dissimilar soils make up about 8 to 24 percent. On 10 percent of the acreage, the dissimilar soils make up more than 24 percent of the mapped areas. Included in mapping are soils that are similar to the Cracker soil but have a surface layer of muck (Slabaugh et al. 1996)

(46) Chobee fine sandy loam, limestone substratum, frequently flooded

This very poorly drained, deep or very deep, nearly level soil is on flood plains. It is frequently flooded. Individual areas are generally irregular in shape and range from 3 to nearly 3,500 acres in size. Typically, the surface layer is very dark brown muck to depth of about 3 inches and very dark brown fine sandy loam to a depth of 11 inches. The subsoil is very dark grayish brown sandy clay loam to a depth of about 21 inches, light brownish gray sandy clay loam to a depth of 28 inches, dark greenish gray sandy clay loam to a depth of 54 inches, and a mixture of greenish gray and light greenish gray sandy clay loam to a depth of 68 inches. Limestone bedrock is at a depth of about 68 inches. On most of the acreage mapped as Chobee fine sandy loam, limestone substratum, frequently flooded, Chobee and similar soils make up more than 85 percent of the mapped areas. Dissimilar soils make up less than 15 percent. Included in mapping are soils that are similar to the Chobee soil but do not have bedrock within a depth of 80 inches, have bedrock at a depth of 20 t o 40 inches, do not have a dark surface layer as much as 10 inches in thickness, have an organic surface layer that is 4 to 16 inches thick, have and average content of clay in the upper 20 inches of the subsoil that is more than 35 percent, or have a surface layer of fine sand, loamy fine sand, or sandy clay loam that is 4 to 20 inches thick. Dissimilar soils that are included with the Chobee soil in mapping occur as small areas of Boca, Bradenton, Demory, Gator, Hicoria, Pineda, Popash, Waccasassa, and Wekiva soils. Also included are soils that are in positions on the landscape similar to those of the Chobee soil but have bedrock within a depth of 20 inches. Gator, Hicoria, and Popash soils are in positions on the landscape similar to those of the Chobee soil. Boca, Bradenton, Demory, Pineda, Waccasassa, and Wekiva soils are in the higher landscape positions. Gator soils have and organic surface layer that is more than 16 inches thick. Hicoria and Popash soils are sandy to a depth of 20 inches or more (Slabaugh et al. 1996)

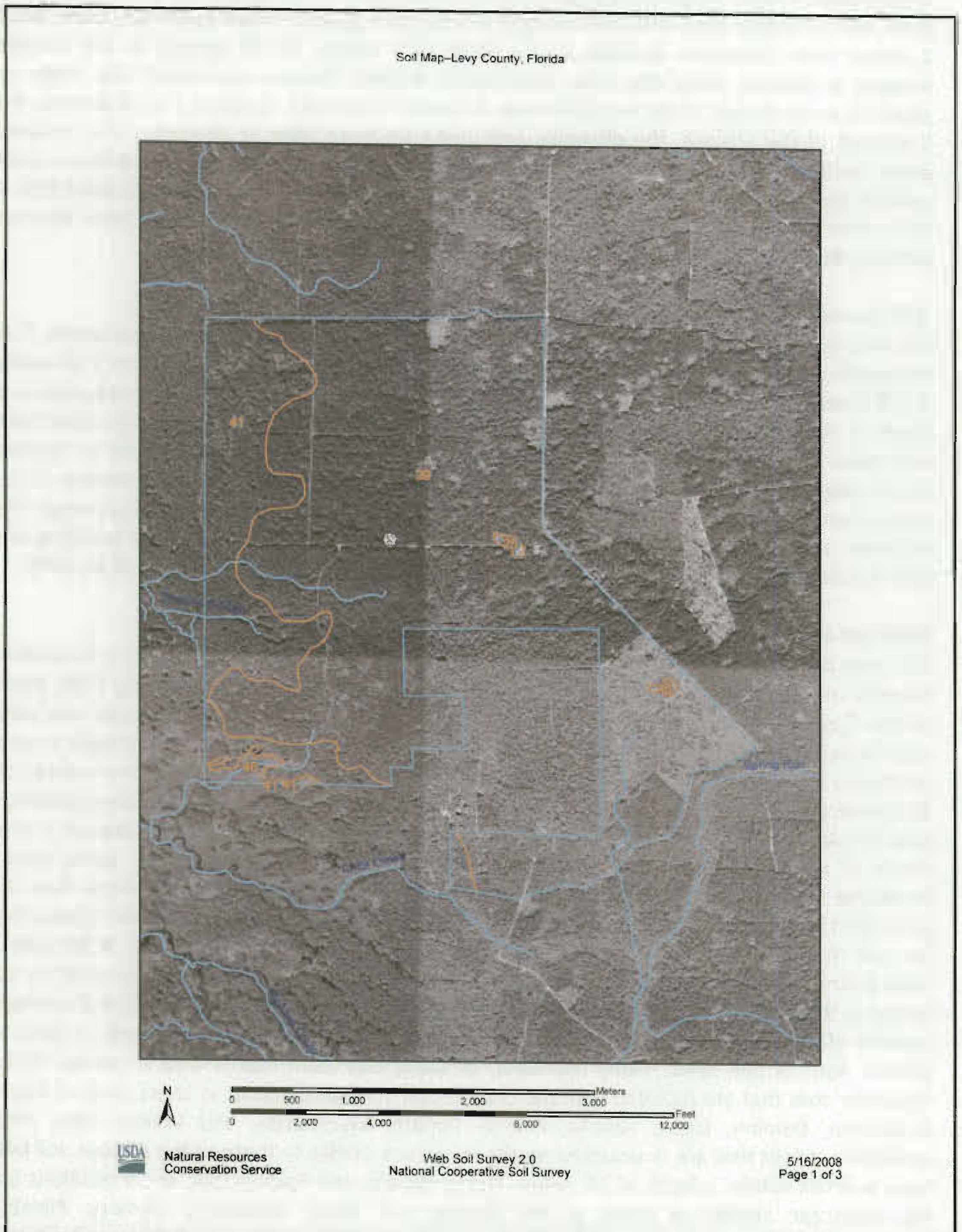

Figure 4. Soils map of the northwest portion of the project area.

Figure 5. Soils map of the southwestern portion of the project area.

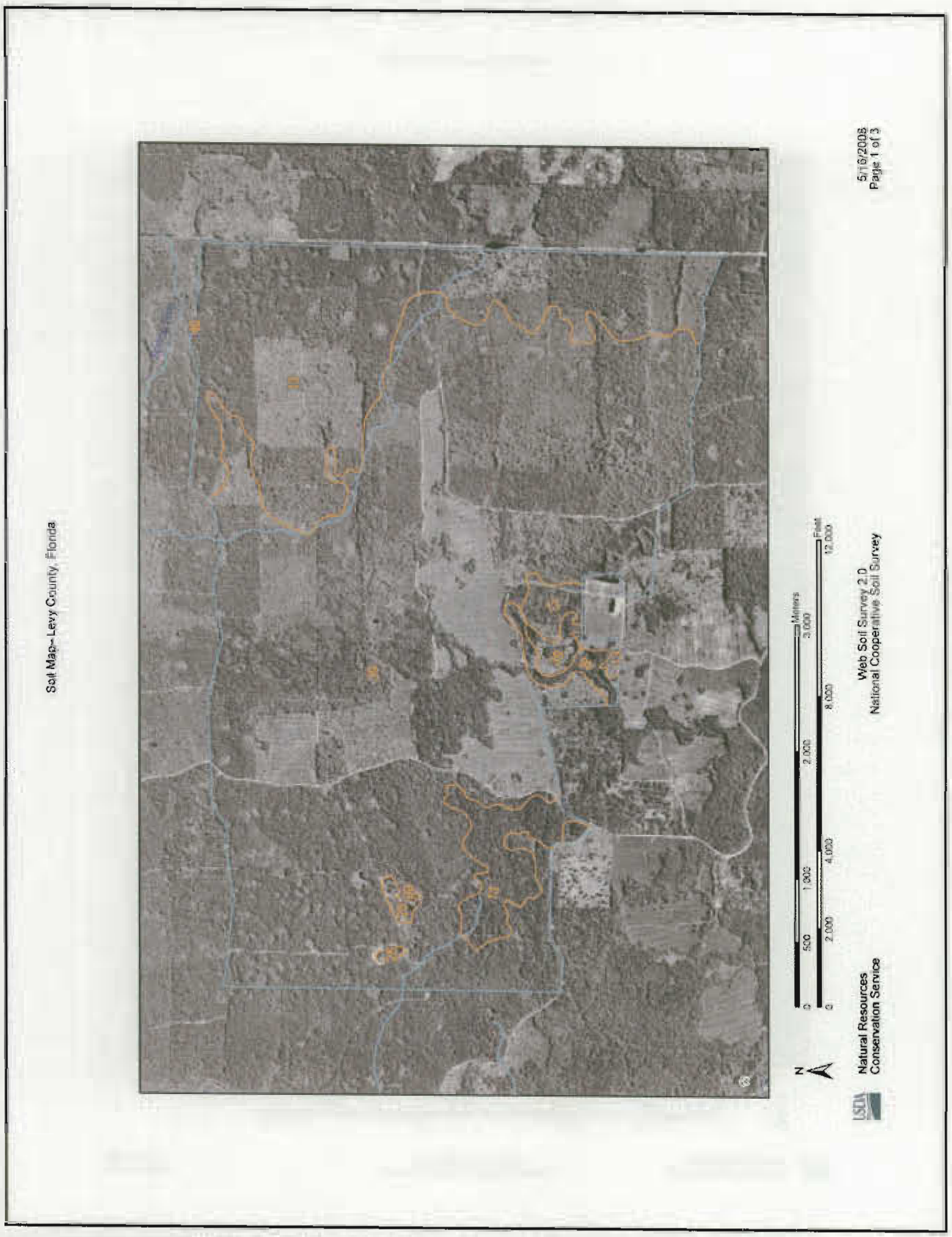

Figure 6. Soils map of the eastern portion of the project area.

PREHISTORIC CONTEXT

Paleoindian Stage

The first human inhabitants of Florida arrived about 12,000 years ago at a time when the environment was very different than it is today, being more arid, with warm summers and cool winters. The sea level was also much lower, increasing the land mass of the Florida Peninsula. Pollen and charcoal studies in north and central Florida indicate a mesic broad-leafed forest natural community (Milanich 1994; Watts and Hansen 1988).

Since the sea level was lower and the environment drier, there were fewer inland rivers, lakes, springs, marshes, and wet prairies in Florida during the Paleoindian Stage than there are in the modern environment. Freshwater sources were important for the early inhabitants, and the animals they depended on for food. This is the basis of Neill's (1964) Oasis Theory of Paleoindian settlement patterns. (Sinkholes were one source of water, and indeed Paleoindian sites tend to be found on karst topography, on which sinkholes form (Dunbar 1983, 1991; Dunbar and Waller 1983; Dunbar et al. 1989; Webb et al. 1984).

The Paleoindians were nomadic, relying on hunting both large and small animals to provide food, which was supplemented by gathering plants. Paleoindians used large, now extinct, animals such as sloths, tapirs, horses, camelids, and mammoths, as well as smaller, modern species such as deer, fish, turtles, shellfish, gopher tortoise, diamondback rattlesnake, raccoon, opossum, rabbit, muskrat, panthers, frogs, and wood ibis (Dunbar et al. 1989). Paleoindian settlement appears to have been seasonal, dependant on what natural resources were available. As populations increased and resource availablitiy changed, settlement ranges shrank during the Middle Paleoindian period (Anderson 1996).

Paleoindians used stone tools, but did not make pottery; therefore, archaeological sites dating to this time period contain primarily lithic materials. Organic materials have been recovered from Paleoindian wet sites in Florida, such as Page/Ladson and Little Salt Springs. Lanceolate points (long, thin, bifacial blade-like points) are the most characteristic artifacts of the Paleoindian Stage, although stone cores and bifacial knives are also found (Anderson 1996; Milanich 1994). Oval ground stone weights, or bolas, may have been attached by thongs and thrown to bring down animals such as water birds (Neill 1971; Purdy 1981). Bone pins were used in skinning and butchering mammals (Waller 1976).

As the environment changed towards the end of the Paleoindian Stage, so did the lithic projectile points that were produced. Smaller points with different hafting attachments functioned as knives more often than projectile points. Changes in lithic technology reflected changes in the environment and in available game animals (Bullen 1975; Powell 1995).

Archaic Stage

The Archaic Stage (9000 to 4000 B.P.) is markedly different from the Paleoindian Stage; Pleistocene fauna were no longer available to human populations. Subsistence strategies diversified, expanding to include new plant and animal. Changes in lifestyles were spurred by climatic and environmental changes, including rising sea levels. Over thousands of years, changes in material culture, social interactions, settlement patterns, and subsistence strategies came about gradually in response to the gradually changing environment. Many of these cultural and social changes can be seen in the archaeological record (Milanich 1994).

The Early Archaic (9000 to 7500 B.P.) began as a continuation of the Paleoindian Stage, but experienced rising sea levels, a gradual warming trend, a less arid climate, and more prevalent oak hardwood forests and hammocks. Subsistence and settlement patterns also became more diversified during the Early Archaic. Settlement patterns changes as human populations grew, moving into more parts of Florida. Settlement patterns became less nomadic, and group sizes increased.

Smaller side-notched and stemmed projectile points/knife forms became preferred, and thermal alteration of chert occurred for the first time during this period (Powell 1990). Alternate beveling of the cutting edges of stone tools was a common practice. The gradual transition from Paleoindian to Archaic points styles is reflected in current archaeological discussions of whether side-notched forms such as the Bolen are Late Paleoindian or Early Archaic point types (Goodyear 1982; Milanich 1994; Purdy 1981; Tesar 1994; Tuck 1974; Widmer 1988).

According to Tesar (1994), during the Early Archaic period base camps were occupied at least semi-permanently and smaller seasonal camps and special use sites were inhabited more sporadically. These sites are often located where different ecosystems intersect, particularly near freshwater sources. Sometimes Paleoindian and Early Archaic artifacts are at the same site, but Early Archaic settlements were more widely spread than Paleoindian settlements. As Florida's environment warmed and became wetter, Early Archaic people used coastal and riverine environments more often (Milanich 1994).

These settlement trends begun in the Early Archaic continued into the Middle (7500-5000 B.P.) and Late (5000-3500 B.P.) periods as well, with ever increasing populations and a climate gradually reaching modern conditions. Archaic Floridians used a wider range of environmental settings and resources, developing more diverse subsistence strategies and social structures. These changes are again reflected in the material culture with different types of stone tools, the use of shellfish, and an increased number of sites that date to this time period. The Late Archaic period is marked in the material cultural record by the use of steatite cooking vessels and the development of fiber-tempered pottery (Milanich 1994; Powell 1990). Shellfish resources were more commonly used during the Late Archaic period, with the result that shell middens become part of the archaeological record. Riverine and wetland settings were still preferred, as large and relatively permanent villages developed. Regional cultures developed during the Late Archaic perioed, with Mount Taylor and Orange in northeast and east Florida, and the Elliots Point Complex in northwest Florida (Milanich 1994).

Fiber-Tempered Pottery

The use of ceramic technologies and horticultural subsistence strategies emerged during the Formative Period. Pottery appeared in the southeastern United States about 4000 and 3000 B.P. (Sassaman 1993). Orange Fiber-Tempered pottery, one of the first pottery types made in North America, was produced by people living along the Atlantic Coast between southern South Carolina and northern Florida. This pottery type was made with clay found along river banks, with the addition of plant fibers as a temper or strengthening material. Fiber-Tempered pottery was made with naturally occurring clays that were collected from areas where creeks or rivers had cut down to the clay-bearing layers. Plant fibers were then added to the clay as a tempering agent to strengthen it. After being made, pots were left to dry to allow moisture in the clay to escape, then fired (Griffin 1945). Sometime around 3250-3000 B.P. sand began to be used as a tempering agent, and the coiling method of making clay pots came into use (Sassaman 1993).

Norwood, a ceramic tradition that extended from the Gulf Coast to the East Coast of Florida, is distinguished from Orange based on surface treatment and temper inclusions, as well as geographical location (Milanich and Fairbanks 1980). Tick Island Incised is a fiber-tempered ceramic variety produced at the same time as Orange series ware but found only in the Upper St. Johns area.

Woodland Stage

Increasing amounts of sand were added as a tempering agent for ceramics made during the late Transitional period, eventually replacing the use of plant fibers. Early sand and grit tempered pottery in north Florida are considered to be characteristics of the Deptford culture. St. Johns pottery, tempered with microscopic sponge spicules, was produced at the same time Deptford wares, and may be found in association with each other. At the same time, Pasco series pottery was produced along the central Gulf Coast of Florida. The Deptford, St. Johns, Weeden Island, and Pasco cultures are organized here under the Ceramic Period. These prehistoric cultures are considered to be part of the Woodland Stage.

Deptford Cultures

According to Milanich and Fairbanks (1980:66) Deptford (500 B.C. – A.D. 500) was a "coastal dwelling culture" reliant on maritime subsistence strategies. Deptford villages frequently are found in or near live oak, magnolia, and palm hammocks near salt marshes. A connection between available natural resources and the Deptford culture is suggested by Milanich (1994), who notes that the northern limit of the Deptford culture corresponds to the northern extent of live oak/ sabal palm on the eastern Florida/Georgia coast.

Deptford period sites include large linear shell middens (Milanich and Fairbanks 1980). Most Deptford-related sites are recorded on the coast, although inland sites have been found in interior forests. These sites are usually short-term occupations for small groups gathering nuts, berries, and other terrestrial resources (wood, game, stone to make tools, etc.). Interior Deptford sites are found along lakes and streams where hickory and oak are present (Weisman and Newman 1995).

In North Central Florida, Deptford developed into Cades Pond, a local variant (Milanich and Fairbanks 1980). At roughly the same time that the Deptford culture was developing, the St. Johns culture was developing in northeast Florida.

St. Johns Cultures

St. Johns pottery was produced from approximately 500 B.C. until circa A.D. 1513 to 1565, slightly after European contact. During St. Johns I phase (500 B.C. to A.D. 100), Floridians relied primarily upon hunting, fishing, and wild plant collecting, exploiting resources found near freshwater wetlands, swamps, and the coastal zones. St. Johns I shell middens are commonly found in coastal zones; low sand burial mounds also appear for the first time during St. Johns I.

Dunns Creek Red, A St. Johns variant ware, is found at St. Johns Ia sites (A.D. 100 to 500). During this time, Deptford and Swift Creek pottery was traded into northeast Florida from north central Florida and the panhandle, and exotic Hopewellian artifacts are found in burial mounds. The St. Johns Ib period (A.D. 500 to 750) is similar to the Ia period except that Weeden Island pottery is more common. As the St. Johns culture continued in northeast Florida, sand mounds continued to be used and grew in size as time progressed.

St. Johns Checked-Stamped pottery appears for the first time during the St. Johns IIa phase (A.D. 750 to 1050). During this phase, populations grew, and the number and size of mounds and villages increased. During the St. Johns IIb phase (A.D. 1050 to 1513), Mississippian traits such as limited horticulture and the use of flat-topped pyramidal mounds can be seen (Milanich 1994). This period ended in 1513 when Spanish explorers arrived in Florida. The St. Johns IIc phase (A.D. 1513 to 1565) is characterized by the introduction of European artifacts, which are recovered in burial mounds dating to this time. Copper, silver, and gold metals were made into Native American status markers and jewelry.

Weeden Island Cultures

In coastal areas and in northern Florida, Weeden Island cultures began to emerge at about A.D. 400. Weeden Island ceramics, which are characterized by the appearance of complicated-stamped pottery along with decoration by punctating and incising, were produced until about A.D. 1200. The Weeden Island culture covered several geographic areas, including Florida's northern peninsular coast from mid-Pasco County northward. In this area, limestone-tempered Pasco series ceramics, sand-tempered ceramics, and St. Johns series ceramics are found at Weeden Island sites (Milanich and Fairbanks 1980).

Much of the cultural change that occurred from the Norwood and Deptford periods into to the later Weeden Island cultures resulted from a location between more northern Woodland cultures and the south Florida populations (Widmer 1988). As Mississippian social, political and religious patterns were introduced into northwest Florida around A.D. 1100, Weeden Island culture ended. Following the Weeden Island period, the Safety Harbor culture flourished to the south in the Tampa Bay area; and Native Americans who produced Pasco series ceramics lived in the vicinity of the project area. In northern and peninsular Florida, these new developments or influences possibly occurred as late as A.D. 1200-1400 (Milanich and Fairbanks 1980).

Safety Harbor Culture

Safety Harbor refers to a culture area on the Gulf Coast of Florida from the mouth of the Withlacoochee River south to Charlotte Harbor, and can be characterized as a Mississippian adaptation to a specialized, coastal environment. The Safety Harbor culture was more socially complex than, and grew out of, the previous Weeden Island culture around A.D. 900. Increased social complexity was due to larger populations and a need for greater social control over those populations (Milanich and Fairbanks 1980). Most Safety Harbor sites are shell middens and/or shell and earth mounds found along the Gulf Coast, but Safety Harbor sites also occurred inland and consisted of camps, villages, and mounds (Milanich 1994).

Safety Harbor peoples were largely hunters, gatherers, and fishermen, and subsistence activities focused on freshwater and marine resources (Milanich and Fairbanks 1980); inland Safety Harbor populations focused on freshwater resources. The Safety Harbor culture lasted well into the historic period. Safety Harbor peoples from the historic period include the Tocabaga, Uzita, Mocoso, Pohoy, Guacozo, Luca, Vicela, and Tocaste. Contact with Europeans had a profound impact on these native groups.

By the middle of the eighteenth century most of Florida's native tribes had been decimated by disease and warfare. Beginning in the late 1700s, groups of Creek Indians began to move south from Alabama and Georgia into Florida. These groups arrived at various times and were pushed off their ancestral lands by European pressure and inter-tribal warfare. These people settled in Spanish Florida and later became known as the Seminoles, although Florida Seminoles trace their heritage back to the PaleoIndian Period.

HISTORIC CONTEXT

Spanish exploration of Florida began in the early sixteenth century, and in 1565, Spain established a permanent settlement at St. Augustine. Spain also granted large parcel of land to loyal subjects, encouraging New World settlement. These land grants were concentrated along the coastlines, rather than in the interior lands. Spain fortified positions along the east coast of Florida against the French and British, the latter of which took control of the peninsula in 1763 under the terms of the treaty ending the French and Indian War. The British also made large land grants to encourage settlement. For the British, as with the Spanish, settlement focused on the coastal areas, although some interior trade with the Seminoles and other tribes did occur. England's hold on East and West Florida was brief, when the treaty ending the American Revolution transferred those colonies back to Spain in 1783 (Gannon 2003).

By the early nineteenth century, Spain was preoccupied with other matters, and agreed to give Florida to the United States in exchange for forgiveness of debts to American citizens. Under the terms of the Adams-Onis Treaty, Florida became the property of the United States in 1821, and an official territory in 1822. Midway between Pensacola and St. Augustine, Tallahassee was chosen as the capital (Gannon 2003).

Florida's history in the first half of the nineteenth century was marked by a series of wars between the United States and the Seminole Indians. As settlers pushed further south, the Seminoles were then pushed both inland and southward. The United States also adopted a policy of Indian removal, forcing Seminoles to relocate to Indian Territory in the American West. During the Seminole Wars, the U.S. Army established a presence in Cedar Key and central Florida, with forts and military trails. A yellow fever hospital was constructed at Atsena Otie, near modern day Cedar Key. The Armed Occupation Act of 1842 further encouraged homesteaders to settle the Florida frontier. Regardless, the area near the mine was virtually uninhabited until after the Civil War (Gannon 2003).

Research Issues

The National Historic Preservation Act (NHPA) of 1966, as amended in 1980 (PL 96-515) and in 1992 (36 CFR 60, 63, and 800) defines the procedures for nominating sites to the National Register of Historic Places (NRHP), and defines the criteria for determining a property's eligibility for NRHP designation: "the quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects possessing integrity of location, design, setting, materials, workmanship, feeling, and association" (U.S. Department of the Interior 1997:2). In addition to possessing integrity, a property must meet at least one of the following criteria to be considered significant:

A. *Be associated with events that have made a significant contribution to the broad patterns of our history; or*

B. *Be associated with the lives of persons significant in our past; or*

C. *Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or*

D. *Have yielded, or may be likely to yield, information important in prehistory or history.*

Archaeological sites are most commonly evaluated under Criterion D, although they may qualify under criteria A, B, or C as well. To be eligible for the NRHP, a site must have the potential to yield important information about the prehistory or history of the area, state, or nation. It must also be shown that the site retains at least some integrity of archaeological deposits; that is, that the ground has not been so disturbed as to make it impractical or impossible to obtain meaningful results from archaeological investigations.

Cultural Resource Probability and Recommendations

Site Predictive Model

Site location information for prehistoric use of the Gulf Hammock is available from previous large-scale archaeological surveys (Ambrosino 2006; Jones 1993; Vojnovski et al. 2000). In general, prehistoric sites are more commonly found nearer the coast rather than in inland forests. This trend may be the result or indicative of maritime-based societies, where food and tool materials came from the Gulf and nearby waterways. No archaeological evidence of prehistoric agriculture has been identified in the Gulf Hammock (Jones 1993). According to Jones (1993:33), "prehistoric sites in the Gulf Hammock are found primarily in area where major creeks bisect the Hammock, and on freshwater ponds."

Prehistoric habitation in the Gulf Hammock occurred primarily in the Woodland Stage, from the Norwood through Weeden Island II periods (3000 B.C. to A.D. 1200). Earlier Paleoindian and

Archaic sites may exist, but may be covered by rising sea levels along the Gulf of Mexico. Jones (1993:37) noted that older prehistoric sites are more common in the South Gulf Hammock than in the North Gulf Hammock, "probably due to differences in elevation and in paleoshorelines."

Prehistoric sites in the Gulf Hammock can be grouped into four types (Jones 1993:33-34):

1. small sites (includes "temporary camps, seasonal camps, food processing sites and other small camps")

2. ceremonial sites ("burial mounds, burial islands, earthern platforms and other ceremonial sites")

3. habitation sites ("villages, large camp sites, permanently occupied island sites and other large permament settlements")

4. other (wet sites, quarries, other technology/production sites).

Of these categories, the last (Other) is the least common. Despite the wet, low lying nature of much of the Gulf Hammock, no wet archaeological sites have been found. Survey results from Jones (1993) suggest that environmental conditions and soils in the Gulf Hammock are not ideal for preservation of materials in wet soils. Jones utilized a 4" auger in an attempt to locate evidence of wet sites as part of his survey strategy. High acidity in this area inhibits preservation of plant and other organic materials. Faunal remains such as bone are better preserved in shell mounds and middens where the shell moderates the acidity of the soil.

Looking at site distribution in the Gulf Hammock, Jones (1993:34) hypothesizes that:

> There were large populations and large settlements at Cedar Keys and at Crystal River. It seems likely that food processing and procurement stations would gradually spread out along the Gulf between these two centers. Abundant game, maritime resources and plant foods could easily be collected and transported back to the major centers.

Furthermore,

> Overall the sites in the Gulf Hammock show a number of small to medium site sites spaced at more or less regular intervals along the coast. Most of the sites cluster near the coast or edge of a salt marsh and are located on higher/dryer areas. Larger sites located further inland are in areas where oak and cedar are abundant . . . . The coastal and island sites may have served as purely extractive sites for the more inland village area. . . . It is not difficult to postulate a series of these small polities up and down the Gulf coast as part of a regional trading system, transporting goods and ideas from south Florida all along the Gulf Coast (Jones 1993:39).

Jones (1993:34) also noted that in the Gulf Hammock, prehistoric village and burial sites are frequently separated by distance, and often by water.

Historic period sites identified in the Waccasassa Bay Preserve are mostly historic homesteads dating to the late nineteenth and early twentieth centuries. Frequently these sites are indicated by square wells, a somewhat unusual feature found more commonly in the Gulf Hammock than in other parts of Florida (Vojnovski et al, 2000). The project area has most recently been owned by a lumber company, and used for timbering and hunting. According to property appraiser records, there are no standing structures in the Tarmac Mine mitigation area. Historic site locations would most likely be identified through field survey, local informant reports, or historic land records.

Recommendations concerning the previously recorded archaeological sites located within the project area include the avoidance of site 8LV110 (Beetree Slough), the prehistoric cemetery and habitation site, and the further investigation and delineation of prehistoric lithic, shell tool, and pottery site 8LV468 (Crackerville) and prehistoric midden site 8LV532 (Turtle Creek North), to determine whether these sites should be avoided or mitigated.

The project area may be divided in probability zones depending on the likeliness of finding cultural resources within this area. High probability zones would include the area around previously recorded archaeological sites, the area immediately off of any historic roads, and mounded areas or areas of high(er) elevation. Medium probability zones would include areas on upland rises near fresh water sources, and less topographically desirable areas, such as the side slopes of wetlands, would be considered low probability.

The majority of the soils within the project area are muck, flooded, or frequently flooded. There are small pockets of sandier, slightly better drained soils such as Wekiva fine sand and Waccasassa-Demory complex, normally vegetated with pines and oak, and found on hammocks and low ridges, within the project area. These areas would be considered to have a higher probability of cultural resources; however, cultural resources may be found anywhere within the project area, regardless of probability.

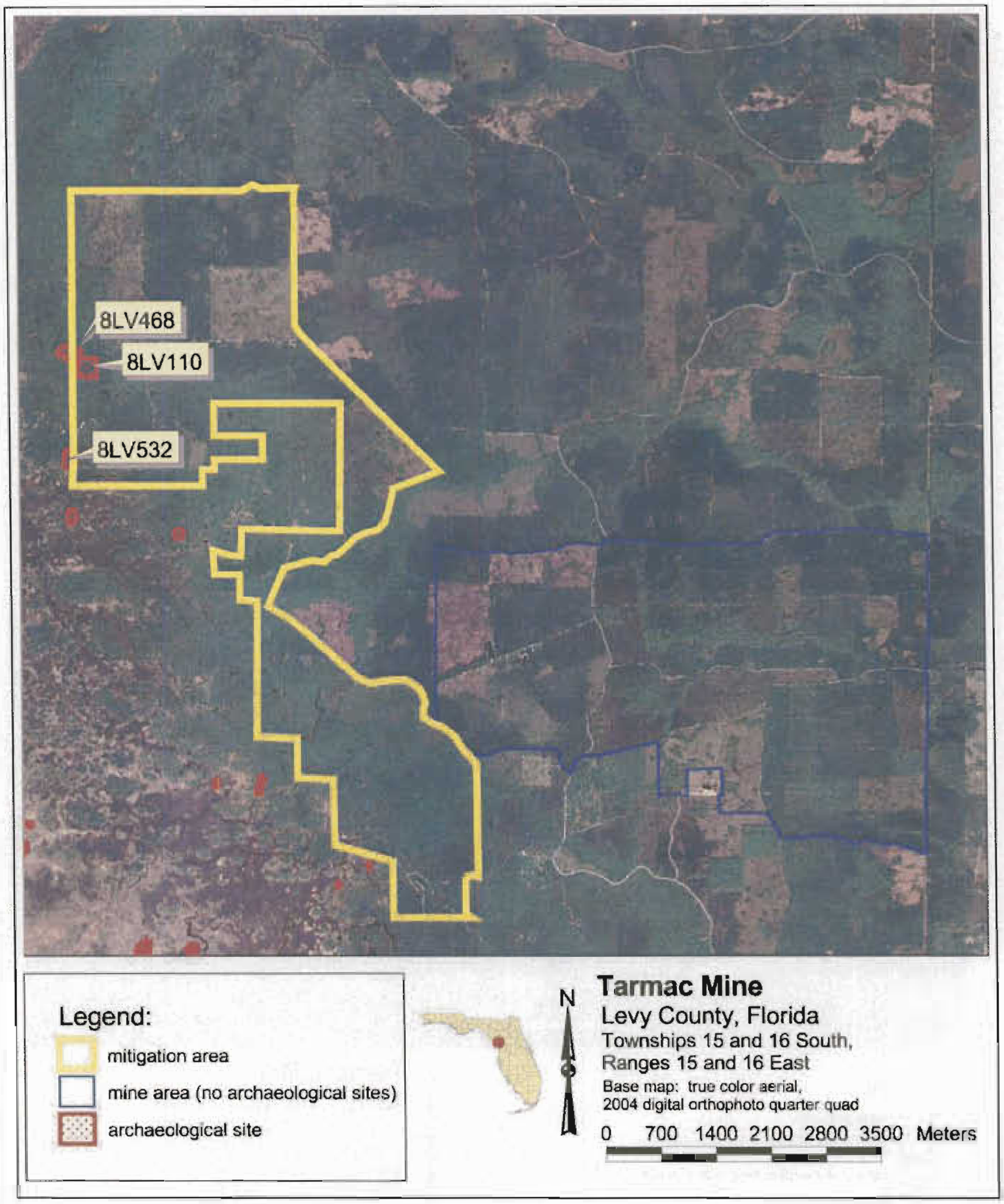

Figure 7. Aerial photograph of the Tarmac Mine project area and the three archaeological sites previously recorded within the boundaries of the proposed mitigation project.

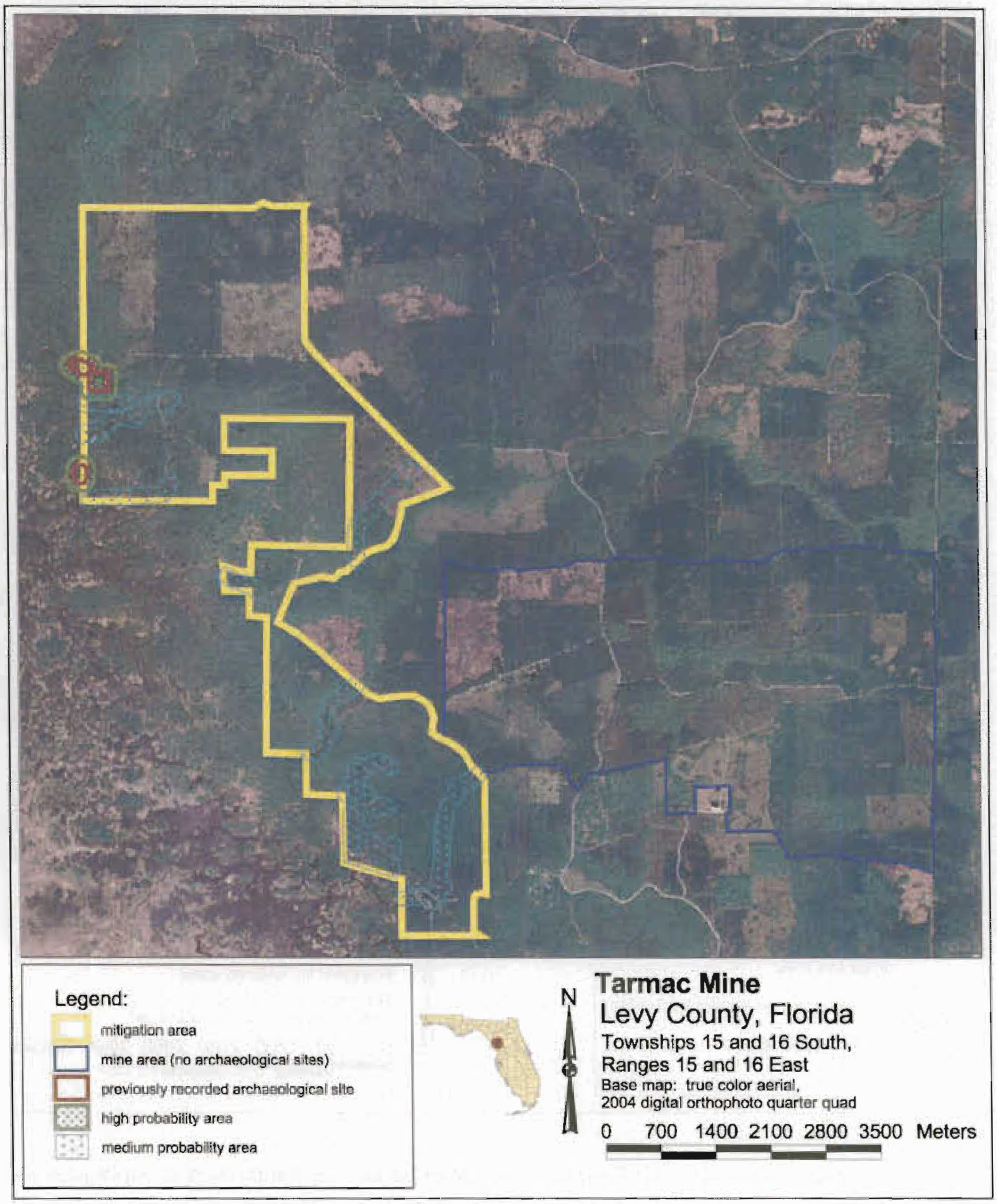

Figure 8. Aerial photograph of the Tarmac Mine project area and the three high probability areas surrounding known archaeological sites, and medium probability areas requiring monitoring within the boundaries of the proposed mitigation project.

MANAGEMENT PLAN SUMMARY

The goal of this Management Plan is to identify any previously recorded archaeological sites, historic structures, NRHP listed properties, cemeteries, bridges or resource groups within the mitigation parcel and prepare a plan to effectively avoid impacts. Only three known sites exist within the mitigation parcel, but all three are potentially significant and should be avoided or tested prior to impact. Due to the proximity of these portions of the project area to previously recorded resources, it is recommended that archaeological testing occur on any open ground surface, and archaeological monitoring by a professional archaeologist take place during the early part of any ground disturbing activities in proximity to these sites. Specific management guidelines are as follows:

Field Methods

In areas to be subjected to ground disturbing activities in the vicinity of the known sites, and in areas within 100 meters of active streams, shovel tests should be excavated within the project area. These shovel tests will conform to the state's guidelines and measure 50-x-50cm in diameter and extend to a depth of 1 meter below surface unless hydric soils or obstructions are met. All excavated soils will be screened through ¼-inch hardware mesh. An archaeologist will be present during the environmental and engineering testing both to monitor the work and to survey the area for the likelihood of identifying cultural resources at this location.

Monitoring will be conducted in accordance with Occupational Safety and Health Administration (OSHA) regulations, with a hard hat and safety vest worn by the archaeological monitor at all times. A sketch map will be produced for the entire property, showing the locations of testing. Notes and digital color photographs will be taken during monitoring. All exposed ground will be inspected, and the backfill from excavated trenches for improved drainage will be inspected for artifacts. The archaeological field notes and copies of the project maps will be kept on file at the offices of Florida History, LLC.

This management summary concerns only archaeological methods and practices. There are no known structures on the property.

Report Production and Artifact Analysis

All collected artifacts will be returned to Florida History, LLC's laboratory and analyzed by a trained archaeologist. These artifacts will be stabilized and returned to the landowner. If this is required, a final archaeological report will be provided to the State Historic Preservation Officer after review by Biological Research Associates.

Confidentiality of Information

All records that contain information regarding the location or character of archaeological resources, or Traditional Cultural Properties, will not be released to the public if disclosure of such information will entail a substantial risk of harm, theft, or destruction to the resources or to the area where the resources are located. No information or documents will be released without the permission of the client.

Procedures to Resolve Unexpected Discoveries

Every reasonable effort will be made during this investigation to identify possible locations of sensitive prehistoric and historic archaeological areas; however, the possibility exists that other evidence of historic resources or burials may be encountered within the project limits at a later date. Should any evidence of historic resources be discovered during later ground-disturbing activities, all work in that portion of the project site should stop. Evidence of historic resources includes aboriginal or historic pottery, prehistoric stone tools, bone or shell tools, historic trash pits, and historic building foundations.

If any suspicious materials, prehistoric or historic artifacts, or suspected bones or other indications of human remains are encountered during subsurface excavation then all work in that area should be stopped and moved to another area until the location can be inspected. Artifacts could include prehistoric pottery, concentrations of shell, bone, and dark soil stains that feel "greasy." This area may also contain human burials, either by themselves or in small groupings. Should you dig up any of these things, **STOP** digging at that location. Do not continue to dig to "confirm" your suspicions. Do not refill the hole. Secure the area safely and have a supervisor contact the people listed below. The discovery must be reported to local law enforcement, who will in turn contact the medical examiner. The medical examiner will determine whether or not the State Archaeologist should be contacted per the requirements of Chapter 872.05, Florida Statutes. Representatives of Florida History, LLC, will assist in the identification and preliminary assessment of the materials.

Recommendations

Specific recommendations include:

1. ***Testing, further investigation, and determination of the specific location of site 8LV110 (Beetree Slough), a prehistoric cemetery and habitation site. Develop a plan for the avoidance of this site;***

2. ***Testing and determination of the specific location of site 8LV468 (Crackerville), a prehistoric site containing lithics, shell tool, and prehistoric ceramics. Develop a plan for the avoidance of this site;***

3. ***Testing and determination of the specific location of site 8LV532 (Turtle Creek North), a prehistoric midden site. Develop a plan for the avoidance of this site;***

4. ***Testing or avoidance of high probability zones, which would include the area around previously recorded archaeological sites, the area immediately off of any historic roads, and mounded areas or areas of high(er) elevation;***

5. ***Training heavy equipment operators to monitor within medium probability zones, after a session with an archaeologist. These areas would include property on upland rises near fresh water sources, as delineated on the probability map.***

6. ***Lower, less topographically desirable areas, such as the side slopes of wetlands, would be considered low probability and require no monitoring.***

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Attachment A:

Key Project Staff

Project Staff

Paul L. Jones, Senior Vice President of Florida History, LLC, has over twenty years of cultural resource management experience as a consultant for public and private entities, and is a Registered Professional Archaeologist. Mr. Jones is also the current President of the Florida Archaeological Council, and serves on the Board of Directors for the Florida Public Archaeology Network. He has served as principal investigator, project manager, and administrator for over 1,800 archaeological and historical projects in Florida and the Southeast; his project experience includes numerous examples in Palm Beach County. He is frequently called upon to appear at public hearings on behalf of clients. An area of particular expertise for Mr. Jones is Native American Consultation, working with tribes to find mutually agreeable solutions when proposed projects will impact culturally significant sites. Mr. Jones was project administrator for the Florida Army National Guard's statewide consultation, which included all federally recognized tribes with current or historic claims to sites in Florida. Additionally, Mr. Jones is an experienced museum director, with experience in master planning, developing strategic plans, designing exhibits, conducting capital campaigns, and supervising volunteer programs.

Kelly A. Driscoll, RPA, is a Senior Archaeologist with the Tampa office of Florida History, LLC. Ms. Driscoll specializes in historic archaeological sites in the southeastern United States, focusing on central Florida and the Florida Keys. She has a B.A. in Anthropology and a M.A. in Public Archaeology from the University of South Florida in Tampa. Projects directed by Ms. Driscoll include testing of prehistoric and historic sites from Florida to South Carolina. Before joining Florida History, LLC, she was a Staff Archaeologist at Panamerican Consultants, Inc., where she worked on project such as the archaeological evaluation of the Sulphur Springs Water Tower (a City of Tampa Heritage site), completion of a Phase II investigation adjacent to Fort Zachary Taylor (a National Historic Landmark in Key West), and the survey of five Naval Air Station Key West housing areas. She has also served as a Principal Investigator for numerous cellular communications projects. Previously, she worked as a Resource Management Specialist for the Department of Environmental Protection, Coastal and Aquatic Managed Areas, Tampa Bay Aquatic & Buffer Preserves, Terra Ceia State Buffer and Aquatic Preserve.

It is anticipated that Paul L. Jones will be the primary point of contact and the project administrator for archaeological services provided by Florida History, LLC, to Biological Research Associates. He will be assisted as needed by Kelly A. Driscoll, RPA, and our full-time field crew. Additional staff can be assigned to this project as needed.

Project Staff Contact Information

<u>Mailing Address:</u>

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Paul L. Jones
pjones@floridahistoryllc.com

Kelly A. Driscoll
kdriscoll@floridahistoryllc.com

Paul L. Jones, RPA

Experience

2007 – Present <u>Vice President and Senior Archaeologist</u>, Florida History, LLC, Tampa, Florida. Duties include direction of the company's Archaeology Division, supervision of principal investigators and archaeological fieldwork, as well as preparation of final reports and bid documents. Current projects are being completed for compliance with Federal Energy Regulatory Commission and Federal Communications Commission standards and regulations.

1998 – 2007 <u>Vice President and Senior Archaeologist</u>, Panamerican Consultants, Inc., Tampa, Florida. Responsibilities included oversight of the Florida operations of a large nationwide cultural resource management firm. Duties included direction and oversight of Federal Highway Administration, Federal Energy Regulatory Commission, and Federal Communications Commission projects. Mr. Jones was responsible for development of the office and author or administrator on over 1,800 projects.

1995 – 1998 <u>Director</u>, Moundville Archaeological Park, University of Alabama Museums. Responsibilities included serving as Director of the University of Alabama Jones Archaeological Museum, development of educational programming, fund raising, and exhibit and program development.

1988-1994 <u>Student Affairs Coordinator and Director</u>, University of Florida, Gainesville. Manager of Lake Wauburg Recreation Center, a lakefront facility. Responsibilities included supervision and training of a staff of thirty employees and graduate assistants. Additional duties included direction and oversight of planning initiatives, formulating construction priorities, and assessment of risk management strategies for programs.

Other Training

National Guard Bureau Integrated Cultural Resource Management Plan Training Session (invited participant)

Joint Services Meeting/Base Realignment and Closure Policy (invited attendee)

Update to Federal Projects and Historic Preservation Law, University of Nevada, Reno (specialized training in implementation of projects utilizing federal funding)

Education

Ph.D. (ABD) Anthropology (Archaeology, Historic Landscapes) University of Florida
M.A. Anthropology (Archaeology) University of Florida
B.S. Anthropology (Archaeology) University of Florida

Kelly A. Driscoll, RPA

Experience

2007 – Present Senior Archaeologist, Florida History, LLC, Tampa, Florida. Supervising archaeological survey and excavation, report writing and document production, creating site predictive models, mapping (including GIS). Field work including Phase I, Phase II, and Phase III archaeological survey, testing, and remediation, and documentation of archaeological sites; historic structures, bridges, and cemeteries; and resource groups, as well as cellular tower surveys and report production.

2002 – 2007 Staff Archaeologist, Panamerican Consultants, Inc., Tampa, Florida. Supervising archaeological survey and excavation, field work including Phase I, Phase II, and Phase III archaeological survey, testing, and remediation, as well as cellular tower surveys and report production.

2000 – 2002 Resource Management Specialist, Department of Environmental Protection, Tampa Bay Aquatic & Buffer Preserves, Terra Ceia State Buffer and Aquatic Preserve, Tampa, Florida. Located and evaluated prehistoric and historic archaeological sites located within the boundaries of the Terra Ceia Preserve; repaired damaged/looted sites within TBABP boundaries, spoke to youth groups about Florida archaeology, and consulted other State Agencies concerning archaeological resources. Construction activities included demolition and restoration work on the ca. 1909 Haley House, creation of a canoe/kayak launch and boat ramp as well as associated parking and signage, and creation of a public trail through the preserve.

2000 Intern, Indian Key State Historic Site, Florida Park Service, Islamorada, Florida.

2000 Exhibitor, University of South Florida Anthropology Exhibit Gallery, Tampa, Florida. Designed and constructed a two-case museum exhibit entitled *Masked Meaning*. Researched and obtained various types of masks for display within the museum for a three-year period. Created gallery plan and exhibit layout, constructed and installed text, signage, and shelves.

Related Experience

2004 Participant, Mayor's 17th Annual Hillsborough River and Waterways Cleanup. Assisted City of Tampa employees and volunteers in the cleanup of site 8HI8937, immediately south of the Sulphur Springs Water Tower, supervising participants to ensure that the site was not disturbed.

2005 Volunteer, Weedon Island Cultural and Natural History Center, Pinellas County, Florida. Identified and researched artifacts recovered from within the boundaries of the Weedon Island Preserve, answered visitor's questions concerning Weeden Island culture and exhibits, assisted Center personnel, and staffed the front desk.

Education

M.A., Public Archaeology Program, Department of Anthropology, University of South Florida, Tampa
B.A., Anthropology, University of South Florida, Tampa

Attachment B:

FMSF Forms –
Previously Recorded Archaeological Sites

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History and Records Management
DS-HSP-3A Rev. 9-74

FLORIDA MASTER SITE FILE

FDAHRM 802==

Site No. 8LV110 1009==

Site Name BEETREE SLOUGH 830==

Other Name(s) for Site ______ 930==

Other Nos. for Site ______ 906==

Type of Site Cemetery & small habitation middens 838==

County Levy 808==

Instructions for locating site (or address) from Lebanon Station on US-19 enter Gulf Hammock Wildlife Management Area & travel 10-12Mi SW on various limerock rds to reach Beetree Slough 2Mi above its mouth on the Gulf 813==

Owner of Site: Name Georgia-Pacific Corp. 902==

Address ______ 903==

Occupant, Tenant, or Manager:
Name ______ 904==

Address ______ 905==

Reporter (or local contact):
Name Stokes, Rev. Luther 816==

Address Williston, Fl 817==

Recorder:
Name & Title Hemmings, E. T. 818==

Address FSM 819==

Survey Date 7112-7201 820== Type Ownership Commercial 848==

Inventory Status ______ 914==

Previous Survey(s), Excavation(s) or Collection(s): (*enter title of survey; date; whether federal, state, county or local; location of survey report(s); and material collected*).

839==

Photographic Record Numbers ______

860==

FSM 804==
7201 832==

Location of Site (Specific):

Map Reference (incl. scale & date) USGS N.ACASASSA BAY 7.5 MIN 1955 809==

Township	Range	Section	¼ Sec.	¼ ¼ Sec.	¼ ¼ ¼ Sec.
T15S	R15E	S35	SW	SW	

812==

LATITUDE AND LONGITUDE COORDINATES DEFINING A POLYGON LOCATING THE PROPERTY

Point	LATITUDE Degrees	Minutes	Seconds	LONGITUDE Degrees	Minutes	Seconds
	°	'	"	°	'	"
	°	'	"	°	'	"
	°	'	"	°	'	"
	°	'	"	°	'	"
	°	'	"	°	'	"

OR

LATITUDE AND LONGITUDE COORDINATES DEFINING THE CENTER POINT OF A PROPERTY OF LESS THAN TEN ACRES

29° 07' 49" N 82° 45' 48" W (0GUL) 800==

890==

Global Reference Code 17 ~~326160~~ ~~323630~~ 328160 3223530 884==

Description of Site:

Type Classification Site 916 ==

Site Size (approx. acreage of property) 35' X 50' 833==

Present Condition of Site:

Check one	Check one		Check one if appropriate
☐ Altered 863==	☐ Excellent 863==	☐ Deteriorated 863==	☐ Moved 863==
☐ Unaltered 863==	☐ Good 863==	☐ Ruins 863==	☐ Original Site 863==
☐ Destroyed 863==	☐ Fair 863==	☐ Unexposed 863==	

Present & Original Physical Appearance (use continuation sheet if necessary)

862==

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History and Records Management
DS-HSP-3C Rev. 9-74

Site No. 8LV110

Site Name BEETREE SLOUGH

ARCHAEOLOGICAL SITE DATA SUPPLEMENT

Description of Site (cont.)

Landform COASTAL SWAMPS 814==

Elevation 0-5 824== Est. Depth of Deposit 837==

Drainage 03110101; WACCASASSA BAY, RAMSEY CREEK, BEETREE SLOUGH 810==

Soil Type(s)/Association(s) 836==

Vegetation 10; MANGROVE SWAMP FORESTS AND COASTAL MARSHES 834==

Water Source BEETREE SLOUGH 831==

Visible Site Features 876==

Artifacts Collected or Observed Sherds: (500) Weeden Island, Carrabelle, pasco, Papys Bayou, Wakulla; fragmentary human bones scattered by vandals also collected 875==

Cultural Classification:

Culture/Phase Weeden Island 840==

Period/Stage 842==

Probable Dates: Beginning 844== Ending 846==

Remarks and Recommendations Other sherds & bone from site were removed by hunters from Bugate Hunting Camp on Tenmile Creek nearby 835==

Major Bibliographic References 920==

STATE OF FLORIDA
DEPARTMENT OF STATE
Division of Archives, History
and Records Management
DS-HSP-3B Rev. 5-75

HISTORIC SITE DATA SUPPLEMENT

Site No. 8Lv110

Site Name

Present Use (check one or more as appropriate)

☐ Agricultural 850==	☐ Government 850==	☐ Park 850==	☐ Transportation 850==
☐ Commercial 850==	☐ Industrial 850==	☐ Private Residence 850==	Other (Specify):
☐ Educational 850==	☐ Military 850==	☐ Religious 850==	☐ ______ 850==
☐ Entertainment 850==	☐ Museum 850==	☐ Scientific 850==	☐ ______ 850==

Period (check one or more as appropriate)

■ Pre-Columbian 845==	☐ 16th Century 845==	☐ 18th Century 845==	☐ 20th Century 845==
☐ 15th Century 845==	☐ 17th Century 845==	☐ 19th Century 845==	

Specific Dates: Beginning ______ 844== Ending ______ 846==

Areas of Significance (check one or more as appropriate)

■ Archaeology Prehistoric 910==	☐ Conservation 910==	☐ Literature 910==	☐ Social/Humanitarian 910==
☐ Archaeology Historic 910==	☐ Economics 910==	☐ Military 910==	☐ Theater 910==
☐ Agriculture 910==	☐ Education 910==	☐ Music 910==	☐ Transportation 910==
☐ Architecture 910==	☐ Engineering 910==	☐ Philosophy 910==	Other (Specify):
☐ Art 910==	☐ Industry 910==	☐ Politics/Govt. 910==	☐ ______ 910==
☐ Commerce 910==	☐ Invention 910==	☐ Religion 910==	☐ ______ 910==
☐ Communications 910==	☐ Landscape Architecture 910==	☐ Science 910==	☐ ______ 910==
☐ Community Planning 910==	☐ Law 910==	☐ Sculpture 910==	☐ ______ 910==
			☐ ______ 910==

Thematic Classification:

■ Aboriginal 912==	☐ Military 912==	Other (Specify):
☐ Architectural 912==	☐ Political 912==	☐ ______ 912==
☐ The Arts 912==	☐ Society 912==	☐ ______ 912==
☐ Exploration & Settlement 912==	☐ Science & Technology 912==	☐ ______ 912==

Statement of Significance (use continuation sheet if necessary)

911==

Remarks & Recommendations:

835==

Major Bibliographic References:

920==

Description (Evidence):

862==

Present & Original Physical Appeareance (use continuation sheet if necessary)

cemetery rather than mound, although some addition of soil to low knoll likely; estimated 10-30 burials; 3 or more small household middens in vicinity; cemetery completely vandalized

935==

Site Name Beetree Slough County Levy

Site No. Lv- 110

ARCHEOLOGICAL SITE SURVEY

UNIVERSITY OF FLORIDA

Other Names

Other Nos. Long. 82° 46' 00" Lat. 29° 07' 30"

Part of Sec. SW 1/4 of SW 1/4 Sec. 35 Twn. 15S Rng. 15E

Period of site Weeden Island 1

Classified by E. T. Hemmings

Date 1-20-72

Location (how to reach): From Lebanon Station on US 19 enter Gulf Hammock Wildlife Management Area and travel 10-12 miles southwest on various limerock roads to reach Beetree Slough 2 miles above its mouth on the Gulf.

Nature of site: Cemetery & small habitation middens Size of site: cemetery area ca, 35x5[0] low knoll 35x50'

Present condition of site Cemetery completely vandalized Soil type: humus

Vegetation and general physiographic situation: Gulf coast swamp or low wet hammock

Owner: Georgia- Pacific Corp. Tenant: --- Attitude toward excavation: Agreeable

Referred to site by: Rev. Luther Stokes, Williston, Fla. Field Party: Hemmings, Bullen

Recorder: E. T. Hemmings Date: Dec. 1971 & Jan. 1972

1256

LV110

Frequency of material: Abundant sherds, human bone, shell

Material collected: 500 sherds: Weeden Island, Carrabelle, Pasco, Papys Bayou, Wakulla, etc. Fragmentary human bone scattered by vandals also collected.

Other materials and location: Other sherds and bone from site were removed by hunters from Bugate Hunting Camp on Tenmile Creek nearby.

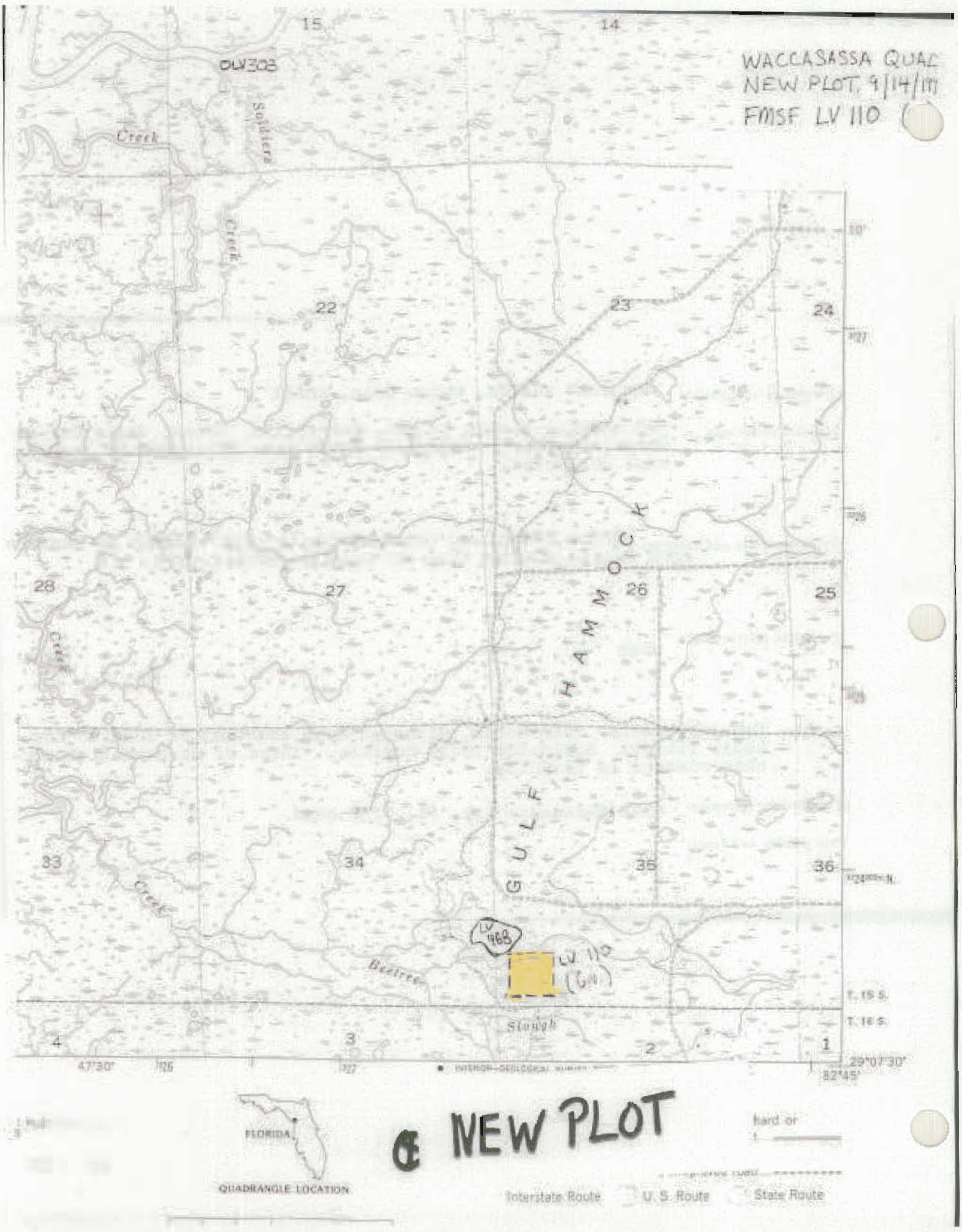
Published references: none

Remarks: Cemetery rather than mound, although some addition of soil to low knoll likely. Estimated 10-30 burials. Three or more small household middens in vicinity.

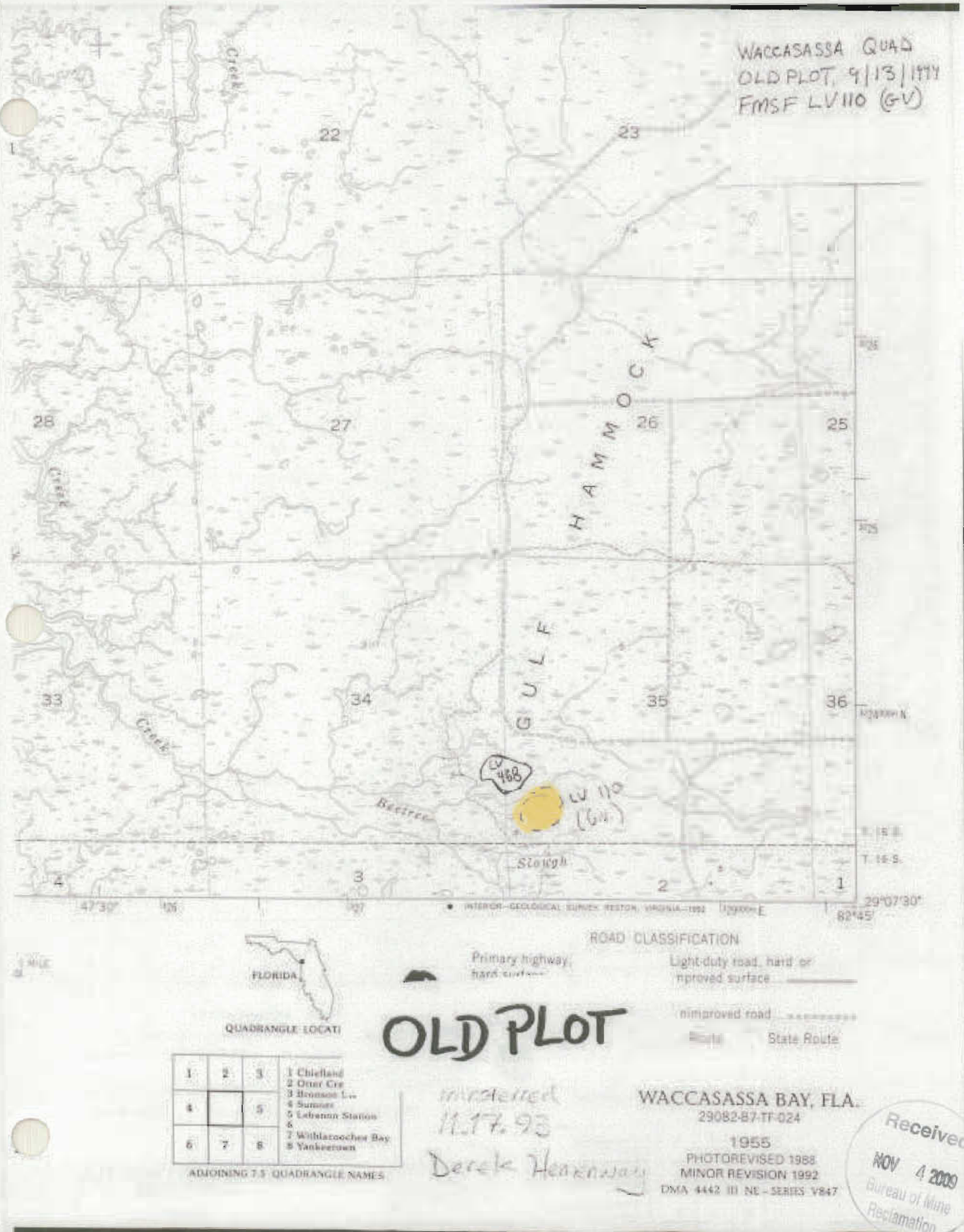
Map used for reference: USGS Wacasassa Bay, Fl. 7.5' quad.

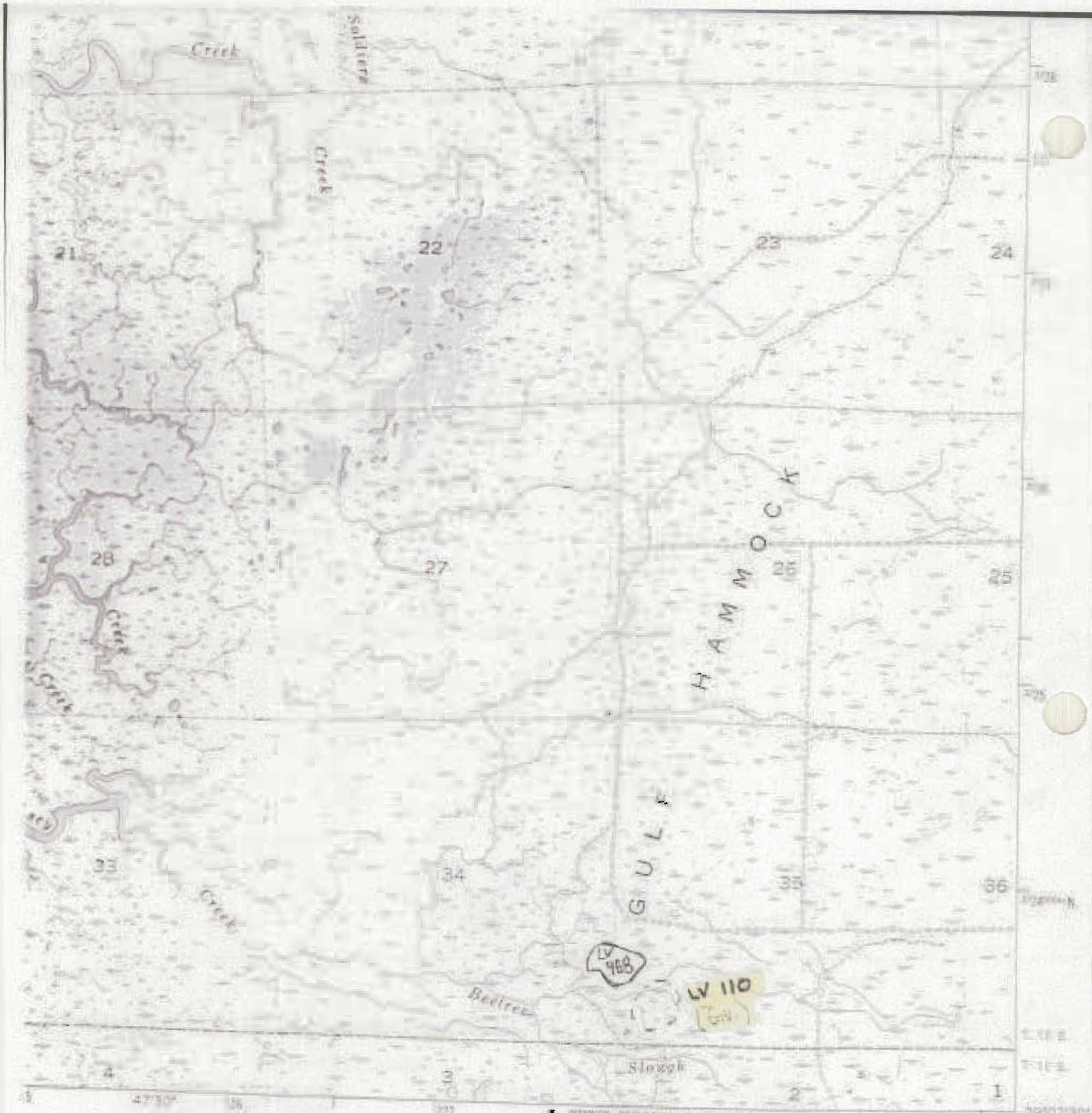
Past owners and dates:

Rev. 1-51



WACCASASSA QUAD
NEW PLOT
FMSF LV 110
15
14
Creek
Soldiers
Creek
22
23
24
28
27
26
25
GULF HAMMOCK
33
34
35
36
LV 468
Beetree
Slough
T. 15 S.
T. 16 S.
4
3
2
1
47'30"
29°07'30"
82°45'
FLORIDA
QUADRANGLE LOCATION
NEW PLOT
Interstate Route
U. S. Route
State Route


WACCASASSA QUAD
OLD PLOT, 9/13/1999
FMSF LV110 (GV)
Creek
22
23
28
27
26
25
GULF HAMMOCK
33
34
35
36
Creek
Beetree
LV 468
LV 110 (GV)
Slough
4
3
2
1
T. 15 S.
T. 16 S.
47'30"
29°07'30"
82°45'
ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
State Route
FLORIDA
QUADRANGLE LOCATION
OLD PLOT
1 Chiefland
2 Otter Creek
3 Bronson
4 Sumner
5 Lebanon Station
6
7 Withlacoochee Bay
8 Yankeetown
ADJOINING 7.5' QUADRANGLE NAMES
microfilmed
11.17.93
Derek Heavenway
WACCASASSA BAY, FLA.
29082-B7-TF-024
1955
PHOTOREVISED 1988
MINOR REVISION 1992
DMA 4442 III NE - SERIES V847
Received
NOV 4 2009
Bureau of Mine Reclamation



QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface

Light-duty road, hard or improved surface

Secondary highway, hard surface

Unimproved road

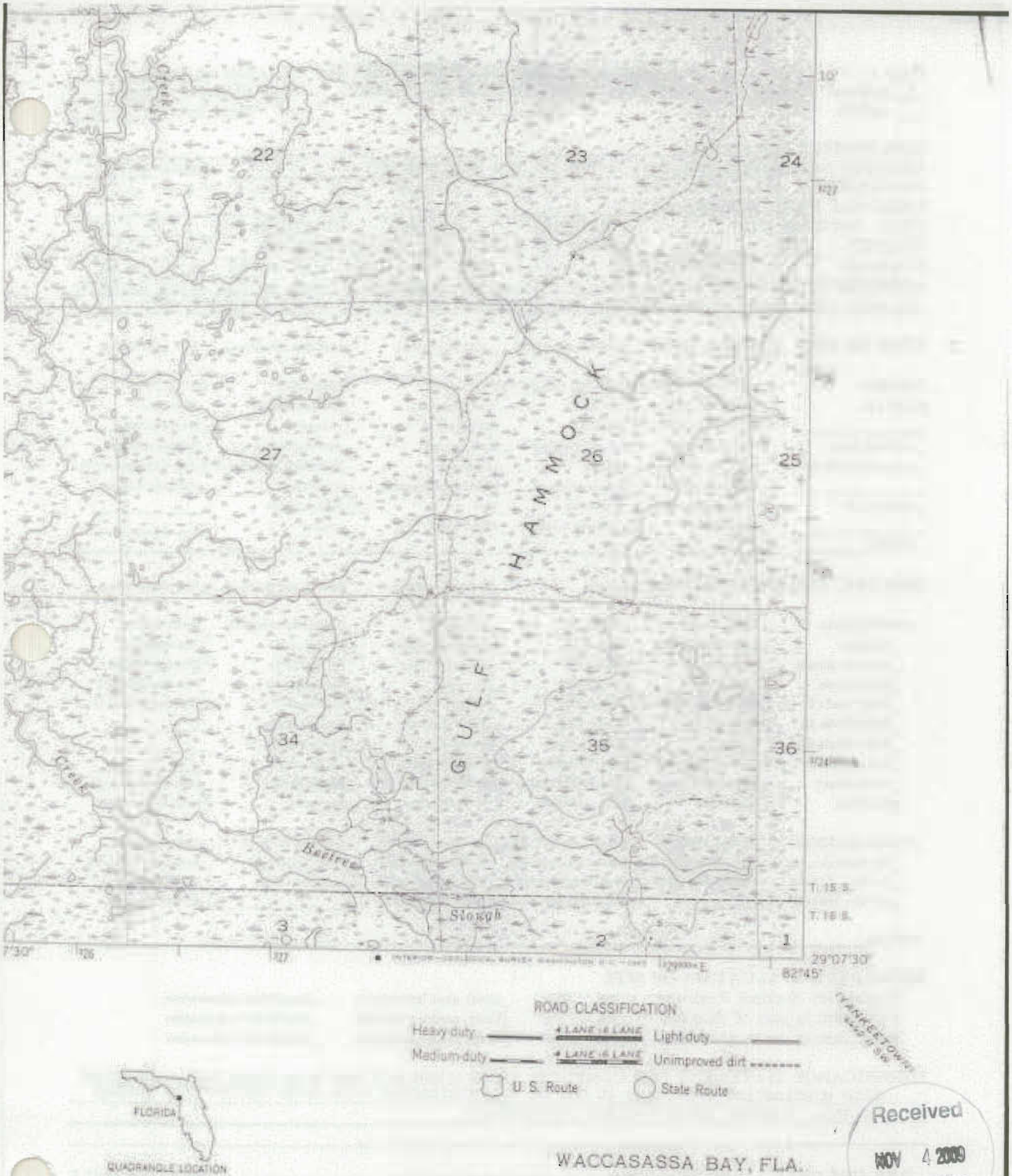
Interstate Route U. S. Route State Route

1	2	3	1 Chiefland SW 2 Otter Creek 3 Bronson SW 4 Sumner 5 Lebanon Station 6 7 Withlacoochee Bay 8 Yankeetown
4		5	
6	7	8	

IA 22092

Transferred
11.17.93

WACCASASSA BAY, FLA.
29082-B7-TF-024
1955
PHOTOREVISED



WACCASASSA BAY, FLA.

N2907.5—W8245/7.5

1955

AMS 4442 III NE—SERIES V847

LV110

Page 1
X original
_ update

ARCHAEOLOGICAL SITE FORM
FLORIDA MASTER SITE FILE

Version 1.1: 11/88

Site #8 LV468
Recorder # Jones
Field Date 2/11/93

SITE NAME(S) Crackerville
PROJECT NAME Archaeological Survey of the Gulf Hammock DHR# 3580
OWNERSHIP _private-profit _priv-nonprof _priv-indiv _priv-unsp _city _county X state _federal
USGS MAP NAME Waccasassa Bay CITY
UTM: ZONE 16 / 17 EASTING /_/_/_/_/_/0/ NORTHING /_/_/_/_/_/_/0/
COUNTY Levy TWP 15S RANGE 15E SECTION 34/35 ¼ ¼-¼ ¼-¼-¼
(Optional) LATITUDE d 29 m 07 s 45 LONGITUDE d 82 m 46 s 10
ADDRESS/VICINITY OF/ROUTE TO Located north of Beetree Slough on the State Preserve boundry 100m south of the junction of S. Gibson Rd. and the State Preserve gate

TYPE OF SITE (All that apply) _prehist unspecified _hist aboriginal _hist nonaboriginal _hist unspecified

SETTING	STRUCTURES OR FEATURES			FUNCTION	DENSITY
X land site	_aboriginal boat	_fort	_road segment	_none specified	_unknown
___	_agric/farm bldg	X midden	_shell midden	_campsite	_single artifact
_wetland fresh	_burial mound	_mill unspecified	_shell mound	_extractive site	_diffuse scatter
_wetland salt/tidal	_building remains	_mission	_shipwreck	_habitatn/homestead	X dense scatter>2/m²
___	_cemetery/grave	_mound unspecif	_subsurface features	_farmstead	_variable density
_underwater	_dump/refuse	_plantation	_well	X village/town	___
___	_earthworks	_platform mound	_wharf/dock	_quarry	___

OTHER ___

HISTORIC CONTEXTS (All that apply) _unknown culture _aboriginal unspecif _hist unspecified

ABORIGINAL:					
_Alachua	_Early Archaic	_Glades IIb	_Manasota	_St. Johns unspecif	_Swift Creek
_Archaic unspec.	_Early Swft Creek	_Glades IIc	_Middle Archaic	_St. Johns I	_Transitional
_Belle Glade	_Englewood	_Glades III	_Mount Taylor	_St. Johns Ia	X Weeden Island
_Belle Glade I	_Fort Walton	_Glades IIIa	_Norwood	_St. Johns Ib	_Weeden Island I
_Belle Glade II	_Glades unspecif	_Glades IIIb	_Orange	_St. Johns II	_Weeden Island II
_Belle Glade III	_Glades I	_Glades IIIc	_Paleo-Indian	_St. Johns IIa	___
_Belle Glade IV	_Glades Ia	_Hickory Pond	_Pensacola	_St. Johns IIb	___
_Cades Pond	_Glades Ib	_Late Archaic	_Perico Island	_St. Johns IIc	___
X Deptford	_Glades II	_Late Swift Creek	_Safety Harbor	_Santa Rosa	_prehistc-aceramic
	_Glades IIa	_Leon-Jefferson	_St. Augustine	_Seminole	X prehistc-ceramic

NONABORIGINAL:					
_1st Spanish unsp	_1st Spn 1700-63	_Amer Terr 1821-44	_Postrecn 1880-97	_Depress 1930-40	_American 1821-
_1st Spn 1513-99	_Brit 1763-1783	_Statehood 1845-60	_SpWar 1898-1916	_WW II 1941-49	_American 1821-99
_1st Spn 1600-99	_2dSpn 1783-1821	_Civil War 1861-65	_WW I 1917-1920	_Modern 1950-	_American 1900-
	___	_Reconstr 1866-79	_Boom 1921-1929	___	_Afro-American

OTHER ___

RECORDER'S EVALUATION OF SITE

Eligible for National Register?	_yes	X no	_likely, need information	_insufficient information
Significant as part of district?	_yes	_no	X likely, need information	_insufficient information
Significant at the local level?	X yes	_no	_likely, need information	_insufficient information

SIGNIFICANCE STATEMENT FOR COMPUTER FILES (Limit to 3 lines here; attach full justification)
Site examination indicates it may be a transitional site from Deptford to Weeden island. Further investigation reccomended.

DHR USE ONLY ---------- *DHR USE ONLY*

DATE LISTED ON NAT REG. ___/___/___

KEEPER DETERMINATION OF ELIGIBILITY: Yes _ No _ Date ___
SHPO EVALUATION OF ELIGIBILITY: Yes _ No _ Date ___
LOCAL DETERMINATION OF ELIGIBILITY: Yes _ No _ Date ___
Local Office ___

ARCHAEOLOGICAL SITE FORM

Site #8 LV468

Division of Historical Resources, Florida Department of State

METHODS FOR SITE DETECTION

_no field check X exposed ground X screened shovel
_literature search _posthole digger
_informant report _auger--size:___
_remote sensing _unscreend shovel

METHODS FOR SITE BOUNDARIES

_bounds unknown _remote sensing _unscreened shovel
_none by recorder X insp exposed ground X screened shovel
_literature search _posthole digger _block excavns
_informant report _auger--size: _guess

Other/Remarks (#, size, depth, pattern of units; screen size) 38 units, 50 x 50 cm, 1/4" screen

COLLECTION STRATEGY

_unknown _unselective (all artifacts)
X selective (some artifacts)
_uncollected _general (not by subarea)
_controlled (by subarea)

ARTIFACT CATEGORIES

_unknown _daub _nonlocal-exotic _bone-unspec
X lithics _brick/bldg matl _metal X unworked shell
X ceramic-aborig _glass _bone-human X worked shell
_ceramic-nonabo _prec metal/coin X bone-animal _subsurf feats

Other (Strategy, Categories)

SITE EXTENT Size (m^2) 13,000 Depth/Stratigraphy of Cultural Deposit 0-80 cm

Perpendicular Dimensions 100 m N/S direction by 130 m E/W direction

SPACE COLLECTED Surface: #units 1, total area 13,000 m^2. Excavation: #units 38, total vol .4 m^3
TOTAL ARTIFACTS Count or Estimate? Surface # 10 Subsurface # 296.

DIAGNOSTICS (TYPE OR MODE & FREQUENCY)

1 Sand tempered plain N= 150
2 Pasco plain N= 47
3 St. Johns plain N= 11
4 St. Johns check stamped N= 8
5 Deptford linear check stamped N= 3
6 Pasco check stamped N= 2
7 Swift Creek complicated stamped N= 2

Remarks 1 Duval style point, 49 other lithics, 1 Melongena Hammer, 1 Columella, 1 shell bead.

TEMPORAL INTERPRETATION Components: _single _prob single X prob multiple _multiple _uncertain

Describe each occupation spatially. For each, estimate begin, end dates BP; basis; if absolute dates, give method, lab, id, date, range, etc.
Site is estimated to be a transitional Deptford - Weeden Island Period based on ceramic and lithic chronologies.

ENVIRONMENT Nearest Fresh Water tidal creeks, Waccasassa Distance (m) 0, 4700mNW
Natural Community Wet flatlands, hydric hammock
Local Vegetation Palmetto, Cedar, Oak
Topographic Setting Hammock wetland
Present Land Use State Preserve
SCS Soil Series Demory Soil Association Wekiva-Demory-Waccasassa

SITE INTEGRITY Overall Disturbance: _none seen _minor X substantial _major _redeposited
Nature of Disturbances/Threats erosion

INFORMANT(S) Contact Information
REPOSITORY Field Notes, Artifacts Florida Museum of Natural History, Gainesville
Photographs (negative nos)
MANUSCRIPTS OR PUBLICATIONS ON THE SITE An Archaeological Survey of the Gulf Hammock, Florida Phase II
RECORDER(S): Name Paul L. Jones Date of Form 7/30/93
Affiliation/Address/Phone Univ. of Fl. 1350 Turlington Hall Gainesville, (904) 392-2031

RECOMMENDATIONS FOR SITE Excavation

NARRATIVE DESCRIPTION: Attach information on site discovery, history, current integrity, apparent threats, environment, and your temporal and functional interpretations.
DISCUSSION OF SIGNIFICANCE: Attach justification for recorder's evaluation (Page 1).

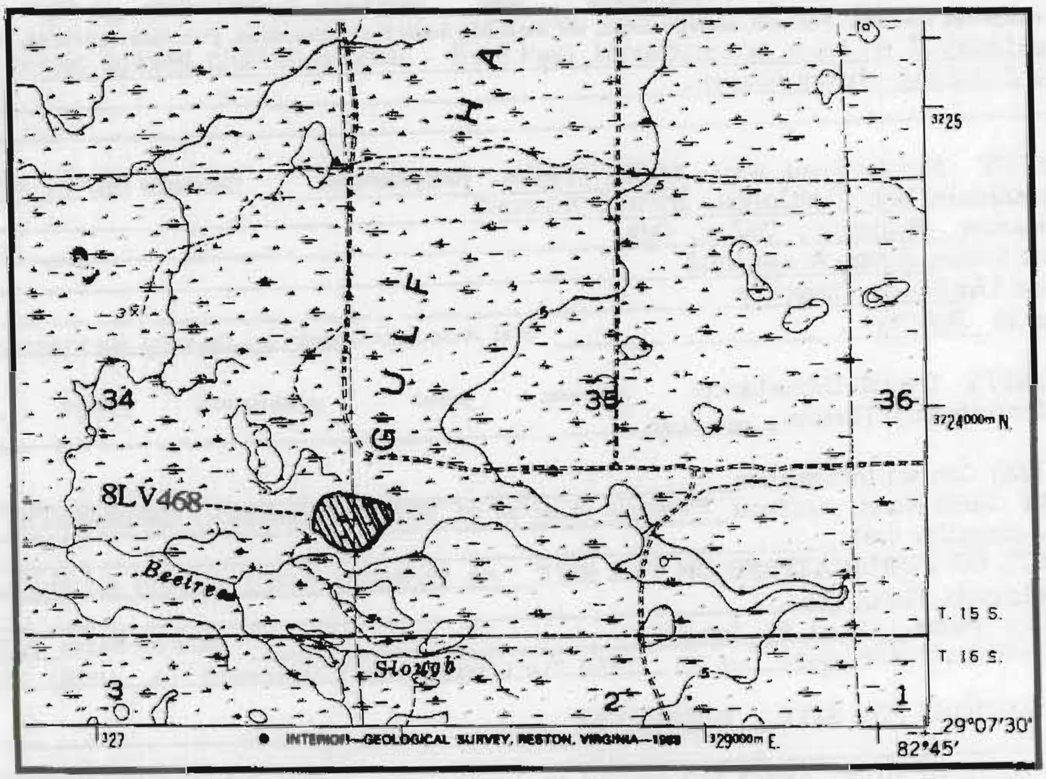
REQUIRED: USGS MAP OR COPY WITH SITE LOCATION MARKED

8LV468
Crackerville

This village/habitation site is located north of Beetree Slough 100 m south of the junction of S. Gibson road and the State Preserve gate. Located both in a state preserve and on land owned by Georgia-Pacific, the site measures 130 m x 100 m. Depth of the archaeological deposits was 0 - 80 cm. The natural community is a hydric hammock with palmetto, oak and cedar vegetation. The site has experienced substantial disturbance due to erosional processes, logging and construction of a jeep trail through the area.

Artifacts collected at 8LV468 included aboriginal ceramics, lithics, shell beads, a drilled shark's tooth and both worked and unworked shell. A Duval style lithic point was identified. Shell artifacts included: 1 shell bead, 1 *Melongena* hammer, 1 columella. The site was judged to be a transitional Deptford to Weeden Island in age. Oyster, *Melongena* and *Mercenaria* shell were found at this site.

Waccasassa Bay Quadrangle USGS 7.5' Series 1955/r. 1977
T15 S/R15E 29°07'45"N 82°46'10"W



GENERAL INFORMATION

Site #8: *LV00532*
First site form recorded for this Site? *Original documentation, site not recorded at FSF*
Identifying code (field date, if none then form date): *199912*
Cultural resource type: *Archaeological Site*
Form type code *NORMal form (new System 3 forms)*
Form status code *Newly Scattered Form (Needs Processing)*
Form quality ranking *Newly scattered form of standard quality*
Recorder #: *** blank ***
Field date: *12/17/1999*
Form date: *10/17/2000*
Staffer: *RECORDER DID THE DATA ENTRY OF THIS SMARTFORM*
Date of FMSF computer entry: *10/17/2000*
Site name(s): *TURTLE CREEK NORTH*
Alternate names: *** blank ***
Project name: *C.A.R.L. SURVEY OF WACCASASSA BAY STATE PRESERVE*
Mult. list #8: *** blank ***
Survey #: ~~*** blank ***~~ 6222
National Register category: *Site, such as battlefield, park, archaeological*
Ownership: *Public-state*
USGS map name & year of publication/revision: *WITHLACOOCHEE BAY/1992*
County: *LEVY*
Township/Range/Section/Qtr: *16 South/15 East/3/Northeastern quarter of square section or 1/4 sect*
Irregular section: *** blank ***
Landgrant: *** blank ***
Tax parcel number: *** blank ***
City: *YANKEETOWN*
In current city limits? *Definitely outside city limits*
UTM: Zone/Easting/Northing: *17/327835/3222283*
Address/Vicinity of/Route to: *NORTH OF TURTLE CREEK WITHIN GULF HAMMOCK*
Name of public tract: *WACCASASSA BAY STATE PRESERVE*

TYPE OF SITE

Type of site: *Prehistoric midden(s)*
Other site type: *** blank ***

HISTORIC CONTEXTS

Historic contexts: *Weeden Island A.D. 450-1000*
Other cultures: *** blank ***

SURVEYOR'S EVALUATION OF SITE

Potentially eligible for local designation? *Insufficient information to render an opinion*
Name of Local Register eligible for: *** blank ***
Individually eligible for National Register? *Insufficient information for independ NR eligbilty*
Potential contributor to NR District? *Data insuff. to judge contribution to NR district*
Explanation of evaluation: *AN EVALUATION OF SIGNIFICANCE CANNOT BE MADE AT THIS TIME AS NO TESTING WAS PERFORMED AND THE SITE WAS NOT VISITED BY C.A.R.L. PERSONNEL*
Recommendations for site: *PRESERVATION WITHIN WACCASASSA BAY STATE PRESERVE*

FIELD METHODS

Methods for site detection: *Informant report; Exposed ground inspection*
Methods for site boundaries: *No boundary determination done by recorder*
No,size,depth,pattern of tests; screen: *NO SUBSURFACE TESTING WAS PERFORMED AT THE SITE*

SITE DESCRIPTION

LU532 – 199917

Extent size (sq m): *-1*
Depth/stratigraphy of cultural deposit: *UNKNOWN. NO TESTING PERFORMED.*
Temporal interpretation – Components: *Components unknown*
Describe each occupation: *PROBABLE WEEDEN ISLAND BASED ON LIMITED ARTIFACT SAMPLE (2 SHERDS)*
Site integrity – Overall disturbance: *Unknown (e.g., site not seen by recorder)*
Disturbances/threats/protections: *AS THE SITE WAS NOT VISITED BY C.A.R.L. PERSONNEL, THE IMPACTS TO THE SITE ARE DIFFICULT TO ASSESS*
Area collected (sq m): *-1*
Surface collection – # units: *** blank ***
Excavation – # noncontiguous areas: *** blank ***

ARTIFACTS

Total # artifacts: *2*
Count or estimate? *Accurate count, not an estimate*
Surface artifacts #: *2*
Subsurface artifacts #: *** blank ***
COLLECTION STRATEGY *Selective: SOME but not all artifacts collected; General: artifacts were NOT separated by subareas*
ARTIFACTS: Category/Disposition *Aboriginal ceramics/SOME items in this category collected*
Other (Strategy, Categories) *** blank ***
DIAGNOSTICS: Type/Number *WAKULLA CHECK STAMPED/1; WAKULLA CHECK STAMPED, LATE VARIETY/1*

ENVIRONMENT

Nearest fresh water type: *** blank ***
Nearest fresh water name: *** blank ***
Nearest fresh water distance (m): *** blank ***
Natural community: *** blank ***
Local vegetation: *** blank ***
Topography: *** blank ***
Other, uncoded topographic setting: *** blank ***
Minimum elevation (m): *** blank ***
Maximum elevation (m): *** blank ***
Present land use: *NOT IN PRESENT USE*
SCS soil series: *** blank ***
Soil association: *** blank ***

FURTHER INFORMATION

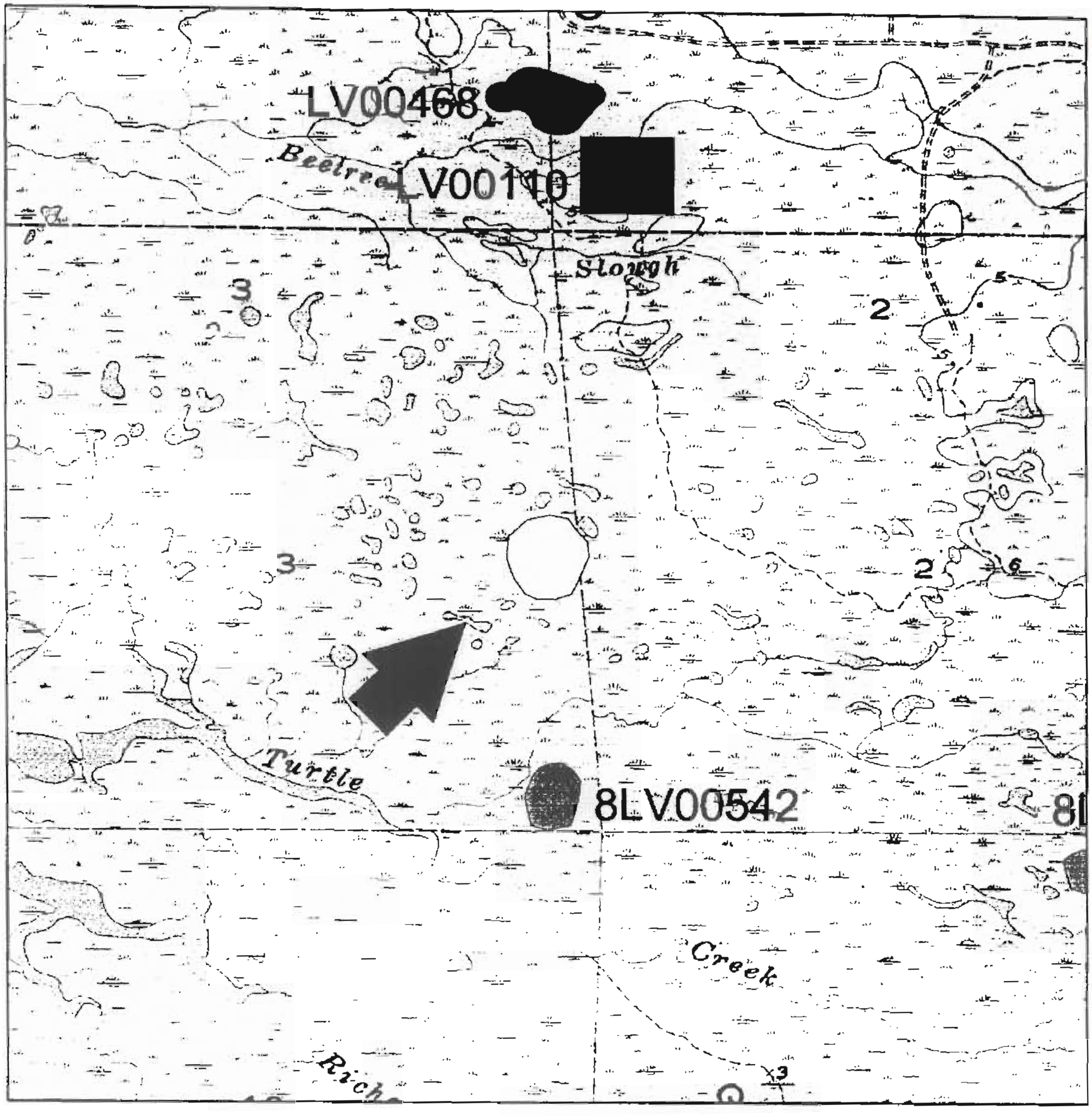
Informant(s) name: *DIMMAGGIO, JEFF*
Informant address/phone: *PO BOX 187, CEDAR KEY, FL 32625 (352)543-5567*
REPOSITORIES: Collection/Housed/ACC#/Describe *All documents and collections at same repository/FDHR/BAR: CARL project/00.195/***
RECORDER Name: *VOJNOVSKI, PAMELA*
Recorder address/phone: *500 S. BRONOUGH ST., TALLAHASSEE, FL 32399 (850)487-2299*
Affiliation: *FDHR/BAR: CARL project*
Other affiliation: *C.A.R.L. ARCHAEOLOGICAL SURVEY*
Memo information status: *SURVEYOR'S supplementary INFO entered VERBATIM*
Is text-only supplement file attached (Surveyor-only)? *YES, text-only supplement file is on the disk*
Text-only supplement file status (FMSF-only): *EXISTENCE OF possible supplement FILE is UNCHECKED*
Form comments by FSF staff: *** blank ***

LV00532_200010

SUPPLEMENTARY INFORMATION

The Turtle Creek North site (8LV532) is located in Section 3 of Township 16 South/Range 15 East on the Withlacoochee Bay quad. The site is located in a hydric hammock with palms, live oaks, and cedar. The site lies roughly one half mile north of Turtle Creek. The site was located by Jeff Dimmaggio, who brought it to the attention of C.A.R.L. personnel. Two aboriginal ceramic sherds were collected by Dimmaggio. One is a Wakulla Check Stamped body sherd weighing 16.5 grams. The other is a Wakulla Check Stamped, Late Variety, body sherd weighing 36.4 grams. These artifacts are now in the B.A.R. collections. Based on the limited artifact assemblage, the site appears to date to the Weeden Island period.

As this site was not visited by C.A.R.L. personnel, the impacts to the site are difficult to assess. Also, an evaluation of significance cannot be made at this time, as no testing has been performed at the site. Currently, no additional work is recommended for this site. However, should ground-disturbing activities be planned for this area, testing should be carried out to determine the extent of the site and to assess its significance. In advance of any ground-disturbing activities in the area, the Compliance and Review Section of the Bureau of Historic Preservation, Department of State, should be contacted.



C.A.R.L. Archaeological Survey
Florida Bureau of Archaeological Research
Division of Historical Resources
R.A. Gray Building
500 S. Bronough St
Tallahassee, Fl. 32399
(850) 487-2299
October, 2000

8LV00532
Quad: Withlacoochee Bay, FL
Township/Range/Section: 16S/15E/3

500 0 500 Meters

SiteID	ACCNO	FS	General	Specific	Qualifier	Condition	Type	Temper
LV00532	00.195.000001.0001	306.001	aboceramic	sherd		broken	Wakulla Check Stamped	sand
LV00532	00.195.000001.0002	306.001	aboceramic	sherd	Late Variety	broken	Wakulla Check Stamped	sand

[illegible]	[illegible]	[illegible]	Wt
body	☐	1	16.5
body	☐	1	36.4

Attachment C:

Florida Cultural Resource Management Legislation

FLORIDA CULTURAL RESOURCE MANAGEMENT LEGISLATION

The 36 CFR 800 (Section 106) process has been incorporated into the state's Historic Preservation Compliance Review Program to avoid confusion between state and federal requirements (Tesar 1990). Florida's professional requirements are the same as those outlined in 36 CFR 61 (Professional Qualifications Standards) and in the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (*Federal Register* 51(46):8248-8252, March 10, 1986).

The primary piece of legislation relating to historic resources in Florida is the Florida Historical Resources Act (FHRA) (Chapter 267, F.S.). The FHRA established the responsibilities of the Florida Department of State, Division of Historical Resources as the state's primarily historic preservation agency, stated Florida's policy relative to historic properties, and established the offices of state archaeologist, state historic preservation officer. The FHRA also:

- created the Historic Preservation Advisory Council (ss. 267.0612),
- created the Historic Preservation Grant Program (ss. 267.0617),
- gave the Division the power to publish materials relating to Florida's history and to cooperate with other entities (including agencies and corporations) with research and publications relating to historical matters (267.081),
- gave the Division the ability to designate archaeological sites as a "state archaeological landmark" or a "state archaeological landmark zone" (267.11),
- grants the power of the Division to issue research permits (267.12),
- enumerates prohibited practices and penalties for violations related to disturbance of archaeological sites (267.13),
- 267.031 and 267.06 grant authority for establishing historic preservation standards under state law, and
- 267.061 contains the historic preservation requirements of state agencies.

Chapter 872 of Florida law concerns offenses related to dead bodies and graves. Sections of this law pertaining to archaeology are:

- 872.01 (dealing in dead bodies),
- 872.02 (injuring or removing tomb or monument; disturbing contents of grave or tomb; penalties); and
- 872.05 (unmarked human burials).

Chapter 872 pertains to burials, human remains, and burial artifacts not already protected under Chapter 497 (Funeral and Cemetery Services) or other state law. This law covers any public or private land in the state, including submerged lands.

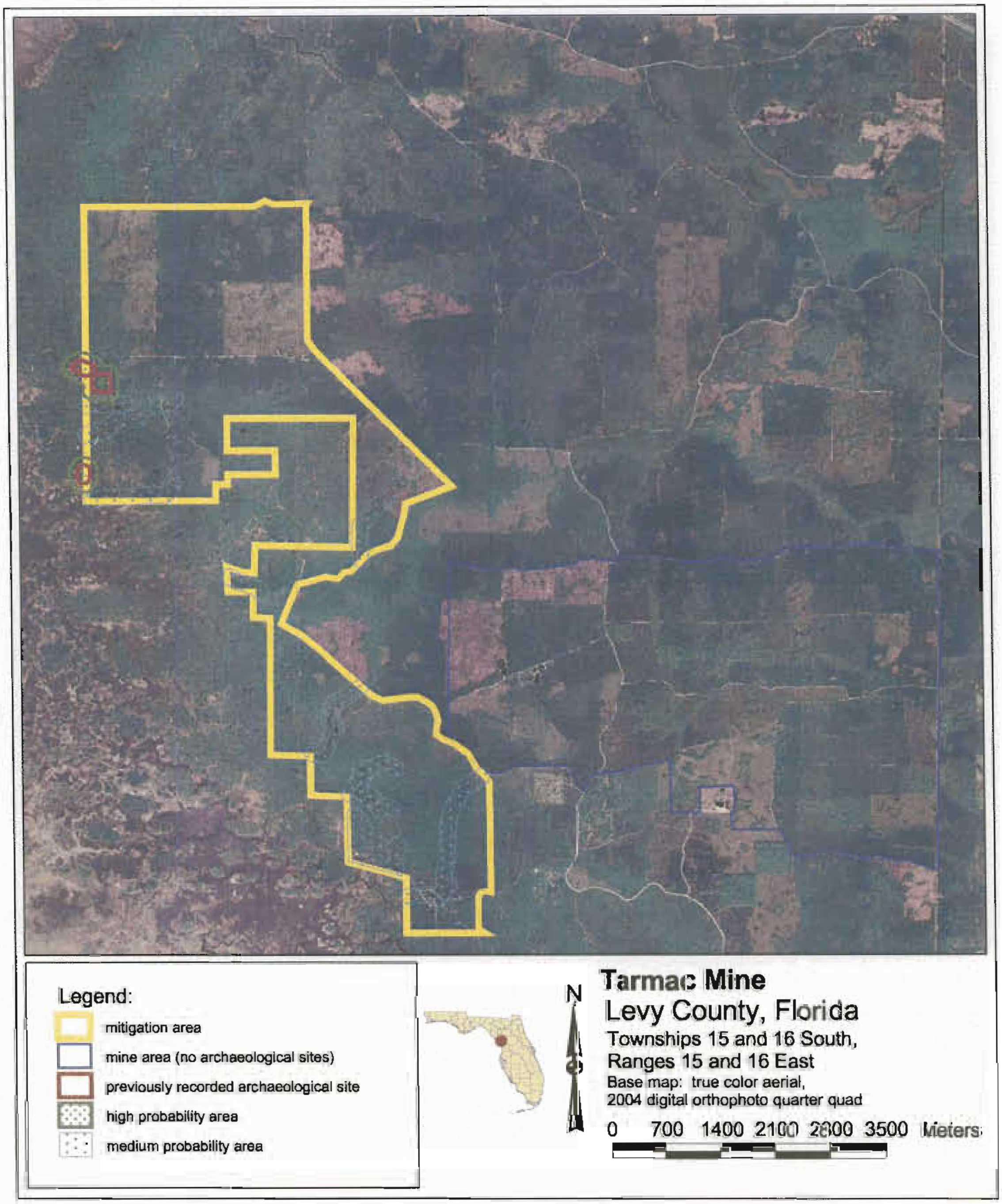
Other Florida legislative actions pertaining to the conduct of cultural resources management services include:

- 253.027 Emergency Archaeological Property Acquisition Act of 1988 (protects archaeological sites of statewide significance from destruction as a result of imminent development, vandalism, or natural events)

- 556.101 Underground Facility Damage Prevention and Safety Act (provides for a notification system to identify underground facilities prior to excavation)
- Rules of the Division of Historic Preservation
  Chapter 1A-46 (Archaeological Report Standards and Guidelines)
  Chapter 1A-45 (Guidelines for the Public Display of Human Skeletal Remains)
  Chapter 1A-40 (Administration of Permanent Collections)
  Chapter 1A-31 (Procedures for Conducting Exploration and Salvage of Historic Shipwreck Sites)
  Chapter 1A-32 (Archaeological Research)
  Chapter 1A-44 (Procedures for Reporting and Determining Jurisdiction over Unmarked Human Burials)

Attachment D:

Probability Map for Tamarac Mine Mitigation Area


Legend:
mitigation area
mine area (no archaeological sites)
previously recorded archaeological site
high probability area
medium probability area
N
Tarmac Mine
Levy County, Florida
Townships 15 and 16 South,
Ranges 15 and 16 East
Base map: true color aerial,
2004 digital orthophoto quarter quad
0 700 1400 2100 2800 3500 Meters

Attachment E:

Tribal Notification

FLORIDA HISTORY, LLC
HISTORY ARCHAEOLOGY ARCHITECTURAL HISTORY 106/110 COMPLIANCE

July 23, 2008

Chief A.D. Ellis
Principal Chief
Muscogee (Creek) Nation
Office of the Administration
P.O. Box 580
Okmulgee, OK 74447

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Chief Ellis:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

- A 4,581-acre mitigation parcel adjacent to and within the Waccasassa Bay Preserve State Park.

At the suggestion of the USACE and in compliance with 36 CFR 800.4(a)(iii and iv) and 800.2(a)(4), Tarmac America, LLC is consulting with your tribe in order to notify you of this project and to get your opinion of the potential effects on sacred areas, archaeological sites, burial grounds or other areas of special sensitivity to you or members of your organization. In addition, archaeological testing is planned in consultation with the Florida SHPO in moderate and high probability areas so that archaeological sites can be accurately mapped and avoided.

Please provide your comments to Tarmac America, LLC as soon as possible so that we may take them into account. Responses may be faxed to Paul L. Jones at (813) 891-6369, or mailed to the address below.

Sincerely,

Paul L. Jones, RPA
Senior Archaeologist,
Florida History, LLC

Cc: McLane Evans, BRA

Received
NOV 4 2009
Bureau of Mine Reclamation

Phone (813) 891-6340 FAX (813) 891-6369
12157 West Linebaugh Avenue #167, Tampa, Florida 33626
info@floridahistoryllc.com www.floridahistoryllc.com

FLORIDA HISTORY, LLC
HISTORY ◆ ARCHAEOLOGY ◆ ARCHITECTURAL HISTORY ◆ 106/110 COMPLIANCE

July 23, 2008

Mrs. Joyce A. Bear
Muscogee (Creek) Nation of Oklahoma
P.O. Box 580
Highway 75 and Loop 56
Okmulgee, OK 74447

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Mrs. Bear:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

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Sincerely,

Paul L. Jones, RPA
Senior Archaeologist,
Florida History, LLC

Cc: McLane Evans, BRA

Phone (813) 891-6340 FAX (813) 891-6369
12157 West Linebaugh Avenue #167, Tampa, Florida 33626
info@floridahistoryllc.com www.floridahistoryllc.com

FLORIDA HISTORY, LLC

HISTORY ◼ ARCHAEOLOGY ◼ ARCHITECTURAL HISTORY ◼ 106/110 COMPLIANCE

July 23, 2008

Chairman Billy Cypress
Miccosukee Tribe of Indians of Florida
Tamiami Station
P.O. Box 440021
Miami, FL 33144

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Chairman Cypress:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

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Sincerely,

Paul L. Jones, RPA
Senior Archaeologist,
Florida History, LLC

Cc: McLane Evans, BRA

Received
NOV 4 2009
Bureau of Mine
Reclamation

Phone (813) 891-6340 FAX (813) 891-6369
12157 West Linebaugh Avenue #167, Tampa, Florida 33626
info@floridahistoryllc.com www.floridahistoryllc.com

FLORIDA HISTORY, LLC

HISTORY ■ ARCHAEOLOGY ■ ARCHITECTURAL HISTORY ■ 106/110 COMPLIANCE

July 23, 2008

Mr. Steve Terry
Section 106 and NAGPRA Representative
Miccosukee Tribe of Indians of Florida
Tamiami Station
P.O. Box 440021
Miami, FL 33144

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Mr. Terry:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

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Sincerely,

Paul L. Jones, RPA
Senior Archaeologist,
Florida History, LLC

Cc: McLane Evans, BRA

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FLORIDA HISTORY, LLC

HISTORY ◼ ARCHAEOLOGY ◼ ARCHITECTURAL HISTORY ◼ 106/110 COMPLIANCE

July 23, 2008

Mr. Beasley Denson
Chairman
Mississippi Band of Choctaw Indians
101 Industrial Road
Choctaw, MS 39350

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Chairman Denson:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

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Sincerely,

Paul L. Jones, RPA
Senior Archaeologist,
Florida History, LLC

Cc: McLane Evans, BRA

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NOV 4 2009
Bureau of Mine
Reclamation

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info@floridahistoryllc.com www.floridahistoryllc.com

FLORIDA HISTORY, LLC

HISTORY ■ ARCHAEOLOGY ■ ARCHITECTURAL HISTORY ■ 106/110 COMPLIANCE

July 23, 2008

Mr. Kenneth H. Carleton
Tribal Historic Preservation Officer
Mississippi Band of Choctaw Indians
P.O. Box 6257
101 Industrial Road
Choctaw, MS 39350

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Mr. Carlton:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

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Sincerely,

Paul L. Jones, RPA
Senior Archaeologist,
Florida History, LLC

Cc: McLane Evans, BRA

FLORIDA HISTORY, LLC
HISTORY ARCHAEOLOGY ARCHITECTURAL HISTORY 106/110 COMPLIANCE

July 23, 2008

Mr. Buford Rolin
Chairman
Poarch Band of Creek Indians
5811 Jack Springs Road
Atmore, AL 36502

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Chairman Rolin:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

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Paul L. Jones, RPA
Senior Archaeologist,
Florida History, LLC

Cc: McLane Evans, BRA

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NOV 4 2009
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Reclamation

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FLORIDA HISTORY, LLC

HISTORY ARCHAEOLOGY ARCHITECTURAL HISTORY 106/110 COMPLIANCE

July 23, 2008

Mr. Robert Thrower
Acting Tribal Historic Preservation Officer
Poarch Band of Creek Indians
5811 Jack Springs Road
Atmore, AL 36502

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Mr. Thrower:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

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Paul L. Jones, RPA
Senior Archaeologist,
Florida History, LLC

Cc: McLane Evans, BRA

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FLORIDA HISTORY, LLC

HISTORY ▣ ARCHAEOLOGY ▣ ARCHITECTURAL HISTORY ▣ 106/110 COMPLIANCE

July 23, 2008

Mr. Mitchell Cypress
Chairman
Seminole Tribe of Florida
6300 Stirling Road
Hollywood, FL 33024

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Chairman Cypress:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

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Cc: McLane Evans, BRA

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FLORIDA HISTORY, LLC
HISTORY ▣ ARCHAEOLOGY ▣ ARCHITECTURAL HISTORY ▣ 106/110 COMPLIANCE

July 23, 2008

Mr. W.S. Steele
Tribal Historic Preservation Officer
AH-TAH-THI-KI Museum
HC-61, Box 21-A
Clewiston, FL 33440

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Mr. Steele:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

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Sincerely,

Paul L. Jones, RPA
Senior Archaeologist,
Florida History, LLC

Cc: McLane Evans, BRA

Phone (813) 891-6340 FAX (813) 891-6369
12157 West Linebaugh Avenue #167, Tampa, Florida 33626
info@floridahistoryllc.com www.floridahistoryllc.com

FLORIDA HISTORY, LLC

HISTORY ▪ ARCHAEOLOGY ▪ ARCHITECTURAL HISTORY ▪ 106/110 COMPLIANCE

July 23, 2008

Mr. Enoch Kelly Haney
Principal Chief
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Chief Haney:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

- A 4,581-acre mitigation parcel adjacent to and within the Waccasassa Bay Preserve State Park.

At the suggestion of the USACE and in compliance with 36 CFR 800.4(a)(iii and iv) and 800.2(a)(4), Tarmac America, LLC is consulting with your tribe in order to notify you of this project and to get your opinion of the potential effects on sacred areas, archaeological sites, burial grounds or other areas of special sensitivity to you or members of your organization. In addition, archaeological testing is planned in consultation with the Florida SHPO in moderate and high probability areas so that archaeological sites can be accurately mapped and avoided.

Please provide your comments to Tarmac America, LLC as soon as possible so that we may take them into account. Responses may be faxed to Paul L. Jones at (813) 891-6369, or mailed to the address below.

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FLORIDA HISTORY, LLC

HISTORY ARCHAEOLOGY ARCHITECTURAL HISTORY 106/110 COMPLIANCE

July 23, 2008

Mr. Pare Bowlegs
Tribal Historic Preservation Officer
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

Re: Cultural Resource Management Plan for
The Tarmac Mine Mitigation Area

Dear Mr. Bowlegs:

On behalf of Tarmac America, LLC, Florida History, LLC is seeking comments on the project described below. Tarmac America, LLC is an international company and the proposed Tarmac King Road Limestone Mine project is regulated by the USACE Pensacola Regulatory Office. Because of increased demand for aggregate, Tarmac America, LLC has proposed expanding its mining capacity with a project called the Tarmac King Road Limestone Mine Project. The project involves construction of a long-term mining project in Levy County, Florida. Adjacent to the mining area a 4,581-acre mitigation area is proposed adjacent to and within the Waccasassa Bay Preserve State Park. As part of the mitigation for the proposed mine, this mitigation area will be returned to its natural state, removing roads and replanting natural vegetation. This mitigation was requested and will be permitted by the USACE Pensacola Regulatory Office. Comments are requested for only the following proposed ground disturbing activities in Levy County as shown on the map in the enclosed management plan:

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FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

August 20, 2008

Mr. Paul L. Jones
Florida History, LLC
12157 West Linebaugh Avenue
Suite 167
Tampa, Florida 33626

Re: Cultural Resource Management Plan for the Tarmac Mine Mitigation Area
Levy County, Florida: Preliminary Plan (Florida History, LLC, June 2008)
DHR Project File No. 2008-5276B

Dear Mr. Jones:

Our office received and reviewed the above referenced project in accordance with Section 106 of the *National Historic Preservation Act of 1966*, as amended and *36 CFR Part 800: Protection of Historic Properties*, and with this agency's responsibilities under Section 267.061, *Florida Statutes*. The State Historic Preservation Officer is to advise Federal and State agencies as they identify historic properties (listed or eligible for listing, in the *National Register of Historic Places*), assess effects upon them, and consider alternatives to avoid or minimize adverse effects.

We reviewed the proposed mitigation plan for 4,581 acres in Levy County. This project is mitigation for proposed mining activities, and project mitigation measures will consist of the removal of existing roads, replanting with native vegetation, etc. There are three recorded archaeological resources within this large parcel, including one site with human remains, and these sites extend onto Florida Park Service property. While these sites may be potentially significant resources, according to the information in the Florida Master Site File, there has been no significance determination made by this office for any of these three resources.

The management plan proposes additional testing at each archaeological resource to determine the exact site extent and location within the mitigation tract, and then develop a plan to avoid impacts to each of these three sites. In addition, the restoration tract will be zoned into areas of high, medium, and low probability areas. High probability areas will either be tested or avoided altogether. Medium probability areas, which would include upland rises near freshwater sources, are proposed to be monitored by heavy equipment operators after receiving appropriate training.

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❑ Director's Office (850) 245-6300 • FAX: 245-6436
❑ Archaeological Research (850) 245-6444 • FAX: 245-6452
✓ Historic Preservation (850) 245-6333 • FAX: 245-6437

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This agency requests that subsurface testing be conducted on approximately 10% of the medium probability areas. Should this testing encounter no sites or no significant sites, then monitoring would be all that would be required for the remainder of the medium probability areas. No testing or monitoring is proposed for the low probability areas. As most of the soils within the restoration area are moderately or poorly drained, sites would not be expected in these areas. Nevertheless, the management plan has included detailed provisions to deal with unexpected discoveries.

Lastly, this agency will require a final archaeological report which meets Chapter 1A-46, FAC, standards.

If you have any questions concerning our comments, please do not hesitate to contact Susan Harp at (850) 245-6333. Thank you for your interest in protecting Florida's historic resources.

Sincerely,

Frederick P. Gaske

Frederick P. Gaske, Director, and
State Historic Preservation Officer